

The Age of Air

By Col. Edward S. Evans

POPULAR MECHANICS MAGAZINE



WRITTEN SO YOU CAN UNDERSTAND IT

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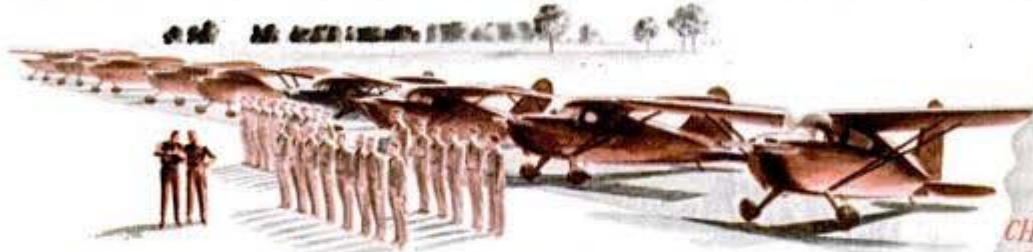



 BUY UNITED STATES
WAR SAVINGS
BONDS AND STAMPS

SEE PAGE 50

Mechanics Illustrated 1945-1946

CHAMPION SPARK PLUGS



 The Civil Air Patrol is a typically ingenious American organization comprised of 55,000 men and women fliers, voluntarily united into a semi-military organization co-operating with our military air forces. Authorized to patrol shipping lanes on all coasts, the C.A.P. has established itself as one of the most useful and dependable branches of the O.C.D. Champions are prime favorites with these pilots because they know they are absolutely dependable in their planes as in their cars.



It's squarely up to you to make your car last for the duration. S-L-O-W down your driving habits to conserve your tires.—S-T-R-E-T-C-H the mileage you get from every gallon of gas, to the maximum. Check your spark plugs regularly. Have a Champion Spark Plug Dealer test and clean them every 4,000 miles. These economical practices are your patriotic duty.



"Old plugs invite trouble", and winter is just around the corner! Cold weather causes hard starting and increased use of choke resulting in wasteful gas consumption. If your spark plugs are worn out or of inferior quality, economy and efficiency are further handicapped. In this event, new Champions are sound economy.



*More Vital -
More Dependable
than ever!*



TO SAVE GASOLINE • KEEP YOUR SPARK PLUGS CLEAN

How to turn a hull into a hornet's nest

THE EFFICIENCY of an aircraft carrier depends upon power—steam power to propel it, electric power to operate it.

Powering these sea-going airfields is a typically *Westinghouse* kind of wartime job. It is a job that calls for the thousand and one different skills in things electrical that are second nature to *Westinghouse*.

Here is just a small part of the equipment that *Westinghouse* has designed and built especially to make American carriers outstanding engines of destruction:

- ★ Steam turbines, compact in size, yet so powerful they drive our new carriers *faster* than any enemy carrier afloat.
- ★ Elevators big enough to hold a bomber, fast enough to deliver a plane to the deck with minimum delay.
- ★ Generators on each ship capable of producing enough electric power to light a city the size of Seattle.
- ★ Intricate radio equipment specially designed to stand up under the shock of battle.

Westinghouse "know how" is being applied—not only to aircraft carriers—but to nearly every type of ship in our Navy.

In this, as in all phases of *Westinghouse* wartime activity, the long-range work of our Research and Engineering Laboratories has played a significant part. Discoveries in many fields are now bearing fruit in the production of better and more powerful weapons of war.

Many of these discoveries, we believe, will someday help to make a better peacetime world.

Westinghouse Electric & Manufacturing Company, Pittsburgh, Pa. Plants in 25 cities; offices everywhere.

This advertisement has been reviewed by Government authorities and contains no information of military value to the enemy.

Westinghouse

... making Electricity work for Victory



DECEMBER, 1942

This One



HLY2-07W-R2CG

1A

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“If I were twice as big”

“Then I could give the public all the service it wants and take care of the war on top of that.

“But I can’t get bigger now because materials are needed for shooting. So I’m asking your help to make the most of what we have.

“Please don’t make Long Distance calls to centers of war activity unless they are vital. Leave the wires clear for war traffic.”

BELL TELEPHONE SYSTEM



Popular Mechanics Magazine

Registered in U. S. Patent Office and Canada

H. H. WINDSOR, Founder

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

December, 1942

Vol. 78, No. 6

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U. S. Planes on World Frontiers

EAST or west from the United States it is less than 24 hours by air to a battle front where Uncle Sam's warbirds are flying. The Flying Tigers shoot down 34 Jap planes for every P-40 lost. A Flying Fortress knocks out 12 Zeros. The army's air transport service exceeds by 10 times the prewar operations of all world air lines. A sky liner with two million miles on its log carries supplies to the Libyan desert, brings home wounded from Iraq. Read the rest of this absorbing story, "Uncle Sam's Warbirds on World Frontiers," in the January issue.

Drafting Our Forests

A MERICA'S greatest crop is trees. They cover one-third of the nation. And they are mighty important right now. Molded, weatherproof plywood, for example, arrived just in time for this war and is making a career in "mosquito" boats and cargo planes, non-metal aqueducts and kitchen sinks. For a closeup of the lumber industry today, see next month's article.

WHAT Schicklgruber has done to the map of Europe is no immediate concern to the map-makers. It's the airplane that bothers them. National boundaries on the maps are changed only after they are fixed by treaty, but air transportation has given the world a new view of itself. Instead of flat land routes, today's maps must show great circle routes as followed by plane and ship, with the North Pole as center of the world. It's only 4,300 miles from Berlin to Fairbanks, Alaska. Read "Maps for the Air Age" next month.

Sluggers of the Sea

UNTIL the "North Carolina" put to sea, America's battleships weren't much for speed. They had the heaviest protective armor and the greatest cruising radius, were built to fight an enemy 3,000 to 5,000 miles from our coasts. But the new battleships of the "North Carolina" and "South Dakota" class will be the world's fastest, biggest, hardest hitting. "Heavy-weight Sluggers of the Sea," they are called in a January feature.

Rough Riders, 1942

WHAT happens to every new type car delivered to the army for test is nothing short of cruelty to vehicles. The first jeep, for example, would get a 4,000-mile test run that is the equivalent of being rolled into the Grand Canyon. It is also torture for the drivers and maintenance men, you will agree when you read "Rough Riders of the Q.M.C." next month.

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So, start getting Pyroil protection, today. Mail coupon, below. Manufactured and guaranteed by Pyroil Company, W. V. Kidder, Founder, 512 Pyroil Bldg., LaCrosse, Wisconsin, U. S. A.



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War Bonds for Victory!

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PYROIL COMPANY
512 Pyroil Bldg., LaCrosse, Wisconsin

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Send details of your Plan for Distributors

Name

Address

City or Town..... State.....

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“Say, Captain . . . what side of the road do they drive on in Rio?”

Don't think the planes of the future aren't *already here!* They are! But, of course, these giants aren't carrying pleasure cars and vacationists. Troops and jeeps and equipment fill their holds.

Just imagine the Day of Victory has already arrived. Visualize the multi-motor bombers and transports of today as fleets of freight planes and super liners.

As sure as Victory will be ours, the America that lies ahead will be a land that brings the horizon to your back door. It will be a land that leads mankind to a new concept of civilization. Today's production lines are geared to it. Today's Americans are working for it.

When the aviation industry was in knee pants, we of B. F. Goodrich started our aeronautical division. Planes were fragile, slow, unsafe. The pilots who flew them were daredevils. But every day some new miracle of ingenuity took place.

For example, from the B. F. Goodrich research laboratories came a new type of aircraft tire, a low-pressure Silvertown which made aircraft take-offs and landings smoother and safer. This helped pave the way for heavier planes. We developed a new type of brake that greatly increased a pilot's ground-control. This helped pave

the way for greater speeds. We developed De-Icers, which protect wings, tail and rudder from ice.

Today, the greatest air force in the world is using this equipment. As the air power of the United Nations grows in strength, the Day of Victory looms nearer. And, when it arrives, we at B. F. Goodrich won't even take time out to look up from our work.

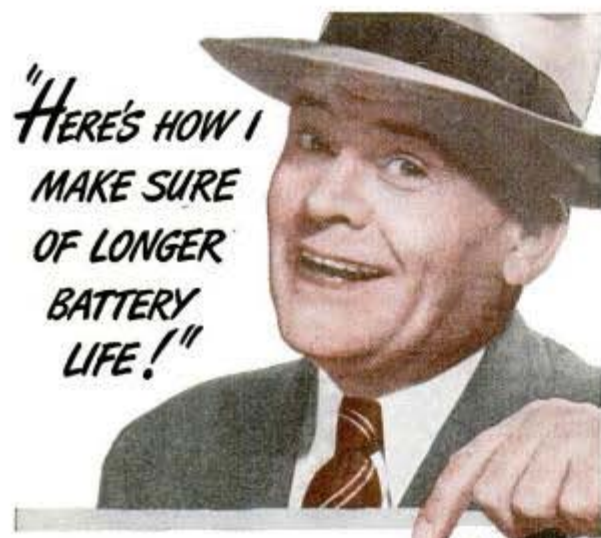
We will start right off on our new job—turning out aircraft equipment for the conquest of new worlds . . . for the creation of a new America. The B. F. Goodrich Co., Aeronautical Division, Akron, Ohio.



Skyway or Highway

B.F. Goodrich

FIRST IN RUBBER



"HERE'S HOW I
MAKE SURE
OF LONGER
BATTERY
LIFE!"

DOUBLE CHECK

*shows
Experts Specify*

Auto-Lite Batteries

FOR years engineering experts have specified Auto-Lite Batteries as original equipment for 1 out of every 3 makes of cars. They pick them for giant ocean-spanning clippers too, where dependability counts most. For longer life, extra power, ask for Auto-Lite Batteries . . . now priced with the lowest.

USL BATTERY CORPORATION
Niagara Falls - (A Subsidiary of The Electric Auto-Lite Company) - New York



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- ✓ Every 1,000 miles use this 4-way service—test charge, add water, remove corrosion, tighten battery in place.
- ✓ Auto-Lite Battery service men can advise you on the size and type of battery for best service, longest life.

AUTO-LITE MEANS AUTO LIFE

IN ITS 26 GREAT MANUFACTURING DIVISIONS, AUTO-LITE IS PRODUCING FOR AMERICA'S ARMED FORCES ON LAND, SEA AND IN THE AIR



✓ Ocean-spanning clippers use Auto-Lite Batteries.

✓ One out of every three car makers specify Auto-Lite Batteries.

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"No, I Can't
Talk to
You..."



AN UNUSUAL TRUE STORY

**It May Have a Tip
for You**

"No, I can't talk to you. I am not interested in a correspondence course in Accounting and besides, I have a bowling date for tonight."

That's what our representative heard one day two years ago from a bright young man, high school graduate and bookkeeper for two years in a western city. Let's call him Jim, although that isn't his real name.

Just a month or so before, this same LaSalle representative had enrolled for the very same training another young man (let's call him Bert) recently arrived from Europe and then working as an office boy in the same town at \$15 a week. Bert worked enthusiastically, aggressively in his spare time on his study.

A year later our representative was asked, as they so often are, to recommend a successor to the chief accountant of Jim's company, a successor to the man under whom Jim worked. He recommended Bert and Bert was hired—as Jim's boss and at a salary considerably larger than Jim received. Four months later, Bert was made comptroller and given another salary increase.

A month later, Jim enrolled for the training which he had turned down a year before and he has since had a salary raise. He had been badly disappointed but he saw the point. He decided that he would not make the same mistake twice.

An Unusual Story—Yes

It doesn't often happen exactly as it did in this case. But in essence it does happen far more frequently than you suspect.

For business, when it has an opening, looks first to its own present employees to see who is ready and prepared for the job. But if, as so often happens, it finds no one, then it goes outside for the person it wants.

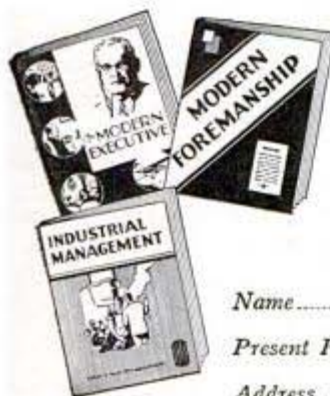
Don't blame the employer. Nine times out of ten, he would prefer a man or woman already experienced and familiar with company policies and methods. But he knows that long, loyal service in the job below may not be enough—he must have trained ability for the position.

That's why business watches its employees so eagerly—to see who is ambitiously and systematically preparing for promotion. We hear it over and over again—this note of gratitude when we tell an employer (as we do on request of any student) that some employee of his is training with us for better service to him.

Can It Happen to YOU?

There's only one way to be certain it cannot. That is to prepare yourself for the jobs ahead—for the place you want, either with your present company or some other. And quick action is particularly important in this critical period with so many changes and opportunities.

Mailing the coupon below can be your first step. It will bring to you—without cost or obligation—a free 48-page booklet about the business field of your choice, telling of the opportunities and requirements and describing our proven and low cost training for success in that field. Why not take that first step now?



LASALLE Extension University **a Correspondence Institution** Dept. 1264-R Chicago, Ill.

I do not want this to happen to me as it did to Jim. Send me your free booklet on the field I have checked below.

- | | |
|---|--|
| <input type="checkbox"/> Higher Accountancy | <input type="checkbox"/> Expert Bookkeeping |
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Name..... Age.....

Present Position.....

Address



... AND INDUSTRIAL WARFARE HAS ITS "COMMANDOS," TOO!

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Industrial warfare, too, has its "commandos"—workers whose skill and experience are backed by sound, practical, up-to-the-minute *training!* These are the men who were Johnny-on-the-spot when the nation called on industry to outproduce the Axis!

Many of these "shop commandos" got their basic and specialized training through the International Correspondence Schools—at surprisingly low cost! It's not too late for YOU to join their ranks—by starting now to get the training that will make you a better soldier on the industrial front, and

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"DEAD MEN TELL NO TALES"

—so—we'll never know how many people have been killed—driving at a high rate of speed—with one hand off the wheel and their eyes off the road—TUNING RADIO!

CAR CRASHES AS DRIVER TUNES AUTO RADIO

While his attention was concentrated on tuning the car radio, the driver lost control of his automobile which struck and knocked down a light post. Driver's left leg was broken and his face cut.

(news item)

THIS HAZARD IS ELIMINATED WHEN—

your car is equipped with Zenith Foot Control Car Radio... you tune your radio with both hands on the wheel and both eyes on the road—a revolutionary and sensational contribution to safety. You change stations with a pressure of your left foot—you silence radio for conversation or danger the same way—and it resumes without a wait for warm-up.

ONLY ZENITH HAS THIS SAFETY FOOT CONTROL RADIO

See the Zenith Foot Control Radio on Fords (sold in 1940-41-42)—Nash (in 1940-41-42)—Mercury (in 1940-41-42)—Lincoln Zephyr (in 1940-41-42)—Hudson (in 1941-42)—Willys (in 1941-42).

Any owner of one of the above cars will gladly demonstrate. Your inspection will be a personal pre-view of post-war car radio—danger-free radio—really safe—radio.

Zenith's leadership in the radio industry has been established by a constant achievement of "firsts." Repeatedly, ideas "brand new" when Zenith "first" introduced them, later became essentials on all radios. And that same "forward thinking" of engineers and factory and organization now concentrates on war production of the thing we know—radio—exclusively radio. We are progressing—we learn every day—and this new experience will inevitably reflect itself when Zenith again produces for peace.

—a Zenith Radio Dealer near you is giving reliable service on all radios—regardless of make.

ZENITH RADIO CORPORATION—CHICAGO

ZENITH
RADIO
•LONG DISTANCE•
RADIO PRODUCTS EXCLUSIVELY—
WORLD'S LEADING MANUFACTURER

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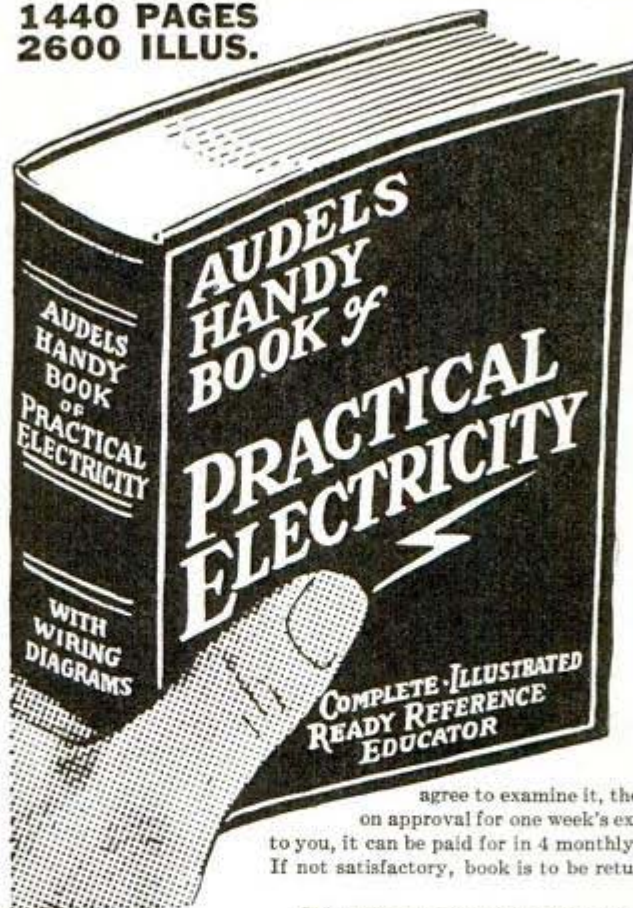
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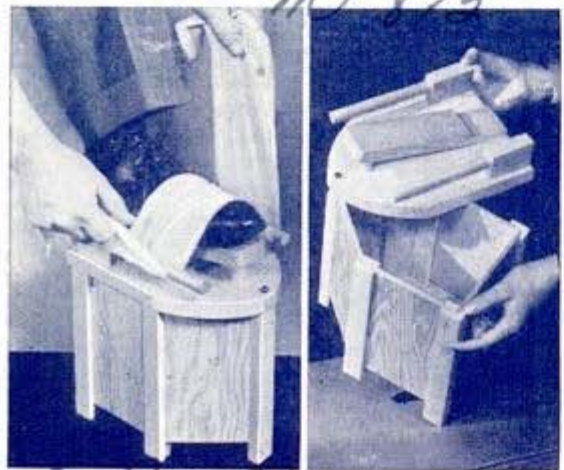
Folding Table Has Slots in Top To Form Convenient Handle



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shining unit now on the market which offers greater convenience. Two wooden pins paralleling the sides of the foot platform serve to hold the cloth down, so when polishing, the cloth is pulled upward instead of pushing it downward. Within the unit there is space for storing supplies, which can be reached easily by swinging the top cover to one side. A hook keeps the cover closed so the contents will not spill accidentally.

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(More Popular Inventions on page 26A)

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WHAT TO DO ABOUT

1 IF YOU SAVED YOUR LAST WINTER'S ANTI-FREEZE...



Some of the ingredients of "Prestone" anti-freeze will last from one winter through the next—those, for example, which protect the car against freeze-up. But to give protection against freeze-up is only one function of a good anti-freeze. A good anti-freeze also performs other functions, just as important. One of these is to guard against rust and corrosion... which is why all good anti-freezes are "inhibited." These inhibitors do wear out; and when that happens the car is no longer protected against clogging and overheating caused by rust.

That is one of the reasons why you cannot use an anti-freeze indefinitely... why, for instance, we guarantee "Prestone" anti-freeze for "a full winter's use," and no more. *New, fresh anti-freeze is always to be preferred over anti-freeze which has gone beyond a single winter's driving.*

If, however, you decide to re-use your anti-freeze, take the following precautions:

If you stored your anti-freeze during the summer, take it to your dealer *before* putting it back in the car. There are 2 good reasons.

A *To make sure that no dirt or foreign matter has spoiled it.* (Cans frequently rust through from the outside and from the bottom. Dirt and foreign matter will clog your cooling system badly.) If your solution is brown or rusty-looking, don't

bother to take it to your dealer but discard it at once. Be extremely cautious in this regard. Your car is a valuable property: it is in the interest of sound conservation to take all reasonable precautions.

B *To have the strength checked...* You don't know, definitely, what concentration you had at the end of the season. If your anti-freeze was "alcohol base," you almost certainly lost strength before you took it out last spring. Even if you used "Prestone" anti-freeze, which contains no boil-away alcohol, have the strength checked just the same. You may have lost protection through careless filling, slop-over at the over-flow pipe, and leaks caused by road-shock and wear-and-tear during driving.

if you left your anti-freeze in your car, and have been driving with it all through the summer, point B (above) is even more important, for obvious reasons.

These precautions are the very least you can take to protect your car. Remember, none of them will put back into the anti-freeze the rust and corrosion inhibitors which were there when you bought it last fall, and which have since been used up. This is one of the sound technical reasons why manufacturers guarantee anti-freeze for only one winter's driving.

ANTI-FREEZE THIS FALL

2 IF YOU DID NOT SAVE YOUR LAST WINTER'S ANTI-FREEZE...



See your dealer at once and get "Prestone" anti-freeze installed in your car. As of the date this advertisement goes to press (approximately July 15th) it appears that there will be enough "Prestone" anti-freeze this fall—after Army, Navy and lend-lease requirements have been met—to supply all regular users. We make this prediction because we have increased our manufacturing facilities and because there will be fewer cars on the road this coming winter.

HAVE YOUR DEALER CHECK YOUR CAR for leaks, rust, sediment, or loose connections which may have developed during summer driving. Make sure your "Prestone" anti-freeze is used in a clean, tight cooling system. Then you can *forget* the anti-freeze

problem for the rest of the winter. You will be protected completely—against freeze-up, boil-away, dangerous and obnoxious fumes, rust and corrosion. You can place complete confidence in new, fresh, full-strength "Prestone" anti-freeze. It is *guaranteed* for one full winter season.

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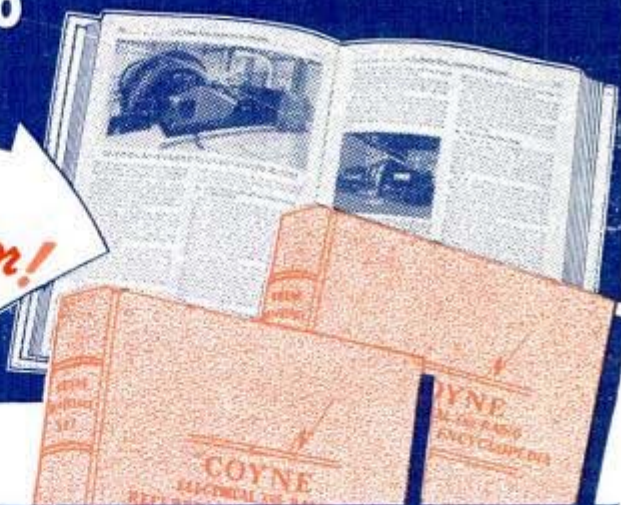
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STATEMENT OF THE OWNERSHIP, MANAGEMENT, CIRCULATION, ETC., REQUIRED BY THE ACTS OF CONGRESS OF AUGUST 24, 1912, AND MARCH 3, 1933, of Popular Mechanics Magazine, published monthly at Chicago, Illinois, for October 1, 1942.

State of Illinois, County of Cook, ss.
Before me, a Notary Public in and for the State and county aforesaid, personally appeared Willis S. Brown, who, having been duly sworn according to law, deposes and says that he is the Business Manager of the Popular Mechanics Magazine, and that the following is, to the best of his knowledge and belief, a true statement of the ownership, management (and if a daily paper, the circulation), etc., of the aforesaid publication for the date shown in the above caption, required by the Act of August 24, 1912, as amended by the Act of March 3, 1933, embodied in section 537, "Postal Laws and Regulations, printed on the reverse of this form, to wit: First, That the names and addresses of the publisher, editor, managing editor, and business managers are: Publisher, Popular Mechanics Company, 200 East Ontario St., Chicago, Ill.; Editor, H. H. Windsor, Jr., 200 East Ontario St., Chicago, Ill.; Managing Editor, H. W. Magee, 200 East Ontario St., Chicago, Ill.; Business Manager, Willis S. Brown, 200 East Ontario St., Chicago, Ill. Second, That the owner is: (If owned by a corporation, its name and address must be stated and also immediately thereunder the names and addresses of stockholders owning or holding one per cent or more of total amount of stock. If not owned by a corporation, the names and addresses of the individual owners must be given. If owned by a firm, company, or other unincorporated concern, its name and address, as well as those of each individual member, must be given.) Popular Mechanics Company, 200 East Ontario St., Chicago, Ill.; L. H. Windsor, 200 East Ontario St., Chicago, Ill.; H. H. Windsor, Jr., 200 East Ontario St., Chicago, Ill.; Henry H. Windsor, Jr., Trustee under the will of Lina B. Windsor, Deceased, 200 East Ontario St., Chicago, Ill. Third, That the known bondholders, mortgagees, and other security holders owning or holding 1 per cent or more of total amount of bonds, mortgages, or other securities are: (If there are none, so state.) None. Fourth, That the two paragraphs next above, giving the names of the owners, stockholders, and security holders, if any, contain not only the list of stockholders and security holders as they appear upon the books of the company but also, in cases where the stockholder or security holder appears upon the books of the company as trustee or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting, is given; also that the said two paragraphs contain statements embracing a full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustees, hold stock and securities in a capacity other than that of a bona fide owner; and this affiant has no reason to believe that any other person, association, or corporation has any interest direct or indirect in the said stock, bonds, or other securities than as so stated by him. Willis S. Brown, Business Manager. Sworn to and subscribed before me this 24th day of September, 1942. N. E. Toole, Notary Public. (My commission expires March 24, 1944.)



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(Continued from page 18A)

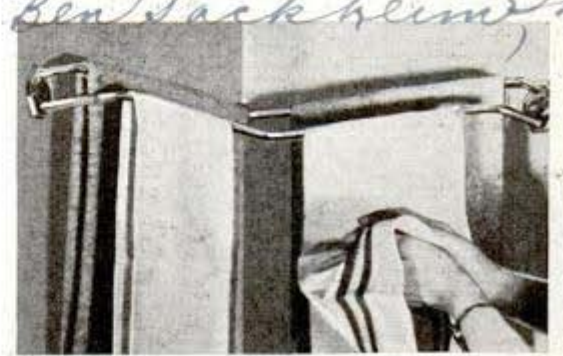
**Button Tape Hidden From View
Replaces Metal Fasteners**



Buttons, not so many years ago displaced by metal slide fasteners, are again coming into their own by reason of restrictions upon strategic metals. A new button tape, for instance, is designed for out-of-sight attachment similar to the familiar fastener tape. It consists of two tapes, one having the buttons and the other button loops spaced to match each other.

Corner Towel Rod Saves Space

Using corner space which usually is wasted, a towel bracket is bent at right angle to follow the wall. Its twin bar holds twice the usual number of towels.

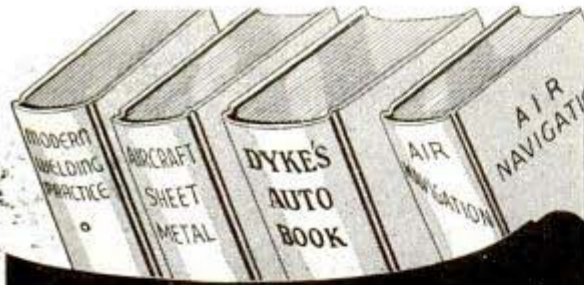


(More Popular Inventions on Page 33A)

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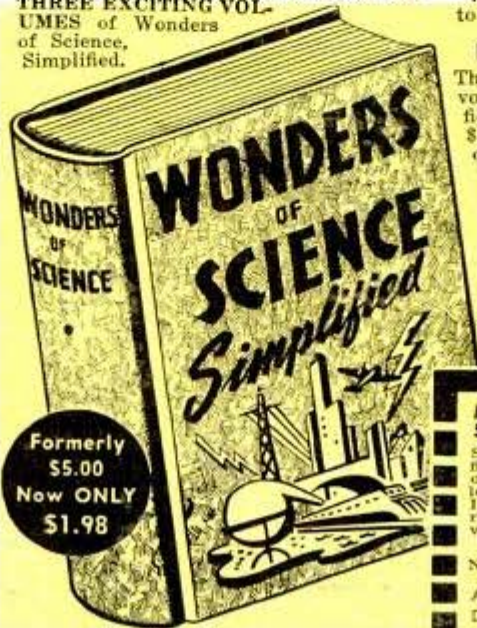
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WORLD'S Largest professional magic shop keeps you in touch with latest tricks. To receive mailings send 25c for 1942 catalog. Holden, 220 W. 42nd St., New York.

BE A magician. Large professional magic catalogue of latest tricks 25c. Ireland, C-109 North Dearborn, Chicago.

MAGICIANS' Headquarters. 216-page catalog, pocket, parlor, professional tricks. 25c. Kanter's, M-1311 Walnut, Philadelphia.

COINS—TOKENS—CURRENCY

OLD Money wanted. Will pay \$100.00 for 1894 dime, S. mint, \$50.00 for 1913 Liberty head nickel (not buffalo). Big premiums paid for all rare coins. Send 4c for large coin folder. May mean much profit to you. Numismatic Co., Dept. 20, Fort Worth, Texas.

10 INDIAN Head cents, different dates, also pricelists, 35c. Schultz, 1053 Richmond, Cincinnati, Ohio.

WE Buy Indian cents, Lincoln cents, old money. Send 10c today for 1942 catalogue of prices. We pay for all wanted U. S. coins. American Rare Coin Co., Dept. 1, Transportation Bldg., Chicago.

GET Profit and pleasure in collecting old coins. Send 10c for 56-page illustrated coin catalog. You'll be delighted with it. Send for it now. B. Max Mehl, 370 Mehl Building, Fort Worth, Texas. Largest rare coin establishment in U. S. Established 42 years.

ETHAN Allen has Lincoln sets. Wants big and half cents. Cawker, Kansas.

50,000 COINS, Medals, papermoney. Lists free. Nagy, 8-P South 18th, Philadelphia, Penna.

INDIAN Head penny with list 10c. Charles Banker, Salina, Kansas.

BARGAIN Coin list 10c. Ramsay, 882 East Market, York, Penna.

COMMEMORATIVE \$1½s. Columbus, Stone Mountain, Long Island \$1.00 each. Large illustrated catalogue 10c. Norman Shultz, Salt Lake Utah.

CENTS 100 Years old 25c, 10 different Indians 25c, large illustrated coin book 50c, list 3c. Coin Shop, Alameda, Calif.

FREE! Foreign coin, banknote and large 50 page illustrated coin catalogue to approval service applicants. Send 3c postage. Tatham Coinco, Springfield-125, Mass.

OLD Money wanted. Big premiums paid, 1,000 quotations. Catalogue 10c. Allan Appell, Sedalia-6B, Missouri.

I MAY Have just the scarce U. S. coins you want. Send me list. "Meet me by mail." William H. Kenworthy, Waterville, Maine.

STAMP COLLECTING

SENSATIONAL "Treasure Island" gift offer—latest Scott's big 1200 page \$4.00 International Stamp Album; Scott's 1943 \$4.00 Standard Catalog—choice other albums (\$7.00 loose-leaf International, etc.) or free stamps—given absolutely free to purchasing applicants of our foreign approvals. "Treasure Island" Service, Vista, California.

FREE! The Stamp Finder! Send today for the big new edition, fully illustrated, enabling you instantly to identify all difficult stamps! Also fine packet strange, fascinating stamps from Bosnia-Herzegovina, Monaco, Patiala, Cyprus, etc., including maps, ships, animals and strange scenes. All free to approval applicants inclosing 3c postage. Garcelon Stamp Company, Box 900, Calais, Maine.

POSITIVELY Greatest free offer—Latest Scott's International \$4.00 Stamp Album—covering entire world, contains 36,000 illustrated, descriptive spaces; Scott's 1943 Standard \$3.50 Catalogues "Philately's Encyclopedia"—absolutely free to applicants for foreign approvals becoming customers. Fair-Play Stamp Service, 1215 Browning Blvd., Los Angeles, California.

WOW! \$10.00 Worth of fun for only 10c! 500 foreign stamps, unsorted and unpicked (mostly on bits of paper) just as received from the church missions and other sources. Africa, So. America, Australia, China, Philippines, Dutch Indies, and other countries are represented. Includes a few commemoratives, airmails, and stamps cataloging up to 25c or more each! The biggest package of fun in stampdom—and you might find something really valuable! Price only 10c to serious approval applicants! Money back if not delighted. Jamestown Stamp Co., Dept. No. 22, Jamestown, New York.

FREE! Canada war stamps. Postage 3c. Smith, 237 East 8th, Roselle, N. J.

BETTER Grade approvals! Free offer. Ephraim, 914 Sherman, Evanston, Illinois.

206 DIFFERENT Stamps including Kedah, Haiti, Cochín, Albania, Johore, Perak, only 10c to approval applicants. Reich Stamp Co., 4647 Kenmore, Chicago, Dept. M3.

INTERESTING Scandinavian collection: 100 Norway, 100 Sweden, all different \$1.25. Approvals. Hermes Stamp Company, Box 276, Hempstead, N. Y.

SENSATIONAL Combination offer! Big packet 105 different including Iceland, Manchukuo, Ecuador (American flag in full colors), Danzig; airmails, commemoratives, triangle stamp, \$4 United States; complete set United States telegraphs, cataloging 20c. Packet British Colonies, including Gwallor, Hyderabad, Burma (new country) jubilee and coronations. Scarce Far Eastern republic cataloging 50c. Big illustrated lists of other bargains. Total catalog price over \$3.00! All for only 5c to approval applicants! World-Wide Stamp Company, Department 600-N, Camden, New York.

FINE Approvals, freshly mounted. Fast, personal service. Tell me what countries you prefer and I'll send them stamps. Skinner, 345 East Ocean, Long Beach, Calif.

CASH Paid for good stamp collections and accumulations. Also envelopes with stamps before 1875. Al Johnson, 727 North Foote, Colorado Springs, Colorado.

5c; 10c BARGAINS, List free. 5 & 10 Stamps, 1018 N. Rampart, Los Angeles, Calif.

100 DIFFERENT 10c With approvals. W. J. Benton, Wetumpka, Ala.

BIG Lot for little! Includes triangles, old and recent U. S. commemoratives, mint British Colonies, free French Colonies and over 100 different others. Everything only 10c to approval applicants. Flax, P.O. Box 45, Queens Village, Long Island, N. Y.

U. S. Mixture. 3 pounds \$1.00. Holmes Stamps, New Albany, Ind.

WONDERFUL Cut-rate approvals 1/4c up. Premiums too. Rheasume, 8949 Routhier, Montreal, Canada.

LATIN-AMERICA—Nice packet, 100 different, only 10c with approvals. "Crested Stamps," London, Canada.

349 ASSORTED U. S. stamps 10c. Plummer, Box 99, Westfield, Mass.

SMOKY Mountain sheet 7c; approvals. Guy Freese, R.R. 6, South Bend, Ind.

BARGAINS In fine approvals! Write today! International Stamp Co., Hallettsville, Texas.

50 HYDRABAD, Travancore, British Colonies 3c. Approvals. Cymerman, 177 Huron, Brooklyn, N. Y.

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FREE! Worldwide packet with approvals. Monjar, 1750 Fairmount, Cincinnati, Ohio.

PREMIUM Approval applicants. Redding Stamp Shop, 1254 Rose, Redding, Calif.

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4,000 \$1. Approvals 1c up. Griest, 409 Oak, Davenport, Iowa.

ICELAND—Ten different, 10c, with approvals. Read, 3401 Parnell, Chicago.

JUMBO Approvals. Books of 500. Beaumont Stamp Exchange, 2667 McFaddin, Beaumont, Texas.

33 DIFFERENT United States 3c. Utech, 11436 North Keeler, Chicago.

75% DISCOUNT Approvals. Fine stamps only. References. Riedell, Greensburg, Penna.

500 U. S. Comm., foreign, etc.—25c Excellent assortment. Jones, 6805 Seville, Huntington Park, Calif.

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50 DIFFERENT Brazil, 10c, approvals. Pinehurst Stampco, 90 Pinehurst Ave., New York.

CANADA Mixtures 70c lb. United States 40c lb. Mission, 4512 North Racine, Chicago.

FREE Outfit! Album, stamps, hinges, gauge, detector, lists, to serious approval applicants. 5c postage. Manchester Stamp Company, Manchester, Connecticut.

500 UNITED States for 10c! 500 U. S. A.—absolutely unpicked and unsorted—just as received from church missions. Many varieties, including commemoratives, airmails, high values up to \$5.00 denomination! Price only 10c to approval applicants! Money back if not delighted. Swan Stamp Co., Dept. 69B, Dunkirk, N. Y.

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1,000 GRABBAGS 15c each, 8 different \$1. Zandy, 630 Bingham, Reading, Pa.

10 DIFFERENT Burma and Nicaragua Will Rogers set complete for only 5c to approval applicants. Wonder Lake Stamp Co., Ringwood, Illinois.

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OLD Russian set—14, 5c. Approvals. Small, Charles Road, Cape Elizabeth, Maine.

SURPRISE Packet only 5c. Distinctive personalized approvals. Stamp Shop, P.O. Lysander, N. Y.

U. S. 15 different 19th century including commemoratives, 10 cents with approvals. Swedell, 3638 Harriet, Minneapolis, Minn.

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WORLD'S Smallest airmail—diamond and triangle stamps, free stamp magazine, also magnifier to study your stamps, with large collections of stamps from scarce countries. A bargain, 5c with approvals. Capital Stamps, Dept. 2, Little Rock, Arkansas.

U. S. Approvals—Fine stock—Want list. Service, Box 488, Minneapolis.

SEYCHELLES, Nejd, Caymans, Manchukuo, Brunel, Turks Caicos, British Solomons (Cannibal), Everything 3c with approvals. Viking, 130-Z Clinton St., Brooklyn, N. Y.

50 DIFFERENT Ships, railroads, etc. 10c. Approvals. Buchanan, 307 East 23rd, New York.

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19th CENTURY U. S. commems. Civil War revenues, battleship \$5 and \$10 stamps, 1942 illustrated U. S. catalogue. Free to U. S. approval applicants. Metropolitan Stamps, 198-P Broadway, New York.

LOWEST United States stamp prices. Free illustrated catalogue. Creevey's, Berwick, Penna.

1000 MIXED U. S. old and new 25c. Weatherby, Troy, Ohio.

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TEN Crazy-shaped stamps, 3c with approvals. Knopp, Box 1381, Bristol, Conn.

FREE! Western Hemisphere packet. Postage 3c. Owens, 806 Welsh, Bay City, Michigan.

1000 U. S. Mixed, dime and 4c postage. Jem Stamps, Port Jefferson, N. Y.

FREE! Complete "United States" stamp catalog with 1,000 illustrations! Send 3c for postage. Harris & Co., 137 Transit Building, Boston, Mass.

VICTORY Packet free—Includes stamps from Tanganyika, British Cayman Islands, animal, scarce babyhead, coronation, early Victorian, airmail, map stamps, with big catalogue—all free. Send 5c for postage. Gray Stamp Company, Dept. PM, Toronto, Canada.

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WHOLESALE Supplements to dealers for 10c postage. Hundreds of bargains. Grossman Stamps, 102 West 42nd, New York.

15,000 VARIETIES 1c, 2c each! Davison, Box 31A, Wollaston, Mass.

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WEEKLY Stamp magazine, thirteen weeks, 10c. Stamp Journal, Kalamazoo, Mich.

A REAL Bargain. Specially prepared packet containing 150 different foreign and 65 different U. S. stamps; catalog value about \$5.00; pamphlet which tells you "How to Make Your Stamp Collection Properly" and large bargain lists, all for only 23c postpaid. Queen City Stamp Co., Room 36, 604 Race St., Cincinnati, Ohio.

PENNY Approvals, that satisfy. Neil Gronberg, Box 5441-P, Philadelphia, Penna.

GIANT Packet 136 all different from Africa, South America, South Sea Islands, etc. Includes Nicaragua airmail, two scarce unused United States cataloging 20c triangle and animal stamps; many others. Also includes fine collection 25 different British Colonies—Charkari, Jamaica, Johore, etc. and United States \$4 and \$5 high values. Total catalog price over \$4.00! Everything for only 5c to approval applicants! Mystic Stamp Company, Department 80-A, Camden, New York.

SEND Postage for free United States price list. Stanley Gibbons, 38-P Park Row, New York.

CANADA 100 Different 25c—approvals all countries. Lists. Victoria Stamp Co., London, 4 Canada.

SMOKY Mountain commemorative sheet, largest U. S. stamp issued, and 33 U. S. including commemoratives, airmail, revenues, etc. Catalogs 75c—70 approval applicants for 5c. Curhan Stamp Company, Gloucester, Mass.

STAMPS Wanted by thousands of our readers. Your ad in this space will bring you some nice orders. One advertiser sold 150,000 stamps. Write for positive proof. F. W. Johnson, Classified Advertising Manager, Room 301, 200 East Ontario St., Chicago.

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20 DIFFERENT Cactus plants postpaid \$1.00. Lida Delap, Azusa, Calif.

GENUINE Arizona ruby and desert sapphire, send quarter for both. Mineral Specimens Company, Box 2651, Phoenix, Arizona.

20 DIFFERENT Cactus plants postpaid, \$1.00. Eulalia Turner, Azusa, Calif.

MOVIE Scenes, 8x10. Silents-talkies! Meginnis, 340 West 29th, New York.

25 VARIETIES, Cactus plants postpaid \$1.50. Mixed seed 25c. Art Glover, San Dimas, Calif.

NEW Hobby catalogue. Pets, Mexican goods, books, stamps, novelties. Fifty pages, illustrated. Stamp appreciated. Quivira Specialties, Winfield, Kansas.

SPECIAL Albums for match books. Albums, also, for photographs, phonograph records, etc. Free booklet. Matchless Album Co., Dept. P, Long Branch, N. J.

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NEW—15 Different match covers 10c. Box 202, Rochester, N. Y.

EXCHANGE Your duplicate stamps, match covers, etc. with collectors everywhere. List, swappers, dime. (Mention hobby.) Secretary, Box 2166, Denver, Colo.

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BASS Says: War time proves Bass leadership. Amazing selection of finest still cameras—Leica, Contax, Korelle reflex, Argus, new and used still available. Write for quotations. Satisfaction guaranteed or your money refunded. Bass buys 'em, sells 'em, trades 'em. Bass Camera Company, Dept. AG, 179 W. Madison St., Chicago, Illinois.

STILL Available at Central—Hundreds of bargains in cameras and supplies. Send for free illustrated catalog listing still and movie cameras, films, lenses, enlargers, meters, supplies—at tremendous savings—all guaranteed. Trade in your old camera or equipment. Write for your free copy of newest money-saving bargain book—just out! Limited edition. Hurry! Central Camera Co., (Photographic Headquarters since 1899), 230 S. Wabash Ave., Dept. L-16Z, Chicago, Illinois.

ENLARGER \$1.79. Enlarges eight times size of small negatives. Fully guaranteed. Paramount Sales Company, 1301A Commonwealth Ave., Boston, Massachusetts.

SPEED-O-COPY Groundglass focusing attachment for Leica, Contax, Argus C-2 and C-3. Send for literature. D. Paul Shull, Dept. FM-11, 240 So. Union Ave., Los Angeles, California.

MAKE Money with your camera. Post card brings details. Graphic Services, 208 Calvin Theatre Building, Dearborn, Mich.

HAVE You a camera? Send ten cents for recent number of our big magazine, showing how to make better pictures and earn money. American Photography, 116 Camera House, Boston, Mass.

MAKE Money in photography. Learn quickly at home. Easy plan. Previous experience unnecessary. Common school education sufficient. Booklet and requirements free. American School of Photography, 1315 Michigan, Dept. 3432, Chicago.

CAMERA Repairing. Bellows made to order, shutters repaired. Bellows made to fit all standard cameras! United Camera Co., Inc., A-1515 Belmont, Chicago.

CASH! Spot cash for cameras, lenses, binoculars, movie or still, sound projectors. Send full description by mail, or wire for prompt cash offer. Over 30 years of dependability insures honorable dealings. Bass Camera Company, 179 West Madison Street, Chicago, Illinois.

PHOTO FINISHING

35 MM. Argus, Leica, etc., (except "Mercury") 36 exposure rolls, fine grain developed (Eastman DK-20) and beautifully enlarged to 3"x4" glossy prints, 90c. Cartridge reloaded with Eastman Plus X, 35c. 18 exposure rolls, 55c, reload 20c. Films permanently protected by revolutionary Cryolite process, 24-hour service. Satisfaction guaranteed. Free mailing bags, sample print. Write Technifinish Laboratory, 605 Brown St., N. W., Rochester, N. Y.

BIGGEST \$1.00 Value in 35 mm. finishing today. 36 exposure fine grain 3 1/2"x4 1/2" enlargements; deckled, embossed margin and date. Eighteen exposures 75c; sixteen exposure splits 55c. Free mailers, 8 exposure rolls in beautiful deckled contact finish with embossed wide margin, 25c. Mailbag Film Service, Box 5440A, Chicago.

VELOX Quality prints! Roll developed, two prints each negative, 30c. Reprints 2 1/2c. Hench Studios, Harrisburg, Penna.

YOUR Prize 35mm. film enlarged 5x7 35c. Grove, Coupeville, Washington.

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6-8 EXPOSURE Rolls developed and enlarged mammoth size 25c. Reprints 3c. Thrifty Photos, Box 46, South Gate, Calif.

PHOTOGRAPHIC Christmas cards, made from your favorite negative—a truly unusual, personal greeting. Write for full details. Joy Photos, G.P.O. Box 606, New York.

COLORED Lifelike enlargements from your snapshot negative 5x7, 25c; 8x10, 40c. Promenade Photos, 13 St. Marks Place, New York City.

THE Photo Mill. Immediate service! No delay! Eight exposure roll developed, printed and coupon for your choice of two beautiful 5x7 professional enlargements, eight reprints or other premiums, for 25c coin. Developing and eight Jumbo prints 30c coin. The Photo Mill, Box 629-12, Minneapolis, Minnesota.

FREE! Best snapshot on attractive photo button with 16 prints each roll 25c. Beautiful novelty premiums. Novel-Ad Co., B.M.-3327 North Ave., Chicago.

EMBOSSD Deckled edge Christmas cards including envelopes from your own negative, 25 for \$1.25; 12 for 75c. Sample order 4 for 25c. Film Capitol Service, Box 504, Rochester, N. Y.

ROLLS Developed: Two prints each negative 25c. Reprints 2c each. Summers Studio, Unionville, Mo.

REPRINTS 2c Each, 100—\$1.50. 6 or 8 exposure rolls developed 2 prints each exposure 25c. 36 exposure 35mm. rolls fine grain enlarged prints \$1.00. Mailing bags free. Mercury, A-109 North Dearborn, Chicago.

16 SPARKLING Lifetone prints, 2 beautiful Hollywood enlargements. Free Leathertone frame and photo wallet only 25c. Free photo album with first order. Lifetone Studios, Dept. A-1139, Des Moines, Iowa.

8 EXPOSURE Rolls, giant size 25c; 16 exposure rolls, 50c. Mayfair Photos, Box 261-K, Toledo, Ohio.

ROLL Developed and 4x8 oversize glossy Velox prints. 8 exposure 30c; 12 exposure 45c; 16 exposure 60c. Overnight service. Clemet Photo Service, 1318 W. Columbia Ave., Philadelphia, Penna.

IDEAL Photos beautifully finished wide border—deckle-edge. 25c per roll of eight. Fade-proof, superior quality. Write for free mailers. Ideal Photos, Box 2255, Paterson, N. J.

EVERY Picture an enlargement! 8 sparkling deckle-edge enlargements and roll developed 25c coin; 116 size or smaller; enlarge reprints 3c. Enlarge Photo, Box 791D, Boston, Mass.

3½x4½ ENLARGEMENTS From 36 exposure roll \$1.00, 18 exposure roll 75c. Double size prints, 8 exposure 828-127-120 rolls 25c. 8 exposure 116-129-130 rolls 30c. Split rolls 45c. Write for complete price list. Village Film Laboratories, Box 4046, Dept. M, Village Station, Los Angeles, California.

IMMEDIATE Service! Pictures returned same day order received. Sixteen guaranteed deckle-edge Velox prints from roll, 25c. One colored or two plain enlargements plus 8 deckle-edge Velox prints, 25c. Free! Coupon for 8x10 enlargement free with each 25c order. Any 36 exposure 35mm. film fine-grain developed. "Magic-Eye" timed, vapo-rated and each good negative enlarged to 3x4 on deckle-edge Velox paper, \$1.00. 18-exposure, 60c! Reloads: 36 exposure, 50c; 18 exposure, 35c. 3x4 deckle-edge reprints, 3c each! Write for free mailers, free premium offers. American Studios, Dept. 406, LaCrosse, Wis.

BEAUTIFUL Enlargement from each picture on roll 25c. Cut Rate Photos, Dept. B-4, Janesville, Wis.

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ROLL Developed and 8 lustrous distinct finish permanent Velox glossy prints 25c—reprints 3c each. Fotoprint Service, Box I, Roanoke, Virginia.

8x10 SILK Finish enlargement—25c. Send negative. Irving Studio, 4006A Irving Park, Chicago.

DOUBLESIZE Prints. Your roll developed and 8 double-size prints 25c; from 116 or 120 size negatives you receive 4x8 inch prints. All other size negatives printed in proportion. 16 exposure rolls 50c; 12 exposure rolls 35c. Reprints 3c each. "Our guarantee." Everlasting hi-gloss finish. Overnight service. Pacific Photo Service, Box 666, San Francisco, Calif.

16 BEAUTIFUL Oversize deckledged prints and two enlargements with first order 25c. Owlphoto M1, Weatherford, Oklahoma.

PHOTOGRAPHY For pleasure and profit. Prepare at home. Common school education sufficient. Write for information and requirements. American School of Photography, 1315 Michigan, Dept. 3451, Chicago.

EIGHT Beautiful enlarged prints (nearly postcard size) or 16 regular prints 25c. 35mm. rolls enlarged 3½x4½ \$1.00. Burton Studios, 443M, Roscoe, N. Y.

PHOTO Enlarger—Make it yourself. Costs little. Simple to make. Illustrated instruction book 25c. Popular Mechanics, 200 E. Ontario Street, Chicago.

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LATEST Film lists and new film exchange. Paramount Mfg. Company, G-110, Box 224, Back Bay, Boston, Mass.

100' 16MM. Used sound films. \$1.00 postpaid. Blackhawk Films, Dept. PM3, Davenport, Iowa.

SOUND Features \$10.00 up, programs rented, silent features \$5.00. Projectors \$25.00. Free lists. Simpson Films, Miamisburg, Ohio.

BASS Says: No shortage of Cine Cameras at Bass. Largest stock in the country of 8 mm. and 16 mm. silent and sound. We have them new and used. Bell & Howell double 8, used F:3.5 lens, \$37.50; Keystone double 8, F:3.5 lens, \$26.50; Revolver Turret Model 98, F:2.5 lens like new \$62.50; Cine Kodak 16 mm. Model B, F:3.5 lens, \$22.50. Bass buys 'em, sells 'em, trades 'em. Write for condensed Cine-price list. Satisfaction guaranteed or your money refunded. Bass Camera Company, Dept. A, 179 W. Madison St., Chicago, Illinois.

"BEASTS of Berlin" 9 reel war talkie with Alan Ladd. Others. Film Rentals Co., Yorkville, N. Y.

RELIGIOUS Films, 16mm. Sound. Silent. Screenart, 723 - 7th Ave., New York.

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8 AND 16MM. film-subjects—Black and white and color—sound or silent. Largest selection ever compiled. 65c to \$200. Write for new deluxe 1943 catalog—profusely illustrated! 25c (coin or stamps)—refunded first purchase. Hollywood Movie Supply Company, Hollywood, California.

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FREE: New movie rental library catalog. (Please specify model projector). Sale 16mm. sound projectors; 8-16mm. movie equipment, films, cameras, screens. Trades accepted; easy payments. Mogul's, 64 West 48th, New York.

SAVE 50% On movies. Big bargain circular. Genera Company, Davenport, Iowa.

"THE World's Greatest Passion Play." 16 and 35mm. Specify sound or silent. Rent or purchase. Hemenway Film Co., 33-F Melrose St., Boston, Mass.

OUTSTANDING Sound 35mm. features. Shorts. Demsey, 1223 Berkley, Youngstown, Ohio.

FREE Movie catalog; sample films 10c. Goodwill Company, Jackson, Tennessee.

35MM. 16MM. Sound silent projectors, film. Savarese, Woodcliff Lake, N. J.

PRETTY Girl productions (catalogue-sample 10c). Midwest Cine Shop, Hannibal Mo.

ESO-S Univex and double 8mm. spooled movie films save you 50%. Particulars. PM catalog. Eso-S, 3945 Central, Kansas City, Missouri.

100 FT. 8mm. Subjects 98c. Spring Films, Hopkinton, Mass.

WANTED: Used equipment for cash. Films, cameras, projectors, etc. Peters, 41-C South Fourth, Allentown, Penna.

RENT—Buy—Sell. 8mm.-16mm. movie equipment, films. Save 50%. Catalogues for 10c. Don Elder's, M-739 Boylston, Boston, Massachusetts.

8-MM.-16MM. Silent-sound: all latest subjects. Films rented everywhere. Free catalogue (sample film 10c). Garden Film, 317 West 50th, New York.

LEARN Movie projection, management. Free catalog. Give age. Theatre Institute, Elmira, N. Y.

8MM.-16MM. Films. Free catalogue (sample film 10c). Parkway Exchange, 961 Eastern Parkway, Brooklyn, New York.

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LYRICS Set to music. Roscoe Barnhart, 1320 - 48th, Des Moines, Iowa.

SONGWRITERS: Send poems for offer and free rhyming dictionary. Phonograph records made. Vanderbilt Studios, Box 112-E.L., Coney Island, N. Y.

SONG Poems wanted: Write for free booklet outlining your opportunity. United Music Corporation, Dept. 14, Salem, Indiana.

POEMS Wanted for musical setting. Send poem for immediate consideration. Five Star Music Masters, 630 Beacon Building, Boston.

SONGWRITERS! Amazing outstanding offer. Hibbeier, Co, 2157 No. Avers, Chicago.

SONGWRITERS: We offer complete service. Melody writing, recording, radio broadcast, marketing. Screenland Recorders, Box 1247E, Hollywood, Calif.

SONGS—Song poems wanted. No charge for melodies. Marketing service. Hollywood Recording Studios, 87G23 Preuss St., Los Angeles.

SONG Poems wanted. Special offer. Siebeneck Music Co., Kalida, Ohio.

LEARN Popular piano! Write Magic Key, 111-A Broadway, Glendale, Calif.

SONGWRITERS—Write today for free, explanatory booklet, plan. Song Service, 331-C West 46th, New York.

SWING—Trumpet, sax, clarinet choruses copied from records. Two \$1.00. Burrows Music, 86 Verndale, Brookline, Mass.

ORIGINAL Music composed to your words. Reginald Belcher, Chatham, New Jersey. Established 1910.

ATTENTION Songwriters! Send us your song poems, lyrics, song titles, songs and melodies for our offer. No obligation in submitting your work. Beehive Music Company, P.O. Box 146, Sugarhouse Station, Salt Lake City, Utah.

WANTED—Piano accordions—any condition. Send description. Immediate cash. Chaton, 600 Blue Island, Chicago.

NEW And used accordions bought and sold. \$25.00 up. Ace-Music, 307 So. Wabash, Chicago.

SONGWRITERS. Write for free booklet, profit sharing plan. Allied Music, 204 East Fourth, Cincinnati, Ohio.

SONGWRITERS—Send poem for immediate consideration and free rhyming dictionary. Richard Brothers, 24 Woods Building, Chicago.

MUSIC Composed to words. Rhyming pamphlet on request. Phonograph recording of completed songs. Send poem for consideration. Keenan's Studios, Dept. PM, Box 2140, Bridgeport, Conn.

WANTED! Lyrics, melodies for songs. We arrange, publish, sell. Superior Song Studios, Passaic, N. J.

MUSIC Composed to words. Wonderful proposition. Bauer Bros., Oshkosh, Wis.

LEARN Swing piano! Postal brings free folder. Christensen, 451 Kimball Hall, Chicago.

WRITE Songs. Big money and reputation. Write for information. J. Gordon Pub. Co., 201 N. Hoyle, Ave., Chicago.

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AMAZING One tube portable anyone can build. Operates practically anywhere on antenna a few feet long. Plans only 20c. Smith's, 2513 Slatery, St. Louis, Mo.

RADIO Service men and experimenters send for our giant radio catalogue. Save dollars. United Radio Co. (1000M), Newark, N. J.

RADIO Communications courses qualifying for all federal licenses. Home study and resident courses. American Radio Institute, 1123 Broadway, New York, N. Y.

RADIO Books—Latest—Bargain catalog free. Popular Mechanics, 633 St. Clair, Chicago.

BUSINESS OPPORTUNITIES

ESTABLISH Quickly local successful upholstered furniture cleaning business. Big profits. Only \$3 capital necessary. Free particulars. Write Shinette, 2621-E Atlantic, Brooklyn, N. Y.

WILL Buy or finance mail order business or correspondence school course. Give complete details. Art White, 1107 Times Star Bldg., Cincinnati.

START Home business making statuary, plaques, art goods, novelties, souvenirs, concrete pottery, garden furniture, artificial marble flooring, liquid marble. Make your own flexible molds. Amazing profits. Valuable folder free. Creative Publishers, (PM12), Glencoe, Illinois.

MECHANICALLY Inclined men—Own and operate general appliance repair shop. Complete, illustrated course shows you how. Welding, refrigeration, motor repair, how to get business, etc., all phases covered. Free literature. Christy Supply, Dept. 123, 2835 N. Central Ave., Chicago.

MAIL-ORDER Information galore in "Progressive Mail Trade." Latest issue 10c. Details free. Wright, 83 Maple Avenue, Irvington, N. J.

HOME Work business. Many propositions. Suggestions free. McPherson Stamp Works, Middletown, Connecticut.

AMBITIOUS People only! The time is ripe. Operate mail order business at home. Send stamp. Hodges, 321 E. 41st, Chicago, Illinois.

MILLION Articles. Buy wholesale. Valuable directory 10c. Ideal Service, D-12, Park Ridge, Ill.

5 MOST Read mail order magazines 20c. Armand Cartier, 695A North, Pittsfield, Mass.

DOLLARS Daily! Start home; mail-order; businesses. Duffy, Covington, Ky.

LIFETIME Business. Steady income. Repairing sewing machines. Book instructions \$1.00. Connan, 114 S.E. 74, Portland, Ore.

2c DAILY Operates New York office under your own name. Co-operative Offices, 126 Lexington Avenue, New York.

MAKE Extra profits. Sparetime. Mailers. 730 W. Gift, Peoria, Illinois.

MAIL Operation at its best—"Permit to Publish." Small capital. Details free. Maupin, LaFayette, Ind.

INTERESTING, Profitable mail order data free. Charles Hansen, Argo, Illinois.

FOR An extremely profitable lifetime business, operate a collection agency-credit bureau. Many make \$4,000 yearly, up. Write Cole Associates, Syracuse, N. Y.

BIG Paying mail order business in your own home. Particulars free. General Sales, 1241 Broadway, Suite 204-A, New York.

HUSTLERS Wanted! To introduce, supply demand for Rawleigh necessities. Good routes open nearby. Rawleigh methods get business. No selling experience needed to start. We supply sales, advertising literature—all you need. Profits should increase every month. Low prices; good values; complete service. Rawleigh Co., Dept. L-63-PPMB, Freeport, Ill.

XMAS Postcards, military stationery, patriotic novelties. Samples, particulars free. Write Goff, 5017 Cermak, Cicero, Illinois.

"MONEY By Mail" brings proven, tested money makers to start your own business, sample copy 25c. Globe Cover Service, 707 - 25th St., Oakland, Calif.

MAIL Order merchandise distributor opening. Your own business. Big profits. \$75 necessary. Dean, 747 Kingsley, Pomona, Calif.

TEN War-time plans. Make \$10.00 a day. Booklet 35 pages 10c. Home Industries, 1318 S30, Omaha, Nebr.

TIN Cans make steel scrap, valuable tin. Process, sample, \$1.00. Forty formulas 25c. Harry D. Cater, 455 Washington St., Denver, Colorado.

MAKE Your own Flexible Molds. Statuary, Art Goods, Novelties, Artificial Marble Flooring, Liquid Marble. Literature free. Kemico, 112-M, Park Ridge, Ill.

SAVO-GAS. Biggest moneymaker yet. Quarter brings sample. Marshall, Box 151, Beeville, Texas.

COLLECTIONS! Dimes get dollars. Profession & Merchant Association, Hinsdale, Illinois.

VALUABLE Mailorder information, latest moneymaking plans. Magazine 10c. I. W. Meeks, Box 792, Weed, Calif.

COUNTY Distributors wanted—Sensational 100% profit—50c seller—Neverfail stormproof cigarette-cigar-pipe lighter. Operates on charcoal principle—more wind blows, the brighter lighter glows. Write, Storm-proof Lighter Company, 126 Lexington Avenue, New York.

OWN Your own letter shop. Small investment. Unlimited opportunity. Professional Products, Kenwood, Cincinnati.

FREE—200 Clever mailorder, homework, local business offers—all snappy money-makers. Lewis Co., 828-M Carpenter, Oak Park, Illinois.

CHRIST'S Coming. Get 30 reliable proofs free. Sheall, 263x, Duluth, Minn.

MAKE Artificial marble, glazed tiles, plaques, figurines, sanitary flooring, pottery, novelties. Brilliantly colorful samples free. (Also—Selfhelp arts, wealth culture, psychology, hypnotism.) Payn, 945 Grande Vista (Room 101), Los Angeles, Calif.

SELL By mail—Suggestions free. Harry R. Dean, 1828 Ave. L, Galveston, Texas.

AMAZINGLY Successful mailorder plan. Work at home. Pays well. Literature free. Leonard Publishers, 255 West 93rd Street, New York, N. Y.

MAKE Money collecting money. Good income; quick results. National Collectors, Newark, Ohio.

LIQUID Marble—Colorful, glazed! Mold, brush, spray! Composition floors, rubber-lastic molds. Particulars free. Marble-In Service, Edwardsville, Illinois.

SWISS Music box works—\$1.85 to \$2.25. Suitable for many novelties. Mermod Manufacturers, 147 West 46th Street, New York.

EXTRA Income—Plenty mail selling opportunities. Write Katz, 4254 N. Kimball, Chicago.

FREE Booklet. How to manufacture many products. Western, 201 Climax Bldg., Cleveland, Ohio.

BRUSH Plating outfits connect to a battery, no tanks necessary. Almost as simple as painting. Your opportunity to make good income plating autoparts, bathroom fixtures, reflectors, mirrors. Get free proof and particulars that put you in a paying business of your own. Gunmetal Co., Ave. H, Decatur, Illinois.

COLOR Cement with chemicals. Make artistic cement garden ornaments Hollywood style. Sample 10c. Hollywood Cementcraft, 8527 Wonderland, Hollywood, Calif.

STATUARY: Make all kinds. Simple process. Make and install artificial stone flooring in color. Liquid marble. Other money-makers. Write promptly. Literature free. Compo-Tex, Box 786, St. Louis, Mo.

PLASTEX Industries offers industrious men an opportunity to start a business of their own, manufacturing art goods, novelties, souvenirs, etc., in Plastex and marble imitation. 5c material makes \$1 articles. Rubber moulds furnished for speed production. Small investment brings good returns. We are now placing big chain store orders with manufacturers. Write for interesting booklet mailed free. Plastex Industries, Dept. A, 1085 Washington Ave., New York.

WEBER Typewriter Mechanics School. Simplified homestudy-repairing increasing. Canton, Ohio.

HOW And where to obtain capital. Fully explained, particulars free. Star Service, Wapakoneta, Ohio.

POPCORN And potato chip machines. We help start men and women in business. Long-Eakins, 1960 High, Springfield, Ohio.

CHARTERS: Delaware; best, cheapest; free forms. Colonial Charter Co., Wilmington, Del.

127 WAYS To make money, in home or office, business of your own. Full particulars free. Elite Co., 214 Grand St., New York.

\$50.00, \$100.00 WEEKLY Using sawdust. Stamp please. Clement, 943 Arthur St., Rochester, N. Y.

START Home business making concrete garden furniture, pottery, bird bath, flower boxes. Amazing profits. Illustrated instruction book 25c. Popular Mechanics, 200 E. Ontario, Chicago.

FORMULAS, PLANS, ETC.

BARBECUE Sauce, barbecue kings recipe \$1. Chas. Moye, 1234 Madison, Paducah, Kentucky.

"LUMINOUS Paint" shines in dark. Easily made. 100 other formulas, plans—all 25c. Ideal Service, 312, Park Ridge, Ill.

RUBBER Preservative greatly lengthens life. Formula 25c. Victory Sales, Box 5172, Chicago, Illinois.

MAKE Fast selling products. No machinery. "Chemist Approved Formulas." Literature free. Kemico, 15, Park Ridge, Illinois.

SINGLE-INGREDIENT Formulas. No manufacturing! Information free. A. Kinford, Wayne, Penna.

23 YEARS Supplying authentic formulas. Catalog free. Grinstead, Edwardsville, Illinois.

REAL Manufacturing formulas. Lists free. Cummings, Chemist, Gordon Ave., Syracuse, N. Y.

AUTHENTIC Formulary 924 pages (illustrated), 10,000 money making formulas, recipes, instructions, substitutes. \$1.75 postpaid or C.O.D. (foreign \$2.10). Catalog 3c. Adams Brown Company, Chestnut Hill, Massachusetts.

FORMULAS—Latest, best. Analysis. Literature free. Belfort, Engineering Building, Chicago.

MONEYMAKING OPPORTUNITIES

SELL Your pictures. Write for details and free market letter. Free-Lance Photographers Guild, Inc., 219 E. 44th St., Dept. 11PM, New York, N. Y.

"MONEY Making Business Starters" a dollar book. Only 25c. Hurry. You need it. C. Felzer, Bellefonte, Penna.

RABBITS For table use, cash income. Booklet free. Taylor Rabbit Farm, Hapeville, Georgia.

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

RED-HOT Legitimate ways to make money fast. We-Ta-Re, Franklin, Penna.

I HAVE Helped many make thousands in contests. Proof, 10c brings exclusive particulars. Lawrence, 4627-P Fernhill Road, Philadelphia, Pennsylvania.

OPERATE Profitable mail order business. Details, opportunity mail—dime. Cusack's Printery, Fulton, N. Y.

YOUR Name printed in 10,000 "Big Mail" directories 25c. Checking copies sent. Arlesse's, 15881 Log Cabin, Detroit, Michigan.

MOLDMAKING—Plaster Casting. Complete formulas—fully illustrated. 25c. Ideal Service RM-10, Park Ridge, Ill.

MAN, You'll like silvering mirrors, reflectors! Making chipped glass nameplates, signs, mottoes. Outfit prices. Sprinkle, Plater, M287, Marion, Indiana.

EARN Money at home! Thousands do "Home Worker Magazine" tells how. Sample, 25c. Sizemore, Box 7, 4917 North Kostner, Chicago.

SAVO-GAS. Biggest moneymaker yet. Quarter brings sample. Marshall, Box 151, Beeville, Texas.

WRITE For trade journals and earn easy full-time or side money if mechanical, technical or mercantile minded. Capitalize on your knowledge. Instructions, markets. Send \$1 bill. Don Wimmer, Trade Journal Consultant, 149 Bel-Aire, Louisville, Ky.

BE A professional scrapbooker. Big fees. Unlimited opportunities. Can be done at home. No competition. No capital needed. Write to Scrapbookers Guild, 59 Park Place, New York, New York.

INVESTIGATE "War Money in Mail Order." Publisher Cutler, Reading, Pennsylvania.

LEARN Metascience. Remarkable drugless healing. No manipulation. No apparatus. Unbelievable simplicity and results. Inexpensive correspondence course. Write Metascience, De Land, Florida.

MONEYMAKING Ideas—Latest books—Barrain catalog free. Popular Mechanics, 633 St. Clair, Chicago.

CHEMISTRY

WINN'S New Idea Home Laboratory Chemical Kits and apparatus outfits for home experimenting. Send 5c for literature and retail supply catalogue. J. H. Winn Co., Dept. 512, 124 W. 23rd St., New York.

CHEMICALS—Small quantities, apparatus. Catalog 5c. Fleischer's Laboratories, Medford, Mass.

EXCELLENT Emulsions instantly, at a piston's stroke—with the Jubilee Emulsifier. No failures, no separation, when ingredient ratio is sound. Saves time, materials. Small compact, powerful. Easy to operate, and to clean. Suitable for experiments, test samples, small-batch production. \$3.00. Money-back guarantee. Send for free particulars. International Emulsifiers, 2409 Surrey Court, Chicago, Illinois.

LABORATORY Supplies at wholesale prices: Chemistry, biology, physics. Catalogue, 10c. National Scientific Co., 2204 W. North Ave., Chicago. Established 1908.

FREE Catalog: chemistry, mineralogy, biology. Special: 28 piece chemistry set, send \$1.00. Tracey Laboratories, Evanston, Illinois.

CHEMISTRY Laboratory apparatus and chemicals for industrial, analytical, and private experimental laboratories. Complete chemical laboratory supply service for correspondence school students. Send 3c for free 48-page catalog of chemicals and apparatus. Dept. M-43, Biological Supply Co., 1176 Mt. Hope Ave., Rochester, New York.

SPECTROSCOPE For quick chemical analysis \$2.50. Kutting Sons, Campbell, California.

HELP WANTED

MAGNETIC Sponge draws dirt from clothing. Used like brush. Saves dry-cleaning. Slick discovery. Samples sent on trial. Write "Inventor," 123 Kristee Bldg., Akron, Ohio.

DO You want a steady job with good pay? Work for U. S. government. Complete list of available positions, qualifications required and how to prepare for a civil service job. \$1.00. Guidance Service, Crosby, North Dakota.

AGENTS WANTED

NEW Air raid shoe sweeps country. Zips on—zips off. No fumbling or breaking of laces in blackouts or when alarm sounds. Huge profits for direct salesmen and women. Hundreds of other fast-selling shoe styles. Write for free sample shoe outfit. Victor Thomas Shoe Co., 610 W. Van Buren St., Dept. V-72, Chicago, Ill.

\$1 STARTS You in business selling men's ties, ready tied Slide-On-Ties and boxed novelties. Write today for descriptive wholesale catalog, free sample materials. Philip's Neckwear, 20 West 22nd St., Dept. P-12, New York.

EVERY Day New Homes, business demand Soapless Wonder Cleaner. Stamp gets details. Whitto, 2712 Bagby, Houston, Texas.

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

RELIABLE People wanted to place engine in stores and appoint agents. Used the same way as eggs in baking and cooking at 10 cents dozen. Full size package and particulars 10 cents postpaid. Morrissey, 4417-21 Madison St., Chicago, Ill.

DON'T Be a job hunter—Start your own business on our capital. No hard-times; no layoffs; always your own boss. Hundreds average \$3,000 to \$5,000 annual sales year after year. We supply stocks, equipment on credit. 200 home necessities. Selling experience unnecessary to start. Wonderful opportunity to own pleasant, profitable business backed by world wide industry. Write Rawleigh Co., Dept. L-U-PPMA, Freeport, Ill.

MAKE Money applying initials on automobiles. Also, sideline salesmen for short run decal name plates. "Ralco," 1483 Washington, Boston, Mass.

SELKO Ointment, women agents wanted. 100% commission. Selected Products Co., Rochester, N. Y.

AGENTS—Whirlwind profit opportunity. Finest silk Nylon, and Rayon hosiery. Big selection. Very latest styles and colors. Replacement guarantee. Your own hose free with large outfit. Rush hose size, name today. Wilknit, Dept. CS-37, Greenfield, Ohio.

CHEMICAL Discovery. Get 20 extra gallons of gasoline for \$1.50 by placing "Gas-Lab" in gas tank. Agents, distributors wanted. Send \$1.00 for it and wholesale prices. R. Bensi, 6521 Pinehurst, Dearborn, Michigan.

DOLLARS Galore selling miracle gasoline saver. Sample 25c. Marshall, Box 151, Beeville, Texas.

AMBITIOUS School seniors—Sell classmates the "tops" in graduation name cards. Best commissions. Free cards. Agencies going like wildfire. Hurry! Craftcards, Box 235-L, Pittsburgh, Penna.

LIFE-TIME Repeater. \$1.20 sale, \$1.00 profit. Labels—circulars free. Thermolt, Peoria, Ill.

SCHOOL Seniors—Sell America's most beautiful distinctive graduation name cards. Positively highest commission. Lowest prices. Free sample kit. Printcraft, 1423 E. Elm Street, Scranton, Penna.

50 FOR \$1.00 Christmas cards with name. 4154-P Fifth Street, Philadelphia.

WHOLESALE Sources, 500,000 articles. Free directory. Maywoode, 1133 Broadway, New York.

BIG Clothing bargains for big profits. Used dresses 10c, men's suits \$1.00, shoes 12 1/2c, men's overcoats 50c. Over 100 sensational values. Experience unnecessary. Free wholesale catalog. Superior, 1250-CY, Jefferson, Chicago.

NEW Wonder toys. Walk without mechanism. S. Kelley, 2302 Ontario St., Ft. Wayne, Ind.

SAVO-GAS. Biggest moneymaker yet. Quarter brings sample. Marshall, Box 151, Beeville, Texas.

AGENTS. Big line including food products. Fast selling premium and bargain deals. Low prices. Send card for big outfit over with gift. Ho-Ro-Co, 2737 Dodier, St. Louis, Mo.

FREE Assortment of actual packages foods, groceries, household products worth \$5.00, if you promise to show to friends and neighbors and try to take orders. Fine profits. Spare time. Experience unnecessary. Zanol, 6321 Monmouth, Cincinnati, Ohio.

FREE Water and our concentrates, makes flavors, lotions, shampoos, 72 products, labels, bottles furnished. Qualco, E-20030 Russell, Detroit.

SCHOOL Seniors—Sell graduation name cards. America's largest, fastest-selling, low-priced display, 35% commission. Free cards. Universal Engraving & Printing, Box 745-PM, Pittsburgh, Penna.

MAKE Money! Selling collection system. Free details. Stephens Service, Box 703, Athens, Georgia.

USED Men's shoes 14c, hats 12c, pants 28c, dresses 10c, winter coats 50c, fall coats 35c. Bargain catalog free. Portnoy, 566-V Roosevelt, Chicago.

MEXICAN Feather pictures. Prettiest Christmas novelty, 50c (stamps) bring \$2.00 worth samples. Refunded if unsatisfied. Mexicanart, Apartado 1593, Mexico City.

SELL New-used clothing from home, auto, store. Men's suits 82c, leather jackets 45c, overcoats 51c, dresses 9c, ladies' coats 35c. Other bargains. Catalog free. S&N, 565A Roosevelt, Chicago.

COMIC Clever Xmas greeting cards. List 10c. Straley, 1015 Mulberry, Springfield, Ohio.

SEND For free copy of illustrated wholesale Christmas catalog! Forty profitable lines! Elfco, 438 North Wells, Chicago.

AGENTS—300% Profit selling gold leaf letters; stores and offices. Free samples. Metallic Letter Co., 438-B North Clark, Chicago.

AGENTS: Stamping names on pocket-key protectors. Sample check with your name, address, 25c. Stamping outfits. Emblem checks, check-fobs, name plates. Hart Mfg. Co., 303 Degraw St., Brooklyn, N. Y.

AGENTS—To mail our literature. Good profits. Home business. Maywood, 1133 Broadway, New York.

DO You want agents for your proposition? Your ad in this space will place your message before hundreds of men seeking fast-selling products. My folder "How to Secure Agents," is filled with proof. I'll gladly send you a copy free. F. W. Johnson, Manager Classified Advertising, Popular Mechanics Magazine, 200 E. Ontario St., Chicago.

HIGH-GRADE SALESMEN

MAN With car to establish retail store route. Openings almost every locality. Handle orders for nationally known manufacturer—jobber. Average 50% commission. Steady big pay opportunity. Sales experience unnecessary. World's Products Co., Dept. 10-Y, Spencer, Ind.

ADVERTISING Book matches. America's largest manufacturer of union label book matches. Fast selling line. Large sales producing kit. Sample matches. Complete cut catalog, 17 color combinations makes selling easy. Commission in advance. Superior Match Company, 7530 Greenwood, Dept. M-12, Chicago.

MAKE More money selling advertising to businessmen, calendars, signs, specialties, souvenirs, desk items, executive gifts, etc. Sideline or full time. Good repeat business. Newton Mfg. Co., Dept. P-12, Newton, Iowa.

BIG Commissions—selling to stores celluloid pricing tickets, metal shelf moulding. To restaurants, menu covers, signs. P. Pricing Press, 124 White St., New York.

ADVERTISING Book matches offer liberal earnings—full, spare time. Experience unnecessary. Factory direct. Low prices, high quality, quick deliveries, powerful patriotic display, repeats. All business firms prospects. Free kit, instructions. American Match & Printing Co., Dept. 612, 4822 South Trumbull Ave., Chicago.

CALENDARS—Sell full or part time. One of nicest lines in the country. Big commission for men and women producers. Outfit free. Gem Match, 74 West Washington, Chicago.

SALESMEN: Marvelous magnetic brush, excels vacuum cleaner, 100 brushes, mops, chemicals. 5%-15% higher commissions. Neway Brush Co., Hartford, Conn.

CALENDARS, Fans, novelties—Beautiful complete lines all sizes, including jumbos, samples free. Start now, be first in field. Fleming Calendar Company, 6539 Cottage Grove, Chicago.

EARN Money in your spare time taking subscriptions to Popular Mechanics. Unlimited possibilities, every family a prospect. Easy to sell. Bonus paid in addition to liberal commission. Send postcard for further details today. Circulation Dept., Popular Mechanics Magazine, 200 E. Ontario St., Chicago.

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TRAIN For a good job in war industries. Learn auto, Diesel, aviation mechanics, welding, lathe machinist. Free catalog. Hanson Trade School, Box 1780-R, Fargo, N. Dak.

MATHEMATICS Without figuring, 400,000 problems solved by graphical method. Multiplying, dividing, adding, subtracting, whole numbers, fractions, and decimals. Price \$2.00. C. Beaver, 1016 So. Westlake Ave., Los Angeles, Calif.

"HOW To Break and Train Horses"—A book every farmer and horseman should have. It is free; no obligation. Simply address Berry School of Horsemanship, Dept. 11012, Pleasant Hill, Ohio.

DRAFTING, Trigonometry, and slide rule courses. Each \$1 complete! Free circular. Write Giles, Dept. PM-1, 1326 Myers, Burbank, Calif.

BECOME Mentally superior! Two books 25c. Popkem, 6204 North Hermitage, Chicago.

SPANISH, French, German, phonograph instruction courses; bargains, books, grammars, dictionaries; sold, rented. Translator, 246 Fifth Ave., New York.

NEW Writers wanted to re-write ideas in papers, magazines, books. Splendid opportunity to "break into" profitable writing field. Rush postcard for free details. Comfort Writer's Service, Dept. FY-149, St. Louis, Mo.

HOME Study course, drugless therapy. Free literature. Inst. of Drugless Therapy, Tama, Iowa.

MEN—Women. Civil service jobs now open. Details free. Kennison Publications, Box 3911, Phoenix, Arizona.

WELDING—Electric arc. Learn profitable trade quickly through actual practice. Individual welder instruction at bare cost of materials. Full particulars free. Valuable welding lessons book 50c. Hobart Welding School, Box M-1222, Troy, Ohio.

