



POPULAR MECHANICS

MAGAZINE

WRITTEN SO YOU CAN UNDERSTAND IT

REG'D. TRADE MARK, GREAT BRITAIN, No. 410426

See page 97



In This Issue

REVOLUTION ON THE FARM

an anniversary feature by Wheeler McMillen

For the Craftsman

HOW TO BUILD A MIDGET



Starliner "hard-top" convertible. Chrome wheel discs optional at extra cost—decorative and other specifications subject to change without notice.

Announcing
the newest of the new for '52

NEW 1952 STUDEBAKER

A NEW 120-HORSEPOWER COMMANDER V-8



A NEW CHAMPION IN THE LOW PRICE FIELD

NOW READY for you in refreshingly distinctive new beauty—the brilliant-performing Studebaker Commander V-8—the sprightly Studebaker Champion.

Vigorously sleek in every line—and impressively proportioned—these sparkling 1952 creations conform faith-

fully to the long established and unchanging Studebaker standards of designing for easy handling, easy maneuvering, easy parking and exceptional gasoline economy.

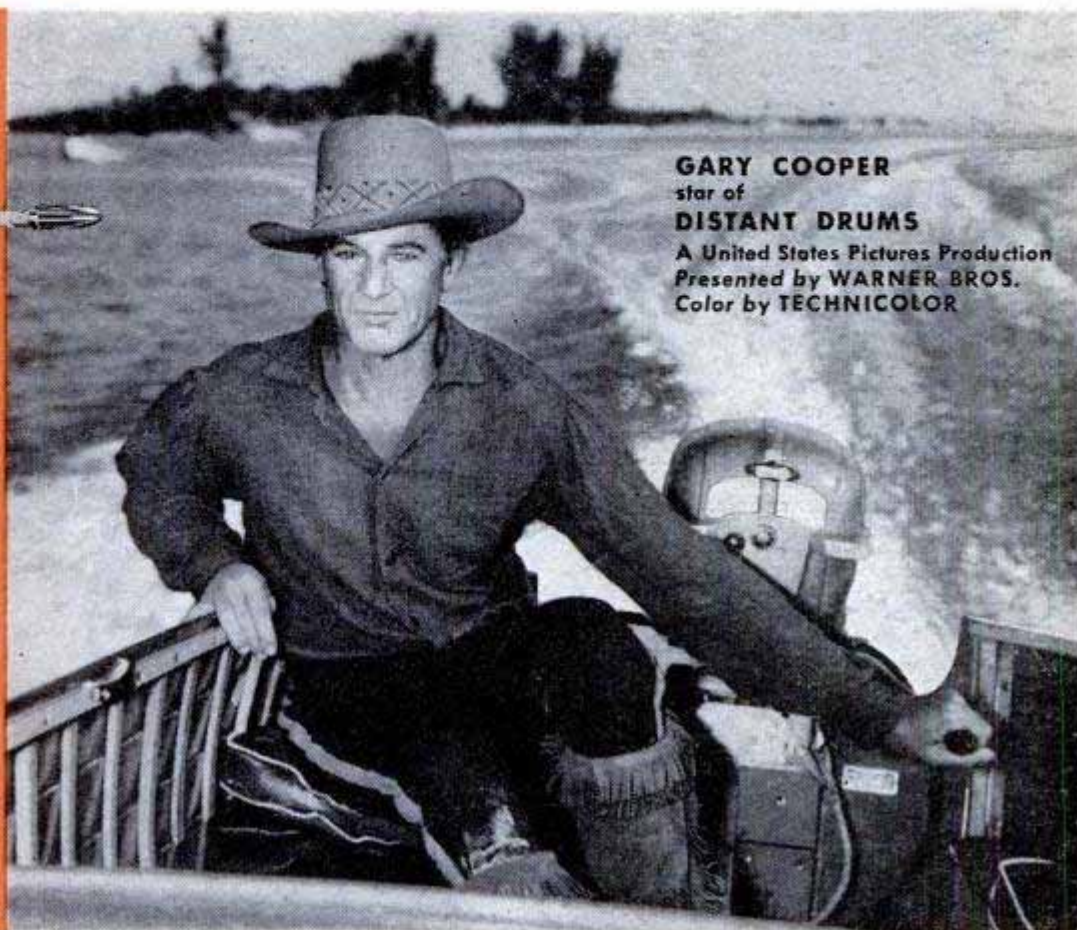
Stop in and see these wonder cars—newest of the new for '52—now on view at a nearby Studebaker showroom.

"It's Sensational!" SAYS GARY COOPER



SEA-HORSE
25

On location in Florida, Gary Cooper makes the 8-mile trip into the Everglades with a Sea-Horse 25—the outboard motor that modernizes water travel everywhere.



GARY COOPER
star of
DISTANT DRUMS
A United States Pictures Production
Presented by WARNER BROS.
Color by TECHNICOLOR



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FREE! New Handy Chart. Describes the 4 great '52 models, including the *all-new* Sea-Horse 3. Write!
JOHNSON MOTORS, 400 Pershing Road, Waukegan, Illinois
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- SEA-HORSE 3 — 3 H.P. Less than 30 lbs.! Amazing new Johnson Angle-matic Drive \$145.00*
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- SEA-HORSE 25 — 25 H.P. Gear Shift. Mile-Master Fuel Tank. Synchro Twist-Grip Speed Control \$390.00*

All hp ratings OBC Certified brake hp at 4000 rpm. *All prices f.o.b. factory. Subject to change without notice.

Johnson
SEA-HORSES
FOR **DEPENDABILITY**

This One



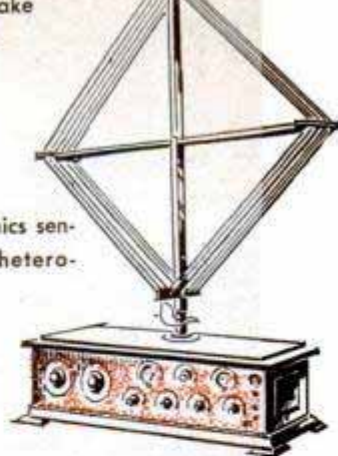
1903 Barney Oldfield lowers track record at Indianapolis.



1909 Wright Brothers make new flight record.

1925

Popular Mechanics sensational Superheterodyne Eight.



1944

The atomic powered auto.



Fifty Years of
POPULAR MECHANICS

19

An album of fascinating articles have appeared

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H. H. WINDSOR, JR., *Editor and Publisher*



this month's cover

WITH HER TUBBY BOW and squared-off stern she's far from the sleekest vessel in the Navy, but despite her weird lines she's a bravely determined craft. She's sort of a floating hotel-garage for miniature minesweepers. In the yawning cavity of her hull she carries up to 27 little boats, each fitted with minesweeping gear. On the edge of a mine field she slowly squats down in the water until she's half submerged, and the flotilla of babies comes sputtering out. These smaller craft form into echelons and sweep through the field, clearing paths for larger vessels to follow. Job done, they head back to the mother ship, swoop into the open stern and are tucked away in the huge room. As water flows out, the big vessel rises until the squadron in her belly rides high and dry. Then she steams away toward her next job. The story of this new seagoing "garage" and how she has helped the war in Korea begins on page 97

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FEBRUARY 1952

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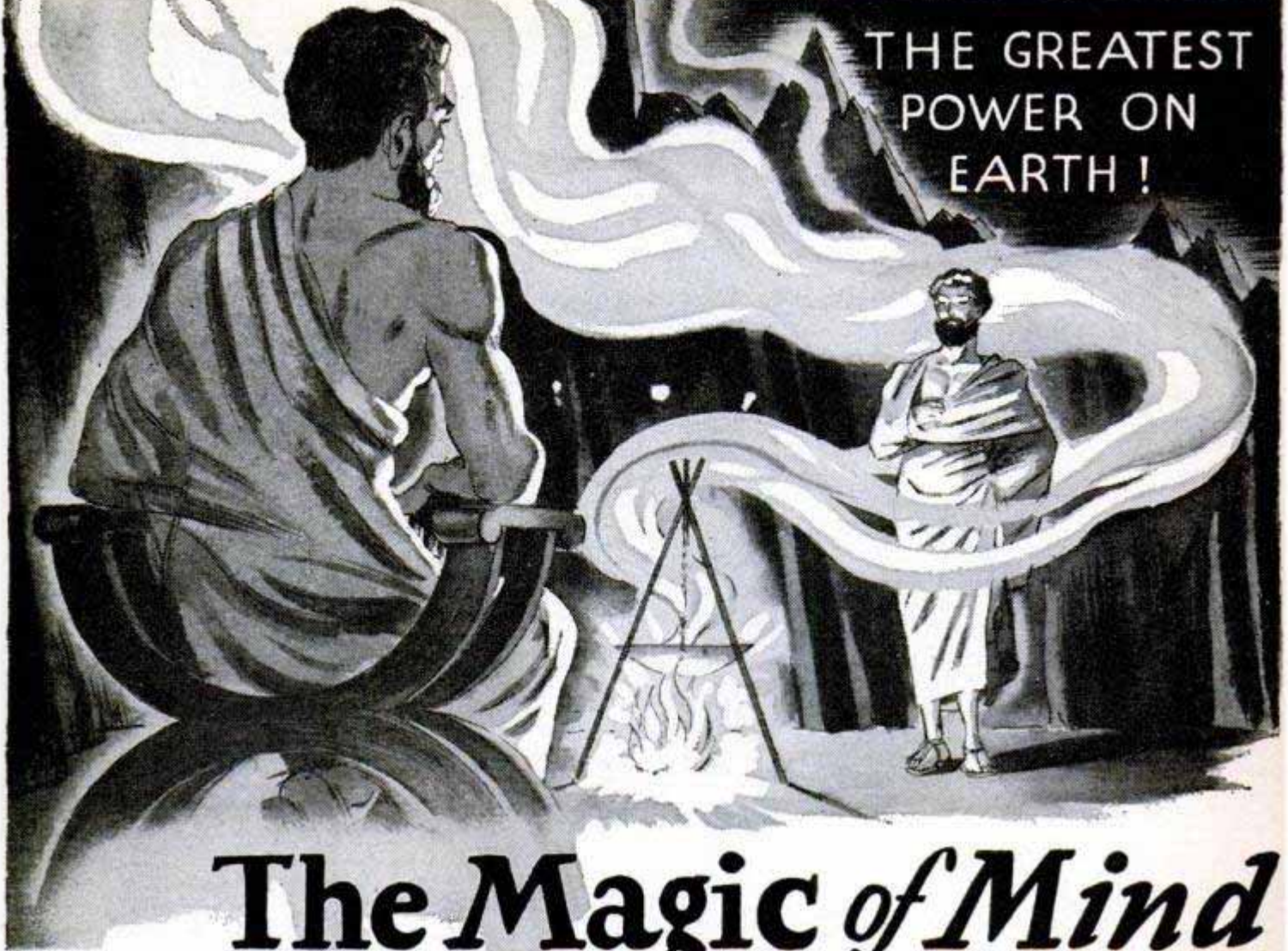
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THE GREATEST
POWER ON
EARTH!



The Magic of Mind

WERE the great personages of the past victims of a stupendous hoax? Could such eminent men of the ancient world as Socrates, Pericles and Alexander the Great have been deluded and cast under the spell of witchcraft — or did the oracles whom they consulted actually possess a mysterious faculty of foresight? That the human mind can truly exert an influence over things and conditions was not a credulous belief of the ancients, but a known and demonstrable fact to them. That there exists a wealth of infinite knowledge just beyond the border of our daily thoughts, which can be aroused and commanded at will, was not a fantasy of these sages of antiquity, but a dependable aid to which they turned in time of need.

It is time you realized that the rites, rituals and practices of the ancients were not superstitions, but superfluges to conceal the marvelous workings of natural law from those who would have misused them. Telepathy, projection of thought, the materializing of ideas into helpful realities, are no longer thought by intelligent persons to be impossible practices, but instead, demonstrable sciences, by which a greater life of happiness may be had.

One of America's foremost psychologists and university instructors, says of his experiments with thought transference and the powers of mind — "The successes were much too numerous to be merely lucky hits and one can see no way for guessing to have accounted for the results." Have you that open-minded attitude of today which warrants a clear, positive revelation of the

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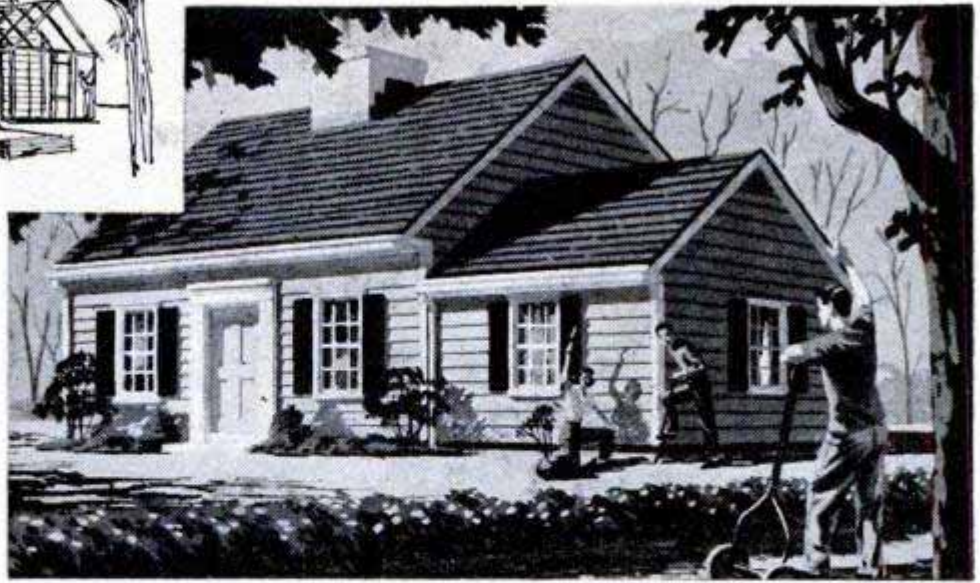
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I am sincerely interested in knowing more about this unseen, vital power which can be used in acquiring the fullness and happiness of life. Please send me, without cost, the book, "THE MASTERY OF LIFE," which tells me how to receive this information.

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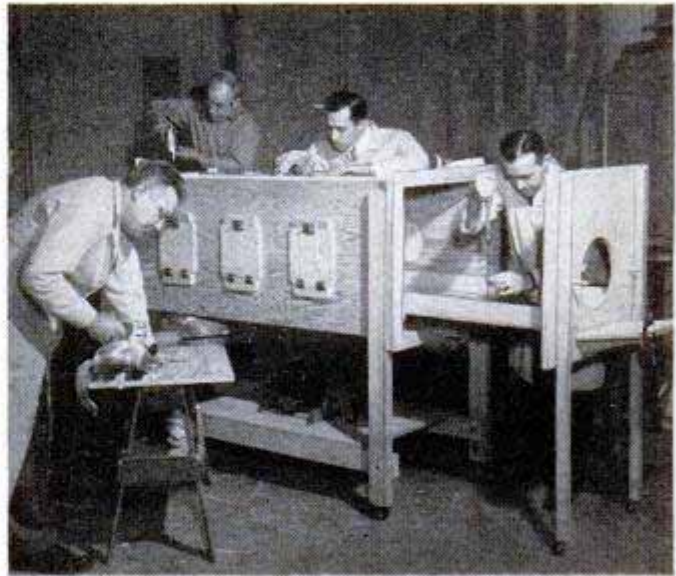
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in this corner.....

THE EDITORS



FROM PLANS and construction details in the January craft section, *Popular Mechanics* employees took time out to build one of their own projects—a “wooden lung” respirator. Made almost entirely of stock plywood, the lung was assembled in *PM*'s workshop and has been made available to the U. S. Junior Chamber of Commerce, which has adopted the emergency unit as a national project. The respirator will be turned over to a local hospital needing such equipment prior to the time they can be furnished one through local Jaycees.

Because of unusual interest shown by service clubs and civic-minded groups, *Popular Mechanics* has made enlarged, detailed plans available free to any group wishing to build this respirator.

Letter From Our Eastern Editor

Dear Boss:

Today, down at Richmond, Va., I had my first interview with a horse. I'm being very careful whom I tell it to around here, since the temperature has been hovering between 95 and 100 for two days, and anyone in his right mind might figure I was troubled with the heat. However, between us, the horse said some interesting things. For instance, she says we'll have a big war in 1952. Do not snicker too loud. In 1940 she said Roosevelt would run for a third term, that Germany would lose the war.

Her name is Lady Wonder, and she's sort of a sly old gal going on 27. Has a nice, gentle expression, with dreamy eyes, a soft, soft nose with which she nuzzles her

(Continued to page 8)

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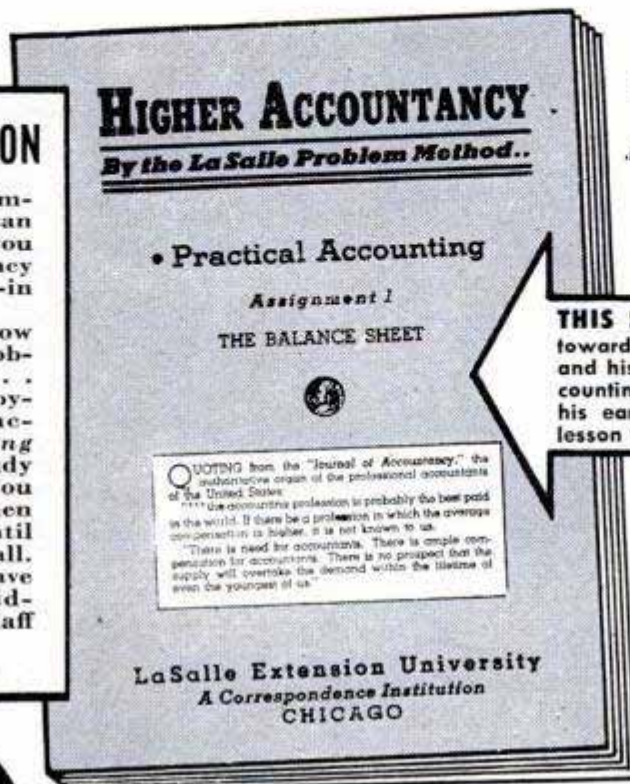
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spelling gadgets as well as her patrons. The customer is led into an old nondescript barn and stands before a rail made of pipe iron. In front of Lady is a keyboard of steel keys tipped with sponge rubber. Ask her a question and she starts nuzzling the keys, carefully choosing the ones she wants. Every time her nose depresses a key, a letter or number tag is released and pops up in front of the questioner. I'm convinced the old nag can at least *read*, or recognize letters of the alphabet and numbers.

Anyway, I asked her the name of my boss in Chicago. She fumbled around a while, tripped a couple of wrong letters, and finally tapped off G-R-A-N—T. (It took her a little longer to get the T.) She has also spelled D-E-M-P-E-W-O-L-F-F.

A real cute horse. Almost like people. And a good deal more frightening, if true. I kept wondering just how much that horse *did* know about me.

Dick Dempewolff.

★ ★ ★

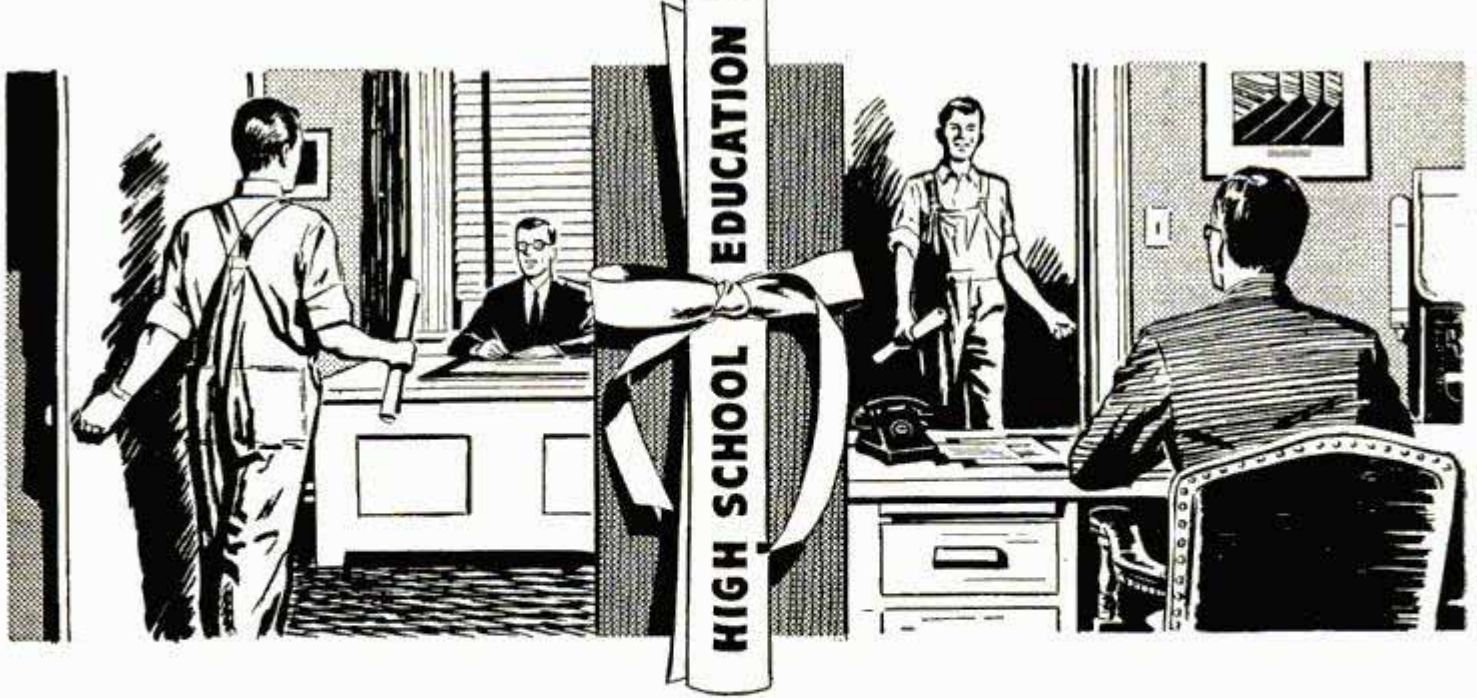
Mr. Dempewolff's article on this mind-reading horse, and a report on the latest developments in the study of extrasensory perception by Duke University scientists—who know Lady Wonder well—will appear in the March issue. Don't miss it!

Clymer Reports on Foreign Cars



Floyd Clymer, who conducts our automobile-owners' reports and tests, has just returned from Europe where he made a survey on foreign cars for *PM* readers. He attended the Paris and London automobile shows, and then made an extensive tour of auto plants in France, England, Germany, Sweden, Italy and Spain. In Vienna he managed to inspect a couple of Russian cars. Clymer is shown above in conference with Dr. Ferdinand Porsche, Jr., builder of the swank Porsche sports car in Stuttgart.

(Continued to page 10)



Is THIS all that separates you from a better job?

When the boss looks around for a man to promote, the chances are mighty good that he'll pick a high school graduate over one who quit school in the 8th grade.

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- Electrical Engineering
- Electric Light and Power
- Lighting Technician
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- Internal Combustion Engines

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- Heat Treatment of Metals
- Industrial Engineering
- Industrial Instrumentation
- Industrial Metallurgy
- Machine Shop
- Mechanical Engineering
- Mold-Loft Work
- Patternmaking—Wood, Metal
- Reading Shop Blueprints
- Sheet-Metal Drafting
- Sheet-Metal Worker
- Ship Drafting
- Tool Designing
- Welding—Gas and Electric

Railroad Courses

- Air Brake
- Diesel Locomotive
- Locomotive Engineer
- Locomotive Fireman
- Locomotive Machinist
- Railroad Section Foreman
- Steam-Diesel Loco. Eng.

Stationary Eng'g Courses

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- Stationary Fireman
- Stationary Steam Engineer

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- Loom Fixing
- Textile Engineering
- Woolen Manufacturing

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- Retailing
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- Traffic Management
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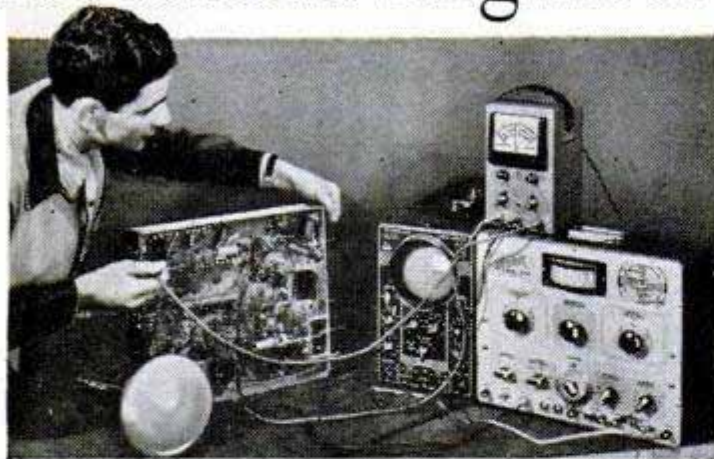
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Porsche is the son of the noted German engineer who designed the Volkswagen. Clymer's authoritative two-part article with some exciting illustrations begins in the March issue.

Letter to the Editor

Looks like you can't stop a GI.

J. M. McMurtry of Hattiesburg, Miss., got a house-moving contract that was too big for his truck. But it wasn't too big for his imagination. As the photo shows, he cut



the house in two. And I have his word for it that this was done with nothing more than a handsaw.

Then, by excavating enough under each section to get timbers in place, the house was jacked up so it could be rolled away.

Seen in the picture is McMurtry checking the connection between the timbers and his G.M.C. 6 x 6 truck. In this way he took the two sections for a four-mile ride. They were nailed together at their new location.

Ed Packer, Chicago.

Letter to the Editor

Your article "Air Support Is the GI's 'Sunday Punch'" in the October 1951 issue came as a very pleasant surprise. I wish to commend you on a splendid article.

I am a member of one of the three major elements that make up a close-support team, being a radio operator with a forward air-control team. . . . Many men [of our outfit] have been decorated and many have been wounded, and some have been killed while on duty with the infantry. We are known as the "Ground Pounding Flyboys," and all of us are proud of our outfit.

Thanks again for the article. . . . It will bring to the American public the wonderful job our Air Force is doing, in helping bring peace to a war-torn country, as its role in the United Nations team.

Cpl. R. B. Gates,
6150th Tactical Control Squadron.

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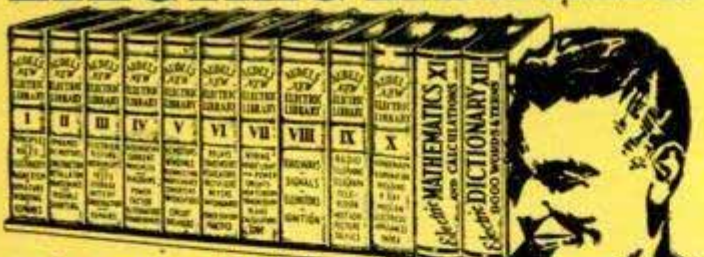
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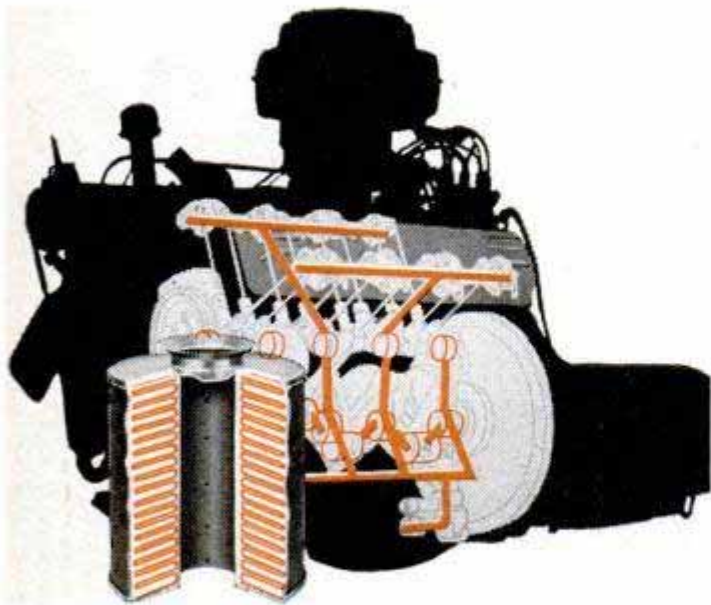
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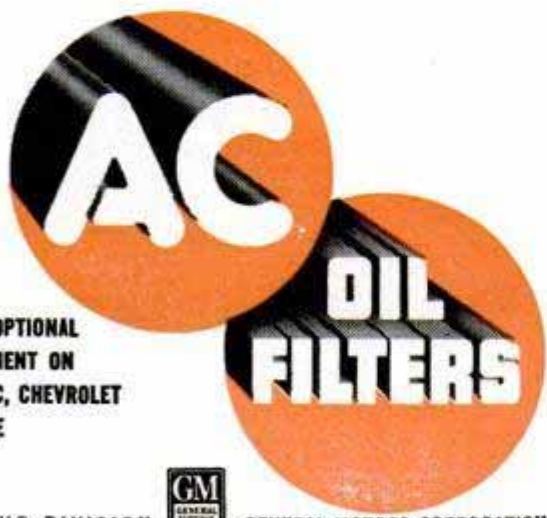
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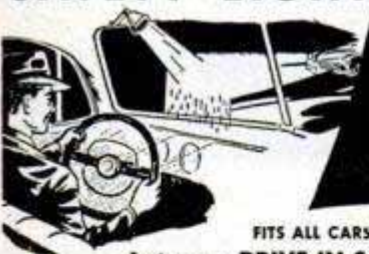
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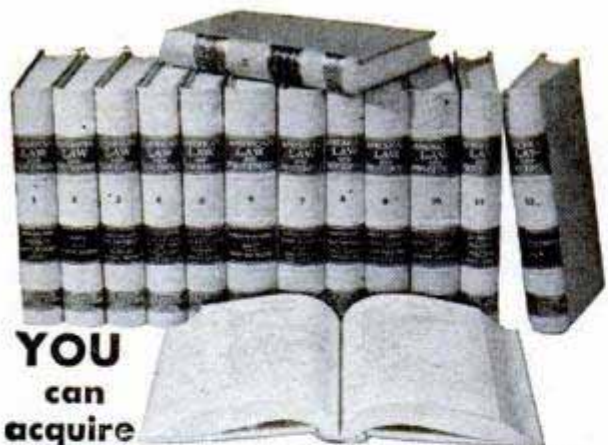
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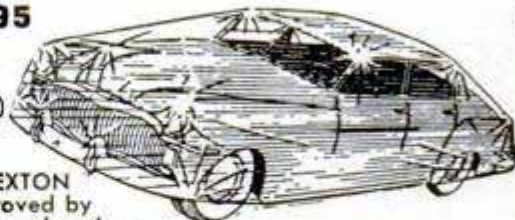


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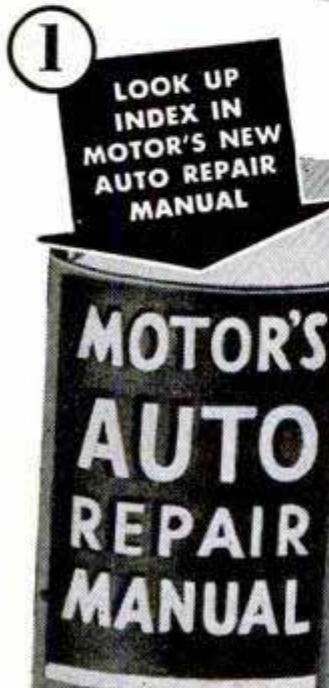
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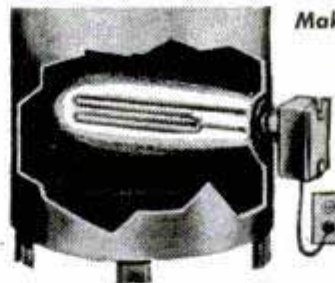
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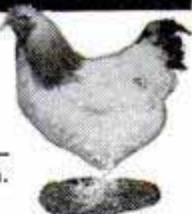
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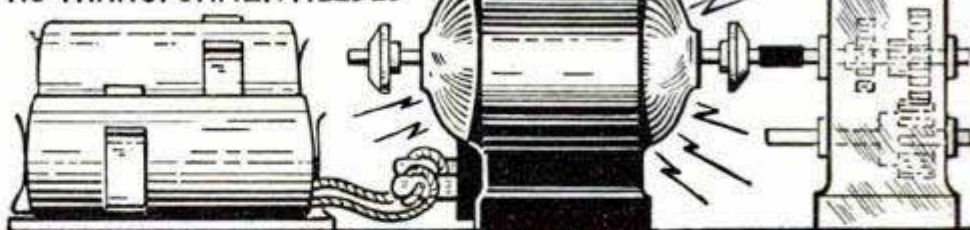
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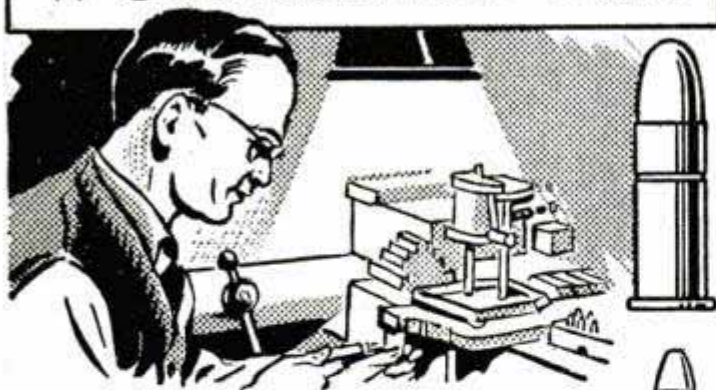
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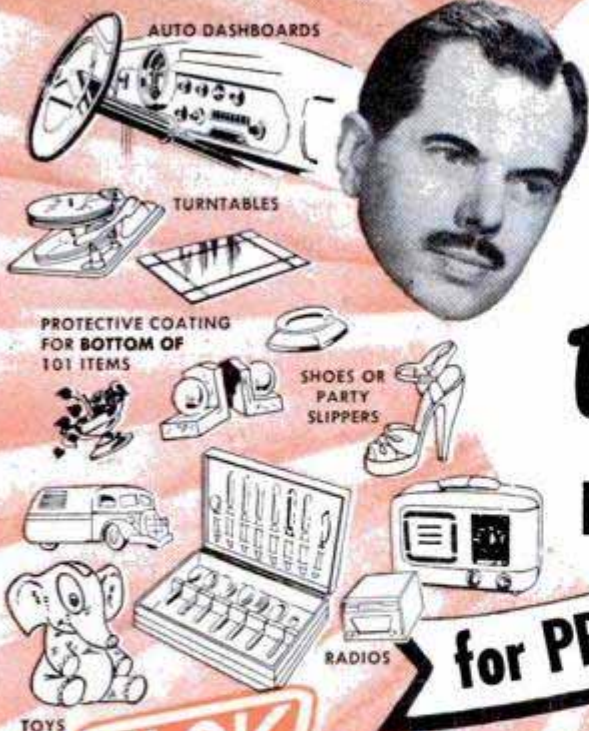
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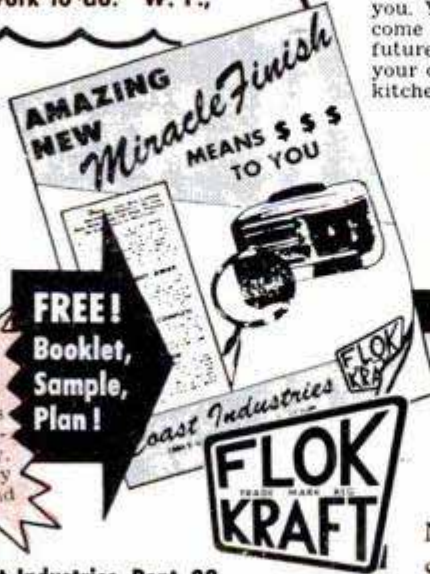
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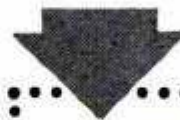
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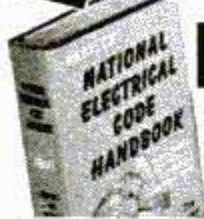
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VITAMIN Sales business complete, \$50! Includes packaged vitamins worth \$126.00, labels printed with buyers name, prepared literature, automatic selling plan. Terrific local, national, foreign sales. Immense profits. Man or woman can operate anywhere. \$3.00 full size, sample \$1.50. Durkin, 410-R West 9th St., Los Angeles 15, Calif.

MONEYMAKING OPPORTUNITIES

MAKE And sell your own plastic foam favors and novelties. Complete introductory kit \$1.00, contains styrofoam, instructions, and patterns. Foam Fantasy Company, 1101 Janes, Saginaw 19, Michigan.

WIN Cash, cars in prize contests! Write for copy filled with current contests, winning hints and tips. Send only 30c. Wright Contest Digest, Dept. 17-B, P.O. Box 2266, St. Louis 9, Mo.

"HOW To Make Money With Simple Cartoons"—A book everyone who likes to draw should have. It is free; no obligation. Simply address Cartoonists' Exchange, Dept. 92-CM, Pleasant Hill, Ohio.

WIN Contest money. General Contest Bulletin gives hundreds of tips. List current contests and rules. Sample 25c. General Contests, 1609½ East 5th, Duluth, Minnesota.

EARN Money evenings, copying and duplicating comic cartoons for advertisers. Adservice, Argyle 1, Wisconsin.

STOP! Write here. Cash opportunities. Green, 13 Earl, Red Bank, N. J.

TREMENDOUS Profits! Sell name-lists by mail. Complete instructions including sample list of 1000 names. 25c. Wilbur Erickson, Englishtown, New Jersey.

SPARETIME Homework opportunities. Free details. Pallo, Box 504, Yonkers, N. Y.

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MAILORDER Magazine, homework offers 10c. William Woodrow Jenkins, Lucasville, Ohio.

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GOOD Indoor income, growing chop suey bean sprouts. Instructions, seed, 30 sprout recipes, \$5.00. Texas Health Products, Box 23, Beeville, Texas.

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MONEYMAKING Opportunities. Free literature. National Hobbies, Box 524, Rochester, Minnesota.

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PLASTIC-Crafters supplies wholesale. Literature 20c. Cosmopolitan, Box 176-PM, New York 8, N. Y.

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PLASTIC. Sheets, rods, tubes, etc. Free list. Plastic Supply Co., 2901 N. Grand Blvd., St. Louis 7, Mo.

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PART Time salespeople—Men and women. Daily cash returns showing Artmoore Products, three "in demand" items. No investment in stock. Liberal no risk starting offer. Write Dept. P-2, Artmoore, 1319 North Third, Milwaukee, Wisconsin.

MAKE Money fast—Sell big value greeting cards. Four new 21 card \$1.00 all-occasion assortments. Birthday, Easter, novelty cards. Gift wrappings, stationery, notes. Unusual gift items. Over 100 fast-sellers. Amazing profits. Write for samples on approval and "get-started" plan. Hedenkamp, 361 Broadway, Dept. PM-18, New York.

A Penny postcard can put you in business. Complete line. Leather jackets, 151 shoe styles. Big commissions. No experience, no investment. Send penny post card for free outfit. Consolidated Shoe System, Dept. CI-99, Chippewa Falls, Wisconsin.

NEED Extra money? Show your friends wonderful Regal line of all-occasion greeting cards. Over 100 beautiful assortments to choose from. Also exclusive stationery unobtainable elsewhere. No experience necessary. Your profit up to 100% plus bonus. Write for free samples. Sales kit on approval. Regal Greeting Card Co., Dept. 83, Ferndale, Michigan.

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FREE Samples, and amazing plan, giving you gorgeous dress without penny cost. Rush name today with dress size. Harford, Dept. G-335, Cincinnati 25, Ohio.

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ABSOLUTELY Free! Big package actual sample fabrics and style presentation of dresses, lingerie, hosiery, etc. Take orders. Commissions big. Send no money. Melville Co., Dept. 6704, Cincinnati 25, Ohio.

SELL Sunshine exclusive everyday cards and make big money the easy friendly Sunshine way. Complete selection greeting cards, stationery, gift wraps, novelties, etc. 21 deluxe miniature everyday cards—75c. Many others. Send postcard today for your Sunshine sample kit on approval to: Sunshine Art Studios, Dept. PM-2, 115 Fulton St., New York 38, New York.

JUST Out! New thrilling sensation in everyday cards. Rich foils, satins, velours sell on sight, 21 for \$1. Make up to 100% profit. 50 assortments, imprint stationery and book matches, gift items. Two \$1 assortments on approval. Imprints free! Joy Greetings, 507 N. Cardinal, Dept. R-60, St. Louis, Mo.

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AGENTS—Every woman needs nylon dip; makes nylons last up to five times longer. Big demand. Robert Smith manufacturing Company, Inc., 4731 East 52 Drive, Los Angeles 22.

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LEARN The secrets of successful salesmen. \$1.00. Wye & Co., 636 Dorchester Avenue, Boston 27, Mass.

SALESMEN—Get happy! Hundreds different things to sell; all details free! Write what you sell now; what you'd like to sell. Your mail box will run over! Salesmen's Service, Drawer 8711, Fort Worth 12, Tex.

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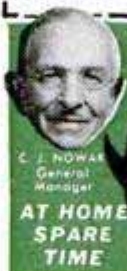
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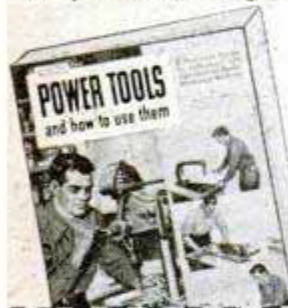
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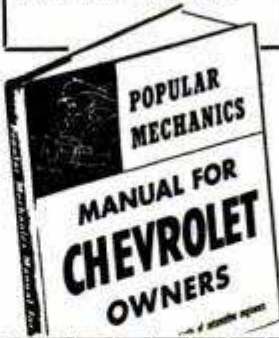
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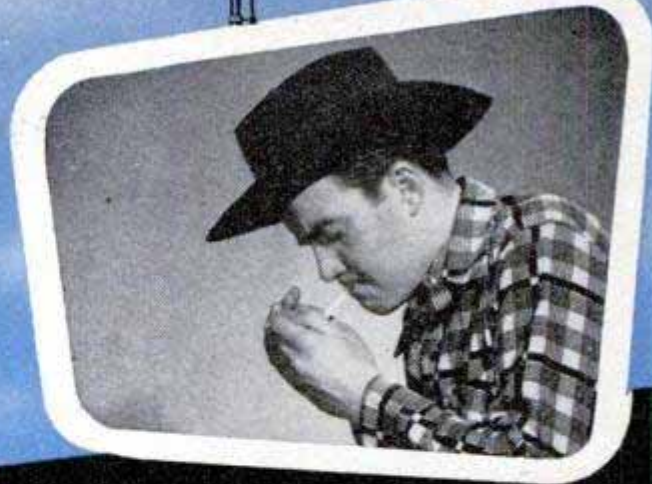
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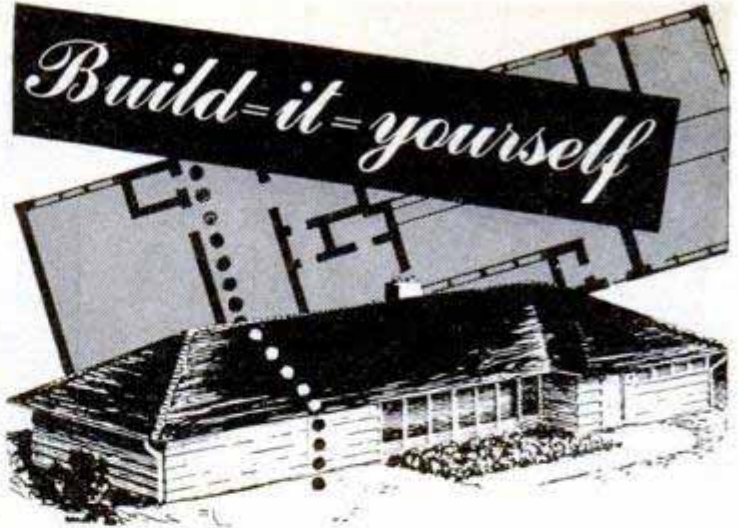
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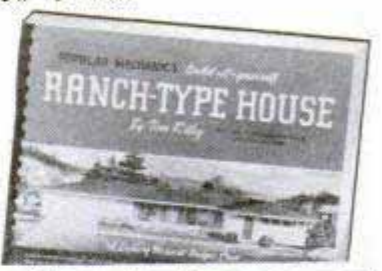
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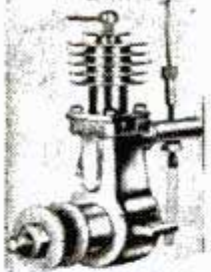
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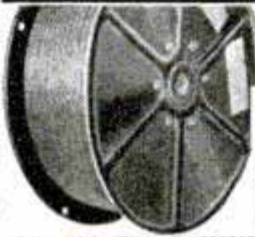
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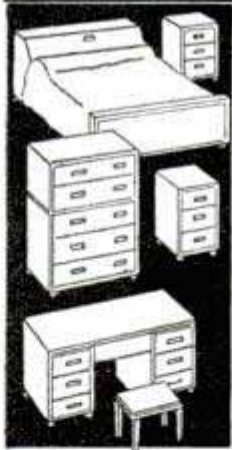
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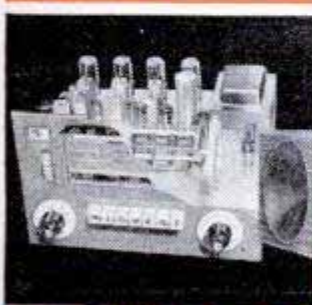
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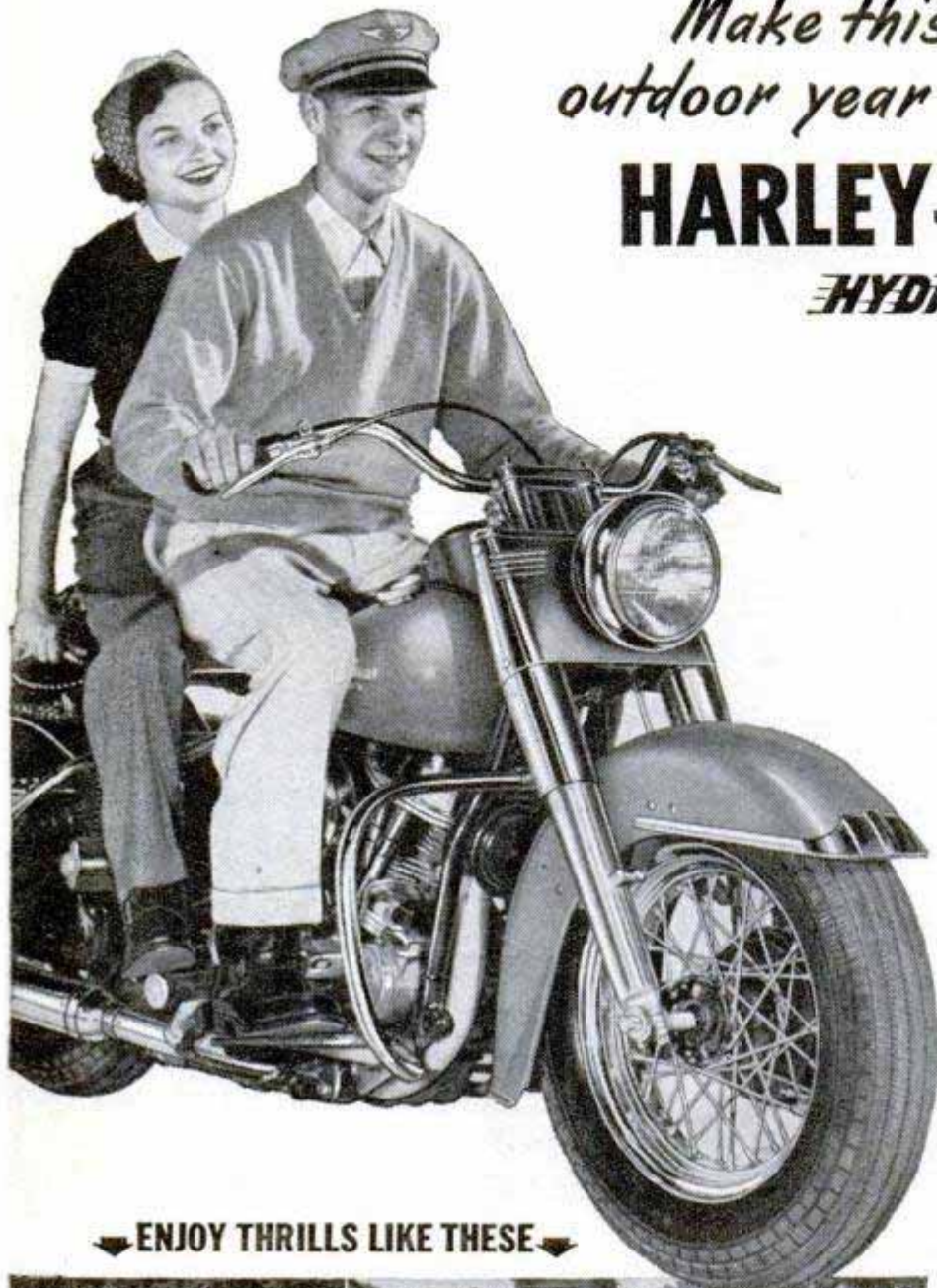


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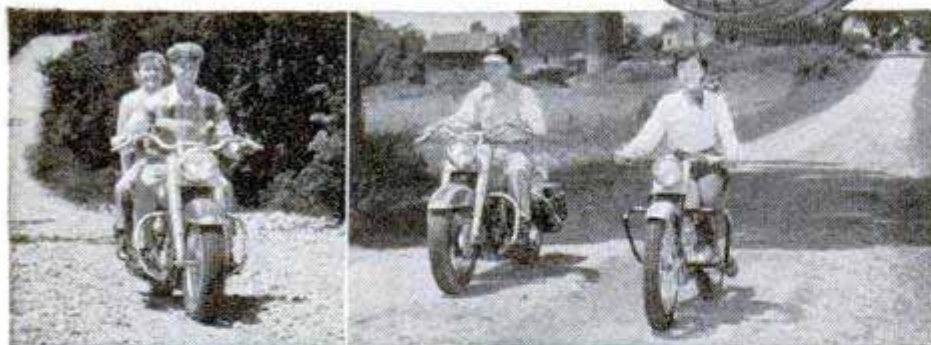
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DEALERS: A few valuable franchises available for the full line of famous Big Twins and the 125 model. Write today.

In Britain a team of chemists has evolved an alkali solution in which two tons of metal can be washed free of rust in an hour and a half.

Through this development, thousands of tons of left-over war equipment—guns, bombs, shells and even radar precision instruments—are being reclaimed from storage dumps.

Guns and projectiles which would have had to be scrapped, melted down and re-made are being laundered whole and returned straight to ordnance stores or explosive-filling plants. Defense ministries are at present taking up 80 percent of the metal laundries' output, and each of the 11 derusting plants operating in Great Britain can deal with 100 tons of equipment a week. The laundry near London cleans and derusts a thousand 3.7-inch antiaircraft shells every day. Rows of shells are laid on special holders—like wine bottles on racks—and dipped by overhead conveyors 56 at a

WRITTEN SO YOU CAN UNDERSTAND IT
VOL. 97

time. Out they come, gleaming like new.

Recently 474 trainer aircraft of the Royal Air Force—urgently needed for the basic instruction of young air crews—were grounded through lack of spare parts. New spares would have taken more than a year to make. With the use of the new derusting solution, the aircraft were all flying within a month.

Until now, derusting processes have depended on violence. Rust flakes can be

RUST MEETS ITS WORST ENEMY

By Eric Bennett

Rack of rusty shells emerges from first tank, where steaming soda solution removes any grease
Photos copyright by Pictorial Press



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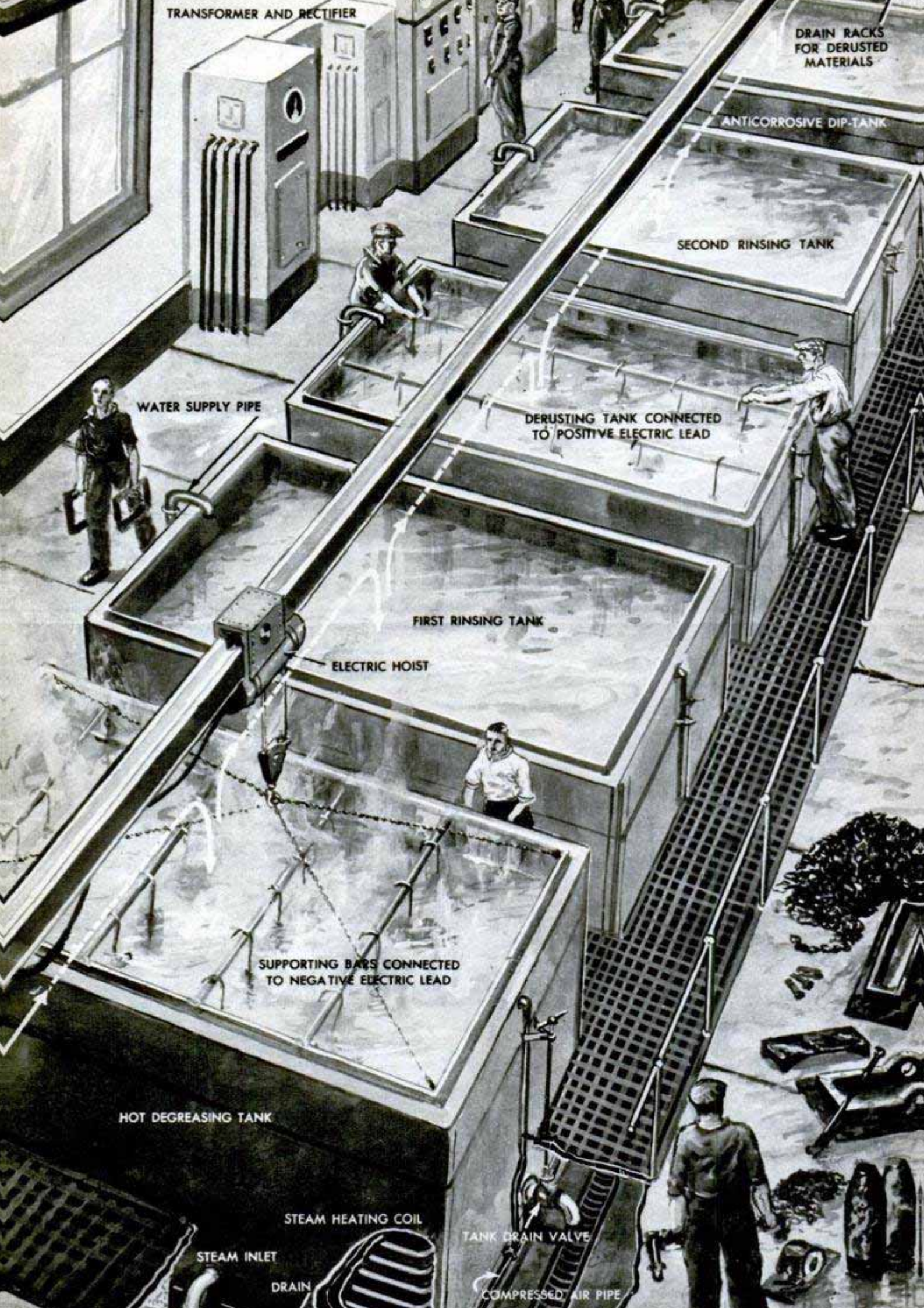
STEAM HEATING COIL

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TANK DRAIN VALVE

COMPRESSED AIR PIPE



knocked off, or literally shot off. In the sandblasting or shot-blasting processes often used to clean heavily corroded ships' plates, a stream of sand or lead shot is directed against the metal by compressed air or steam. Rust can also be burned off by preparations of phosphoric acid.

The first method can hardly be used on delicate machinery. The second goes too far. The acid will remove the rust, but it may also remove part of the metal surface. And its own corrosive action may continue indefinitely even under a protective coat of paint or grease.

The value of the novel derusting process, perfected by chemists under the direction of Alfred Arthur Grahame-Chapman, is that it does not affect the surface of the metal. Since it uses only alkali activated by an electric current, all the rust can be removed from a precision instrument or from a machine tool gauged to .001 inch. There will be no mark on the metal surface and not the minutest reduction of dimensions. Complicated machines do not have to be dismantled. Calculating machines and typewriters, rusted after being salvaged

←
Material to be derusted is soaked in five successive tanks. In the third tank, rust disappears through combined action of an alkali solution and electrolysis. Final tank coats metal with a protective film

New lamps for old. Rusted old hurricane lamps once might have been scrapped. Now, through the derusting process, they can be converted into gleaming new lamps. Even locomotives have been derusted

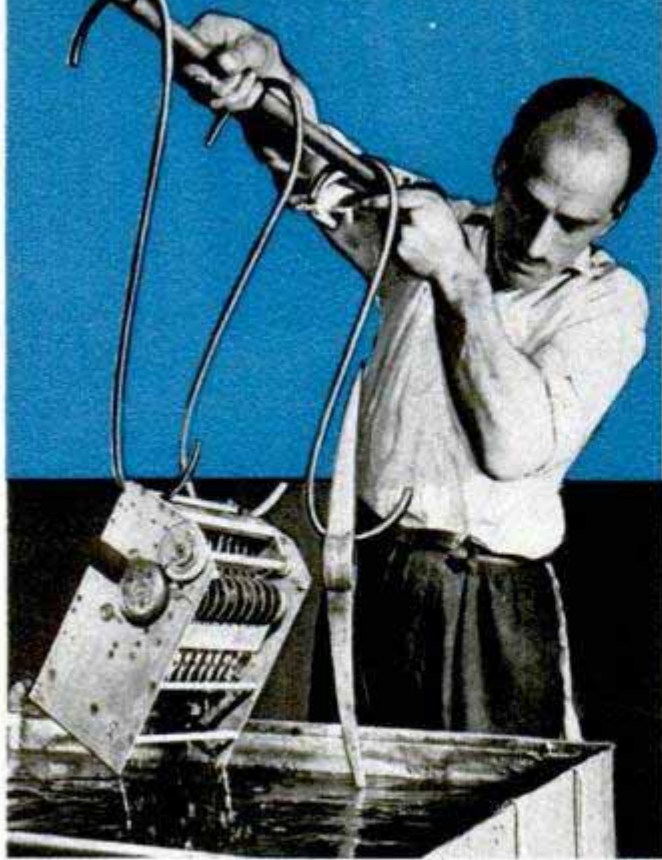
from a fire, have been dumped whole into the metal laundry and have emerged clean and in working order.

Chapman set up his first plant in London in 1945 under the name Derustit Ltd. By derusting taffy-wrapping machines, banking and printing plants, cigarette-making machines, electrical equipment and more than 40,000 different items from nuts and bolts to refrigerators, the electrolytic process soon saved industry millions of pounds in capital expenditure.

Dumped in Manchester were unassembled locomotives which had been under construction for the Turkish railway when war broke out in 1939. Some of the heavy cast-iron sections had flakes of rust $\frac{1}{8}$ inch thick in the internal passages. They were laundered and the locomotives were shipped to Turkey some eight years after they had been first built.

A fire in a Lancashire cotton mill gave derusting the chance to show its value to the textile industry. Water used in putting out the fire had made a million steel rollers useless with rust. The roller makers said that it would take at least 18 months to





System can be used on intricate machinery. Here an adding machine and a pickax are derusted together

re-equip the mill. Derustit laundered the rollers and the mill was back in production within a fortnight of the fire.

Now the derusting plant at Bury, in Lancashire, does a full-time tubbing service for the textile industry. Rollers in textile mills may not be oiled, and since they are in continuous contact with moist flakes and other damp materials they rust rapidly. Formerly the only way to combat the rust was with sandpaper and elbow grease. After several treatments the rollers were polished out of true dimensions.

These days they are sent regularly to the laundry, like the manager's shirts, and they come back bright and shining—and still true in dimensions. What is more surprising is that the derusted rollers stay bright and shining. Normally there is no bright metal to be seen in a cotton mill. The steel attracts the fluff that fills the air. The derusting process, however, changes the polarity of the steel, so that it repels the fluff and remains clean.

In addition to economies of time and material, the direct saving of money is considerable. Electrolytic derusting can be done cheaply because maintenance and labor costs are low. The most expensive item is the derusting fluid; to fill a 3000-gallon tank with it costs \$3000. But that fluid will give service for six months, and a plant can be run for a full shift by four unskilled men under a foreman with electroplating experience.

The electrolytic process dates back to

1940, when Chapman walked into the electric-lamp factory at Ilford near London after it had been gutted by fire bombs. Delicate machinery had been left a mass of rusty junk. Many of the more intricate machines had been imported from the Continent, and in time of war were irreplaceable. Chapman's job, representing the Emergency Services Organization, was to get bomb-damaged plants working again as quickly as possible.

In charge of a metal department at this factory was an old craftsman named William Buck. As early as 1919, Buck had used an electrolytic process, which was really electroplating in reverse, to clean the rust from ancient suits of armor.

He described his work to Chapman. A derusting tank was made. More than \$100,000 worth of machinery was laundered and emerged rustfree, bright and shining. In less than six months the factory was mass-producing lamps with the restored machinery. Chapman was neither a chemist nor an engineer. But he saw a big future in the derusting process if it could be speeded up. Buck's work, though effective, was slow and therefore costly; some of the machine parts took as long as 26 hours to derust.

In the process worked out by Chapman's team of chemists, a piece of machinery to be derusted is dunked successively in five 3000-gallon steel tanks.

The first tank is the degreaser. It contains a hot caustic-soda solution which removes grease, paint, varnish and enamel from the surface. The solution is kept at 180 degrees F., and by passing an electric current through it, the operators reduce the time needed for the degreasing process from 45 to 18 minutes.

The second tank is a cold-water rinse. Now comes the deruster. This third tank is connected to the positive lead from a rectifier, which converts alternating electric current into direct current. The metal bars, from which the machine is suspended into the secret alkaline solution, are connected to the negative lead.

When the rectifier is switched on, current flows from the side of the tank, which is now emitting a positive charge, toward the negative machine. As it does so it liberates a mass of hydrogen bubbles from the alkaline solution. These bubbles bombard the rusty surface of the machine. They also combine chemically with the rust.

Rust is oxidization, or the combination of the surface metal with oxygen absorbed from the air or from water. Now oxygen and hydrogen together make water, and oxygen has a natural affinity for hydrogen. So the hydrogen bubbles combine with the oxidization on the metal surface and the rust disappears.

Four fifths of the way through the process the electrical current is reversed. The result is that the hydrogen bubbles are forced away, and with them the last flakes of oxidation.

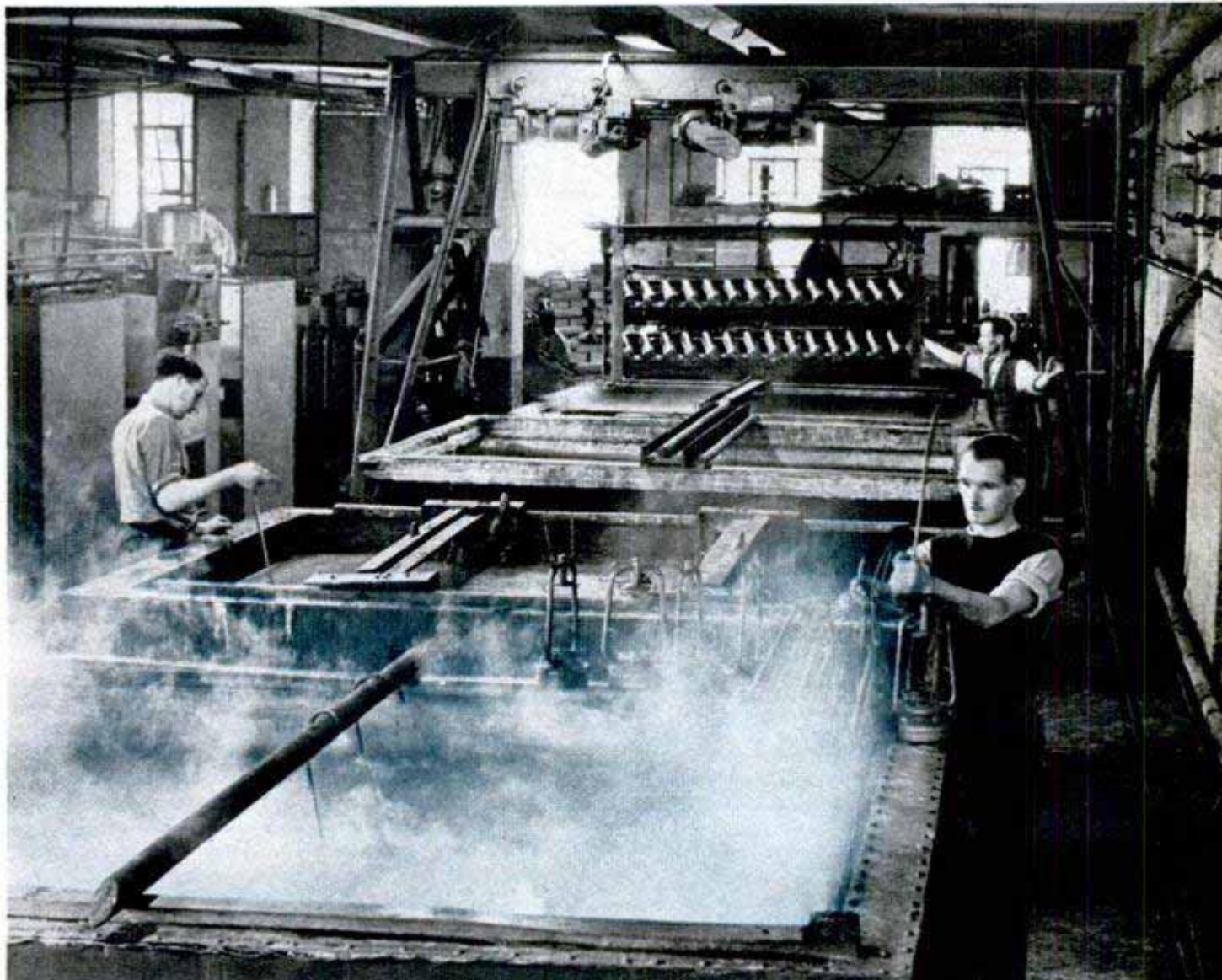
The fourth tank contains another water rinse. Great care is taken to wash off all traces of the derusting solution because it is poisonous and can inflict dangerous chemical burns if it is touched. Finally the derusted machine is dipped into a tank of dewatering oil, which penetrates every part of the metal surface, actually throws off all the water on it and finally coats the metal with a protective film. This last quality is important to the derusting process, because although the electrolytic alkaline bath removes rust it cannot prevent a recurrence.

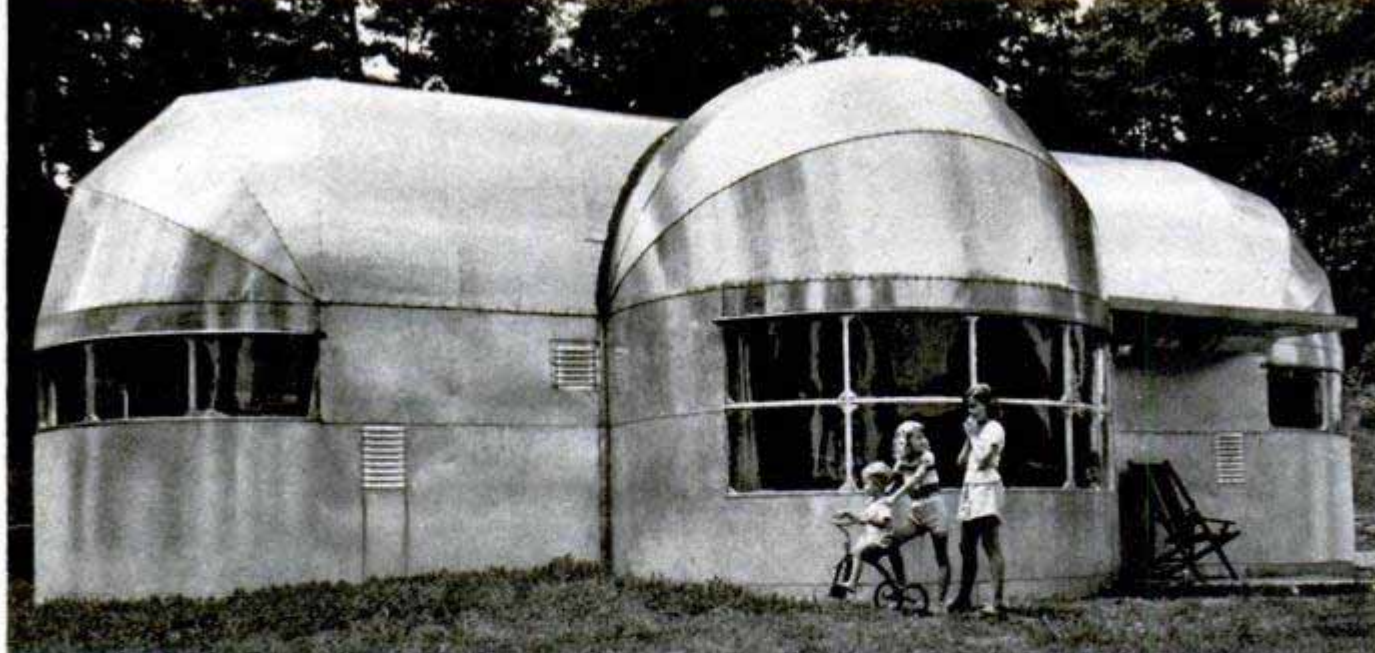
Derustit Ltd. has already made the first moves toward operation on a worldwide scale. In South Africa, Chapman found that equipment in the damp atmosphere of the gold mines rusted rapidly and that only antiquated methods were used to remove the rust. He has now helped to set up three plants in South Africa, which are working all out on mining machinery. There are also plants working in Italy and Sweden. Negotiations are under way to set up derusting companies in the United States, Canada, Argentina, Australia, New Zealand, Belgium, India, Pakistan, Japan and Germany.



Girl holds samples of shells, one treated and the other untreated. A thousand can be processed daily

Labor costs are low—five men can operate a derusting plant, dipping by hand or with electric hoist





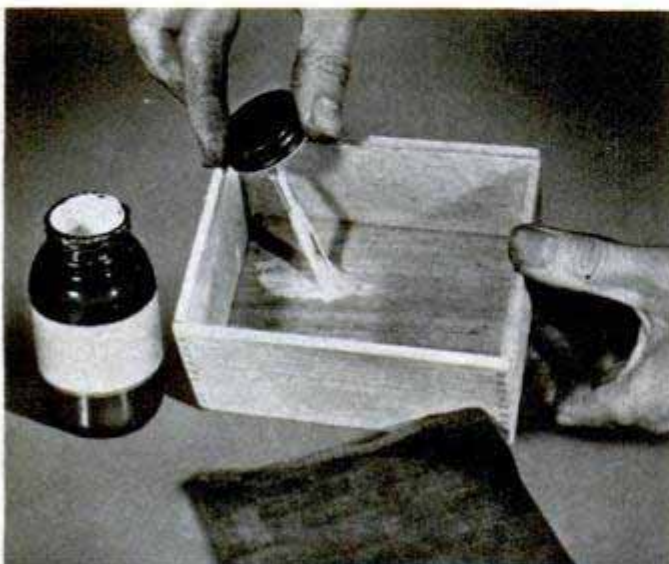
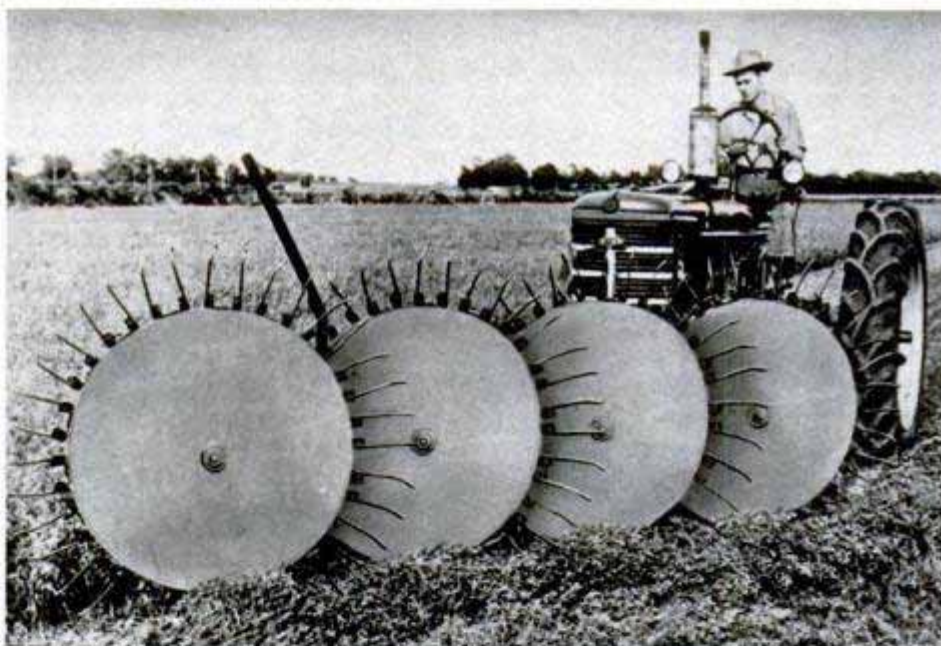
Dustless House

Dust just can't find its way into a new all-metal house built recently near Marion, N. C. Air-conditioning units filter all the dust from air entering the cornerless,

rounded rooms of the house. Built of aluminum alloy, the shiny abode has curved plastic windows which fit the contour of the rooms. The home is said to have floor space equivalent to an average five-room house of conventional lines.

Wheel Rakes

Farmers can mow and rake forage crops simultaneously with a new tractor attachment. Rake-wheels push the cut grain out of the way to the left of the tractor wheels, while on the right side the mower is cutting the next swath. With each wheel individually mounted, the unit adapts itself to uneven ground. The wheels are mounted diagonally and covered to shield the crop from the wind during the raking operation.



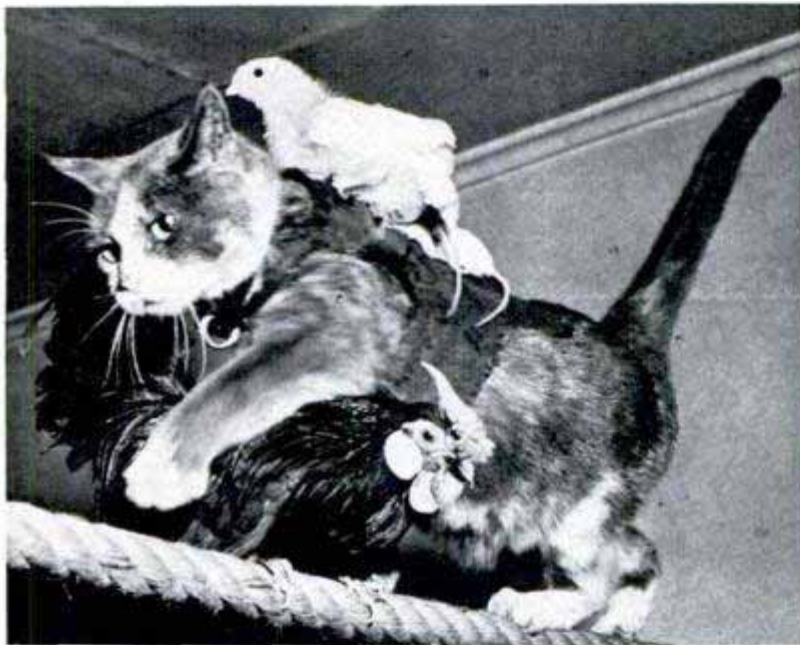
Cement for Fabric

Especially suitable for fastening two or more thicknesses of cloth together, a new nonflammable cement is useful in making women's hats and lining boxes with velvet and other fabrics. It is also used for attaching foil and cementing wood, paper and cardboard.

Sources of available products described in this issue are listed on pages 12, 14 and 16. Sources of further information on other articles are listed in the WHERE-TO-FIND-IT LIST, which is available to readers without charge simply by writing the Bureau of Information, *Popular Mechanics Magazine*, 200 East Ontario Street, Chicago 11, Illinois

Seven-Foot Arm On Jeep Lays Wire

By rigging a Jeep with a collapsible radio antenna, Capt. Francis J. Carr of Dallas, Tex., has produced a vehicle that lays communication wire in Korea at high speeds. The wire runs from a spool up in eyelets on the seven-foot mast and off the tip. The mast is built at an angle so the wire will unreel well to the side of the road. The Jeep also is equipped with a field telephone so the wire-laying crew can remain in constant contact with its headquarters.



Fisherman and His Pets

Most fishermen have a hobby of some kind and Henry Larsen, lobsterman of Freeport, N. Y., is no exception. He likes to train pets of all kinds. He hasn't yet discovered a way to train the lobster, but he has worked out a tightrope routine starring Sonja, his cat. Sonja gracefully trips across the rope carrying two white mice and a small chicken on her back. To make the act a little more exciting, Julius, a bantam rooster and another of Larsen's pets, perches unconcernedly on the rope, forcing the cat to step over him as she carries her passengers along the rope.

Battery-Powered Baseball Scoreboard

Mounted on rubber-tired wheels so it can be rolled off the field when the game is over, a compact scoreboard shows balls, strikes, hits and errors with colored lights. Current for the lights is provided by battery, the lights being sealed-beam auto headlights. Folded, the board occupies very little space and can be stored easily. When opened, it is 10 feet long and 6 feet high. It is designed for use in parks without a permanent scoreboard.





American Way of Life Photo Contest

7th Prize: "Pied Piper"
Bill Peery, Denver, Colo.

Last month, *Popular Mechanics* printed the top 14 winners in the American Way of Life Photo Contest. This month we present the remaining 18 winners. Seventh and eighth prizes are \$100 each; honorable mention awards are \$25 each.



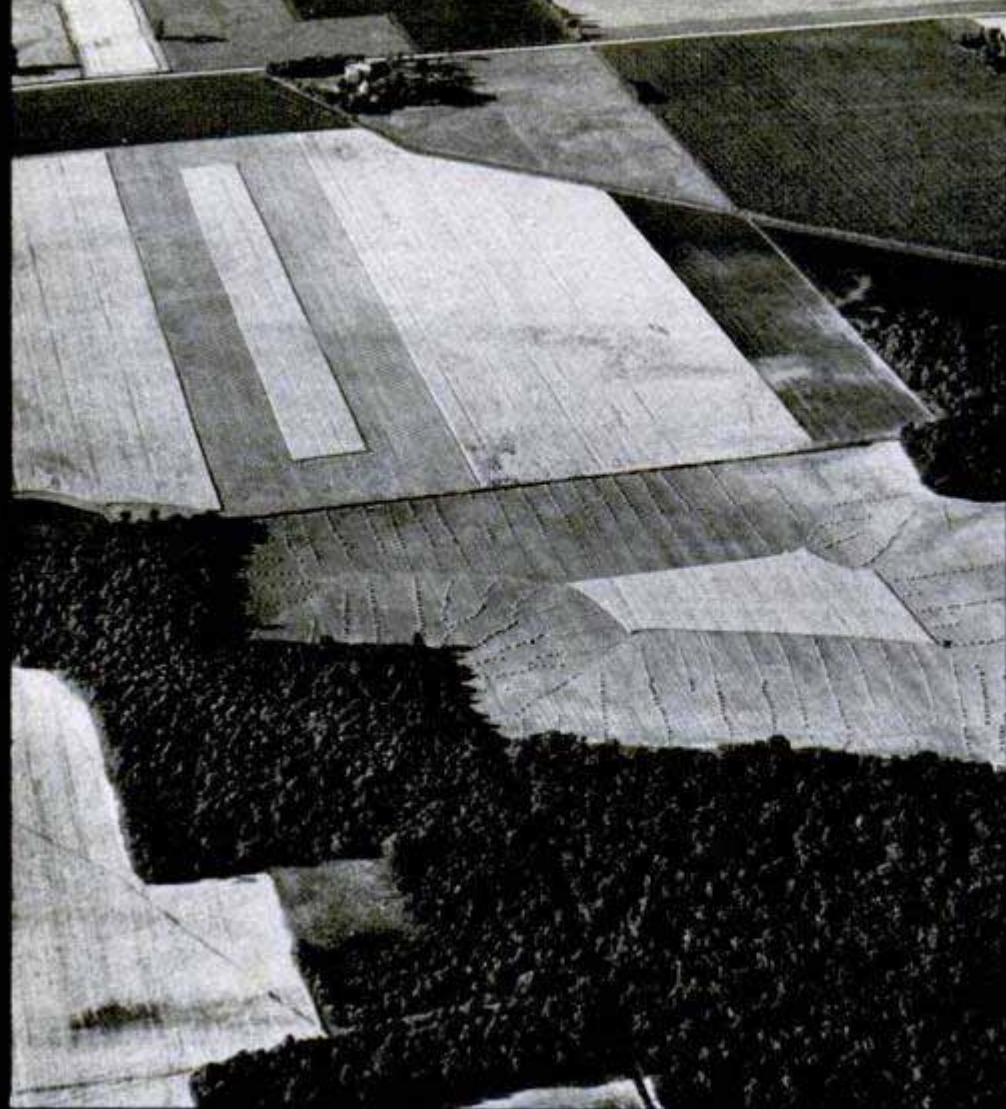
Honorable Mention:
"Main Street"
Carl Robert Mesterton,
Rye, N. Y.

Honorable Mention:
"Circus Day"
Howard Riome,
Toronto, Can.



8th Prize:
"Sunday Afternoon: U.S.A."
K. F. Kunkel, New York City





Honorable Mention:
"Land of Plenty"
G. L. Osmanson,
Morris, Ill.

Honorable Mention:
"Come On In"
John Gajda,
Detroit, Mich.





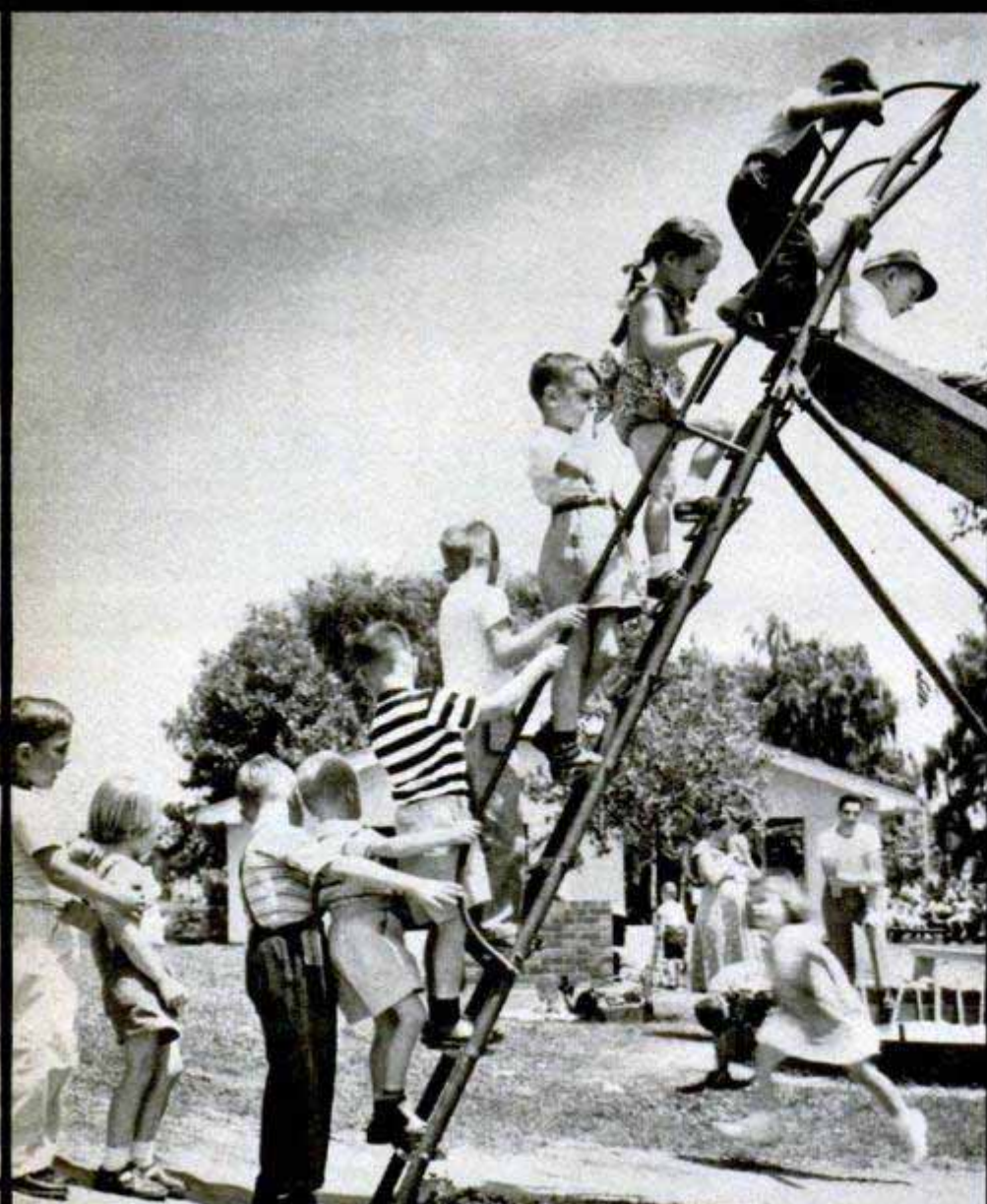
Honorable Mention: "Teddy Bear, Teddy Bear, Touch the Ground!"
Roger Baele, South Bend, Ind.

Honorable Mention: "White Water and Black Shadows"
Vincent Mandese, Santa Barbara, Calif.





Honorable Mention:
"School Days"
Janet Konkle,
Grand Rapids, Mich.



Honorable Mention:
"Wait for Me!"
Charles S. Rice,
New Holland, Pa.

Honorable Mention:
"Lunch-Hour Engineers"
Alvin M. Radin,
Yellow Springs, Ohio



Honorable Mention:
"Boys and Marbles"
Byron W. Campbell,
Watertown, Mass.

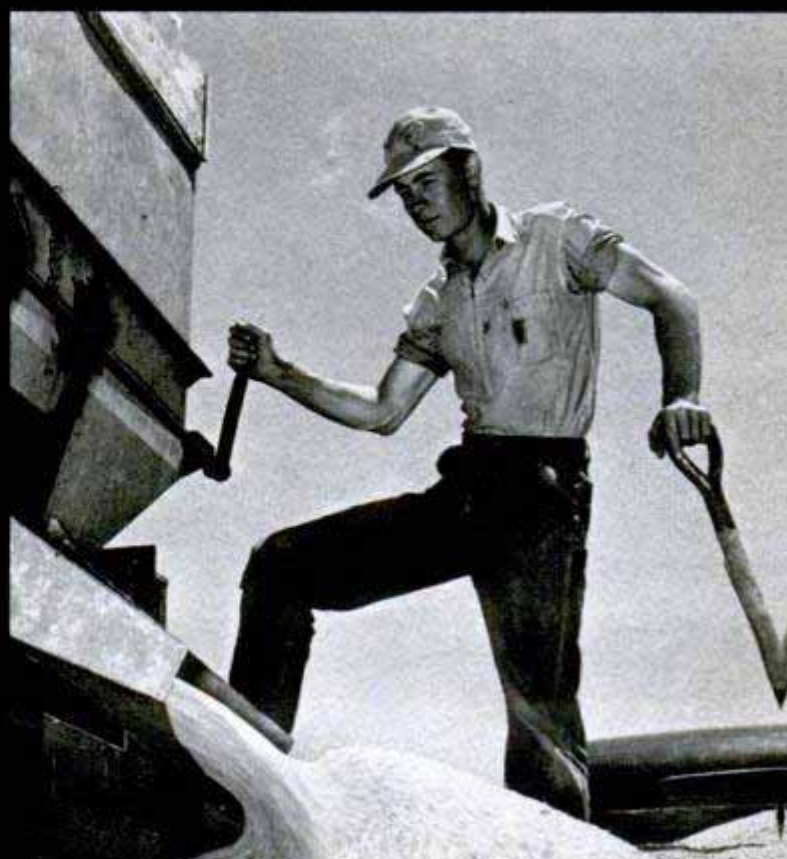
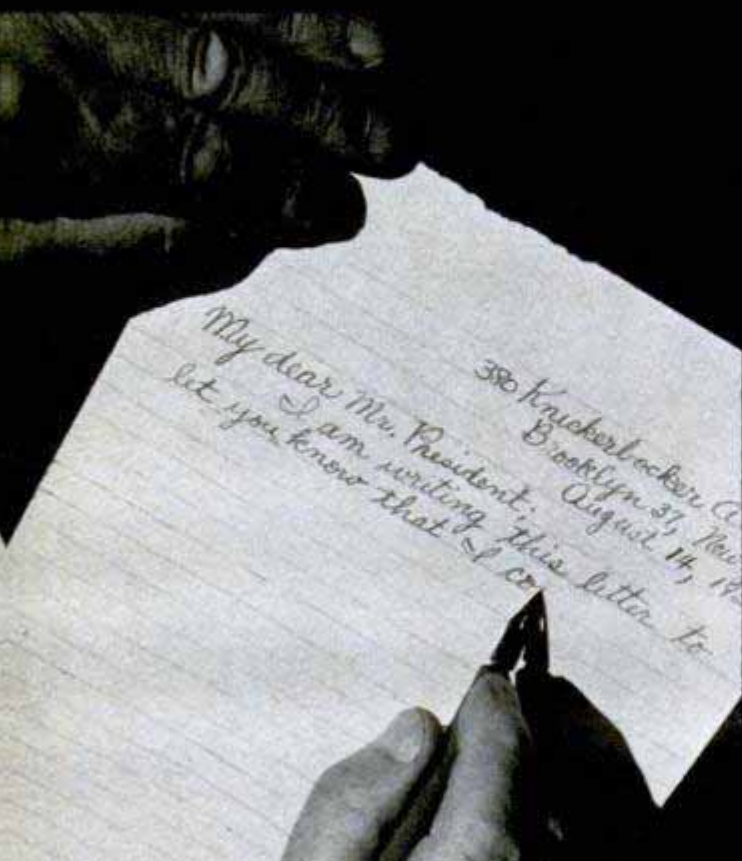




Honorable Mention:
"Youth"
Vivienne Lapham,
Norwalk, Calif.

Honorable Mention: "Dear Mr. President"
Percy J. Hussakof, Brooklyn, N. Y.

Honorable Mention: "River of Grain"
Bob Taylor, Cordell, Okla.



Honorable Mention:
"Family Album"
Sallie Sawyer Smith,
New York City

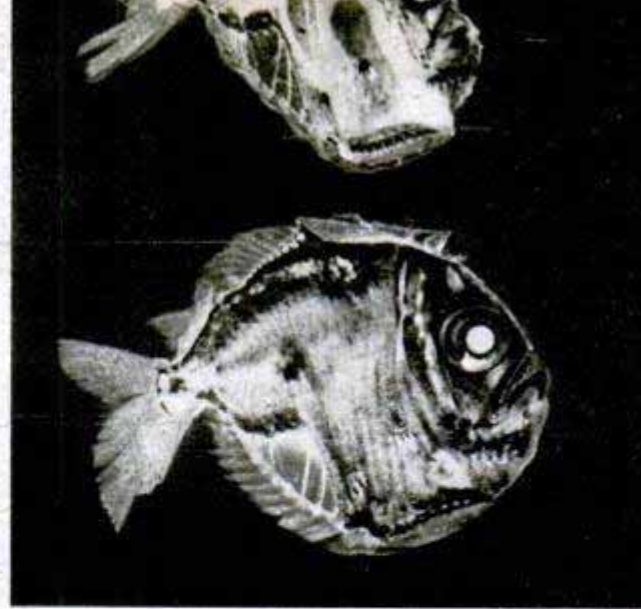


Honorable Mention:
"Supermarket"
George H. Padginton,
Buffalo, N. Y.



Honorable Mention:
"Reading Lesson"
Lil and Al Bloom,
Chicago



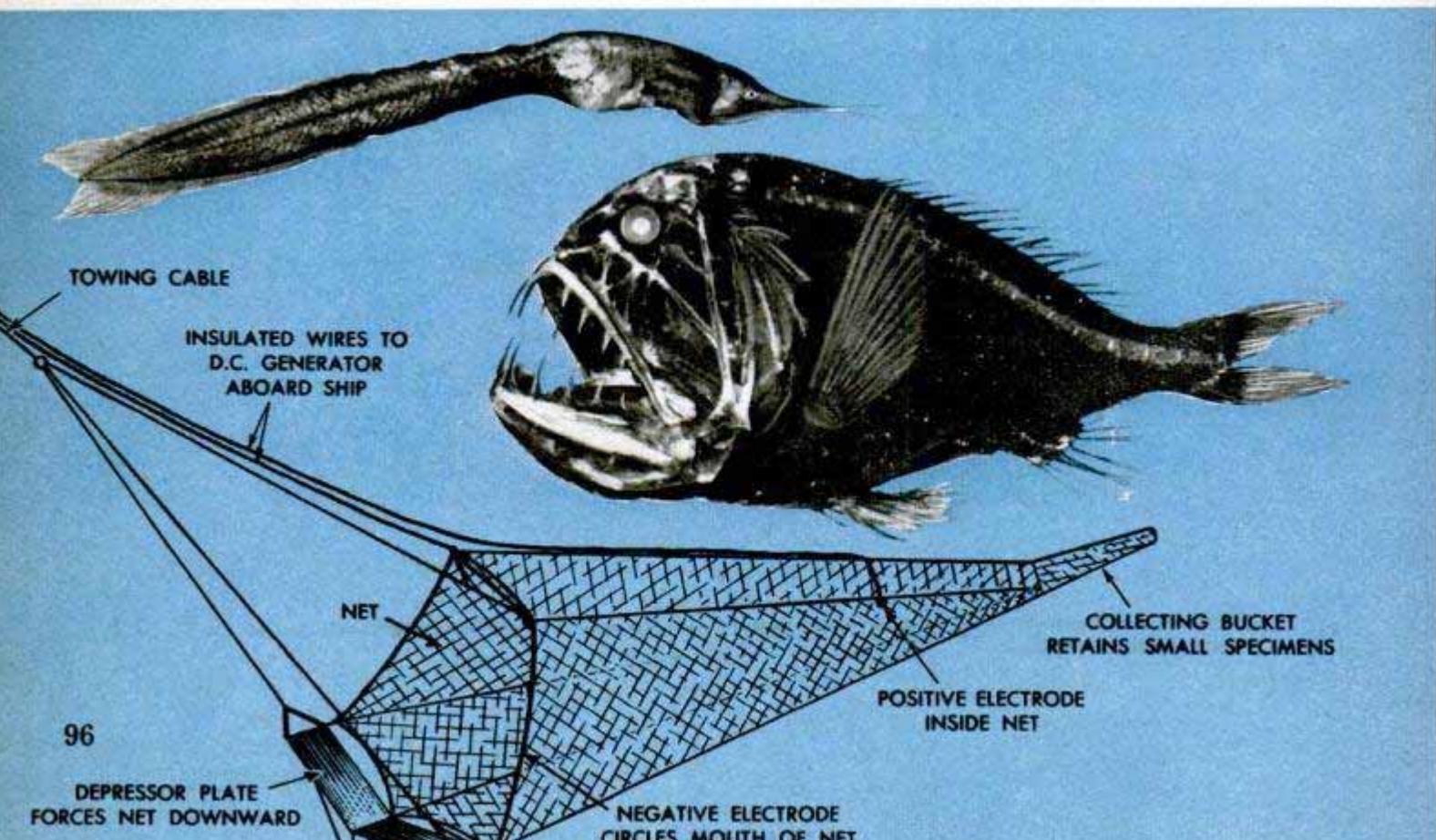


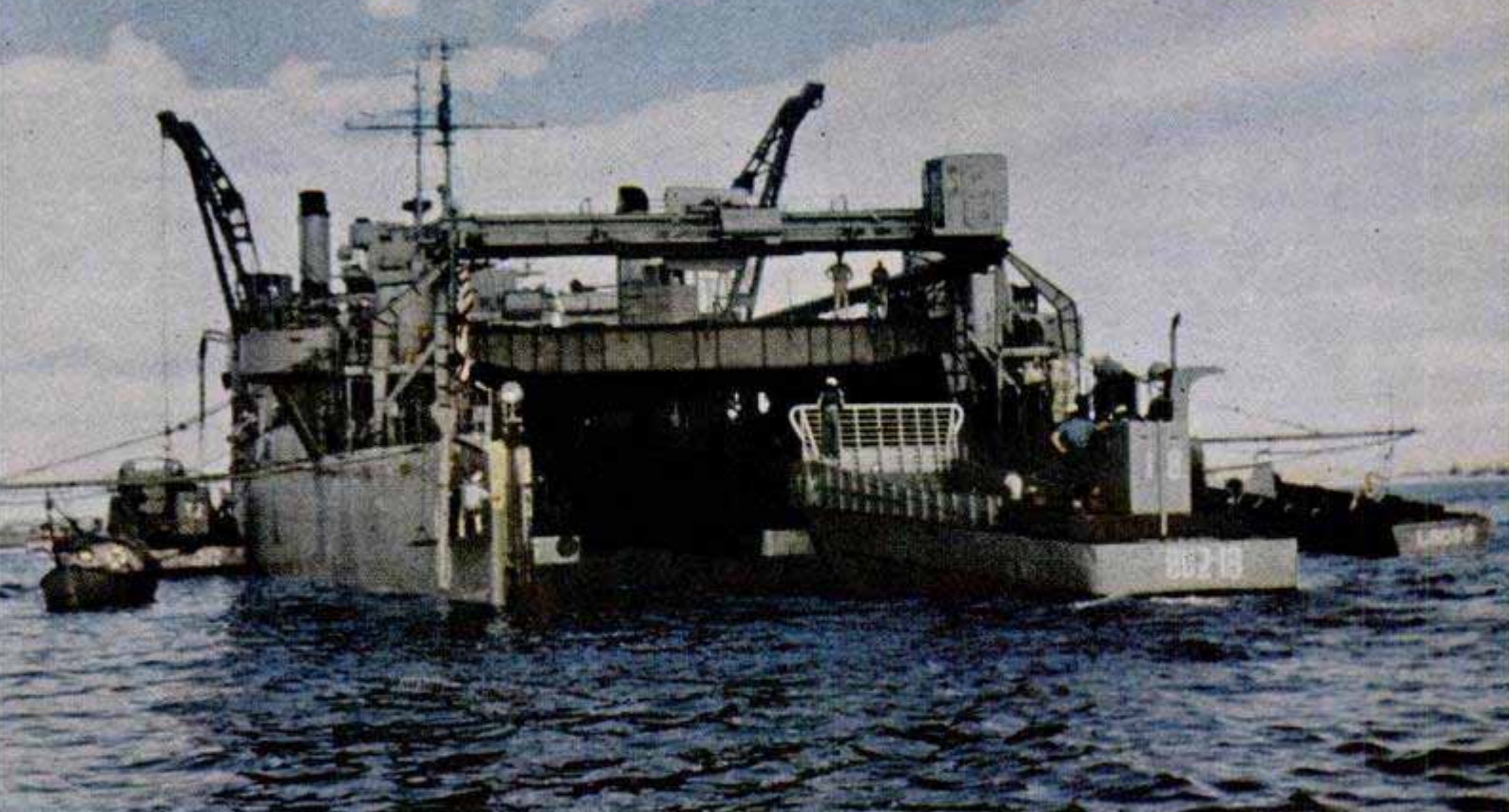
Net, or "trawl," hauled aboard from depths of the Pacific, snares such specimens as these hatchet fish

ELECTRIC FISHING

BY ELECTRIFYING their nets, oceanography experts expect to catch strange specimens of fish from the depths of the Pacific. Dr. Carl L. Hubbs of the Scripps Institution of Oceanography has designed a net with a depressor plate which forces the assembly downward. The net already has collected such weird specimens as fish with telescopic eyes, well-defined necks and extensible stomachs. It now will be electrified with surges of direct current. Experiments show that fish tend to move away from a negative pole and toward a positive pole. The negative pole will be at the net's mouth to prevent fish inside from escaping. In another study, the American Institute of Radiation is investigating the possibility of herding fish toward commercial nets with boats dragging electric cables.

Net soon will be electrified. Then it may yield even stranger fish than "bobtailed snipe eel" and "fangtooth"





While the USS *Lindenwald*, LSD-6, squats low in the water, baby minesweeper enters cavernous docking well

MOTHER of the MINESWEEPERS

By Richard F. Dempewolff

CAUTIOUSLY, the long hull of the minesweeper USS *Pirate* nosed into unswept waters along the approaches to Wonsan Harbor, Korea, on a bleak October day in 1950. Most of her crew, bearded for protection against the icy spray, lined the rails ready to stream sweeping gear. "Vikings of the modern Navy," they call these rugged men who flirt with sudden death during every instant of operation in mine-infested waters.

Behind the *Pirate* streamed a column of ships, each ship relying on her splinter of a leader to clear a track through the explosive waters. The *Pirate* threaded her way nicely, but there's a limit to the dexterity of 180 feet of steel ship in a hazardous harbor inlet.

Suddenly the lookout yelled, "Shallow mine close aboard starboard bow!" With a lurch, the ship heeled into a hard left turn—one split second too late. With a dull

After its day's job of clearing away deadly mines, a formation of LCMs returns to the waiting mother ship

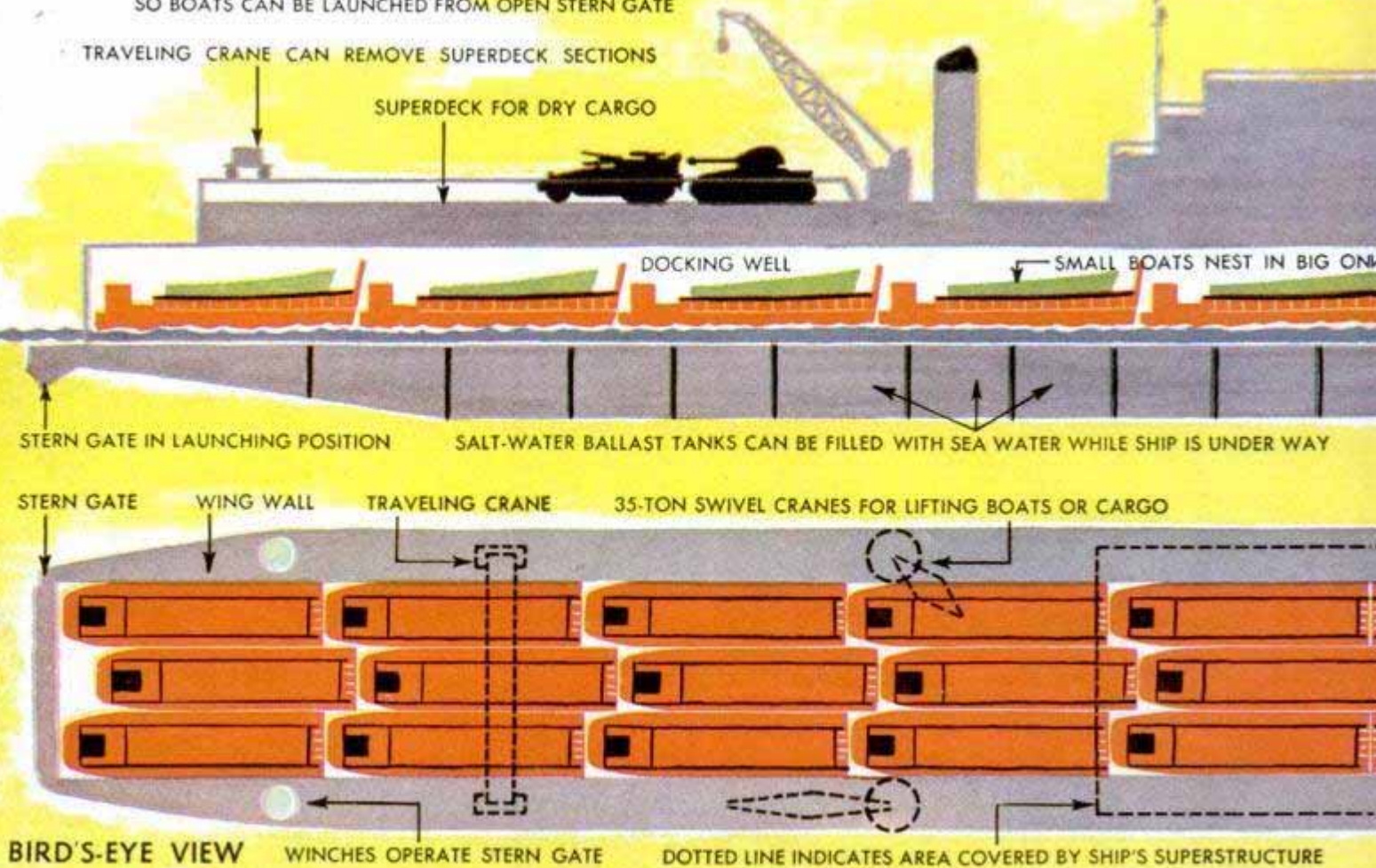




Small craft edge their way into the mother ship; the superdeck is made of removable sections of steel grating

LSD (LANDING SHIP DOCK)

DIAGRAM SHOWS LSD IN BALLAST WITH "DOCKING WELL" BELOW SEA LEVEL SO BOATS CAN BE LAUNCHED FROM OPEN STERN GATE



roar, water and flying steel sprayed skyward. Heavy gear skidded across the bouncing deck; mangled men fell, screaming. The captain, thrown against the bridge bulkhead, fell unconscious. Within four minutes, the *Pirate* disappeared in a whirlpool of bubbles and oil.

Shore batteries opened up as rescue boats set out from the other ships to pick up survivors. In the confusion another sweeper, the *Pledge*, struck a mine and went down. Total score: Six missing, 43 injured.

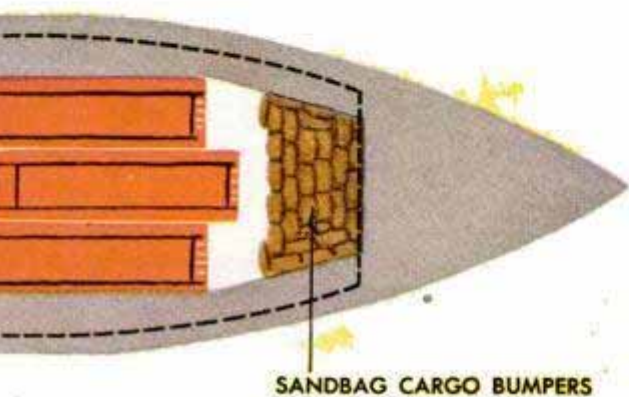
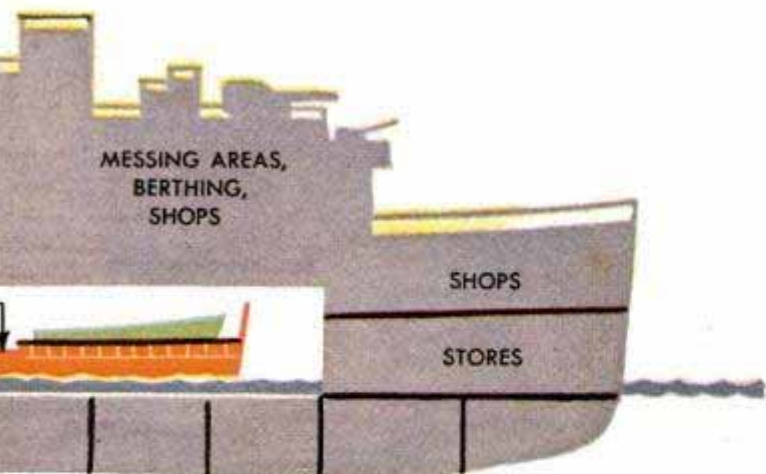
Minesweeping in any water is a tough business. But in confined areas, modern sweepers have a really grim time of it. Ideally, small minesweeping boats might clear a path for bigger sweepers to follow. But small boats can't keep up with a minesweeper convoy making its way from harbor to harbor. Until now, the advantage has been on the side of the minelayers.

In recent months, however, North Korean lookouts, posted by the Reds to count the U.N. ships blowing up in their freshly mined shallow harbors, have been seeing something that probably made their eyes pop.

Out of the fog it comes—a monster ship of war with a blunt, tubby bow, a massive bridge house, and weird lines that slope away to a squared-off stern that looks as

After launching from mother ship, LCM comes around to side where a swivel crane lifts out the smaller LCVP which was nested inside it in the docking well

The diagram shows how the *Lindenwald* accommodates 18 LCMs with an additional 18 LCVPs nested inside them. It takes only about 10 minutes for launching

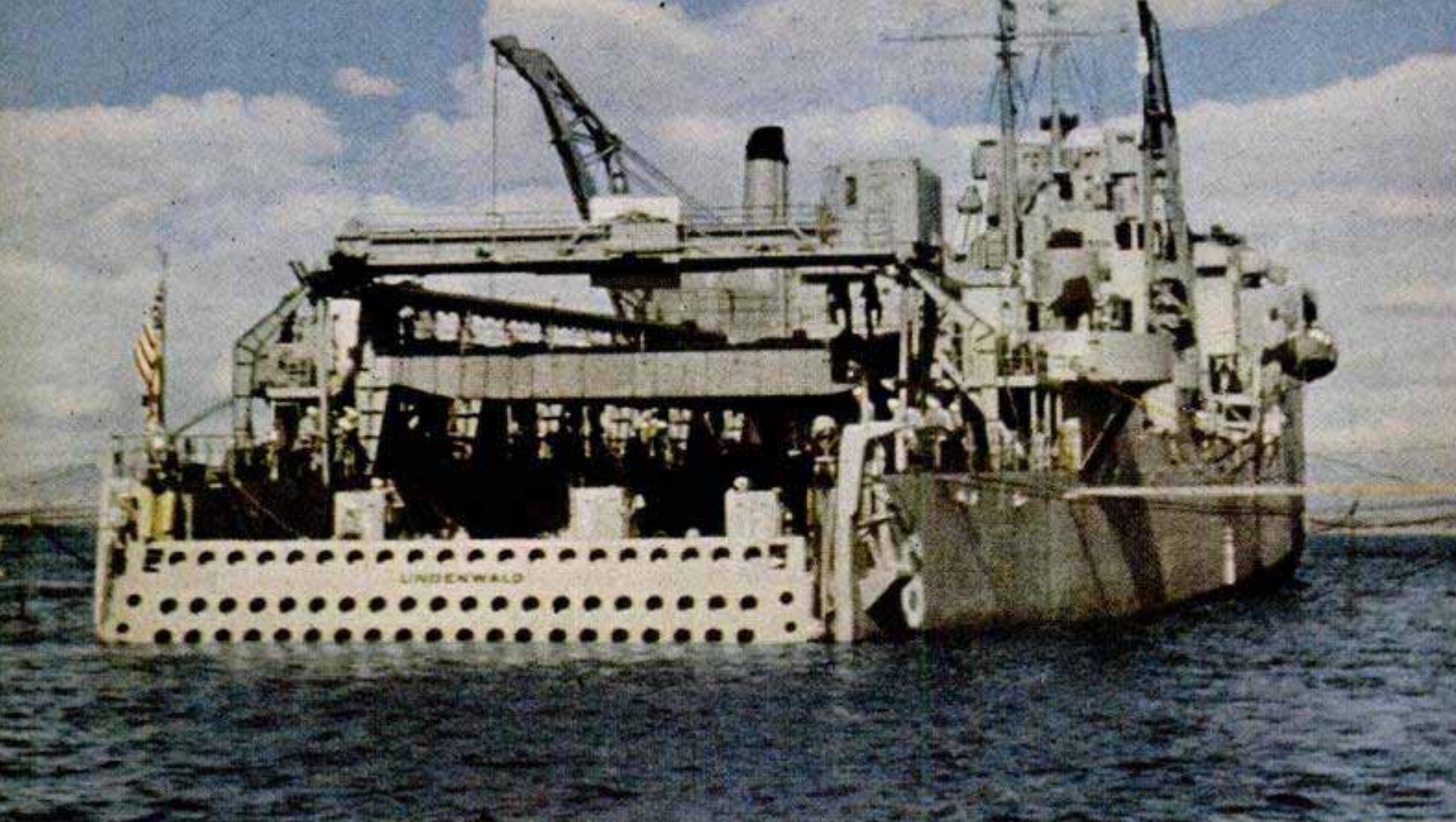


though it were for a gigantic rowboat. Outside the mined harbor channel it stops and slowly squats down in the water like a hen covering her brood, until its hull is half submerged. The flat stern folds downward into the sea, revealing the flooded bowels of the ship.