FREE Illustrated lesson handwriting analysis. Examination free. Afga, Linn Creek, Mo.

FINGER Print experts earn big pay! Learn easily at home. Low cost! "Crime Book" free. Write stating age. Dept. 26, Inst. Applied Science, 1920 Sunnyside, Chicago.

SECRET Investigation. Experience unnecessary. Detective particulars free. George Wagner, M-2640 Broadway, N. Y.

BECOME A Doctor of Psychology (Ps. D.) Teach secret of contentment, happiness. Solve mental worries. Free book. College of Universal Truth, 20-B East Jackson, Chicago.

LOCKSMITH Course. Lock picking, key fitting, etc. \$1.00 prepaid. Locksmith, Canadian, Texas.

CLINICAL Laboratory technic taught in your own home. Practice outfit supplied. Bulletin free. Imperial Technical Institute, Box 973-E, Austin, Texas.

LEARN Telegraphy! Splendid opportunities now prevail. All expenses low. Catalog free. Dodge Institute, Dept. M, Valparaiso, Indiana.

RADIO Engineering, broadcasting, aviation and police radio, servicing, marine and Morse telegraphy, taught thoroughly. All expenses low. Catalog free. Dodge Institute, Dept. R, Valparaiso, Ind.

GET A better job. Our books will help you advance. Bargain catalog free. Popular Mechanics, 633 St. Clair, Chicago.

CARTOONING, COMMERCIAL ART, SHOWCARD WRITING, SIGN PAINTING

CARTOONING Course—36 lessons—6 booklets—816 illustrations—\$2.80. (Guaranteed.) Templeton Studios, Elgin, Ill.

EARN Money, popularity—Patriotic chalk talking—Free details. Gross, 67-70 Yellowstone Blvd., Forest Hills, New York.

AMAZING Cartoon business plans. Hartman Studios, 2438 W. Lincoln, Nebraska.

EARN Money evenings, copying and duplicating comic cartoons for advertisers. Ad-Service, Argyle, Wisconsin.

CREATE Cartoons—Over 350 illustrations, 11,000 words. \$1.00 postpaid. Hettler, Box 407, Rochester, N. Y.

FREE—Big list of helpful books. Popular Mechanics Press, 200 E. Ontario St., Chicago.

ADVERTISING AGENCIES, LETTER WRITERS, FOR ADVERTISERS

MAIL-ORDER Or agent ad reaching 1,000,000 families throughout United States \$14.00 inch. Newspaper, magazine, mailing-list, rate-book, free. Chicago Advertising Agency, 20-PM West Jackson, Chicago.

ADVERTISE: 24 Words, 149 newspapers, \$6.50. Lists free. Advertising Bureau, 4515-C Colgate Grove, Chicago.

INCH Display advertisement fifty magazines, year \$15. Wood's Popular Services, Atlantic City, (N. J.)

MAIL Order sales are skyrocketing. Back your product with our 30 years of successful mail order experience. Costs nothing. Write Van De Mark, Times Star Tower, Cincinnati.

FREE—New Advertisers Rate Guide. 44 pages. Includes everything. Lowest rates. E. H. Brown Advertising Agency. Merchandise Mart, Chicago.

ADVERTISING Placed all magazines, newspapers U.S.A., Canada. Lowest rates. Free service. 64-page catalog free. Baker Advertising Agency, A-189 W. Madison, Chicago. Established 29 years.

FREE—"Amazing New Book"—"Profits From Classified Advertising." Tells how and what to advertise. Be sure to read this book before you invest one cent in advertising. Remember—it's free! Write for your copy now. F. W. Johnson, Classified Advertising Manager, 200 East Ontario Street, Chicago, Illinois.

BUSINESS SERVICE

CHICAGO Mail address: \$1 monthly—Receiving, reforwarding your business, personal mail. General, 30 West Washington, (Established 1919).

LETTERS Mailed 20c. Shopping—Mexico, Arizona, Holiday specials. Stamp, Sarah Poage, 106 E 17th, Tucson, Arizona.

INFORMATION

WHAT? When? Where? How? Who? Why? All questions answered. Formulas, problems, dates, methods, people. Any subject! Send questions—no money! Pay \$1.00 when answered. 3 day service. Satisfaction guaranteed. Information Research Institute, Box 8725, Pittsburgh, Penna.

TYPEWRITERS, DUPLICATORS, OFFICE DEVICES

TYPEWRITERS, Adder, mimeograph, multigraph, addressograph. Send for free lists of machines that will help you at half price. Pruitt, 28 Pruitt Bldg., Chicago.

RUBBER STAMPS, OFFICE SUPPLIES

PRIORITY Stamps, send copy for estimate. Name address three lines 35c, four 50c. Slocum, 814 Bradley, Peoria, Illinois.

SUPERB Quality, cushioned, indexed 3 lines 35c. Signatures \$1.50. Lentz, Box 402, Youngstown, Ohio.

3 LINES 30c; Cushioned, indexed, 35c. Signatures \$1.50. Stamprite, Wauwatosa, Wis.

2 LINES 25c, 3 Lines 35c. Stamp Works, Auburn, Nebr.

KNOB Handle, cushioned, 2 lines 25c, 3—35c. Stamp Works, Centerport, N. Y.

PRINTING, MULTIGRAPHING, MIMEOGRAPHING, GUMMED LABELS

FIRST Quality printing—Reasonable. Samples. Treaster Printing Service, Millroy, Pennsylvania.

500 8½x11 HAMMERMILL Letterheads and 500 6¼ white-wove envelopes, printed your copy, \$4.50 prepaid. Drew Press, Box 423-N, Greensboro, N. C.

LETTERHEADS Modernized, artist sketch \$1.00. Gill Art Service, Huntsville, Alabama.

5000 LOTS—Postcards, \$8.75; envelope slips, \$3.75; 6x9 circulars, \$8.25; folders, \$9.95. Samples. Goodprint, Harrisonburg, Va.

250 PERSONAL Letterheads and 100 envelopes \$1.25. Strang, 48 Stockwell Street, Painesville, Ohio.

6x9 CIRCULARS—1000, \$2.95. All kinds printing. Lowest prices. Reporter, Chelsea, Oklahoma.

100 ENVELOPES, 200 Letterheads. Standard size. Neatly printed and postpaid \$1.65. Ben's Art Shop, Box 638, Alamosordo, N. Mex.

500 — \$1.95, 1000 — \$2.95. LETTERHEADS. Other savings. Ask quotations. Bell Wilson, 1724 Monroe, Madison, Wis.

HAMMERMILL Letterheads, envelopes, any color, 39 type styles. Free particulars. Woodruff's, 217-A4 Lewis, Duluth, Minnesota.

500 EACH Letterheads, billheads, envelopes, business cards, \$8.50 complete; 1000 \$10.00 complete. Calendars, circulars, offset printing, etc. 4154-P Fifth Street, Philadelphia.

LETTERHEADS, Envelopes, statements —250 of each neatly printed, postpaid, \$2.85; 500 each \$5.00; 1000 each \$8.60. Lonelml Press, Paulding, Ohio.

BETTER Grade printing reasonable. Estimates on anything. Economic Press, Leonia, N. J.

250 LETTERHEADS, Envelopes, or statements, \$1.00 postpaid. List for stamp. Holmco, Celeste, Texas.

250 DISTINCTIVE Bond letterheads or envelopes printed \$1.50 postpaid. Lumco, Kimball, Nebraska.

500 ¾x2¼ FOUR Line gummed stickers, 25c. Moritz Printery, Saginaw, Mich.

WANTED Printing of all kinds by thousands of our readers. Your ad in this space will bring you some nice orders. Write for positive proof. F. W. Johnson, Classified Advertising Manager, Room 304, 200 East Ontario Street, Chicago.

PRINTING OUTFITS AND SUPPLIES

PRESSES, Type, cabinets, supplies. List for stamp. Lincoln Press, 220-K Hartwell, Fall River, Mass.

PRESSES, Type, illustrations, strip-maternal, cabinets. Complete supplies. Bargain bulletins. Send stamp. Bradshaw, 3214-P Huron, Chicago.

INEXPENSIVE 6x9 Printing press. Details free. Novelty Shop, Downsville, Louisiana.

PRINT Your own cards, stationery, circulars, advertising. Save money. Simple rules furnished. Print for others, nice profit. Junior outfit \$8.25, senior outfits \$17.38. Details free. Kelsey, Inc., T-11, Meriden, Conn.

PRINT At home. 10c will bring a complete catalog of presses, type and supplies. P. Peiffer & Company, 6 Columbia St., Newark, N. J.

BARGAINS — Presses, type, supplies. Send stamp. 159 Harvard, Cambridge, Mass.

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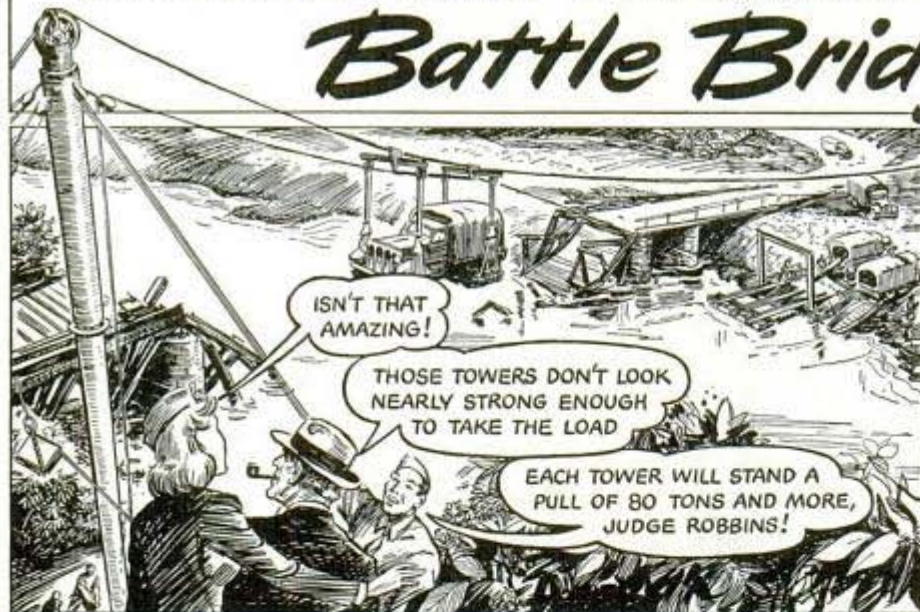
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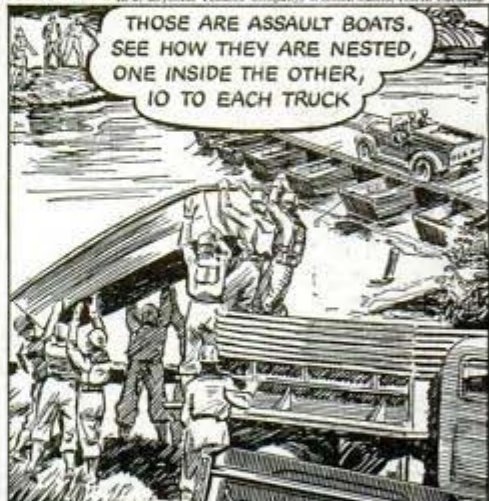
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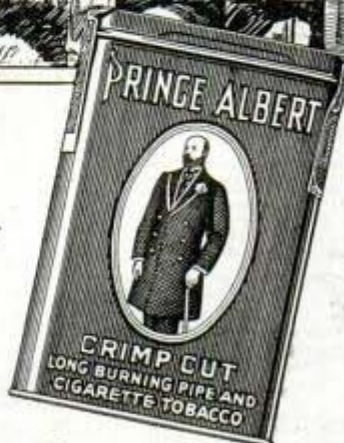
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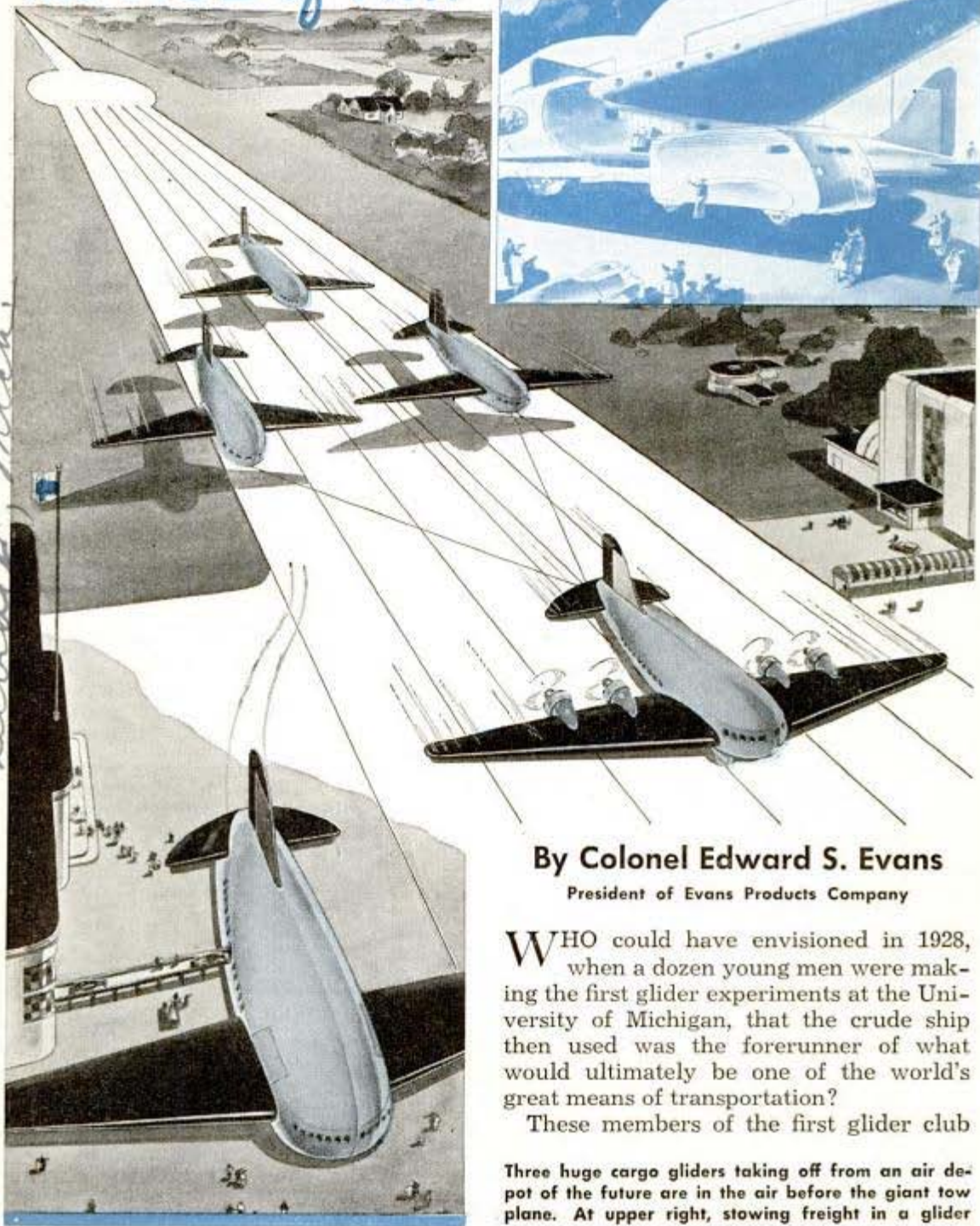
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Vol. 78

DECEMBER, 1942

No. 6

The AGE of AIR



By Colonel Edward S. Evans

President of Evans Products Company

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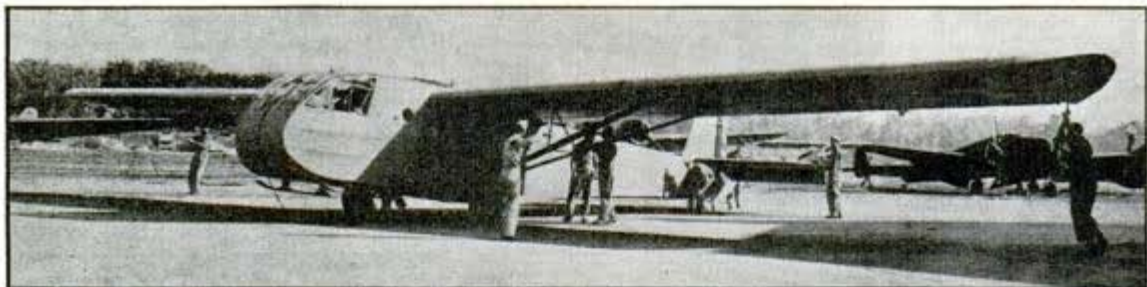
These members of the first glider club

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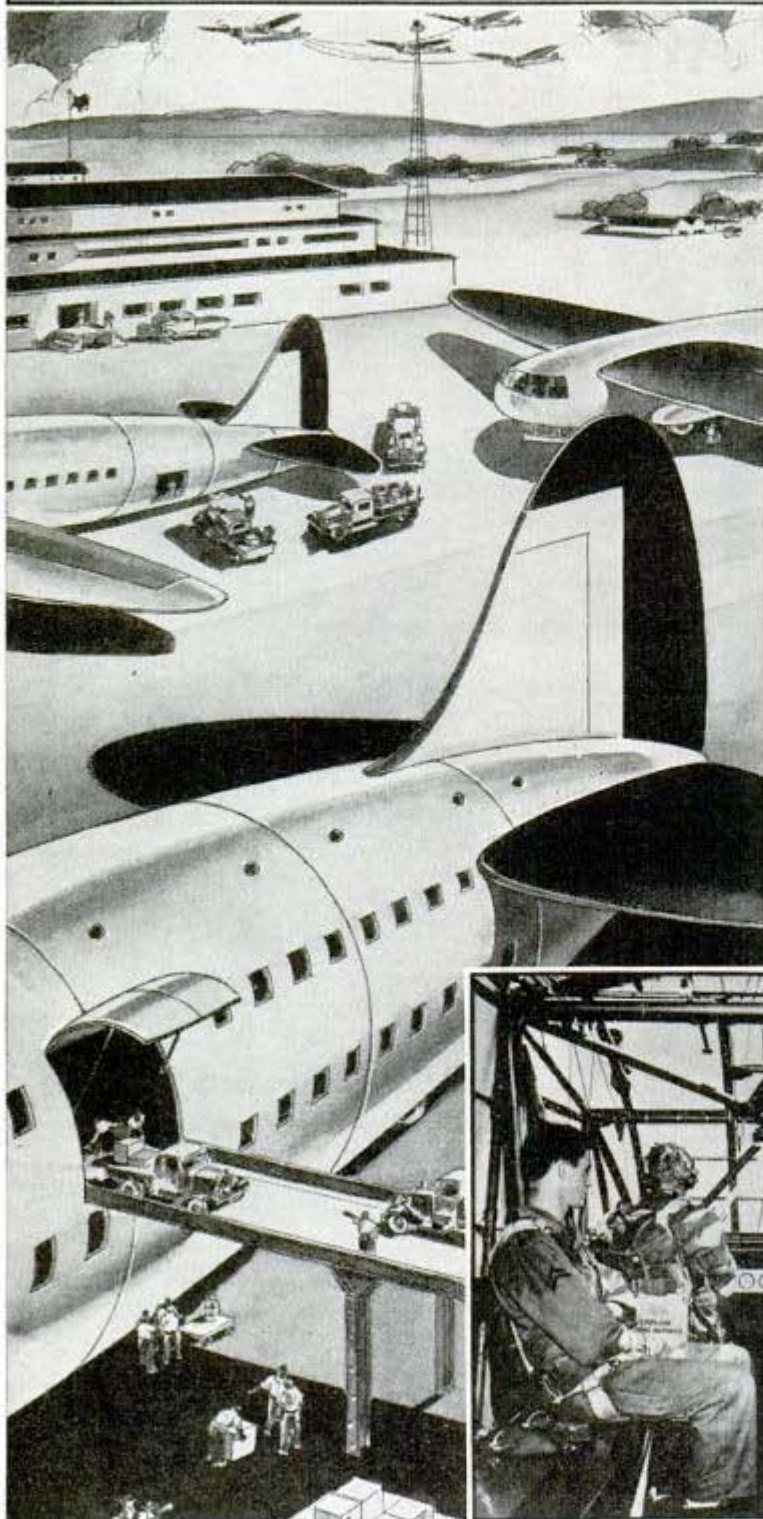
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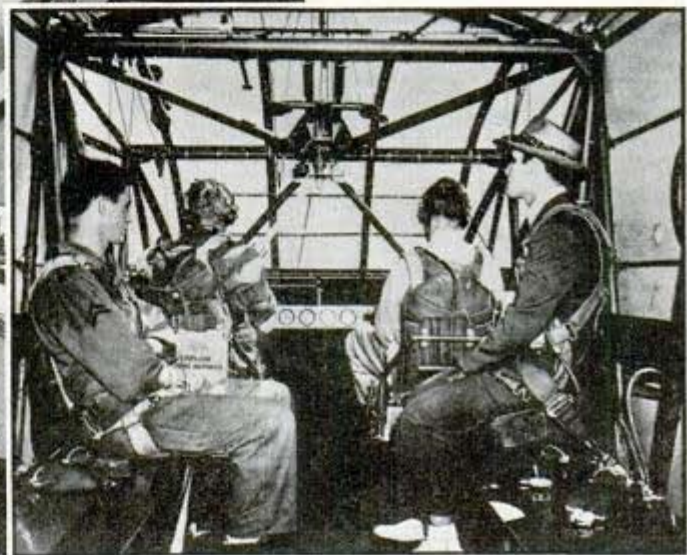
15-seat gliders of U. S. Airborne Command are only a beginning

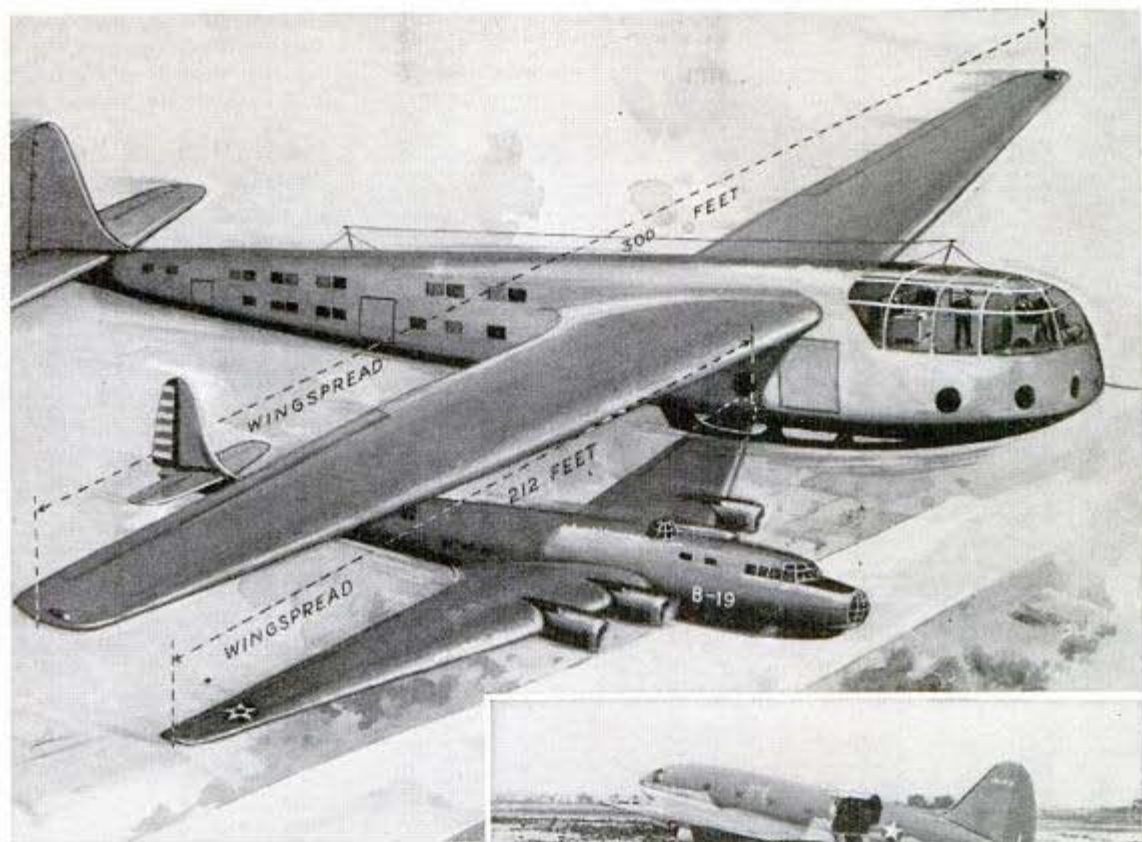


of America, which was formed under my sponsorship, learned the delight of being pulled into the air with a rubber cord and gliding gently to the ground several hundred yards away. Some of these same young men today are still flying gliders, beautiful ships known as sailplanes which have established records of distance, altitude and duration that are almost unbelievable.

Looking toward tomorrow, we can see the same principle employed for motorless cargo ships towed by tractor or tug planes, carrying enormous loads of freight or deliver-

All perishable and first class cargo eventually will be shipped economically by air, says Colonel Evans. Left, air freight terminal; below, cockpit of army glider





The author foresees a motorless freight and passenger ship with a 300-foot wing spread—nearly 100 feet wider than that of the B-19, drawn to same scale, above



Transport planes of the Airborne Command (above and at left) are vast enough to carry army jeeps and large number of men

vibration, no noise, with a wing span and a speed which will assure smooth riding. One employing such facilities can rest comfortably at night and arrive at his destination as rested as if he had slumbered in his own bed.

ing human cargo in the most quiet and delightful way ever known to man; ships that will carry twenty tons or more freight or up to 100 passengers, with no engine

Freight thus transported could be delivered in quantity at 200 miles per hour and at a cost well within the range of economical shipping; in other words, somewhere



Some Alaskan city may be the "New York of Tomorrow," strategically located on air routes from U. S. to Europe and Asia

and delivered in New York in time to go on the breakfast table the next morning.

A few basic figures will give a fairly good conception of the advantages of this modern means of transportation over anything evolved before. The average train of loaded box cars carries 2,000 tons of freight at 25 miles an hour. Seven glider trains could deliver the same freight in one-tenth the time or, to express it differently, seven glider trains could deliver ten times as much freight as a railroad train in the same length of time and

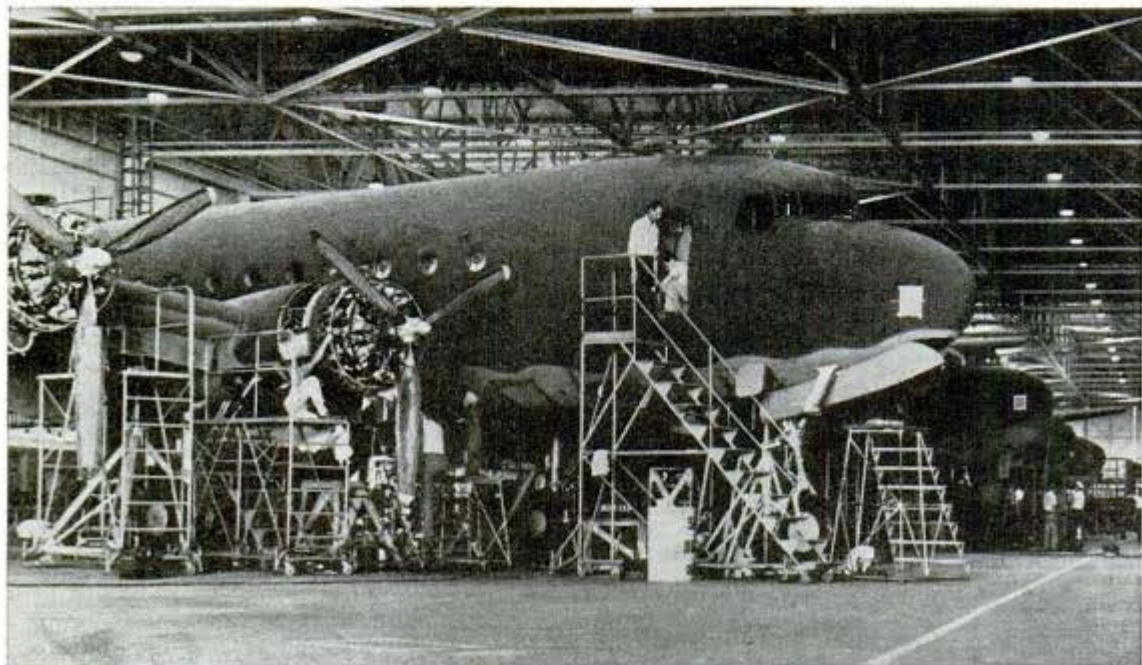
between two and three cents a ton mile. According to the best information obtainable today this is less than truck freight or boxcar freight and only a fraction of the cost of railway express.

Cargoes of oranges, grapes and other perishable fruits could be loaded ripe in California, something unheard of today,

in much better physical condition, as the cargo will not be subjected to the shocks of switching and shunting.

The Army, transporting goods from Northern India into China by airplane, requires 35 planes to do the work formerly done over the Burma Road with 7,700 trucks, 4,500 of which were in constant

Giant four-engine C-54 transports with cargo capacity of a railway boxcar are in production at Douglas plant





Flight strips like this, built along an eastern highway, will be a familiar part of air travel in the future

service and the balance in reserve or in the shops for repair. The trucks delivered about 30,000 tons per month. These comparatively few transport planes now can deliver the same with a smaller percentage of waste in human labor.

We are not talking now about glider trains but about transport planes alone. If glider trains were used, this same amount of freight could have been delivered with eight glider trains as compared to the 7,700 trucks used on the Burma Road. Transports being used in China can carry a payload of $9\frac{1}{2}$ tons. If they pulled three gliders, each glider could probably carry 18 tons. The speed would necessarily be decreased, but nothing like the proportional increase in payload.

The Army has come to the conclusion that three gliders in an inverted "V" formation are the most practical number to be towed.

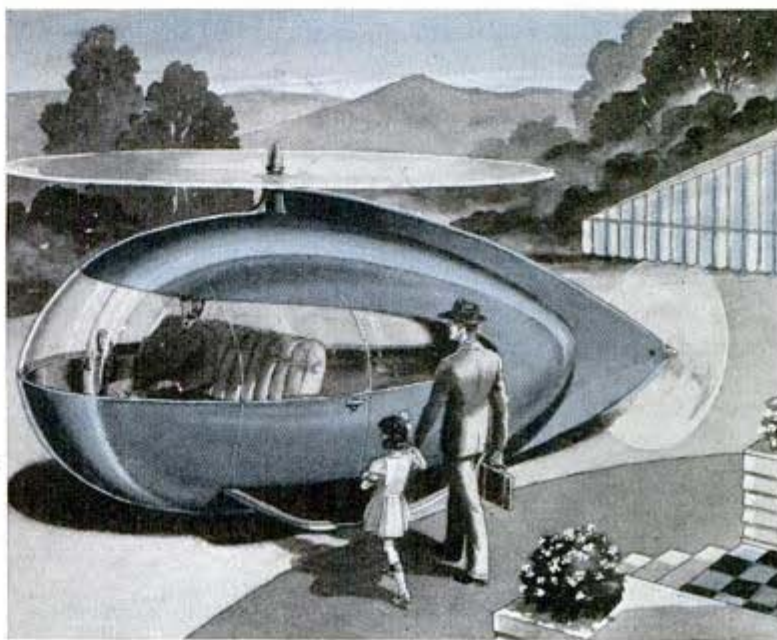
I have found the one

Colonel Evans believes the helicopter, capable of vertical ascent and descent, will be the average man's "car." There will be helicopter sedans like this

thing that invariably commands a situation is the law of economics. Therefore, I can assert that economics will ultimately force the use of airplanes and gliders for the transportation of freight and passengers to a point where a majority of our passengers and at least 60 percent of our high grade freight will take to wings.

For carrying freight, the glider has certain advantages over the air transport plane. Not having engines and propellers

(Continued to page 183)



Jacket Worn by Inner Tube Adds Life to Old Tires



Jacket slips over inner tube before going into casing

Old tires condemned to the scrap heap are good for several thousand miles of additional travel when inner tubes are protected with a cotton cord "jacket" developed by Firestone Tire & Rubber Company. The jacket fits around the tube, protecting it against chafing by the broken casing. In tests, a worn tire with four cuts in the side wall was run for 4,055 miles.

Railway Inspector Rides Sedan With Flanged Wheels

When travelers see a big sedan speeding along the Illinois Central railroad tracks



Bell and cowcatcher complete this rail-going sedan

they probably think someone has found a novel solution to the tire problem. The car, equipped with solid flanged steel wheels, is used by J. T. Stanford, Chicago terminal manager of the railroad, for inspection trips. Aside from the wheels that are attached to an extra underframe, there are no other mechanical changes on the machine. No steering is required. An oil hydraulic jack can be dropped into position to serve as a turntable and a cowcatcher and bell are added features. The automobile is operated as an "extra" train and its movements are checked and directed by the dispatcher.

Leather Plugs in Wooden Sole Keep Shoe From Clattering

Hinged wooden soles that do not clatter are an innovation developed since the government took over most sole leather stocks for the Army and lease-lend use. The sole is made in two pieces hinged with leather



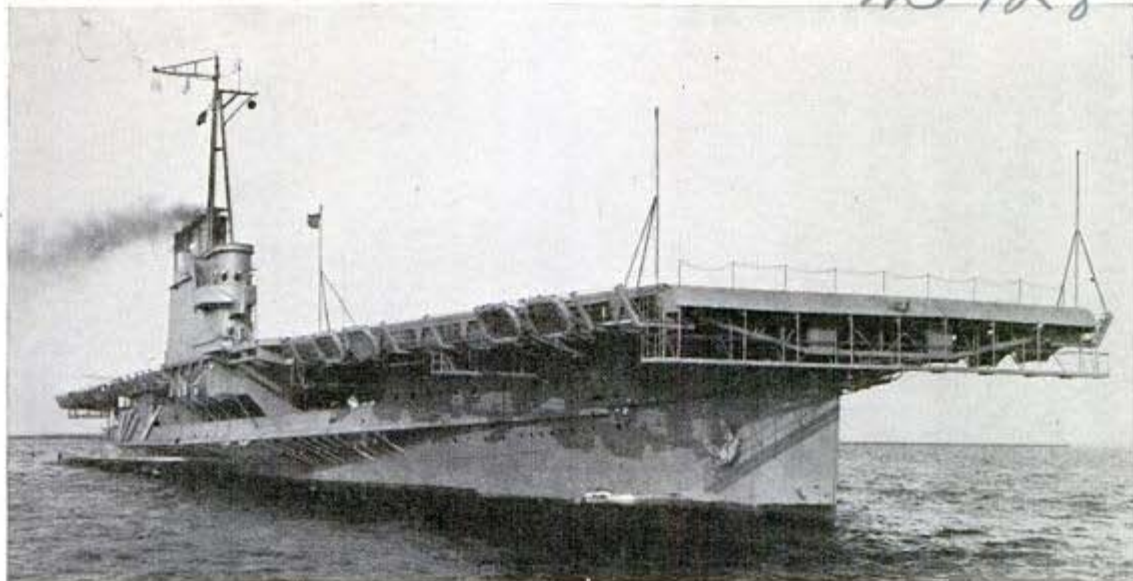
Hinges give flexibility to wooden sole for war shoe

to give flexibility. The clatter is eliminated with leather plugs that also provide better traction and a small leather heel piece that cushions the impact of walking. If leather for tops is unavailable, shoe manufacturers can use fabric to produce a wartime shoe for civilians that contains little leather.

Boats can be sent full speed astern without reversing engines or shifting gears by a reversible-pitch propeller developed by General Motors Research Laboratories.

U. S. Navy Public Relations
3337 Michigan Ave. Chicago
Lake Ship Becomes Queen of Inland Flat Tops

M 928



Official U. S. Navy photographs

Two views of the aircraft carrier Wolverine serving on the Great Lakes to teach carrier-based pilots

Naval fliers at a Naval Reserve Aviation base near Chicago, are trained for carrier duty on a "flat top" that was formerly a Great Lakes excursion boat. The job of converting the passenger sidewheeler Seeandbee into the streamlined aircraft carrier Wolverine was performed by Navy craftsmen in three months. The superstructure was cut off and the four center

smoke stacks were moved to one side to make room for a landing deck more than 500 feet long. The carrier, designed for training only, provides facilities similar to those of a seagoing craft. It is equipped with the Navy's secret arresting gear and other regulation paraphernalia. Fliers take training trips aboard the Wolverine as it cruises up and down Lake Michigan.

Plug-In Horn to Replace Sirens Used in Industrial Plants

Since the Office of Civilian Defense placed a ban on industrial sirens that sound like air raid warnings, the operators of manufacturing plants, mines, construction camps and other places where some type of signal is needed have been looking for a substitute. An electric horn designed for this purpose can be plugged into any circuit and can be operated from a central switchboard or individually. It is available for either alternating or direct current and is waterproof and airtight.



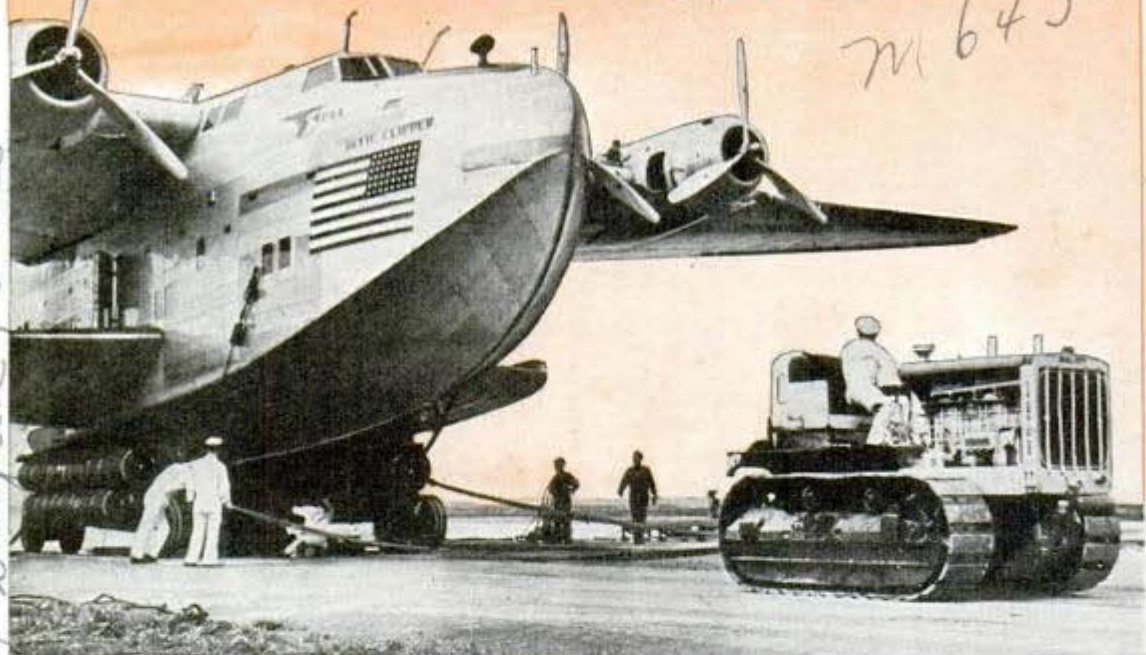
Electric horn averts confusion with air raid siren

DECEMBER, 1942

Federal Elec. Co.
8700 S. State St. Chicago

DIESELS on GUARD

M 643



A Diesel-driven Caterpillar tractor acts as shore tug for one of the big Pan-American Clippers which are part of the air fleet providing vital fast transoceanic transportation during the war emergency

ON THE fighting front and on the home front, Diesel is a magic word. For from engines of that type are coming millions of horsepower each day, horsepower that contributes mightily to America's victory program.

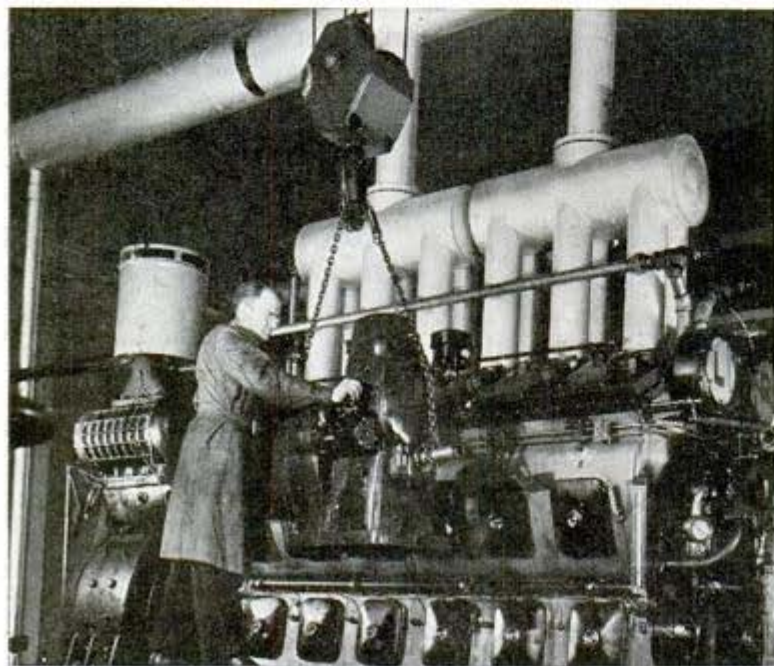
Wherever there is work to be done, you find the reliable, economical Diesel—in the Army, in the Navy, on the flying field, at

the war plant, in the mine, on the waterfront, in the oil field, on the farm and scores of other places where uninterrupted activity and production are vital.

Far from this country's shores, roads must be built for Yankee soldiers and machines; air fields must be prepared for fighting, flying Americans; harbor facilities must be made ready for a thousand

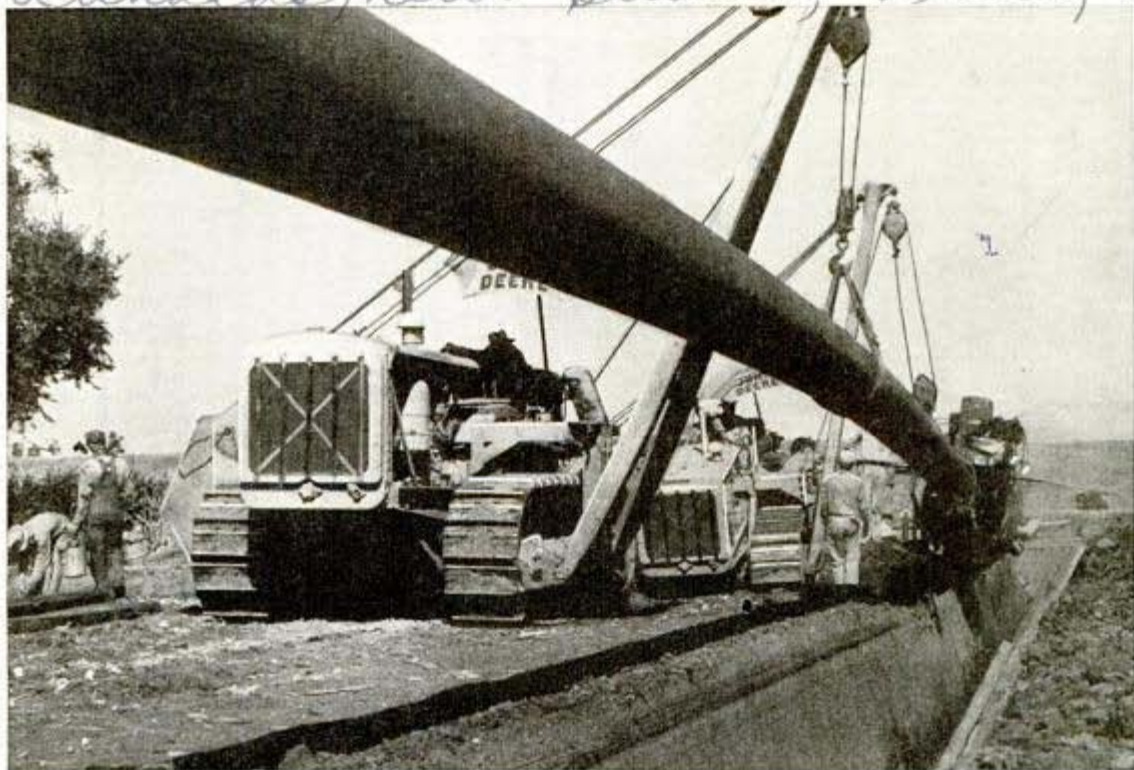
ships—and everywhere this sturdy generator of horsepower is on the job. Here, the whole top of a mountain must be scraped off to make way for a "table-top" landing field; there, desert sands must be leveled, packed and otherwise prepared for the use of bombing planes. So the machine goes to the mountain—a fleet of Diesel tractor-drawn scrapers, each capable of taking a 20-cubic-yard bite at a time,

The big and little of Diesel. Swinging in front of the 12-cylinder Diesel generating power in a war plant is a small one-cylinder auxiliary power plant



Capt. J. P. Lippert, 22107 av Hills Ave, Wakewood, Dayton, Ohio

Caterpillar Tractor Co.; Jerry Richards, News Bureau, Peoria, Ill



Diesel tractors with side booms lay twenty-inch pipe for a new oil artery essential to prosecution of the war

goes to work and removes 1,000,000 cubic yards of earth in a surprisingly short time.

Somewhere else the Quartermaster Corps is building a supply depot; there, too, Diesel equipment hurriedly prepares the site for buildings. The Army Engineers find road-building machinery driven by the same type engines highly useful in dozens of jobs at home and abroad. The lines of transportation must be sure and fast, and they must be built in a hurry. On

one emergency mission, four Diesel-powered machines built a military road 170 miles long in 76 days. And then went on to lay 56 miles of oil mix on the same road.

Fast cleanup after bombing raids is vital, London has found, for business must go on—the business of supplying the fighting men all over the globe and hard-working civilians in war plants. There, too, equipment of this same type gets the call. Big Diesels swing into action to rebuild streets,

The Diesel helps provide food for fighting men and workers. Here a tractor pulls a combine harvesting wheat





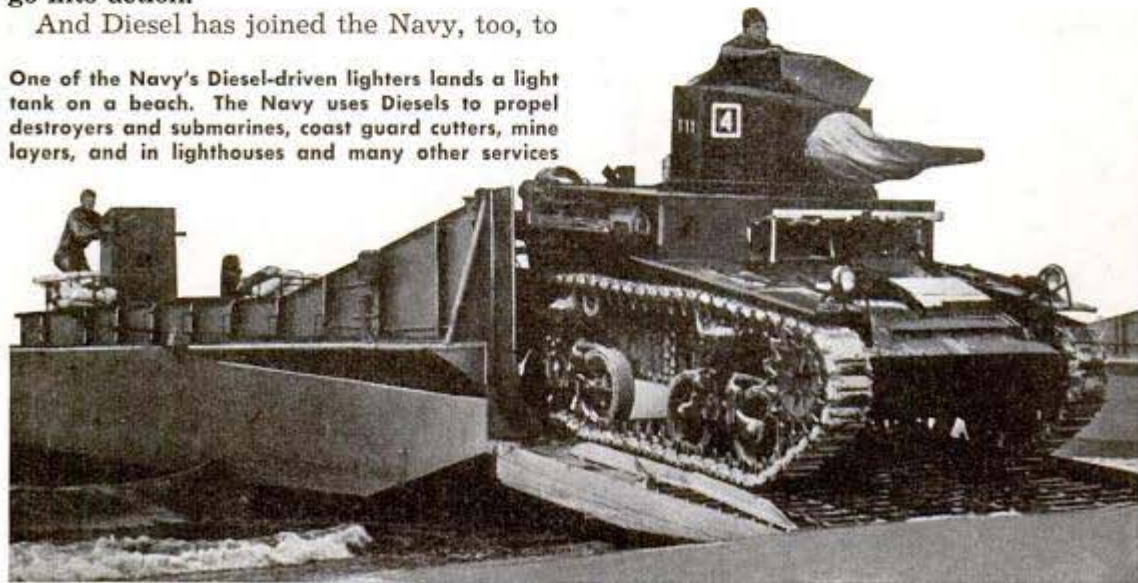
Diesel equipment works at bottom of a new dam in northwest

airports, and highways and to clear away debris of wrecked buildings.

Uncle Sam's Army also finds this "work horse" useful in hauling heavy guns over considerable distances. Hooked behind powerful tractors, the artillery goes rolling over what appears to be impassable terrain, a feat that promises unpleasant surprises for the enemy wherever the fighting Yanks go into action.

And Diesel has joined the Navy, too, to

One of the Navy's Diesel-driven lighters lands a light tank on a beach. The Navy uses Diesels to propel destroyers and submarines, coast guard cutters, mine layers, and in lighthouses and many other services



propel destroyers and submarines, Coast Guard cutters, mine layers and mine sweepers, net tenders and seaplane tenders and similar craft. Diesel-driven lighters transport guns and light tanks, as well as vehicles, from ship to a beachhead on enemy shores. In landing boats, powered by the same type of engine, fighting men follow the tanks ashore.

Important developments are being made in the Diesel engine field. One type is actually two engines so coupled that one or the other or both may be used at the will of the operator, simply by throwing a clutch. For instance, one engine provides "cruising" power, but on a hard pull on mountain grade or heavy sand, the second engine is put to work. Accessories are installed on either side of this two-in-one engine to make possible this ultimate in flexibility.

In another development, it has been found possible to use fuel other than the standard fuel oil commonly used in Diesels. At least one type has proven its adaptability to burn crude oil, coal oil, tung and soya bean oil, as well as gasoline with 80- and 100-octane rating. Use of other than standard fuels would be in emergencies, such as shortages of fuel oil in foreign lands.

A third comparatively new development for Diesels is interchangeability of parts—

which is highly important in wartime, when servicing frequently becomes an impossible task because supply forces cannot move up sufficient stocks of spare parts for repairs. One series of Diesel engines has been standardized, providing interchangeability of vital parts, making it possible for a fast-moving attack force to carry one set of spares for several sizes of engines in the series.

Standing guard on the home front, working harder than any horse day and night, the Diesel can do virtually anything. For example, a Diesel engine not so many weeks ago was assigned the unusual job of protecting a war plant from fire. It powers the first completely automatic fire pump ever installed in a war plant. The fire protection system is independent of outside power lines and can be buried in bombproof shelters. Ingenious automatic controls test the equipment periodically; in case of fire, these controls put the pump into operation.

Elsewhere on the home front, giant logs ride out of forests behind Diesel tractors to supply lumber for barracks for the fighting men, homes for defense workers, war plant buildings and spruce for airplanes.

Telephone cables are threaded into the ground with machinery using Diesel power. Maintaining railroad right-of-ways, so the fast freight and passenger may hurry their burdens of fighting men and equipment to destination, is another



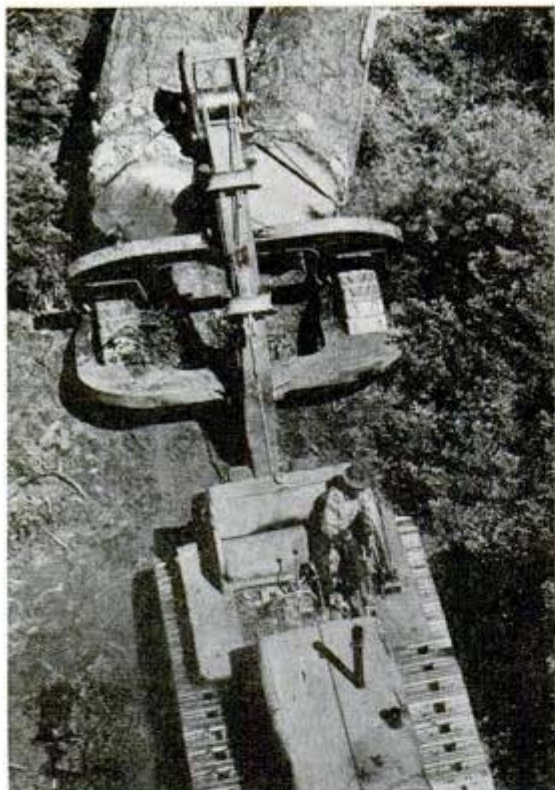
Diesel-operated dragline with 90-foot boom sets forms for a rail bridge



A compression-ignition excavator "mines" limestone for war construction

Scraper carrying 13-yard loads helps grade land for a new ordnance plant





Giant logs ride out of the forest behind Caterpillar tractors to supply lumber for barracks and factories

important task of this workhorse. Out on the farm, Diesel tractors enter into the gigantic task of feeding not only American soldiers, sailors and civilians but also about half of the rest of the world. A single tractor pulls a combine capable of harvesting three to four acres of wheat per hour. Fast handling of coal is essential, too, so Diesel takes over the job.

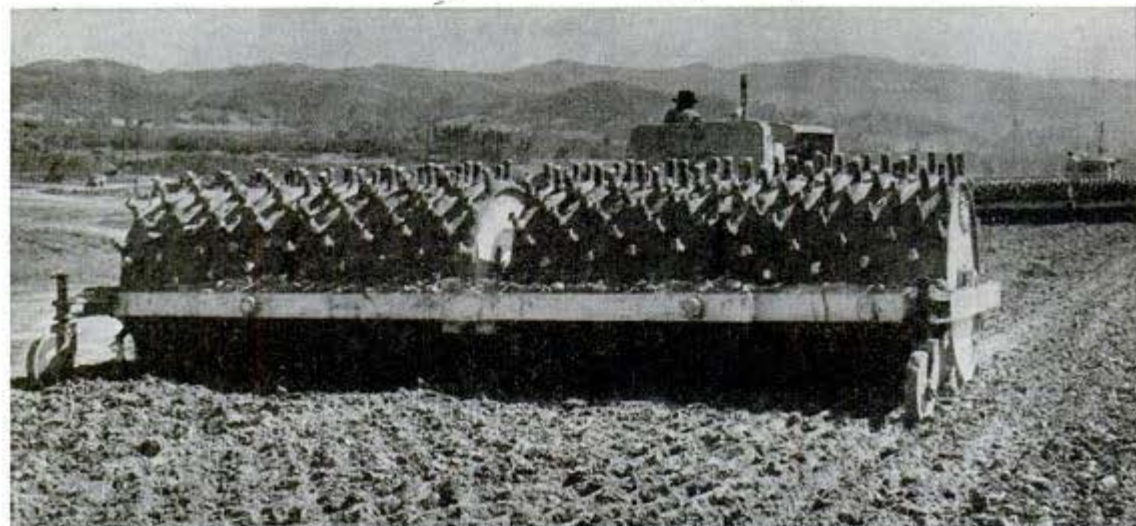
Oil, oft-times called the life-blood of

victory, also has the touch of Diesel before a drop of it is burned to produce power. Diesel engines and tractors form the strong right arm of the oil industry, providing power for drilling, pumping, servicing, hauling and lighting—yes, the work goes on when the sun goes down, with Diesel electricity generators furnishing the illumination. Laying pipe lines to carry the oil is an added task for tractors with this type of engine, tractors fitted with side booms to handle long 20-inch pipe sections while they are doped, wrapped, connected and laid in deep trenches.

Diesel power comes into its own in still another highly important field—mining. Up on the iron range, these tractors handle ore, spreading and hauling, to speed up production. South America's heavy tin-bearing clay is pushed within reach of the shovel by an angledozer. A quicksilver mine in the south is powered by a Diesel engine that generates electricity for production. A Diesel tractor helps in mining brucite, a relative of magnesium, by uncovering deposits, building roads to new deposits and leveling waste piles. Similarly, this same type of power is employed in searching for bauxite, from which comes the aluminum so vital in airplane manufacture, and for hauling the ore; also for providing all power for a 200-ton tungsten concentrating plant and for driving generators and blowers in mines from which are obtained copper and nickel-cobalt.

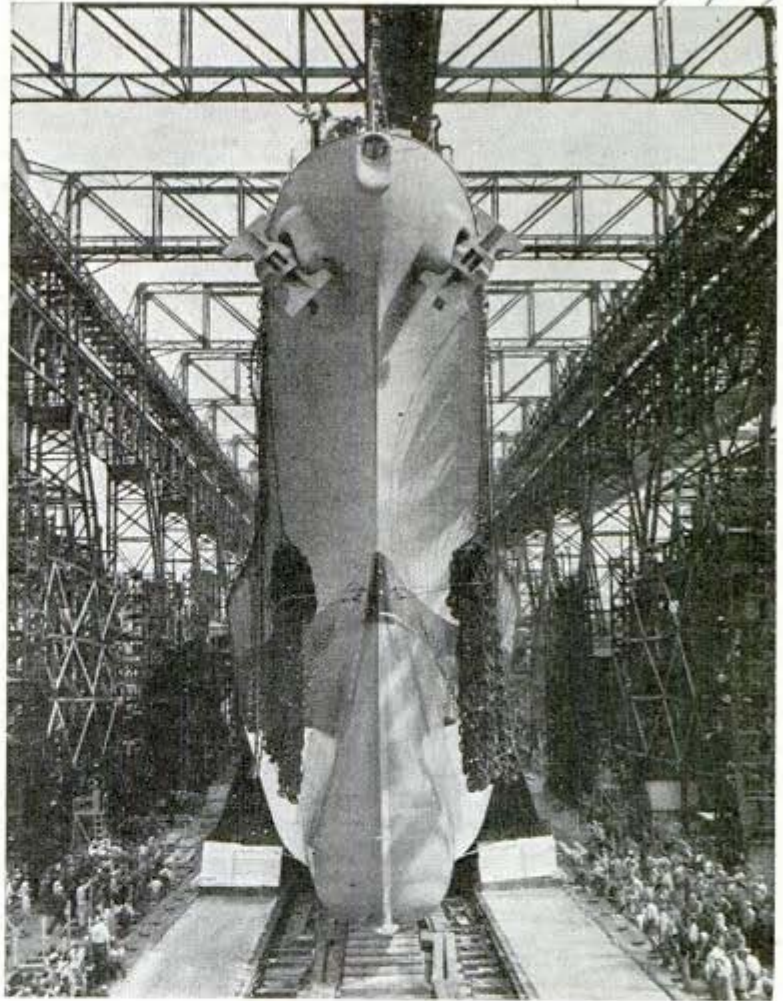
On all these, as well as hundreds of other essential tasks, the Diesel chugs on, smoothly and efficiently, constantly on guard against America's enemies.

Dams must be built to increase the nation's power. Here a tamping machine, Diesel-drawn, rolls an earth dam



*Acme Newspictures, Inc.,
461-8 Ave Nyc.*
U. S. Fits 16-Inch Guns on Mightiest Battleship *m 949*

When the U.S.S. Iowa slid down the ways of the New York Navy Yard in Brooklyn—seven months ahead of schedule—she was hailed as the largest and most formidable battleship ever built. The ship weighs 45,000 tons and is 880 feet long. Her powerful 16-inch guns will shoot farther than those of any ship afloat and her armor is heavier than the 16-inch belts of the 35,000-ton North Carolina, the last warship built at the yard. She will carry 1,600 officers and men. The Iowa will be the first of six dreadnaughts of her class to join the fleet. The others are under construction.



Amid the cheers of men who built her, the U. S. S. Iowa slides down the ways at New York Navy Yard. Her full-load displacement of 52,000 tons will include the shells to be shot from a battery of fast-firing 16-inch guns

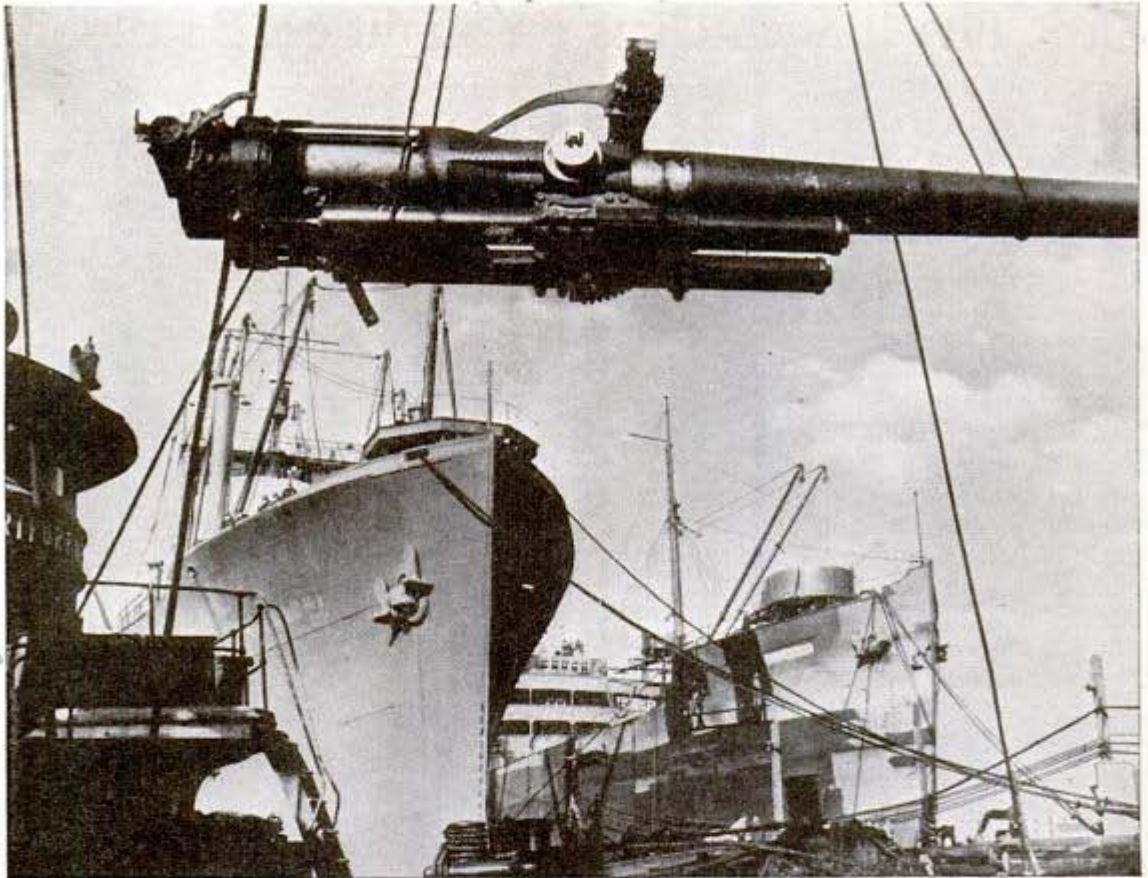
Auto Tire Wears Cotton Sandal to Give Longer Mileage



m 946
From 2,500 to 3,000 miles of life can be added to automobile tires by putting "sandals" on them, according to tests conducted by United States Rubber Company. Made of cotton pile fabric, somewhat resembling a closely stitched bath mat or rug, the sandal is given a treatment of asphalt emulsion, and its manufacture does not require use of strategic materials. Although it is not as cheap or as practical as recapping or building new tires, it is one solution for the present tire problems of civilians. Tires wearing the sandals should carry 40 pounds of pressure, and the car's speed should be limited to 30 miles an hour, for efficient service. The material would be suitable for tires on portable air compressors and bomb carriages and for vehicles such as civilian defense fire carts, but would not be practical for travel at high speed.

Sandal wraps around tire and points tuck in at rim

*Rockefeller Center
Publicity Dept.
Nyc.* 13



FANGS *for* FREIGHTERS

The U-boat sport of torpedoing defenseless merchant vessels, practiced by Axis subs, is now a dangerous business. One reason is the big gun, above, being hoisted aboard U. S. freighter

*Allen Warren Elliott
7 Park Ave, NYC*

M 655

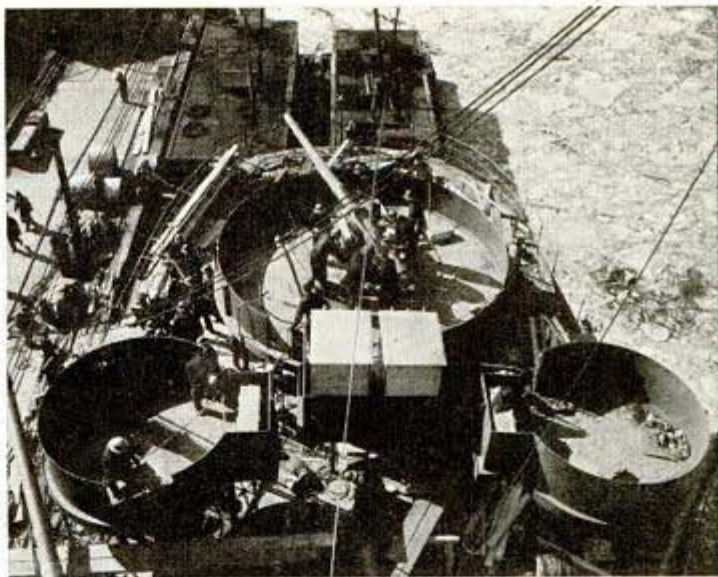


Above, placing .30 caliber machine gun shells in belts at the Navy's Armed Guard School at Norfolk, Va., where gun crews are trained for duty on merchant ships. Left, a machine gunner ready to blast enemy bombers attacking ship

Official U. S. Navy photos



A machine gun nest, held in place by a huge crane, is being welded to superstructure of merchantman. One of the Navy's big jobs is outfitting the new merchant ships with guns as well as arming older vessels and those of our allies. The weapons used range from big five-inch guns and machine guns to revolvers. The training of gun crews is conducted at special schools by navy veterans taken off warships or recalled into service. Only young men are accepted



Testing gun after installation in steel nest on merchant vessel. When in danger zone all members of gun crew "stand by" for hours



Practicing loading deck gun and handling ammunition at an Armed Guard School. Below, mounting the first gun on a merchant vessel



Gun crew holding aloft the .45 caliber automatic pistols that may come in handy in emergency. Training continues after men go to sea and they teach ship's crews to help operate the big guns



*Grand Laboratories
Starm Lake, Iowa*
Stretcher Makes an Ambulance of Small Car

m 903



"Sway-backed" stretcher, curved for suspension between front and rear seats fits any private two-seated auto. Left, lifting stretcher and patient into car; below, stretcher placed with head on back of rear seat, and foot on front seat



Two-seated cars can be converted into emergency ambulances with a stretcher recently adopted by the California Highway Patrol. The stretcher is made of a framework of metal tubing covered with canvas. Ends of the stretcher are supported by the backs of the front and rear seats.

"Backyard" Kitchen, Bath Units Speed Housing Program

Packaged rooms designed by a Californian to speed the construction of homes for war workers provide complete kitchen and bathroom units. They contain all the nec-

m 924
 essary features such as stove, cupboards, bathroom fixtures and hot water heater. Also included are plumbing, wiring, master switch, lead-in wires and circuit outlet box. The ready-made rooms can be used in any type construction, according to their inventor, Hoyt Martin, of Los Angeles. A house can be constructed around them or finished with the exception of interior wall and floor covering before the rooms are installed. The two-room unit, which has been approved by the War Production Board, requires only 527 pounds of critical materials and building costs are reduced about 20 percent.



Ready-made kitchen and bath unit, being hoisted from truck, may be installed before or after the house has been erected

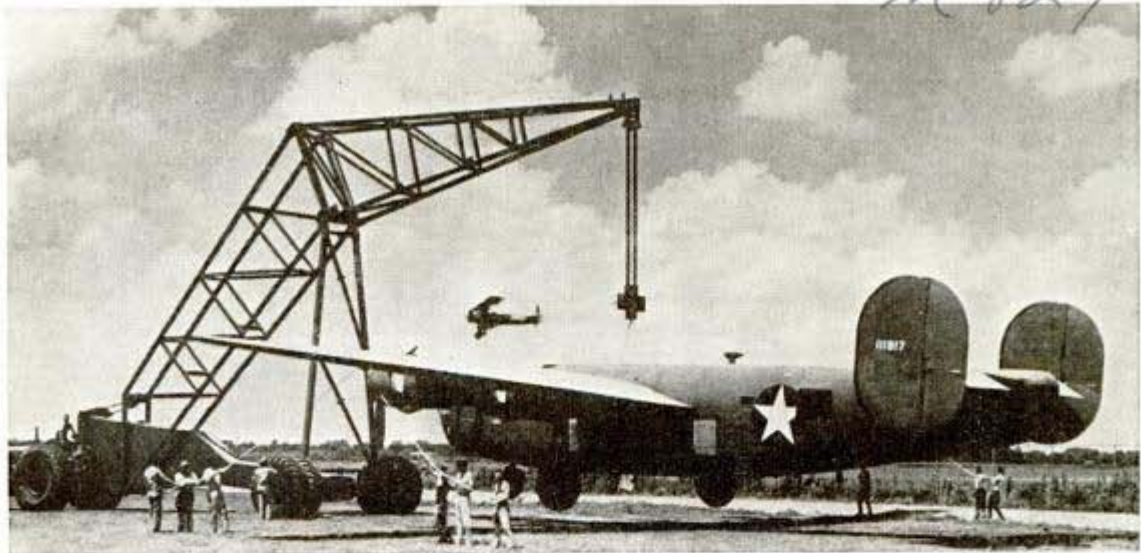
□ American inventiveness has reached a new peak with the submission to the National Inventors Council of 91,823 suggestions for devices to help win the war, Chairman Charles F. Kettering reports.

*Designed by Whitney-Mead Co
2263 E. Wilcox Ave. Los Angeles, Calif.*

Acme Newspictures, Inc
461 - 8 Ave. N.Y.C.

Giant Crane Hoists Army Bomber With Ease

m 829



Big four-motored bomber is lifted by crane in test for clearing air field of damaged planes during raid

Damaged aircraft will be removed from air fields under attack with a huge crane that can carry a load of 60,000 pounds at a speed of 18 miles per hour. In tests at Wright Field, where the crane was devel-

Dayton, Ohio

oped by the Army Air Corps, a giant Consolidated B-24 four-motored bomber was lifted with ease. During a raid it is vital to clear a field of damaged planes in a hurry so others can take off and land.

Plane Silhouettes on Playing Cards Help Identify Aircraft

m 822

Civilians can join in one of the soldier's favorite pastimes—identifying combat aircraft—with playing cards that have silhouettes of Allied and enemy planes on their

faces. The United States planes are spades, British are hearts, German are diamonds, and Japanese are clubs. In the corners are the "pip" signs. The airplane card idea was suggested by officers of the Third Air Corps, Tampa, Fla., who have been conducting classes in aircraft identification.



Silhouette cards combine war training and pleasure

DECEMBER, 1942

Brace and "Bit" Unscrews Nuts With Wrench Attachment

m 840

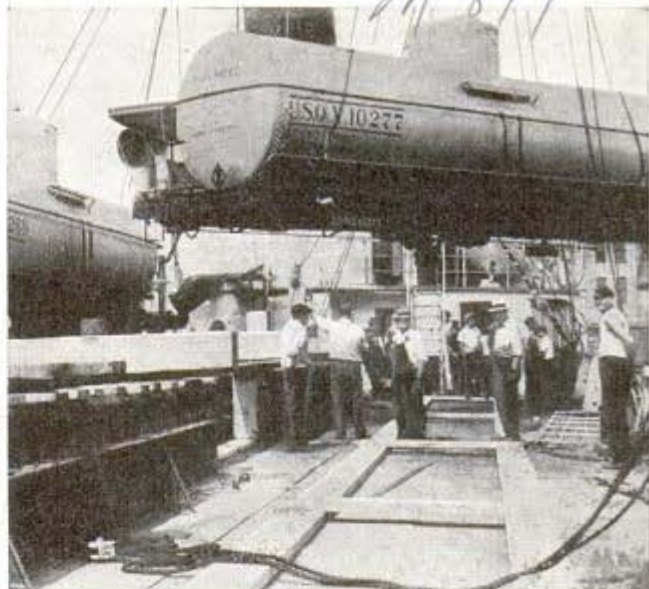
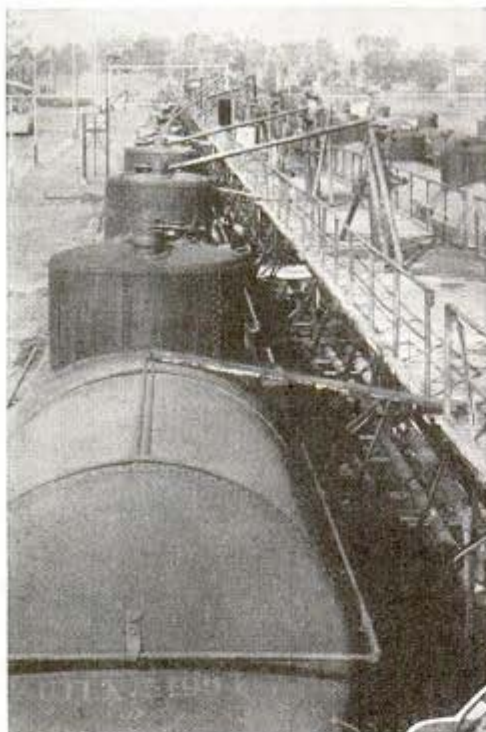
Nuts and bolts can be screwed on or removed quickly with a special wrench with a square shank that fits into any brace. The tool, which is made in several sizes, is chucked into the brace and locked like an ordinary bit, providing an inexpensive substitute for a speed wrench.



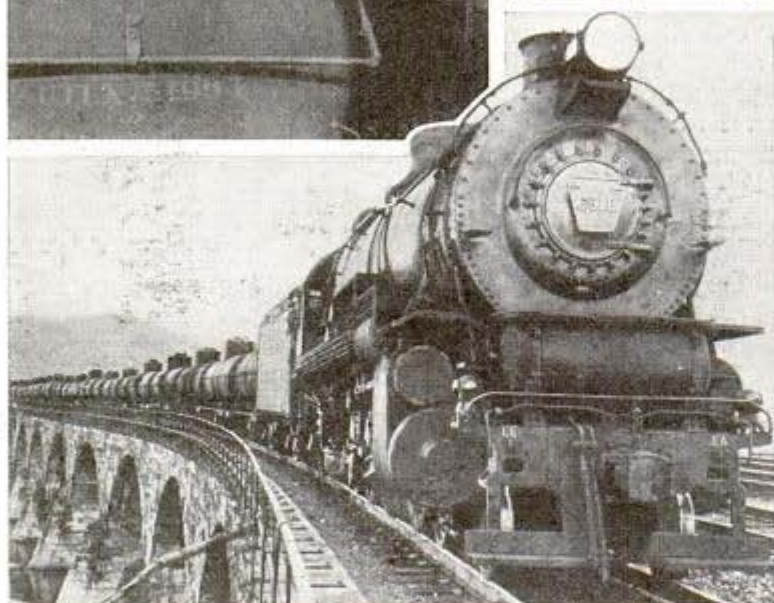
Dist: Izenstark
Adv. Co., 60 W. Van
Buren, Chicago

Acme States Playing
Card Co., Park Ave
Camden, N.J.

Solid Trains of Oil Race to Ease Coast Crisis



At upper left, oil flows into tank cars from a 48-car loading rack at a Pure Oil Company refinery. Right, tanks are shipped to an army base



With daily delivery of 1,000,000 barrels of oil from the mid-continent to the eastern seaboard their goal, the railroads have set rolling a fast schedule of trainloads of oil. More than 50 solid sixty-car trains of petroleum move eastward virtually nonstop each day, matched by the same number of empties westbound. Hourly reports of the progress of every train are telegraphed to the Association of American Railroads, government and oil officials. All available tank cars have been put into this service, many being withdrawn from the midwest to form a fleet of about 75,000 cars compared with 1,000 in the east before the war.



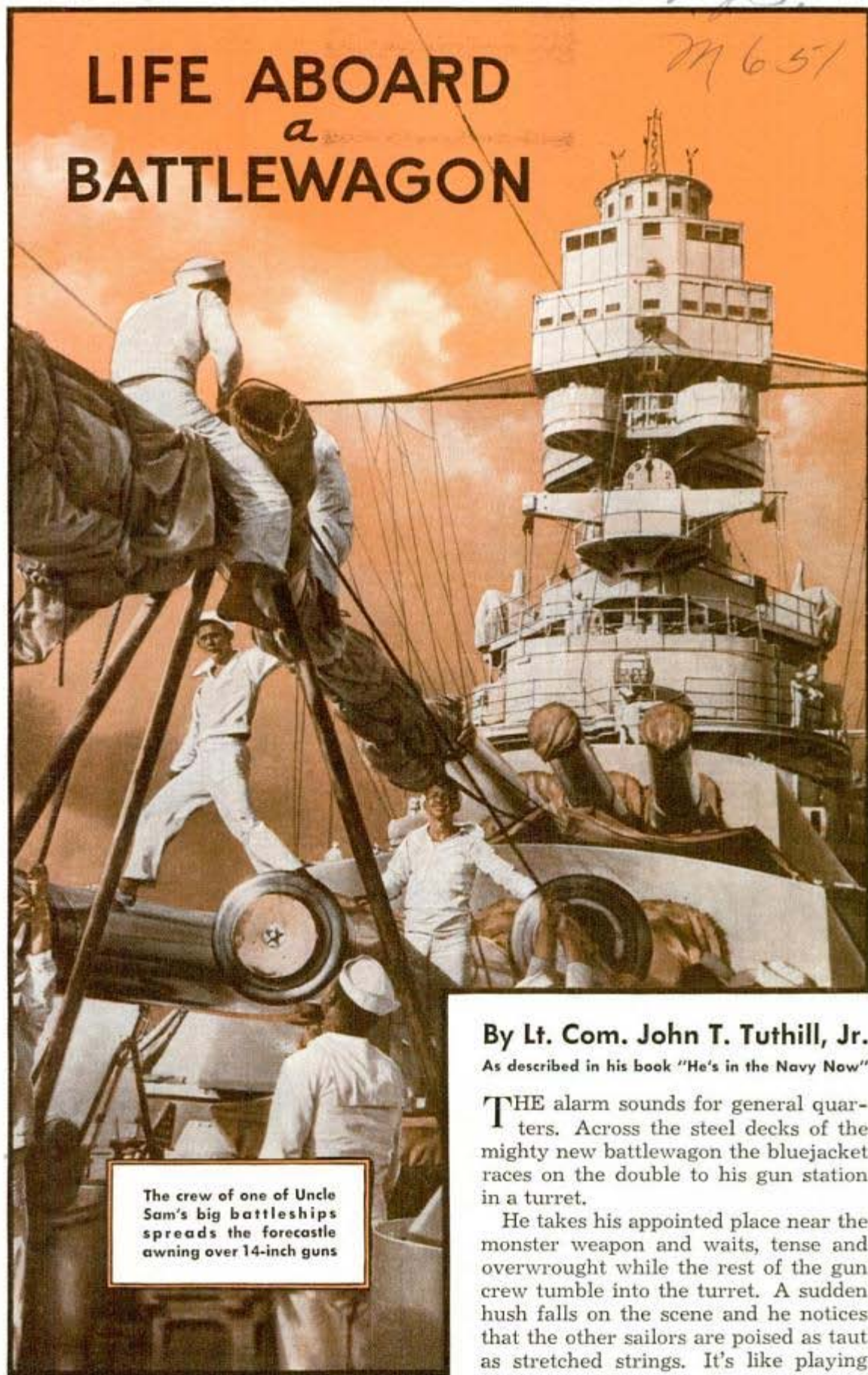
In center, a solid trainload of oil heads eastward on the Pennsylvania railroad. Bottom, filling up a tanker at a Pure Oil station in Ohio

*Transportation Bldg
Washington, D.C.*

Allen Warren Elliott, 7 Park Ave
N.Y.C.

M 651

LIFE ABOARD *a* BATTLEWAGON



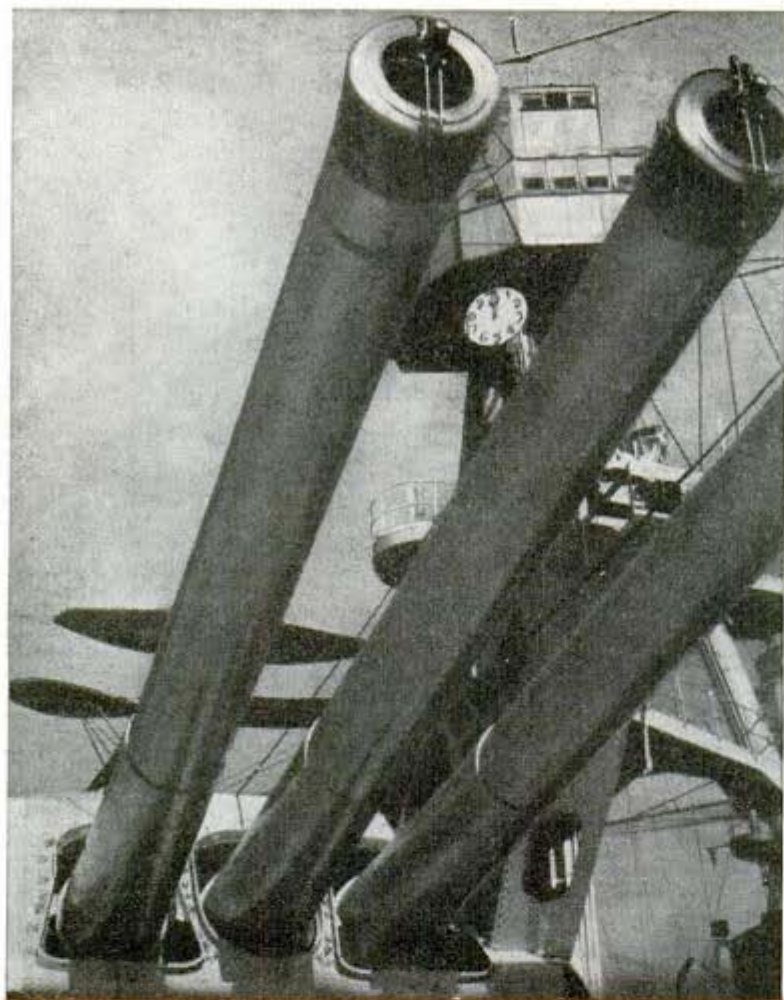
The crew of one of Uncle Sam's big battleships spreads the forecandle awning over 14-inch guns

By Lt. Com. John T. Tuthill, Jr.

As described in his book "He's in the Navy Now"

THE alarm sounds for general quarters. Across the steel decks of the mighty new battlewagon the bluejacket races on the double to his gun station in a turret.

He takes his appointed place near the monster weapon and waits, tense and overwrought while the rest of the gun crew tumble into the turret. A sudden hush falls on the scene and he notices that the other sailors are poised as taut as stretched strings. It's like playing



14-inch guns of a modern battleship talk with deadly effect over a range of 20 miles or more

a finger near the button which will fire nine 16-inch guns, the main battery, and ten 5-inch guns simultaneously. Proud of his new ship and crew.

The gunnery officer sings out over the telephone:

"Report when manned and ready!"

Gears whirl on his gun. Wheels and machines turn and click. Now it's like being inside the works of a gargantuan clock. From the handling rooms come big 16-inch shells. Then powder bagged in silk. The guns are loaded, primed, laid and ready. Gun muzzles swing. His turret is trained on the beam, he observes.

Over the ship's battle circuits and loud speaker the word comes:

"Stand by... stand by."

In breathless suspense he waits, motionless, alert. He has a moment to realize he is a part of this drama. A small part, but with definite responsibilities. A member of a team.

The captain's finger presses the button.

A bone-shaking shock rattles the bluejacket's body. Red flames shoot skyward above the masts and streak across the ocean's surface, disappearing somewhere among the distant waves. Thousands of pounds of smokeless black powder have hurled tons of heavy

steel projectiles into space in an instant.

His ears are stuffed with cotton, but still the roar is deafening. The hot breath of the great guns penetrates the turret. Again a hush falls over the group. He winks at



U. S. Navy photos

A trio of "boots" is given instruction in the use of a signal blinker tube

football on the high school team, back in Tennessee. They're a team waiting for the quarterback to call signals.

The quarterback is the captain, far above, standing cool and proud in his station with

the sailor who is grinning his way. It's something like smacking the ball out of the park—a home run in the ninth with bases loaded—this job of firing one of the fleet's big guns.

It's teamwork on Uncle Sam's team.

Everyone aboard the huge, new battlewagon had been waiting for this drill which was to mark the final test of a series given every new ship to determine the effect of firing on its structure. In this test the entire main battery and half of the secondary battery were fired simultaneously from a single key, not much larger than a doorbell button.

He wonders, as the ship plows ahead in a brisk 25-knot wind with the acrid, ether-like smell of powder still hanging about her, how she had stood it. His own sense of shock had disappeared and his mind has turned to the ship. Pretty soon word seeps throughout the craft. It gives every man a warm thrill.

This battlewagon is okay.

It isn't the kind of activity that makes the headlines, this testing of new ships and new crews. This training of new American teams to play the game of war on the widest field of action the world has ever seen. But the life of the nation depends on it. And as every new ship and every new crew passes the test, the day of victory is brought nearer.

Today, the nation can

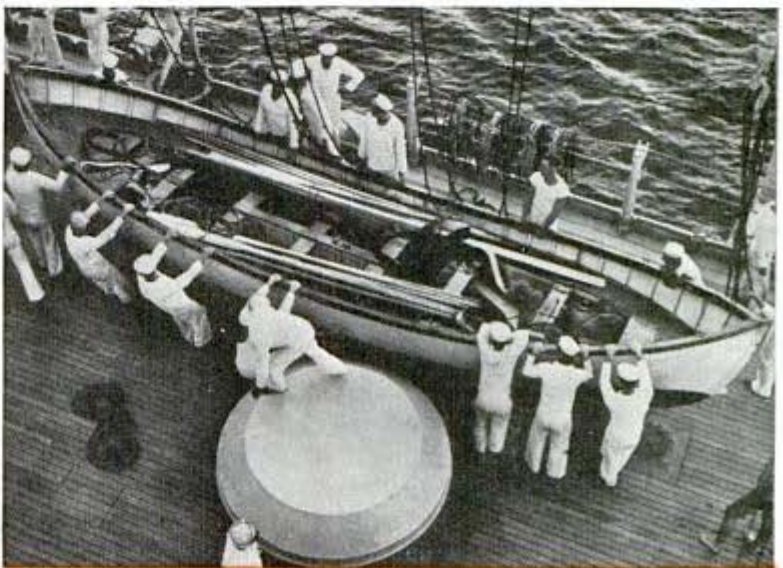
Rigging a boat for small boat drill, a routine but important part of a bluejacket's training



One of the key men on a battlewagon is the director operator, seen at the controls of a director in photo above



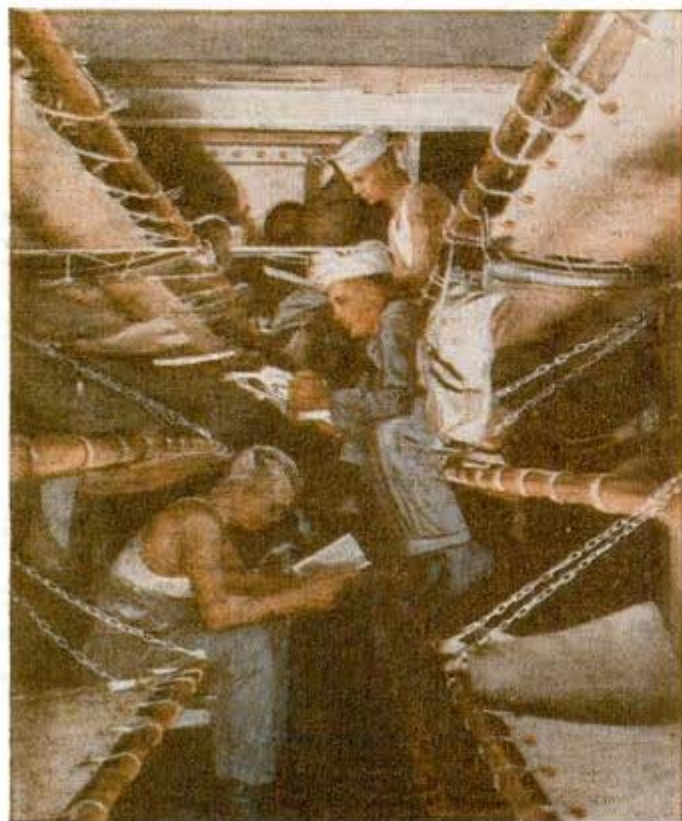
Arms of the big ships range from small automatics to 16-inch guns. Here a gunner's mate works on a small gun





Officers and men check a warship's course in the chart room

Time out for relaxing in bunks below deck, where space is tight



rest assured on this: American warcraft and American crews are passing the teamwork test in the greatest numbers in history.

To produce these teams, life on a battlegon is conducted by strict rules, though it is pleasant enough if a man conforms willingly.

From the moment the blue-jacket climbs the gangway and salutes the colors before stepping to the deck, his duty is to learn his particular job whatever it may be, so that when the time comes to fire the 14- or 16-inch guns of battle, he will function as perfectly as a cog in the great machine. He has certainly spent months, he may have spent years in the Navy preparing for that moment—a moment that might change world history.

The 16-inch guns can discharge tons of shells every thirty seconds or less, and such discharges can sink anything afloat. Therefore, it is imperative that everything be in readiness and that every man know his job

when the great moment comes to fire them. Every officer and enlisted man in the far-flung naval organization has exerted his energies toward this end. The men detailed to recruiting, to the ordnance offices, to the shipyards and other vessels of the fleet—to all the vast interlocking network of naval activities in their many ramifications—have applied themselves throughout their careers to the end that at the zero hour our dreadnaughts can get into proper position to discharge their broadsides speedily and accurately before the enemy has a chance to fire first.

Battleships are about 95 percent steel and so compactly arranged that regulations governing the conduct of the men aboard must necessarily



↑ The Chief Petty Officer on a capital ship of the United States Navy inspects one of the vessel's powerful hoists



↑
Emery, oil, and plenty of old-fashioned elbow grease keep the guns and gear of a battleship in fighting trim at all times

The men, too, have to be "in trim," and the volunteer ship's barber is kept busy. A big ship carries men of nearly all trades →





Man and gun are symbols of America's might. This is the muzzle of a 14-inch gun

first issued to him. The place assigned to him for sleeping quarters is known as his billet. On a crowded ship this billet may be a gun turret where he hangs his hammock from hooks in the steel hood covering the gun, rolling and stowing it out of the way when he is not using it.

Since everyone is cramped for space he stows his belongings in his seabag and a small steel box about two feet square. The only thing stowed separately is his heavy waterproof raincoat which is hung on a rack.

Once a week he must remove all his effects from his bag and spread them on the deck in a straight line with the clothing arranged on top for bag inspection. Everything must be folded or rolled and placed in proper position as prescribed by regulations.

Clothes are usually scrubbed with stiff brushes, each man doing his own washing. He hangs his clothing on lines along the deck to dry, observing strict regulations as to how they shall be hung or "triced up." If he occupies a cot, he must air his mattress periodically. Some of the larger ships have laundries where the bluejacket who feels flush and chooses to indulge in the

be more stringent than they are in an army camp. To prevent our ships from sinking they are divided into many watertight compartments separated by heavy steel doors which can be shut, isolating the compartment, if it is damaged by a torpedo. These doors are marked with big letters on each side. The newcomer quickly learns, if he has not known it before, that the letter "X" on a door means that particular door always must remain shut; that the letter "Y" on another door means it must remain closed after working hours, and that the letter "Z" means that doors so designated must be kept open at all times during battle.

Living space aboard some ships is sometimes limited to the point where the crew may have an insufficient number of bunks. In that event the new bluejacket must sleep in the hammock



Sailors in the steering engine room watch on a battlewagon
U. S. Navy photos

luxury may have his clothes washed cheaply. Every item must bear his name, clearly marked with a stencil and ink. His blanket must even be marked eight times, in each corner on both sides, so that his name will always show, no matter how he folds it.

All sailors must learn to handle and shoot rifles, and periodically they receive target practice, but primarily their job is to help operate a warship, whose big guns must be kept free of dirt and water. Men detailed to the gunnery department must be experts in caring for and firing the guns. To keep them clean they plug the ends with tampions and protect them with canvas covers known as bloomers.

Anticipating the day when the ship may go into action, all activities aboard are carefully planned, and much time is devoted to drills. Periodically the fleet engages in target practice, training the guns at

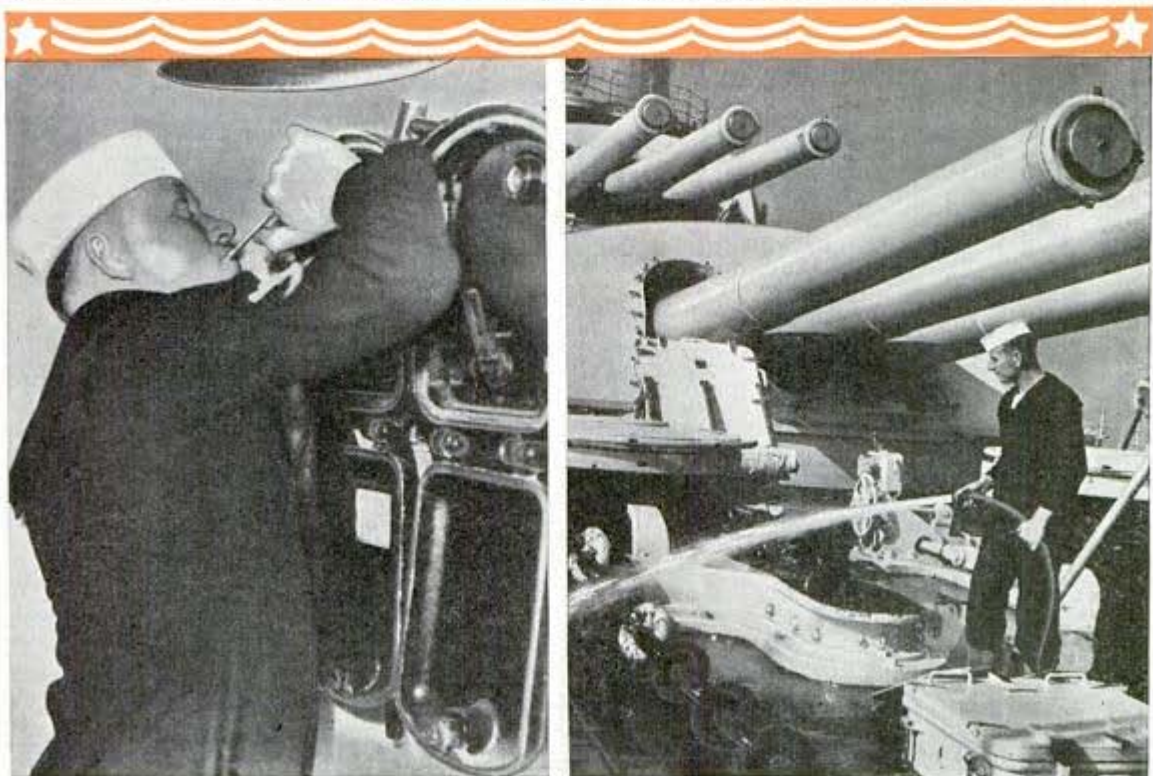


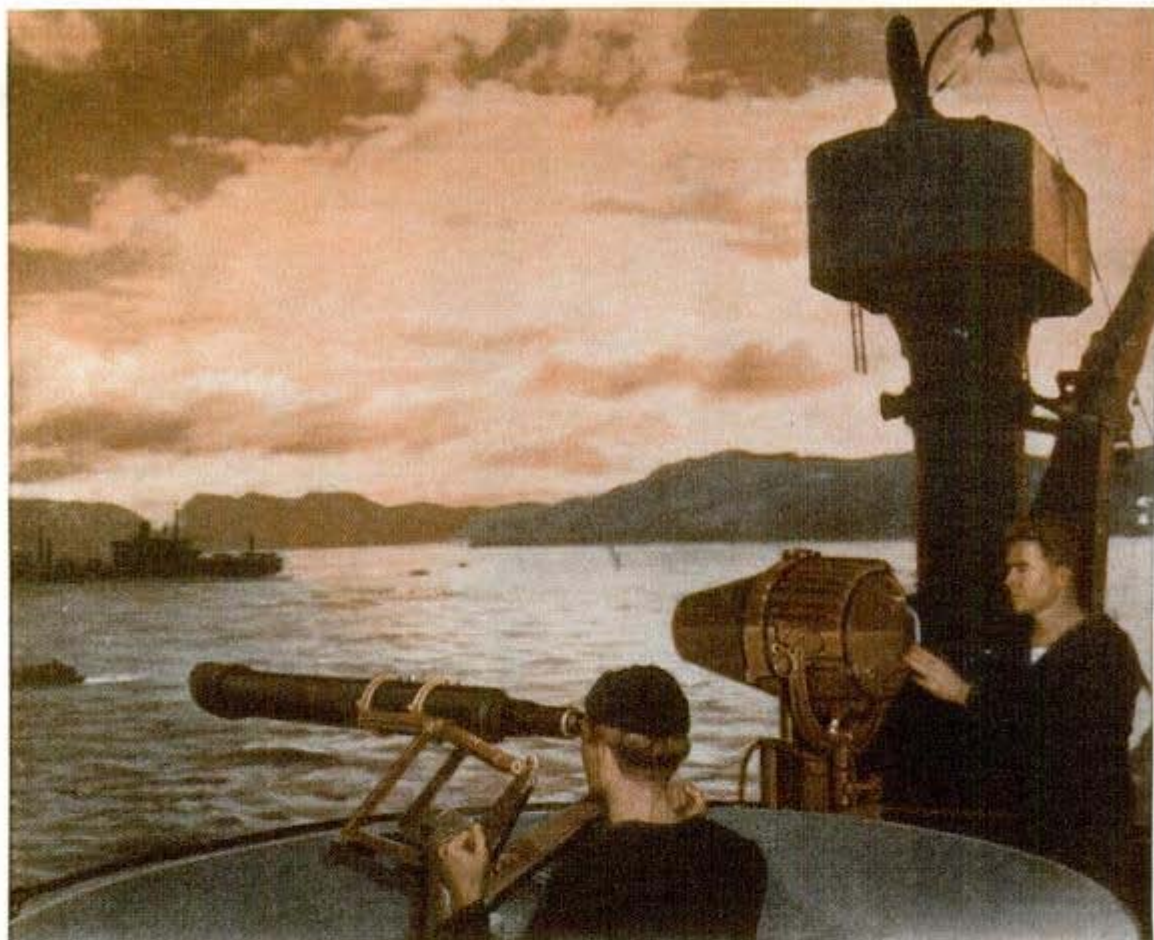
Signal men read the message of a searchlight blinking on another vessel

wooden targets towed to sea by a tug. Dirigibles may hover over the targets to observe the marksmanship.

Again, a man-overboard drill may be scheduled, in which event the ship is stopped and parties attached to the deck force are sent overboard in rowboats to search for the practice dummy, popularly known as Oscar.

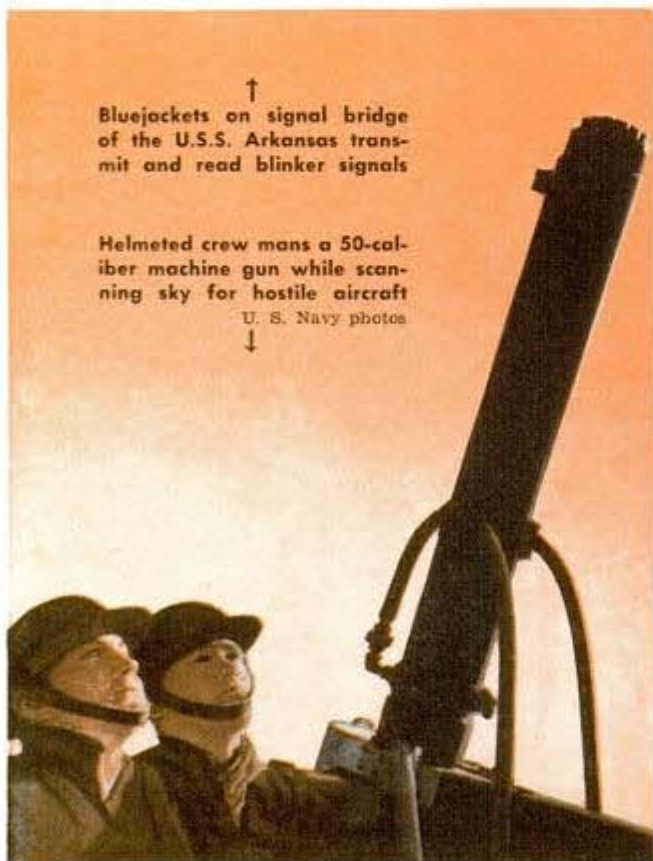
Left, boatswain's mate piping a call over battleship's public address system; right, washing anchor windlass





↑
Bluejackets on signal bridge
of the U.S.S. Arkansas transmit
and read blinker signals

Helmeted crew mans a 50-cal-
iber machine gun while scan-
ning sky for hostile aircraft
U. S. Navy photos



Other standard drills are fire, abandon-ship and collision drills, and all bluejackets must proceed to their stations on the double with fire extinguishers, rations and repair equipment.

Drills are usually announced by a gong, with a bugle call following almost immediately over the ship's loudspeaker system. This can be heard even by men working deep in the bowels of the ship who hustle to their stations on the double quick, in their work clothes known as undress blues.

Along with the drills which are held several times a week and which present the practical aspect, every bluejacket must attend classes. He may spend an hour in the morning on gunnery and another hour in the afternoon in a seamanship class where he becomes acquainted with the problems aboard his individual ship.

Most bluejackets have learned all

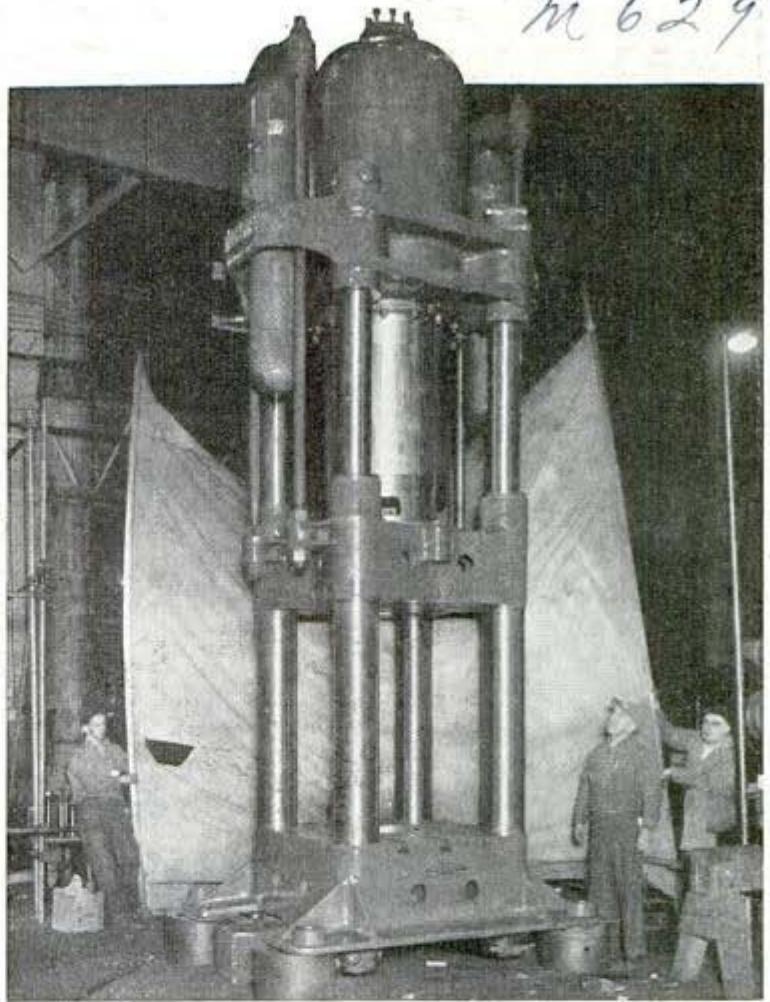
(Continued to page 176)

Philadelphia Pa.

Output of Shells Is Speeded by 500-Ton Press

M 629

Production of shells for our fighting forces will be accelerated by a new 500-ton piercing press completed by Baldwin Southwark Division of the Baldwin Locomotive Works. Standing 25 feet and 3½ inches high, the press is sturdily constructed of cast steel to deliver 240 strokes per hour in a continuous 24-hour day operation. The main ram has a diameter of 32 inches and a stroke of 42 inches. All rams are of hard cast iron, and cylinder and column guides are bronze bushed. The distance between platens is 99 inches and the stripper cylinder in the bottom platen has a diameter of 12 inches.



Tall, husky press will do its bit in keeping up the steady flow of ammunition to our armed forces by turning out shells at a speedy pace

Wheels or Track-Laying Tread Speed Scout Car Overland

M 734



Captured while on scout duty in Egypt, this German car rides either on four wheels or a pair of "tracks" as required by the changeable terrain.

Whether its path is a pavement, deep mud or loose sand, an armored observation car used by German forces in Africa and Egypt is equipped to make the best of it and push through at high speed. To meet varying conditions, this vehicle travels either on four wheels or on a pair of track-laying treads, which can be used interchangeably. After churning through rough or sodden terrain, the treads can be raised and the wheels lowered on reaching level, solid ground.

DECEMBER, 1942

International News Photos 27
30-6 40' ...

Cont. Thos. C. Stimson, Jr. 3872 Franklin Ave. Los Angeles, Calif.

HOW TO BECOME AN ARMY OFFICER

M 817



161st Signal Photographic Company photo

It's all in knowing how to grab the other fellow's gun when he attacks with drawn bayonet, and students at the Fort Benning Officer Candidate School, above, acquire technique. Below, four men in an obstacle race



clusion. Courage is needed, but daredevils who act before they think will not be trained as officers. They might sacrifice their men and themselves needlessly.

Our armed forces are becoming so large that the officers themselves comprise a small army. Seven million men or more will be under arms a year from now. To help command this force, several hundred new officers are being graduated from training schools nearly every day.

The training facilities at West Point cannot begin to handle so many students. The army has had to set up special training camps known as officer candidate schools. The Infantry School at Fort Benning, Georgia, for instance, is now graduating

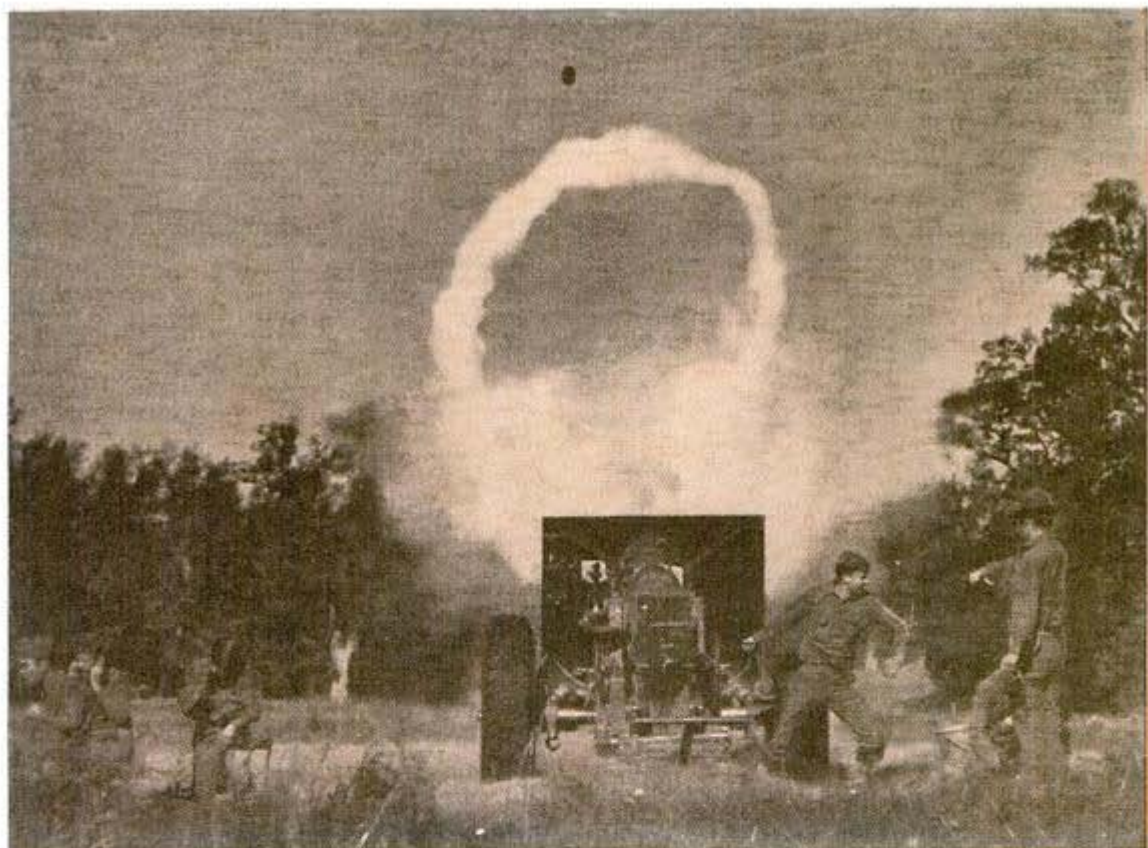
Officer candidate learning use of bayonet by piercing "vital parts" of dummy held on wires



Def. Bureau of Public Relations
1700 ar Dept. Washington D.C.

HOW would you like to become an officer in the United States Army? If you have the qualities that make a good leader and if the prestige and responsibilities of command appeal to you, Uncle Sam will go out of his way to train you for a commission. It doesn't matter whether you are in the army now or not, nor do you have to be a college graduate.

What the army wants as officers are men who can think rapidly, clearly, and comprehensively. Leadership requires a determination to carry one's actions through to a logical and satisfactory con-



That black dot just above the smoke ring is a shell fired from the giant 155-mm. howitzer manned by soldiers at Camp Roberts infantry replacement center in California. Note men holding ears

several classes of second lieutenants every week. Twelve times as many officers as before are now being trained for field artillery, quartermaster, and signal corps duties. Eight times as many officers as before are being trained for coast artillery and armored force duties. The chemical warfare and finance departments have increased their officer training capacities by five times, the engineer corps by 16 times, and the ordnance department by 20 times: In all, additional officers are being trained for 13 branches of the service.

If you would like to apply for admission to one of these schools, here are the basic requirements: you must be a citizen of the United States, must be between 18 and 45

Firing a .20-caliber air-cooled machine gun which eats up thousands of bullets to train men

years of age inclusive, must have a good civilian or military record and have a capacity for leadership, must make a score of 110 or higher in the army general classification intelligence test that every recruit receives, and must pass the "final" type of physical examination although certain





One way to get a jeep across a river—ferrying it on a cable with pulleys, ropes and chains. This mechanical pet of the armed forces is being pulled by prospective officer candidates

minor physical defects may be waived. Under some circumstances you may retake the intelligence test if you failed at first.

If you are in the army now and can satisfy the requirements listed above, you are eligible for admission to an officer candidate school as soon as you have served three months. It doesn't matter whether you enlisted or are a selectee, whether you are still in training or are on active duty, or in what part of the world you are stationed. It is possible to receive your commission six months after you joined the army, spending three months in training camp and then three months at officer training school.

The army urges that all enlisted men who have the desired qualifications apply for this training. Select the school for which you are best fitted, then write your unit commander requesting appointment to the school. If you possess qualifica-

tions suited to a different branch of the service from the one you are now in, you may apply for officer training in either or both branches. That is, if you are now in the infantry but have had previous experience in heavy construction or as a radio amateur, you might apply for admission both to the infantry officers school and to the engineer or signal corps school. The examining board will decide which school you should attend.



A 75-mm. howitzer bounces clear of ground at full recoil after firing. Barrel is drawn far back

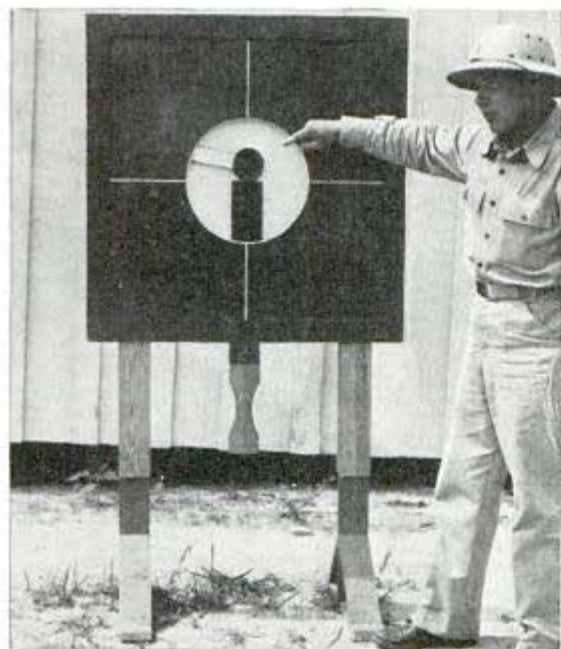
Field Artillery Replacement Training Center photo, Camp Roberts

If you are a civilian who is eligible for army duty and if you wish to become an officer, your first step is to join the army. It takes at least three months to teach you the basic subjects that every soldier must know, so your start is at a regular replacement training center. Actually, there is no guarantee that you will make the grade to officers school. Your soldierly conduct, your attention to details, the thoroughness with which you absorb instruction, and the way you learn to operate equipment will all affect your chances.

If you are a married civilian, deferred from service because of dependents, you may apply for officer training through your draft board as a volunteer officer candidate. You must pass the same moral, physical and mental examinations imposed on enlisted candidates and you spend the first three months just like any other soldier at



Trainees competing for high scores during target practice at a replacement center, above. Below, examining model showing Garand rifle action



a replacement training center. If you prove to have the qualities needed, you will then attend an officers' candidate school. But if you are not selected for officer training or if you fail to graduate from officer school, you may transfer to the enlisted reserve with a deferred status, returning to civil life, from which you will not be called to active duty until others in your own draft classification are called.

When you are sent to one of the training schools you should be ready for three months of rigorous training. The instructors will try to teach you in that short time as much as would ordinarily be learned in courses lasting many times longer. The streamlined course includes technical studies of all the equipment each officer

Wooden model to indicate proper sight setting for Garand rifle, used at officers' school, Fort Benning



Officer students surprise the "enemy" with commando tactics, above. Below, floating a jeep across river after first converting it into boat with use of some waterproof tarpaulin



will have in his charge, together with tactical studies and administration. At Fort Benning, for instance, prospective infantry officers learn the mechanical parts, operation, uses, and limitations of all infantry weapons. They study the rifle, bayonet, grenade, carbine, automatic rifle, machine guns, and various mortars. Much of this they have already learned during replacement training, but now their training is more complete.

All students wear the uniforms they wore during basic training, the chevrons of noncommissioned students being removed so that all are equal. Acting company officers and noncommissioned officers are appointed weekly from the ranks. Each student is given training in commanding the other students. Each is trained to think and act like an officer and stress is laid on each candidate's voice and bearing.

The pace is fast and students are flunked out if they can't keep up. Graded tests and practical field problems are held frequently and those who fail are returned to the ranks. Students who complete the course with passing marks are commissioned as second lieutenants and go on active duty at once. The younger graduates are put in charge of combat units, and older officers are sent as instructors to replacement training centers. Exceptionally qualified graduates may receive additional training.

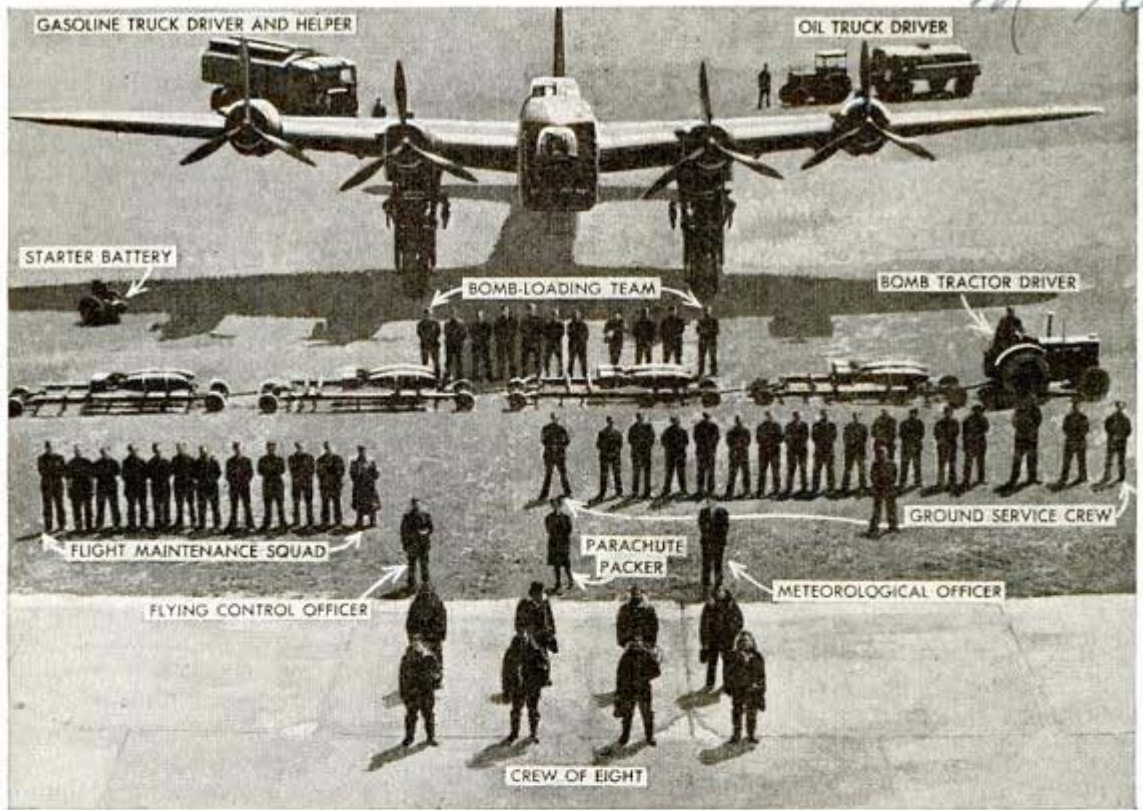
Obtaining a commission through the Reserve Officers Training Corps is another way to become an officer, but this is part of a standard four-year college course and is too long for most men these days. The most rapid way of all to become an officer, if you are now a civilian, is to obtain a direct appointment, but this is also the most difficult. Such appointments are given to men whose technical knowledge is needed in the army. Most such men as these, if they are under 30, are asked to enlist and then attend officer candidate school so that they will have a soldierly background.

Recruits learning to pitch hand grenade from foxhole at basic training center



*International News Photos
326 Madison Ave, Chicago*

Work of 56 People Required to Launch Bomber



Can you resist counting 'em? The 56 workers indicated here are all needed in launching a big bomber

To picture for the layman what it takes to launch a big bombing plane at Germany, the British Royal Air Force has posed a Stirling four-motored ship with its flight crew, corps of ground workers, and equipment. It reveals that a staff of 56 workers is required to maintain and fly one of these

skycraft. In the photograph are included the crew of eight, a meteorological officer, parachute packer, flying control officer, flight maintenance squad of 12 men, ground service crew of 18, bomb-loading team of 11, bomb-tractor driver, oil truck driver, gasoline truck driver and helper.

Three-Place Auto-Sled Retracts Front Wheels in Snow

Packed snow, ice or bare roads are traveled at speeds up to 50 miles an hour in a three-place auto-sled operating in the Alps at Arosa, Switzerland. The Schneeteufel (or Snow Devil) is a rocketlike car with four runners, being driven by the rear wheels. On encountering snow or ice the front wheels may be retracted so the vehicle can slide on the runners.



To run on bare ground this sled lowers its front wheels; rear wheels carry the driving force

*Dev. by Martin Schmed
Luzerne mechanic*

*Interphoto News Pictures
Dec 11 11 26 42
Mys.*

CHEATING DEATH WITH BLOOD

FROM the day of the cave-man, one of the main objects of battle was to eliminate opponents by severing one or more of the tubes through which blood circulates in the body, thus permitting the vital fluid to leak out.

In less scientific days, this was accomplished principally with sword, dagger, lance, spear, arrow, bayonet and bullet. With the advent of explosives, it became clear that shock, as well as loss of blood and infection, would result in death on the battlefield.

How concussion of an explosion or mere impact of a missile—which are two causes of shock—keep on working to kill a wounded man after hours or days still has angles of mystery. Scientists blame the loss



Actress Ann Sheridan gives a pint of blood to Red Cross

Clear plasma is drawn by vacuum from individual bottles to large bottle (left), tested for sterility, then frozen



This badge is awarded donors of blood

of blood plasma, the more or less colorless liquid which carries corpuscles and chemicals through the body. Shock causes gradual escape of the liquid into tissue spaces, they say, even if the victim does not bleed too profusely from a wound. Circulation is reduced. Infection is encouraged. Vital functions cease—for one reason because insufficient oxygen is transported.

The same loss of circulating liquid explains why the human body seldom survives an ex-

Allen Warren Elliott, 7 Park Ave. NYC

Looney

749



Shockproof and waterproof packages in which plasma can be dropped from planes over land or sea have proved successful

tensive burn, another common war injury. Plasma exudes from the burned skin in large quantities, as it fills an ordinary blister in small quantities. Soon the blood function fails.

Addition of plasma to the bloodstream prevents this, in one way, by keeping up the volume. It also seems to attract lost blood back into veins and arteries by way of capillary walls through which it escaped. It stimulates circulation.

As war crept around the globe, nations began setting up ordinary blood banks and liquid plasma banks to save fighters' lives. The difficulties were many. Whole blood deteriorated in storage. Refrigeration necessary to both whole blood and liquid plasma was cumbersome in time of battle. Certain types of whole blood were worse than useless if injected in the veins of persons with other types of blood. Hasty, on-the-spot, first aid station transfusions from one man to another were impractical. Liquid plasma was better and did not require typing, but it was hard to keep it fresh.

Then came the remarkable dis-

Individual donations are taken from centrifuge which drove red and white corpuscles to bottom, leaving clear plasma on top





Before blood is accepted for army and navy use, the donor is given a triple test of blood, temperatures and blood pressure



The needle inserted in an arm vein withdraws a pint of blood for the Red Cross plasma bank, to be shipped to the war front

Each refrigerated container holds 85 pints of blood. It must reach a laboratory within 24 hours to process as dried plasma



covery that plasma can be dehydrated, or dried, does not require typing and keeps at least five years. Based on this discovery is the huge Red Cross campaign for blood donors which is literally cheating death with plasma. Simple arithmetic proves its value. Guns and tanks may take a strategic position, planes may bomb it and warships shell it, but it still takes men on the spot to hold it just as it has for centuries despite mechanization.

If, for example, 10,000 Americans and 10,000 Japanese or Germans are wounded in an action, and blood plasma saves the lives of 5,000 men it means that 5,000 trained soldiers, many of them specialists, eventually may be ready for duty again. If the foe has the plasma, it will mean 5,000 more enemies to fight. If Americans have the plasma, it will mean 5,000 more Americans to do the job.

The Red Cross function is collecting blood from volunteer donors and this is being done as rapidly as permitted by laboratory facilities to process the blood.

But it is when the refrigerated blood reaches the laboratories of the nation's leading pharmaceutical companies, like Sharp and Dohme in Philadelphia, Lederle in Pear River, N. Y., and others which are taking up the day and night job, that the modern miracle is worked.

Following a shipment of blood through the laboratories of Sharp and Dohme where the method of preserving plasma by dehydration was developed is a scientific eye-opener. The blood corpuscles are not only separated from the plasma as cream is separated from milk, but the plasma is dried much as milk is converted into powder, except that the drying process is conducted while the plasma is actually frozen solid. This is accomplished by a very high vacuum which literally sucks the moisture out. It is based on the discovery that ice can be vaporized in a high

vacuum without passing through a liquid phase.

The first thing done by laboratory experts after receiving the whole blood, from the Red Cross or individual donors, is to check it carefully against infection to make sure it is sterile. After that the cellular portion of the blood is separated from the plasma by whirling it around in a centrifuge much like a cream separator in a dairy. Then the laboratory workers draw off the plasma and place it in individual containers.

Before being drawn off, the plasma, a light straw-colored liquid, is at the top of the jar and at the bottom is a deposit of red solid material, like thick red paint. This is principally the red cells from the blood.

Next they freeze the plasma at a temperature far below zero and place it in the vacuum tanks.

After the vacuum process, the dehydrated blood plasma is a light powder looking something like old-fashioned, hard molasses candy, still light straw-colored, and inside the bottle it takes the shape of a hollow cone.

It takes a pint of whole blood to make one unit of plasma, but when the dried plasma is mixed with distilled water and administered to a patient it is equivalent to the liquid part of one pint of whole blood. About half of human blood, therefore, is plasma.



Frozen plasma is placed in huge tanks (above) and moisture is drawn off by vacuum pumps, leaving straw-colored powder. Below, loading dried plasma into plane at U. S. Army air field



Lower left, bottles of dried plasma and distilled water are sealed in tin cans with tubes and needles. The donors at lower right are having preliminary examination at a Red Cross center





↑
Preparing to inject blood from bank into wounded man's veins, a captain of medical corps mixes distilled water with flaky plasma, restoring it to a liquid

New life trickles into the veins of a navy seaman who was one of the first casualties at Pearl Harbor last December 7. This man has now fully recovered →

After giving blood, donors are advised to take plenty of liquid nourishment. Here, they receive refreshment at New York Red Cross Blood Donor Service ↓



The liquid plasma is frozen by putting the container in a mixture consisting of Dry Ice in a low freezing solvent. By inclining the container away from the vertical position and rotating it, the liquid plasma to be frozen forms a layer on the inside wall of the container; this procedure is referred to as "shelling." A large surface of the frozen material is thus exposed, which hastens removal of water vapor when subjected to high vacuum. This produces the cone shape to the dried plasma inside the flask.

The escaping water vapor is removed by several methods, one of which is by means of a condenser, the bulb being immersed in a freezing mixture so that the water is frozen therein as fast as the vacuum withdraws it from the material. The temperature of the material under process is gradually raised after much of the moisture is removed. The dehydration is then contin-

ued until the final moisture content is less than one percent.

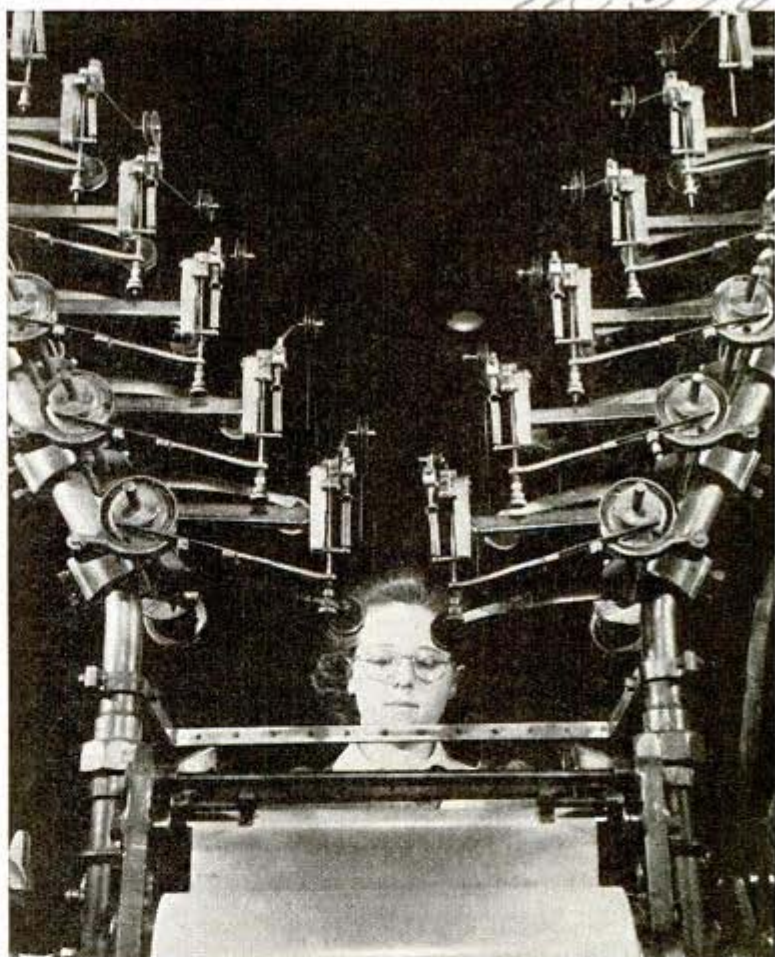
Tests have shown the value of the plasma and its sterility are best preserved if it is kept constantly under vacuum. For this reason the container is especially designed to maintain the vacuum after dehydration, and into the neck of each container is inserted a tightly fitting rubber stopper. Then the vacuum is released; the containers are removed from the apparatus and immediately flame-sealed, which insures the maintenance of the vacuum indefinitely.

(Continued to page 166)

Westinghouse Elec. & Mfg. Co 306-
400 Alleburg Pa.
M. 570

"V" in Transformer Winder Symbolizes Victory

As though symbolizing the remote but essential part it plays in the Allied Nations' drive for victory, the letter "V" is formed by a machine winding coils for electric transformers made by a Westinghouse plant. The two slanting arms of the "V" serve to support several spools of copper wire, which can be wound onto as many as nine coils at a time under the guidance of one operator. Transformers in which the coils will go are used to "step up" or "step down" the voltage as required by electric power tools in defense industries.

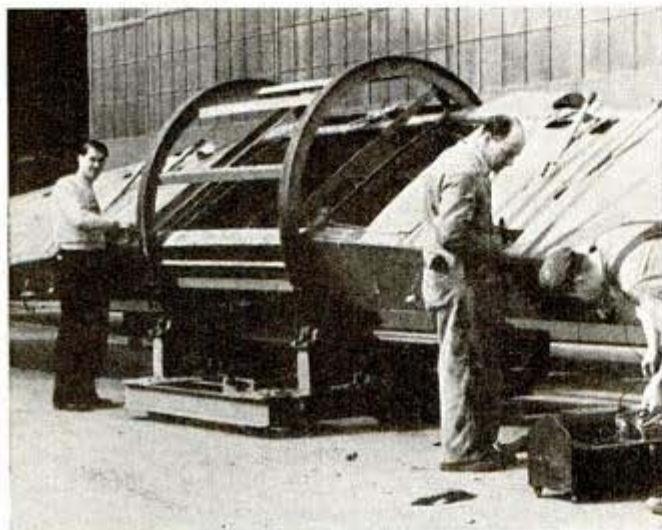


Arms holding wire-spools on transformer winder slant to right and left in "V" formation, as though indicating that the machine is playing a part in the victory campaign

Rotary Dolly Turns Plane Wing to Best Working Position

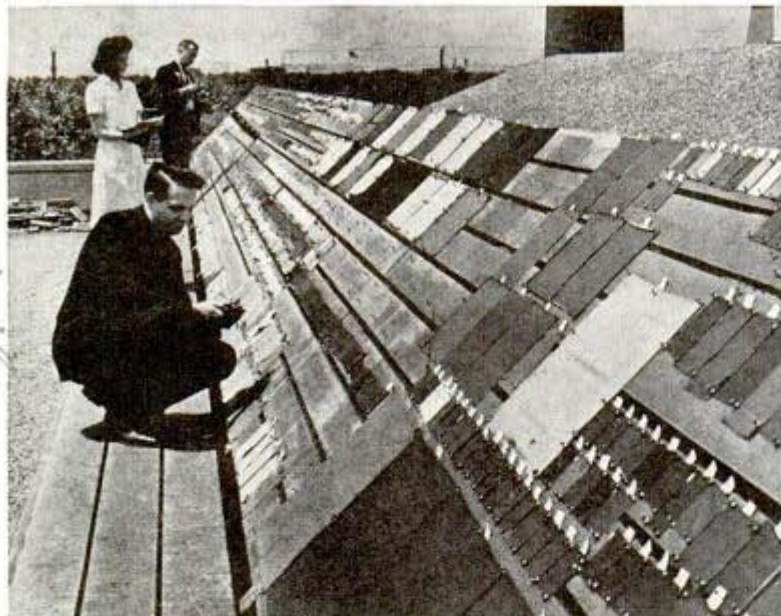
Unwieldy airplane wings are now being handled with greater ease, and at a saving of 35 percent in time, by workmen making repairs at de Havilland Aircraft Company's

overhaul department in Toronto, Ont. The huge wings are mounted in a wheel-like dolly which may be rolled forward or backward to support the wing in horizontal or vertical position or any angle of tilt. Previously the wing was fastened to a stationary jig which required the services of at least eight men in changing position. Now the aircraft mechanics and painters are saved the necessity of lying on creepers to get at the underside of a wing, as they are able to bring any part of it into easy reach simply by adjusting the dolly. Its installation would save considerable time for production plants as well as for the service and repair shop.



Airplane wings mounted in rotary dolly are turned easily to meet convenient working position, thus saving time and energy of repairmen

ALL DRESSED UP



Samples of fabrics for uniforms and other items being tested for weather resistance on the roof of the Army's principal Quartermaster Depot

some 4,000,000 soldiers produces figures which are easy enough to read, but are so huge that no human mind can envision the separate articles.

Take a single item, like wool. If you discover this winter when you buy a suit or overcoat that it isn't quite up to former standards, remember that one soldier in his first year of service is issued necessary clothing containing a minimum of 200 pounds of wool.

That produces the staggering figure of 800,000,000 pounds of wool. But a soldier needs 45 more pounds of wool as soon as

he goes into combat service. Add 180,000,000 pounds. There go 980,000,000 pounds of wool. Since there is no reason to believe the Army will be limited to 4,000,000 men, the round figure of 1,000,000,000 pounds of wool might be a simple one to keep in mind.

If you can't imagine 1,000,000,000 pounds

YOUR Uncle Sam is not only a first class fighting man, but he's the world's greatest tailor, too.

In addition, he is a haberdasher and style dictator and decides what the best dressed man will wear. Just now, the fashion is running strongly toward uniforms. Uncle Sam's activities in procuring garments for

Uniforms for ski troops, soldier in the tropics, and paratroops, left to right, combine camouflage, comfort



Allan Warren Elliott, 7 Park Ave NYC

and **SOME PLACE to GO!**

of wool, perhaps thinking of it in terms of sheep and their fuzzy coats would help. It takes 26 sheep to produce the first 200 pounds of wool per man. That's 104,000,000 million shearings. Combat service will require another 20,000,000 shearings. There you have roughly 125,000,000 shearings, much of which will come from the 50,000,000 or more sheep which are nibbling grass in the United States to add to the stockpile.

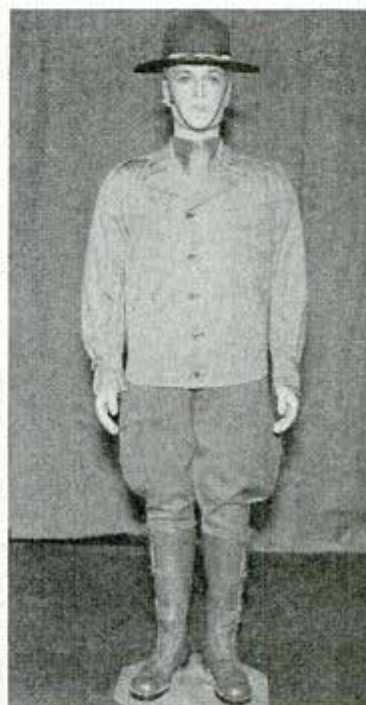
And now cotton. It takes approximately four times as much cotton as it does wool to equip an army.

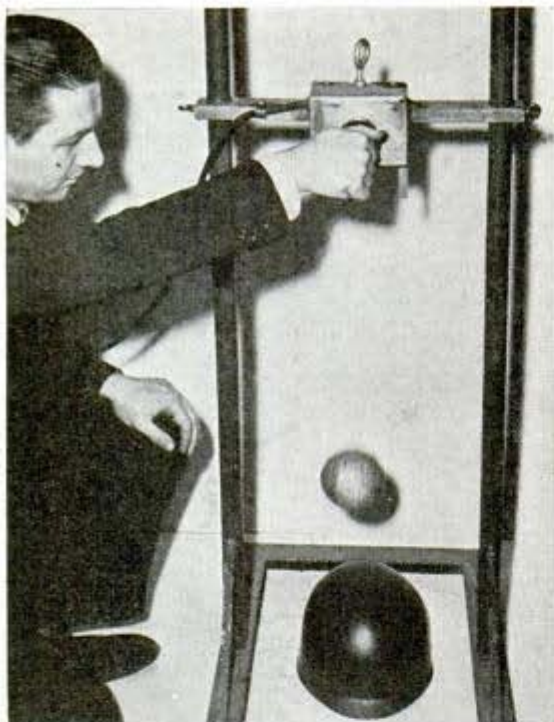
Not all of these textiles go into uniforms, of course. Some are used in other garments. In fact, a mere 90,000,000 yards of wool will go into uniforms for 4,000,000 men. Cotton goes into hundreds of items. Some 15,000,000 blankets will use both wool and cotton. And then there are 9,000,000 pairs of gloves, 40,000,000 pairs of socks, 10,000,000 undershirts, 10,000,000 drawers, 42,000,000 yards of flan-



Inspecting plastic "liners" that are worn under steel helmet during combat and as regular headgear for other service

Here's what the well-dressed Army mechanic, fireman, and cavalryman are wearing by decree of Uncle Sam





This "torture" machine drops eight-pound steel ball to test tough shell of new plastic military helmet

nel shirting and 30,000,000 yards of overcoating for the army-to-be. There are also ties, hats, gloves, mattresses, sheets, pillow cases, tape, buttons, thread, medal ribbons, flags, banners, guidons, mosquito nets, nurses' clothing and a host of special items for cold and warm climates.

Each selectee is furnished with a uniform and equipment, consisting of some 60 items valued at the army wholesale cost of \$200.00. Exclusive of specialized equipment for such forces as paratroops, air corps, and ski troops, which cost more, the basic list of clothing includes: one woolen coat, six pairs of trousers (two woolen), one woolen overcoat, eight pairs of shorts (both woolen and cotton), nine undershirts (both woolen and cotton), two caps (one woolen and one cotton khaki), one cotton field jacket with woolen lining, one pair of woolen olive drab gloves, nine pairs of socks (both woolen and cotton), four neckties, three herringbone twill jackets, three pairs canvas leggings, one herringbone twill hat, one khaki waist belt, three pairs of shoes, six white handkerchiefs, and one steel helmet.

Most of these products are made or purchased in one spot, along with numerous others such as band instruments and flag standards, and that spot is the U. S. Army's main Quartermaster Depot. It's one of the busiest places in the business world today.

Clothing the Army is not only a supply job. It is a morale service, too. No soldier is going to feel much like fighting in the Arctic wilds with cold feet. No man in the tropics can battle mosquitoes all night and Japs the next day. A soldier is likely to wonder what he is fighting for if his

Tank uniform for combat, left; snug winter field outfit, center, and a field uniform made of cotton, right



uniform turns out to be shoddy.

The life of an American soldier may depend on the fastness of the drab, brownish yellow color, imparted by khaki dyes. Improperly dyed khaki fades into a yellowish white which makes a uniformed man a conspicuous target for a sharpshooter. Tropical suns, wear and repeated washings demand top quality dyes and in getting them, the Army has had excellent cooperation from chemical corporations. The Du Pont Company risked \$43,000,000 in plants and experiments to be used largely for this purpose.

Nothing made by man in such quantities as the supplies turned out in the huge depot can be absolutely perfect, but the staff is on the job night and day in a miniature city of nearly 100 acres which has its own police and fire protection, water and heating systems, street markings and traffic control. This "City of Supplies" maintains its own fleet of trucks and even its own railroad system, operating over three and one-half miles of track, complete down to the roundhouse which shelters four locomotives.

One laboratory building contains one of the best textile laboratories in the world. Here, fabrics and items of uniform are tested to make sure the high standards required in Army specifications are maintained. Such vigilance has often been referred to as "the first line of defense of the soldier's health and comfort."

Textiles are tested for tensile strength, water repellency, wind resistance, resistance to wear, color-fastness, shrinkage, chemical composition, wool content, resistance to the passage of moisture as in raincoat fabrics, reaction when laundered or dry cleaned, and construction of the fabrics. In addition, buttons are tested in a special crushing machine.

Slide fasteners are tested on a machine that subjects these fasteners to thousands of slides. A "robot" machine measures the



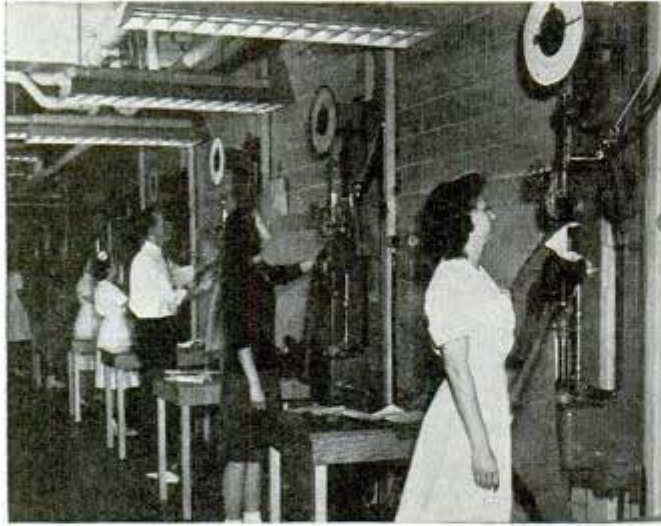
Examining samples of fabric to assure uniformity of shade is one of many analytical tests performed by a staff of experts

Army blouse—"coat" to civilians—receives final inspection by tailor to make sure it meets exacting Army specifications





Assembly line for chevrons—every one is carefully inspected by trained women shown examining first sergeant's chevrons



Testing tensile strength of cloth at row of special machines

The Purple Heart, prized Army decoration, must be without flaw



yardage of spools of thread. The diameter of wool fabrics is magnified 500 times to determine the grade of wool. This machine is used in cases where the visual inspection of the depot's wool grader is doubtful. Samples are set out on the roof of the laboratory to insure their reaction to weather conditions.

Two cold rooms, capable of producing temperature as low as 68 degrees below zero, are used to determine the warmth of certain fabrics and combination of fabrics. Every conceivable type of chemical and analytical test, including the reaction of gold and other elements from button platings, is conducted in the laboratory building, which is called the "House of Magic."

All testing procedures are established in an effort to determine whether or not the fabrics or finished garments meet specifications established by the research and development branch of the depot.

The cloth which the depot procures is inspected before it goes to the contractor, who fabricates the finished garment. The contractor works from government patterns, uses the government's materials and findings, and returns the finished garment plus the scrap which is reused.

The manufacturing division, which has about 4,000 employes, makes all types of outer clothing, including the latest garments designed for parachute troops and for wear in cold climates. However, it makes only a part of the clothing required by the Armed Forces. The remaining items are produced by private contractors.

One of the most interesting subdivisions of the factory is the special measurement section which takes care of men built out of proportion, both large and small. It recently made a uniform for Joe Louis. Another was made for a sergeant having the following measurements: height, 6 feet; weight, 310 pounds; chest, 60

(Continued to page 166)

Acme Newspictures, 461-8 av, NYC.

Home Guards Train to Cross River on Ropes

m 814



Lack of a bridge won't stop these British Home Guards. The man behind the pole is covering the "crossing"

British Home Guards learn to cross rivers by crawling along heavy ropes strung between posts. The men practice fully

equipped. Home Guard units are training with anti-aircraft batteries so regular troops may be released for foreign service.

Battery-Operated Blinker Signal Talks With 14-Mile Beam

Failure of the regular communication system during war emergency would not find civilian defense workers unprepared at Hillsdale, Mich. They have a blinker signal system of their own ready to be set up at a moment's notice so messages may be transmitted between predetermined points, with the angles for the beam already plotted. Mounted on a tripod, the apparatus consists of a sealed-beam headlamp installed within a piece of stovepipe and powered by an auto battery. The key for blinking the light is fastened to the operator's knee. The beam can be seen 14 miles at night.



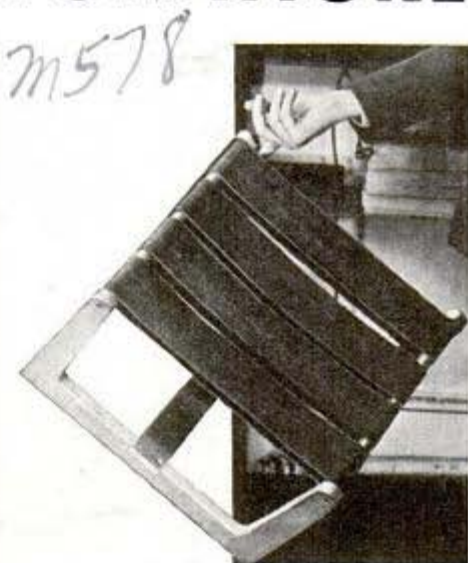
Charting angles at which light signals will be used (left) while (right) keyboard fastened at the knee taps out the messages

Acme Newspictures, 461-8 av, NYC.

KNOCKDOWN FURNITURE



There's a new style of furniture made to order for this changing world. War-time homes are smaller, especially the more or less temporary homes in defense housing projects and trailer parks. Priorities are rapidly eliminating the civilian use of metals. Americans move from job to job, from home to home in large numbers; shipping space is at a premium. So designers are rushing into production light, knock-down, plywood furniture to fit the home of the moment. Examples are the small cabinet and other pieces at top

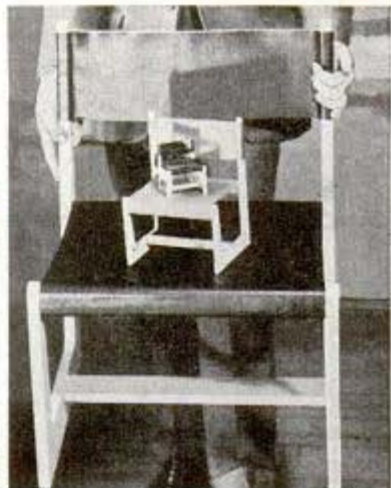


The simple, five-piece plywood stool above weighs just a little more than two pounds

Eight pieces of plywood, plus a few cleats, hinges and screws form an extending table

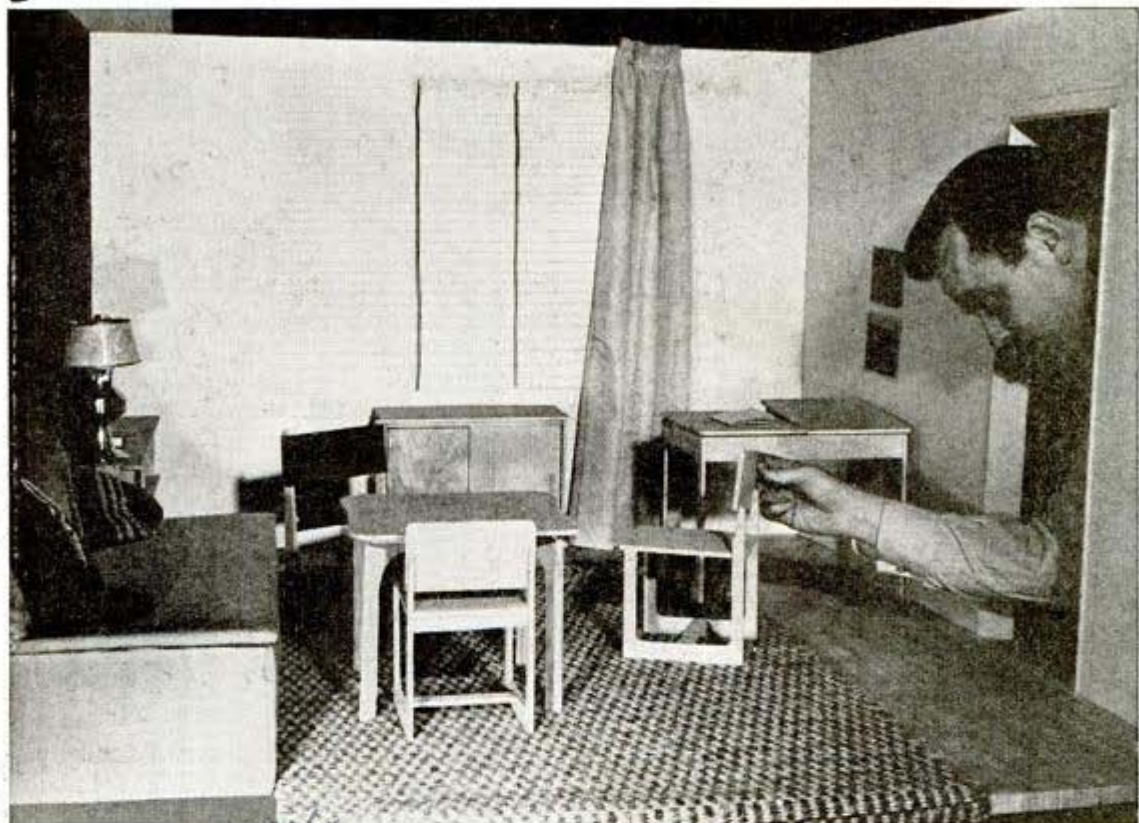


Right, how a five-piece knock-down plywood chair develops after leaving drawing board. Below, remove the screws and this furniture comes apart in parcels easily carried by hand



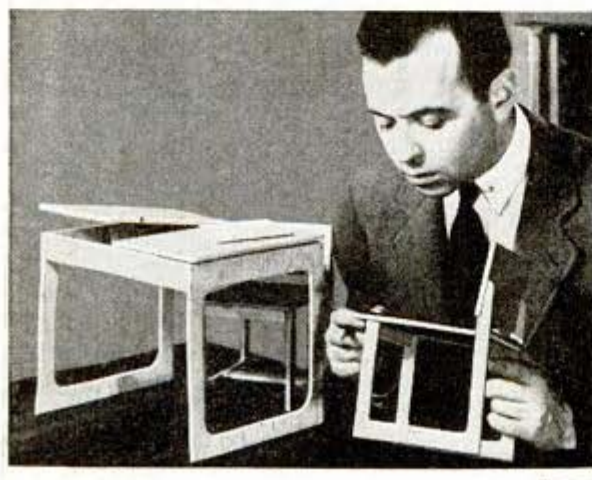
*Miss Warren Elliott; 7 Park Ave
nyc*

for KNOCKDOWN HOMES



and info.

One designer who has applied himself to the problems of "knockdown" living is C. Coggleshall of New York City, *266 55 St, nyc.* shown here with some of his work. Since smaller homes require smaller furniture, he studies the proper proportions with miniature sets, as seen at top. Some of his innovations are being prepared for an immediate wartime market. For example, there is the collapsing table at the lower right, shown fully assembled for your living-dining room and dismantled for shipment; this knockdown feature saves considerable space in shipping, an important factor at the moment



Mr. Coggleshall has applied for a patent on this writing desk-vanity, cut from plywood. A buyer may build his own desk from plywood imprinted with copyrighted pattern



Pocket Guide Dials First Aid For Injuries and War Gas



Dials give condensed information to aid treatment of cases of gas poisoning (top) and injuries (bottom)

What kind of poison gas has been used by the enemy, and how should victims be treated; what is the nature of the injury, and what is the proper treatment? These questions are answered in a jiffy by two ten-cent first-aid dials, one covering war gases and the other injuries. Eighteen different war gases are identified by their odors and the effects and symptoms of each. Spin the dial to the gas you have identified and a window reveals the treatment that should be administered. Numbered and easily located on the "injury" dial are 20 of the most common injuries, such as fractures, dislocations, rupture, heat exhaustion, shock, sunstroke, asphyxiation, drowning, burns, snakebite, wounds and bleeding. When the dial is turned to the type of injury involved, the window

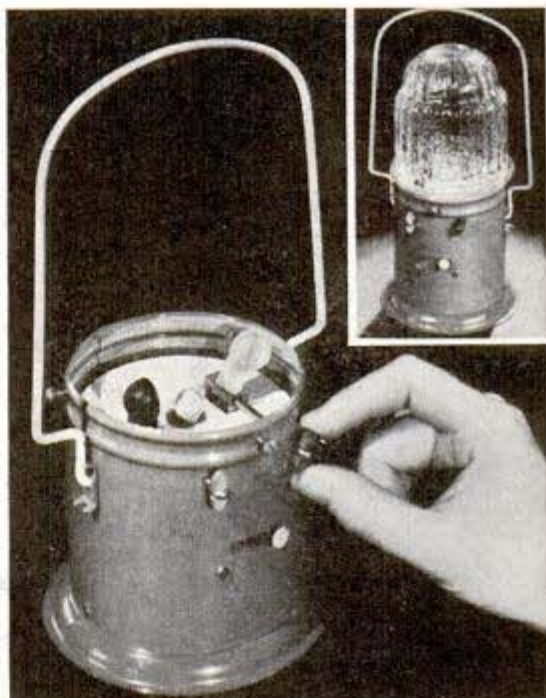
reveals a description of the symptoms and the right kind of first aid treatment. The two guides are of a size convenient for tucking into the coat pocket or first aid kit.

Weir to Save Niagara's Beauty By Curbing Erosion at Falls

In their endless struggle to guide the destiny of Niagara Falls, engineers are now building a weir in the upper rapids to keep the swirling, rushing waters from gouging out the apex of Horseshoe Falls. The underwater weir will stretch from a point above Goat Island to the Canadian bank, reducing the flow toward Horseshoe Falls and sending a larger volume over the American side where the shallow run has robbed the falls of some of their beauty in the last few years.

Hoods in Raid Warden's Lamp Give Dim or Red Light

Black and red hoods inside the globe of an electric lantern designed for air raid wardens make the lamp useful for black-outs and signaling as well as ordinary lighting. The hoods are lowered by turning small screws. A switch on the side turns two ways to make contact with either of two sets of batteries. The handle and switch are finished with luminous paint.



Hoods for bulb are adjusted by buttons on the side

POPULAR MECHANICS

Mandel Bros State & Madison, Chicago

B. 48 F. McDonald co
1248 S. Hope St. Los Angeles
Anselio Carr

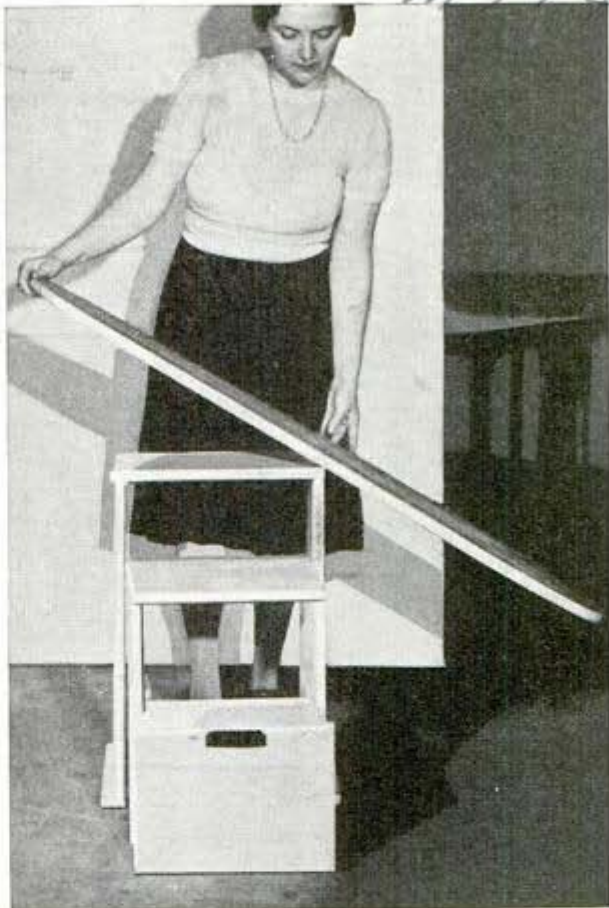
McDonald's
Nov 10-47

Allen Warren Elliott, 7 Park
av, NYC

Ironing Board "Chair" Has an Adjustable Top



Maybe it's war economy—or just plain economy, anyway the inventors who exhibited their wares at a show sponsored by the American Hobby Federation in New York featured three- four- and five-in-one articles. Above is a three-in-one instrument, operating on the pendulum principle, that serves as a square, plumb or a level



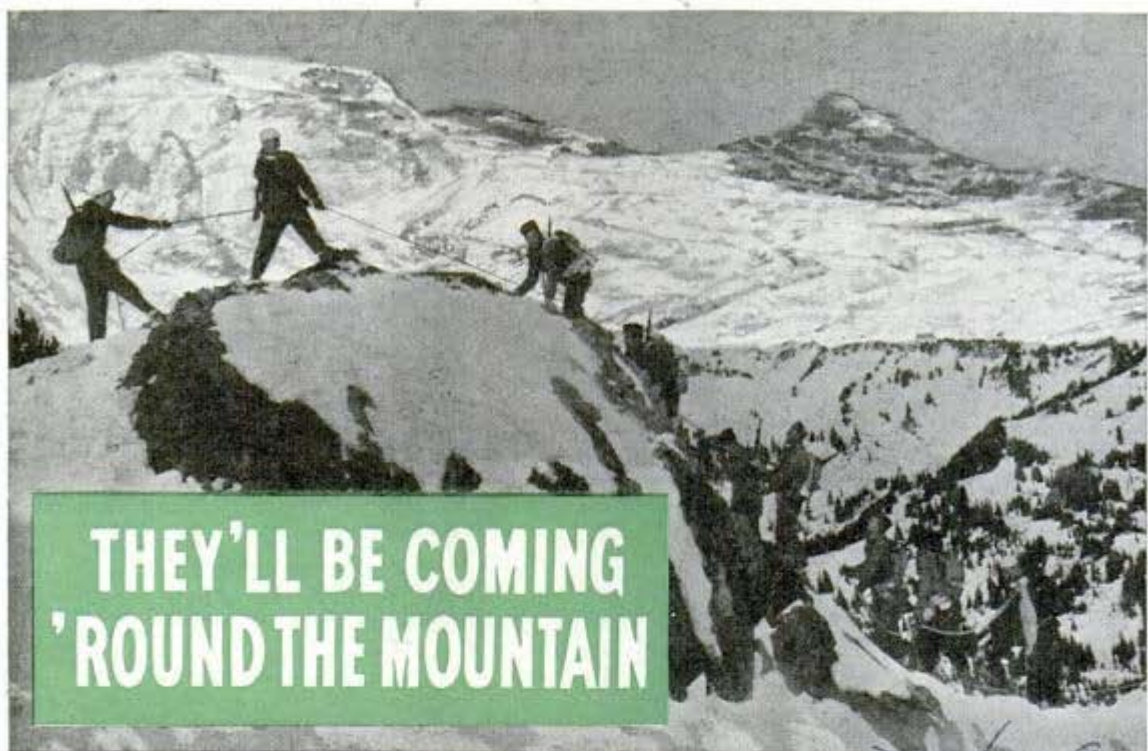
The ironing table above is a five-way item, providing ironing board, kitchen stool, chair, shoeshine box and stand, and a stepladder. The hinged board swings to a vertical position to form a chair back. When used as an ironing table a lower part is pulled out to form a stool. The shoeshine box and stand are in the base. If a stepladder is required, the three pieces—box, stool and board—form the steps. Below, dusting and renewing shine on shoe by thrusting it beneath cloth on holder



Three vegetables and meat are cooked in this sectional pot all at the same time. The wire sections have hooks which permit them to be raised and attached to the sides, making room for meat in bottom. It's said to save vitamins



Denson & Frey
347 Madison Ave
N.Y.C. all articles. 49



**THEY'LL BE COMING
'ROUND THE MOUNTAIN**

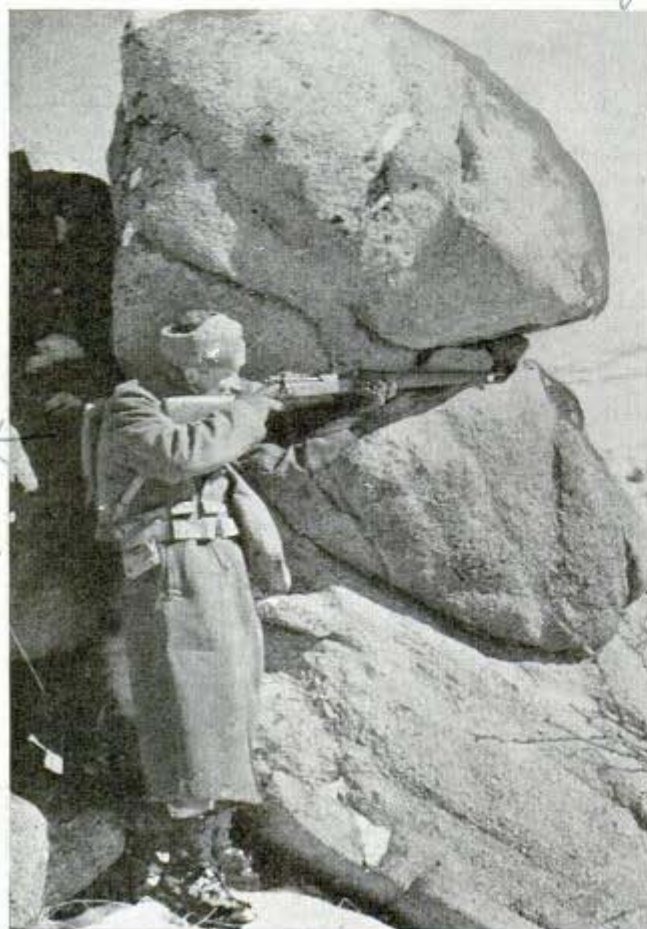
Mountain men of the U. S. Army scale a height with ropes in winter conditions near Fort Lewis, Wash. Below, in the Rockies of Wyoming, a private from Ft. Francis E. Warren takes cover behind a huge boulder with which his uniform blends.

m 679
By Roderick M. Grant

WHEN the time comes to climb the Caucasus or pack a gun over the mountains of Norway or plant the Stars and Stripes on the button of Fujiyama, Uncle Sam's new mountain troopers will be heading the parade.