There's a roar of revving motors. A haze of blue exhaust smoke rises over the superstructure. And through the yawning maw where the stern used to be, pours a whole navy of baby minesweepers—LCMs and LCVPs—all fitted out with special minesweeping gear. As they emerge, they break off into groups, circling behind the mother ship until all are out. They form into echelons, stream their gear and sweep through the harbor—clearing a path for bigger minesweepers that may follow later, or sweeping out shallow areas which no standard destroyer-sized minesweeper could ever reach.

Job done, the baby sweepers stream back to the waiting mother ship, enter the open stern singly or in pairs, until all are safely tucked away in the massive belly. The stern gate closes up behind them, and the big ship steams away to the next harbor, slowly rising out of the sea as heavy pumps suck the water from her ballast tanks, raising the





With 18 LCMs packed in its "docking well," the 45-foot-wide stern gate is closed as ship prepares to move on

level of her "docking well" so that the squadron of minesweeping boats inside her belly is soon riding high and dry.

Though little publicized, this fantastic combination ship-submarine and seagoing garage first made her appearance in World War II. Dubbed LSD (for Landing Ship Dock) by its Navy designers, her function was to carry and launch landing craft with the Pacific task forces. But it wasn't long before she was being used for everything else under the sun. Her ability to squat down in the sea and take aboard small boats and ships, made her an ideal dry-dock repair ship. Her huge docking well could carry tremendous cargoes of invasion

equipment. Since the war, she has taken on a host of new chores—minesweeping among them.

The Korean minesweeping stunt of the USS *Comstock*, LSD-12, and her brood of little converted LCM and LCVP sweepers, has been so successful that the Navy today is building specially designed "pickaback" minesweepers, which will be carried by several mother ships like the *Comstock*. Task forces previously hampered by having to move slowly so regular minesweepers could keep up with them, now will be able to steam full tilt. The sweepers will be tucked in the docking well of a fast LSD accompanying the convoy, ready to be

Side view of the mother ship, USS *Lindenwald*, moving on to new location after sweeping job in harbor



turned loose on the spot when they're needed to clear a path for the force.

Today some half dozen of the strange-looking mother ships ride the seas with our Navy. Recently one of them, the USS *Lindenwald*, LSD-6, under the command of Capt. Leland Shaffer, went through its paces for *Popular Mechanics* in the Windward Passage, just outside Guantanamo Bay, Cuba. The first thing you learn from Captain Shaffer is that LSDs are named for famous homes. "Lindenwald" was the estate of Martin Van Buren in Kinderhook, N. Y.

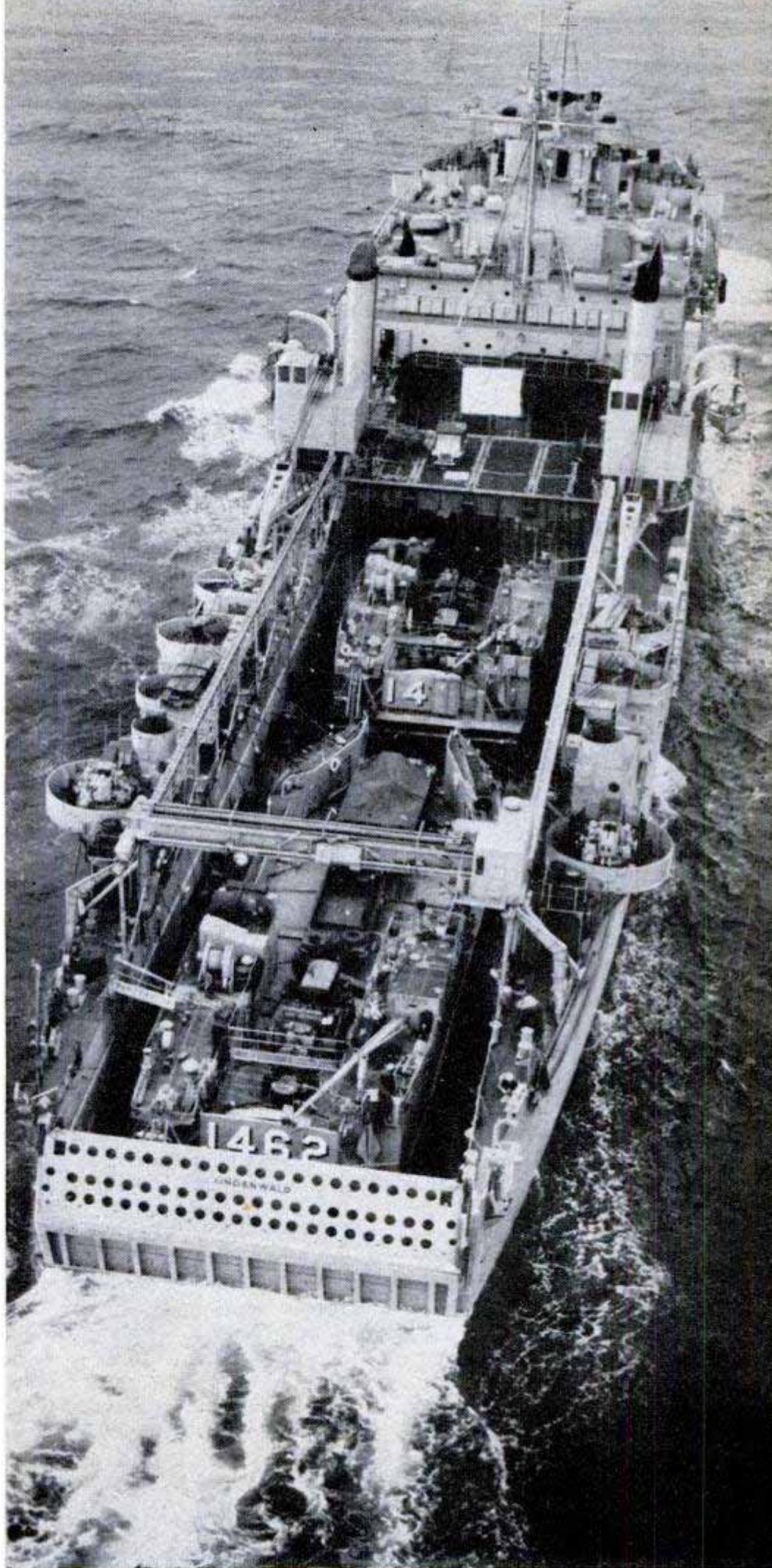
Like her sisters, the *Lindenwald* looks like something the Navy Yard forgot to complete—a tremendous shell of a hull, with a yawning cavity 396 feet long and 44 feet wide tunneling from the stern clear up under the bridge to the bow.

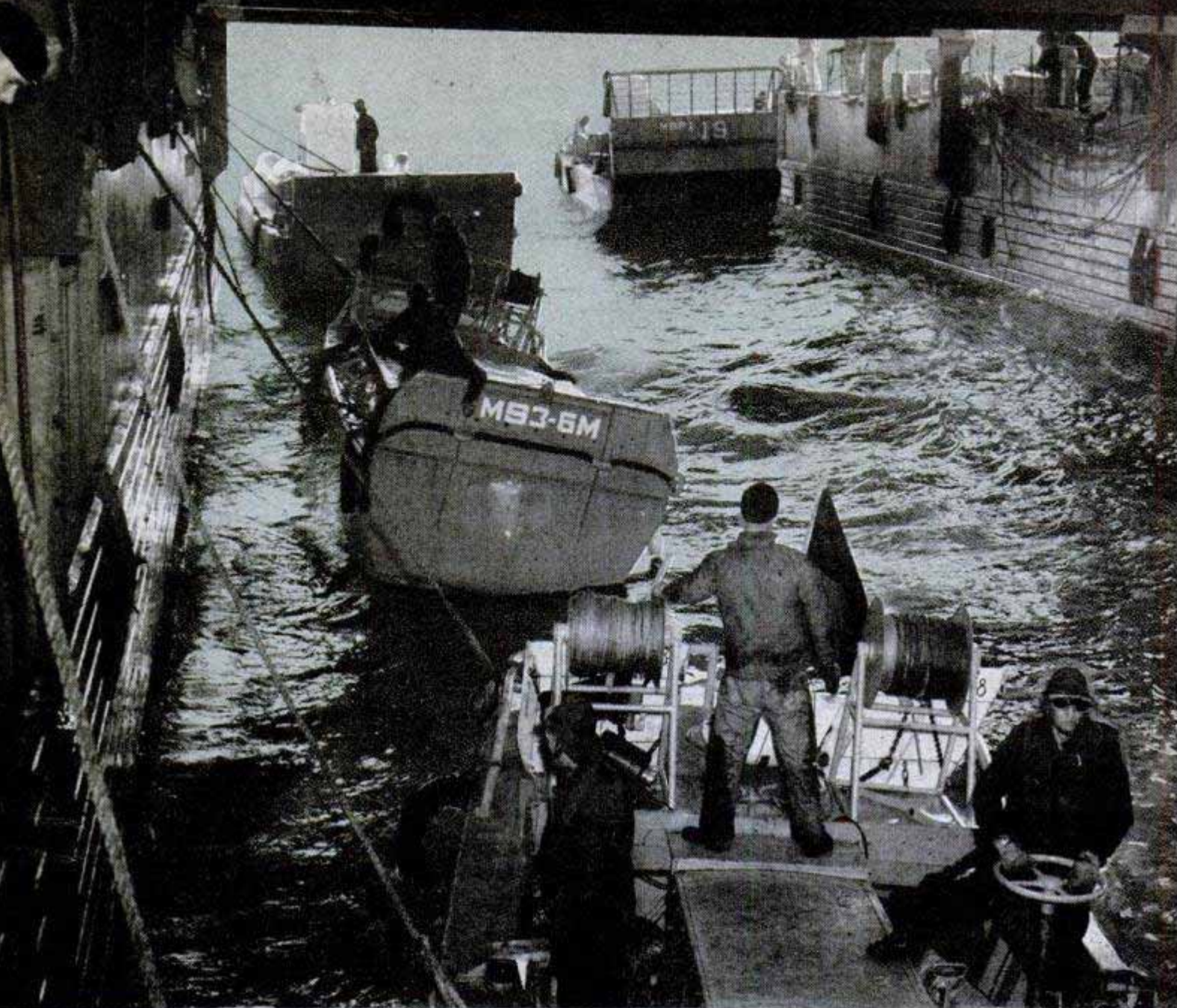
This vast docking well is only 60 feet short of the entire length of the ship. In it will fit 27 little LCVPs, or 18 LCMs six deep and three abreast—each with a smaller LCVP nested inside it.

"We've floated three LSUs in here," says Captain Shaffer, "and have taken aboard an LSM on several occasions. We even floated a destroyer escort in and dry-docked her off Korea during the last war. Anything narrow enough to squeeze through the stern gate can come aboard."

Captain Shaffer revels in the fantastic things his ship has done. The monstrous boom of the biggest crane in the world was trundled over from Germany. "We just tucked it

Aerial view shows the *Lindenwald* under way with open well for small minesweepers packed with boats and equipment for servicing them while en route





Back from minesweeping operation, small craft enter docking well while men scramble to make lines fast

in our docking well," says Shaffer, "and had room left for a few other things." He tells about lugging a self-propelled gun to Aberdeen, Md., for the Army. "No other ship afloat could take it," he says. "It was so big they had to clear roads and dismantle bridges to get it to the ship."

Besides her tremendous docking well, the *Lindenwald* sports a superdeck of steel grating that bridges the top of her cavernous interior. On this goes 350 tons worth of invasion cargo of all kinds—tanks, cars, trucks, DUWKs, 66 amphibious tanks or other amphibious vehicles. "The superdeck comes in six-ton sections," Shaffer explains, "and that six-ton traveling bridge crane you see, riding tracks along the top of the wing walls, lifts the sections off and carries them to the 25-ton swivel cranes amidship, where we lift them overboard when we don't need them."

It takes 330 men and 18 officers to man the *Lindenwald*, and they're all busy when her snubby bow turns toward the harbor channel and heads for a mission under the smooth heat of her big 7000-horsepower reciprocating engines at 16 knots.

Though operations look simple, they're extremely complex. "It takes an hour and a half to ballast her down until there's enough water in the docking well to float the small craft," explains the skipper. "So we start while we're still underway."

As the ship plows along, you can see preparations being made. Men with telephone gear stand at six different stations around the ship to report ballasting progress. Each phone connects with the ballast-control center—a tiny shelter on the starboard-wing wall, lined with huge panels of wavering dial needles reminiscent of the control room in a submarine. The trembling deck



Top right, an LSU swings her blunt nose in through open stern gate of mother ship. Just below, stern gate is partly opened when taking on ballast so sea can rush in; man standing on top deck "talks" boats in

underfoot tells you the big pumps are pulling sea water into the ship's 36 tanks, located along the keelson, under the wooden planked deck of the docking well.

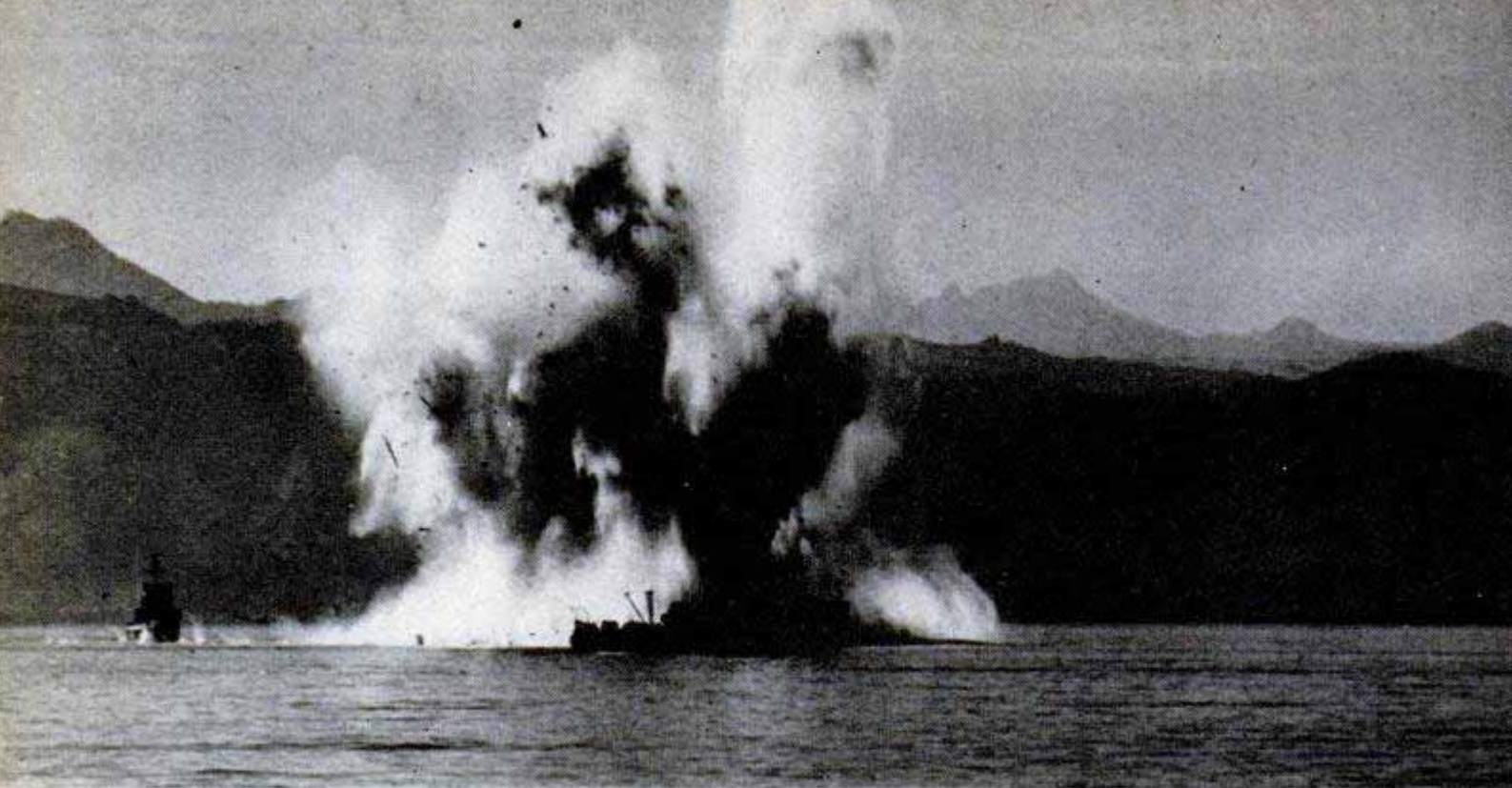
"We watch like hawks," says Shaffer, "to keep from having any half-full tanks with 'free surface'—where water can slosh around. If the ship is rolling in a heavy swell, free surface water will slosh steeper than the roll, and keep the roll going—an invitation to a capsizing."

The engineering officer on the wing wall orders the 45-foot steel stern gate open a crack, and the first sea spills in around its lower edges as the ship settles in the sea. Slowly, the well fills like a big bathtub. Before the destination is reached, 7000 tons of salt water will flood the docking well to a depth of six feet or more. Actually 3500 tons are enough to float the 40-foot LCMs

sitting snugly side by side, and they soon bob like corks, their steel sides screeching as they rub together in the swell. As the mine field is reached the *Lindenwald's* engines stop and she coasts into the wind.

Gears whir and down goes the gate, folding neatly in half, then doubling back under the stern. Boat engines roar. A blue, smoky, exhaust haze fills the docking well. Three at a time the sweepers emerge from the pungent fumes, through the open stern of the mother ship, and circle on the open blue water near by until all are out of the ship's belly.

At a signal from the pilot leader standing on the stern of his square, tubby boat, the tiny sweepers break off into stepped echelons of two to five boats each. Paravanes stream from each craft, carrying steel cable well out across the bow of the boat behind.



Big minesweeper blows up in Wonsan Harbor, Korea; baby minesweepers carried on mother ships reduce hazards

At intervals along these cables, steel hooks with knife-sharp inverted wedges will snag and cut the anchor lines of any moored mines in their path. As the freed mines bob to the surface, they are exploded by gunfire from the deck.

Thus, the sweeper echelons, overlapping each other, proceed around the bay, carving a cleared path for big sweepers to follow later, and clearing out shallow areas where, with their small draft, they can penetrate without danger of running aground.

Sweeping done, they head for the mother ship, which has been standing by with her stern gate open, ready to receive them. Again the boats form two circles off each quarter of the big ship's stern, revolving

like human "pinwheels" in an aquacade.

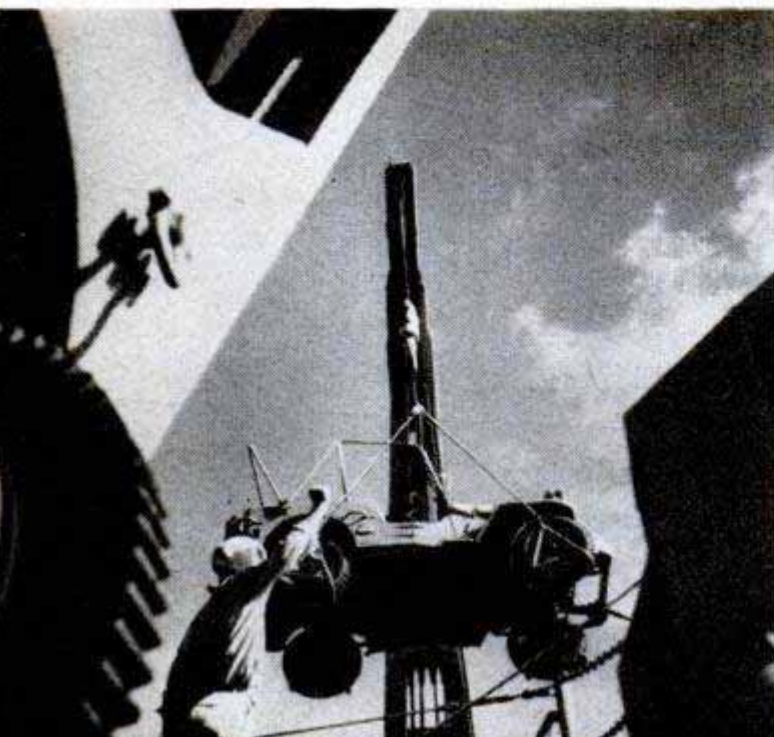
Up on the after end of the port-wing wall stands the docking officer, holding a power megaphone with which he calls signals. Like the LSO on an aircraft carrier, it's his responsibility to bring each of the boats aboard again safely. Only he "talks" them in, like this:

"Number six aboard center; seven and eight follow port and starboard," booms the big speaker.

In they come; the first LCM roaring right down the center of the mother ship right up to her bow. Two others follow, flanking it, until they are wedged in and secured. The loading proceeds, three at a time, until the last of the little craft have disappeared into the dark maw of the big ship. Then, the stern gate closes part way, to allow the ocean inside the *Lindenwald's* belly to seep back out where it belongs as the ship de-ballasts underway.

It's a pretty smooth operation in a calm sea. But when the mother ship is heaving and rolling in rough weather, it takes a highly skilled crew to handle bounding, five-ton landing craft. As they enter the heaving docking well, they whirl and spin, bashing the bulkheads and each other as the action of the confined sea water tosses them around like corks in a typhoon. In combat areas, to make matters worse, the boats must be backed in so they can be

(Continued to page 244)

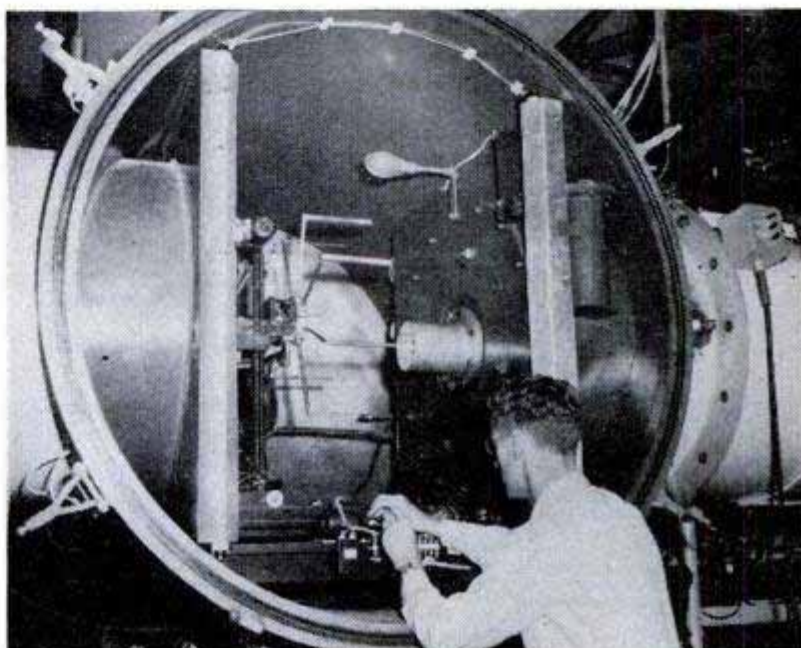
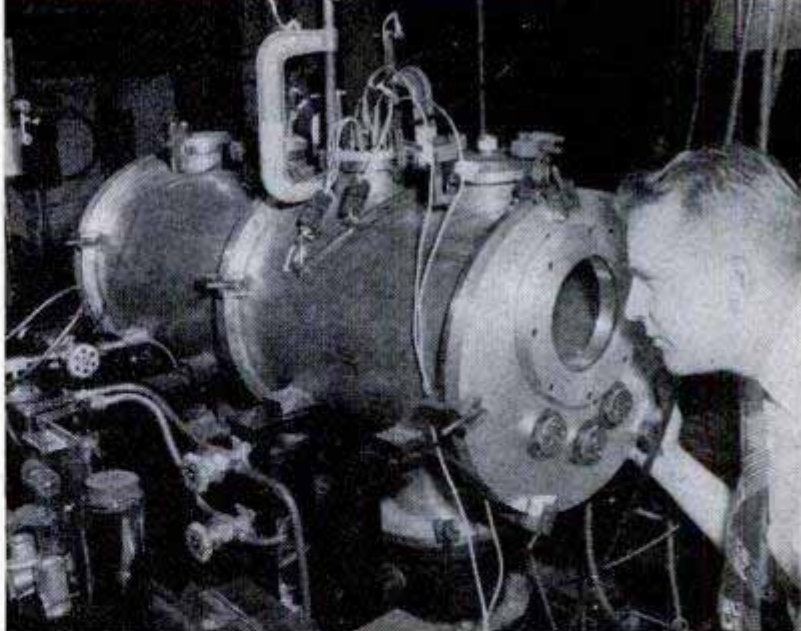


On removable superdecks, LSDs can carry 350 tons of cargo like tanks or trucks. Full load is 66 amphibious tanks for invasion. Here a Jeep is lifted on

Right, in this vacuum chamber models are tested under conditions like those at 200 miles above the earth. Below, low-density chamber for testing at 70-mile altitudes

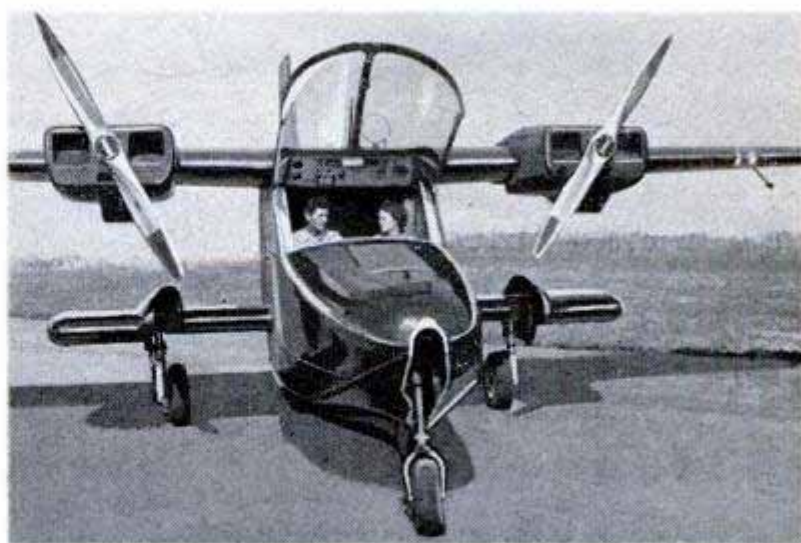
Windless "Wind Tunnel" For High-Altitude Tests

Simulating conditions in the region from 80 to 200 miles above the earth, a vacuum-chamber "wind tunnel" provides data for improving upper-atmosphere aircraft. University of California scientists developed the wind tunnel that has no wind. Instead, a beam of nitrogen molecules is hurled at supersonic speeds against a test plate. The molecules bounce from the plate in a diffuse pattern which is studied to discover ways of minimizing the turbulence. Another wind tunnel, designed to simulate conditions from 50 to 70 miles above the earth, requires a less complete vacuum than the 200-mile chamber. Shapes to be tested are mounted inside the tunnel and subjected to speeds up to 2.6 times that of sound. Ordinary methods of photographing shock waves won't work in the vacuum chambers because of the rarefied air. Therefore a screen charged with high-voltage electricity is placed in front of the test section to impart an orange-green glow to the air stream, making it visible to the eye and camera.



Metal Amphibian Has Plastic-Bonded Plywood Hull

Strategic materials have been spared by building the underwater part of the new Aqua II's hull of plastic-bonded plywood. The remainder of the amphibian is made of metal. Two 225-horsepower Lycoming engines give the six-place craft a top speed of 170 miles an hour. Its stalling speed is 55 miles an hour. To increase the plane's flying efficiency, the powerplant nacelles are formed as a forward extension of the wing. When the plane is used for evacuation missions, four litters, which are loaded through the top-hinged windshield, are put behind the pilot and copilot. The Aqua II's gross flying weight is 4650 pounds, and it has a range of nearly 500 miles. Its wingspan is 36½ feet. Its length is approximately 10 feet. In addition to the craft's



evacuation role, it has military possibilities as a light cargo carrier and for liaison and reconnaissance flights. Meredith C. Wardle of Wilmington, Del., is the designer.



Detroit Listening Post

By Siler Freeman

THE YEAR 1952 may go down as the year of the small car. Hudson has joined the parade of passenger-car manufacturers who are tying their destinies to a smaller, more compact and more economical, if not cheaper, car.

The field already contains Nash's Rambler, Kaiser-Frazer's Henry J and Willys-Overland's first passenger car since World War II days. Of these three only Willys' offering is over 100 inches in wheelbase. The nearest of the present so-called "small" cars is the Ford.

The current level of prices places this triumvirate of pioneers outside what could be called the low-priced field. Certainly, the "Big Three" smaller cars have been

getting farther and farther away from this designation.

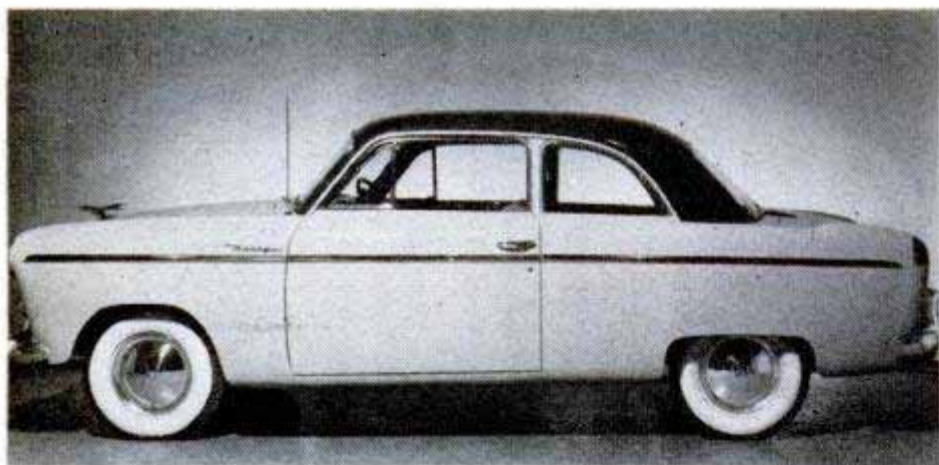
Hudson's addition will not be out until some time in the spring and it will follow the 1952 styling in design. It will feature the "step down" styling, combining body and frame, and will seat six average-sized passengers, according to Pres. A. E. Barit. In price, he said it would be "several hundred dollars" lower than any present model. This would still not make it low-priced.

According to Barit's outline of Hudson's planning, the car will have both power and economy. This is the challenge of the independents. Already the Rambler and Henry J have made a niche for themselves in the present market because of high mileage per gallon.

Rambler sales this year should total more than 60,000 units. Henry Js accounted for 50,000 of Kaiser-Frazer's 1951 output. Willys has a late start on its product and will not be able to show any share of the market for a while. However, the looks and comfort plus economy of operation should draw buyers in the restricted market.

Hudson has been working on its light car for several years. It pushed production this year for two reasons: First, it could stretch out its allotment of steel by putting it into this car rather than the larger models. Second, it cannot afford to buck the medium-priced market this year. Dealers have been asking for something less costly to offer their customers.

The struggle will be an interesting one. It is a chance for the independents to get a segment of the market which the Big



Willys "Aero Wing" two-door sedan, designed for outstanding gasoline and maintenance economy, has a high-compression, six-cylinder engine



Powered by an improved 119-horsepower "Spitfire" engine, '52 Chrysler Windsor club coupe, above, is available with Hydraguide power steering

Three has so far decided to stay away from. Public acceptance will be watched carefully. Light-car programs are costly to undertake, but experimental work may be resumed and put in high gear at any sign that the market prefers lighter cars.

The 1952 models show a trend toward the use of stainless steel. It appears manufacturers have located a good supply of the metal and they are using it liberally in preference to the thin chrome. At any time, however, it may get scarce again and chrome will be back in the brightwork.

The increase in aluminum capacity, as illustrated by Kaiser's New Orleans plant that just went into production, is drawing the attention of the auto builders. General Motors' C. E. Wilson was on hand when the first pour of aluminum was made, and he was in a reflective mood in conferring with both Henry J. and Edgar F. Kaiser.

An automotive engineer recently estimated about 250 pounds of steel in the present car could be replaced with aluminum. Stampings and forgings of aluminum have been successful. Engine blocks of the light metal might be a distinct possibility in the future.

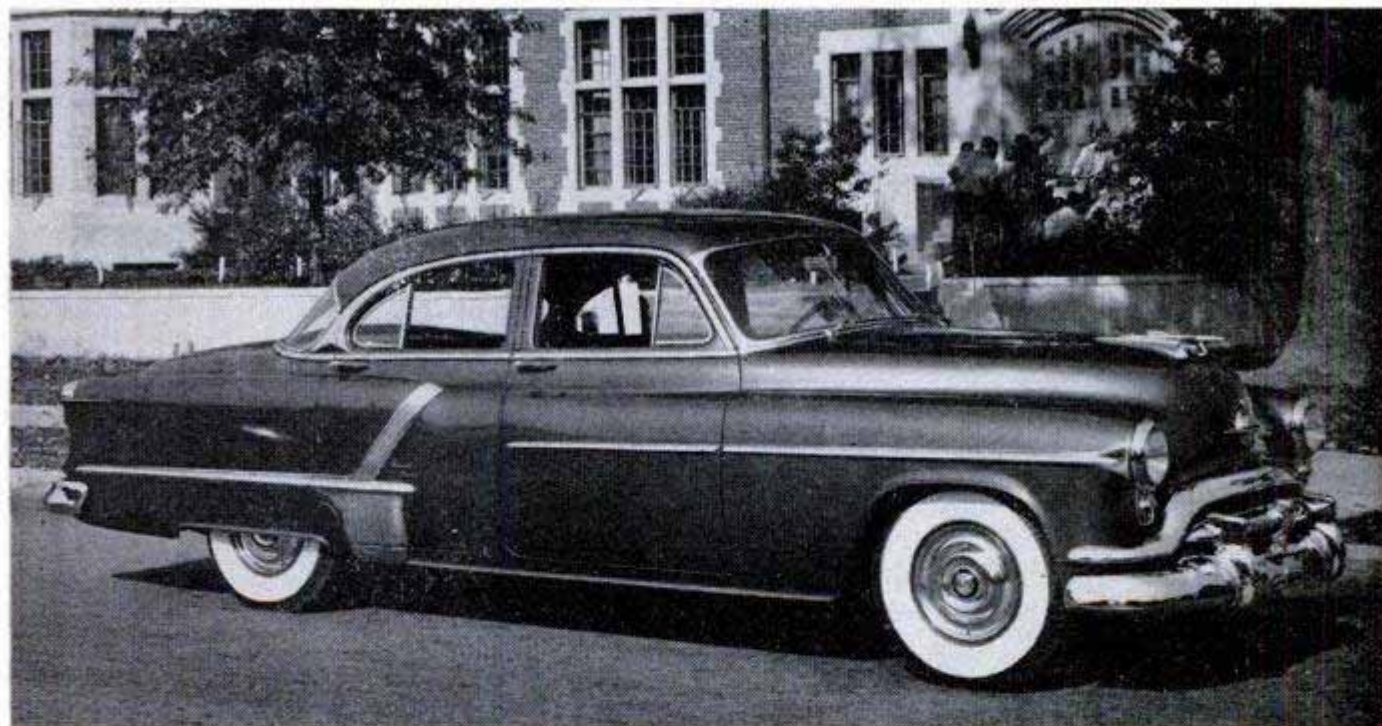


Sears' Allstate, with four or six-cylinder engine, is upholstered in plastic fabrics. Overdrive is optional equipment

Edgar Kaiser has been doing a lot of research and experimental work with aluminum. Price is still a big obstacle to widespread use after the defense program is satisfied. Rival for the postwar use of the aluminum capacity is the canning industry, which has plans to make tops and bottoms of cans from the light metal.

Like *Popular Mechanics*, Nash is celebrating its Golden Anniversary this year. The Rambler had two cars built in 1901 but these were experimental models. The first Rambler offered for sale came out in 1902 and was priced at \$750. During that year,

(Continued to page 270)



With Hydra-Matic Superdrive transmission, Olds 98 four-door sedan is available with G.M. hydraulic steering

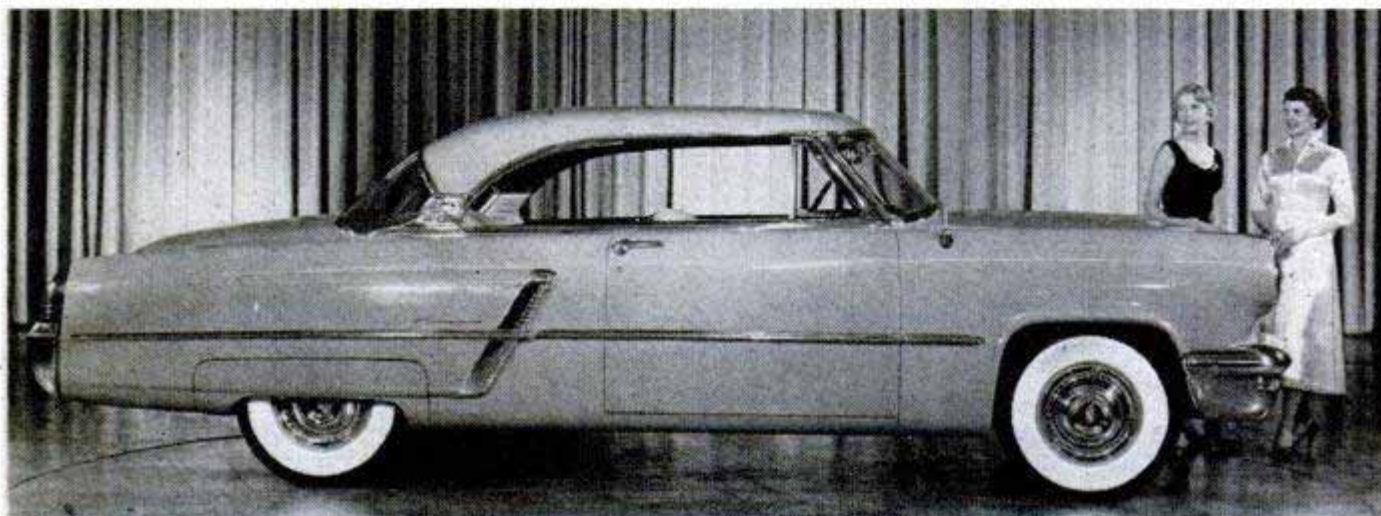
1952 Oldsmobile

Featuring a powerful 160-horsepower "Rocket" engine with high-performance, Quadri-Jet carburetor, the 1952 Oldsmobile 98 is longer and more luxurious. Extra-long-fender contours blend into the body

lines, and broadcloth upholstery in pastel shades adds beauty to Oldsmobile interiors. A new Hydra-Matic Superdrive transmission gives greater performance through a dual-driving range. Two other series offered by Oldsmobile for '52 are the Super 88 and the De Luxe 88.



Mercury's Monterey hardtop convertible, above, has wider windshield, lower hood and raised fender crowns. Following the same lines is Lincoln's Capri hardtop convertible, below, with new 160-horsepower V-8 engine



1952 Lincoln and Mercury

THE 1952 LINCOLN is featured by its new styling outwardly and its new 160-horsepower V-8 overhead-valve engine, the first in the Ford Motor Co. line. The Lincoln will come in only two models, the Cosmopolitan and the Capri, the latter being the luxury line. The Cosmopolitan offers a 124-inch wheelbase with an over-all length of 214 inches. It weighs slightly over 4000 pounds. It features a hardtop coupe and a custom four-door sedan. The Capri, on the same wheelbase, has a special custom hardtop coupe with leather-cloth combination trim, or all leather. The four-door sedan uses special fabrics to give it the lush feel. Lincoln's styling is new. It has a high, prominent fender line and low, flat hood contour. Double front-bumper bars give it a massive look. The car is eight inches shorter and one inch lower than the 1951 models, the wheelbase having been cut two inches. Rear legroom is increased three inches and the door height boosted. The chassis uses a frame with an I-beam type of X-member. Brake and clutch pedals are suspended from a bracket between the dash

and instrument panel, making Lincoln the first American car to use this feature. The front-wheel suspension employs ball joints and eliminates kingpin and spindle-support forging. Over-all-steering ratio is reduced from 29.7 to 26.1 to 1. The engine bore is larger than the stroke. It has five main bearings, balanced by eight integral counterweights. Its displacement is 317.5 cubic inches. Compression ratio is 7.5 to 1. It can operate on nonpremium fuels.

The Mercury follows the same basic styling of the Lincoln, with high fenders and low hood. Its wheelbase is 118 inches with an over-all of 202. The engine is the same as last year's but stepped up to 125 horsepower. Compression ratio is 7.2 to 1. The car is slightly lower, narrower and shorter. Headroom is improved. Fuel filler is concealed behind the license-plate holder, below the luggage-compartment lid. Two lines are offered, the Mercury and the Mercury Monterey. Five models are offered in the first and three in the second, with a hardtop coupe in each. The convertible comes only in the Monterey.

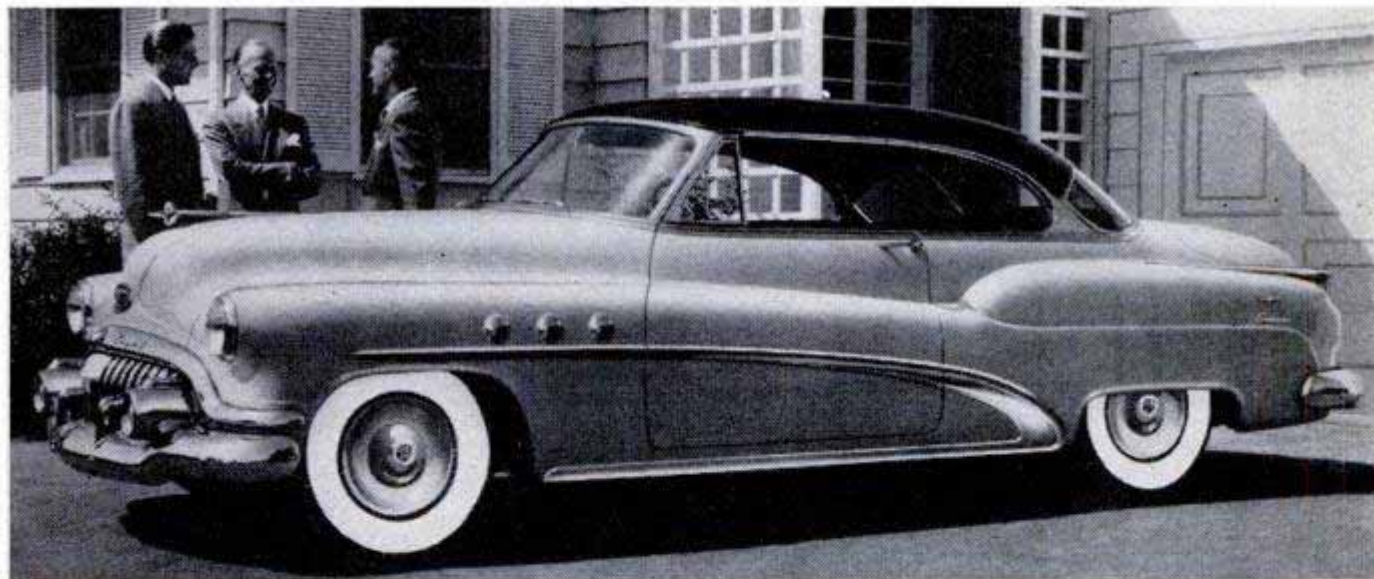


Two-door Styleline Chevrolet shows redesigned grille. Optional Powerglide models will have automatic choke

1952 Chevrolet

With new grille and ornamentation, '52 Chevrolets offer greater riding comfort through redesigned shock absorbers and

new three-point rubber engine mountings, engineered to reduce vibration in the passenger compartment. Powerglide models, optional in the De Luxe line, will be equipped with an automatic choke.




Buick's Super Riviera has bigger front-wheel brakes, more luggage space and shorter decorative sweeppear

1952 Buick

The 1952 Buick line will feature the Roadmaster, the most expensive member of the family. The engine has been stepped up to 170 horsepower and it has been fitted with a new type of carburetor and a power-steering device which, while not as delicate to the touch as Chrysler's Hydraguide, gives similar effect to ease of handling. The decorative spear has been shortened and

the rear lights changed. The grille has fewer members, but is claimed to be stronger. The new carburetor has boosted the engine compression from 7.2 to 7.5 to 1. Horsepower is up 18 from last year. The carburetor is claimed to give additional economy of operation, yet hold reserve power when needed. Interior fabrics have been made to fit the new outside colors. Exterior decorative trim is stainless steel instead of chrome.



Tiny enough to fit in the palm, this cheap electric motor may mean the end of the windup toy

MINIATURE REVOLUTION

By Leonard Engel

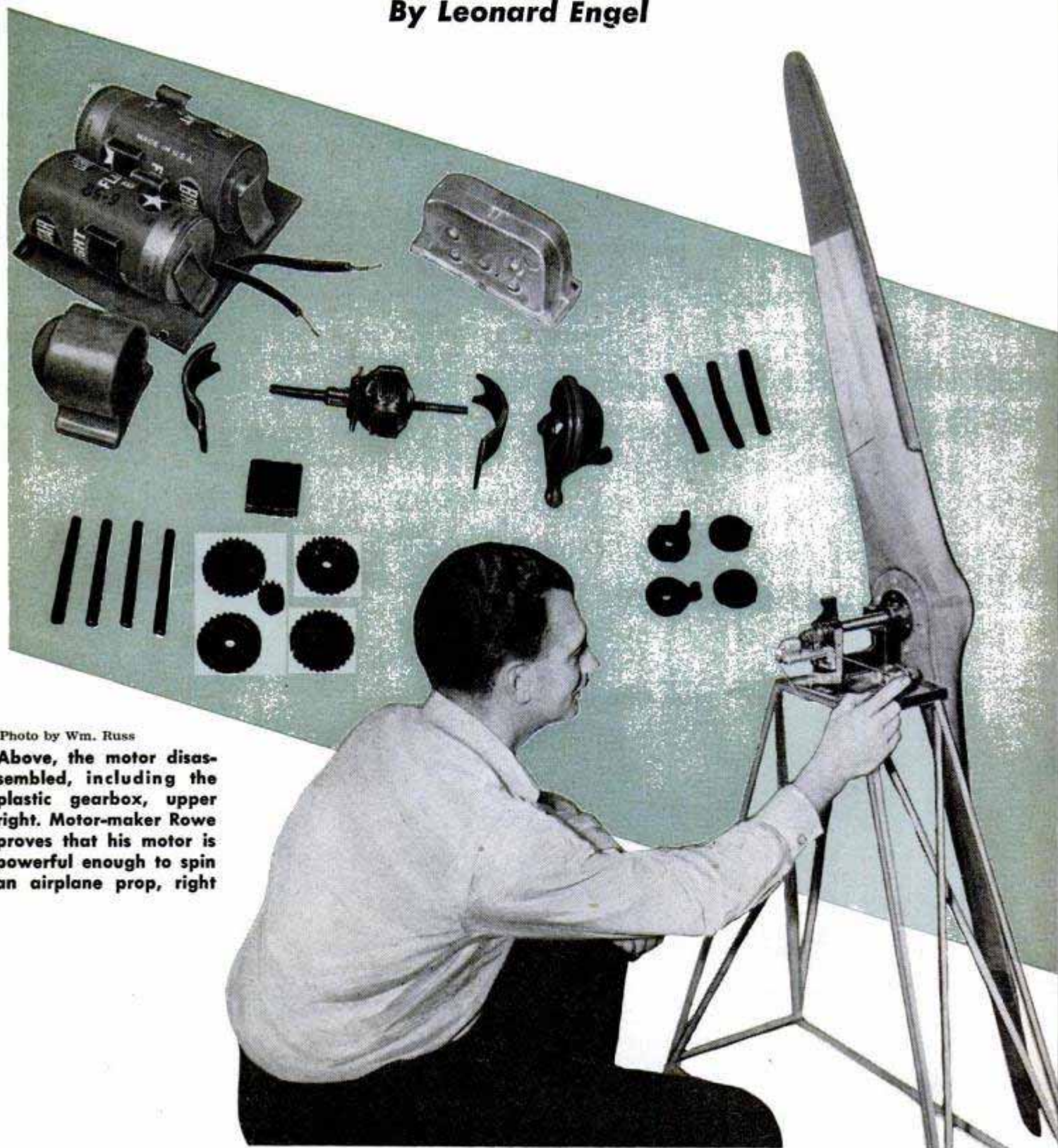


Photo by Wm. Russ

Above, the motor disassembled, including the plastic gearbox, upper right. Motor-maker Rowe proves that his motor is powerful enough to spin an airplane prop, right

THERE'S A REVOLUTION brewing in the toy world. Its cause is a tiny high-speed electric motor—a subminiature of big industrial motors—costing no more to make than any but the cheapest windup motor. Since an electric motor can do things the finest spring motor can't match, the days of the windup toy may be numbered.

The motor, about the size of a walnut, is completely shockproof as it runs on flashlight batteries. So it's safe enough for the smallest child.

Godfather of the electric midget is a tall, engaging Brooklyn-born lawyer turned engineer named Robert L. Rowe. Rowe has been turning the midget out at a rate of several thousand a week for more than a year in a small plant in Sag Harbor, the one-time whaling port at the far end of Long Island.

Rowe's motor is not limited to toy applications. It is also used in a low-cost electric drink mixer and will soon be seen in other inexpensive items. Military applications are likewise in the offing.

This mighty mite measures about one inch in each direction and weighs just over an ounce. Rowe rates it at "10 mouse-power," or, if you really want to be technical about it, .00067 horsepower at its top speed of 7000 revolutions per minute on six volts (four flashlight cells hooked up in

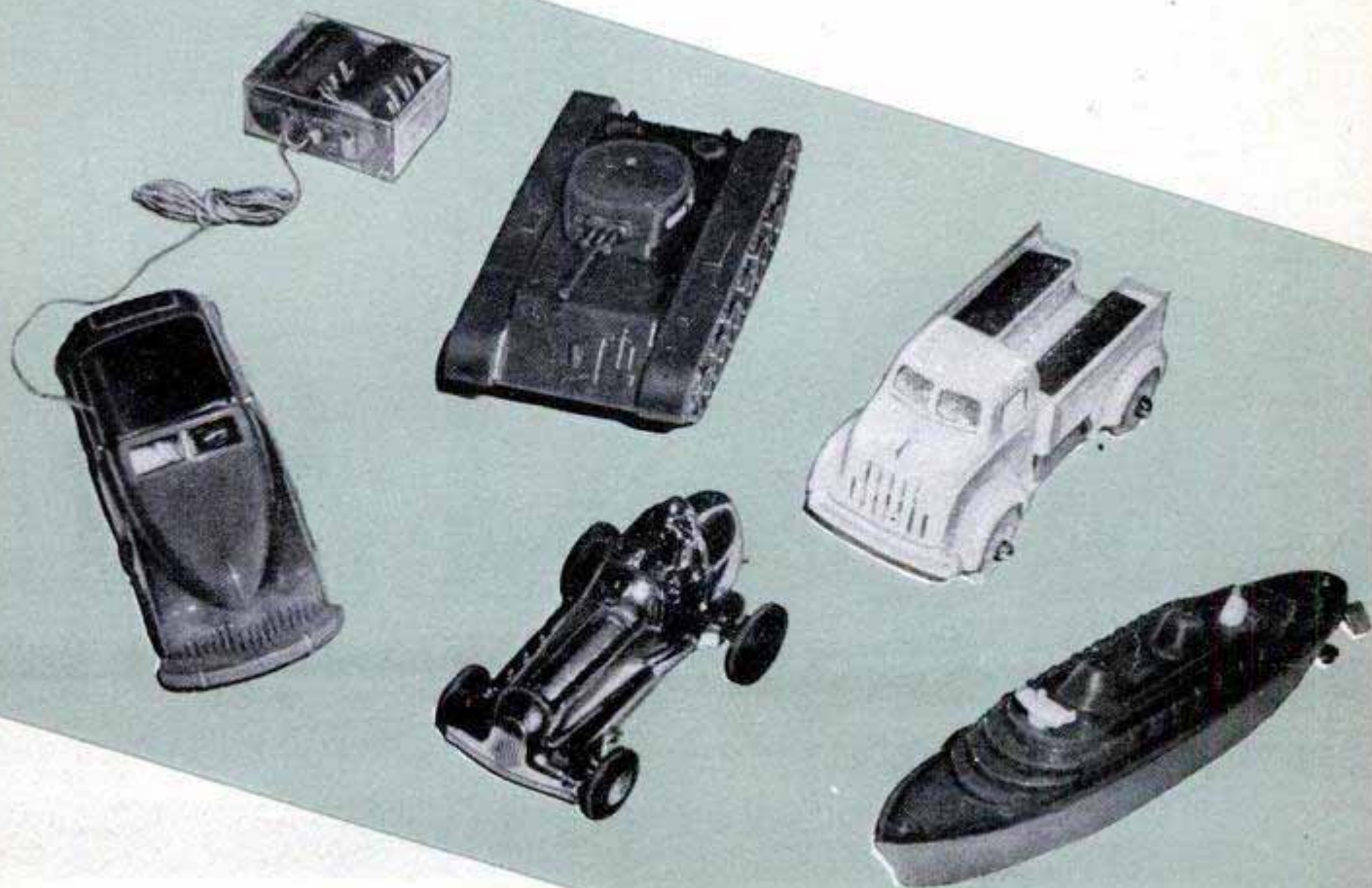
series). On a single cell (1½ volts) it turns over 2400 times a minute. On three volts, the motor is husky enough to spin a six-foot airplane propeller 20 times a minute when properly geared down.

Midget motors, of course, aren't new. Scores of thousands are in use in remote-indicating instruments in aircraft and in the automatic pilot and other servo mechanisms. These, however, have been precision jobs—indeed, some were made with jeweled bearings, though subminiature steel ball bearings are now the rule. Moreover, conventional midget motors are extremely difficult to assemble. As a result, they cost from \$20 to \$100 each.

HO and OO-gauge electric-train models also have small motors. But these are actually considerably larger than either the Rowe motor or servo-driving units, and, as anyone who has ever bought electric trains for himself or his youngster knows, they're not cheap either.

Rowe's midget is made cheaply by a number of novel short cuts. For one thing, the armature (a five-pole unit to assure high speed) is wound on a high-speed automatic winding machine contrived by Rowe out of an old lathe some years ago, when he went after an armature-winding contract to get started in the electrical-manufacturing business. For another, there's no field

Shown below are just a few of the large number of toys that have been electrified with the miniature motor. The car at left has remote controls as well





Looking like bonbons in a candy factory, the tiny motors are tested and "run in" until the drain and speed remain constant before they are shipped out

Electrified toy crane, below, not only features a power plant, but it also has an electromagnet for picking up metal pieces. Batteries, motor and gear-box fit neatly inside body of tiny race car, right

Crane photo by Wm. Russ

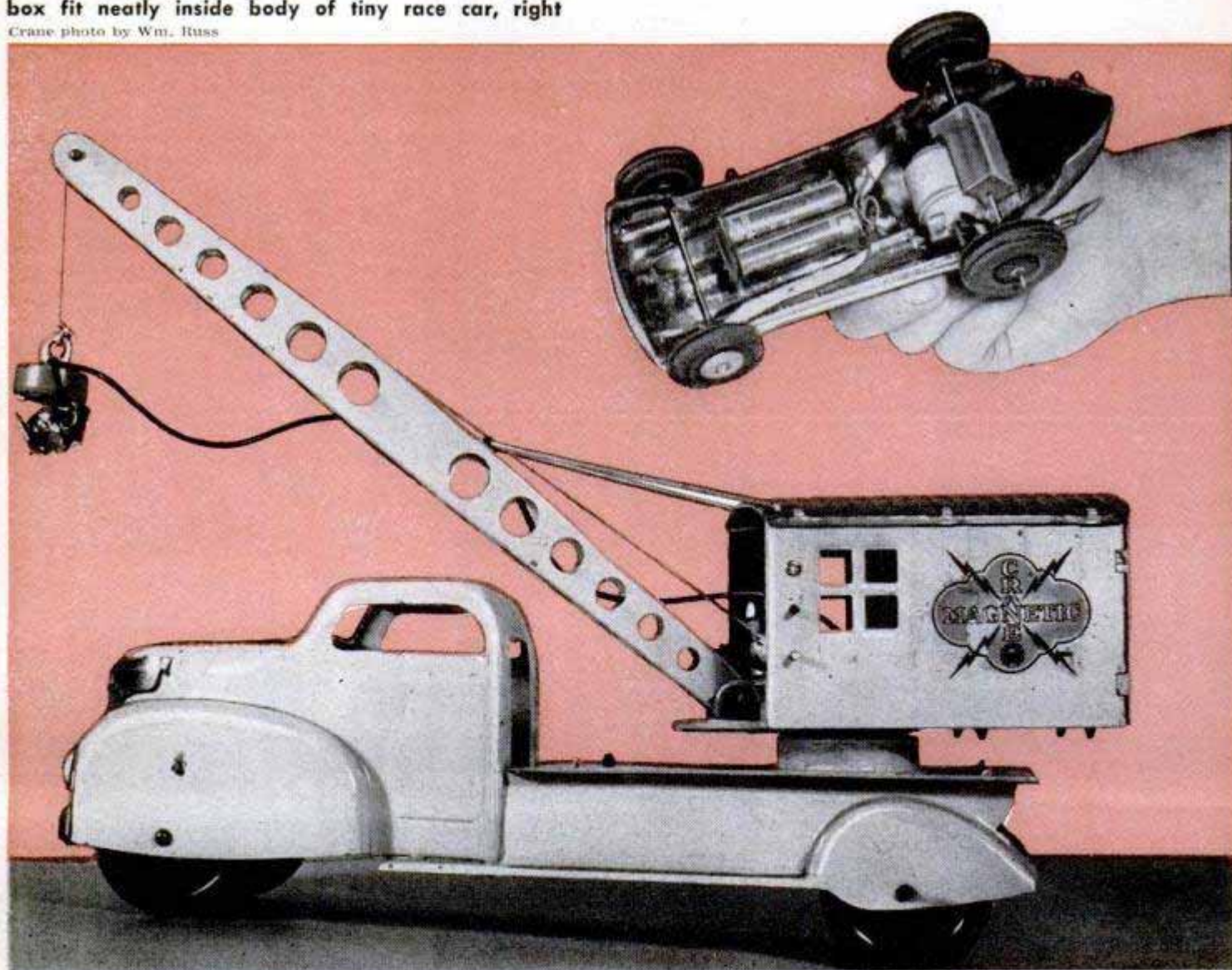
winding at all. An Alnico permanent magnet and two soft-steel pole pieces provide the magnetic field that interacts with the armature field to turn the motor over. A third cost-cutter is that, despite the extremely high speed of the motor, there are no ball bearings. The armature shaft enters and leaves the housing through an eyelet bearing molded into place in the housing.

Most ingenious is the housing itself. This is formed of polystyrene plastic and is designed to provide insulation for the brushes, which are also molded into place with the housing. This eliminates brush and insulation assembly, one of the most tedious chores in assembling conventional midget motors.

An insulating-plastic motor housing with integral brushes and bearings may not sound extraordinary, but it is, because of the economics of making plastic articles. In fact, there'd be no insulating-plastic motor housing and no cheap midget motor if it weren't for the perseverance of two engineers, Alex Gorfin and Leon Kardorff. The two came to New York from Belgium 10 years ago.

Gorfin and Kardorff got their idea, for

(Continued to page 262)



Sea-Water Still

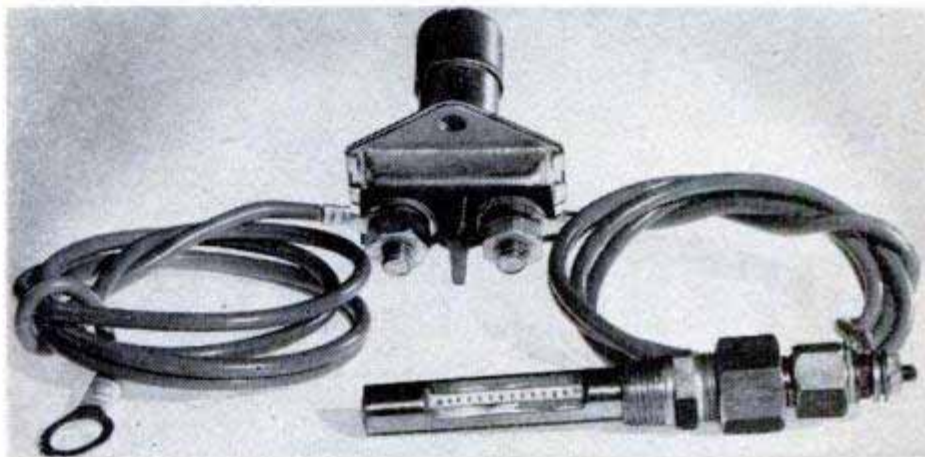
To aid downed flyers adrift at sea, there is a new sun still that makes salt water drinkable. A 24-inch sphere when inflated, it is fabricated of Vinylite plastic sheeting. Inside a black-cloth drain bag is attached at many points to the outer plastic skin. Salt water poured through the still neck fills both the bag and a ballast tube that keeps the unit upright alongside the raft or boat. Sunrays passing through the sphere heat the water-filled drain bag and start the process of evaporation and condensation. The desalted water collects below the bag and is drained off



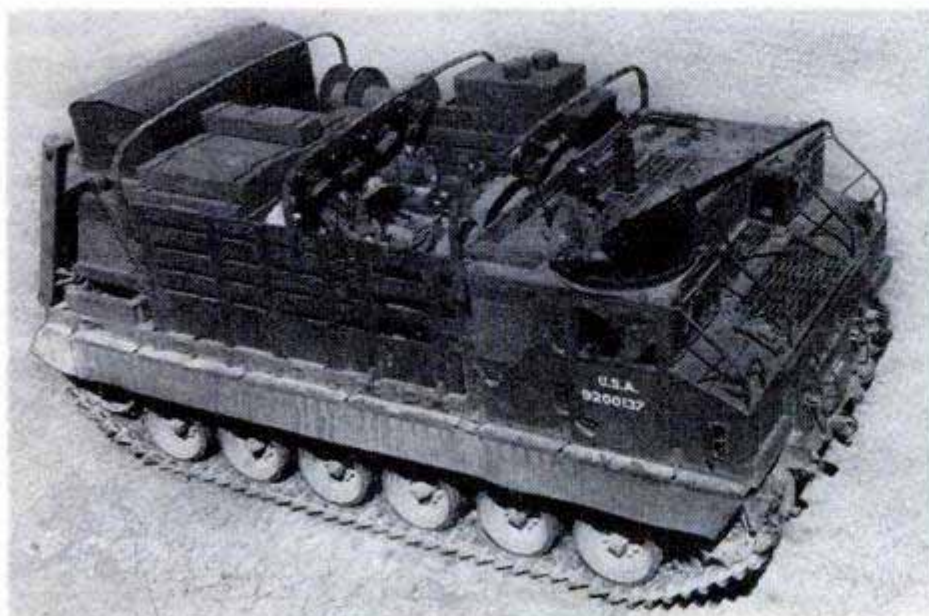
through a plastic tube. Even on cloudy days the sun's infrared rays produce one to two quarts daily. On an ideal day, 2½ quarts of potable water are produced.

Fuel Preheater

Starting diesel-fueled engines in subzero weather is no problem when a fuel-preheater-igniter unit has been installed. Using a 450 to 500-watt element, the unit will ignite any kind of an oil spray, whether atomized or not. It is battery-operated and requires no starting fluid. The ½-inch-diameter unit is 4½ inches long and is equipped with an adapter nut for installation in the intake manifold. A similar 100-watt fuel heater is easily adapted to almost any car. In many models, it may be installed in the intake manifold through the vacuum take-off port. In other cars, a thin vacuum spacer ring is placed between the

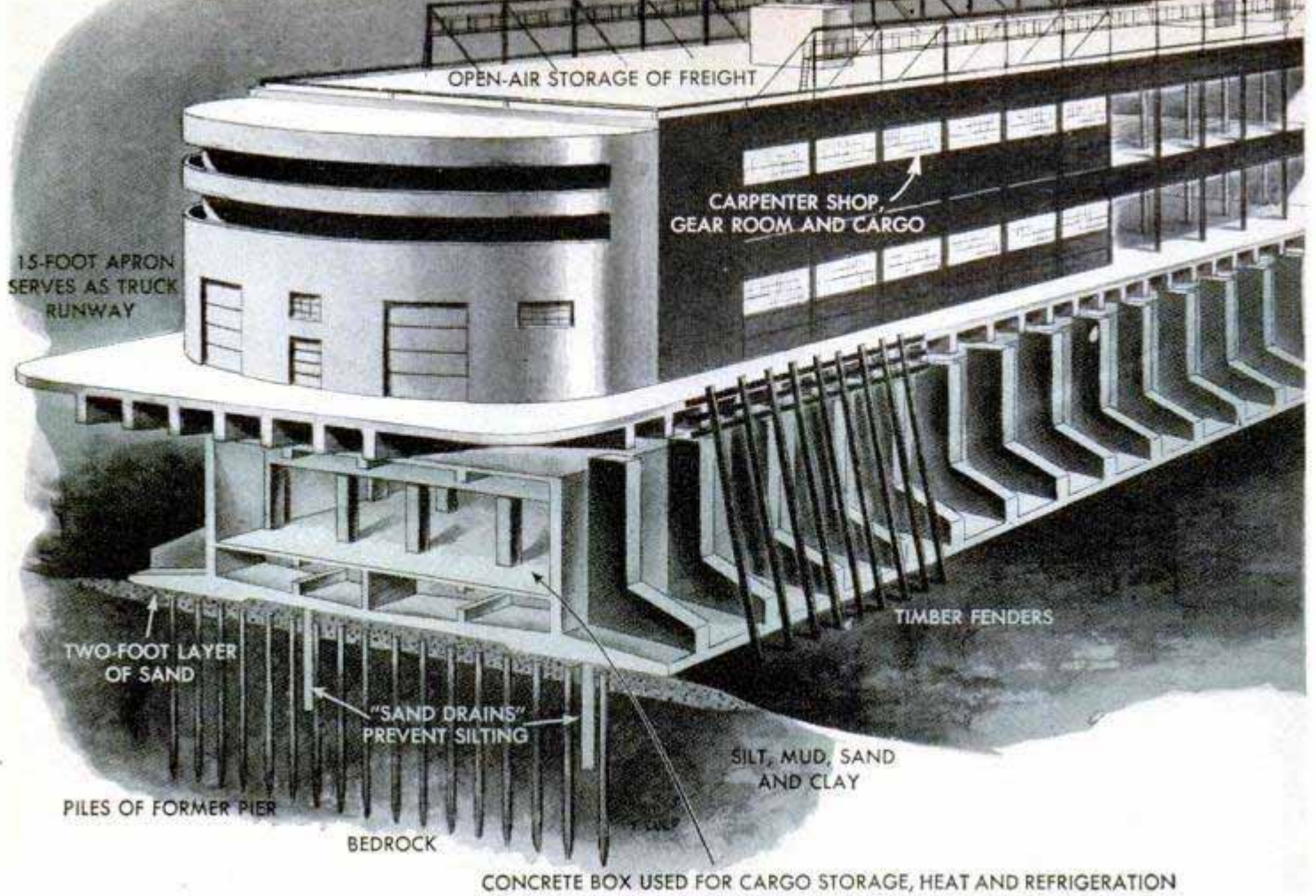


intake manifold and the carburetor. The vacuum line is then moved up to the spacer and the unit is attached in the original vacuum take-off port. A push-button type switch mounted on the instrument panel activates the heater, which develops six B.T.U.s within 30 seconds.



Versatile Tractor Has Many Jobs

Interchangeable bodies enable a new Army tractor to function as an artillery tow, a wrecker, a bulldozer or a general cargo hauler. The 22-ton vehicle has a top speed of 40 miles an hour and can negotiate swamps, trenches and 35-degree slopes. Its primary use will be to tow 75-mm. "Skysweeper" antiaircraft guns, but it also can haul heavier weapons up to an eight-inch howitzer.



CONCRETE BOX USED FOR CARGO STORAGE, HEAT AND REFRIGERATION

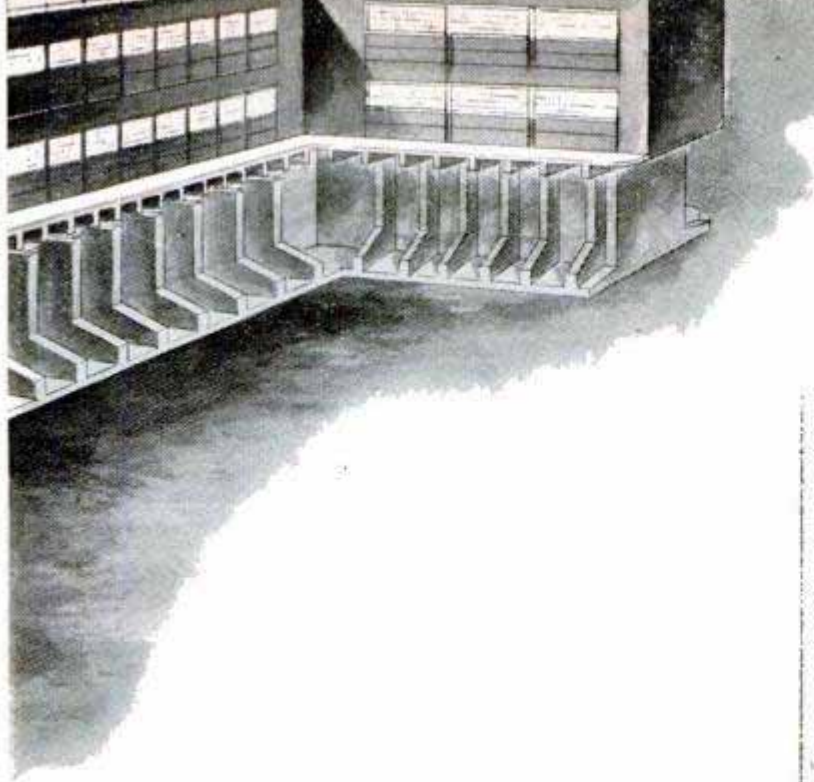
“SUPERPIER” ALMOST FLOATS

UNIQUE in harbor construction is a new pier being built on the North River in New York. Basically the pier consists of three hollow concrete boxes. The huge

boxes will be sunk to the bottom of the river, yet are so buoyant they'll almost float, and will support virtually the entire weight of the superstructure. The unusual pier will

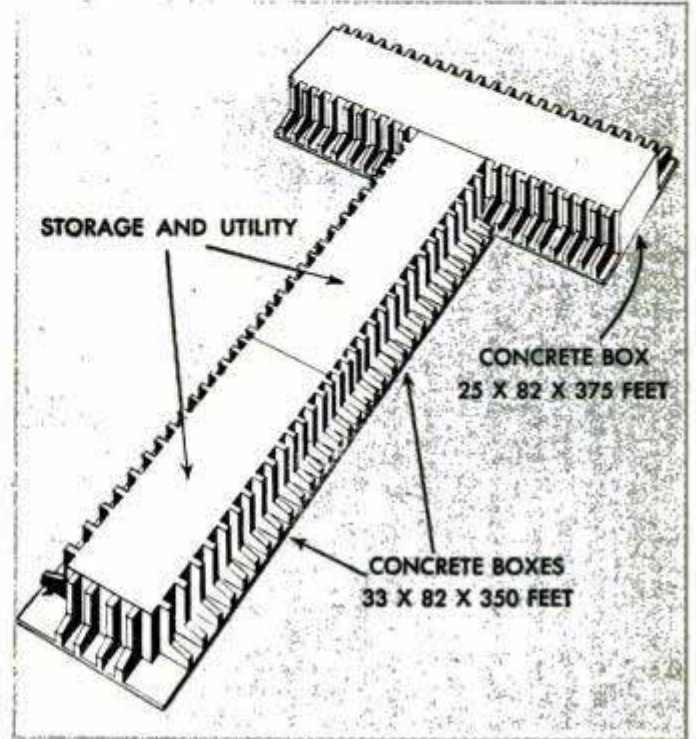
Fire destroyed the old pier in 1947, leaving only a tangled mass of piles, beams, cranes and charred wood





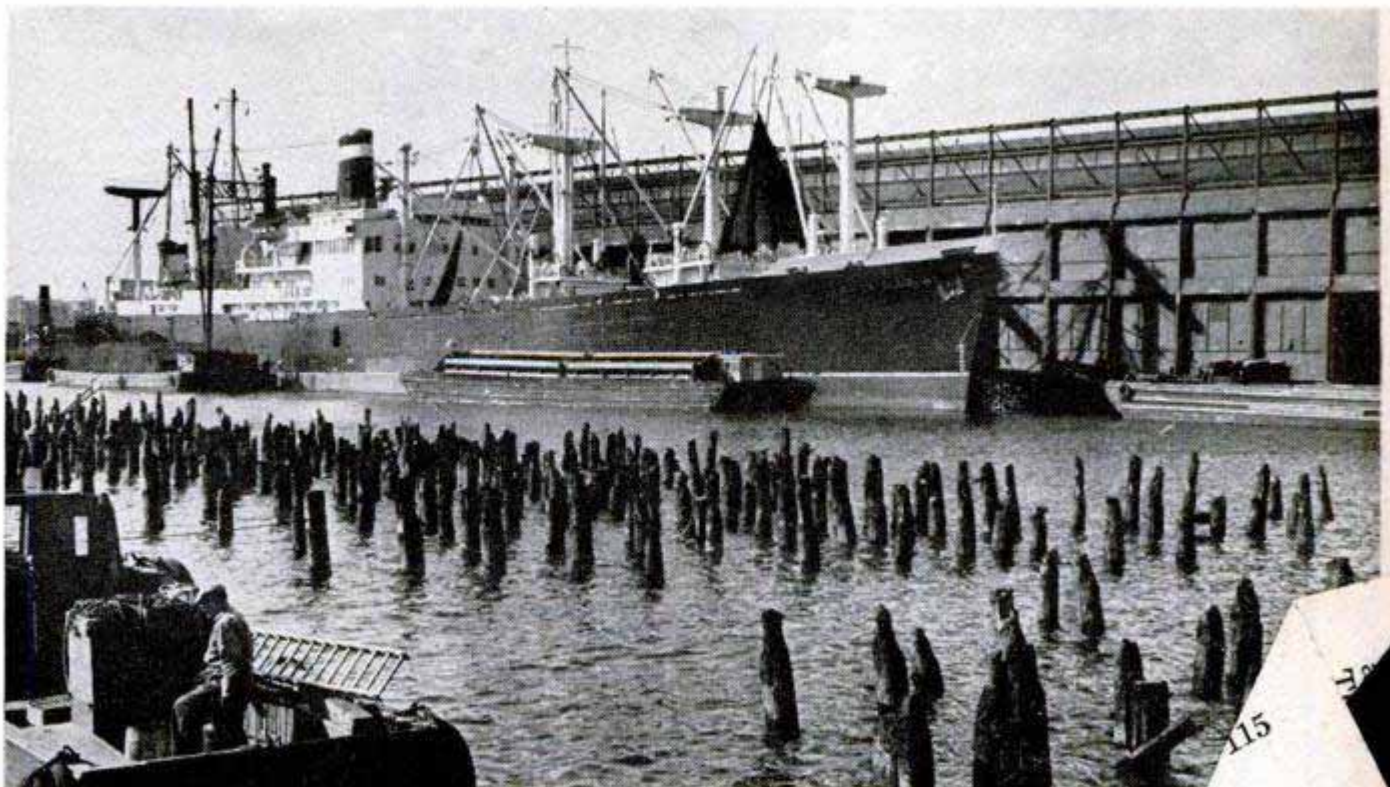
cargo and passenger space of its predecessor. As weight is added to superstructure during construction, water will be pumped from the sunken concrete boxes. New pier will be fire-proof and can't be attacked by marine borers

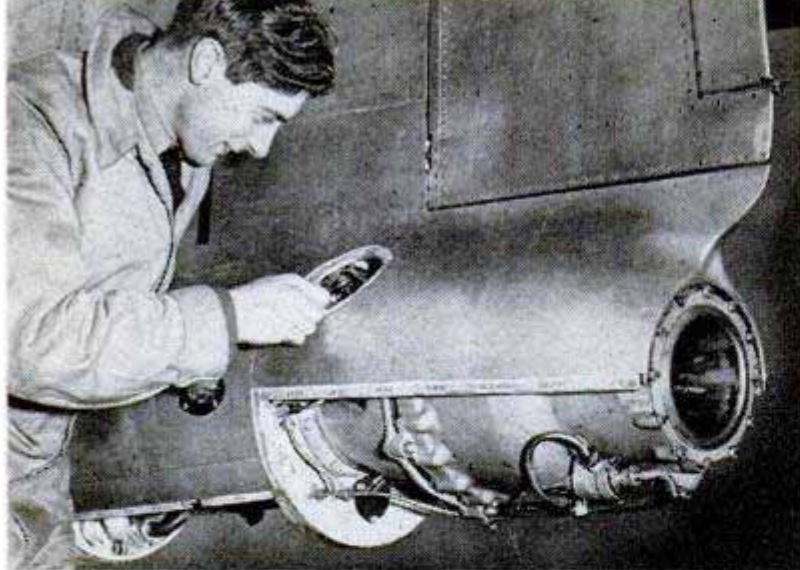
replace Pier 57, which was destroyed by fire. Only the piles remain, and these will be cut 34½ feet below water level to give added stability to the new pier. Two of the boxes will be sunk end to end jutting out into the river, the other forming the bulk-head along shore. These huge boxes are poured 30 miles upriver in a diked basin. When the dike is removed and the basin flooded, the boxes float and are towed to the pier site and sunk. Gradually, as the superstructure is built, water is pumped out. The pier will have three levels to accommodate cargo and passengers.



Sides of sunken boxes will be about two feet thick. The boxes not only will support the pier but also will provide much-needed cargo space. The structure will rest on a blanket of sand two feet thick

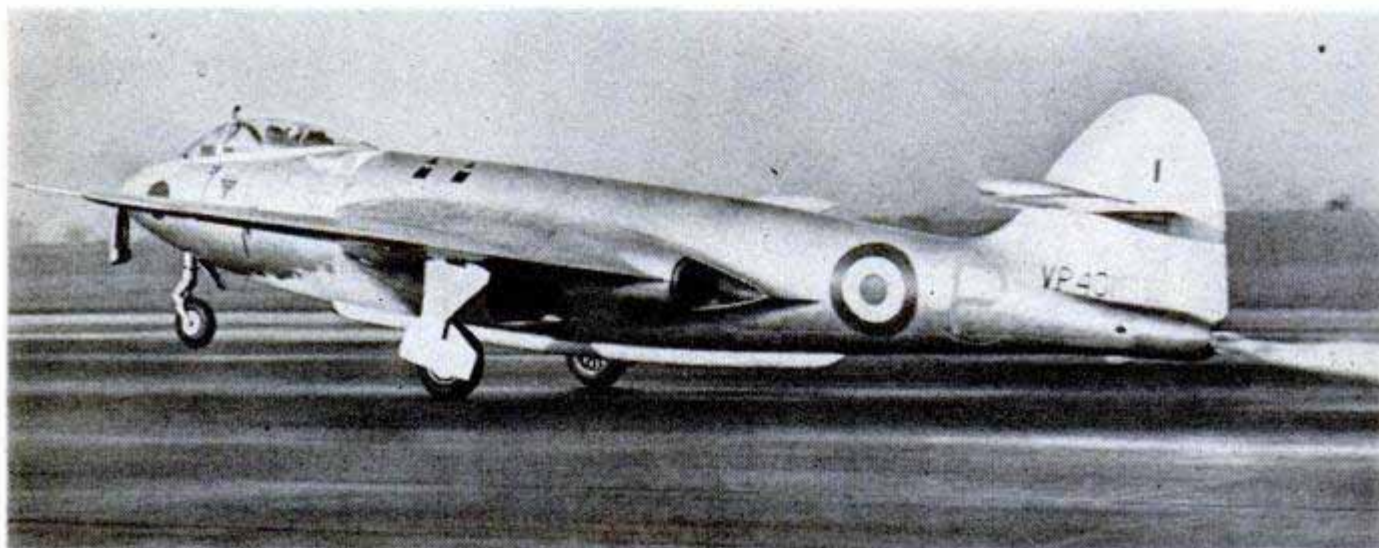
Piles of the old pier, expensive to remove, will be cut off 34½ feet below water level for added stability





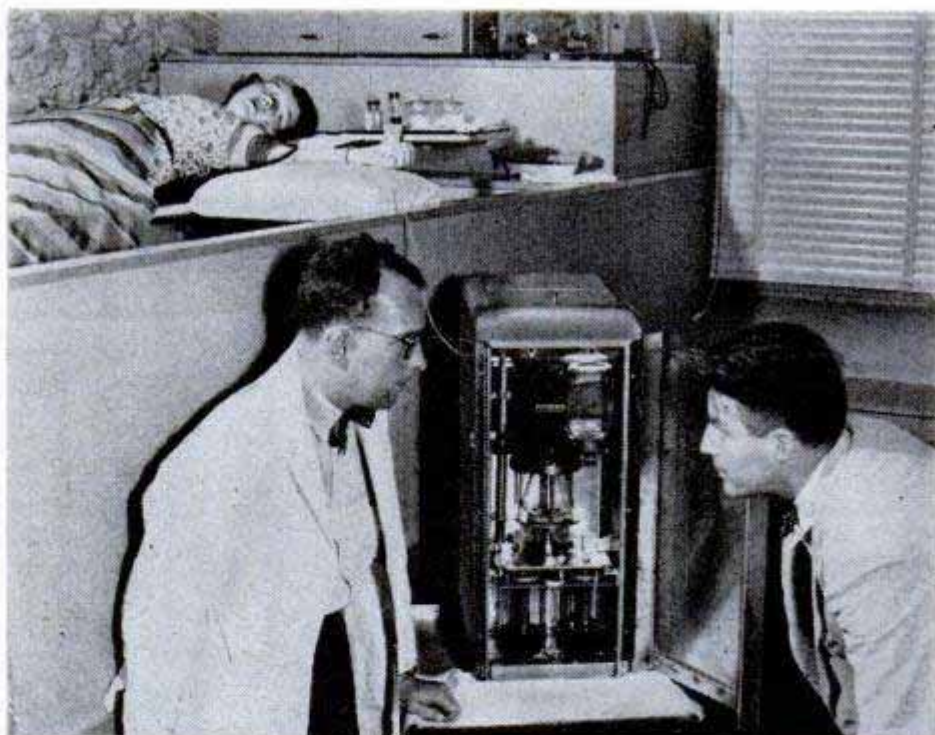
Rocket Motor Doubles Power of Jet Fighters

Designed to double the power of jet fighter planes, a revolutionary rocket motor that can be switched on and off by the pilot has been successfully tested in Britain by Armstrong Siddeley Motors, Ltd. Called "Snarler," the motor has a 2000-pound thrust at sea level and weighs 215 pounds. Using fuel consisting of liquid oxygen and a water-methanol mixture, the motor gains power the higher it goes. The compact new rocket motor fits into a 3-by-6-foot space.



Blood Fractionator

Blood is automatically separated into plasma and red cells at the same time it is being collected from the donor by a processing device known as a blood fractionator. Processing is completed in a totally sealed system. The speed with which the blood is processed will permit stock-piling plasma and red cells for longer periods than is possible with current methods. Portable, the new equipment eliminates the collecting bottle. The blood flows from the donor's arm directly into a small centrifuge which separates the plasma. Separation of blood components and processing of plasma follow in minutes. The entire fractionating operation is conducted in a hermetically sealed system. Theainers filled with blood components can be moved without destroying the seal.



Many trees contain newly discovered chemicals that can kill insects, fungi and bacteria, and these may be synthesized by man, according to Prof. Holger Erdtman of the Royal Institute of Technology in Stockholm, Sweden.

Music writer for the blind has nickel-plated frame in which the stencil slides. Desired symbols are drawn easily by tracing around cutouts in the stencil



SO THAT THE BLIND CAN WORK AND PLAY

By J. Alvin Kugelmass

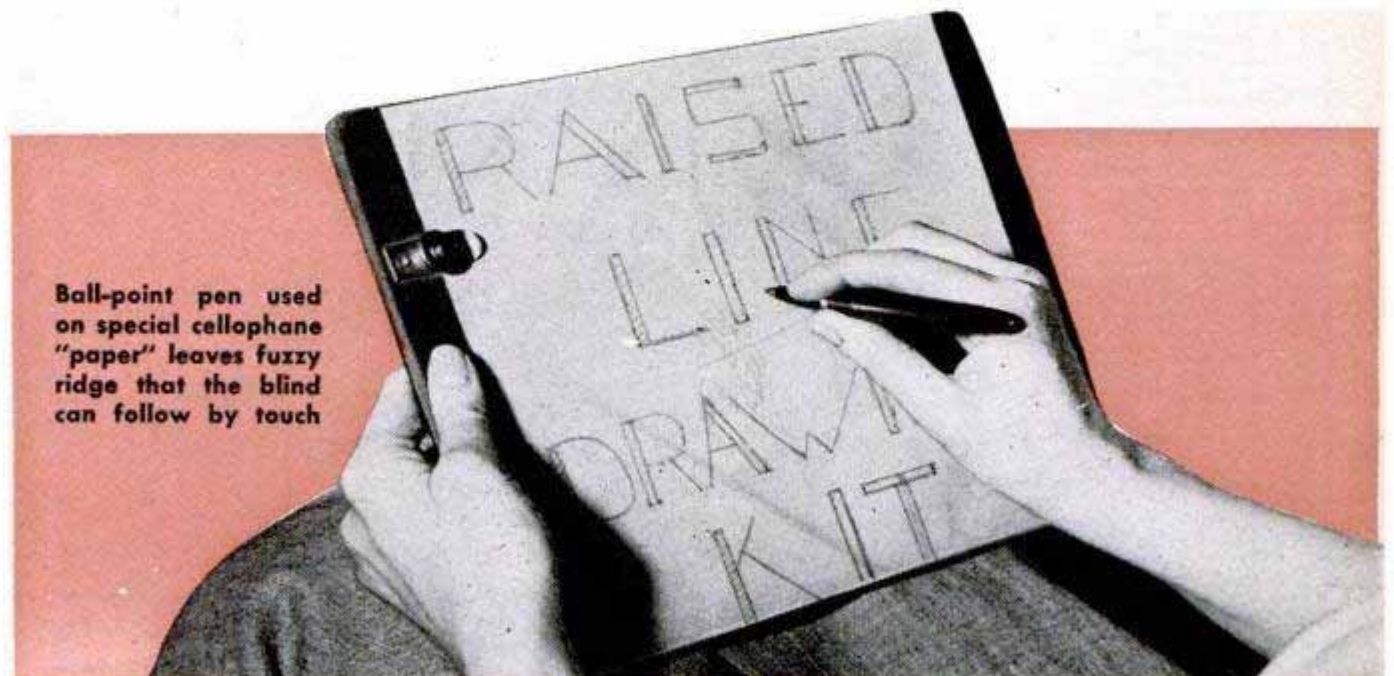
ABOUT 100 YEARS ago, a small, slight, tubercular man named Louis Braille died alone and embittered in a Paris rooming house. Blind since the age of three, he left a system of reading for the sightless which has been utilized in the home, factory, workshop, hobby shop and school.

Since his day, the method devised by this unsung and unhonored man has been adapted to almost every known tool and device for the benefit of the hundreds of thou-

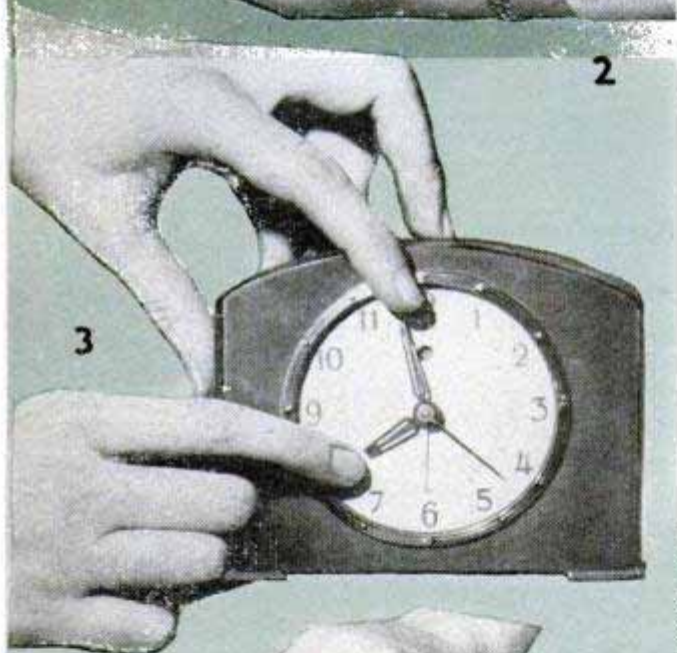
sands in the world who, either by birth or illness, have lost their sight.

Time was when the blind person was a beggar or a subject for mockery. Today, the sightless take their places as workers, designers, cooks, housewives, electronic experts, pedestrians, assemblers, carpenters, painters, mechanics, authors, construction workers, musicians and even as photographers.

The Braille system utilized raised dots



Ball-point pen used on special cellophane "paper" leaves fuzzy ridge that the blind can follow by touch



which, when the blind ran their fingers along, gave sense, sensibility and feeling. Today, the blind, because of Braille and science and mechanics, are not much more helpless than the seeing. The blind are enabled to take advantage of this mechanical age and to take their places as productive and earning citizens. Even more, they are enabled to have productive lives, almost as normal as have the seeing.

So widespread is blindness that today large producers of watches, such as the Elgin Watch Company, put out pocket and wrist watches with Braille dots fused on the surface at each hour. Three o'clock is located at the stem as a beginning point. To the seeing this may sound peculiar, but the Braille system works best on fingering two dimensions at right angles as a starting point (close your eyes and see). Tiny models are made for blind women.

There are games for blind persons. The blind can play chess, checkers, dominoes and even a pinball machine where the score is tallied by Braille. It's all a matter of position and precision.

There are Chinese checkers and cribbage boards, ticktacktoe and Braille poker cards, anagrams for blind intellectuals and crossword puzzles.

The blind cannot get much pleasure from travel, except for climate changes. They cannot see old landmarks or appreciate scenes which are historical landmarks. But like many hundreds of thousands of people who cannot travel and who yet like to pore over maps, the American Foundation for the Blind puts out maps which the sightless can finger and trace along even as we, who cannot travel, do before our fireplaces and



on our rugs. They can travel afar by tracing such names as Baluchistan and Zanzibar, and who knows, in their imagination they may travel farther than that.

The blind housewife has a pancake turner which is automatic. This lifts under the egg or batter pancake, and when the handle is squeezed, turns it over neatly and flops it into the same space.

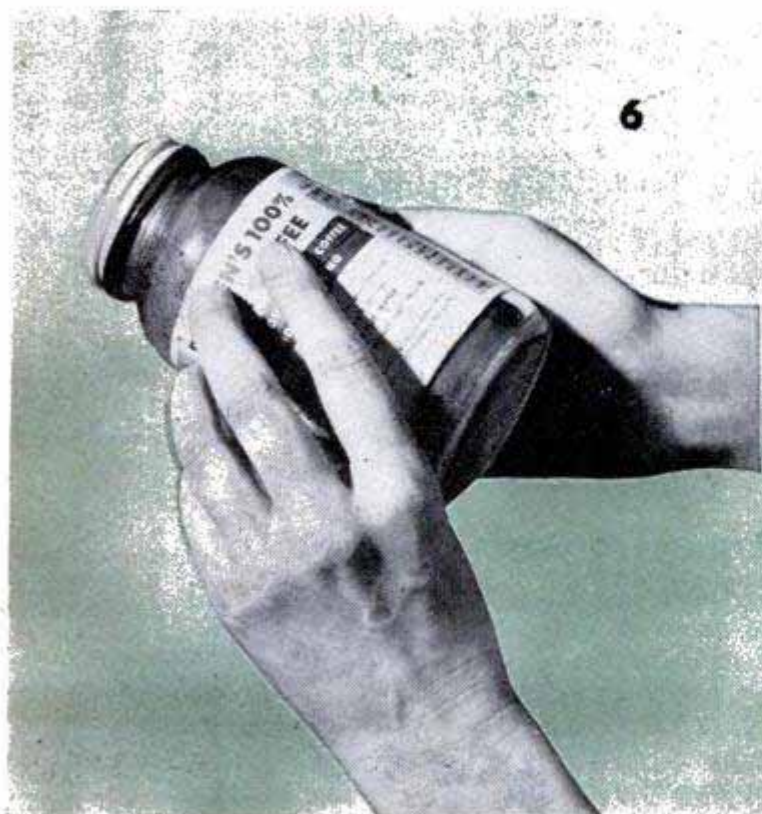
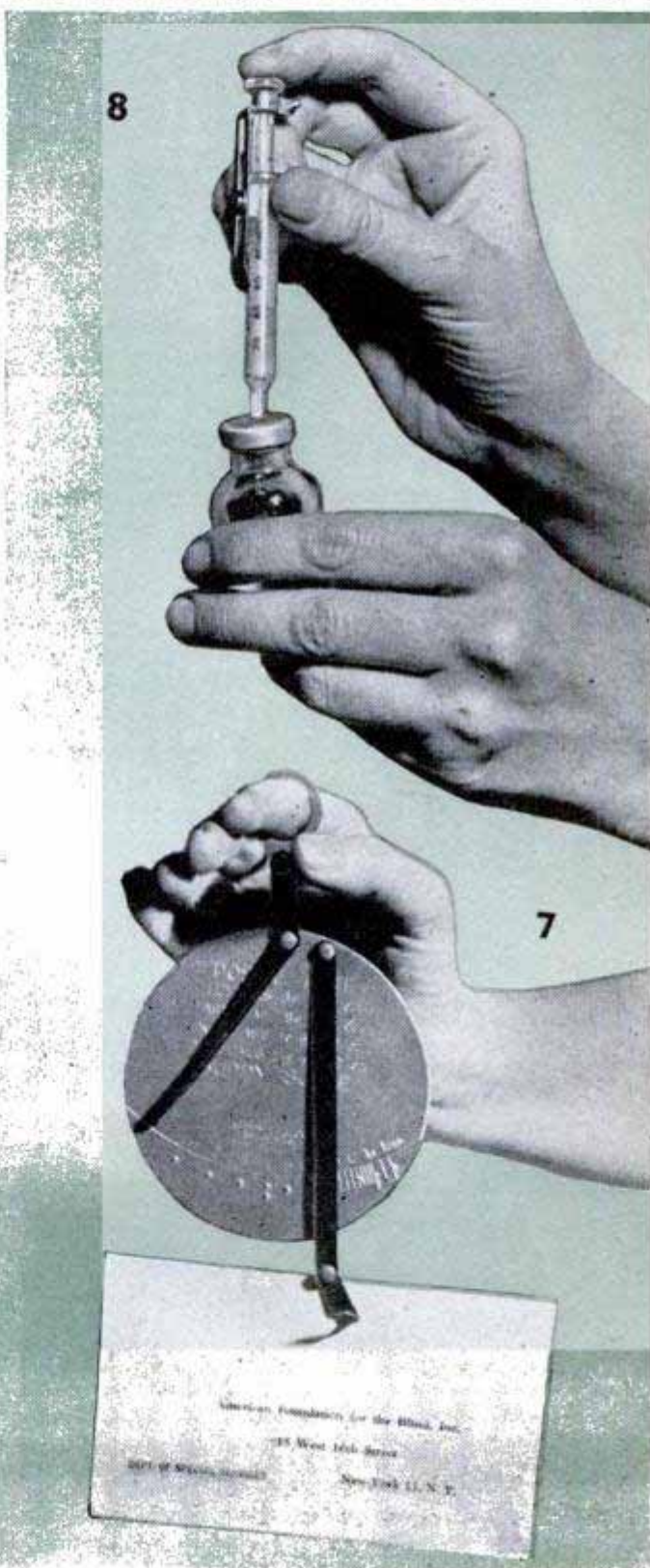
There is the can opener for the blind. When the cycle is completed, it emits a squealing sound because of the juxtaposition of the blade and the can. The sound informs the sightless housewife that the can has been cut through.

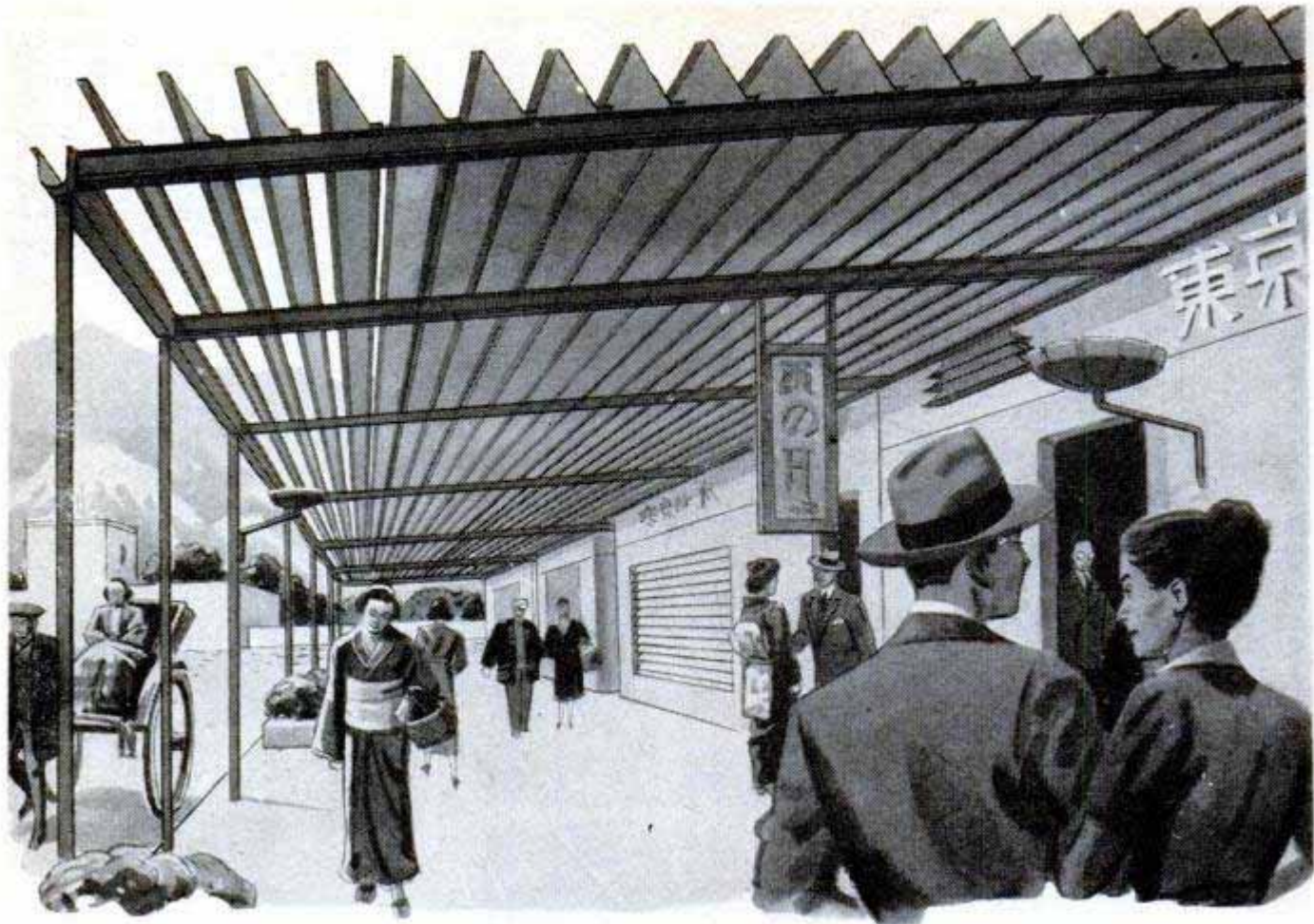
There is out now, for example, a drop-at-a-time drop measure. This is a conventional rubber ball and glass medicine dropper. The bulb, however, is reduced in size at the top to leave a little bulb above the main one. When the tiny bulb is depressed, a drop is released, surely an invaluable aid to near-blind persons who must take medicine drops several times a day.

There's a carving knife with a heavy wire guide running back of and parallel with the blade, which may be adjusted manually up to $\frac{5}{8}$ -inch slices. A pressure cooker for the blind housewife has three holes drilled around the circumference. Pressures of 5, 10 and 15 pounds are secured by setting the different holes on a vent pipe in the lid of the pan. One hole may be indicated by a slight file mark so that the different pressures may be identified. One kitchen boon is a set of canisters made of plastic. The gauge consists of a sleeve into which an eight-ounce cup is set to provide measurements of tablespoons or

(Continued to page 236)

Pictured to the left and below are aids for the blind, which make them not much more helpless than the seeing: 1. Collapsible cane measures 12½ inches when it is retracted; 2. Combination try-square and wood-marking gauge has slide that may be locked in any position; 3. Electric alarm clock which has been adapted for touch reading; 4. Carpenters' level consists of a steel ball rolling in V-shaped strip of metal; the calibrated screw shows deviation from level; 5. Kitchen timer is marked with single Braille dots at each minute and double dots every five minutes; 6. Special kit enables the sightless to make their own labels for jars and bottles — Brailled slate ridges will not wear off; 7. Postal scale is graduated up to 1½ pounds, the first eight ounces being marked with Braille dots after which dots appear at 12, 16 and 24 ounces; 8. Insulin syringe permits blind diabetic to administer proper dosage to himself

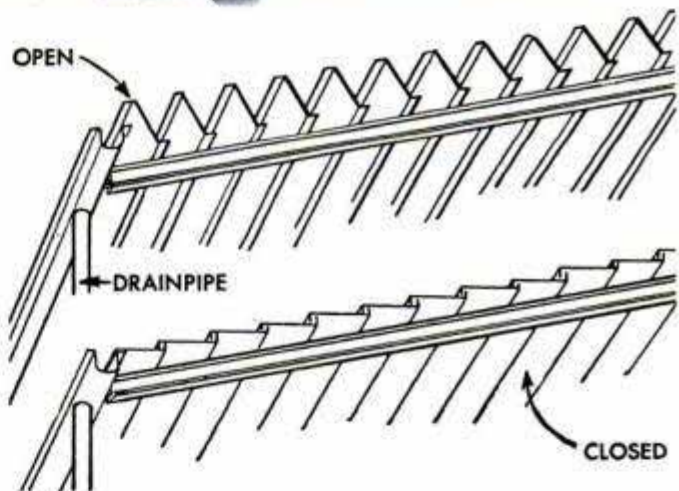




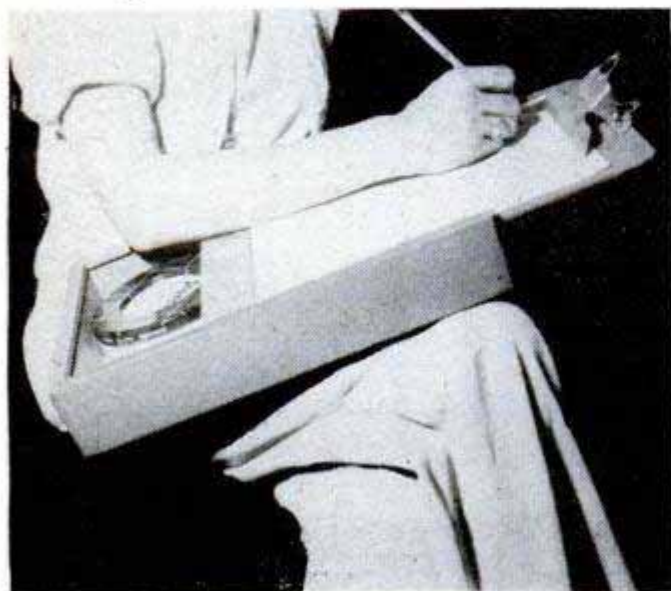
During good weather slats are left open to provide free air circulation. In case of rain, slats are closed over entire sidewalk, as shown in diagram

"Venetian" Awnings

Huge awnings installed above the sidewalks of one of Tokyo's busiest streets operate like Venetian blinds. The slatted awnings, made of light metal alloy, are pivoted by the turn of a handle. When a roof to close out the rain is desired, the slats are turned so their edges join. When only shade is needed, they are opened to provide free air circulation yet shut out the sun's rays.



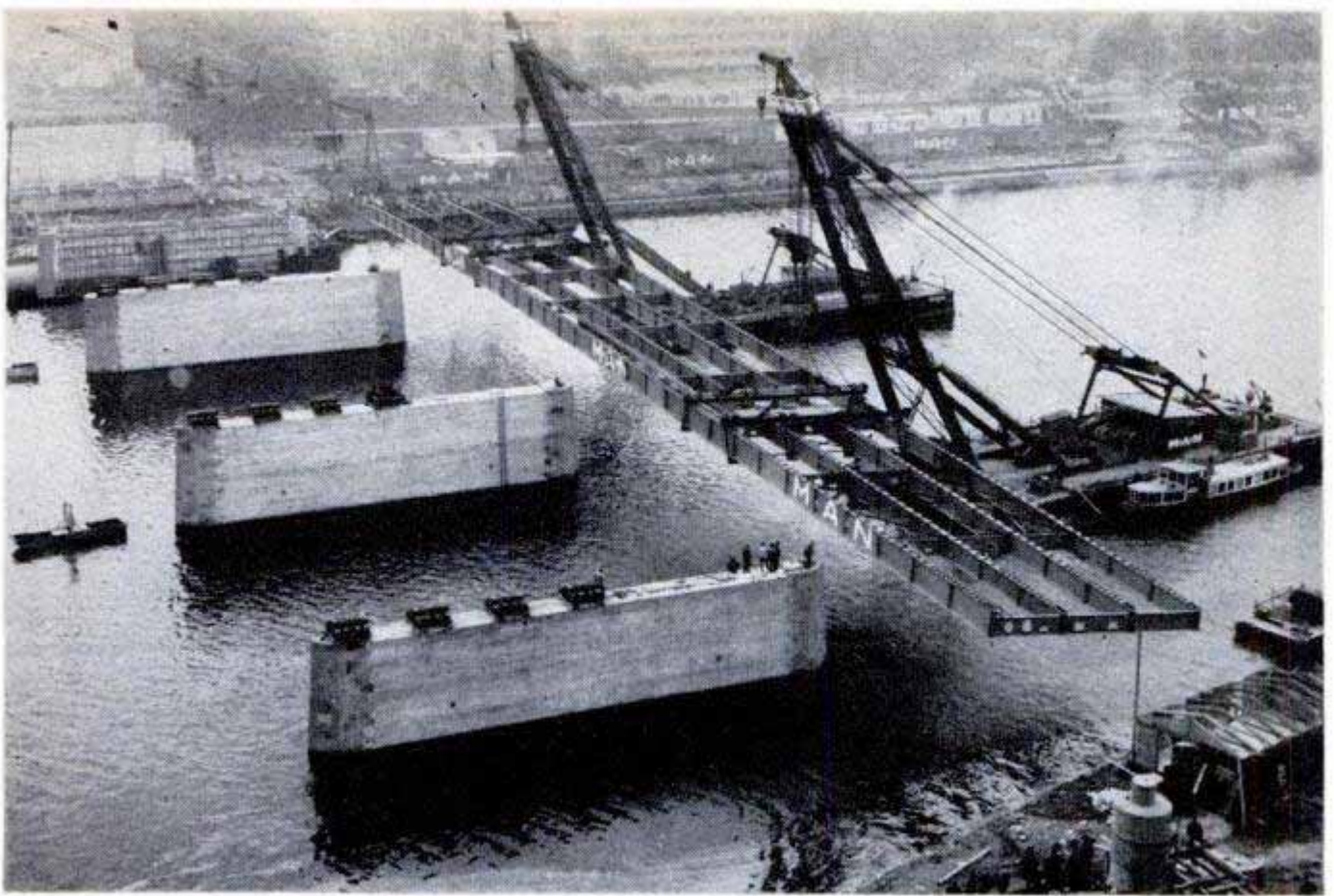
Writing Materials Carried Inside Portable Desk With Sliding Top



Pencils and paper, order forms and drawing equipment can be carried inside a compact portable desk. The desk is a shallow box with a clipboard which slides into the grooved sides to form a cover. The clipboard can be slipped entirely out of the box. When not in use the portable desk can be fastened shut and hung by the clip.

Japan Transmits by Facsimile

Facsimile now is speeding transmission of news in Japan. The teleprinter, used in this country, is not satisfactory in Japan or China because of the complicated characters used in writing. With facsimile, exact copies of printed pages are received by newspapers subscribing to the service.



Bridge Floated Downstream Into Position on Piers

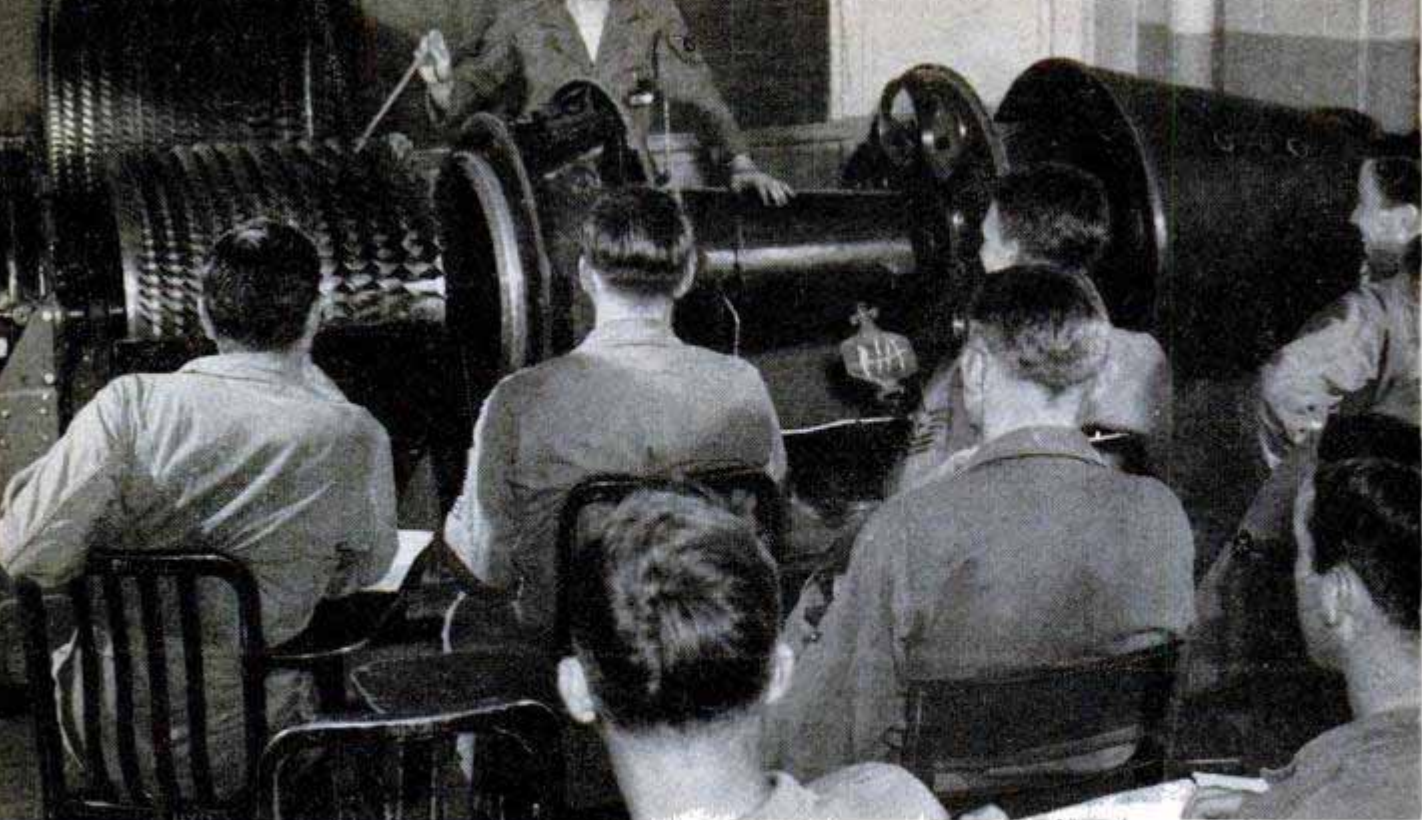
To speed construction of a new bridge at Frankfurt-on-Main in Germany, the new span was built while the old one was being dismantled. The long steel spans—two were required for the full width of the roadway—were assembled on the river banks while the wreckers were tearing down the old bridge and erecting new piers. Then two

large river cranes picked up the spans and floated them down the river to the supports. The new bridge replaces the historic Wilhelmsbrücke, which was captured by the Allies in World War II with only minor damage. Repairs by the engineers kept the bridge in operation until the heavy traffic dangerously weakened it.

Crash Canopy on "Cat" Shields Loggers From Falling Trees

Loggers get added protection from a new crash canopy for Caterpillar tractors without sacrificing vision or convenience. It is a socket-type installation designed by Vern Parten, master mechanic for a Yakima, Wash., lumber firm. Canopies welded to the chassis tend to shake loose. To offset this, the structures have had to be "beefed" up with additional supports. This has lowered the operator's chances of leaping clear if a tree falls, the machine rolls over a bank, or a log starts to climb the "cat" on a downhill pull. Parten's canopy is made of heavy-gauge pipe, with welded end socket, fitted onto pipe spurs that are bolted to the chassis. Single vertical supports on each side stiffen the over-arch and there is a heavy sheet-metal top above the driver.





Actual jet engines mounted in classrooms help specialist students to understand technical facts more readily

CAREER SCHOOL for

IT TAKES more than a "hot pilot" to keep a jet fighter aloft. It takes a smart jet mechanic, one of those new specialists who have been added to the U. S. Air Force between wars. A few weeks ago he might have been the fellow at the corner filling station near your home.

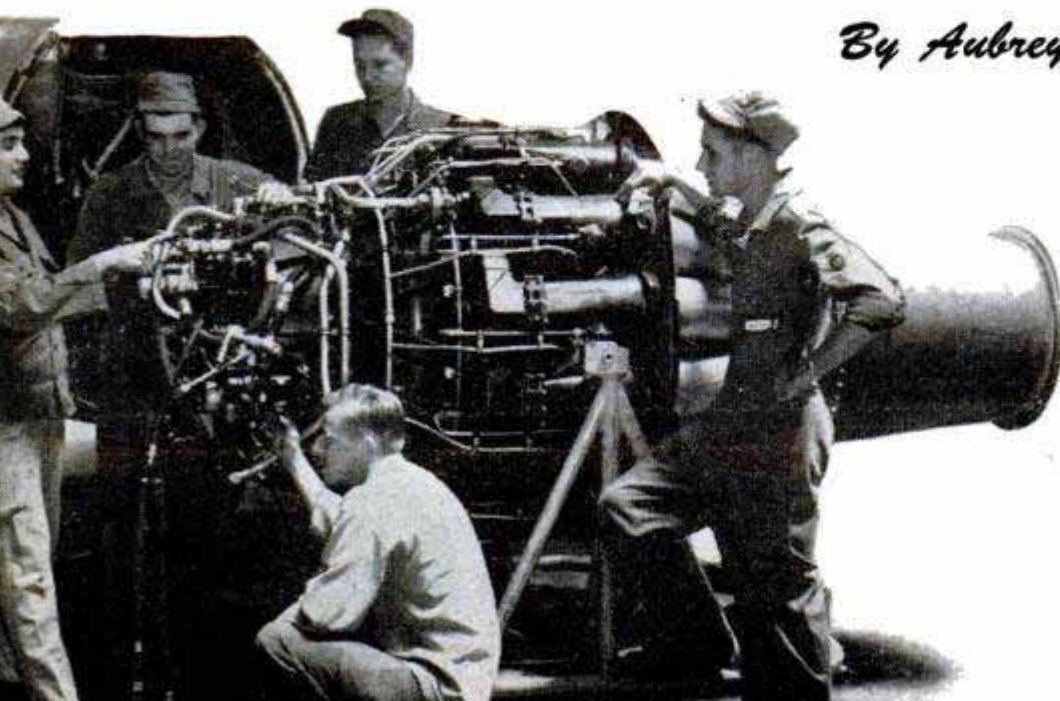
Only a misty memory now are the days when the skimpily trained pioneer pilots flew "by the seat of their pants" and gambled their lives on the expertness of mechanics who were often seeing their first

airplane. In this supersonic-speed era, when a single, complex flying machine can cost over a million dollars, the fate of the man and the airplane can't be left to chance.

Knowledge has shoved pure daring out of the picture as the prime requirement for success as a pilot.

With 19-year-old Joe Doakes as our new Air Force recruit, let's tag along closely and see how today's methods attempt to fit square pegs into square holes. Like other newcomers, after induction he'll be headed

By Aubrey O. Cookman, Jr.



THIS is the second of four articles about the training of our recruits. Next month, the Navy. In April, the Marine Corps.

Class sizes at Chanute are kept small so that each man's questions can get individual attention



Groups marching between classrooms add a military touch to the "campus" at an Air Force technical school

JET MECHANICS

for the "world's largest university," Lackland Air Force Base at San Antonio, Tex., with its 10,000 teachers and 300,000 graduates yearly. So tight and complete is its organization that 15 men handle the training of each man during his 13-week indoctrination period.

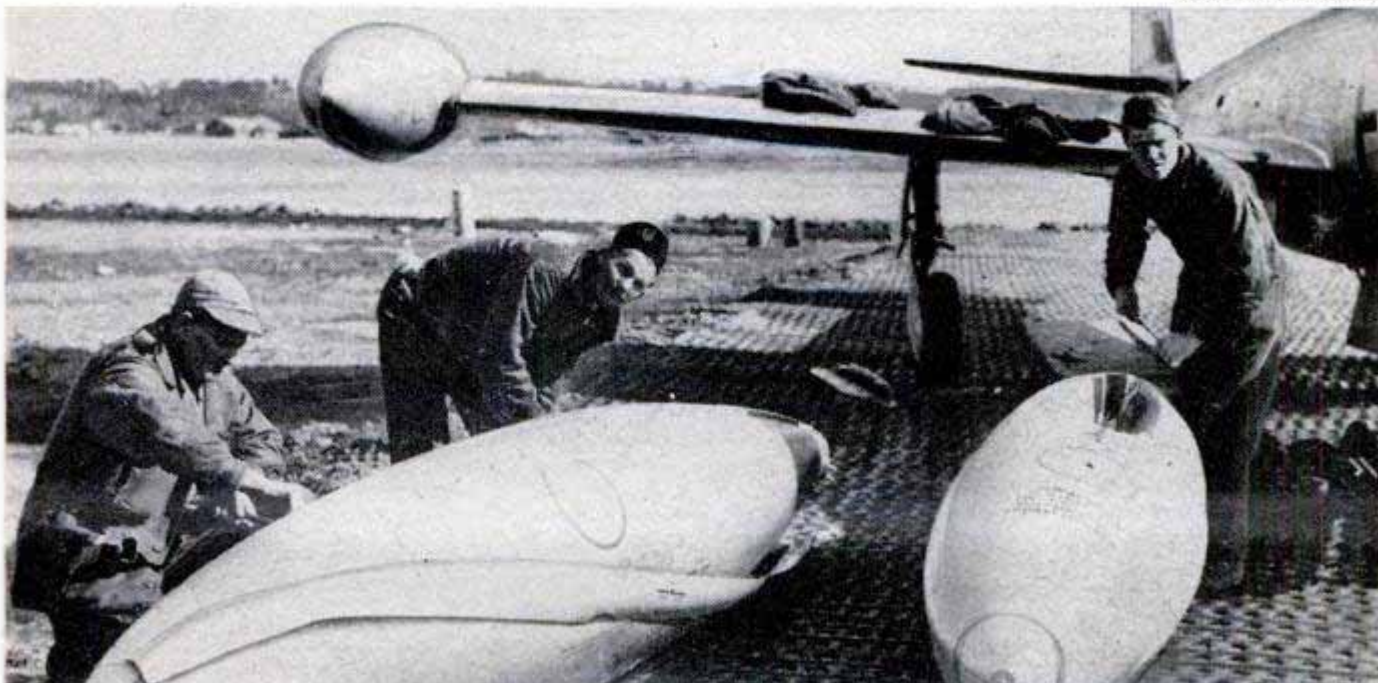
Three hours after Private Doakes has hopped off a bus, the last lap to Lackland, he has had a GI haircut, received a basic

uniform and taken the first steps toward completing a detailed record of his pre-military life. Spread over 2000 acres, the busy Texas base is aptly called "The Gateway to the Air Force."

Trained interviewers next pick Joe up and continue the task of discovering what makes him tick. They learn, for example, that he is a hot-rod enthusiast and that his best high-school grades were in shop

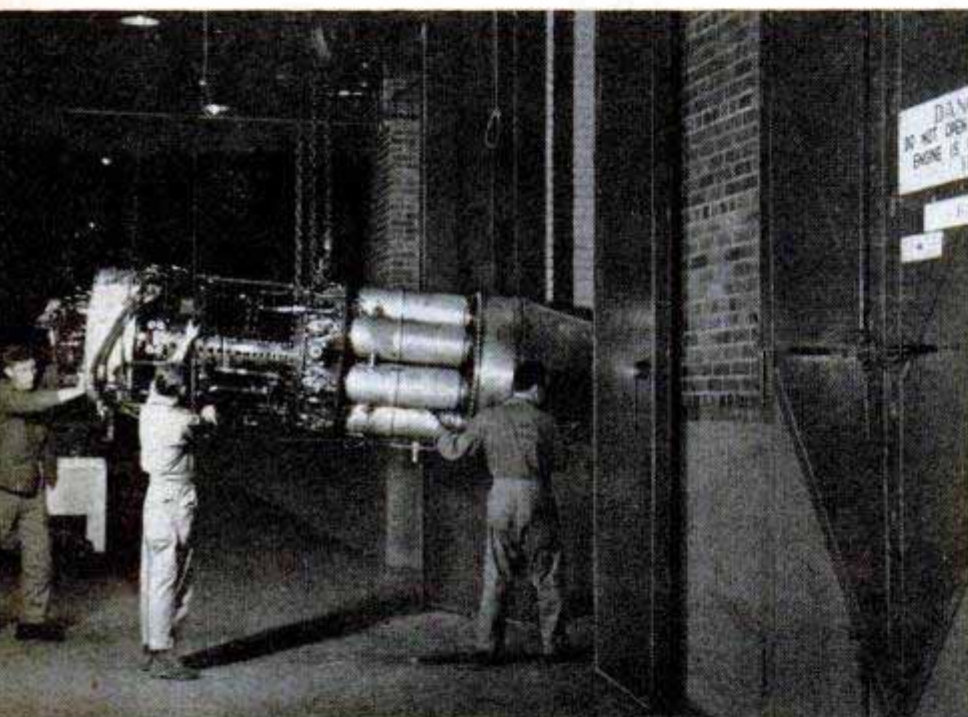
Putting their book learning to work, ground crewmen in Korea replace a pylon tank on a Republic Thunderjet

U.S. Air Force photo

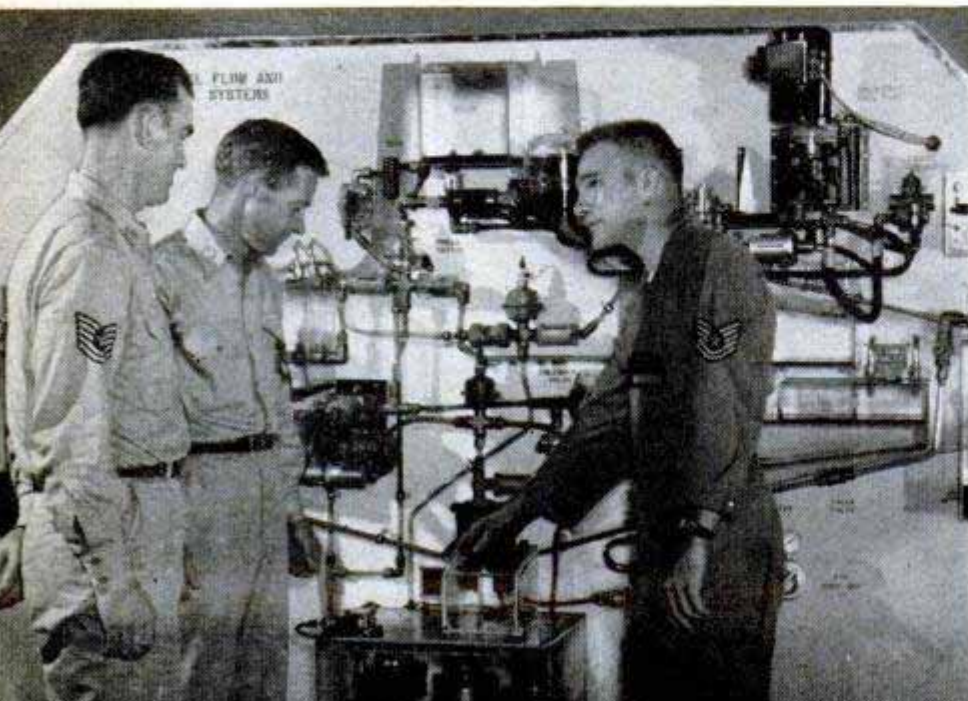




Mechanics hoist a jet power plant back into an F-80 that in a matter of minutes will again be combat-bound against the Chinese Communists



Students guide an engine into one of a long row of test cells at Chanute. Below, an instructor explains fuel flow in a piston engine



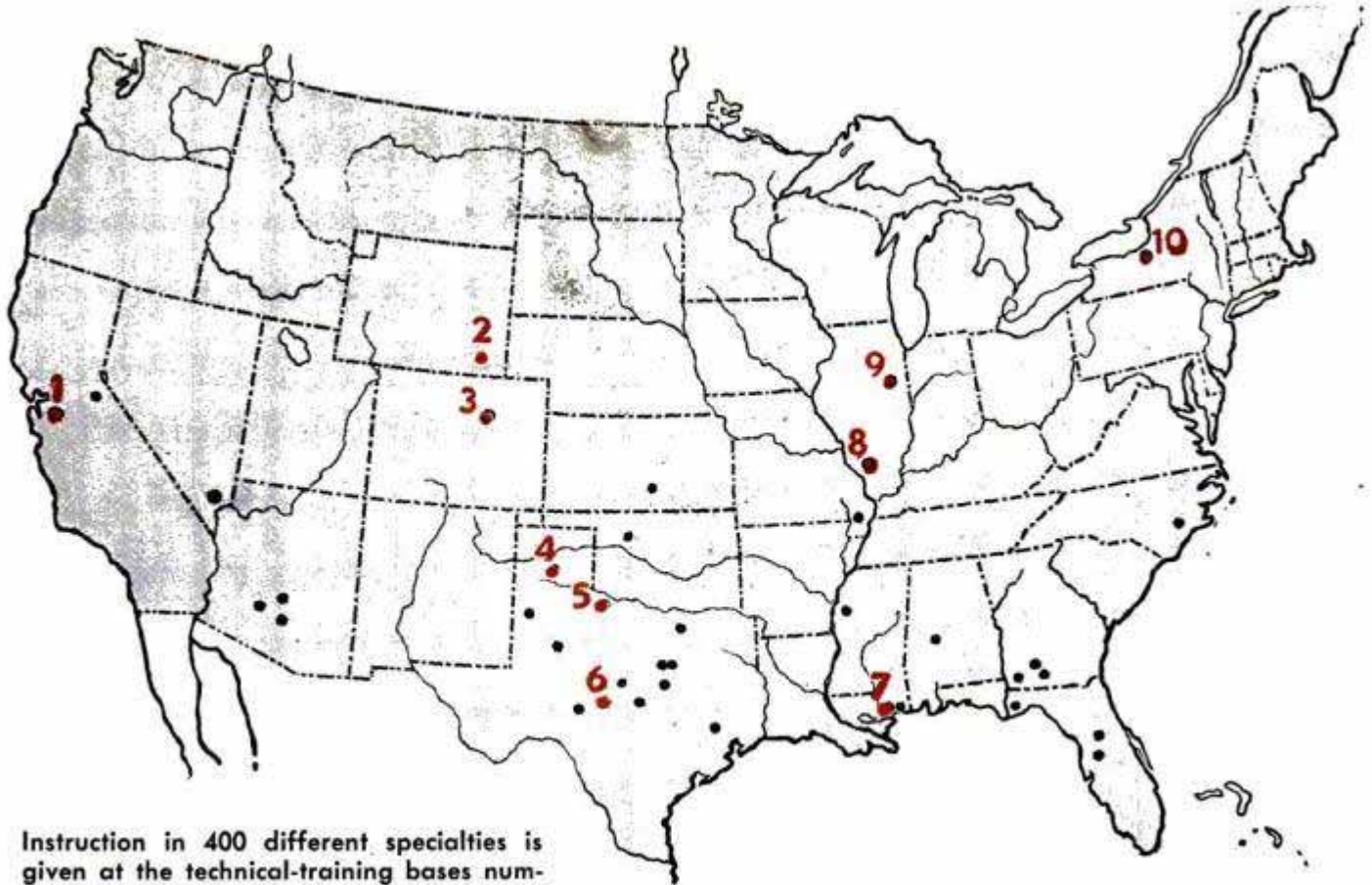
courses. A group counselor then steps in and begins filling in the other part of the picture, advising him and explaining how the Air Force operates.

About here he encounters something that would surprise old-time air trainees of World War II. No longer so heavily emphasized are the familiar psychomotor tests, devised to determine their relative aptitudes for specialized fields of training. Instead, Joe gets a pencil and a batch of examination papers. The answers he comes up with tell more accurately, and in less time, where is his greatest potential usefulness in the service.

Lackland's Human Resources Research Center tries to find "clusters" of ability in each man, leanings or skills that indicate several jobs he'll likely do well. The tests average about three days. Later his subsequent school grades are returned to Lackland, as a double check on both the lab's diagnosis of the man's talents, which they call predictive efficiency, and the adequacy of the training that follows. In some cases the reports lead to correcting flaws in the service's teaching methods.

From Private Doakes' test results and interviews his new employers get surprisingly complete impressions about his qualifications. Joe's own knowledge of his service and the career possibilities it offers is meanwhile reinforced by inspecting miniature displays of men working in dozens of fields of Air Force activity. So lifelike is their detail that one model has a stream with water actually trickling along its bed.

Tests and interviews don't occupy all of Joe's time. The medical station gives him a thorough physical check-up and catalogues his health history. The flight chief, a non-commissioned officer in charge of Doakes' group, begins educating him on the routine facts of military life,



Instruction in 400 different specialties is given at the technical-training bases numbered in red above. Bases 1, 6 and 10 are indoctrination centers at Livermore, Calif., San Antonio, Tex., and Geneva, N. Y. The seven major training schools, with a few of their main courses, are (2) Warren, Cheyenne, Wyo., clerks, Teletype mechanics; (3) Lowry, Denver, Colo., armament, photography; (4) Amarillo, Tex., jet maintenance, overhaul; (5) Sheppard, Wichita Falls, Tex., piston-engine maintenance, overhaul; (7) Keesler, Biloxi, Miss., radar, electronics; (8) Scott, Belleville, Ill., communications and cryptography; (9) Chanute, Rantoul, Ill., welding, weather, special engine courses

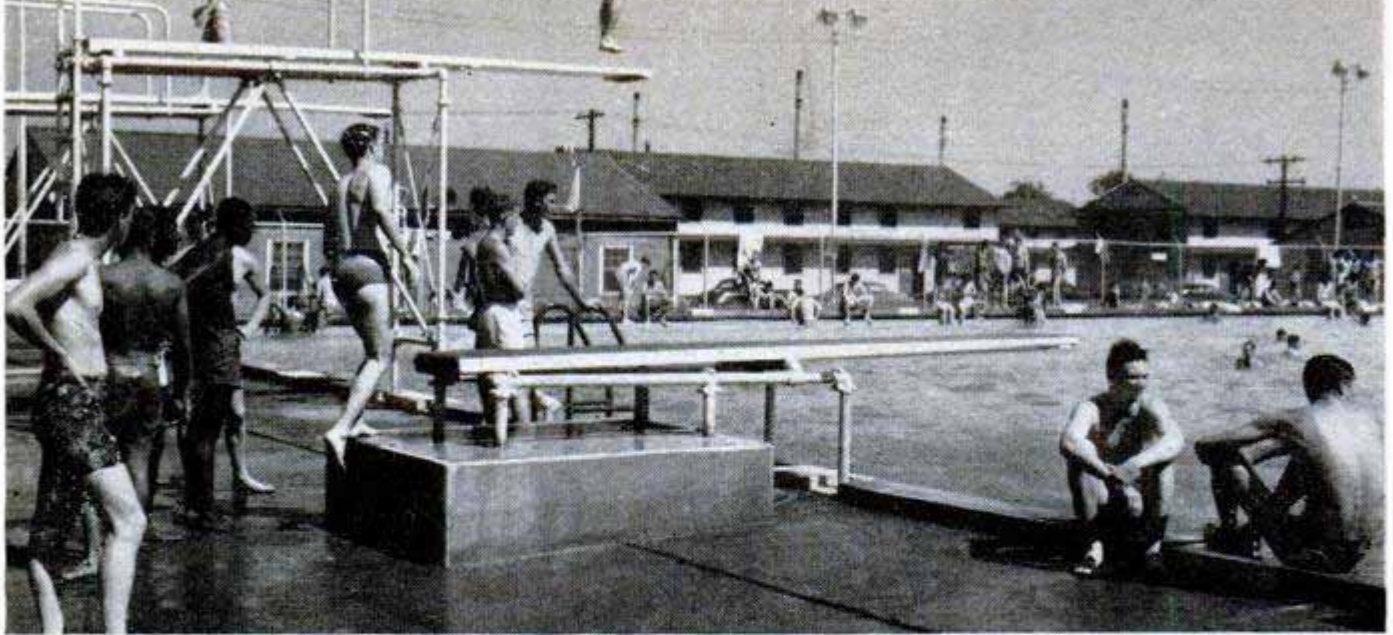
like keeping his bunk orderly and his shoes shined. Marching and the handling and firing of a carbine are added to his abilities.

During indoctrination, Joe is asked to select three first choices from among the many technical-training courses, with the reminder that class-size quotas, his qualifications and other factors might make acceptance impossible in some categories. The Air Force's most pressing specialist needs, of course, take precedence over all else in determining for what most of the men will be schooled. Wherever possible, however, recruits are matched up with their first choices.

Joe's performance at Lackland indicates a capacity for mechanics, and after 13 weeks he is shipped to Amarillo, in the Texas panhandle. Others, slated to be pilots, navigators, bombardiers, radar observers and combat crewmen, move on to flight-training bases.

Two technical-school graduates team up to repair a damaged wing on a front-line jet fighter in Korea





Knowing that "all work and no play makes Jack a dull boy," all the schools provide recreational facilities

At Amarillo, for 26 six-day weeks, he is intensively schooled in classes, hangars and on the flight line in basic aircraft maintenance. Joe's instructors, using movies, cutaways and mockups, gradually peel away the mysteries surrounding such things as airplane electrical and hydraulic systems, panel instruments and the workings of both piston and jet engines.

Already tagged to be a jet specialist, he is now ready for advanced training at Chanute Air Force Base, Rantoul, Ill. While the engine's basic simplicity was stressed during jet's early days, they've become more complicated electronically in the race for supersonic performance. The course on the Allison J-33 engine, for example, in five years has been lengthened from five to seven weeks. The widely used F-80 and F-94 airplanes both use J-33 engines. Other units

like the Westinghouse J-34 and the General Electric J-47 have likewise increased in complexity as well as power.

The atmosphere at Chanute and other Air Force training bases is dominantly scholastic. The men there are getting a concentrated education as technician craftsmen, not as commandos. There is little evidence around the fields of rugged combat exercises or intensive weapons drills.

Among the few military touches apparent are saluting, the marching and singing of groups moving between classes and the fatigue uniforms—loose-fitting coveralls and caps—they all wear during their school shift. Books and note pads are more familiar sights than rifles and metal helmets.

Specialist students like Joe are on one of two shifts, starting at 6 a.m. or noon and lasting six hours. All have two hours of supervised study daily,

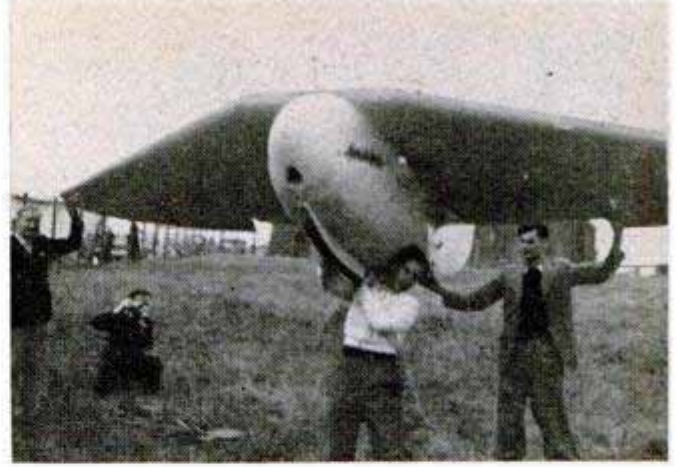
plus whatever each individual decides he needs. About 10 percent ask for additional tutoring from counselors rotated from the instructor ranks. Every barracks has a special room set aside for study and counseling.

The age and educational differences among these inductees, more varied than in colleges, present teaching problems. At Chanute they find that many mechanically

(Continued to page 266)

Before they select an Air Force career field the new men view dozens of lifelike miniatures that show typical specialists at work under typical field conditions





Glider Trainee Gets Over-the-Shoulder Instruction

Glider instruction is simplified in a new German craft that has the teacher's seat directly behind and above that of the student. Only one instrument panel and one steering gear are required and corrections

can be made over the shoulders of the pupil. Another design exhibited at a recent soaring meet was a tailless glider, with a wing-span of more than 20 feet and weighing only 110 pounds.



Electric "Hot Foot"

When your feet are cold, you're cold all over and that is why an electric foot warmer is good news. Made of Goodyear's Pliotherm, the conductive rubber that electricity heats, the foot warmer can develop 100-degree temperatures. Pliotherm has long been used for de-icing airplane propellers and wing surfaces. Made into a square mat, the rubber increases the comfort of persons who work in places where floors are cold and drafty. Being waterproof, it can be used outdoors where it makes more comfortable the job of the taxi starter, doorman and traffic policeman.

Chemical Sterilizer for Fruit Trees

Growth of fruit on trees prized for their shade or appearance can be halted by spraying them at the flowering stage with a stronger mixture of the same solution used to make fruit adhere to trees. Many tree owners object to having lawns littered with undesirable fruit.

Poor Man's "Hot Rod"

One of the most economical cars ever built, both in purchase price and mileage, recently made its appearance in France. It's a little two-seater weighing only 380 pounds. The two-horsepower motor is in the rear. Canvas fastened to a tubular metal framework forms the seats.

☐ In 11 years Capt. L. B. "Buddy" Messenger, a British Overseas Airways pilot, has flown across the Atlantic Ocean 350 times.



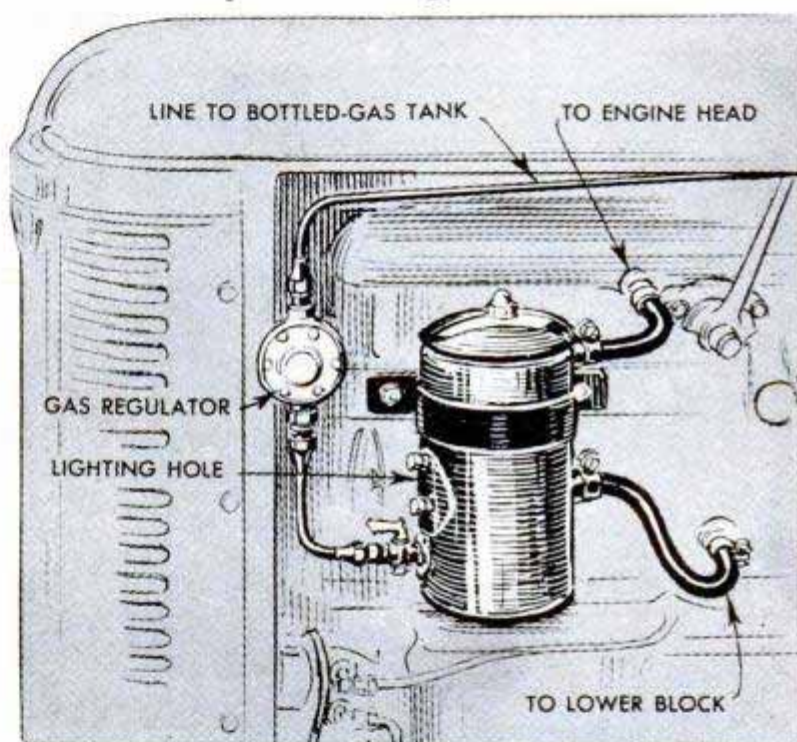
Overhead Heater

Installed in the ceiling, a new gas-fired heater distributes warm air horizontally in all directions to eliminate cold spots and direct hot blasts. The warm air passes through seven diffuser rings, mixes with the warm ceiling air, then flows down the walls. Eventually it moves back up to the return air intake in the bottom of the heater. A control keeps the fan in operation even after the gas has been shut off.



All-Night Heater Burns Bottled Gas to Keep Truck Engines Warm

No matter how low the temperature drops, truck and tractor engines are kept warm when not in use by a small heater that burns bottled gas. The heater, a little larger than an oil filter, is mounted on the side of the engine and connected to the block by rubber hoses. As the engine coolant is heated by the small gas burner, it circulates through the block, keeping the engine warm. Invented by a Minnesota mechanic, the heaters keep mining and lumber trucks and equipment warm all night so they start instantly in the morning. An automatic heat regulator controls the burner, which costs about one cent an hour to operate. The block heater is adaptable to any water-cooled engine and is made in three sizes.



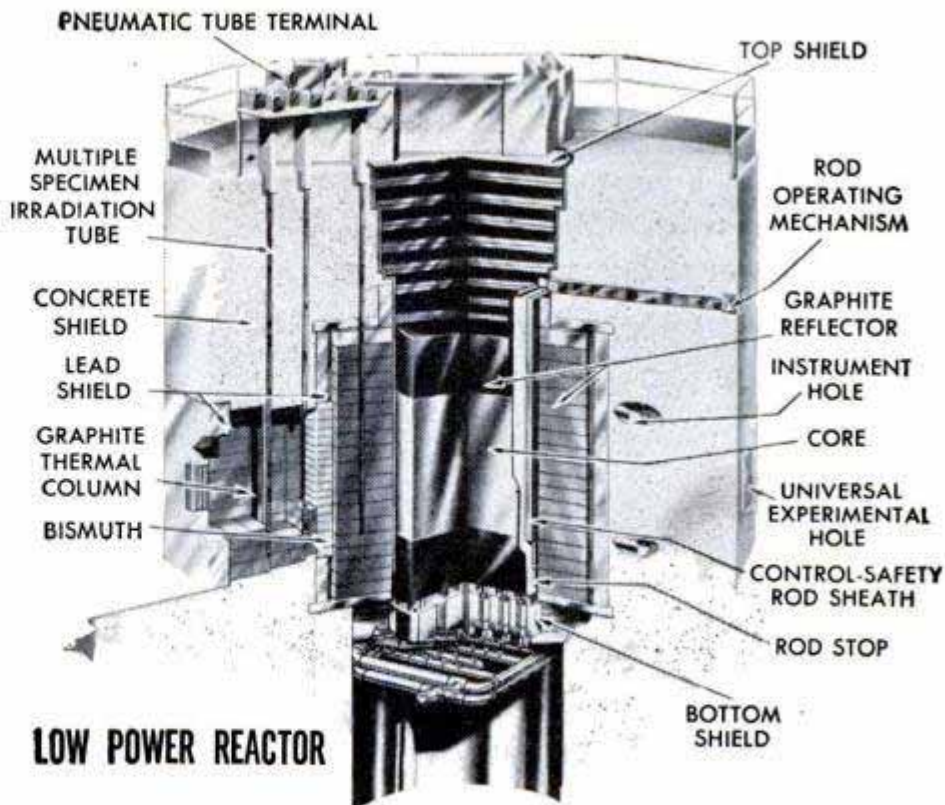
British Use Indoor Wind To Test Their Skiing Form

British skiers faced "gales" of 85 miles an hour—indoors—in preparing for this year's Olympic Games championships in Norway. The athletes used the Royal Air Force wind tunnel at Farnborough, where new jet aircraft are usually put through their paces, to test their ski clothing and perfect a less wind-resistant stance.

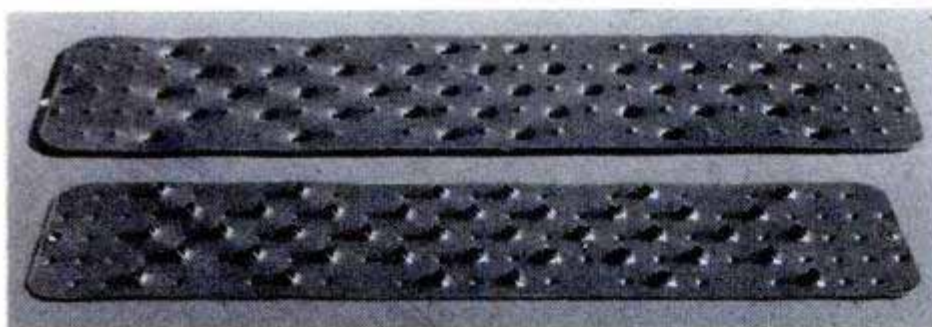
☐ Silicone-rubber-treated glass cloth having high heat resistance and excellent flexibility is now being used for electric motor and cable insulation.

Atomic "Furnace" for Use in Industrial Research

Private industry and research institutions now can contemplate building their own reactors, or atomic "furnaces." A small, low-cost, low-power reactor has been designed by North American Aviation for the Atomic Energy Commission. It is estimated that the reactor could be built for about \$1,000,000, which would put it within the reach of many large educational and industrial institutions. The reactor is designed for research only. It could be operated at 160 kilowatts eight hours a day, five days a week for 10 years on a single charge of uranium. Such a reactor would be especially valuable on the West Coast for producing short-lived isotopes, or "tagged atoms," for medical and industrial research. Currently, isotopes must be shipped from Oak Ridge. Some have such



short lives they lose most of their strength by the time they arrive. The reactor is octagonal in shape, stands 11 feet high and weighs about 450 tons.

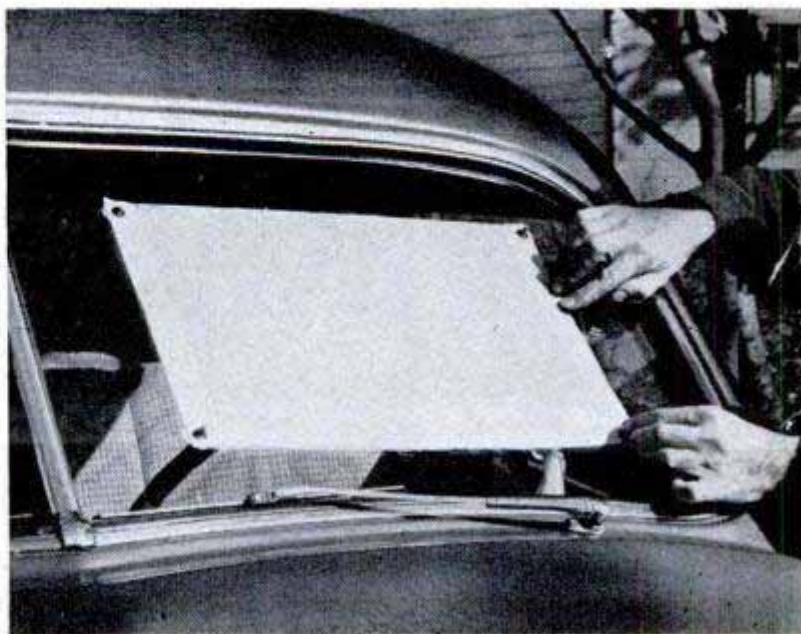


Metal Traction Aid

Built like a giant vegetable scraper, a perforated sheet-metal strip provides traction for starting cars on ice. The underside is covered with sharp points that grip into icy surfaces beneath the rear tires.

Winter Parking Shield for Car Windshields

Ice and snow on the windshield or other glass area of a parked car will be easy to remove if the glass has been covered with a plastic protector. Installed as soon as the car is parked, the 12 by 18-inch shield is fastened by rubber suction cups at each corner. When the car is to be driven again, the plastic panel, together with its wintry coating, is stripped off, affording clear vision immediately.



Information not listed on articles in the index often is listed in the WHERE-TO-FIND-IT LIST, available at no cost from the Bureau of Information, *Popular Mechanics*, 200 E. Ontario, Chicago 11

WHAT'S NEW FOR

W



1. COMPACT AIR DRIER removes up to 10 quarts of water a day from air of average room. Small enough to be carried from room to room, it plugs into any electrical outlet. The water is collected in a pull-out drawer or can be piped to a drain

2. THREAD HOLDER ends tangles or knots when you crochet. The two conical endpieces on the spindle automatically hold spools with center holes of any size. Made of smooth plastic, the cones permit the ball to rotate easily as the thread is used

3. DULL SILVER a problem at your house? Then here is good news. It's an invisible coating that prevents tarnishing indefinitely. You just brush it on. When you want to remove it, peel it away from the metal. It protects chrome on cars, too

4. CLOTHES DRIER operates from any 110-volt outlet. The clothes hang on horizontal rods at top and fan forces hot air around them, fluffing them as they dry. Blower-heater can also be used as a room heater and hair drier between washdays



5. PORTABLE BREEZES can be carried on your trips when you have a double-fan unit that weighs less than 20 pounds. It is about the same size as a suitcase and can be stowed in the car trunk. With it, you need not worry about hot hotel rooms

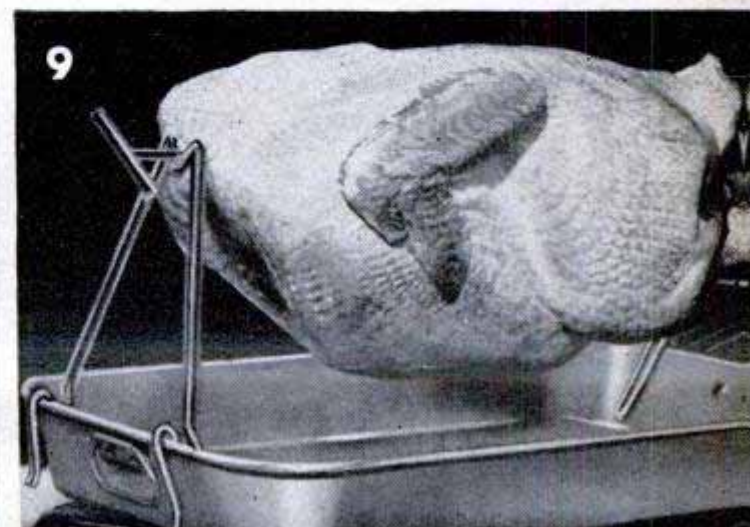
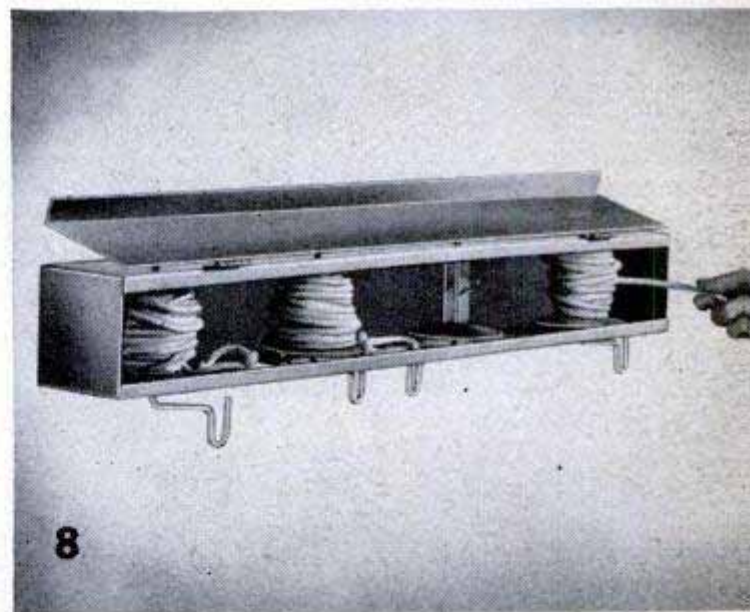
6. KNIFE SHARPENER makes it simple to keep your carving knives as sharp as razors. It is driven by a small electric motor that runs on alternating current. To sharpen the knife blade all you do is draw the cutting edge through the honing slot

7. AQUARIUM-PLANTER will decorate your mantel, dining table or television set. One end of the piece is an aquarium, while in the other end is a glass-lined planter. Under the aquarium is a small bulb that spreads a soft light up through the water



8. CLOTHESLINE HIDEAWAY not only keeps lines out of sight when not in use, but also keeps them clean and dry. Inside the steel box are four spools, each with 50 feet of line. Locks on the spool cranks hold the line taut once you've strung it

9. OVEN BARBECUE slips over the rim of any open roasting pan and suspends the turkey or roast in air, eliminating the searing and rupturing caused by contact with the hot metal. Meat and fowl brown and cook evenly without basting or turning





Folding Fairway

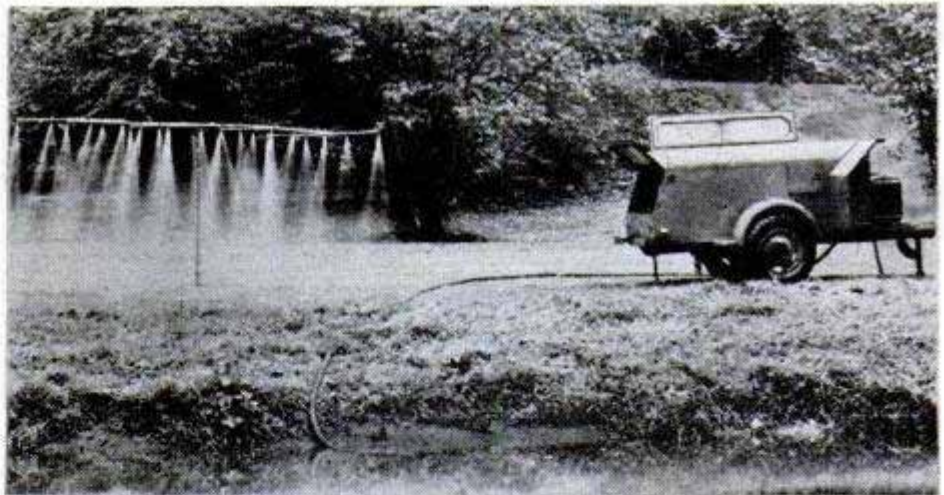
Golfers can set up a folding fairway in the back yard for a wide range of practice shots from long drives to delicate chips. The machine tells the golfer the distance and direction of any drive, even indicating whether he has hooked, sliced or driven the ball completely out of bounds. Suspended on a nylon cord from the cradle-like device is a regulation golf ball. When



the golfer makes his drive, the ball travels in an arc at the end of the cord, causing the cradle to pivot against tension springs. The springs measure the distance of the drive, from 25 feet to 350 yards. The cord comes to rest in one of several slots which indicate whether the ball was hooked, sliced or whistled straight down the fairway. The new device, called "Folda Fairway," can be set up wherever there is enough room for a golfer to swing a club.

GI Showers

Hot showers can be set up in the field for combat troops anywhere there is water now that the Army has a mobile shower system. Everything except the showers is built into a small, two-wheel trailer weighing less than two tons. In the trailer is a gasoline engine that pumps the water from a pond or stream, a boiler that heats the water to sterilizing temperatures and two heat exchangers to reduce water temperature for delivery to the shower heads. The heat that is removed after sterilization is not wasted—it preheats the water before it en-

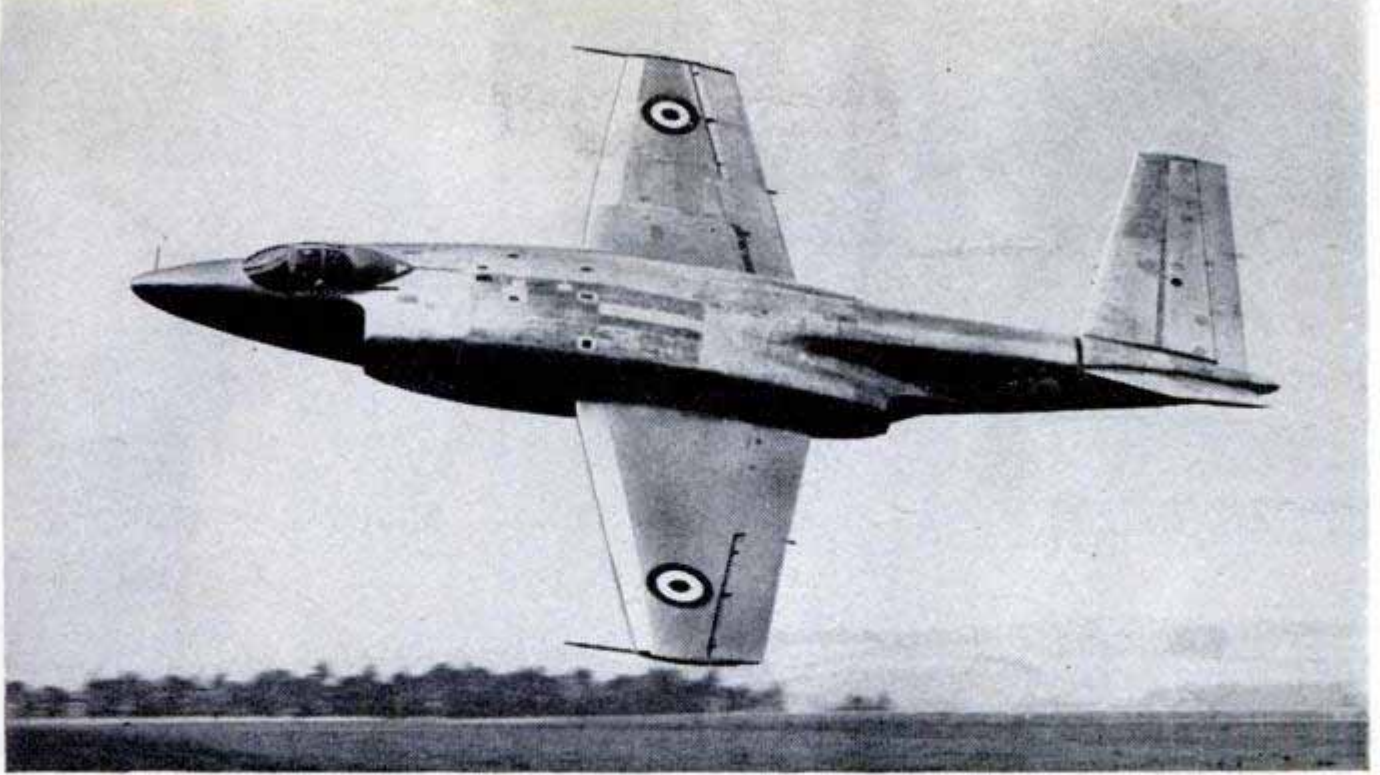


ters the boiler. With the new unit developed by the quartermaster corps, soldiers can enjoy the luxury of hot showers 20 minutes after the trailer pulls up to a water supply.

Air Controller Synchronizes Truck-Tractor Brakes With Trailer

With a new air-controller unit, drivers of truck-tractors with attached trailers can operate air brakes on the tractor and electric brakes on the trailer by a single application of the brake pedal. Developed after years of research, the unit provides syn-

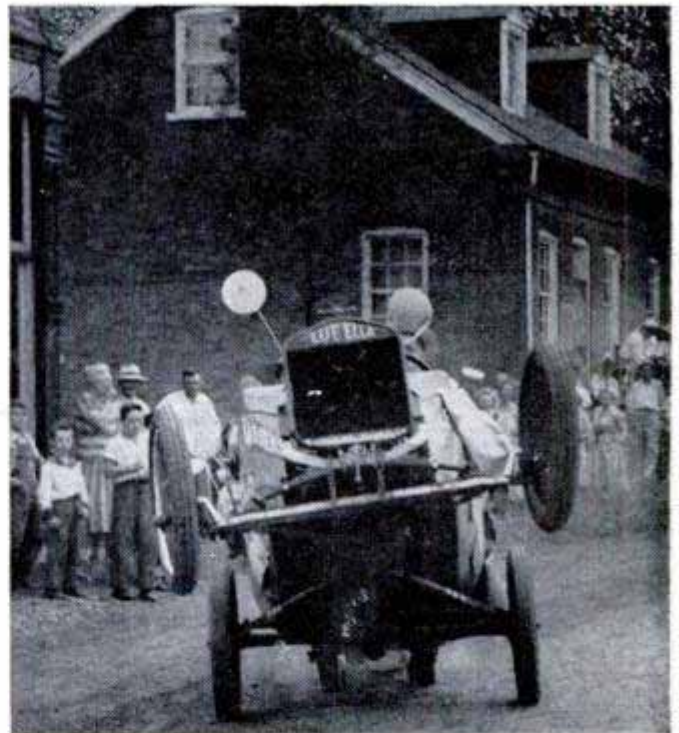
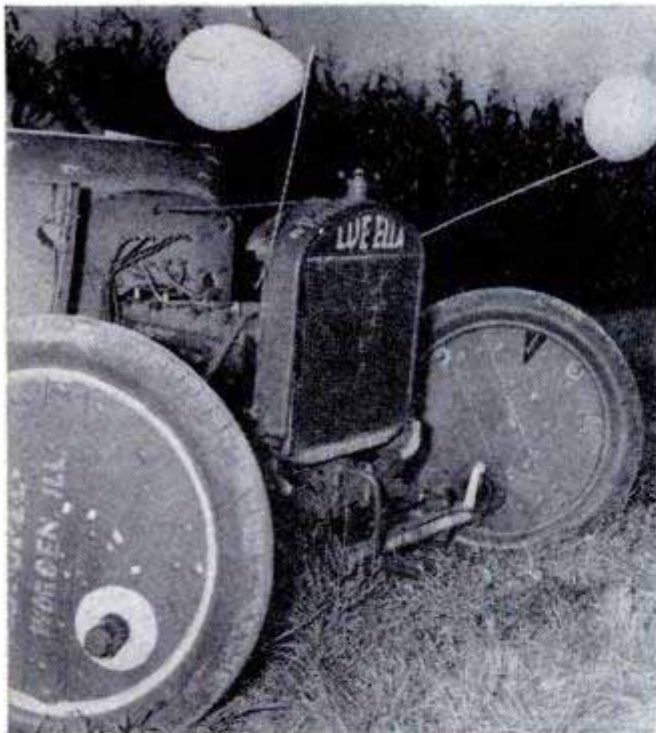
chronization of brakes on the tractor with those on the trailer. The controller actually makes two braking systems available; an air system for the tractor and an electric system for the trailer. If one fails, the second is in reserve for emergencies.



British Carrier-Based Jet Features "Butterfly" Tail

Powered by two Rolls-Royce Avon jet engines that are housed within the fuselage, the Supermarine 508, Britain's latest carrier-based jet fighter, is still on the secret list as far as performance details are concerned. Its "butterfly" tail unit, similar to

that used on the Beechcraft Bonanza, has no separate rudder. The hinged trailing portions work both as elevators and rudders. The Supermarine is the first aircraft of such high performance to use the V-type tail assembly.



Leaping Model T

When driving his bucking Model-T jalopy, O. F. Opel of Worden, Ill., always has his share of fun in parades. By sawing out wooden disks to replace the spokes in the front wheels and mounting the hubs off center, Opel can make the car weave along

with froglike motion at low speed. Driven faster, the front end leaves the ground like a frisky bronco.

¶ With less than seven percent of the earth's population, the United States produces nearly one half of the world's supply of electricity.



This pontoon bridge across the wide Han River in Korea was built in a few hours by U. S. Army engineers

In Battle, There's Always ONE MORE RIVER TO CROSS

By Michael Day

FOR ARMY ENGINEERS, war is just one river after another, intersecting the battle front like lacy patterns in a bug's wing. Korea is no different. Few of its rivers have bridges over them. Bridges that do exist are soon bombed or dynamited into crumpled heaps of half-submerged concrete and steel as opposing forces blast them during retreats to delay oncoming hordes of attackers.

To minimize these delays, U. S. Army engineers have devised ingenious "packaged" bridges of aluminum or steel that can be thrown across a good-sized river in a matter of minutes or hours. Some are sturdy enough to allow heavy equipment like trains, tanks, supply trucks and weapons carriers to roar across vast bodies of water. Others, floated into place, provide threadlike footbridges across which troops

Sections of a pontoon bridge are floated into place to form treadway bridge across Pyong-yang River





Big tank crosses river in Korea over newest type of "underwater" bridge made of rocks and many sandbags

can pursue, single file, a retreating enemy.

If a packaged bridge is not available, Army engineers know all the tricks for making what they call "expedient" bridges—jerry-rigged spans built of anything handy. Korean chasms and river beds are bridged by some fantastic structures. Bamboo suspension bridges, hanging by cable or twisted vines, sway across canyons. Spindly arches of saplings leap mountain crags. Timber trestle bridges of native trees lashed with rope provide roadways across water for heavy vehicles. At one river the men had plenty of steel treadways for a pontoon bridge, but no pontoons. They rounded up about eight broken stake trucks, pulled out the stakes, drove the trucks into the river and spaced them side by side all the way across, spotting them on high ground so that the truck beds were above water. Then they laid the treadways from truck bed to truck bed, and attacking vehicles roared across the 300-foot-wide river over the backs of those eight trucks.

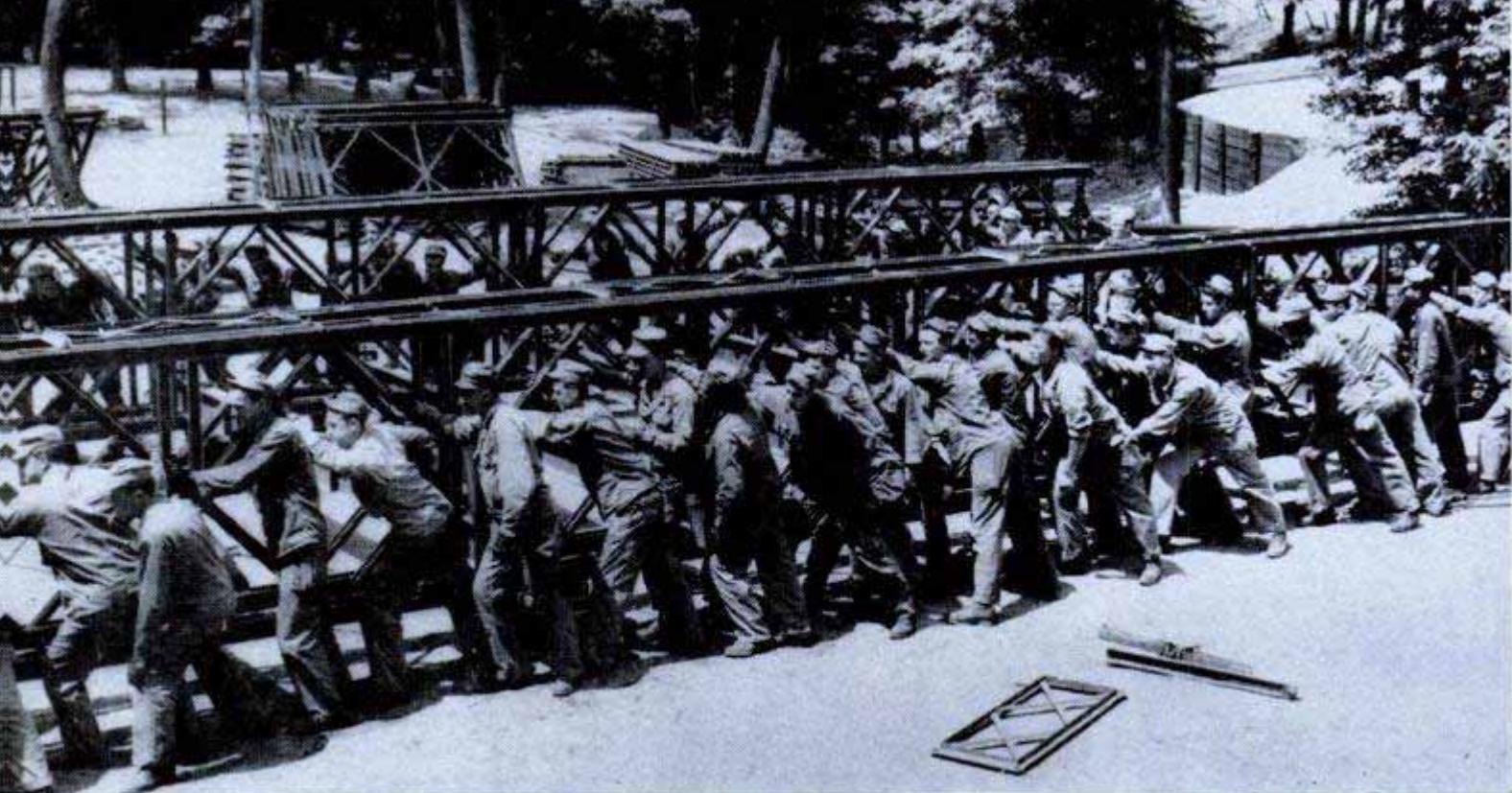
The knocked-down packaged bridges, of course, are more effi-

In the shadow of a wrecked bridge, U. S. forces build a sturdy structure across the meandering Taedong River at Chinju

cient. They are designed for easy transport and fast assembly. Some, like the rugged, fixed Bailey bridges of latticed truss-steel construction, come in prefabricated sections that bolt together. They make as permanent a span as any you've seen here at home. The difference is that six men can lift and carry into place the heaviest unit in the Bailey package.

Baileys go up with frightening speed. Huge trucks roll to the site, laden with chunks of bridge which are unloaded by built-in cranes that rise hydraulically from the tailboards of the trucks. Engineers swarm in and assemble them on the





At Fort Belvoir, Va., engineers learn how to handle prefabricated Bailey bridge; sections move on rollers

spot. A complete bridge section, 20 feet long, goes up in half an hour. Long, supporting girders for the span are assembled on rollers at the brink of the gorge or river, and are pushed out over the edge by manpower and cantilevered into position. To help, the men sometimes use a span launcher, which consists of a 100-foot cantilevered I-beam mounted on a flatcar or truck. The launcher picks up an assembled bridge span and lifts it out over the gap

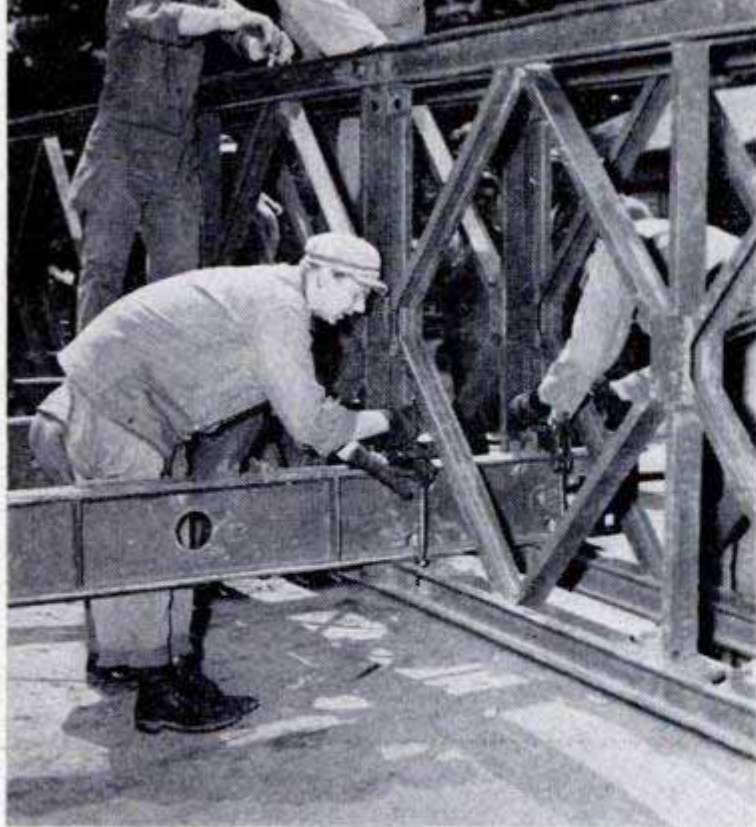
like a long arm reaching across the river.

Complete Bailey bridges 500 feet long have spanned the Han River on old piers within half a day. If no piers are available, Bailey sections can leap across a series of anchored barges and provide a sturdy, "strafeproof" floating bridge whose rugged trusses will support anything on wheels, including railroad trains.

A new Bailey is now undergoing rigid tests at Fort Belvoir, Va., where the engi-

Jeep advances over aluminum treadway paths bolted to steel assault craft with timber supports near shore





Engineers practice assembling a Bailey bridge. Here trainees clamp on transom which will support deck

neers test out many of their devices. Made of lightweight aluminum, its 20-foot sections will go together in half the time required by its predecessors. It will span chasms up to 640 feet and carry a load of 150 tons.

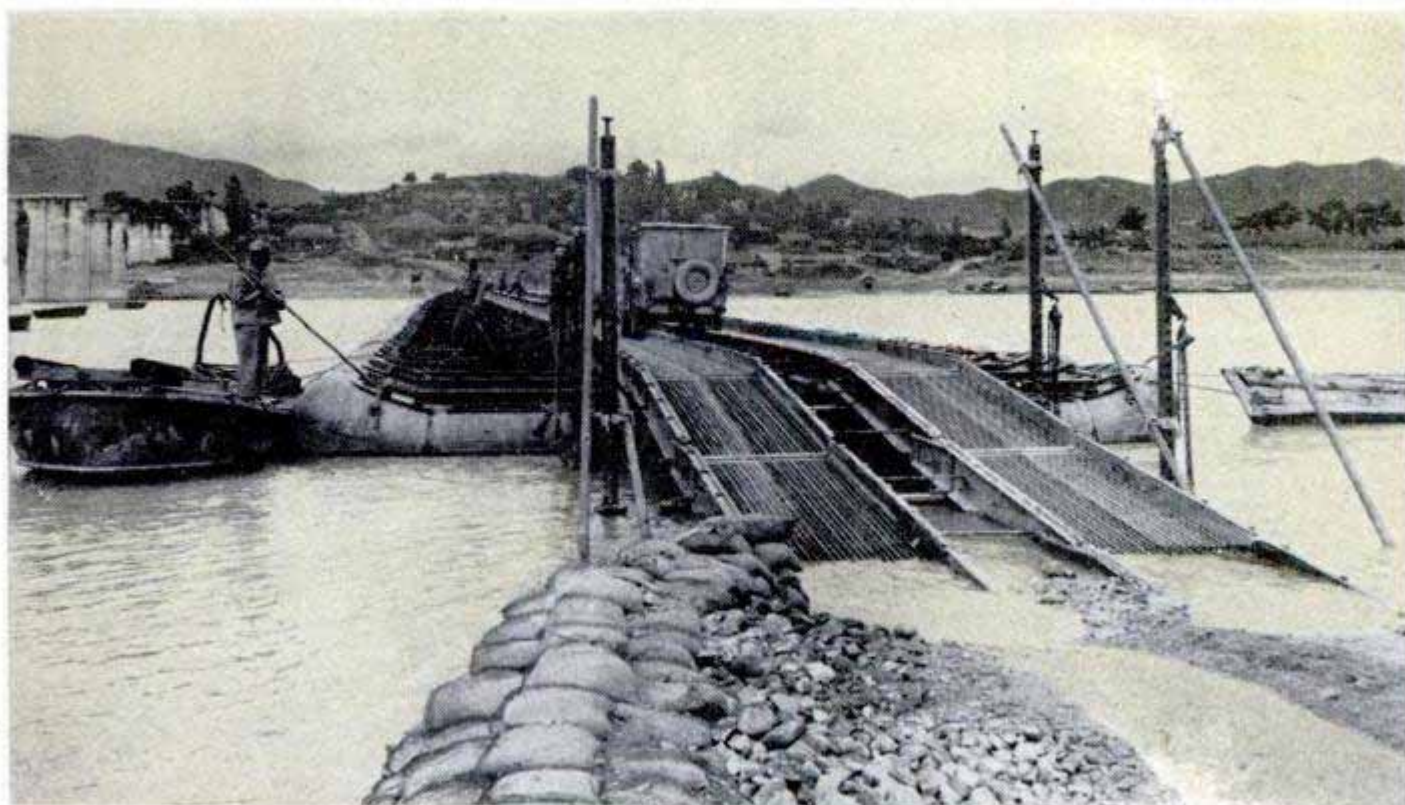
Since military engineers must design everything with an eye to getting the most possible use from it, new floating treadway bridges—consisting of floats carrying

metal treadways across their backs—use small assault boats instead of the pontoon-type float. pontoons, while light and inflatable for easy transport, are also easy for enemy planes to puncture and sink. The assault-boat floats are steel shells that can also be used to ferry troops across a stream. The little boats stack inside each other like pie tins, for easy transport, and are light enough for swift handling. As floating bridge piers they have one disadvantage; maintenance crews must patrol the bridge continually and bail out the hollow assault craft after rainstorms.

Pontoon or assault-craft bridges, however, can be assembled faster than the Bailey, and it doesn't take experts to do the job. Two platoons of men, waiting as trucks come in laden with floats and treadways, can carry the parts into the water and assemble a 500-foot span, with a 55-ton capacity, in six or seven hours. Known as treadway bridges, these floating roadways come in a vast assortment of combinations. Newer ones consist of big assault boats with slots in the gunwales. The treadways—long, hollow columns of steel—have wide, steel fingers bent at right angles at each end. These fit into the slots, keep the roadway in place and link the floating boats. When laid in overlapping fashion, the treadway pieces form a solid roadway of steel from boat to boat.

Other floating bridges have steel or aluminum treadway sections, about 14 feet long, that fashion a pair of tire tracks over the water. Treadway bridges are versatile, too. A small section of one can double as

Steel-grate treadways bolted to pontoons form this bridge built by the 55th Engineer Battalion in Korea





Final link of pontoon bridge is floated into place on the Tong Dong River by the 11th Engineer Battalion

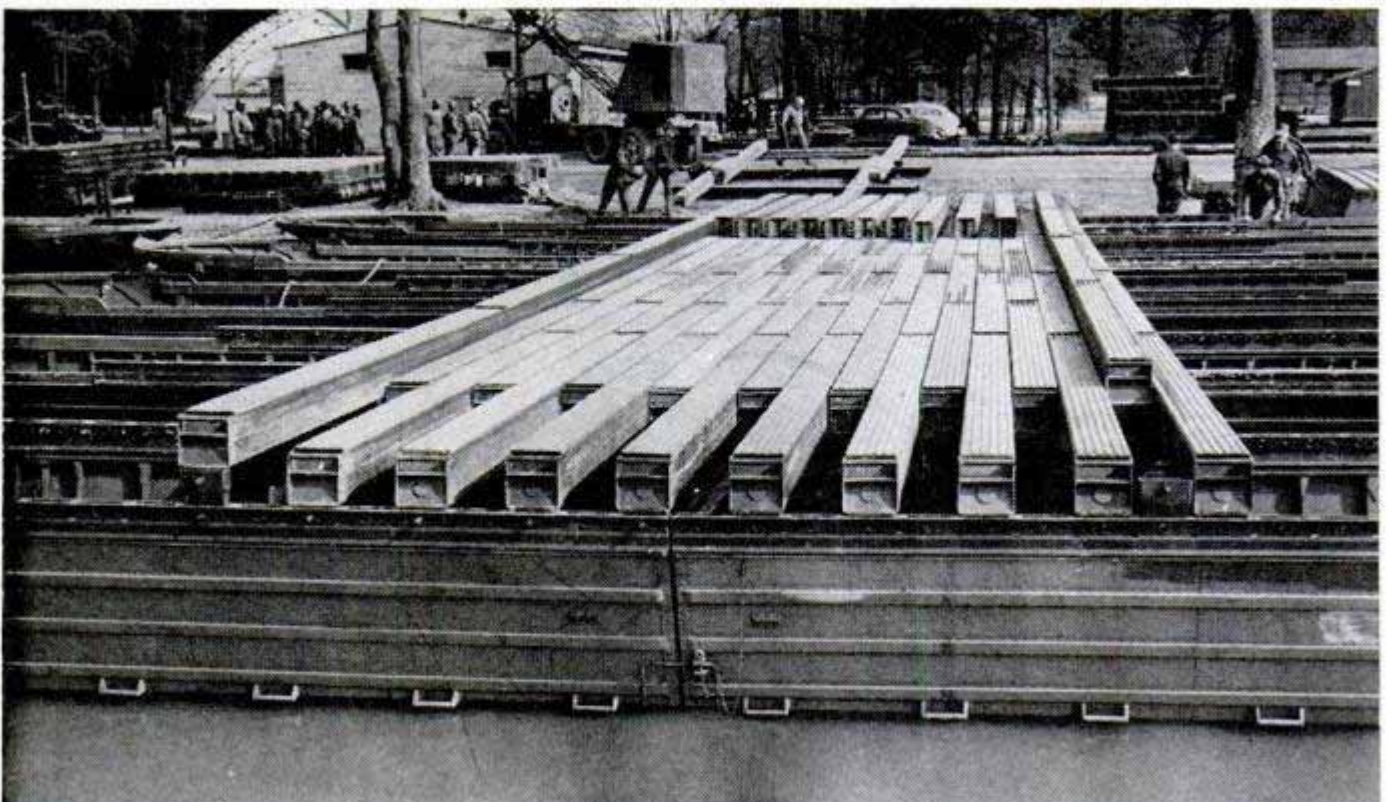
a vehicle ferry when there isn't time to complete a whole bridge. To get tanks and trucks across the Kumho River in a hurry, engineers simply strung together a few assault boats with a few treadway sections of aluminum. Treadway sections on each end were hinged, so that they could be raised like flaps to prevent vehicles from rolling off as the makeshift ferry was towed back and forth by a powerboat.

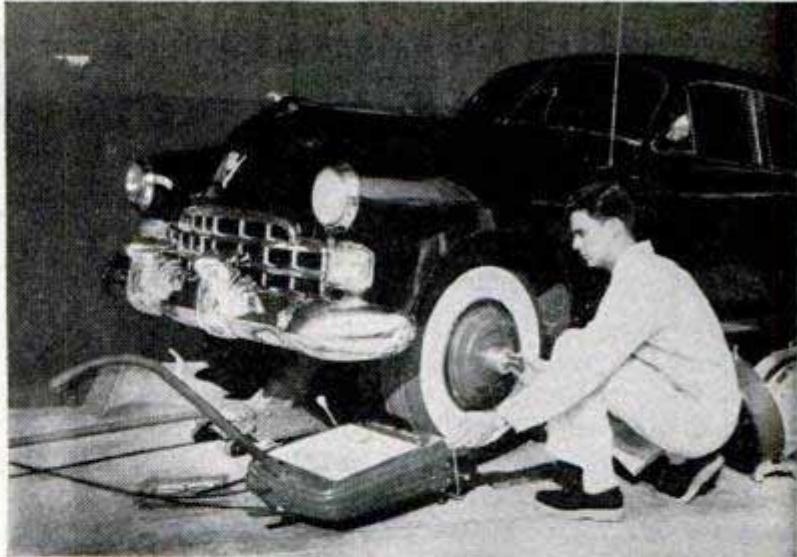
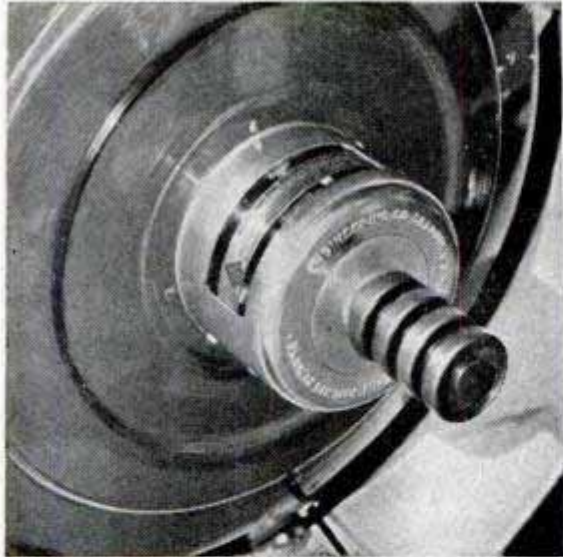
Even the 14-foot treadways alone are versatile. Bolted together, they can span narrow gullies and streams without benefit of floats. Laid in a single line across special steel pontoons recently devised by the engineers, they form a footbridge for infan-

trymen that can be stretched out over miles of water if necessary.

Besides building bridges, engineers must also know how to destroy them in a hurry when necessary. Every company has its demolition experts who know how to plant minimum charges in just the right places to make a perfectly good bridge useless for the enemy. Floating bridges are blasted loose to sink or float downstream. Fixed bridges can be dumped neatly to the river bottom in sections or all at once without, as one Army engineer puts it, "mussing up the piers so they can be used to build another bridge when we come back that way a second time."

Long hollow-steel columns are arranged below in the same way they are placed over pontoons to form bridge





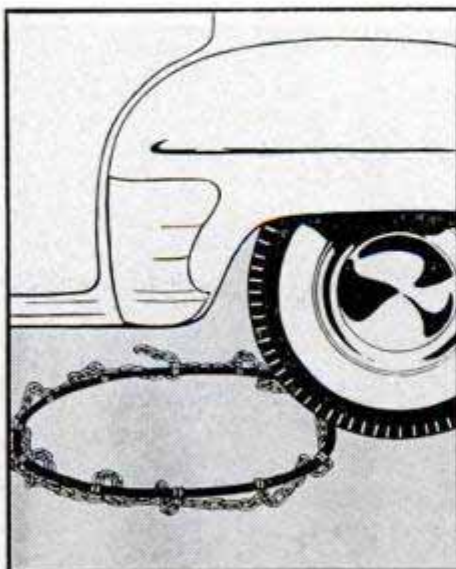
WHEEL BALANCER shows amount and location of weights needed to end imbalance with wheel in place on the car. A motor-driven roller spins the wheel as mechanic "tunes in" corrections on four knobs at the hub



HEEL MAT slips over accelerator pedal to provide a "pillow" for the heel that stops shoe scuffing. Made of rubber, it is put on without tools. It prevents wear on the floor mat, too



GAS-TANK "WATCHDOG" is screened to prevent siphoning. No key is used. Cover is opened by pushing pump nozzle into it



EASY-ON CHAINS eliminate reaching behind wheel to hook inner link because inner band is a rubber hoop, left. Wheel is driven inside hoop, chain lifted over wheel, center, and only outer link has to be snapped



SUN-GAZER'S TELESCOPE

SOLAR ECLIPSES don't happen every day—nor every year for that matter. Yet only during an eclipse can astronomers study the sun's corona, that enormous halo around the sun. From this corona come the radiations that affect us on earth.

Not only are eclipses infrequent, but they're brief. None exceeds $7\frac{1}{2}$ minutes, and most are much shorter. To make things more difficult, eclipses are often seen only in distant parts of the world. There's one this month, but it's visible only in the Middle East and Siberia. The United States will see its next eclipse June 30, 1954, and then for only $2\frac{1}{2}$ minutes.

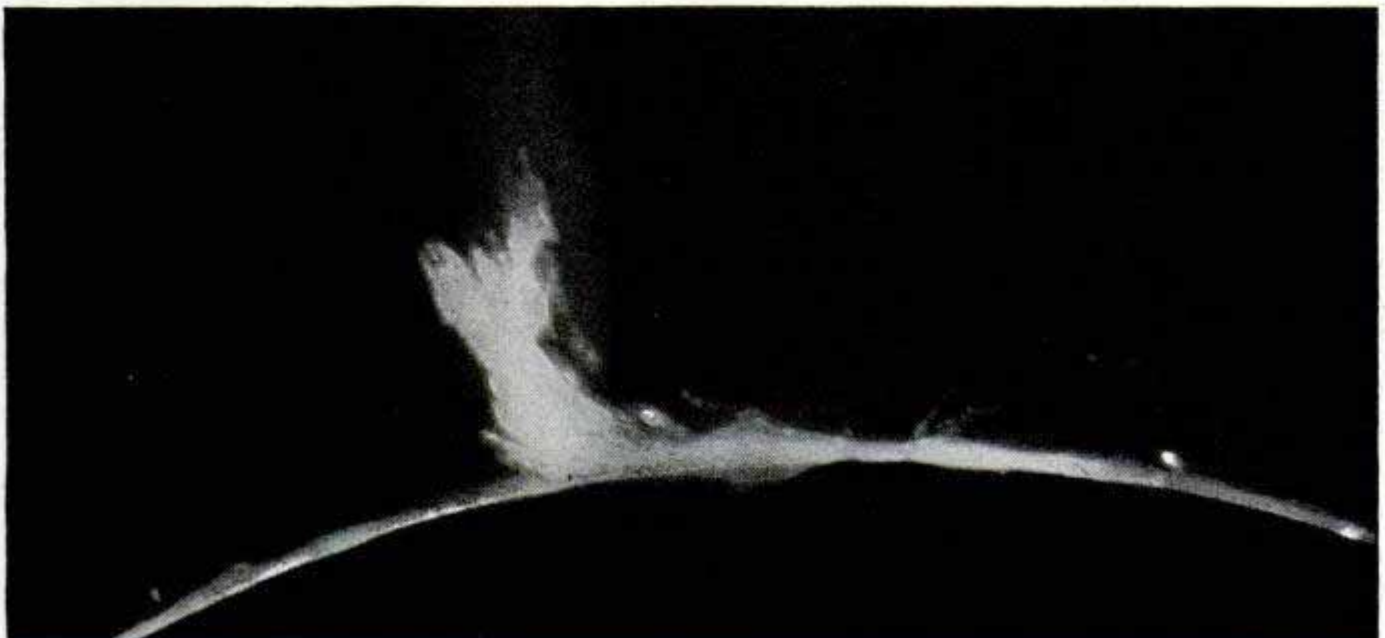
Fortunately, astronomers can make their own eclipses with a telescope called a coronagraph. An occulting disk mounted in the optical system blocks out, or occults, the bright face of the sun, creating an artificial eclipse. Studies can then be made of the sun's turbulent limb, or edge, and its halolike corona.

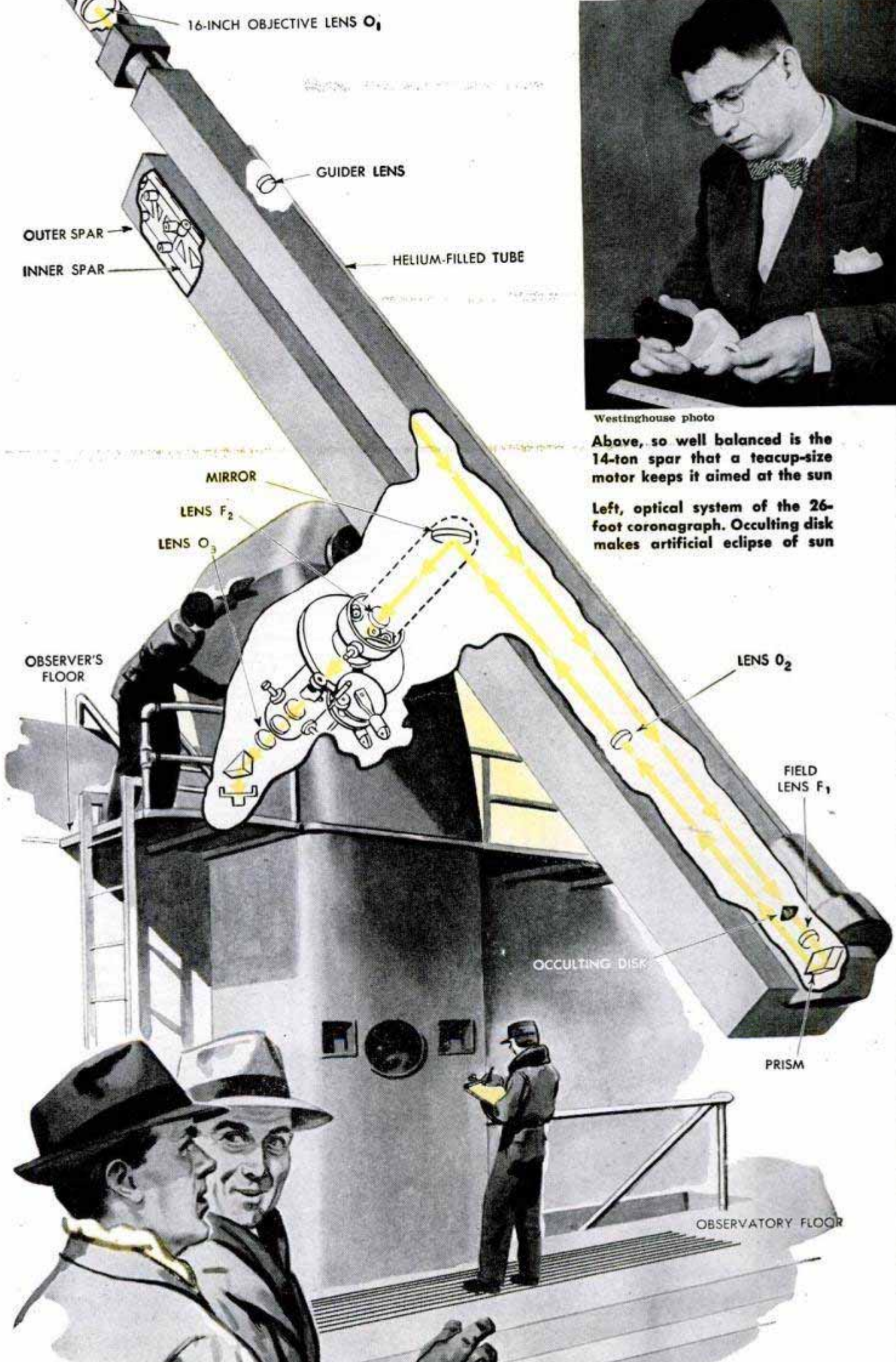
Two new 26-foot coronagraphs are being installed in high-altitude, dust-free observatories atop Fremont Pass in the Colorado Rockies and on Sacramento Peak in New Mexico. With these new telescopes, astronomers hope to learn more about the sun and its effect upon us earthlings.



Above, an occulting disk blocked out the sun's face as this 27,000-mile-high prominence was photographed

Below, in 10 minutes, the incandescent hydrogen solar prominence soared to a height of 133,000 miles!





16-INCH OBJECTIVE LENS O_1

GUIDER LENS

OUTER SPAR

INNER SPAR

HELIUM-FILLED TUBE

MIRROR

LENS F_2

LENS O_3

OBSERVER'S FLOOR

LENS O_2

FIELD LENS F_1

OCCULTING DISK

PRISM

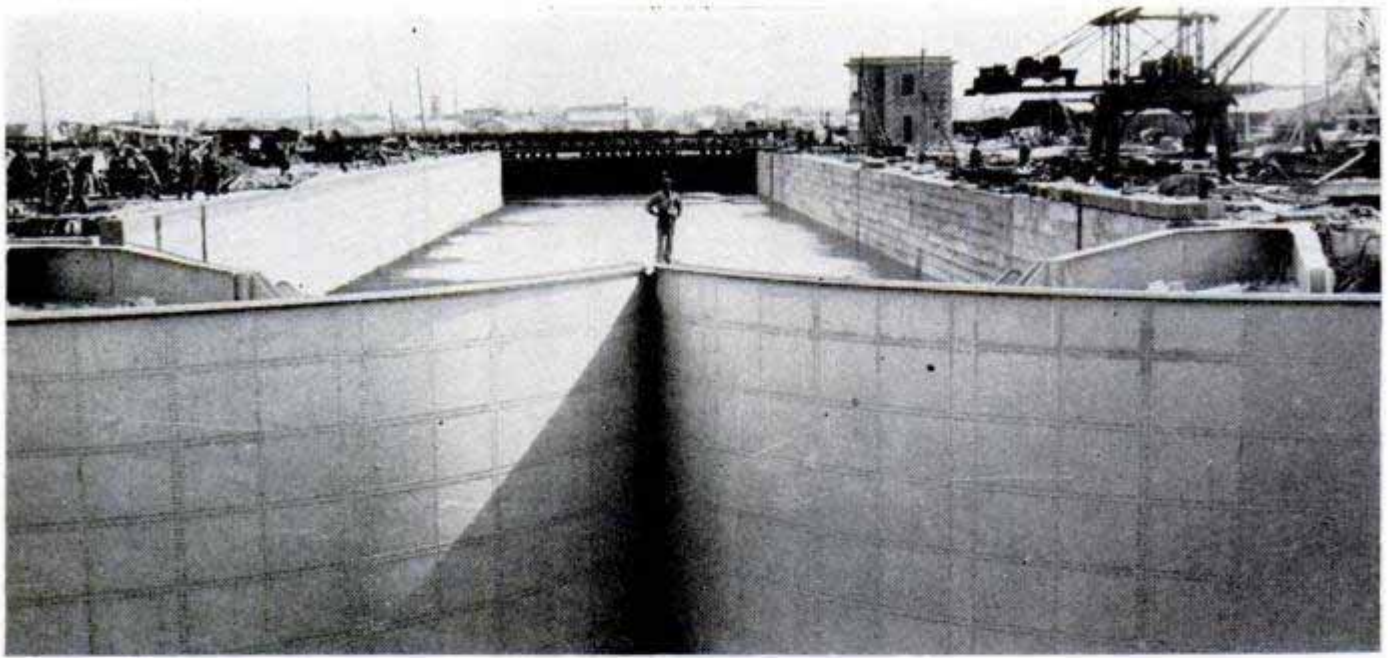
OBSERVATORY FLOOR



Westinghouse photo

Above, so well balanced is the 14-ton spar that a teacup-size motor keeps it aimed at the sun

Left, optical system of the 26-foot coronagraph. Occulting disk makes artificial eclipse of sun



Pneumatic tubes at the joint below man, above, expand to make a watertight seal when the gates are closed

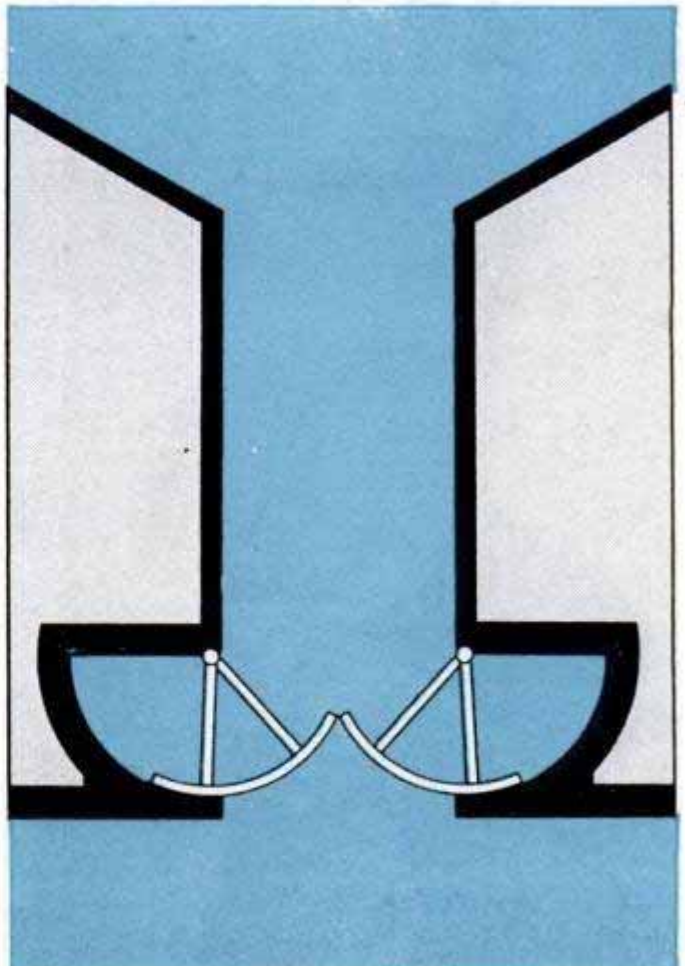
Curved Locks Open by Rotating on Pivot

INSTEAD OF OPENING against the flow of water, curved locks at Saint Malo, France, open by rotating on a central pivot. Just as you can spin a log in a stream although you can't push it against a strong current, rotating locks open with little effort. Another feature is a pneumatic seal

With the lock almost dry, clearly visible are the two sealed bearings on which the heavy lock gate pivots

on each end to provide a tight joint without friction. When the gates are closed, air is pumped into pneumatic tubes which inflate to press against each other and seal the lock tightly. When the lock is to be opened, the air is released and the seal opens. The gates pivot on oil-filled bearings.

Plan drawing of the lock shows the arc shape of the gates and the way they turn around the center point



50th ANNIVERSARY
FEATURE

REVOLUTION ON THE FARM

1902 - 1952

**By Wheeler McMillen,
Editor-in-Chief, Farm Journal**

A MERICA'S FARMERS moved into the 20th century convinced that modern times had come. The long ages of primitive drudgery, they felt, had come to an end. Farmers were riding their plows and cultivators, grain binders, mowing machines and hayrakes. A man no longer had to walk from sunrise until dark.

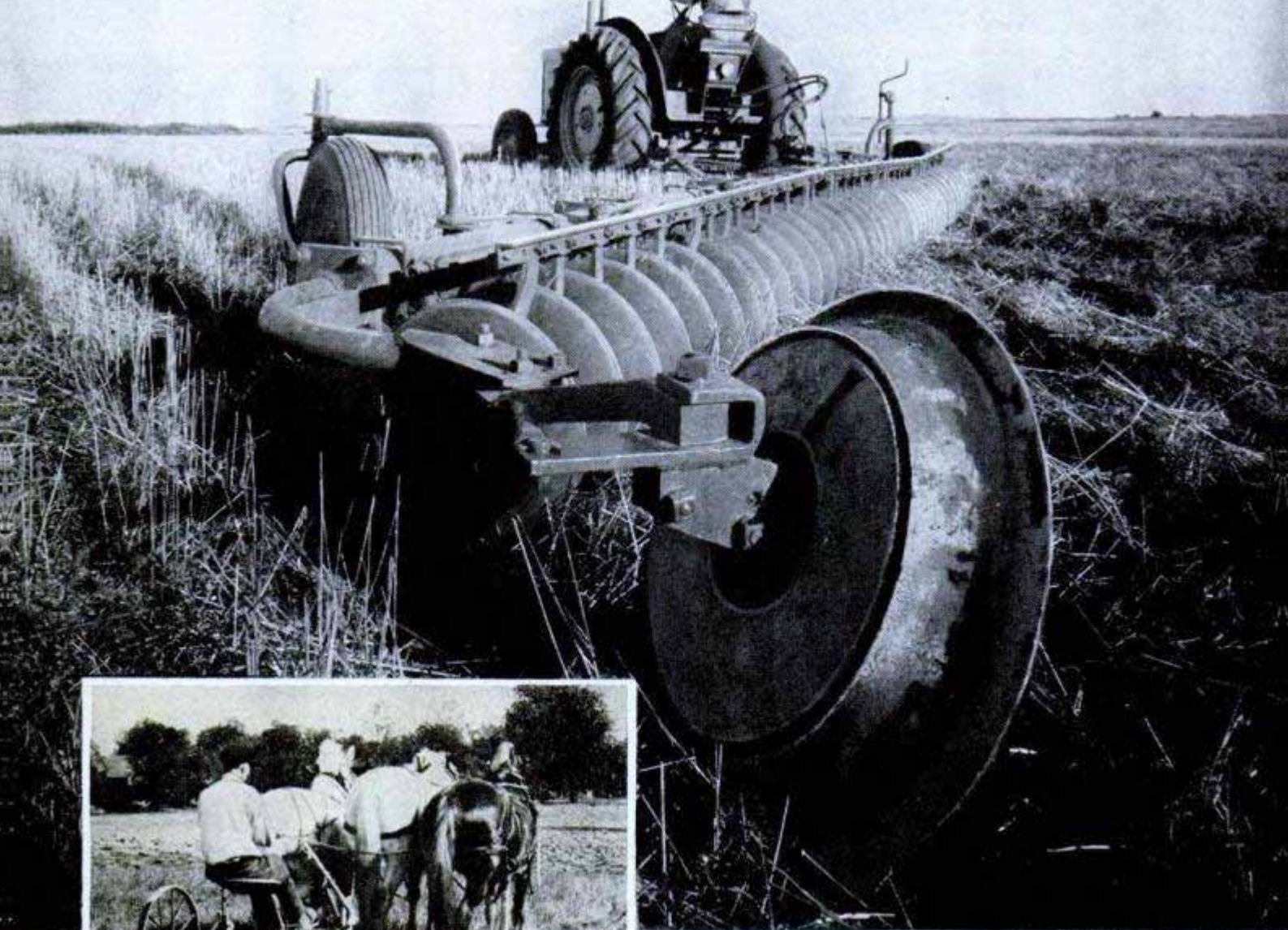
Progressive neighborhoods were putting up telephone lines. Principal roads were being "piked" with gravel and crushed stone. Rural free delivery already was bringing the mail daily. New houses were

going up with furnaces in the basements. Some even had bathrooms and running water in the kitchens.

By 1902, when *Popular Mechanics* was founded, advanced agriculturists were talking about "scientific farming." The agricultural colleges and state experimental stations, organized a decade or so earlier, were hitting their strides. Instructive bulletins were appearing in the mailboxes. Old-timers thought this stuff was nonsense, but nevertheless they went to the Farmers' Institutes to hear

Midcentury farmer harvests 50 bushels of wheat per acre with the aid of a diesel tractor and modern combine
Caterpillar Tractor Co. photo



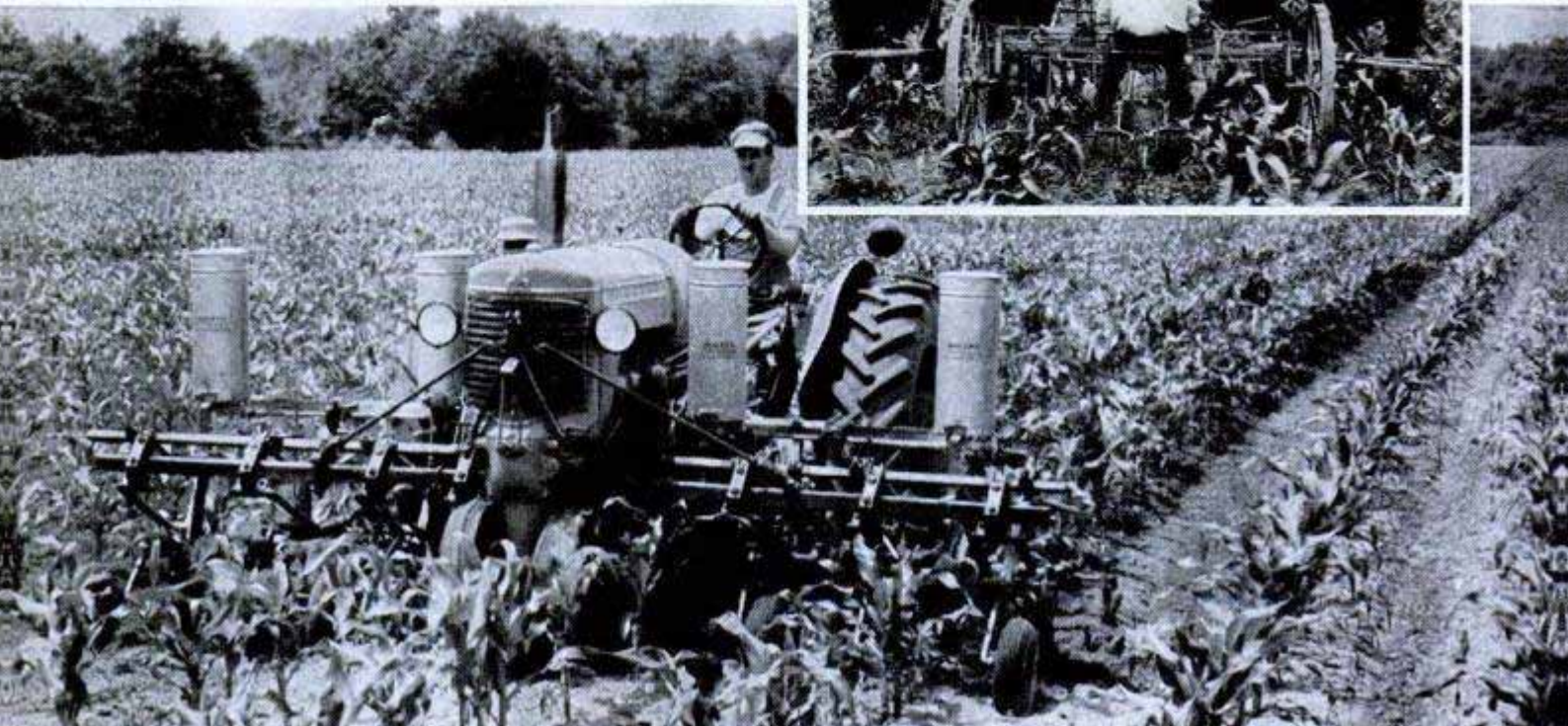
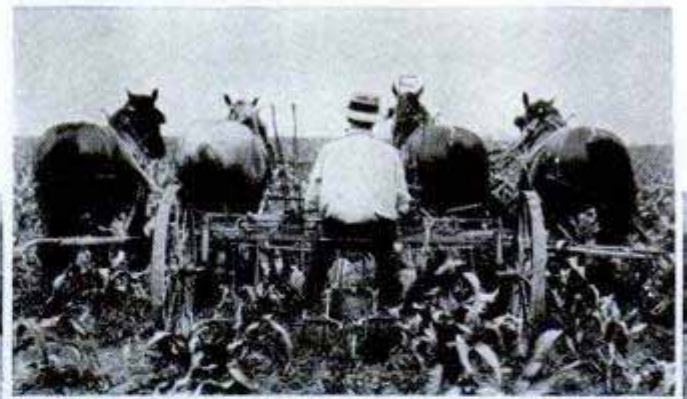


Deere & Company photo

Giant tractor-pulled disk slices a broad swath of earth. With such equipment, modern farmer can cover as much ground in one day as his 1902 forefather covered in two weeks with horse-drawn sulky plow



Modern four-row corn cultivator fertilizes the crop as it moves along. The fertilizer is carried in four cans atop the attachment. Inset, the pre-World War I two-row corn cultivator was pulled by team of horses
Minneapolis-Moline photo





1910 24,211,000 HORSES AND MULES (NOT ALL WORK ANIMALS)



1910 1000 TRACTORS



1951 7,500,000 HORSES AND MULES (ESTIMATED)



1951 4,300,000 TRACTORS (ESTIMATED)

If the above graph were carried to completion, there would be a total of 4300 tractor symbols, representing more than four million tractors now in use. In the past 41 years the number of tractors has multiplied 4300 times and the number of horses decreased two thirds. Each tractor does the work of several horses, and for each horse replaced, an additional five acres becomes available for human food instead of horse feed

about it and some tried out the new ideas.

The improvements in which the farmers of 1902 took pride were indeed astounding when viewed in the light of their grandfathers' experiences. Farmers had ceased to broadcast seed from a heavy shoulder bag. No longer did they harvest with sickles and scythes. They drove horse-drawn grain drills and two-row corn planters, sickle-bar mowing machines, twine binders, and used steam threshing machines. The corn binder and the corn shredder were coming along. Hay loaders were replacing pitchforks. Yet all these remarkable advances, which had unfolded swiftly in the wake of American freedom, were but prelude to what was to appear by 1952. The next half century was to see more agricultural progress than all the previous generations of mankind had accomplished.

"Revolution" is a strong word, to be used

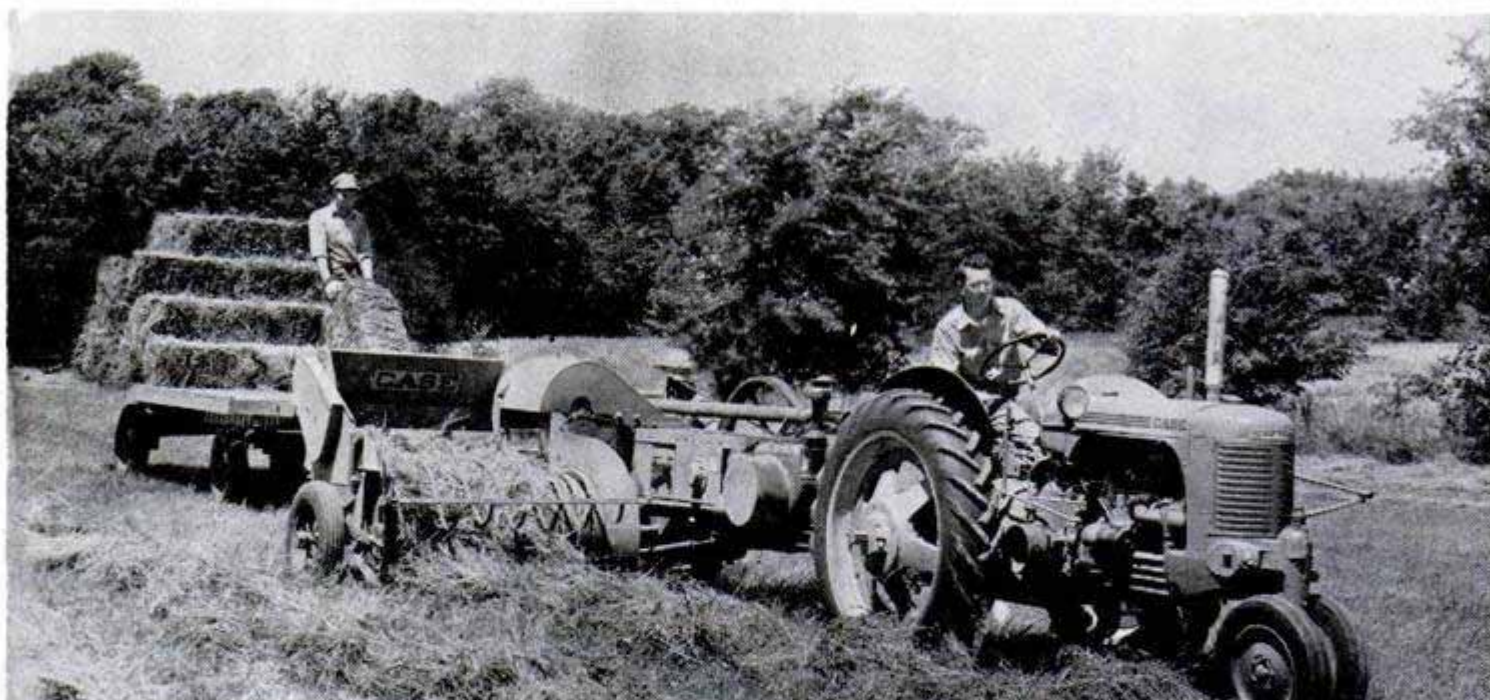
only sparingly. But agriculture in America has been revolutionized during this half century. A bright boy from Horace's Sabine farm could have done good work his first day on Washington's Mount Vernon lands, and he would not have been entirely useless on a farm of 1902. However, if a 1902 farmer were transplanted without notice to the management of a 1952 farm he would be completely unqualified.

Mechanical improvements have created most of the tremendous changes. But by no means all, for unprecedented advances have been made in the management of soil, in seeds, in overcoming diseases and pests, and in the education and environments of farmers themselves. Machinery has only set the pace.

Significant as these 50 years of progress have been to farmers, they have meant even more to the nonfarm people of the

Caterpillar diesel, with attachments, applies gas fertilizer as it cultivates at rate of five acres per hour
Caterpillar Tractor Co. photo





J. I. Case Co. photos

Sun's still hot, but making hay is a lot faster today. Bales are easier to handle and take less storage space than loose hay, left, hoisted to hayrack by horse-drawn loader

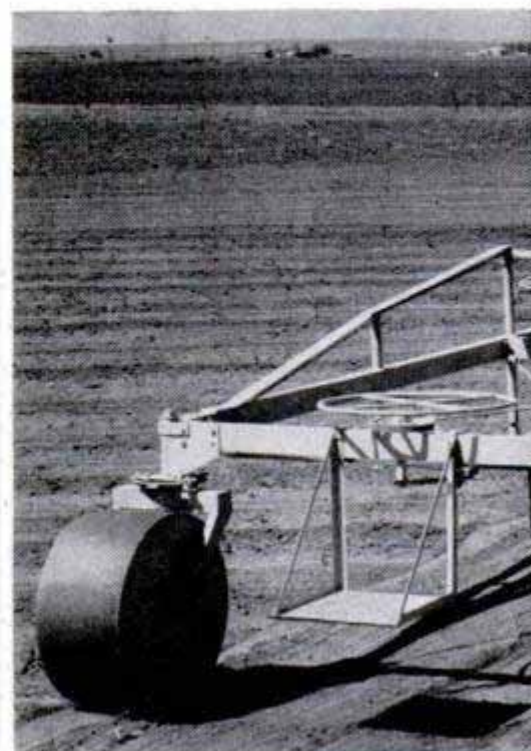
nation. By providing the ever-present assurance of ample food supplies, advances in agriculture have permitted city populations to multiply and industry to flourish.

One farm worker in 1902 could support eight other persons. Now he supports 16. The "other people" are enjoying more food of better variety and greater quality and

are working fewer hours daily to pay for it. With abundant and usually not-expensive food supplies, all Americans are able to devote more of their earnings to satisfying other wants.

The 24 million horses and mules that furnished most of agriculture's power in 1902 have dwindled now to seven million. Over

Two-row cornpicker knives through a field in the Midwest. In 1902 the corn farmer worked almost 21 hours per acre; today he works less than four
The Oliver Corp. photo





Minneapolis-Moline photo; Inset, International Harvester Co. photo

Modern self-propelled combine does work of old-time binder (shown in inset) and thresher in one operation

four million tractors, two million trucks and great numbers of electric motors energize 1952's farming. In many a corn-belt county more horses are kept for pleasure-riding than for draft. For every disappearing horse another five acres begins to supply human food instead of horse feed.

The 20th-century farm revolution started in 1903 when the gas traction engine first appeared. The word "tractor" came into use around 1906. Men still argue over who really made the first tractor. The numbers

Caterpillar Tractor Co. photo



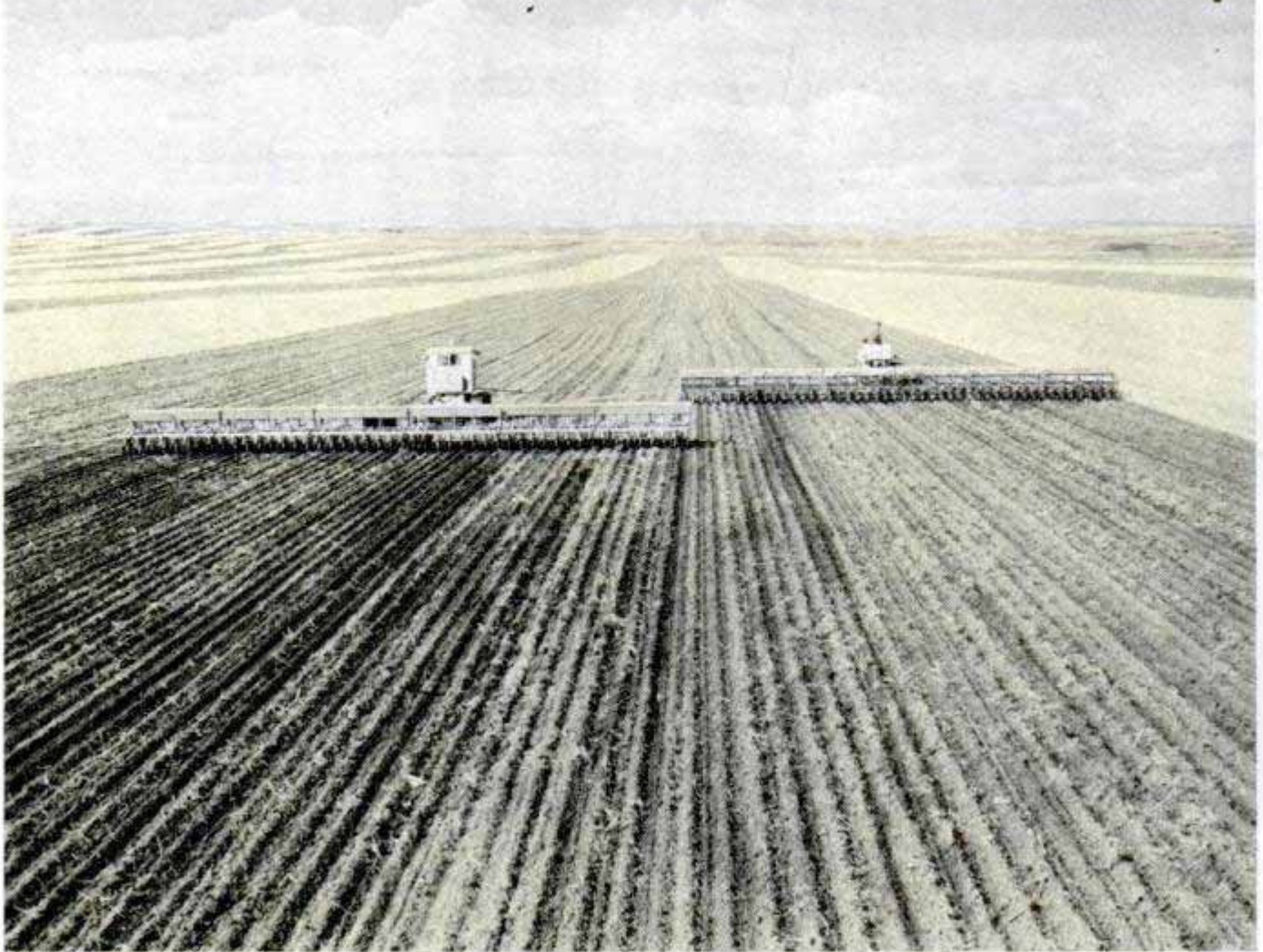
produced raced upward from 600 in 1907 to 4000 in 1910, 21,000 by 1915 and then, in 1920, 203,207. The spurts came after 1918 when Henry Ford offered the first light tractor, 1924 when the tricycle-type machine adapted tractors to corn cultivation, and 1932 when low-pressure rubber tires increased the tractor's speed, shock resistance and general usefulness.