They are getting in trim by leaps and bounds—leaps from paratroop transport planes into ten-foot snow banks and bounds up the rocky facades of some of our best western mountains.

To these lean, hard, bronzed mountaineers a polar expedition would be little more than a week-end holiday. The training mill grinds them pretty fine. They'll scout miles through forests and across treacherous ice fields, often with thousand-foot cliffs falling away at the side of the trail, and then turn in at night to slumber snug in a two-pound down sleeping bag at 50 degrees below zero. On the blizzard-swept slopes of Mount Rainier they carve caves in the snow for shelter, and dash out on forays riding a two-man motor toboggan at the speed of an automobile. Down in Arizona, Indian



*Private Albert Appleton
Alliance, Neb*

*Native
Park West*

*Pvt Harold J. Lutz
Minneapolis, Minn*

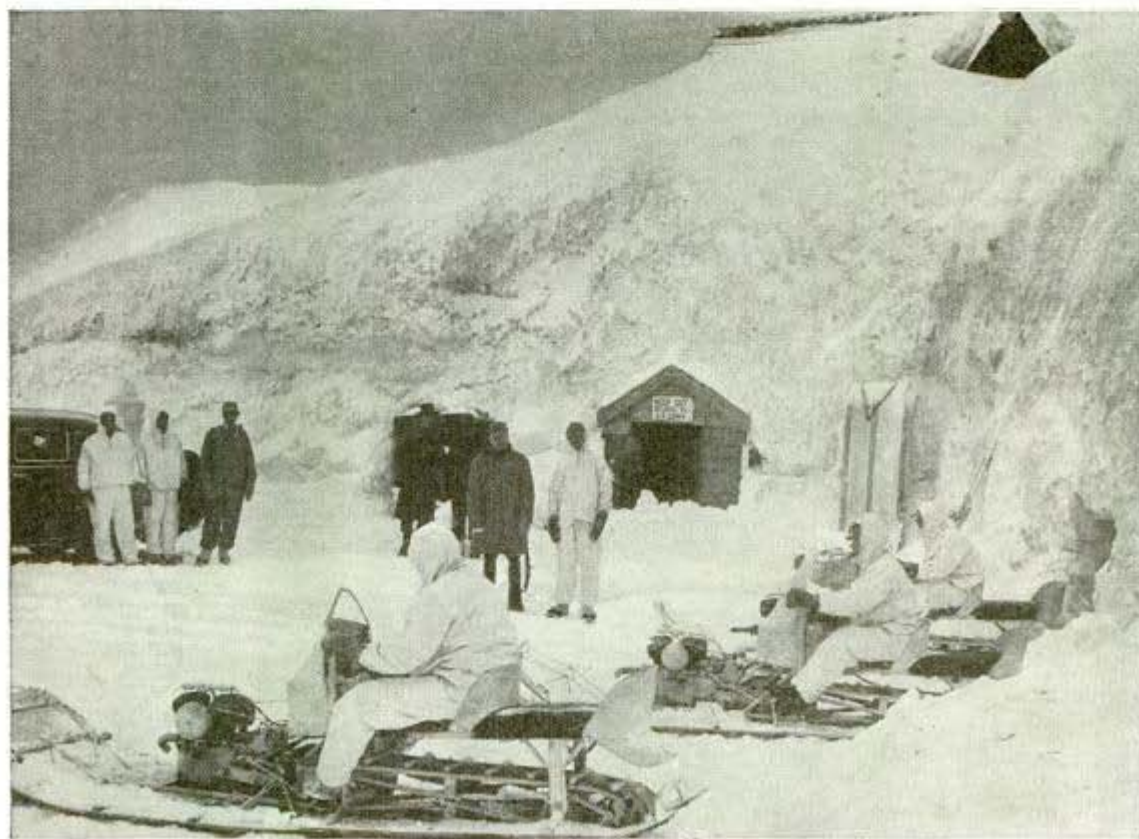
Scouts scale rugged peaks and in the Wasatch mountains of Utah white-clad flying infantrymen—many of whom have never before seen snow—tumble out of planes into a white wilderness, retrieve skis and provisions dropped by parachute, and glide away on a dawn-to-dusk assignment.

Some of the toughest jobs of this war are being saved for these men. Jobs like stealing through enemy lines to raid supply columns, scouting ahead of the main army, hauling light artillery over the mountains and leaving TNT calling cards under enemy bridges and munition dumps. It all has a certain aura of glamor on paper; but it's not pure glamor to pour out of a plane into someone else's back yard with your pockets full of TNT and caps and fuses. Not until afterward.

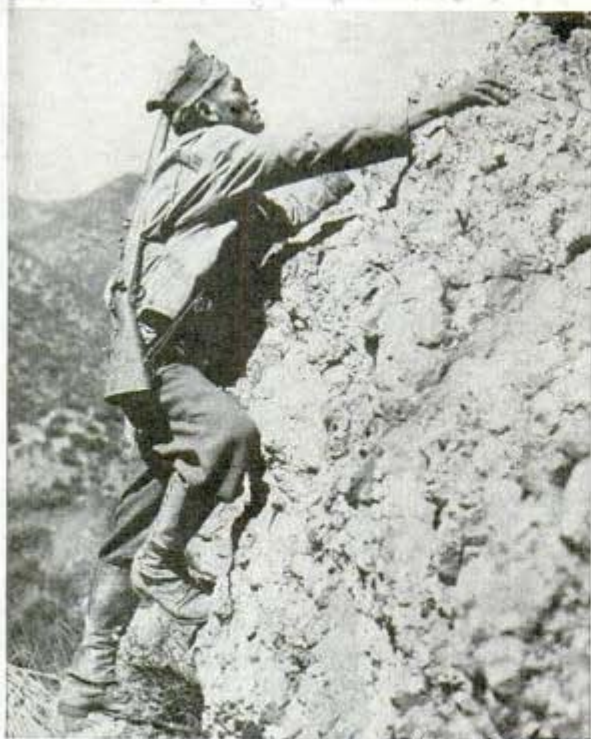
But they're doing that right along, in dress rehearsals for a show to open soon in Tokyo and Naziland. And when you learn that they've parachuted cases of eggs from planes and retrieved them whole and unscrambled, the demolition



Above, a rifleman from Minnesota hardens up his "web feet" on snow patrol. Below, motorized, track-driven toboggans which have attained high speed in maneuvers on Mt. Rainier



Put An Arrow Pattern



One of the famed Indian Scouts scales a peak in Arizona

Fort Huachuca

kit in your back pack ceases to be a source of worry.

There were several unknowns that bothered the paraskis when the pioneer units began training in the Wasatch mountains. Would the rarefied air in these heights support a parachute as well as at lower altitudes, and would snow landings be safer or more hazardous than on open ground? The commander of the paraskis

—they are all volunteers—made the first jump to find out. The chute billowed out and floated down as nicely as it would in sea-level Georgia, although it was slightly less maneuverable; and the captain plumped down into a ten-foot bank of snow which was a soft enough cushion but not designed for a double-time march. The boys learned on subsequent experiments that a sheet of bare ice is a harder landing field than a concrete runway.

So far no one has given the army a suitable folding ski which the chutist can carry down with him. That's something for the inventors. Instead, the procedure is to drop bundles of skis and supplies, clearly marked with colored parachutes or ribbons, then circle back over the spot and spill out the parachutists, who land as close to their equipment as possible, retrieve the supplies, strap on skis and packs and glide away on their mission.

In the mountain maneuvers around Mt. Rainier the men make five- to seven-day trips, each man carrying a ten-pound gun and a 50-pound pack containing dehydrated food and tinned meat, melting snow for water. The mountain trooper is taught to ski alone and in formation, and to use ropes and other Alpine equipment in climbing and descending rock and ice precipices and crossing glaciers. More than any other soldier, he is trained to operate independently, to carry out his mission and

Ski and snowshoe troops in white parkas storm a wooded section on Canadian border. Propeller-driven "aero-sleds" seen in middle distance carry two men and machine guns. Similar motor sleds are used by the Russians



Over the nose of this propeller-driven sled is a machine gun

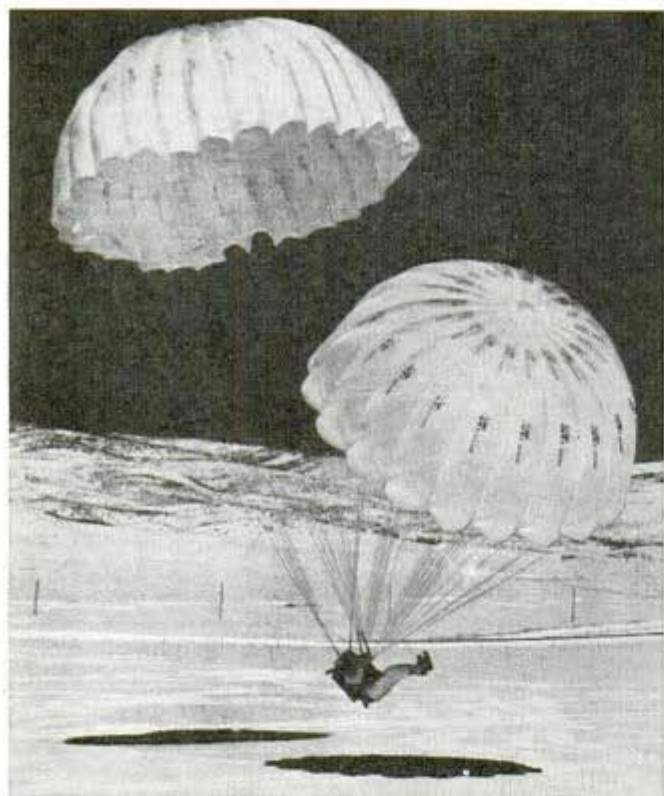
subsist alone if separated from his unit in a blizzard. He may carry a radio with which to summon supplies by plane. He must understand tracking, construction of shelter and beds in sub-zero weather, he must live without fire if fire would betray him to the enemy, he must learn winter first-aid, evacuation of casualties, camouflage, emergency ski repair, map reading and orientation, sketching, observation and demolition. He must know his exact location at all times and have the stamina to travel on skis, snowshoes or afoot under difficult and dangerous conditions. That doesn't mean he must be the hefty varsity fullback type. He's more likely to be the lanky, agile and enduring center of the basketball team. All ski troops are not mountain troops, but all mountain troops must ski. The paraskis—who regard parachuting as an elementary exercise compared with skiing and call their skis "torture boards"—are picked volunteers of 21 to 32 years, weighing 120 to 185 pounds.

Perhaps the most famous of the mountaineers who formed the pioneer ski patrol unit of the 15th

On outpost duty, the ski trooper at right wears his lightweight but warm down sleeping bag. He's all ready for bed

A baby tank tows a queue of soldiers on skis in winter battle maneuvers. These little tanks travel 60 miles an hour





Just before the bump! This paraski trooper training in Utah opened his reserve chute because of a ripped seam in the other

Infantry at Fort Lewis, Wash., was Corp. Walter Prager, 28, a tall, lean Swiss who has taken a number of International Ski Federation firsts in Europe. One of the world's best skiers, he coached at Dartmouth for five years before his induction into the army. In European competition he often entered international events against a Bavarian, Peter Pringsheim, although they never met personally. Pringsheim was then on the German national ski team, taking prizes in slalom and downhill races. They met and became firm friends as members of the 15th Infantry ski patrol. Others in this outfit are an American-born private, Wladyslaw T. Mietelski, who spent nearly ten years in the Polish army ski troops; Pvt. Glen Stanley, former captain of the Colorado University ski team, and other

The whirling propeller, invisible at the rear, takes two men scouting by sled on Mt. Rainier

famous skiers from Sun Valley and Yosemite.

American mountain troops have learned from Finnish and Russian and Austrian and Swiss techniques and improved on them. They wear white parkas in the snow, reversible as a forest-green covering for concealment in the pine woods. The fabric is wind- and water-repellent, consisting of two layers of rubberized cotton duck fabric. Polarized goggles, flexible and with plastic lenses, filter out the light rays that threaten men with snowblindness. Light and strong skis have been developed, and the U. S. Forest Products Laboratory at Madison, Wis., collaborated in a six-months study of the cause of ski breakages during which it was found that most skis can be repaired, at enormous savings in wood and other materials. Most breaks, the tests showed, occur near the tip of the ski at the bend.

The German pack artillery which fought its way over the rugged mountains of Greece utilized a lightweight pack saddle on horses or mules, with a frame of metal tubes. American experiments, however, led to the adoption of pack racks of metal rods rather than tubes, since these seemed more adaptable for bending into shape. Packs were designed to shift the weight from the soldier's shoulders, and the frame can be converted into a res-



cue sled in an emergency.

Ordinary company mess equipment calls for heavy mobile kitchens too unwieldy for life in the high Sierras, and instead tiny stoves are issued for every two to four men on the patrol. These little oil burners weigh about three pounds—a new one just being tried out actually weighs one pound—and can be set up and put to work in less than a minute. Even in low temperatures it is expected to bring a couple of quarts of water to boiling within ten minutes. The stove burns gasoline, kerosene, alcohol or low grade oil and occupies a space about eight by four by four inches in the back pack. It can be used for heating as well as cooking, should these hardy outdoorsmen ever indulge in the luxury of heat; and it will operate at full blast continuously for four and one-half hours on one filling. One pint of fuel



Caves in the snow are home to the troops on Mt. Rainier. They learn to live comfortably outdoors in severest weather and "live on the country"

is sufficient for the cooking requirements of one soldier for ten days. Furthermore, you can fling this tough little stove across the room without doing it bodily harm. It was built to take the same rough treatment the mountain troops must take.

(Continued to page 168)

Across snowdrifted slopes of Mt. Baldy, near Salt Lake City, paraski troopers practice their silent approach



Frank Kowalecki, Jr

Electric-Line "Safety Valve" Blows Out Arc in Silence

m 716



Cutaways of blown (foreground) and unblown limiter

Where two separate circuits supply electric power to all parts of a factory so power may be kept flowing in the event one circuit is damaged by sabotage or a short circuit, a noiseproof "safety valve," tested recently by Westinghouse laboratories, is able to snuff out 54,000 kilowatts of electricity in 1/60 second, and thus guard the cables against serious damage. Enclosed in a heavy copper can, the limiter, as it is called, breaks the circuit when a copper bar is transformed into vapor by heat generated by the flow of excessive current. Almost instantaneously the vapor condenses to solid copper on the relatively cool inside surface of the container. The arc which then occurs between the ends of the melted bar is blown out by a blast of gas released by the heat of the arc from a fibrous ring surrounding the bar. A blown limiter can be replaced inexpensively.

Bullet's Telltale Flash as It Hits Helps Rifleman Correct Aim

m 717

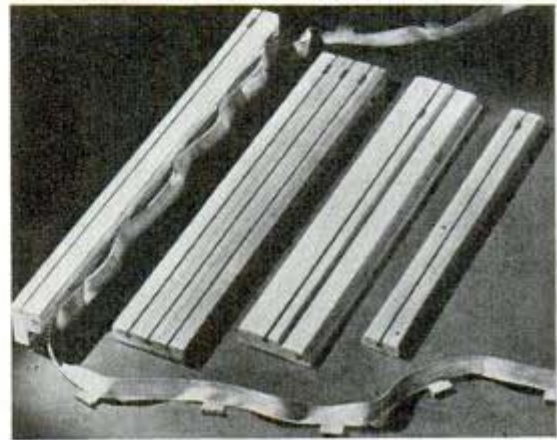
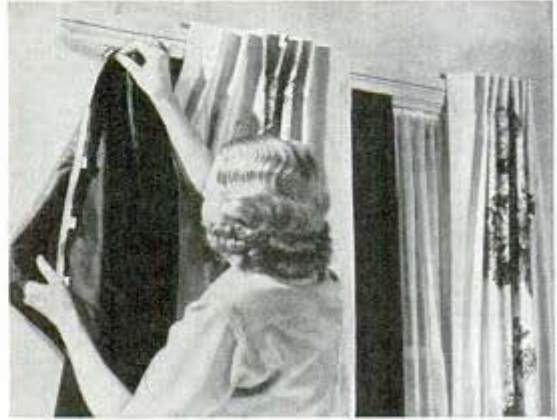
Better control of small-arms fire should result from the development of a telltale bullet that flashes or smokes as it hits, enabling the marksman to correct his aim

just as the artilleryman does after watching the explosion of his shell. Ordinary small-arms bullets register their fall only when they strike on dusty ground or quiet water. An army man recently obtained a patent on a new hollow bullet for rifle or machine gun. Near the point, its metal is very thin, encasing a smoke-making compound for daytime use or an incendiary mixture that will flash at night.

Slotted Molding Above Window Replaces Curtain Rods

m 662

Easily nailed or screwed to the top of the window frame, neat-appearing moldings of wood fitted with slots for hanging curtains are offered as a substitute for metal rods which may become scarce due to lack of material. Special tape equipped with sliding tabs that fit into the slots, or tracks, is sewed along the upper edge of the curtain, and the moldings are provided with one, two or three slots for convenience in arranging various combinations of draperies and curtains. The molding also helps in putting up blackout curtains quickly.



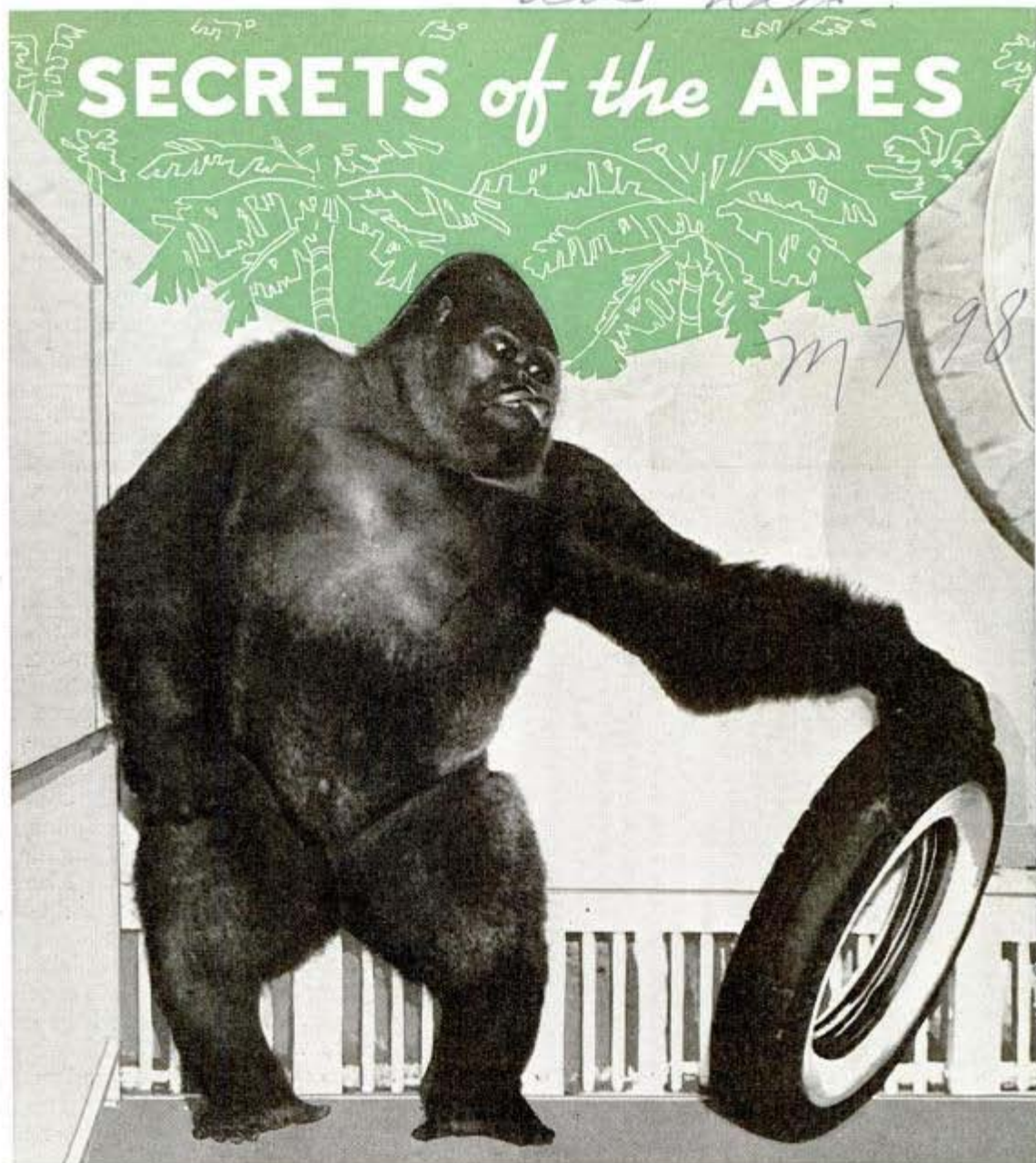
Fitting curtain, top; slotted molding and tape, bottom

Chas. & N. S. Co., Inc., East Pittsburgh, Pa.

56 *Science Service*
July 9-42

POPULAR MECHANICS
Jeffy-Jain, Inc. 203 E
18th St., N.Y.C.

Allen Warren Ellsall 7 Park Ave, N.Y.



Gargantua the Great was one of the author's gorillas. He likes to play with a tire or throw it at you

MANY things have been grown in backyards, but people tell me that my backyard crops are the strangest in the world.

There were almost 6,000 dogs. Over 5,500 were St. Bernards of the noblest strain ever produced; 300 were Pekingese, 110 bull terriers; one was the rare Hungarian poli, with a coat the color of steel wool and a temper as sharp as a steel knife. He's still the watchdog of my backyard.

And there were 1,200 Rex rabbits, 400 guinea pigs, 3,000 tropical fish, 5,200 pigeons, 100 canaries, two horned owls, six

By Gertrude Davies Lintz

Author of the book, "Animals Are My Hobby"

cockatoos, 30 African parrots, three macaws, three snakes, one leopard, one Chinese dragon, one monkey, one orangutan, two gibbons, 60 chimpanzees and two gorillas.

I mention them last, but the apes—particularly my chimps and gorillas—are first in my affections.

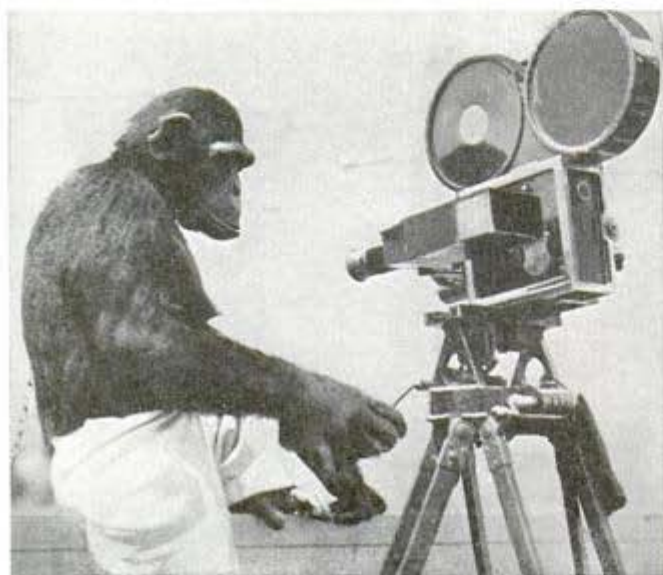
My dogs brought me as much as \$1,500 apiece. My pigeons sold as high as \$250 a pair. My Rex rabbits with their chinchilla fur brought up to \$175 a pair. A chimpanzee sold for \$1,500. One of my gorillas, Massa, went to the Philadelphia zoo for



Mrs. Lintz watches Mary Lou, the chimpanzee, one of her St. Bernards and a Hungarian poli which is afraid of chimpanzee



Like most of his kind, Skippy was an acrobat. He loved monkey-shines and was ever a daring young man on the flying trapeze. Captain Jiggs was a natural actor—one of the author's smartest chimpanzees. These fellows both imitate and improvise



\$7,500. Another, Buddy, brought \$10,000 from the Ringling Brothers and Barnum & Bailey circus. You may have seen him. He's called Gargantua.

With these pets on my hands and a 14-room house in Brooklyn to run, I have had little time to keep precise books. I presume I have made a profit financially. But I am positive of this: my thousands of pets have brought dividends in the form of happiness. They have given me the feeling that I have done something in this world better than any one before me.

I have made hundreds of friends among people who came to see the animals. There developed the desire to write what I had learned. I have one book to my credit and am writing another. The first book told of all of my pets, but my next will be devoted entirely to—you've guessed it—my apes.

I am the only person to bring up two gorillas side by side, let alone to have raised 60 chimps, their smaller cousins. And this experience has taught me that while they are lower on the scale of animal life than man, they are in some ways keener than man.

For example, the ice box in my Brooklyn home is a long way from the Simian House in the backyard. Many persons were continually opening and closing it. I doubt that any of us could even have heard the click of the door from

where the apes were confined. Yet both chimps and gorillas not only could distinguish the sound, but could invariably tell when I was the person opening and closing the ice box. This meant food for them and they always set up a clamor, paying no attention when someone else opened the door.

The same was true of the automobile door. Though the car might be quite a distance away, with the house between it and the quarters of the apes, they could tell when it was I who opened the car door. This meant some lucky ape might be going for a ride.

And for months before we could believe it, it was observed that the apes set up a commotion every morning about the time I awakened. My room was at the front of the house. They could not see me. They could not hear me. Yet these mysterious animals knew when I arose from my bed every morning whether early or late. I

Visiting the Atlantic City Boardwalk on a gentleman's vacation trip, Captain Jiggs sits on a rocking chair to watch the surf



DECEMBER, 1942



This is M'Toto, now on tour with the circus as Mrs. Gargantua. Unaware of the touch system, Maggie Klein just hunts and pecks



never got up at the same time. They seemed to read your mind at times, and, at others, they could be fooled by pantomime and acting. Much of it was very hammy acting, but it brought the desired results.

For instance, it was not I or any other human who kept the colony in order, in case you have wondered how a woman could master apes weighing up to 300 pounds.

It was the Bogeyman. He was a visible threat of something mysterious and all-powerful. I owned a weird carved Chinese head mounted on



**It's Saturday night, and M'Toto is getting all lathered up
Mrs. Lintz used this bogeyman to keep apes under control**

a stick. It had a dark-brown face with a mouth twisted in an ugly snarl, and a mop of wool hair. None of the others ever touched the Bogeyman, and I always held it away from me, pretending to be scared to death of it. Apes are the most suggestible creatures on earth, and they fall for suggestive acting. Introducing the Bogeyman to a newcomer, I would shrink and shiver as if it were a python; my voice would choke and tremble with fear.

I could enter the playroom where a free-for-all fight was in progress—everybody tearing out each other's hair and slapping and biting and shrieking—and lay the Bogeyman on the floor, and retreat from it, jibbering in fear. Instantly they would take to cover. All who could would fly to my arms, the rest would hide under blankets and rugs. The family was so thoroughly conditioned that merely saying, "Here comes the Bogeyman," was enough.



But for years I carried my demon in a pocket—just in case.

Simian fears are precisely the same uncontrollable fears that embarrass us even as grownups. Thunderstorms and certain loud noises; rats and mice; anything crawling on the body; snakes at the head of the list. I have never seen my apes afraid of anything that is not a common fear of human infancy and certain grownups. My apes were terrified at being left alone, especially at night, and they were all afraid of the dark and of falling.

Anything too big meant in their fresh jungle memories a leopard

or a wild elephant. In Brooklyn horses were the nearest thing to a large, dangerous animal. But they were also afraid of the smallest mouse. Even when Buddy was huge I have come into his cage and found him cowering on his bed or on a shelf, with his feet tucked under him and his huge jaws open in craven fear—all at a tiny mouse nibbling a bit of food. And yet he made pets of the gray squirrels which looked very much like big gray rats. He even shared his food with them.

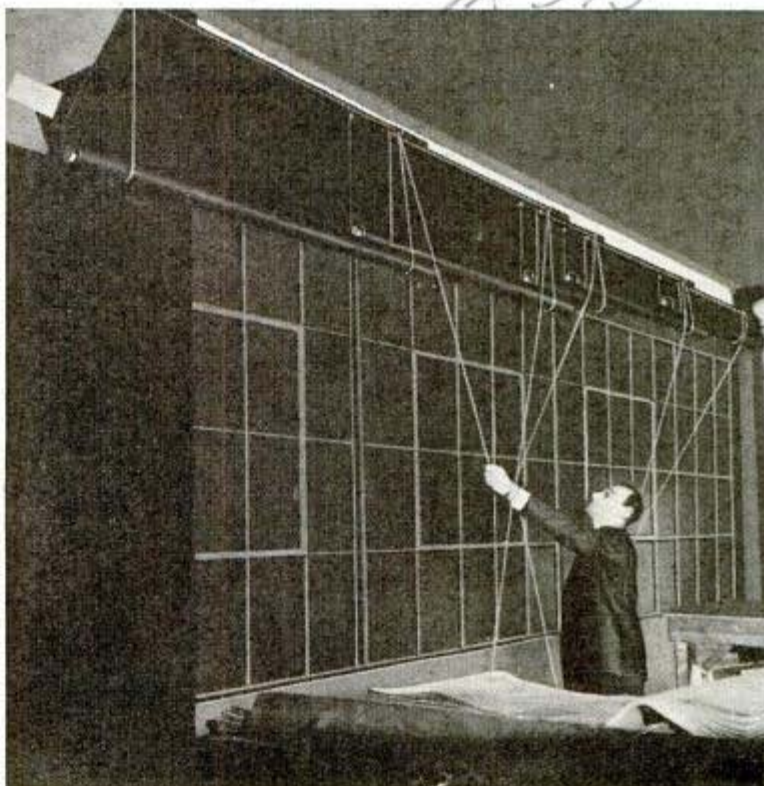
(Continued to page 170)

*Clapay Corp, Clapay Square
Chickagona, Ohio*

Overlapping Shades Blackout Factory Window

M 513

Factories with multiple windows are given complete blackout protection with overlapping shades that are raised and lowered in sequence. They allow no light to escape should a shade be pulled down slightly askew or if a corner be lifted by a current of air. The shades roll up on wooden strips and give a neat appearance when raised.



Telltale cracks of light are eliminated with handy blackout shades that overlap. The shades, lowered in sequence, cannot be lifted by sudden gusts of air. They are designed for multiple windows

Model Planes Train Aerial Gunners to Recognize Enemy

M 635



How to recognize enemy planes and where to hit them is taught aerial gunners with the aid of models strung about the ceiling at an Air Force Preflight School in Texas. Drawing a bead through sights of a .50-caliber machine gun as one of their first lessons, cadets learn to identify German Junkers, Heinkel, Dornier, Messerschmitt and Jap Nakajima bombers, Showa Sho fighter-bombers, and four-place Mitsubishi "Otori" bombers, and instructors point out their vulnerable spots.

Classroom for student army pilots where identification of enemy planes and machine gunnery are combined. Inset shows sights of dummy machine gun trained on a Nazi Heinkel bomber model

TRAIN YOUR DOG TO RUN ERRANDS

If your dog has learned to obey such commands as "Sit," "Come" and "Speak," he can be taught to perform many useful tasks, according to Carl Spitz, Hollywood trainer of movie dogs. At left, the dog is being trained to call his master when the telephone rings. When the phone rings, the dog is led up to it and given the command to speak. He quickly learns to bark when the bell rings. Next, he is led to his master in a remote room of the house or outdoors before he is given the command, "Speak." After a few days of this training, the dog will work alone



It's old stuff to Buck, famous movie dog shown above and below, but he is willing to pose so other dogs may learn. Below, training a dog to bark when a stranger approaches. As door opens, the dog is led forward and told to speak. "Guard duty" is the dog's most fundamental job

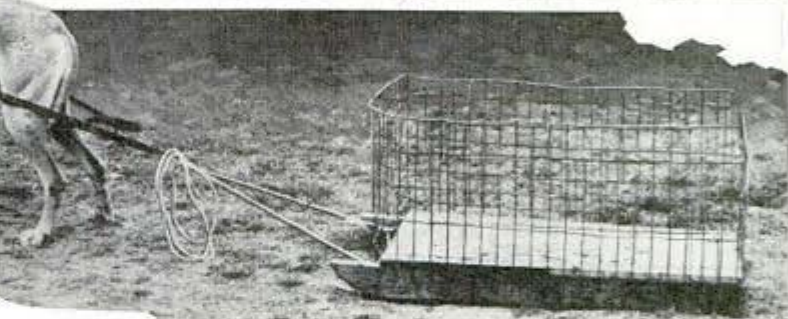


Training a dog to carry a market basket starts with teaching him to walk with a rolled newspaper in his mouth. Then he graduates to carrying the wood dumbbell, above, and finally to the basket, below



cont: R. Sewell Miller, 457 S. Serrano Ave, Los Angeles Calif

Any dog weighing more than 75 pounds can be taught to pull a small cart or wagon in harness. First teach him to pull an empty box with a rope held in his teeth to overcome fear of an object tied to him. Then harness the dog to a small platform or a sled (below) that will not tip over easily. After he has learned to pull the platform, weights can be placed on it gradually. He will offer no objections when a dogcart or wagon is substituted for the platform



Left, training dog to bring newspaper into house. First, lead him to the paper and give command, "Pick it up." Then place it in his mouth. Next, stop several feet from the paper and give command while the dog goes forward. Increase the distance between you and the paper gradually. Below, dog is calling his deaf owner by grasping the wrist



Acme News Service
461-8 ad nyc

Dinghy Tossed From Plane at Sea Aids Rescue of Downed Pilot



Attaching container with dinghy before starting rescue mission

British war pilots forced down at sea can be given temporary relief when spotted by a scouting plane carrying a dinghy fitted with supplies to last until rescuers arrive. The dinghy, containing rations, hand paddles, flares, torch and other apparatus, is dropped from Lysander planes when they spot a wrecked plane. Smoke bombs are also dropped as a mark for either Walrus amphibian planes or high-speed motor launches which would be summoned to make the actual rescue.

U. S. Bureau to Sift Inventions To Speed War Production

Organized as a clearing house for new inventions to further the war effort, a new "office of technical development" set up within the War Production Board would also finance worthwhile inventions with an appropriation of \$100,000,000. The agency will centralize all experimental work, search for new sources of raw materials and substitutes, with special reference to synthetics, and work for simplification and standardization in all branches of war pro-

64

New York Times
July 15-42

duction. Typical problems laid before the bureau will be suggestions for mass production of large cargo planes, the construction of standard hulls that could be used for minesweepers or sea-going tugboats, and the building of a standard chassis for trucks and buses with interchangeable bodies. A staff of scientists and engineers will interview inventors, analyze new developments and direct the operation of experimental plants for building and testing models.

'Snatcher' Holds Fire Bomb Until It Burns Out

Incendiary bombs, even when burning fiercely, can be snapped up safely with a pair of metal jaws and held within the enclosure until their fury is exhausted. A long handle permits the operator to work out of harm's way. By pulling back a lever he closes the jaws about the burning bomb which then drops into a lower section where the white-hot, molten material remains without spilling out. The jaws, which form a cylinder when closed, have a refractory lining, and in the event a bomb explodes within the container it would cause no damage since the upper section is free to open and thus relieve the pressure.



Split cylinder picks up bomb and holds it safely

POPULAR MECHANICS
McGraw-Hill Co. 5201
W 65 St., Chicago

Models Teach Quick Spotting of Enemy Tanks

Toy-sized models are helping men of our armored force to learn easy recognition of tanks of various nations, a talent of prime importance in the smoke and dust of battle when all tanks look much alike. At the armored force school at Fort Knox, known as the "Blitz College," an identification table has been erected in the semblance of an outdoor scene on which the models make a momentary appearance and disappear again. The student soon learns to identify the various tanks quickly.



me 677
Staff Sgt.
Robert
Zeidman
of
Pittsburg

Table bearing a miniature reproduction of outdoor scene trains tankmen in distinguishing at a glance the warrants of various warring nations

Third-Dimension X-Ray Pictures Viewed in Stereoscope

An elaborate viewing apparatus reminiscent of the old family stereoscope that once graced nearly every parlor table has been evolved for scanning large X-ray pictures in three dimensions. Its purpose

is to aid in quickly locating hidden defects within essential war equipment, even to the extent of showing the depth of each imperfection. Two radiograph films are prepared of each specimen, using high-voltage rays penetrating from slightly different angles corresponding to the direction from which each eye would see it. These two films are placed in the stereoscope, one at the right end and the other at the left end of a long table. A pair of mirrors, placed midway between the two films, gives each eye the view it would have actually looking through the specimen. When the X-ray films are viewed in the stereoscope with mirrors correctly adjusted, the internal structure of the object being examined appears as though it were made of glass.

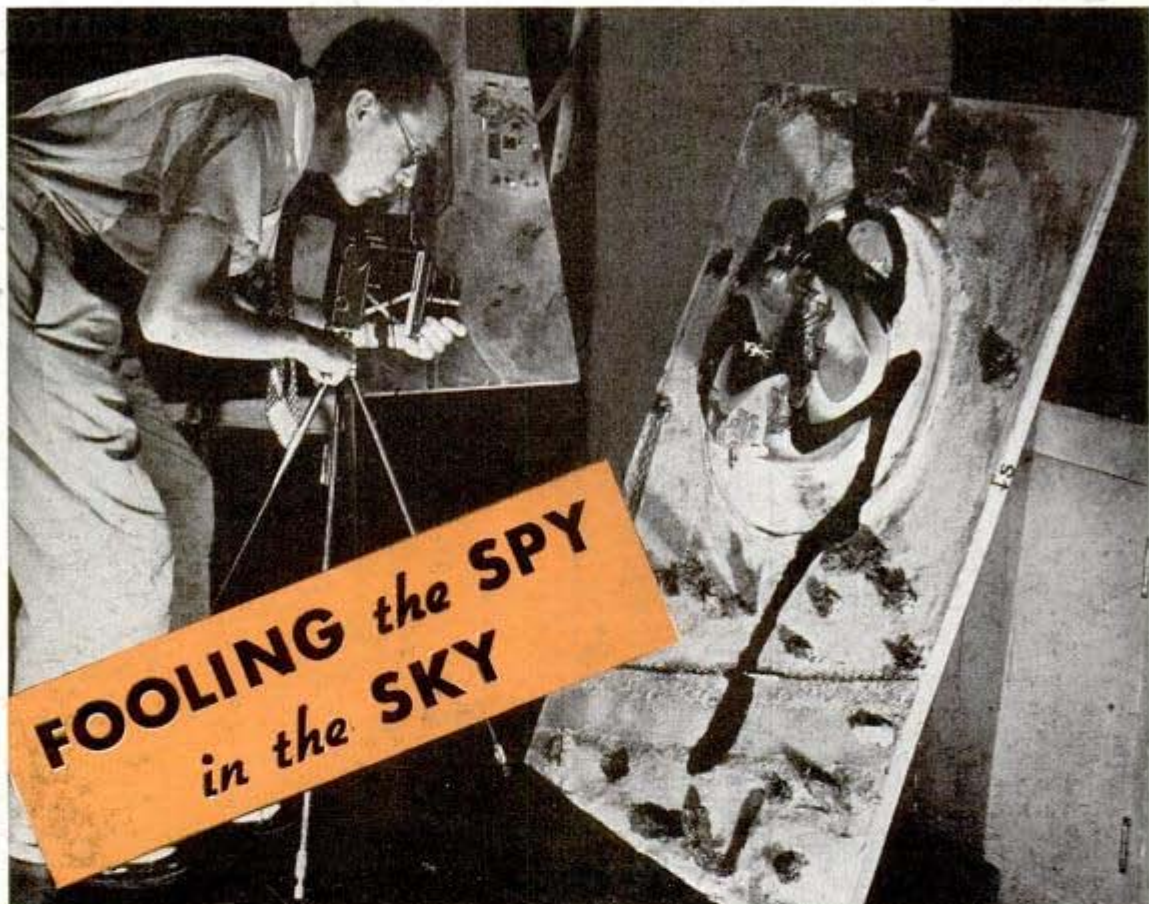


X-ray pictures at extreme left and right are given "depth" by mirrors

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Elizabeth Malanowski
P. E.

General Electric Co
Schenectady, N.Y.



Photographer makes camera test of camouflage on oil tank
Examining camouflage texture on cross-section of a shelter



Camouflage Engineering Corp.

m 681
NATURE camouflages fish by making their bodies in a two-toned pattern, light on the bottom to blend with illumination from the surface and dark on top to merge into the dusk of the depths. She protects birds in a similar manner. She mottles the coats of deer so they are almost invisible in a forest. She makes insects look like twigs and gives butterflies the form and coloration of leaves and flowers.

She seems to have neglected mankind, apparently never anticipating that millions of the lordly creatures which rule the globe would be forced to hide themselves and their creations from attacks of their own man-made monster, the airplane.

But today civilians around the world, particularly in the United States where the home workshop abounds, are beginning to do what nature forgot: fooling the spy in the sky with camouflage. A recent estimate indicates that more than 5,000 civilians have taken up cam-

Allen Warren Elliott.
7 Park Ave. N.Y.C.



Pratt Institute students build a model of waterfront and dock area to be used for studies of camouflage.

ouffrage research as a serious occupation, about 80 percent of them without pay from the government. Many more work at it as a pastime in cellar workshops. The result is that many extremely valuable ideas have been fed into the military and civilian defense organizations. So intriguing has the study of protective concealment become it is likely that no less than 25,000 specialized civilian brains will be backing up the experts of our armed and civilian defense forces within a year or so. This is aside from experimenters in the military forces, where anyone who displays a working knowledge of camouflage is snapped up quickly.

A helmet of foliage tops a costume that will blend a soldier almost imperceptibly into his background

New York City experts organized a Civilian Camouflage Council. Corporations like General Motors encourage research men to tackle the problems. Schools like Pratt Institute, Rutgers and Syracuse universities, New York State Institute of Agriculture and Kansas City Art Institute are cooperating with army, navy and civilian defense officials. Philadelphia high schools have classes. Brooklyn Museum and American Museum of Natural History are doing their share. It has even become a





James C. Boudreau, head of Pratt Institute Art School, operates machine which duplicates sun-shadow conditions at any given moment of year

Camouflaging spherical oil tanks with irregular superstructure that breaks up its telltale pattern of shadows →

The sun machine (top) produced on model below the shadows that would occur in Philadelphia on a specified day of the year at nine a.m.



business; companies like Camouflage Engineering Corporation of New York have been formed.

Artists, architects, engineers, photographers, industrial designers, stage designers, magicians, chemists, sculptors, mathematicians, modelmakers, taxidermists, landscapers and movie technicians whose special training fits them for angles of the fooling game are contributing to the national effort. From dentists, who learn to camouflage teeth, to paint and dye experts, who know the importance of color in protective concealment, the list is long. In fact, camouflage research is showing signs of growing into a hobby. Any fertile mind can help, and the best ideas may yet come out of a home workshop.

Much of what was learned in previous wars has become practically useless because of the color camera and infrared photography which spot color differences invisible to the eye. The development of gigantic flashlights for night spying, combined with the use of the airplane, have made it extremely difficult to fool the enemy. The fundamentals of camouflage, however, are still simple.

Since military camouflage is well in hand, the best point of approach to the subject is industrial or civilian camouflage, because the problems are million-fold and each has a different aspect. Every important building, every road, every gas or oil tank within reach of possible bombing needs protective concealment. The government has not yet completely coordinated local civilian camouflage efforts, and most manufacturers and municipal officials have not really tackled the problem. But eventually every important spot requiring camouflage will be photographed from the air, maps will be made, concealment designs worked out.

Camouflage will be applied, aerial mapping will test the results.

Meanwhile the field is wide open for patriotic and inquisitive minds. Cooperation and information will be given by the office of Civilian Defense in Washington, D. C. to responsible persons.

The basic idea is to provide either concealment or confusion of identity, or both. An example of concealment would be the application of splotches of paint to the roof of a small factory and the construction of screens and ragged extensions to the roof, to blend it into nearby trees and shadows. An example of confusion of identity would be to change the exterior of the factory and add fences, smaller buildings and vegetable patches to make it look like a farm, or to build similar fake rooftops nearby.

A railroad spur which gives away the presence of a factory, can be made to look like a road, or extended beyond the factory with dummy tracks and ties to mislead the bombardier. Roads which lead to an important building can be extended by false work so that they rise to the roof, cross it and continue beyond. Concrete roads can be painted blue, as they have been in Europe, or brown in the winter and green in the summer to merge with surrounding fields. Many materials can be suggested to

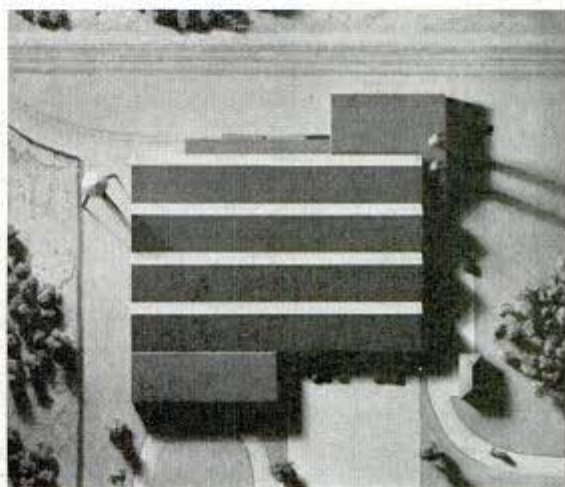
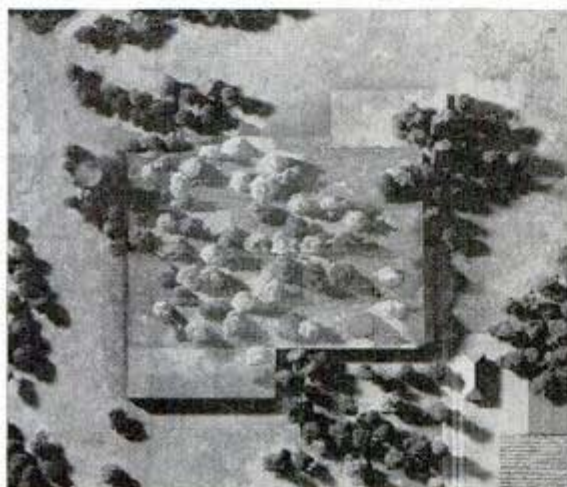


To learn how to camouflage a gun, students first build the gun of wood
Photo from Pratt Institute

prevent roads from shining with reflected sky light when wet. Dyed crushed stone, oil and sand are useful. Better materials may be available in local supplies.

Important highways can be given the benefit of confusion by adding parallel or intersecting false roads. Strategic road junctions can be disguised by painting out some of the known roads, screening others, covering the junction point with nets and using detours, both real and fake. Plans are needed. Smoke pots have been found valuable to hide roads, their efficiency depending upon the visibility, the wind and time available to get them in operation. Parking fields are another telltale sign of a big factory and any bright mind can work

Model factory (right) vanishes behind real or painted shrubs, a method most effective at 3,000 feet altitude





Experimenting with shadow patterns for bomb-resistant roofing material at Camouflage Engineering Corp.

out irregular arrangements of trees, nets and screens to make a parking lot look like a grove.

Tanks can be painted dark and their shadows broken up with false work extending to the edge of the roof and beyond. Paints should match surrounding colors. Dazzle painting is called for in some cases. Or two tanks can be connected with false-work and squared off to look like an innocent barn. Docks can be shielded with irregular roofs projected from adjacent buildings, and painted so they harmonize

with the nearby water, even to the ripples.

Smokestacks can be removed and forced draft installations substituted to carry smoke to a point some distance from a plant needing concealment. Or other sources of smoke can be added to produce confusion. Windows can be treated in many ways to lessen reflections. Landscaping arrangements can be planned for roofs. New materials to simulate grass can be found. Bridges are hard to hide, but approaches can be masked and the bridge structures painted to blend with water beneath. Where one prominent object exists which cannot be concealed, like a tank, the erection of a number of dummies in the same vicinity will cause confusion.

Two general principles must be kept in mind.

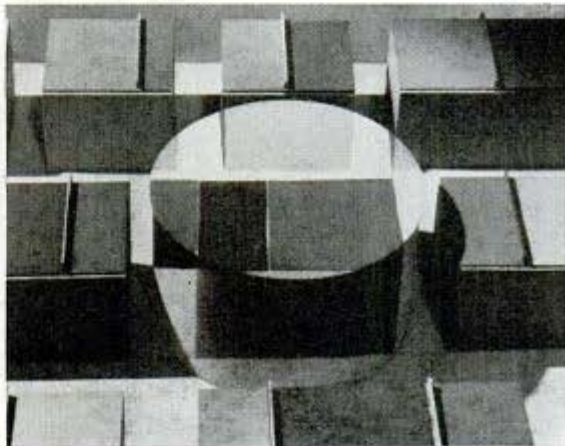
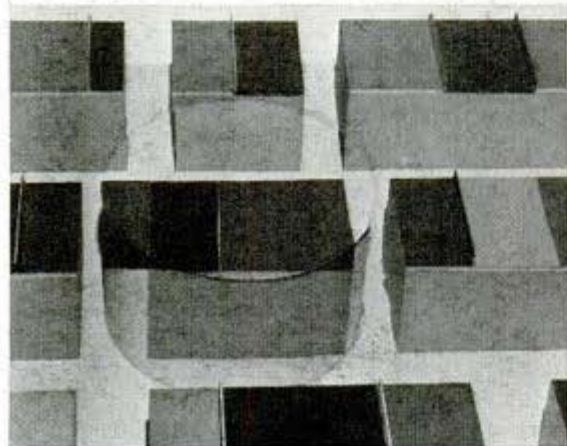
Nature creates rivers, hills, trees, shrubbery and other features in her landscape in irregular patterns and colors them with many contrasting hues. Man builds his roads and docks in straight lines, his buildings in rectangular form and paints in one or two tones. The straight line, the oval, the triangle, the circle, the square and rectangle in somewhat perfect form are his invention. The object of the fooling game is usually to restore the diffused pattern of nature.

The second thing to remember is this: thanks to the scientific perfection of the modern aerial camera, a shadow is often easier to see than the object itself and the aerial camera is so good it can spot a man's footprints on grass from two miles in the sky. The camera can pierce fog opaque to the eye.

One way to conceal a shadow is to paint another on a building so as to extend or

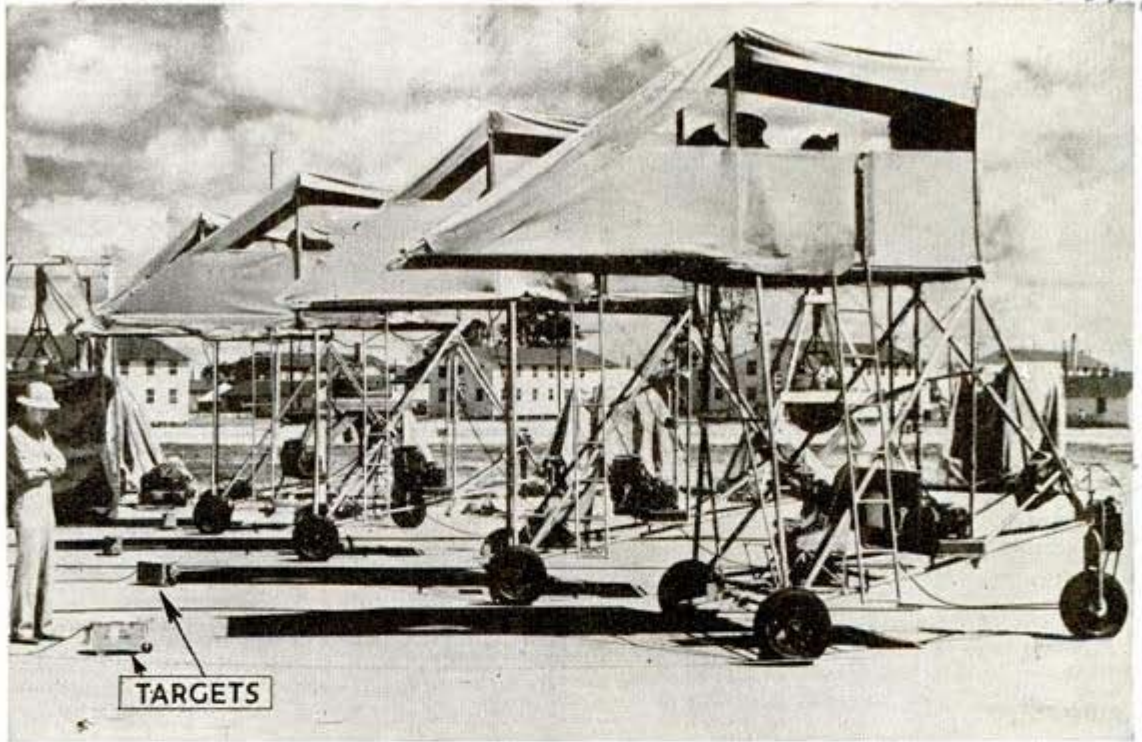
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Oil tank is well hidden under favorable shadow conditions (left) but at another hour the sun gives it away



Bombardiers Train in Mock Fuselage on Stilts

m 818



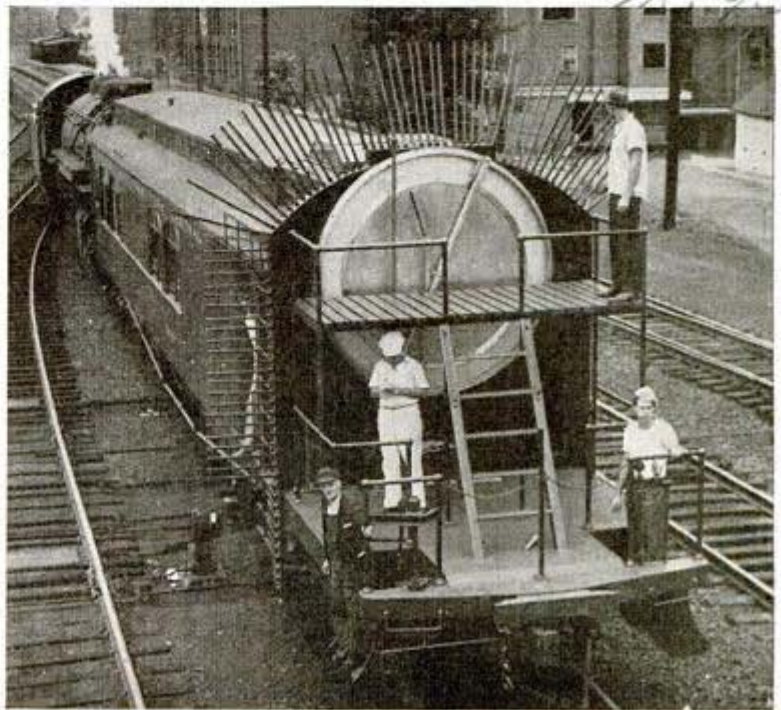
Trainer fuselages are "flown" by instruments as students learn bombing accuracy by hitting the "bug"

Bombardiers acquire accuracy at a southeast training center with a game of "hit-the-bug." They ride in replicas of

fuselage mounted on wheeled stilts and "fly" by instruments above moving targets that are called "bugs" by the students.

"Porcupine" Car Has Feelers to Gauge Tunnel Clearance

To measure the clearances of tunnels and bridges, a railroad car is equipped with wooden feelers that stick out like the quills on a porcupine. The feelers, which have a swivel arrangement, hold their deflected positions when they strike the sides of a narrow bridge or tunnel. Measurement of clearances is performed by a steel pantograph which records the position of the feelers. Development of the "porcupine" car by the New York Central System was prompted by the great number of bulky pieces of war equipment which are being shipped over the road.



With all of them in place, the "porcupine" car would carry 112 feelers

DECEMBER, 1942

*Public Relations Dept, 466 Lexington
Av. N.Y.C.*

*used on Docton & Albany
Div. of N.Y.C.*

MIGHTY MIDGETS of FILMDOM



Microfilming "V-mail" for overseas troops is done with machines like the one above. Below, postage-stamp-size film record shows how space is saved in newspaper files



m 750
MODERN total war has the bewildering effect of changing our values, eliminating many of the things which seemed essential in peacetime and giving a terrific boost to the importance of others.

Microfilm is in the latter class.

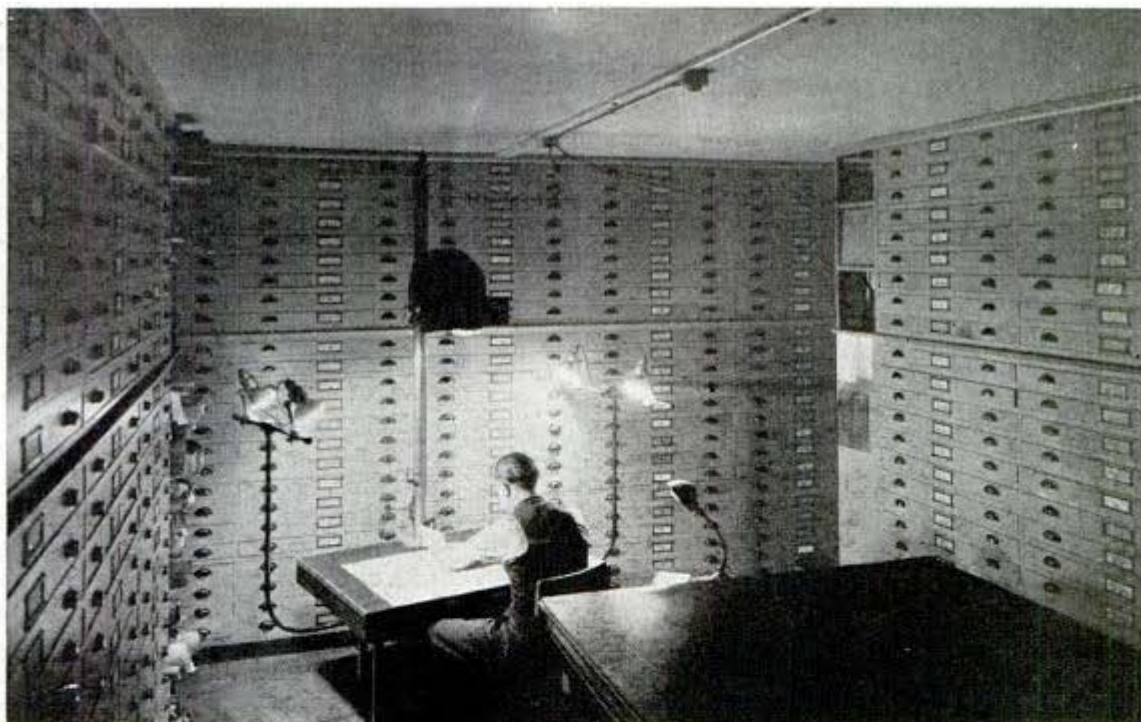
Strangely, these little films have now attained gigantic value because of their small size. They are suddenly mighty for the very reason that they are midgets. Even the larger type is only as wide as a man's thumb from tip to first joint. The smaller microfilm might be compared roughly to the size of the nail on that section of the thumb. Yet, they are doing a Herculean task.

Industry has awakened to the fact that engineering drawings, contracts, corporation records, insurance policies, building plans, checks, correspondence and hundreds of other irreplaceable documents are vulnerable to bombing raids, especially to the fires which inevitably follow. Recorded on microfilm, instead of perishable paper, these valuable records may be stored in fireproof and bomb-proof vaults for an indefinite period in about one or two percent of the space they formerly occupied. About 400,000 films a day are exposed for this purpose.

The Army and Navy, with the cooperation of postal authorities, are microfilming the mail of service men. The "V-mail" letters are filmed so that millions can be shipped in a few packing cases to faraway lands where the messages are printed just like photographs on thick paper, folded into half the original size, and distributed to men hungry for word from home. Huge numbers of microfilms are being used for this patriotic task.

Newspapers are hurriedly microfilming their back files, museums are copying their works of art, hospitals are photographing X-ray plates, libraries are pre-

Allen Warren Elliott, 7 Park Ave, NYC.



servicing their volumes. And spies and propaganda agents are having a field day, thanks to the mighty midgets of the photographic world.

The Chinese, always an ingenious people, have matched America's V-mail with what is called bee-mail, a clever spy system based on the fact that a bee will return to its hive as long as the queen reigns. During most of the war with the Japanese, the Chinese have been on the retreat because of their lack of mechanized equipment and combat supplies. As their lines move backward, their spies capture a number of bees from a farmer's backyard, carrying them in tiny cages. Microfilming their messages and printing them on very thin paper, they attach the paper to the bees and release them. The bees wing their way back to the hive at a speed of 30



Microstat Corporation photo
 † Microfilm cameraman at work in vault reducing 70,000 engineering drawings to 90 film rolls which will save valuable space

Left, showing how spies conceal microfilm frame by prying open sole of shoe and then carefully slipping the small film inside
 Reading projected image with a boxlike reader, below, in which the microfilm is handled on rolls and moved by turning the crank





The dark bands encircling reel are newly developed microfilms being dried under heat lamps, a final step in the processing

to 40 miles an hour just as efficiently for short distances as homing pigeons which are employed in the same manner. The message is picked up at the hive. This system works both ways across the lines.

Most of the atrocity and propaganda articles which filter mysteriously out of conquered nations like Poland to see the light of day in American newspapers are transmitted to this country by refugees who have concealed microfilms around their persons and baggage, or by spies who turn them over to allied agents in neutral nations like Switzerland or Portugal. A single microfilm will easily transmit from 5,000 to 10,000 words of information printed in fine type.

Many of the anti-Nazi publications which continue to circulate in a wide underground network throughout Europe are read in the form of small photographic prints from microfilm, or are enlarged and published in hideaways from articles transmitted by microfilm.

As in the case of the Chinese

Hiding microfilms between rows of matches makes their transfer easy among spies

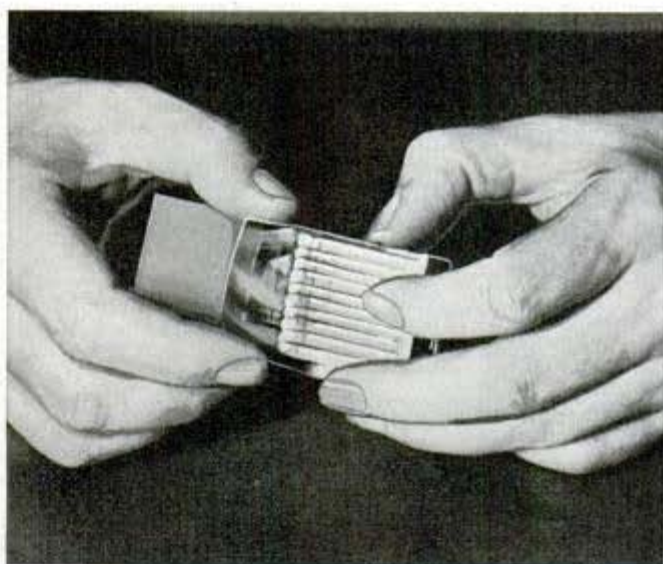
and the bee hives, this use of microfilm works both ways, to get facts into the United States and to get them smuggled out. Nearly every important spy trial since America entered the war has revealed that Nazi and Japanese spies are making full use of microfilm. In one case a hidden movie camera caught the spies in the act of operating with the mighty midgets. In this case, too, the small size of microfilms is the key to their value.

The little fellows certainly lend themselves to concealment. One popular method of transmitting spy messages is to pry up the sole of a shoe, particularly if it is rubber, slip the film in and let the sole fall back into place. Fountain pen caps will hold a microfilm and the pen, too. Trimmed down, microfilms are concealed beneath a postage stamp. The new style filter pipe in which the stem fits over the interior section where pipe and stem join, is helping spies.

Microfilms are slipped between rows of matches in a paper match container. No one notices if a spy discards an apparently empty paper match container, or hands it to an assistant.

In addition, microfilms may be hidden in the nose, in seams of clothing, in a woman's coiffure and they are even slipped into capsules, usually of silver, and swallowed.

They fit nicely in the back of watch cases and in one instance a trapped Nazi spy was

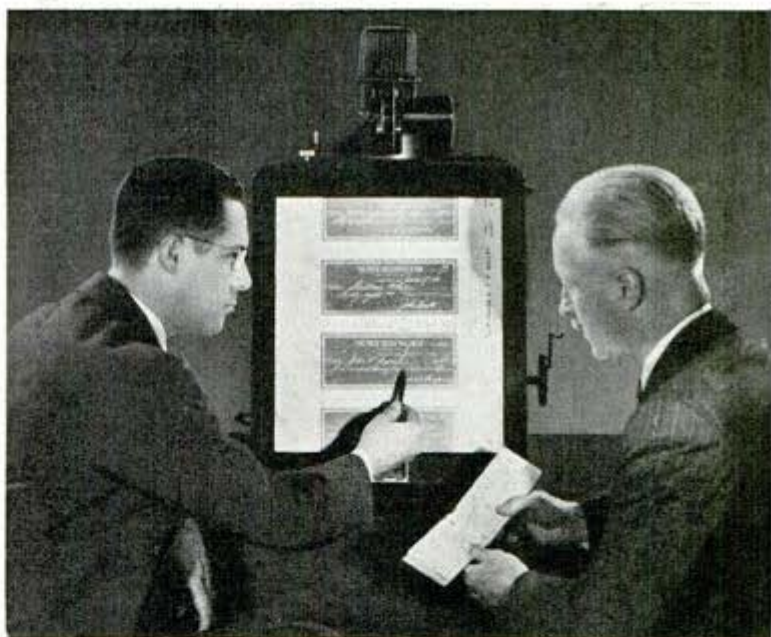


found to have bleached a microfilm and substituted it for a lens in his eye glasses, indicating that the Germans have a process which will restore the message on the bleached film.

But they have more respectable war purposes, too. In cases where one war plant wishes to farm out contracts for intricate mechanical parts to a number of other concerns, the objects themselves or the detailed plans are being micro-filmed and shipped by air mail. At the receiving end, these pictures are enlarged and scanned in a reader, or photographic prints are made. Weeks of delay are avoided. A tiny spot can be blown up as big as a door mat.

They are valuable for the making of templates, when not too large, for the metal may be coated with sensitive emulsion and the pattern printed right on the plate.

Testing airplanes has been speeded up along with experimental flying to discover the efficiency of various types of plane de-



Recordak Corporation photo
Verifying a disputed payment with a machine that preserves 7,000 checks on 1,000 feet of film. This new machine both photographs and projects

sign and equipment. It has been standard practice for a test pilot to make a flight in the morning with a pad of paper and a pencil on his knee for notes. He spent the rest of the day calculating what his instruments recorded and preparing his data for other tests the next day. Now a microfilm camera goes aloft with him, constantly recording the facts told by his instruments as he concentrates on flying the plane. On land-

Looking up a story in the files is made easy for editor, left; right, storing filmed records in bank vault



Made in Detroit Edison
Co by Eastman Kodak



↑ Giant projector used for large engineering drawings—only machine of its kind in the world

This handful of films contains 60 full-length books—possible forerunner of future libraries



ing, he is able to scan records within an hour or two and then take the craft aloft for additional tests.

New uses crop up constantly. The state of New York recently destroyed 7,000,000 canceled checks, filming them so that the record was just as good with a saving of 99 percent of the storage space. Draft numbers are always microfilmed so that they show the date and time they were drawn to establish the proper order. The famous Westinghouse time capsule, buried deep under the site of the New York World's Fair for the benefit of future generations, contained microfilm records which will give a complete picture of contemporary civilization.

One great newspaper, the New York Times, microfilms its pages daily and readers may subscribe for the film edition, which is mailed to them. Another, the Philadelphia Inquirer, keeps its back files in this manner and even supplies a Philadelphia library with copies so that anyone

Photographing corporation records with special camera that boasts a focus true to .00025 of an inch

can search for an item with a microfilm reader which throws the type into clear enlargement. This is far simpler and easier than thumbing through hundreds of pages in a bulky volume which soon wears out. The editions for an entire month occupy little more space than a bar of soap.

Tiny films were used as far back as 1870, during the Franco-Prussian war, to fly messages out of besieged Paris by tying them to the legs of pigeons. However, it is only during recent years, and particularly in the last few months that the business of microfilming has boomed. This volume concerns itself principally with the haste of business concerns to protect their records from bombing and, possibly, sabotage by fire.

A number of new companies have sprung up because of this available business, also a number of theories about the best methods of microfilming. These theories deal largely with the size of the film, whether they should be filed in strips or rolls, and type of equipment.

One of the leaders is the Microstat Corporation

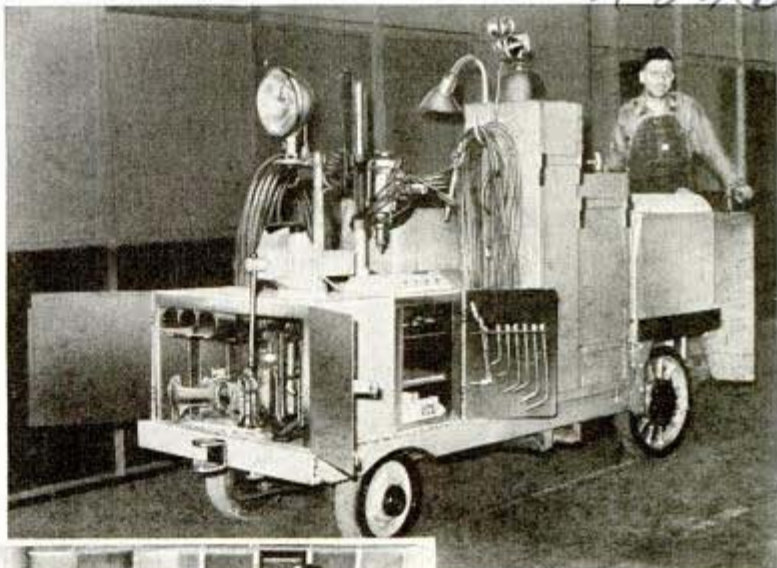
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Trouble Shooter Joins Fire Cart at War Plant

M 846

To shorten as much as possible the loss of production time that might result from damage by air raids or sabotage, all Fisher Body plants engaged largely in defense work, are provided with two small-size mobile outfits, one to fight fires and the other to make quick repairs. The miniature fire wagon, pulled by a tractor, carries six buckets of sand, eight extinguishers for chemical



At a moment's notice these two mobile units, trouble shooter above and fire truck at left, can rush out to cope with fires or damage to shop equipment caused by bombs from enemy planes or uprising of saboteurs

fires, four axes, two crowbars, two wrecking bars, one stretcher and two 12-foot ladders. Other equipment includes lanterns, gas masks, 300 feet of hose, 130 feet of rope, pumps, fire guns and various small tools. The repair truck or trouble shooter,

designed for use in restoring disrupted services, clearing debris and making repairs, contains jacks, shoring timbers, crowbars and chains. In many instances this unit can be used temporarily to replace some damaged shop equipment.

"Cradle Gym" Strapped to Crib Has Trapeze and Rings

Even the baby can take his "daily dozen" with a trapeze, climbing rope and rings strapped to the crib or play pen. The bar has rings suspended from straps at either end, convenient to the child's reach, and a central rope strung with blocks on which he can pull himself up. It is designed to develop the baby's larger muscles and bolster his self-confidence.



Early training for the flying trapeze starts in the cradle for this fellow with an arrangement of bar and rings

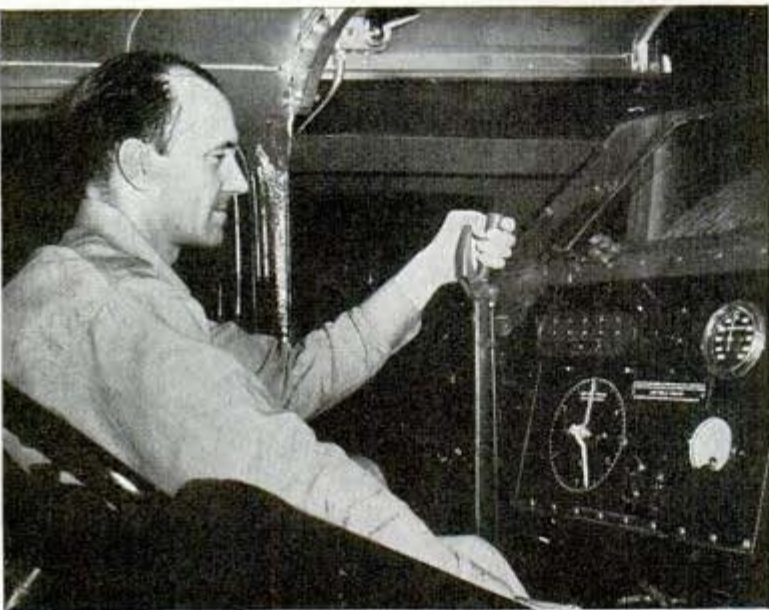
Harry E. Miller
Childhood Institute
Roselle, N. J.

General Motor Corp
Detroit Michigan

Marshall, Sverdlovsk, Moscow, U.S.S.R.

Thos. E. Stinson, Jr. 3872 Franklin Ave. Los Angeles, Ca

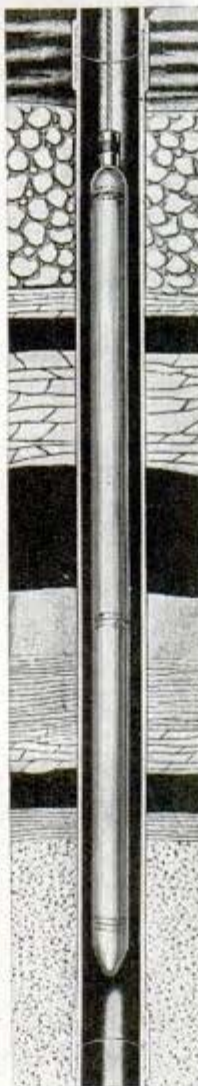
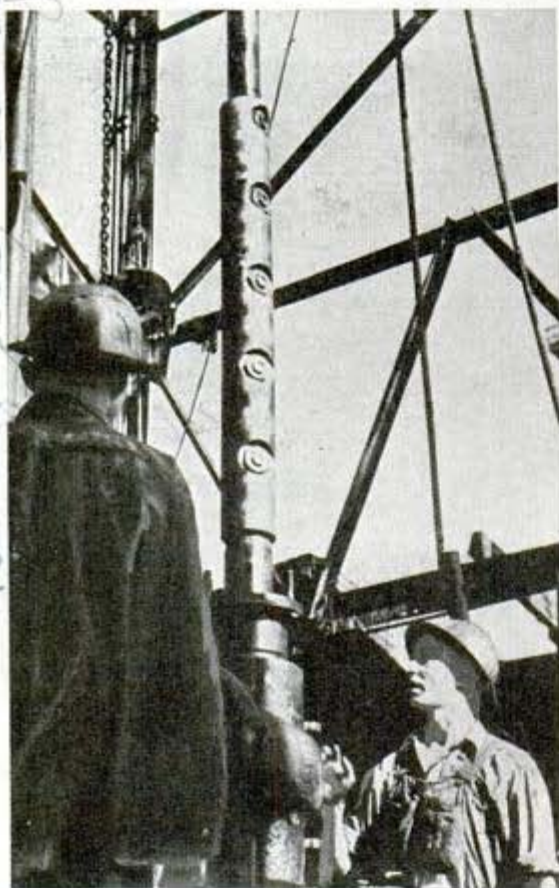
BRINGING DEAD OIL WELLS



The operator at the controls of the special truck watches dials of "electric log" indicating oil pool

Gamma rays from strata around casing ionize gas in a three-foot tube (right), actuating recording pen

A Lane-Wells 10-shot Gun Perforator is ready to be lowered into well to blast an opening into oil pool



THEY couldn't lose, officials of an oil company decided, when a group of Lane-Wells Company research men asked for an abandoned oil well to play with. The technicians wanted to try a scheme for bringing old oil wells back to life. They were perfectly happy when the oil concern offered them a well that had been pumped dry and was due to be sealed with concrete.