The automobile had opened the gate for the tractor. Farmers began buying motor-cars in numbers before 1910. The low-priced models, especially the rugged Model T, suited farmers. They became accustomed to the tunes of motors, and were prepared to buy as soon as really useful tractors were offered at reasonable prices.

Naturally, the first tractors were designed to replace horses, which meant that the machines were hitched on behind. Soon the idea dawned that the tractor could do things horses could not do. By 1924 implements began to be mounted directly on the tractor. The tricycle made row-crop cultivation practicable. Weight and bulk were reduced until the tractor could actually perform nearly every operation that could be done with horse teams. By 1930 completely horseless farms were known, where every operation was mechanized.

Farmers had long realized that for most field operations each season offers only a

Here's the easy way to level land for irrigation. Landplane measures 8 by 30 feet, scoops off the high spots to provide a just-right surface for drainage



Caterpillar Tractor Co. photo

Out West the farmer thinks big, works big. Two 56-foot furrow drills plant winter wheat at 15 acres per hour

few ideal days. If the grain can be planted, the weeds killed and the harvest gathered on these "just right" days, the profits will be far higher than otherwise. The tractor had the speed and the tireless power to get jobs done at the right times. That one fact has not only paid for countless tractors, but has greatly enlarged U. S. food output.

About all the horse could do was to pull. Tractors never have colts, but they have pulleys and power take-offs. The power take-off meant that more efficient machines could be hitched on, machines that did not have to be half bull wheel. It brought the cornpicker, the combine and the field pick-up baler into business.

The internal-combustion engine, along in the 1920s, began to find another farm job. Hauling a two-ton load of produce or livestock to market with team and wagon had been an all-day task. It limited the choice of sales and buying points to those within a few miles. So the motor truck became a necessary tool on one third of U. S. farms. With the truck, markets could be 50 or 100 miles away instead of 5 or 10. Supplies could be brought from equal distances. Speed lessened spoilage and weight losses. Light trailers serve thousands of farmers whose loads do not call for trucks.

The march of machines through the half

century has steadily clipped hours and minutes off the man-hours of farm production. The wheat farmer who in 1902 plowed with a horse-drawn, two-bottom gang, sowed with a broadcast seeder, used a section harrow, harvested with a binder, shocked the bundles by hand and threshed by steam, was putting in 8.8 hours for an acre and .44 hours per bushel. By 1952 he was handling an acre in 1.82 hours and a bushel in .09 hours with a five-plow tractor, subsurface blade, disk harrow, heavy grain drill, self-propelled combine and motor trucks.

As the corn farmer progressed from 1902 methods of fitting and planting his fields, husking by hand and hauling with wagons, he cut his hours per acre from 20.8 to 3.88 and his hours per bushel from .38 down to .05. Tractors and mechanical pickers reduced hours per acre in cotton fields from more than 100 to fewer than 30, and on the Texas high plains, where four-row tractor equipment and two-row strippers are used, to as few as 6.5.

Likewise the dairyman who milked by hand and cleaned his stables with a manure fork had cut his hours in half. Where once he gave a cow 135 hours of his year, in 1952 he is taking better care of her in 60 to 70 hours. Litter carriers, pen barns, milking

(Continued to page 250)

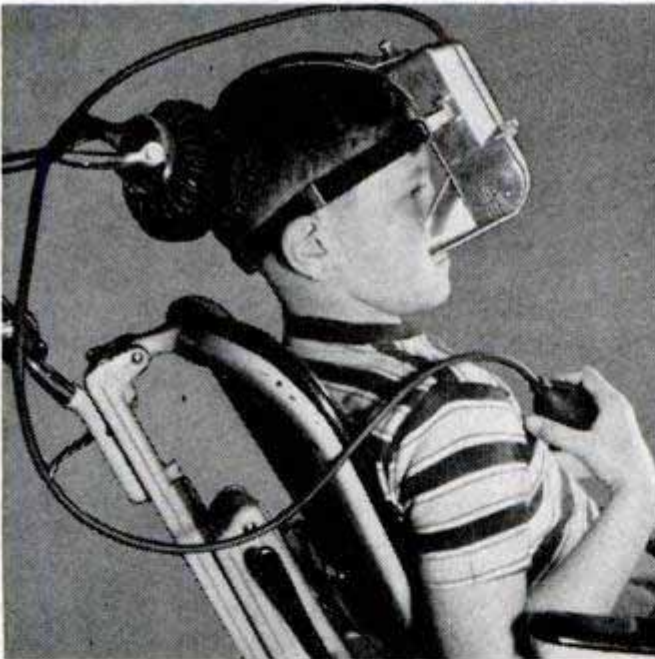


Lightweight Diver's Suit

Divers have more freedom of movement underwater when they wear a lightweight suit developed by the Army Engineers. Made almost entirely of canvas, the suit has an opening in the back through which the diver enters. The flaps of the opening



are twisted and held tightly closed by a metal clamp. The usual heavy metal head-piece is eliminated. Instead, a glass front-piece is held firmly by rubber straps around the head, the water sealed out by a contour-fitting rubber strip. Divers can work at depths of more than 100 feet with the new suit.



Self-Administered Anesthetic

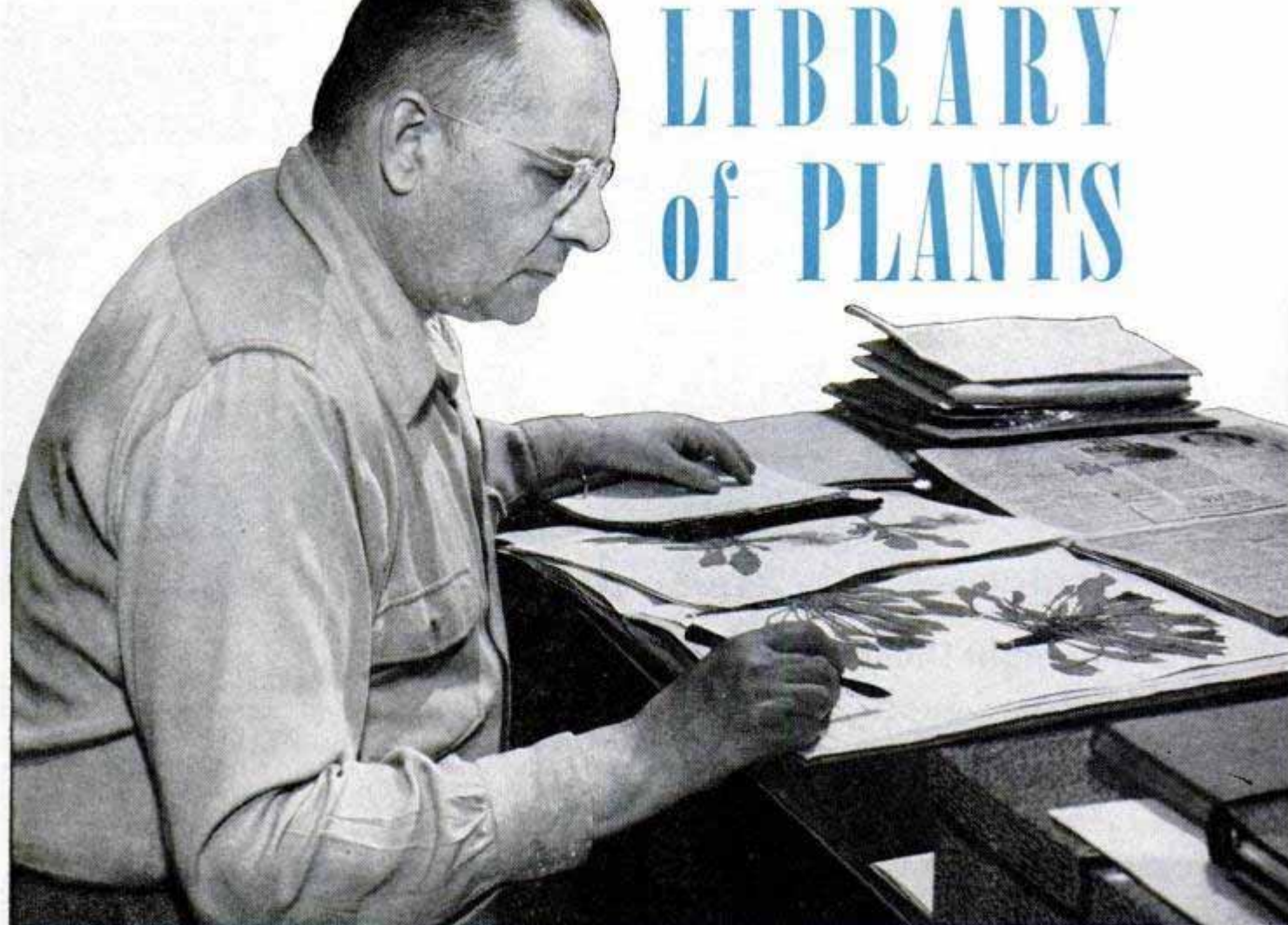
Medical and dental patients can administer a mild anesthetic to themselves with a bulb-operated instrument designed to relax nervous tension. The instrument fits over the patient's nose. In his hand he holds the rubber bulb which administers the analgesic. When he relaxes he automatically stops pumping the bulb but can resume pumping at any time. The relaxed stage lasts from 1 to 1½ minutes and leaves no ill effects.



Tool Winds Rope Around Cable

Steel cable for ships' shrouds and hand-rails is wrapped with a layer of rope by a new tool. Frank Fagan, a ship's rigger in Seattle, Wash., invented the tool, which is called a serving board. Most older-type serving boards require two men to wrap the canvas-covered cable. Fagan's board holds a large spool of rope. A spring keeps the spool from turning too easily so the cord will wind tightly around the cable, and a notch on the board guides the rope.

LIBRARY of PLANTS



Soil Conservation Service photo

After a trip to the field, the collector identifies and mounts a new plant in his 20,000-specimen collection

By O. A. Fitzgerald

PICKING PLANTS and pressing them between sheets of newspapers or blotters may sound like a soft, genteel and, in every respect, harmless hobby.

Filling a cabinet or two, or a whole room of your home, with mounted plant specimens may seem a needless waste of good space.

But take it from J. H. "Heinie" Christ, Pacific Coast regional director of the U. S. Soil Conservation Service, plant collecting can't be matched as a useful pastime.

During the past 30 years, this energetic posy-picker and his wife, his companion on most of the collecting jaunts, have been towed, lifted, shoved or dug out on roads all over the state of Idaho. They have smacked into snowdrifts in July. They have been rained out, hailed out and blown out of camps and off roads in spots far too numerous to remember. They've had to stop and repair old roads, even built short stretches of new ones to keep rolling.

As head man of the soil-saving forces in five states, California, Oregon, Washington, Nevada and Idaho, "Heinie" is in a position to know the basic value of plant collecting.

"Knowledge of soil and nature's protec-

tive covering never has been more useful than it is today," he declares.

When "Heinie" talks cash value of plant knowledge he's speaking from experience—his own and that of farmers and ranchers. At the start of his posy picking he was in a field frequented only by the scientific botanist. Not today. This generation knows the importance of plants in soil conservation.

"More and more land users are coming to realize that it isn't the number of head of livestock that are run on a particular range or pasture that counts," he declares. "Rather it is the number of pounds of beef, lamb or mutton that can be produced year in and year out that is important."

Because it's the meat that counts, ranchers and farmers are watching the kinds of plants on their hills and in their pastures. Hills can look green and still not produce a lot of meat. Plants that are of little value often make a field just as green as those on which livestock thrive.

"The modern rancher knows the earmarks of a rundown piece of land and knows what needs to be done to rebuild it," the conservationist continues, "and plant knowledge is the starting point. I find that

many ranchers can identify and use the scientific names of plants just as freely as those of us who were brought up in the botanical jargon. To all in the business of soil conservation, that's just about the most encouraging news anyone could ask."

Wesley Cruikshank of Montour, Idaho, is one of those progressive ranchers "Heinie" has in mind. Cruikshank is emphatic that "a rancher must know his grasses and other plants in order to manage his range and livestock properly. It is just as important for him to know plants and their characteristics as it is for the farmer to know varieties of wheat and other crops.

Some ranchers are even building their own amateur plant collections. Frank Lenzie of Paterson, Wash., for instance.

"He's a good botanist in his own right and uses the information in operation of his sheep and cattle ranch," Christ observes.

These ranchers use their collections in just the same way the professional botanist does. When they come in with a specimen picked up on a range ride they turn to the collection to help in identification.

For seeing the country—the mountains, the lakes, the rivers and the lonely sagebrush deserts far off the beaten path—plant collecting is a hobby that can't be beat. Plant collectors must poke into every corner of the country their collections represent.

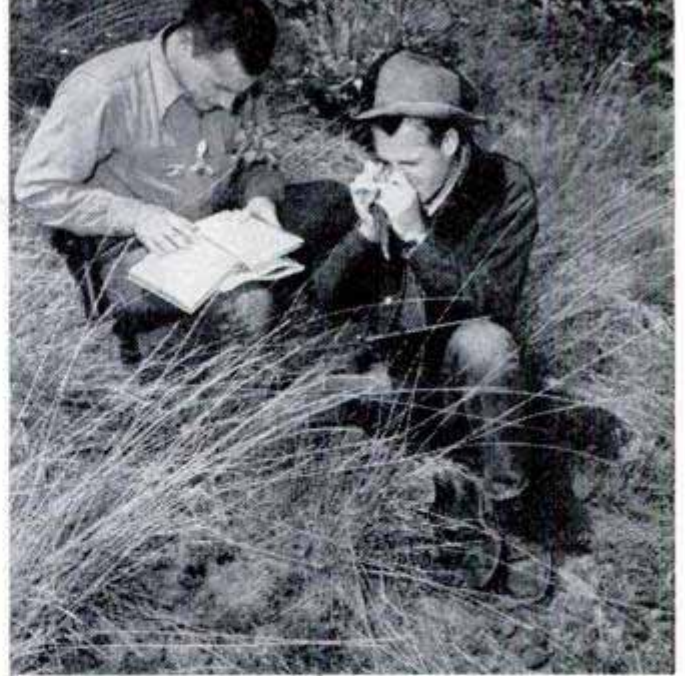
In building his personal collection of more than 20,000 specimens of Idaho plants, representing some 2500 species and subspecies, Christ has seen just about all there is to see in Idaho's 88,000 square miles.

"When you haven't been on a horse for months, then mount one, you finally get so saddlesore that you decide it's your turn to carry the horse," he says in describing some of his forays into the roadless primitive area.

Bear, deer and elk are readily spotted during plant-collecting trips. "Strangely though," Christ laments, "when I go into the mountains in the fall during the regular hunting season, I seldom get a glimpse of one."

Plant collecting began for Christ when he was a student at the University of Idaho. Later, as superintendent of the branch agricultural experiment station in the northern

Standard tool of the plant collector is a small pick, used to dig deep into the ground for plant roots and to pry out the plants growing in rock cracks



Two university students who soon will be forest rangers use a hand lens and manual to make accurate identification of a plant. Knowledge of plants is especially valuable in lumber and meat industries

part of the state, he collected plants as part of some research work in helping farmers and ranchers get burned-over pasture and range land back into forage. When he discovered that Idaho was a neglected field, botanically, he decided to do something about it. He's been collecting Idaho plants ever since.

Christ estimates there are around 3000 different plants in Idaho. He has around 500 to go. And most of these will come from the rugged peaks and the dusty deserts he has yet to cover.

Plant collecting, even for a personal herbarium, is much more than pulling up some posy and slapping it between the leaves of a book to dry out.

"It actually takes quite a bit of gear to care for plant specimens properly," he explains. "You need lots of old newspapers,





Ready for expedition, plant collector carries a field press, trowel, pick

Into the press goes a new specimen. Newspapers, blotters and cardboard separators speed the drying to help preserve fresh-cut plant

to fold over the plants so they will press to best advantage.

A collecting can, a metal contraption about 20 inches long and six inches deep with a strap for carrying, is the receptacle for holding the day's treasures. Sheets of moist paper layered inside the can hold up the humidity of the pack and reduce wilting.

A small pick is needed for the harvesting. This has a blade on one edge and a pick on the other, and is used to dig down for portions of the root or to pry out plants that have crowded into crevices of rocks. Another handy collecting tool is a garden trowel, used for excavating roots in soft soil.

All collectors carry notebooks in which they note the spot where a plant was obtained and the conditions under which it was growing. Blotters by the hundreds are used to absorb the moisture from the plants. These can be made from the felt paper used under linoleum. Cut size is usually 12 by 18 inches. The Christs take as many as 300 of these blotters on one trip.

Drying the blotters and papers for reuse sometimes is a real task. The Christs have done it in schoolyards, on sidewalks, vacant lots, alleys, parks, road edges and at times in the ovens of stoves in mountain cabins when it was raining so steadily they couldn't do it outdoors.

"Often there is a breeze to contend with," Heinie declares. "Then comes the scramble to recover the blotters and keep the work moving."

Changes of blotters must continue until the plants are thoroughly dry or the specimens may fade or become moldy. Slatted wooden-press covers are placed on the top and bottom of the day's collection and these are cinched up tightly with heavy straps.

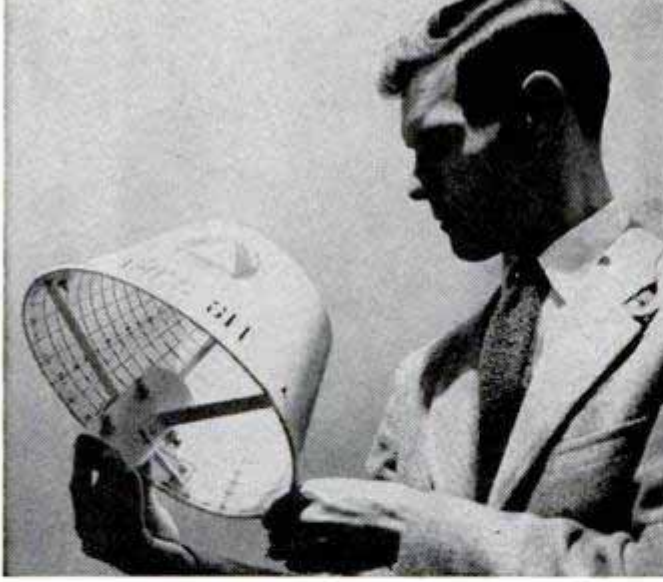
Home from the field, the collector turns

to the new job of preparing mountings and identification. Notes must be prepared for each specimen and its identification completed. All of this is recorded on a label that goes with the plant. Running down the exact identity of some plants calls for a visit to a library unless the collector has one of his own, as the Christs do. Theirs is a modest one by college standards. Yet it contains enough books, monographs and bulletins on plants to fill five shelves, each four feet long.

After labeling comes the task of mounting. A card 11½ by 16½ inches is used. On it the plants are arranged for gluing. The specimen is backed with a heavy glue, thinly spread on plain glass and then returned to the card and affixed under pressure. Heavy portions of a plant are taped to the card.

Cabinets about 3½ feet high and 4½ feet wide, divided into compartments, hold the mounted specimens. Here they are arranged by families. Just leafing through the family groups in Heinie's collection brings out the richness of the plant groups that make up so much of the greenery of Idaho. In the collection are eight different huckleberries, more than 30 different kinds of asters, 40-odd daisies and 12 goldenrods. He has more than 25 clovers, 21 evening primroses, 33 different kinds of phlox, 21 delphiniums, about 40 buttercups, more than 60 willows, 18 currants and gooseberries, 20 violets and many others in equally high proportions. The 20,000 specimens come through subspecies and differences because of environment.

"It's a right smart job to keep these separated and properly catalogued, but solving such complexities makes plant collecting one of the world's best hobbies," he says.



Radiation "Lamp Shade"

Resembling an ordinary lamp shade, a new civil-defense instrument will enable officials to determine quickly and accurately the position of the bomb blast in the event of atomic attack. This information is needed if rescue workers are to perform their duties with maximum efficiency. The "lamp shade" was developed to aid civil-defense officials in Schenectady, N. Y. A number of the instruments would be mounted permanently outdoors around a possible target area. If an A-bomb burst, the heat radiation would scorch the paint on the inside of the lamp shade. A brass rod which runs through the center of the instrument would block the radiation, casting a permanent shadow on the scorched region. Through grid lines, the shadow would plot information showing the height and location of the blast.



"Traffic Lights" for Planes

Mid-air refueling operations by the Air Force now are aided by "traffic lights" installed on the big Boeing tanker planes. The lights help the plane receiving the fuel to maintain the proper position while gas is pumped through the line. They are triggered automatically by relay switches connected with the boom between the two planes. When the planes are in the proper position a green light glows, but when the aircraft receiving the fuel moves away, red lights flash on to advise the pilot to move up, down, forward or aft. Instruction in night refueling was started recently at Castle Air Force Base, Atwater, Calif.



Switch-Box Brackets

Aluminum brackets, pressed into place, hold electric switch boxes in plasterboard, plywood and other materials where screws or nails are impractical. After an opening for the switch box is cut in the wall material, one of the brackets is pushed into place. A rear lip on the bracket holds it against the back of the wallboard and a prong is pressed into the edge of the board. After another bracket is installed on the opposite side, the switch box is slipped into position and the brackets are bent around the edges of the box.



Daniel Boone the Sixth piles coal on the forge in a truncated-pyramid shape as did his ancestors

DANIEL BOONE

KEEPS UP A TRADITION



Preforged units of fleurs-de-lis combine to form an ornate fire screen that is typical of Daniel Boone's colonial craftsmanship

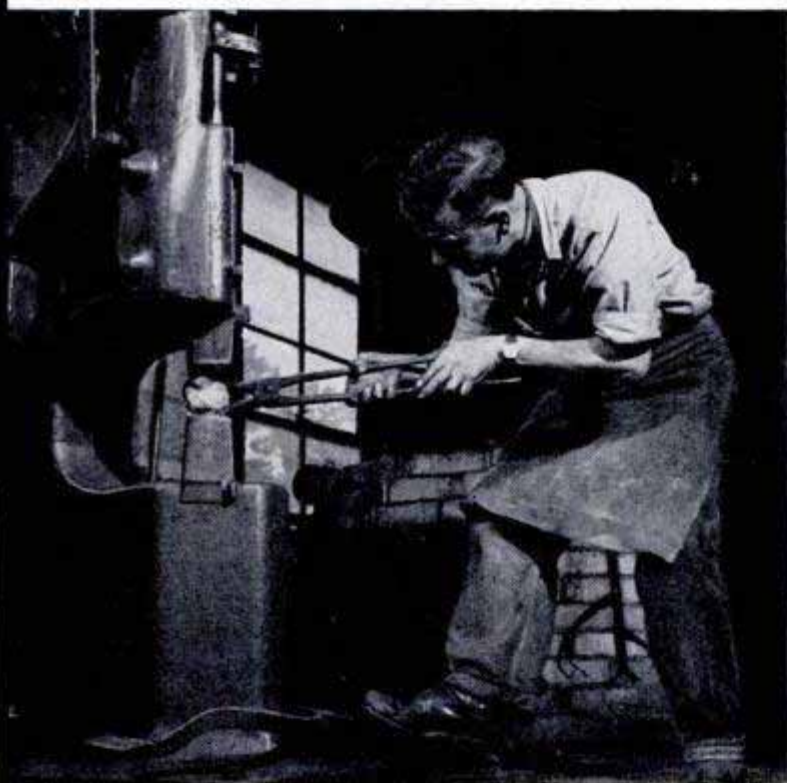
DANIEL BOONE was America's most famous pioneer and trail blazer, but he had a trade, too. In his less exciting moments, he was a wagoner and blacksmith and, history states, was as skilled at the forge as he was behind a rifle. Today, Daniel Boone the Sixth operates a wrought-iron forge in Burnsville, N. C. There the great-great-great grandson of the Indian fighter produces hand-wrought hardware in the finest colonial tradition.



Entirely hand-wrought and forged, a massive set of andirons took weeks to complete, costs about \$1000



Times may have changed, but the village smithy and his clanging anvil are still favorites of the kids



Boone's only power tool is a steam hammer used to shape iron balls, like those on the andirons, at top

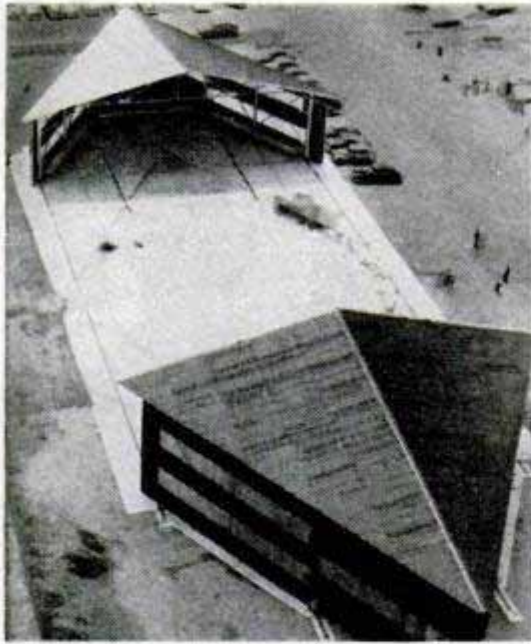
Below, the craftsman rings a dinner bell which is completely handmade even to the links of the chain



Heavy steel swage block contains variety of shapes into which metal is pounded to form desired contour

Below, the special chalk that Boone uses to trace the pattern will not disappear in the high heat of the forge





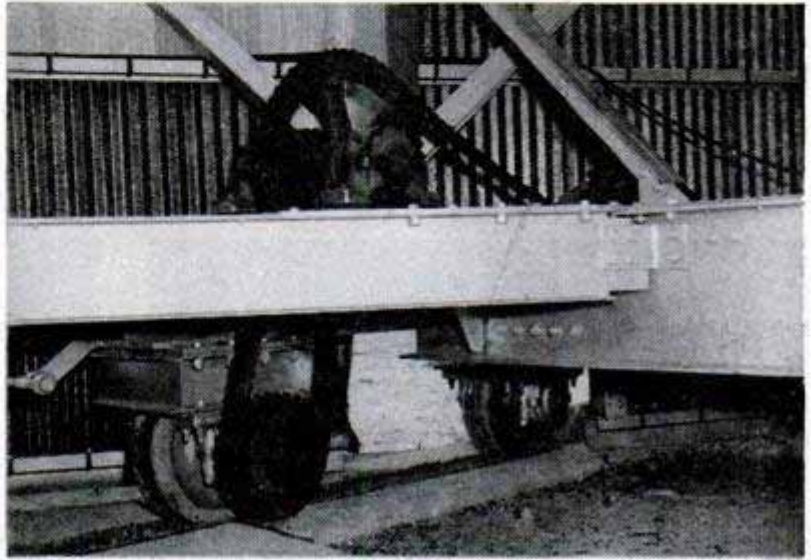
Opened hangar leaves plenty of maneuvering space so a plane in need of repairs can be wheeled onto reinforced concrete apron

"Clamshell" Hangar

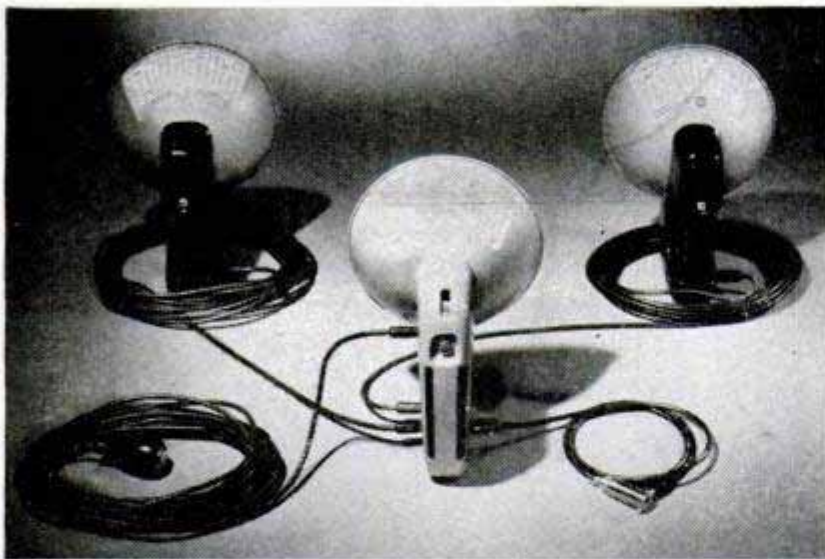
Nicknamed the "clamshell" because of its unique closing action, a mobile hangar installed at the Marine Corps Air Station, Cherry Point, N. C., literally closes in around a plane. The building consists of two triangular sections, each mounted on small iron wheels that roll on railroad tracks. Four electric motors move the sections back and forth. An aircraft needing repairs taxis into place between the sections, which then move in to "swallow" the plane. Workbenches and offices are located



Two sections move together to "swallow" the plane. Below, sections glide on power-driven wheels which move on rails



inside the structure and move with it. When the building is closed, the longest diagonal corners are 173 feet apart. The hangar is 29 feet high and can accommodate any plane based at the air station. It takes about two minutes to open or close the hangar, which weighs approximately 118 tons, not including the foundation.



Flash Gun Has Pistol Grip

Using one or two miniature 22½-volt batteries and condensers, a compact photoflash unit features a pistol grip for exact aiming. Batteries last for a year or more. When two batteries are used, the flash system will fire

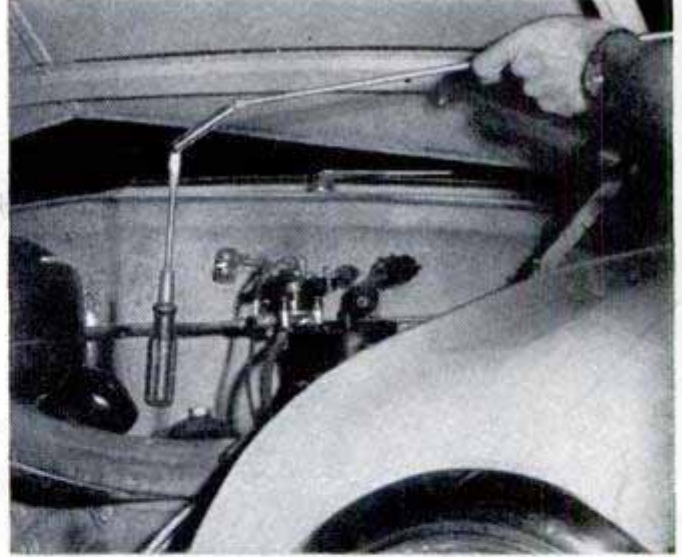


up to seven lamps in synchronization at the same time. Developed by Eastman Kodak, the new design also permits compact storage of both the main unit and extension lights. The reflectors nest like saucers and the rectangular-shaped guns stack compactly in any carrying case.



Car-Door Pocket

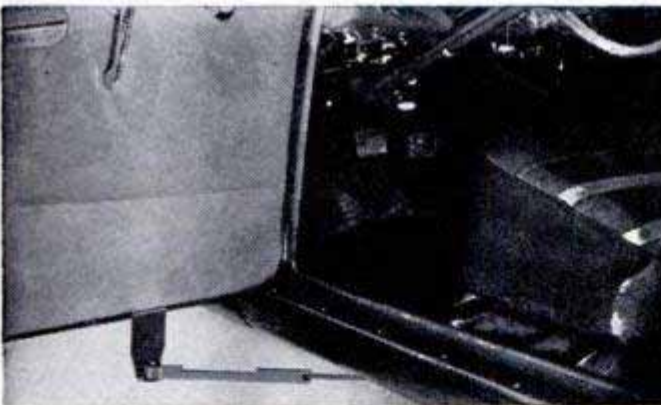
Installed by merely snapping it between the upholstery and window roller or door-handle plate, a handy car pocket holds road maps, sunglasses, cigarettes, baby needs, flashlight and many other small articles. Fitted over a brightly plated metal frame, the pocket is made of plastic trimmed with imitation leather that comes in red, green or blue.



Magnetic Arm

Nuts and bolts or even tools dropped onto the splash pan of an automobile engine are easily recovered without skinned knuckles with a magnetic pickup device. A permanent magnet on the end of a telescoping rod pokes into tight places, around corners, behind generators and starting motors. The magnetic head adjusts to any angle and the rod extends 27 inches.

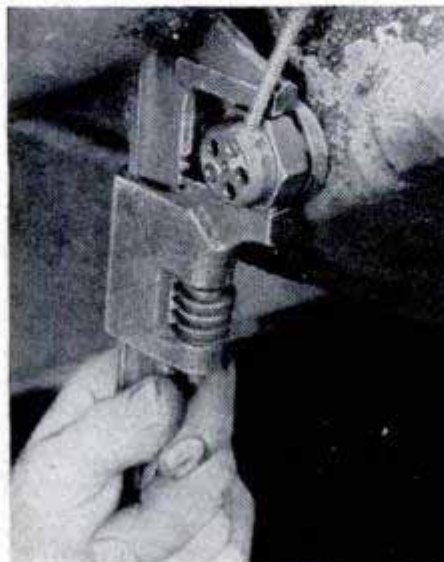
Shoescraper for Automobiles Without Running Boards



Now that the running board is virtually extinct, the motorist has no place to scrape his shoes before getting into the car. To overcome this deficiency, a sliding scraper has been developed to remove mud or snow from the shoes quickly. One end of the scraper fastens to the underside of the car door. The other end slides through the frame out of sight when the door is closed. When the door is open, the blade-like scraper is easily accessible. It is designed for installation on any car.

Remote-Control Drain Plug Simplifies Oil Changing

Operated by a flexible cable that extends up under the hood of the car, a remote-control drain plug enables the motorist to change oil without crawling under the car. The valve, which is screwed into the drain hole in place of the original plug, has a three-way sealing action. The operating part of the valve fits inside the crankcase so it can't be jarred or torn loose in case the oil pan hits an object on the road.





Snow research calls for specialized types of transportation. Track-laying vehicles, above, were used in a snow-surveying trek along Oregon's Cascade Mountain range

Dept. of Agriculture Soil Conservation photo

Two snow surveyors, right, weigh a sample tube of snow in California to determine the snow's density. Top snow may contain a third less water than that near bottom

California Division of Water Resources photo



Our Army engineers are deep in a big investigation this winter—Project Sipre:

THE PRIVATE LIFE OF A SNOWFLAKE

By Thomas E. Stimson, Jr.

WHO CARES WHAT happens to a snowflake?

The Corps of Engineers of the United States Army does.

As a military agency, it is participating in "Project Sipre" (Snow, Ice, and Permafrost) to learn the strength of snow under different weather conditions and, in turn, the sizes and weights of vehicles that the snow can support.

As one of the nation's chief dam-building agencies, it also is studying the life histories of snowflakes and raindrops to find a way of forecasting flood conditions. It's easy to forecast the time that a flood will reach a downstream point after it starts; what the engineers want to predict are the times when flood conditions will be created in

the snowbanks and rivulets far upstream.

Sometimes a warm rain melts the snow and causes a flood. Sometimes the snow acts as a sponge and absorbs the rain, preventing a flood. Forecasting the manner in which a mountain snow pack will behave under a given set of weather conditions is vital for efficient operation of dams used for flood control and water conservation.

Research on both these projects is being conducted at the corps' Central Sierra snow laboratory near Donner Pass in California. The site is a small enclosed mountain basin with only one outlet, an ideal sample of Sierra watershed. The small valley covers four square miles. Its elevation ranges from 7000 feet on the valley floor to 9000 feet at the summits of the sur-

rounding peaks. Here the corps' technical staff under Walter J. Parsons, Jr., keeps close track of precipitation as it falls, observes what happens to it while it remains in the basin, and finally measures it as runoff when it flows down Castle Creek.

Another snow lab in the Rockies, near Glacier National Park in Montana, and a third in the Willamette Valley in Oregon also are used for collecting data. When the forecast formulas are put together they are expected to be of worldwide value as a means of forecasting floods.

The work of the laboratories is separate from the seasonal snow surveys conducted by other agencies. These other surveys answer the question, "How much snow do we have in the bank?" A close estimate of the amount of water to come downstream during the spring runoff season helps farmers select crops to plant, and allows power-plant engineers to plan their power schedules well ahead of time. Army engineers aid in this work, but their main interest is in learning when the peak quantities of water will start flowing, and not in the seasonal totals.

In the summertime their Sierra laboratory area is a pleasant mountain region, but by August it becomes so dry that the staff must haul in water. In the winter it can be a place of raging storms. Forty feet of snow may fall in a season, as much as

four feet a day, and the snow pack averages 12 to 15 feet deep. Precipitation in all forms averages 50 inches of water a year.

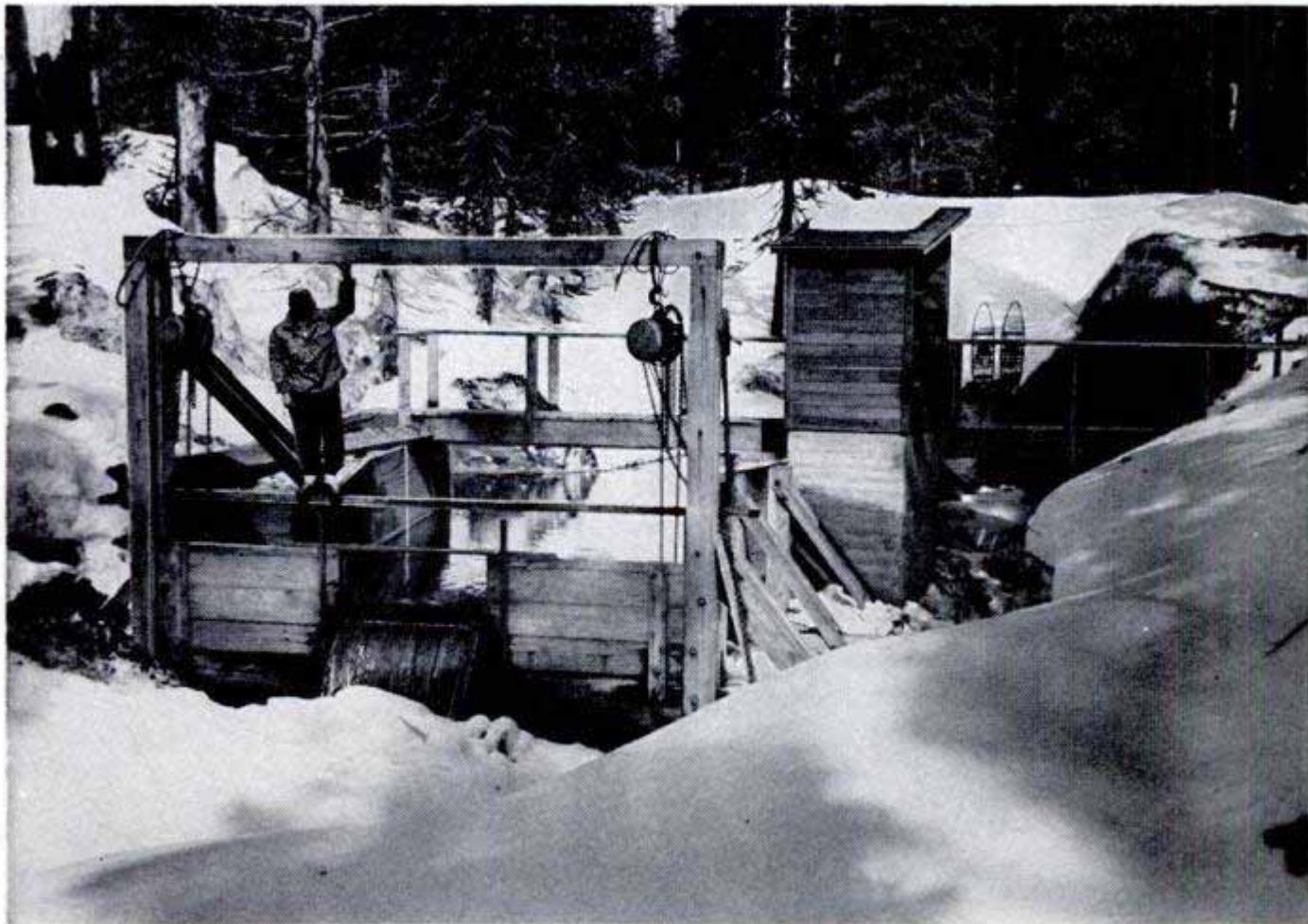
The main laboratory at the foot of the valley has exit doors at both the first and second-story levels because of the heights to which the snow often drifts. Sometimes the men have to shovel their way upward through the snow from the second level to get to the top of the drifts when they start out to inspect field instruments. They travel in pairs for safety.

Once two of them almost perished only half a mile from a shelter cabin when their snowmobile broke down in a blizzard and they lost their way on skis.

In seeking the relationship between weather and runoff, Parsons and his staff installed a network of measuring instruments in the valley. Then, to avoid the hazards of daily inspection trips, they connected as many of the instruments as was practical by wires or radio circuits with the laboratory itself.

Sitting in comfort at a desk, one of the snow crew can read instruments that tell the outside temperature, the direction and velocity of the wind and the barometric pressure. Once a day he tunes in on the "radio snow stakes" that measure the depth of the snow at various locations and report the figures by short wave. One set of dials reveals the contents of several seasonal

Water from snow or rain falling in the test valley flows through a measuring gate at the valley's only exit





Located around the test valley are snow gauges that collect the snow so the total fall can be measured

snow-storage gauges at remote locations. Still other instruments show the amount of moisture in the soil in other distant parts of the valley.

Even the amount of solar radiation and the amount of this radiation that is reflected back from the top of the snow is measured by remote control. Only one inspection trip a week needs to be made in the field.

Many ordinary weather instruments

don't work well under the severe Sierra conditions, and the staff had to invent new ones in some cases and adapt others to their needs. Snow and rain gauges are dosed with measured amounts of antifreeze solution, for instance, so that their electrical measuring devices won't freeze up solid. Stream-flow instruments that are suspended in water also tend to accumulate ice, so electric lights are suspended overhead to keep them warm.

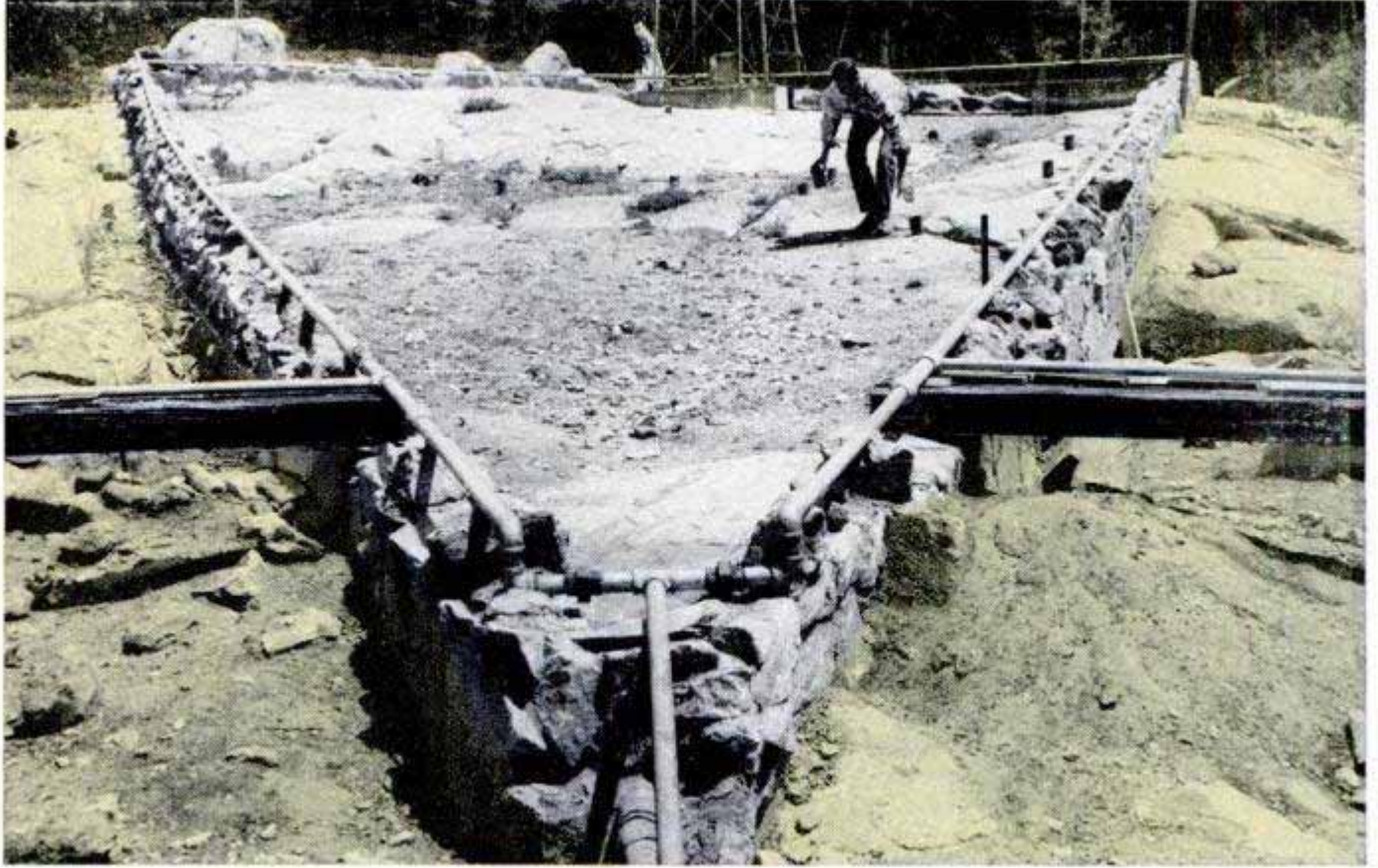
The research people found that ordinary thermometers gave absurd readings when buried in a snowbank. The snow was at a subfreezing temperature, to be sure, but the thermometer might read as high as 45 degrees F. This was due to solar glare through the snow. The men developed electrical-resistance thermometers that are more accurate.

To learn the amount of moisture in the soil at a certain location, they buried a block of plaster of paris attached to a pair of wires so that it was part of an electrical circuit. The plaster absorbed moisture from the surrounding earth and its electrical resistance was a measure of its moisture content. A block usually gives accurate readings for a week or so, then it's apt to give readings that obviously are incorrect. The trouble, the staff found, was that the local chipmunks like a plaster-of-paris diet and they seek out the blocks and eat them, sometimes leaving nothing but the bare wires. The only solution has been to replace the blocks as soon as they begin to give suspicious readings.

Measuring the depth of the snow at a distant location by remote control was a prob-

Electrical-resistance thermometers take readings at various levels under snow. Canvas screens off solar heat





Water spray melts snow on paved triangle so scientists can measure runoff to determine snow's water content

lem that the staff solved with the help of radioactivity. They installed a capsule of radioactive cobalt in a concrete container at ground level and suspended a Geiger tube 15 feet overhead. With no snow on the ground, the Geiger tube gives off a constant

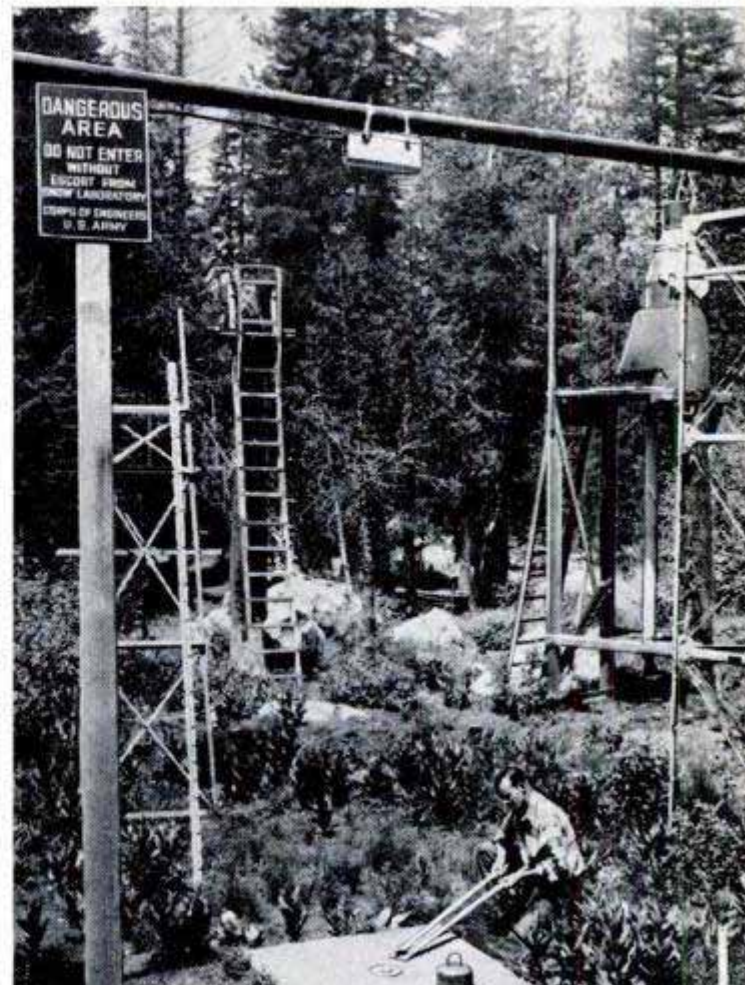
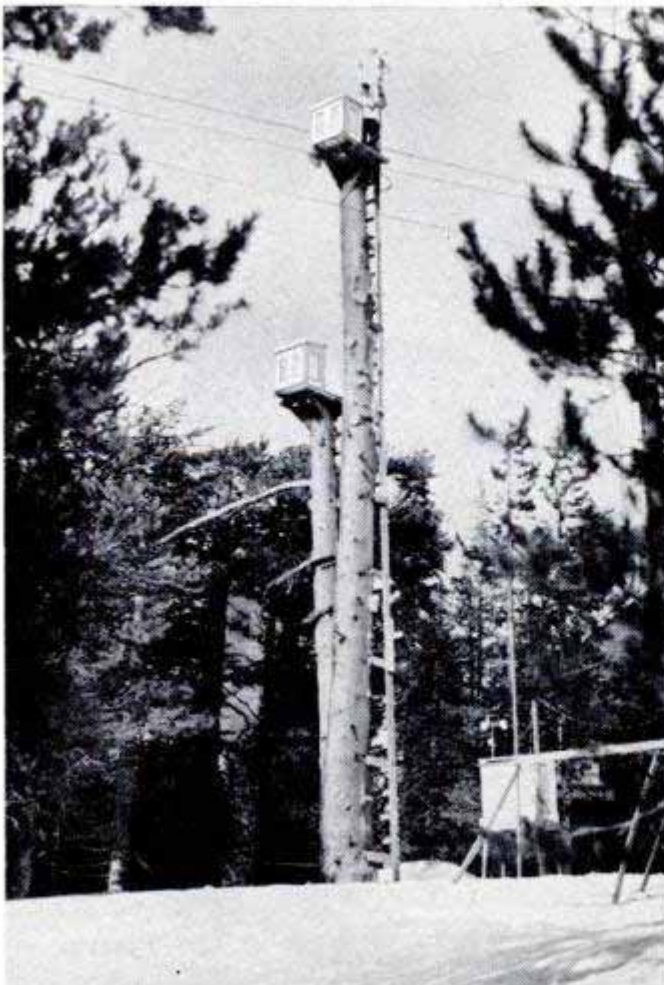
series of clicks. Several feet of snow on top of the radioactive source slows down the number of clicks; 10 feet of snow makes an even greater difference because moisture

(Continued to page 242;

see additional photos on next two pages)

Instruments that record and relay weather data to the lab are housed in shelters at various heights

Snow gauge uses radioactive source in slab. Reading on overhead Geiger counter varies with depth of snow



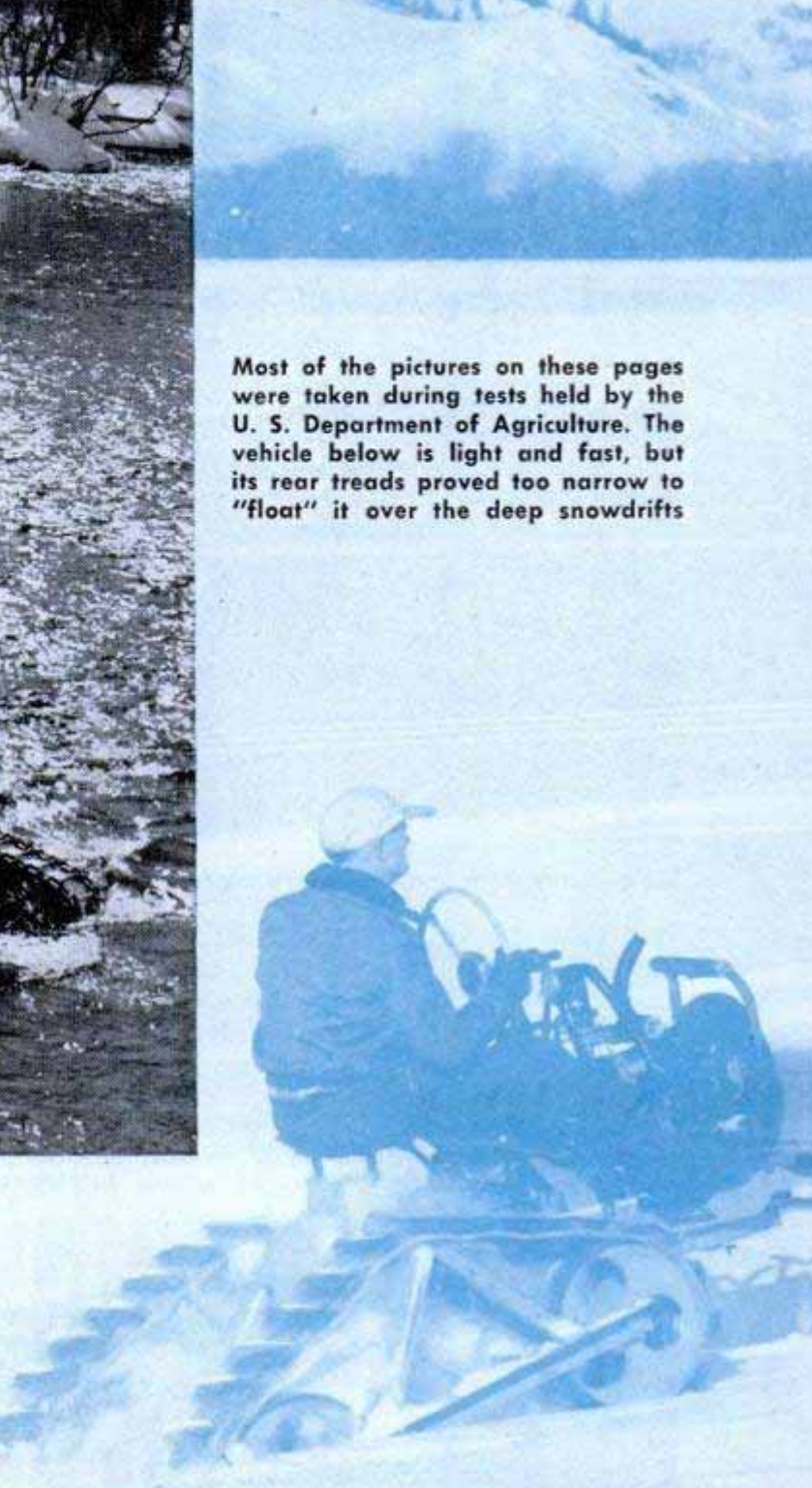


Nothing fazes this vehicle. Its snow tracks wrap around four pontoons that float it across rivers
Dept. of Agriculture Soil Conservation photos

Proving their mettle by climbing over snowbanks, these over-snow rigs are undergoing tests in Idaho



Most of the pictures on these pages were taken during tests held by the U. S. Department of Agriculture. The vehicle below is light and fast, but its rear treads proved too narrow to "float" it over the deep snowdrifts



Recording men at the California test valley often travel from station to station in snowmobiles. An extra set of skis for the car is carried in case of emergency as are skis for the men, who always travel the area in pairs



Another type of snow vehicle, right, is powered by a chain-driven series of slats. It floats easily over the snowdrifts because of its wide tread

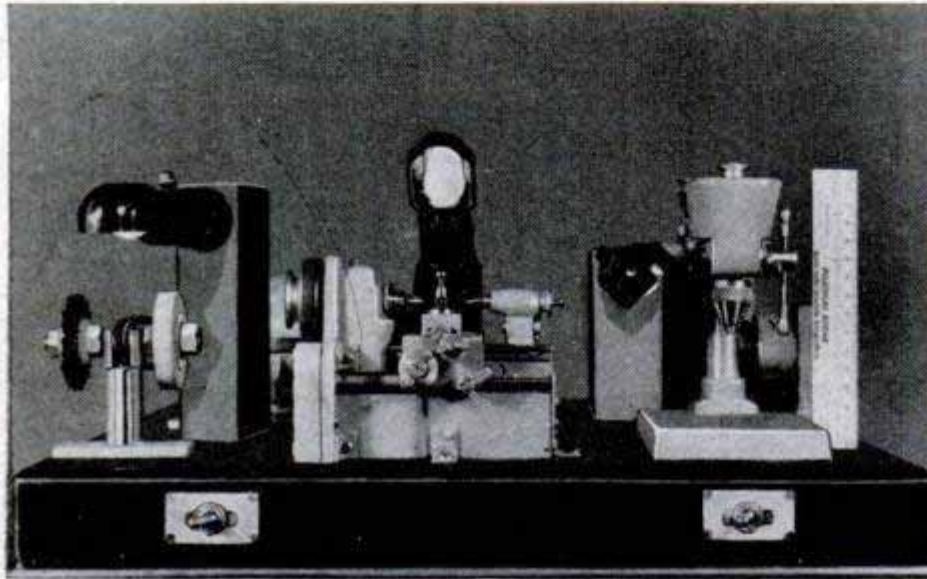


Also participating in tests at Idaho was this compact snow vehicle, shown here in one of the cross-country runs



Table-Top Workshop

Down in Guatemala City, Luis Francisco Munoz has built a complete "pocket size" workshop of miniature power tools. He made most of the parts by hand, though a few were turned on a lathe. The workshop includes a tiny lathe, drill press and grinder with grinding wheel and buffer. The bed is the only cast piece of the lathe, which has an automatic main feed. The cross-feed is provided with a set of gears for moving the toolholder forward when the handle is turned from left to right. Both the drill press and the lathe have two speeds. Power is supplied by a small sewing-machine motor. The tools are small enough so all three can be mounted on a table measuring only 16 by 18 inches. Munoz estimates he spent 700 hours on the tools. He uses them for camera repairs.

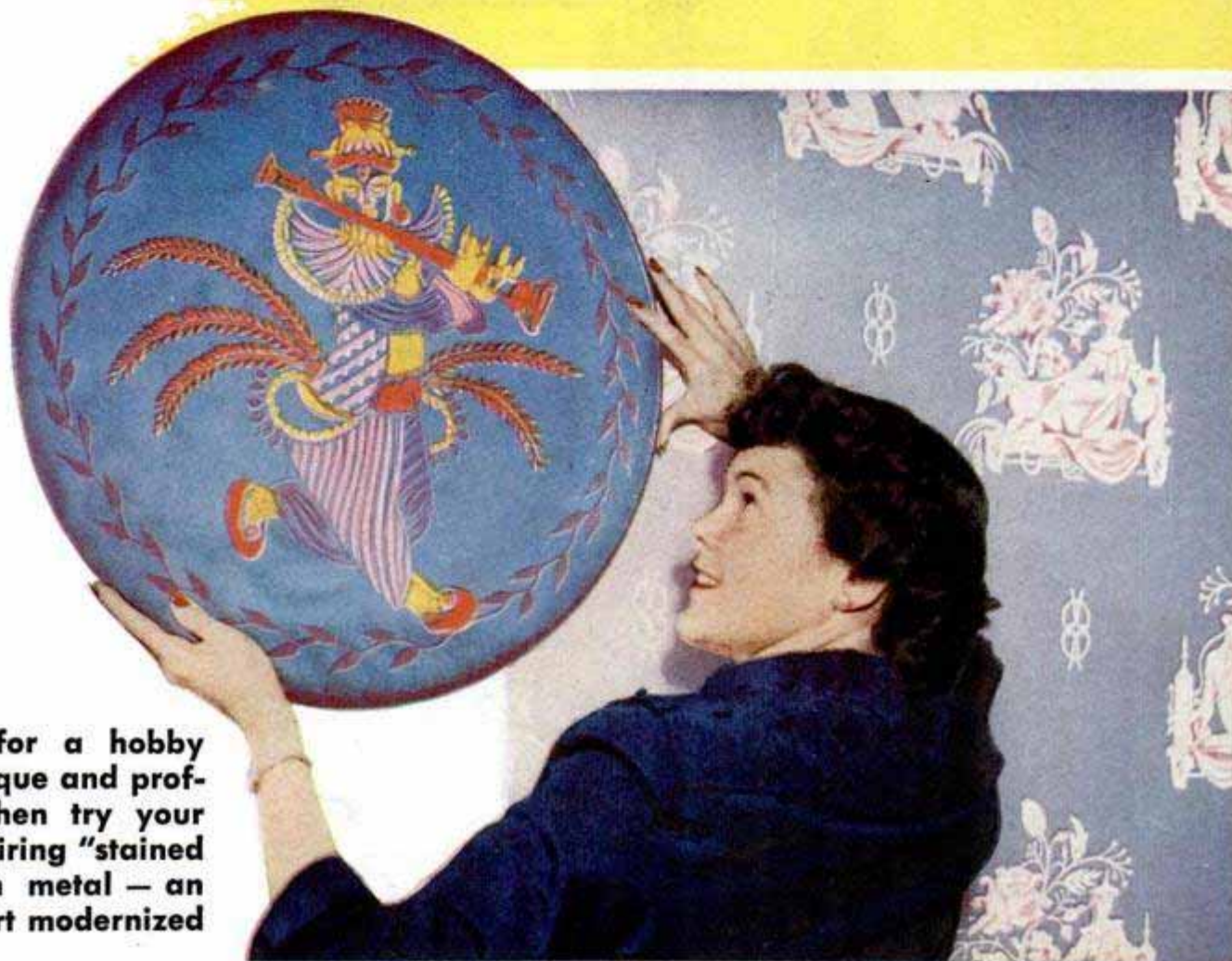


"Tug" For Maneuvering Semitruck Trailers Pivots on One Wheel

Built by a Palm Springs, Calif., mechanic, a dry-land "tug" for maneuvering semitrailer-truck units can pivot on either power wheel. The machine is so maneuverable it turns figure eights in less than twice its own length. The two additional wheels which support the vehicle are mounted on caster-type supports so they automatically swing with the unit. Hydraulic switches lock or unlock the power wheels to steer the unit. With the axle locked the unit will move in a straight line over curbs, rocks and other obstructions. The tug was built from the parts of several trucks. The power and steering systems, according to the inventor, are applicable to fork lifts, skip loaders, tractors and other transport units.



If you do not find the information you need in the index on pages 12, 14 and 16, sources of further information are available without charge from *Popular Mechanics*. Write to the Bureau of Information, 200 East Ontario Street, Chicago 11



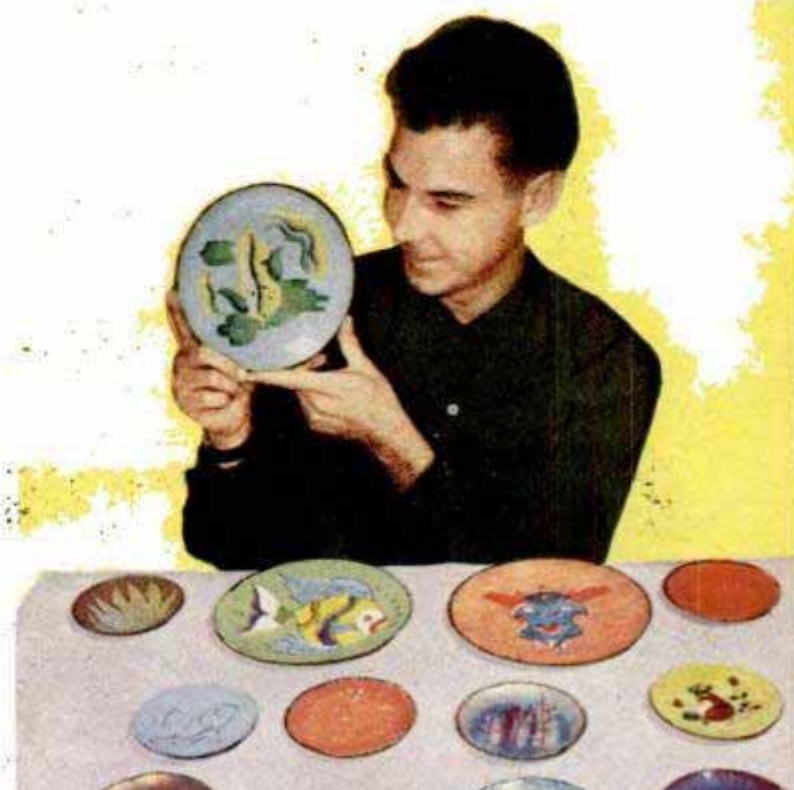
Looking for a hobby that's unique and profitable? Then try your hand at firing "stained glass" on metal — an ancient art modernized

FUSED-ENAMEL FINISHES

By Tom E. Stinson, Jr.

AN ART as old as the pyramids, coating metal objects with jewellike finishes of fused enamel, no longer is limited to a few highly skilled craftsmen. Now that all the necessary materials are available ready for use, this fascinating craft can be enjoyed by the average hobbyist. The enamel, which is nothing more than a special mixture of powdered glass, is applied to a clean metal surface and fused in a furnace. The enameling technique described was developed for use on copper primarily and also on silver. This consists briefly of cleaning the metal surface, applying a gum coat, sprinkling the powder over the gum, and

Large decorative plate shown above must be fired in special oversize kiln. Less pretentious samples of enamelware, pictured at the right, can be handled by the hobbyist who has a small electric furnace





then fusing the enamel by placing the object in a hot kiln (1400-1500 deg.) for two or three minutes. (*Do not inhale the powder or accidentally take it internally.*) The technique for enameling steel is slightly different, as the enamels are painted on the work. A small furnace can be purchased for about the same price as a good-quality power tool, or a kiln can be built from firebrick and high-temperature cement.

The photos on these pages, which were taken at the Grant Beach Art School, Los Angeles, Calif., picture the steps required to make a cloisonné plate. A preformed copper plate or bowl may be used, or one can be formed from sheet copper. The sheet metal should be at least 18 ga. to prevent buckling when fired, and any rough edges rounded with a file. The plate is cleaned with a dilute-acid bath or by scouring with pumice or household cleaner. It is then rinsed and dried.

Next, an even but generous coat of gum tragacanth is brushed on the surface. The gum, purchased from a druggist in dry form, is powdered and sifted into water, using 1 teaspoonful of dry gum to 1 cup of water. This is allowed to stand overnight. Then it is stirred and enough water is added to bring the solution to a creamy

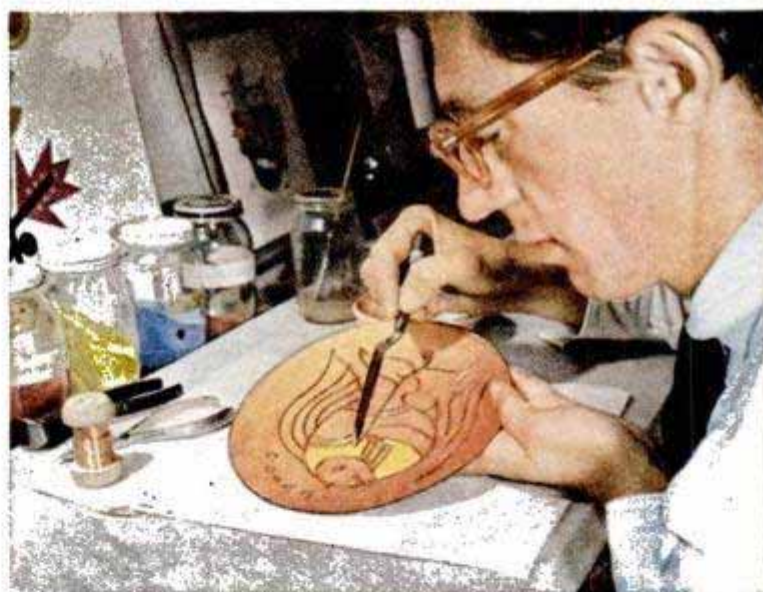
Below, a long pair of iron tongs is used to insert and remove the prepared plate from the furnace or kiln. Plate rests on grille of chrome-nickel mesh or wire to facilitate handling





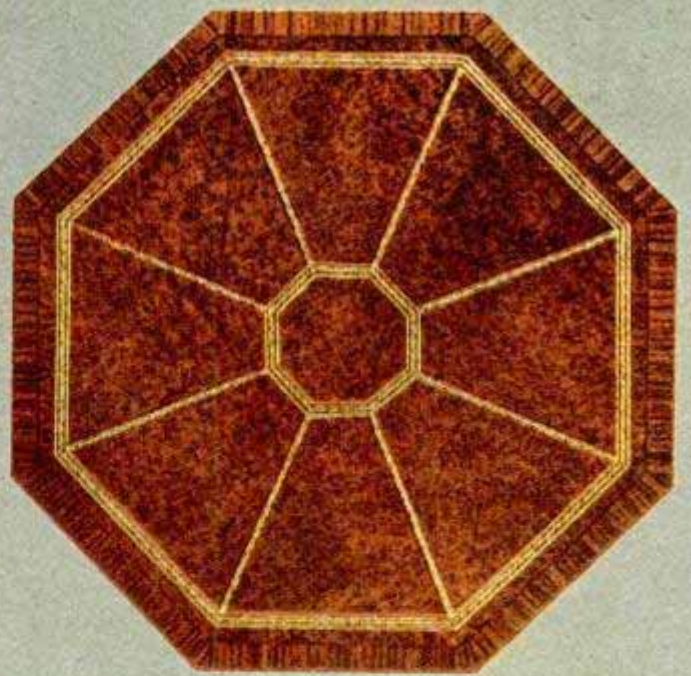
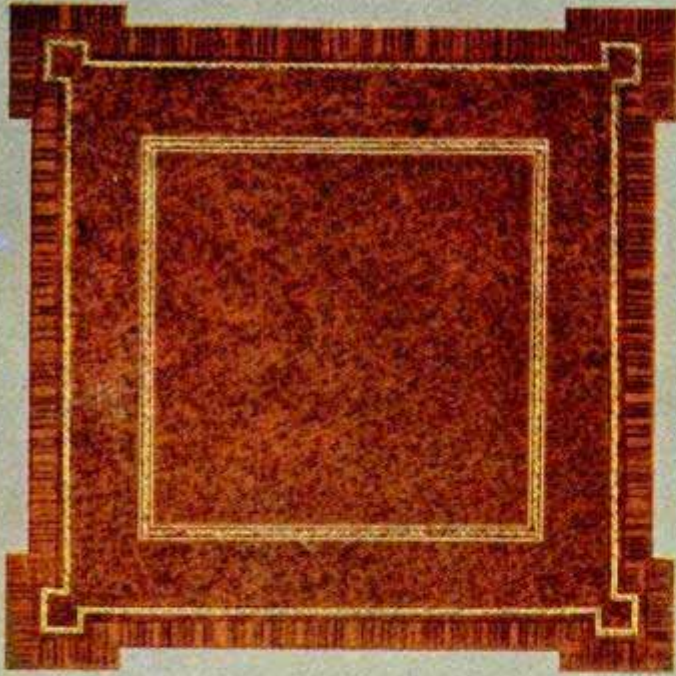
Enamel flux is sifted on gum coat, completely covering plate. Start near edge and work toward center

consistency. Clear enamel flux is sifted on the tacky gum surface. After a few minutes, the plate is inserted in a preheated kiln. As you inspect the plate during firing, you will notice that the enamel first turns black, next it thickens, and then it acquires a bumpy, glassy appearance. Finally, the humps smooth away, indicating that the fusing is complete. Remove the plate and allow it to cool for about 10 minutes before handling, protecting it from cold drafts that might crack the enamel. Then clean the back of the plate with steel wool and the edges with a file to remove any scales that might fly off during the next firing. This transparent coating forms a binder, which is followed by one or more coats of colored enamel. These are applied basically in the same way as the first coat, applying a fresh coat of gum, spreading the powder over the surface and firing. However, there are several techniques used in applying the decorative coats. A stencil can be pressed into the tacky gum and powder spread over this surface. The powder is removed after the gum dries. Another method is to scratch a fresh layer of enamel with a blunt tool to expose a previously fired layer. This is called sgraffito. A third method, cloisonne, utilizes copper wire to separate areas enameled in different colors. The 18-ga. wire, which is bent to follow a pattern scratched in the surface of the plate, is pressed into a gum coat applied after firing the transparent flux. Firing again, before applying the colored enamel, sinks the wire segments into the flux coat.



Enamel is mixed with thin gum solution and dropped into sections of cloisonne plate with knife blade. Polish exposed wire with steel wool after firing





Realistic "tooled leather" in decal form makes it easy to produce beautiful tops for new or old tables at surprisingly low cost

"TOOLED LEATHER" TOPS





Table designs by John Bergen

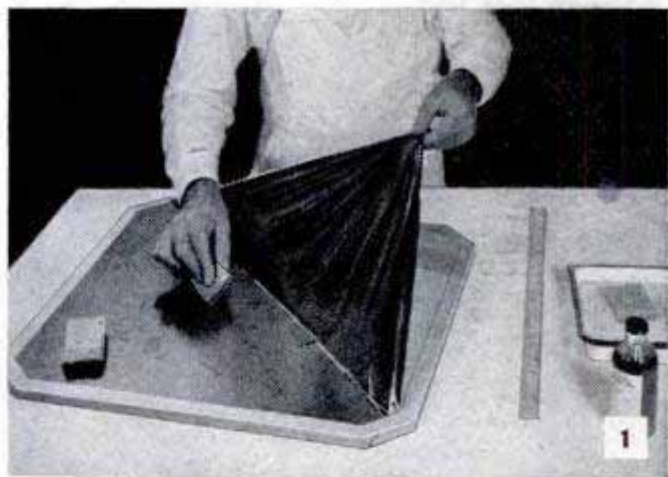
FOR YOUR FURNITURE

By Wayne C. Leckey

HAVE YOU WISHED you could duplicate the beautiful gold-tooled leather tops featured on smart custom-built furniture? Now, thanks to the makers of plastic veneer, both leather and gold tooling can be applied easily and inexpensively with decals. Closely resembling actual leather, this veneer, which is available in large sheets, has the color and texture of leather printed right on it. When applied and protected with a top coating of lacquer or varnish, the veneer is difficult to tell from the genuine.

First featured in a two-part article beginning in the January 1951 issue of *Popular Mechanics*, plastic veneer offers the craftsman a practical means of beating the high costs of select cabinet woods. In addition to the new leather grain, it is available in many rare wood grains and fine marble finishes. It is low in cost and, being opaque, can be applied over inexpensive materials such as plywood, hardboard and glass, hiding all joinery. Printed from photoengravings of the actual wood, marble or leather, the veneer is uniform in color and grain, thus eliminating the staining operation, which always is a troublesome job for the inexperienced worker.

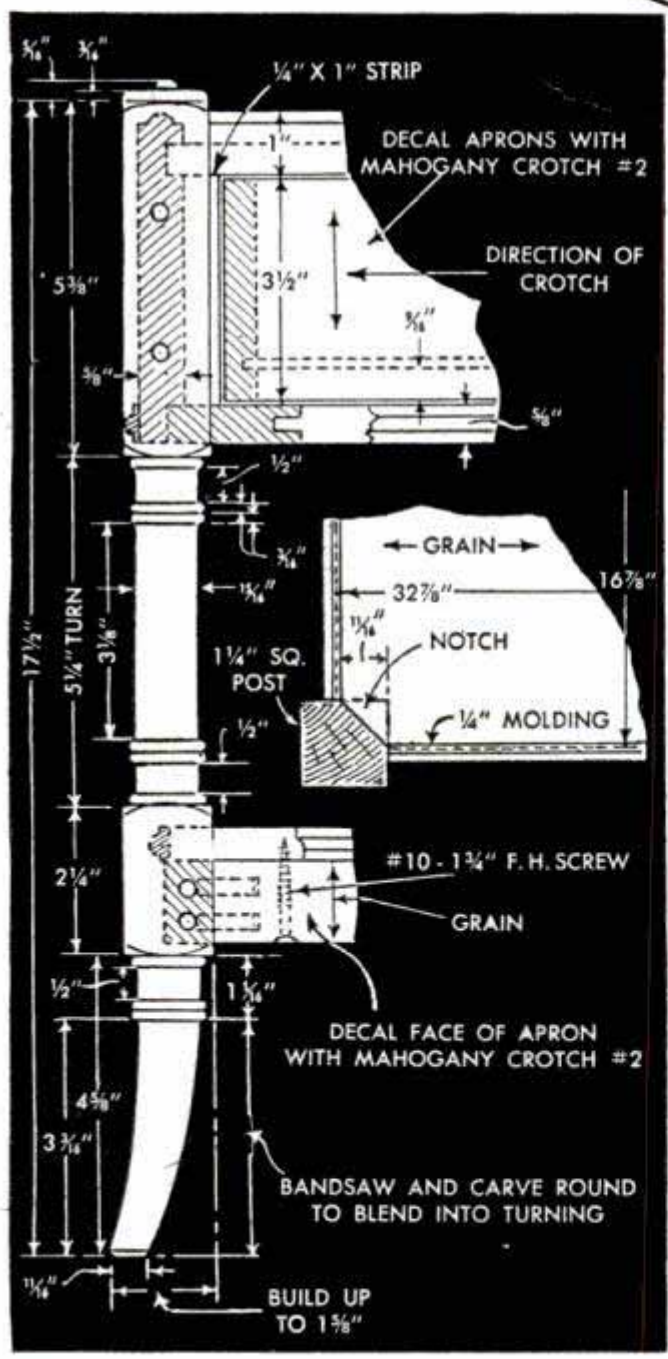
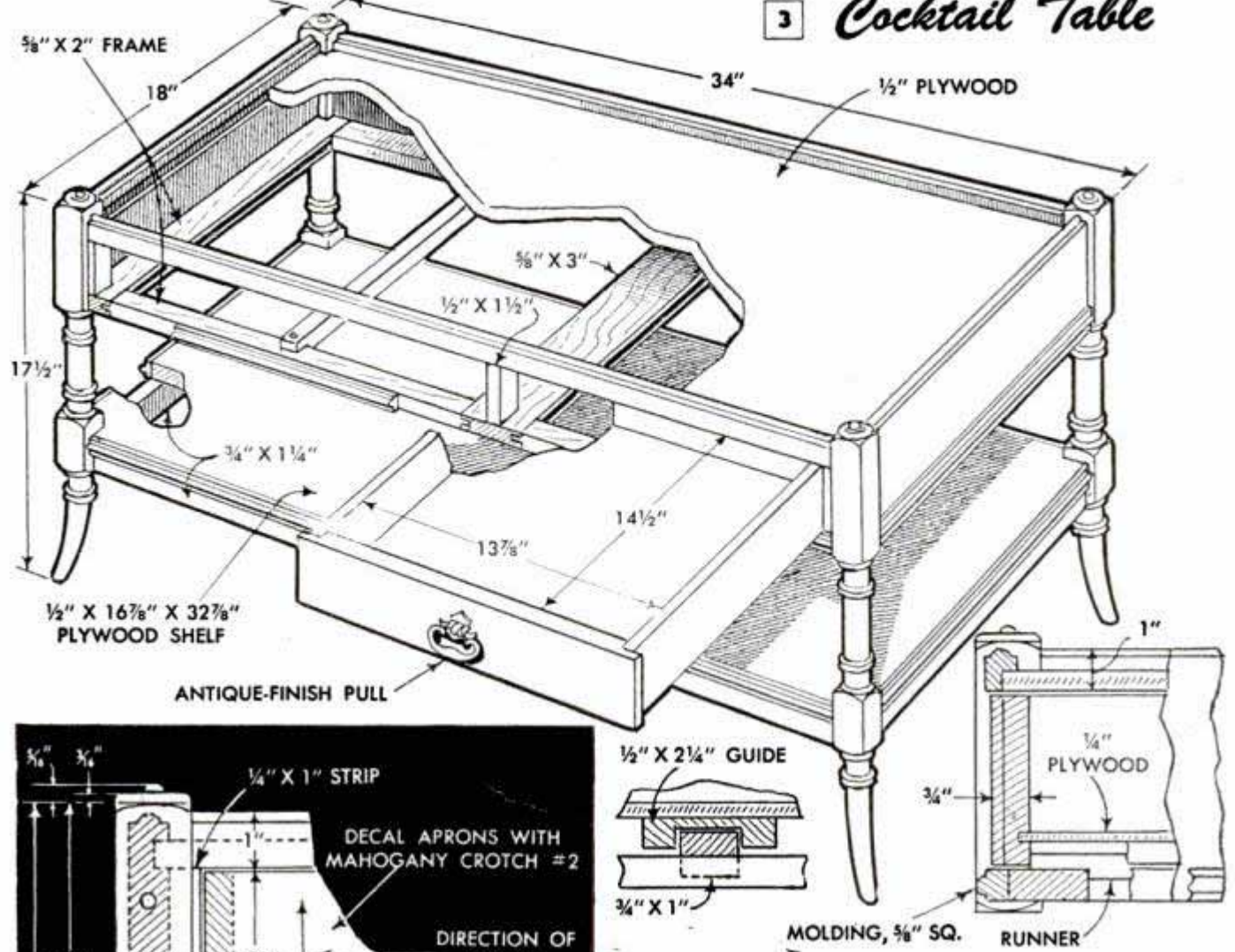
Plastic veneer comes with a paper carrier that is removed by soaking in water, but, unlike a decal, it is cemented to the



Above, the veneer is squeegeed smoothly to the surface with a soft-rubber block. Below, gold tooling is applied to leather before carrier is peeled off



3



surface with a special, ready-prepared adhesive. The tools needed to work plastic veneer are a razor blade, rubber squeegee, metal straightedge and a cellulose sponge.

Preparing the surface: Fir plywood is not recommended for covering because of its pronounced grain. Nor are any other woods that have a porous or open grain. Poplar plywood is excellent for the purpose as well as being fairly inexpensive. Hardboard also is very good because of its exceptionally smooth surface. The surface to be veneered should be sanded well. As the veneer consists of a film of lacquer and is actually drawn to the surface by the adhesive as it dries, flaws in the surface tend to be even more pronounced. Although the veneer consists of a film of lacquer, the surface to which it is applied must be sealed with shellac, varnish or lacquer, and rubbed down with very fine sandpaper to produce a smooth base for the veneer.

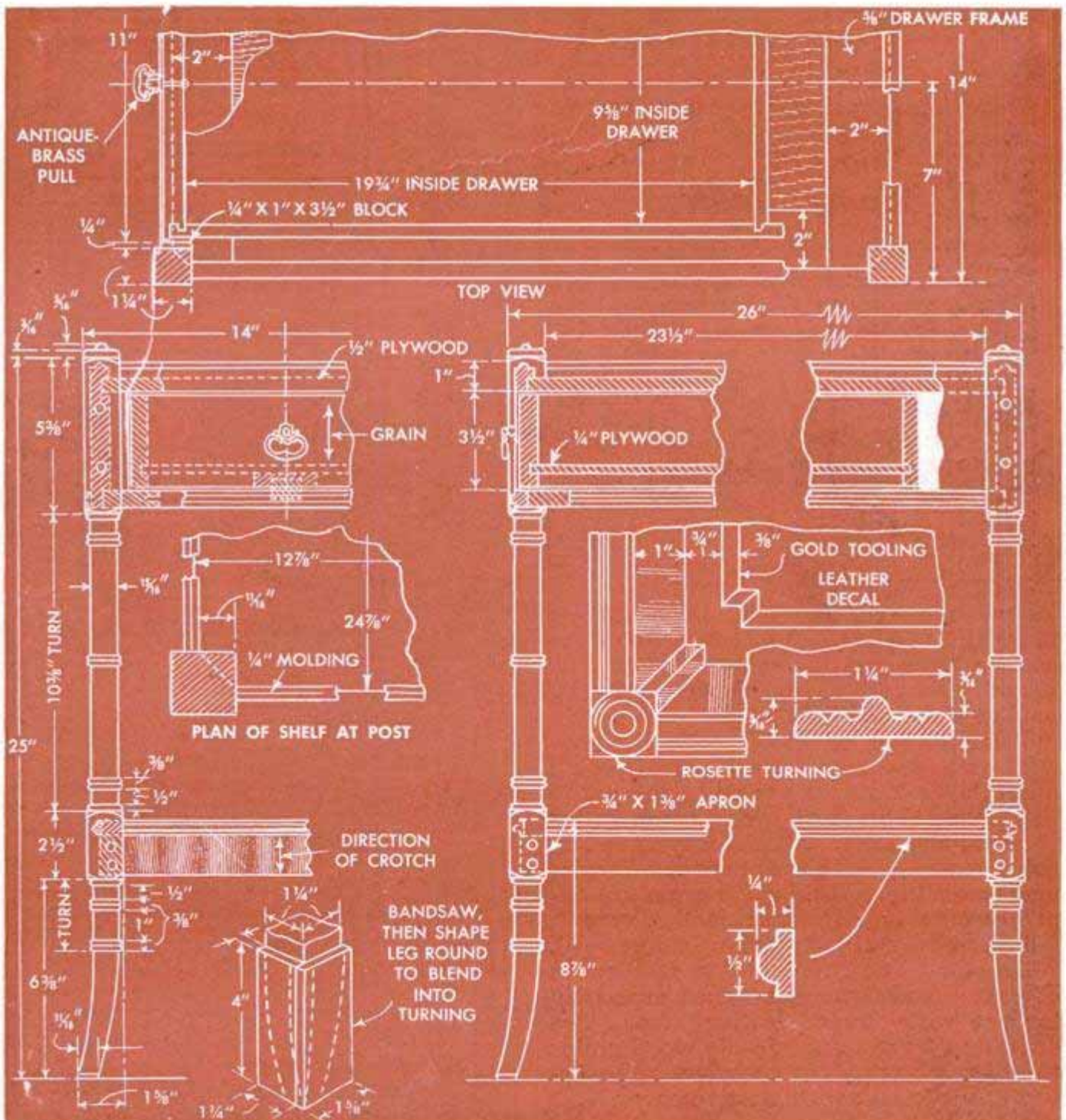
Applying the veneer: The first step is to cut the veneer to size with a razor blade and a straightedge. After the veneer is cut, it is placed in water a few minutes to soak off the paper carrier. While this is being done, the surface is coated with the adhesive supplied with the veneer. This is used as it comes from the can and is swabbed liberally on the surface with a sponge. Next, the ve-

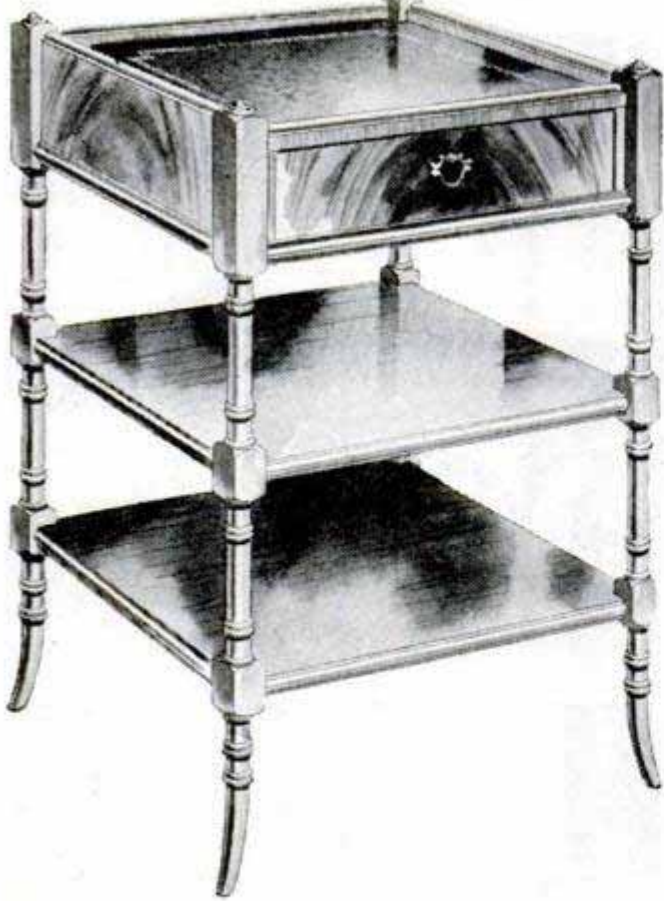
neer is peeled off and the veneer held momentarily to drain off excess water. A soft-rubber block, called a squeegee, is used to smooth out any air bubbles and wrinkles in the veneer. This is done lightly at first and, if it is necessary to lift up the veneer to remove a wrinkle, it is done by lifting a corner as in Fig. 1. Finally, the veneer is wiped off lightly with a dampened sponge to remove any possible film of cement.

Applying the gold tooling: The gold tooling can be applied immediately right on top of the leather veneer. Being printed in gold on a film of clear lacquer, the tooling allows the leather veneer to show through the clear areas of the design and makes it appear that the design is a part of the leather veneer. First cut the strip to length, mitering the ends. Lay a metal straightedge on

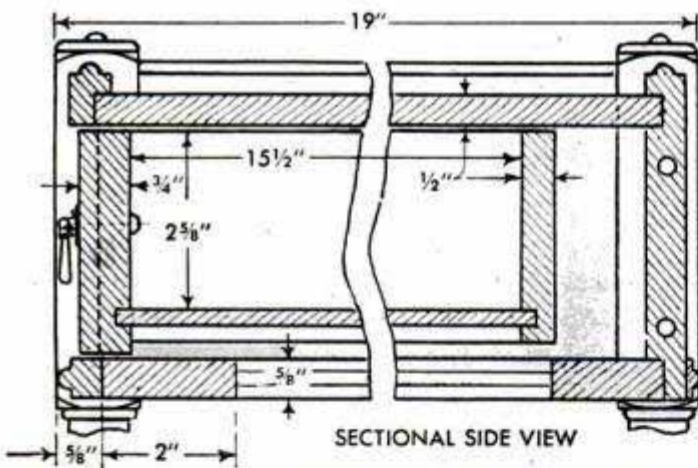


4
End Table



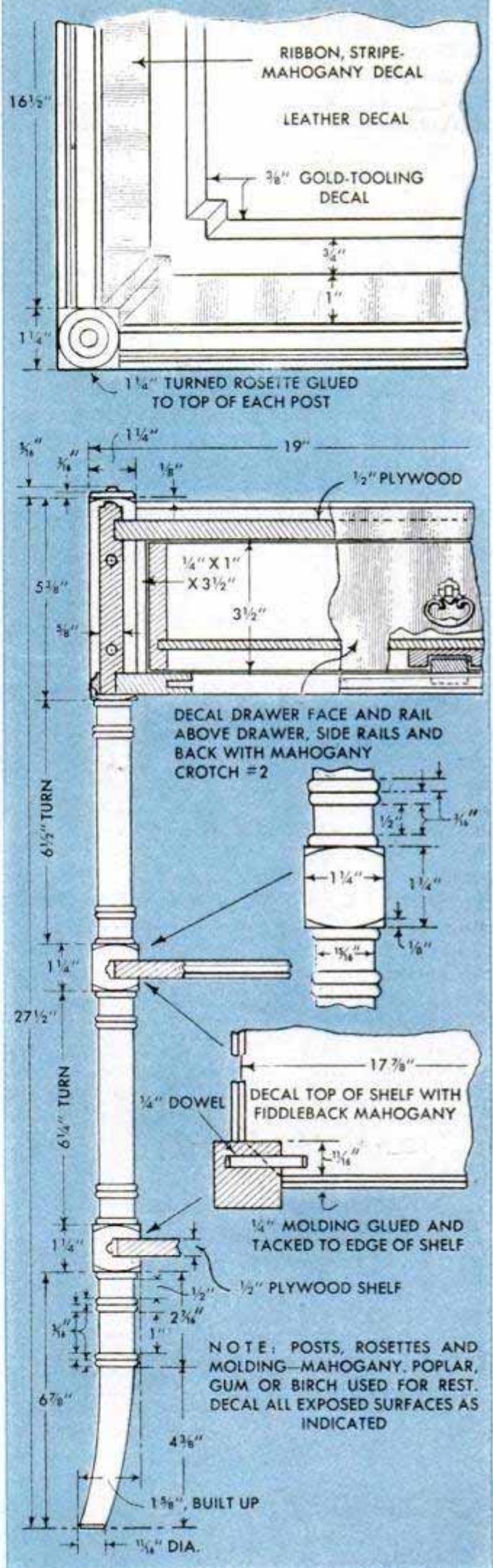


5 Lamp Table

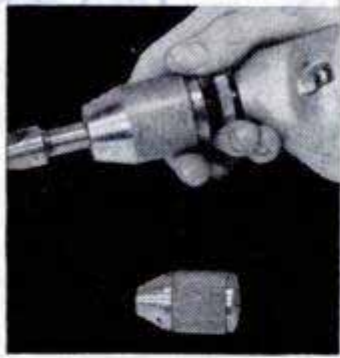


the work to serve as a guide in positioning the strip, and apply the adhesive to the leather. Squeegee the tooling in place, Fig. 2, and then peel off the paper carrier by holding down one end of the tooling with the thumb. This comes off easily if dampened with a sponge. Under the carrier you'll find a layer of rice paper still adhering to the tooling. This is allowed to remain for about 30 min., after which it is removed by rubbing gently with a wet sponge. Border veneers of the desired wood grain are applied around the edge of the leather veneer, following the method previously described.

The three matching tables detailed in Figs. 3, 4 and 5 were designed especially for use with "tooled leather" tops. The drawings suggest appropriate wood grains to use in covering the complete table, except for the legs, with plastic veneer.



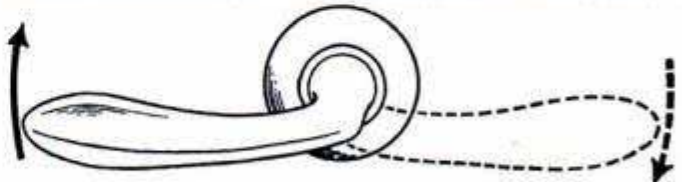
Fitting Oversize Chuck to Spindle Increases Capacity of Drill



The usefulness of a small electric drill can be increased by attaching a larger chuck to it for occasional heavy work. For instance, a 1/2-in. chuck often can be fitted directly to the spindle of a drill having a 1/4-

in. chuck. While not designed for continuous heavy-duty operation, a small portable drill equipped with a large chuck can be used to drive a buffing or grinding wheel without overloading the drill.

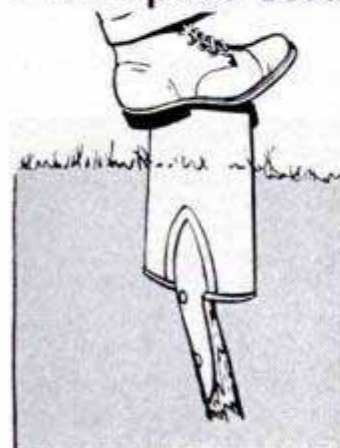
Richard Hanscom, Elmhurst, Ill.



Estimating Paint Coverage

To estimate the approximate number of gallons of paint needed to cover any given surface inside or outside the house, find the number of square feet of area and divide by 400. Following are several "quick" formulas for finding the areas of various surfaces. To figure the outside of a house, first multiply the distance around the house by the height to the eaves, and subtract the total window area. Add the remainder to the total number of square feet in the gables, the area of a gable being found by multiplying one half the height by its width at the base, and you have the total area. When figuring interior walls, deduct 15 sq. ft. for each door and window. The number of running feet in baseboards can be considered as square feet. Use 135 sq. ft. as the total area for an average staircase. Figure roughly 15 sq. ft. for each side of a window, including the sash and frame, and about 35 sq. ft. for each surface of a door and its frame. Four times the amount of the front area of a radiator will approximate its total area.

Worn Spade Used as Shooscraper



An old spade or shovel can be used as an excellent shooscraper. If the handle is intact, saw it off and square the cutting edge of the blade. Then, embed it in the ground or concrete as shown. — R. M. Woodbury, Natick, Mass.

Reversing Handles on Car Doors Prevents Accidental Opening

A handle that is pressed down to open a car door is a hazard, especially to small children, as the door can be opened when the handle is accidentally leaned on or unknowingly pulled. To avoid this danger, just reverse the position of the handle as shown. Then the door can be opened only by pushing up on the handle.

W. Shields, Bloomington, Ill.

Lighter Fluid Cleans Typewriter

Lighter fluid is an effective cleaner for the type on a typewriter. The long spout on most containers is handy for applying the fluid directly to the type where it quickly loosens the accumulation of dirt and dried ink, which then can be removed with a brush.



or from one motor of the Chrysler group of same period - This permits the 8 hr. battery running time.

of the Chrysler group of same period - This permits the 8 hr. battery running time.

Book for Boys
WTM 53
Toys You Can Make



SIDEWALK PLAY CAR

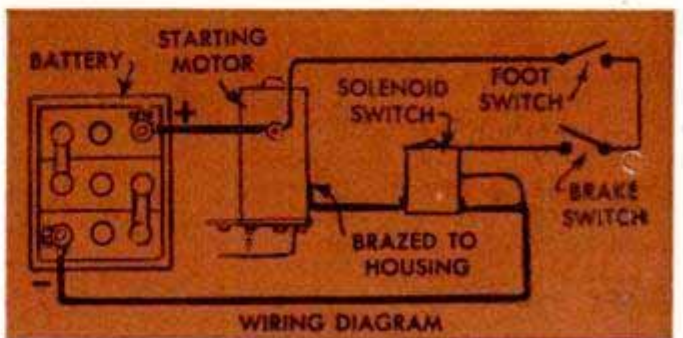
has electric drive

By Elmer V. Clark

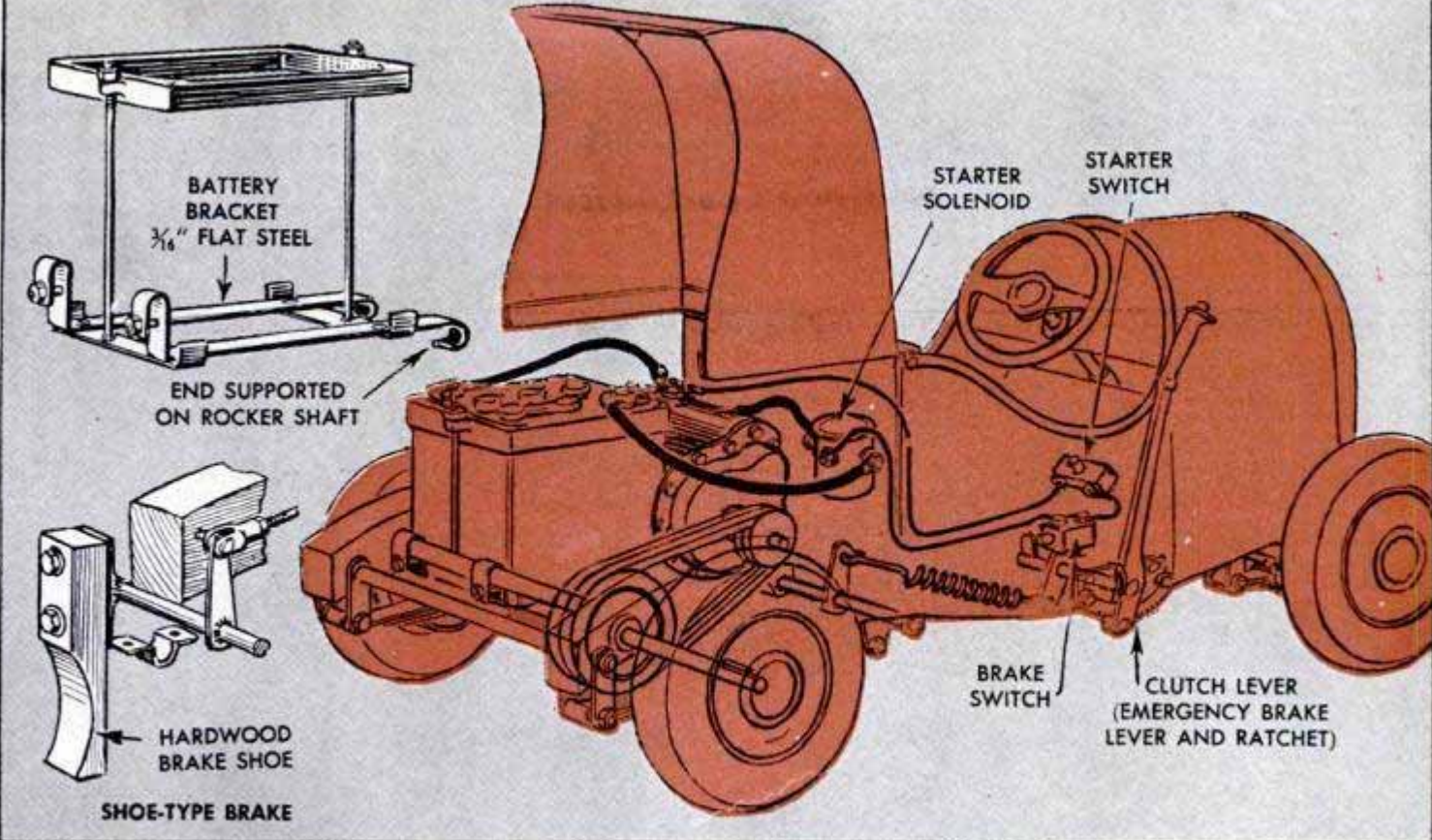
LIVELY youngsters and craftsman fathers alike will get a thrill out of this tiny play car, which looks and drives like a real automobile except that it's scaled down to sidewalk-coaster size and travels at slow, safe speeds. It's driven by an auto starter motor of the type having a built-in reduction gear and is fitted with a foot brake, lever-operated clutch, pneumatic tires and a conventional steering gear. As pictured above, the original car measures 58 in. overall length, with a 42-in. wheelbase and 20-in. tread, but allowable variations in dimensions and the necessity of adapting certain parts according to availability, may change these dimensions slightly. For these reasons certain dimensions have been purposely omitted and adaptation or substitution of parts has been left to the discretion of the builder. An example is the length and type of the springs specified in the construction details. Obviously, these can be longer, or even slightly shorter than the lengths given. The side frames are of 2 x 2-in. oak and, in order to avoid waste in forming the curved ends, or lifts, the members are built up to the rough shape by gluing together strips of 3/4-in. stock. Before gluing the strips together, be sure that there is ample allow-

ance for bandsawing the curved sections at both ends of each piece. Use waterproof glue in the joints. After the glue is dry, bandsaw the curved ends and plane and sand the parts to the finished size. Apply a coat of shellac to prevent absorption of moisture. The side frames are joined near the ends with long studs, or draw bolts, and pipe spacers as shown on the blueprint on a following page. Note that the front and rear-spring shackles are mounted on the draw bolts and that these must be left loose so that the shackles can move freely. Note also that the brake pedal is pivoted on the same draw bolt as the front-spring shackles. In this case two spacers are used to serve only as collars to position the pedal. Exact sizes of the draw bolts and spacers are not important.

Note especially the construction and



WIRING DIAGRAM



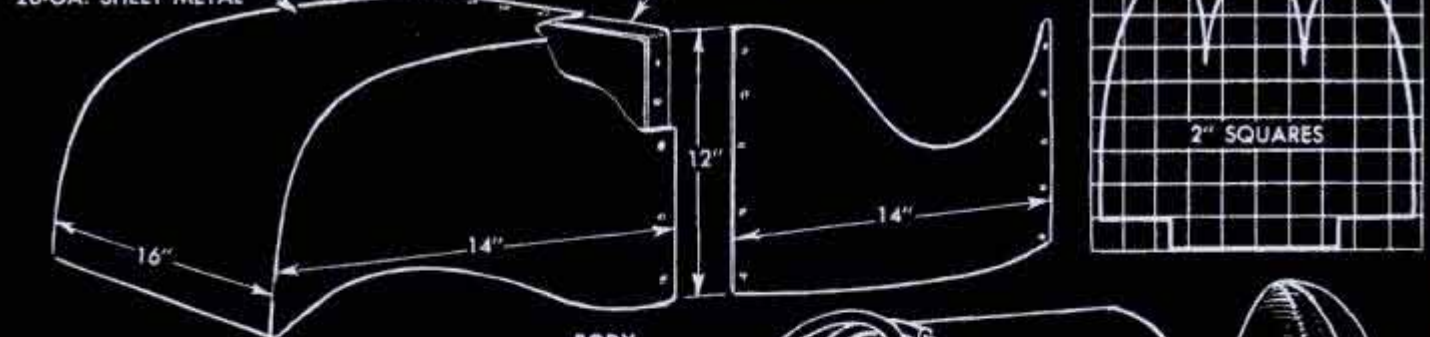
mounting of the front and rear axles on the springs. The front axle is fitted with drilled pads to which the underslung springs are bolted, but at the rear it will be noted that the axle bearings serve as spring pads. Shims of $\frac{1}{8}$ -in. flat steel are placed between the spring and the bearings, one shim being longer and having a drilled lug welded near the forward end to provide a bearing for the brake shaft when the band-type brake is used. When the shoe-type brake, shown in the detail above, is used, the brake-shaft bearing is attached to the car frame.

The front axle is of the conventional auto-type construction, the principal parts being made from pipe and flat steel, bent, welded and bolted together as in the blueprint. The drag link and tie rod can be taken from Ford Model-A steering linkage. Crosley or

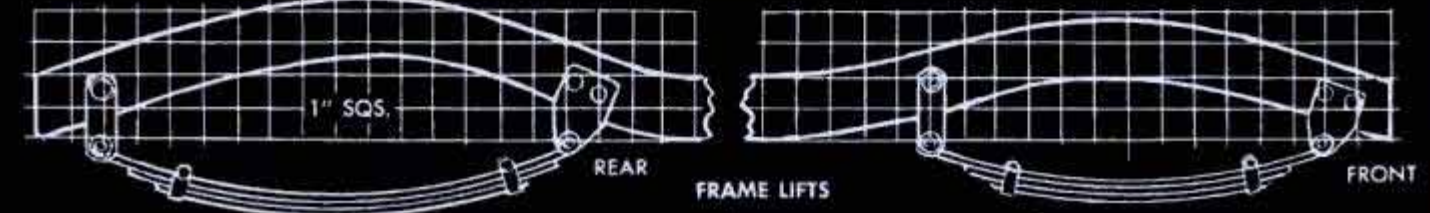
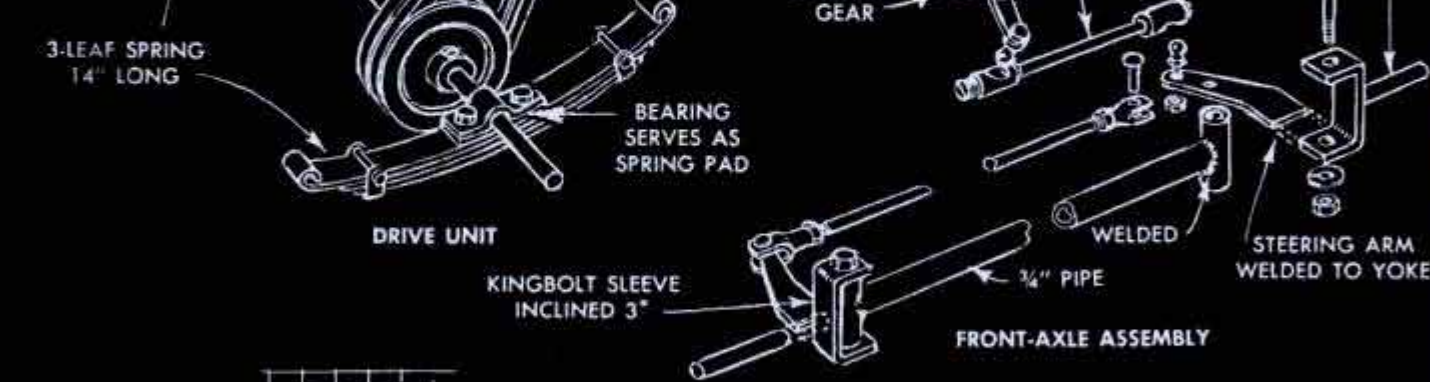
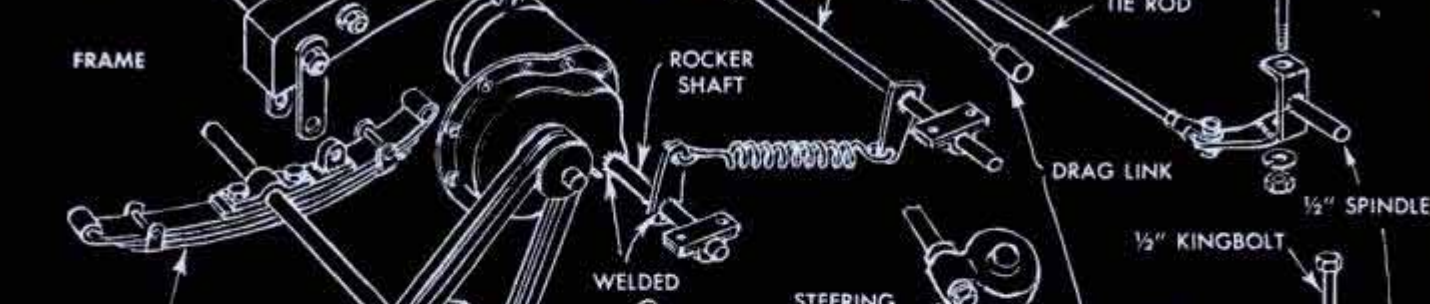
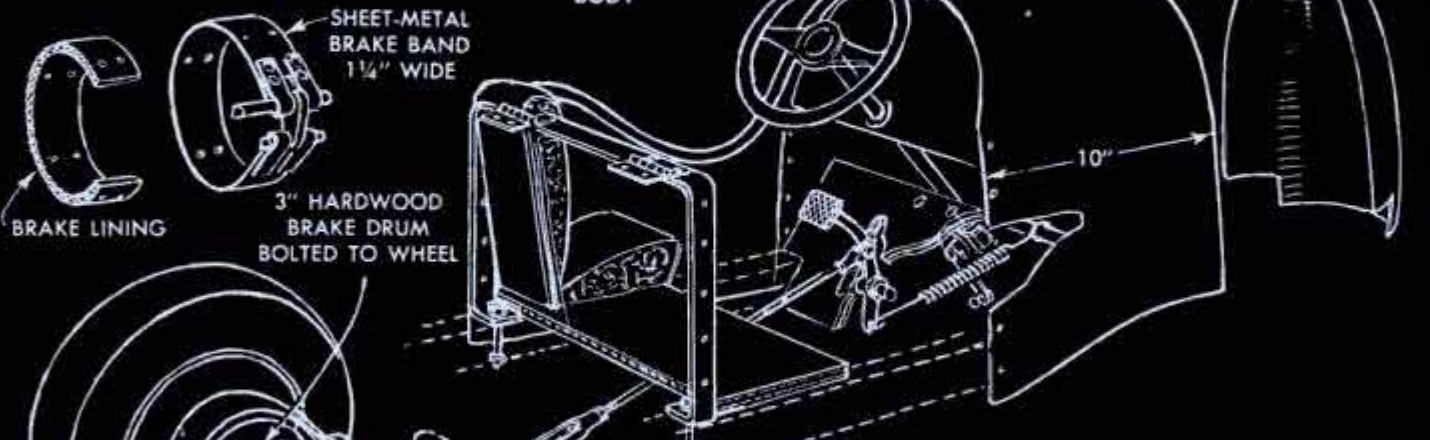
American Austin parts may be substituted. Rods with ball joints also can be improvised. A Crosley or Austin steering gear can be used, the gear being mounted on a bracket under the hood. The steering shaft is approximately 22 in. long and $\frac{1}{2}$ in. in diameter and is mounted on a generator bearing at the top end. The lower end of the shaft is fitted into an adapter sleeve, the size and length of the sleeve depending on the type of steering gear used. The steering wheel is 8 in. in diameter, the original being taken from a discarded toy.

Although details on the blueprint show the starter motor welded to a rocker shaft, which passes through a hole drilled in the flange of the reduction-gear housing to which it is welded, for best results weld a bracket to the gear housing and then weld





BODY



the free end of the bracket to the rocker shaft. This construction will give a somewhat better clutch action when tightening and slackening the double V-belts with the clutch lever. The rocker shaft turns in bearings bolted to the side frames. The clutch shaft, with its tension spring, is mounted in the same manner. Use a 2-in. V-pulley on the reduction gear and a 5-in. pulley on the rear axle. Although double V-pulleys are shown, single-groove pulleys will serve the purpose quite satisfactorily. Only the right-rear ground wheel is fixed on the axle and serves as a driver. The left rear wheel turns free. This arrangement gives the necessary differential when turning.

Details on pages 174 and 175 give the wiring diagram, construction of the battery bracket and the position of the controls. Note the arrangement of the brake switch and how it works in the motor circuit. When it is desired to stop, the clutch lever is pushed forward and the brake pedal depressed. A small lug welded to the inner end of the clutch-lever shaft opens the brake switch and stops the starter motor. The motor cannot be started until the clutch lever is pulled part way back. This arrangement prevents undue idling of the starter motor. With the pulley sizes given and with the gear ratios of the average reduction-gear starter motor, the car travels at a speed of approximately five miles per hour. A 6-volt, 130-amp. battery will give about eight hours of service on one charge.

Construction of the sheet-metal body is quite simple. It is made in three sections which consist of the hinged rear deck, the driver's compartment and the hood, which includes the separate false grille. The pattern for the grille is first laid out on 2-in. squares and then cut to the form shown, before bending and soldering. Sides of the cockpit and the hood are attached to the side frames with screws uniformly spaced. The seat bottom, floor boards and dash are cut from 1/2-in. plywood. The seat can be upholstered if desired. Bumpers, dummy lights and other fittings are optional with the builder.

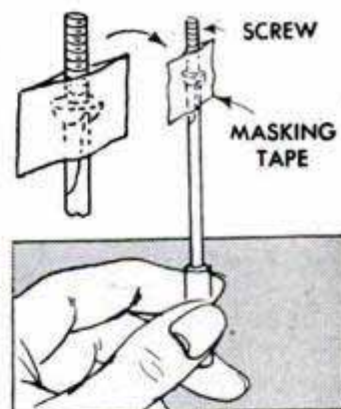
Muffin Tin Provides Multiple Target For Tiddlywinks Game



The old and entertaining game of tiddlywinks will be increased in fun value if a muffin tin is employed as a target for the disks instead of the usual single cup. The individual cups of the tin may be given different value numbers, or each player must hit a certain cup to score.

Screw Taped to Screwdriver Is Started Easily

Next time you have a screw which must be driven in a restricted place where you cannot hold it with one hand while starting it with the other, tape the screwdriver blade in the screw slot as shown. This will hold the screw



over the edge of tool blade. After the screw has been driven, a sudden pull on the screwdriver will release it from the tape.

Sid Corlin, Chicago.

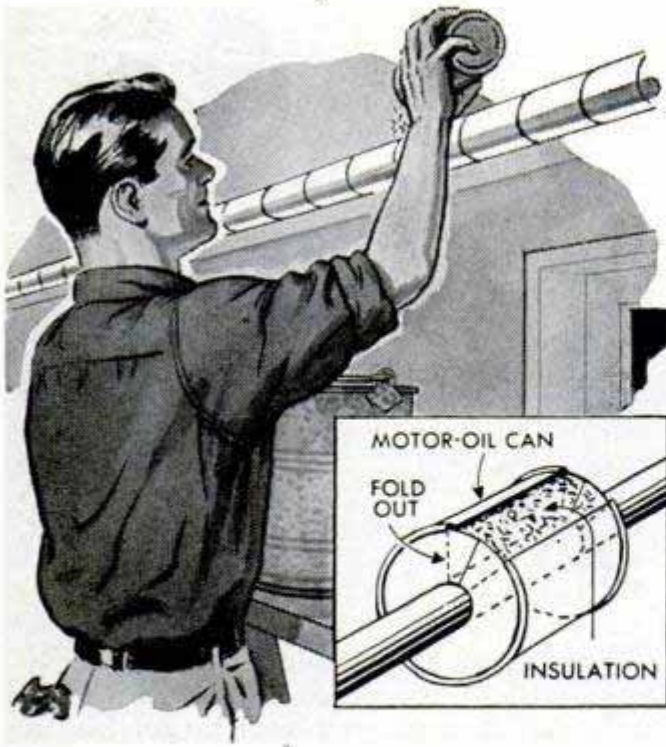
Legibility of Labels May Be Preserved When Liquids Are Poured From Bottles



When pouring liquid from a bottle where it is desirable to retain legibility of the label, turn the latter upward before starting to pour. In this way, any liquid that may run down the side of the bottle will not touch the label. Another way of preserving labels is to cover them with cellulose tape or, on larger bottles, tape a piece of acetate or wax paper over the label. If any liquid does get onto the tape or paper it can be wiped off before it stains.

Harry J. Miller, Philadelphia, Pa.

tin Cans Hold Insulating Material Around Water Pipes



The cost of insulating water pipes in a basement was reduced considerably by one homeowner who did the job himself with a granulated-type insulating material held around the pipes in motor-oil cans. A slot was cut lengthwise in the side of each can and a hole the size of the pipe was cut in each end. The ends were slit, and flaps turned out to permit placing each can over the pipe, after which the flaps were folded back in place and insulation poured into the cans through the slots.

R. W. Natchtrieb, Orland Park, Ill.

Drying Outboard Motor

Should you have to retrieve an outboard motor from fresh water after it has worked loose from the boat, be sure that it is thoroughly dry before using. To dry the motor, first empty the fuel tank. Then, remove spark plugs, carburetor and fuel line, cleaning and drying them. After placing the motor in an upside-down position so any water will drain out, turn the flywheel

slowly with the starter rope. Leave the motor in the sun so that any drops of water on the inside will evaporate. Then reassemble the motor, refill the fuel tank and let the motor run for awhile out of the water, clamping it securely to a large block, drum or barrel.

R. A. Jenkins, Los Angeles, Calif.

Skater's Portable Bonfire Is Towed Across Ice

Danger of a fire spreading when built on the bank of a river, or lake, often induces many skaters to locate their bonfire on the ice away from shore. As this usually results in the ice melting to form puddles around the fire, one sportsman uses a portable bonfire. This was made from an old washtub in the bottom of which was poured a 2 or 3-in. layer of sand to serve as an insulator. Air holes were then punched in the sides of the tub a few inches above the top of the sand layer. A length of rope tied to a handle of the tub permits towing the burning bonfire to any location.



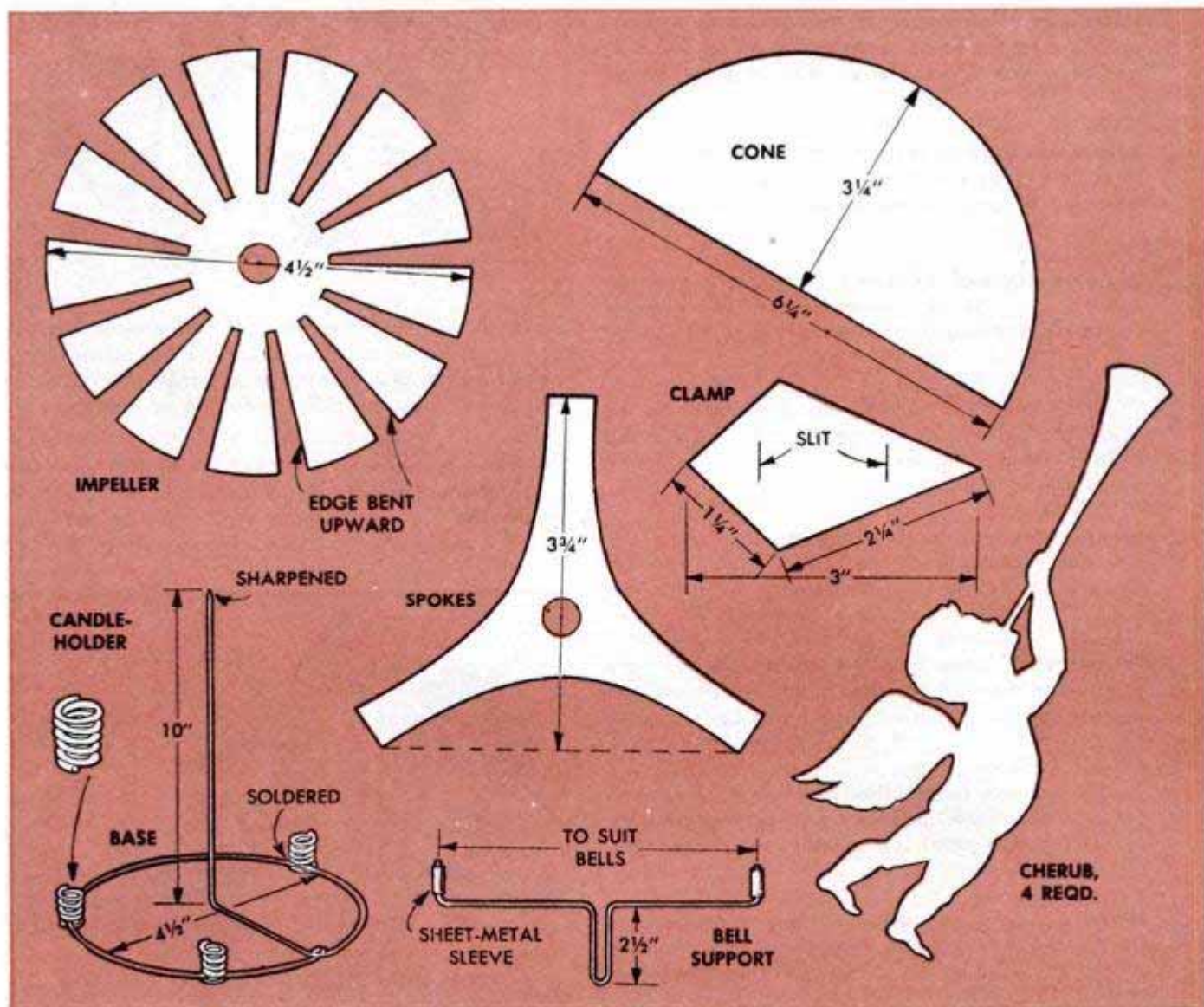
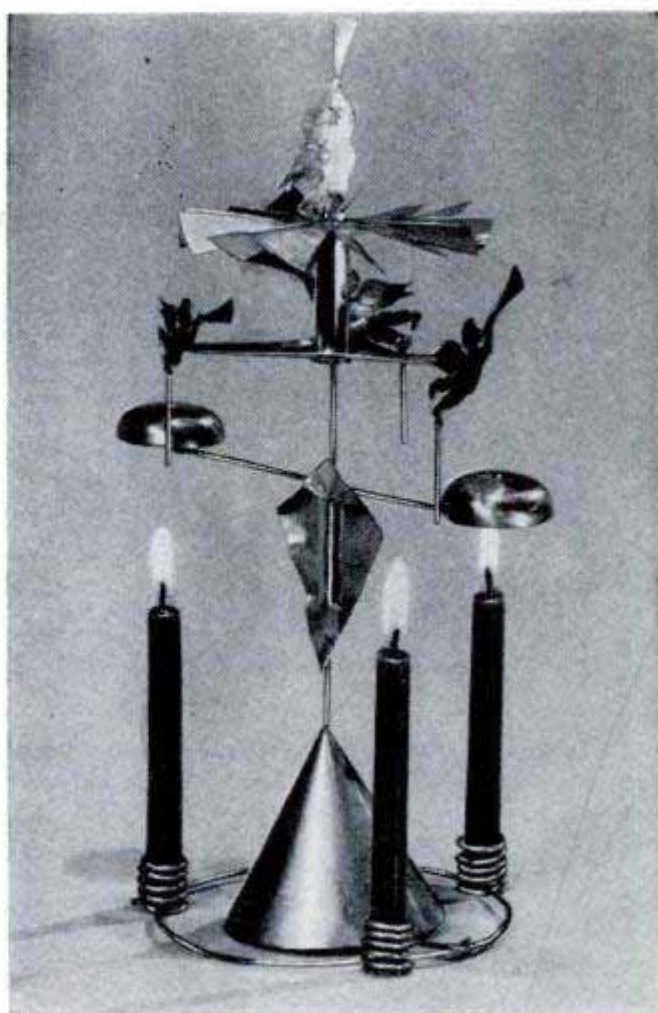
Build a "Wooden Lung" for Your Community

So many requests have come to us for plans for the wooden respirator described in the January 1952 issue, and since adopted as a national project by the U. S. Junior Chamber of Commerce, that *PM's* Craft Editors have prepared large, fully detailed plans for free distribution. These emergency "lungs" are being built throughout the country by "Jay-cee" groups with the cooperation of the National Retail Lumber Dealers Association. If

polio or other lung-crippling disease strikes your community, a respirator will be needed—and minutes will save a life. Organize a civic-minded group in your town, send for our respirator plans—they are free—build the "lung" and put it at the service of your local hospital and doctors. To order the plans for this emergency respirator, just drop a postal card to Popular Mechanics Book Dept., 200 E. Ontario St., Chicago 11, Ill.

Tinkling CENTERPIECE

THREE cherubs revolving near the top of this unique table centerpiece carry strikers which tinkle against a pair of bells. The heat from burning candles drives a sheet-metal impeller at the top of the unit and, in turn, propels the cherubs which are soldered on the ends of three spokes. Although copper is preferred, ordinary tin cans will do for the sheet-metal parts. Heavy wire is used for the base, standard and bell support, the latter being held to the standard with a kite-shaped clamp. The width of the support is determined by the diameter of the bells. The impeller and spokes are soldered to a discarded fountain-pen top which is placed over the end of the standard. The strikers consist of cotter pins or short lengths of heavy wire and are wired to the cherubs through holes drilled in the lower feet. Some adjustment will be necessary so that the strikers just touch the inner surface of the bells and move across them without stopping the motion of the cherubs.



Solving HOME PROBLEMS

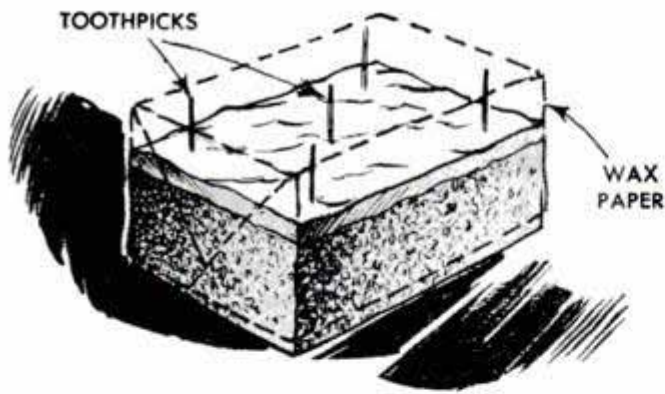
- Fastened to the face of a hammer with ordinary adhesive tape, a small magnet will hold tacks and brads for starting in hard-to-reach places
- Plastic squares cut from torn or worn-out tablecloths provide airtight, moistureproof wrappings for storing meats, vegetables and bakery goods
- Use envelopes of the type having a transparent window to store rickrack, bias tape and edging. You can see the color without opening envelope
- When something is spilled on the table, slip a blotter under the tablecloth and place another on top of it to absorb moisture and minimize damage
- Frayed and worn furniture welting is given a new appearance by completely covering with cotton yarn. Use a curved needle to bind the welting
- To keep a mirror from becoming cloudy, do not hang in direct sunlight. Scratches can be prevented by coating back of mirror with clear shellac
- Before boiling a cracked egg, rub common table salt into the cracked portion. Salt will keep the egg white from seeping through the crack
- Instead of using turpentine to remove paint from a child's tender skin, apply baby oil to the area and then wash off the paint with soap and water
- Before unwrapping a package of raisins, warm it in a slow oven for a few minutes. This prevents particles of paper from adhering to the raisins
- Paste swatches of fabric in a matchbook cover before carrying them in your handbag. This protects the fabric and makes it easier to find when needed
- To melt paraffin safely, use the teakettle as a double boiler. Steam the paraffin by placing it in a deep pan set in the top of the kettle
- When painting chair legs, place a jar cover upside down under each leg. This allows room for the brush, and cover catches any paint drippings
- To anchor a loose furniture caster, fill the hole with wood putty or sawdust mixed with glue, and replace the caster. Dried putty holds caster tightly
- Coffee grounds form suitable sweeping compound for basement floor. Instead of discarding grounds, store in gallon paint can or other large container
- When a washing-machine wringer slips because its surface has become glazed, restore "pulling power" by rubbing the rollers with fine sandpaper



Sawdust will take the skid out of icy walks as thoroughly as sand or ashes, and has the advantage of not being harmful to carpets or hardwood floors. Also, the sawdust is easily swept up or washed away

Use fine steel wool, powdered whiting or pumice to clean the underside of an electric iron. These will polish the surface without scratching or scoring it. Don't use harsh abrasives for cleaning the iron





Soft frosting or meringue on cake that is wrapped for carrying in lunches will not stick to the wax paper if toothpicks are used to hold the paper away from the icing. Toothpicks are pressed into icing as shown



Save time spent rummaging through your sewing basket in search of a thimble by pressing the thimbles over small corks glued to the basket lid. The tapered sides of the corks will hold the thimbles in place

Attached to the handle of a shopping bag, a key ring will hold a shopping list for easy reference. Leave the ring on the handle, and when you go shopping, just insert the list between sections of the ring



Indoor clothesline is strung quickly if each end is fitted with screen-door hook. Drive screw eyes into opposite walls and hook line between them

When stitching heavy material on sewing machine, rub soap along the seam before running it through the machine. This saves needles and speeds sewing

To keep brass water faucets bright and shiny, coat them with furniture polish. Before applying polish, clean and dry the faucets thoroughly

Candleholders and tablecloths will not be splattered with wax if drippings are caught by aluminum foil placed in holders before inserting candles

Inexpensive glassware will sparkle like crystal if it is coated with a thin baking-soda-and-water paste, rinsed with cool water, dried and polished

Seams in linoleum floors are sealed by covering them with strips of cellulose tape. Taped surface will withstand usage if coated with shellac

Butter will stay cool but retain its spreadable consistency when stored in the refrigerator, if it is first placed in an insulated ice-cream bag

Save nail-polish brushes and give them to the children for use with their paint sets. Better quality than the average "toy" water-color brush

If carrying keys and change quickly wears out the trouser pockets of your husband's work clothes, line lower portions of the pockets with chamois

Don't try to scrape off paper which has become stuck to a polished table top. To be safe, moisten the paper with olive oil and then rub it off

Stains can be removed from tall, slender vase by filling vase with vinegar, adding tea leaves and, after awhile, shaking the vase vigorously

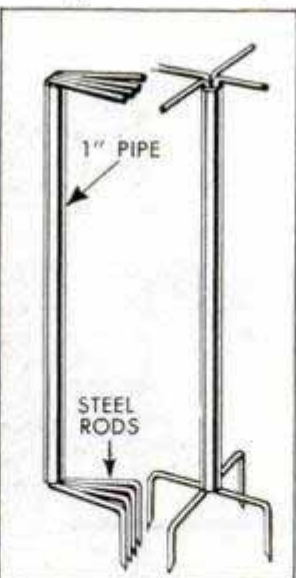
When necessary to remove stains from clothing or thoroughly scrub small soiled areas, use a coarse-toothed hair comb as miniature washboard

Trying to rub or wash soot from felt or fabric hat only spreads the stain. To clean the spot, cover soot with salt and remove with stiff brush

Pins and needles are stored conveniently in a sewing box by pressing them into block of sponge rubber. Cement the rubber in one corner of box

A worn refrigerator-door gasket that no longer affords a tight seal can be repaired temporarily by covering it with long strips of adhesive tape

Portable Rack Supports Guns Safely When Shooting on Open Range



Instead of using a tree or the fender of a car to support guns used in open-range target shooting, one sportsman carries this portable holder, which may be placed in any location desired merely by sticking it into the ground. It consists of a length of steel pipe in which four lengths of steel rod are inserted and bent as indicated. Ends of the rods are sharpened to ease pressing them into the ground.

Sheet Metal Clamped in Vise Cut Out Neatly With Hammer and Cold Chisel

The next time you want to cut a hole in a piece of sheet metal and do not have the regular tools for the job, try using a cold chisel. First, outline the shape of the hole on the metal and then clamp it in a vise with the outline mark flush with the jaws as pictured. In this way the vise will hold the metal firmly so that you can cut accurately and smoothly on the outline. It will, of course, be necessary to turn the metal to keep the outline flush with the jaws.

John E. Wills, Brightwaters, N. Y.



Mirror Reflects Headlight Beams To Warn Oncoming Motorists

Carrying an ordinary shaving mirror in the glove compartment of your car may prevent a serious accident if you should be stalled on the highway. If you don't have a flashlight or if its battery has gone dead, the mirror can be used as a reflector to warn approaching cars.

Bess Ritter, New York City.

Trim Boards Removed Undamaged by Sawing Off Nails

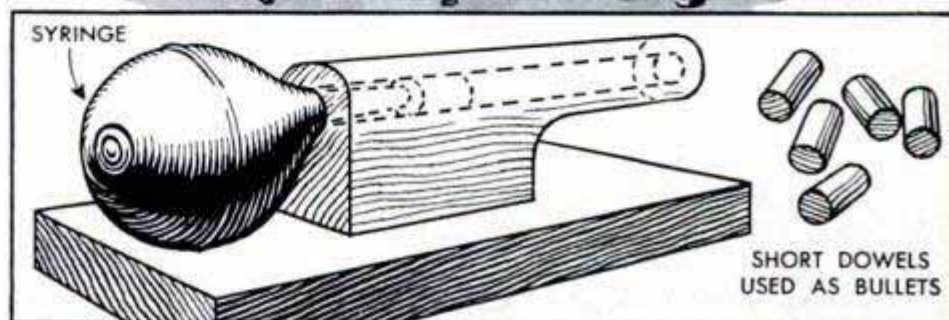
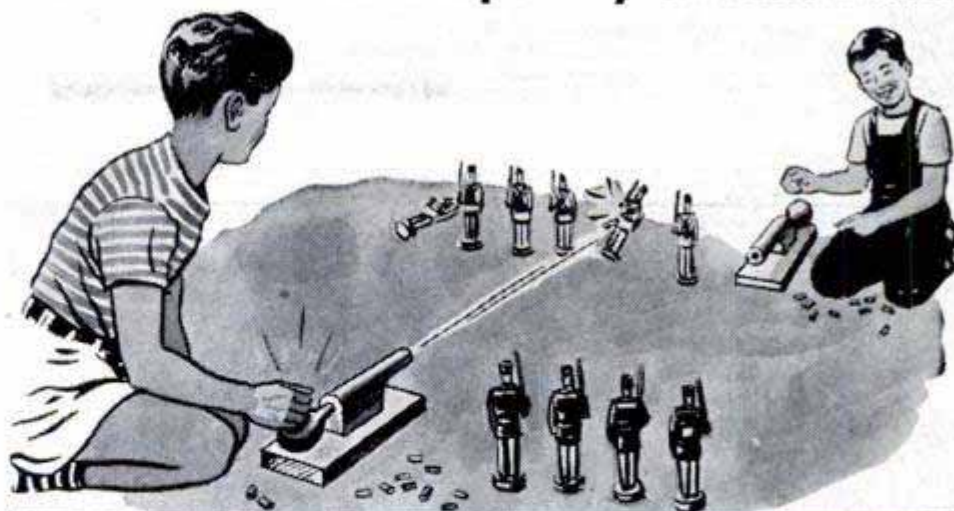


When it is necessary to remove door or window casings, jambs and other trim boards, the job can be done without pulling the nails through the boards or otherwise splitting them if a hacksaw is used to cut the nails before prying off the boards. This can be done with a saw of the type shown. First, use a chisel or heavy screwdriver to lift the board sufficiently to permit entrance of the saw blade behind it. Any projecting nails that have been cut off and cannot be pulled out, can then be driven in and countersunk easily. This will provide a smooth surface for reassembling the casing.

Michael Ligocki, Gary, Ind.

A safe and entertaining toy cannon that shoots short lengths of dowel is made from a discarded bulb syringe and two pieces of 1-in. wood. The barrel is drilled to take the dowels loosely, and the stem of the syringe is cemented to the breach end of the barrel to make an airtight fit. Then the barrel unit is nailed onto a base as detailed. In use, the cannon is loaded through the muzzle, and the projectile is fired by air pressure from a quick blow on the syringe. If the inside of the barrel is waxed, the range of the cannon will be increased considerably. A length of dowel having a smaller diameter than the shells will provide a ramrod for the barrel.

Bulb Syringe Fires Dowel Ammunition From Unique Toy-Cannon Barrel

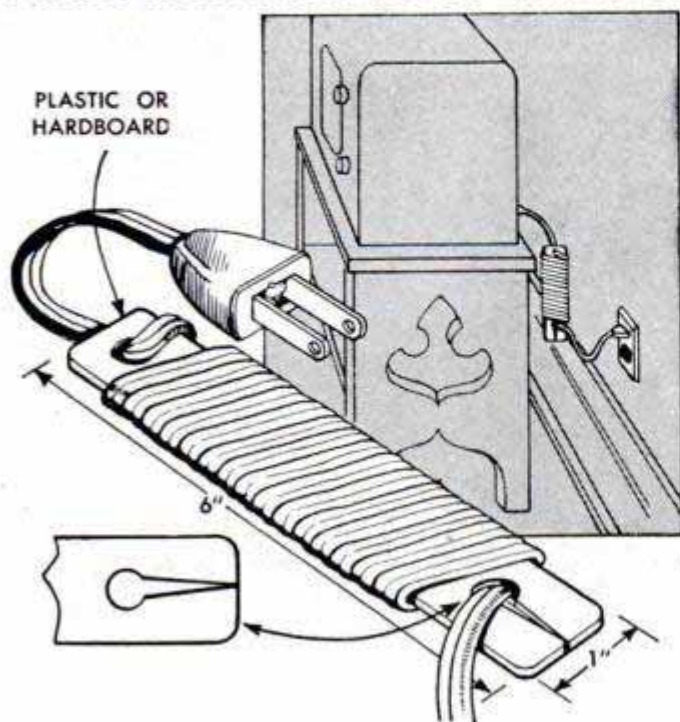


Thin Chrome Plating on New Cars Requires Special Care

Because of government restrictions on the use of nickel by car manufacturers, most of the chrome parts, except bumpers and buffer plates, are now being given only a light film of chrome. This film, in many cases, is protected with a coat of transparent enamel. It is important that you do not wax or polish these parts for the first three months after buying your new car. Instead, wash them frequently

with clean, cold water. After 90 days, a coat of wax may be applied periodically to maintain luster. Should the enamel coating become chipped or scratched, it can be repaired with a colorless enamel recommended by the car dealer. Do not use a colored-type chrome protector, as this may stain or discolor the original enamel. On bumpers and buffer plates, the chrome can be kept bright with liquid wax.

Plastic or Hardboard Reel Eliminates Danger of Tripping Over Lamp Cord



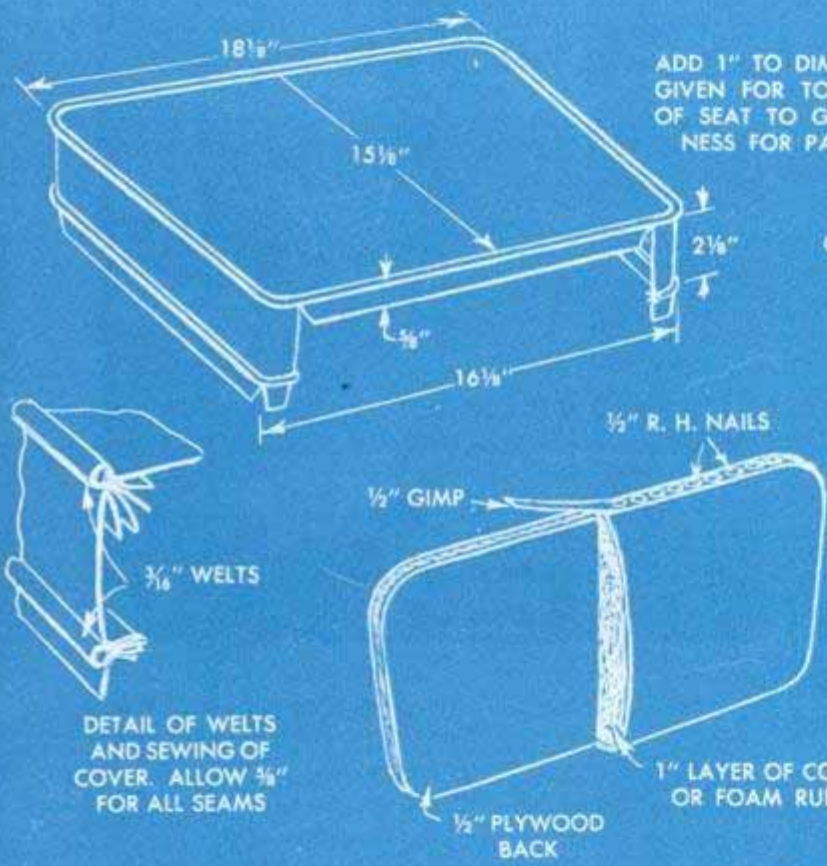
If a lamp or appliance cord is too long, it not only offers a hazard in the home by having someone trip over it, but it also may be dangerous to small children, especially those at the creeping age. Slack in the cord may be taken up by using a reel like the one pictured. It is made from a piece of plastic, which is drilled near each end to take the cord, a tapered slot being cut from one hole to the end of the reel. In use, remove the plug from the cord and thread it through the unslotted hole, allowing the cord to extend a few inches at this end. Then, replace the plug and wind the cord on the reel to take up the desired amount of slack. After this has been done, slip the cord through the slotted end into the hole. This will keep it wound snugly on the reel and permit suspending from the appliance or placing on the floor.

Arthur Trauffer, McClelland, Iowa.

...Dining Chairs Furniture

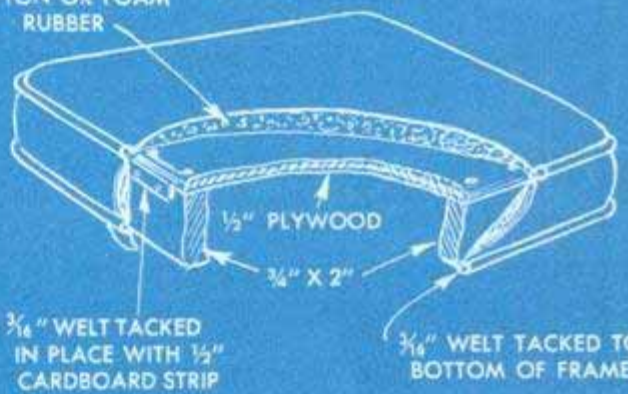


To offer the home craftsman a wide selection of the very best in build-it-yourself furniture, Popular Mechanics introduces, in this issue, its plan of the month. If you are not ready to start building this particular project, cut out the plan pages, tape them together and save the plan for future reference. Although these modern dining chairs match a table to be described in the plan next month, their styling lends itself to use with the popular drop-leaf tables. So, if you've been wondering what to do about extra chairs, make these of the same wood as your table and upholster them in suitable fabric

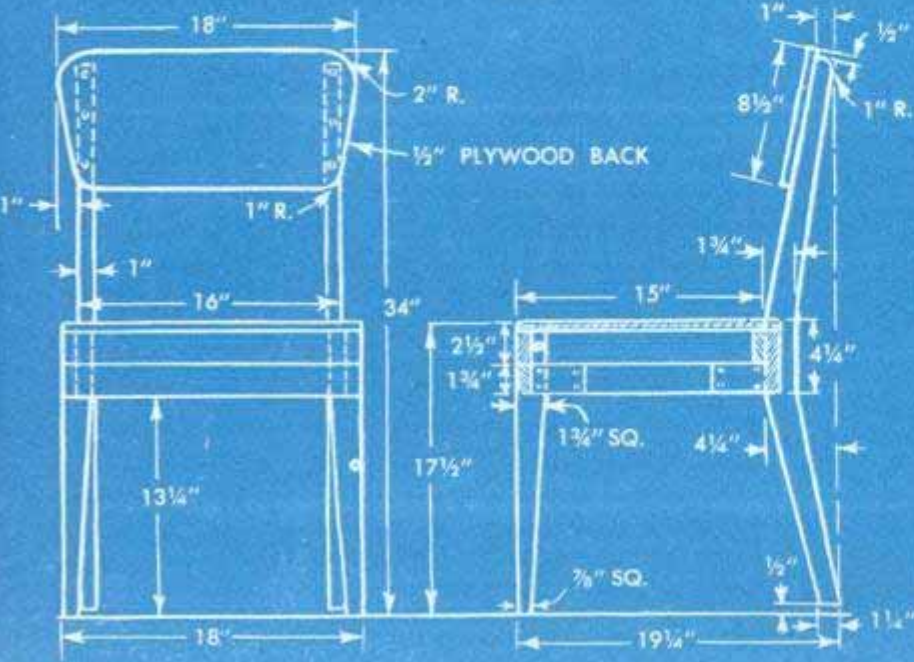


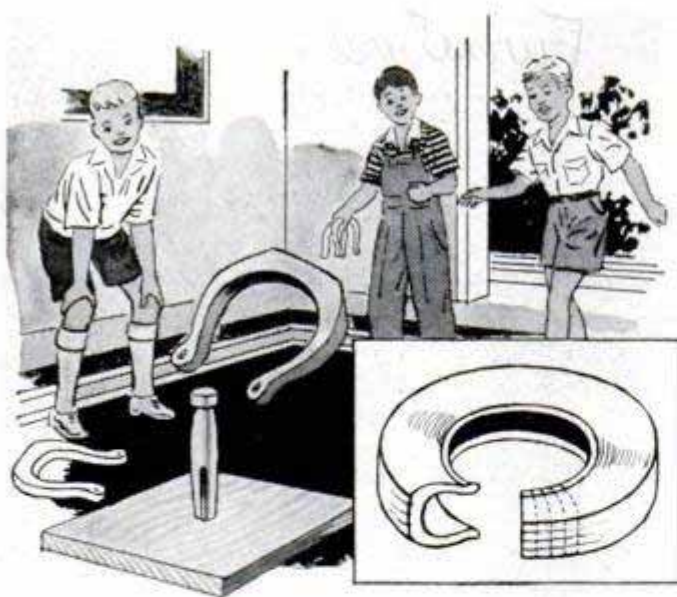
ADD 1" TO DIMENSIONS GIVEN FOR TOP COVER OF SEAT TO GIVE FULLNESS FOR PADDING

1" LAYER OF COTTON OR FOAM RUBBER



DETAIL OF WELTS AND SEWING OF COVER. ALLOW 3/8" FOR ALL SEAMS



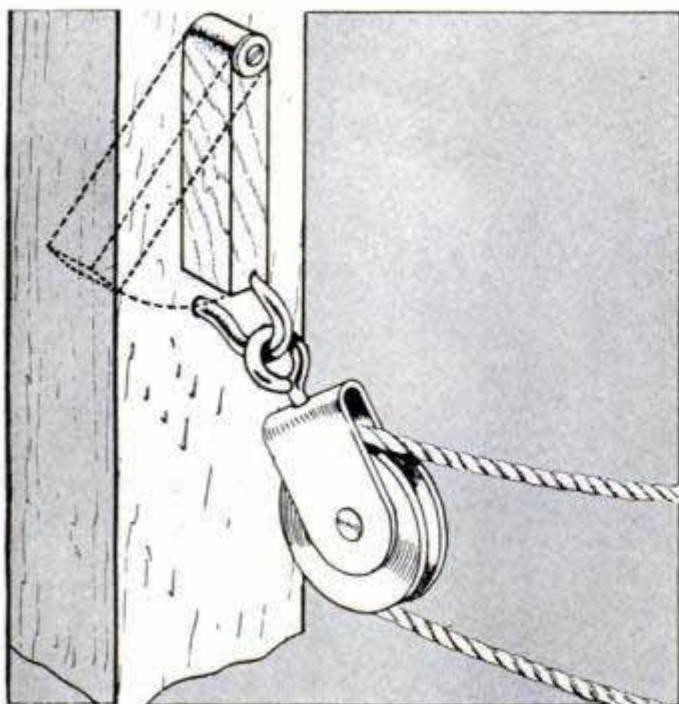


Tire Provides Rubber "Horseshoes" When Game is Played Indoors

Especially suitable for indoor play, this game of horseshoes is ideal entertainment for children on rainy days. As the "shoes" are rubber, being cut from an old car tire as indicated, they cannot scratch the floor and also help to keep the game a quiet one. The stakes are provided by driving two clothespins or wooden pegs into blocks of $\frac{3}{4}$ -in. wood 10 or 12 in. square.

Pulley Hung for Easy Removal Locked With Wooden Block

When a pulley is hung on an open hook, such as those used in conjunction with hay carriers or those on some clotheslines, it can be locked in place by means of a small wooden block. This is simply pivoted above the hook to swing down and close the gap between the point of the hook and the post.



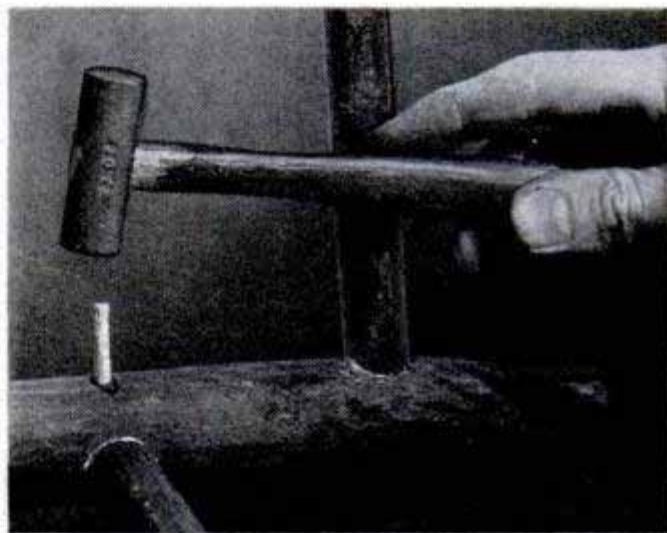
Tape Kept From Sticking to Coins

Before taping coins to a piece of cardboard for mailing, place a strip of paper over them. This will permit easy removal of the coins, as the paper will keep them from sticking to the tape.



Regluing Furniture Joints

If the glued joints on a chair or other piece of furniture loosen, it is possible to reglue them without taking the piece apart. First, drill a small hole at right angles to the tenon of the joint, drilling to a depth that will just reach the tenon. Then, fill the hole about halfway with glue, insert a



snug-fitting dowel or other plug, and tap it with a hammer. This will act as a plunger and force the glue throughout the joint. Before doing this, it is necessary that the joint be pulled up tightly with clamps.

Walter E. Burton, Akron, Ohio.

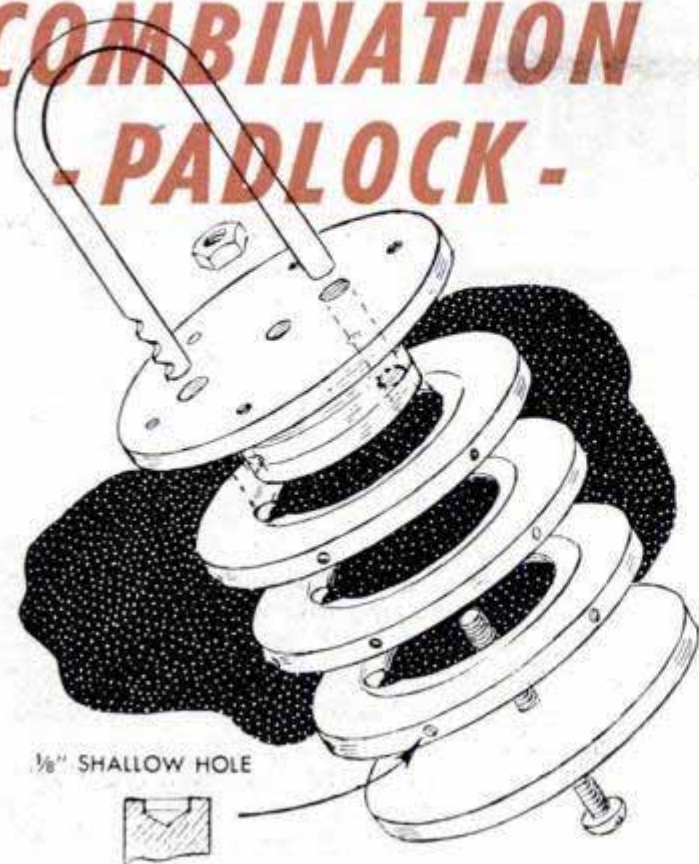
Safety Reflectors on Car Doors

Strips of light-reflecting cellulose tape stuck to the edge of the left-hand car door will warn approaching motorists when the door is opened on a dark, heavily traveled street. If desired, a similar effect can be obtained by painting the outer edge of the car door with luminous paint.

W. M. Dierks, Chicago.

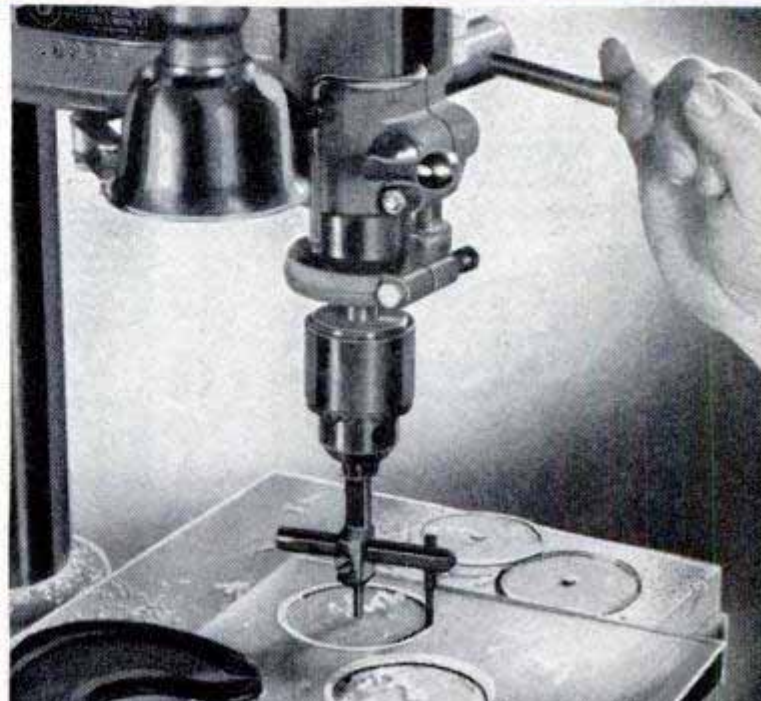
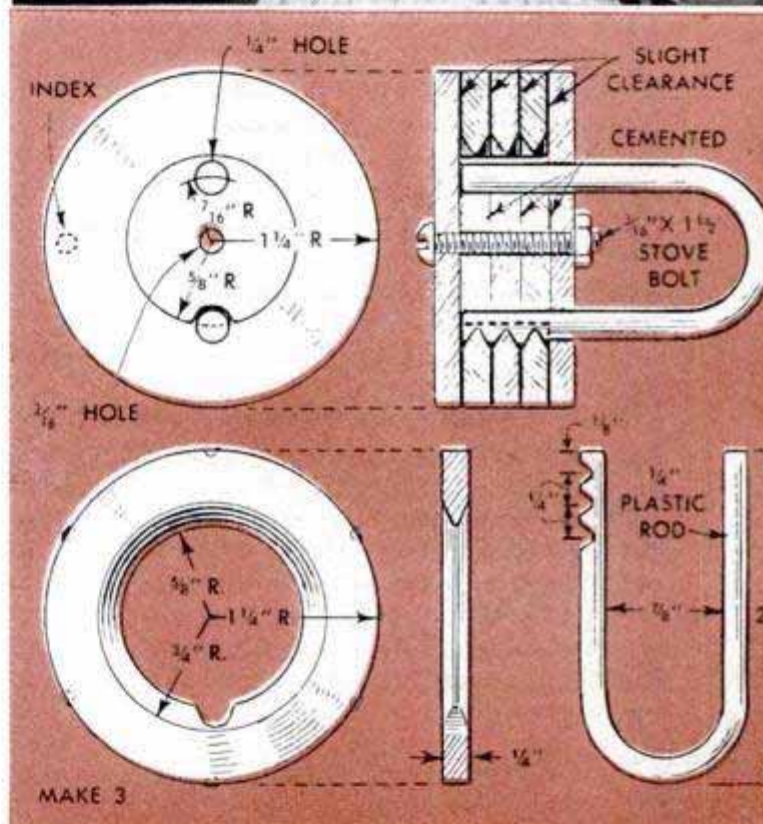
☞ Shoes can be waterproofed with a mixture consisting of mutton fat, 1 part, and beeswax, 2 parts. Apply this mixture in the evening and again in the morning. Then wipe the shoes with a piece of flannel cloth before wearing them.

Kiddie COMBINATION - PADLOCK -



By Marvin Reid Hartley

AN UNUSUAL TOY of lasting interest, this colorful padlock is opened by aligning a specific combination of four colored dots on the sides and top of the lock. The body, which can be made of plastic or hardwood, consists of five disks joined together with a stove bolt. The three center disks are cut out to form rings. These rotate around a core made by cementing the waste cut from the centers of the rings to the underside of the top disk. The latter is drilled to take a yoke of $\frac{1}{4}$ -in. plastic rod, one arm of the yoke being notched to engage the chamfered edges of the three rings. As shown in the detail at the right, the hole for the notched arm is drilled on a $\frac{5}{8}$ -in. radius from the center hole and the hole for the unnotched arm is on a $\frac{7}{16}$ -in. radius. In this way, the yoke is installed off center so the unnotched arm clears the rings. The yoke is released only when notches cut in the rings are aligned with the notched arm. Note in the detail above that six shallow holes are drilled an equal distance apart in the outside edges of each ring as well as in the top of the upper disk. Each of the six holes is painted a different color or fitted with a small synthetic jewel cemented in place. The photo at the right shows a circle cutter being used to cut the disks from sheet plastic.



Care and Repair of

MORTISED DOOR LOCKS



By Charles Kimball

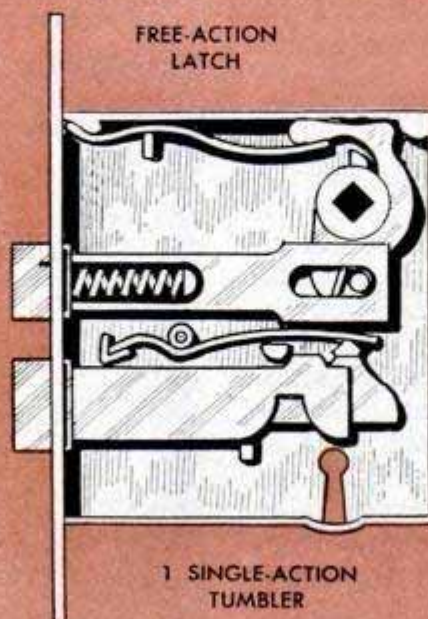
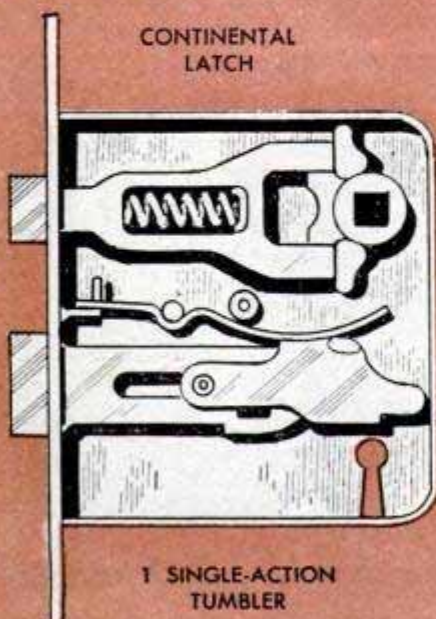
BECOMING acquainted with the workings of the door locks in your home is the first step in keeping them troublefree. Although commonly called locks, those faithful guardians mortised in the doors of your home actually consist of two distinct mechanisms—a latch and a lock. The drawings below picture four lever-type tumbler locks in general use, including the popular free-action latch. The various parts of a typical lock are labeled in the lower right-hand detail on the opposite page.

How the latch mechanism works: When the doorknob is turned in either direction, movement is transmitted to the hub via the spindle. The hub, in turn, transmits the movement to the latch bolt by means of two cams which operate through a latch lever or a shoe. This retracts the latch bolt and puts tension on the latch-bolt spring. All the various latch-spring actions illustrated

below are designed to place a strong tension on the hub, so that when the knob is released, it snaps back to an idle position.

How the lock mechanism works: In some locks, the tumbler is on the case side of the lock, while others are made with the tumbler on the cap, or cover, side. The key must raise the tumbler to exactly the right height to allow the tumbler stump on the key bolt to pass between the upper and lower shoulders of the gate in the tumbler. If the tumbler is lifted too high or too low, one shoulder will prevent shooting the bolt, as shown in the detail on page 190.

Where to obtain repair parts: As a rule, hardware stores do not stock extra parts for locks, other than knobs, spindles, trim and key blanks. Thus, in most cases, it is necessary to obtain replacement parts direct from the manufacturer of the particular lock. If the lock has not become obsolete,



the part needed can be ordered by giving the number of the lock and enclosing a pattern of the broken part. When buying a replacement lock, it is always best to take along the old lock for comparison as to size, thickness, backset and spacing.

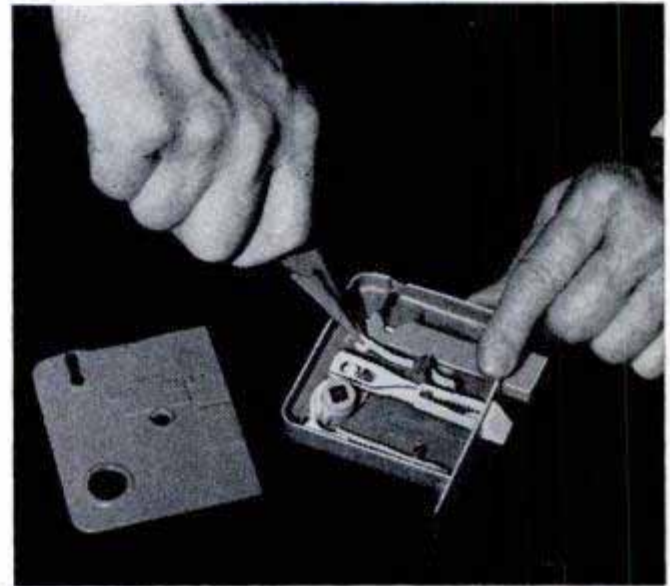
Loose front plate: Vibration resulting from slamming a door sometimes causes the front plate to work loose from the case. If the lock is of the type in which the front is screwed to the case, simply tighten the screws. If the front is held by lugs, retighten by pressing the lugs down between the jaws of a vise. To tighten a riveted front, simply peen over the rivets.

Sluggish latch-bolt action: Generally, this condition is due to lack of either cleaning or lubrication, or both, or to a weak spring. If the latch bolt won't extend, look for a broken latch-bolt spring. If this isn't the case, try loosening the cap screw. When the screw is turned too tightly, it will sometimes buckle enough to bind the latch bolt.

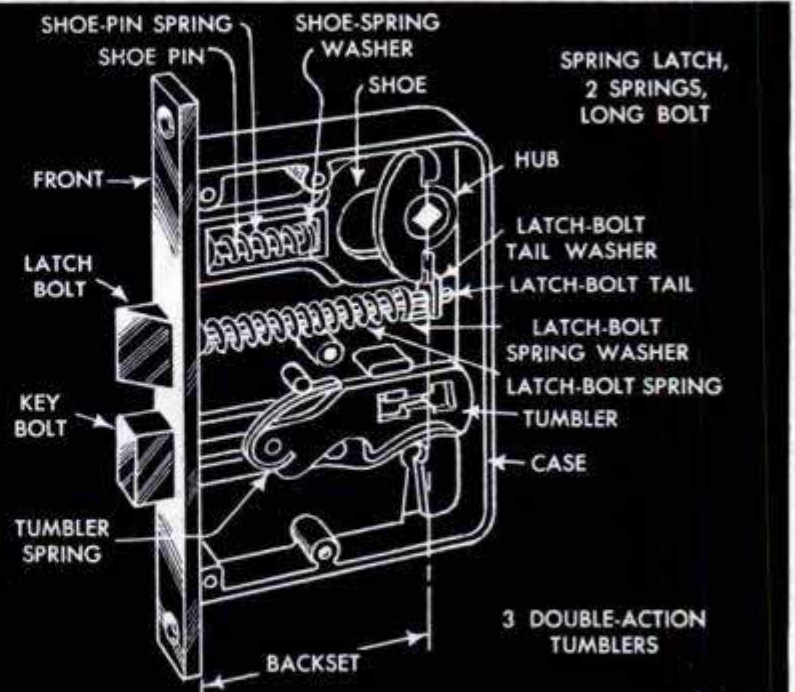
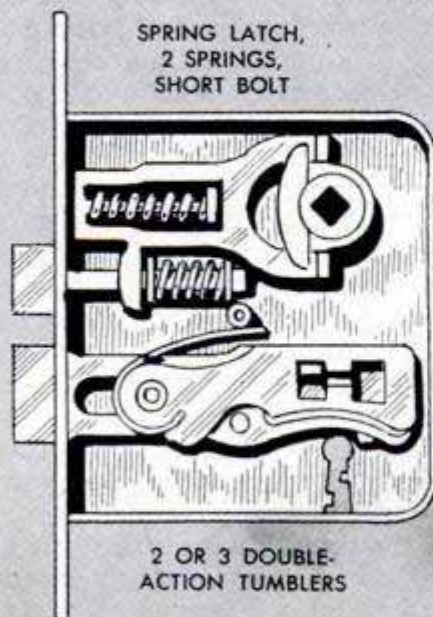
Broken tumbler spring: If the mechanism is well lubricated, gravity may move the tumbler down even though the tumbler spring is broken. However, the remedy is to cut and form a new spring and slip it in place. If the lock is of the type having a double-action tumbler, the spring may allow the tumbler to work up and stick at a point where the lower shoulder in the gate will prevent passage of the tumbler stump on the key bolt, making it impossible to operate the lock. If this is the case, remove the broken spring from the notch in the tumbler. If the replacement spring is undersize, it can be enlarged slightly to fit the notch by peening it with a hammer. In the event it is oversize, file down the end for a tight fit and press it in place in a vise.

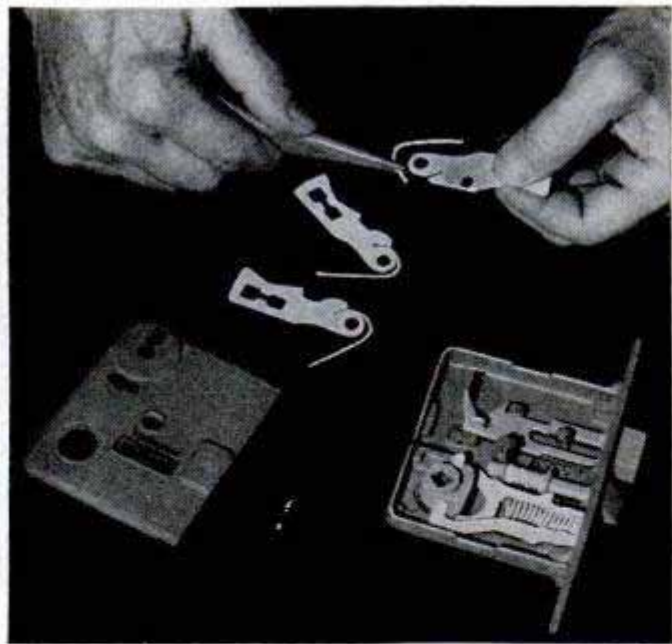


Above, replacing broken lever spring in free-action latch. Long-nose pliers are used to bend new spring



New spring for single-action tumbler is slipped in place, above, after it is cut to length and formed





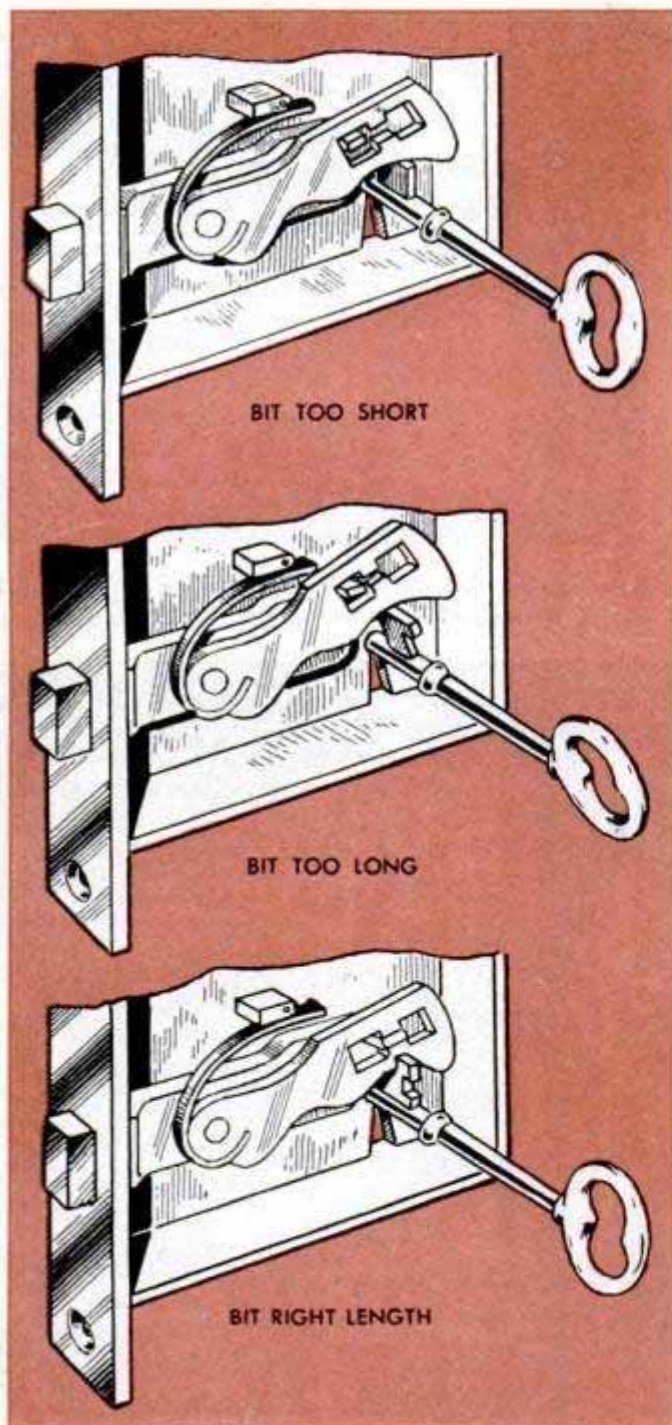
Replacing springs: An important thing in replacing a broken spring is to see that it is of the same tension as the original one. Flat spring stock is available in lengths of 12 in. and longer and is easily cut and bent with pliers. Compression coil-spring stock is sold in lengths of 12 in. and in a variety of diameters. Extension coil springs with eyes formed at both ends are manufactured in assorted sizes and tensions, and some locksmiths have bending machines with which they make coil springs from wire.

Tumblers rusted together: In a seldom-used lock having two or three tumblers, the tumblers sometimes rust together, making it impossible to shoot the bolt. The remedy is to remove the tumblers, clean off the rust with sandpaper and use light machine oil to lubricate the sides of the tumblers which rub together. This is the one instance where oil may be used in mortised locks. Use the same method to restore the usefulness of a lock in which the tumblers have stuck together as a result of gummed oil or prolonged idleness.

Lubrication: Use fine, dry-flake graphite to lubricate a mortised lock. Never use oil or grease, as these catch dust which clogs the mechanism and causes the lock to work sluggishly. Lubricating with graphite can be done without taking the lock from the door. Turn the knob to retract the latch bolt, and blow a few whiffs of graphite into the hole in the front on the beveled side of the latch-bolt head. Release the knob and then inject a little of the graphite into the keyhole. Do not use too much graphite, as a light dose about once a year will afford better results than excessive lubrication at less frequent intervals.

Cleaning: Many lock troubles caused by gummed oil and dust in the mechanism can be cured by cleaning. After removing the lock from the door, soak the lock for several hours in mineral cleaning solvent or mineral paint thinner. Take the lock from the solvent occasionally and work it by inserting a screwdriver or spindle in the hub and moving the latch bolt. Also use the key to lock and unlock the key bolt. After draining the fluid from the lock, dry the mechanism with compressed air or by allowing it to stand overnight in a warm place. Finally, give the mechanism a light dusting with graphite. Cleaning may be accomplished in much less time by disassembling the lock, removing the springs first, and washing the individual parts in solvent and drying them with a cloth. But before lifting out any of the parts be sure to make a diagram of the mechanism, using the cap as a template and drawing as many outlines of the case as there are layers of parts in the particular lock. As you remove each part, trace it on the outline.

Spring in double-action tumbler, above, should fit tightly in notch. Burrs are filed from both sides



Storing Game Carroms on Cue Stick Keeps Them at Hand



If you have a Carrom game and have been inconvenienced by losing or misplacing some of the Carroms while in storage, try this. Store them on one of the cue sticks by drilling a tiny hole through the stick to take a small rubber band.

Thus, when placing the Carroms on the stick, they can be pushed over the band easily and the rubber will prevent them from falling off. If desired, different colored Carroms can be kept on separate cue sticks.

Paper-Clip Note File

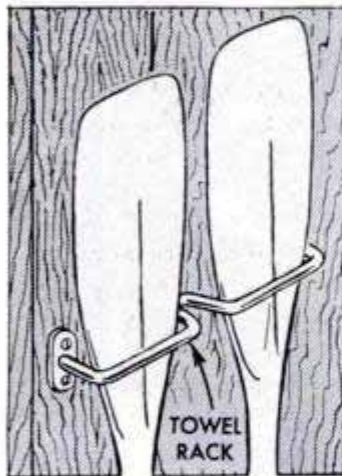


Notes, business cards, special phone numbers and other small papers containing useful information can be kept out of the way but readily at hand by means of an ordinary paper clip. The clip is simply placed part way

over the papers to form a hook for hanging on a nail driven into the wall.

Louis Hochman, Sherman Oaks, Calif.

Towel Rack Holds Boat Oars



An inexpensive, rod-type towel rack will serve as an ideal holder for a set of boat oars. Just bend it, as shown, and screw it to the wall of the boathouse or garage. If desired, a similar type holder for several sets of oars can be made from a length of rod

slightly larger in diameter. However, before forming it, flatten and drill the ends of the rod, and then bend them to right angles. This will permit screwing the rod directly to the wall.



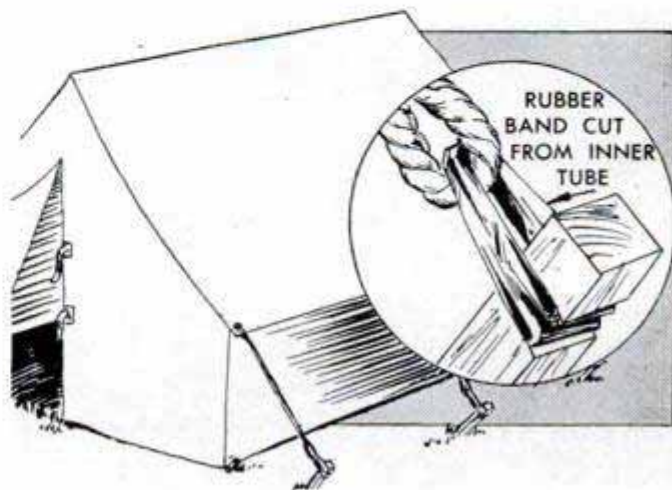
Handy Tool for Salvaging Lumber Made From Auto-Spring Leaf

Especially designed for salvaging boards when dismantling an old building, this tool is made from a section of auto-spring leaf and a steel rod. One end of the leaf is heated, bent to a right angle and cut off about 6 in. from the bend. A V-notch is cut in the thin end of the leaf and the edges beveled to permit cutting nails. Then, the rod is welded to the spring to serve as a handle.

Tent-Rope "Shrink Absorbers" Prevent Pulling of Stakes

To prevent the shrinkage of tent ropes from pulling the stakes or tearing the canvas, attach the end of each rope to a large rubber band cut from an inner tube. Then, stretch the latter over the stake to tighten the rope. When shrinkage occurs, the band will stretch, yet keep the rope taut.

G. A. Lemmon, Auckland, C. 1, N. Z.



Make a PAPER MENAGERIE

By Allan Carpenter

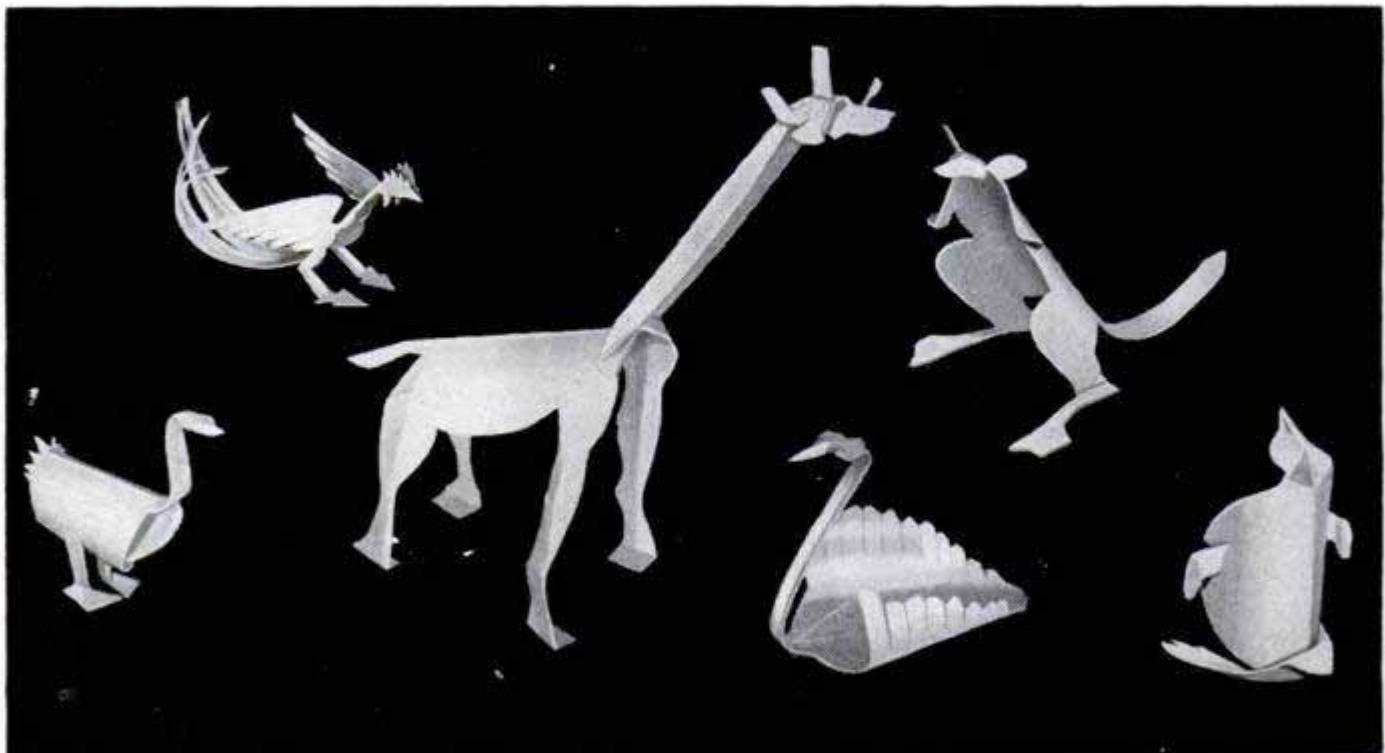


tracing directly from the magazine page. If you have no objection to cutting the magazine, the page can be pasted to a sheet of cardboard and each pattern cut out with a razor blade to provide accurate master patterns that can be used over and over again. The complete pattern is made by flipping over the half pattern along a center line on your paper. Folding is done on the heavy dotted lines, and the photo below can be followed in shaping each particular animal. Note that the bodies are rounded out to give contour and that the legs are creased to add stiffness. A simple method to use in rounding the bodies is to hold the paper animal between the thumb and a knife or scissors blade and pull the blade across the paper. This will make the paper curl nicely and is especially helpful in producing the right curl for tail feathers of the rooster and wings of the swan.

LIFELIKE paper cutouts are always popular with a youngster, especially when they can be folded to stand by themselves. The six animals included in the representative group shown below will get a child off to a good start on a real circus menagerie and will serve to suggest others. Made of gold, silver or colored paper, the animal cutouts will also make novel party place favors.

Each animal is fashioned in one piece from construction paper. Actual-size half patterns are given on the opposite page for

By cutting each particular animal from paper of an appropriate color, such as yellow for the giraffe, white for the swan, tan for the kangaroo, etc., the coloring can be completed quickly with water-color paints.





Rooster



Penguin

Kangaroo



CUT ON SOLID LINES
FOLD ON DOTTED LINES

Giraffe

HALF PATTERNS,
ACTUAL SIZE

Goose



Swan



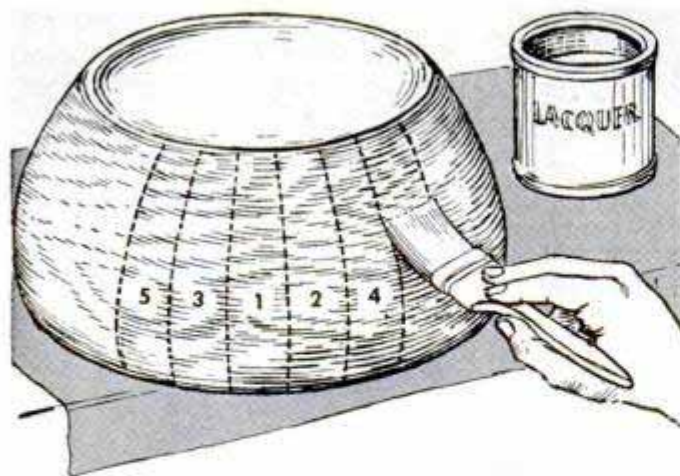


When using brads, glazier points and other small parts, a tray from which the contents may be selected easily is made from a small tobacco can. Just remove the lid and cut out one side of the can as shown. The small parts can be returned to their original container by holding the can on its side and pouring them back into it.

G. E. Hendrickson, Argyle, Wis.

How to Apply Lacquer Without Brush Marks

Brush marks that often mar the appearance of a lacquered finish applied by an amateur painter can be avoided by using



a high-grade brushing lacquer and applying it correctly. Since brush marks usually result from painting over lacquer that has started to set, plan your work so that successive strokes of the brush lap over lacquer which has just been applied. Usually the best way of doing this is to alter-

nate the brush strokes on opposite sides of the starting stroke as shown. Flow on a generous coat with the first brush stroke and work it out as little as possible. Lacquer dries very rapidly, which minimizes the possibility of its sagging when applied to the surface in a heavy coat.

Clinton D. Cook, Richmond, Mass.

Temporary Brake-Hose Repair

Finding myself miles from a service station with a broken brake hose on the left front wheel of the car, I managed to stop the leakage of the brake fluid and restore braking action to the three other wheels. I cut the defective rubber hose near the wheel, doubled the hose back beyond the broken portion and bound the folded hose with tape. This prevented further loss of fluid and retained sufficient braking action on three wheels to allow me to proceed at low speed to the nearest service station. Twine, wire or cloth strips could, of course, be used to bind the broken hose.

John Krill, North Lima, Ohio.

Wax Protects Scale on Rule And Lubricates the Joints



Occasional applications of wax to a folding rule will provide lubrication for the joints and protect the scale figures and markings against abrasion from handling. The hard, wax surface also makes it easier to remove adhesives such as asphalt and glue as well as grease and paint smudges.

Antimoisture Products Are Safe For Mixing With Auto Fuels

Tests made by a West Virginia university indicate that motorists may feel safe in mixing most commercial antimoisture products with gasoline to prevent freezing of carburetors and other failures caused by water in fuel systems. Technically known as "additives," the liquids tested were found to be effective when as little as 1 pt. was mixed with 10 to 15 gal. of gas. However, using in excess of 1/2-gal. additive in a full tank of fuel is apt to interfere with the operation of the engine.

VERSATILE KNITTING TABLE

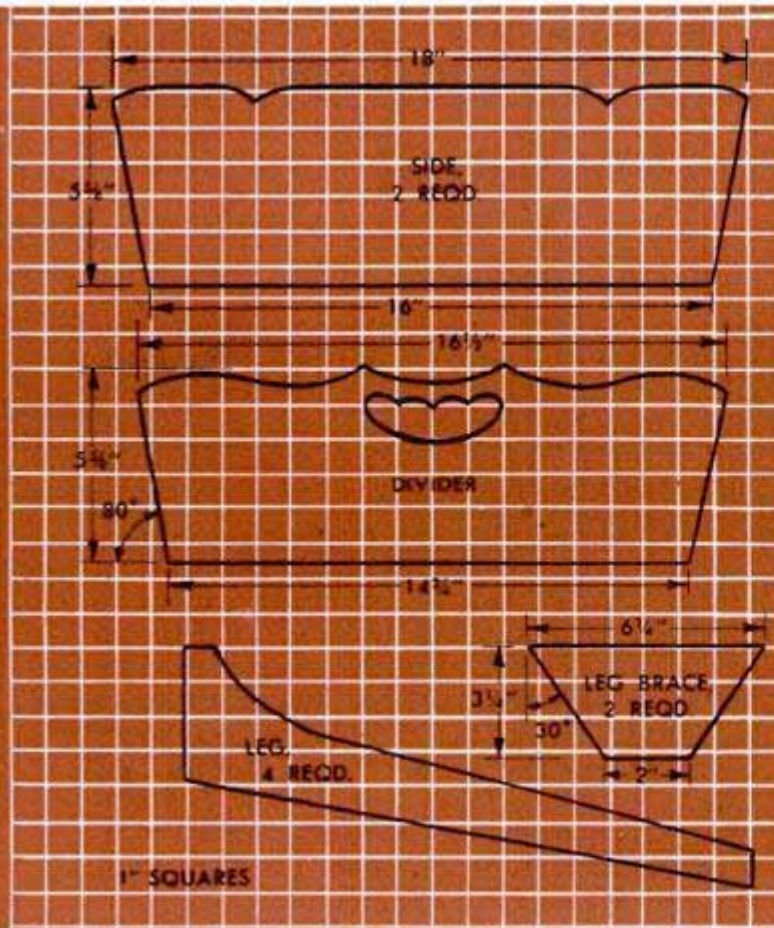
By Roberta L. Fairall

ATTRACTIVE in appearance and adaptable to a wide variety of uses, this handy knitting and sewing table may also be utilized to hold books and newspapers, candies or floral decorations. It may be constructed easily from $\frac{3}{4}$ -in. white pine and smartly finished in paint or varnish. With the exception of the bottom section, which measures $9\frac{1}{2} \times 14\frac{3}{4}$ in., lay out all members on $\frac{3}{4} \times 5\frac{5}{8}$ -in. stock. A paper pattern is helpful in tracing the outline of the legs and divider section onto wood. Cut the separate pieces just outside the guide lines, using a compass saw on the curved portions. Now assemble ends, sides, divider and bottom sections with glue and finishing nails. After fastening two legs to each leg brace with glue and flatheaded screws, rule diagonal lines from corner to corner of the bottom section. Then center the tops of legs over the lines and attach them to the underside of section. For accurate fitting of parts, glue and nail the pieces together before drilling pilot, shank and countersunk holes and driving in screws. Use a wood rasp to round all edges and sandpaper to provide a smooth surface before application of varnish or paint.

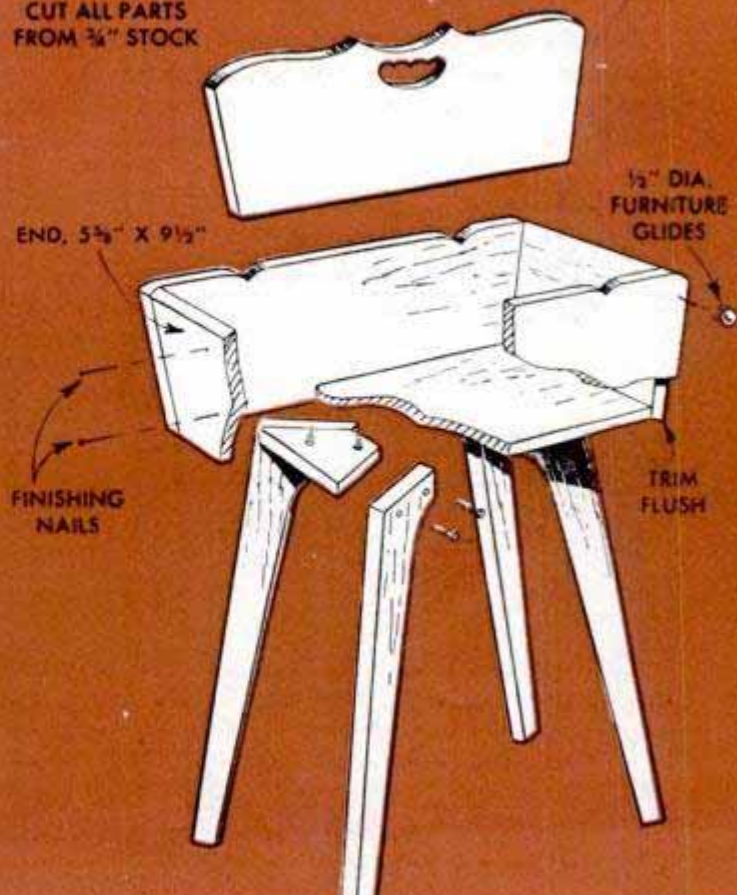
A driftwood finish may be obtained by using yellow pine, sanding down the soft wood around its pronounced grain and



applying a light-gray stain—turpentine, 3 parts, to 1 part clear varnish—to which has been added a little dry pigment or oil colors. When dry, rub with No. 3 steel wool to bring out the grain and leave gray remaining in the low surrounding areas. Tack $\frac{1}{2}$ -in. furniture glides onto sides to give appearance of dowel pegs and paint with gray enamel. Apply two coats of dull-finish clear varnish to complete the job.



CUT ALL PARTS FROM $\frac{3}{4}$ " STOCK





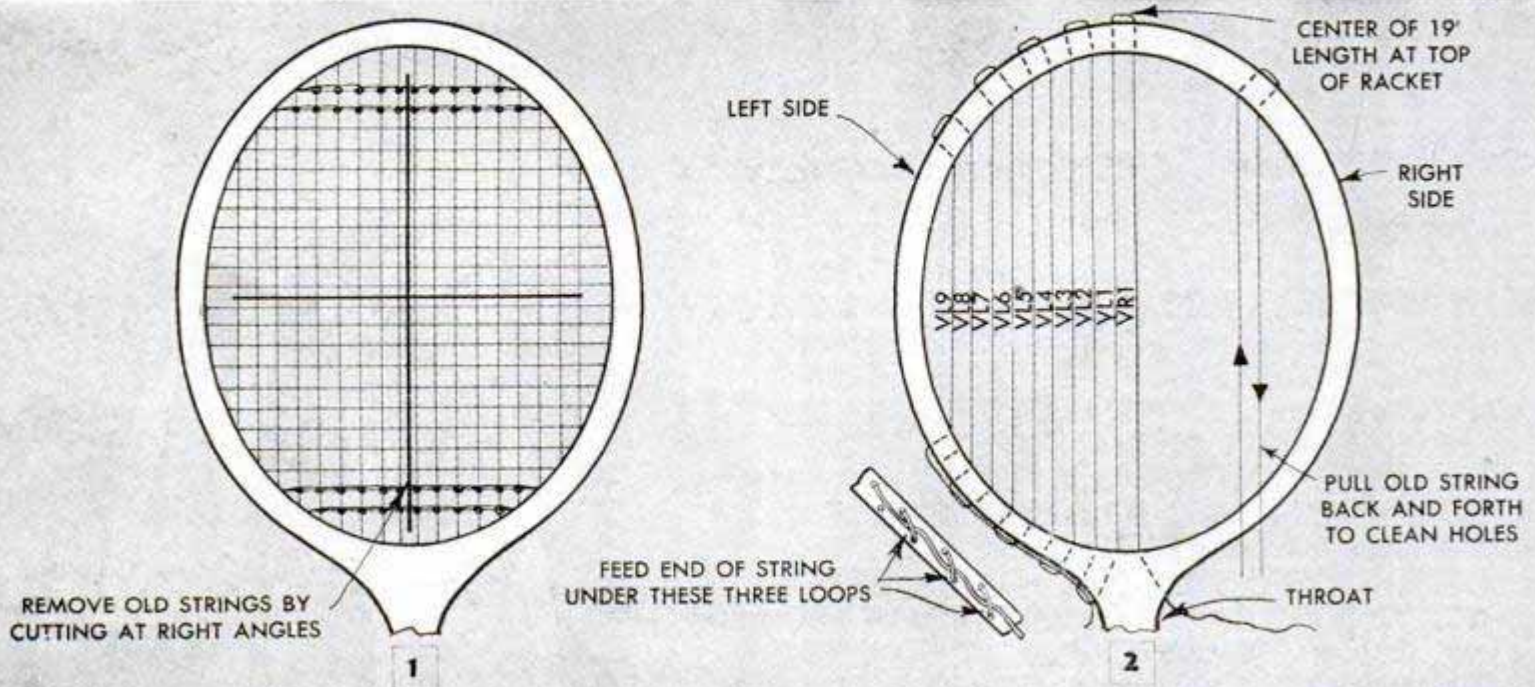
Restring THAT OLD TENNIS RACKET

By Robert M. Kintz

Tightening vertical strings of racket, left, held by tennis vise. Working from center, strings are pulled, slack taken up until end is secured to rim

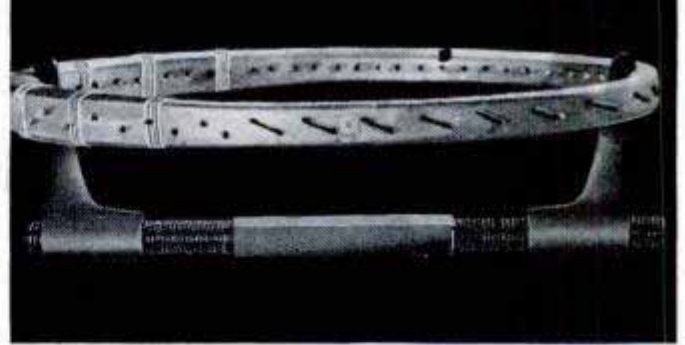
BEFORE discarding that old tennis racket, or paying to have it renovated, try your hand at restringing it yourself. This simplified method, also applicable for restringing squash and badminton rackets, will not only provide the craftsman with a useful and interesting project, but may eventually provide a pleasant and profitable hobby. Before getting underway, however, the beginner should read the instructions carefully to familiarize himself with the proper sequence of each phase of the operation and with tools and supplies needed for each step. A tennis vise or a billiard, which is pictured on the following page,

combined with an ordinary bench or machinists' vise, and three tennis awls are the only special equipment and tools required. When using the billiard, the handle of the racket is held in the jaws of the bench vise. In addition to these, the beginner must obtain the following tools and supplies before starting to restring a tennis racket: Pliers (those with parallel-acting jaws are best); a leather or rubber-covered dowel; a razor blade or sharp knife; a can of white shellac, and a brush. To complete one racket, a set of tennis strings consisting of one 19-ft. coil and one 17-ft. coil is required. Tennis trimming strings may be included to provide a



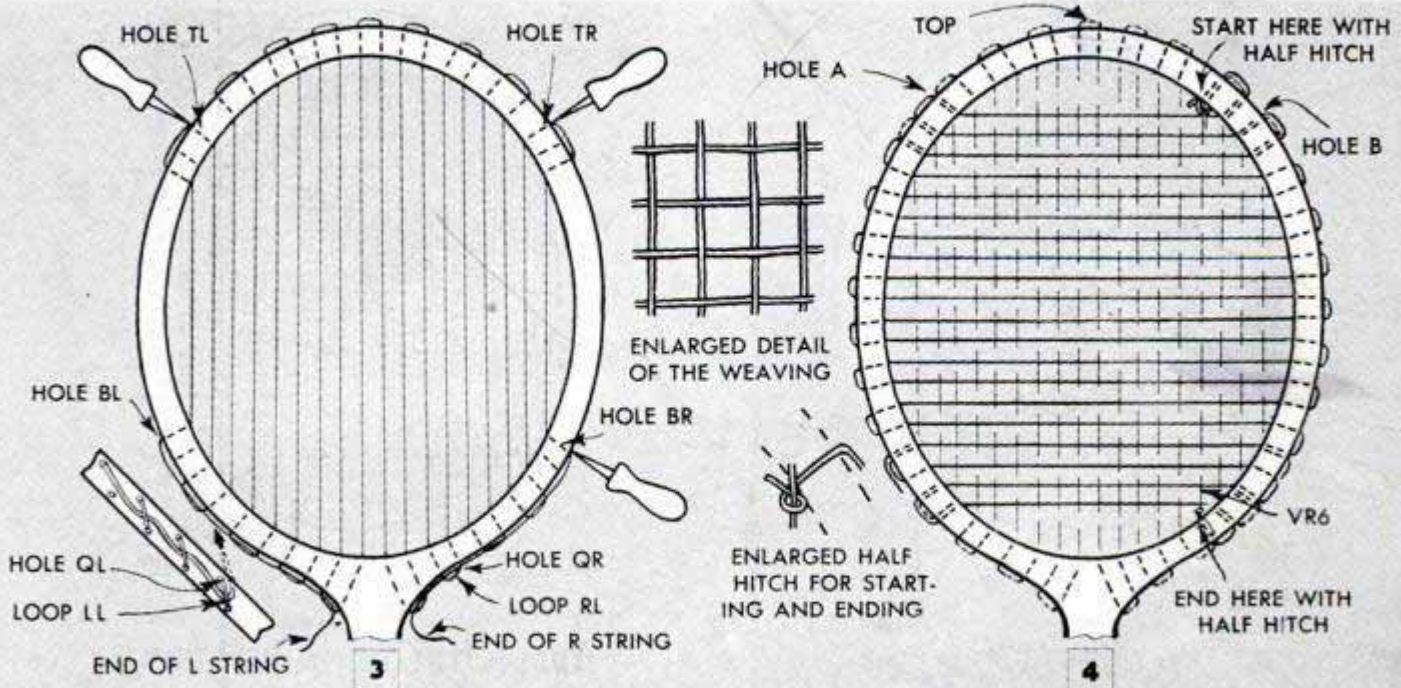
starting, it is wise to check carefully the condition of the racket frame and the edges of each string hole. The racket frame should be examined for any cracked, split or warped condition that permanently weakens it, thus making the racket no longer worth repairing. If the frame proves to be in sound condition, you may then proceed to remove the old strings. This is accomplished by making two cuts in the form of a cross with a razor or sharp knife, Fig. 1. The short lengths of old string which remain are quickly extracted with a pair of pliers. After the strings are withdrawn, ream and clean the holes. In most rackets that have been restrung before, the edges of the holes usually are quite sharp and must be rounded before restringing is begun. To do this, simply take a piece of used string 20 to 24 in. long and pull it back and forth through two holes at a time, as shown in Fig. 2, until the edges are smooth.

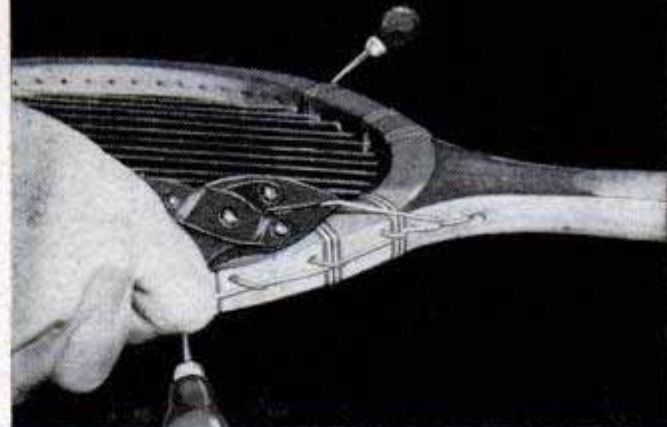
Vertical strings: The vertical strings are put in first. It should be remembered when handling new tennis strings that every precaution should be taken to avoid bending or kinking them. They may be damaged beyond further usefulness. With the handle of the racket held firmly in the bench vise, take the 19-ft. length of string and start to thread at the top center of the frame, Fig. 2. Vertical strings should be threaded before attempting to apply and tighten the billiard. The center of the string must be located at the top center of the racket and the two ends threaded back and forth in separate operations until stringing resembles that of the racket shown in Fig. 3. The strings should be kept fairly loose at this stage of the operation to permit the ends of the string to be inserted under string loops



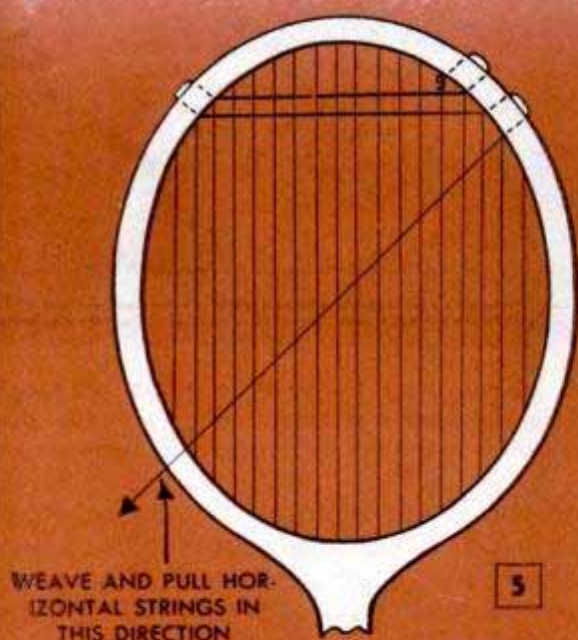
Billiard, above, may be used in place of tennis vise, if racket handle is held firmly by bench vise. The billiard is adjusted by turnbuckle arrangement

around the lower edges of the racket-head rim. This aids in the final securing of strings after they have been tightened. Most present-day rackets have 18 vertical strings, designated VR1 through VR9 for those on right side of racket, and VL1 through VL9 for those on the left side, Fig. 2. For the important task of tightening vertical strings, secure the handle of the racket in the vise so that there is little chance for movement or distortion of the frame while under tension. Now insert awls in holes TR, BL and BR, Figs. 3 and 7. Awl in TR may be used in hole TL, alternating back and forth, as required. Using the finger tips, Fig. 7, pull on VL2 string with one hand to tighten VL1 string, but before releasing it, move your free hand on to VL3 string and take up slack by pulling as before. In the same manner, pull on VL4 string before releasing VL3 string and repeat this operation until tension applied to VL9 string tightens VL8 string. At this stage of the operation, insert an awl in hole TL to hold VL8 string securely, remove awl in hole BL and pull on the loose end of the left string until VL9 string





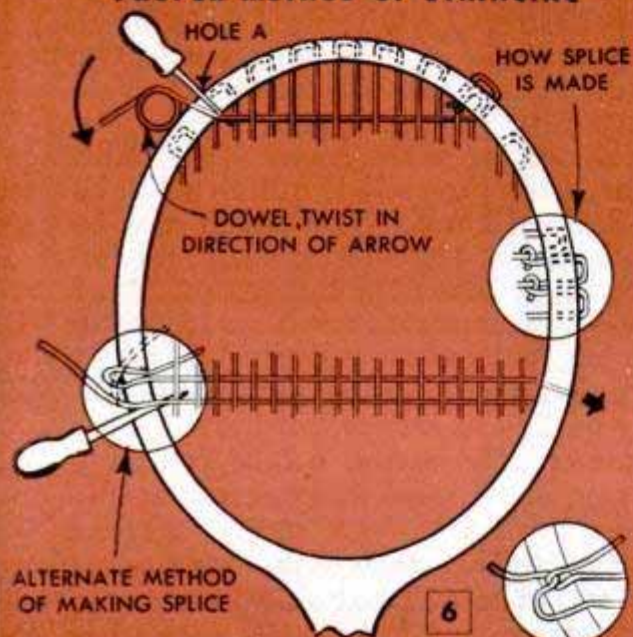
Pliers are used to tighten and turn back left string, for wedging and locking in near-by hole, QL. Awl holds strings in place until ends are secured



WEAVE AND PULL HORIZONTAL STRINGS IN THIS DIRECTION

5

PROPER METHOD OF STRINGING



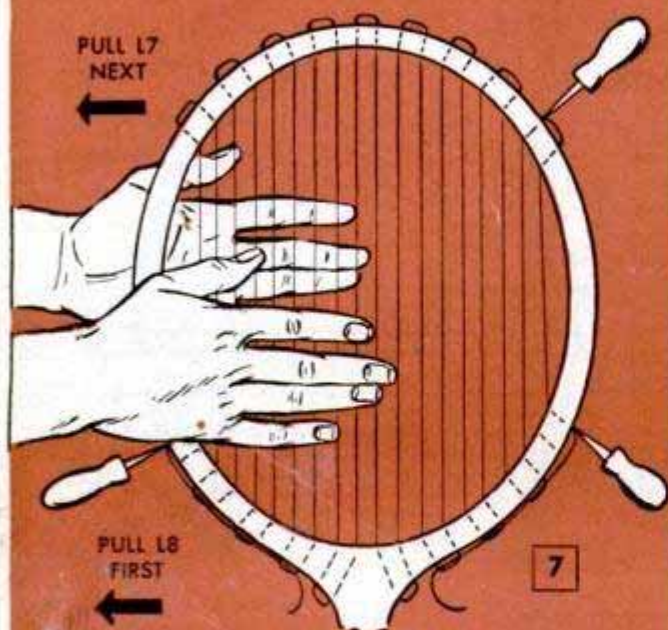
ALTERNATE METHOD OF MAKING SPlice



6

WEAVING HORIZONTAL STRINGS

COMPLETED SPlice



PULL L7 NEXT

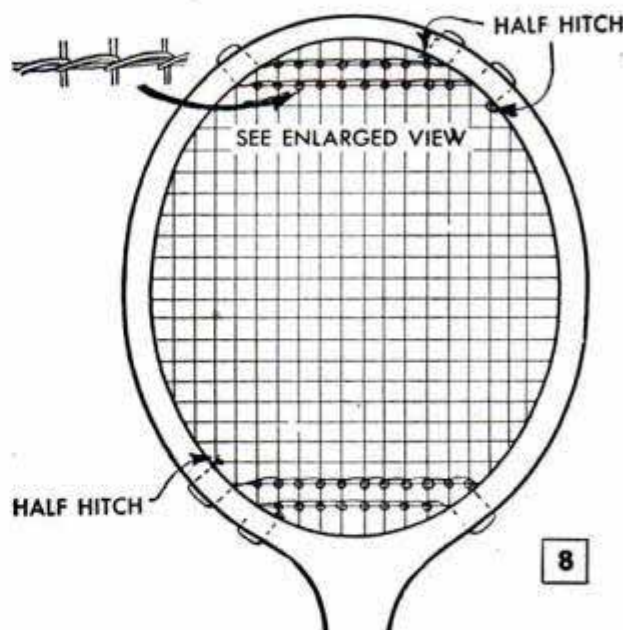
PULL L8 FIRST

7

TIGHTENING VERTICAL STRINGS

is tightened. Before removing the awl from hole BL, use pliers to pull the end of the left string tight and to double back for insertion in hole QL, where it is wedged and locked. This operation is carried out in an identical manner for the right side of the racket. An attempt should be made to keep all vertical strings under an equal amount of tension. Tautness of strings may be easily checked by plucking the strings and comparing the pitch of the various sounds that result. The tightening operation usually must be repeated several times before strings can become properly aligned and evenly taut. When the ends of both left and right strings have been made fast in holes QL and QR, respectively, loose ends are trimmed off. Care should be taken to avoid cutting or nicking strings near by.

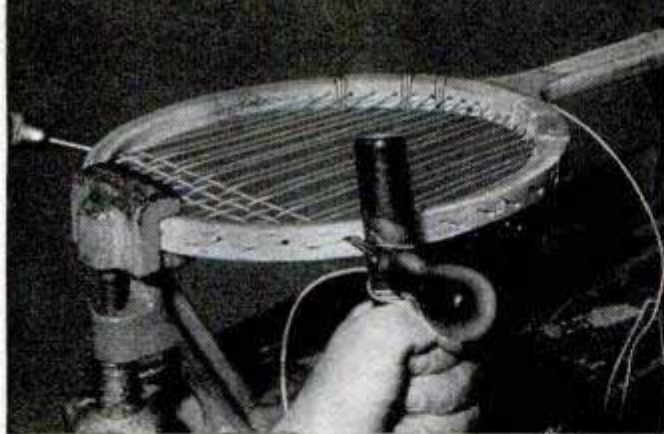
Horizontal strings: There are 20 horizontal strings in most rackets, designated H1 through H20. It is not necessary to move the racket in the vise for installation of horizontal strings. Taking the 17-ft. length



HALF HITCH

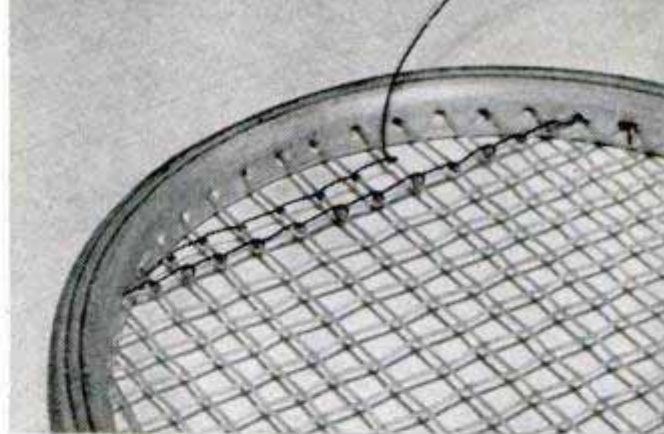
8

ADDING THE TRIMMING STRINGS



In tightening horizontal strings, rubber-covered dowel is used to pull strings tight. Awl wedges and locks string to free dowel for repeating the operation

of string, start at the top right side of the racket, Fig. 4, and attach end of string, using half hitch, to vertical R6 string. Then proceed to thread string across the racket, weaving over and under vertical strings, until hole A is reached. To avoid twisting or kinking the string, thread across three or four vertical strings and then, pulling diagonally, draw through the remaining string. Repeat this procedure, threading a few strings at a time, until the other side of the racket is reached, Fig. 5. Unlike the vertical strings, each horizontal string is tightened after it is installed in place. In tightening horizontal strings, a rubber or leather-covered dowel, wound with several loops of string, cinches and draws string tight when turned in one hand. Using your free hand, insert an awl in the hole to wedge and secure the string while the remaining strand is threaded—using a reverse weave, this time—to the opposite side of the racket. Again using the dowel to tighten string, the operation is repeated until the final string (H20) is installed, and secured with a half hitch around vertical string R6, Fig. 4. When inserting the awl in the hole, after the horizontal string has been pulled tight with the dowel, Fig. 6, be careful not to release the pressure on the string too suddenly. This may cause the string to slip, resulting in a loose string in the finished racket. Pressure on the string should be released gradually after the awl is inserted, allowing sufficient time for the tapered point of the awl to wedge and lock itself against the string in the hole. While pulling on the horizontal strings, it is important to straighten each string before locking it with an awl and proceeding to the next. A neater job will result and strings won't have to be straightened after restringing has been completed. When all horizontal strings have been installed and secured, ends are trimmed about $\frac{1}{8}$ in. from the half hitch, again taking care to avoid cutting or nicking the strings near by. Before putting in



Trimming strings are laced between vertical strings at top and bottom of racket head. These help prevent slipping of other strings under impact of ball

trimming strings, all vertical and horizontal strings should be carefully straightened and aligned with an awl.

Trimming strings: Usually added for decorative effect, trimming strings serve a practical purpose in that they tend to keep other strings from slipping under impact of the ball. They are also used to indicate the "smooth" and "rough" side of the racket, determined by the way in which they are laced. On the smooth side of the racket, loops of string connecting the vertical strings appear uppermost. The side where loops of trimming strings separately encircling each vertical string appear uppermost is regarded as the rough side of the racket. Similar to the toss of a coin, tennis players will generally spin a racket to determine which side of the court each will take before play is begun. Needless to say, care should be taken to see that both top and bottom strings are laced alike to provide identical lacing on rough or smooth sides. Fig. 8 illustrates an easy method for installing the top and bottom trimming strings on a racket. It is advisable to avoid the use of trimming strings on a racket to be strung with nylon strings. Tightly drawn trimming strings will eventually cut through strings of nylon. To apply finishing touches to the restrung racket, carefully inspect the racket to insure that all string ends are neatly tied and trimmed and that all strings are evenly aligned. Now, using a small brush, apply a thin coat of white shellac to both sides of strings and around the frame. The shellac should be cut approximately 50 percent with denatured alcohol. Allow to dry thoroughly. It is recommended that the renovated racket be kept in a racket press and protected by a waterproof cover until ready for use.

☞ Rusty screws can be removed easily with a screwdriver if a hot soldering iron or red-hot poker is held on the head of the screw for a few minutes beforehand.



A glazed bird shelter, such as the one pictured will provide many hours of enjoyment for all members of the family, who can sit comfortably in the living room and watch the birds at their feed. This is made possible by mounting the shelter on the window sill where it offers the further advantage of easy accessibility. Two opposite sides of the shelter are open while the other two are sheets of glass. The latter are slid into shallow grooves cut near the edges of the roof and floor, which may be the ends from a wooden box supported by screwing them to the ends of a section of tree limb as indicated. If desired, a shingle may be tacked onto the roof or heavy cord wrapped around it and coated with creosote. A further pleasing effect may be had by tacking pieces of tree bark onto the floor. With the cardboard backing removed, inexpensive picture frames will provide side panels that are already glazed.

Mrs. Jean Wangler, Ossining, N. Y.

Improperly Mounted Air Cleaner Will Lower Gasoline Mileage

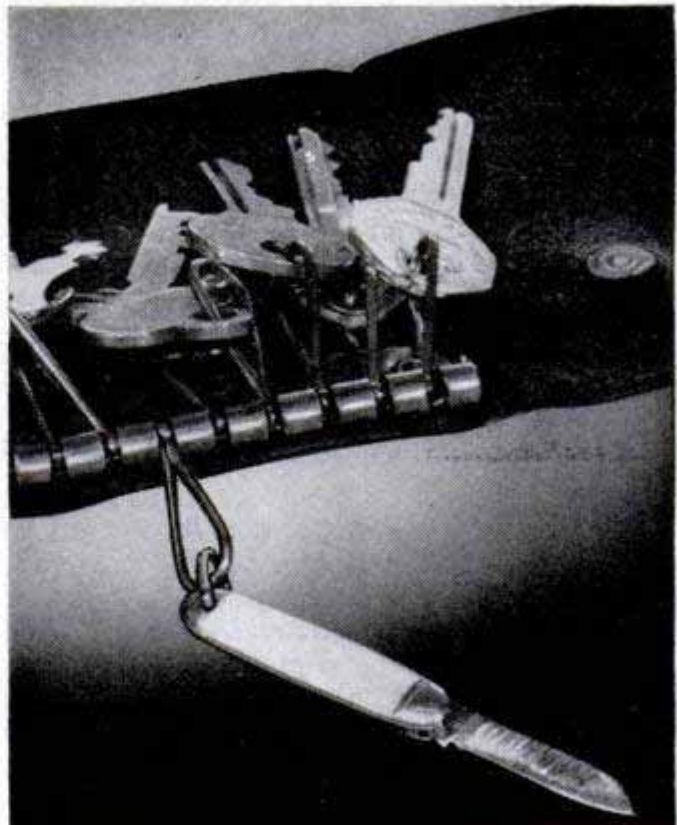
An air cleaner that is mounted with the front toward the radiator of the car can lower gas mileage in two ways. First, it will cause the cleaner to become clogged more quickly than it should, with the result that passage of air is reduced and the fuel mixture enriched. Second, before the cleaner has become clogged, it will permit the entrance of more air than needed,

which will cause the use of a compensating amount of gas in the mixture. On some cleaners, the front is indicated by the portion of the wall that is not perforated, while others have a slight projection at the front that serves to deflect air currents. Thus, when either type is properly mounted, blasts of air and dirt from the fan cannot be blown directly into it.

Ring-Fitted Pocketknife Is Carried in Key Wallet by Clipping to Fastener

You will always have a small pocketknife at hand if you carry it in your key wallet. Purchase a single-blade knife of the type that has a ring at one end and just clip it into one of the fasteners in the wallet.

Harrison Neustadt, New York City.



Glue Anchors Switch-Plate Screws

The screws of a wall switch plate can be kept from working loose with a dab of glue. After driving the screws until the heads are about $\frac{1}{8}$ in. in from the plate, dip a toothpick in the glue and wipe off the surplus. Then dab a little glue under the head of each screw before tightening it. Although the glue will keep the screws from working loose, it will not interfere with removing the plate when necessary.

T. F. Watts, Charlotte, N. C.

☐ Rugs that curl up around the edges may be stiffened with hot starch. Brush the starch on the wrong side of the rug and press the rug with a hot iron.

KNOW YOUR CAR'S "NERVOUS SYSTEM"

By William K. Mitchell

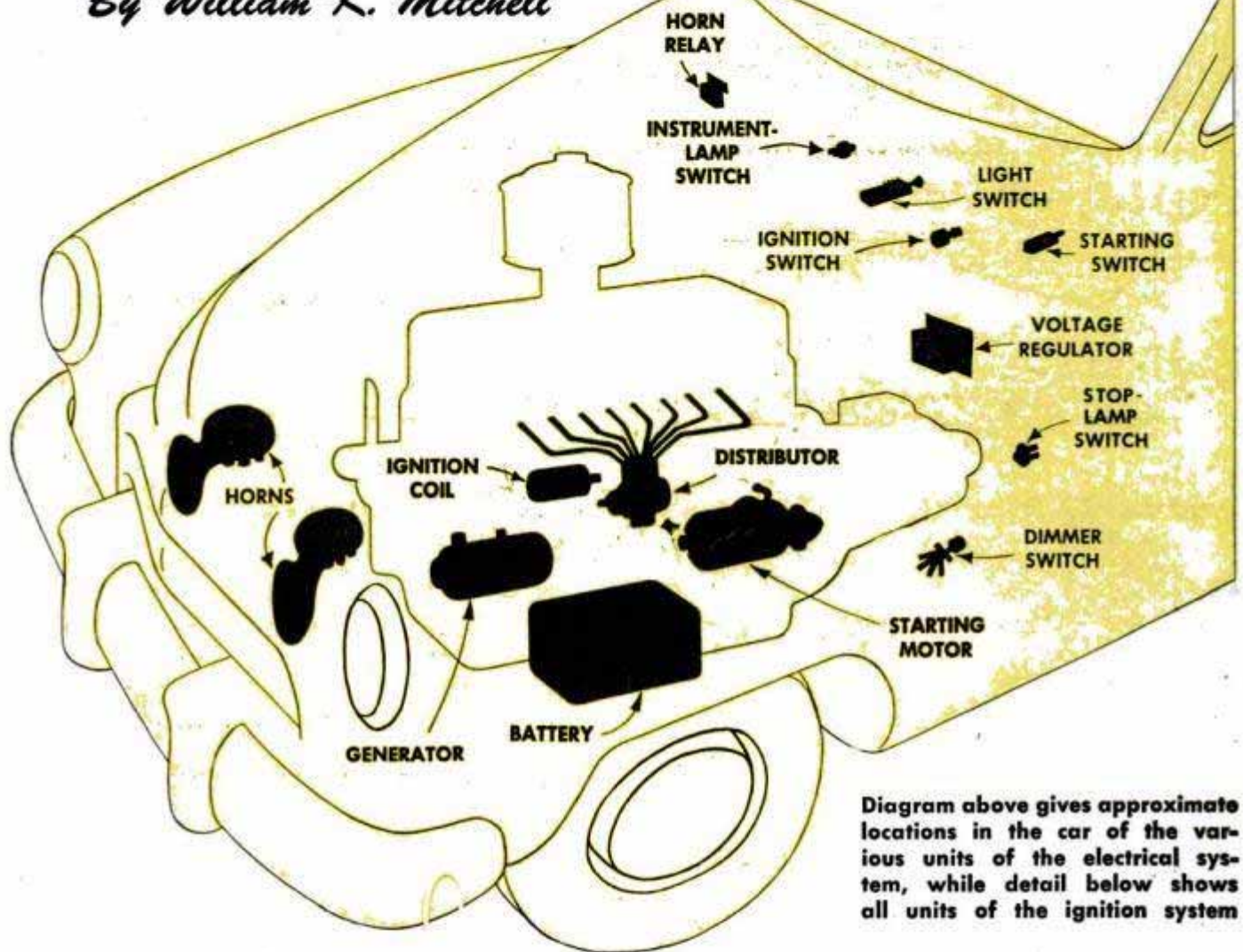
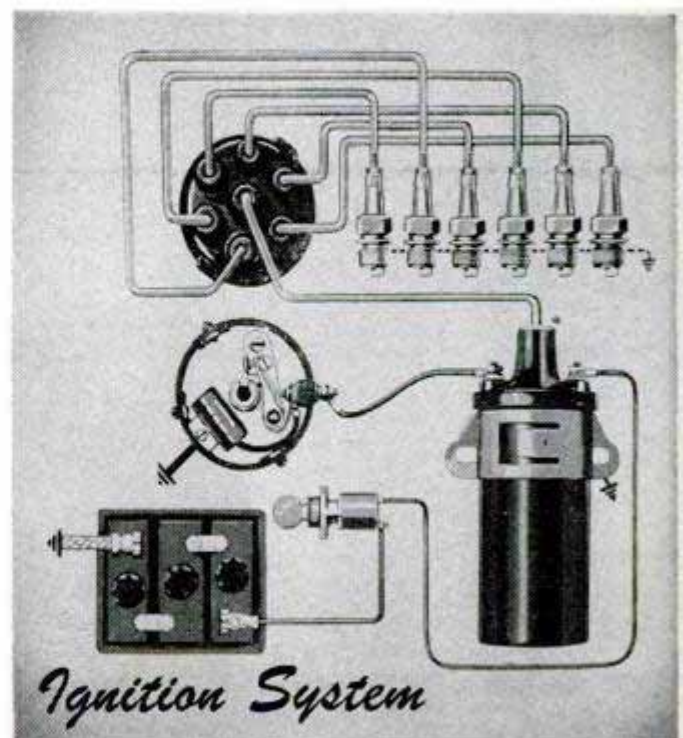


Diagram above gives approximate locations in the car of the various units of the electrical system, while detail below shows all units of the ignition system

KEEPING the electrical system of your car operating at peak efficiency makes a "healthy car" just as a healthy nervous system in your own body makes you feel well; the two are comparable as they both produce the stimulus to make other parts function. Also, both are highly complex and sensitive and are easily thrown out of balance with detrimental results to the parts that depend on them.