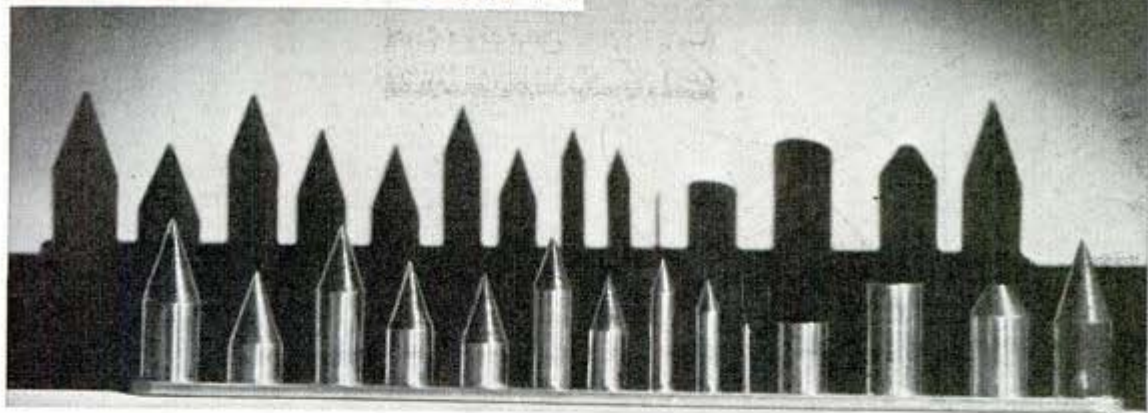
The amazing thing is that the scientists restored the well. The "dry hole" has delivered 150,000 barrels that no one knew were there and is still producing.

The methods that rejuvenated this well are now helping maintain our petroleum production rate. Few people realize that oil production in the United States averages less than 10 barrels per well per day. Although this is partly because the flow is restricted to insure longer production, more than 10,000 new wells have had to be brought in each year to replace wells that dry up.

About 1,000,000 wells have been drilled since 1859, of which 400,000 are now producing oil. The remaining 600,000 were dry or have played out. From some of these 600,000 holes, it is thought, more than enough oil can be obtained to maintain our necessary wartime production rate. Of course, the United States has fabulously rich oil reserves, but steel can't be spared for a heavy

Ref: Mrs Lawrence, McCarty - Co, Bendix Bldg, Los Angeles Calif

BACK TO LIFE



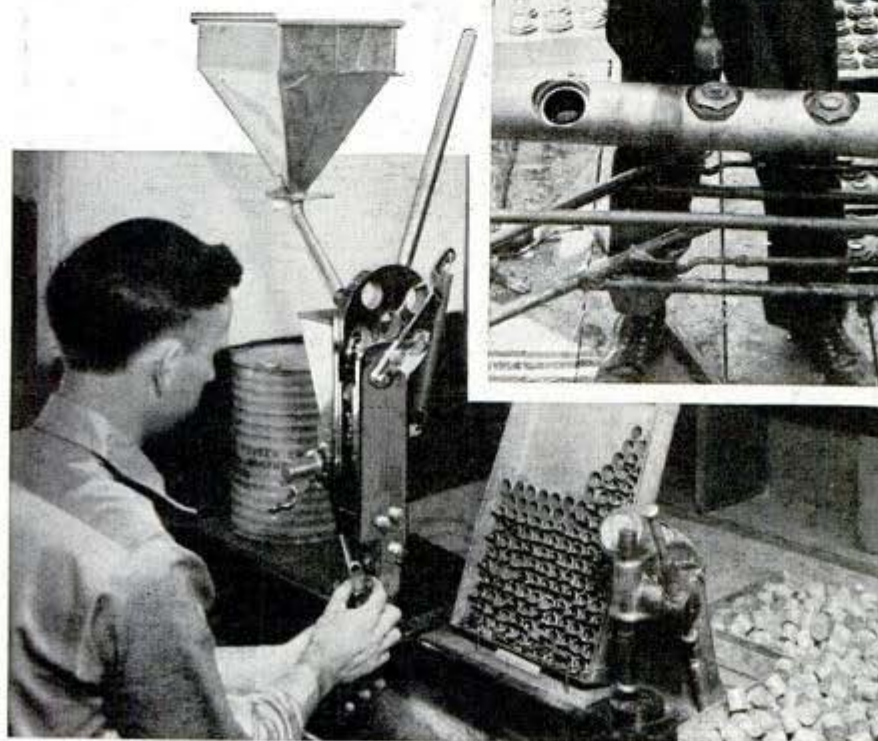
Bullets of many shapes are used to pierce oil or gas areas, open clogged screens, and perform many other tasks for oil men

drilling program now. The casing alone for a 4,300-foot well weighs 61 tons.

The miracle that transformed the dry hole into a flowing well is easy to understand. The scientists took advantage of the earth's radioactivity to find the oil, then broke into the deposit with an electric machine gun.

When a rich pool of oil is discovered many wells are drilled to tap the deposit. Shallower oil

(Continued to page 164)



↑ Loading the underground Gun Perforator with half-inch bullets to be shot through the steel casing into oil-bearing ground

← Preparing bullets for the underground gun. Behind each bullet is a half-inch charge of powder, fired by electric-heated filament

Dist: Daughan's Lead Store, 101 Randolph, Chicago

Plow-Shaped Garden Hoe Digs Furrows, Covers Seed



Hoe throws dirt to either side, making clean furrow

Handy for Victory gardeners is a plow-shaped hoe that can be used for digging a furrow several inches deep and filling it in after the seed is planted. The implement is turned on its side to provide a flat surface for smoothing the ground, or it can be pushed with the plow in a level position to fill holes. Small or large holes can be made with the point.

Plastic and Wire Screen Window Resists Bomb Concussion

To guard against flying glass shattered by bomb explosions, a transparent, flexible

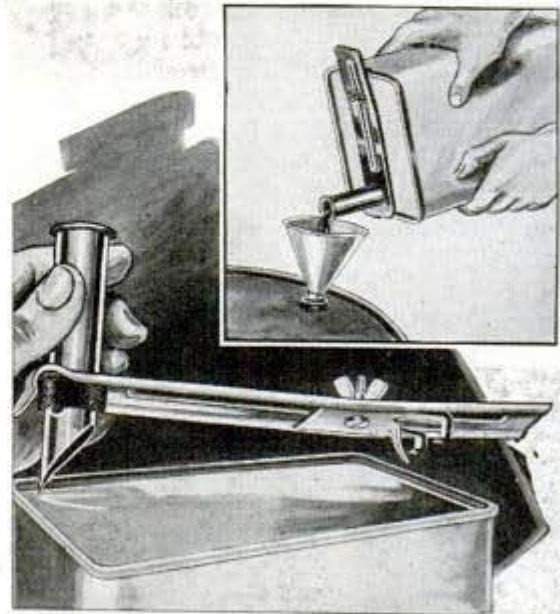


"Sandwich" of plastic and wire makes safer window

plastic substitute for window glass has been developed. Said to be capable of resisting the concussion of a 150-pound bomb exploded eight feet distant, the sheet consists of two layers of laminated plastic reinforced with a wire screen "welded" between them. In comparative tests, a quarter-pound steel ball dropped from a height of 40 inches broke safety glass, but a two-pound ball dropped from 42 inches was needed to penetrate the protective sheeting which gave way without shattering. The plastic window gives good visibility and passes 97 percent of the sun's ultraviolet rays, making it suitable for greenhouses, hospitals and the home.

Adjustable Spout for Tin Cans Clamps on With Hooked Bar

Contents of tin cans can be poured without spilling with an adjustable metal spout held in place with a bar that clamps to the rim. The pointed end of the spout which



Can is pierced with pointed end of "clamp-on" spout

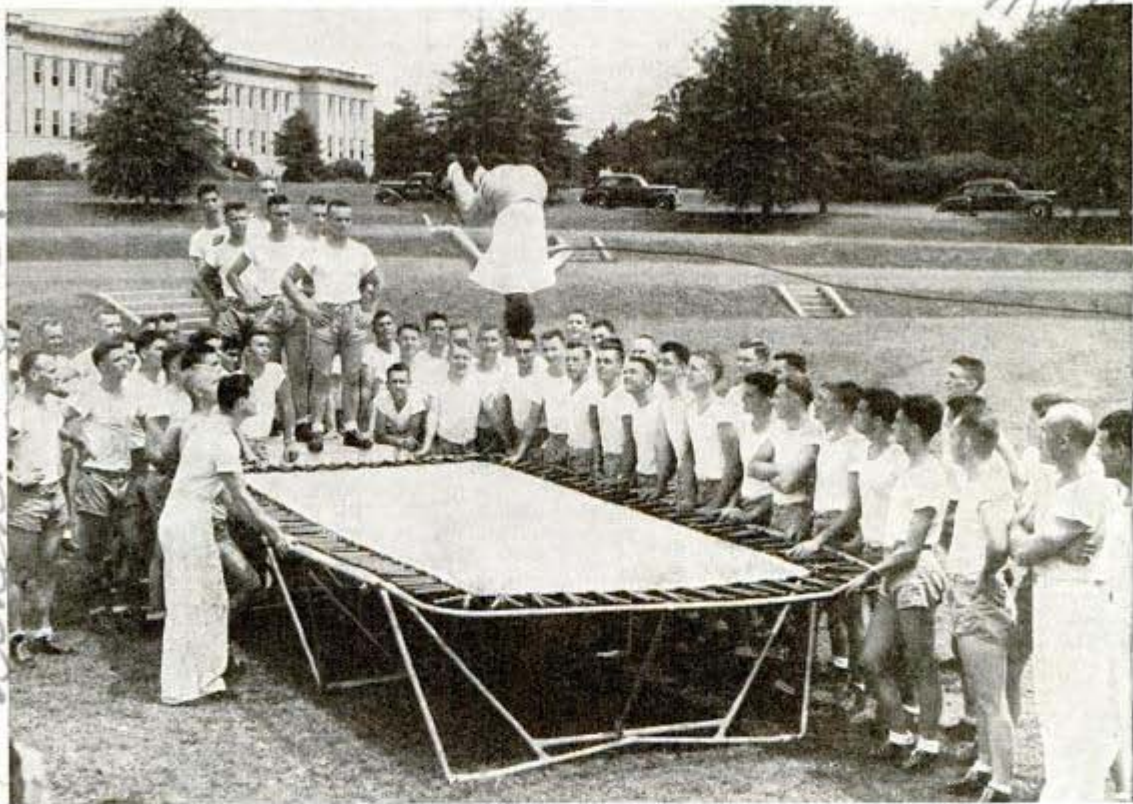
extends through the bar is eased into the can and a lip slips over one edge. The other edge of the can is engaged with a sliding prong and hooks fastened to the bar with a wing nut. Felt padding around the spout prevents leakage.

Write to the firms listed in the Where-to-Buy-It index, to learn more about products described in this magazine. Say You Saw It in Popular Mechanics.

POPULAR MECHANICS

Dist: Sears, Roebuck & Co. State 42 W. Van Buren Chicago, Ill.

Delaware-Alberloid Co. 115 Madison Ave. N.Y.C.



Student pilots of the Navy make their first "flight" from this bouncing blanket in athletic training

Athletes usually make good flyers, so the U. S. Navy begins the training of cadets by making them good athletes. At one pre-flight school, the men learn balance and coordination by bouncing on a large oblong

"net" supported all around by coil springs. The apparatus, called a trampoline, rebounds when a man falls into it, sending him high into the air where he can do fancy turns or loops before coming down.

'Super-Ear' Gives Quick Warning of Approaching Planes

Every second that elapses between an air raid warning and the arrival of enemy bombers means more lives will be saved. A "plane detector" that picks up high frequency vibrations at the instant of origin instead of many seconds later, as is the case with ordinary sound detectors, is the invention of Charles LaMar of Pasadena, Calif. The detector looks like a giant ear trumpet.



This huge "ear trumpet" speeds an air raid warning by several seconds. It is non-electrical

DECEMBER, 1942

International News Photos 326 W
Madison St, Chicago

at U. of Virginia
Athens Ga

Cadet O. F. Rhodes
Fayetteville Ark

YOUR VICTORY CAR

See Johnson & Sons Racine Wis

Designed as a mobile research car for a manufacturer, this front-wheel-drive car with a 95-horsepower V-8 engine has living quarters for three men



M 845



Traveling salesrooms may have an important place in postwar automotive development. The car below was built for a publishing company; its interior, above, is an office with standing headroom

By Brooks Stevens

Industrial Designer

340 Milwaukee St

THE American civilian is recovering gradually from the shock of his country's complete entry into the greatest war in history and its necessary sacrifices. Production of passenger cars ceased months ago, and the public is getting used to the idea that the family auto must last for the duration, possibly longer.

It is not premature to talk of the postwar possibilities in this field of manufacture, for certainly it is one of the country's largest, and one upon which the people are definitely dependent.

Although the general public may feel that the postwar car will be a radically styled, all plastic, rear-engine vehicle with a completely transparent top, it is only wise to discount this to a great extent. The length of the war will, of course, be a powerful governing factor. If the war should come to a quick end, the first postwar cars undoubtedly will

Milwaukee, Wis

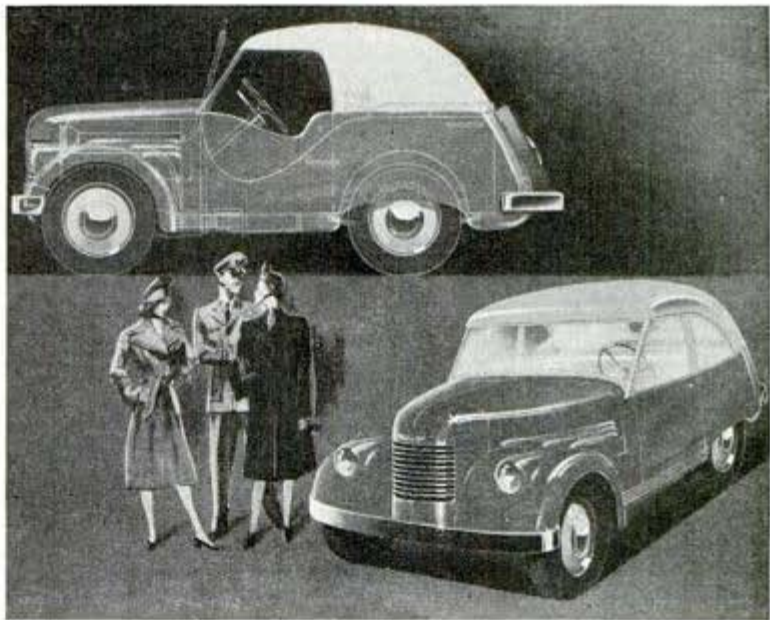


*for Whitman Publishing Co
Racine Wis*

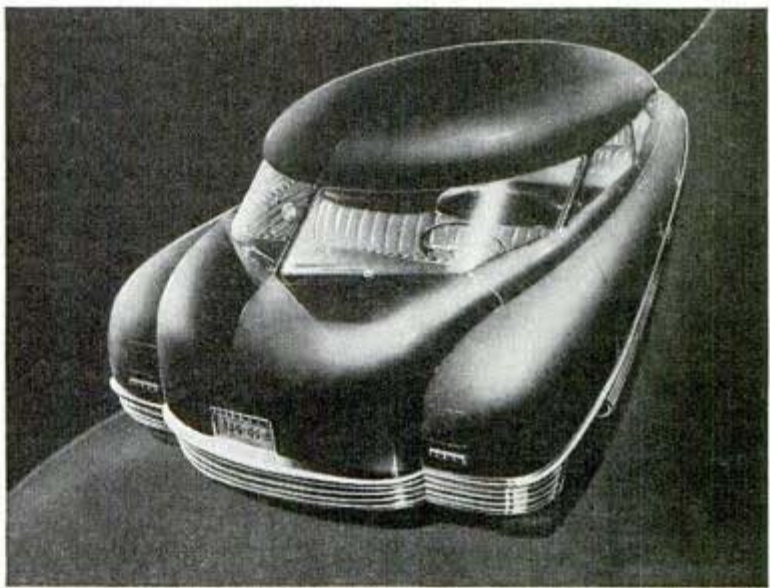
be revisions of the 1942 models. This would be the only practical measure in consideration of the thousands and thousands of dealers who have been hit so badly by the cessation of automobile manufacture.

Conversion from war production and a resumption of passenger car manufacture will be effected more quickly in this manner than to attempt complete retooling for radically designed models. In fact, revisions of 1942 models might be available six months after the war as against retooling completely for rear-engine or other radically styled models which might require 18 to 24 months before reaching the market.

Reasonable revisions will include a greater emphasis on the elimination of individual fenders, as such; front fenders will blend gracefully into the body instead of being applied appendages; and complete elimination of individual rear fenders will be effected through widening of the body to absorb them. This makes for fewer individual stampings, smoother exterior streamlining, and from a practical standpoint the generous smooth surfaces can be

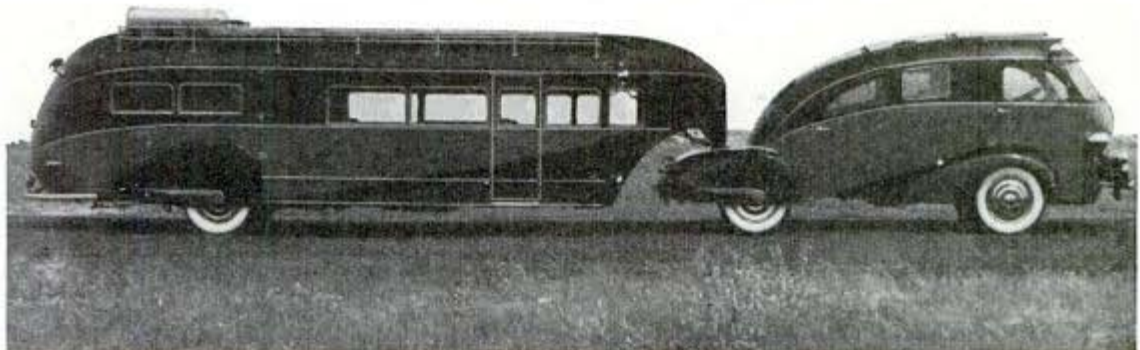


Today's jeep could become tomorrow's popular car with a minimum of tooling and fabrication cost. Note outlines of army jeep on open car

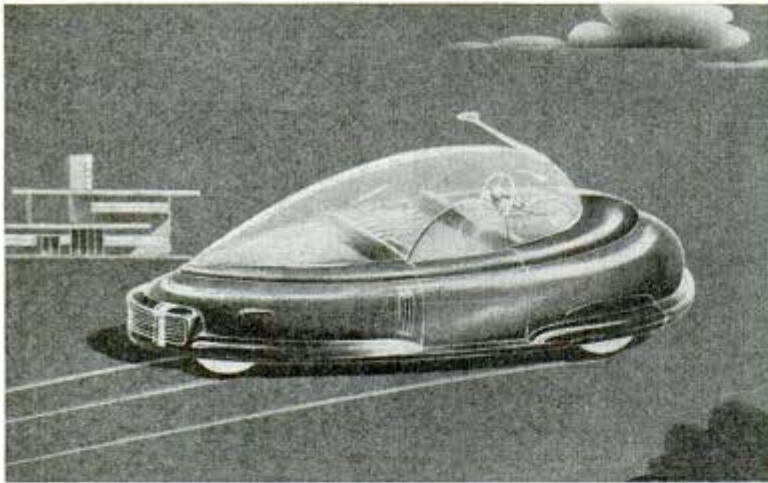


This head-on view illustrates the possible trend toward rear-engine design, with improved streamlining and greater vision for passengers

Seven people sleep in the trailer, two in the tractor of this mobile home equipped with shower bath and stove. It is forty-five feet long



*for W W Plankinton,
N.Y.C.*



Typical of many prophecies, this three-wheel car of extreme "teardrop" shape has a plastic body and transparent top presenting many problems

reshaped more easily after accidental denting.

Sacrifices made by civilians during the war and a general attitude of restraint will only be satisfied by the elimination of superfluous bright work, chrome grills, stripes, bars, and other useless ornamentation. The simplified front-end treatment will include concealed or retractable headlights, already in use, and more functional air scoop intakes as a part of a substantial bumper design.

There will and should be increased vision in this postwar model. The panoramic full-vision windshield, accomplished by moving the heavy door and corner post outward and back from its former position, will allow for 180-degree driver vision. Safety glass windshields will be bent at the $\frac{3}{4}$ point to accomplish this partial encirclement; however, they will be bent in one

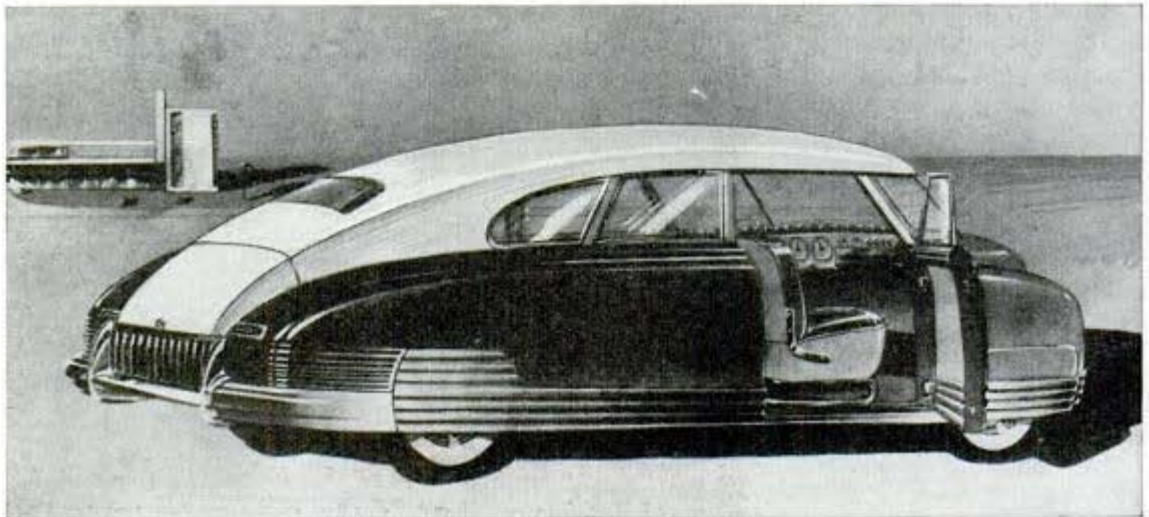
plane only. Curved plastic windshields, long the dream of many designers, have not yet proven hard enough to withstand windshield-wiper action in conjunction with grit and dirt present in rain. Spherical shaped plastic windshields are apt to distort vision. Plastics, however, will play an ever-increasing role in tomorrow's car, certainly in connection with all interior trim, instrument panels, control levers, and the like. Interesting

and satisfactory upholstery has already been executed from woven plastics. Permanent color and durability will be the keynotes. Plastics may also play an increasing part for many small elements in connection with the power plant.

There has been considerable speculation as to the use of molded plastic body panels and fenders to replace steel. This is doubtful at least for the first postwar car. The tremendous increase in the production of aluminum, which in 1943 will be several times the 1939 production, will result in an increasing use of this material in automobile bodies. Stronger lightweight steel is also being experimented with.

The real postwar car will not appear until enough time has elapsed to develop a completely new type of automobile. Before touching on this "postwar car," I should like to make another reasonable

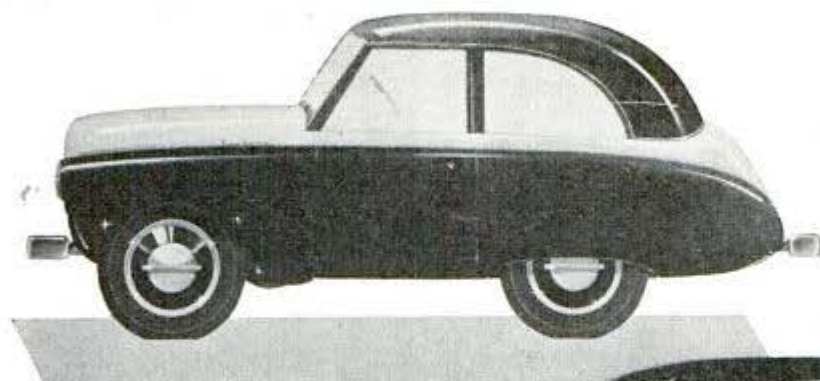
The rear engine is easily accessible by way of former trunk lid and fender openings. Notice the cooling grills



and conservative prophecy: With the ever-rising cost of this war and the possible taxation measures brought on by it, we may find the average American forced to accept an undersized car in comparison to prewar models. It is entirely possible that a civilian version of the army jeep might be a most acceptable and desirable piece of transportation equipment. Conservatively styled versions of this jeep could be manufac-



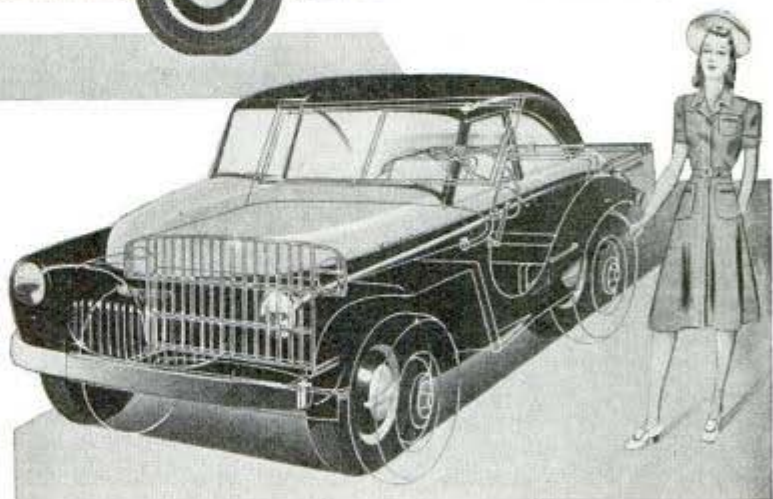
The author believes the design above represents the most likely treatment of the postwar family sedan. It is a revised version of your '42 model with increased panoramic vision, further elimination of individual fenders, simplified front end and less ornamental "bright work"



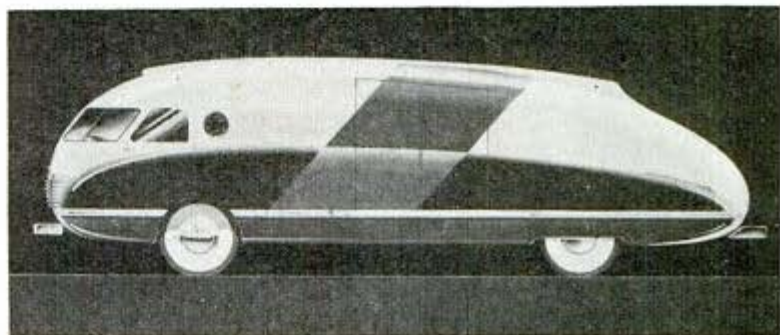
tured during the war to fill necessary civilian needs. This conservatively styled model, in both open and closed types, could be executed with simple tooling and a minimum of fabrication expense, yet it could have pleasing lines within these limitations.

The civilian jeep could then be projected into a postwar "victory car" in a more completely styled form. This model will take on graceful lines through the elimination of fenders and stressing of longer and more sweeping lines in an effort to make up in appearance for a short wheelbase. This car would have maneuverability, reasonable speed, greatly increased

(Continued to page 162)



The two drawings above show how a civilian jeep can be given grace and style; short wheelbase is helped by single fender blending into body. Below, functionally streamlined truck with 22,000-pound payload capacity



*Powell Clark, Boy
5403, Metropolitan
Station
Los Angeles
Calif*

Movie Camera Swings With Girl To Film Rhythmic Action



Swinging girl (top) filmed by camera on platform (bottom)

In order to get close-up movies of the rhythmic motions of a girl in a swing, to accompany a musical number, cameramen at Republic studios devised a swinging camera platform. So the girl would remain in focus at all times, the swing seat was roped to a plank extending from the end of the swinging platform. As the camera swung to-and-fro the swing and girl traveled with it in the same arc, eight feet in front of the camera lens, resulting in a novel swinging photographic effect.

Marvin Camras

Sound Recorded on Fine Wire By Magnetic Impressions

Steel wire as fine as a human hair can be used for reproducing sound under a process developed by Armour Research Foundation of Chicago, affiliated with the

Illinois Institute of Technology. So fine is the wire that an eight-hour continuous recording can be wound on a spool five inches in diameter and two inches wide. The recording instrument is about the size of a typewriter. Unlike other systems, the recording is entirely by magnetic means, which causes no mechanical change in the wire. Sounds can be played back as soon as the recording is made, without processing of any sort. The wire will retain its recorded sound potential for years if desired, or it can be wiped clean instantly by passing it through a demagnetizer. Because of the recorder's small size and portability, and the inexpensive wire used, it is believed to have many applications.

Thin Tape and Bar Solder Applied Without an Iron

m 6.97

Solder supplied in two forms—one a flat, narrow tape and the other a bar—may be applied without the use of a soldering iron. The tape will solder most metals, except aluminum, and contains its own flux. In soldering small parts the tape is wrapped around or placed between them and the heat applied while the parts are pressed together. The bar, on the other hand, will solder radiators, motor blocks, aluminum, granite, porcelain, wood, tin and stone, besides copper, brass, galvanized iron, etc. It is only necessary to heat either the bar or the article to be soldered and rub the bar on the joint. The flame of a candle or match is usually sufficient.



Tape solder, left, and bar solder, right, need no more heat than the flame of a candle or match

Barclay Eng. Co., 385 Grand Ave., N.Y.C.

Plastic-Coated Wall Panel Has Lasting Finish

m 582

Construction of emergency housing can be speeded by using wall panels coated with a plastic needing no treatment after installation. Three types of finishes and ten different colors are available, and the coating is waterproof and washable with soap and water. A carpenter can install them quickly, using either brads or waterproof adhesive. The panels come in sheets as large as four by eight feet, and may be used for remodeling by application over old wall surfaces, as well as in new houses.

Three different types of plastic-coated wall paneling are shown here. The finish is permanent and saves the extra time and expense entailed where plaster or unfinished boards are applied



Portable Huts for Barracks Form Own Shipping Crates



m 615
Easy to assemble at military camps or war industry housing centers, a streamline cottage with arched roof is made in various sizes by a Los Angeles manufacturer. A two-man unit that can be assembled in two hours weighs 700 pounds and forms its own crate 4-by-4-by-10 feet for shipping. Larger models will house 10 or more men.

Arched sections and flooring are assembled quickly to form a military hut, and can be taken apart for shipment to new site. The pieces of a single unit form a crate when stacked together

Acme Newsprint Co. 461-8 av, N.Y.C.

WHEN THE SIREN SHRIEKS



As the siren screams over an air base, special detachment of ground troops, above, of the First Air Corps dashes from station in the hangar to take up positions covering the field. In a few seconds the base becomes beehive of activity both in the air and on the ground. Anti-aircraft guns sweep the sky in the direction of expected attack, fighter planes roar across the field, sharpshooters rush to their posts as loud speakers blare orders from the field headquarters



Defenders of America's coastal areas leap into action during a test alert conducted by the U. S. Army First Air Corps at an unidentified airfield. Before the air raid siren reaches its crescendo, every man on the field is in action. Months of secret drilling have resulted in perfect co-ordination between the various units. Above, orders are shouted through big speaker at the first note of the siren. At right, the general exodus from the barracks recreation room where a few minutes before pool and ping-pong were in order. Below, right, fighter pilots race toward their planes, fastening their helmets as they go. The planes are already being warmed up by the mechanics who jerked out chocks and set propellers spinning when the siren sounded. The soldier at far right is grinding a hand siren. In a few minutes the fighter pilots will be in the air, on their way to intercept enemy bombers. Meanwhile, "desk" soldiers at the field desert their typewriters and grab rifles and ammunition from sergeants in charge. Every man has a previously assigned post and duty and he knows every split second counts



Mary Elliott, Park Av N.Y.C.



Above, women and children are evacuated by jeeps from homes near the air field under attack. Specially trained soldiers direct the evacuation. One of their minor problems during a test alert is to get the children out of the jeeps after they arrive at destination. Their fondness for jeeps is only second to a merry-go-round. At right, donning equipment on the run, men pour from barracks to defend the field. Orders from their commanding officer are heard through the loud speakers over the door. Their enfilading fire will command field and wipe out any enemy paratroops

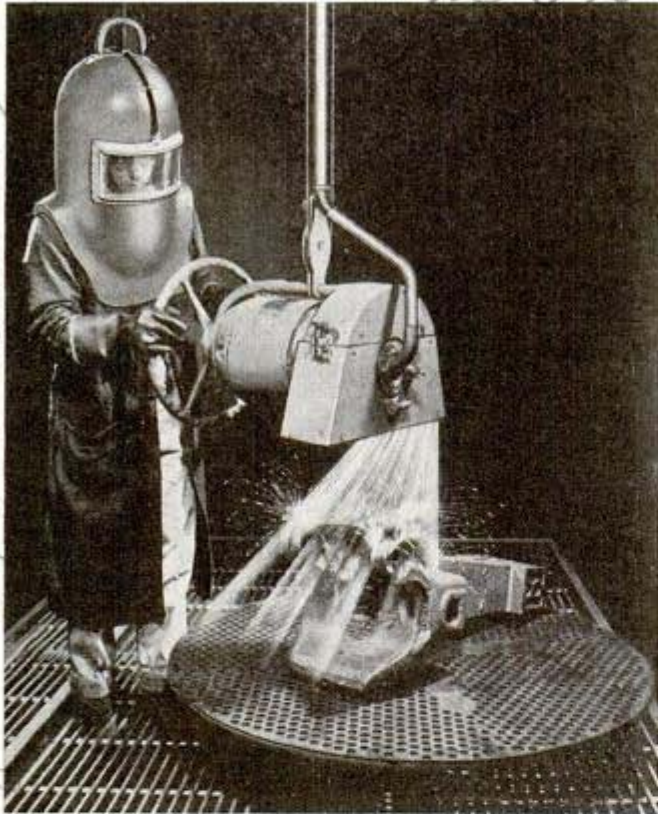


Take cover! The troops waste no time in occupying one of the many fox-holes, left, at strategic points about airfield. They would play havoc with a low-flying enemy pilot attempting to strafe the base with machine-gun fire. Planes in the background will not be caught on ground. Although the scene of a test alert at a coastal airfield has an air of confusion, movement of every man is planned

Man the guns! The crew of an antiaircraft machine gun unit springs to action with the clocklike precision of crack football backfield. The .50 caliber weapon will reach far up into the sky with a fiery reception for enemy bombers over the field. The gunners are experts at quickly distinguishing between enemy bombers and fighters and U. S. aircraft. The photographs on these pages are the answer of the Army air command to the query: What will happen if the enemy attacks?



Portable Airless Blast Cleaner Uses Centrifugal Force



Blaster slings sand mechanically instead of by force of air

Cleaning large or small metal products in the blast room can be done with greater ease by using a new portable blasting machine that throws the abrasive mechanically by centrifugal force instead of by air, eliminating the use of air compressor motors, pressure tanks, hose, valves and nozzles. Suspended by a cable with a spring balance, the machine can be raised or lowered easily, and the balance, in turn, is mounted on a carriage moving horizontally on a radial track so any point in the blasting area may be reached. Typical work cleaned by the machine includes lathe beds, gears, frames, valves and furnace castings.

"Rocket" Motor for "Subs" Said to Increase Range

German U-boats raiding the Atlantic coast are believed to be driven by a new type "rocket" motor, which would explain their greatly

increased range and effectiveness, according to "Sea Power," magazine of the Navy League. Burning oil fuel on the surface and a mixture of compressed hydrogen and oxygen when submerged, the motor, which is an adaptation of the usual Diesel engine, would eliminate electric batteries and electric motors as well as the danger from chlorine gas. It would permit construction of lighter, smaller and more easily maneuvered submarines capable of crash-diving with incredible speed and moving without leaving a telltale wake. The magazine points out that the single compressed-gas engine gives a small submarine a cruising range of at least 12,000 miles.

Dust From Long "Shaker" Smothers Fire Bomb

Incendiary bombs can be extinguished within thirty seconds, it is claimed, with a powder sprinkled from a long tube that anyone can handle. Because of its length, the tube permits the operator to remain six to eight feet from the burning bomb while shaking out the powder.



Smothering bomb with extinguishing dust poured from tube

POPULAR MECHANICS

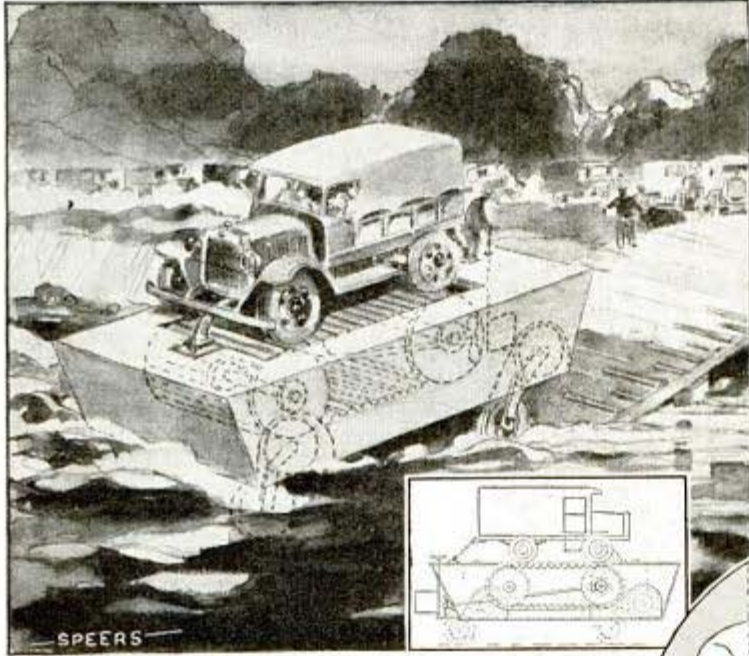
Dust!
Steinmetz + Kelly, Indee
Mail, Chicago

American Foundry Equipment Co
503 S. Bykit St. Michawaka, Ind
U.S. Naval Inst
Proceedings, July 42.

Frank G. Preston, Tacoma, Wash

Car-Driven Ferry Is Among New Inventions

m641



A raft designed for ferry service or military use, patented recently, is built like a pontoon with a treadmill forming part of the deck. The treadmill, operated by a truck or passenger car held in place by a brace and chains, is connected with a propeller shaft which extends through rear of the pontoon. The boat also has wheels so it can be loaded on land and then rolled down a ramp into the water.

Below, combination bookshelf and end table has an adjustable arm which is lifted vertically, then swung to a horizontal position to serve as a handy reading table.

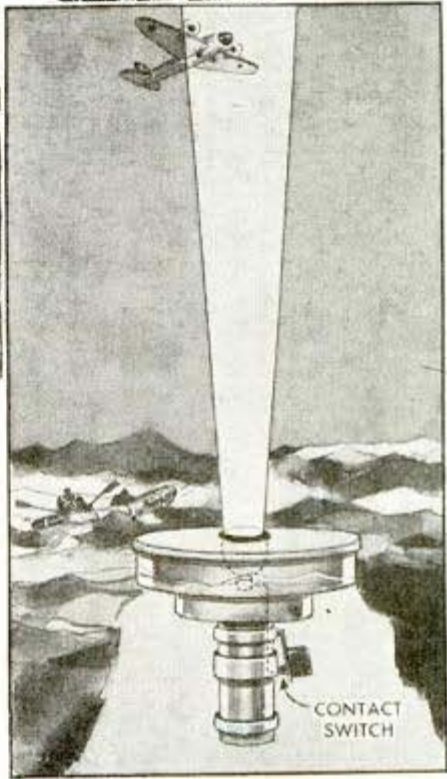
To foil holdups, the circular cashier's cage below has bulletproof wall sections that rotate inside a fixed wall to close the openings when a bandit whips out gun. Diagram shows how oppositely arranged sections operate



Abel Steinberg Chicago



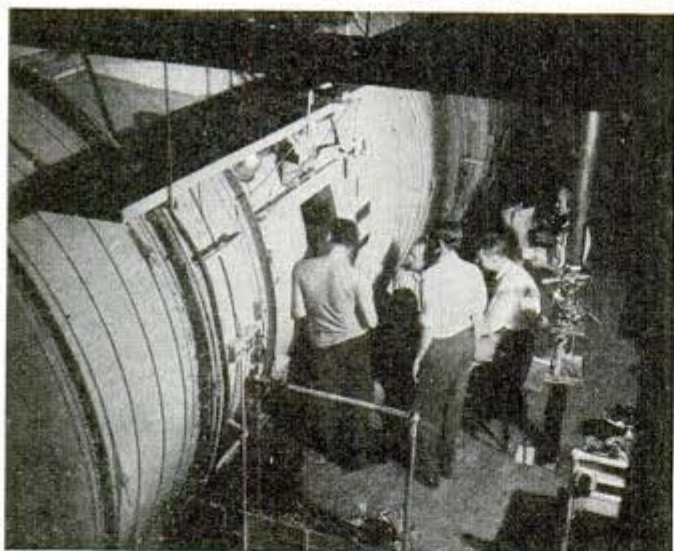
Another new device is the marine sky beam, right, constructed like a buoy with electric signal lamp in the top. The light is turned by a switch closed automatically by pressure of a material that expands as water drips through a small hole. All of the articles on this page were recently patented, but no other information is available for prospective purchasers



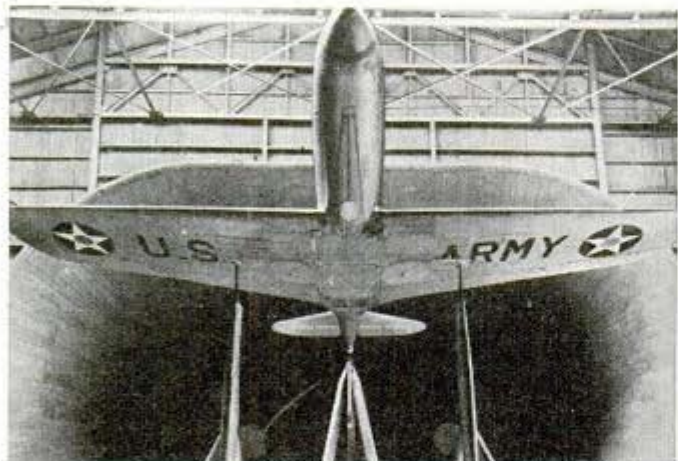
Benj A. Malan, Andover, Mass

Benj L. Berman Los Angeles Cal

CAGED "HURRICANE"

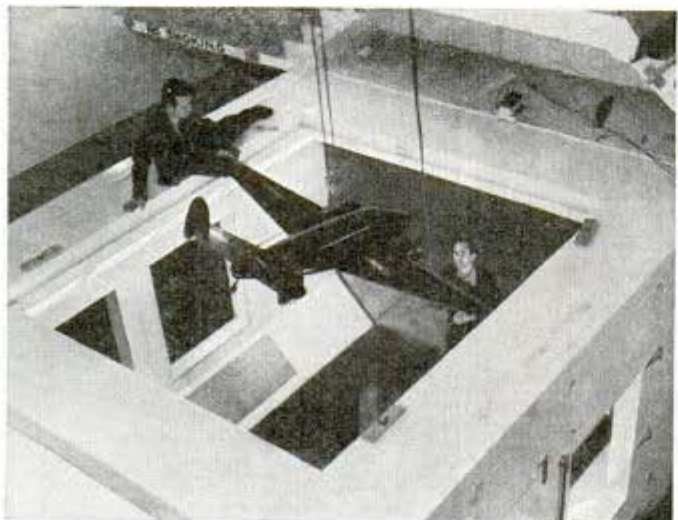


Douglas engineers watch a test run through the tunnel window



A full-scale model of Bell Airacobra in Langley Field tunnel

Lowering a model of Hudson bomber into Lockheed's wind tunnel



M 654
WORLD WAR II has plunged America into an all-out race in which this nation is pitted against competitors who planned and trained strenuously, then fired the starting gun themselves.

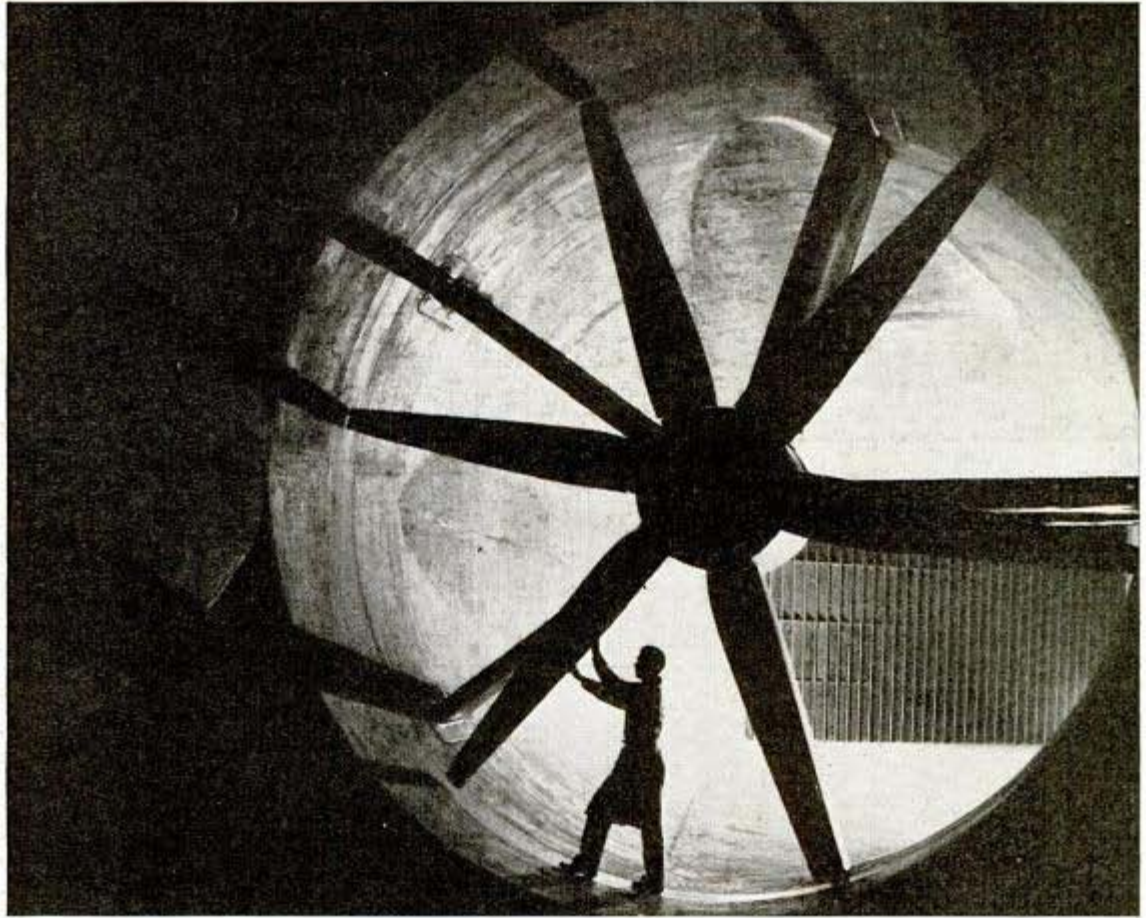
Under the handicap of an early lead piled up by his better-prepared enemies, peace-loving Uncle Sam has the almost superhuman task of matching and then surpassing the fast pace set by the Axis powers. Vast quantities of manpower and huge areas of factory space are two of the "muscles" just being flexed for the race, while lengthening of the stride also calls for research into the development of new weapons and the improvement of our existing tools of warfare.

This nation's air strength is expected to prove a major factor in the winning of this war and this fact makes of the utmost importance the recent completion of an extremely useful tool for building up the air forces—a wind tunnel more powerful for its size than any other in the world. This tunnel creates a 400-mile wind which can be directed over the surfaces of a model airplane in such a manner that engineers can determine how a full-size plane might be expected to react to air currents while traveling at 400 miles an hour, and faster.

It is safe to say that not a single airplane used by American forces in any part of the world went into service before being subjected to a wind-tunnel test of the utmost severity—that is, as complete as a test could be made with existing equipment. Perhaps the test was made on a scale model in a small-size tunnel or on a full-size model in the gigantic tunnel at Langley Field, Va., which is capable of creating a wind with a speed of less than 125 miles per hour. But this is not a satisfactory test for airplanes which will

Capt. J. P. Leggett, 2200 Far Hills Ave, Oakwood, Dayton, O

TESTS SUPER-PLANES



This 20-foot propeller can generate a 300-mile-an-hour wind to test Lockheed planes. In background are water-filled vanes which speed air flow around turn of tunnel and cool it by reducing friction

be called upon for speeds of 400 miles an hour and more in actual service.

Since the erection of a wind tunnel for testing full-size planes in a high-speed air blast would call for a vast expenditure of money, plus the engineering of motors more powerful than any ever built, the wind tunnel just completed at Wright Field in Ohio, represents an almost ideal combination of the small-size equipment and the full-size installation—it has high wind speed, 400 miles per hour, and it is large enough for the testing of models with a wing-spread of about 16 feet. A model of that size is sufficient for engineers to obtain readings so accurate that they will be applicable, in most cases, to the full-size

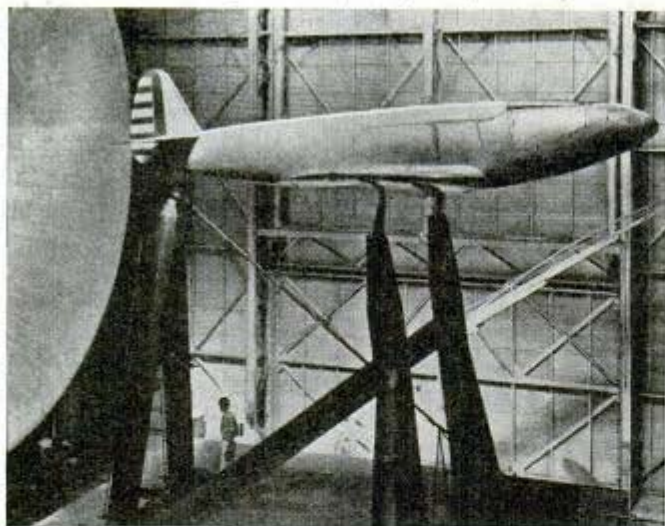
plane in operation. The Wright Field tunnel, built for testing of models of airplanes likely to be adopted for the use of the Army Air Corps, is literally a mass of superlatives. An electric motor of colossal horse-



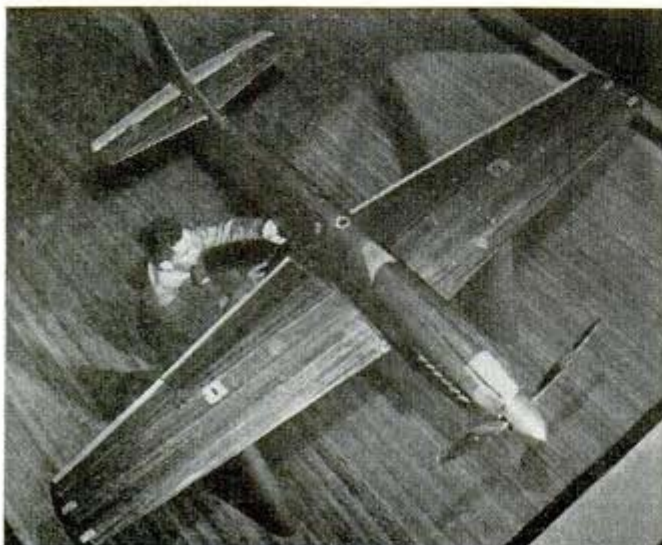
Douglas transport model is mounted upside down for special tests at California Tech

Courtesy - Wright Corp
30 Rockefeller Plaza, NYC

Воспроизведено по материалам архива



Above, Airacobra goes on test. Below, unusual view from inside Wright Field wind tunnel, camera aimed at "maw" from which powerful air jet is emitted



power rating drives two fans, each with 16 wooden blades, with a solid steel shaft 16 inches in diameter and 120 feet long. The two fans are each 40 feet in diameter, large enough to blow up more than a mild breeze, and they are used in tandem. Each blade weighs 1,500 pounds and each complete fan 394,000 pounds. Six tons of air pass through each fan per second. Centrifugal force tending to rip each blade from its mounting on the fan hub is close to 400,000 pounds when the hub is rotating at 300 revolutions per minute.

Just keeping the motor cool calls for 85,000 cubic feet of air to be filtered and forced through it every 60 seconds—and that's enough to supply the normal breathing requirements of about 100,000 people. Again, the motor, weighing 125 tons, is so large that a small truck could be driven through its core when the 50-ton rotor is removed.

How is it possible to build up a wind speed of 400 miles per hour when Mother Nature's hardest huffing and puffing rarely results in winds exceeding 100 miles per hour? The Air Corps engineers tell us that it is accomplished by "squeezing" the air current. Air driven at 100 miles per hour by the motor and fans passes suddenly from a 45-foot section of the tunnel into a section only 20 feet in diameter. Since the same amount of air is forced through the smaller section in the same time as it takes to pass through the larger section, the velocity of the air is quadrupled from 100 to 400 miles per hour.

Sealed off from the pressure exerted by the roaring blast is an air-conditioned control room from which the engineers may watch the 16-foot models suspended in the wind jet. This room, the "key" to all tests, contains all the instruments necessary for automatically measuring and recording the results of the tests. The model is so suspended that its position may be regulated by remote control and changes in its attitude can be made without shutting off the air jet. When the conditions for one de-

Installing a test model of P-51 Mustang fighter in North American Aviation's tunnel

sired point are correct, the engineer presses a button and all instrument readings are recorded automatically on tape.

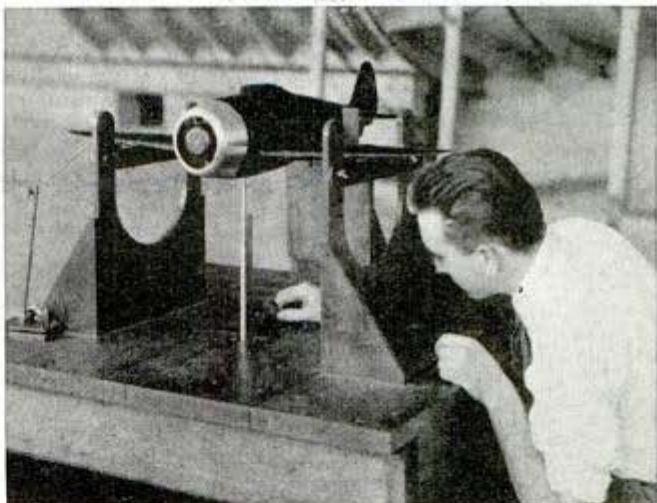
The tests involve the model's reaction to six kinds of forces exerted by air currents on an airplane in flight. Three are called forces—lift, drag and side forces—all tending to cause movement of the aircraft in the three dimensions; the other three are called moments—pitching, yawing and rolling. Pitching is turning end over end, yawing is twisting in a horizontal plane and rolling is a corkscrew motion. By properly linking up the model, the six reactions may be measured independently in pounds or ounces.

Work of the research men at Wright Field is directed primarily toward the practical aspects of flying warplanes, as distinguished from pure research. The idea, according to one engineer, is to find out how an existing airplane, or a new airplane, would be affected by proposed modifications in original or existing design; also how to get the best possible performance from each of Uncle Sam's military craft.

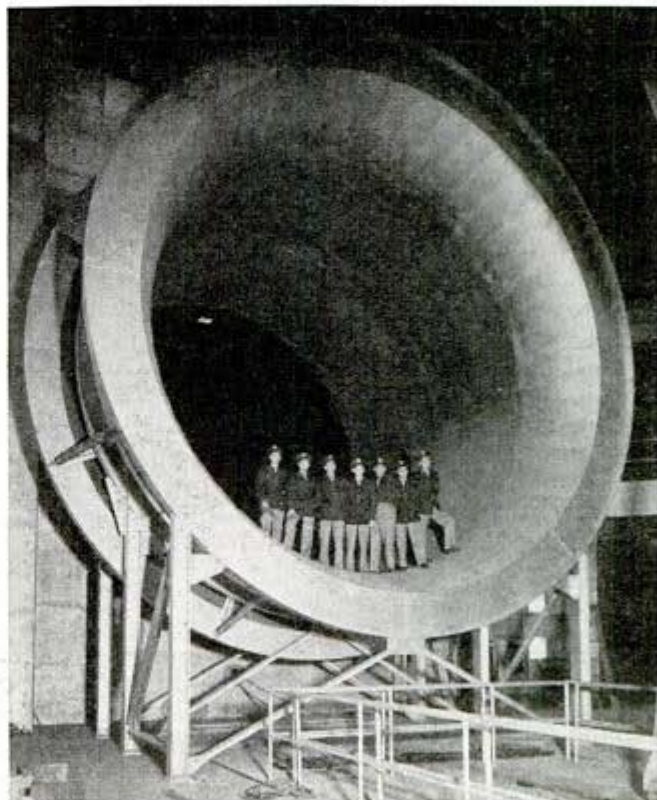
Thus, would one of the big bombers be able to fly faster if the gun turrets were shaped differently? Or, could more speed be extracted from a pursuit ship, without changing the engine to obtain more horsepower, by altering the wings?

Problems like these can be taken into the new wind tunnel and reliable answers obtained. And much new information regarding

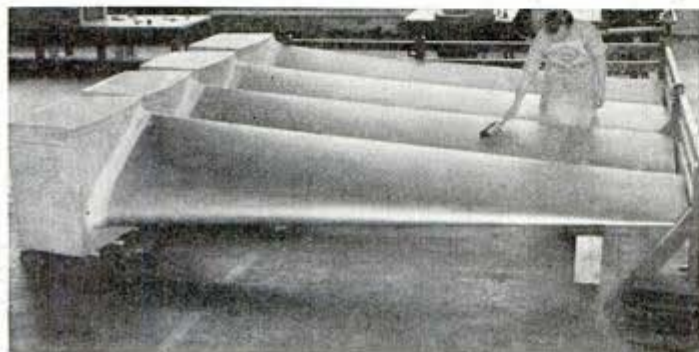
(Continued to page 172)



Every new plane is preceded by full-size models; before these come the miniature models like this pursuit type being set at proper angle of attack prior to adjusting it on balance for test



↑ Seven uniformed men stand in the "throat" of the 20-foot wind tunnel at Wright Field, giving an idea of the vastness of this "hurricane cage" used by U. S. Army for research that is developing for us the world's best planes



← Resembling aircraft wings, these are fan blades for a wind generator nearing completion. The final step will be to shape the blocks at the base and install the parts which anchor the giant blades to the rim of the metal fan hub

*Dist. Gaidblatt Bros
60 N. Van Buren, Chicago*

Wrenches on "Screwdriver" Fit Nuts of Five Sizes

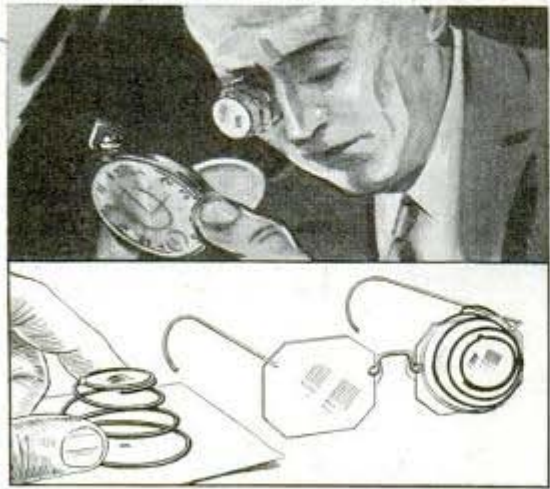


Wrench units fitting five sizes are carried on shaft

Hexagon nuts and bolts are turned on or off in screwdriver fashion with a socket wrench set that stores units of five different sizes on the shaft. Small catches on the shaft prevent the handle and wrenches from slipping off accidentally. The shaft is removed from the handle in order to get the desired wrench unit.

Magnifier on Light Coil Spring Has Variety of Uses

Several applications are possible with a magnifying lens mounted in a metal rim and soldered to a lightweight coil spring. For examining stamps and other small-size

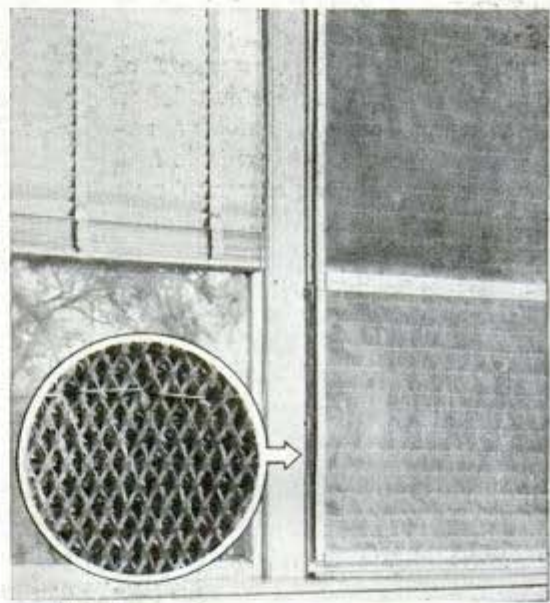


Here are three ways to use spring-mounted magnifier

items it may be placed upright over the specimen for viewing at ordinary reading distance. If closer adjustment is needed the lens can be brought nearer the object by slight pressure upon the rim. Because of its light weight, the magnifier may be worn over the eye like a jeweler's loupe or slipped over the wearer's eyeglasses. For safekeeping a leather case is supplied in which the instrument, compressed flat, may be tucked.

Blackout Screen Catches Glass Shattered by Explosion

Dependable protection from the perils of flying glass blown inward by an exploding bomb can be obtained by covering the window with a new blackout screen that per-



Circle is magnified view of porous blackout screen

mits the force of air to penetrate but stops the shattered glass. Made up of 16 layers of black flameproof expanded fiber and four layers of light-colored similar fiber, the blanketlike screen is porous to air, but woven closely enough for opacity and strongly enough to stop splintered glass from passing through. The material is mounted in light wooden frames so it may be attached easily to the inside of windows, skylights and door glass.

Write to the firms listed in the Where-to-Buy-It index, to learn more about products described in this magazine. Say You Saw It in Popular Mechanics.

*Research Products Corp
1015 E. Washington Ave
Madison, Wis*

*Genetank - Adus Co
60 N. Van Buren, Chicago*



The CRAFTSMAN



Hand-carved "LAPELLIERES"

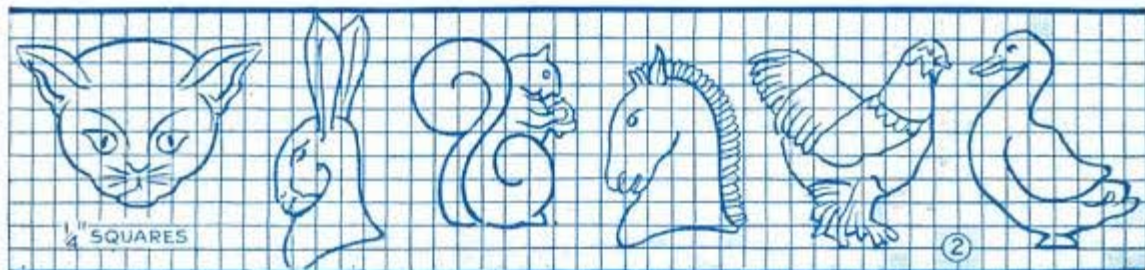
Fifteen novel dress-pin designs to carve in wood. All you need is a coping saw, a jackknife and sandpaper

By Elmer J. Tangerman

YOU'LL want to remember someone this Christmas with a gift of these smart wooden dress ornaments. They're fun to carve and not at all difficult, as the photos in Figs. 1 and 5 make it easy for you to see just where to whittle and the right contour to duplicate. Patterns for the ornaments shown in Fig. 1 are given on squares in Fig. 2, so that they can be readily enlarged for tracing on $\frac{3}{16}$ -in. stock. Hardwoods, such as maple, walnut, mahogany, cherry,



After scroll-sawing a figure roughly to size, it's easy to carve it with a jackknife and sandpaper to a smooth finish



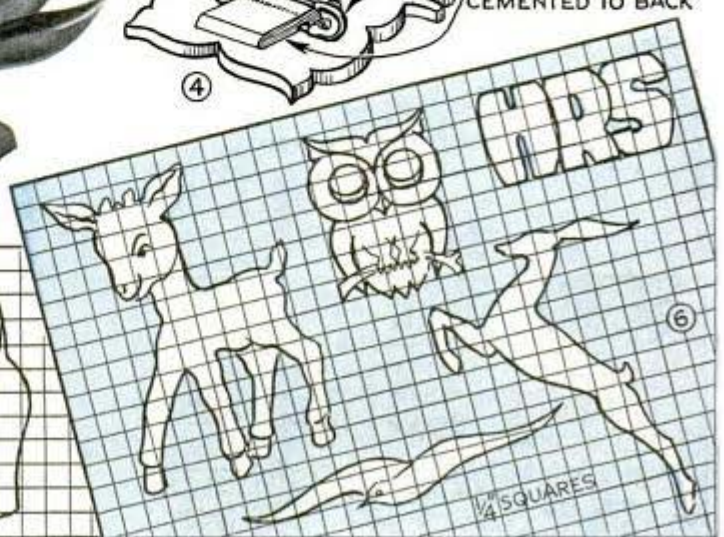
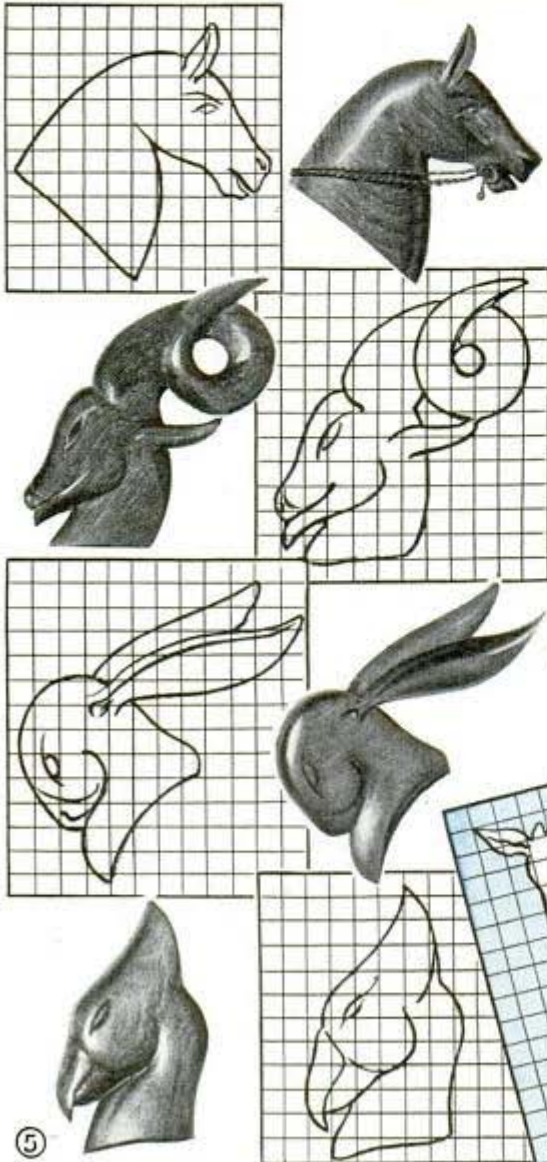


etc., are preferred to softwoods, as the cross grain is stronger and a higher polish can be had in finishing.

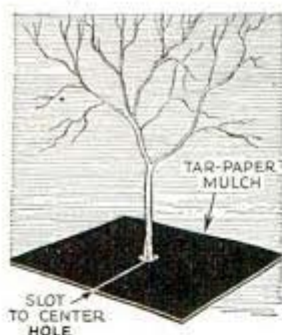
If you have a scroll saw, you can saw out as many as ten blanks of one kind at a time by stacking and bradding the layers together. In carving, mouth and eyes are outlined with clean-cut V-grooves while contours are shaped by sloping the cut to meet a vertical one. For example, the squirrel's body and tail in Fig. 1 are formed by the latter method, the eye being simply a deep V-cut accentuated with black ink.

The ornaments can be sanded or left rough-carved and may be finished with several coats of hot linseed oil rubbed to a rich luster with a soft cloth, or finished with wax, shellac or varnish. Toning provides still another variation for finishing the figures. For instance, the little fawn, shown in Fig. 6, can be two-toned by staining the hoofs and nose black and the upper part of the body and legs brown.

Fig. 4 shows how a common safety pin can be attached to the back of the figures to provide a suitable clasp, or clasps made for the purpose can be purchased. Monograms, Fig. 6, and belt buckles, Fig. 3, are other examples of what can be done.



Paper Mulch Aids Young Trees



When a small tree is transplanted, much of your success in saving it depends on keeping plenty of moisture around the roots for the first few months. One way to assure this is to mix plenty of peat moss with the soil and then place a large square of tar paper on top of the ground around the tree. This helps to slow evaporation of moisture from the soil.

Rod to Steady Scaffold Plank

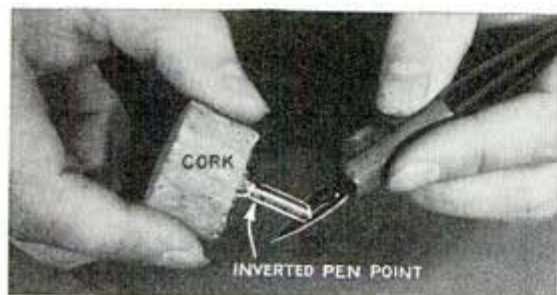
Painters and paperhangers who employ stepladders to support planks used for indoor scaffolds often are annoyed by having the planks tip when their weight is thrown on one side or the other. To avoid this, one



painter uses steel rods, which are inserted through holes in the side of the ladder so that the plank is held firmly between the rod and ladder step. When not in use, the rods are carried in screw eyes driven into the sides of the ladders.

Simple Cleaner for Pen Point

Try using a simple tool like the one shown to remove dried ink and corrosion from a pen point. This consists merely of a large cork with a pen point inserted into it in an inverted position. The tool is used as shown in the photo.



Closet-Door Rack Holds Cleaner And Set of Attachments



The problem of storing a vacuum cleaner and attachments led one home owner to construct a simple rack for them on the back of a closet door. A piece of plywood was first cut to cover most of the inside door surface, after which this was laid on the floor so that the cleaner and attachments could be arranged on it and positions marked to take advantage of all available space. The holding units consisted of short lengths of dowels forced into holes bored in the plywood panel. Before driving these in place, however, a hole was drilled near the end of each one for a peg as shown. The cleaning unit rests on a small platform and is held upright by wooden turnbuttons.

Poultry Wire Stiffened by Stays

To prevent his poultry-yard fences from sagging and twisting out of line, one poultryman threads heavy wire stays through the netting as shown. These extend the full height of the wire.



Solving HOME



DOWEL ADHESIVE TAPE



CLOTH-WRAPPED BRICK



LIQUID WAX IN OILCAN

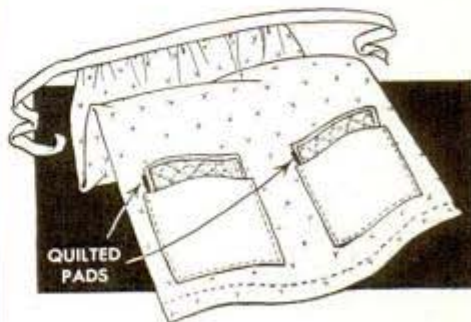


BENT OVER END OF PIPE

Consisting of a small dowel wedged between the casing of an open window, the "clothesline" at the left is ideal for drying small laundered articles. A pouring spout formed at the edge of a pot lid, as shown above, which is made by hammering the lid over a rod, will help to avoid bad scalds when draining cooked vegetables



A cloth-wrapped brick is a handy item in your sewing room, as any work that must be held taut while sewing it can be pinned to the brick as shown at the left. You can keep a recipe card clean while using it by inserting it between the tines of a table fork to hold it at a readable angle when it is laid on the kitchen table



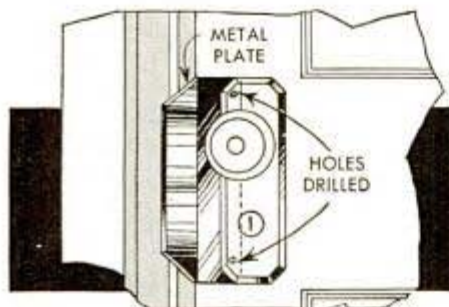
QUILTED PADS

Left, keep a supply of liquid wax polish in an oilcan and you will find it handy for applying wax to the runners of a drawer that sticks. Instead of carrying sponge pads around to kneel on while doing work in the house, provide your apron with pockets in the lower corners so that pads can be inserted as shown above

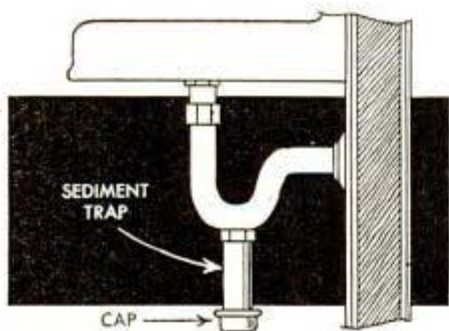
PROBLEMS



After his small son had been burned trying to retrieve a ball under a radiator, a father tacked a strip of linoleum to a pair of tapered blocks and slipped it under the radiator as shown at the right. One housewife prevents stove legs from marring her linoleum by putting press-top can covers under them as shown above.



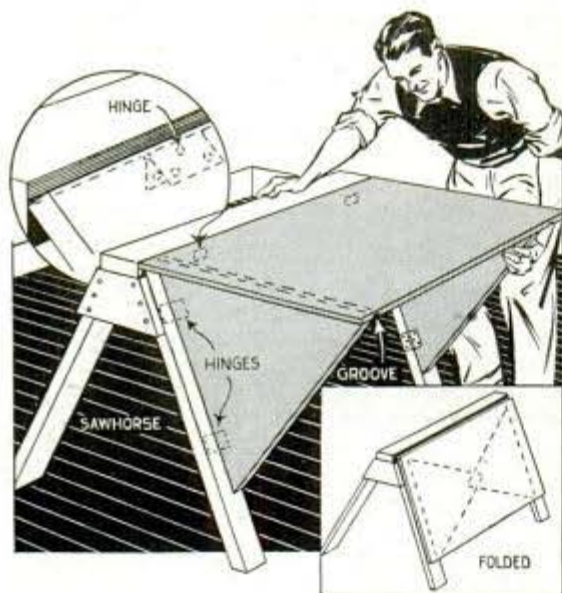
A home owner converted the lower half of a linen closet into a clothes hamper by cutting the closet door in half as at the right. If you often injure your knuckles on the jamb when opening or closing a door, a piece of sheet metal bent at right angles and slipped under the lock plate will provide a protective shield.



The jolly chef at the right laughingly dispenses paper towels in the kitchen. He is jigsawed from plywood and painted to suit. On laundry tubs and older types of kitchen sinks having a drain plug on the trap, a pipe nipple to replace the plug as above will catch sediment and make cleaning periods less frequent.



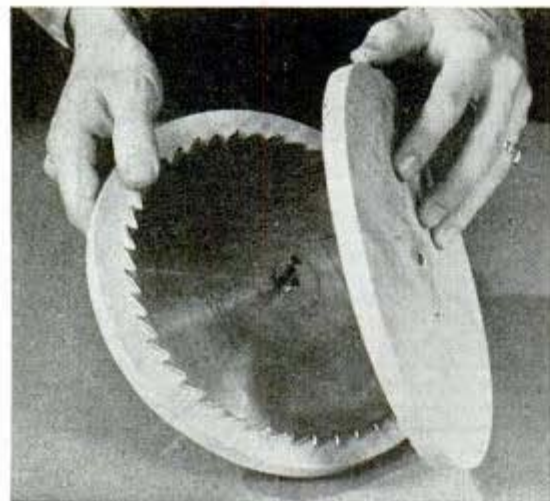
Folding Leaf Hinged to Sawhorse Makes a Work Table



Hinged to the top side of a sawhorse, a wooden leaf provides a sizeable working surface that can be folded out of the way when not needed. The leaf is supported by triangular side pieces which are hinged to the legs of the sawhorse as indicated. The supports when opened out fit into grooves on the underside of the leaf. When folded, the supports and leaf are held parallel to the side of the sawhorse by the hinges.

Protect Teeth of Circular Saw When Blade Is in Storage

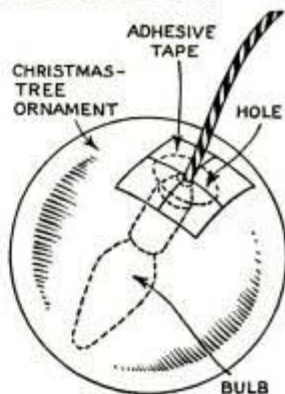
Teeth of cordwood saws and other circular-saw blades are often damaged more in storage than in actual use. One effective way to protect the blade from damage



and rust is to cut two disks of $\frac{1}{2}$ -in. plywood, each 2 in. larger than the blade and centerdrill them for a $\frac{1}{2}$ -in. bolt. Then coat the saw with heavy oil, place one disk on each side and bolt them together.

Illuminated Christmas-Tree Ball Produces Colorful Effect

By illuminating the glass-ball decorations on your Christmas tree you can give it a more colorful appearance without additional cost for the purchase of more lights. To illuminate the balls, just break off the necks to provide



holes large enough for the insertion of a tree lamp in each one. A piece of adhesive tape slit from one side to the center will hold the bulb in place. Tint the tape the color of the ball, using water colors.

How to Remove Glazier's Points



Time and labor can be saved when removing glazier's points from a sash if the projecting ends are bent upward. When bent in this manner, the points are pried out with a screwdriver.

Compact Refills Made Easily

Refills for your face-powder compact of any desired shape or color can be made at little cost, using loose powder which is available in economic sizes and a variety of colors. First, prepare a binding agent by dissolving powdered gum acacia, $2\frac{1}{4}$ grains, in water, $\frac{1}{4}$ fl. oz. Then add tincture of benzoin, 15 drops, and mix thoroughly. To one ounce of face powder stir in sufficient binder to form a stiff paste. If the powder is not already perfumed, add two or three drops of perfume while stirring. Press the paste into molds and let dry.

—H. Lemberger, Chicago.

Tree Stand Is Scenic Layout for Toy Train

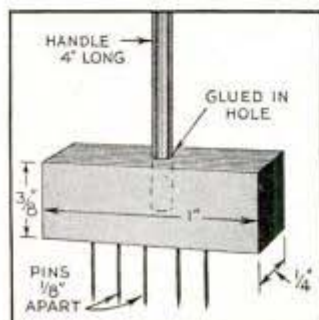


Simulating a miniature snow-covered mountain, this attractive Christmas-tree base, which includes a toy-train layout, can be made in a couple of hours from a few burlap sacks, scrap lumber and plaster of Paris. Although exact dimensions depend upon the particular tree at hand, you start by making a square frame, using boards at least 3 in. wide. Then a box-shaped tree holder is assembled and braced securely as shown, after which pieces of burlap are selected to fit over the entire framework. These are saturated thoroughly with plaster of Paris by dipping them in the mixture. When draped over the framework, all exposed edges of the burlap are covered with the plaster to provide a rough surface, which gives the desired snow-covered effect. Novelties that help to complete the mountain scene in-



clude a miniature lake, made by placing a sheet of blue paper under a piece of window glass, toy houses, trees, animals, etc.

Music Sheets Are Ruled Easily With This Simple Marker



Those who rule their own sheets of paper for copying or writing music will find this inexpensive staff marker a real time saver. To make it, just file or cut off the heads from five pins, drive them into a small block of wood and fit a short handle to the block as shown. In use, a new sheet of carbon paper is placed on a sheet of white paper, and then a rule is used as a guide for the staff marker.

By placing about a half cup of kerosene in the garbage can, worms will not form and flies will not lay eggs there to hatch. It also lessens the odor from the can.