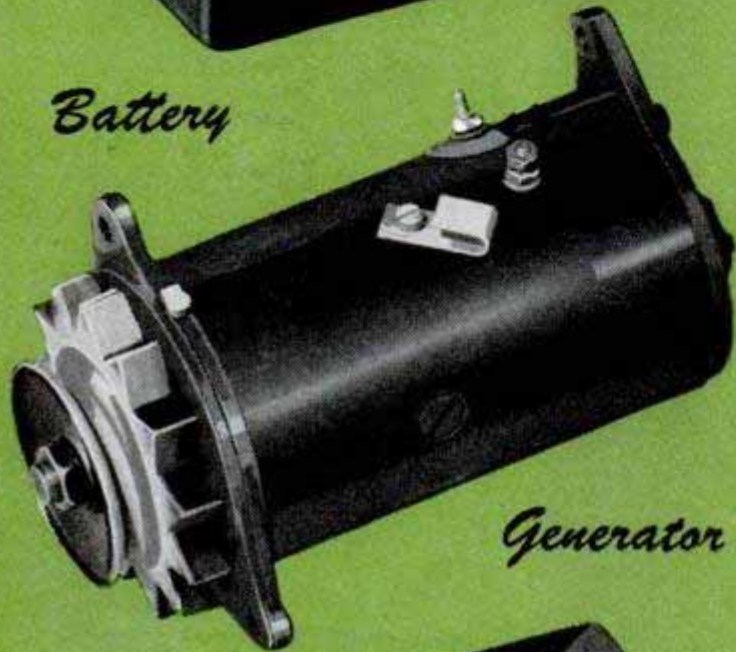
Unlike the human nervous system, however, the car electrical system can be understood, adjusted and repaired by the car owner to keep it at peak efficiency. In this and following issues, *Popular Mechanics* will describe each unit of the electrical system and tell how owners can care for them.

Often the terms "electrical system" and "ignition system" are confused. Actually the ignition system is only a branch of the electrical system. The diagram above shows the approximate locations of the parts of





Battery



Generator



Voltage Regulator



Horns

Horn Relay

the electrical system and the diagram below it shows the part of the electrical system that is called the ignition system. The units composing the basic electrical system, which are pictured on this and the following page, are the battery, generator, coil, distributor, condenser, starting motor, voltage regulator, spark plugs, switches and relays. To these basic units are added the horns, lights, radio and other accessories.

The ignition system, which handles the job of actually firing the fuel charge in the engine cylinders, includes the battery, coil, distributor, condenser, spark plugs and wiring. With the exception of the battery, these units carry high-voltage current, stepped up from a low six volts by the coil to more than 14,000 volts. This high voltage is necessary in order to make the current jump the gap between the spark-plug electrodes and produce a hot spark to fire the gasoline.

Again, comparing the electrical system to the human body, the battery and generator can be considered the heart of the system, the battery storing the electrical energy and the generator producing it.

The battery performs three functions. First, it supplies current for the starting motor and the ignition system when cranking the engine. Second, it intermittently supplies current for lights, radio, heater and other accessories when the electrical demand of these devices exceeds the output of the generator, or when generator output is not available. Third, the battery acts as a voltage stabilizer in the electrical system. Your car cannot operate dependably unless the battery performs each of these functions satisfactorily. Since the battery can supply the electrical needs only for relatively short periods, it is necessary to provide some other means of carrying the electrical load most of the time. This job is handled by the generator, which performs two functions. It supplies all the current needed for operation of the engine and accessories, and produces the electrical energy stored in the battery.

Since the battery and the generator act as a team to provide electrical current whenever needed, it is essential that some type of control be provided between them to coordinate their efforts. This service is performed by the voltage regulator, which is known as the policeman of the electrical system. This unit protects voltage-sensitive units of the electrical system and prevents the battery and generator from damaging each other. When the generator is operating at charging speed, the regulator permits current to flow to the battery to re-

charge it, but it limits the voltage of the generator so that the battery will not be overcharged. It also limits the total output of the generator, when necessary, to prevent overloading. When the generator slows below charging speed, the regulator automatically breaks the battery-generator circuit to prevent a reverse flow of current from the battery to the generator.

The ignition coil acts as the booster for the system. Its job is simply to step up the primary voltage supplied by the battery or the generator into a high-voltage surge, capable of igniting the gasoline vapor in the cylinders. Essentially, it is a transformer.

The ignition distributor is the brain of the system. It times the high-voltage surge supplied by the coil and directs it to the proper spark plug at exactly the right instant to fire each cylinder in its proper turn.

Included in the distributor is a small but indispensable item known as the condenser. It has but one duty and that is to provide a place where primary current can flow until the distributor contact points are safely apart each time they open. This is necessary to prevent a voltage-sapping arc as the points first begin to separate.

The cranking motor, or starter, as it is commonly called, performs only one job—that of cranking the engine.

The spark plugs provide an electrical gap in the firing chamber of each cylinder, across which the high-voltage surge can jump, igniting the gasoline vapor, which explodes and drives the piston.

In modern gasoline engines the task performed by the ignition system is staggering to the imagination. For instance, on an eight-cylinder passenger car, the system must produce and distribute 12,000 high-voltage surges per car mile. At 90 miles per hour the ignition system is delivering 300 ignition sparks every second. This means that the entire system must go through its complete cycle of ignition each $\frac{3}{100}$ part of a second.

It is readily apparent, therefore, that anything which can be done to keep the electrical-system units in tiptop condition will be a tremendous aid to better car performance. You will be surprised how much you can do, at home, along this line. The first unit to be described next month will be the storage battery.

A knowledge of how the battery operates will enable you to care for it properly, thus increasing its life as well as making car-starting much easier.

Photos and information courtesy Delco-Remy Division, General Motors Corp.

(To be continued)



Starting Motor



Ignition Coil

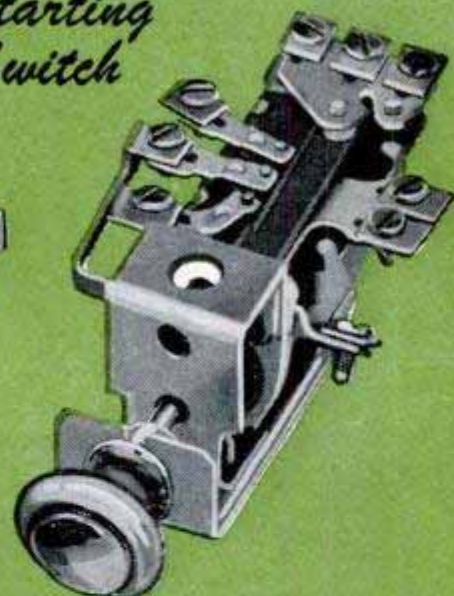


Distributor



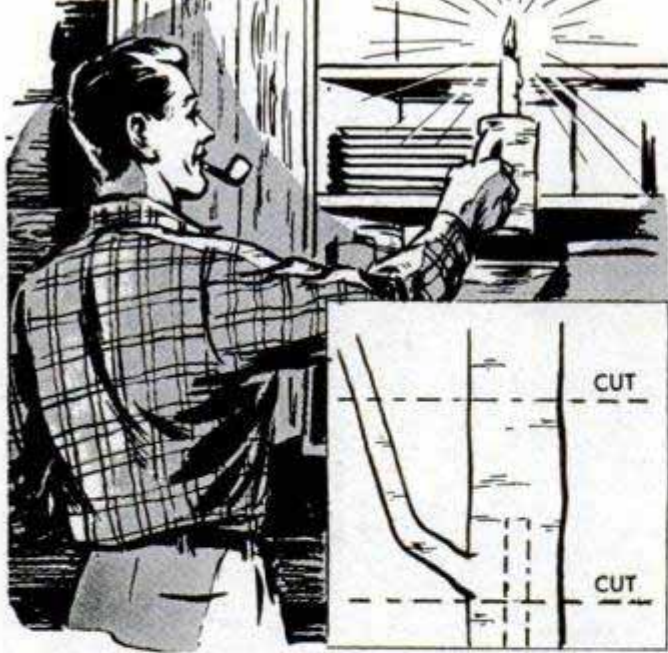
Starting Switch

Light Switch



Dimmer Switch





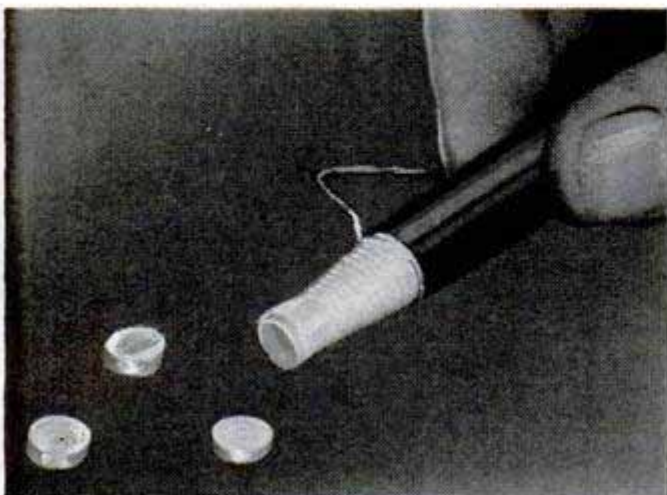
Rustic Candlestick for a Cabin

A novel candlestick or candleholder for use in your summer cottage or camp can be made by cutting a section from a tree limb as pictured in the drawing. The smaller branch serves as a handle for the holder. To insert the candle, a hole of suitable size is drilled lengthwise into the end of the holder. A tree branch 3 in. or more in diameter should be selected for this purpose in order that the holder will have sufficient weight. The candle should not burn down to the holder as this might ignite the wood and cause a fire.

Rubber Pads From Pencil Eraser

If you have need of several rubber disks to pad the bottoms of ash trays, table lamps or similar household items, cut them from a pencil-type eraser. However, be sure it is not the kind used to erase ink, as pads from such an eraser may scratch fine furniture surfaces. The disks also will serve in an emergency as insulating washers if a hole is punched in the center of each.

John J. Rea, Urbana, Ill.

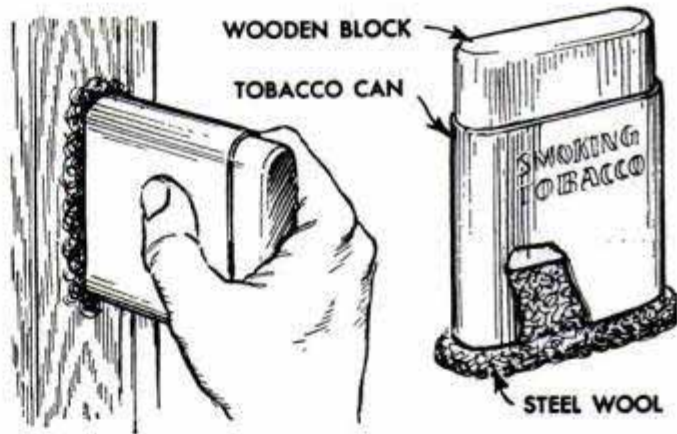


Removable partitions for small drawers can be installed with simple tools by using $\frac{1}{8}$ -in. hardboard. Short lengths of quarter round form channels in which the partitions are fitted.—Frank L. Brunckhorst, Chicago.



Tobacco Tin Holds Steel Wool To Protect Hands

When steel wool is used around the home or the home workshop, it's advisable to use some kind of a holder to avoid getting fine particles of metal in the hands. A good holder for this purpose can be made from an ordinary tobacco tin of the kind a smoker might carry in his pocket. To make the holder, remove the bottom and lid of the



can and pack the tin full of steel wool. Then, make a small wooden plug that will fit inside the tin at one end. This is used to push out the steel wool as it wears away. A simpler way of pushing the wool out as required is to wad paper and put it into the lid end of the can, after which the lid is closed to push the wool out a short distance. This operation is repeated each time it is necessary to push the wool out farther.

Ed Packer, Chicago.

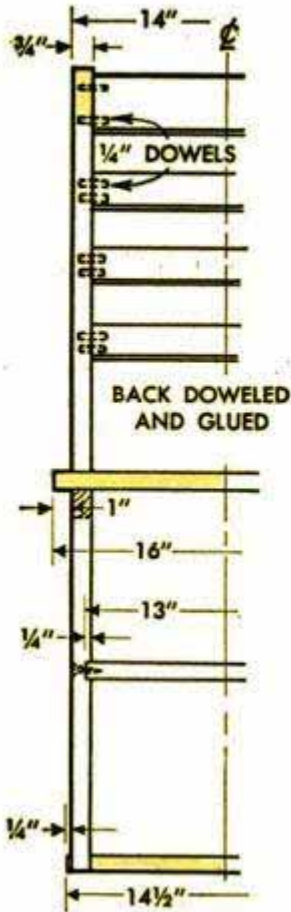
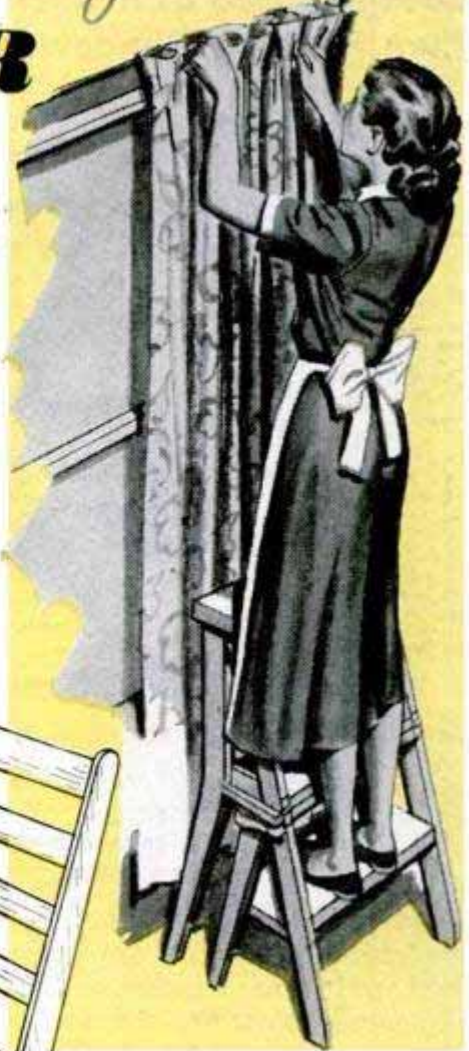
Solder Locks Nut on Bolt

Where it is desirable to lock a nut on a bolt and it is not feasible to use a regular lock washer, place a few drops of solder on the bolt threads just at the point where they extend from the nut. The threads should be cleaned well before applying the solder, and in some cases may have to be tinned to make the solder adhere.

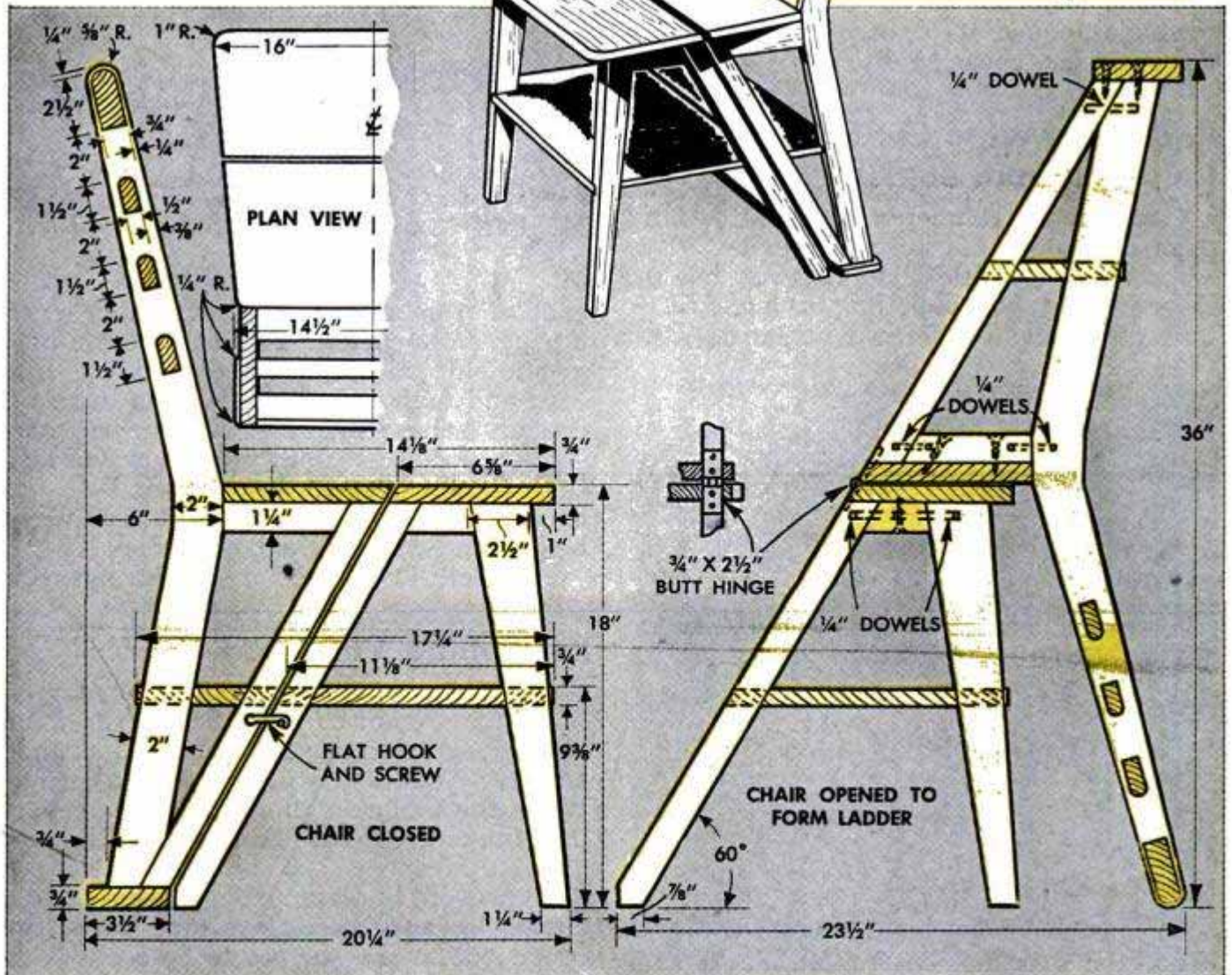
Ervin L. Strayhorn, Beebe, Ark.

CHAIR-LADDER

This unique chair, which quickly flips over to become a sturdy 3-ft. stepladder, will prove to be indispensable to the busy housewife. No longer will it be necessary for her to carry a cumbersome ladder or balance precariously on a step stool or chair to hang draperies and curtains or to reach high shelves. The chair may be made both attractive and comfortable with the addition of a removable cushion. Screws, driven from below, are used to attach the two-part wooden chair seat.



Doweled joints and hardwood construction (birch or oak) are recommended for additional strength. Hook at side, locks unit together when used as a chair



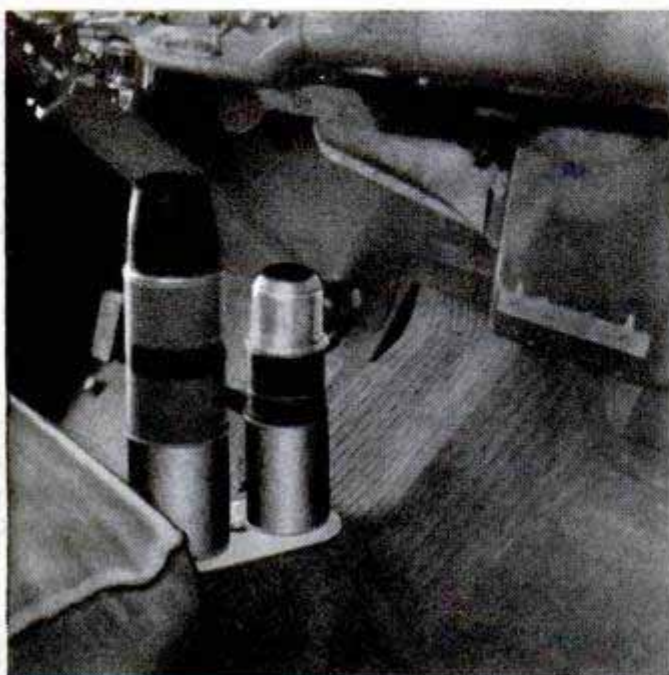
Squeegee Used as a Shield When Painting Windows



A small rubber squeegee is ideal for use as a shield to avoid smearing the panes when painting windows. Just hold the squeegee in position to mask the glass while painting adjacent to it. Keep at hand a cloth dampened with turpentine to wipe the squeegee occasionally.

Rack Screwed to Car Floor Holds Vacuum Bottles

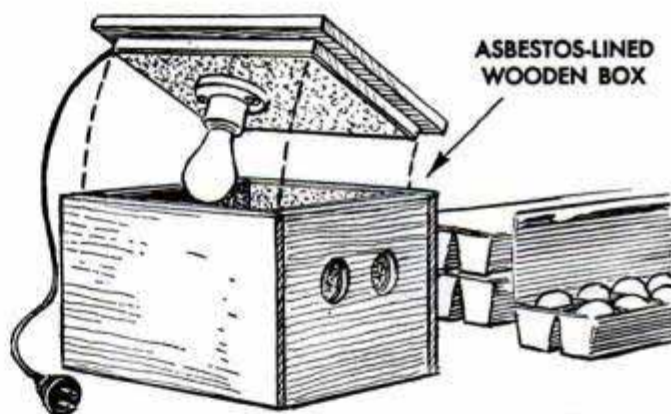
Carrying refreshments in the car on long trips is sometimes more convenient than stopping at roadside stands, but having loose vacuum bottles rolling back and forth under the seat becomes a nuisance. One



simple rack to hold two vacuum bottles. The rack is fastened to the car floor with a self-tapping sheet-metal screw, and is located as in the photo, where it is within easy reach of the right-seat passenger. The rack consists of two tin cans screwed to a piece of plywood, the cans being just slightly larger in diameter than the bottles they will hold.—Edward Siml, Tucson, Ariz.

Egg Candler Quickly Improvised

If you find it necessary to candle a few eggs occasionally, a candling box can be made at practically no cost by using any small wooden box at hand and fitting it with a light bulb. First, line the box with asbestos paper to reduce the possibility of fire, then install a porcelain lamp socket to the underside of the lid and drill one or two holes in one end of the box, over which the eggs can be held. If the edges of the holes are lined with felt you will be able to hold the eggs in position without any possibility of accidentally breaking them. For emergency use where only a few eggs are to be candled, you can improvise a



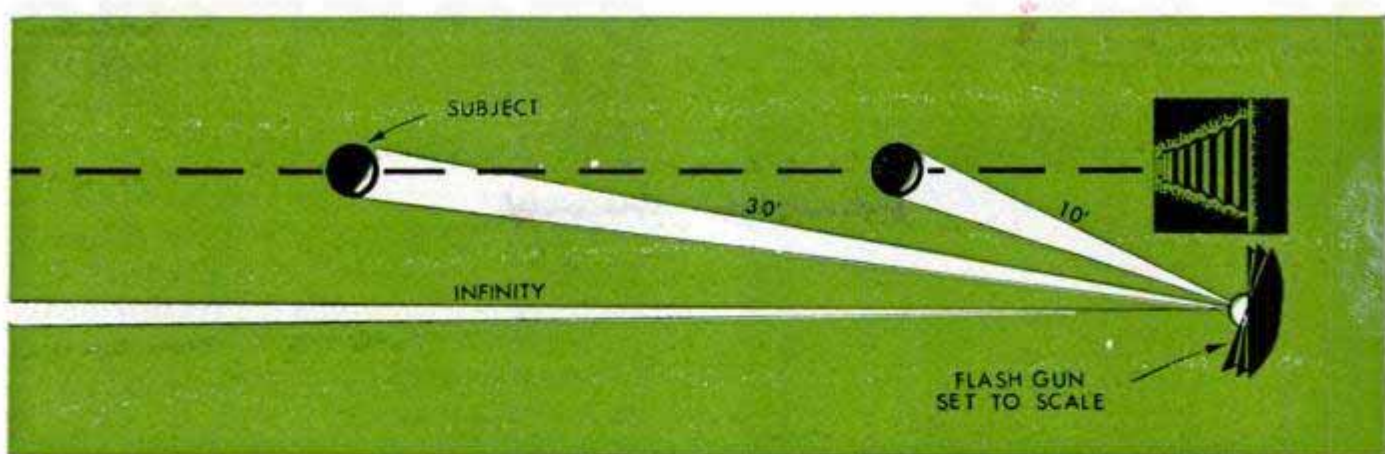
candler from a small cardboard box—even a paper milk carton. To do this, cut a hole in one side of the box and install a drop cord and bulb inside, suspending the bulb directly behind the hole. When this emergency candler is used, put a low-wattage bulb in the drop-cord socket and do not leave it on too long as sufficient heat might be generated to set the box on fire.

Seth D. Wade, Russell Springs, Ky.

Renovating Varnished Floor

Worn spots on a varnished floor may be matched in color to that of the rest of the floor by applying one or two coats of orange shellac. This also will serve as a sealer. When the shellac is thoroughly dry, revarnish the entire floor.—A. E. Fenn, Chicago.

☞ To prevent linoleum from cracking when cutting it, apply cellulose tape along the inner side of the surface to be cut.

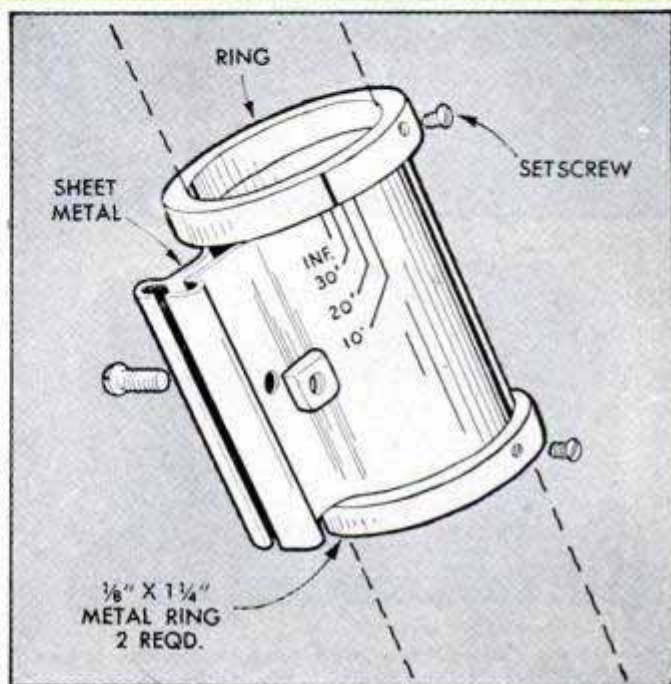


CORRECTING FLASH-GUN PARALLAX

By G. M. Pomeroy

Coordinating the setting of your flash gun with the parallax setting of your view finder is done accurately when the gun is fitted with its own calibrated scale. Whether it's a distance of 30, 20 or 10 feet, you'll not be lighting your subjects with only a portion of the flash intensity, as is generally the case when the gun is directed straight ahead. Synchronizing both flash-gun and view-finder parallax will improve the quality of your negatives and the resulting prints considerably. All you need are two metal collars which are made to slip over the barrel of the flash gun. These are placed above and below the camera bracket and are locked in position with set-screws. The collars allow the gun to be rotated in its mounting bracket for synchronizing with the parallax setting of the view finder. While the detail at the right shows how the collars are used in the case of a Speed Graphic or other press-type camera, the collars easily can be adapted to the bracket on almost any camera. The calibrations may be scratched right on the bracket or inked on paper and glued in place in line with a witness mark made on the upper collar.

Calibrating the scale for your particular camera is done by placing the camera at a point 50 feet from a wall. Next, a test shot is made of a picture hung on the wall by aiming the flash gun as near to the center of the picture as possible. Without disturbing the setup, the negative is developed and then checked for the point of light reflection. The reflection is readily visible when the test shot is made on a dark-colored wall. Test shots are made as many times as neces-



sary to center the reflection in the picture, and when this has been accomplished, a mark is scratched on the bracket in line with the witness mark and labeled INF (infinity). This same procedure is repeated for distances of 30, 20 and 10 feet. When this has been done, the calibrations are tested under actual conditions by shooting a person standing about two feet from the wall. In each case, the subject is brought into sharp focus, the footage scale on the camera bed read and the flash-gun distance scale set to coincide. By having the subject stand two feet from the wall, it is easy to see where the greatest concentration of light is hitting the subject.

Water Controls Print Reduction

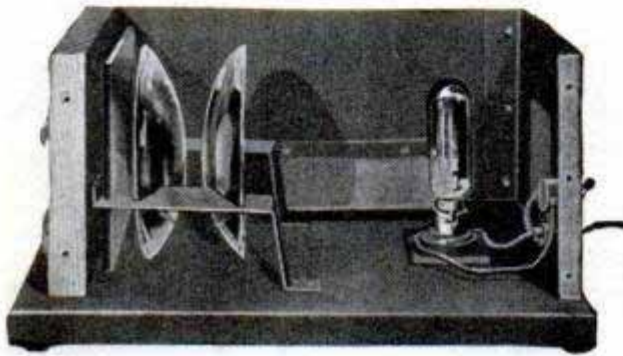
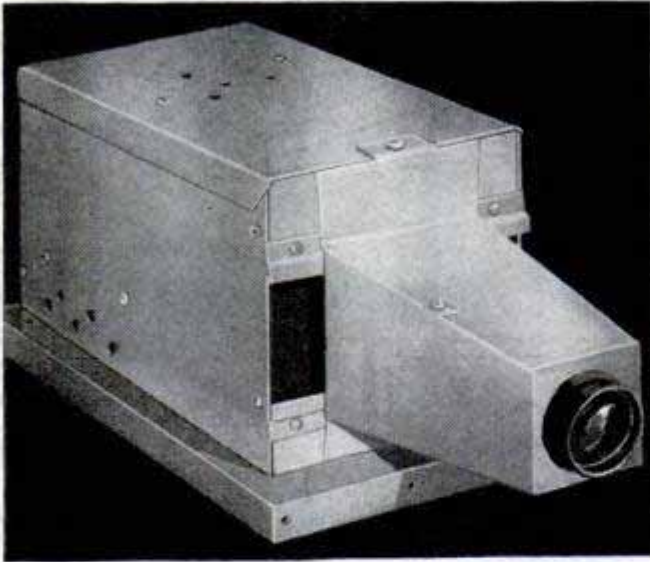
If you frequently spoil prints when applying reducer over a light-gray area, try applying the chemical while the print is under water. Use a cotton-tipped applicator and immerse the print in a tray containing about $\frac{1}{4}$ in. of water. Reduction is easily controlled for soft outlines.

Frank H. Tooker, Lakehurst, N. J.

☐ Paste exposure data supplied with film and paper on cardboard for handy reference.

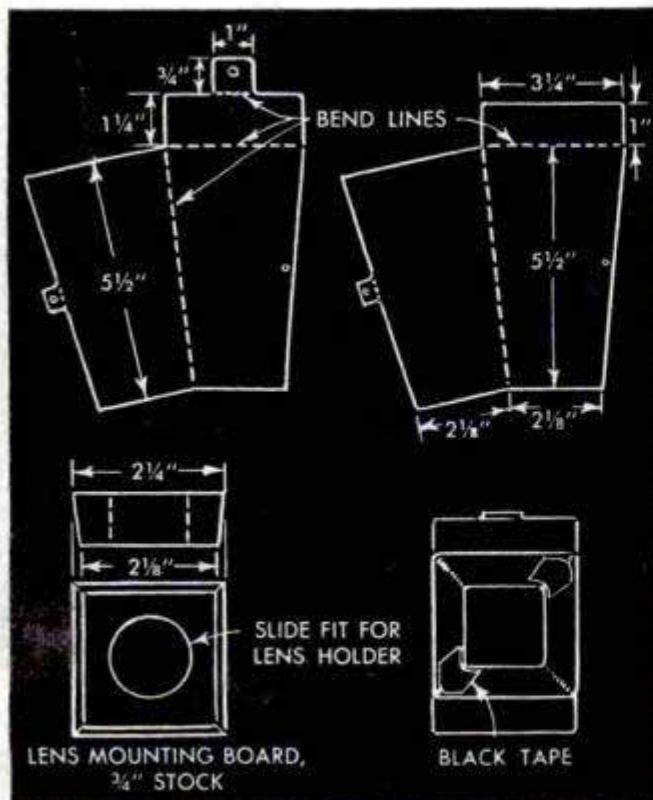
35-MM. SLIDE PROJECTOR

By Kermit A. Slobb

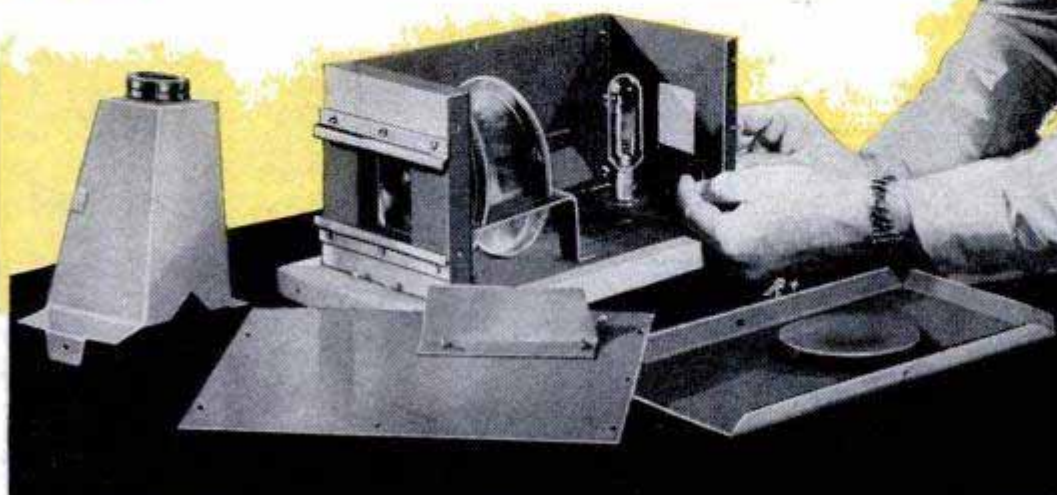
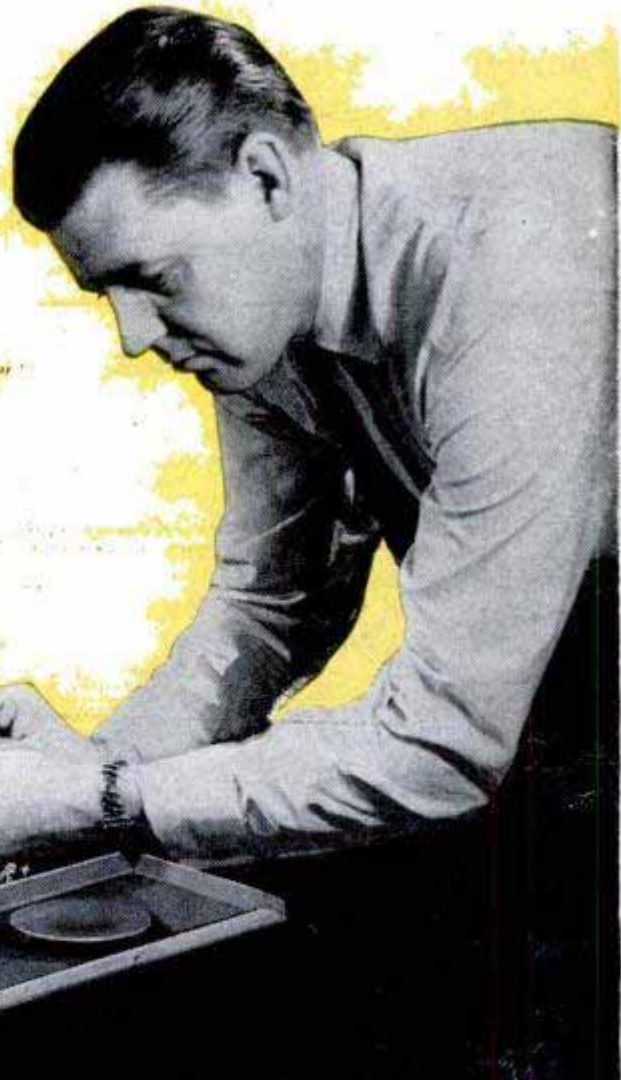
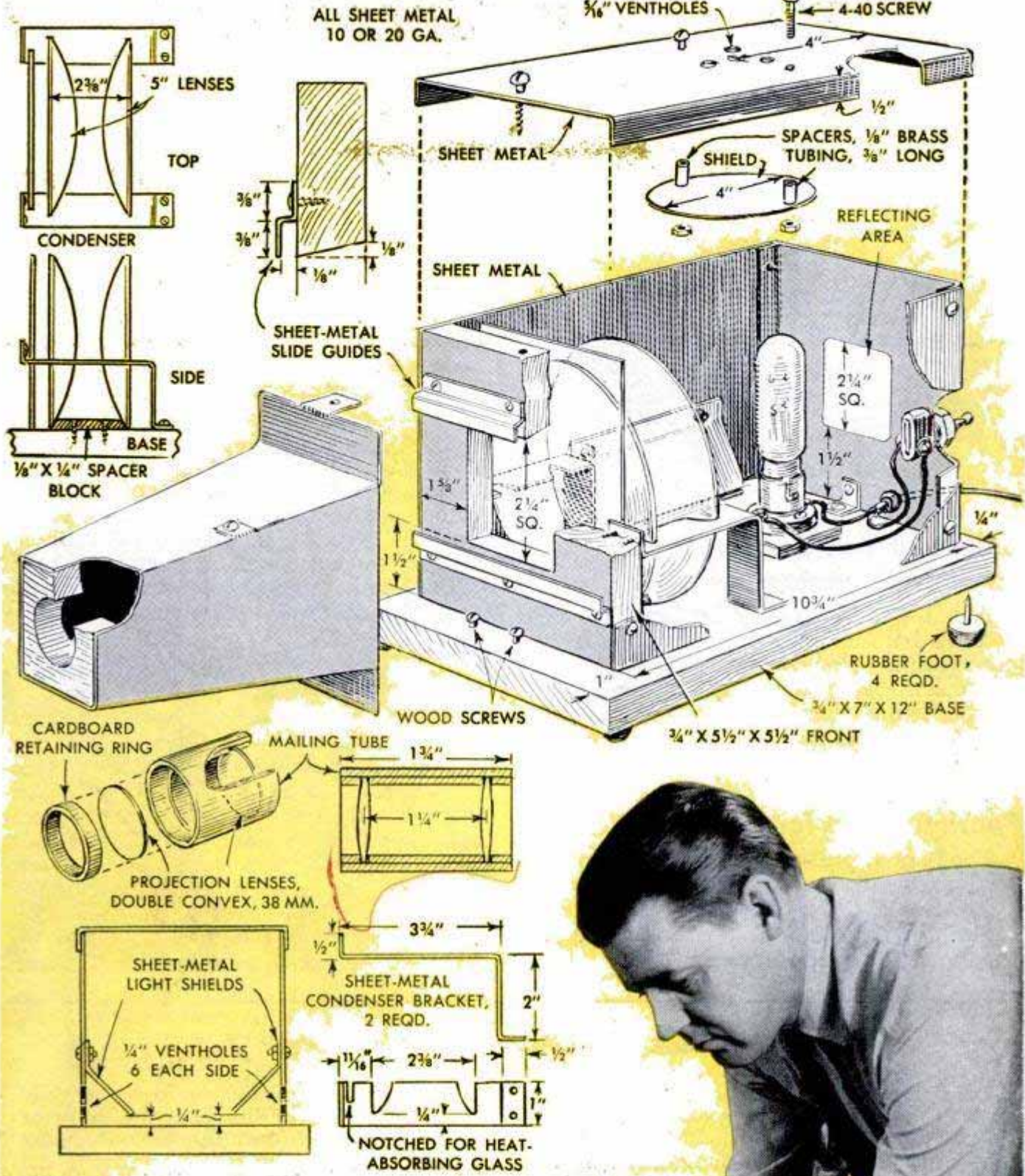


Upper photo shows completed projector while lower photo shows side view looking into the lamp house. Note position of condensing lens and light shield

Details below show how to cut and bend sheet metal to form the extended holder for the viewing lens. After assembly, all joints are sealed with black tape



FOR AMATEUR SHOWINGS of standard slides in color, and black and white, this inexpensive projector fills the requirements of photographers with limited budgets. It's built almost entirely from lightweight sheet metal and scrap wood. Use of double condensers and a noncorrected viewing lens reduces cost to a minimum, yet definition is sufficiently sharp to permit distortion-free images on a projection screen of average size. The sheet-metal lamp house is built up on a wooden base, as in the details on the opposite page. Two notched brackets made from flat steel support the condensing lenses and the heat-absorbing glass, which is mounted directly in front of the condensers. A circular baffle is attached to the underside of the lamp-house cover by means of spacers and small bolts and serves as a heat deflector and also as a light trap. Several ventholes are drilled through the cover as shown. A square reflector of aluminum foil is cemented to the inside of the lamp house. Details at the lower left show how to cut sheet metal and assemble the projecting holder for the viewing lens. A wooden mounting board is fitted into the small end of the holder as indicated. The mounting board is drilled to take the cardboard lens mount in a sliding fit. Note that two double-convex lenses are combined to form the viewing lens. These are fitted into the cardboard tube with a spacer between and are held in position by cardboard retaining rings. Center a square hole through the front of the lamp house, then fit the front piece in place and fasten with screws. Attach the brackets which support the condensing lenses and the heat-absorbing glass. Fit and wire the lamp socket and toggle switch, but do not fasten the socket permanently in place. Form S-shaped guides for the photo slides from sheet metal and attach to the front of the lamp house. Be sure these are correctly spaced, then attach the lens holder. Now, with all parts in position except the top, insert a slide in the guides and turn on the lamp. Focus the image on a screen or on the wall. If the lamp is incorrectly placed, an image of the filament may show on the screen. Move the lamp until this disappears, then mark the location of the socket and fasten it permanently in place with screws. Fit light shields inside the lamp house and drill several ventholes through the sides as indicated. Attach the top, or cover, and drive four rubber-headed tacks into the wooden base near the corners.





Ball-Point Pen Used as Stylus To Emboss Photographs

A ball-point pen may be used for embossing border lines or other designs in photographs. Remove the ink from the pen and clean the tip thoroughly. Then, place the photo on a hard, flat surface, such as a plate of glass, to do the embossing.

H. Klein, Pittsburgh, Pa.

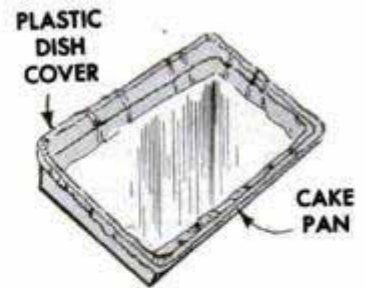
Pouring Spout for Chemical Can

The handy, pull-up spout on the top of a cardboard salt box can be used to dispense dry chemicals. Cut the complete top from the salt box and tape it over an opening in the top of the chemical can.

Bowl Cover and Cake Pan

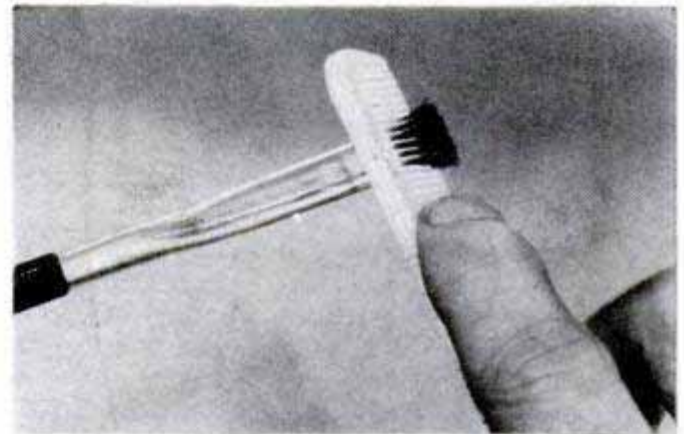
Improvise Photo Tray

An emergency tray that will not be affected by photographic chemicals may be improvised from a cake pan by placing a plastic bowl cover in it as shown. The cover, which is hemmed with an elastic band, should be of a size that will stretch tightly around the rim of the pan and, at the same time, sag into it to conform with the shape of the pan.



Cleaning Rubber-Cement Brushes

When the brush used to apply rubber cement has become clogged and stiff with dried cement, it can be cleaned with an ordinary pocket comb. Just run the teeth of the comb through the bristles of the brush several times as shown.



Is Your Garden a "Problem"?

Don't you envy the fellow next door whose lawn is a velvet green carpet, whose garden is profuse with color from the first spring thaw until frost? And your neighbor on the other side grows a nice crop of dandelions and plantain, just right for the prevailing wind to reseed your lawn with weeds. With the greenest thumb in the world, you have your problems!

Some folks can grow prize-winning flowers and lush vegetables, but they lack the knack of planting. Tall delphinium in the front row hide the rich mass of nasturtiums behind, or you give a prominent spot to a group of lilies only to find that their bloom is here today, gone tomorrow.

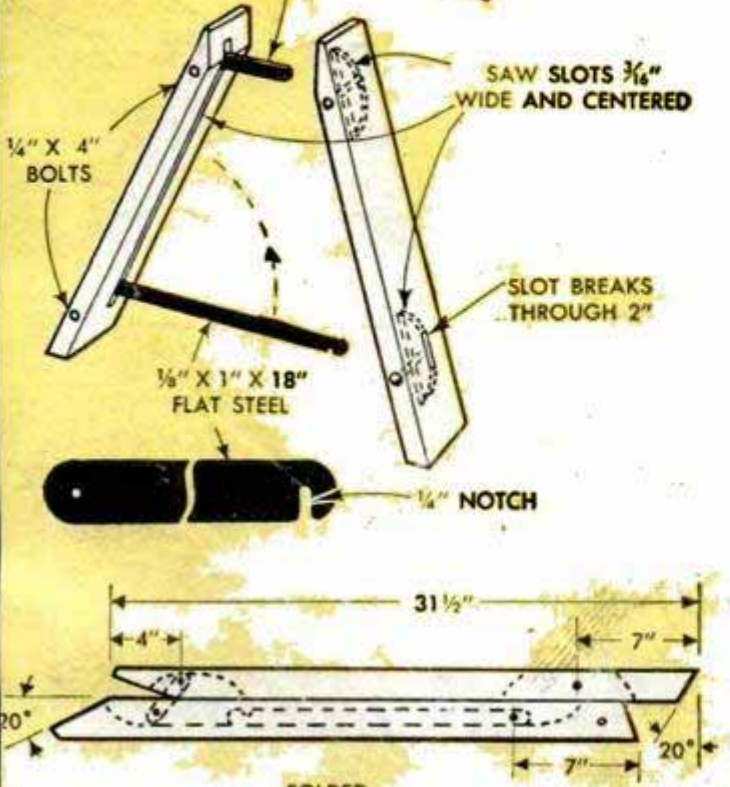
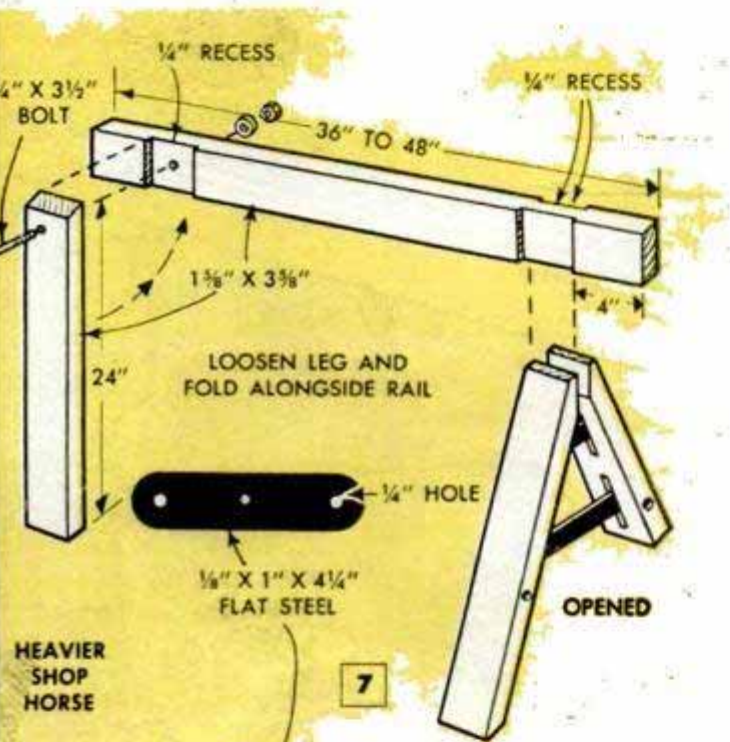
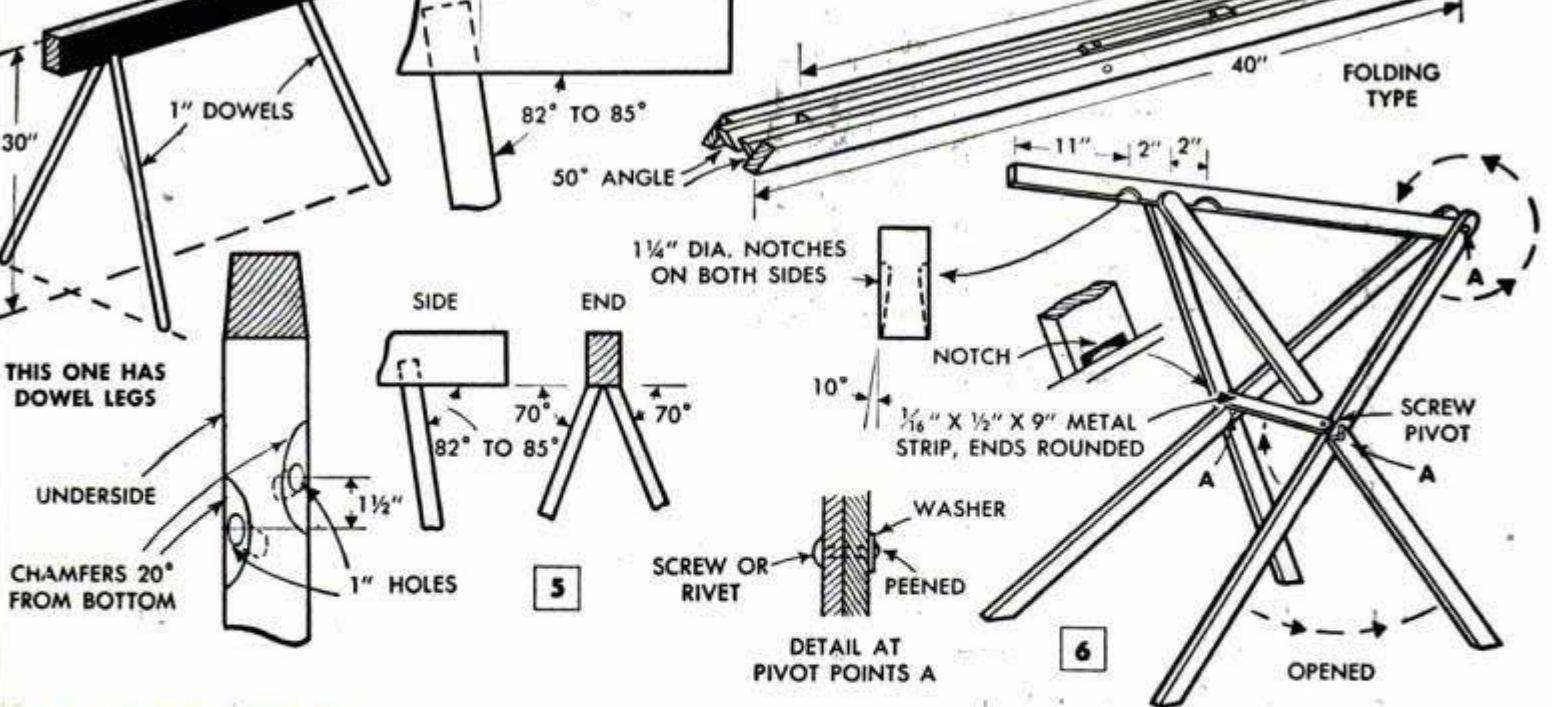
Well, here's first aid for the green thumb with the irking problems . . . a *Popular Mechanics* book with all the answers implicit in its title: "How to Grow the Best LAWN AND GARDEN in Your Neighborhood."

Now is the season to start reading it, to let

it plan your landscaping, to begin building the arbor or outdoor fireplace, the trellis or rock garden or lawn furniture for the coming summer.

Here are some of the topics in this easy-to-read, easy-to-follow book for the gardener, amateur or expert: Landscaping . . . Getting Rid of Weeds . . . Preparing the Soil . . . Rebuilding the Soil . . . Planting . . . Renovating your Lawn . . . How to Select and Plant Trees . . . Shrubs, Vines, Flowers for the Home . . . Getting Rid of Insect Pests, Diseases . . . Grafting Trees and Shrubs . . . How to Build Your Outdoor Fireplace. . .

This complete guide to home landscaping and gardening, packed with a wealth of down-to-earth information, rich with plans and photographs from which you can build, is yours for \$2.50. Just write to *Popular Mechanics* Book Department, 204 E. Ontario St., Chicago 11, Ill., and ask for LAWN AND GARDEN.



and for scaffolding used on roof work.

Lightweight horses: Figs. 1 to 6 show lightweight 30-in. horses for many everyday jobs such as painting screens and storm windows, wallpapering and light assembly work. Length of rails or stretchers can be varied to suit. The horse shown in Figs. 1 to 3 has a slotted rail that holds the legs vertically. Legs can be given an outward slant to increase the end-to-end sturdiness by cutting the rail grooves at slight angles, but legs should not project beyond the work limits. The rail rests on the leg braces and is locked to the leg units with large nails to prevent the horse from coming apart when it is lifted by the rail. The nails are slipped into holes drilled through the tops of the legs and into the rails. The nails will always be at hand if attached to the legs with lengths of furnace chain. For legs, use white or yellow pine that is free of knots. However, hardwood, if available, gives greater strength.

When used outdoors or on uneven floors, a three-point floor contact prevents wobbling. To gain this advantage substitute a single leg for a double leg as in Figs. 3 and 5. If accurately made, the legs will fit the slots interchangeably, but if there's any variation in the locking holes, mark matching legs and rail slots.

X-legs: Leg units of the horse shown in Fig. 3 do not fold and require more storage space than the folding X-legs of Fig. 4.

These are pivoted near the top so that weight on the horse tends to spread them and, at the same time, tighten the grip on the rail. Close-grained hardwood is best for these legs, particularly if the horse is used for heavier work, as hardwood has greater resistance against splitting. To prevent the legs from slipping off the rail when lifting the horse, tighten the pivot bolt while the legs are pinching the rail. Use washers under the bolt head and nut.

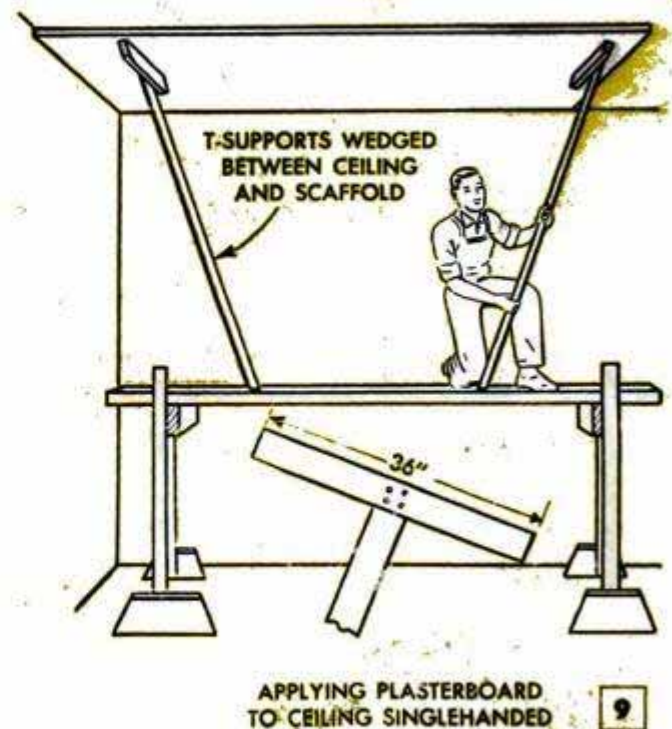
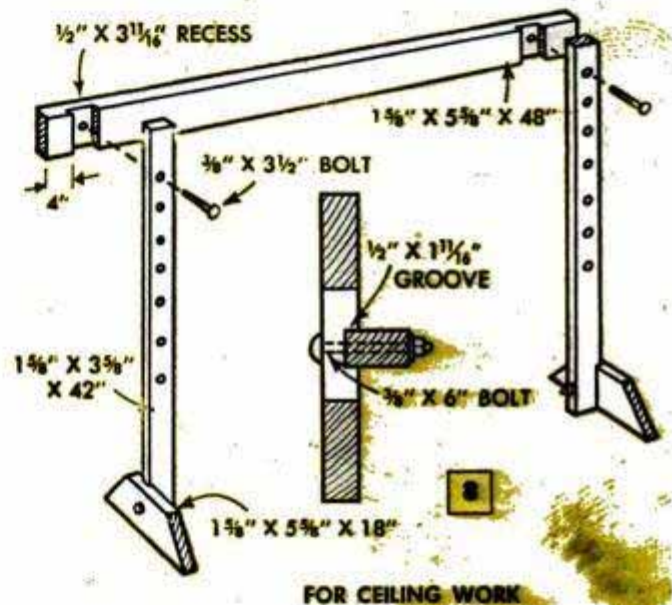
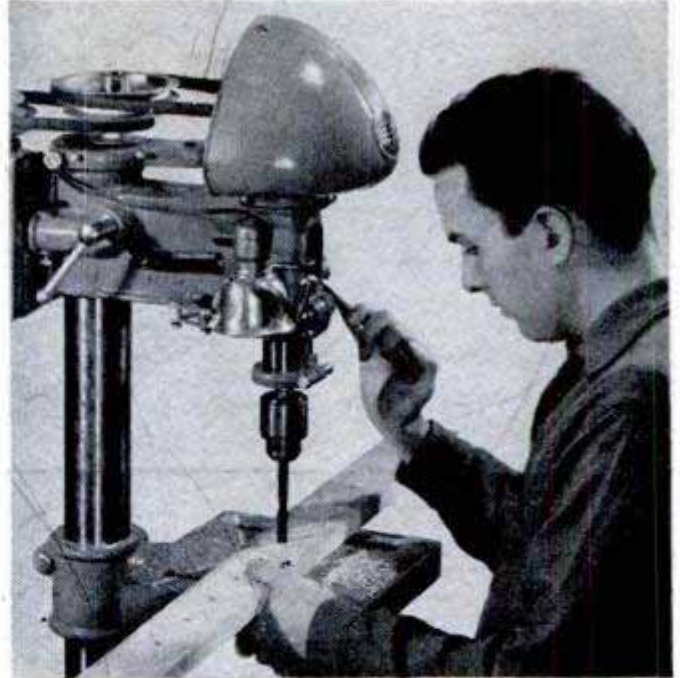
Light, dowel-leg trestles: About the simplest type of horse to make for light work is the three-legged one in Fig. 5. The 1-in.-dowel legs are pushed into holes in the underside of the rail. The legs are slanted outward for greater over-all sturdiness. Adjacent holes at one end for the pair of legs are staggered. Chamfer a flat for each so that boring at the right angle can be controlled easily.

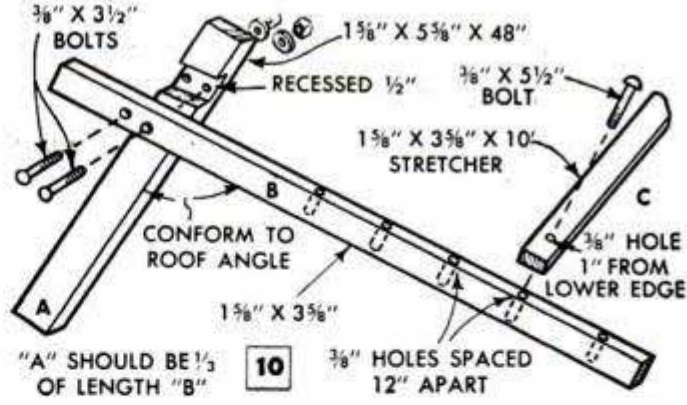
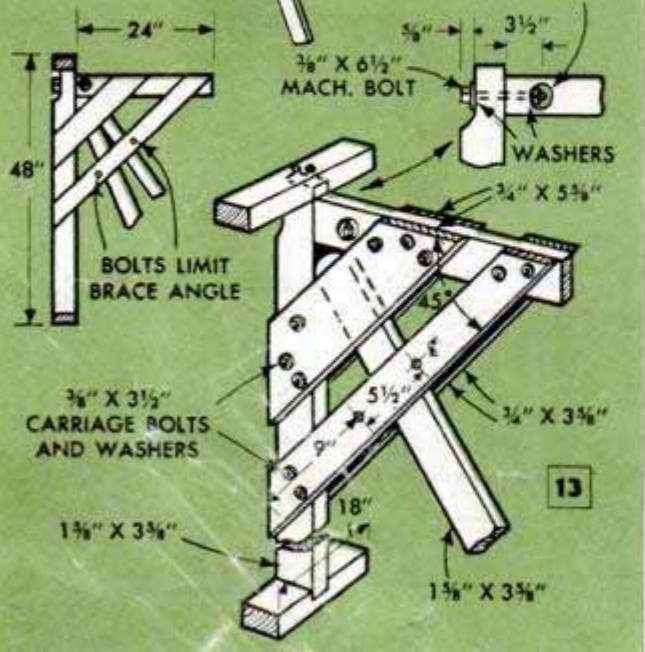
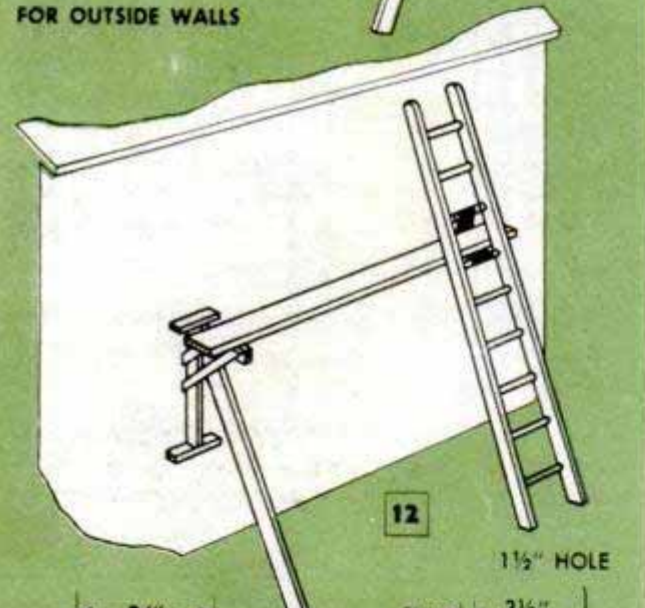
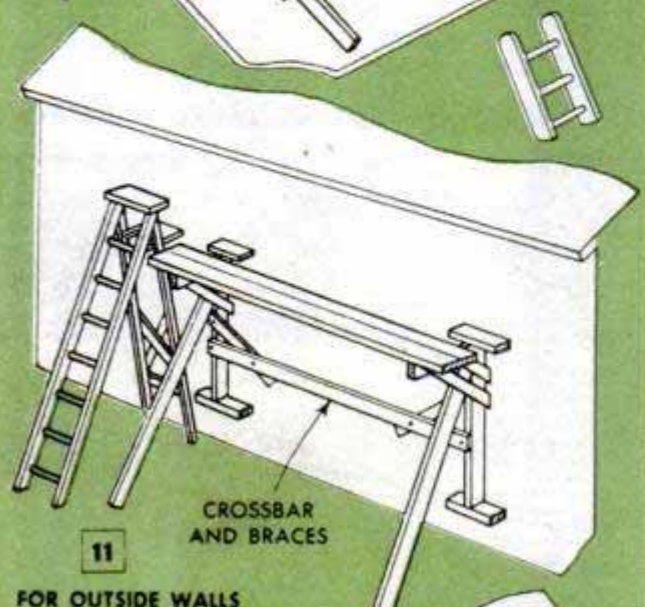
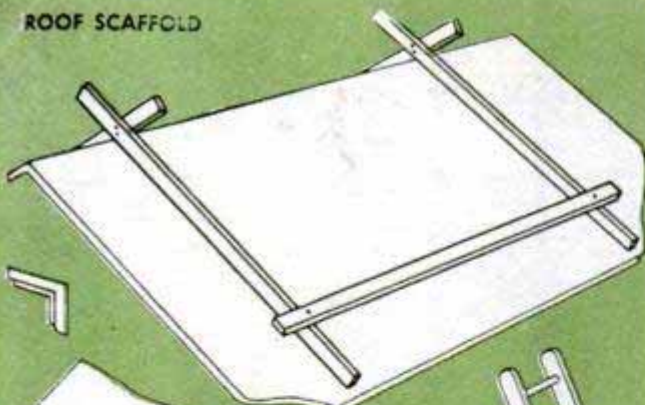
Wallpaper-table trestles: You can set up a worktable for wallpapering instantly by using two folding hardwood horses as shown in Fig. 6. They are adjustable to heights from 30 to 33 in. Similar ones are commercially available at small cost. A convenient work top can be made from a hardboard panel reinforced on the underside to keep it straight.

Sturdy shop horses: Fig. 7 shows a sturdy, folding shop horse for sawing and other work requiring a 24-in. height. To avoid wobbling on uneven floors use a single leg at one end. For storage, this swings alongside the rail, and the twin legs fold together. Note how the latter are grooved centrally (which is done easily with a circular saw) to house the cross braces. The top one on which the rail rests is pivoted to both legs, the lower one to one leg, the other end having a notch that slips on a pin or bolt. If made carefully, the legs grip the rail firmly in the recesses, and pressure on the rail is maintained by the outward push of the lower brace. To assemble, first slip lower brace through the slot in leg having the pin, then place the rail in position, spread the legs outward so that the notch of the lower brace engages the pin.

Scaffold for ceiling work: Scaffold trestles shown in Figs. 8 and 9 provide safe and rigid support besides being adjustable in height. You can use two trestles, or use only one in conjunction with a stepladder. Grooves and recesses must fit joining members snugly so there is no play when bolts are tightened. For installing plasterboard, a couple of T-supports that can be wedged between the ceiling and the scaffold planks enable you to position the board snugly against the ceiling for nailing.

Roof scaffold: When repairing a leaky roof or reshingling it, you need a safe scaffold such as the one in Fig. 10 and the upper





"A" SHOULD BE $\frac{1}{3}$ OF LENGTH "B"

10

$\frac{3}{8}$ " HOLES SPACED 12" APART

detail of Fig. 11. It should fit the roof angle. To find this, measure—from a ladder—the height of the ridge above the edges of the roof at the eaves and get the horizontal distance across the points at the eaves. Then draw a triangle to correspond at a scale of 1 in. per foot. From this you get the angle for cutting the recesses in the hook members A into which pieces B must fit snugly. When tightly bolted—two bolts in this case—pieces A and B cannot spread. The crosspiece C usually is held by long bolts pushed into holes in members B. For extra security you can slip the bolts upward through pieces B and C, and then turn nuts on tightly. More than one crosspiece can be used; one near the eave will enable you to get on the roof from a ladder.

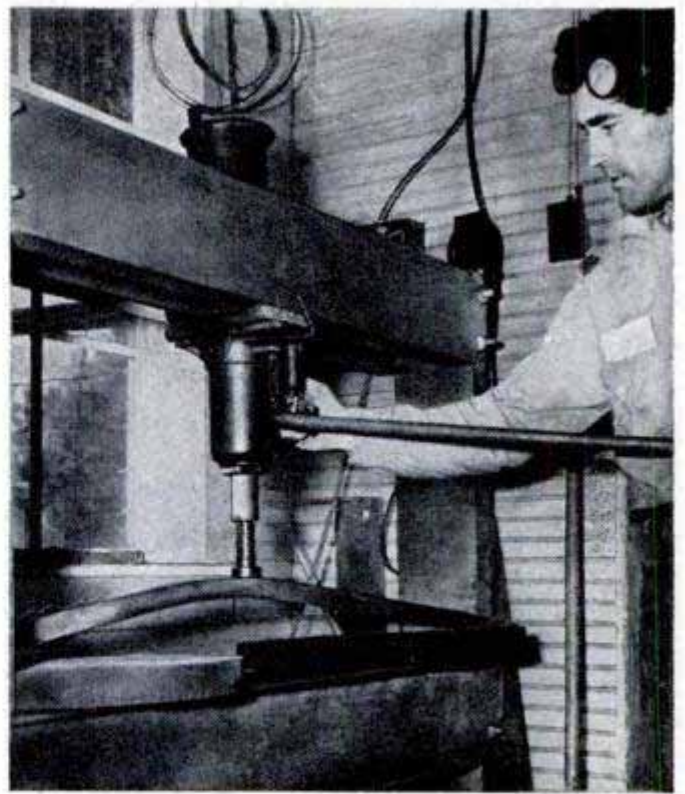
Outside-wall scaffolds: Using two ladders and a pair of ladder jacks is the customary way of holding a plank or extension board to form a scaffold for painting outside walls, cleaning or repairing gutters, or starting a reshingling job. If you have no ladder, you can use wall jacks like the ones shown in Figs. 11, 12 and 13. Made as shown in Fig. 13, with the horizontal member no longer than 24 in. and the vertical leg no shorter than 48 in., and with two crosspieces attached to each jack to minimize side twist, there is all the rigidity required. If two jacks are used, maximum sturdiness is obtained by using a crossbar and diagonal braces as in Fig. 11. However, only one may be used in conjunction with a ladder jack, Fig. 12. The lengths of the supporting legs can be varied for different heights. Note the strong corner construction which is required. The lower braces on the jacks prevent them from twisting toward either side when the two bolts limiting the angle of the supporting legs are tightened firmly.

Washing solution for the windshield of your car may be carried in the glove compartment without danger of spilling if it is kept in a spray-deodorant container. Pry the inner cap and tube from the container, fill to about $\frac{1}{2}$ in. from the top and replace the cap.

Cylinder From Truck Jack Operates Hydraulic Press

Having only occasional use for a press in his garage, one auto mechanic made this press in which the ram can be moved horizontally to any position within the width of the press frame. The latter was assembled from lengths of 6-in. channel steel, the two top cross members being placed parallel and with the channels facing to produce a slot in which the ram slides. A 12-ton hydraulic jack, used as the ram, is welded to a square of steel plate. This is bolted in the center to a second steel plate, which overlaps the lower sides of the steel channels. This plate assembly keeps the jack suspended vertically, yet allows it to be moved from side to side. The supply of hydraulic fluid is stored in a tank connected permanently to the jack inlet by a length of copper tubing. The tank is supported on an arm welded to the jack unit.

L.H. Houck, Jefferson City, Mo.



Simple Rules for Installation of New or Used Spark Plugs

When installing new or cleaned spark plugs, proper dissipation of heat through the plugs can usually be assured by following these simple rules. First, clean the threads of the plugs and those in the cylinder head, being sure to remove all accumulation of carbon. Always use new gaskets and take care that they are not seated in a "cocked" position. To avoid this, place

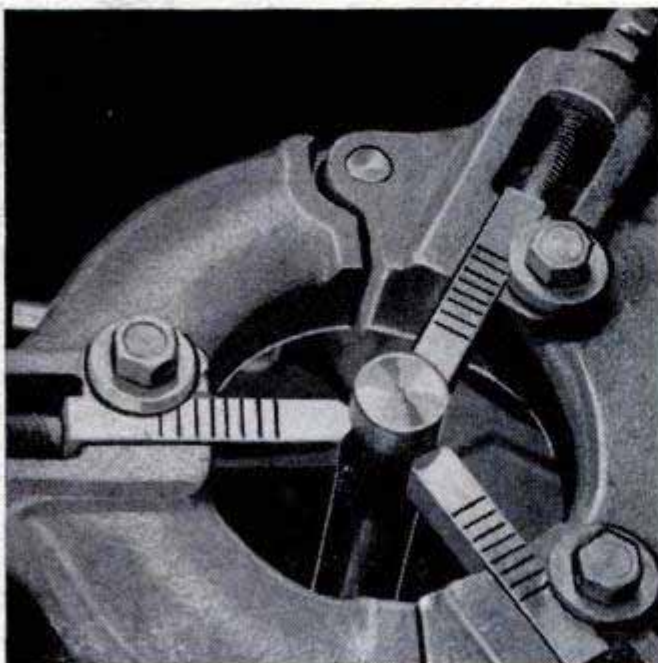
a small amount of grease on each gasket to make it adhere to the body of the plug, and then start the latter with your fingers. If plugs cannot be turned all the way in without the aid of a wrench, apply a small amount of oil to the threads. Finish tightening the plugs with a torque wrench to the value specified by the manufacturer of the plugs used.

Guide Lines on Lathe Steady Rest Help When Centering Work

Scored on the jaws of a steady rest used in a metal-turning lathe, guide lines will save time when adjusting the jaws to center work of different sizes. To locate the lines, chuck a short rod or piece of shaft-

ing in the lathe and move the steady rest close to the chuck so there will be no chance for the piece to bend. Adjust the steady-rest jaws so they ride uniformly on the work and make one score across the face of each jaw with a scribe, using the edge of the casting as a station mark. Then, remove the jaws and, measuring with a machinist's rule, scribe a series of lines so a variety of sizes of work can be accommodated. If care is taken to space the lines exactly the same distance apart on all jaws, the lines will make it possible for you to center the work quite accurately.

Henry Hanscom, Elmhurst, Ill.

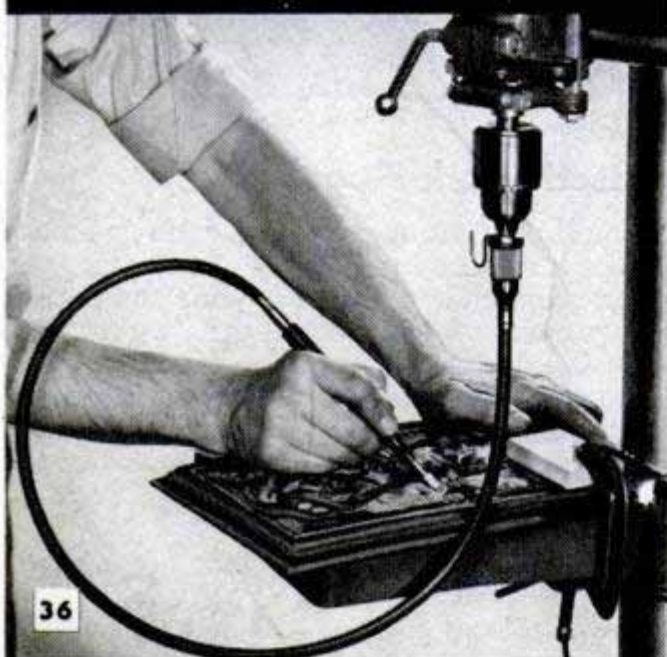


Engine Data Taped to Fire Wall

Frequently needed data, such as spark-plug and point gap, firing order of cylinders, etc., will be readily at hand if typed on strips of adhesive tape and stuck on the fire wall of the car. This eliminates the necessity of referring to the manual each time repairs are made. Clean a spot on the fire wall before applying the tape.



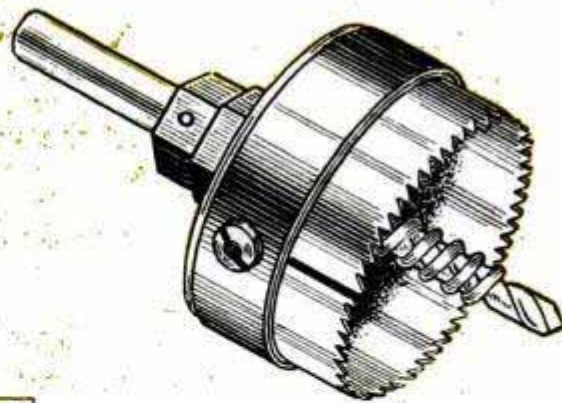
PLUG CUTTING



FLEXIBLE-SHAFT CARVING



JIGSAW ATTACHMENT



HOLE-CUTTING SAW

24

extra uses
for your

DRILL PRESS

Part II

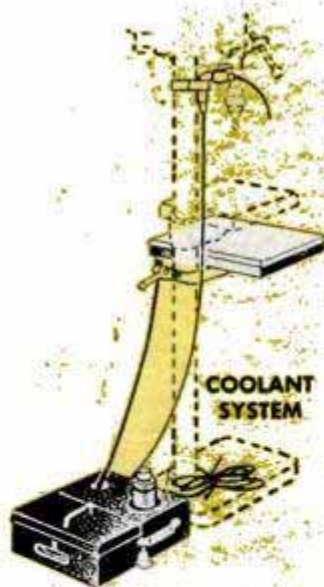
IF YOU have been using your drill press only for routine jobs of drilling, and mortising, you have not been utilizing it to best advantage. It will save other machines, or even replace them in many cases on light work.

Besides the many uses described in Part 1 of this story last month, your drill press also will handle jobs such as those pictured on this and the following five pages. For example, boat plugs—grain running across the end—can be made in quantities with a special cutter as pictured in Fig. 34.

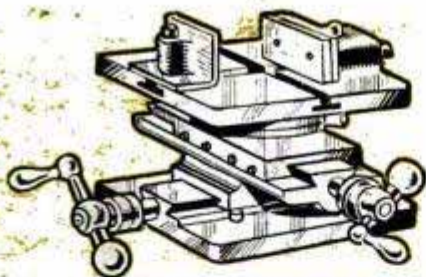
Large holes and disks: Hole saws from $\frac{3}{4}$ to 3 in. in diameter, Fig. 35, are available for making toy wheels, disks, or simply cutting large holes. Speed should be about one third or one fourth that used on corresponding size drum sanders mentioned in Part 1.

Carving: For carving wood and plastics, small rotary cutters, run at about 5000 r.p.m., may be used with a flexible shaft attached to a drill press as in Fig. 36, or they can be mounted directly in a chuck or an adapter, in which case the work must be moved instead of the cutter.

Jigsawing: With a small attachment chucked in your drill press, as in Fig. 37, a vertical reciprocating movement is pro-

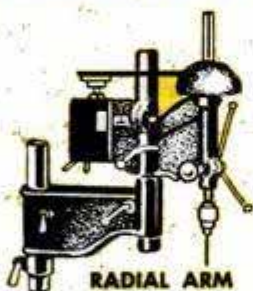


COOLANT SYSTEM



COMPOUND SLIDE AND VISE

38



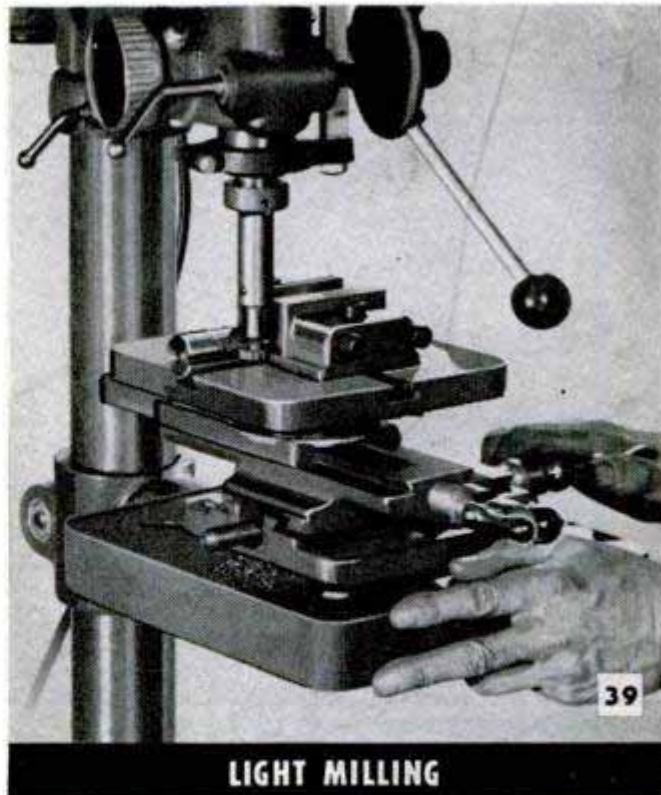
RADIAL ARM

vided, which permits jigsawing with accuracy. The same attachment may also be used for hacksawing. The tool is run at the slowest drill-press speed.

Besides the numerous woodworking applications of a drill press, its versatility extends to many metalworking uses and other functions. Equipment for metalworking may even include a coolant system as in Fig. 38, for milling, tapping and grinding, particularly when engaged in light production work. For precision operations, the work often is held in a compound vise, or in a lathe compound slide rest, the work being clamped down by the tool post or held by a vise attached to the slide. Such provision not only holds the work rigidly, but permits feeding it slowly and evenly.

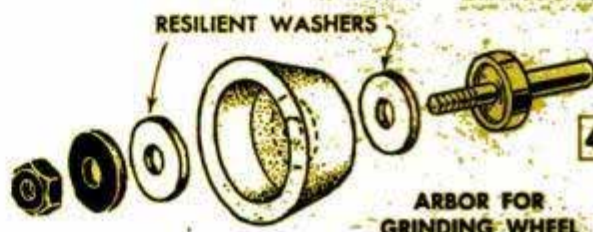
If necessary, the throat clearance of the drill press can be increased by installing a radial arm as in Fig. 38, in which case a larger table is also required. Other accessories also are available. For example, you can get column collars to hold the head or table so they can be swung sideways. There are also screw-type devices for elevating and lowering the table or head, besides variable speed units. On drill presses having slip-on chucks, you should always use a spindle adapter, special spindle, screw-on chuck or a chuck that is integral with the spindle, to hold tools that exert considerable side thrust when in use, like wheels for grinding, scratch brushing and buffing, and side mills.

Milling: One of the most natural, occasional applications for a drill press is milling, Fig. 39. However, it should be used for light cuts only, employing small cutters, as a drill press is not basically designed for milling, its spindle overhang being much greater than that of a conventional milling



39

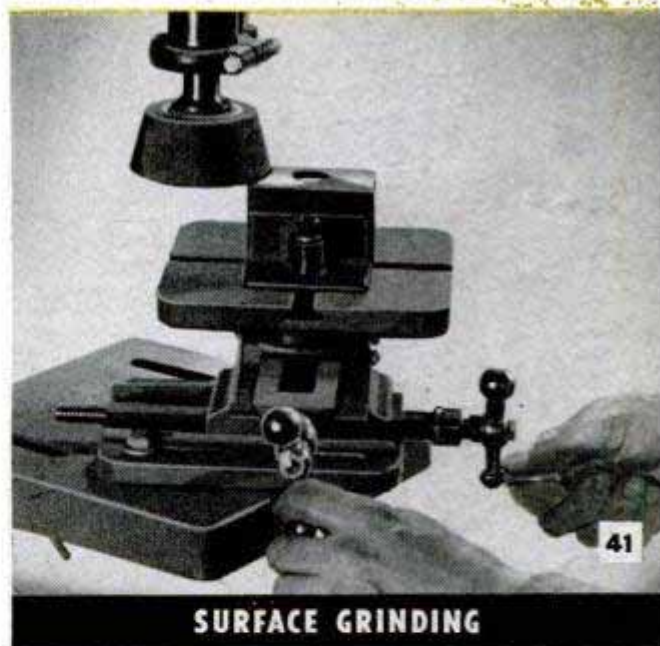
LIGHT MILLING



RESILIENT WASHERS

ARBOR FOR GRINDING WHEEL

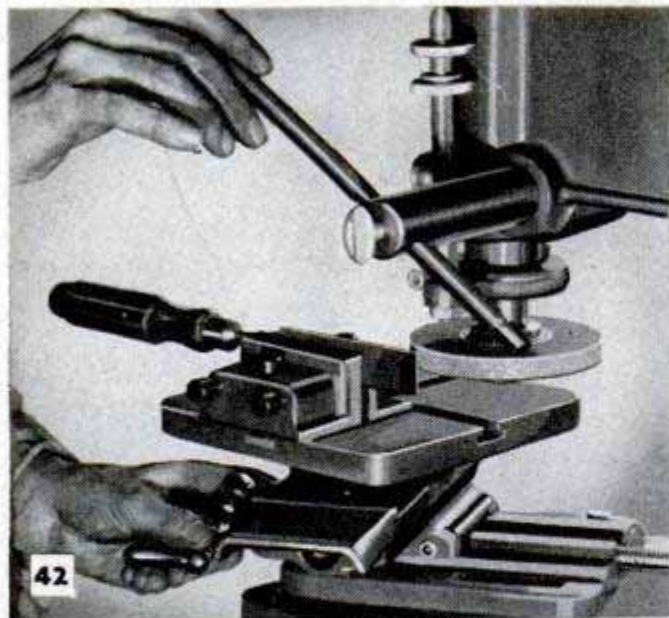
40



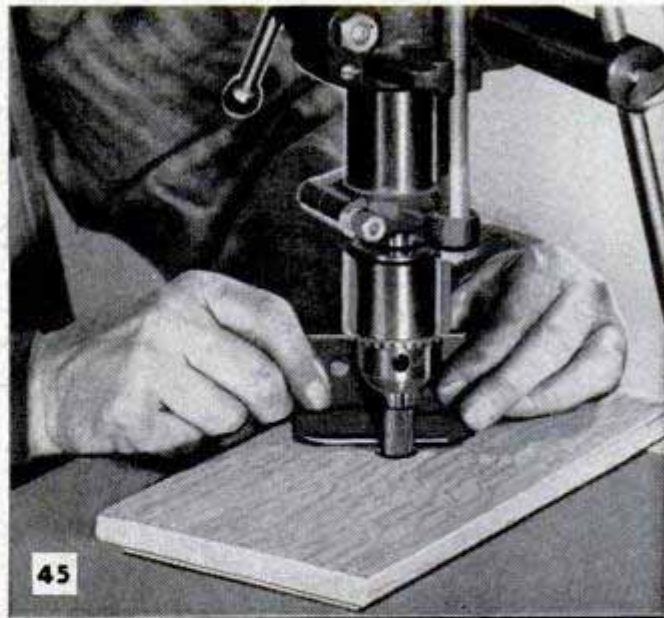
41

SURFACE GRINDING

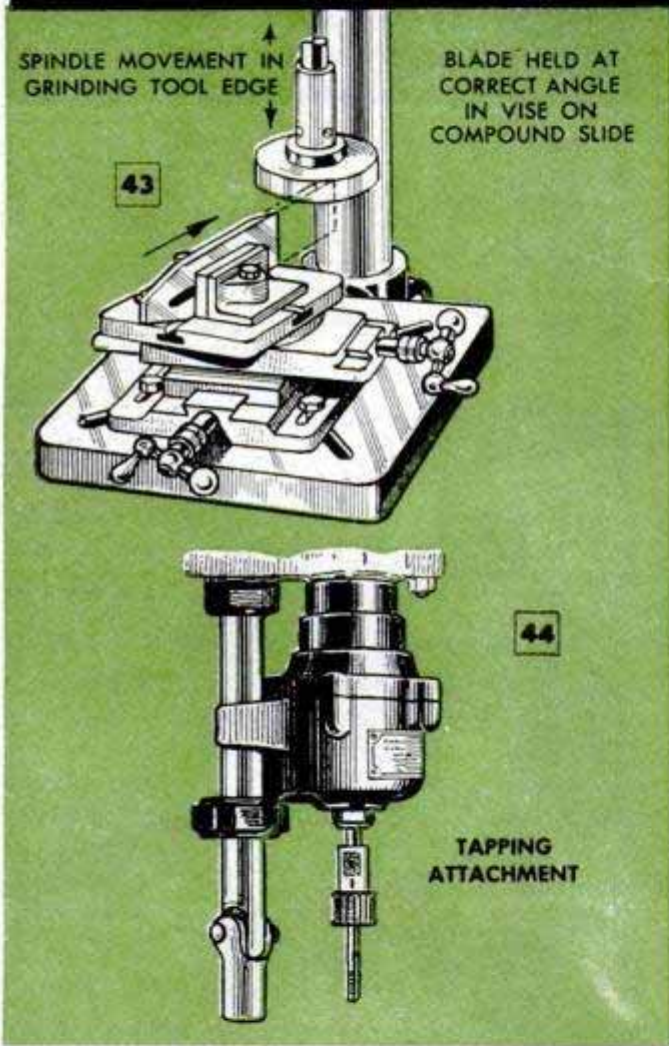
machine. The work must be mounted rigidly on a compound slide or vise clamped to the table. Either the table is raised or the head is lowered to avoid unnecessary spindle overhang. This assures greater accuracy and minimizes the tendency to chatter. Average speed for light cuts on annealed tool steel should be about 70 feet per minute (peripheral speed of cutter). This requires a spindle speed of about 400 r.p.m. when using a 3/4-in. side cutter, which is about the maximum size advised



TOOL GRINDING



-FILING



SPINDLE MOVEMENT IN GRINDING TOOL EDGE

BLADE HELD AT CORRECT ANGLE IN VISE ON COMPOUND SLIDE

TAPPING ATTACHMENT

wheel, or whenever a wheel develops irregularities, dress the face true—straight across—except on wheels that are used for contour grinding.

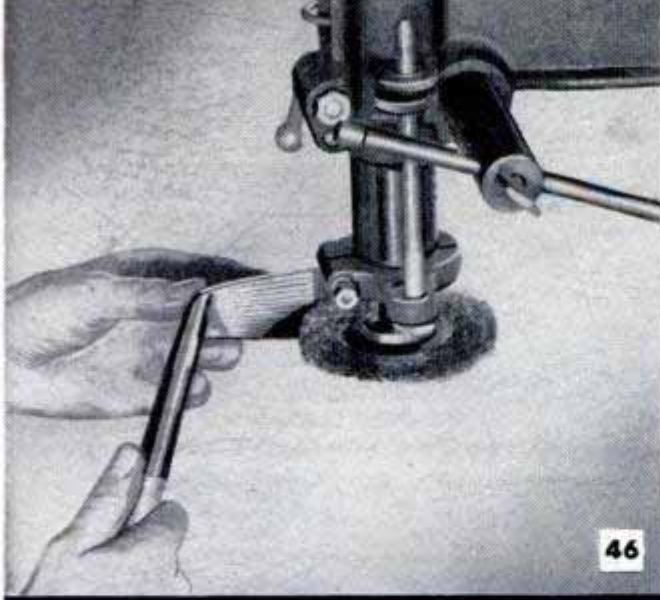
Accurate surface grinding on a drill press, Fig. 41, is done with a cup wheel not exceeding 4 in. in diameter. A medium-hard, 50 or 60-grit aluminum-oxide wheel is useful for average work in grinding tool steel. Support the work rigidly on a compound slide for precision results, although sometimes you can take light cuts by simply holding the work in a drill-press vise and sliding it slowly over the table while the quill is clamped in position. Or, you can lock the vise on the table and swing either the table or the head sideways, using a column collar to support the table or head.

For sharpening straight-edge tools such as chisels and plane irons, use an ordinary flat grinding wheel not over 4 in. in diameter, Figs. 42 and 43. Although freehand grinding is sometimes possible, you usually get more accurate results by mounting the tool in a compound slide, adjusting it to correct grinding angle for the tool. The wheel rotation must be toward the edge, not away from it. Cuts are made by lowering and raising the spindle. As it is essential to keep the tool edge cool to avoid drawing its temper, a small stream of water, supplied through a tube from an overhead container, can be directed against the edge being ground. In this case a splash guard may be necessary.

Generally, grinding is done at high speeds of 5500 to 6000 surface feet per minute. On a 4-in. wheel this would require a spindle speed of 3600 to 5000 r.p.m. However, for grinding hardened and tempered tool edges, slow speeds often are recommended to minimize the tendency to overheat the

for drill-press work. Smaller cutters are run at proportionally faster speeds to obtain the same peripheral speed.

Grinding: Grinding wheels are mounted on special arbors (or special drill-press spindles) and are secured by recessed washers, Fig. 40. Use compressible washers of blotting paper or rubber between the wheel and washers to distribute the pressure uniformly, tightening the assembly just enough to hold the wheel securely. Before grinding with a newly mounted



SCRATCH BRUSHING

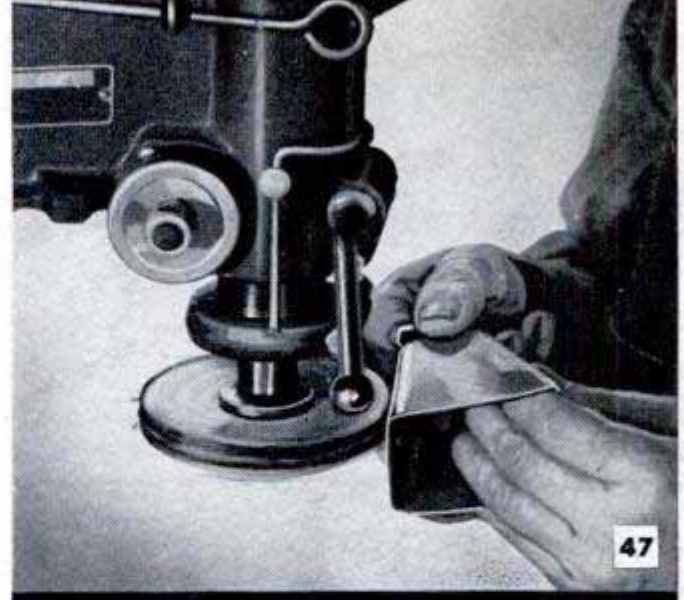
work. As a safety measure when grinding, scratch brushing and buffing, be sure to wear goggles.

Tapping: For tapping metal you need a special attachment such as shown in Fig. 44. This runs the tap at any speed suitable to the material. It is clamped to the drill-press quill, which is lowered to engage the tap with the work. When the tap reaches the proper depth it reverses automatically at a speed usually twice that of tapping.

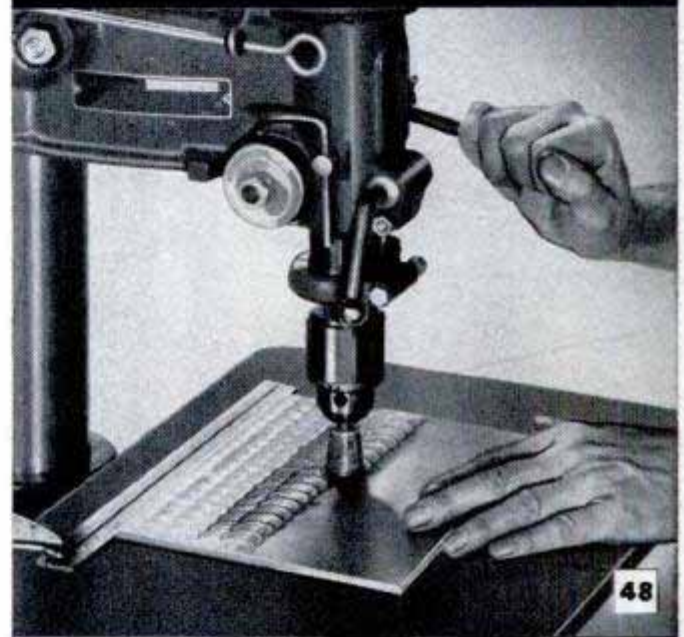
Filing: You can do external and internal filing, as in Fig. 45, using special rotary files. However, if such files are not available you get creditable results sometimes with a short piece ground off an ordinary round hand file. The piece must be straight, not tapered, and is wrapped at one end with tough paper if mounted in a screw-on chuck, to protect the chuck jaws.

Scratch brushing: Metal can be cleaned of rust, dirt and hardened grease, and can be burnished to a satin finish by scratch brushing as in Fig. 46. Scratch brushes in various sizes with the wire mounted on the side or end are available. Maximum size for drill-press use is 4 in. in diameter. Hold the work freehand and turn it while feeding. Speed depends on size of brush and type of material. Medium speeds are best generally, but for fine effects on softer metals use high speeds and light feeding. Paint removal by scratch brushing should be confined to painted-metal surfaces since wood surfaces will be roughened.

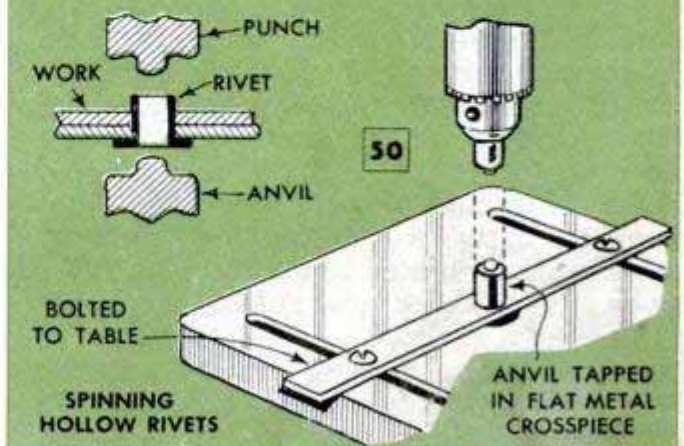
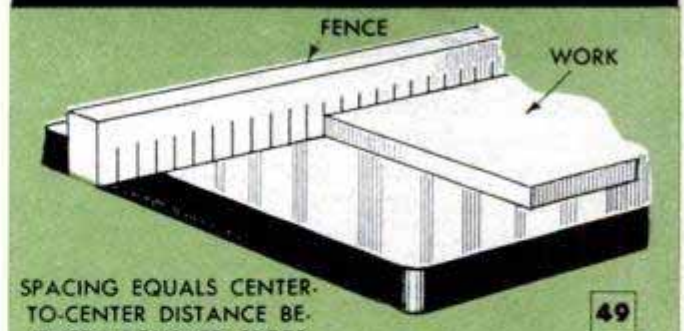
Buffing: You can buff metal surfaces to a fine luster as in Fig. 47, using 4-in. or smaller buffing wheels and a suitable abrasive such as rouge in cake form. Use speeds of 2400 to 5000 r.p.m. As the work is held by hand, swing the table aside to provide adequate working space. Take care to prevent the wheels from catching the work at sharp

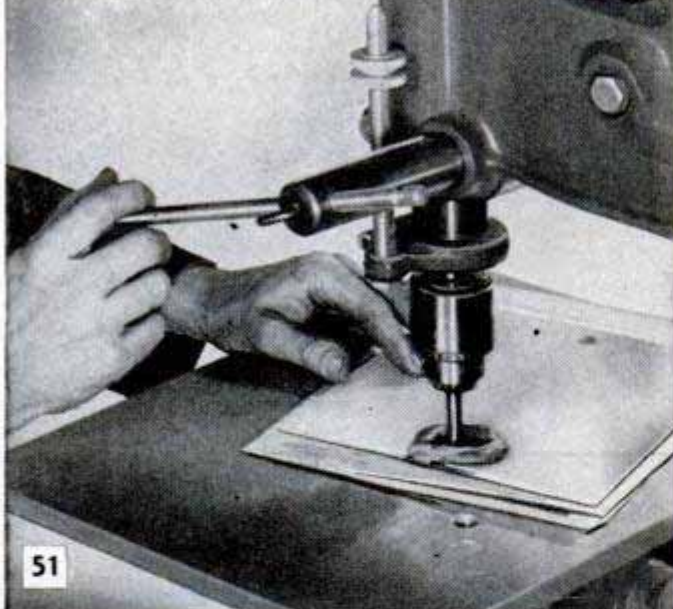


BUFFING



SPOT POLISHING





51

DRILLING GLASS

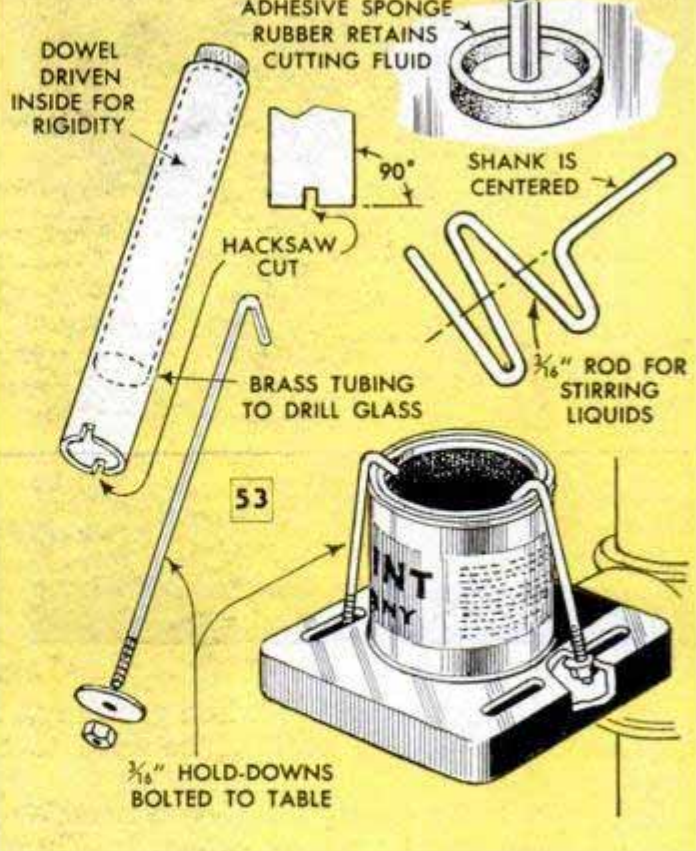


52

MIXING LIQUIDS

corners or in tapered grooves, which may wrench it out of your hands.

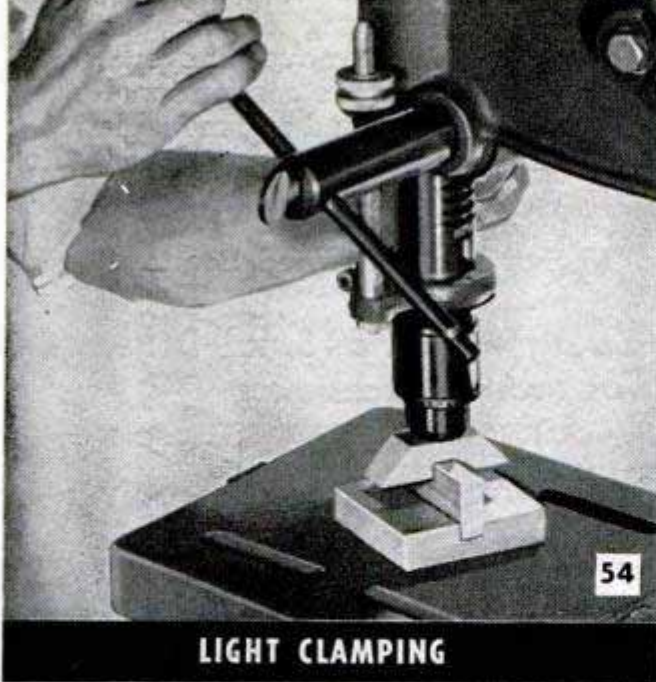
Spot polishing: For spot polishing as in Fig. 48, use a dowel with or without a leather facing. If the dowel is of greater diameter than the chuck capacity, turn down one end or drill a hole concentrically for a short metal shank, which is cemented in place. Or, you can use a bottle cork of suitable size in the same way. In any case, the surface contacting the work should be turned or sanded square with the shank axis. Fine valve-grinding compound or emery mixed in oil is applied to the end. The work is slid along a fence and is advanced equally for each spot, using a tough paper scale cemented to the fence as in Fig. 49, or a 1/8-in.-thick steel rule to serve both as fence and scale. The spots should overlap about 1/4 to almost 1/2 of their diameter. The second row is spaced this same distance from the first by simply moving the



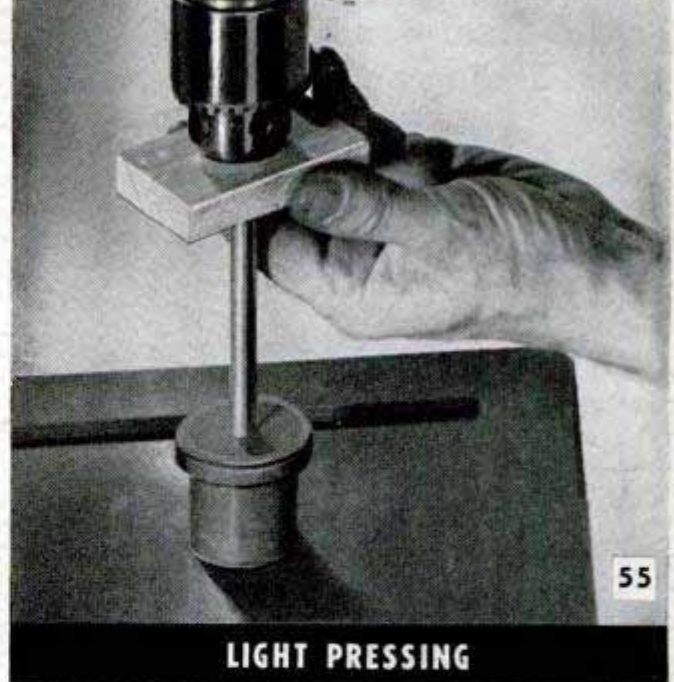
fence, starting at the same end and staggering the spots so that they come midway between those in the first row.

Spinning hollow rivets: Hollow rivets used for fastening sheet metal and other thin materials can be spun tight by using your drill press as in Fig. 50. The anvil, which holds the rivet, is screwed into a flat-metal base bolted to the table so that the anvil is in alignment with the punch mounted in the chuck. The rivet is slipped in place on the anvil, followed by the two sheets to be joined, these having been punched or drilled previously to fit the rivet. For steel rivets, a spindle speed of 2000 to 2500 r.p.m. is used. Lower speeds are effective for brass, copper and aluminum. If much spinning is done the punch should be hardened.

Drilling glass and china: For glass drilling, Fig. 51, best results generally are obtained by using a brass tube of suitable diameter. It is cut off squarely at the working end and is notched with a hacksaw or file as shown in the upper detail of Fig. 53. To prevent a piece of thin tubing from buckling in the chuck, a snug-fitting dowel is driven into the chucking end of the tube. A putty wall retains the cutting fluid. This consists of fine valve-grinding compound or emery mixed with turpentine or oil. The drill press is run at its lowest speed. Intermittent, light contact with the glass will prevent heating and fracturing it. A sheet of glass should lie on a uniform, flat surface, preferably on a sheet of rubber or felt. Other ceramics and baked-enamel finishes



LIGHT CLAMPING



LIGHT PRESSING

on metal can be perforated neatly in this way without chipping.

Glass edges can be ground and polished also on a drill press. Use a fine grinding wheel or drum sander fitted with an emery-cloth sleeve. Polishing is done with a buffing wheel loaded with progressively finer abrasives. The glass must be fed lightly and is kept moving while in contact with the wheel to avoid heating and fracturing.

Mixing liquids: Paint and other liquids can be mixed thoroughly and quickly by means of an improvised stirring rod rotated at slow speed, Figs. 52 and 53. The wings of the stirring rod should extend an equal distance from the shank so that proper balance is obtained. If made of $\frac{1}{8}$ or $\frac{3}{16}$ -in. steel rod, it will not bend out of shape easily. The lower wing should be horizontal to scrape off pigment accumulation on the bottom of the paint cans. The spindle is

raised and lowered while mixing. Clamp the can securely to the drill-press table, by using the method shown in Fig. 53, or hold the can by hand. If this is not done the container may move against the rotating mixer, resulting in spilled paint.

Clamping and pressing: A drill press also makes an excellent clamp where only moderate pressure is required, Fig. 54. Examples of this application are holding pieces of sheet stock together while measuring, laying out and scribing, particularly at points where the pieces are to be joined.

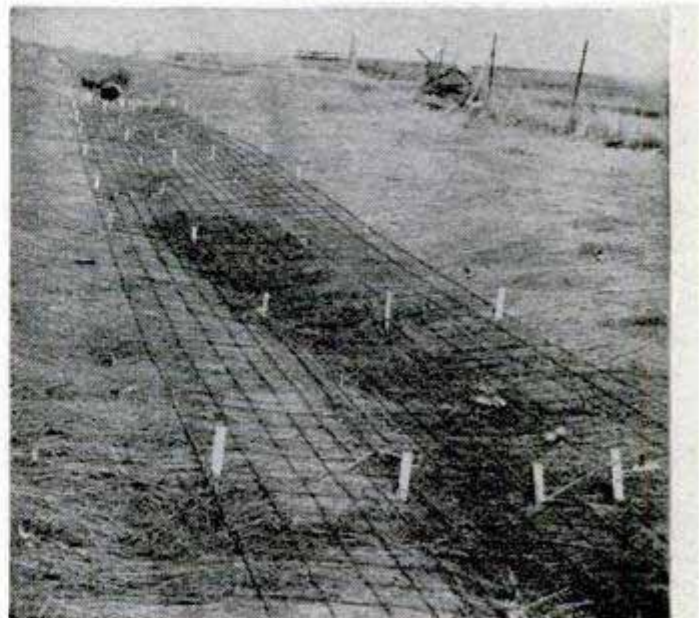
Occasionally, you can use the drill press somewhat like an arbor press for light work such as removing or replacing bushings, sleeves and plugs as in Fig. 55. Parts to be ejected are centered over the hole in the drill-press table. When doing work of this kind keep the pressure light.

(The end)

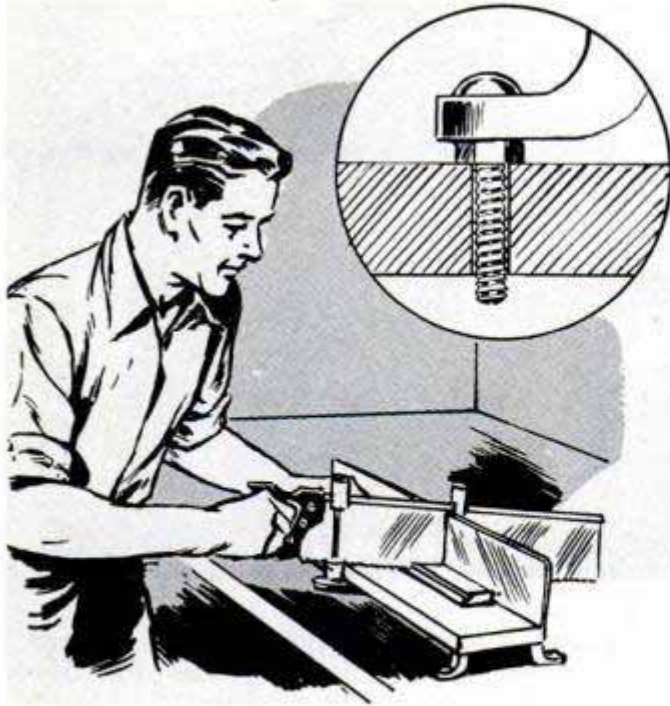
Hog Wire Used to Protect Grass Seed in Fight Against Soil Erosion

An effective method of preventing erosion and the formation of gullies in newly seeded pastures and other uncultivated fields consists of using woven hog wire to protect fast-germinating grass seed. Two rolls of wire are unrolled, one overlapping the other, and spread across the area to be protected. The wire is staked to the ground and the area is seeded over the top of the wire. During a rain the wire collects soil and debris carried in by the water and a mat is formed which will keep the seed from being washed away.

☐ When using a center gauge to check the angle of a lathe tool bit, hold a small piece of white paper behind the gauge to make it easier to distinguish the space between the bit and the gauge.



Nonskid Miter-Box Feet Prevent Sliding on Bench



In order to keep his miter box from sliding back and forth on the workbench, one woodworker attached short bolts permanently to the feet of the box to be inserted in holes drilled in the bench top. The bolts are attached as pictured in the detail and serve as pegs, which slip into the holes when the box is in use.

Portable Mop "Bucket" and Wringer For Cleaning Large Floors

Sturdily built for heavy-duty service in an automotive repair shop, this portable wringer was made by cutting a 55-gal. drum in half to form a tank, which is mounted on a rubber-tired tricycle as pictured. The



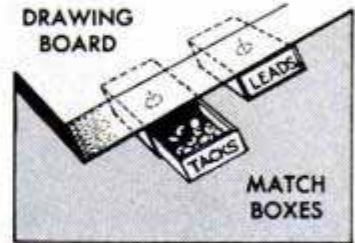
axle brackets and the yoke for the front caster wheel were built up by welding flat steel parts to form the shapes desired. Then heavy steel angles were welded to the sides of the tank to form a base for the wringer and a single baffle was welded in the tank

to prevent overflowing of the contents when the unit is moved over uneven floors. The wringer unit is the conventional type with one fixed roller and one movable roller. The latter is brought into contact with the fixed roller through the use of a U-shaped treadle.

M/Sgt. James R. Wood, Seattle, Wash.

Drawing Board Has Small Drawers Made From Matchboxes

Tacks, leads and other small parts used by draftsmen or artists can be kept within convenient reach by storing them in small matchboxes



fastened to the underside of a drawing board. Remove the cover of each box and tack or tape it to the board as shown. Then, the contents of each box may be indicated by labeling the outer end.

Damage to Welded Castings Reduced by Baking Process

To avoid porosity and cracking of magnesium castings being repaired by welding, one California metalsmith developed a cleaning and baking process which reduced such damage by 70 percent. Preparatory to welding, the casting is degreased and baked at a temperature of 350 deg. F. for 30 minutes. Then the repair is made using the heliarc method of welding.

George B. Davis, Coronado, Calif.

Lathe Gears Spaced Easily

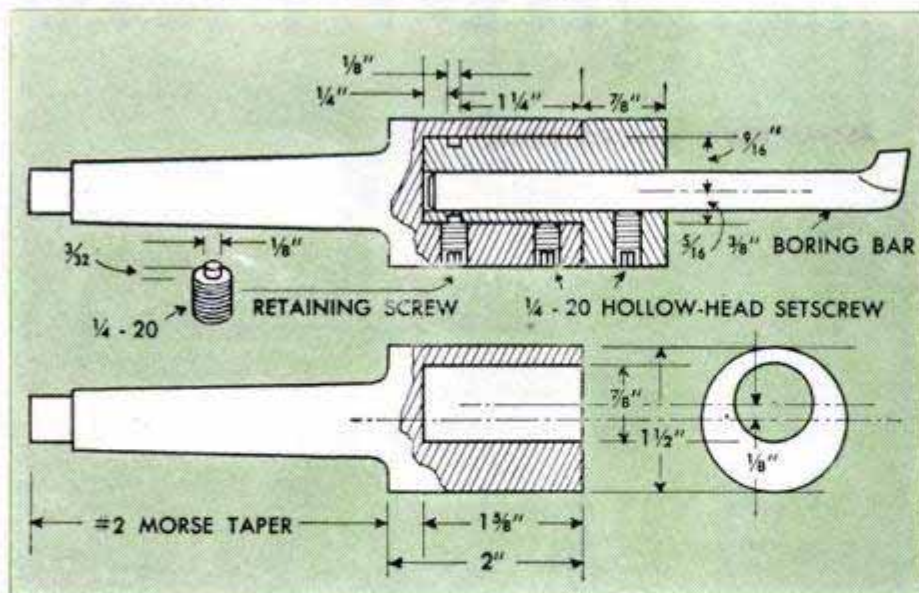
One of the simplest methods of spacing gears in a loose-change lathe is to use a metal spacer as shown in the photograph.



To prepare it, cut a strip of 33 to 35-ga. sheet metal and feed it between two of the gears while they are turned by hand. This will shape the strip so that it can be slipped into place between gears that are being mounted. A spacer of this type will be ejected as soon as the gears are turned. It's a good idea to drill a small hole in one end of the strip so that it can be hung up when not in use.

☐ The next time you have small tubing to bend, pack it with salt instead of sand. It's easy to remove the salt with water.

BORING-TOOL HOLDER ADJUSTS TO CLOSE TOLERANCES



For precision work with a milling machine or the milling attachment of a lathe, this boring-tool holder features an eccentric adjustment which permits setting the cutting radius to extremely close tolerances. The holder consists of two pieces made as shown in the detail. The shank of the body section is turned to a No. 2 Morse taper and the face is drilled $\frac{1}{8}$ in. off center, thus forming an eccentric sleeve to take the shouldered head in which the boring bar is locked. To make the head section, turn the eccentric shank to a sliding fit in the sleeve and turn the shouldered

end to the same size as the outside diameter of the sleeve. The shank should fit the sleeve just loosely enough to permit turning the head by hand when adjusting the boring bar. Cut a groove for the retaining screw near the end of the shank and knurl the surface of the shouldered section. Drill the head, as detailed, to take the boring bar, drilling and tapping both head and sleeve for setscrews and retaining screw. Measure carefully to be sure that the retaining screw engages the groove in the shank of the head section.

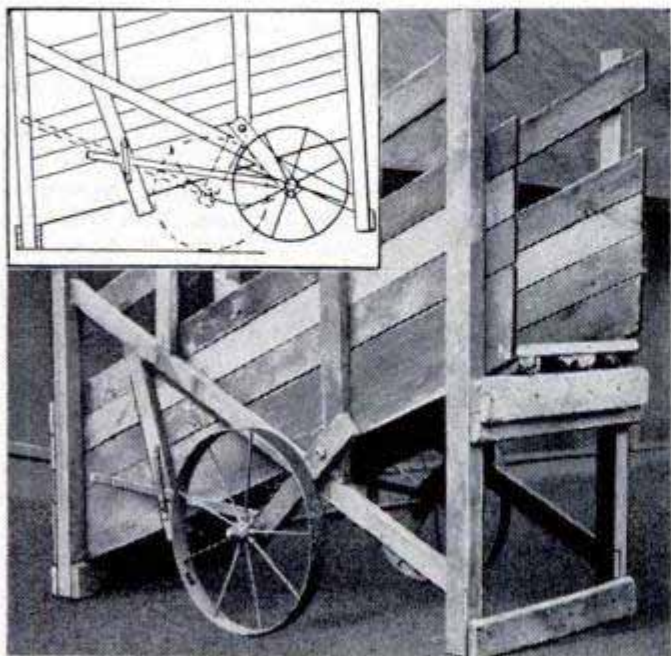
C. W. Woodson, Miami, Fla.

Portable Livestock-Loading Chute Is Fitted With Retractable Dolly

Easy portability and stationary rigidity have been combined in this livestock-loading chute by fitting it with a folding, two-wheeled dolly. Wheels from a discarded implement were fitted with an axle of suit-

able length which was pivoted to the frame of the chute by means of two hardwood arms. Wheels are held in the lowered or raised positions by means of two notched levers, the lower ends of which are attached to the axle. The free ends of the levers pass through U-shaped, flat-iron guides and extend to a point near the rear, or low, end of the chute. A lag screw passing through a hole drilled near the lower end of each guide is turned into the hardwood frame member to provide round lugs to engage the notches cut in the levers. Raising the low end of the chute and lifting the levers disengages the dolly.

A. M. Wettach, Mt. Pleasant, Iowa.

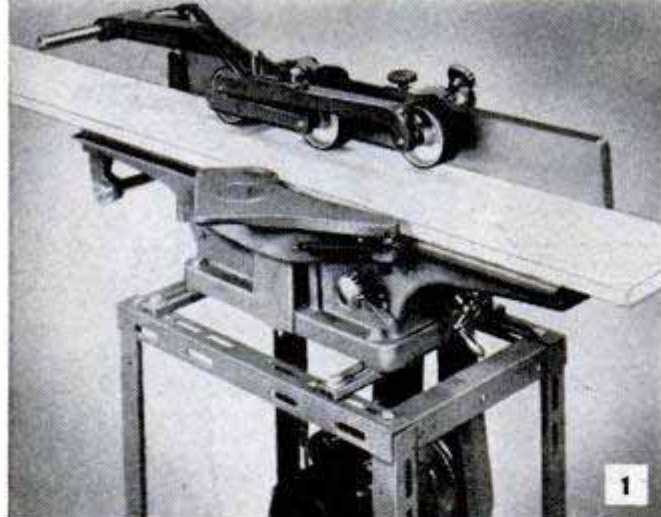


Iodine Loosens Frozen Nuts

Iodine provides an excellent substitute for penetrating oil when it is necessary to remove a frozen nut. Use a medicine dropper to apply a little iodine to the exposed threads at the face of the nut. Allow a few minutes before backing off the nut.

J. R. Spurgeon, San Diego, Calif.

SHOPPING



1



2

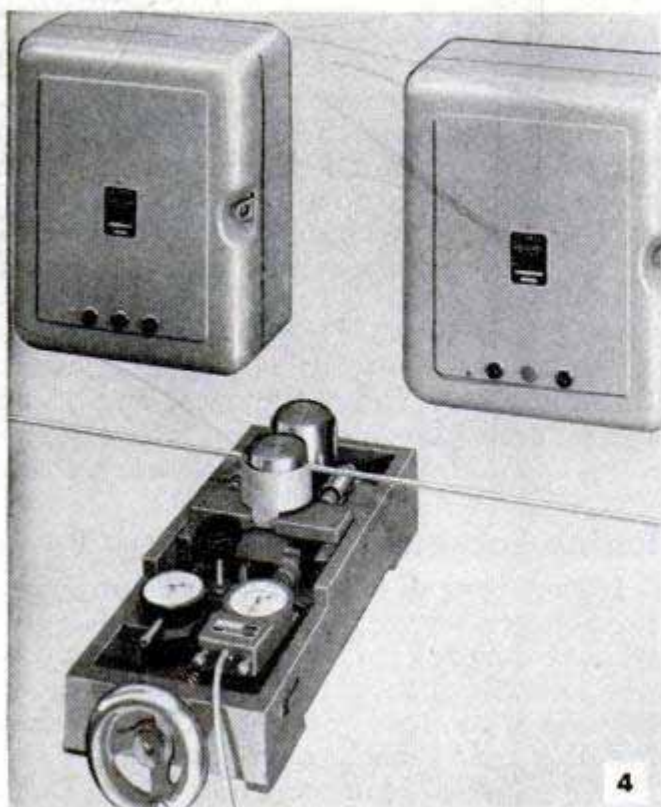


3

1. HOLD-DOWN ATTACHMENT for small jointers is designed to hold stock securely against jointer fence and at same time exert uniform downward pressure to assure accuracy. Operator starts end of stock under the first roller, then pushes it through with a push stick. Works perfectly on all sizes of flat stock and also handles small moldings and wedge-shaped pieces

2. VALVE LIFTER for 1950 Chevrolet engines enables mechanics to remove and reinstall the valves without damaging the rubber seal on the valve stems. The lifter is easily and quickly positioned and locks with the valve spring compressed, exposing valve keys for removal. Unit comes complete with instructions. Tool can be adapted for use on other valve-in-head engines

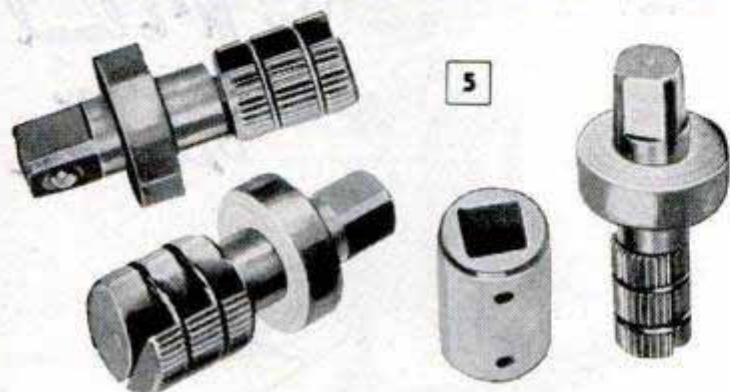
3. PAINT HEATER prepares enamels and lacquers for application by the hot-spray method. Unit is electrically operated and automatically controlled. Enamel or lacquer is heated and mixed in original container. Top half of heating unit is clamped in place over container and the switch is turned on. When liquid reaches proper temperature, heat is automatically turned off



4

4. WIRE-MEASURING GAUGE is designed to control automatically the amount of insulating material the extruder places on the wire. Handles coated wire up to 1 in. in diameter. When set for wire of a given size the unit controls thickness of coating by automatically controlling the speed of the wire as it passes through the extruder, thereby effecting a saving in material

FOR TOOLS

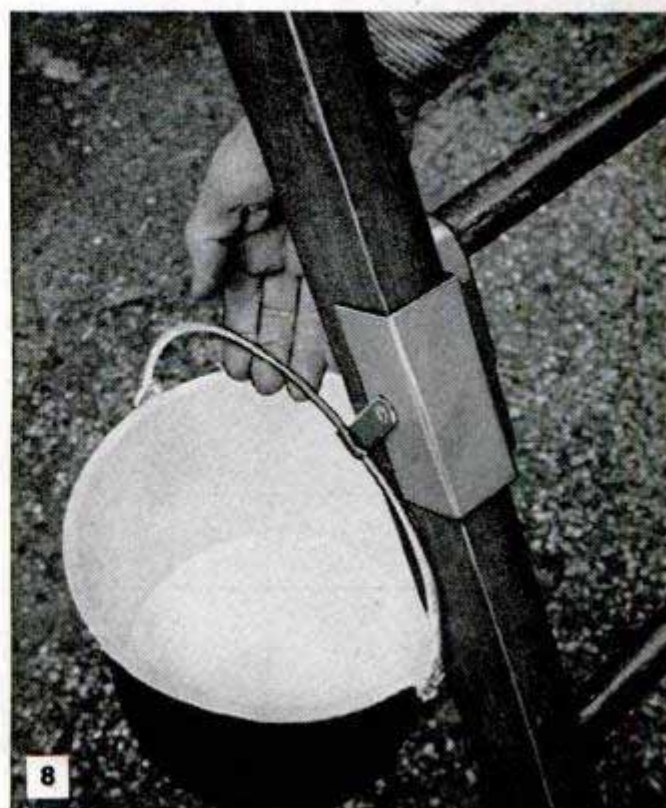
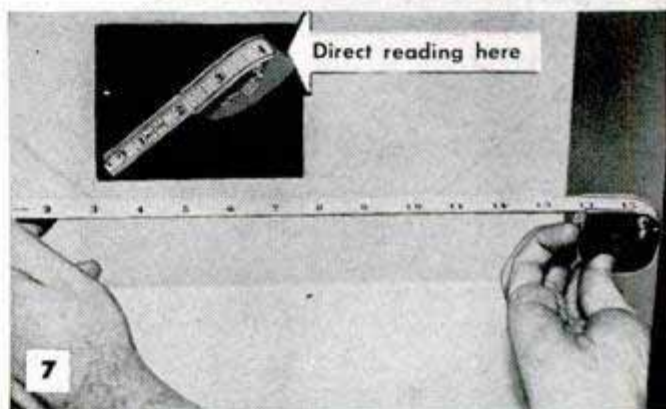


5. INTERNAL PIPE WRENCH grips the inside of pipe when tightening or loosening. Works close against walls, in hard-to-get-at corners and narrow openings. Wrenches are made in five standard pipe sizes and can be operated with a ½-in. ratchet handle, or, if necessary, with an end wrench. Grips pipe in same manner when turned either right or left. Cannot drop into pipe

6. TREETOP HOIST for chain saws enables the operator to raise and lower saw to any position while in the tree. Supports saw securely at any point and permits the operator to release it when changing position in tree. The top anchor plate is fitted with steel prongs that grip the tree trunk or a limb and support the swinging crane to which hoist and saw are attached

7. PUSH-PULL STEEL RULE for inside measurements is housed in a special case having one right-angle corner. This feature makes it possible to measure distances between walls, doorjamb and window frames with extreme accuracy. To use, place end of rule against one side of opening. Extend rule until the square corner of the case is flush against the opposite side. Then press the locking lever to hold measurement

8. PAINT-PAIL HOLDER fits over the side frame and rung of a ladder and holds a 1-gal. paint pail without any danger of tipping. Can be attached to either right or left side of the ladder. There are no screws or bolts to tighten or loosen or adjust when making the change, or when shifting holder to different height on ladder. Suitable also for holding a fruit-picker's bag



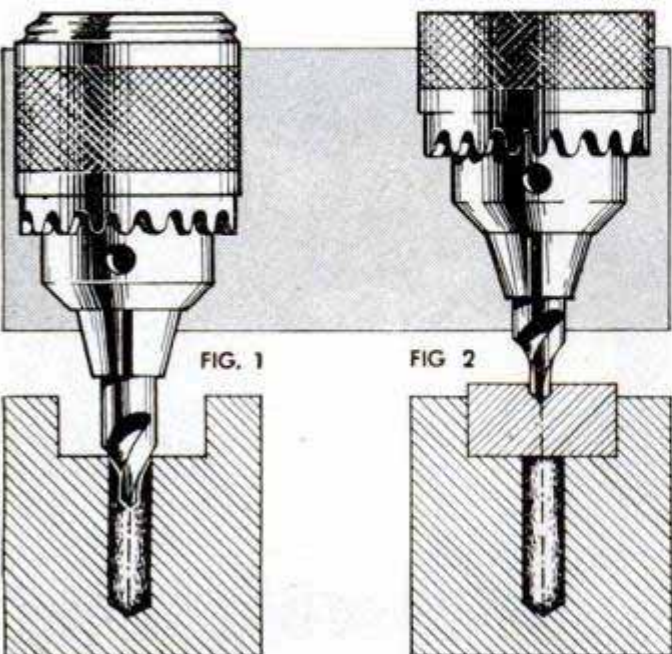
False Bottom Placed in Desk Tray Speeds Removal of Paper



The difficulty of removing typing paper from a box or tray may be overcome by the use of a false bottom of cardboard. This is fitted with a tab of cloth tape long enough to extend over the end of the box. By lifting on the tab, the packet of paper is raised for easy removal of one or more sheets.

How to Transfer Blind Holes

Transferring the location of holes already drilled in one piece to an additional part that must fit accurately in place can be accomplished without measuring by the method shown in Fig. 1. The work is adjusted on the drill-press table under a heavy center drill by inserting the drill in the hole. The work is then clamped to the table and the new part to be drilled set in place, Fig. 2, and the hole started with the drill. After an accurate start has been made, the drill can be changed to the size



required and the hole continued through the work. If the hole to be transferred is large, the jaws of the drill chuck may be used to center the work, after which the work is clamped and the hole drilled in the new piece.

Portable Electric-Power Unit Drives Farm Machinery

Welded together from scrap metal and utilizing a $\frac{3}{4}$ -hp. electric motor, this lightweight power unit is adaptable for driving various machines around the farm. It is especially useful for turning the windlass on a chopped hay or grain rack, as its reversible speed reducer has an automatic clutch which prevents any breakage



should the windlass become clogged or the rack overloaded. The power unit is mounted on a two-wheeled cart and is adjusted for height by means of a screw-type bumper jack welded to the axle and frame. If necessary, a conventional-type telescoping power-take-off shaft can be used to connect the drive unit to the shaft to be driven on the machine.

Formula for Machine-Screw Sizes

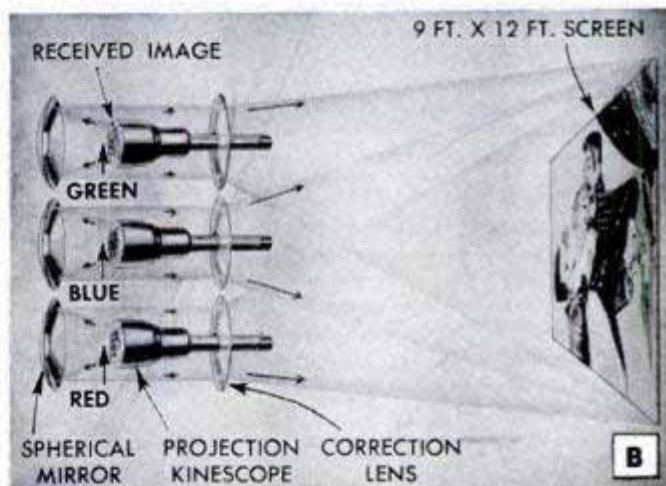
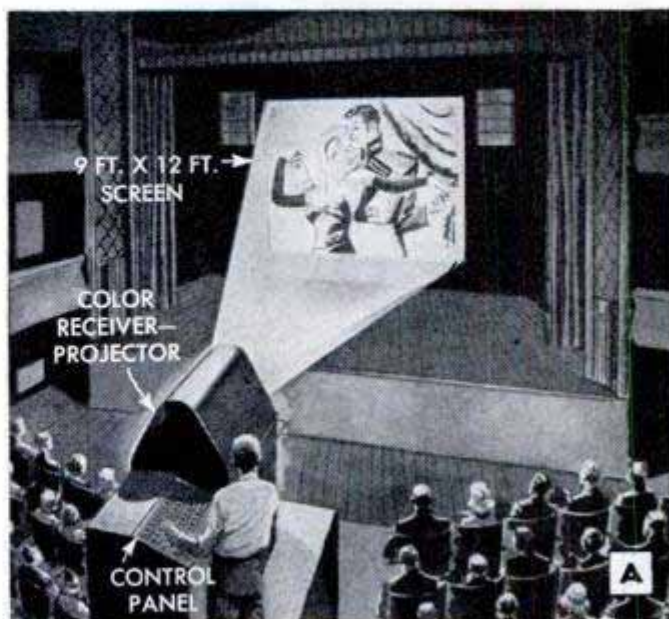
When you want to duplicate a particular machine screw on your lathe, it isn't necessary to search through a handbook to find the diameter to which the blank must be turned. First, remember to multiply the number of the screw by .013 and add .060. Thus, the diameter of a No. 2 screw is $2 \times .013$ plus .060, or .086 in. A No. 3 screw is $3 \times .013$ plus .060 or .099 in.

I. E. Wallace, Los Angeles, Calif.

COLOR TV FOR THEATERS

PROJECTED color-television pictures of theater-screen size were shown recently at the Colonial Theater in New York City by the Radio Corporation of America in tests that revealed further advances in the RCA compatible, all-electronic color-TV system. The color show, produced in the NBC studios at Radio City, was broadcast on channel 4. This enabled owners of all existing television sets in the area to view the same program in black and white.

Sketch A shows the experimental receiver-projector setup in the theater. The principal components of the improved theater tri-color TV receiver-projector system are shown in sketch B. Three projection kinescopes, spherical mirrors and correcting lenses are employed. In the operating apparatus, photo C, these are mounted in the triangular arrangement projecting colors that are superimposed on the large screen as a single brilliant picture. RCA engineers claim that future receiver-projectors of this type will fill full-size theater screens up to 18 x 24 ft. The projection apparatus uses the same type of optical system used in RCA's black-and-white theater TV projectors now installed in theaters in New York, Chicago and other cities. Photo D shows the tri-color camera in operation.



VERSATILE AMPLIFIER SERVES

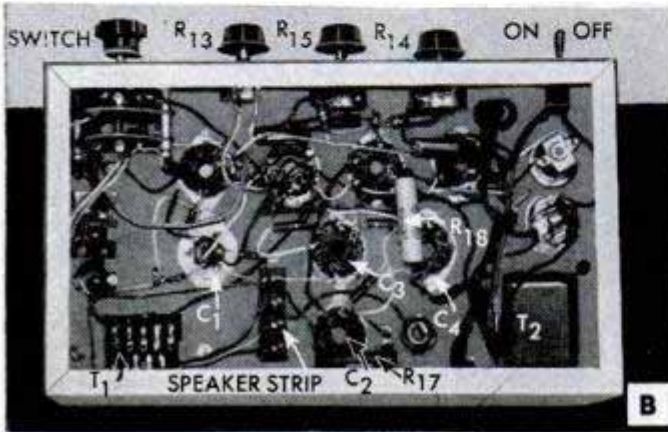
By Dr. R. C. Hitchcock

PERFECT stability and also unusual gain are outstanding features of this versatile audio amplifier. The undistorted output is 3.8 watts, and the maximum is 4.5 watts. Four input circuits are available and a reluctance pickup can be used in the microphone channel. Two separate phonograph inputs take high-impedance crystal pickups; a low-gain channel will work with radio or television as indicated in Fig. 1-A.

Bass and treble controls are always in the circuit. These may be set to give a variety of frequency curves. With bass and treble set at the halfway point, the output is linear, or high fidelity. Turning the "bass" control gives either minus 10 DB (cut) or plus 8 DB (boost) at 100 cycles per second. The "treble" control gives minus 25 DB (cut) or plus 5 DB (boost) at 5000



A



B



C

RESISTORS

- 3—100,000 -ohm, 1/2-watt carbon (R1, R2, R16)
- 2—10,000-ohm, 1/2-watt carbon (R3, R4)
- 2—6000-ohm, 1/2-watt carbon (R5, R6)
- 3—5000-ohm (filter), 1-watt carbon (R7, R8, R9)
- 3—500,000-ohm, 1/2-watt carbon (R10, R11, R12)
- 1—1/2-megohm logarithmic potentiometer Mallory taper No. 1 MR48 (R13)
- 1—100,000-ohm linear potentiometer Mallory taper No. 4 MR41 (R14)
- 1—1-megohm linear I.R.C. potentiometer No. Q 11-137 (R15)
- 1—500-ohm wire-wound (R17)
- 1—250-ohm (Koolohm type) Sprague, 10-watt (R18)

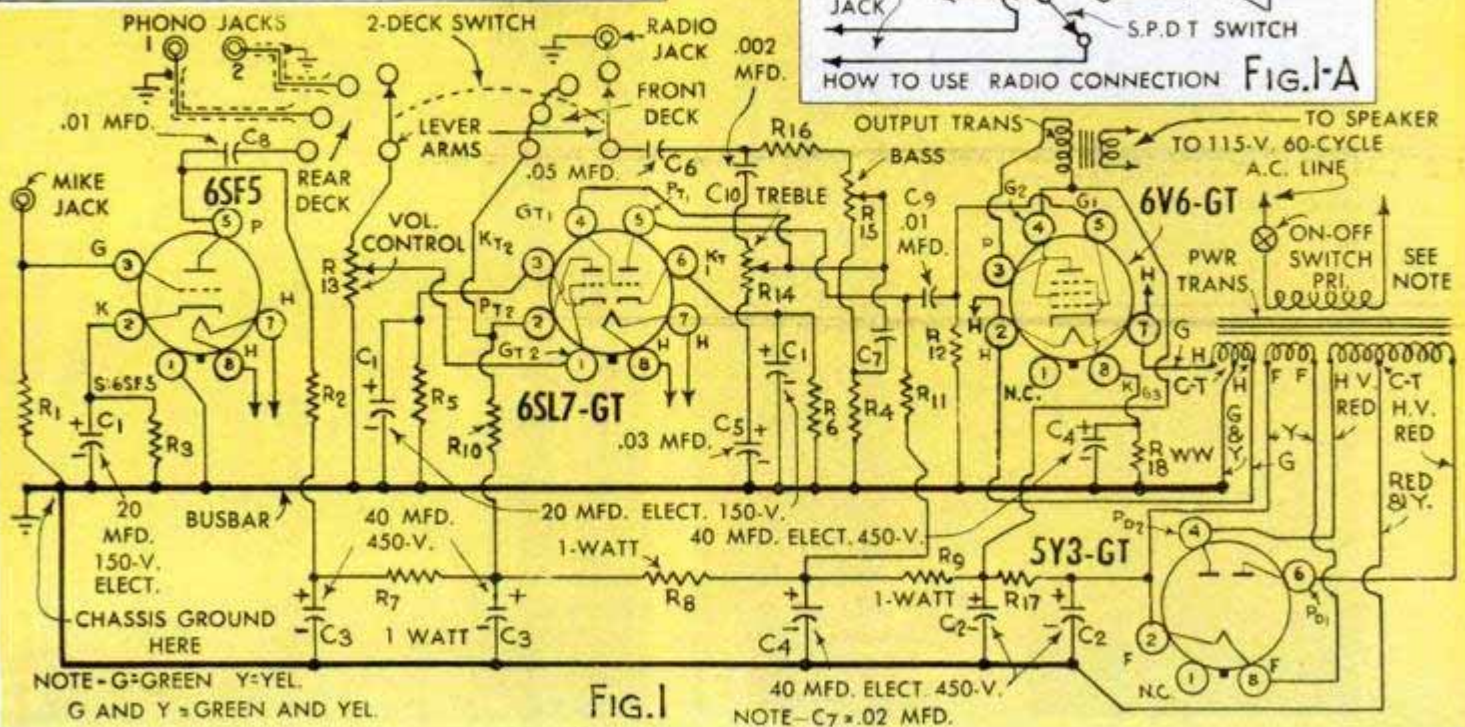
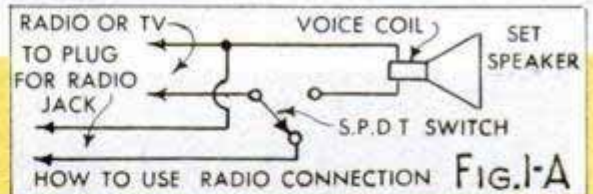


FIG. 1

NOTE—G=GREEN Y=YEL.
G AND Y=GREEN AND YEL.

NOTE—C7=.02 MFD.

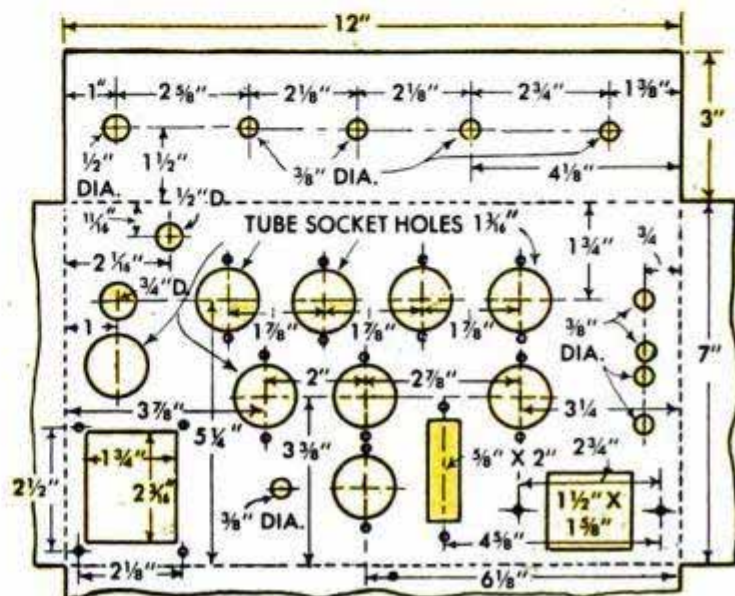
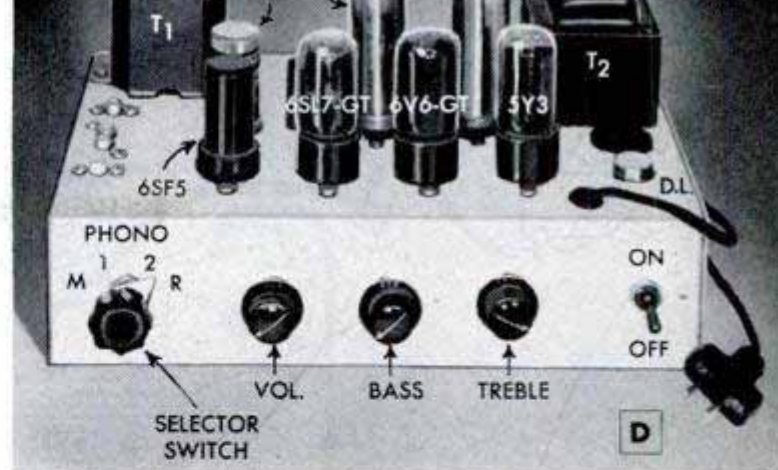
PRACTICALLY ANY AUDIO PURPOSE

cycles per second. The "radio" channel bypasses the "volume" control, so that the volume control of the radio set is the only one in use. Good audio quality depends largely on the output transformer; it may be the UTC S-14 used in the model or a Stancor A-2313. The power transformer can be the one specified, or a Stancor P-6119, or P-4078.

The schematic circuit diagram is given in Fig. 1. Photos B, D and E show various views of the completed amplifier. Photos A and C illustrate a convenient unit assembly arrangement of the amplifier with a record player, microphone and radio receiver, using a separate loudspeaker. All drilling details for the 3 x 7 x 12-in. standard chassis base appear in Fig. 2. The external circuit for using a reluctance pickup is shown in Fig. 3. When using this turn the "bass" to full "boost," and the "treble" to full "cut." Tape the leads to the resistor and condenser then cover them with tin or copper foil which should be grounded to the chassis base. The components are miniature types.

A complete bottom-view pictorial wiring diagram, Fig. 6, appears on the following page. Please note that the filter condensers C2, C3 and C4 are of the dual-section electrolytic plug-in type, which makes replacements very simple. The triple-section electrolytic condenser unit C1 is a Mallory twist-lock type, FP 354. All sockets shown in Fig. 6 are bottom view. The a.c. outlet is convenient for operating a record player or radio set. These units are "off" when the amplifier is "off." The two-deck selector switch makes all channel connections. Note the location of the switch arm in Fig. 4. The separate speaker jack, shown connected to the 8-ohm tap, is handy for quick connections. Detailed student material list R-407 is available from Popular Mechanics Radio and Electronics department upon receipt of ordinary letter postage.

(See diagram, Fig. 6, on following page)



(LOOKING DOWN ON CHASSIS BASE)

FIG. 2

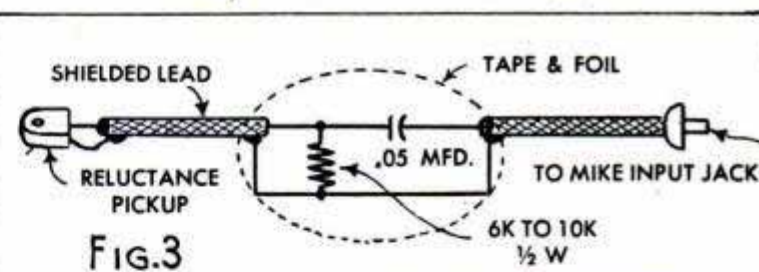


FIG. 3

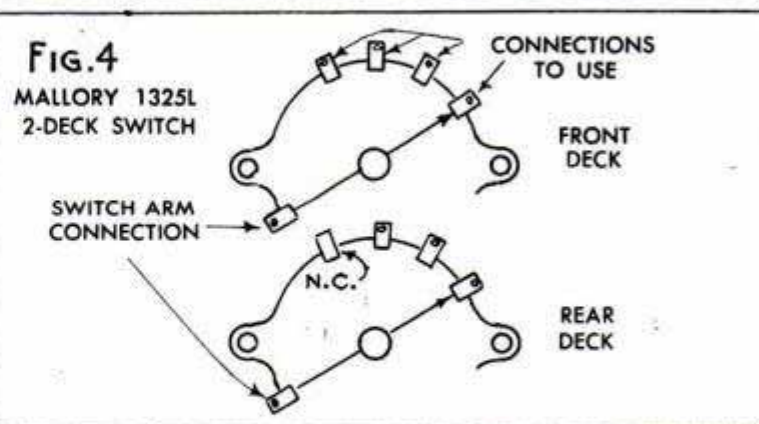


FIG. 4
MALLORY 1325L
2-DECK SWITCH

CONNECTIONS
TO USE
FRONT
DECK
REAR
DECK

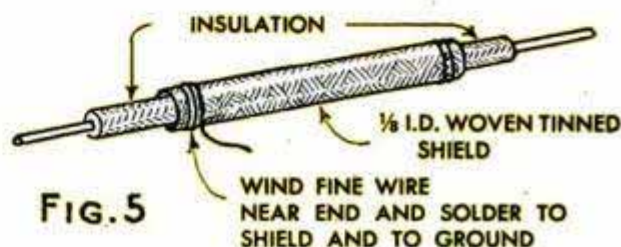
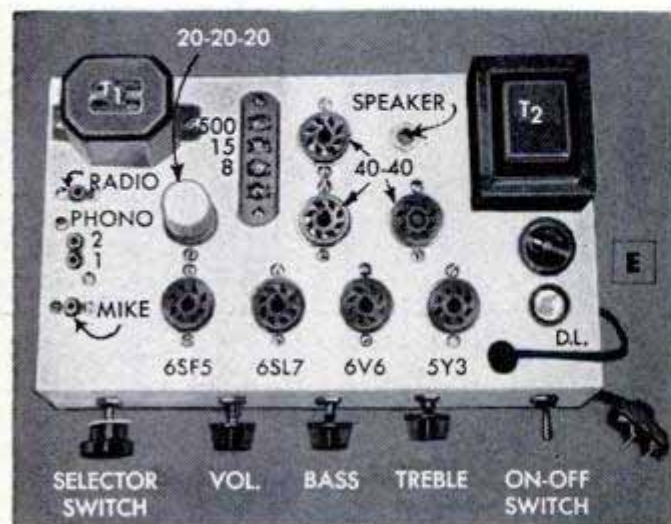


FIG. 5

WIND FINE WIRE
NEAR END AND SOLDER TO
SHIELD AND TO GROUND



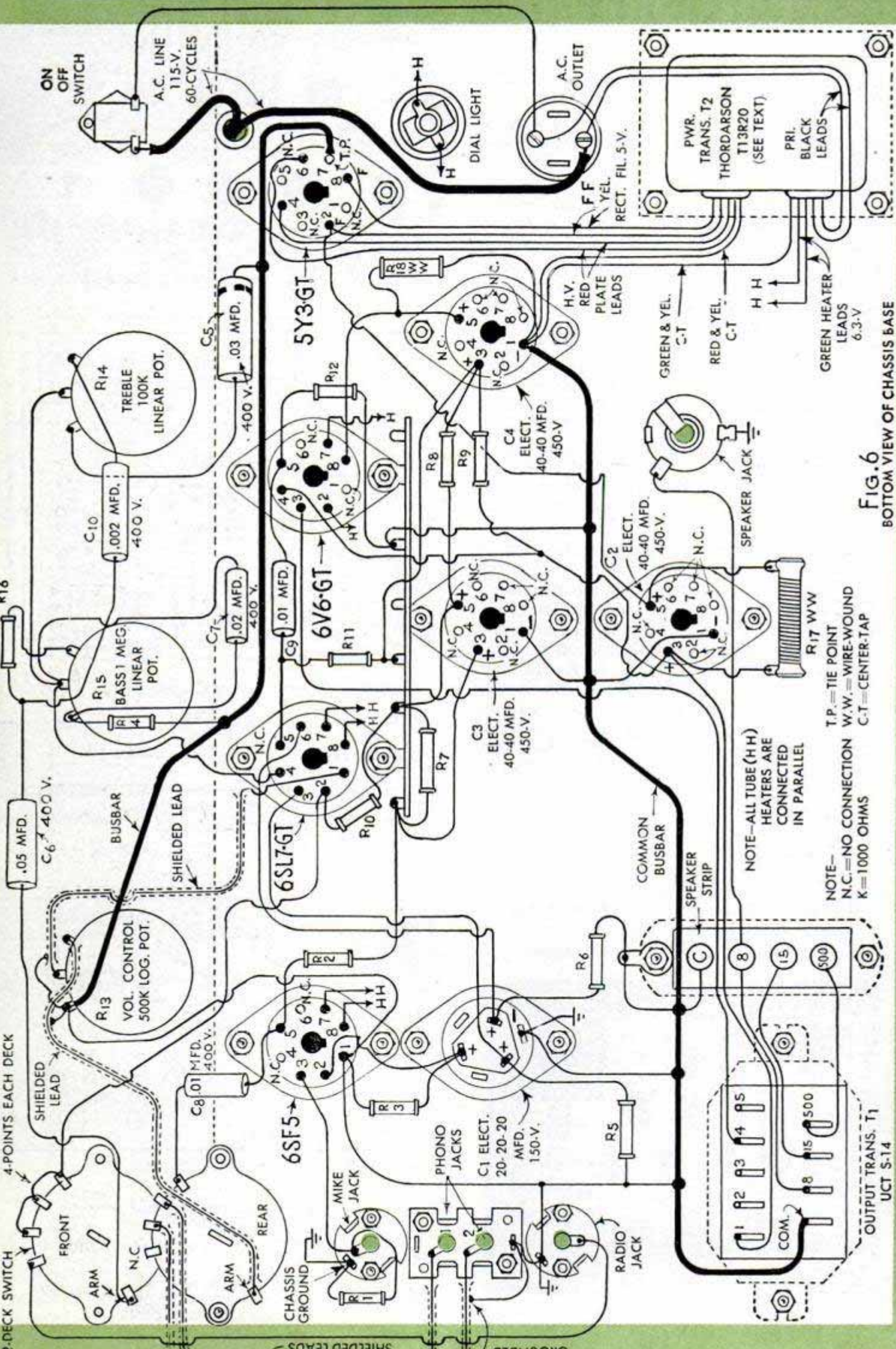


FIG. 6
BOTTOM VIEW OF CHASSIS BASE

NOTE—
N.C.=NO CONNECTION
K=1000 OHMS

NOTE—ALL TUBE (H H)
HEATERS ARE
CONNECTED
IN PARALLEL

T.P.=TIE POINT

W.W.=WIRE-WOUND

C-T=CENTER-TAP

COMMON
BUSBAR

SPEAKER
STRIP

R17 WW

SPEAKER JACK

GREEN HEATER
LEADS
6.3-V

RED & YEL.
C-T

GREEN & YEL.
C-T

H.V. RED
PLATE
LEADS

RECT. FIL. 5-V.

PWR. TRANS. T2
THORNDARSON
T13R20
(SEE TEXT)
PRI. BLACK
LEADS

A.C. OUTLET

DIAL LIGHT

H

H

ON OFF SWITCH

A.C. LINE
115-V.
60-CYCLES

5Y3GT

6V6-GT

6SL7-GT

6SF5

PHONO JACKS

MIKE JACK

RADIO JACK

CHASSIS GROUND

FRONT

REAR

ARM

ARM

N.C.

SHIELDED LEAD

BUSBAR

SHIELDED LEAD

4-POINTS EACH DECK

R16

C6

R15

R14

C10

C5

C7

C9

C8

C3

C4

C2

R11

R12

R8

R9

R7

R10

R6

R5

R3

R2

R1

OUTPUT TRANS. T1
UCT S-14

COM.

8

15

500

8

15

500

8

15

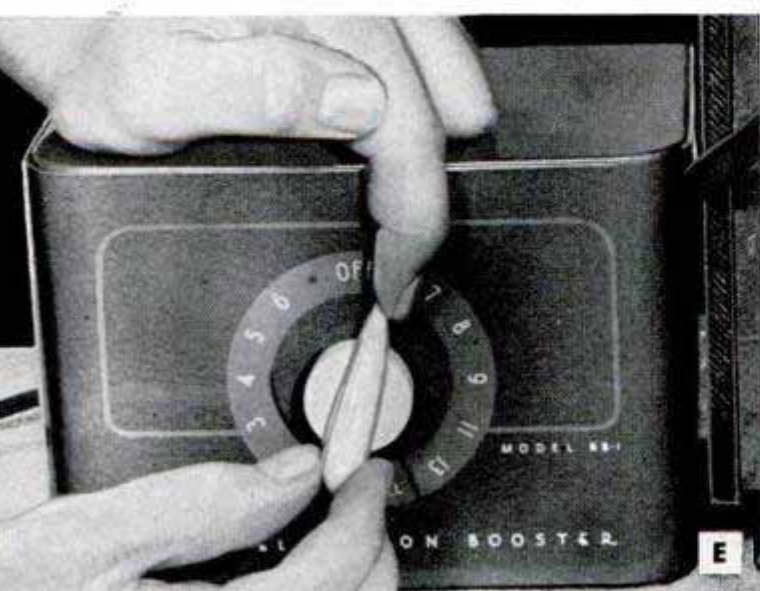
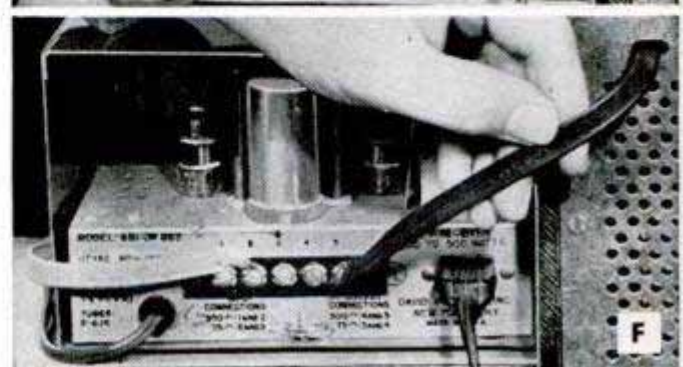
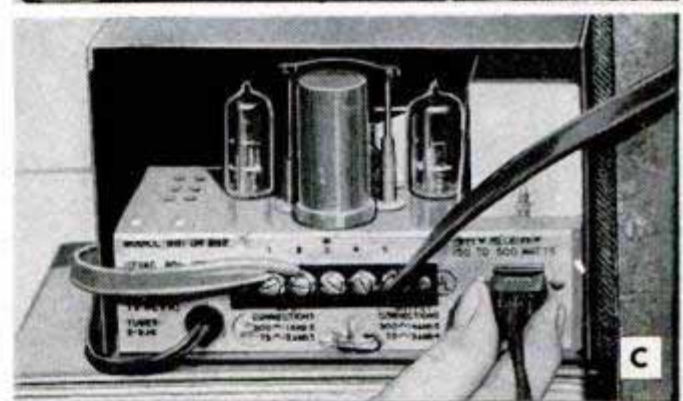
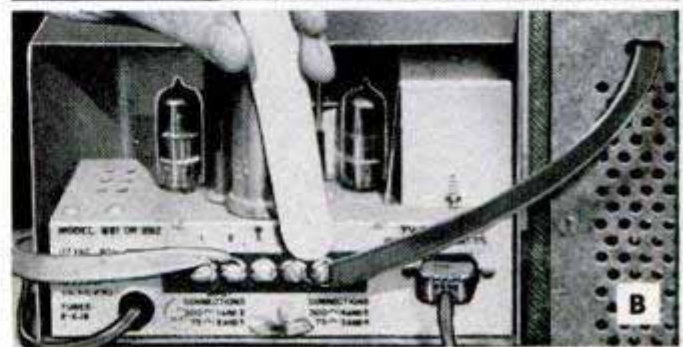
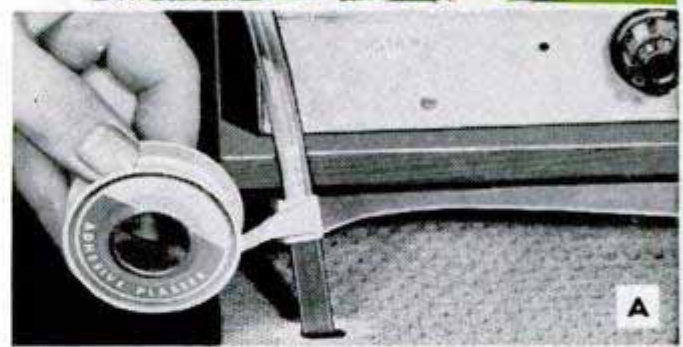
500

TV-BOOSTER HINTS

TELEVISION boosters may increase the signal strength from 5 to 10 times in fringe areas if care is used when making the connections with the twin-lead transmission line. While the manufacturer's instructions for any particular make of booster should be followed, the illustrated hints shown will also be of assistance. A TV booster is usually a self-powered r.f. amplifier unit connected between the antenna and the receiver. It is tuned to receive any of the 12 television channels, from 2 to 13.

A typical TV booster is illustrated in the photos. In some TV receivers the twin-lead antenna line is permanently attached and extends a few inches outside the back cover. In this case, it is always a good idea to guard against the lead pulling loose when the booster is attached. Disconnect the set from the power-line outlet, remove the back cover and tape the line just inside the cover, as illustrated in photo A. Since the terminals on the booster are usually close together, as in photo B, make sure that the fine strands of wire are not shorting them. Use soldering lugs in the antenna twin-leads. The set power plug that goes in the receptacle on the rear of this booster should make good contact, see photo C. The TV-set switch operates both units.

Some boosters employ more than one tube. One operates on the low bands and the other on the high. When these tubes are of the same type an improvement may often be had by switching the tubes from one circuit to the other, as indicated in photo D. A slight pressure on the top of the booster control knob while band changing, photo E, will help you make the adjustment accurately. The twin lead from the receiver that connects to the output terminals of the booster should be as short as possible, as indicated in photo F.



MODERNIZE YOUR OLD RADIO-PHONOGRAPH COMBINATION

By Ken Strelow



IMPROVE the appearance of your living room by getting rid of that old-fashioned radio-phonograph cabinet. The radio receiver and phono turntable are probably just as good as the day you bought the set. Slight alterations in the illustrated plans for the new cabinet, photo A, may be necessary to suit different makes of radio receivers and record-player units. However, you have the old cabinet for all cutout dimensions; the record player lifts out to permit access to the speaker. The cabinet can be finished to fit into any modern decorative scheme. With the plate-glass top, it may be used as an end table, or coffee table, thus doing double duty and conserving valuable space, especially in small apartments where space is at a premium.

Although only general dimensions are given in Figs. 1 and 2 (because you will have to adapt them for your equipment), the following materials were used in the model shown: Two pieces, $\frac{1}{2}$ x 11 x 25 in., for the sides; two pieces, $\frac{1}{2}$ x 11 x 14 in., for the ends, and one piece, $\frac{1}{2}$ x $15\frac{1}{4}$ x $26\frac{1}{4}$ in., for the top. The legs required four pieces, $1\frac{1}{2}$ x $1\frac{1}{2}$ x 24 in. This lumber was all black walnut and the cost was about \$7.00. The plate glass, cut to size, and the edges ground, cost \$3.50.

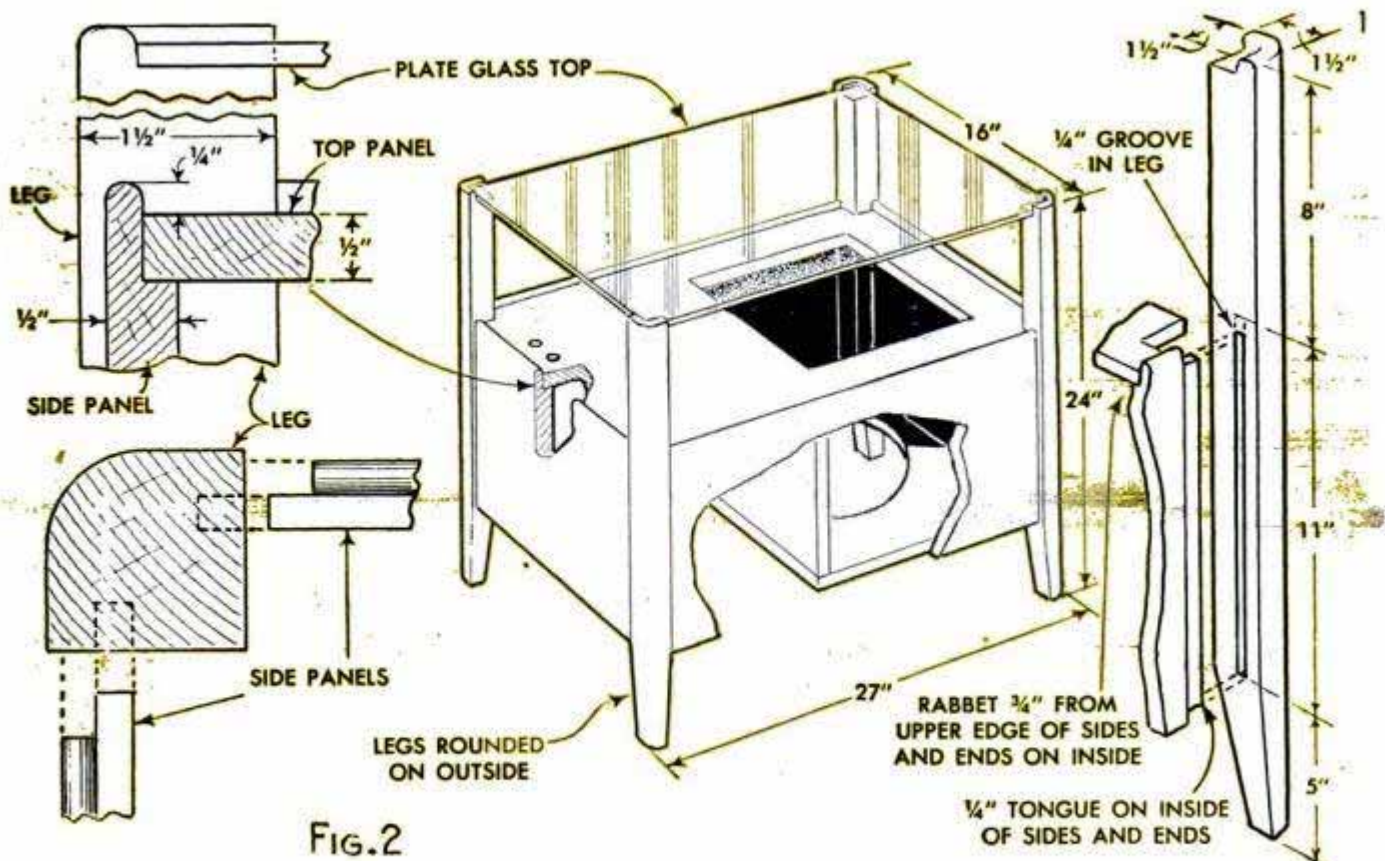
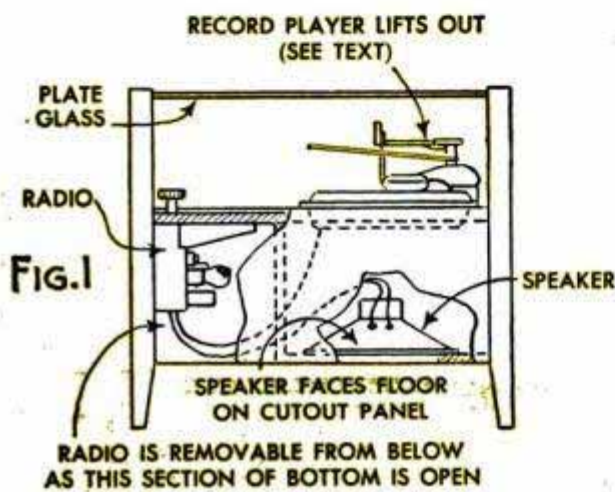


FIG. 2

POPULAR MECHANICS

readers know that they get smoother performance and quick starts when worn-out spark plugs are replaced with

AUTO-LITE SPARK PLUGS

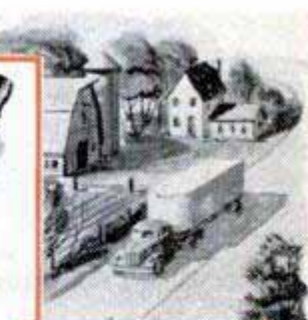
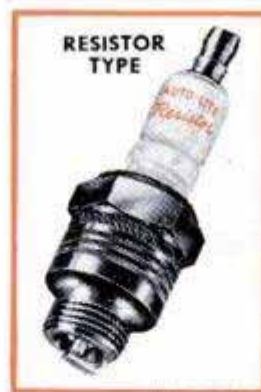
THESE three world-famous Ignition Engineered Auto-Lite Spark Plugs have been selected as original factory equipment on millions of America's finest cars, trucks and tractors.

- **Auto-Lite Resistor Spark Plugs** offer greater gas savings plus benefits found only in automotive type spark plugs with built-in resistors.

- **Auto-Lite Standard Spark Plugs** offer unsurpassed quality and unbeatable performance.

- **Auto-Lite Transport Spark Plugs** are especially suited to rugged farm, truck, bus service and give lowest cost per mile of spark plug operation.

See your Auto-Lite Spark Plug Dealer today, because "You're Always Right With Auto-Lite."

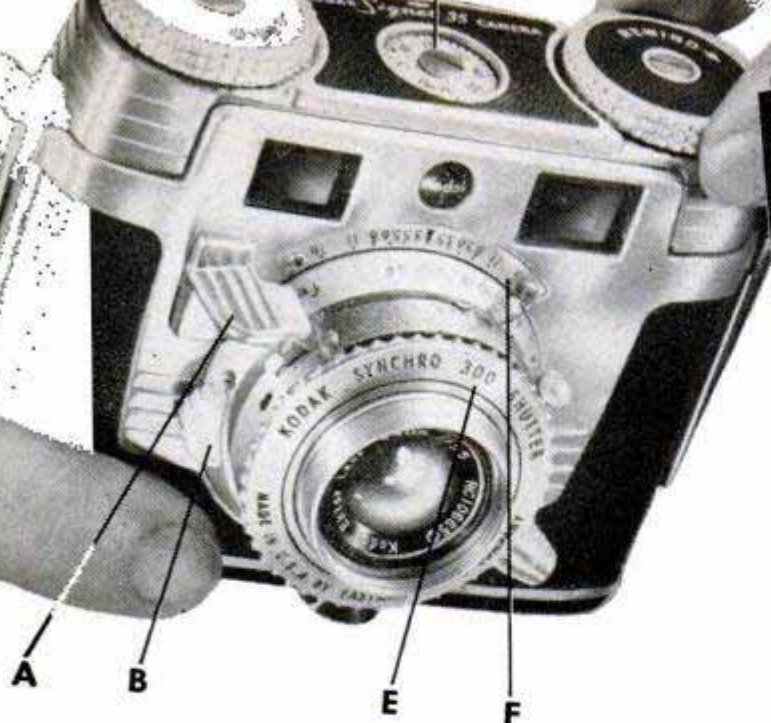


Auto-Lite Spark Plugs—Patented U.S.A.

TUNE IN "SUSPENSE!" . . . C B S RADIO MONDAYS . . . C B S TELEVISION TUESDAYS

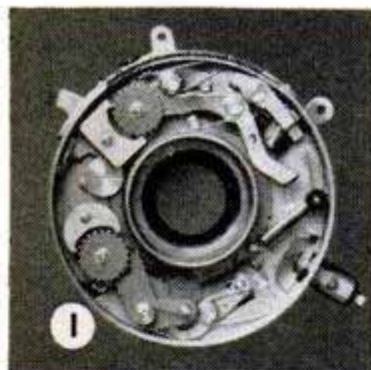
Kodak's newest color miniature with world-famous **EKTAR LENS**

Here's a gem of a range-finder "miniature" that boasts a Kodak Ektar Lens (f/3.5 Lumenized)—famed as the finest in countless photographic fields—unsurpassed for producing sharp, brilliant color slides for projection or full-color prints. Be sure to see the Kodak Signet Camera at your dealer's—only \$92.50.

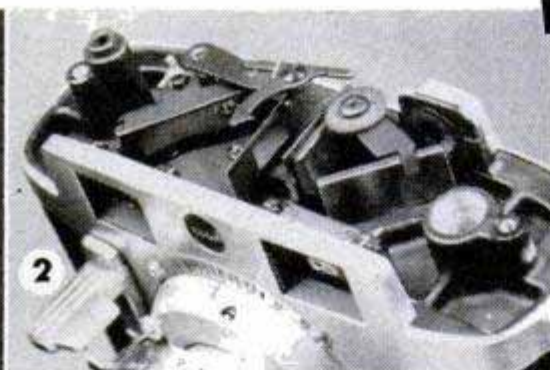


EASY-TO-USE CONTROLS

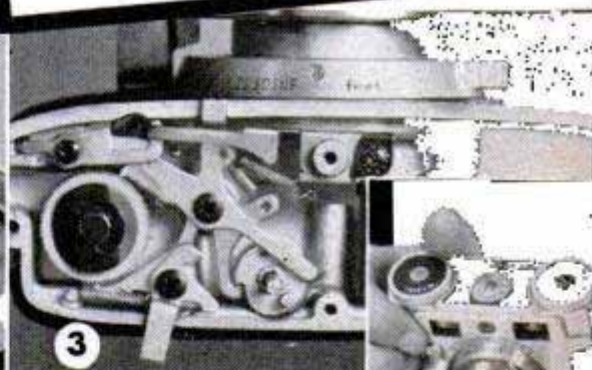
- A** Feather-touch shutter release bar
- B** Finger-tip control for superimposed-image range finder
- C** Winding knob has interlocks for double-exposure prevention and film stop
- D** Easy-to-read exposure counter
- E** Shutter with speeds up to 1/300, built-in "flash"
- F** All lens-and-shutter settings visible from above



1. Shutter mechanism is sturdily built for lasting reliability. Accurate flash timing for the popular No. 5 and 25 lamps at all speeds—1/25 to 1/300. "B" setting for time exposures. Sturdy, 2-blade design is exceptionally efficient.

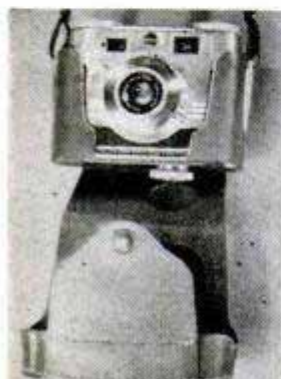


2. Superimposed-image range-finder mechanism is rugged, with all parts generously dimensioned. Spring-loaded, V-block bearings eliminate the small



bearing variations that cause serious range-finder errors. Range finder is combined with view finder for rapid focusing and framing through a single window.

3. Film-advance mechanism is smooth and jam-proof. Film can be advanced with a flick of the thumb (see inset). Exposure count and double-exposure prevention are automatic, but deliberate double exposures can be made at the touch of a lever.



For protection and convenience—Handsome, tan leather field case with neck strap.
\$8.50.

For brilliant indoor shots—the Kodak Flashholder, Model B, is quickly attached for synchronized flash pictures.

\$10.55.



The "payoff" in
color photography
is a

BRILLIANT SHOW

On your screen . . . on your viewer . . . it's the show that counts. 2x2-inch slides of travels, home scenes, lecture subjects sparkle with new brilliance in living room or auditorium when shown with the right equipment. On this page you'll find a selection from which to choose. Ask your Kodak dealer for a demonstration. He'll be glad to help you.



Kodaslide Merit Projector—Features improved slide-feeding mechanism—you feed slides in top of projector, minimizing jarring of instrument. Includes Kodak Projection Ektanon Lens, 5-inch $f/3.5$. \$26.10.



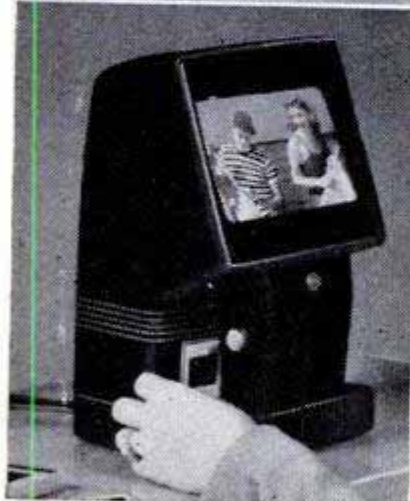
Kodaslide Projector, Model 2A—Ideal for small shows. Heat-absorbing glass protects slides. Powerful lamp projects images up to 7 feet wide. With Kodak Projection Ektanon Lens, 5-inch $f/3.5$, \$52.80.



Kodaslide Table Viewer, Model A—Projector, screen, and slide changer in a single unit. Projects brilliant images even in a lighted room. Takes 75 cardboard or 30 glass slides. \$97.50.

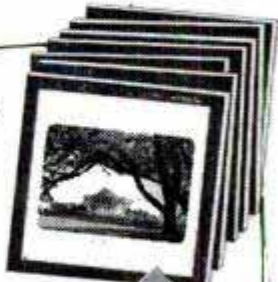


Kodaslide Projector, Master Model—For large-group showings. Fast lenses and 1000-watt lamp can deliver more light to screen than any other 2x2-inch slide projector. Turbine-type fan cools both sides of slide. Choice of four projection lenses. From \$169.



Kodaslide Table Viewer, 4X—This new low-priced viewer enlarges slides more than four times on its built-in screen. Ideal for effortless showings to small groups. \$49.50.

FOR A SURPRISE SHOW—
Treat your audience to professionally prepared color slides, too. Many interesting subjects at nominal cost. Ask your Kodak dealer.



Prices are subject to change without notice and include Federal Tax where applicable

EASTMAN KODAK COMPANY, ROCHESTER 4, N. Y.

Kodak

(Continued from page 119)

fractional cups, and the cup is notched for sight reading. Someone did stop to think that it must be arduous for a blind housewife to measure oatmeal, flour, sugar or coffee.

There's even a fantastic adding machine for the sightless which can total up to \$999.99. It looks something like a small cash register. Five wheels carry tabs around their outside edge, 10 of the tabs always being exposed on each wheel. Every tenth tab is turned to point vertically, while remainder are horizontal. For sighted use, the answers are read in windows across the center of the machine. For touch reading, the answers are found by counting the number of positions the "ten" tabs are down from the top. Addition is accomplished by counting up from the bottom. Thus, to add seven and seven, a blind person counts up to the seventh tab on the right column, and that tab is pulled down. Then repeating, the second wheel pulls down one position and the answer can then be read off as 14. No tape is used on the machine at all, but tape can be inserted that punches out figures in Braille for permanent records.

There are compasses, protractors, tracing wheels, foot rules, yardsticks, weighing scales and even a flameless cigarette lighter, which depends upon the generation of heat by passage of alcohol vapor through a platinum-coated sponge. It works well in strong winds and saves a blind person many a painful burn.

From grocers' scales, to check on those who might cheat a blind person, to bathroom scales, to a pocket calendar in Braille, the new developments are endless. There is hardly a sizable manufacturer in the nation who has not cooperated fully in developing one or more of these aids for the sightless. And, most are sold at cost.

It is difficult to think of an area of life and activity that has been neglected in this merciful development for the handicapped.

Nine-Mile Tunnel Through Mountain Solves Mexico City's Water Problem

Completion of a nine-mile tunnel drilled through the hard rock of a 14,000-foot mountain has won Mexico City a 400-year-old battle for an adequate water supply. It reverses the normal flow of Lerma Lake's water to the Pacific and turns it toward Mexico City, which is on the Gulf watershed. The project, begun 10 years ago, gives the 7600-foot-high capital 400,000 cubic meters more water daily.



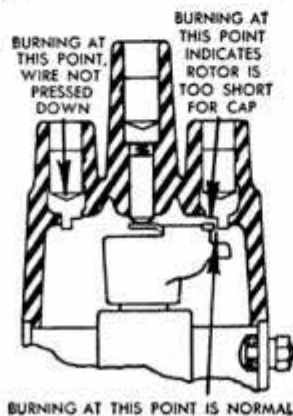
Care and Feeding of Engines

BY S. P. CORP

COLD-WEATHER STARTING

One cause of hard starting in cold weather can be ignition trouble. One cause of ignition trouble can be high resistance in the heavy wire to each spark plug, or from coil tower to distributor cap. A leak or dirty connection can cause a lot of trouble.

First: Stop engine. Grasp each wire near top of distributor cap and try to force it down. You may feel it slide into place. Out of place, it could have caused hard starting. *Next: Pull out one wire at a time and see that clip is clean.* Look into wire tower with a flashlight; if dirty, clean with abrasive paper on end of a pencil. Replace wire, making sure it is down in the cap. Do this with each wire, even the coil wire. Clean top of distributor with carbon-tetrachloride.



STOP-LIGHT SWITCH

Your stop-light switch can run your battery down. This small hydraulic switch on the brake line is closed by pressure when brakes are applied. Dirt and dust with oil vapor will at times cause a current flow when switch is open. Make sure connections are clean and tight.

When replacing this switch, have the new one ready to install at once, in order to avoid losing brake fluid. Have someone depress brake pedal slightly, to fill fitting as old switch is removed. Install new switch quickly and tightly. Then replace wires. If brakes are then spongy, bleed air from brake line.

IF YOUR CAR SMOKES TOO MUCH

An engine that uses too much oil needs new Sealed Power piston rings. The Sealed Power MD-50 Steel Oil Ring does the world's best job of oil control, even in badly tapered and out-of-round bores. Your dealer has Sealed Power Rings or can get them for you. They save gas, save oil, restore original power to your engine and lengthen its life. A postal to "Sealed Power, Dept. G-2, Muskegon, Michigan," will bring you free a helpful book, "More Power, Less Gas, Less Oil!"



Ball Bearing Arbor—Lubricated for Life!

DUNLAP 8-inch REG. U.S. PAT. OFF. Tilting-Arbor Bench Saw



Saw Only
\$46⁹⁵ Cash
Without motor, ex-
tensions, bench
Only \$5.00 Down on
Easy Terms

Complete Outfit as shown
\$110⁰⁰ Cash \$11.00 Down
\$10.00 Monthly
With motor, pulley, belt, side table ex-
tensions, bench, light and Powr-Pan!

These 5 important features mean
faster, easier, more accurate work..

1. Precision ball bearings — sealed and lubricated for life!
2. 8-inch blade — the most popular size!
3. The tilting arbor feature—blade tilts instead of table!
4. ONE lever locks fence at BOTH the front and the back!
5. Grid type side extensions!

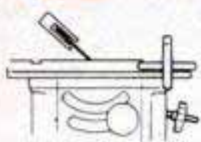


Table ALWAYS level. Work lies flat regardless of angle of cut

Only \$5 Down . . . puts this saw in your shop

We've made many careful comparisons . . . and we know of no other bench saw of this size and type that beats this 8-inch DUNLAP. Its rugged quality and exceptional accuracy in operation are almost unbelievable! At this amazingly low price it is truly a sensational power tool value . . . one of the best we've offered, ever!

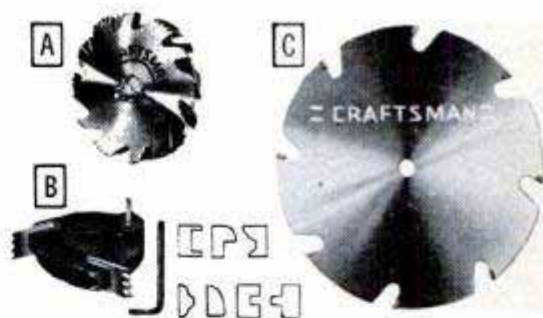
Floating-drive motor mounting supports motor on a special mount on bench behind saw . . . smoothes vibration . . . permits easier tilting . . . and eliminates need for a separate motor. (Just slip the belt off, pick up the motor, and use it on other power tools with our regular motor rail clips.)

Super-lubricated sealed precision ball bearings have larger oil chambers than are usually used—NEVER need further lubrication. These double-row ball bearings form integral unit with arbor shaft and prevent misalignment.

Greatly improved fence design. Fence squares directly against front of table instead of usual guide bar, for accuracy. Can be used on either side of blade. Easily removed if desired.

17 x 14-inch table of cast semi-steel has top AND sides machined. 8-inch combination blade (1/2-in. bore) gives up to 2 1/4-inch depth of cut; tilts any angle up to 45°. Not a stripped model—complete with blade, guard, splitter, miter gauge, fence and machine pulley. (Use minimum of 1/2-H.P. motor; 3450 R.P.M. with 2 1/2-in. pulley, 40-in. belt; or 1750 R.P.M. with 5-in. pulley, 44-in. belt.) **Complete Outfit (as illustrated)** includes CRAFTSMAN 1/2-H.P. 3450 R.P.M. ball-bearing capacitor motor (110-120 volt 60-cycle AC); 2 1/2-in. motor pulley; 2 side table extensions; 40-in. belt; adjustable steel power tool bench; tool light; and Powr-Pan! for plugging in. See this DUNLAP Saw today at your nearest Sears Retail Store.

Your nearest Sears Retail Store will furnish you with exact selling prices which will not exceed ceiling prices under applicable price regulation of O.P.S.



Bench Saw Accessories

- A CRAFTSMAN 6-in. Dado Set.** Dados, rabbets, grooves. 1/2 or 3/8-in. arbor. \$9.50
- B CRAFTSMAN Molding Cutter Head.** Fits most bench saws with 1/2 or 3/8-in. arbor. 4-in. diam. With Allen wrench \$4.50
Cutter Bits for use in above head. 1-in. wide bits cut styles as shown. Styles \$2.95 per set, and up.
- C CRAFTSMAN Carbide-tipped Saw.** New! Safer—has only 8 teeth projecting only .020 in. above non-cutting edge. Tungsten carbide tipped blades last 20 times longer than ordinary circular saw blades! For ripping, cross-cutting or mitering. 5/8 to 10-in. diameters; all arbor sizes. . . \$10.85 and up.

CRAFTSMAN and **DUNLAP** Tools by **SEARS, ROEBUCK and CO.**
REG. U.S. PAT. OFF. REG. U.S. PAT. OFF.

Famous for fine quality . . . precision performance . . . low price!

Here's how for home painters



Radiators — what to beware of; how to take care of. Never finish a radiator in metallic paint. According to the American Society of Heating and Ventilating Engineers, metallic paint reduces heating efficiency. By using same color

paint (Devoe Velour Flat Finish) as you have on walls, you can "hide" an ugly radiator. Apply thin coats, so heat won't crack finish.

Here's the right way to paint a wall. Always start painting in the corner nearest the main source of light. This way you can easily spot any places you've missed. Start right in the corner, working from top to bottom in three-foot strips. Spread paint evenly, stroking with a light up-and-down movement at the finish.



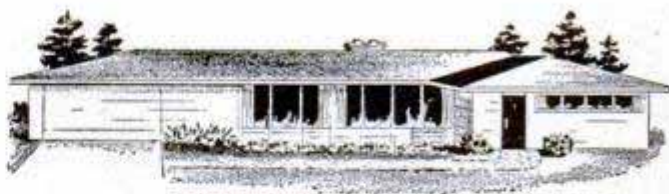
Pour paint accurately — without a funnel. If you have to pour paint from one can to another and no funnel is handy — here's a trick that needs no special equipment. Hold a small stick across the mouth of the pouring can — and pour the paint down the stick. It will

guide the flow accurately, with no spilling.

Easy way to take off old wallpaper. Using the spray attachment on your vacuum cleaner, soak the paper with warm water. When it's soft and saturated, strip it off with a broad scraping knife. Then patch plaster cracks, sandpaper rough spots and you're ready for a priming coat of paint — or new wallpaper.



You can get all the painting accessories that you need — and many more helpful tips at the sign of the Devoe Diamond. Why not stop in and see your Devoe Dealer very soon? You'll find his name listed in the Classified Phone Book.



As a service to our readers in solving the hundreds of problems pertaining to a home — inside or out — the editors of *Popular Mechanics* invite you to present your problems to The Clinic Editor for help and advice. Address your questions to The Clinic Editor, *Popular Mechanics Magazine*, 200 East Ontario Street, Chicago 11, Ill.



Screen Stains

Q — I have bronze window screens which have been in use only two seasons, but the bronze wire has turned dark colored and for some reason is causing discoloration of the paint on the screen frames, window sills, and even on the siding below the windows. I had always understood that bronze screening was

corrosionproof and would last indefinitely without any finish being applied. Is there any way I can prevent the discoloration of the window frames and house siding? — A. Y., Calif.

A — If not damaged, the bronze screening will outlast the frames. The coating which forms on the screen does not destroy the metal but will discolor painted woodwork, such as the screen frames, window sills and painted siding directly below the windows as you describe. A good protective finish for bronze screening, also black or galvanized screening, consists of a mixture of varnish, 2 parts, linseed oil, 1 part, and pure turpentine, 1 part. A suitable applicator is easily made by tacking a piece of pile carpet to a small block of wood. There also are available clear-plastic sprays, supplied in pressurized containers which may be used as a coating for bronze screening. Although more costly than the varnish-oil-turpentine mixture, these sprays are less work to apply and may give better results in the long run. Either finish will help to prevent the discoloration of the window frames and siding, but for best results the finish should be renewed periodically.

Preventing Mildew in Clothes Closets

One of our readers in the Philippines, Robert K. Zimmerman, has outlined the following suggestion for preventing mildew in clothes closets:

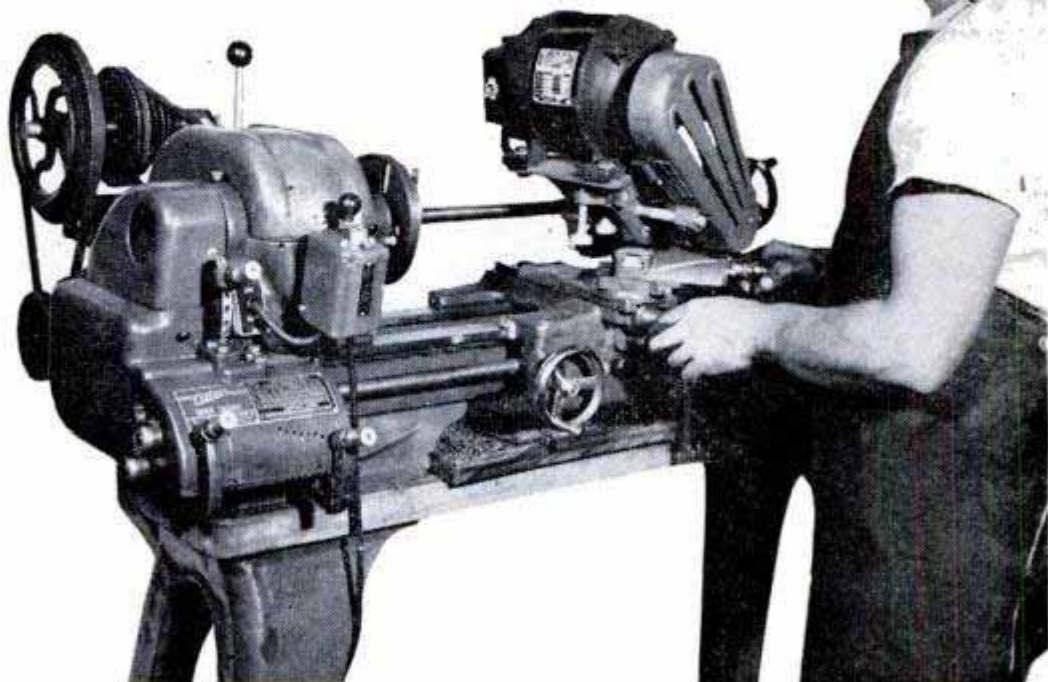
In the average-sized clothes closet two 60-watt lamp bulbs, kept burning constantly, will supply sufficient heat to "dry" the air in the closet and prevent mildew from damaging clothing and leather or canvas shoes. Use a 60-watt bulb in the ceiling fixture and install an outlet box and socket at a point just above the baseboard. The lower bulb should be protected with a heavy wire guard or some other adequate provision to prevent breakage and should be so placed that no clothing will touch it or hang directly over it. In some cases it may be permissible to control both lamps with a single wall switch, but as a rule it is more practical to install a separate switch for the lower bulb. The closet door should be kept closed at all times while the lamps are burning.

(Continued to page 240)

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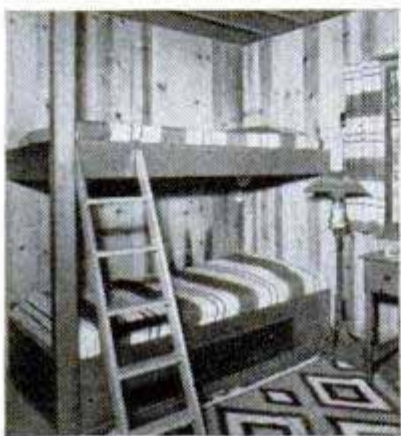
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- * IDAHO WHITE PINE
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- * SUGAR PINE

(Editor's note—It should be emphasized that this arrangement is suitable only for small to medium-sized closets. In some cases it may be permissible to use a lamp cord to supply current to the lower bulb but do not permit the cord to lie loose on the floor as it may be crushed and broken when the door is closed. If the lower bulb is to be installed permanently, consult the requirements of your local electrical code before making the installation in this manner.)

Surfacing Concrete Floor

Q—I'm laying an asphalt-tile floor in my basement recreation room. There are slight irregularities in the troweled surface of the floor which prevent the tile from lying flat. As a remedy, I was told to spread the cement a little thicker in the low places, but this didn't work. Fortunately I discovered this before finishing the job. Isn't there a surfacer available which is suitable for leveling a floor in the condition described?—T.R., Me.



A—Yes, there are surfacers available, but first you will have to dispose of the problem of completely removing the cement which was used under the tile. The manufacturer of the cement used will be able to supply you with a cement solvent, which will be available through your local dealer in floor coverings. When using the solvent, follow the instructions in detail. After the cement has been removed, the floor should be thoroughly scrubbed before the surfacing material is applied. When applying the surfacer, be sure to follow all preparatory steps specified in the instructions. Another method, frequently used to level irregularly surfaced concrete floors, or floors that have cracked from various causes, is to etch the surface with a hydrochloric (muriatic) acid solution and then trowel on a layer of concrete averaging about 1½ to 2 in. This type of "overfloor" should be poured and troweled at one time. It is never advisable to pour it in sections as new cracks may result.

Cedar Closet Lining

Q—I have recently moved into an older-type home which has two cedar-lined clothes closets both on the second floor. The cedar lining seems to have entirely lost its characteristic pungent aroma and appears rather dull and unattractive. I have been told that I can apply a half-and-half mixture of turpentine and boiled linseed oil which will brighten the wood without affecting its moth-repellent properties. Is this advisable?—M.B., Ky.



A—No, unless you wish merely to enhance the beauty of the wood and sacrifice whatever repellent properties it may possess. Ordinarily, cedar closet lining is not finished, as any ordinary finishing material will seal in the natural oils, the slow evaporation of which causes the wood to give off its characteristic aroma. If the lining is dulled with age, you can brighten it up by going over the surface lightly with fine steel wool. This will remove accumulated dust and restore the original color. Then, if you wish, you can apply the special preparation which is supplied for the purpose of restoring cedar closet lining. This consists mainly of certain cedar oils which penetrate the wood without changing its natural color appreciably. When applying this preparation, be sure to follow the manufacturer's instructions in all details. If the wood is rough in places, it's generally a good idea to sand the entire wall, using several grades of sandpaper ranging from medium to fine grit.

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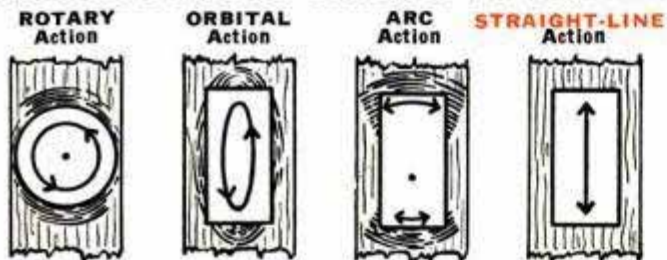
—Fastest seller in the field for rugged power and smoothest finishes at lowest cost. Ample power for furniture and cabinet making, boat building or refinishing, resurfacing large areas. Great for building operations—woodwork, stairs, dry-wall joints, siding, etc. Does a superb polishing job! Weighs 5 lbs.; 21 sq. in. of sanding surface; over-all size 3 1/8" x 4 1/2" x 7". Price includes steel carrying case, 25 asst'd. abrasive sheets, and a sheepskin pad.

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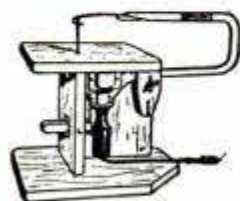
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DREMEL MFG. CO., Dept. 112-B, Racine, Wis.

(Continued from page 161)

imparts insulating qualities to the snow. The tube was hooked up to a short-wave transmitter that automatically turns itself on once a day and broadcasts the Geiger-tube clicks. These are picked up by a receiver in the laboratory, counted on an electrical counter and are transposed directly into a reading of snow depth at the distant location.

The water content of the snow at the location of one of the radio snow stakes is assumed to be the same as at the laboratory, where it is measured from time to time with an electrical instrument fitted with two prongs that serve as electrodes that are plunged into the snow. The conductivity of the snow between the prongs is a measure of its water content.

To learn the amounts of rainwater that may be absorbed and retained by snow that is lying on the ground, the research staff paved a 1200-foot triangle and built a wall around it so that all the moisture that fell in the paved area would have to run off through a single opening where it could be measured.

After winter storms had filled the triangle with snow the investigators sprayed a measured amount of water onto it from

overhead sprinklers, simulating a rain storm, then measured the water that drained away. The difference between the figures told how much of the water had been captured by the snow. The work was repeated under different temperature conditions to provide information on the way a snow pack can hold back or contribute to a flood, depending on temperatures.

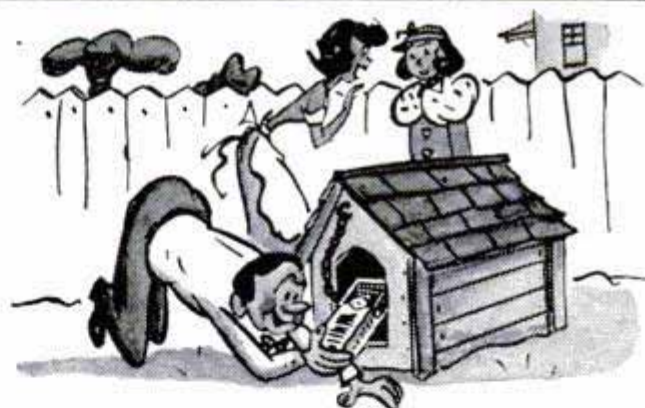
This winter the flood research at the Sierra laboratory is being completed and the area is being devoted to the Sipre program. From the flood studies that have been made, formulas and tables are being prepared by which floods and their severity can be forecast quite accurately. With this information, the operators of a dam can lower the water in their reservoir to take care of an oncoming flood by just the proper amount. They won't waste precious water by releasing too much of it, and they won't be inundated when a flood comes down because they hadn't released enough water to balance it.

To get a long-range picture of where flood troubles can be expected later on in a season, the engineers "fly the snow line" during winter months all along the Sierra range, from Mount Shasta in the north to Bakersfield in the south. An observer in the plane maps the lower limits of the snow

(Continued on page 244)



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fields and gauges snow depths by observing the tops of fence posts and other objects of known heights. Too, information from the state-conducted snow surveys on the depths of the snow packs in the different watersheds is used.

A river basin that is found to have plenty of snow is regarded as being safe; that is, the snow packs can absorb and retain a great deal of the rainfall, slowing down the runoff, and the main body of water will come down in normal amounts during the spring.

A basin with little snow on the ground, however, is a potential danger area. One warm rain could melt the snow and add the snow water to its own precipitation, causing an immediate and heavy runoff. That's the kind of information the engineers like to have ahead of time.

Mother of the Minesweepers

(Continued from page 104)

launched faster. In dirty weather, not a second can be lost. Men scramble along the wing walls, climbing over each other to grab lines and make them fast. Hoarse shouts add to the din of crashing steel.

Everything is timed to the last instant. As the boats start coming aboard, the mother

ship begins to deballast at once—forward tanks first. If the engineers are on their toes, the forward end of the docking well will be tipped up and dry, and the first boats will be grounded seconds after they're lashed in place. Deballasting proceeds sternward, so that as each threesome of boats is tied up, they'll ground immediately. Hence, they can't bang around as they would if afloat.

Once the stern gate locks in place, everything is snug. "You'd think," says Shaffer, "that heavy seas might splash over the top of the gate, but since we never back down into a sea, we never ship any water—even though the waves tower above the 18-foot-high stern." "But," he adds, "we do get something that no other ship afloat can match. Plenty of times after deballasting, nice big fresh fish are left flopping around the docking well. We've had lots of fresh sea bass for supper as a result."

The business of partial ballasting, so that the after end of the well only is afloat, has other advantages than just beaching the boats in heavy weather. It enables the LSD to become a launching beach for amphibious craft.

LVT's, or amphibious tanks, for instance, can be lowered from the superdeck to the bow end of the docking well by crane.

(Continued to page 246)

UNCLE WALTER

IT SMELLS GRAND



SNIFF IT! YOU'LL SAY "THAT'S FOR ME!"

IT PACKS RIGHT



CUT TO PACK IDEALLY!

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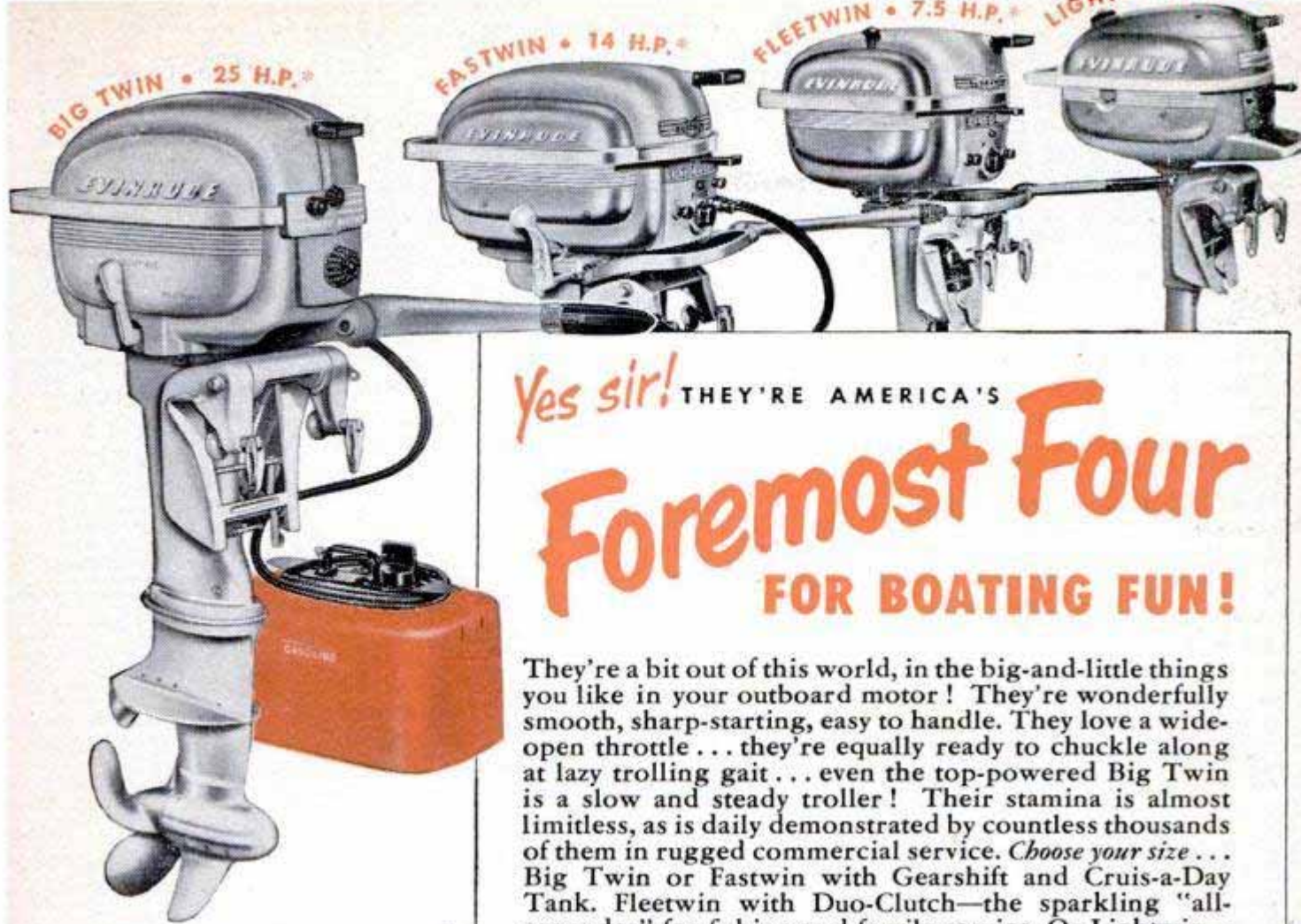
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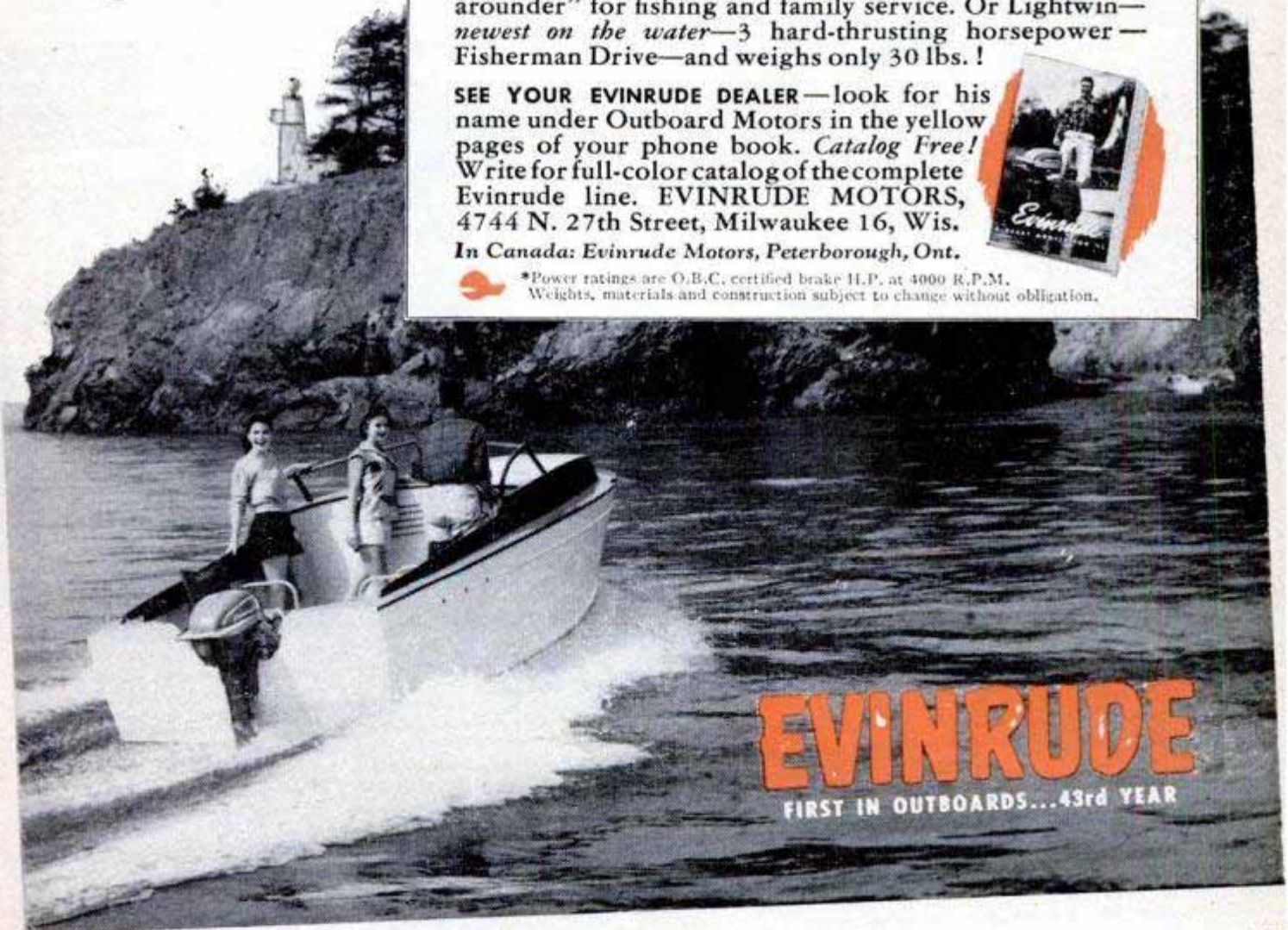
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EVINRUDE

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tanks are filled and the after end of the well sinks into the ocean. The amphib, sitting high and dry in the bow end, simply rumble down the sloping deck as though they were taking off from a beach, enter the water half way down, and by the time they go through the stern gate, they're afloat. As each group of amphib takes off, others are lowered to the "beach" by midship crane from the superdeck.

There is no end to the versatility of this type ship, according to Captain Shaffer. Some even have a mezzanine deck between the superdeck and the docking well, with a special ramp to handle tanks. One of these, the *Casa Grande*, can handle 100 LVTs and 100 DUWKs.

The *Lindenwald* and a sister ship, the *Gunston Hall*, have just been "winterized" for Arctic work. Their hulls are newly strengthened and insulated to brave the ice pack. Crane controls and deck equipment are sheltered. The bridges are housed, and there are steel shacks for bow and gun look-outs. Their new reciprocating engines can give them fast, sudden back-ups in ice-floe regions.

With all of this, LSD-6 and her crew will be able, if necessary, to add more honors to her battle-studded history. According to the bronze tablet on her quarter deck, she

cific battles in World War II—Lingayen Gulf, Okinawa, Kwajalein, Emirau and Saipan.

What the next new role of the LSD will be, no one knows, but you can be sure it will be something fantastic because the Landing Ship Dock is a fantastic kind of ship. Right now a new one—much bigger than any of the 456-footers afloat—is either building or about to be built. What new wrinkles she'll have is anyone's guess.

You get an inkling when Captain Shaffer, standing on the *Lindenwald's* chunky bridge and sweeping the horizon with his glasses, says, thoughtfully—"She's the hottest ship in the amphibious force today. We haven't even begun to scratch the surface of her potential."

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Australia has begun mining its big iron-ore deposit at Yampi Sound, in the north-west corner of the continent, far removed from the steel mills on the east coast. There are an estimated 100 million tons of high-grade ore in the deposit, which can be mined by cheap open-cut methods. The ore is loaded aboard ships which travel 3000 miles to the mills, the equivalent of a crossing from New York to England.

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Cross Cut Blade.....\$2.95

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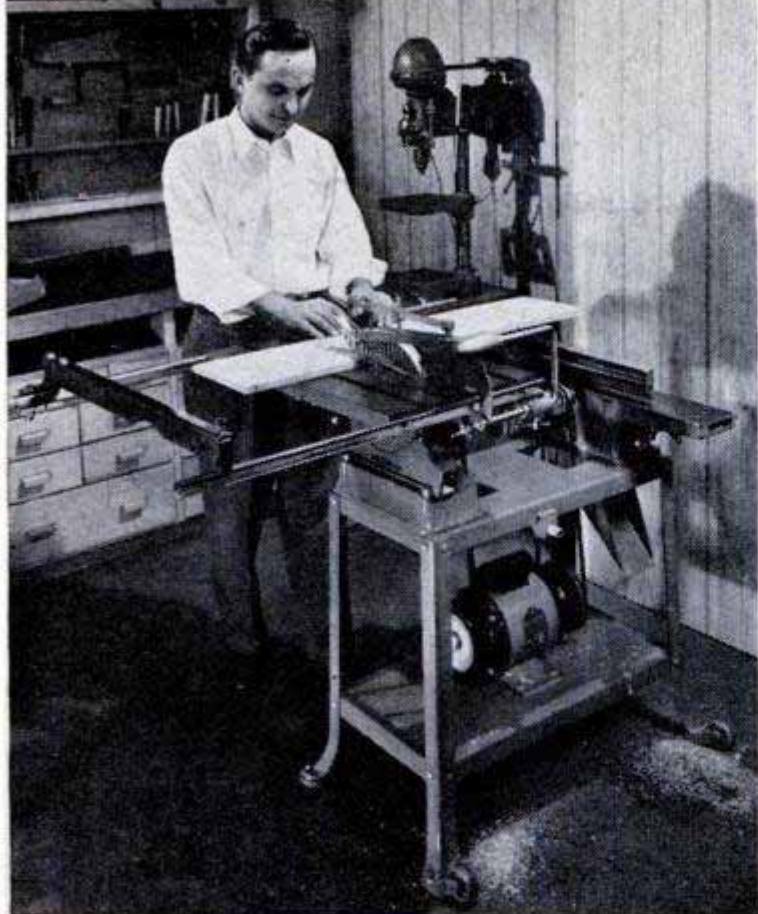
If 8" combination Rip and Cross Blade is desired, enclose \$2.95 extra and check square at left.

CUTS 2" x 6s" in 2½ SECONDS!

You can mitre, bevel, or saw any length wood at any angle yet the table and work are always level. A simple adjustment of the patented, improved mechanism tilts the blade up to 45°. Patented built-in motor mount eliminates compli-

ated gears, always keeps belt at correct tension. Has height lock for dadoing. Blade raises and lowers. Does everything a \$60 saw will do! Cuts joists, siding, rafters, frames, joints, slots, etc. Accurately rips, wide or narrow panels! With attachments cuts dadoes and moldings! Mounts on any kind of tool bench!

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**almost every
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 you'll ever need
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**... AND IT COSTS
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- With the drill press, you can drill, mortise, rout, carve, sand, shape, polish and grind—and with the exclusive Delta interchangeable spindle, it takes only seconds to put on the new cutting tool.

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Chrysler Corporation's program helps people build better products and better careers for themselves

George Heyer, noted magazine photographer, turns his camera for this picture story on a program of importance to American production — how people learn to build new jet engines and military vehicles, and the cars and trucks that play a vital part in American life.

Heyer's pictures were made in Chrysler Corporation factories, classrooms and training shops. He shows a few of the thousands of men and boys now taking part in Chrysler's widespread training and technical education program.



"TOMORROW DEPT." Intent young Robert Chura—son of a Chrysler Corporation employee—learns how to use tools. In special workshops set aside by Chrysler, many boys work in wood, leather and metal under the guidance of veteran Chrysler artisans—borrowing from a "Library of Tools" to finish projects at home.



ON TRAINED MEN



CLASS IN JETS. These men are learning supervisory jobs for jet engine production at the Navy-owned Chrysler Jet Engine Plant in Detroit. Engineer J. E. Engstrom is teaching the latest in jet design. Like most Chrysler Corporation officials, these men came up from the ranks.



"GOOD MACHINES DESERVE GOOD MEN." Albert Bazner learns about grinders from machinist H. A. Nelson. Albert is a Chrysler Industrial Education apprentice, learning a trade—at good pay. In other courses, high school and college students earn both classroom credits and pay.

THEY THINK IN CLAY. At Chrysler Institute of Engineering, employee students D. M. Holiday, *left*, and Paul R. Diehl study body design with engineer Carl Hood. The Institute offers courses that compare with those in leading engineering colleges. At Chrysler, employees find training to improve themselves . . . become more valuable to America now when production need is great.



CHRYSLER CORPORATION

PLYMOUTH, DODGE, DE SOTO,
CHRYSLER CARS & DODGE TRUCKS

Chrysler Marine & Industrial Engines • Oilite Powdered Metal Products

Mopar Parts & Accessories • Airtemp Heating, Cooling, Refrigeration • Cycleweld Adhesives & Building Panels

QUALITY PLUS
PRECISION . . .

Shopmaster

Tools and
Accessories

for
**BUDGET-MINDED
Hobbyists**

CIRCLE SAW BLADES

- 8" blades combination crosscut and rip \$3.95 each
- 8" Hollow-Ground Combination Blade (3/8" bore) \$9.95
- Also 10" and 7" combination blades

QUALITY DADO SETS

5 1/2" . . . \$7.45 to \$10.95

LATHE TURNING TOOLS

Professional set of 5 and 8 tools . . . \$7.95 and \$14.50

JIG SAW BLADES

7 different sizes—package of 6 . . . 35c to 50c

SABER SAW BLADES

3 different sizes—package of 6 55c

The Complete DRILL PRESS MORTISING KIT

Chisel holder, fence, hold-down, bit and chisel . . \$14.50

DRILL PRESS SHAPER KIT—

Adapter and table bearing and three three-wing cutters \$9.75

ROUTER ADAPTER KIT—

Has four 1/2" shank bits of 3/16" 1/4", 3/8" and 1/2" \$5.95

RUBBER SANDING DISC—Includes two 5" sanding discs, one lamb's wool polishing bonnet \$2.25

DRILL PRESS PLANING ATTACHMENT—Knives, cutter head and housing \$9.95

DRILL PRESS VISE—Opens 3" \$5.95

2" DRILL PRESS SANDING DRUM AND GARNET SLEEVE . . \$1.95
Garnet Sleeves for SD-640 Drum, 6 per package . . . \$1.00

FRONT TABLE EXTENSION \$4.45

BAND SAW RIP FENCE—for 10" or 12" \$4.25

DRILL PRESS COLUMN COLLARS \$1.50

6" and 4" JOINTER KNIVES—Set of 3 \$4.95

SHAPER COLLARS—Set of 10 collars. Graduations, 1/16" from 7/8" to 1 7/16" diameter. Have 1/2" centers . . . \$3.50

4 Versatile Tool Stands to select from \$6.45 to \$18.95

Other Lathe Accessories

SCREW CENTER
Use on any lathe with No. 1 Morse Taper headstock . . . \$1.50

FACE PLATES—4" to 6" Face Plate threaded both right and left hand. For 3/4"—16 thread headstock spindle . . . \$2.95

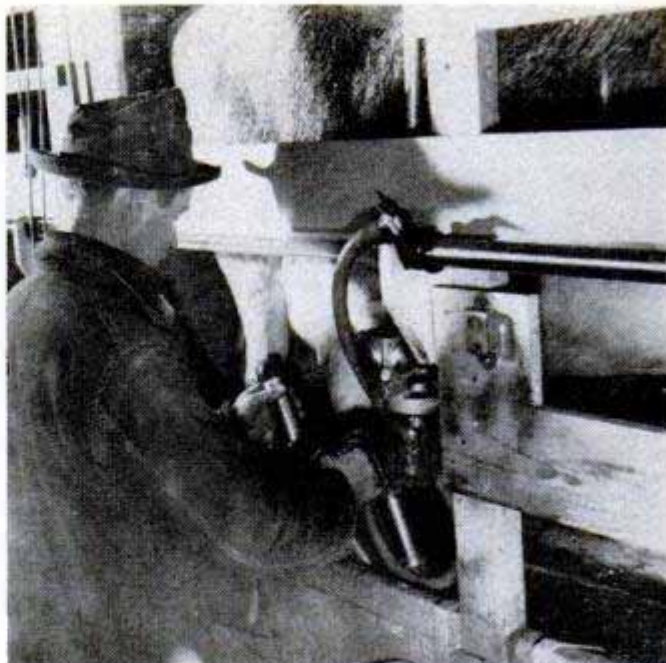
Four Jaw Chuck. Threaded 3/4"—16 \$9.95



SHOPMASTER, INC.

1214 Third St. S., Minneapolis, Minn.

See any one of the 5000 Shopmaster dealers in the United States. If one is not near, write



International Harvester Co. photo

Dairy farmers and health experts swear by the milking machine. It pipes milk direct from cow to can

machines, automatic watering, automatic barn cleaners and tractor manure loaders have made the difference.

Although they could not take all the credit for profound changes in farm management and farming practices, machines made many of them possible. Agricultural colleges, which sprang up soon after the Civil War, exerted small impact in their early years because actually they could find little to teach. Aside from formal outlines of geology, botany and a few other subjects, little was known that could be called agricultural science. Recognizing this, Congress in 1887 provided for state agricultural-experiment stations. New

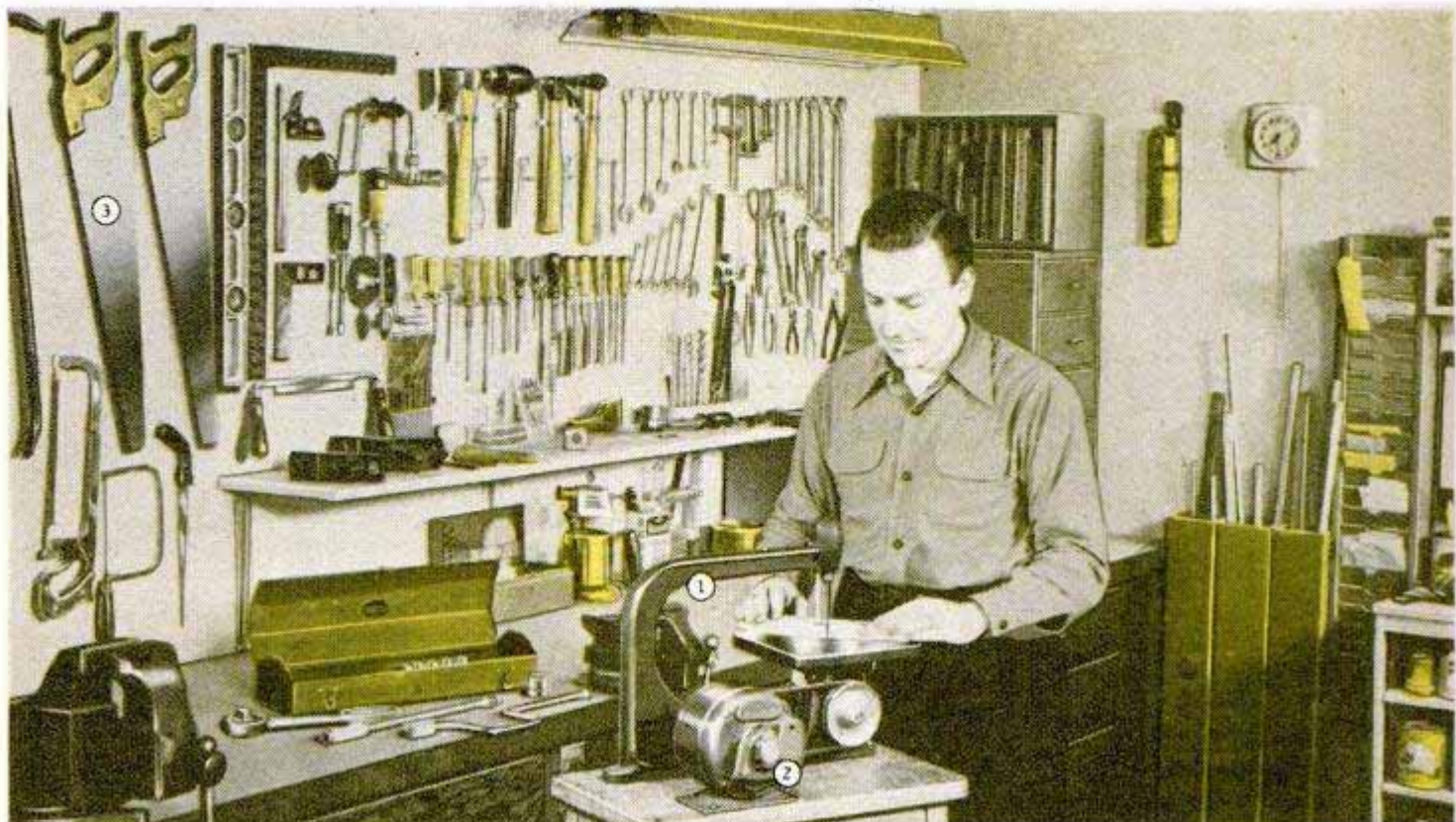
Mechanical pickers have reduced farmer's hours per acre in cotton fields from more than 100 to about 30

International Harvester Co. photo



(Continued to page 252)

With Prices Like These, No Wonder Thousands Choose Professional Quality Westcraft Tools:



Before you buy any tools be sure to see, try and compare Westcraft. Like thousands of other tool buyers, you'll discover these famous, shop-tested tools give you the same precision engineering and

lasting accuracy of other brands costing far more. Westcraft tools are fully guaranteed and are yours on easy terms. Here are a few from our complete selection — see them at Western Auto this week!