SIGHTING IN



By W. C. Lamme

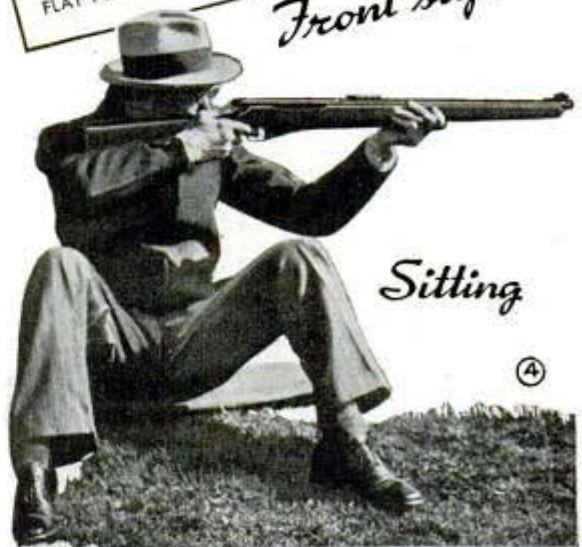
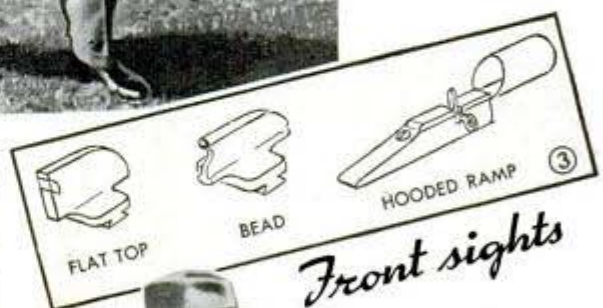
ACCURATE rifle shooting, either in competition over a given range or in the field on live game is a matter of good eye and muscular coordination. The shooter must train his faculties by persistent and continuous practice.

There are four generally accepted body positions, Figs. 1, 2, 4 and 5. Hunters make use of all of them on occasion, but the range rifleman usually takes the prone position because it is the steadiest of all and is generally required by the range rules. The standing position is used by serious riflemen only for quick shots at moving game in the field or for exhibition shooting at objects thrown in the air or moved horizontally by some mechanical device. The kneeling and sitting positions are much steadier for long shots in the field, and, where game is unaware of the hunter's presence, the prone position is often taken and the sling made use of to steady the shot over extremely long ranges. In the prone position, the body, trained to the stance, is largely at rest,

relaxed. The arms, bent at the elbows and the latter serving as points of support, form rough triangles. Another triangular support or arch is formed by the inclination of the forearms, while the head, with cheek resting on the rifle stock, becomes a keystone which "locks" the structure. The gun-sling acts as a brace to neutralize any muscular tremor and prevent its being transmitted to the rifle barrel. It is largely due to mastery of this shooting

position that range riflemen can turn in almost unbelievably high scores consistently.

But, it isn't just position alone. The rifle is important, and most of all, the sights. Reputable rifle makers have taken care



YOUR RIFLE

of such mechanical details as barrel accuracy, cartridge head spacing, trigger pulls, shape of the stock and the like. No need to worry about that. But the actual sighting in of a rifle is up to you before you can expect to do accurate shooting. Rifle sights are of many variations but they all fall roughly into three groups, the first being the so-called "open" sights consisting of a V-notched rear sight on the barrel back near the receiver and a bead front sight, Fig. 3, near the muzzle. Second, comes the aperture or "peep" rear sight, Figs. 10 and 15, mounted on the receiver within a few inches of the eye and combined with a flat-top, bead, or hooded ramp front sight,

This rifle combines many of the features of both the target and sporting rifles. It is suitable for either hunting or non-competitive target shooting

SHOTGUN-TYPE BUTTSTOCK
LARGE, FULL PISTOL GRIP
REAR SLING SWIVEL
LOADING PORT



Prone ⑤

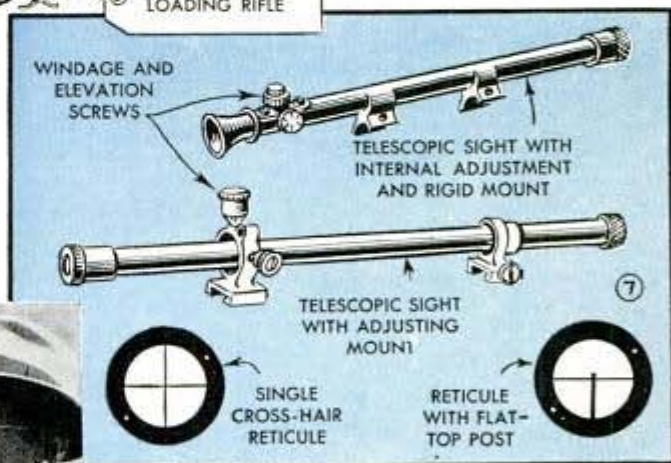
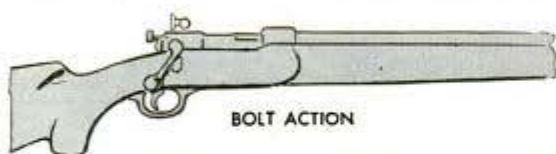
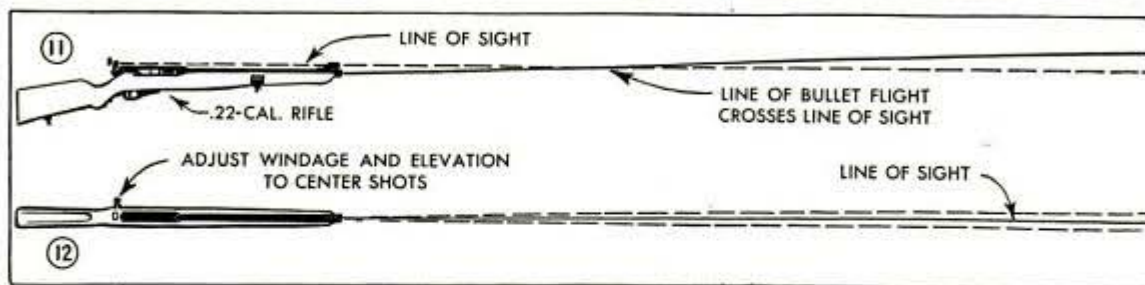


Fig. 3. These two groups are known to range riflemen as "iron" sights. Thirdly, there are two general types of telescopic sights, Fig. 7, either of which makes the iron sights unnecessary. Range shooters generally use the types having an adjustable mount and a single crosshair reticule, Fig. 7, while hunters prefer the type with internal windage and elevation adjustments and a rigid mount, which makes the sight less likely to get out of adjustment. Reticules with a flat-top post are generally used for hunting, Figs. 7 and 24.

Rifles are of four general types distinguished by the design of the action. The bolt-action, Fig. 13, is used for both target



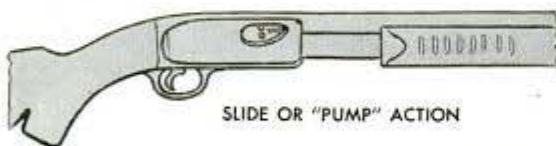
Gunslung-right



BOLT ACTION



LEVER ACTION



SLIDE OR "PUMP" ACTION



Sandbag rest

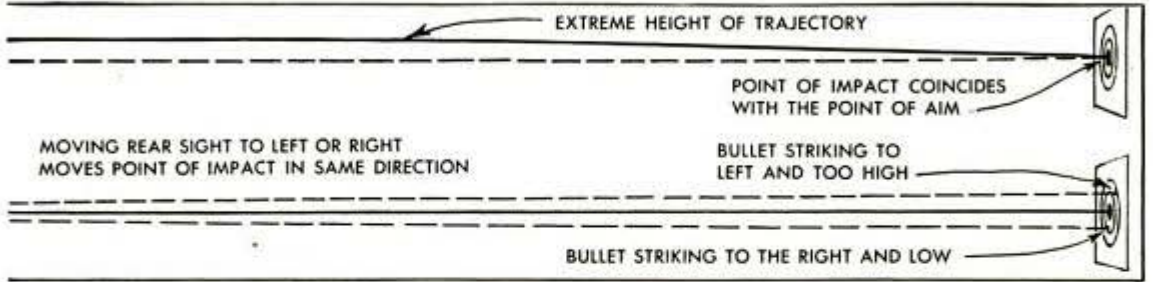
What takes place when aiming a rifle and firing it is shown in Figs. 11 and 12, which have purposely exaggerated details. When in a prone position, a good rest for high and low-power rifles is made by packing a small bag with material such as sand, sawdust, upholstery hair or straw. Don't use a stone or block

shooting and hunting and comes in both sporting and target types, the former being much lighter. Lever and slide-action rifles are used almost exclusively for hunting. Another type of rifle in the popular .22-cal. bore, which is a combination of both target and sporting rifles and in addition, is a fast, self-loading type, is shown in Fig. 6. Although such a rifle is practical for both hunting and noncompetitive target practice, manufacturers and shooters say that, due to the rapid reloading mechanism and a looser chamber, it is not quite as accurate as the more expensive target rifle with its extra heavy barrel, tight chambering and precision-fitted bolt. Essentially the same thing is true of the lever and slide-action rifles.

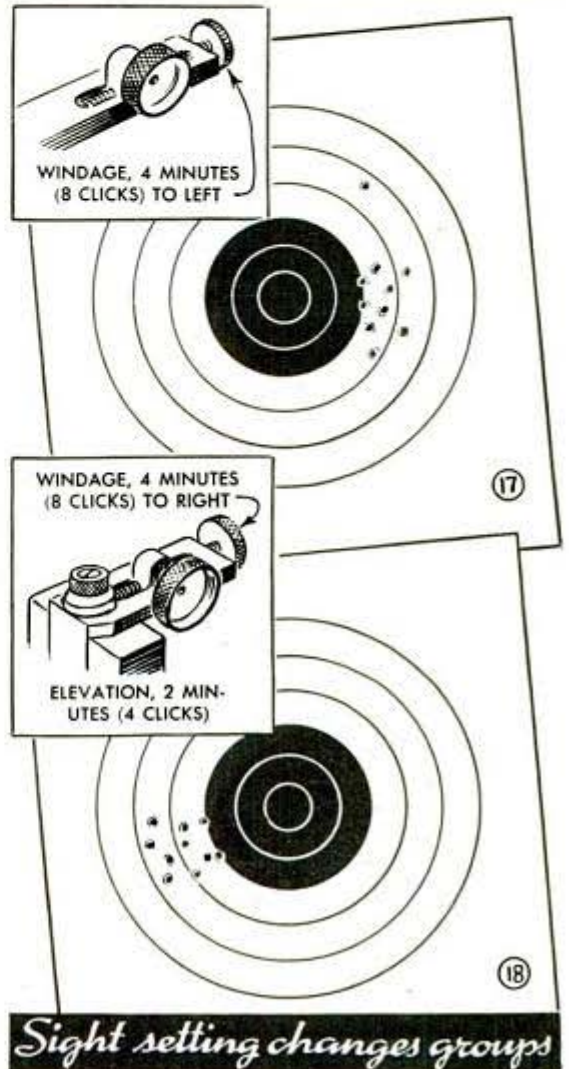
Now, to get in mind the necessity of sighting in a rifle for either hunting or target work, look at Figs. 11 and 12, which are purposely exaggerated details to show what takes place when you aim through the sights at an object and fire. In Fig. 11 the sights are correctly set for a particular rifle and a cartridge of given ballistical performance. If you change to another cartridge of the same caliber but of different ballistics, you would have to reset the sights to get the same result over a given range. In Fig. 11 the rifle is sighted for what riflemen generally call a point-blank range. This can be any practical distance, 50, 75, 100 yds. or more. Tables of ballistics, available from manufacturers, give com-



16
Gunslung-left



plete data on the trajectory curves of rifle cartridges they supply. Fig. 12 shows how the bullets may group on the paper target to the left and too high, to the right and too low, or anywhere else on the surface in relation to the X-ring or bull's-eye. In either of the two examples shown you will have to make both a windage and elevation adjustment of the rear sight to correct the error. This is done by moving the aperture of the rear sight to the left or right and up or down. Where an open rear sight, Fig. 6, is used, it can be moved right or left and up or down with whatever adjustments are provided. More trial rounds are necessary to correct an error with this latter type of sight. The aperture sight in Fig. 10 is a simple, inexpensive type designed for the shooter who wishes to sight in his rifle for a given range and keep this setting for small game and pest shooting, and an occasional round at the targets. The sight shown in Fig. 15 is indispensable to the target rifleman and is a much more elaborate affair with precision micrometer screws and elevation and windage scales graduated in minutes of angle. One common feature of both sights is that the adjusting screws are fitted with a mechanism that clicks audibly as you turn the screws. On most sights of this type one click represents a half minute of angle although some designed for fine work are graduated in quarter minutes. One half minute of angle means that the point of



Sight setting changes groups



impact will be moved $\frac{1}{2}$ in. on the target at a distance of 100 yards, one minute of angle being the equivalent of 1 in. per 100 yards. Now, with this sort of reckoning, Fig. 17 shows what you do with the rear peep sight when a ten-round trial string turns up an off-center group on the 100-yd. target. Here you want to move the group approximately 4 in. to the left, disregarding the one wild shot which might have gone high for any one of a number of reasons. It should be kept in mind that the setting given is only an approximation. In the first place, it is unlikely that you will ever exactly duplicate the group shown, and some minor peculiarity of rifle or sight might require a slightly different setting to

accomplish the desired result. The same is true of the group and settings in Fig. 18. Here both a windage and elevation adjustment are required. Although 10-shot strings are shown, it is usually necessary to fire only 5-shot strings in order to center a group by sight adjustment.

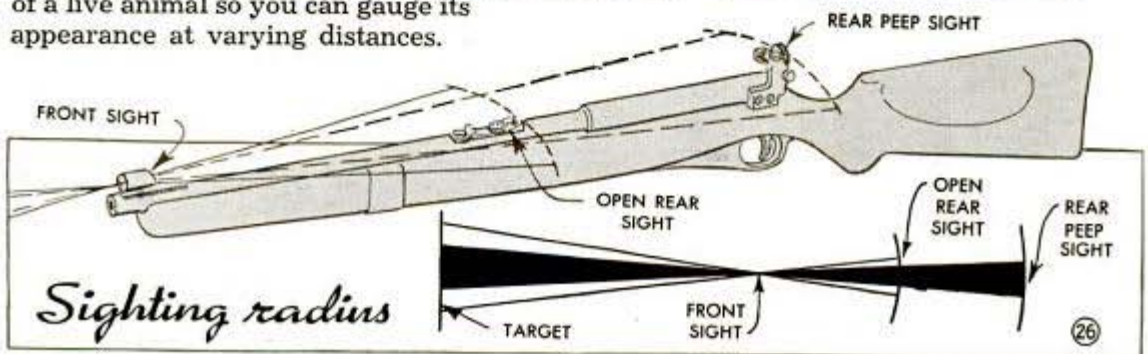
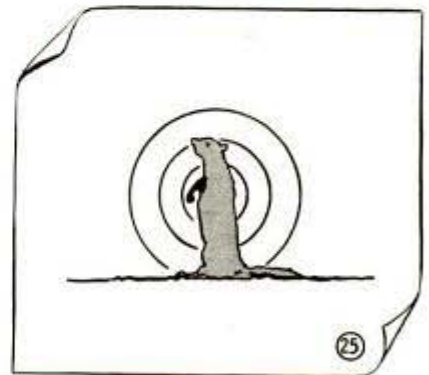
Most shooters who wish to do both game hunting and occasional target shooting, or hunting exclusively, sight in the rifle for a point-blank range of say 75 yds. At shorter ranges, as 50 yds., they hold slightly under the point they wish the bullet to strike and proportionately over for longer ranges. If you are to go after large game in open country where the shooting will be at comparatively long ranges with a high-power rifle and ammunition giving a flat trajectory, you should sight in for a longer point-blank range. In this case the range rifleman has one advantage over the hunter in that he knows the range beforehand and can set his sights accordingly. But he still has to cope with the same unknown factors; both he and the hunter must estimate as accurately as possible the drift of the bullet over long ranges due to a strong cross wind and under certain conditions light refraction can be the cause of error. Most hunters using a flat-top front sight want the rifle sighted so that the top edge of the sight just touches the lower edge of the bull's-eye when aimed on the point-blank range. In this way the sight does not obscure the object. See Fig. 20. Some target shooters prefer to have the round bead centered over the bull's-eye, Fig. 21, and when using a telescopic sight they want the crosshairs to quarter the bull's-eye as in Fig. 22.

Figs. 8, 9 and 16 show how to get into a gunsling of the military type and how most shooters use it in the prone position. But to sight the rifle properly without



a sling one must provide additional aid to steady holding. A good rest for both high- and low-power rifles can be made by packing a bag with material such as sawdust, curled upholstery hair or straw, Fig. 14. Never use a block of wood or rest the barrel on a solid object, particularly with a high-power rifle. Before firing a sighting string, clean all oil or grease out of the bore, wipe dry, and then fire two or three random shots to foul the barrel so that it will give consistent groups. The first shot through a clean barrel will usually strike higher than following shots, an example being the high one in Fig. 17. Another suitable rest, to be used with the sitting position, is shown in Fig. 23. It consists of crossed sticks held together with a stove-bolt and wingnut. Although not as steady as the sandbag or the prone position with sling, it will serve for any but the most critical work. It's especially good with a small-bore rifle where there is negligible recoil and minimum barrel vibration. When you're ready to fire the first string of test rounds there comes the technique of the trigger squeeze. To avoid any tension, jerk or other movement in pulling the trigger which might change the position of the rifle barrel, most shooters grasp the tang or grip well up so as to bring the middle joint of the index finger on the trigger, Fig. 19. In this way, after some individual practice, the trigger can be released by simply tightening the grip slowly and uniformly. If you pull with the finger alone the muscular tension may cause a tremor. Some target rifles are fitted with an adjustable trigger pull which makes it easy to lighten the pull to individual preferences.

Fig. 26 shows in exaggerated detail the advantage of the longer sighting radius of the peep sight and how it tends to minimize any error in aiming, particularly for long shots. For close shots at moving game and for exhibition shooting, many riflemen still prefer the open rear sight. To make casual target shooting more animated, you can have a lot of fun by cutting silhouettes of small animals and pasting these over the standard paper targets as in Fig. 25. The silhouettes should be the approximate size of a live animal so you can gauge its appearance at varying distances.



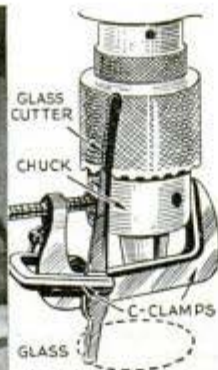
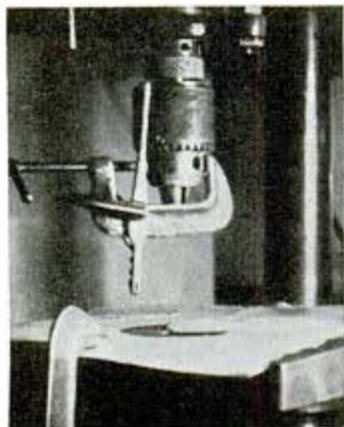
How to Figure Coal Bin Capacity In Tons of Fuel



Should you move into a different home and wish to know the capacity of the coal bin before ordering your fuel, here is a way to find out the exact number of tons that it will hold. Multiply the length by the width by the height in feet, and then multiply the result by 56 for hard coal and by 50 for soft coal. Divide the figure by 2,000, which will give you the number of tons of fuel the bin will hold.

Drill Press Used as Glass Cutter

Here is a simple way to rig up your drill press so that it can be used to cut circular openings in glass. Using two C-clamps and a glass cutter assembled on the drill press as shown, making the opening is merely a matter of rotating the drill press by hand. Diameter of the circle that can be cut is limited only by the length of the C-clamp that is used on the chuck. It is necessary of course, to cut straight lines at an angle



from a circular score before breaking the glass. If this is not done the glass may break directly across the circular score.

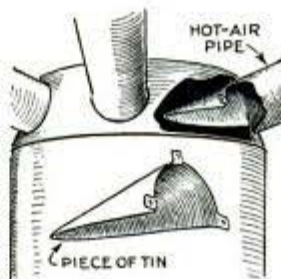
—Roy Ellis, Hutchinson, Kans.

Emergency Eave-Gutter Strainer From Slotted Tin Can

Just slot a tin can as indicated and insert it into the upper end of the downspout if you need a leaf strainer for an eave gutter and none is available. While not permanent, such a strainer will last for many months, or until a suitable one can be obtained.



Circulation in Hot-Air Pipe Improved by Hood



If you have trouble heating a room in your home because of poor circulation through the furnace pipe leading to it, try putting a sheet-metal hood at the end of the

pipe inside the furnace bonnet. Shape and attach the hood as shown so that it will tend to direct the rising heated air into the pipe, and thus cause the air to travel faster to the room. In some cases, it may be necessary to experiment with the hood in different positions to get best results before anchoring it permanently in place.

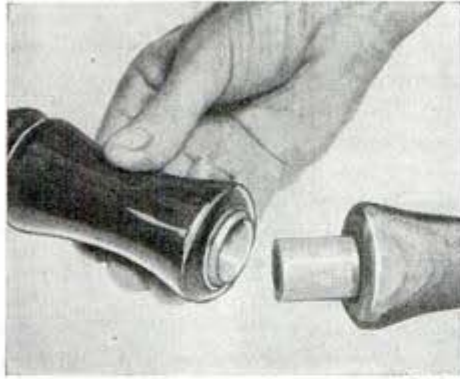
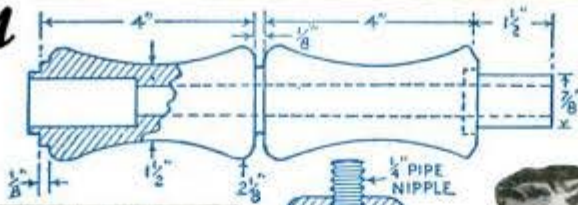
—Corneal DeWitt, Zeeland, Mich.

Paint to Use in Smoky Districts

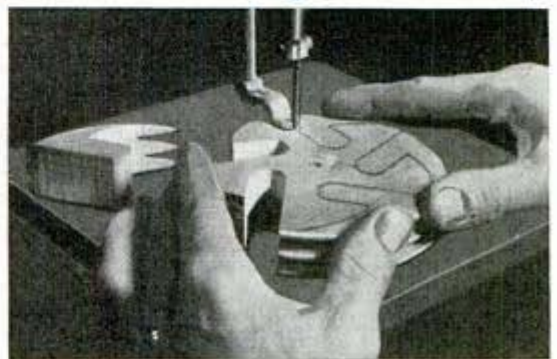
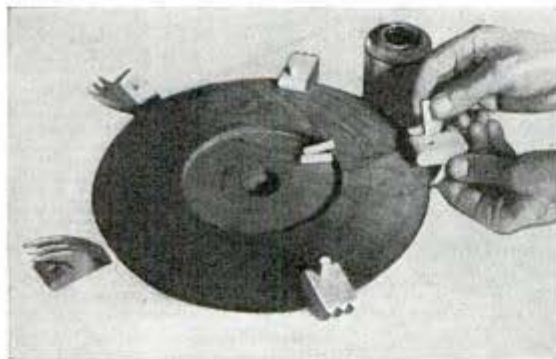
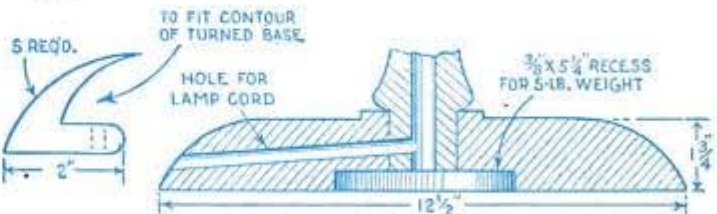
When painting a building white in industrial localities where there is smoke in the air, use a paint with a zinc base instead of white lead. If the latter is used, sulphur in the smoke combines chemically with the lead and forms lead sulphide, which is black, thus giving the building a dirty appearance. However, if paint with a zinc base is used, the zinc forms zinc sulphide which is white, thus the building remains white as long as there is any paint on it.

Spool-
design

FLOOR LAMP



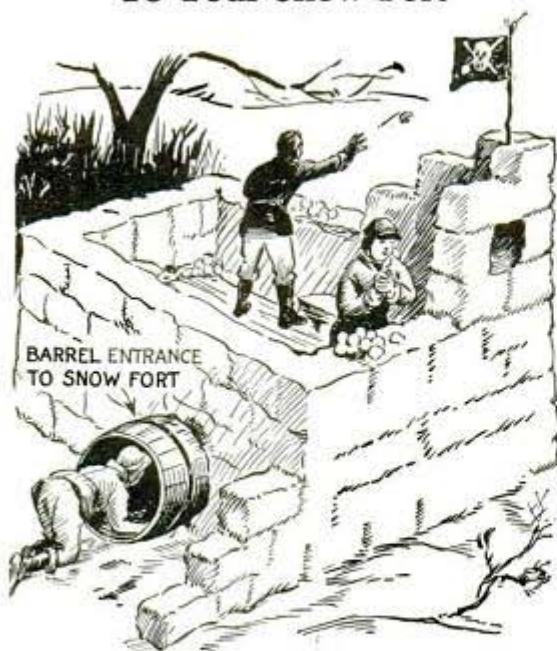
In making this attractive lamp, short sections are turned to the shape shown in the upper detail, and glued together to form a standard that appears to be a long, continuous turning. This method of assembly is easier than turning a long standard and boring it for the electrical cord. When fitting the sections together, the grain of the wood should be matched as nearly as possible so that the standard looks like one piece of wood. The top end is fitted with a 1/4-in. nipple to which the lamp head is attached, and the bottom end is turned to fit a hole in the base. If a new head is not available, you can use one taken from a discarded lamp



If material thick enough for the turned base is unavailable, it may be built up. A recess is turned in the underside to take a 5-lb. lead weight, which may be taken from an old floor lamp

The interesting maple feet are turned at one time, shellacked and polished while in the lathe, then marked off and scrollsawed as shown. These are glued to the base, using 5/16-in. dowels

Barrel Provides Safe Entrance To Your Snow Fort

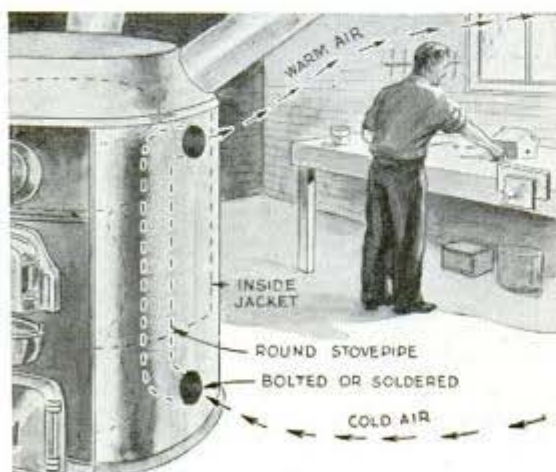


Next time you build a snow fort, look around for an old wooden barrel, knock out the ends and use it for an entrance to the fort. It will prevent the walls of the fort from caving in so that you can build them as high as desired for protection again "enemy" snowballs.

—S. P. Wiener, So. Norwalk, Conn.

Extra Pipe in Hot-Air Furnace For Heating Basement

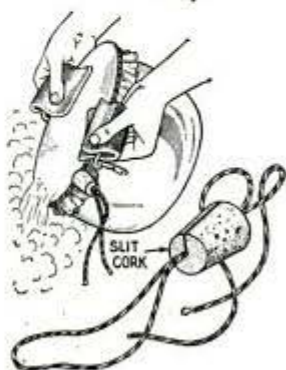
If your basement is too cold in the winter, it can be heated by providing a separate warm-air duct on your hot-air furnace without allowing air from the basement to mix with that which circulates through the rooms above. This prevents any possibility



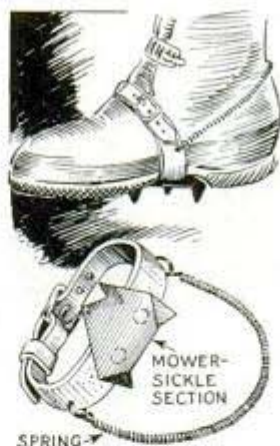
of coal-dust or disagreeable odors being transmitted into the system. The installation shown consists of two 90-degree elbows and two or three lengths of round stove pipe. Holes are cut in the furnace jacket and connected with the pipe, which passes between the furnace jacket and fire box.—Everett Hanson, Argyle, Wis.

Strainer Cloth Held on Kettle By Cork and String

Slit from one side to the center and slipped over a doubled string, a small cork will hold a strainer cloth on a kettle or pail so that it is easy to remove. The loop is pulled out wide enough to drop over the kettle and cloth after which the string ends are held while the cork is pushed against the kettle.



Nonskid Grippers for Walking On Icy Ground



During icy spells this winter, try a pair of these grippers on your shoes for safe walking. Each gripper consists of a mower sickle section having the corners bent downward and riveted to a strap for buckling around the instep of your shoes. If available, a small coil spring attached to the strap to slip up over the heel of your shoe will help keep the gripper in place. Grippers of this type will last indefinitely because the metal of the sickle section is very hard and will withstand a lot of severe wear.—L. Strosnider, Havensville, Kan.

☐ Before washing ties, baste them carefully, to prevent the lining or padding from becoming lumpy. Remove the basting thread before ironing the ties.

Typist's Hints to Save Time and Improve Copy

To be a good typist is not just a matter of being able to operate a typewriter. It's also necessary to produce neat copy, which necessitates knowing a few "tricks of the trade." Every typist is likely to make an error at least occasionally, and therefore should have an erasing shield. One can be made from an old photo negative. The erasure openings can be cut in the negative with a razor blade. If the lower edge of the shield is bent upward, the trough will catch eraser particles and keep them from falling into the typewriter mechanism. Rubbing chalk on white paper where an erasure has been made will improve the appearance and make it almost undetectable.

Hard brass platens often are used on typewriters to obtain good impressions when a number of carbon copies must be made. The typist who has such work only occasionally can use a piece of light sheet metal as a substitute for the brass platen. It is formed to fit halfway around the regular platen and is moved forward each time that the paper is advanced.

Making a ribbon last as long as possible is especially important now. In doing this, you will find that a one-color ribbon is the most economical because when the ink is depleted from the upper side, the ribbon shift can be moved to bring the lower side into use. This saves removing the ribbon and turning it over. If it is necessary to type in two colors when using a one-color ribbon, just insert a narrow strip of red carbon paper underneath the ribbon guide. When underscoring, keep the ribbon under tension by winding it by hand. Both underscoring and vertical ruling can be done by holding a pencil or pen in the ribbon guide so that it rides on the paper, moving



ERASING SHIELD FROM OLD FILM



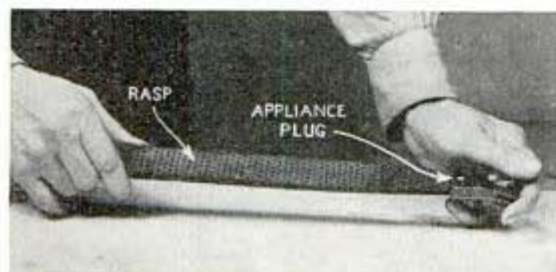
METAL "PLATEN" GIVES CLEARER CARBON COPIES



CHALK IMPROVES ERASURES

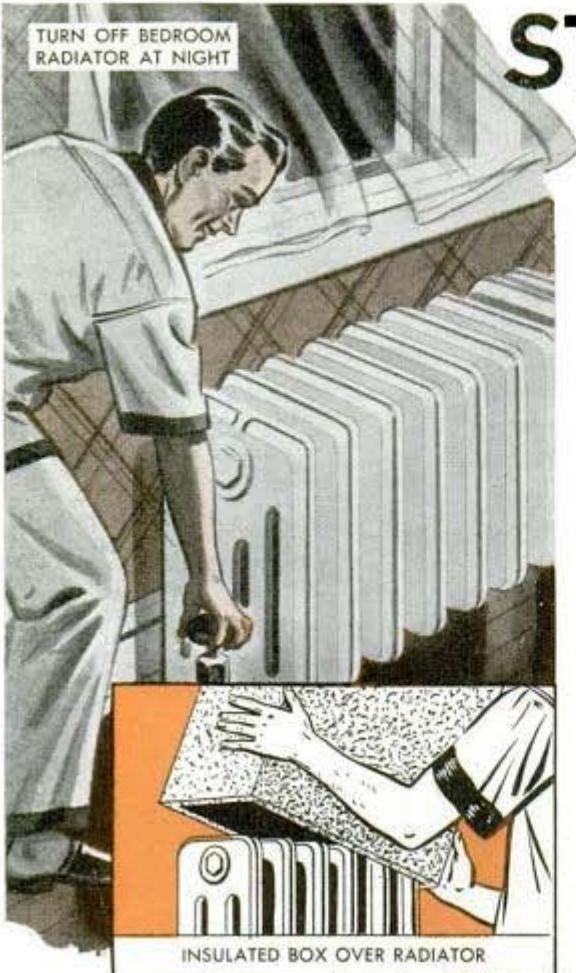
the carriage back and forth to underscore, and rotating the platen to rule vertically.

Discarded Appliance Plug Provides End Grip for Rasp or Coarse File



A discarded appliance plug can be converted easily into a useful and comfortable end grip for a rasp or coarse file. Just remove the brass contact parts and discard the holding screw nearest the front. Then file or grind off the projections on the inside of both halves of the plug so that the end of the tool will fit when the remaining screw is tightened.

TURN OFF BEDROOM
RADIATOR AT NIGHT



INSULATED BOX OVER RADIATOR



RUG SEALS CRACK UNDER
BEDROOM DOOR



USE ORDINARY OIL PAINT
INSTEAD OF BRONZING
ON RADIATORS

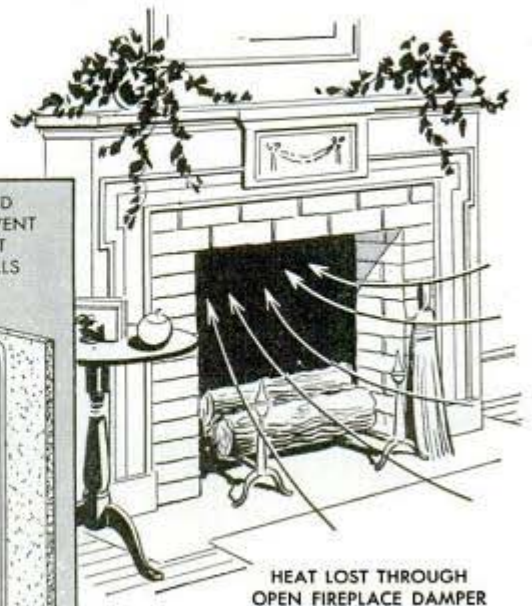
SHIELDS BEHIND
RADIATORS PREVENT
WASTED HEAT
THROUGH WALLS

STOP *the* WASTE

Little things that can be done in every home to cut heat losses and make it easier to "get by" on less fuel without less comfort

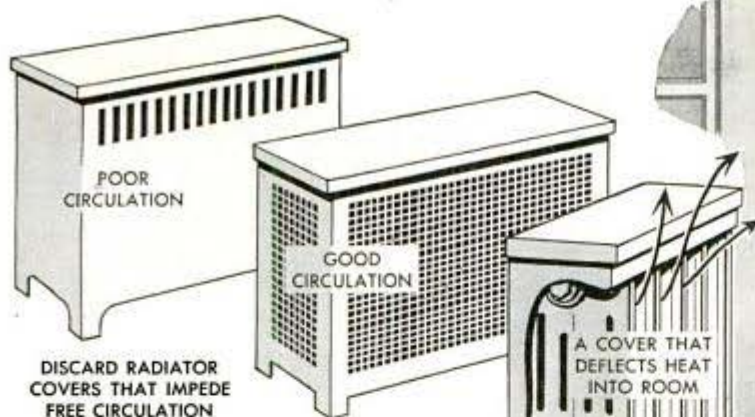
KEEPING your home warm with less fuel need not be a big problem, because much fuel can be saved by doing many little things to keep the heat in and the cold out. But, where the aggregate of little heat savers does not cut down your fuel consumption sufficiently, you may have to resort to storm sash, insulation and automatic control instruments. While these major fuel savers are somewhat costly, they may be necessary in some cases to maintain comfort on less fuel than was used previously.

Losses through negligence: Whether or not you provide storm sash, insulation and control instruments, you can save considerable heat by avoiding carelessness in such simple things as leaving outside doors open longer than necessary, forgetting to close a furnace draft after adding fuel, forgetting to keep a fireplace draft shut when not in use, and neglecting to turn off radiators or registers in "open-air" bedrooms at night. If a hot-water radiator cannot be turned off on account of possible freezing, wrap it in a woolen blanket or slip a box



HEAT LOST THROUGH
OPEN FIREPLACE DAMPER

and **SAVE** the **HEAT**



made of insulating board over it, and leave it turned on. The object is to avoid the lowering of water temperature in the entire system, which causes more fuel to be burned to restore the temperature to normal. Likewise, cold-air returns in an open bedroom should be shut off to prevent extremely cold air from entering. It is best to turn off the heat in a bedroom a few hours before retiring so that the temperature will decrease gradually, instead of attempting to chill the room suddenly and wasting heat through an open window. Space under a bedroom door should be closed with a throw rug or folded blanket to prevent cold air from circulating into the rest of the house.

More heat from radiators: Some heat can be saved by providing shields behind radiators that are set against uninsulated outside walls. Such shields, which prevent absorption of heat by the walls and consequent waste, may be of insulating or reflective material, or simply hard-pressed board mounted so that there will be an air space of at least 1 in. between it and the wall. If your radiators are covered with boxes or grills that allow little circulation of air, you'll get more heat from the system by removing these impediments. Only those that do not impede the free circulation of air are satisfactory. Also keep dust and lint from accumulating in the open spaces by frequent cleaning, to assure good air circulation. Paint on radiators has much more to do with the amount of heat that they radiate than most people suppose. If painted with bronzing, especially aluminum, they produce from 12 to 15 percent



ALL CRACKS AT DOOR AND WINDOW FRAMES, AND THOSE BETWEEN WARPED SIDING, SHOULD BE FILLED WITH CALKING COMPOUND.



less heat than if painted with ordinary oil paint. Bronzing tends to reflect heat back into the radiator. Liberal use of caulking compound on all cracks in the walls and at door and window frames will help to save some heat, whether or not the house is provided with storm sash and is insulated. Cracks in brick and stucco walls should be filled with mortar.

Directing heat to living quarters: In case the simple measures already mentioned are not enough to effect a substantial saving of fuel, and the living quarters are not fully comfortable, you may have to shut off heat to quarters where it is not required, such as an attached garage or a storeroom, precautions being taken to prevent freezing of water in pipes and radiators. Even bedrooms may have to be closed during the

DIRECTING THE HEAT WHERE IT IS NEEDED MOST



day and heat turned on only a few hours in the evening to eliminate the chill, to direct most of the heat to the living quarters during the day. Many basements are much warmer than is necessary and much of the heat can be directed to the living quarters by insulating the steam or hot-water pipes and covering a boiler with a 2-in. layer of shredded asbestos confined with muslin. Excess heat in a basement where a hot-air furnace is located can be directed into the rooms above by installing registers. Although much basement heat is transmitted to the rooms above through the floor, absorption of heat by basement walls and floor represents a loss.

Hot-water heater and smoke pipe losses:

An unsuspected heat loss occurs when a hot-water heater connected to the furnace or boiler is not insulated, as considerable heat is radiated from the tank into the air around it. Similarly, the top of a furnace bonnet can be covered with a 6-in. layer of non-burning insulation to keep the heat

in. Then excessive loss of heat through chimneys should be stopped if possible. One home owner fitted heat-radiating fins on a long smoke pipe to "rob" it of excess heat, while another slipped a sheet-metal duct over the smoke pipe, allowing cool air to enter at the lowest point and the heated air to come out

at the other end. Another method used was the provision of a steel drum through which the gases are passed. This method is applicable also to a stove. While on the subject of heat losses through the chimney, one should remember that the draft opening below the firepot of a boiler or furnace should be tight when closed so that no more air is supplied to the fire than just enough to keep it barely going, except of course, when the draft is opened intentionally. On the other hand, a leaky chimney allows air to enter, which acts as a check damper, preventing necessary draft for proper combustion of the fire. Such chimneys should be pointed up with mortar.

Economical firing: Firing a boiler or furnace by hand economically is not just a matter of following a set of rules, but adapting the technique of firing to a number of variable factors such as the type of fuel used, the atmospheric conditions and the peculiarities of the heating system. Generally it is most economical to keep the fire burning slowly to provide constant heat, instead of burning the coal with considerable draft at intermittent periods, and allowing the fire to die down slowly before adding more fuel. Such forcing results in smoky fires and the loss of combustible gases that would produce heat if ignited. For efficient burning of coal, be sure to remove the ashes each time that the grates are shaken, as accumulated ashes limit the

STOP UNSUSPECTED LOSSES AND USE "WASTE HEAT"

air supply besides being largely responsible for warped grates. Grates should be shaken gently to avoid dumping the fire; one should stop when a few live coals drop into the ashpit. The opening in the fire door or directly below it admits air into the combustion chamber. This should always be kept open when burning soft fuels as it helps to burn combustible gases. Soft coal requires more frequent furnace regulation to keep it burning slowly than hard coal or coke. During cold, clear weather, the fire must be kept checked for longer periods than on foggy days and nights when the air is heavy and the fire tends to burn sluggishly. When adding fresh fuel, open the draft for a few minutes to brighten up the fire, and then scatter the coal on uniformly, leaving the draft open until the fuel is ignited. When banking the fire for the night, add fresh fuel in two batches at intervals. Allow the first batch to ignite, then add a second and leave the draft open until the flames appear. This method produces less smoke and a minimum loss of combustible gases. If you have trouble holding a fire overnight, a light sprinkling of fine ashes over the second batch of fresh fuel will help. However, if you are using fine coal of the grade known as "mine run," this is not advisable as it tends to form clinkers. As a general rule, it is best to avoid disturbing a fire, although mine-run coal tends to crust over and should be broken up occasionally with a poker. Also be sure to pick the clinkers out of the firepot or the fire will go out unexpectedly.

Limed pipes and "stale" water: In steam and hot-water systems, the inside of the pipes and radiators tend to accumulate a coating of lime, especially where the water is hard. Thick accumulations act as insulation, preventing the transfer of heat from the water to the pipes and radiators. Also, deposits will restrict the flow of water in the pipes, especially at elbows. Rain water is best because it is free from lime. However, if you use hard water, do not drain the system but retain the "stale" water un-



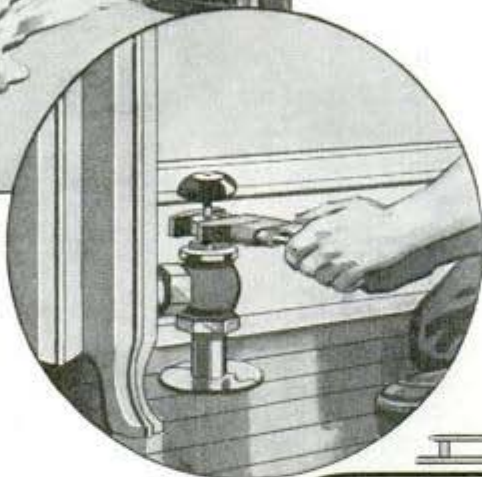
less repairs on the system are necessary, or the house is closed and the water in the pipes may freeze. Stale water is soft because the lime has already been "boiled out." Also, it contains less oxygen than fresh water, and the tendency of rusting is decreased greatly. To prevent the need of frequent additions of water to the system, be sure that none of the valves on the radiators leak.

Automatic controls: Control of a boiler or furnace draft and damper by means of a thermostat eliminates the waste of fuel and unnecessary high temperatures that result when several members of a family

DON'T CHANGE WATER IN SYSTEM UNLESS NECESSARY



TO AVOID EXCESSIVE "LIMING" AND CORROSION IN HOT-WATER PIPES AND RADIATORS, AVOID ADDING FRESH WATER BY RETAINING "STALE" WATER AS LONG AS POSSIBLE. KEEP RADIATOR VALVES PACKED SO THEY WON'T LEAK

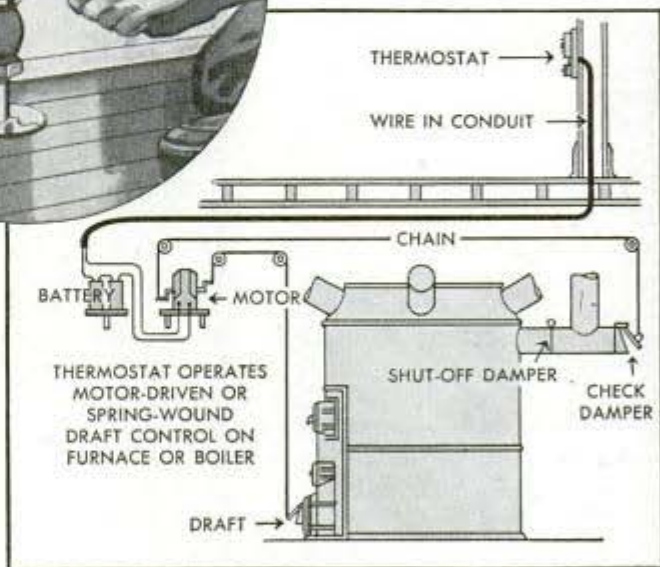


tend the fire and forget to close the draft. In heating systems a thermostatically controlled damper in the smoke pipe will effect a saving in fuel burned, as the unit greatly restricts the opening when the fire is low, or when the flame is out, in case of flash burners using oil or gas. Due to the restricted draft, the coils of a boiler or the bonnet of a warm-air furnace will not be cooled off as quickly as otherwise by incoming cold air which, after absorbing heat, passes up the chimney.

Humidity: By keeping the moisture content or humidity of the air in your home between 30 and 40 as determined by a reliable humidity indicator, you will be able to reduce the temperature a few degrees lower than necessary when the air is dry, the reason being that moist air feels warmer than dry air of the same temperature. For the average home, several gallons of water must be evaporated daily to maintain the desired humidity. There are sev-

eral methods of humidifying the air automatically. Apparatus for this purpose can be installed to work in conjunction with the heating system, the exact type of unit depending on the kind of heating system you have. A coil can be installed in the firing chamber, to which water is fed in small, controlled amounts, and the resulting steam is conducted through a short pipe to a radiator in a room above, where the steam is carried off by the warm air.

Storm sash and weather stripping: Tests have shown that as much as 20 percent of fuel can be saved in many cases by having tight-fitting storm sash on all windows and doors. The initial cost will be repaid in savings on fuel bills over a period of years. If you can afford a few sash only, put them on the sides exposed to prevailing cold winds. The

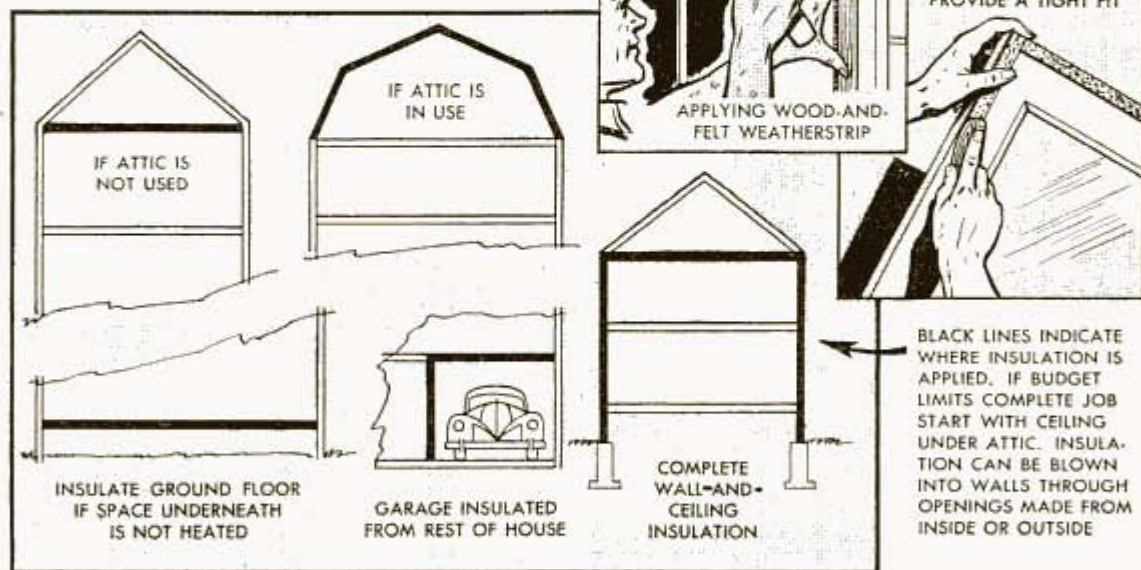


space between the regular sash and the storm sash should be as much of a dead-air space as possible. Therefore, the regular sash should be fitted with weather stripping—strips of wood and felt set snugly against the sash if regular metal weather stripping is not available. Also, the storm sash should be fitted into the window frames tightly, which can be done by gluing strips of felt to the sash where they contact the frames. In some cases it may be advisable to seal cracks between sash and frames by means of adhesive tape.

HOW TO FIT STORM SASH AND WHERE TO INSULATE

"Weep holes" in storm sash are handy to admit a slight amount of fresh air when the temperatures are extremely low. However, when not used for this purpose, these holes should be closed tightly by corks or snug-fitting covers, as leakage at these points defeats the purpose of sealing the sash.

Insulating: A major saving of fuel can be accomplished by insulating. If your expenditure for this must be limited, start by covering the ceiling below the attic if the latter is not in regular use, as more heat is lost through the ceiling than through walls of the same area, other conditions being equal. If you make use of the attic regularly, insulating bats should be placed between the rafters. However, before installing insulation, check up for leaks in the roof and at the flashing along the chimney and valleys, and make repairs,



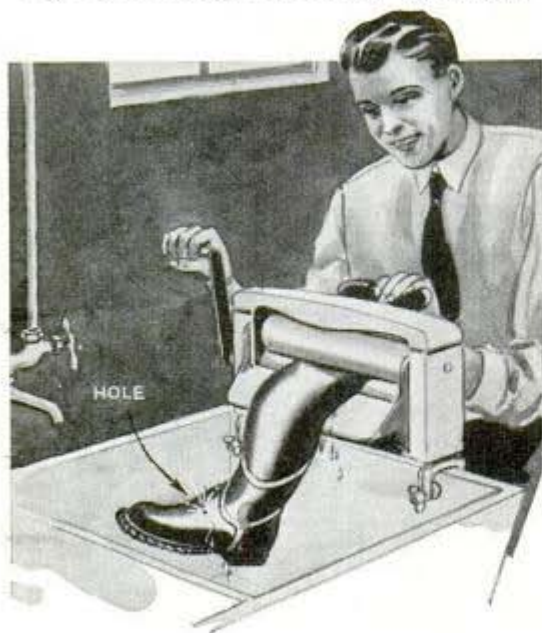
because if moisture soaks into the insulation it will reduce its effectiveness greatly. On ground floors that have no basement under them, and are subject to outside temperatures, insulation is applied between the joists below the floor. Similarly, any room over a built-in garage should be insulated from the garage. If you wish to continue insulating, have the insulating material blown between the studs through openings cut through from either the outside or the inside of the house. While the expense of providing insulation may be

considerable, it will eventually pay for itself in the course of years by the savings in fuel that will result.

Keeping Outboard Motor Clean

An ideal way of keeping the cooling system of an outboard motor clean is to operate it in a barrel of clear water after using it. This is especially desirable after use in dirty or salty water, but it's also desirable when using the motor on lakes and rivers to remove sand and silt.

Leaks in Rubber Boots Located By Squeezing Them in Wringer

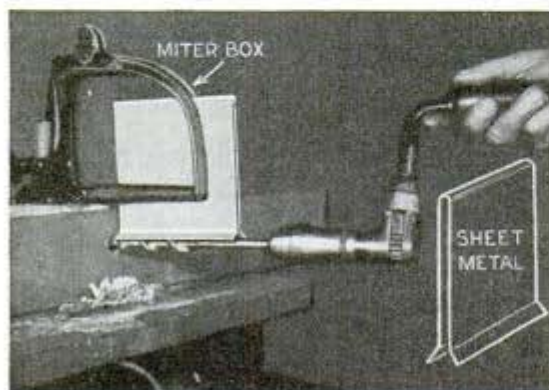


Minute leaks in rubber boots can be located by first filling them with water and then running them into a clothes wringer, putting them between the rollers top first. As the boot passes through the rollers the water is forced out through any leaks so that they can be located readily.

—C. M. Vanderwal, Portland, Ore.

Miter Box Used as Gauge to Bore Holes in Wood at an Angle

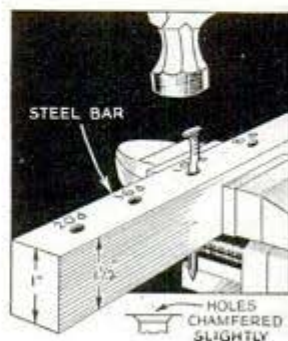
If you have a miter box of the type shown, it can be used as a guide in boring holes at an angle. To do this, make up a jig from sheet metal like the one shown, using a piece about 5 in. wide and 10 in. long. Fold this in the center and spread the open end to form a V as indicated. The sides of the jig can be tacked with solder if they have a tendency to spread. In



use, set the saw guide of the miter box to the desired angle and clamp the stock to be bored in the box, preferably with a thin waste piece behind it. Then slip the jig in the saw guide. Barely start the auger bit in the work and then push the jig down over the bit. The V will then act as a guide for the bit.

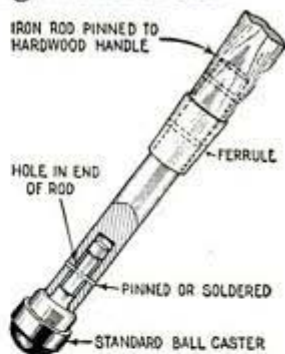
Straightener Helps Salvage Nails Removed From Old Boards

During the present shortage it will pay to salvage used nails, which can be done by using a straightener of the type shown. It consists of a piece of scrap metal, in which are drilled holes corresponding to the most common sizes of nails. In use, the nails to be straightened are merely driven through the holes nearest to their sizes:



Marks on Spun Metal Avoided With Moving-Head Tool

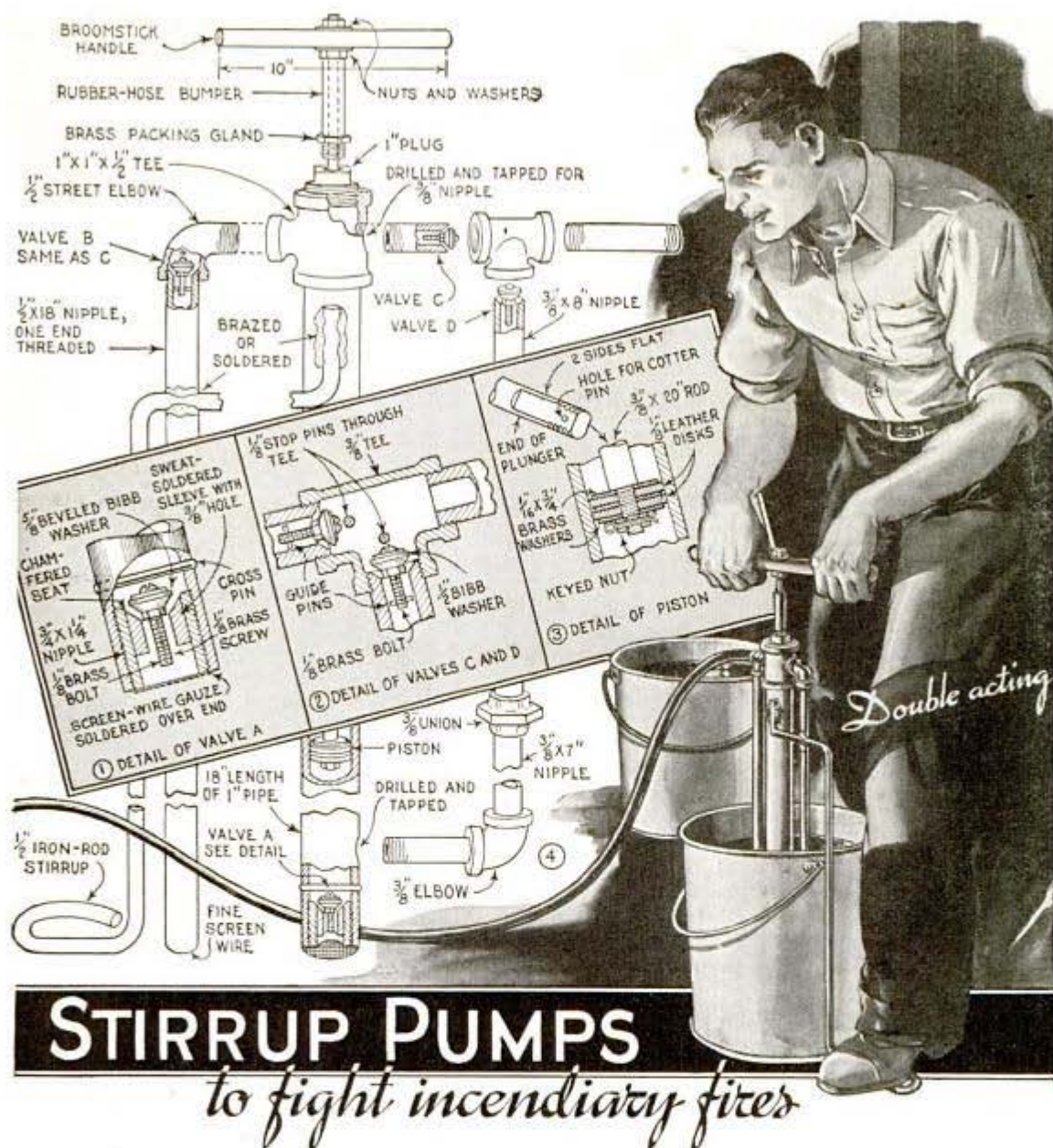
By using this forming tool, you can spin metal to a mirror-smooth finish without tool marks showing, because the ball tip of the tool rotates when held against the work. The tool will be found especially



useful in conforming the metal to chucks that do not require the forming of sharp bends. As shown, the tool consists of a ball-type caster pinned securely to a hardwood handle.—Robert Clark, Chicago.

Burn Oil From New Stovepipe

Before putting up a new stovepipe, take it outside and burn a few old newspapers inside it to burn off the oil that all new pipe is covered with to prevent rusting. If this is not done, the oil will burn off when a fire is started and cause a disagreeable odor in the house.



STIRRUP PUMPS

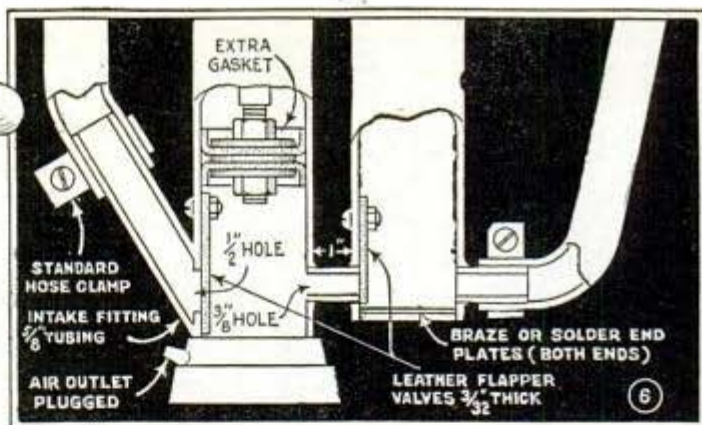
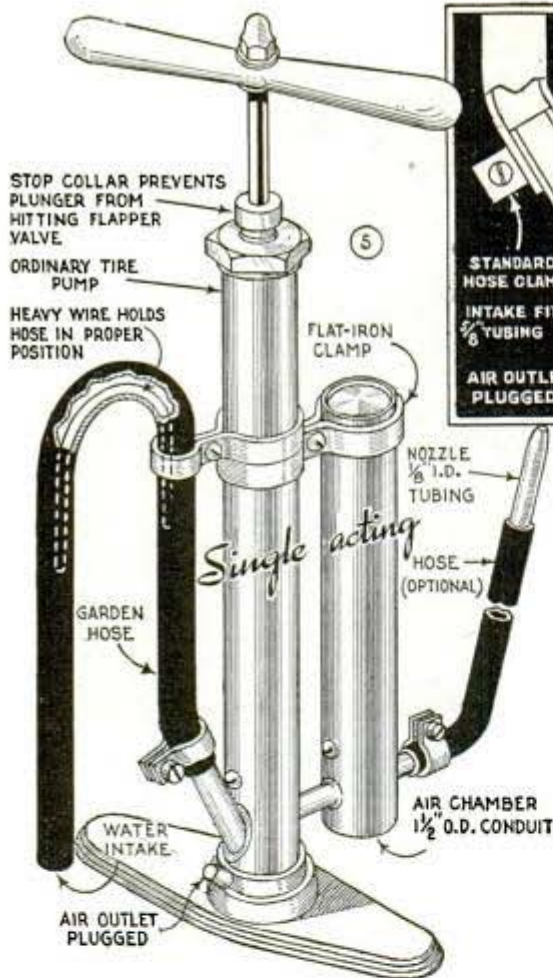
to fight incendiary fires

CAPABLE of forcing a stream of water a distance of 30 to 40 ft., these home-made pumps are not only good for combating fires, but also can be used for many other purposes. One is double-acting and is made of pipe, while the other is single-acting and is made by converting an auto-tire pump.

For the double-acting pump, which is assembled as shown in Fig. 4, you will need some 1-in., 1/2-in. and 3/8-in. pipe and fittings. The larger pipe is used for the cylinder and has a 1 by 1 by 1/2-in. tee at the upper end. The tee is plugged at the top opening and is drilled and tapped on the side opposite the 1/2-in. opening for a 3/8-in. pipe nipple. Also, the plug is drilled for

the plunger or piston rod and is tapped for a packing nut.

To avoid rusting of the piston rod which would "chew" out the packing in the nut, a brass rod should be used for this purpose. It is fitted with a handle and hose bumper at the upper end and a suction assembly at the lower end. This assembly, which is detailed in Fig. 3, consists of two leather disks sandwiched tightly between three brass washers. The disks should be large enough to press snugly against the walls of the cylinder, and the washers should be about 1/10 in. smaller in diameter than the leather disks. In most cases, it will be necessary to smooth the inside surface of the cylinder pipe. This can be done



After this has been done, openings are made in opposite sides of the cylinder and tubing is brazed over them for an intake and an outlet as shown in Fig. 6. Next, an air chamber is brazed to the outlet tube. This can be any large diameter tube. Then, leather flapper valves are fastened over the inlet opening inside the cylinder and outlet opening inside the air chamber. After this has been done, a second opening is made in the air chamber to take a tube for attachment of the nozzle hose, and the ends of the chamber are closed with metal disks. The only alteration of the piston or plunger, is to add a second suction leather or gasket in an inverted position. Providing a stop collar at the top of the cylinder to keep the piston from hitting the flapper valve completes the job.

best by boring it out in a lathe. If a lathe is unavailable, a fair job can be done with emery cloth wrapped around a large dowel.

All four valves are of similar construction as detailed in Fig. 2, the only variation being the seat of valve A at the bottom of the cylinder as detailed in Fig. 1. Here the opening of the cylinder is reduced by inserting two smaller pieces of pipe to form the seat. If suitable taps and dies are at hand, the pipes can be threaded and screwed into place. Otherwise, you can sweat-solder them. Each valve consists of a beveled faucet washer locked on a brass bolt or machine screw to seat on the chamfered end of the pipe in which it fits. A pin of a length to permit free movement inside the seat is inserted in a hole drilled through the threaded end of the bolt to keep the valve in alignment, while a stop pin through the pipe or fitting in front of the valve lets it open only a given distance.

The single-acting pump in Fig. 5 requires a tire pump of the type having a removable base so that the air outlet can be plugged.

Guide Lines on Dark Wood Made Legible With Chalk

When guide lines are to be made on a dark-colored wood, merely scribe the lines with a sharp point, then rub the surface with chalk. This will cause the lines to stand out distinctly. The method assures sharp lines and greater accuracy than if a white pencil is used.



Initials Identify Overshoes



To avoid the confusion of identifying your overshoes or rubbers when they are placed with several others at a public gathering, put your initials on them. This can be done by cutting your initials from patching material used on auto inner tubes and sticking them to the rubbers in the same way that a patch is applied to an inner tube.

Drive Graded Before Graveling Holds Loose Material in Place

Instead of dumping loose gravel or crushed stone on a level surface to make a driveway, first grade the surface so that the loose material will stay in place and result in a neat job. The grading can be done with a shovel by simply cutting away the sod or dirt to a depth of about 3 in. at the edges. Throw all loose material to the

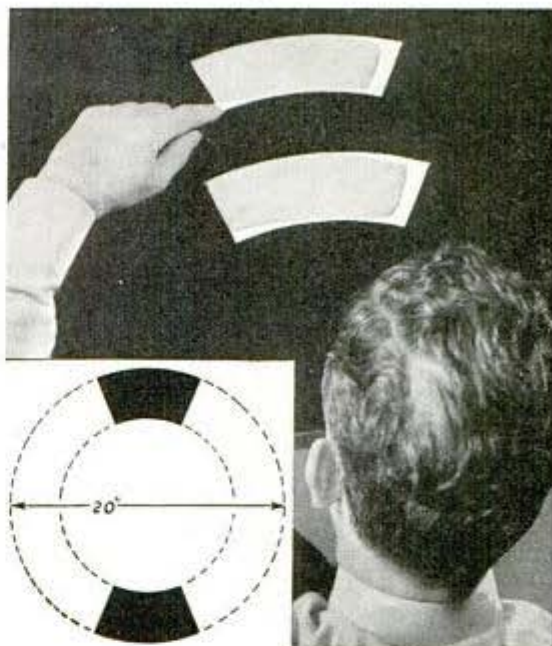


center but avoid ridging it as otherwise grass and weeds will push through the thin covering of gravel or stone. After dumping and leveling off keep the material raked away from the edges until it has been settled by several heavy rains.

CASH FOR UNUSUAL IDEAS

If you have an idea that might be used for a short article in these pages, send it to the Home-craft Editor. Enclose a snapshot or drawing and give all the necessary information in as few words as possible. To be accepted, material must be of general interest and different from any we have published previously.

Segments From Cardboard Ring Produce Optical Illusion



Two identical segments cut from a 20-in. cardboard ring as indicated by the black portions in the lower detail, will not appear to be the same size when laid down next to each other on a table and viewed from the position indicated. The effect that results was reproduced by taking a photo from a position behind and above the head of the figure. In analyzing the illusion, there is the natural effect of the closer segment appearing larger, to both eye and camera, but this effect is accentuated by the angles and curves of the arrangement.

Solder Kept on Cord of Iron

If you have trouble keeping track of a spool of solder on small jobs, just wrap a length of solder around the cord of the iron as shown. It is always convenient, and helps keep the cord from tangling.



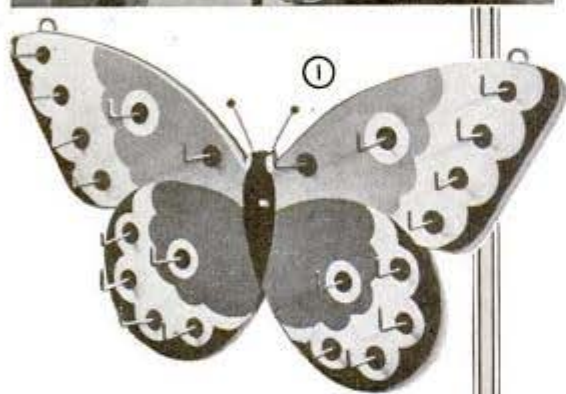
Decorative Fittings

By Bess Livings

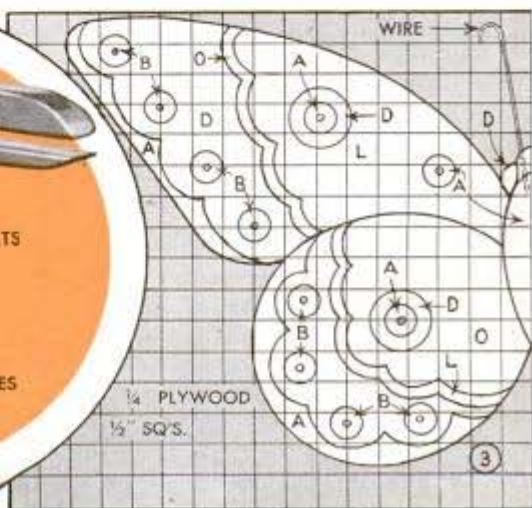
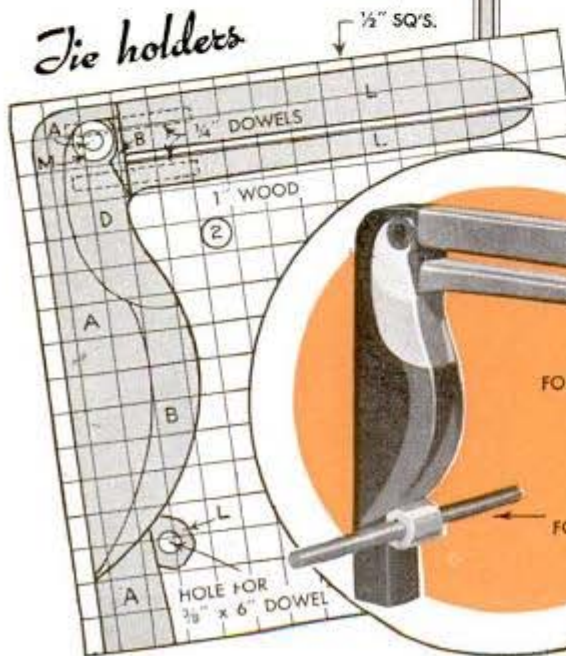


THESE colorful wooden accessories will brighten up your closet and provide storage for shoes, hats, belts, neckties, etc. They can be used individually or they can be made up in matching sets suitable for either a woman's, man's or child's closet. For example, a set that would have a distinct feminine appeal could consist of the butterfly belt-and-tie holder in Fig. 1, a shoe rack with floral sides like that shown in the upper right-hand detail of Fig. 6, and the lady-bug hat stand of Fig. 13, as well as the floral shelf edging and garment hanger shown in Fig. 12. For a man's closet, the "Gentleman's gentleman" shown in Fig. 11 would be ideal. It consists of a number of accessories assembled in one unit. A child, of course, would like a set consisting of the "doggy" clothes hangers, shoe rack, handkerchief hamper, etc.

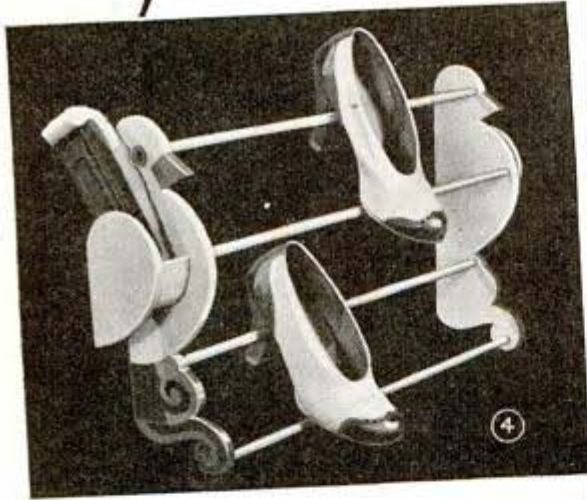
Painting of the accessories is important to produce a realistic effect. To aid the amateur in this work, all parts are "keyed" by letters so that a glance at the chart in Fig. 14 will give you the colors to use. Construction of the parts is simple, consisting mainly of jig-sawing and doweling. The butterfly tie rack detailed in Fig. 3 is cut from plywood and then fitted with dowels to hold ties and belts although screw hooks were used in the original model. A couple of glass-headed pins provide the ornamental antennae. The gay-colored toucan



Tie holders



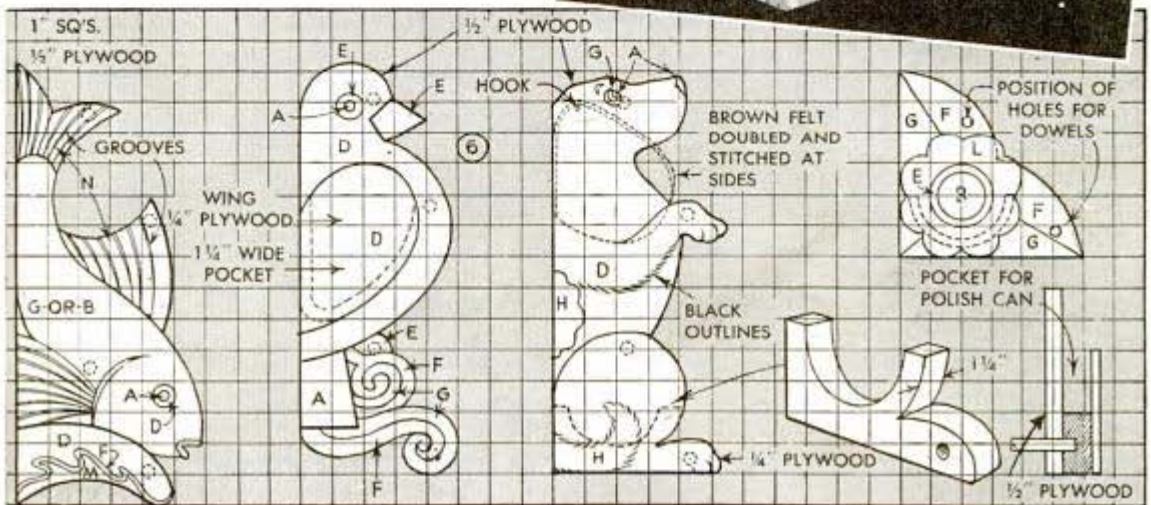
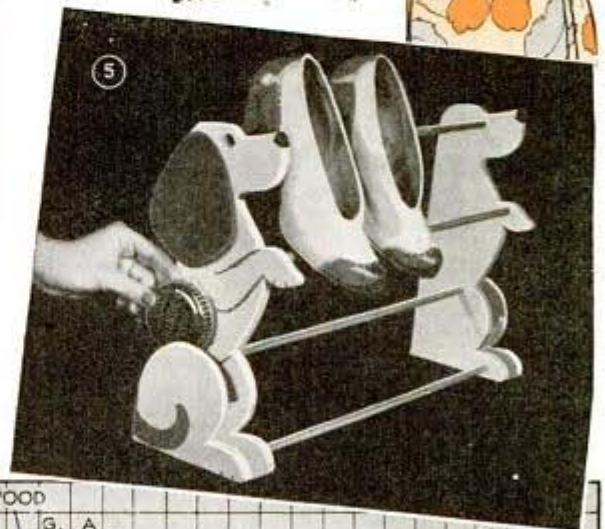
in Your Closet



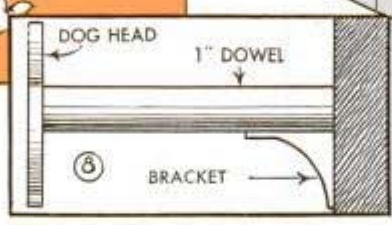
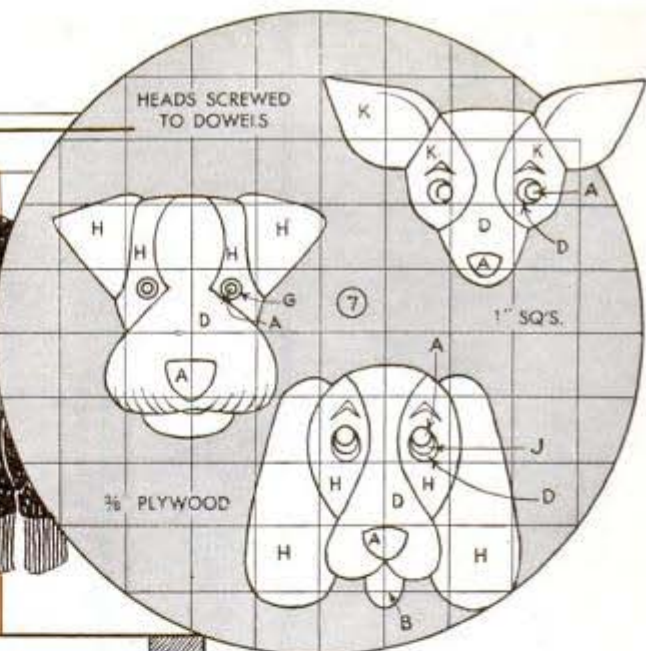
tie holder in Fig. 2 has a jig-sawed body to which the two parts of the long beak are doweled and glued.

The shoe holders shown in Figs. 4 and 5 consist of two sides connected by long dowels on which shoes are set. The sides are jig-sawed to represent either fish, birds, animals or flowers as indicated in the detailed drawings of Fig. 6. The fish is grooved to outline the tail and fins. The dove, dog and floral ends are similarly treated, except that the dove's wing, dog's hip and the floral center of the flower are outlined by attaching separate pieces to form pockets in which brushes and small cans of polish are stored. In addition to this, the dog's ear is a removable piece of felt to use as a polishing cloth.