① **Tilt Table Jig Saw**, cuts to center of 24" circle. Scotch yoke, oilite bearings. Uses 5" pin or plain end blade. **\$19³⁵**
Yours now for only(2H1102)

② **½ HP Electric Motor**, 1725 rpm, 115 volt, 60 cycle AC. Split phase. GE guaranteed for 1 yr. Use with jig saw, washer, paint sprayer, etc. **\$17²⁵**
(2H1600)

③ **8-Point Crosscut Saw**. 26", 4 gauge, double tapered blade. Precision tempered and polished. Comfortable hardwood grip. Yet only.....(4HR6329) **\$4⁷⁹**



½" Electric Drill, 115 volt, AC-DC, 60 cycle. Drills metal, wood, plastic. Guaranteed 1 yr.(2H1379) **\$11⁹⁵**



14-Piece Accessory Kit with attachments for sanding, polishing, grinding, etc. **\$4⁷⁵**
Steel tool box....(2H1378)



Hacksaw, chrome-plated adjustable steel frame. Cuts 3 3/8" deep. Safety grip plastic handle. 10" blade (4HR4159) **\$2²⁵**



11-Piece Socket Set, ½" sq. drive. Alloy steel, chrome plated. For small nuts & bolts. Plastic box (HR2924) **\$3⁶⁹**

Professional Quality—Wizards of Performance

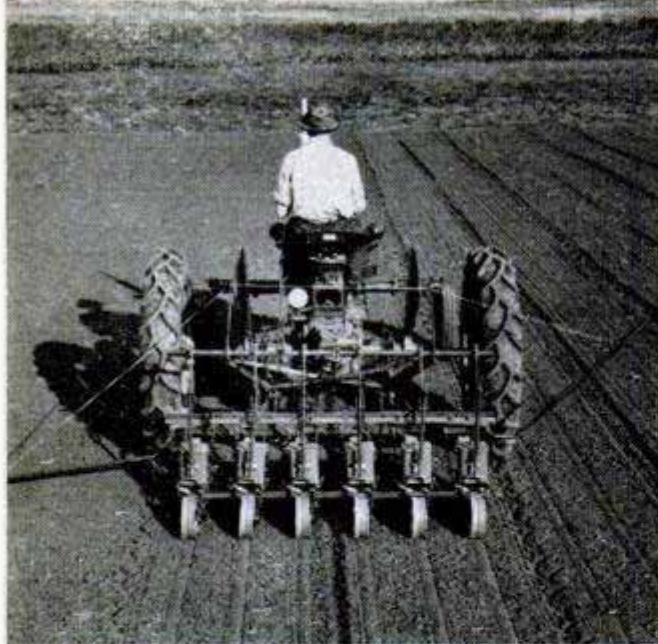
WESTCRAFT TOOLS

Sold by the largest group of associated tool departments in America

WESTERN AUTO
STORES & ASSOCIATE STORES

Sold
Only By

NOTE: Western Auto Associate Dealers own their own stores and set their own prices. Terms quoted are recommended terms, subject to variance. ©1952 Western Auto Supply Co., K. C., Mo. (PM22)



International Harvester Co. photo

Six-row beet planter is one of modern farmer's tools

knowledge emerged from these stations in a steady and important flow, but reached few farmers. The scientists did not know how to write for or talk to farmers. So, in 1914, Congress established the extension system which brought county agents, home-demonstration agents, and later 4-H club leaders into most counties.

The boys' and girls' 4-H (head, heart, hands and health) clubs, and the Future Farmers of America, which later were organized in connection with the vocational agricultural high schools, sharply stepped up farm receptivity toward scientific practices. The youngsters found the practices interesting. Their fathers found them profitable. Then the natural turnover of the generations put most farms by 1940 into the hands of men who had directly or indirectly been schooled by 4-H and F.F.A. ex-



Dearborn Motors photo

Tractor totes a hydraulically operated disk harrow

periences, or had learned to utilize the new techniques.

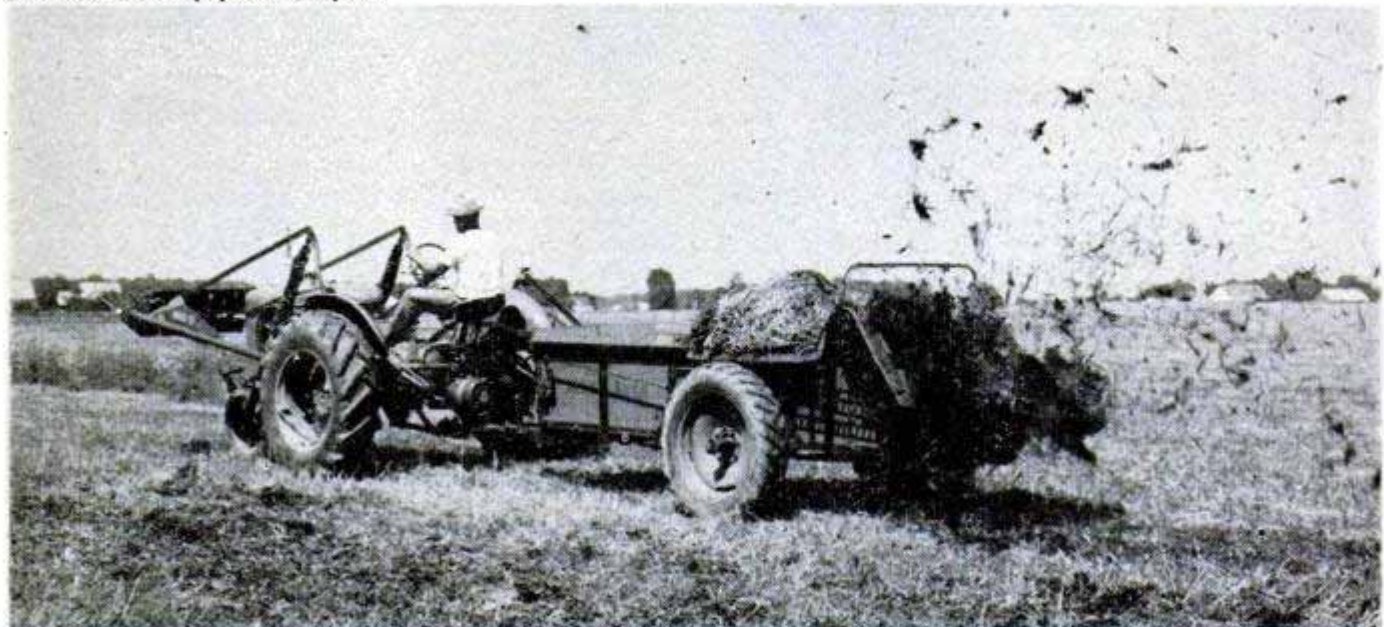
The techniques which 1952 farmers follow have originated in laboratories of private industry as well as in the Department of Agriculture and in the state experimental stations. Insects will be sprayed with DDT. Weeds will be fought with 2,4-D and other chemicals. Calves, pigs and chickens will grow 10 percent faster than their progenitors because minute quantities of new antibiotics, such as aureomycin and terramycin, will have been mixed into their feeds. These antibiotic effects, discovered only a couple of years ago, have created a multimillion-dollar market already for manufacturers, and have proved highly profitable to their farm users.

During the first half of the 1902-1952

(Continued to page 254)

Hydraulic manure spreader, with loader on front of the tractor, can do the work of many 1902 farmers

New Idea Farm Equipment Co. photo





1 Paying Out \$10 to \$30 A Month for "little" engine repairs? Burning up dollars—in gas and oil? Then you're *paying* for a WIZARD-IZED Engine. Why not get it?

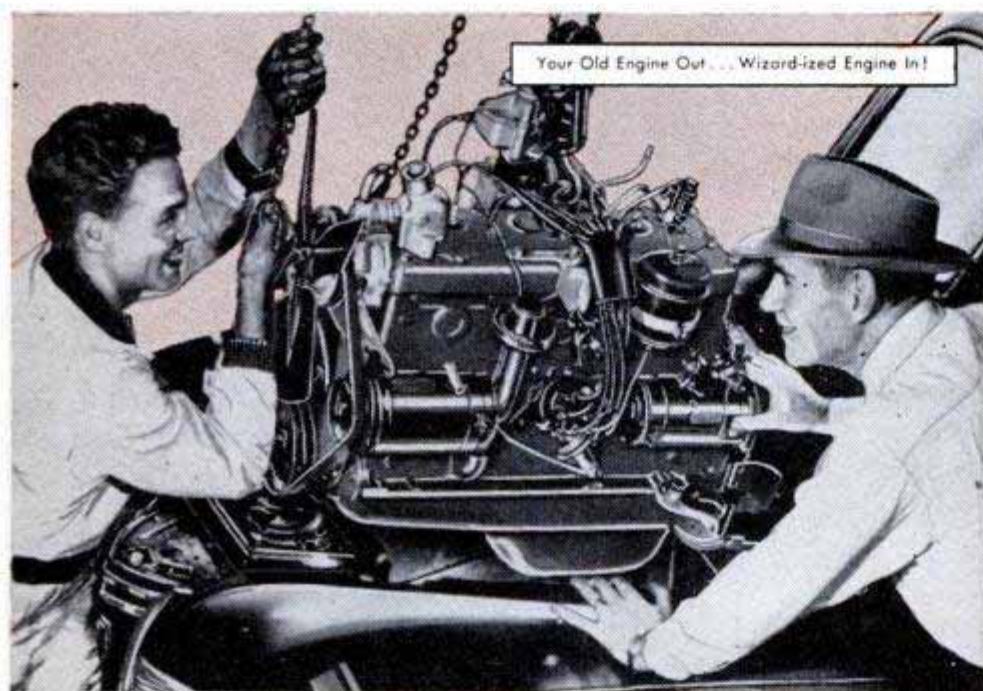


2 Afraid To Take Your Car out for fear the engine will "conk out"? Better to put your money in a WIZARD-IZED Engine—than in costly towing and repair bills!



3 Engine Too Sluggish And "Old" to provide the power to pass other cars safely? The money you might pay for repairs could buy your WIZARD-IZED Engine!

Now You Can **"NEW-ENGINE"** Your Car For About The Price Of An Overhaul!



Instead of merely overhauling, "new-engine" your car this easy WIZARD-IZED way — for about what you'd pay for an overhaul. Expert installation by trained

mechanics in fully-equipped garages. And your old engine is worth a generous *guaranteed* trade-in allowance. See your Western Auto man — now!

And A Factory Remanufactured **Wizard-ized Engine** Has A New Engine Guarantee!

That's right! Why pay \$150 to \$180 for a bearing-ring-and-rebore overhaul, and have all the other "tired" old parts left in your engine? — when the same money can buy you a completely remanufactured Wizardized Engine? Why take 10,000 to 15,000 engine miles for your money—when you can get up to 50,000 miles or more?

Here's what we mean by remanufactured: It is **not** just your old engine, overhauled and put into your car! Your Wizardized Engine is precision remanufactured, using original factory block, in one of five large factories that handle no other work. Every part meets new-engine tolerances.

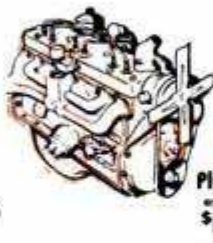
Every moving part is brand new or fully remanufactured to function like original equipment.

New car engine guarantee—backed by Western Auto, the most trusted name in auto parts—plus free 500-mile inspection!

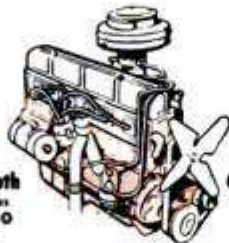
So before you buy any overhaul, see how much more you get in a Wizardized Engine!



Ford as low as \$16.00 down



Plymouth as low as \$17.00 down



Chevrolet as low as \$14.00 down



(Terms vary by area, make, and model of car)

Wizard-ized Engines

FACTORY REMANUFACTURED

The Engine You Can Buy with New Car Confidence!



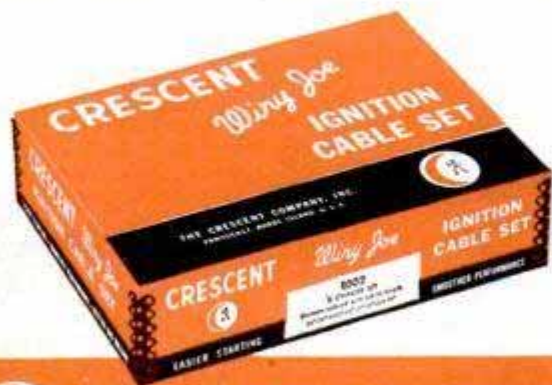
NOTE: Western Auto Associate Dealers sell their own stock and at their own prices. Terms and conditions quoted are approximate, and subject to variance. Prices are subject to change without notice. ©1952 WESTERN AUTO SUPPLY CO., 2107 Grand, Kansas City, Missouri (PH2)

NEGLECTED WIRES CAUSE AUTOMOBILE FIRES



The Fire Report of the City of Philadelphia shows "the chief known cause of fires in 1950" was automobile short circuits! And every day . . . all over the country . . . fires caused by defective wires destroy cars, trucks, and buses by the hundred!

Is a fire hazard hitching a ride in *your* car? Better have your wires and cables checked today. Not only to prevent fire—but to prevent hard starting, poor engine performance, battery failure. When wiring is bad, install new genuine Crescent Wiry Joe Wires and Cables. There are none better! Send for free folder "The Effect of Defective Wiring On Car Performance."



THE CRESCENT COMPANY, INC.
PAWTUCKET, RHODE ISLAND

mained largely unsatisfied. Here and there a farm close to a town could get service. Individual plants, driven by gasoline engines, gained popularity for lighting but were inadequate for power. By the mid-1920s, a few electric utilities began to see possibilities along the highways. Most were deterred by the thought of having only three customers per mile and failed to envision the high power consumption which was to come. The Rural Electrification Administration stimulated their efforts. As a result 1952 finds high-line power reaching 86 percent of all farms.

At first, farmers used current mainly for home lighting. Poultry houses were lighted when higher yields of higher-priced winter eggs paid the bills. Barn lights soon found acceptance for their safety and convenience. Pump motors and pressure water systems followed. Today electric power finds nearly 200 farm applications, and electric motors have become almost as numerous on farms as rubber tires. Power does housework, milks cows, cleans barns, grinds feed, broods chicks and pigs, freezes food supplies, fences livestock and has become famous as the "wired hand" that replaces the hired hand.

The combine-harvester, which first flourished only in the big wheat fields of the West, crossed the Mississippi early in the 1920s to bring down the cost of soybeans and to begin that new crop on its versatile career. The combine now harvests 100 different crops. This economical harvesting machine set the plant breeders to shortening grain sorghum stalks just as the corn-picker called for and got smaller, more uniform cornstalks. Ten years later hybrid strains took hold through the corn states. Their added vigor added an estimated 30 percent to the corn yield, and stimulated breeding studies in many crop plants.

Along in the 1930s, industry discovered the inexhaustible raw-material possibilities latent in crops which can be reproduced every year and which, unlike minerals, are ever-renewable. More than 200 uses have been revealed for soybeans, as many for corn, and hundreds of new markets for other crop ingredients. Industrial and governmental laboratories continue large-scale chemurgic research into the natural chemical compounds which sun, air and moisture build up in plants.

The extraordinary progress which agriculture has achieved through the 1902-1952 period bears tremendous meanings. It has given increasing populations assurance of ample food supplies and freedom from fear of famine. It has permitted a steadily

(Continued to page 256)



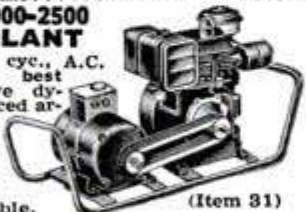
Portable LIGHT PLANT

PUSH BUTTON START
500-700 watts 110-120 v. - 60 cyc. A.C. Powered by a sturdy dependable, easy starting, air cooled 1 3/4 hp. gas engine. No wiring necessary, just plug in and operate. Plenty of current for any oil burner, freezer, brooder, pump, emergency lights, etc. which require up to 700 watts. Ideal for Civil Defense, Fire Depts; trailers & camps. Complete with Voltmeter and built-in winding to charge 6 v. auto batteries. Wt. 85 lbs. Fully guaranteed. Be prepared if war or storm knocks out power lines.

- (Item 24) etc. which require up to 700 watts. Ideal for Civil Defense, Fire Depts; trailers & camps. Complete with Voltmeter and built-in winding to charge 6 v. auto batteries. Wt. 85 lbs. Fully guaranteed. Be prepared if war or storm knocks out power lines. **\$143.50**
- Reg. \$275.00 value.
- 700-800 Watt Plant (Item 44)** Same as above but greater output. **\$169.95**
- 1000-1200 Watt Plant (Item 45)** same as Item 24, but larger generator & engine. **\$199.50**

GIANT 2000-2500 WATT PLANT

110-120 V. 60 cyc., A.C. Absolutely the best made - exclusive dynamically balanced armature; heavy windings developed up to 5000 watt overload for motor starting. S.K.D. mounted - portable. Powered by easy starting Briggs or 6 hp. Wisconsin engine - complete with all accessories; engine easily disconnected for other uses. Big outlet box, voltmeter, no wiring necessary. Ample current for all purposes. Factory warranty and instructions included. Wt. 220 lbs. Reg. \$585.00. Special at **\$299.50**



(Item 31)

With Electric Self Starter (Item 179) **\$359.50**
GENERATOR ONLY and control box. **\$169.50**
Drive it with your engine or tractor

HI-LINE 6000 WATT PLANT

Start, 115-230 v. 60 cycle A.C. A brute of a power plant with a rugged 13 hp. Wisconsin engine. Plenty of electricity for ranges, water heaters, freezers, pumps, machinery, etc. Affords both 110 and 220 volts. Ideal where heavy current is needed. Wt. 590 lbs. Easily worth \$995.00. (with self starter) **\$645.00**
Factory special. **\$585.00**
Same plant (with crank starter) (Item 166) Wt. 570 lbs. **\$585.00**
Generator and control box only, belt driven. Use your engine or tractor. **\$345.00**
Wt. 240 lbs.

We Are World's Largest Direct Factory Distributors of Light Plants

Variable Speed Selector

Heavy duty, made by B. F. GOODRICH for industrial use. Provides instant speed changes for any drive. For machine tools, dryers, printing, conveyors, production lines, hoists - any operation requiring variable speed. Ideal for midsize autos. Employs reliable "trouble free" planetary system. No hydraulic power losses or creeping. Infinite range, smooth operation, easy installation. 3 sizes: 1/2-1 hp. wt. 36 lbs.; 1-2 hp. wt. 55 lbs.; 2-3 hp. wt. 105 lbs. Reg. list \$228, \$252 and \$352. Brand new, in Goodrich boxes and guaranteed. Complete installation data included. Unprecedented surplus sacrifice **\$79.50, \$89.50 and \$114.50.**



(Item 68)

HEATING & VENTILATING FAN

(Item 10) Easily installed in furnace pipes. Forces even heat to all rooms. Over range, removes kitchen smoke and odors. Powerful continuous duty motor, 110-120 V. A.C. Quiet, super efficient fan moves huge volume of air (400 to 600 c.f.m.) 8" Fan, wt. 5 lb. **\$6.35**; 9" Fan, wt. 6 lbs. **\$7.45**; 10" Fan, wt. 7 lb. **\$8.45**; 12" Fan, wt. 8 lbs. **\$9.45.**



HIGH PRESSURE HAND PUMP

(Item 53) Positive displacement type. Cap. 550 gph. Completely self priming. 1" pipe thread inlet and outlet. Use for fuel or water transfer on boats, trailers, air craft, etc. Ideal for insecticides, energ. sump pump or as vacuum pump. Wt. 15 lbs. Govt. cost \$95. Our Special. **\$12.95**

GAUGE TESTER

(Item 27) Precision made of solid bronze and steel by Ashcroft. (Cat. #1300-5). Calibrated weights (incl.) acting against hydraulic piston provides quick accurate testing of all pressure gauges up to 500 psi. Brand new. Wt. 90 lbs. Reg. \$318.00. Our Spec. **\$95.00**



IMMEDIATE DELIVERY - ALL ITEMS HEAVY DUTY D-C ARC WELDER



(Item 38)

Use as portable or shop welder. Up to 300 amps. Senior model. Made for years of trouble-free, continuous service. Will handle light or heavy jobs. Easily welds up to 3/4" plate using 1/4" rods. Built-in air-cooling system. Arc is easy to strike and hold, because of specially designed arc stabilizer. Hi-line switch and dial control gives wide range of welding heats. Run welder at 2600 rpm. with tractor, jeep or 15 hp. gas engine, or 7 hp. elec. motor. Complete with instructions, guar. and double V belt or flat pulley. **\$99.75**
Wt. 110 lbs. A \$400 value at.

DUAL CONTROL MODEL same as above but with built-in dual rheostat for low heat soldering, brazing and welding. **\$119.50**

WELDING KIT. Two 10 ft. leads, welding helmet, electrode holder, ground clamp. Sold only with welder at **\$10.50**

A-C ARC WELDER

(Item 168) Master Hi-Line A-C Arc Welder. 20-150 amp. output. Welds or cuts iron, steel, brass, etc. from 24 gauge to 3/8" with single pass. Operates from 220/230 V. 50/60 Cycle A-C line. None better. Meets REA requirements. Handles 1/16" to 1/4" rods. Adjustable output for any job. In sturdy steel cabinet, on casters. Full instrum. and 1 yr. guar. incl. Wt. 210 lbs. Reg. \$250 value. **\$159.50**

20-100 amp. A.C. Welder (Item 169) operates on 110 or 220 V. Wt. 65 lbs. Worth \$125 **\$64.95**

Welding Kit (Item 181) incl. helmet, 2 leads, electrode holder, ground clamp, power cord and rods (sold only with welder) **\$12.50**
Wt. 12 lbs.



CARRY-AIR



(Item 32) Stainless steel tank - capacity 500 cu. in. at 400 lbs. press. complete with inlet and shutoff valves, press. gauge, detachable air hose, tire chuck. Fill at any service station. Carry air for tire inflation, blowing out lines, spray painting, insecticides, etc. One emergency pays back cost. Wt. 10 lbs. Worth \$20.00. Our price. **\$8.95**
(Item 55) With big double tank (1000 cu. in.) **\$11.95**

POTTERS WHEEL

(Item 47) Complete, prof. equip. for making finest ceramics and pottery. Large dynamically balanced cast-aluminum reversible turntable with variable speed drive (38 to 140 rpm) controlled by foot-pedal. Built-in adjustable arm rests, water cup and wedging wire. 16x12" enclosed throwing table - ample area for largest pieces. Reg. 1/4 hp. motor (not incl.). Can be set up on 20x24" table and stored on edge. Complete with pulleys, belts and instructions. Wt. 26 lbs. **\$59.95**
\$145 value at.

Automatic Electric WATER HEATER

(Item 76) Immersion type 115 v. AC - 1250 watts. Convert your present tank to modern automatic hot water heater. Long life Westinghouse or Chromalox element screws into std. 1 1/4 in. opening in tank. Adjustable thermostat keeps water at desired temp. Can also be used in washing machine or tub. Wt. 8 lbs. Heater element and thermostat **\$14.95**
regularly \$49.50. Special. **\$7.95**
Heater only, for manual control. Wt. 3 lbs. **\$7.95**



RUBBER HOSE

New genuine Neoprene Hose - outlasts ordinary rubber 3 to 1. Reinforced with super tough cotton cord plies. Flexible. Easy Flo brass couplings with standard pipe threads for quick connections. Included. Pump water for irrigation, stock tanks, home, barn, fire fighting, etc. Pump Gas or Fuel Oil. Save more than 60%.

TERRIFIC VALUES!

(Inside Diam.) 1" 1 1/4" 1 1/2" 1 3/4" 2"
Length 10 ft. 25 ft. 50 ft. 100 ft. 30 ft.
Price 5.95 9.25 24.75 49.95 14.75

If specified we will send special hose for gas or oil at same prices.

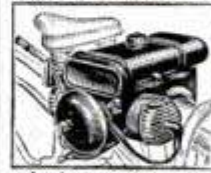


MAKES SNOW REMOVAL REAL FUN! SNOW-BLO



(Item 72)

The sensational device that makes snow removal a real fun. Easy - a child can operate it. Safely guarded whirling impeller quickly scoops up the snow and blows it 25' either side. Big timesaver. Clears driveways and walks in a jiffy. Eliminates dangerous exhaustion and overtaxed heart, which kills so many every winter. BOYS! Make big money clearing snow for neighbors. Easily converted to lawn mower when desired. New silent electric model powered by 1/2 hp. motor clears 16" swath. Complete with shockproof 100' cord (Item 72) **\$139.50**
Gasoline Model with easy starting 2 hp. 4 cycle engine (Item 73) **\$159.50**
For large areas (2 1/2 hp. engine) (Item 74) **\$179.50**
We pay freight on Snow-Blo FREE with purchase of any model, an extra 100' extension cord.



COMMANDO BIKE MOTOR
(Item 90)
New, super-modern 1952 model. This job is the Cadillac of all bike motors. Sensational Auto-Clutch prevents killing motor at each stop. Also selects proper ratio on hills. Mounts behind and drives rear wheel with Dynarotor. Free Wheeling lever permits pedaling if desired. Rear Mounting eliminates fumes, heat, dirt, and hard steering. Easily installed in 15 minutes with home tools. Sturdy, trouble-free, easy starting, light weight, Airplane type engine; up to 150 miles per gallon. Fully guaranteed for fun or profit. Ideal for deliveries, paper routes, messenger service, etc. Ride to work and save.

The Commando Captain, 1 cylinder 1 1/2 hp. **\$99.75**
The Commando General, 2 cylinder 3 hp. (Item 91) **\$125.00**
All Commandos shipped prepaid in U.S.

FIRE EXTINGUISHER

(Item 39) Fully charged at 1,000 lbs. P. S. I. or more) with CO2 (carbon dioxide), the proven miracle fire fighting chemical that smothers oil, gasoline and electrical fires. Play safe; keep one in your car, garage and home. Heavy ICC approved steel cylinder, valve and 3000 lb. gauge that shows available remaining pressure. REFILLABLE at nominal cost. Hose included for emergency tire inflator or air blast. Wt. 4 lbs. **\$19.50**
value. Special. **\$6.95**



GIANT BUNSEN BURNER

(Item 61) Operates equally well on gas or ordinary alcohol. Economical. 1 pt. burns for hours. Produces intense blue smokeless flame. Ideal for lab. or as emergency cooking unit. Fine for camping. Heavy brass burner with shut-off and adj. valve. Simple and safe. 5 ft. flex. hose, 1 qt. tank incl. Wt. 5 lbs. **\$4.95**
A \$15 value. Special. **\$1.49**
(Item 62) Metal Cooking Stand for above (not illustrated) **\$1.49**



EXTENSION CORD

(Item 16) 40 ft. heavy duty, made of specially insulated No. 14 2-conductor wire. So tough that you can drive over it and yet flexible and easy to handle. Resists oil, grease or water. Extends electricity up to 400 ft. without voltage drop. Use indoors or out. Complete with heavy rubber plug and outlet. Wt. 2 1/2 lbs. Usually \$4.50 - Special 40 ft. **\$1.99**
Comb: 2-40 ft. and 1-20 ft. (total 100 ft.) **\$2.95**
100 foot length (one piece) **\$4.85**
WIRE ONLY (Item 50) No fittings, 100 ft. \$4.00



TIRE CHAINS

(Item 43) Extra heavy for triple side links, made by Intl. Chain. Reg. list \$57.50 - our special. **\$19.50**

32 pc. SOCKET SET

32-pc. Socket Set (Item 59) Highest quality guar. non-breakable sockets made by Husky. Beautiful, matched chrome alloy, absolutely the best. Complete range of 21 sockets from 1/4" thru 7/16" in 1/4" drive and 7/16" thru 1-1/16" in 1/2" drive; 2 extensions, reversible 1/2" ratchet, adaptor bit, slide head, all angle coupling, 2 end wrenches, speeder handle and sturdy metal tool box. For prof. mechanics who want the best. Wt. 14 lbs. Easily worth \$41.50. While they last. **\$16.95**



All items brand new. Prices f.o.b. Chicago area. 10 day Money back guarantee. Send check or M. O. **MASTER MECHANIC MFG. CO., DEPT. 16A Burlington, Wis.**

BIG MONEY

in your hands!



BE YOUR OWN BOSS! Men who are determined to get ahead in something for themselves will find this opportunity hard to beat! Where else can a man turn his own labor so quickly and easily into **BIG MONEY!** Earn as high as \$50 and more a day sanding floors with an easy-to-run American Machine—and **YOU ARE BOSS.** Prospects everywhere—old and new homes and remodeling. Pleasant indoor work—steady the year round. No schooling—no experience needed. Age makes no difference—men 18 to 80 are active and successful. Send coupon for “money-making” booklet entitled “Opportunities in Floor Surfacing”—enclose 25c in coin or stamps to cover handling.



AMERICAN

FLOOR MACHINES

SEND

The American Floor Surfacing Machine Co.
535 So. St. Clair St.
Toledo 3, Ohio

Enclosed find 25c in stamps or coin for booklet “Opportunities in Floor Surfacing”, telling me how I can start my own floor sanding business.

Name _____

Street _____

City _____ State _____

produce the food for everybody and has thus released the manpower necessary to the comparable progress which industry has achieved. It has shortened the long hours of farm work and lifted the drudgery from nearly all forms of agricultural production. It has increased profits for farmers until agriculture as a lucrative business compares favorably with other careers.

This half century of farm progress will unquestionably exert far-reaching effects around the world. The American farming idea of high production per man portends high hope for all mankind. Most of the world's population farms for a living and gets a poor living. While American farm methods cannot be transported bodily to such areas as India, they do contain characteristics of progress which can be adapted wherever farmers till the soil. The next half century may see enough worldwide application of American farming ideas to lift the pall of fear, hunger and starvation from much of the human race, and open the way to industrial development in areas where the ever-present problem of food supply leaves few workers free for manufacturing activities. The chemurgic idea that crops are industrial raw materials will open manufacturing opportunities in countries where mineral resources are small.

Few people could have predicted, from the vantage point of 1902, that by 1952 cotton could be picked by machines, the sugar-beet crop entirely mechanized, that airplanes would dust and spray the fields, that flame throwers and chemicals would kill weeds, or that rubber-tired tractors and electric motors would put engine muscles in place of horse and human muscles.

Just as certainly few who now stand on the high ground of 1952 can predict what the years ahead will unfold. The foundations of science and experience are now immensely broader.

Atomic farm power may emerge from the new knowledge of nuclear fission. New electronic applications are reasonable to expect, perhaps some kinds of push-button farming whereby one operator will simultaneously control equipment working in various fields and buildings. Increasing knowledge of plant synthesis and of “why grass is green” may open new agricultural approaches. New plant species will almost surely become crops as organic chemistry explores the values of plants now wild. Food from seaside algae or from synthetic short cuts may supplement field-grown supplies. On-farm industrial processing will become more widespread.

If freedom continues to encourage the

(Continued to page 258)

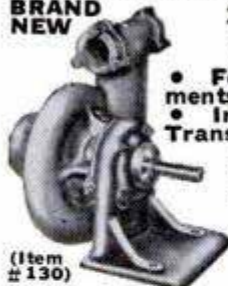
GROBANS WAR SURPLUS BARGAINS!

BRAND NEW • UNCONDITIONALLY GUARANTEED

General Motors — Allison CENTRIFUGAL PUMP

BRAND NEW

200 GALLONS PER MINUTE



- For Draining Basements
- Fire-Fighting
- Irrigation
- Fuel Transfer
- Swimming Pools
- Home Water Systems
- Dewatering

This General Motors-Allison Centrifugal Pump—designed for use on U. S. Air Force Mustang fighters, now converted for commercial, home, and industrial high volume pumping applications. Inlet, 2 1/2" standard pipe thread, twin outlets with 1 1/2" pipe thread, ball bearing supported 3/4" shaft. Easy, fast simple priming. Rotation, counter-clockwise facing shaft. Shipping wt. 35 lbs. Gov't. acq. cost \$145.00. F.O.B. Chicago

39.50

NOW ONLY

| Suction Lift | Head Pressure | Gal. Per Min | H.P. | R.P.M. |
|--------------|---------------|--------------|------|--------|
| 10' | 75' | 260 | 6.0 | 3500 |
| 10' | 65' | 200 | 5.2 | 3500 |
| 10' | 80' | 40 | 1.5 | 2500 |
| 10' | 50' | 140 | 5.0 | 3500 |
| 10' | 30' | 100 | 3.0 | 2500 |

D. C. GENERATORS



For welders, plating, truck and marine use. D.C. appliances, lights, etc. Aircraft quality — lifetime grease sealed ball bearings. Heavy duty.

ITEM #90—Type P-1, rated 200 Amps.—28 Volts, 2500 RPM. Mfd. by General Electric, Ford, Delco-Remy and Westinghouse. Gov't. Acq. Cost \$300.00. Shpg. wt. 53 lbs. F.O.B. Chicago

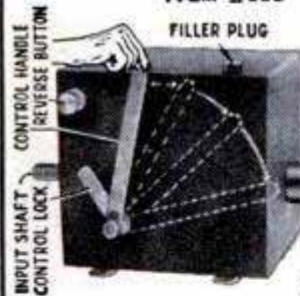
22.50

ITEM #91—Type R-1, rated 300 Amps.—30 Volts. Mfd. by Jack & Heintz. Gov't. Acq. Cost \$380.00. Shpg. wt. 59 lbs. F.O.B. Chicago. Each individually packed in wooden box.

35.00

HYDRAULIC SPEED REDUCER WITH FINGERTIP CONTROL

ITEM #115



- USE FOR:
- Reamer Drives
 - Midget Cars
 - Feed Mills
 - Canning Machines
 - Conveyors
 - Lathes
 - Milling Machines
 - Motor Boats
 - Cream Separators
 - Garden Tractors
 - Pumps

Variable output speeds from 0 to input speed available by moving control handle. Locking handle maintains setting. Internal relief valves prevent overloading. Use input power of 1/4 to 1 1/2 H.P.

This Westinghouse-Oil Gear Unit converted to commercial use from 40 MM anti-aircraft traversing mechanisms consists of a variable displacement hydraulic pump feeding a fixed displacement hydraulic motor. Adjustable relief valves set at factory for 100 inch pounds of torque may be reset up to 180 inch pounds. Independent reverse control allows full output power and speed selection in either direction of rotation.

Both input and output shafts measure 5/8" diam., include keyway. Input rotation is counter-clockwise facing shaft. Recommended input speed not to exceed 750 R.P.M. Overall dimensions 7 1/2" x 7 1/2" x 11 1/2". Gov't acquisition cost, \$428.00. Shipping weight 31 lbs. Complete with 2 qts. of oil and full instructions. F.O.B. Chicago

54.50

FREE: NEW 1952, 48-PAGE CATALOG, loaded with unsurpassed War Surplus Bargains. Write for yours today!

Write, Wire or Phone Webster 9-3793

PREPARE NOW FOR GENERATING PLANTS

Immediate Delivery—Large Stock—Many Sizes
Designed for Continuous or Intermittent Service
PLENTY OF EMERGENCY STAND-BY OR GENERAL UTILITY POWER, FROM 350 WATTS TO 25 KVA.
Item #183 — 3000 to 4000 WATT GENERATOR SET
FEATURES—Power for your home or business. Simply connect to power panel or house circuit. • Constant voltage regardless of load. • Push button start or stop. • Easily made full automatic start or stop. • Circuit breaker stops plant in event of short circuit.
SPECIFICATIONS—Sizes 19"x30"x48". Steel skids, weatherproof housing, requires no building. Wt. 725 lbs. • Hercules 4-cyl. gasoline engine. Load governor. Oil filter. Quiet muffler. 6-volt generator. • Hobart 115 volt, 60 cycle, 3,000 to 4,000-watt single or three-phase power, 2 or 3 wire. • Panel contains oil circuit breaker, voltage regulator, start button.

Today's Cost Over \$1,200.00. SALE PRICE, F.O.B. Chicago

Item #178—350 watt—115 volt—60 cycle A.C. direct coupled to 1 cylinder Midea engine. Shpg. Wt. 116 lbs. **125.00**

Item #182—Onan Generator—5KW—120/240 volt—60 cycle A.C. single phase, direct coupled to Willy's Jeep 4 cylinder, water cooled engine with push button start, battery ignition. (Battery not included.) Shpg. wt. 1200 lbs. F.O.B. Chicago

795.00

Item #201—PE 95-G—10 KW—110/220 volt—50 cycle A.C.—Single Phase. Totally enclosed. Onan generator direct coupled to Willy's Jeep, 4 cylinder, water cooled engine, push button start, instrument panel with engine and generator instruments, circuit breaker controls, etc. Uses 6 volt car bat. (Battery not incl.) Skid mounted. Ship. wt. 1500 lbs. F.O.B. Chicago

1295.00

Item #180—15 KW—127/220 volt—60 cycle AC—3 phase 1800 RPM. Hrazek & Krachy Generator direct coupled to International Harvester 4 cylinder, water cooled engine with magneto ignition—push button start. Panel has voltmeter, ammeter, 4-wire electrical system, belt driven excitor generator, rheostat voltage control. Engine and generator mounted on steel skids. Shipping wt. 2000 lbs. (Battery not included.) F.O.B. Chicago

1650.00

Item #128—25 KVA—250 volt, Single phase—60 cycle. Totally enclosed-Hobart generator driven by a GMC 270, 6 cylinder gas engine, button start, liquid cooled. Has control panel with full set of instruments for both engine and generator. Shipping weight 2600 lbs. (Battery not included)

2250.00

Write for information on other size generating plants ranging from 350 watts to 25 KVA.

HEAVY DUTY HYDRAULIC EQUIPMENT AIRCRAFT QUALITY

Large supply of new labor-saving, economical hydraulic equipment in many types and sizes. Use these positive, highly efficient smooth pressure hydraulics on presses, arbors, lifts, loaders, power control, positioning, brakes, plastic dies, auto frame alignment, etc., etc.

ITEM #127—Double acting hydraulic cylinder, 1" bore, 1" stroke, 1/2" diam. shaft, 1/2" tubing thread ports. Overall length closed—6 1/2". Clevis mounting at both ends. Perfect for clamping and feeding. Post-paid

5.95

ITEM #29KJ—Double acting hydraulic cylinder, 1 1/2" bore, 26" stroke. Will lift 1760 lbs. with 1000 PSI line pressure. Weight 8 lbs. A \$55.00 value. Now only, Postpaid

16.95

ITEM #126—Four-way, open center control valve with built in adjustable relief valve. Factory set at 1000 P.S.I., spring loaded neutral position, for use with one double acting cylinder. Fully balanced plunger type, smooth, positive, easy operation, can be used as single unit or mounted in series of any combinations desired. Has 3/4" pipe thread inlet and outlet, 1/2" pipe thread cylinder ports. Newly manufactured to our specifications. Shipping weight 8 1/4 lbs. An outstanding Buy!

21.50

ITEM #103—Double acting hydraulic cylinder, 2 1/2" bore, 17" stroke. Clevis mounting. Will lift 4900 lbs. with 1000 PSI line pressure. 1 1/4" diam. shaft. 3/4" tubing thread ports. Overall length closed 28". Shpg. wt. 11 lbs.

21.50

ITEM #6—Double action hydraulic cylinder, 3" bore, 24" stroke, will lift 7070 lbs. with 1000 PSI line pressure. Steel barrel, 1 1/4" stainless steel shaft. Gov't. acq. cost \$178.00. Ship. wt. 26 lbs.

28.00

ITEM #42—Double action hydraulic cylinder, 4" bore, 18" stroke. Rated lift capacity with 1000 PSI line pressure is 12,500 lbs. Ship. wt. 30 lbs. F.O.B. Chicago. An Excellent Buy for

32.50

ITEM #29KJ—Gear Type Hydraulic Pump. Ideal in industrial applications and for operating all hydraulically powered farm implements including loaders, stackers, swathers, plows, etc. Delivers 1000 PSI (may be set at lower PSI if desired), 12 GPM at 400 RPM. Maximum operating speed 800 RPM—rotation counter clockwise. Has built-in relief valve, permanent or torque bar mounting, 1" diameter shaft, 3/4" pipe tap inlet, 1/2" pipe tap outlet.

45.50

NEW MODEL 353 D.C. ARC WELDER

— DUAL RANGE — Stationary or Portable Use. HEAVY DUTY RANGE TO 250 AMPS. NEW 'MAGIC TERMINAL' FOR LOW CURRENT 30 TO 100 AMPS. IDEAL FOR • FARM • FACTORY • GARAGE • WORKSHOP

These precision engineered D.C. Arc Welders contain the highest quality War Surplus aircraft components built to exacting government specifications. They are light in weight, have oversized lifetime grease-sealed ball bearings, air cooled commutator, dial type rheostat for easy pin-point control, a high-low rheostat switch, reactor coil for even arc and the new 'MAGIC TERMINAL' low current welding range for welding lighter materials. Designed for many years of trouble-free service. Run welder from drive pulley or power take off of a tractor or Jeep, 7 1/2 HP electric motor or 10 HP gas engine at 2500 R.P.M. Uses two V belts or flat belt. Continuous output rating 200 amps. Intermittent welding rating 250 amps, 30 volts. This sensational price includes double V or flat belt pulley and complete operating instructions. Shipping weight 107 lbs. \$350.00 Value.

119.50

F.O.B. Chicago

Welds Anything From Auto Fenders To Tractor Frames

ORDER DIRECT FROM AD — SEND PAYMENT OR PURCHASE ORDER TODAY — SATISFACTION GUARANTEED

GROBAN SUPPLY CO. 1139 SO. WABASH AVE., CHICAGO 5, ILL. DEPT. PM-2

For cross-grain planing
and light with-the-grain
cuts — Millers Falls No.
16 Block Plane



For finishing large sur-
faces — Millers Falls
No. 9 Smooth Plane



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eral all-round use — Millers
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Three Great Planes

There's a feel and balance and fast-cutting accuracy in Millers Falls planes that has made them favorites for generations with men who use and prize fine tools. So, when you buy a plane — ask for a Millers Falls. Sizes and types for every purpose — smooth-cutting, long-lived tools you will be proud to own.

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**MILLERS FALLS
TOOLS**

SINCE
1868

®

The Mark of Superiority

urge for betterment, invention and science will provide agriculture with continually improved equipment and methods, probably at an accelerated rate. Those who look back after another half century are likely to regard the farming of 1952 as primitive as the methods of 1902 appear to the eyes of today's farmers.

Calendar of Farm Progress, 1902-1952

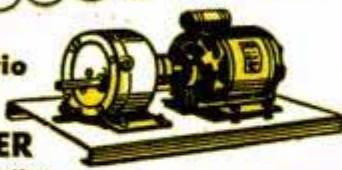
- 1902**
- Portable grain elevator
- First successful cylinder corn sheller
- Steel stanchion for dairy cows
- 1903**
- First gas traction engine produced commercially
- 1904**
- Track-type traction engine offered for sale
- Steel thresher
- 1906**
- "Tractor" came into use as a word
- 1909**
- Cornpicker built commercially
- 1910**
- Electric water systems produced in quantity
- Colony-type heated brooder for baby chicks
- Rod weeder for fallow-land farming
- 1911**
- Pressure regulator and air chamber for power sprayer
- 1912**
- Rotary hoe produced commercially
- Automatic, individual water bowls for cows
- 1913**
- Haber-Bosch process for fixing atmospheric nitrogen
- Frameless, or unit, design in farm tractors
- 1914**
- County-agent system launched
- Reel-type, side-delivery rake
- Power-operated milking machine introduced
- 4-H Club named and formally launched
- 1915**
- Motor-cultivator-type tractor
- 1916**
- Garden tractor introduced
- 1917**
- Two-row potato planter
- 1919**
- Farm tractor equipped with power take-off
- 1920**
- American Farm Bureau Federation organized
- Hammermill introduced
- Starter and lights for tractor
- 1921**
- Tool-bar idea for mounting tillage tools on tractors
- 1923**
- Combination tool-carrier for heavy implements
- 1924**
- Mounted-type tractor implements introduced
- Electric ventilating system for dairy barns
- Cultivating or tricycle-type tractor
- 1925**
- Two-row, tractor-drawn rolling stalk cutter
- 1926**
- Cotton stripper built commercially for the high plains
- Jet-type pump introduced

(Continued to page 260)

BUY from C&H - you'll save and be sure!

ALL ITEMS GUARANTEED AS REPRESENTED
Order with confidence from C&H

80-1 ratio GEAR REDUCER



Double reduction. Operates on any 1/8 to 1/2 HP electric motor. 22 RPM. Can be used as winch, barbecue, dummy elevator, operate turntable, electric garage door opener, television antenna. REGULARLY \$45.00. NOW ONLY \$22.00

54 to 1 BOSTON Speed Reducer



Reduces speed of ordinary 1750 rpm electric motor to 33 rpm. Lists at \$35.00. Our price \$29.50



CLUTCHES

For motor scooters, motor bikes, lawn mowers, etc. Centrifugal action enables electric motors or small gas engines to handle heavy starting loads. 3" A belt pulley. NEW. 3/4" bore \$9.95; 1" bore \$10.95; 1 1/2" bore \$11.95



BEARING ARBORS

Grinding and saw arbor, has 1 1/2" double end shaft, 1 1/2" long with 2" center pulley. New Departure double roll ball bearings. Right and left hand thread. Self aligning Dodge pillow block. 10,000 RPM. Bearings alone list at \$10. NEW \$6.95. SLEEVE BEARING ARBOR 1 1/2" shaft 9" long. Only \$3.00

ALARM HORNS • SIRENS



Motor driven (not a vibrator). Heavy duty with great power and long life. Adjustable for high, medium or low tone. 110v. AC current. Weather proof. For alarm or signal horn on boats, school yards, factories, air raid siren, etc. List price \$47.00. Our price NEW \$15.45

HOT ROD SUPERCHARGER

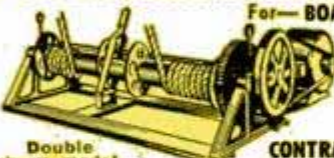


Extra soup and go at a price you can't afford to miss. SEE HOW SIMILAR SUPERCHARGER is used in PICTURE and article on p. 67 AUG. '50 issue of POPULAR MECHANICS. Mfr'd. by Borg-Warner. Specifications: 7 1/2" deep, 7" high. Wgt. 17 lbs. Compact and sturdy. 4 base mounting holes. 3/4" outlet. 5/8" shaft with female Lovjoy coupling. Priced today at \$85. OUR SPECIAL SALE PRICE \$31.00

POWER and HAND WINCHES



For—BOATS, TRUCKS, FARMERS, LOGGERS, CONTRACTORS, ETC.



Double drum model WINCHES, 1,000 lb. cap. Hand oper. \$ 9.95 WINCHES, Hand operated ball bearing model, 1500 lb. capacity. 3-1 ratio, hand brake two speeds. \$ 39.50 WINCHES, 6,000 lb. double drum, Hand operated \$ 49.50 WINCHES, 1,500 lb. electric drive. \$ 89.50 WINCHES, 6,000 lb. electric drive. \$188.50 WINCHES, Single drum, 3/4 HP. Motor 110 or 220 AC. Start, stop and reversing switch, belt, pulleys. 100 ft. 3/16" steel cable. 2000 lb. pull. Ratio 12 to 1. NEW \$125.00. Double drum model \$135.00 CABLE, 1/4" preformed stainless steel aircraft. 100 ft. or less \$175/ft. Over 100 ft. \$185/ft.



BOOSTER FANS

Fits any 8", 9", 10" furnace pipe. 1500 RPM motor with 8' cord, mounting frame, 7" blade. Motor, 110 volt, 60 cycle 1550 RPM. Easy to install. Silent operation. Warm those rooms with long runs. Stock #583. Regular \$11.95. Your price \$6.95

| FANS | FAN SHUTTERS |
|---------------------|--------------|
| 10" \$12.95 | \$4.50 |
| 12" \$16.95 | \$4.95 |
| 16" \$23.95 | \$5.95 |
| 20" \$39.95 | \$6.95 |



High Volume BLOWERS

Top performance for forced draft, ventilating, exhausting, cooling and drying. 110 volts AC, Intake 3", discharge 2 1/2". 75 cubic ft. per min. \$10.95 Intake 5", discharge 3" 150 cubic ft. per min. \$13.95

BUILD YOUR OWN DUMB-WAITER ELEVATOR

Get all the convenience of a dumb waiter elevator in store, shop, restaurant or home at lowest cost. We furnish complete parts for elevators similar to those described in ARTICLE on pp. 174-177 Dec. '51 issue of POPULAR MECHANICS. Steel car-Guide Rings—Worm Gear—Limit Switches—Electrical Controls—Steel Cable. SEND 25c for completely diagrammed instructions with list of parts, kits and prices.



ELECTRIC HOT WATER HEATER

Heat water faster, easier with this immersion unit. 115 v. AC—1250 watt Westinghouse or Chromolox element. Manual unit, \$42 value, \$6.95; thermostat Fenwall control \$3.95. Element with Fenwall thermostat \$8.95. 10 gal. steel tanks 12x21" — \$9.95; 8x42" — \$11.95; 18" cord #12/2 or 3 conductor with plug \$2.25.

"JANITROL" AIRCRAFT HEATERS



Warms up fast—just the thing for heating trucks, buses, garages, etc. Has an output of 50,000 BTU's per hour. 24 volts DC. Length 23", diameter 13", weight 14 lbs. Original cost \$130. Our special sale price NEW, only \$19.95

AUTOMATIC AIR COMPRESSOR UNIT



Compressor with 2x1 3/4" piston controlled for intermittent duty by regulator and check valve. Heavy duty capacitor motors 110/220 v. AC. 12x24" tank mounted on rubber tired wheels. 1 1/2 hp. \$99. 1/2 hp. \$109. Tank only \$14.95.

Flexible Shaft Grinder



"MALL" PORTABLE 1/2 HP. 3450 RPM. 110-220 volt dustproof motor mounted on universal trunnion. Heavy base has a convenient tool tray and large easy rolling casters. Flexible shaft is equipped with both full speed, angle spindle and straight spindle. List price \$172.00. Your price with all attachments, NEW \$109.00



NEW TOOL POST GRINDER

1/2 hp. AC-DC 7000 rpm motor with 3 1/2 x 3 1/4" external grinding wheel, smaller internal wheel, 7 ft. rubber cord, switch and attachments. Lists at \$90. Only \$49.50

SAVE OVER 50% ON THESE BRAND NEW WAR SURPLUS POWER UNITS



BE PREPARED for any emergency!

300 WATT 110-220 volt AC, 60 cycle light plant powered by 1 HP gas engine, direct drive, mounted base, wgt. 40 lbs. Ideal for campers, P.A. systems, house trailers, etc. Equipped with handle for easy carrying. \$99.00

750-1000 WATT 110 volt AC, powered by Briggs & Stratton gas engine \$169.00

1000-1200 WATT 110 volt AC \$194.00

2000-2500 WATT 110 volt AC, 60 cycle, slow speed generator, 5.10 HP Briggs & Stratton gas engine. NEW \$294.50 To make plant 110-220 add \$40.00 for transformer.

2500-3000 WATT 110 volt AC, 60 cycle, Leland generator—runs at slow speed (1800 r.p.m.) for longer life. 8.25 HP Briggs & Stratton gas engine. You can rely on this plant for all average home needs—freezer, stoker, pump, hot plate, radio, etc.—and overloads from starting motors. Reconditioned and fully guaranteed. \$295.00, NEW \$345.00

Plants, same as above, built in 1951, with tools and spare parts. Lists at \$790.00. Our price \$426.00 To make plant 110-220 add \$48.00 for transformer.

3000 WATT, 110-220 volt with push button starter. Starter battery is automatically charged by plant. Gas engine same as in plant above \$465.00

5000 WATT, 120 volt, 60 cycle AC, Hercules 4 cyl. gas engine. Generator mfr'd by Hobart Bros. Unit includes remote control cable, 150' 2-wire #6 and 150' 3-wire #18, exhaust pipe, power cable plug, spare parts, manual, battery, radio and TV filtered. Unit is completely automatic. List price today \$1910. Now priced for you at \$675. used. NEW \$895. To make plant 110-220 add \$72. for transformer.

For complete information and specifications on the following plants, WRITE for our FREE circular.

7500 WATT 110 volt AC, 4 cyl. gas engine, NEW \$995.00

10,000 WATT 110-220 AC. Recond'nd \$1195. NEW \$1494

25,000 WATT 220 v. AC, 3 phase, or 110-220 v. AC, single phase. Reconditioned. \$1995.00. NEW \$2495.00

35,000 WATT 110-220 volt, Diesel. Rebuilt. \$2995.00

50,000 WATT 240 v. AC, 3 phase. Diesel. NEW \$5900.00



HEAVY DUTY RUBBER ELECTRIC CABLE

(Nothing less than 50 ft.)

4-Wire #18 Neoprene standard, per ft. 7c
 2 Wire #14 18 ft. with plug \$3.00
 2 Wire #14 18 ft.—NO plug \$2.60
 2 Wire #14 50 to 225 ft., per ft. .17c
 2 Wire #12 12 ft. with plug \$3.50
 3 Wire #10 75 ft., per ft. .30c
 4 Wire #10 75 ft. length, per ft. .40c
 2 Wire #6 150 ft., with connector. \$ 90.
 2 Wire #4 75' reel and connectors. \$ 80.
 1 Wire #4 Concentric 50 to 250 ft. underground, per ft. .60c
 15 Cond. #18 GE Stranded 50-300' O.D. 13/18", per ft. .50c
 10 Cond. #18 Solid, per ft. .10c
 Telephone wire—250', per ft. 2c; 1000' 1 1/2c

BRASS HAND PUMP



Mfr'd. by Red Jacket. Double acting—pumps on both forward and return strokes. Capacity 1000 gal. per hr. at 30 strokes per min. Ideal for boat bilge, basements, cattle troughs or other water transfer. 1 1/2" inlet, 1 1/2" or 2" discharge. 71 lbs. \$48 value. Only \$18.50

GENERATORS



300 Watt, R.P.M. 3400, 110 and 220 volt, 1/2" shaft, \$40.00. 2500-3000 Watt, R.P.M. 1800, 115 volt, AC. \$235.00. 3000 Watt, R.P.M. 2800, 110 volt, DC. Delco ball bearing, 1" shaft. List \$343.00. To you at only \$99.00. 5000 Watt, 115 volt, R.P.M. 1800, single phase \$259.00. 10,000 Watt 110-220 R.P.M. \$550.00

TRACTOR DRIVEN GENERATOR 2500 W. 110-220 volts with floating mount to keep belts tight \$287.00. Generator only \$235.00

and other bargain items

GOODRICH RUBBER HOSE 2" I.D. 2 ply. 25' lengths, worth \$25, at \$3.95; 3 lengths \$10.00

AIR COMPRESSORS from 1/2 HP. 12 gal. tank at \$99.00, to 10 HP. 80 gal. tank at \$777.00

WELDING ROD—Manufactured by Murex. All purpose type S, AC-DC 5/32", 50 lb. box \$3.00

OHMMETERS. Read 25 to 0. In leather carrying case. Reg. \$29.95. Only \$7.95

FYR FYTERS. Fire extinguisher approved by Underwriter's Reg. \$14.95. Only \$6.95

1/2 TON SHOP Utility WAGONS, steel frame, rubber tires, ball bearings. \$48.50

ORDER DIRECT from this ad! All prices F.O.B. Milwaukee. 25% deposit required on all C.O.D. orders. No C.O.D.'s under \$10.00. Many other bargain items not listed. Write for our FREE CIRCULARS!

C&H ELECTRIC MACHINE Co. Inc.
 434D W. Juneau Ave., Milwaukee 3, Wisconsin

INDUSTRIAL BUYERS When you can't find a scarce item — try C & H

**FOR SURE
QUICK STARTS**

**INSIST ON
BOWES**



**Corrodeless
TERMINAL
Battery Cables**



Most battery cable trouble starts at the terminal because of corrosion or bad fit. Bowes "Seal Fast" battery cable terminals positively will not corrode. They are specially engineered, tailored to fit the posts snugly, assuring longer cable life and full power from your battery. Stop battery cable trouble before it begins. For sure, positive starts insist on Bowes "Corrodeless Terminal" Battery Cables—then you'll get all the power your battery is designed to give you.

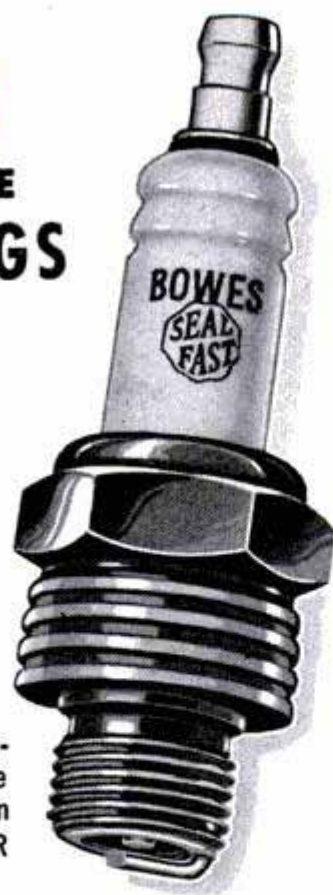
**BOWES
DEPENDABLE
SPARK PLUGS**

Assure

**SMOOTHER
MOTORING**

There is a Bowes Spark Plug specially designed for your car! Oversize Special Alloy Electrode—with welded construction for positive connection assures longer life. One-piece, leakproof construction.

Every Bowes Plug is individually tested to assure complete motoring efficiency. **INSIST ON BOWES SPARK PLUGS FOR SMOOTHER MOTORING.**



**BOWES "SEAL FAST" CORPORATION
INDIANAPOLIS 7, INDIANA**

- One-way or wheatland disk plows popularized
1928
- Future Farmers of America organized nationally
- Two-row, power-take-off cornpicker, and one-row mounted picker
- Land-leveler for irrigation farming
1929
- Hybrid-corn seed first sold
- Two-row mounted cornpicker
- Attachments for placing fertilizer in bands
1930
- Portable sprinkler irrigation
- Farm tractor equipped with power lift
1931
- First diesel-powered, track-type tractor
1932
- Field pickup baler introduced
- Low-pressure rubber tires for farm tractors
1935
- Lift-type mounted plow introduced
- One-man, power-take-off combine
- Factory-built, high-compression tractor to burn leaded gasoline
- Hydraulic-lift equipment on tractors
- Farm Chemurgic Council organized
1936
- Forage harvester built commercially
1937
- Automatic barn cleaner built commercially
1938
- Self-propelled combine
- Tractor loader built commercially
1939
- Single-seed beet planters available commercially
1940
- Automatic, self-tying pickup baler
- Potato harvester
- Side-delivery rake driven by power take-off
1941
- Successful cotton picker built
- Hydraulic remote control of drawn implements
- Precision planting of vegetable seed
- First factory-built LP gas tractors
- Department of Agriculture's chemurgic laboratories opened
1942
- First commercial planting of segmented beet seed
1943
- First appreciable use of commercial sugar-beet harvesters
- Tractor-mounted cotton stripper
1944
- Duster with attachment to inject liquids
- Low-pressure, low-volume sprayer
- Power-take-off and drawbar dimensions standardized
1945
- Mow-hay finishers built commercially
1946
- Self-propelled cornpicker
- Silo unloader introduced
- Transmission clutch for live power take-off
- Rear-engine tractor
1947
- Equipment to apply fertilizer in vapor form (anhydrous ammonia)
1949
- Hydraulic remote-control cylinder dimensions standardized

Principal source: Farm Equipment Institute



FIRE EXTINGUISHER. For safety's sake order now! Every home, garage, car, workshop should have this handy fire fighting wonder. It's fully charged (at 1,000 lbs. P.S.I. or more) with that miracle CO₂ (carbon dioxide) chemical that smothers oil, gasoline & electrical fires. Anyone can operate, in a hurry. Heavy ICC approved steel cylinder, valve and 3000 lb. gauge that shows available remaining pressure. REFILL costs very little. Hose included for emergency tire inflator or air blast. Wt. 4 lbs. Approx. GOVT. COST \$25. NEW, complete with cloth carrying case, just \$6.50.



CUNO OIL FILTER, permanent type. This is the maximum capacity unit (not the small type) that gives greatest protection to your pump, boat, midget racer or engine. It's the perfect filter to keep motor oil or hyd. fluid clean at all times. Just turn handle and element is clean. Inlet & outlet ports take 3/4" pipe. Accommodates 16 GPM at 30 PSI. Mtg. bracket. Wt. 4 lbs. Approx. GOVT. COST \$35. Cost to you, NEW, \$3.75.



HIGH SPEED DRILLS All new. Fractional & numbered. Orig value \$18. Nationally known brand. Assorted sizes. Set of 30, \$3.50

WOODWORKERS DRILLS



From 5/16" to 1/2" with 1/4" shanks. A \$12.50 value - NEW - just \$2.50 for complete set!

HIGH SPEED STRAIGHT SHANK DRILLS

10 different size H.S. Straight Shank Jobber Length Drills, 1/2" to 1/2". (shank same diameter as drill) \$25 value. NEW - \$3.50.



HIGH SPEED DRILLS

SET from 1/4" to 3/4", 5 sizes with 1/2" shanks-NEW-get this, \$3.00 takes this set!

"BALTIC" SWEDISH TOOLMAKERS VERNIER CALIPER

ULTRA PRECISION-0.6" in .001 graduations. Quick, accurate depth, inside, outside measurements, fine engraving. Extra heavy rule, hand-fitted sliding head, no side play. Rockwell C.60, lapped measuring surfaces. For the extra particular mechanic who must have the best-used and recommended by most critical experimental and research machinists at Lockheed, Douglas, Bendix, GM, RCA, General Electric. Save 60%! A \$37.50 value-only \$14.75, leather case incl. Also a standard grade Mouser Design Caliper made in Germany. For the production machinist, 0-6" in thousands, the most accurate caliper of this type on the market, 1000's of satisfied users. Only \$10.95, leather case incl. These Calipers are of acceptable quality for precision aircraft work. Both are guaranteed buys, money back if not entirely satisfied. Order now! **New low price due to lower import duty!**



LOW VOLTAGE CIRCUIT TESTER

Made for U. S. Ordnance Dept. to rigid specifications. Portable steel hand carrying unit is a self-contained trouble shooting device for making a complete and rapid check of the generator battery circuit, including any circuit and voltage regulators. Battery voltage, regulators, cut-out settings and generator performance can be easily determined. A terrific testing unit for garages, mechanics, truck fleet owners, boat and marine mechanics. Can be used on any 6 or 12 volt system. Govt. cost approx. \$175. NEW-complete with instruction book-only \$32.50. Shipping weight, 20 lbs.



GAS OR FUEL STRAINER. This'll save you money because it protects fuel pump & carburetor... removes foreign particles, water, prevents sludge formation... for all cars, trucks, tractors & boats. Will handle aromatic fuels & light oils. Easy to connect to gas line in few minutes. Design allows for use either right or left-handed without changes. Stainless steel filter screen easy to remove to clean or replace. 3/4" pipe inlet & outlet ports. Quick opening drain cock. Capacity up to 60 GPH., 2 mtg ports. Wt. 2 3/4 lbs. Made to Air Corps specs, type C2C. Approx. GOVT COST \$27.50. NEW! Now only \$3.75.

U. S. BAROMETRIC ALTIMETER



This U. S. Gauge Altimeter is terrific for auto or airplane. Tells altitude accurately, guaranteed! It's NEW! Approx. GOVT. COST \$175. NEW! TO YOU, only \$9.95.

SOCKET-PACK WRENCH SET



Chrome-plated alloy steel, heat treated, broached to close tolerances. Reversible ratchet handle, with screwdriver bit on reverse side. Built-in spring-loaded ball retainer on both handle and extension. Clear top plastic kit. 10 piece set - NEW - complete \$3.75. POSTPAID in U.S.A.

MAGNETIC BASE INDICATOR HOLDER

For all types of dial indicators with guaranteed lifetime ALNICO magnets. V-slotted base has a 45 to 50 lbs. pull, permits immediate application without clamps or special attachments and mountings can be made on cylindrical surfaces. For machinists, tool-makers and inspectors. Base 3 1/2" long by 1 1/2" wide NEW \$3.50 ea.



PORTABLE WELDER



Will weld, bronze, solder and cut all metals up to 3/16". No experience needed, full instructions included. Weld iron, steel, brass, aluminum and other metals. Plug into any 110 Volt A.C. or D.C. line. Save hundreds of hours and money doing repair work for yourself and others. A great item for any mechanic or hobbyist, etc. Not a toy. Comes complete with electrode and carbon holders and an ample supply of electrodes, carbons, flux and necessary components to do a thorough welding job of any type. This unit cannot be duplicated for many times its price. NEW-price \$12.00.



RIVET SETS Universal type, case hardened tips. Set of dies will head up any brazier or round head rivet from 1/16" to 1/2". With adapters for air gun or hand use. All new-cost Govt. approx. \$27.00. Complete 15 piece set (wt. 2 lbs.) \$3.00.

DRILL GRINDER

Sharpens round, square or tapered drills up to 6" long. Even an amateur mechanic can get a new, factory finish on a drill in 25 seconds. New protractor feature gives every drill sharpening angle, with 5 convenient angles already marked off. Usable with hand or power stone. A brand new development. All New \$2.80 ea. Postpaid in U.S.A.



Blades inlaid Wolfram Vanadium, guaranteed to hold edge under constant severe use on heavy gauge metals. Duckbill blades cut straight, circular or irregular forms. Handy spring opening handles for better leverage. NEW-10" size \$2.45 ea.-12" size \$2.95 ea.



HAND MITRE. It pays its way in just 1 day! It's sensational! New HAND MITRE saves 100's of hours, requires only a "flick" of the hand for a precision mitre every time. HAND MITRE will cut any desired angle. Its rugged construction handles hard and soft wood mouldings, plastic trim, base shoe, laminated materials, rubber extrusions, etc. Made of heavy gauge stainless steel. \$3.95 postpaid.

BRAND NEW PUMP AND MOTOR

Pump has 1" connections, built-in relief valve, adjustable up to 1500 lbs. Max capacity 6 GPM. 1 1/2 H.P., 24-volt motor. 4000 RPM. Can be used on 12 or 36 volts. Govt. cost approx. \$350 -our price- NEW LOW PRICE \$9.75



FLEXIBLE SHAFT MAGNET

For picking up cotter pins, nuts, wrenches, etc. from inaccessible places. Removes Babbie Pins, etc. from drains. Lifetime Magnetism Guarantee. Highly polished magnet and handle. \$2.00 postpaid



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Chrome plated precision engineered, care fully toolled to give long life. All new 0-1" capacity-\$2.25 ea. 1-2" capacity-\$3.50.



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**Cut Like
the Wind!**

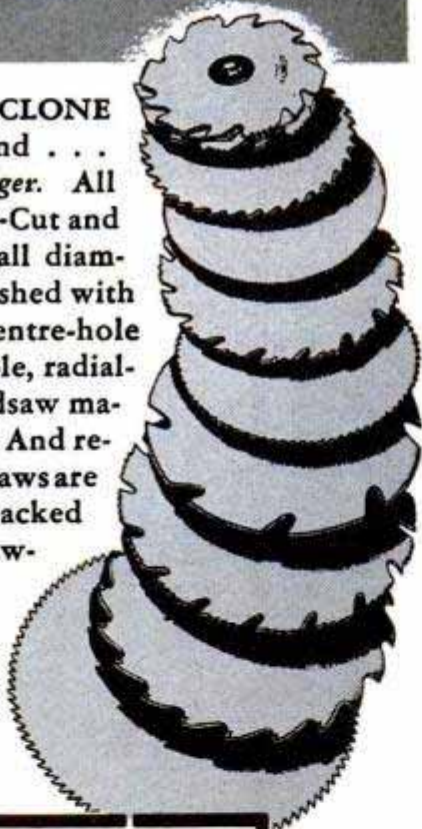


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SI-CLONE

...new low-priced, high-quality
SAWS for home workshops

Yes, these new SI-CLONE Saws cut like the wind . . . and stay sharp longer. All types, including Easy-Cut and Carbide-Tipped, in all diameters up to 12". Furnished with any type or size of centre-hole . . . for use on any table, radial-arm or electric handsaw machine on the market. And remember SI-CLONE Saws are SIMONDS quality, backed by over 75 years of saw-making experience. So "blow in" to your hardware store today and ask for SIMONDS NEW SI-CLONE SAWS.



SIMONDS
SAW AND STEEL CO.

FITCHBURG, MASS.

Factory Branches in Boston, Chicago, San Francisco and
Portland, Ore. Canadian Factory in Montreal, Que.

(Continued from page 112)

which they hold a U. S. patent, while working for the Navy during the war. When they tried to get samples made up after the war, however, they came up against two facts harder than the toughest plastic. The molds might cost a couple of thousand dollars a set. And no one in the plastics-molding industry can afford to make fewer than 10,000 impressions from a mold; the molding machines are too expensive and too much time is needed for make-ready. Since as many as a dozen sets of molds and sample housing moldings might be needed before the design proved out, it looked as though it might take \$50,000 to take the midget motor off the drawing board.

Many a good plastic device has died right there. But Gorfin and Kardorff, who now run a small instrument shop in downtown New York, couldn't let their idea go. They slaved over their own molds and devised their own injection-molding machine to make samples. More than a score of sets of molds had to be cut before the housing finally turned out right.

The low-cost midget naturally doesn't have the performance of the high-priced models. But it will run for several hundred hours without trouble. It draws only 250 milliamperes in operation.

Manufacturers are using it in a wide line of toys, ranging from miniature electric fans and kitchen mixers to drawbridges, earthmoving toys, extension-ladder fire trucks, boats and cars. With a plastic gear-box, which Rowe also manufactures, and a bit of plastic-bonding glue, you can motorize junior's fleet yourself.

In addition to the low-cost drink mixer, already on the market, a battery-operated, "use it anywhere" electric shaver that uses the new miniature motor is in the works. Another possible application of the tiny motors is on subminiature power tools such as buffers and drills, for model makers. Still another, now under study, is in the motor-driven telemetering devices that radio back high-altitude weather information from radiosonde balloons. There seems to be literally no telling how far or how high the mighty midget will go.

Atomic Energy Heats Building

For the first time atomic energy is being used to heat a building. "Atomic radiators" have been put into service in an 80-room building at Harwell, the British atomic-research station. Heat from the atomic pile warms coils of water pipes, and the hot water then flows through the heating system.

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BECKER *Self-Contained* SPRAY GUN

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TAKE IT ANYWHERE—the first completely portable spray gun. Needs no compressor, motor, or electrical outlet. Pressure-powered with an inexpensive CO2 cartridge that sprays up to 21 liquid ounces, depending on viscosity. Extra cartridges, 10 for \$1, postpaid, or buy from your dealer.

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MOTH-PROOFS • INSECTICIDES**

Every home needs a Becker Spray Gun for dozens of jobs in the house, workshop, garden or garage. Complete instructions furnished for effective results. Order yours today for the season ahead.

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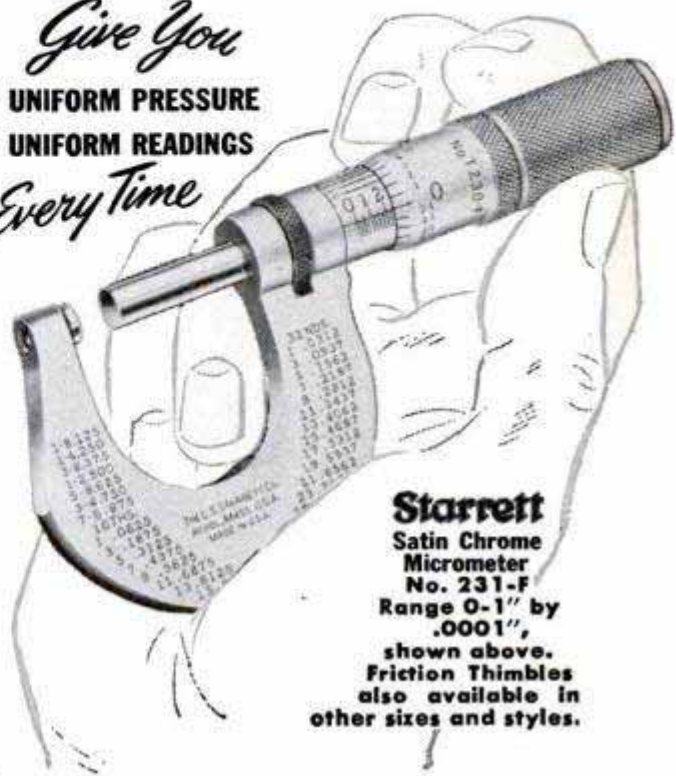
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**FRICTION THIMBLE*
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Every Time



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Range 0-1" by
.0001",
shown above.
Friction Thimbles
also available in
other sizes and styles.

*An improved ratchet stop mechanism built right into the thimble permits easy, one-hand operation — insures uniform contact pressure for every measurement. You get the same sure accuracy every time . . . plus 12 other big Starrett features including Satin Chrome Finish, Tapered Frame, Hardened Threads ground from the solid and stabilized and Hi-Micro Mirror-Lapped Finish on contact faces. See it at your Starrett Tool Distributor's.

VARIABLE SPEED HYDRAULIC POWER TRANSMISSION



It has Infinite Speeds 0 to 550. Reverse, Automatic Overload Protection; Adjustable Torque up to 180 inch pounds. 5/8" Input and Output Shafts. It will handle 1/4 to 1 1/2 H.P. Motor. Case measures 7 1/2" long, 7" high 6 1/2" wide. VALUE OVER \$300. Shipping Wt. 25#. On C.O.D. Orders we require a 10% only Fob. Chicago

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DIRZIUS MACHINE SHOP "K" 1423-25 So. 52nd Ave., Cicero 50, Ill.

**CARBURETOR TOO RICH
MAKES MOTORIST TOO POOR**

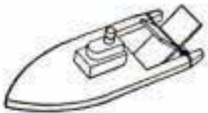


Car owners who are wasting money and not getting proper gas mileage due to over-rich mixtures will be pleased to learn how to save gasoline by VACU-MATING over-rich mixtures. VACU-MATIC fits all cars, trucks and tractors. It is automatic and operates on the supercharge principle. Easily installed in a few minutes.

SALESMEN WANTED! Big Profits! Send name, address on penny postcard for free particulars and how to get yours for introducing.

VACU-MATIC CO., 7617-1858 W. State St., WAUWATOSA, WIS.

NEW TOY PATTERNS—6 FOR 25¢



Happy hobbying for you . . . happy playing for the youngsters. Full size patterns—trace and cut out. Send for Patterns P1: Paddle Wheel Boat, Clacker, Tumbling Clown, Cradle, Insert Toy,

and Fighting Roosters, all for 25c post-paid. STANLEY TOOLS, 322A Elm St., New Britain, Conn. In Canada: Stanley Tool Company of Canada, Ltd., 322A Stanley St., Roxton Pond, Quebec.



**PAGE
Garden Tractors**

NEW 1952 MODELS! MORE FEATURES!

Both riding and walking models 2 to 6 HP with complete gear drive and reverse . . . no chains, ratchets, or belts. Quick-hitch for easy changing. Over 50 attachments for all farm and home chores.

Also new, handy 1 wheel Page "Bantam." **LOW PRICES, EASY TERMS**

26 years' experience behind every Page tractor. Every model guaranteed!

PAGE FARM EQUIPMENT

1904 S. 81st St., Milwaukee, Wis.



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SEND FOR IT — ONLY 10¢
Starrett "Tools and Rules" Book shows the right tools for any measuring job. 50 pages, 100 pictures, helpful reference tables. Address Dept. AP



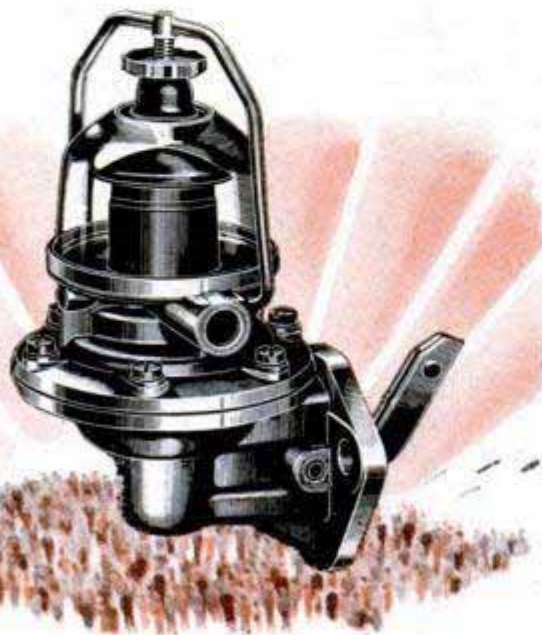
THE L. S. STARRETT COMPANY • ATHOL, MASS., U.S.A.



SINCE 1880
WORLD'S GREATEST TOOLMAKERS

BUY THROUGH YOUR DISTRIBUTOR MECHANICS' HAND MEASURING TOOLS AND PRECISION INSTRUMENTS - DIAL INDICATORS - STEEL TAPES - PRECISION GROUND FLAT STOCK - HACKSAWS, BAND SAWS and BAND KNIVES

**100,000,000
BUILT SINCE 1927**

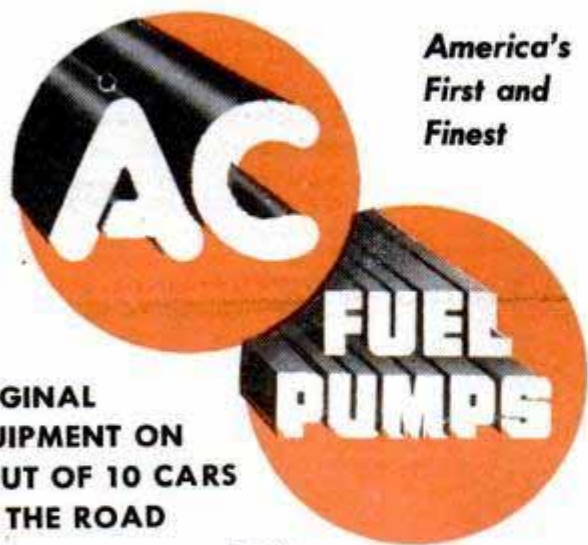


The AC Fuel Pump was the original and is still the finest. It was the first efficient, reliable means of supplying the carburetor with the gasoline necessary to run the engine.

100,000,000 have been built, 40,000,000 are in daily use.

More than 90% of the cars in use were factory-equipped with AC Fuel Pumps.

ACs have held their leadership for 25 years, because they have been constantly improved, to give better service and longer life.

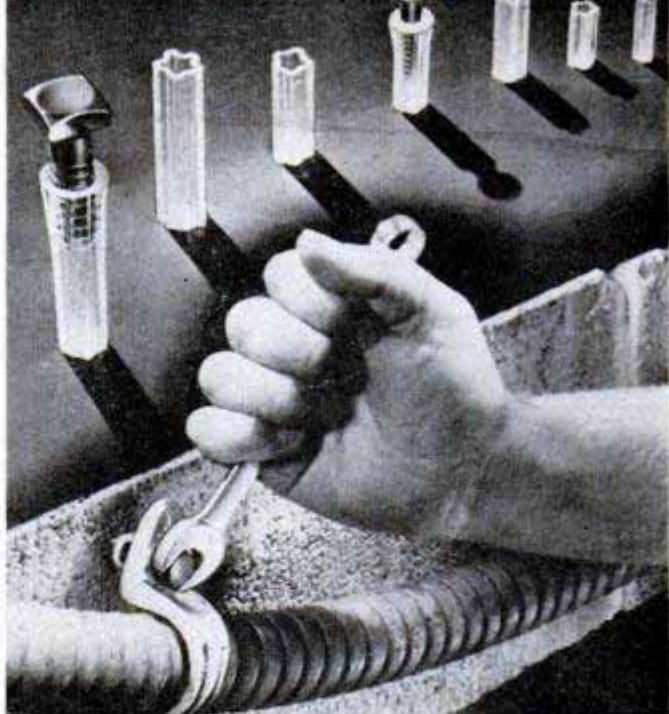


*America's
First and
Finest*

**ORIGINAL
EQUIPMENT ON
9 OUT OF 10 CARS
ON THE ROAD**



AC SPARK PLUG DIVISION GENERAL MOTORS CORPORATION



Star-Shaped Tenite Plug Anchors Screw in Concrete

There's no trick to anchoring shelves, conduit or anything else in concrete when you use plastic anchor plugs. You simply drill a hole, drive in one of the Tenite-plastic plugs and run in the screw, either wood or lag type. Being plastic, the plugs are noncorrosive and nonconductors of electricity. Oversize screws up to four sizes larger than the anchor size can be used. The anchor is star-shaped. As the screw is driven in, it expands to grip the sides of the hole tightly.

Magnesium Protects Metals Buried Underground

Bars of magnesium will be buried, for no apparent reason, all around the new Fairless Works of the United States Steel Corporation at Morrisville, Pa. Actually, the magnesium will prevent underground corrosion of structural steel, steel piping and lead-sheathed electric cables. The bars will set up their own electric currents to offset the natural currents that cause underground corrosion of metals. Magnesium is especially effective in setting up a current from itself to lead, copper and steel. Periodically it will be necessary to replace the magnesium bars as they are eaten up by the currents they produce.

Construction of the world's first commercial synthesis plant to produce gasoline and diesel oil from coal will start soon in South Africa about 40 miles south of Johannesburg.



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FOR
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Sheard "Gold"
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Marble's
Flexible
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(532)

NEW 1952 KING MIDGET AUTO

World's Lowest Priced 2 Passenger Car Drive it for 75c per week. Amazing performance. Surprising comfort. All steel construction. Full accessories, top and heater. Ready to run or assemble it with our bolt together parts. Rider agents wanted. Earn your car free. Send 25c for detailed literature or \$1 (refunded first order) for actual assembly book and service manual filled with photos, drawings, specifications, etc.



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ATHENS, OHIO

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Absolutely the finest in hand power tools. Cool running, controlled power for those countless small jobs. A whole toolshop in your hand... grinds, drills, engraves, cuts, polishes, saws, routs, sands... pays for itself quickly!

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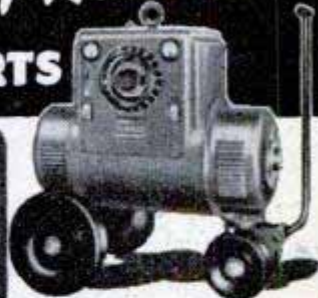
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BIG PROFITS -
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Remote Control

1 KW Power Outlet

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Cash in on the big demand for dependable arc welding. Set up your own shop now with Hobart and you'll start earning hundreds of dollars of extra profit monthly. Farmers, contractors, factories, builders will keep you mighty busy based on your reputation for low costs and better work.

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With mechanical ability and a Hobart "Simplified" Welder, you'll soon be turning out top quality jobs and can handle all types of work. They're the same rugged, dependable, economical welders you'll find in America's leading production plants. You'll get such exclusive advantages as 1,000 combinations of welding heat and remote control (at no extra cost) Auxiliary power outlets let you operate lights, tools, etc. Portable models equip you for profitable emergency outside jobs. Check coupon for complete details.

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Hundreds of profitable welding ideas in design form. 3 vols. of 100 designs each. 1 vol., \$3.50; set of 3, \$10.

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(Continued from page 126)

inclined farmboys and others who dropped out of high school have difficulty understanding semitechnical classroom explanations and examination questions. To offset this, a special effort is made to keep sentences short and the terms simple, though many unfamiliar engine-part identifications have to be retained.

Every newcomer gets specific instruction on how to study, with emphasis on learning to read, organizing notes and reviewing more efficiently. The Air Force's pamphlet on the subject, which some of the nation's outstanding educators helped to prepare, would be a useful addition to any college student's bookshelf.

Both servicemen and civilians instruct. Most of the latter, usually in their early 30s, have degrees in education. About 80 percent are veterans. One out of four has always been a jet specialist.

The first 10 days of the jet engine specialists' school are devoted to repair, the next five to the power plant's many accessories and the following 10 to operating and adjusting the engines in test cells. Engine change and inspection occupy the final 10 days. The entire 35 days are spent on one particular engine, like the J-33, with which all the planes in Joe's future squadron will be equipped. There is a separate course for each of the three most widely used power plants.

In contrast to the pre-World War II private's \$21 a month, today's GI moves from \$75 to \$80 automatically after four months' service. In addition there are allotments for dependents. At Chanute most of the students live in temporary wooden barracks, two to a room, though some enjoy the luxury of "Buckingham Palace," a modern brick structure housing some 2000 airmen. Beside using the base's recreational and entertainment facilities, students making passing grades can leave the field during their off-shift hours.

Directing this nation-wide educational system, the largest of its kind in the world, is Lt. Gen. Robert W. Harper, head of the Air Training Command and an officer long experienced in the Armed Service's mass-teaching field. From his headquarters at Scott Air Force Base in Illinois, he supervises 27 flying-training bases and 10 technical-training bases, three of them indoctrination centers like Lackland.

Eighty percent of the men under General Harper's command, biggest in the Air Force, are being technically trained. Seven major schools at Chanute, Scott, Amarillo,

(Continued to page 268)

HIGH SPEED STRAIGHT SHANK DRILLS

- SET 12** different size H.S. Straight Shank Drills, 7X 1/4" to 1/2", lengths up to 7" **\$3.98**
- SET 10** different size H.S. Straight Shank Drills, 8X 1/4" to 1", extra long, \$40 value. New and slightly used surplus **\$6.95**

HIGH SPEED DRILLS

1/4" to 1/2" with 1/4" Shanks
1/2" to 1" with 1/2" Shanks

- SET 6** Different Size H. S. Drills, 3/4" to 1 1/2" all with 1/4" shanks..... **\$3.50**
- SET 10** of 35X above..... **\$4.95**
Set 35X and 36X will fit any 1/4" drill.
- SET 5** Different Size H. S. Drills, 1/2" to 1" with 3/2" shanks..... **\$6.95**
- SET 10** Different Size H. S. Drills, 1/2" to 1" with 1/2" shanks..... **\$12.95**

These new and used H. S. precision drills with 1/2" shanks can be used in a 1/2" electric drill or a 1/2" capacity lathe or drill press.

HIGH SPEED MORSE TAPER SHANK DRILLS

- SET 15** Different Size High Speed Morse Taper Shank Drills up to 9/16" with No. 1 and 2 tapers. New and used. \$50 value. Priced at only..... **\$6.49**
- SET 20** Different Size High Speed Morse Taper Shank Drills from 1/4" to 1". New and used. \$70 value. Priced at only..... **\$12.95**
- SET 10** Different Size High Speed Morse Taper Shank Drills from 1/2" to 1 1/4". New and used. \$50 value. Priced at only..... **\$9.95**
- SET 8** Different Size High Speed Morse Taper Shank Drills from 1" to 2" with No. 3, 4, and 5 tapers. New and used. \$125 value. Priced at only..... **\$29.95**

HIGH SPEED STRAIGHT SHANK CHUCKING REAMERS

- SET 20** Different Size High Speed Straight Shank Chucking Reamers up to 1 1/2". New and used. Priced at only..... **\$7.95**
- SET 15** Different Size High Speed Straight Shank Chucking Reamers from 1/4" to 1". New and used. Priced at only..... **\$6.95**

HIGH SPEED WOODRUFF KEY SEAT CUTTER

- SET 5** Different Size Cutters. Can be used as mounted milling cutter or circular saw. All with 3/8" and 1/2" shanks, widths up to 1 1/4", dia. up to 1". New and used. Priced at only..... **\$3.95**

HIGH SPEED STRAIGHT SHANK DOUBLE-END END MILLS

- SET 4** Right hand twist 7/16 shank end mills, size 5/16 to 7/16. New and used..... **\$3.95**

NEW HIGH SPEED COMBINATION DRILL AND COUNTERSINKS

- SET 8** selected sizes from C2 to F2 (1/16 drill x 13/64 body to 3/16 drill x 7/16 body) 60 degree angle of countersink. New cost on these countersinks 75c to \$2.50 when available. Your price for set of 8 only..... **\$4.95**

6 SLITTING SAWS WITH MANDREL

- SET 6** Different Size High Speed Slitting Saws, 2 3/4" dia. x 1" arbor. Thickness from .040 to .071. Cuts wood, aluminum, brass, steel, etc. PLUS SPECIAL MANDREL which enables use of saws in 1/4" or 1/2" elec. drill. \$25 Value. Only..... **\$4.95**
- 7 selected, sharp H. S. Slitting Saws as above to use on your own mandrel or milling machine. New and used. A bargain at..... **\$4.95**



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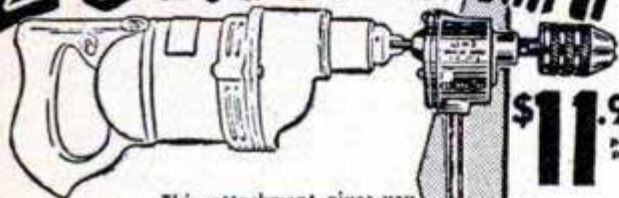
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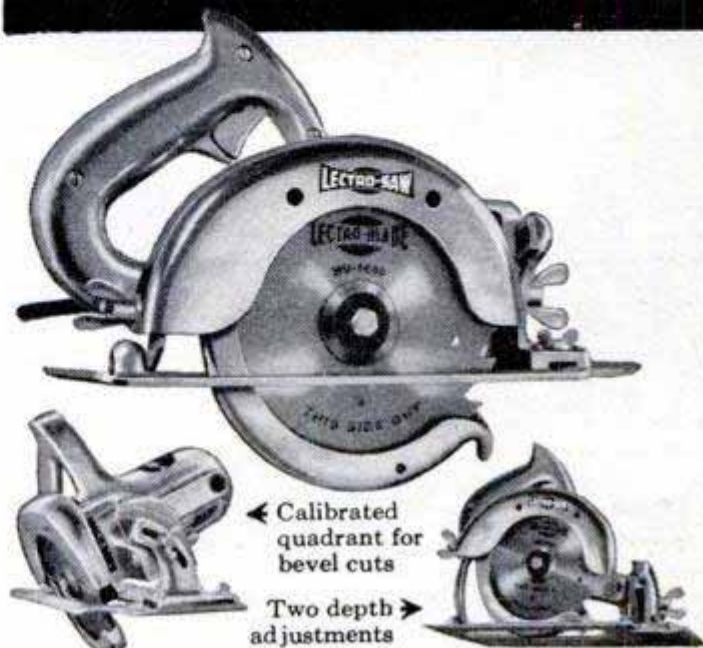
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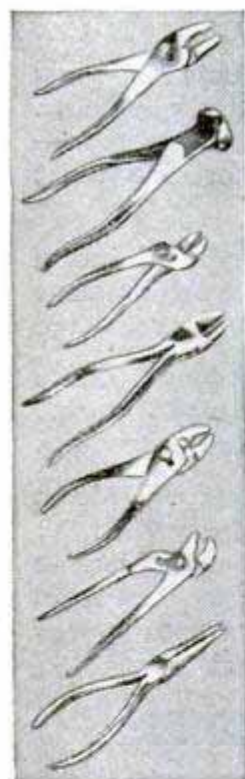
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(Continued from page 107)

the company estimates it sold 1500 cars.

The clamp went on machine tools except for defense needs, but some of the new-engine programs are believed to be at the stage where they may squeeze through. These include Dodge and Buick among the passenger-car builders and the Ford tractor engine.

Buick, which had originally planned the new V-8 for its 1952 offerings and later set it back to 1953, may still come out all right for next year. It is so close to realizing the power plant that it may be permitted to go ahead.

Dodge, too, is close to achieving its modified V-8 FirePower. It still lacks a few vital machines, but it may work around them.

The great experiment of Kaiser-Frazer and Sears, Roebuck and Co. is getting mixed appraisal. Sears' selling of the All-state, a disguised version of the Henry J, may get its big test this spring. K-F plans to step up production on the light car even before Sears' experiment shows results.

Chrysler engineers are busy working out details of their new test track near Ann Arbor. Headed by James C. Zeder, director of the engineering division, they have been visiting present automotive test tracks and getting ideas.

G.M.'s layout at Milford is about the best in the industry today. But Chrysler plans to outdo it in at least one department. The G.M. speed track is designed for speeds up to 100 miles an hour. Chrysler's will have a top speed of 160 miles per hour. This indicates in what direction its engineers are thinking.

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Two pilot plants soon will be producing nitrogen from the air through a new system developed at the University of Wisconsin. The method uses only air, water and energy as raw materials. One plant already is producing a ton of 60-percent nitric acid per day at San Jose, Calif., and another will be built soon at Sunflower, Kans. Nitrogen is taken from the air in a high-temperature furnace which produces nitrogen oxides. After the oxides are concentrated, water is added to yield nitric acid, vitally needed for fertilizers, explosives and propellants.

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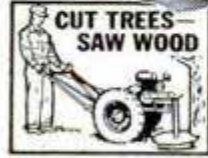
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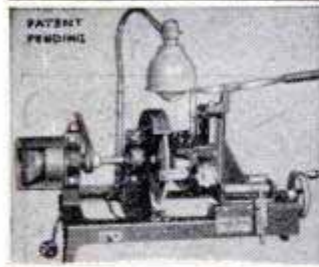
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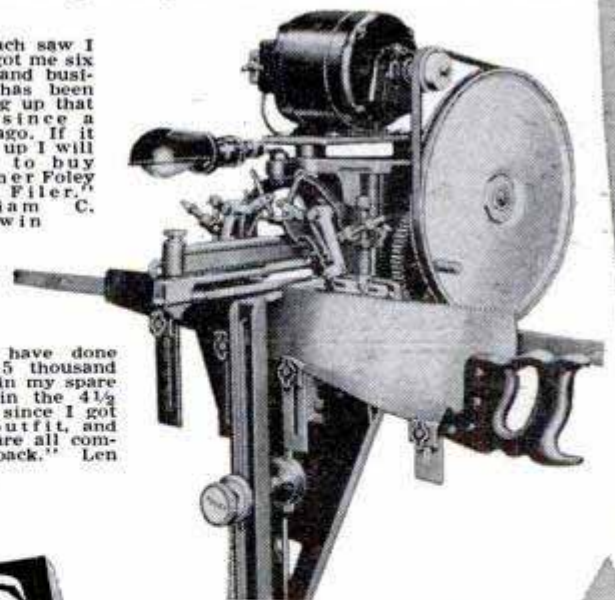
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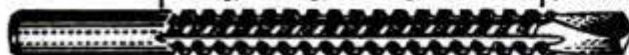
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→ sawing, cutting, reaming section → drills hole



DRILL, SAW, REAM . . .

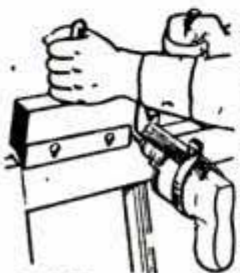
. . . metal, pipe, wood, plastic, Transite, etc., with the all-purpose International Rotary Cone-Saw Drill-bit shown above. Use with any electric drill, slow drill press, lathe or milling machine. Drills own starting hole—upper part of bit is used to cut, saw or ream circles, ovals, squares or scrolls. Easy to operate. Ideal for carpenters, mechanics, electricians, plumbers, hobbyists, many others. Abrasive resistant, high speed steel. Flutes ground from solid. Will withstand severe continuous use without breaking. Resharpener at no charge. Takes place of up to \$50 in tools. 1/4" diameter, 2" cutting sections, total length 3 1/2". Also available bits specially designed for wood or metal and in 2 3/8" and 1 3/4" lengths. Write for details. Specify all-purpose bit.



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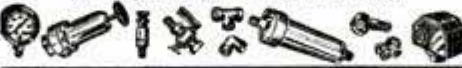
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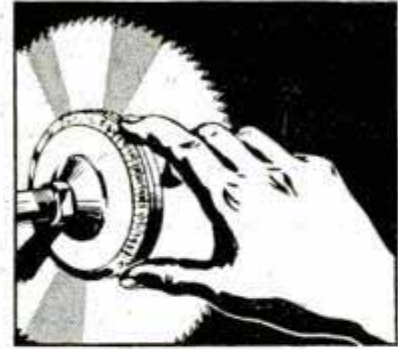
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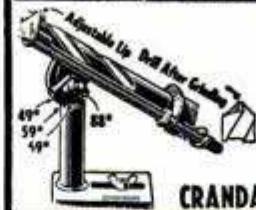


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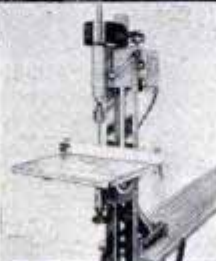
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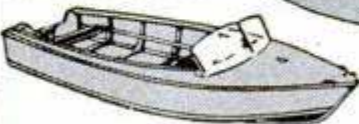
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- 27x28 in. table, 13 1/2 in. capacity in front of blade
 - 10 in. blade cuts 3 1/4 in. deep, tilts full 45 degrees
 - Floor model 34" high, table always stays level
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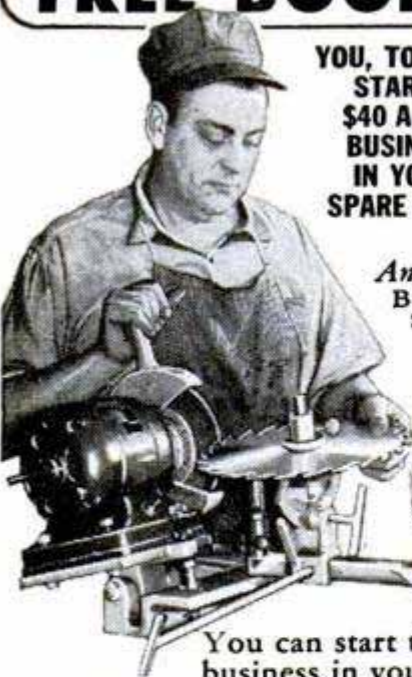


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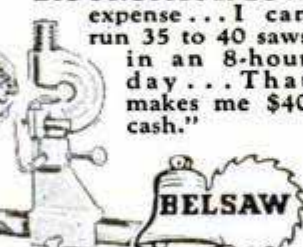
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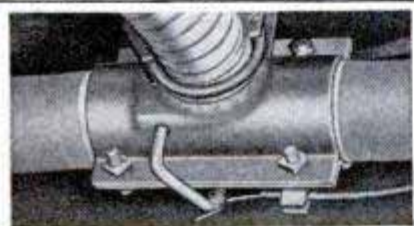


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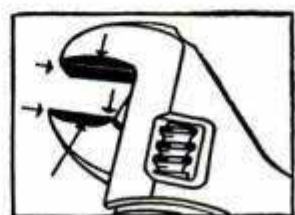
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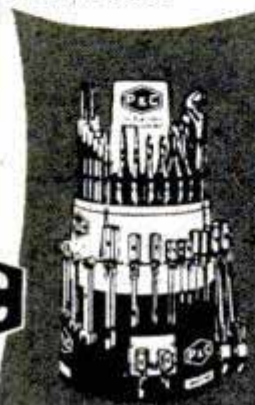
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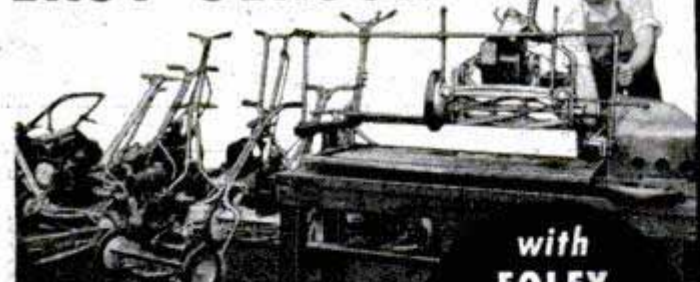
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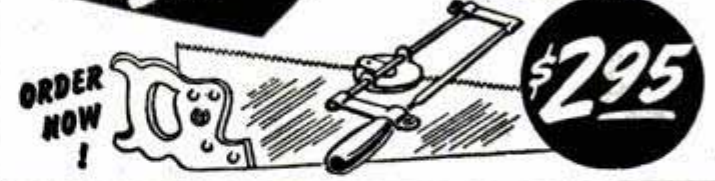
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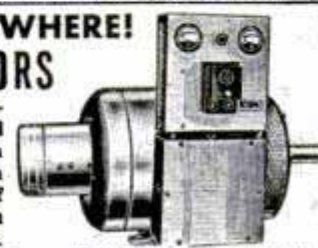


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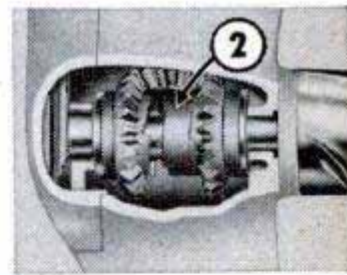


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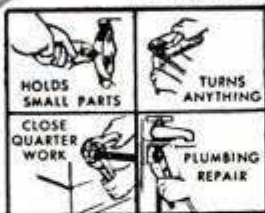
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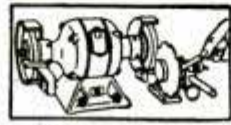
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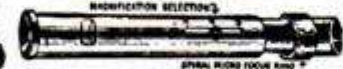
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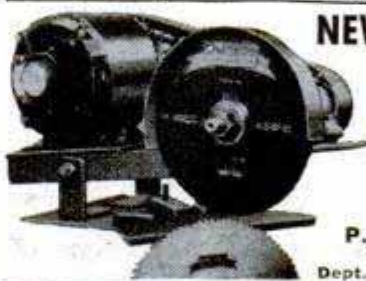
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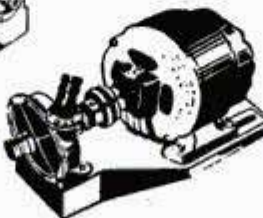


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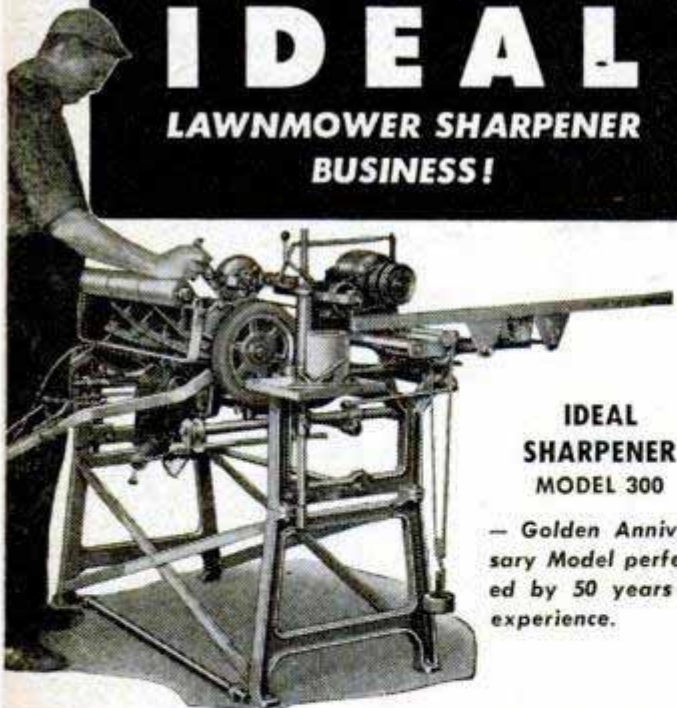
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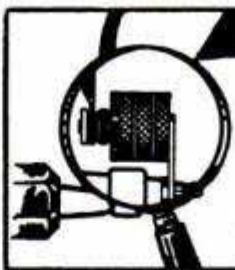
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 Shaded Pole Motor, brushless, Non-Radio, T.V. Interfering. 110 V.-60 cy. A. C. Speed 1550 RPM for light machine duty, exhaust fans, furnace fans, blowers and many practical and experimental purposes. Handles fan blades from 12 to 20 inches.
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FOR ELECTRIC GRINDER
 \$10.00 VALUE — ONLY
 Here's what you get! Mounted Stones on 1/4" mandrel, Drum Sander, Sanding Sleeves for sander, Rotary Cutters, Wire Scratch Brush, Bristle Brushes, Circular Saw, Buffing Wheel, Grinding Wheel, Rubber Polishing Wheel, Cut-off Wheels, Rubber Cylinder, Mandrels to fit above tool, asst'd.
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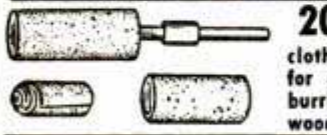
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FEATURES: 2 compression and one oil ring, aluminum alloy connecting rod. Stainless steel valves with brass seats and retainers. Cool-flo cylinder head, spray mist lubrication to every moving part. 10 1/4" V groove fly wheel for 3/8" B section belt.

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EXTERNAL ATOMIZING GUN

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5" x 8" tank 400 lb. test with 1/4" air regulator, gauge, safety valve and shut-off cock. Complete as shown. **\$12.95**

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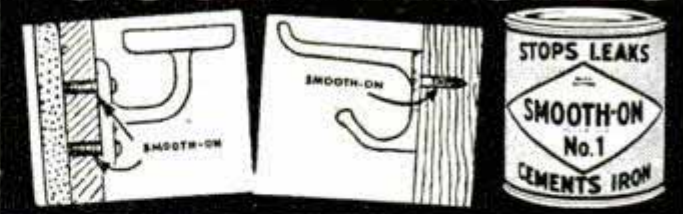
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Genuine USAF, Type T-30-Q. Gives distinct voice reproduction. Consists of 2 microphones mounted in rubber neckpiece & elastic neck band. 100 to 300 ohm operation. **139**

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Cyl. parts 1/2" AN tube.

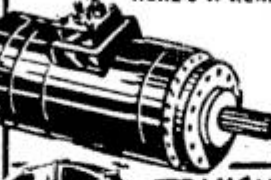
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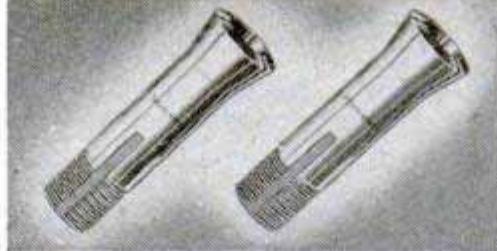
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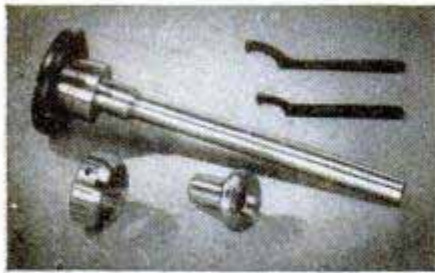
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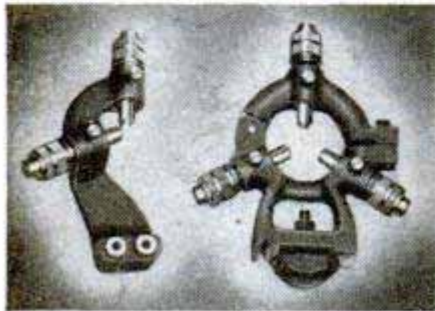
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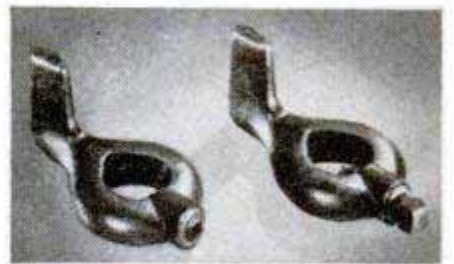


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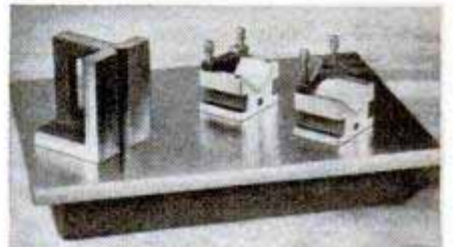
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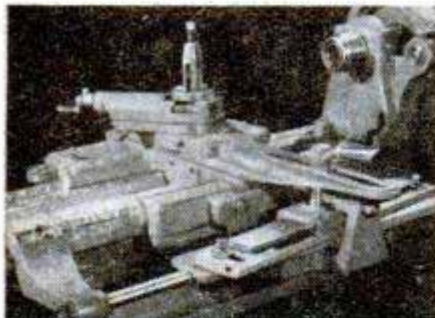


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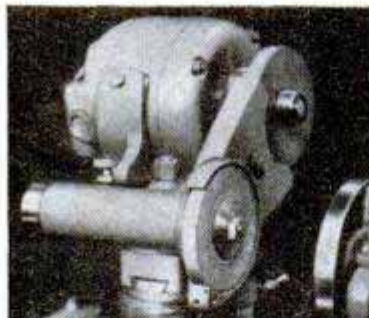


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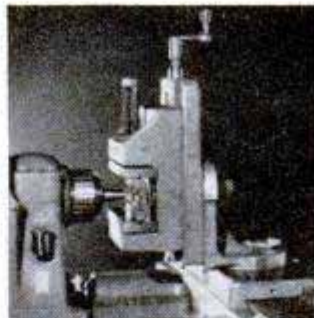
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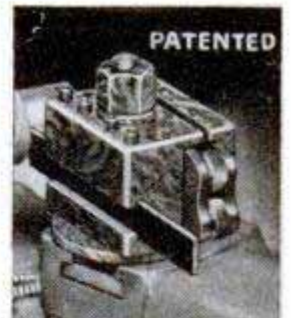
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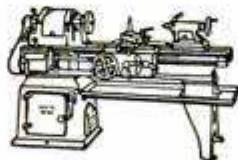


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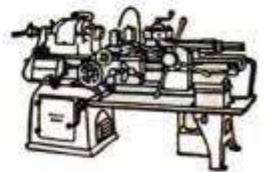
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