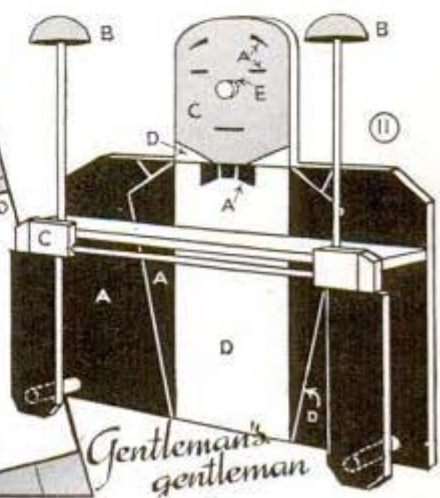
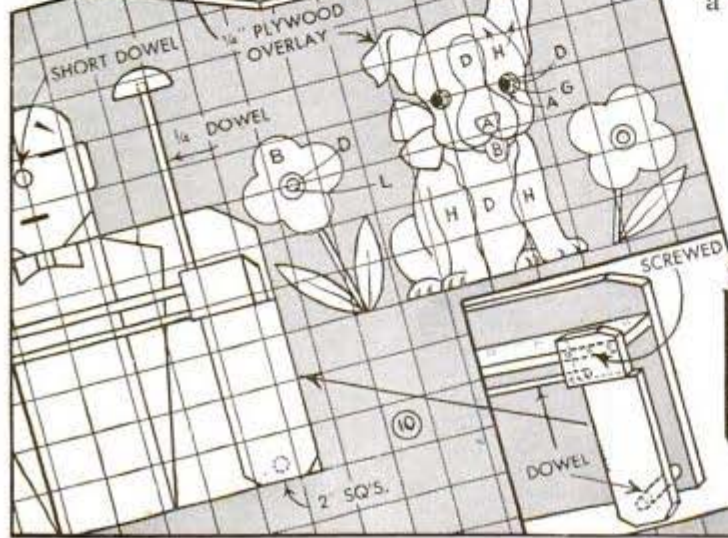
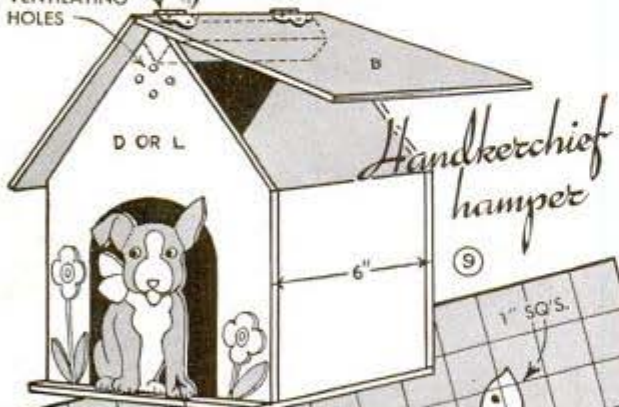
Children will appreciate the "doggy" clothes hangers detailed in Fig. 7. Each

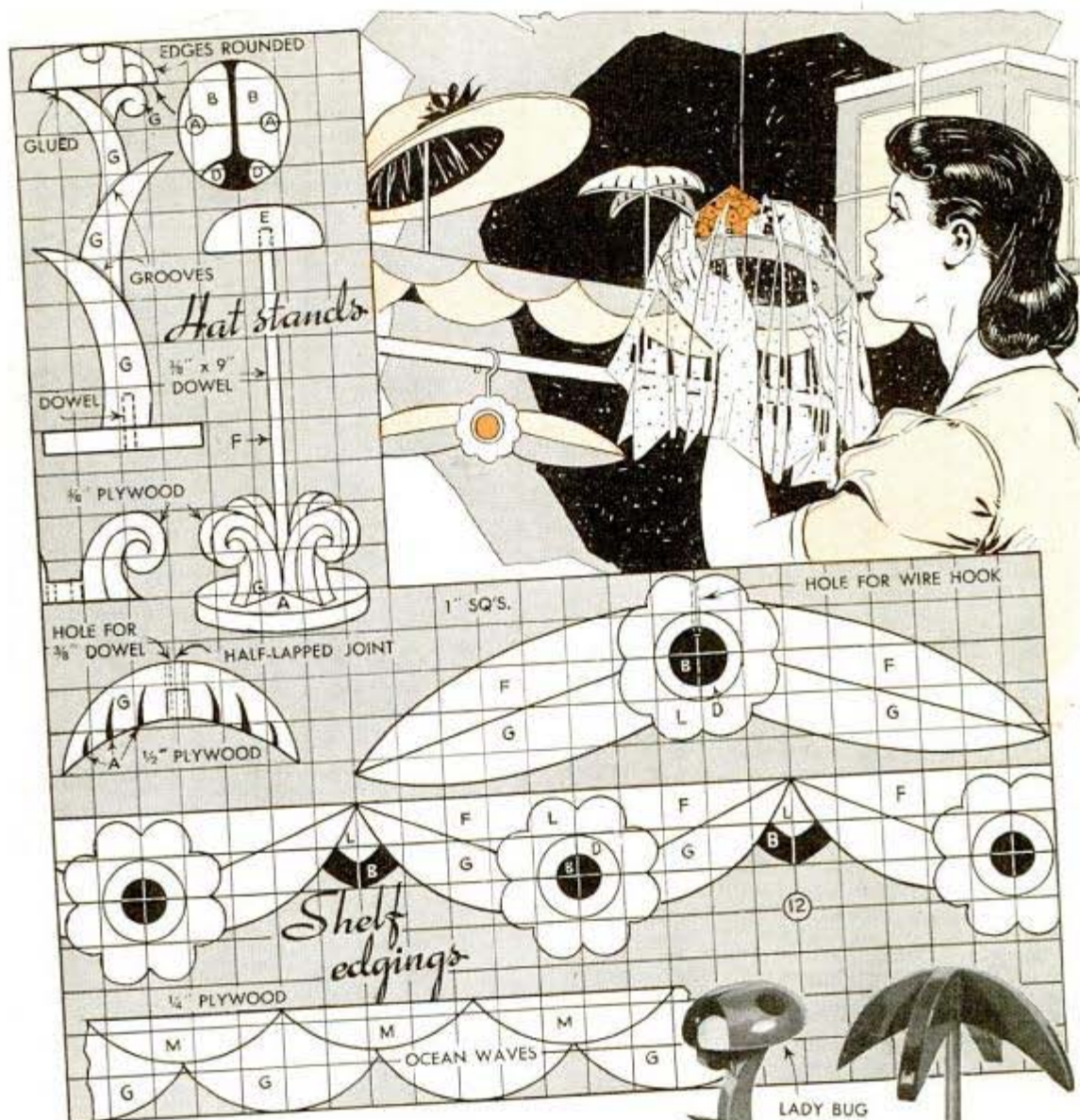


Doggy clothes hangers



hanger consists of a large dowel having a jig-sawed dog's head screwed to one end. It is mounted on a back board, which is drilled to take the end of the dowel. This is glued in the hole, and a bracket is used for further support as shown in Fig. 8. A clothes hanger for adults is shown in the upper right-hand corner of Fig. 12. The hanger is jig-sawed to shape and has a flower overlay glued to the center. A hook taken from a regular hanger can be used, or one can be shaped from heavy wire. A hamper for handkerchiefs, hose, etc., is shown in Fig. 9. It is made in the form of a doghouse, which has a hinged





roof; a jig-sawed dog and floral overlay glued to the front add to the effect. These are detailed in the upper part of Fig. 10.

The "Gentleman's gentleman" shown in Fig. 11 and detailed in Fig. 10 holds a shelf, which is equipped with hat stands and a tie rack. The dowels at his elbows are convenient for hanging belts, umbrellas and scarves.

Edging to decorate the shelves is shown in the lower part of Fig. 12. It is jig-sawed from thin wood, and can be cut from one long piece, or it can be made in short sections to utilize scrap wood. The hat stands shown in Fig. 13 and detailed in the upper part of Fig. 12 complete the accessories. The one on the right is made in the form of a palm tree. The top is made in two sections and glued together and a dowel forms the trunk, which is glued in the base and top. The stand on the left consists of a standard sawed to represent a plant stalk topped by a large lady bug. The latter is turned or whittled to shape and glued in place.



14 COLOR KEY	
Black - - A	Brown - - H
Red - - B	Amber - - J
Flesh - - C	Tan - - K
White - - D	Yellow - - L
Pink - - E	Blue - - M
Lt. green - F	Silver - - N
Green - - G	Orange - O

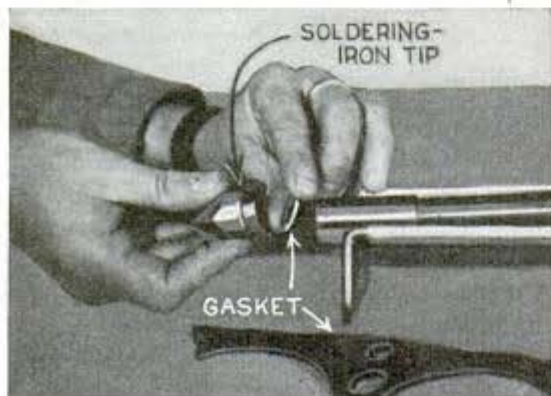
Stucco Patch on a Masonry Wall Anchored With Nails



Where a patch of stucco had loosened and come off a concrete-block wall, one home owner repaired it as follows: First, all the loose stucco was removed and the wall cleaned thoroughly. Then the wall was coated with liquid asphalt and galvanized nails were driven into the mortar joints of the wall, spacing them about 6 in. apart and allowing the nails to project about $\frac{3}{8}$ in. to serve as anchors for the new stucco. Two coats of stucco were applied.

Fume-Proofing Heating Element Of a Soldering Iron

Electric soldering irons sometimes are damaged by corrosive fumes from soldering acid, which enters the hollow tip. Wear or mechanical damage to the threads of the tip allow enough space for the entrance of the fumes. To avoid this, put a soft gasket



over the threads and turn the tip on tightly. A good gasket for this purpose can be had by cutting one from an old auto-cylinder gasket. In most cases, you will find that one or more of the holes already in the gasket will be of a suitable size to fit over the threads, thus making it unnecessary to cut a hole in the gasket.

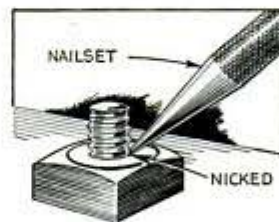
Sponge Lifts Up Pin Feathers For Easy Plucking

In dressing a fowl for cooking, the pin feathers often lie so snugly against the skin that they are difficult to grasp with the fingers for plucking.

If a coarse rubber sponge is rubbed over them, against the growth of the feathers, the ends will be lifted so that their removal is much easier.



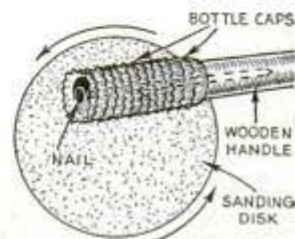
Nicking Threads With Nailset Prevents Nut From Loosening



When a nut must be held tight on thin, springy sheet metal and a lock washer cannot be used, turn the nut down tight then place a nailset in the position shown and strike it a light blow with the hammer. This will dent the threads sufficiently to prevent the nut unscrewing under vibration or movement.

Sanding-Disk Surface Cleaned With Bottle Caps on Stick

Rosin or paint can be removed from sanding disks by using several bottle caps on a stick. These are punched in the center and then slipped on a nail, which is driven into the end of the stick. In use, the stick is handled much like a tool for dressing grinding wheels. When held against a rotating disk, the caps loosen the rosin or dry paint.



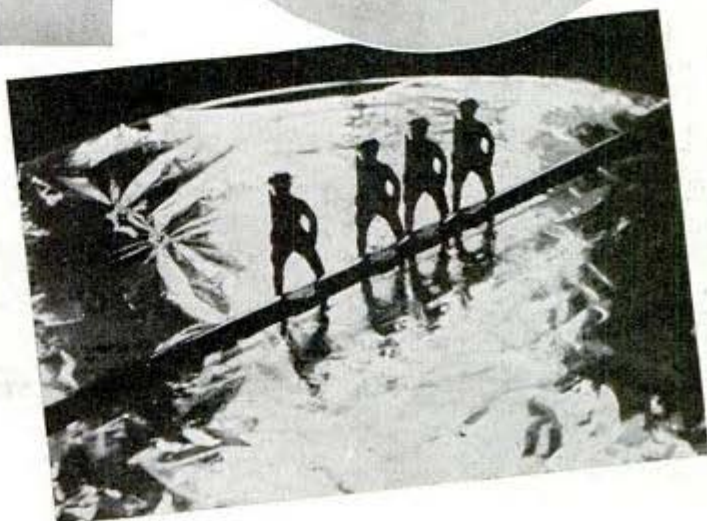


The "bubble" portrait above was made with the setup at right. A piece of crinkled Cellophane in front of the lens is sidelighted with a photo-flood bulb. Moving the Cellophane farther from the lens and shifting the light gives different effects

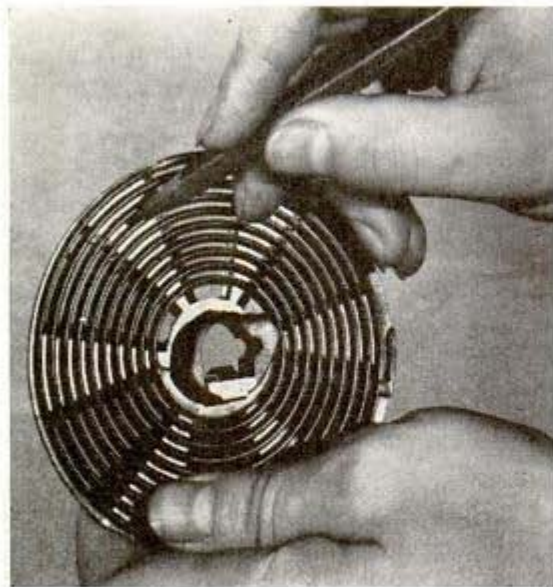
NOVEL PHOTO EFFECTS with Cellophane



Shown on this page are a few of the many novel effects that can be produced in photographs by using Cellophane in different ways when taking the pictures. Many other uses for the material can be found by experiment. To achieve the vignettted effect in the photograph of the cat, a 5-in. tube of Cellophane was slipped over the camera lens as shown above. Arranged, lighted and photographed properly, a piece of Cellophane can be made to look enough like water to fool even an expert. In the table-top photograph at right, a large sheet of Cellophane was placed on a table, the figures of the soldiers arranged on it, and the whole setup lighted from the back

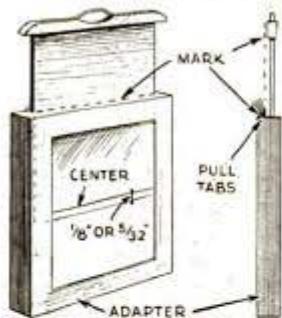


You Can Use a Soft Lead Pencil To Lubricate Film-Tank Reel



Film will slide more easily into the grooves of a developing-tank reel if the point of a lead pencil is run around the grooves before the film is loaded. The small amount of graphite deposited on the reel will lubricate it sufficiently to allow the film to slide in without sticking. A fairly soft pencil, about No. 2 lead, is the best to use.—Thomas Weston, Merced, Calif.

Making Half- or Full-Size Photos On the Same Film Pack



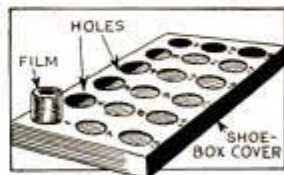
Half- or full-size pictures, as desired, can be taken on a film pack without altering the pack adapter. First, locate the center of the picture opening in the adapter, withdraw the dark slide so its lower edge is $\frac{1}{8}$ in. below this point and, with a colored crayon, draw a line on the outside of the slide flush with the top of the adapter. Before starting to use a pack, mark each of the tabs with a pencil line, also flush with the top of the adapter. To take half-size pictures, first withdraw the slide so the mark on it appears at the top of the adapter, and make the first exposure. For the next shot, pull the film tab out until the line on it is even with the

top of the dark slide. After making the second exposure, pull the tab out the rest of the way and you are ready for the next shot—either full- or half-size. If the results show you are leaving too much or too little space between the half-size pictures, you can change the mark on the dark slide accordingly. In taking half-size pictures, the same side of the view finder is used for each half of the film.

—Marvin Stutzman, Boyden, Iowa.

Holes in Shoe-Box Lid Hold Film For Titling and Assembling

One amateur movie-maker uses a shoe box with holes cut in it to hold small pieces of film while he is assembling them in proper order and inserting the titles. Eighteen round holes



are cut in the lid and numbers above each hole aid in keeping the pieces of film in order while assembling them.

Spring Clip Over Focusing Cloth Anchors It to Camera

Even a strong wind will not blow your focusing cloth off the camera if this clip is used while working outdoors. The clip is bent from spring steel to fit tightly over the camera box and one edge of the focusing cloth.—Opie Read, Jr., Chicago.



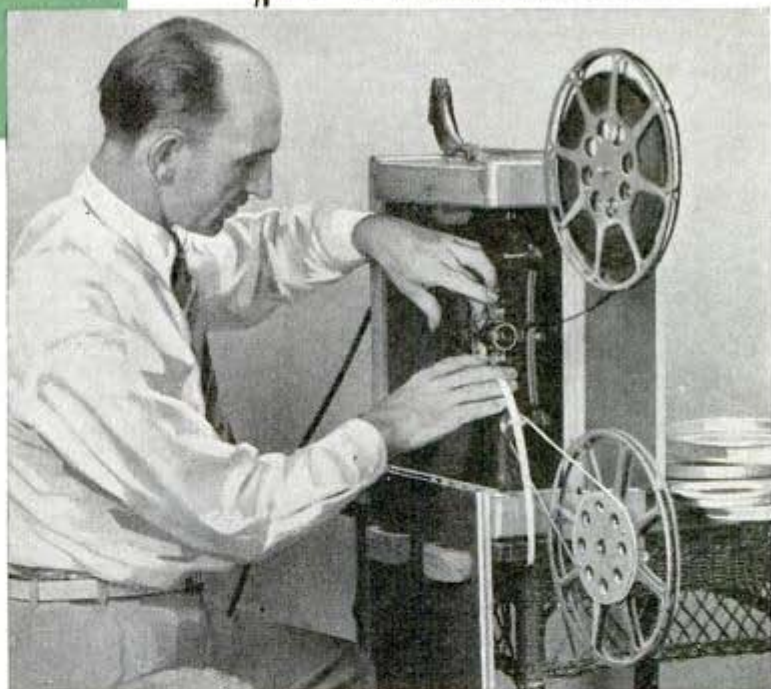
POPULAR MECHANICS



Portable... PROJECTION "BOOTH" for 8-mm. movies

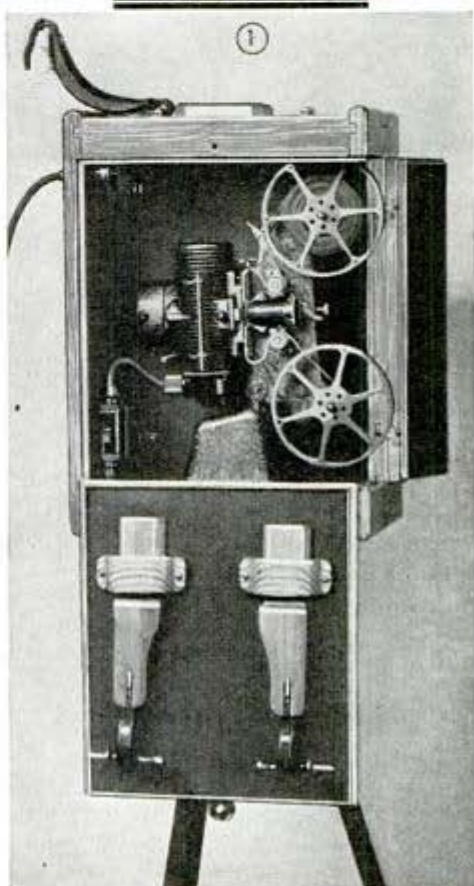
No need to remove the projector from the case, which is screwed quickly to a tripod. Extra slip-on reels increase film capacity to 800 feet

By
Chester Hooley



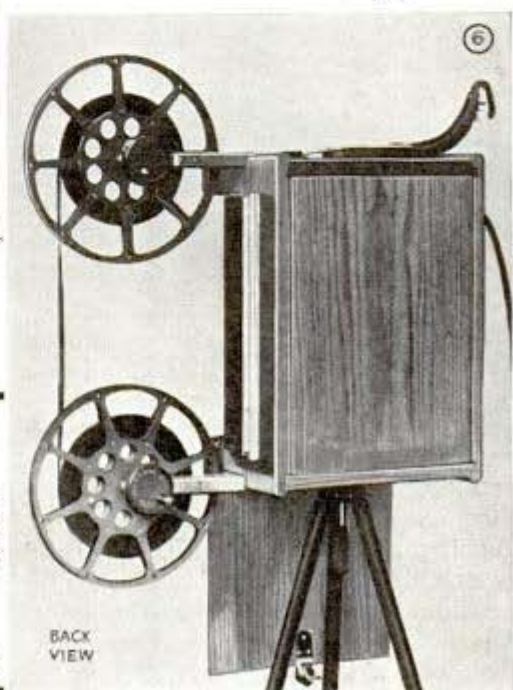
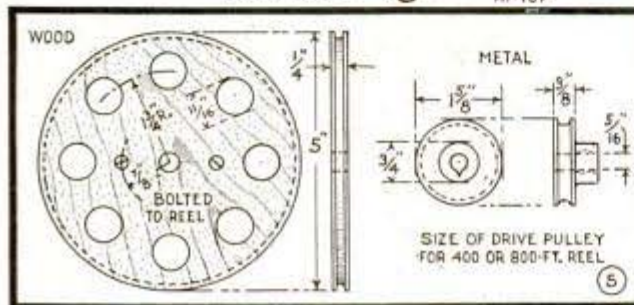
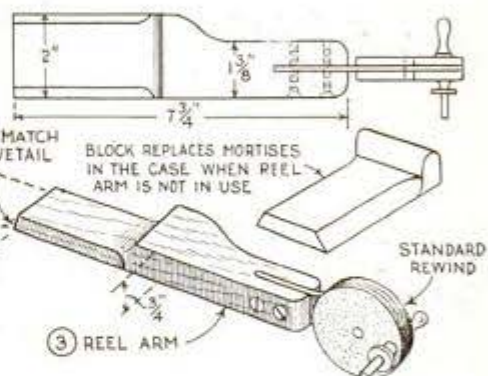
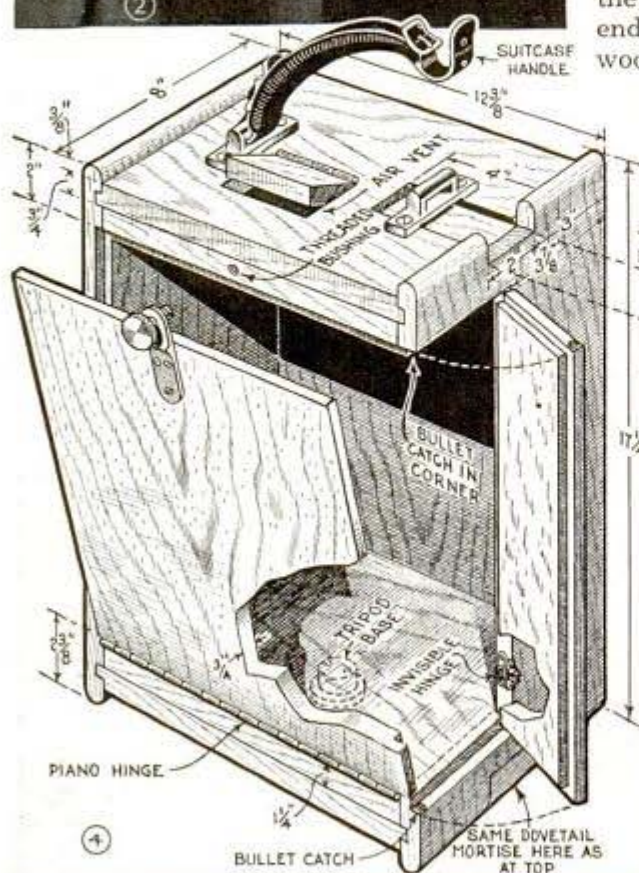
THIS compact carrying case for an 8-mm. movie projector can be set up instantly and a couple of large reels on extension arms can be used to go through a vacation trip or other long film without the usual interruption of changing reels frequently. To obtain a reel holding more than 400 ft. of 8-mm. film, you get a 16-mm. reel of 800-ft. capacity and cut it down to size. When not in use, the extension arms are held by brackets attached to the hinged side of the case as shown in Fig. 1. By fitting standard rewinds to the extension arms, the film may be rewound quickly by hand as in Fig. 2. When using the large reels, a small metal drive pulley is attached to the take-up spindle of the projector and is belted to a 5-in. pulley fastened concentrically to the face of the lower reel, as shown in the photo above Fig. 1. Two projector drive belts hooked together make up a belt large enough for this purpose.

Fig. 4 shows how the case is assembled of $\frac{3}{4}$ -in. wood. The dimensions given may be followed if you have a projector like the one shown; otherwise, overall dimensions may have to be altered to suit the machine at hand. Any hardwood such as oak, birch or walnut will do nicely for the case. Note how the front and side doors are rabbeted to exclude dust, the front door being held closed by a bullet-type friction catch placed in





top and bottom corners. The side door is hinged to a strip which is set flush and screwed to the bottom. At the top, a similar strip is added to receive the door rabbet and the threaded bushing for a thumb-screw. A small hasp or lock could be used in place of the arrangement shown. The back of the case also is rabbeted, which makes it necessary to assemble the sides, top, bottom and back at the same time. Filler blocks to replace the extension arms when they are not used, are cut to fit the dovetail mortises rather snugly so they will not fall out. Their purpose is merely to give a finished appearance to the case by concealing the mortises. These blocks and the arms are detailed in Fig. 3, while Fig. 5 gives the size of the two pulleys. If you are unable to obtain a suitcase handle like the one shown, that is, with buckles at each end to permit detaching it from the case, a wooden handle may be substituted. In

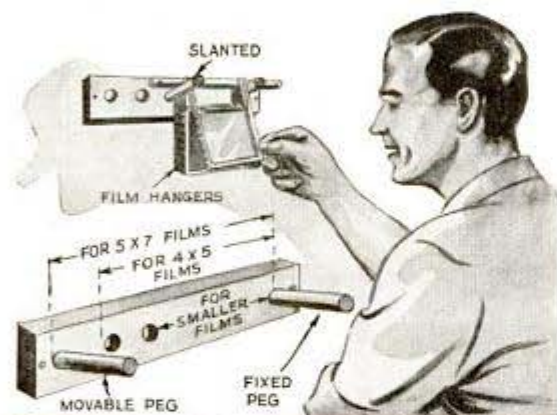


making the wooden handle, be sure to allow ample clearance for opening the vent door.

The projector can be operated with the side door closed without overheating, as the front door and the vent in the top of the case give adequate ventilation. Lining the case with felt or cloth adds a finish to the inside. If the case is to be supported by a tripod as shown in Fig. 6, you'll have to provide a threaded bushing in the bottom to receive the tripod stud bolt.

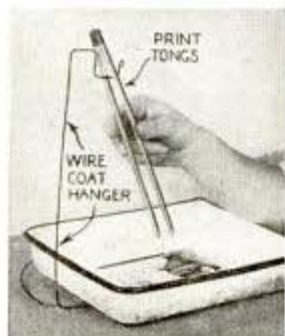
Film-Hanger Rack Is Adjustable To Hold Different Sizes

Designed to hold film hangers after they are loaded and before placing them in the developing tank, this rack can be adjusted to accommodate all sizes. A short length of dowel rod is mounted permanently at



one end of a strip of wood and a similar length is movable from one to another of a series of holes. The rack is fastened on the wall over the loading table.

Print Tongs Are Held Over Tray By Simple Wire Holder



the tray on the holder's circular base is sufficient to keep it upright.

—Robert Scott, Saltsburg, Pa.

Fuller Ball Provides Finger Grip On Cable Release of Camera



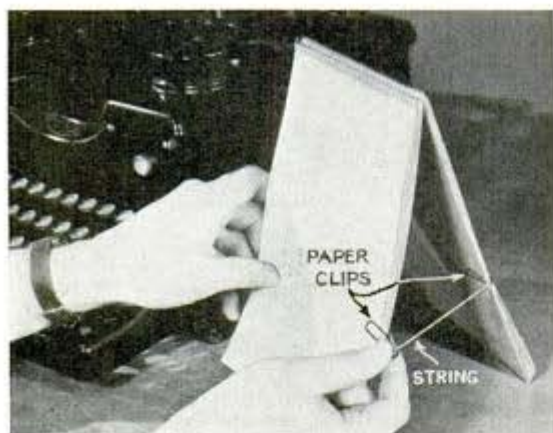
After losing an important picture by having the cable release of his camera slip from his fingers just as he released the shutter, a news photographer now uses the oversize grip shown. It is a Fuller ball, slit on one side and slipped in place on the release. This provides a much firmer support for the fingers than the small metal flange on the release.

White Cardboard on the Camera Reflects Light on Subject

Certain subjects that require shadowless lighting can be illuminated with reflected light by turning the floodlights on a cardboard reflector in front of the camera. Place the lights so they shine on the reflector at an angle and use a large lens shade so the light will not strike the lens. It also may be necessary to cover part of the floodlights with black cardboard deflectors.



Stenographer Makes Note Book Self-Supporting With String



When transcribing shorthand from her note book, one stenographer uses a string to hold the book in a vertical position for easy reading. To do this, paper clips are tied to the ends of the string so that they

can be slipped over the front and back of the book as indicated.

—Francis E. Curtis, Attleboro, Mass.

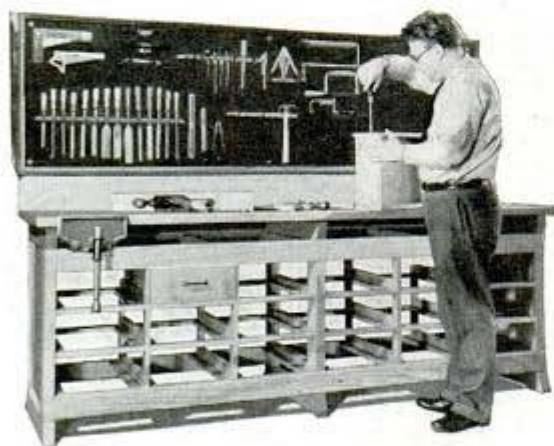
Steel Square Used as Protractor

The next time you want to lay out a 30- or 60-degree angle on some work and have no protractor



at hand, use a carpenter's steel square. Place it on the work so that the 13-in. mark on the tongue and the 22½-in. mark on the body come exactly on the edge of the work or on a line drawn at the desired location. In this position, the angle between the tongue of the square and the line or work edge will be 60 degrees, and the angle between the body of the square and the line will be 30 degrees.

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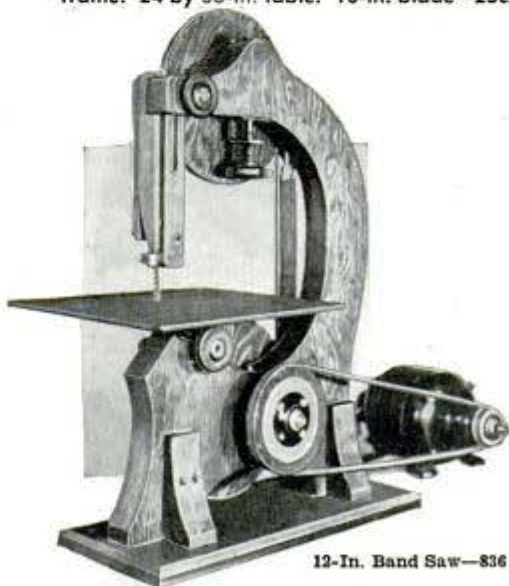
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SHOP NOTES



Make Your Own TELESCOPING GAUGES . . .

By Henry and Richard Hanscom

DIFFICULTY in obtaining precision tools does not prevent the machinist from making some of them, such as a set of telescoping gauges, which could even be used as substitutes for expensive internal micrometers. The set, shown in Fig. 2, consists of a handle and three interchangeable heads. In use, a gauge head is placed inside the opening to be measured, Fig. 1, and a locking rod inside the handle is loosened to permit a spring-loaded, telescoping pin in the head to span the opening. A twist of the rod then locks the pin in this position, after which the gauge is withdrawn and the exact measurement of the opening is taken by spanning the pin with a micrometer.

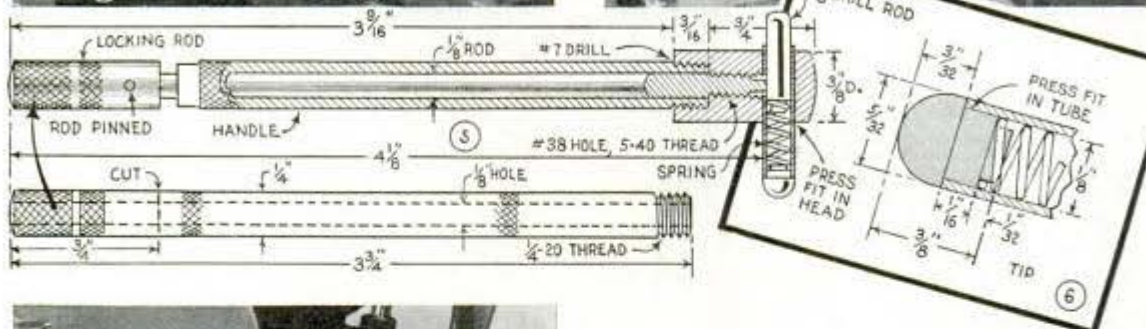
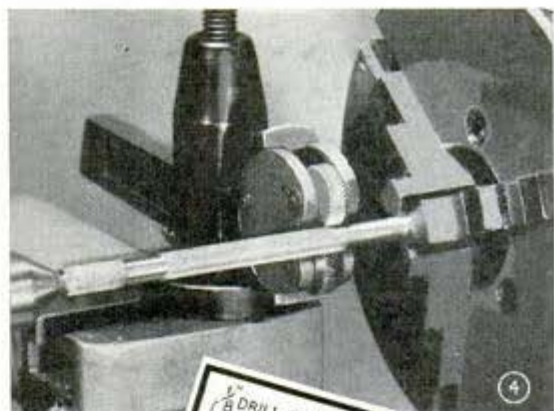
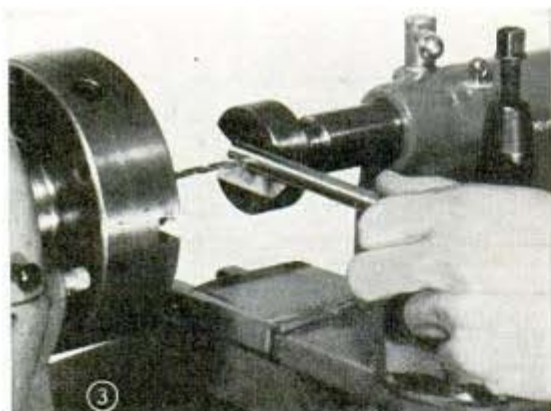
To make the set, as detailed in Fig. 5, first mount a $4\frac{1}{8}$ -in. length of $\frac{1}{4}$ -in. round brass stock in the lathe and fine-knurl it as in Fig. 4. Then drill a $\frac{1}{8}$ -in. hole through



THREE INTERCHANGEABLE HEADS GIVE $\frac{3}{4}$ " TO $1\frac{1}{4}$ "-HOLE CAPACITY

it lengthwise to take the locking rod. A tip or grip for the rod is provided by cutting off a $\frac{3}{4}$ -in. length of the handle and soldering or pinning it to the rod. Threading the end of the handle and the locking rod to screw into the heads completes this part of the set.

The heads are basically the same in construction, differing only in the length of the telescoping pin, tubes and springs. Each head is made of $\frac{3}{8}$ -in. stock, which is drilled lengthwise to a depth of about $\frac{9}{16}$ in. in a lathe and then tapped to take the



threaded end of the locking rod. All threading and tapping should be done in a lathe, Fig. 7, if possible, to assure neat fitting of the various parts. Next, the hole in the head is counterbored $\frac{3}{16}$ in. deep, the counterbored portion being tapped for the threaded end of the handle.

To assure accuracy when drilling the head for the cross tube, it is best to do the

work in a lathe, Fig. 3, and use a crotch center if possible, as the tube must be a press fit in the head. The length of the tube will vary according to the range of the head. Fig. 6 shows a small steel tip that is pressed into one end of the tube as a retainer for the spring. The tube projects only slightly at one side of the head, and its wall is drilled to permit the end of the locking rod to press against the telescoping pin. To determine the length of the pin, the spring is put inside the tube, and the pin is pushed down as far as it will go, after which it is held in this position by tightening the locking rod in the handle. Then the pin is marked and cut off so that it projects slightly beyond the end of the tube, after which the end is rounded. A slight step or shoulder is filed on the inner end of the pin to slip tightly inside the spring and prevent it from leaving the tube.

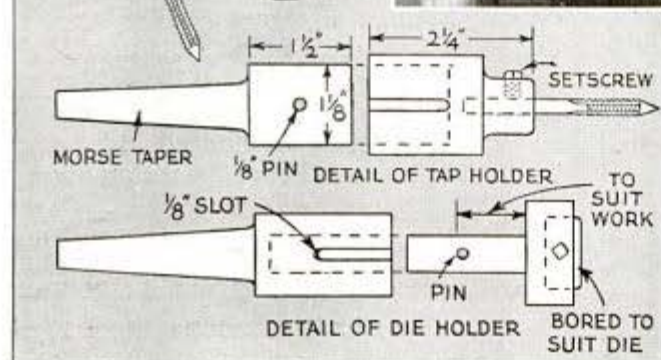
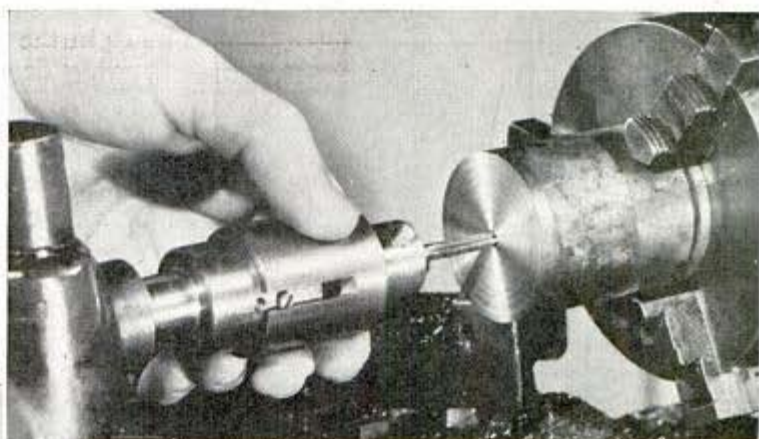
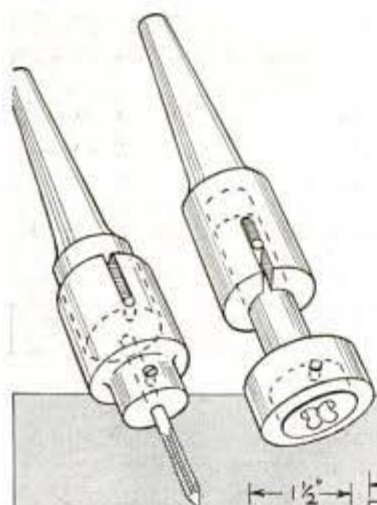
Repairing Burned-Out Rheostat on Linotype Mouthpiece

When the rheostat on the electrically heated mouthpiece of our linotype machine burned out, I fixed it as follows: The rheostat cover was removed, then, using a couple of test prods connected by a wire, each of the contacts on which the variable resistance rotor made contact was tested from one to the other. When there is no open circuit, the test light will burn as the

contacts are progressively connected by moving the test prods from one to the other. When the rheostat is burned out, however, an open circuit will be indicated between two of the contacts by failure of the test light to burn. If an open circuit is found, connect a jumper wire between the two contacts.

—Max Cline, Greenwood, Ark.

Tap and Die Holders for Use in Small Lathes



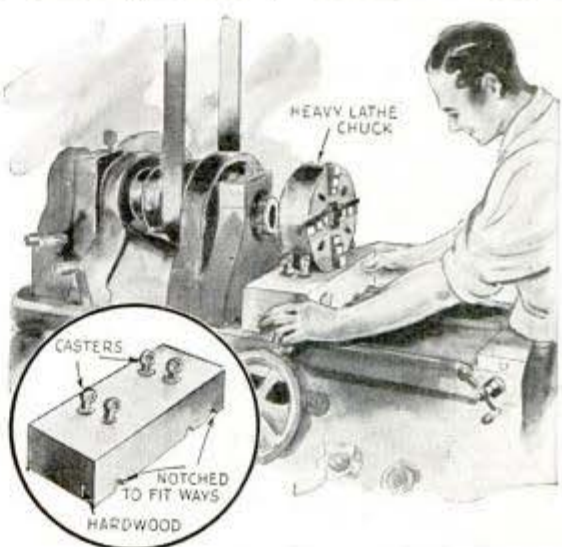
or die, after which the power is turned on at the slowest speed. In this way, the tap will feed itself into the work until the slot in the head of the holder passes a pin in the shank, which will permit the head to spin with the work, thus stopping the action of the tap or die. In removing the latter, the process is reversed, first moving the tailstock spindle forward slightly to engage the slot with the

With these tap and die holders, production threading can be done rapidly in a lathe. The holders are especially suitable for use in small bench lathes for which such holders often are difficult to obtain. In use, a holder is put in the lathe tailstock and the work is rotated in the chuck, the lathe being turned by hand to start a tap

pin, then reversing the lathe and slightly backing off the tailstock as the tap comes out of the work. The holders are made from cold-rolled steel and can be any size desired. If taps and dies of different sizes are to be used, heads for each size will be necessary, but the same shanks can be used on the various sizes.

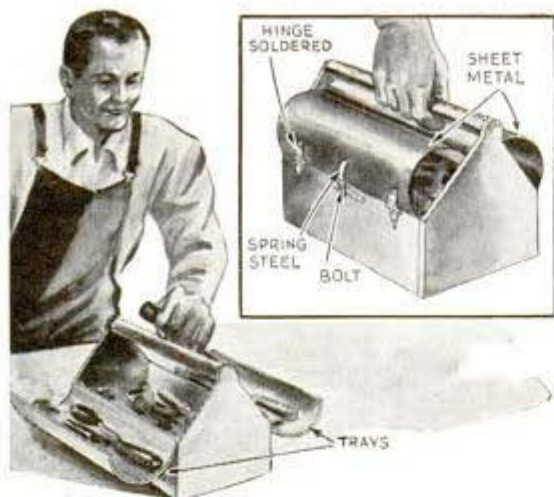
Castered Block Simplifies Mounting Heavy Lathe Chuck

The job of putting a heavy chuck on a lathe single-handed was simplified by one operator who used a castered support of the type shown. This holds the chuck at exactly the correct height to screw onto the headstock spindle. The support consists of a large hardwood block having inverted casters on the top side, and four V-grooves on the underside to fit the lathe ways. In use, the block is set on the ways and the chuck placed on the casters, after which the assembly is pushed up against the headstock spindle, the casters permitting the chuck to be rotated.



Small boxes tacked to a desk-drawer bottom are good holders for pins, clips, etc.

Two Folding Trays on Tool Box Provide Extra Storage Space



Hinged to the side of an ordinary tool box of the type shown, a couple of metal trays will provide extra space on which to lay out tools for the job at hand. Made from sheet metal, the trays are curved so that they form troughs when opened up, thus providing extra space without adding materially to the weight of the box.

Jar Cap Holds Make-Ready Paste

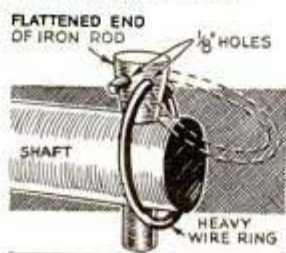


Instead of carrying a supply of make-ready paste smeared on the back of his hand when getting jobs ready on the presses, one printer soldered a wire ring to the jar cover so that this could be worn on

the middle finger. Paste carried to the job in this way is always conveniently at hand.

Loss of Removable Pin Avoided By Use of Retaining Ring

Wherever a removable pin is used, such as in the end of shafts to hold wheels in place, a retaining ring will be found much more handy

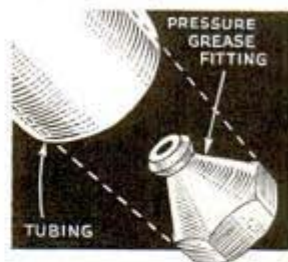


than a cotter key or wire to prevent loss of the pin. The ring is made from a piece of heavy wire and the open ends slip through holes in the upper end of the pin. In use, the ring drops over the end of the shaft to retain the pin, but is removed in a jiffy when necessary merely by prying it off.

Tubing Shields Grease Fittings From Paint Spray

One man who specializes in custom painting of farm tractors, trucks and machinery uses a length of metal tubing to shield all grease fittings

so that they will not be clogged with paint. The shield is slipped over the fitting before spraying the adjacent area.



Sheets of Metal Clipped Together To Make Duplicate Shapes

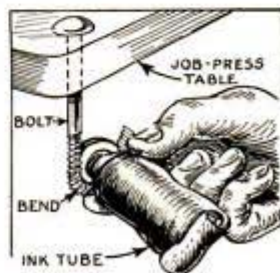


Anyone who has to cut duplicate patterns or shapes from sheet metal will find the following an easy method of holding

several sheets together while cutting a number of pieces at the same time. Along the edges of the sheets where there will be waste stock, cut the metal to form short, narrow tabs and then bend these over as shown. This will lock the sheets securely.

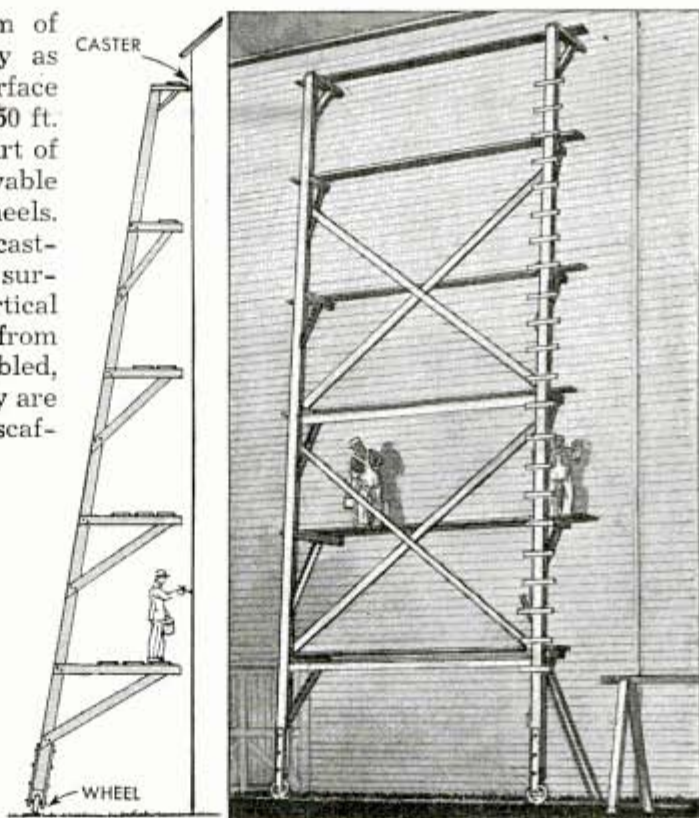
Hook Bolt in Job-Press Table Loosens Caps of Ink Tubes

To loosen the caps of ink tubes quickly when working at a job press, one printer inserted a small bolt through the press table and bent the threaded end to provide a sharp-angle hook. By pushing the tube cap down into the hook it is loosened easily when the tube is twisted.



Large Rolling Scaffold Saves Time for Painter

Confronted with the problem of painting as quickly and cheaply as possible a flat uninterrupted surface approximately 60 ft. high and 1,050 ft. long, a paint contractor solved part of his problem by constructing a movable scaffold, which rolled along on wheels. At the top of the scaffold are two casters or wheels that rest against the surface to be painted. The two vertical supports which can be built up from lengths of 2 by 10-in. stock, doubled, are spaced about 15 ft. apart. They are cross-braced to provide a rigid scaffold. Brackets at 10-ft. intervals accommodate the walk planks, each of which consists of two or more planks laid side by side. The wheels that support the scaffold at the lower end can be any type suitable for the purpose. The original ones were pneumatic type used on wheelbarrows. Crosspieces on one vertical support provide a means of ascending the scaffold.



Simple Method of Determining the Tons of Hay in a Stack

Anyone purchasing hay in the stack can save the time and labor of weighing it load by load if the table shown in the detail is used to determine the number of tons in the stack. If all measurements are made carefully, the table will work out accu-

rately enough in most cases to be suitable for determining the tonnage. As indicated, multiply the length of the stack by the width by the overthrow (the distance up both sides and over the top) by 3. Divide the product by 10. Then, if the hay has been freshly stacked and the stack has settled but little, divide the quotient by 700 to get the number of tons. If the hay has been stacked for one or two months, divide by 525. However, if the stack has been up longer than two months, divide by 400.



Solvent to Remove Enamel Letters

Enamel letters that have been attached to a window glass with the usual cement used for this purpose, can be loosened with paint remover of the type that stays moist for some time after application. The remover is spread around the edges of the letters, using a medicine dropper as an applicator. Two applications at 15-min. intervals usually are sufficient, after which the letters can be taken off by running a safety-razor blade along their edges.

JUDGING USED CAR PARTS

BY C. E. PACKER



Engine block



Valves

AS THE use of secondhand parts is becoming increasingly necessary in the maintenance of cars and trucks until new parts are again available, anyone purchasing such parts should be able to judge them with a fair degree of accuracy. Some flaws in the parts may be self-evident but unimportant, while others may be deeply hidden and serious enough to make the part useless. Some reputable used-parts dealers boil the parts in a solution that removes paint and grease. In this way both they and the purchaser can see, usually, whether or not the part is cracked or has been welded, or if anything else is wrong with it.

Engine blocks: In judging these it is best to see whether or not one or more of the cylinders has been resleeved. Also be sure that the valve seats have not been cut or faced excessively, and that water jackets

have not been cracked by freezing. Sometimes blocks are reground to such an extent that it is impossible to fit pistons to them. An oversize of .035 in. generally is the maximum limit, Fig. 1. Most dealers will give a receipt agreeing to accept the return of a part in its original condition if the purchaser finds it faulty or unsuitable for his use.

Valves and pistons: In buying valves or a reconditioned block assembly, take a look at the thickness of the edge of the valve, Fig. 2. Frequently, old valves have been refaced to such an extent that they have knife edges. Such a condition shortens valve life, as the sharp edges will become red hot under operating conditions, causing

preignition and burning off quickly. Also be sure the valves are not noticeably loose in their guides. This is especially important with intake valves, as looseness of these parts will cause high oil consumption, poor idling due to the leakage of air past the guide, and early gumming of the valves with carbon. While it is well to check the diameter of pistons carefully, Fig. 3, before accepting them for use in a block, it is important to check that the wrist-pin bushings are in good condition, and especially that the piston-ring grooves are not worn. Even the best fitted piston ring will not hold oil if the ring can move up and down in the ring groove.

Crankshaft assembly: Where it is necessary to replace a connecting rod, it is best to exchange the complete set, Fig. 4, or bring in a sample of the kind that you are replacing so that one of exactly the same



weight can be selected. If this is not done, the motor will be badly out of balance and will have troublesome vibration. Before purchasing a crankshaft, be sure that the journals are round within .001 in. and free of taper, Fig. 5. Also be very certain that they have not been reground to an under-size so small that it will be impossible to get bearings for them. Regrinding crankshafts is not an unusual practice, but sometimes is overdone to such an extent that it is difficult to find bearings to fit.

Timing chains and fan belts: Timing chains have hundreds of flexible joints, their links being pivoted on pins which may have worn only a trifling amount individually, but in the aggregate may have developed such looseness as to be unusable. Insist on comparing a number of chains when purchasing one, and alternately force the links together and pull them apart, Fig. 6, choosing the chain which appears to be the tightest. Similarly, in purchasing a replacement fan belt, it is not unusual to find belts that appear to be in good condition, especially if they have been wiped down with black rubber dressing, but which have worn on their sides so that they go to the bottom of a V-pulley. A belt that is too narrow will not perform satisfactorily as it will not have the necessary wedging effect, will ride in the bottom of the pulley, and give no better performance than an ordinary flat belt as shown in Fig. 8.

Clutch: Most used clutch plates available probably will be refaced. This is likely to throw the purchaser off his guard. In addition to being sure that the plate has been refaced, also be sure that splines in the hub are not worn, Fig. 9. If they are, the clutch plate will not ride snugly on the shaft and will cause back lash, which will overload the universal joint, the pinions, ring gear, axle shafts, keyways, and hubs.





7
Clutch

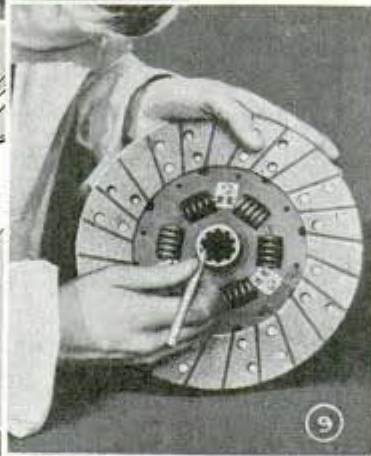
When purchasing a clutch pressure plate, look closely at the surface of the plate for any heat cracks that may be present. Slipping a clutch, especially when pulling a trailer, generates extremely high temperature which causes burning and cracking of the pressure plate. If the heat cracks are very shallow the surface of the plate may be reground and be entirely satisfactory for continued use, Fig. 7.

Electrical units: Before choosing an ignition unit, be sure that new points have been installed and that it is in good condition. Holding it firmly, work the cam from side to side and do the same with the shaft and pinion. Any noticeable side motion in these parts will upset the timing badly, as it will allow the cam to shake from side to side and make spacing of points incorrect.

If a complete generator or starting motor is purchased it's a relatively simple matter to inspect the commutator and brushes and see if the inside of the unit is clean. Any starter or generator that is filled with oil or grease has had its insulation seriously damaged and, in addition, suggests that the bearings must be loose to allow such a volume of lubricant to enter. Oil in an electrical unit, in addition to rotting rubber insulation, catches and holds carbon dust worn from the brushes and copper dust worn from



Fan belt



the commutator. This forms a material that will cause partial or complete short-circuits in the brush holders and in other parts. Another check is to see that there is no up-and-down movement in a bearing, and only a slight amount of end play in the shaft. If purchasing a replacement armature only, note the amount of copper remaining on the commutator, Fig. 11. In normal service, it's often necessary to turn down the commutator, and by noting the amount of material remaining, it is a simple matter to judge the probable length of life in the unit. If there is very little material on the commutator there is very little life left in it.

Starter gears and springs are important items and may be purchased without hesitation if a few details are watched. The eccentric weight at the end of the pinion should not be loose on the pinion, and there should be a small pin and spring inside the weight to bear against the threaded shaft to keep the pinion assembly from drifting into mesh with the flywheel.



Battery

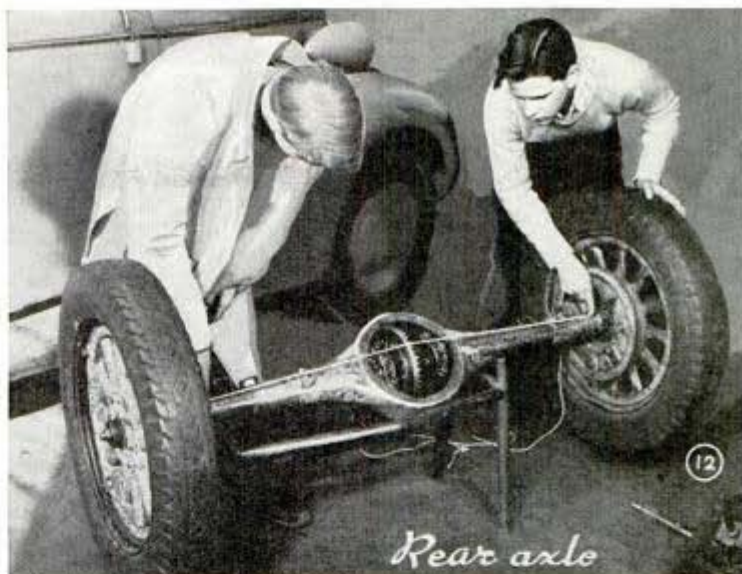


11 *Commutator*

Battery: Purchasing a used battery must be considered more or less of a gamble, and yet there are ways of being reasonably certain that the purchase will not prove to be a loss. All three cells should test alike. The gravity of each cell should be checked carefully with a hydrometer, and a variation of more than 25 points should be sufficient warning that all is not well. The addition of a little acid, however, is a simple matter and may make the gravity test appear to be all right, but in reality the battery will be far from satisfactory. To check against this possibility a voltmeter, Fig. 10, should be used to see that the voltage of all cells is the same within one-tenth of a volt. Open-circuit tests are of no value. The battery should be delivering about 200 amperes or approximately the amount required to crank an engine, when the voltage test is made.

Brake drums: Frequently, these parts will be refaced on a drum lathe and may look excellent, but actually may be so thin that in use they will distort. Instead of stopping the car satisfactorily they will merely stretch out of shape. Therefore, it is important to check drums as in Fig. 13.

Rear-axle assemblies: Usually rear axles are sold as a complete assembly. Rather than remove a pinion and ring gear or shafts, the used parts dealer will often make as good a price on the entire rear axle as he would on the internal parts alone. The thing to watch, especially on a rear axle, in addition to seeing that the internal parts are in reasonably good shape, is for a sprung housing. While stretching a string from one end to the other and bringing it down at the center is not an infallible guide, Fig. 12, it will indicate any extreme condition that may be present. If the axle



Rear axle

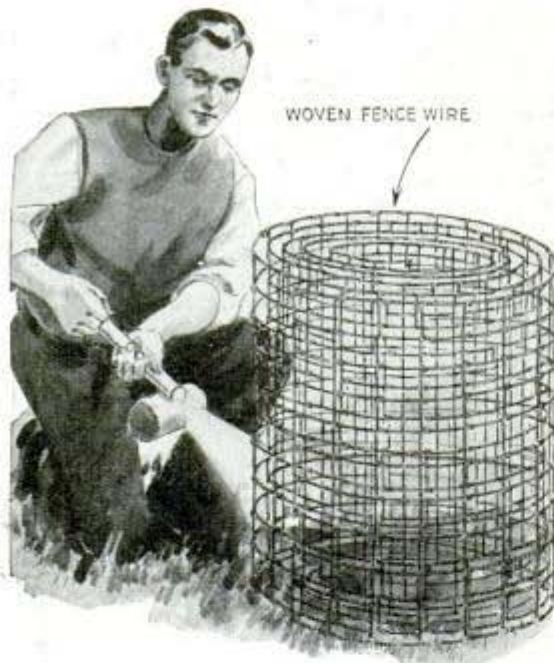


Brake drums

housing is not square, early failure of the pinion and ring gear is almost certain.

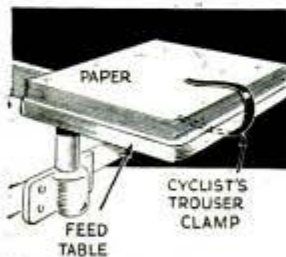
In general, in purchasing any part, especially those that have to do with the running gear of the car, check closely to see if there is any evidence that the parts have been straightened by heating. Strength is given to the steel parts of the car by heat treating. This strength can be removed by careless heating. The parts to watch especially include the front axle, spring perches, steering arms, and spindle bodies. Of course when one of these parts has been heated it is likely that the mechanic will paint it to remove the evidence. But look closely in cracks and corners, or in any holes where bolts may pass through. If there is indication of blistered paint or of discoloration, avoid that part.

Oil Spray Preserves Fence Wire Rolled for Storage



The next time you take down old woven wire fences and roll up the wire, spray the rolls with used crankcase oil, using an insecticide sprayer as shown. This precaution will prevent rust.

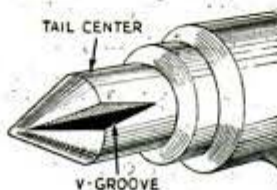
Paper Stock Held on Job Press By Trouser Clamp



A simple method of holding stacks of paper on the feed table of a job press so that the sheets can be removed one by one without being jolted off, is to use a bicycle trouser clamp. This is slipped over the paper and table as indicated.

V-Groove in the Tailstock Center Aids When Facing End Work

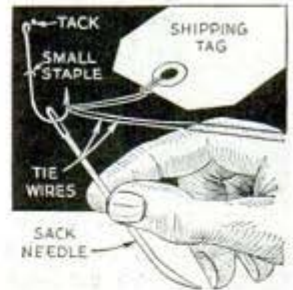
When facing the end of cylindrical work held between centers, you will be able to cut across the full radius of the work if a V-groove is filed in the side of the tailstock center as indicated. The groove per-



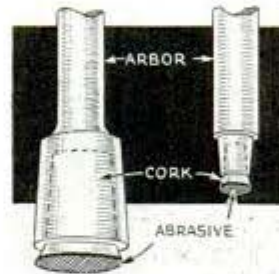
mits the cutting tool to remove the small shoulder around the centering hole, which otherwise cannot be reached.

Fishhook on Wall Pulls Tie Wires Through Eye of Sack Needle

One merchant uses a fishhook to thread tie wires of shipping tags through the eye of a sack needle for attaching them to cloth bags. The hook is tacked to a wall and the sides of the barb are filed down so that the needle will slip over the hook. Then the wires are placed just under the barb as shown, after which the needle is pulled over both the barb and the wires to thread it quickly.



Polishing Arbors to Finish Work



Using regular corks in the larger sizes and small vial stoppers or lead-pencil erasers in the smaller sizes, the drill-press polishing arbors shown have many uses.

The arbors are turned from shafting in sizes required with tapered sockets in one end to take the corks and with shanks on the other end to fit the drill-press chuck. Abrasive cloth is glued on the corks for surface grinding and general finishing or the corks are merely charged with fine buffing or lapping compound for putting decorative finishes on metal.

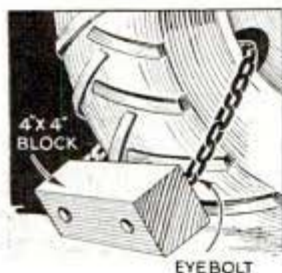
Saving Shipping-Room Adhesive

Sodium silicate (water glass) is used in most shipping departments for sealing corrugated containers. The usual practice is to keep an open vessel of this solution on the shipping table. During the night, however, much of the water-content of the silicate solution evaporates, leaving a crust on the top of the liquid, and a jellylike globule on the brush; thereby rendering the brush useless for the next day. To avoid this get an empty pint or quart bot-

tle with a screw cap. Vinegar and rubbing alcohol bottles are ideal. With a nail, punch a small hole in the cap. Fill the bottle with the silicate solution. When you have a carton to seal, shake as much of the adhesive as you need on the inner lip of the carton. Don't bother to spread it, for when you apply the gummed tape the glue will spread.

—Ernest Crossman, Los Angeles, Calif.

Block Lugs Help Stalled Tractor Pull Out of Mud



If you get your rubber-tired tractor mired deeply in soft or muddy fields you can save a lot of gas and time by using a lug of the type shown on each

wheel. These are made from lengths of 4 by 4-in. stock, four eye-bolts and two short lengths of chain. The chains are long enough to reach around the tire and rim.

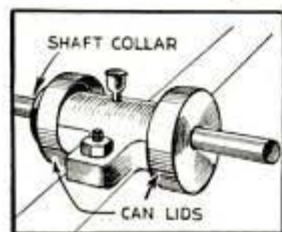
Hook on End of Oilcan Spout Opens Caps of Soft Oilers

To open small caps of soft oilers or oil cups used on many kinds of machinery, I filed the end of the oilcan spout to leave a projection, which was then bent into a hook.



This was used to lift the caps of the oilers while injecting oil.—G. E. Hendrickson, Argyle, Wis.

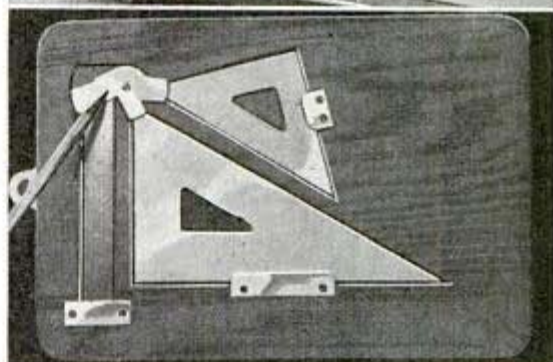
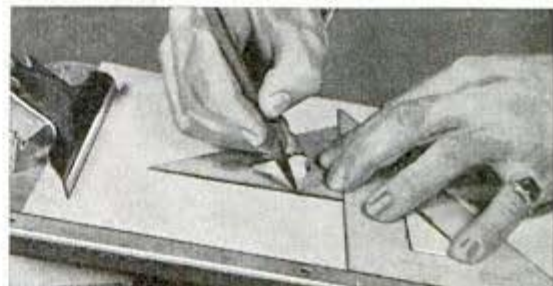
Can Lids Used as Anti-Slingers On Split Bearing



In order to prevent oil slinging from a split bearing in which the shaft is operated at a fairly high speed, one mechanic used ordinary can lids at each end of the bearing as shown.

These were drilled to fit the bearings, one lid being held in place with a shaft collar and the other by the pulley on the outboard end of the shaft.

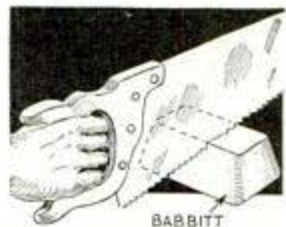
Clip-Board Used as Drawing Set For Shop Work



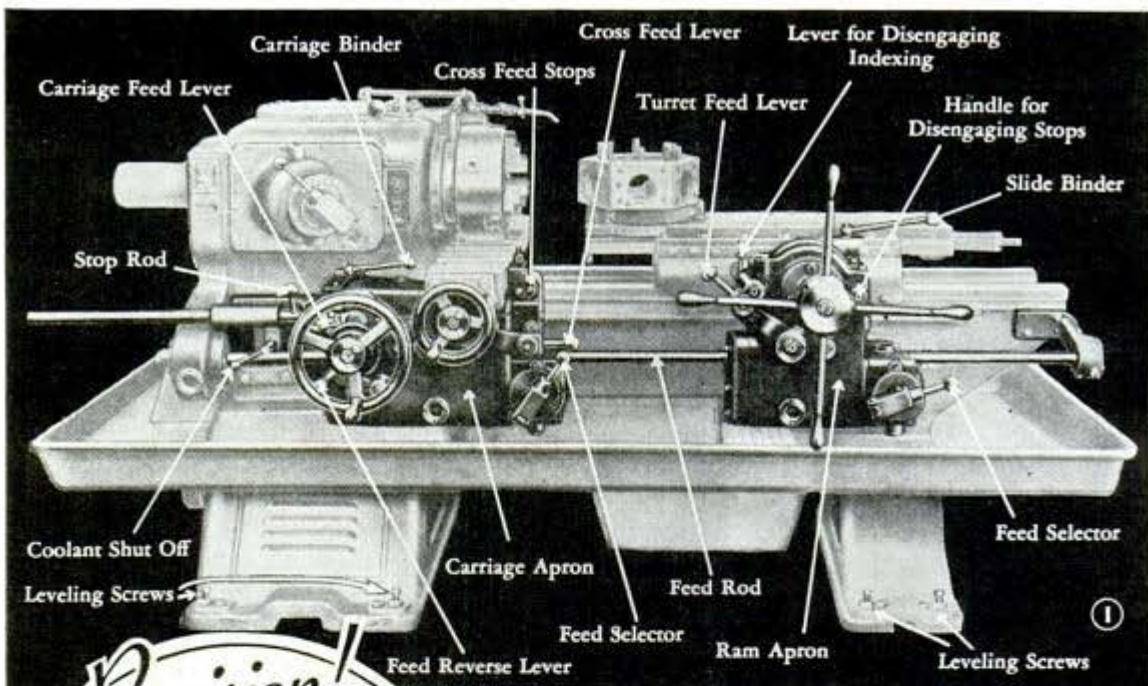
By a few simple additions a clip-board can be made into a small drawing board. A strip of $\frac{1}{16}$ -in. metal $\frac{1}{2}$ in. wide is screwed to the left side of the board, and a piece of plywood recessed for the scale and triangles is attached to the back. A 6-in. steel scale, a 4-in. 45-degree triangle and an 8-in. 30-60-degree triangle will be about right; these are held in place by metal clips and a turnbutton. The clips should be slightly below the surface of the plywood, or large-headed tacks may be placed on each corner of the board, small screws holding the plywood and clips in place. In use, the drawing paper is held by the clip and the 30-60 degree triangle is used against the metal clip in place of a T-square.—John M. Avery, Holley, N. Y.

Teeth of Sharpened Saw Burred With a Piece of Babbitt

Wishing to avoid dulling a newly sharpened saw by putting it into use with the filing burrs still clinging to the teeth, one carpenter removed them by passing the teeth over a piece of babbitt metal.



This knocked off the burrs without damaging the teeth.



Precision!

Speed without sacrifice of precision—that's the part the turret lathe is playing in producing the vast amount of war supplies so urgently needed. This article explains the mechanics of the turret and tells what the machine-shop apprentice should know to become proficient in its operation

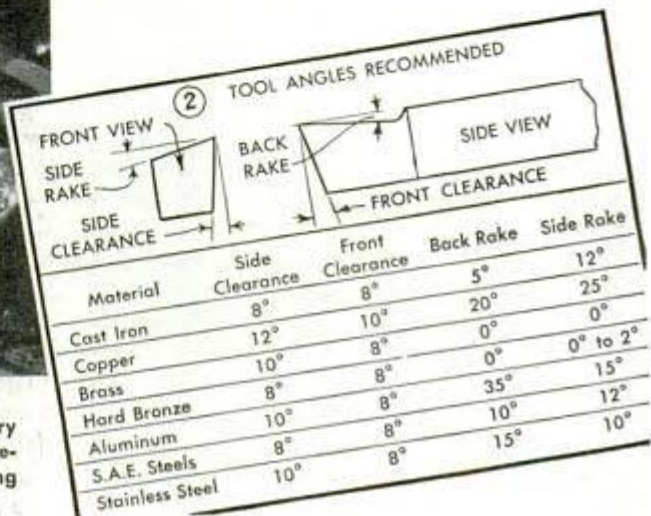
MACHINING *with*

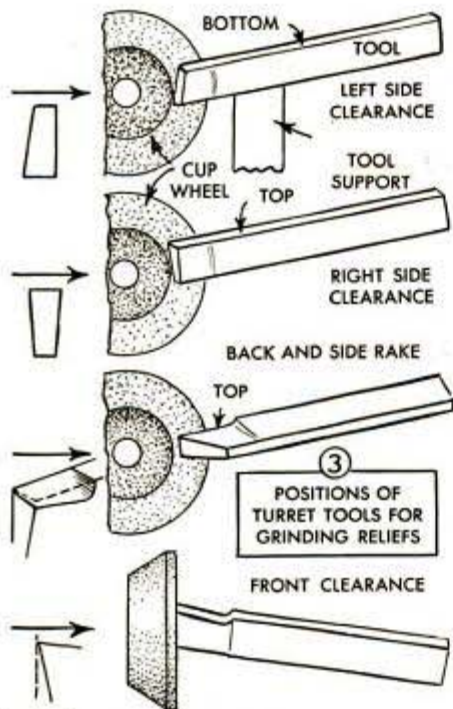
By H. J. Chamberland

THE conventional ram type of turret lathe has a single-spindle, a hexagon-shaped turret head and differs from an ordinary lathe in that it can machine externally from the rear as well as from the front of the work. The turret replaces the tailstock of a lathe and its functions are to bring into cutting positions by quick indexing, a predetermined number of cutting tools in order to center, chamfer, drill, bore, ream, thread, etc., in making a variety of parts such as shown in Fig. 4. Moreover, it is not uncommon, by means of longitudi-



The turret replaces the tailstock of an ordinary lathe. It holds a number of tools used successively in machining operations, each tool being brought into position quickly yet accurately





TURRETS

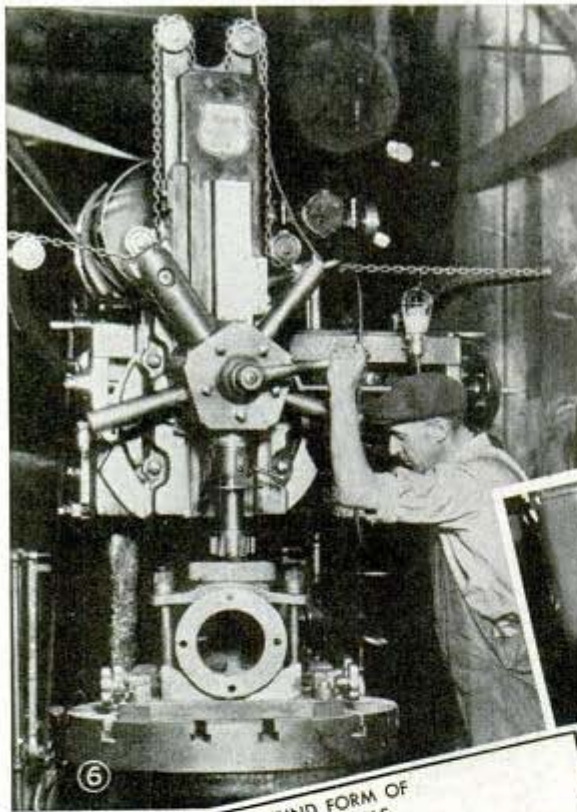
Photo at the right shows a busy turret-lathe department in continuous operation to meet heavy production demands



nal and cross-feed movements, to turn, face and otherwise machine work in a combined setting of internal and external cutting tools. The purpose of a turret lathe is to save time in changing from tool to tool in quantity production. Fig. 1 shows a ram type of turret lathe in which a double traverse movement gives considerable longitudinal range between work and tools. Another type of turret lathe is known as the saddle type, in which there is but a single movement of the turret in relation to the ways. While the conventional turret lathe is of the single-spindle type, there are twin-spindle machines, with which the extra time spent in setting up tools and work results in substantial returns by doubled production.

Fig. 5 shows a special type of single-spindle turret lathe having a turret of different construction than the usual type. Bars of stock are held in evenly spaced spindle-chuck assemblies, which are geared to and revolve in a large cylinder. Both the cylinder and the turret automatically index in timely performance so that as the work is being completed and cut off from the bar, the first operation on the



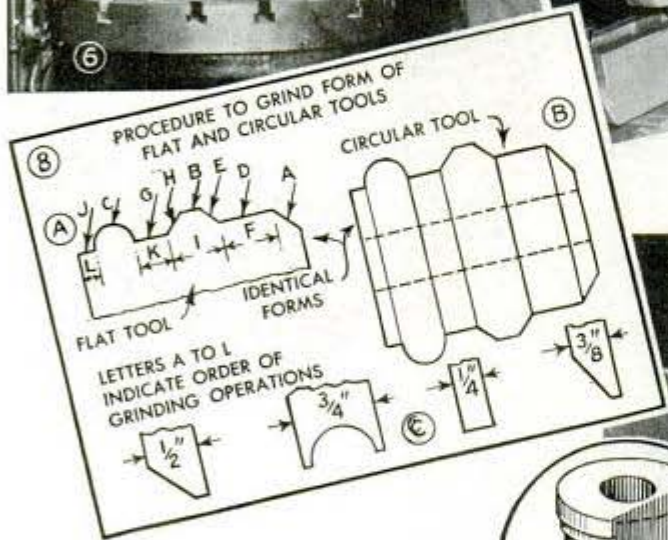


ing from 12 to 32 in. in diameter. Two-jaw chucks, auxiliary jaws for all chucks and some seventy-five specially designed jaws that can be attached. There are numerous types of face plates, angle plates and chucking fixtures. Also included in work-holding devices are numerous collet chucks to hold round, square, octagon, hexagon and other shaped bar stock.

Grinding the tools: Maximum effi-



Flat forming tools for use in turret-lathe work are sharpened on a tool grinder as shown above



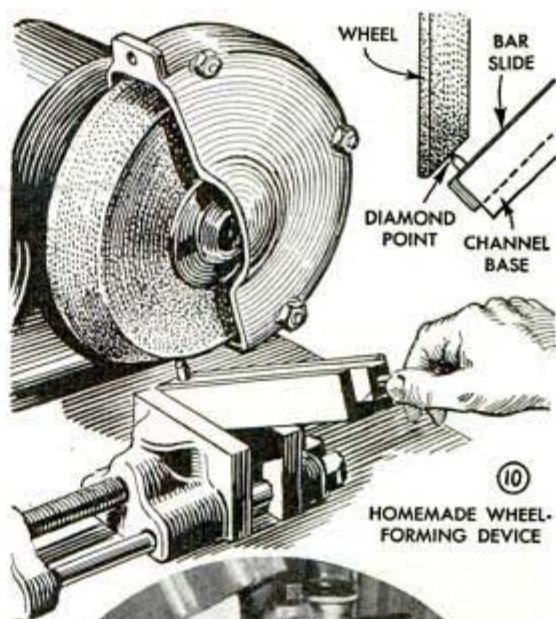
next piece is simultaneously performed on another part. Also commonly used is the vertical type of turret lathe shown in Fig. 6, heavy work being done with the aid of jigs and fixtures. The tendency to encounter vibration is greatly reduced, maximum rigidity of the work is assured and the wear in the work head is reduced as there is no overhang.

How work is held: There are many methods of holding various types of blanks or castings to be machined. All of these methods cannot be described in this article but the most important are as follows: Three-jaw universal geared scroll chucks and four-jaw independent chucks, rang-

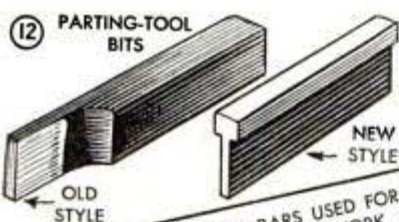


While flat forming tools are used in turret lathes, automatic screw machines use tools of circular design. These may be cut out on a band saw if the tools are not intended to be ground after hardening

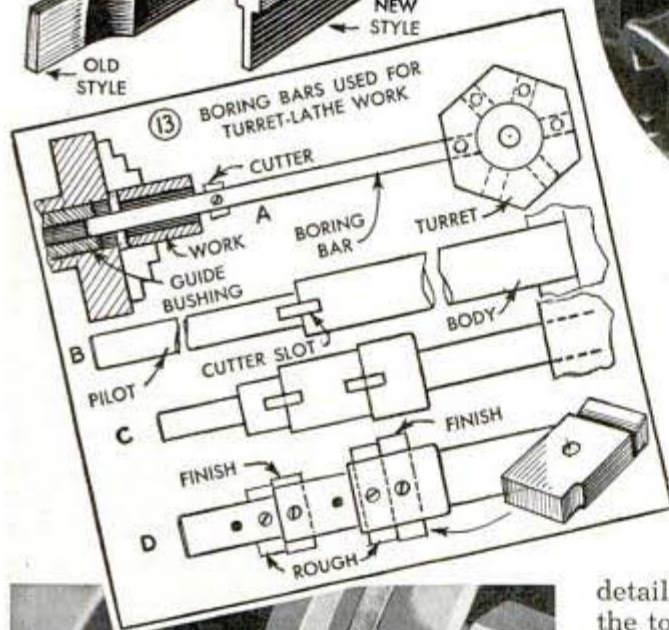
ciency of a turret lathe is maintained only as long as the tools stand up and therefore good care of cutting tools spells success or failure. Although a worker operating a turret lathe may not grind his own tools he should nevertheless know whether a tool is correctly ground and is in good condition. To machine externally, generally a combination of two or more tools is used, arranged to turn various diameters simultaneously with the front tool block, then to face, bevel, cut off and otherwise machine, also simultaneously, with the rear tool block. Fig. 2 gives general recommendations for grinding the tools for use on various metals, while Fig. 3 shows various positions of holding the tools while grinding. When doing this, the tools are clamped to adjustable supports set to the correct grinding angles. With turret-lathe work, flat forming tools such as shown in detail A of Fig. 8, are used frequently to machine straight, radial and angular surfaces simul-



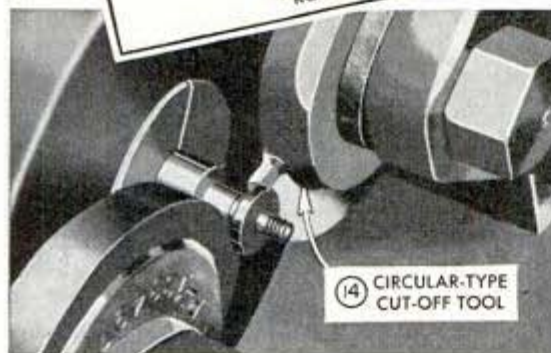
HOMEMADE WHEEL-FORMING DEVICE



PARTING-TOOL BITS



BORING BARS USED FOR TURRET-LATHE WORK

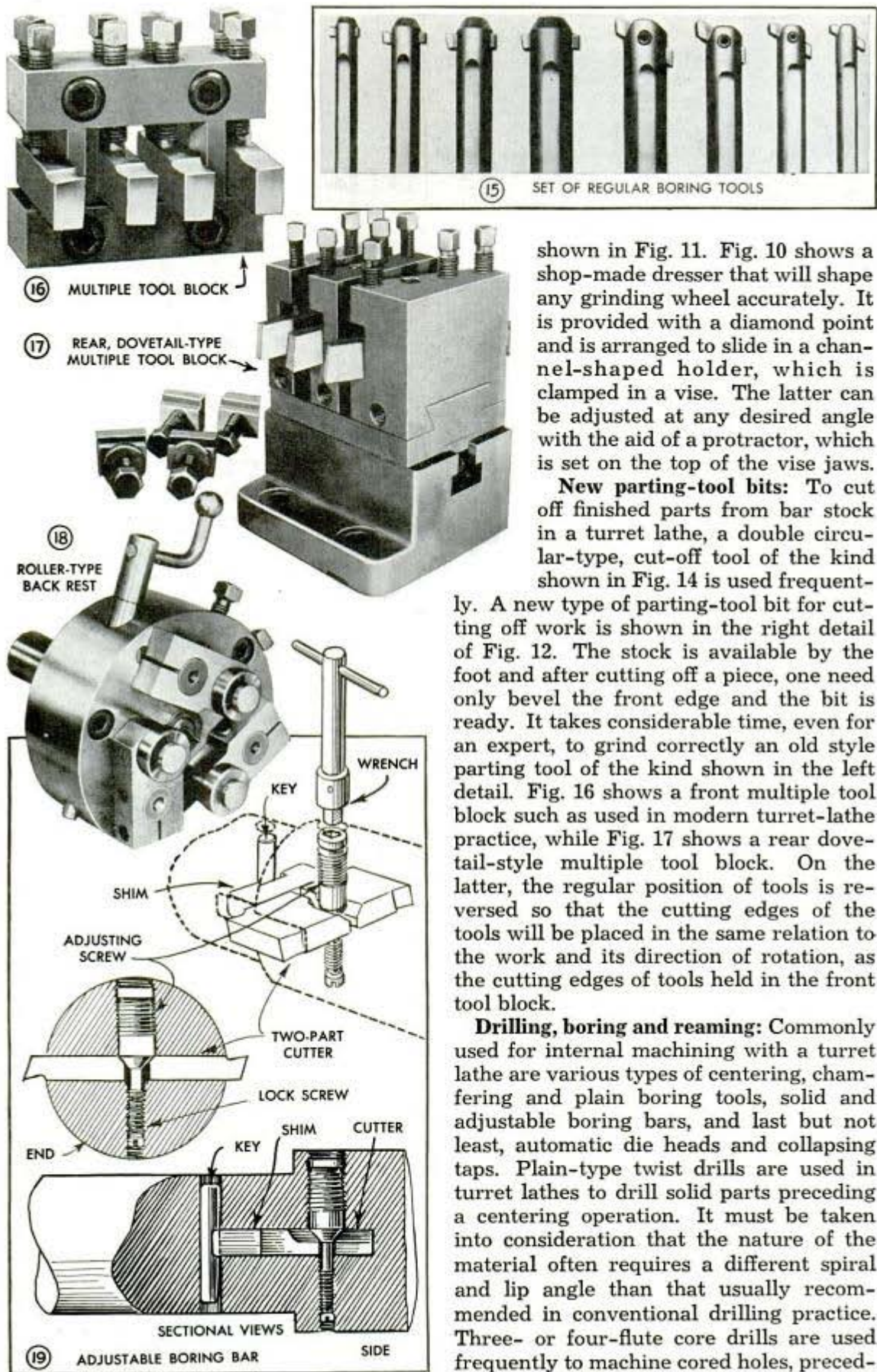


CIRCULAR-TYPE CUT-OFF TOOL

taneously. These tools are usually 1 in. thick and have a 10 to 15-degree front angle. Note how they differ from tools on automatic screw machines, which are of circular design as shown in detail B of Fig. 8. Tools of this style are turned step by step or with master forming tools, allowance being made for ground finishing. Fig. 8,

detail C, gives the shapes of wheels to grind the tools shown in details A and B, which have identical forms. Circular tools are ground on centers in regular tool-grinding machines. Fig. 9 shows how sections of circular forming tools are cut out with a band saw to produce the cutting edge, this procedure being possible when the tools are not to be ground after hardening.

Flat forming tools for turret-lathe work are finished on a tool-room grinder such as shown in Fig. 7, the wheel being dressed as



shown in Fig. 11. Fig. 10 shows a shop-made dresser that will shape any grinding wheel accurately. It is provided with a diamond point and is arranged to slide in a channel-shaped holder, which is clamped in a vise. The latter can be adjusted at any desired angle with the aid of a protractor, which is set on the top of the vise jaws.

New parting-tool bits: To cut off finished parts from bar stock in a turret lathe, a double circular-type, cut-off tool of the kind shown in Fig. 14 is used frequently.

A new type of parting-tool bit for cutting off work is shown in the right detail of Fig. 12. The stock is available by the foot and after cutting off a piece, one need only bevel the front edge and the bit is ready. It takes considerable time, even for an expert, to grind correctly an old style parting tool of the kind shown in the left detail. Fig. 16 shows a front multiple tool block such as used in modern turret-lathe practice, while Fig. 17 shows a rear dovetail-style multiple tool block. On the latter, the regular position of tools is reversed so that the cutting edges of the tools will be placed in the same relation to the work and its direction of rotation, as the cutting edges of tools held in the front tool block.

Drilling, boring and reaming: Commonly used for internal machining with a turret lathe are various types of centering, chamfering and plain boring tools, solid and adjustable boring bars, and last but not least, automatic die heads and collapsing taps. Plain-type twist drills are used in turret lathes to drill solid parts preceding a centering operation. It must be taken into consideration that the nature of the material often requires a different spiral and lip angle than that usually recommended in conventional drilling practice. Three- or four-flute core drills are used frequently to machine cored holes, preced-

ing a chamfering operation on the edge of the rough hole to assure concentric location of the drill. Often a rose reamer is used instead of a core drill. Detail A of Fig. 13 shows how boring bars operate on a turret lathe. The pilot end is supported in a hardened steel bushing either in the spindle bore or in the rear of the chuck jaws as shown. Many boring bars are 60 in. long and of proportionate diameter so that holes as large as 12 in. can be produced with



22 RECOMMENDED FACE GRINDS FOR CHASERS

Material	Grind for Die	Grind for Tap
Cast-Iron and Bronze Castings	No. 1	No. 3 at 5°
Aluminum Castings	No. 3 at 15°	No. 2 at 20°
Malleable and Wrought-Iron Castings	No. 3 at 10°	No. 2 at 10°
Copper	No. 3 at 10°	No. 3 at 20°
Low-Carbon Steels	No. 3 at 10°	No. 2 at 15°
High-Speed Steels	No. 3 at 15°	No. 2 at 20°
Most All Alloy Steels	No. 3 at 10°	No. 3 at 10°
Stainless Steels	No. 3 at 10°	No. 3 at 10°

Diagram showing four types of face grinds: 1. STRAIGHT, 2. RADIAL, 3. ANGULAR, 4. SNUB.

Diagram showing chamfers: 22° FOR FREE-CUTTING MATERIALS, 15° FOR MOST ALLOY STEEL, 10° FOR HEAT-TREATED MATERIALS.

NO. 4 GRIND (SNUB) USED MOSTLY FOR FIBER, RUBBER, BAKELITE, ETC.

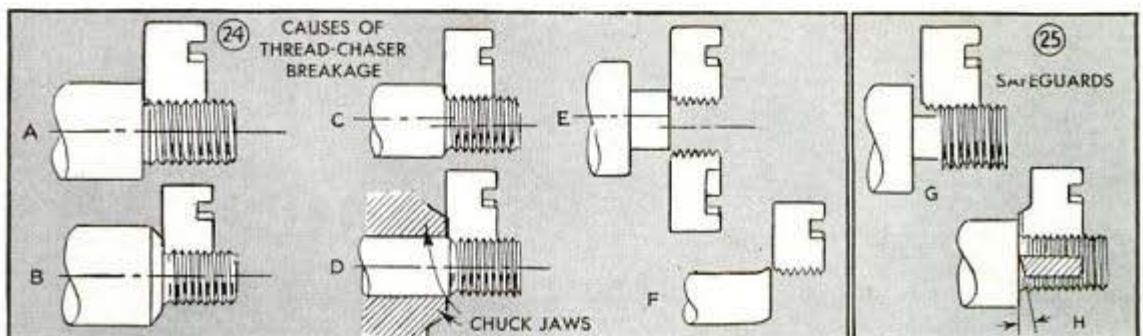
CHASER DAMAGED BY RUNNING INTO SHOULDER OF WORK



UNUSED SET OF CHAMFERS SHOWING ORIGINAL CHAMFER GRIND

accuracy. Boring bars are purchased or are shop-made in various designs, with solid or adjustable cutters operating singly or in multiples. Generally, single boring bars are used to rough only, leaving the bore to be reamed. Detail B of Fig. 13

shows a single-cutter, boring-bar body, while detail C shows a compound roughing and finishing bar, which will eliminate the cost of a reamer if spindle and turret are in good alignment. Detail D shows a bar designed to rough and finish two different diameters simultaneously although boring bars are also made for triple cuts. A set of regular boring tools for light turret work is shown in Fig. 15. On long boring bars, which require sup-



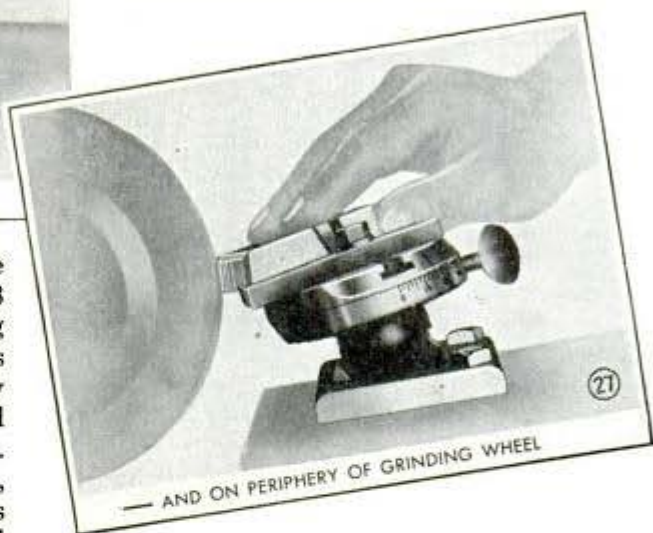


CHASER CHAMFER SHARPENED ON SIDE

port between work and turret, the roller-type back rest shown in Fig. 18 can be used. An adjustable boring bar fitted with a two-part cutter is shown in Fig. 19. The adjusting screw has a fine-pitch thread and a broached hole in the end to take a wrench. After adjustments have been made, the screw is held in position by means of a lock screw. A shim is placed against one side of both cutters and a tapered key is driven against the shim so that the cutters are locked securely, as they must not be able to move in the holder.

Production threading: Automatic die heads and collapsing taps offer the most efficient means of cutting threads in turret lathes and screw machines. Regular taps and dies are seldom used but are helpful in cutting threads in an ordinary lathe equipped with small turrets. The specialized threading equipment just mentioned is adjustable to various thread fits; the die automatically opens and the tap similarly closes for the return movement, which is very important as many good threads produced with regular tools on the cutting pass have been damaged by the return action. Die and tap heads contain either four or six cutters, known as chasers, which after sharpening, must be replaced in their respective slots, both slot and chaser being marked for correct setting. Such die and tap heads cause no trouble if they are periodically cleaned and if chips are kept out. However, the chasers must be watched and kept in good condition. Fig. 21 shows an automatic die head used in threading a

brass pipe fitting, and Fig. 20 shows an automatic collapsing tap for threading a similar but larger fitting. Four chasers are used in both heads but for large diameter threading six chasers are used. Chasers of a set must be kept exactly alike when re-sharpened. Fig. 22 shows the four face grinds and three chamfer angles commonly used. The relation of the face grind to the material being threaded is very important. The 22-degree angle giving a two-thread chamfer is standard but should be in-



— AND ON PERIPHERY OF GRINDING WHEEL

creased to 15 or 20 degrees according to the hardness of the material.

Running into a shoulder is the most disastrous thing that can happen to a set of chasers. Fig. 23 shows a set of unused chasers having the original chamfer grind and also a chaser damaged by running into a shoulder. Major causes of chaser breakage are indicated in Fig. 24. Detail A shows the top face of a chaser rubbing against the shoulder of the work and cutting into it. In detail B the chaser hits the fillet in front of the shoulder. If stock is out of round or oversize, castings not turned, bored or reamed to size, the chaser cannot stand the strain, detail C. A chaser hitting chuck jaws as in detail D undoubtedly will be damaged, which also results from misalignment between the spindle and the turret as in detail E, as well as from a bad job of cutting stock, leaving sheared edges as shown in detail F. To safeguard against such troubles, a wide and deep recess can be provided as shown in detail G of Fig. 25, and if this is not possible, projection chasers should be used, in which case the tools are still good if the chamfer breaks, as in detail H.

Chasers cannot be sharpened free-hand. Correctly serviced chasers seldom require regrinding on the face and the original face grinds should not be altered. For grinding the chamfers, equipment available from chaser manufacturers is used. Chaser-grinding fixtures, regardless of style, are all intended to produce four or six identical chamfers. The fixtures have adjustments for various angles and clearances, and are bolted to the table of a tool-grinding machine. With these provisions all chamfers of a set are given identical cutting action by feeding them to a stop determined by the first one sharpened. Chaser chamfers are sharpened in two ways: on the side of a 6 by 1/2-in. wheel as in Fig. 26, or on the periphery of a 6 by 1-in. wheel as in Fig. 27, using the same style of fixture in both cases. When grinding on the periphery, the wheel should not be less than 5 in. in diameter in order to avoid a concave surface. Chamfer edges should be stoned always after grinding. When the face of chasers must be reground, generally the entire set is lined on a magnetic chuck for a simultaneous operation and uniform depth of cut. A 60-grain and I-grade wheel is recommended for this kind of work.

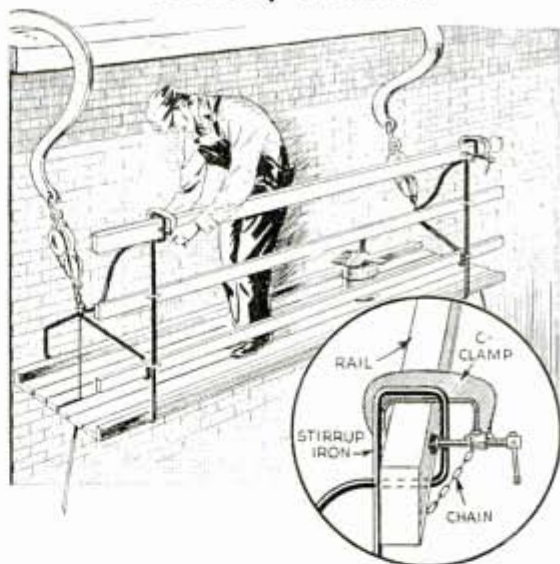
Speeds and feeds: Regarding speeds and feeds for turret machining, no specific recommendations can be made. With good equipment, speeds and feeds depend mostly on the material, type of cutting tool and the type of cutting lubricant used. However, an important rule is to start with the highest speed and feed that will not cause machine vibration, and also be guided by the color of the chip. A straw or light colored chip is about correct but a blue chip is too hot, indicating too fast a speed or too much feed. Cutting tools tipped with tungsten carbide will stand up to two or three times as much speed and feed as high-speed steel tools. All turret machining demands an ample flow of cutting lubricants. **Next month: Sharpening Milling Cutters**

Nail Started With Hammer Claws

Having several hundred yards of wire lath to nail up, I was confronted with the problem of holding a sheet of lath while driving the first nail. I solved this by magnetizing the claws of my hammer so they would hold the nail to start it.

—Andy Vena, New York City.

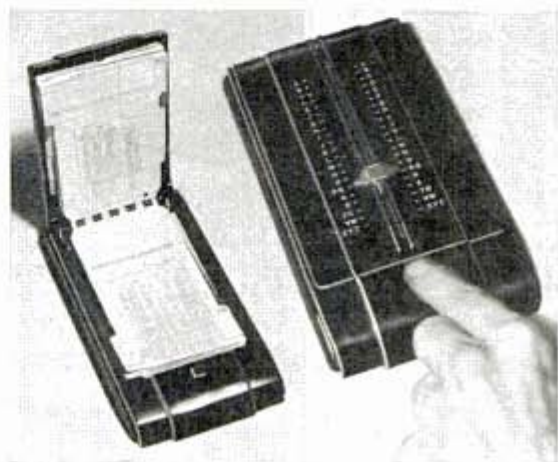
Scaffold Safety Rail Clamped Securely in Place



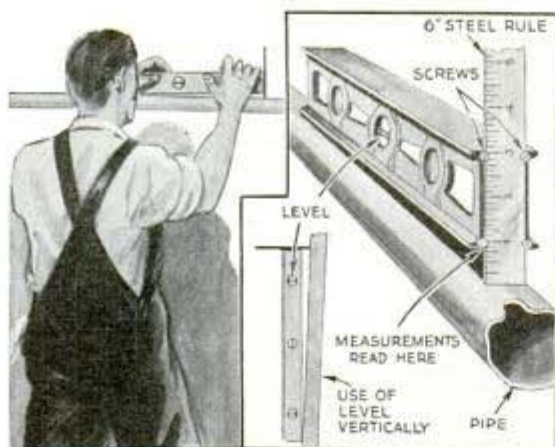
Instead of tying the safety rail on a scaffold in place with cord or light rope, use C-clamps as shown. Clamping makes the rail more secure, and takes less time. The clamp jaws are placed on each side of the scaffold stirrup as indicated in the detail; a short, small chain being fastened to each clamp to prevent its loss when not in use.

Telephone Index Aids Draftsman

One draftsman cuts out the charts and pastes them to the alphabetically indexed leaves of a telephone selector index instead of keeping several books and manuals at hand as a source of necessary tables and charts for a job. In this way, any one of numerous tables and charts can be selected and referred to instantly. The tables can be taken from old books, manuals and manufacturers' catalogues.



Steel Scale on One End of Level Shows Pitch of Work



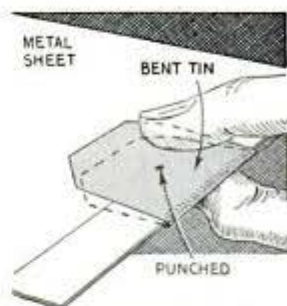
Fitted to one end of a carpenter's level, a 6-in. steel scale will enable you to tell at a glance the pitch of rafters, pipe work, etc. The scale is held by four machine screws which are tapped into the end of the level, the scale being a snug, sliding fit under the screw heads. If a level is one foot long, the reading can be taken directly from the

scale, but if the level is longer than one foot the reading will be proportional to its length. For example, a 2-ft. level may show a reading of one-half inch. This would mean that the pitch per foot is just one half of that or $\frac{1}{4}$ in. per foot.

—R. Boettinger, Englewood, N. J.

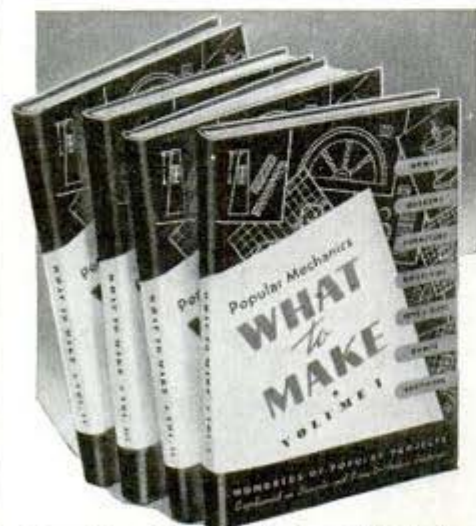
Prick-Punched Strip of Folded Tin Scribes Rivet Line on Metal

To scribe the rivet lines on a number of sheets of metal, one tinsmith prick-punched a narrow strip of tin and bent this over the edge of a sheet so that the indented point could be pressed down against it to mark the metal as it was drawn along. The bend of the strip served as the gauge for the marker so that the work could be done rapidly and effectively.



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PARTIAL LIST OF CONTENTS

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Radio

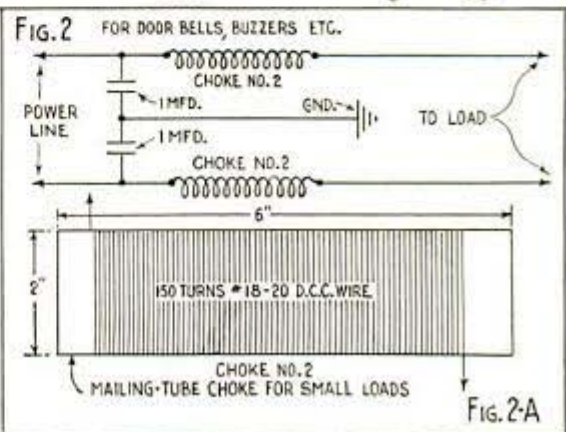
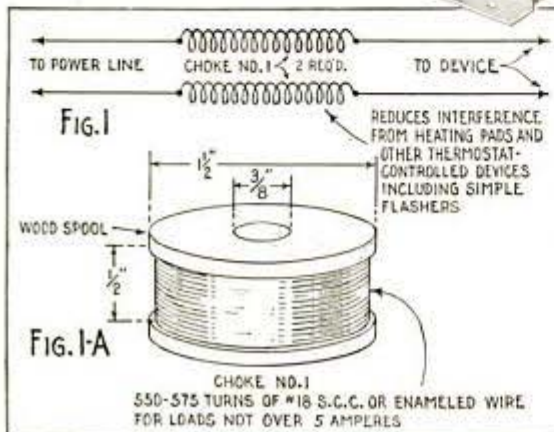
First Aid for Radio Sets

PART VII

WHEN you turn on your receiver and the set is "dead," try a table lamp in the wall socket where the set plug was. If the lamp does not light it is evident that there was no power on the set. Perhaps the power has been shut off temporarily, or you may have a blown fuse in that particular house lighting circuit.

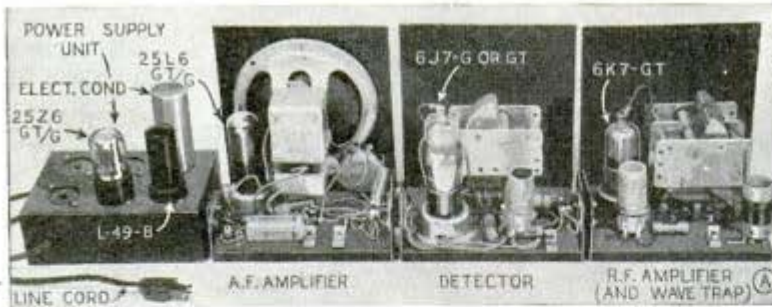
One of the greatest pests to broadcast listeners is interference from nearby electrically operated machines, door bells, buzzers and electric heating pads. Commercial line filters like the ones shown in photos B and C plug in between the set and the power line and eliminate much of this interference. They consist of chokes and condensers or combinations of both such as shown in the homemade varieties detailed in diagrams Figs. 1 and 2. The 1 mfd. condensers must be 400-volt types. Choke No. 1 is layer wound on a paraffined wood spool. Line voltage regulators like the one shown in photo A plug in the same way and protect against fluctuating line voltage that shortens tube life.

(To be continued)



Four-Unit

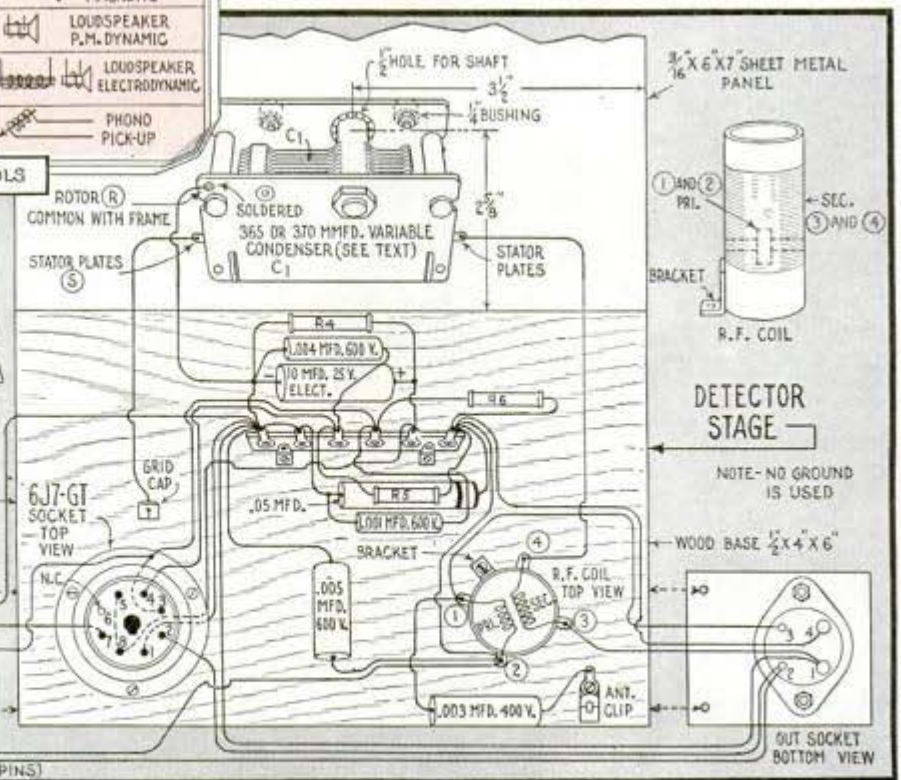
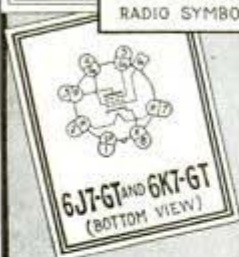
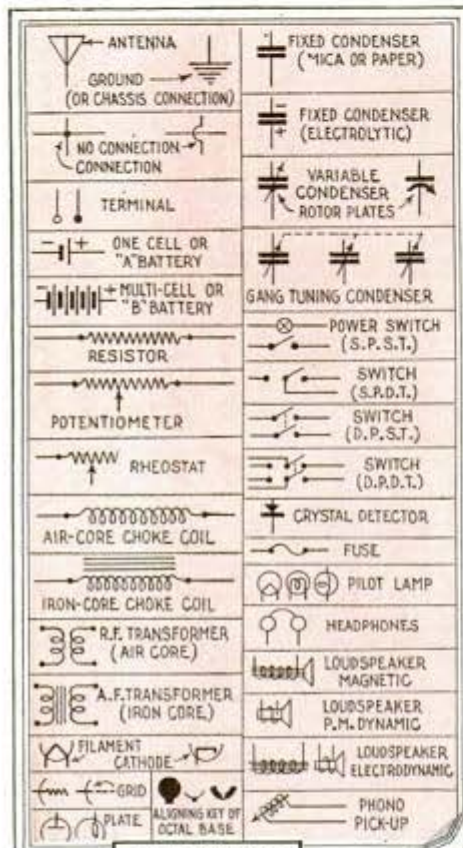
By M. N. Beitman



AFTER thoroughly checking and testing the power supply and audio amplifier units of this modern progressive student set, described in the November issue, we are now ready to build the detector and R.F. stages, which complete the 4-tube T.R.F. broadcast receiver shown in photos A and B.

These additional units, shown in photo C, are assembled on baseboards and panels identical with the one used for the audio amplifier stage, and plug together in the same manner, the tubes being moved forward from the sockets in the power supply unit to their new locations in the added units. All circuit connections are automatically made by means of the plug and socket connectors. Care must be taken to maintain the proper continuity of each connecting lead, and this is not intended to be easy. The student should check each plug and socket terminal for continuity upon completing each unit. This can be done with a voltmeter or pilot light bulb connected in series with a dry cell. Check your wiring against both the simplified and schematic circuit diagrams, using the chart of radio symbols to identify

them. The student should check each plug and socket terminal for continuity upon completing each unit. This can be done with a voltmeter or pilot light bulb connected in series with a dry cell. Check your wiring against both the simplified and schematic circuit diagrams, using the chart of radio symbols to identify



A.C.-D.C. STUDENT RECEIVER

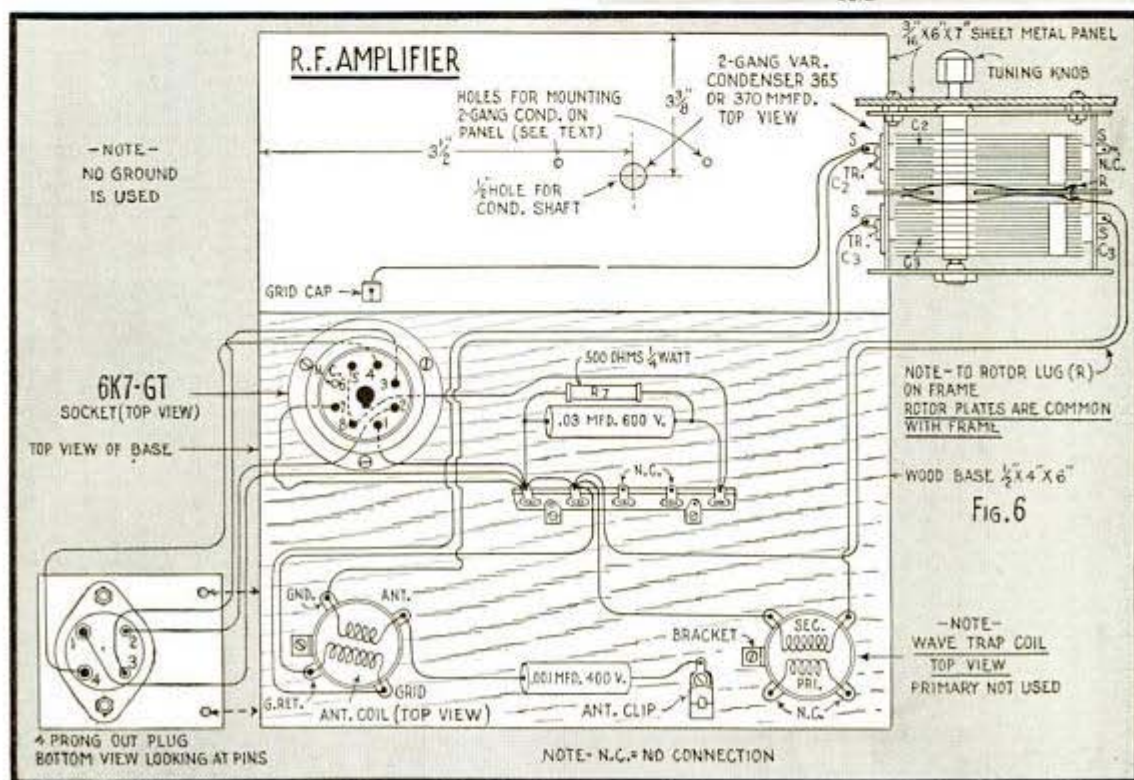
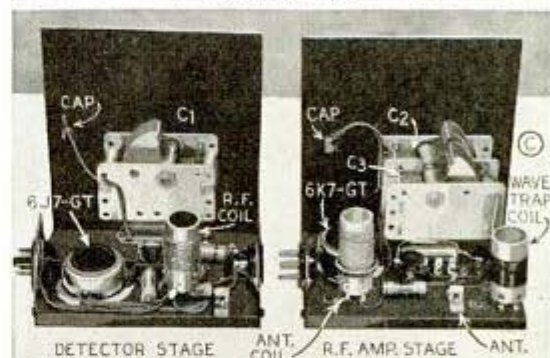
PART II—DETECTOR AND R. F. AMPLIFIER STAGES COMPLETE THE 4-TUBE SET

tify the various parts shown in schematic diagrams in Figs. 7 and 8.

As stated in Part I, this progressive set is designed primarily for the student, and the parts values are not critical. Condensers may vary to twice the indicated values, or to half of the specified values and still give satisfactory results. This enables the builder to use "junk box" parts.

Build the detector unit first; the simplified wiring diagram for this stage is shown in Fig. 5. Mount the "in plug" panel at the proper height so that the plug will fit into the "out socket" of the audio amplifier stage by merely pushing the two units together. Please note in Fig. 5 that the "in plug" connections are bottom view looking at the pins and considering the ends of the pins, or prongs, as on the bottom side. This reverses the usual pin numbering stamped on some plug connectors but simplifies the wiring in this case, and corresponds with the same method used in wiring the "in plug" employed in the audio amplifier unit

(Continued to page 180)



Cloth Covered Cabinet Modernizes Old Set

By Martin Fixen

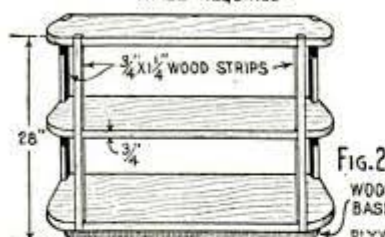
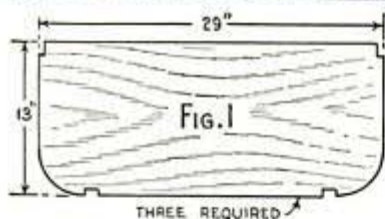
DO NOT discard your old receiver just because the cabinet is out of date and does not look well with your present furnishings. If the set is still giving good service, you can house the chassis and speaker in this attractive and easily built cabinet that will blend in with your other furniture. Designed to provide a large baffle surface for the speaker, tone quality of the old set is greatly improved in most cases.

Made from ordinary pine lumber and plywood, the dimensions may be altered to suit the builder; however, the specifications given will provide adequate room for any ordinary receiver chassis and speaker. Three identical $\frac{3}{4}$ -in. pieces for the top, bottom and shelf are detailed in Fig. 1. Four wood strips $\frac{3}{4}$ by $1\frac{1}{4}$ by 26 in. are required for the uprights which are screwed in position as shown in Fig. 2; the height of the center shelf being adjusted for your set.

The 2 by 2-in. wood base is detailed in Fig. 4; this should be set in about 3 in.

from the outer edge of the bottom board and is mounted by means of long screws through countersunk holes. The outer edge of this base frame is given a coat of black enamel, or finished to match the top. Plywood, $\frac{1}{4}$ in. thick, is measured and cut to fit the outside of the cabinet, and the necessary openings for the dial, speaker grill and

(Continued to page 182)



START TACKING CLOTH INSIDE REAR UPRIGHT STRIPS $\frac{1}{8}$ X $\frac{3}{4}$ FIG. 5



FIG. 5

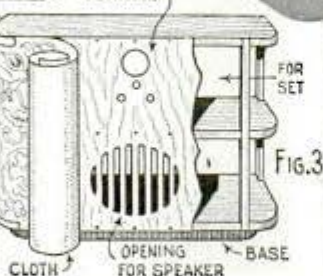


FIG. 3

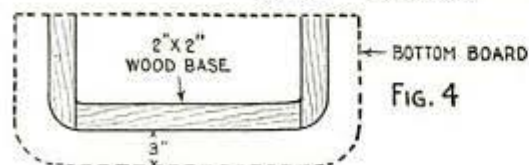
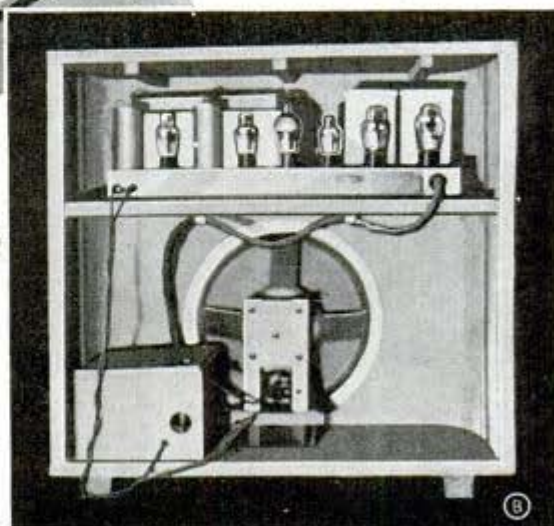


FIG. 4



Practical RADIO HINTS

(A) Simple low-voltage tester provides an inexpensive means for checking filament circuits. When used with a small 22½-volt B-battery it makes an excellent continuity tester for students. It consists of a tiny neon lamp and two flexible leads that terminate in spring clips that can be attached to wires or parts. Other suggested student uses are for testing radio frequency, tubes, polarity, blown fuses and defective fixed condensers



(B) Tubular cardboard dry electrolytic condensers now replace chassis mounting wet types formerly supplied in aluminum thread-neck cans

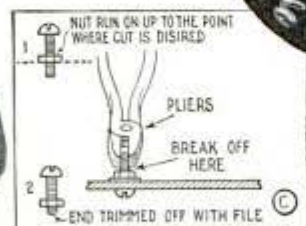


(E) To remove kinks from salvaged wire, clamp one end of the wire in a vise, straighten out all loops, then give the wire a sharp jerk with a heavy pair of pliers

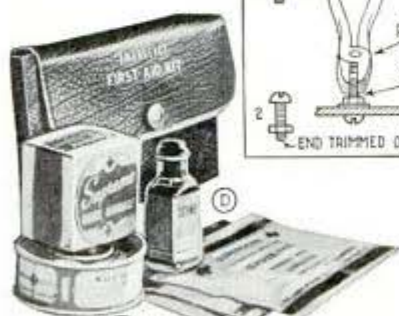
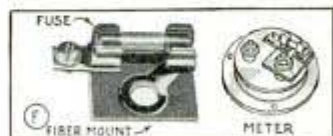
(C) To cut off machine screws without injuring the threads, run up the nut to point where cut is to be made, as in Fig. 1, then use a hack saw, after which trim with a file as indicated in Fig. 2. The sketch shows a quicker method for smaller screws



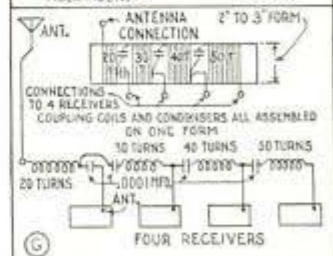
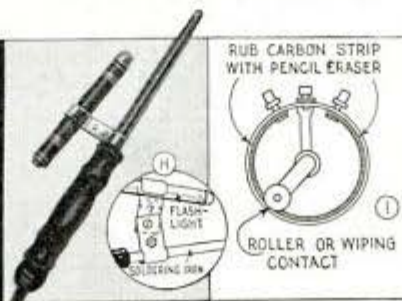
(F) Fuse holder mounts directly on one meter post. (G) Homemade antenna coupler for using 4 receivers on a single antenna. Wind coils on a cardboard tube 10 in. long with common bell wire, or similar insulated wire, and space coils 1 in. apart. Solder in the series condensers and tape them flat against the form. Mounted in a metal can, the antenna leads are brought out to each set



(H) Pocket flashlight mounted on a soldering iron. (I) Cleaning carbon type volume control. (J) Photo corners will hold log in portable set lid



(D) First-aid kit for radio workers fits in pocket or may be worn on your belt; when empty it makes a handy utility kit. Also useful for air-raid wardens and hunters



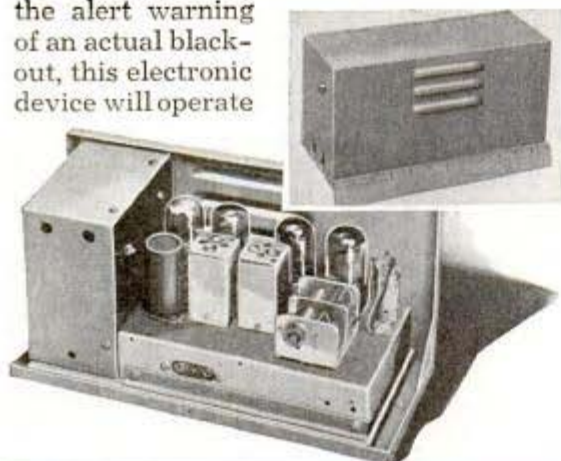
Circular-Type Radio Antenna



Designed for mobile use, this General Electric "doughnut" antenna shown at the recent convention of the Institute of Radio Engineers, can be installed directly above the roof of an automobile and is claimed to give the same results as the tall whip-type (vertical) antennas commonly seen on police squad cars. Efficient for both receiving and transmitting, it provides equal radiation of radio waves in all directions horizontally. The demonstration model was mounted on a toy train.

Electronic Light Control Unit

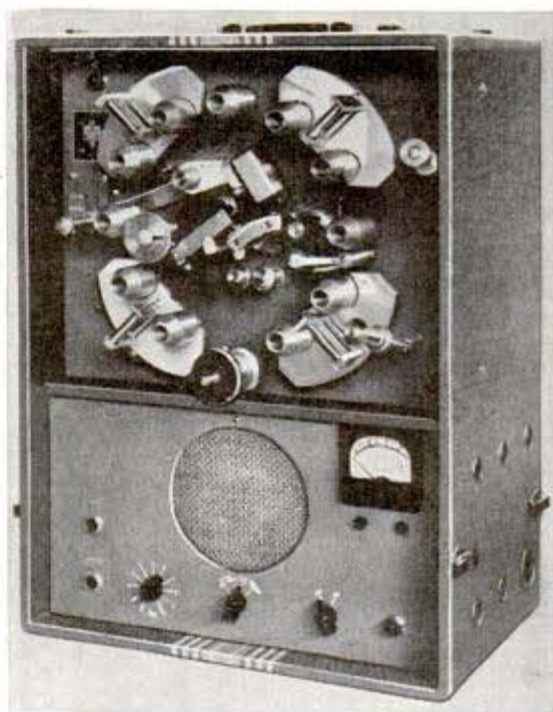
Operated by the cutting off of the carrier of a standard broadcasting station during the alert warning of an actual blackout, this electronic device will operate



instantly to put out all lights connected to its power relay and turn them on automatically after the blackout when the station to which it is tuned comes back on the air. If anything goes wrong with the unit itself, the device will cut off the lights.

Tape Recorder Is Automatic

Employing noninflammable acetate film for permanent reference recording and automatic audio amplifier play-back, this portable tape recorder plugs into the power line and may be connected to a radio, telephone or microphone for continuous re-



ording over periods up to 4 hours without supervision. It is designed for business offices, airline dispatch, airport control towers and similar applications where continuous recording operations are required over long periods.

Blueprints covering simplified radio construction articles in this and past issues are available for 25¢ each. Many popular tested circuits for beginners, students and experimenters may be built with used parts. Detailed material lists can be obtained from Popular Mechanics Radio Department upon receipt of postage.

NEXT MONTH—Simple Four-Watt A.C.-D.C. Phono Amplifier. Designed for student construction and suitable for use in amplifying records played on any type of record player; employs noncritical parts and the volume is sufficient for small group dancing in recreation centers. Also—**First Aid for Home Receivers, Part 8.**



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Outdoors . . . Indoors . . .
you can always count on

KODAK FILM

Your Victory Car

(Continued from page 85)

operating economy, and could be moderately priced. The trend toward simplicity will do much in connection with initial cost, yet predictions on cost are dangerous because of the unknown economic results of the war.

As the world gradually emerges from war conversion to peacetime manufacture, we may find the rear-engine type as an ultimate and desirable possibility. Passengers will be moved forward for further increased vision, more interior lounging space, more complete body streamlining. The placing of engine noise, heat, and fumes behind the passengers instead of in front of them is a long-desired change. The rear engine design offers traction over the rear driving wheels, yet there is speculation as to whether it might reduce the weight over the front wheels to a point where satisfactory steering characteristics might be reduced. Moving the passengers forward enables the rear-engine car to approach more nearly the teardrop shape; however, the degree to which passengers can be moved forward is limited by the space required to turn the front wheels when steering. The rear-engine car with its relocated power plant will eliminate the need for drive-shaft tunnels and the car can then be lowered to a somewhat greater extent than existing models, yet this, too, is governed by ease of entry and exit and by existing curb heights.

Plastics will predominate and may be applicable to windows, windshields, and perhaps to some body panels, yet we must remember that three important industries will be competing for the same business—steel, aluminum, and plastics. It is impossible to say whether this business will be shared or dominated by any one material.

Smaller air-cooled engines requiring less space and offering greater operating economy will be utilized. Functional streamlining will help maintain reasonable performance with less power. There will be no tendency to offer the general public 100 to 150 miles per hour speed.

The field of automotive transportation undoubtedly will be enhanced in the postwar period by addition of a new method of merchandising a line of products. I am speaking of the definite development of sales cars or traveling display rooms. This

method of demonstration and selling has been through the preliminary stages. Five years ago, we were commissioned by a client to design and produce an experimental vehicle for this purpose. Each succeeding year has brought improved models of which a number have been custom-built and put into service. A complete office and showroom on one motorized wheelbase within a length limitation of twenty feet, bumper to bumper, is the result. These sales cars are held to twenty feet in length to facilitate parking in downtown areas. The units have six feet two inches headroom, a comfortable lounge for customers, storage space for samples, a radio, heaters, fans, and the other comforts of an office. The control cabin forward, partitioned from the sales room, provides the salesman or chauffeur with air-liner vision and safety of operation. Note here the similarity to the windshield prophecy we have just made in the postwar car and the rear engine car. Powered by a standard V8 engine and utilizing tubular steel construction throughout, we have light weight and flexibility. Top speeds of 85 miles per hour are safely possible, and performance costs have shown an average of 15 miles per gallon of fuel. This type of project is applicable to many businesses, and may supplant the trailer as a mobile home because of its ease and safety of operation.

The postwar advent of freight-hauling cargo airplanes will influence commercial cross-country truck design. Cross-country haulers, already designed and ready for construction, are capable of carrying 22,000 pounds in one streamlined hull with the same driver advantages of vision pointed out earlier in this article. This truck body of welded tubular steel construction literally becomes a fuselage on wheels. The body has been designed around a practical pay load, as well as taking into consideration aerodynamic qualities and advertising appeal.

Each succeeding week of worldwide warfare will find new scientific and technical discoveries which will influence the transportation field. Because of his work in almost every field of manufacture, the industrial designer is qualified to observe and prophesy acceptable trends and consumer demands.



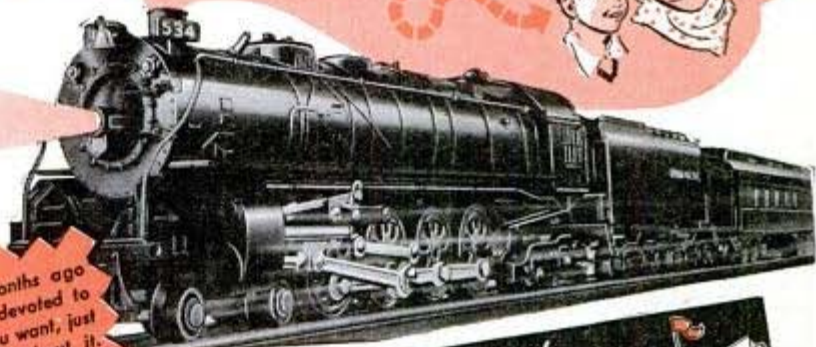
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BOYS! Look and listen for the most thrilling and realistic-sounding American Flyer "Hot Shots" that ever pounded down the track.

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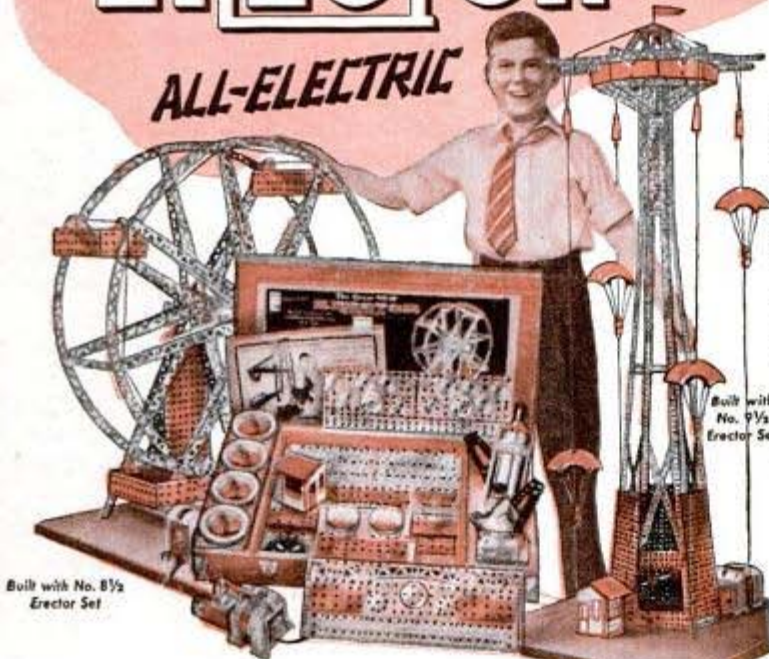
GILBERT AMERICAN FLYER TRAINS
HEAR 'EM "CHOO-CHOO"



Toys on sale were manufactured many months ago and Gilbert production facilities are now devoted to war materials. If you can't get the set you want, just be a good sport and a good American about it.

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Built with No. 97s Erector Set



It's colossal, boys . . . that towering Erector army training parachute jump. Piece by piece you build it yourself. Click a switch and the powerful Erector electric engine hoists the four parachutes up and up. Then watch them plummet downward—unfold—and float to the ground.

Now get a load of that mighty Ferris wheel. It whistles—twinkles with light—operates in either direction at slow or high speed.

You can build hundreds of spectacular mechanical marvels with one Erector set. The Erector electric engine makes them buzz with action! See my new Erectors at your nearest toy store. *A. C. Gilbert, President.*

BOYS! Send 10¢ for big 48-page illustrated American Flyer Train catalog. Or mail post card for free 24-page book "Fun and Action for Boy Engineers." The A. C. Gilbert Co. 105 Erector Square, New Haven, Conn. Offer good only in U. S. A.

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Bringing Dead Oil Wells Back to Life

(Continued from page 79)

sands may be pierced on the way down but the drillers keep going to get their share of the oil at the bottom. After the main pool is exhausted the drillers try to plug back to drain off oil that may lie closer to the surface. The trouble has been to find a way to locate such deposits without drilling new wells.

Measuring the electrical resistance of underground strata will indicate the locations of oil and gas areas. To do this a complicated electrode is lowered into the well. But electrical logging can be done only in open holes, before the casing is set. Once the steel liner is in place the electrical fields won't operate.

One way by which the formations may still be studied is to measure the traces of radioactivity that exist in most terrestrial materials. Coals are weakly radioactive, for instance, and some volcanic ash is strong. Various shales and sandstones emit characteristic amounts of gamma rays that penetrate steel and concrete. Thus to survey the strata pierced by an old well it is only necessary to find a way to measure the radioactivity of the underground structures and learn to interpret the results.

The Lane-Wells technicians do this by slowly lowering a three-foot tube inside the casing. Gamma rays from the formations that surround the well ionize a gas in the tube, allowing varying amounts of current to flow between two interior electrodes. The current increases when the tube passes through shale that is highly radioactive and decreases when sandstone of low radioactivity is encountered. An amplifier strengthens the current, which travels up a coaxial cable to the surface and is further amplified so that it can operate an automatic pen. This makes a fluctuating line on a graph that also shows the depths being recorded. By correlating the strength of the radioactivity indications against the reactions of known formations, trained men can get an exact picture of the different strata the well pierces.

This is called radioactivity logging. Besides providing a way to explore unknown formations it is being used to determine the exact distance down to known producing zones. This varies with each well, de-

pending on its position in the field and how straight the well was drilled. Few oil wells point straight down; the bottom of an 8,000-foot well may be only 7,400 feet deep, for instance, if it slants to one side or goes down like a corkscrew.

Exploring the possibilities of an old well in this way is one part of the job of restoring it to production. The next step is to test formations that seem likely to contain oil. This is done by lowering a gun into the well and shooting holes through the steel casing so that any oil that may be present can flow into the hole. The oil-well gun is a long steel tube studded with steel bullets. Each bullet has a heavy charge of powder behind it and is capable of making a half-inch hole through a couple of inches of steel and concrete. Fired one at a time by an electric current that heats a filament embedded in the powder charge, the bullets penetrate the casing and rip into the formation, opening up holes through which oil may enter the well.

These bullets can do all sorts of underground jobs. Thin needle-type bullets are used for perforating the screens at the bottom of a well when these become clogged. Flat mushroom bullets fired radially will cut a casing in two when sections of it are to be hauled out of the hole. One sharp-nosed bullet is used to open up a formation that is to be acidized, a treatment that allows the oil to flow more easily. Another sharp bullet has the special task of opening up a gas zone so that the pressure of the trapped petroleum gases can help force oil into the well and up to the surface.

New methods like these are helping the petroleum industry do its part in winning the war. One freak condition the industry is trying to overcome is the transportation problem. There isn't enough gasoline to go around on the east coast, because of lack of transportation, but there is so much gasoline on the west coast that operators are experimenting with pumping it back down into the ground. The demand for fuel oil is very heavy and so much gasoline is being created as a by-product of fuel oil refining that present gasoline storage facilities are at the point of overflowing. Pumping the gasoline down into the formations from which crude petroleum has already been extracted is one way to store it for future use. In time of need the gasoline can be brought back up to the surface.

HOW AND WHY

WILLIAMS' TOOLS AID WAR PRODUCTION

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★ Since *socket wrenches*, today, play an important part in the servicing as well as manufacture of mechanized war equipment, a general knowledge of standardized types is desirable. Williams' "Supersocket" Wrenches include 5 separate and distinct patterns of *standard drive sockets*, each with its full assortment of handles and parts. A brief description of each pattern follows, together with information on the type of service for which it is designed.



MIDGET—1/4" Square Drive. Openings, 3/16" to 7/16". Slim, straight wall sockets. Ideal for magnetos, timers, generators, wiring connections, radios, carburetors, etc.

BANTAM—3/8" Square Drive. Openings, 1/4" to 3/4". Light, strong, straight wall sockets for use in close quarters. Universal sockets are fitted with spring tension to maintain desired operating angle. For aviation and general service.



STANDARD—1/2" Square Drive. Openings, 7/16" to 1-1/4". The 12-point sockets have straight, thin walls. Those with square openings are the Taper Nose type. Extra Deep sockets have cross hole for use with a bar. For industrial and general service.

HEAVY DUTY—3/4" Square Drive. Openings, 7/8" to 2-1/4". Designed for harder service than on the "everyday" job, this pattern provides ample strength without clumsy bulk.



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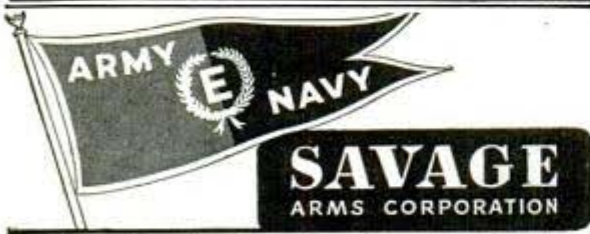
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★ **Delta POWERlite** ★



All Dressed Up and Some Place to Go!

(Continued from page 44)

inches, and leg (inseam) 32 inches. It required approximately 6 yards of cloth to make this man a uniform. The average allowance is 2½ yards.

The manufacturing division occupies a vast amount of floor space and is the largest and most modern uniform factory in the United States.

The specifications for the Army wardrobe are the result of careful and long experiments to determine the best materials and best construction. The strictness of the government's examination of all uniform materials, and their insistence on specified high grades of wool, make manufacturers particularly careful in fulfilling Army orders and guaranteeing "perfect deliveries." Today's uniforms and equipment are superior in many particulars to the uniforms furnished officers, during the World War. The aim is not to make a dandy out of the men in service, but to furnish them with good and durable uniforms of excellent quality.

Says Major General Edmund B. Gregory, the Quartermaster General:

"Our job in the Army is to deliver the goods and that means, among other things, making the American soldier the best clothed soldier in the world."

So, if you find it necessary to skimp somewhere along the line in clothing during the next year, the chances are the Quartermaster Corps has grabbed something for the lads in uniform who deserve the best and all of it they can get.

Cheating Death With Blood

(Continued from page 38)

Restoration of the dry plasma to a liquid form is simple. With each vial of plasma a container of sterile distilled water is supplied. One end of a double-pointed needle is inserted through the rubber stopper in the bottle of distilled water, which is then inverted, and the other end of the needle passed through the stopper in the vial of plasma. Sufficient vacuum is present in the vial to draw in all the distilled water.

To prepare this plasma there is needed an elaborate system of collection, proc-

essing and transportation. It starts in the 18 Red Cross donor stations, of which the New York establishment is typical. Here hundreds of blood volunteers are received daily. Registration, blood, pulse and temperature tests occupy about half an hour, although the extraction of blood takes only five or ten minutes.

Donors usually arrive expecting to go through quite an important experience, but they usually leave remarking that it was "really nothing at all." Some encounter a sensation of weakness after being bled, but Red Cross officials regard this as mostly psychological. Those who desire it are served food and coffee, tea or milk.

Anyone, male or female, in average health, and between 21 and 60 years of age can give a donation. Those between 15 and 21 do so with parents' written permission. Mobile units visit industrial plants and Red Cross Chapters within a 50-mile radius to collect blood from workers.

A person may give another donation after two months but not more than five in one year. Many on the New York Chapter's register of over 70,000 donors have given five and six donations, some 10 and 11.

The Red Cross is keeping up with the demands for deliveries to the Army and Navy by July 1 of next year, according to Dr. G. Canby Robinson, national director of the Red Cross blood donor service. A steady stream of donors is needed if the armed forces are to be fully supplied.

Meanwhile scientists continue research. The Lederle Laboratories have developed a process which may recover more plasma from a given amount of blood without centrifugal separation through using chemicals which cause the blood corpuscles to settle down in a compact mass, forcing plasma out. Harvard Medical School scientists have discovered that beef blood plasma can apparently be substituted for human plasma. Of 2,690 Massachusetts prisoners who served as "guinea pigs" only seven reacted badly to injections.

These developments, however, are not of practical value up to now and donors should still keep on shedding their blood at home, helping to cheat death with plasma on the fields of battle where other Americans are shedding blood for the nation.

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



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3265 Bermuda, Dept. PM-122, Ferndale, Michigan

They'll Be Coming 'Round the Mountain

(Continued from page 55)

Fast motor sleds jockeyed by fighting Russians in ghostly white made it an unhappy winter for the German invasion armies. Our Arctic troops in Alaska or Iceland, Siberia or the Cascades will have their putt-putt sleds too. They have been experimenting with an air propeller-driven sled, and on Mount Rainier they see the sights in winter on a track-driven toboggan that carries two men and their equipment. They are trained to use dog teams, also, but neither the dogs nor the motor sleds are very efficient for really steep travel, particularly when skis will cover the ground at anywhere from three to sixty miles an hour. For hauling mortars and supplies in country too difficult for the motor toboggans there is a cargo sled to which several men are harnessed.

Uncle Sam's mountain men and paraskis are less than a year old now. They began with a nucleus of veteran Alpinists and forest rangers, lumberjacks and cavalrymen, national park guides and college ski stars and European ski instructors. The pioneers of the force are the trainers of an expanding army of timberline fighters who will carry the war to the enemy with the craftiness of an Indian and the most modern of sky and ski weapons. The boys are looking forward to the winter sports on Fujiyama.

Mighty Midgets of Filmdom

(Continued from page 76)

of Norwalk, Conn., founded by V. E. Pratt, a former advertising man. After he retired from business, he set up a workshop in his barn in Silvermine, Conn., and in 1938 completed the first model of his microstat camera which takes pictures, enlarges, prints and projects them. Now, microfilming trucks of his company thread the highways across the nation.

His instruments are completely motor controlled. They will separate lines packed together as closely as 3,000 to the inch. Their focus is calibrated accurately to .00025 of an inch. They make duplicates on transparent paper, photo-sensitized tracing cloth and transparent acetate. A

whole book can be condensed on a dozen inches of film.

In addition to this device, the Pratt company has developed a six-pound film reader. Although it is so small it can be carried in a suitcase, it can hold a million pages of material copied on microfilm.

Among his other inventions which will be produced for sale after the war are a teledex reader to replace the cumbersome big city telephone book, and an optigraph reader which will make books easier to read.

Another leader is the Recordak Company of New York City, an affiliate of the Eastman Kodak Company. On its equipment, records can be condensed to about one percent of their volume. A 100-foot strip of 16-mm. film will reproduce 2,352 letters or 4,812 filing cards. The film is stored in a carton 4 by 4 by 1 inch. Copies of books can be microfilmed as fast as the pages can be turned. Bank checks can be recorded at a rate of 140 a minute. On its machines, 1,600 pounds of V-mail can be reduced to less than 15 pounds, which indicates the approach of trans-Atlantic air-mail in volume.

Aside from microfilming, its big brother, photocopying, is performing much the same commercial function. The principal difference is in the size of film used, the larger film having advantages and disadvantages, according to the job.

All types of film, most of which were developed by Du Pont and Eastman Kodak, are fire and water resistant acetate and will "keep" for generations if properly stored.

These mighty midgets are booming business right now and it looks like an attractive field for an ambitious man, but the truth is that machines are rarely sold since it is almost impossible to obtain the materials essential to their manufacture. Instead, microfilming has tended to become a service, operated by experts. Later on it will probably be different.

The boom is not likely to end with the termination of the war. Microfilms, in post-war jobs may be as important as the mighty midgets in "uniforms" are today.

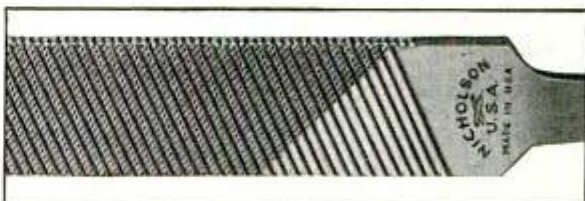
Write to the firms listed in the Where-to-Buy-It index, to learn more about products described in this magazine. Say You Saw It in Popular Mechanics.



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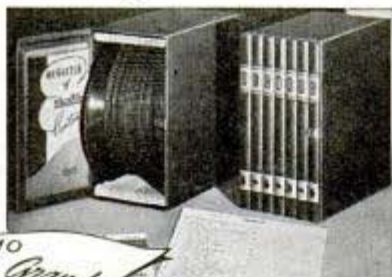
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APPLIANCES



MOTORS



FUSES

Secrets of the Apes

(Continued from page 60)

A certain element of human disgust comes into the ape's feelings about rodents. One of my most intelligent chimps, Suzabella, learned to kill mice and rats, but she would rather die than touch them. She would wait until the intruder was hidden under the brown paper on the floor of her cage, and then pounce on it and kill it with a powerful blow of her fist. Then she would wrap up the rodent with averted face and throw it out of her cage with loathing.

By taking advantage of their fears when necessary and by showering them with kindness and affection, I kept the apes in control—except on one occasion and it was terror on the part of my favorite, Massa, the gorilla now in the Philadelphia zoo, which nearly cost me my life. I raised "her" as a girl, only to find I was mistaken later on, and I still picture her as an energetic housewife, scrubbing the kitchen the morning of the nearly fatal incident.

She had a pail of soapy water, a brush, and a cloth to mop up, and she did such a perfect job on the kitchen floor that I sometimes wondered whether gorillas might not have a future as domestic servants. But Massa was so powerful that she could scrub the linoleum off the floor, or lift the kitchen stove from its moorings.

She was in one of her domestic frenzies one morning, and a young friend staying with me had retreated to the next room, and drawn the bolt on her side of the door. I came into the kitchen to see how Massa was getting on, and evidently she was too intent to hear me. Her back was toward me and she was on all fours, blissfully scrubbing away. She had left a patch of soapy water in one spot, and I suddenly slipped and fell with a thud. My foot hit the pail and overturned it full on Massa.

For the first time in her life with me, she had a shock. She hadn't seen me, and suddenly she was drenched with water. A mountain gorilla is terrified by water in quantities. I think that what happened had nothing to do with me. She became a creature of instinct, obeying the first and oldest reflex in life—danger instantly translated into the need to kill.

She whirled about and rose to her full height, face contorted, eyes closed. There came from her a roar like nothing on this

earth, a frightful, tremendous, howling screech. It took from me all power to struggle or save myself, and yet a corner of my mind was telling me: "This is the warning when the gorilla is ready for the kill. Now the beast will charge me."

In another instant she was rushing at me, jaw pushed forward to show her powerful fangs; and my own instincts came alive. I must protect my throat. I threw an arm across it as she sank her great teeth into my thigh, then again and again into my abdomen, ripping the flesh like paper. Then the beast made for my throat, catching my arm in her teeth. I tore it free, and the gorilla caught it again. I was conscious that an artery was torn, and jets of blood were spurting on the wall.

But this wasn't a beast, it was Massa. I must remind her, quickly, in Missy's voice.

"Massa, Massa! This is your Missy!" I screamed.

The beast didn't hear me. But in the next room my brave little friend heard my voice and realized I was in danger. She rushed in, seized a heavy iron skillet from the stove, and with all her strength brought it down on Massa's skull.

Massa was stunned for a moment, so I could turn over and press on the torn artery. I began crawling away, and felt Massa's teeth in my leg again, but I kicked with the last of my strength. As the darkness came down, I knew I was safely away.

There were seventy odd stitches in twenty-two wounds, and long weeks in bed. I wondered what her attitude would be. One night I sneaked out of bed and went to her room. She greeted me with delighted chuckles and open arms. We embraced and patted each other as usual, but there was tension in the air. When I gave her an order, she refused to obey me. She had learned that she was my physical master. So she was confined to a cage. Later on I sold her—or him.

I see Massa occasionally at the Philadelphia zoo. I greet Buddy at the circus. I run into my chimps in vaudeville acts, roadside zoos and the most unexpected places. They never fail to recognize me and show signs of affection they have for no one else. And I am convinced most of these animals I raised from babyhood recognize me as their mother. They should. I am the only mother they have known.

What a difference, when you smoke the

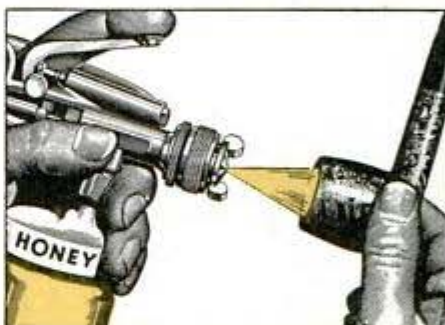
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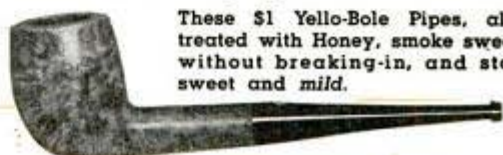
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Caged "Hurricane" Tests Planes

(Continued from page 95)

military aircraft may be uncovered, information that might be the key to victory over nations lacking the equipment necessary for such tests. In Germany, Uncle Sam has a most formidable opponent in this research race, for it is widely known that Germany has several well-equipped wind tunnels and air laboratories that have contributed important findings to the powerful Luftwaffe. With the Wright Field tunnel rated as the world's most powerful, Uncle Sam now has the means for competing on something like an even basis. Other research tools of the same sort are being developed—in secret, of course—that may hasten the day of victory, and peace.

Whether man will ever be able to fly at, or in excess of, the speed of sound is a question that may be answered some day in the Wright Field tunnel, or in a test laboratory yet to be built. That means, roughly, some 700 miles per hour—a speed of incalculable value to the bombing plane or freighter. Air is compressible, so any solid object, such as an airplane, sends out a pressure wave as it moves through the air, thus "warning" the air ahead to prepare for the object and flow around its surfaces. This wave travels, in normal air, at approximately 1,120 feet per second, or 765 miles per hour. If the plane should travel faster than its own pressure wave, it would slap against a mass of air not "ready" to receive it. The result would be a severe shock, with possible damage to the plane.

Some work on high speeds has been done, but no one has yet found conclusive answers to what happens when the critical point of 765 miles an hour is approached. We know that it is possible for aircraft to move through the air without damage at speeds some 100 miles an hour slower; at least two military planes have been dived at over 600 miles per hour. The pilots agreed that such speeds seemed little different from those attained in slower dives.

The large propellers which impart 2,000 horsepower and more to the air already have reached the size and speed where their tips whirl faster than the velocity of sound. So perhaps an airplane may be able to travel 700 miles an hour, if designed properly. The wind tunnel may supply the answer.

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Fooling the Spy in the Sky

(Continued from page 70)

confuse its outlines. But painted shadows, valuable as they are, have a fatal drawback. They do not shift with the sun and the seasons like real shadows. Thus shadows must be painted so as to look natural at the most likely time of aerial reconnaissance or bombing raid and must often be shifted with the seasons.

To provide this shadow information throughout the year, Pratt Institute in Brooklyn, N. Y., has put into operation a sun machine which will calculate the direction of a shadow cast by any object, any second of the day, any day of the year in any part of the world. This information is available to anyone.

Other organizations which will cooperate with information are the American Institute of Architects, National Paint, Varnish and Lacquer Association, the American Society of Civil Engineers, National Society of Heating and Ventilating Engineers and the Camouflage Society of Professional Stage Designers which have a camouflage laboratory in New York City.

Since most of the preliminary research is done with miniature, table-top models, which may be tested by table-top photography, it is likely that camouflage will develop into a widespread home workshop hobby if the war lasts long. Lots of us will be fooling the spy in the sky.

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Powdered metals used in making small gears and bearings are measured with an electric eye to determine the size of the tiny particles, some of them as small as 1/25,000 of an inch. The "eye" is placed beside a tube in which the particles are floated in a suitable liquid. Their size is determined by the speed with which they settle, recorded by the electronic apparatus according to the amount of light transmitted through the tube as the liquid clears. The particles are measured by this method in one-thirtieth the time formerly required when the metal powder was floated in glycerin.

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Life Aboard a Battlegwagon

(Continued from page 26)

about bugle calls in training school, so the sound of reveille coming over the amplifier at 5:30 a.m. is nothing new. Then comes the bo's'n's mate with his "Up all bunks" or "Rise and shine," which means business. There is no more sleep. All hands wash and dress before turning to at 6:00 a.m. Five minutes before sunrise the quartermaster's striker hoists the "prep" on the starboard side of the yardarm and turns off the anchor lights.

The master at arms and the police Petty Officers who arouse the crew are called at 5:10 a.m. by a bluejacket on the anchor watch who also turns out the battle lights. By 5:35 a.m. all hands are stirring except late bunks, men who work in the laundry or have night details. They have an extra hour.

When the men have stowed their hammocks or triced up their bunks, the smoking lamp is lighted in the living and mess compartments—an old tradition.

A bo's'n's mate passes the word to "pipe all sweepers" and promptly at 6:00 a.m. all hands turn to. They scrub and wash down all weather decks, shine the airports and various brass appurtenances. With several hundred hands at work, it doesn't take long, but the job must be thorough.

At 7:30 a.m. the meal pennant, or "bean rag," is hoisted on the mainmast yardarm, and breakfast is ready.

At 7:50 a.m. the Guard of the Day is called and the word is passed over the loudspeaker system to go aft and make ready for the call to colors. The band plays the National Anthem. At 8:15 a.m. on the deck, the division officers outline the plan of the day and detail working parties.

At 8:30 sick call is piped for those requiring medical attention, while all others clean their quarters. After that come the various drills and classes, which occupy the morning.

When the meal pennant has been hauled down after noon-day chow, a bo's'n pipes the sweepers to clean the mess, the living compartments and "topside." At this time bedding may be aired.

Promptly at 1600 by the ship's clock (4:00 p.m.) all bluejackets not on special duty may knock off work. If the ship is in port, those with liberty cards can make ready to go ashore. The liberty call is

sounded over all the crew circuits at 1630. At 5:30 p.m. the meal pennant is hoisted and the crew is piped for supper.

Ten minutes before sunset the Guard of the Day is summoned by the band or by all the duty buglers. At five minutes before sunset the prep is hoisted. After it has been hauled down at sunset, the evening colors are hauled down.

At 1800 the anchor watch, which changes every two hours, is mustered, and frequently the motion-picture screen is rigged, usually on the afterdeck, weather permitting.

Taps is sounded by a bugler on the quarterdeck at 2100—9 o'clock. Tired, but with a fatigue which brings a contented feeling, the bluejacket turns in. He doesn't realize it, perhaps, but most of his activities of the day are part of the drill, the teamwork which brings perfection and coordination. But it is all teamwork.

That's life aboard a battlegwagon.

Small Car With Bicycle Wheels Saves Rubber and Fuel



This "baby" car travels 45 miles on a gallon of gas

Using a motorcycle engine and six bicycle wheels and tires, J. B. Heflin, Sonora, Tex., has built a "baby car" that saves tires and gasoline. The two extra wheels make a dual set at the rear. About seven feet long and weighing 515 pounds, the automobile has a speed of about 50 miles an hour and gives 45 miles on a gallon of gas. The inventor has applied for patent on his midget auto.

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American industry has scored again! Pictured above is the set-up that has helped many a war plant out of a bad hole in small part production. It just hasn't been possible to build enough screw machines so resourceful production engineers have turned to the modern Atlas F-Series 10" Lathe equipped with tailstock turret and lever-type collet chuck. Operation is quickly mastered by beginning workers. Serious production bottlenecks are being smashed right and left!

"Match the machine to the job" is the Atlas idea for war manufacturers — big machines for big work, modern compact machines for small precision work so that capacities of larger machines will not be wasted. It's a production idea that is getting real results as more and more Atlas Lathes, Milling Machines, Shapers, and Drill Presses go into key plants throughout the nation. Atlas Press Company, 1243 N. Pitcher St., Kalamazoo, Michigan.



MILLING MACHINE



SHAPER



DRILL PRESSES

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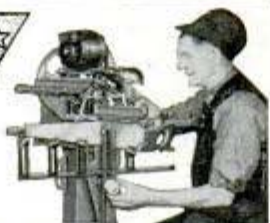
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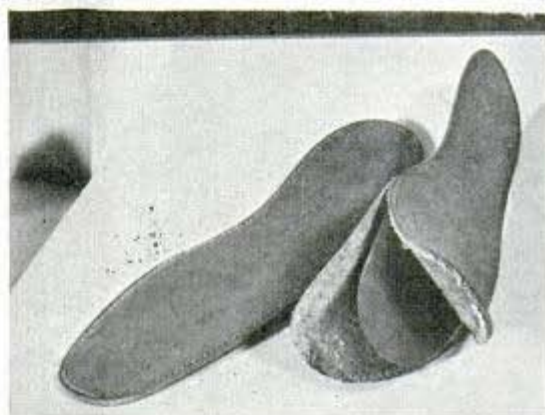
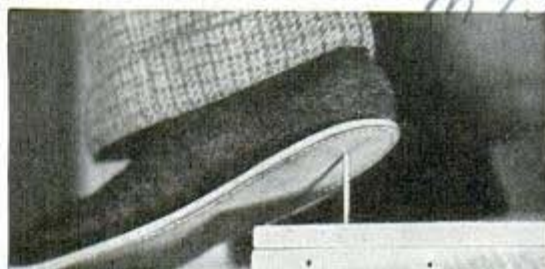
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Steel 'Sandwich' Inside Shoe Prevents Foot Injuries

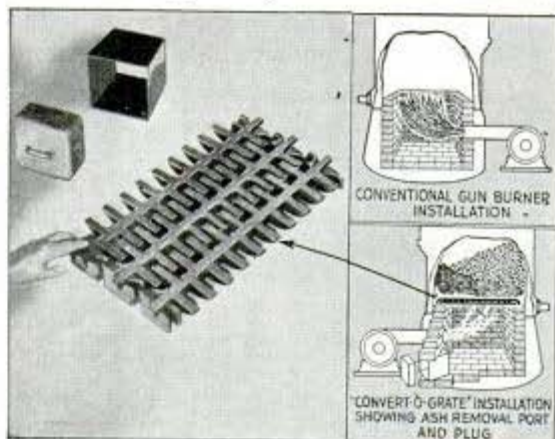


Shoe, top, made punctureproof by insole at bottom

Rubber boot and shoe soles worn thin can be protected against hazardous nail punctures with a safety inner sole that resists penetration of sharp objects. It consists of two layers of high grade leather sewed and cemented together with a sheet of steel sandwiched between them.

Oil Furnace Converted to Coal Without Removing Burner

Oil-burning furnaces with forced draft are converted to coal burners in 10 minutes with a special grate that fits over the



Parts at left convert oil to coal burner as at right

Heating Sew, Anchor
POPULAR MECHANICS
Post Time Co, Eastern
+ Kane, Baltimore Md

combustion chamber. The oil burner is left in place for quick conversion back to oil and its fan is used to provide the draft. Preliminary installation, which can be done during warm weather, includes blocks to support the grate and ash removal port. The grates are cut to fit and laid aside until the oil supply is exhausted. The actual conversion consists of placing the grate in position, removing the coupling between the fan and the fuel oil pump, and also the ignition lead to the relay binding post. After the lead to the shut-off switch is removed the furnace is ready for coal.

Fire Pump With Upright Handle Is Easy to Operate



Person controlling hose can also operate pump handle

Only materials without strategic importance are used in the construction of a simple pump designed for extinguishing incendiary bomb fires. Wood and fabric replace metal and rubber, even in the two lengths of hose, which are made of fabric. The pump supplies a strong stream from the nozzle when the upright handle is rocked back and forth while the operator stands on the base to steady it. Said to be less fatiguing than the stirrup pump, this unit is suitable for such peacetime uses as spraying insecticides.

*The Zadiq Patents,
DECEMBER, 1942
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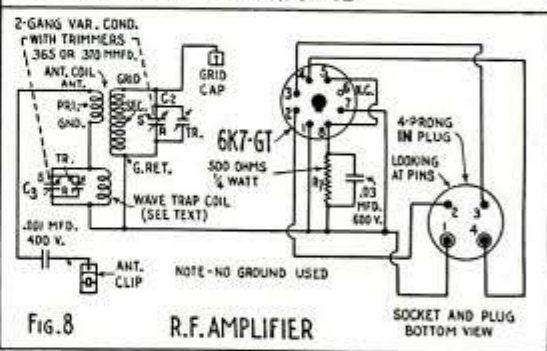
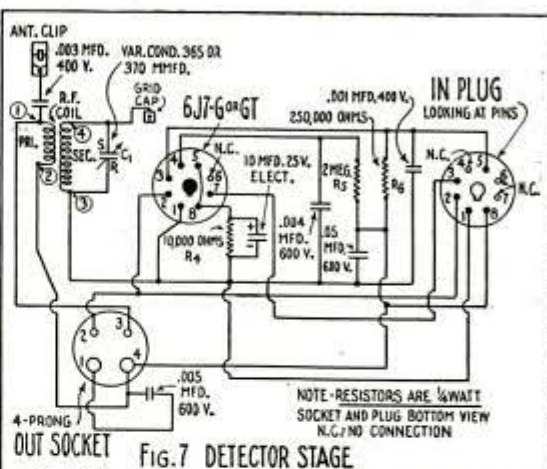
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1076 Royalston Avenue - MINNEAPOLIS, MINN.

Four-Unit A.C.-D.C. Receiver

(Continued from page 157)

and the 4-prong "out plug" in the R.F. unit. Variable condenser C_1 is mounted directly on the panel by means of two $\frac{1}{4}$ -in. bushings, the shaft hole being $2\frac{1}{8}$ in. above the baseboard. The coil in the detector stage may be any ordinary R.F. coil that will match C_1 . Common connections for such a coil are clearly indicated in diagram Fig. 5.

To test the completed detector stage,



plug it into the audio stage and move up the 6J7-GT tube from the power stage. This now makes a complete 3-tube receiver. Connect the antenna to the antenna clip and you are ready to tune in stations. Use a good long outdoor antenna as the gain without the R.F. stage is limited. If you wish to use headphones with this 3-tube set, connect them to the clips formerly used for phono input on the audio amplifier stage. A detailed list of materials for all four units is available to any student, from Popular Mechanics radio department without charge.

The R.F. unit, Fig. 6, is constructed last; this employs the high-gain 6K7-GT pen-

(Continued to page 182)

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In this crisis, aviation engineers were quick to remember a new type of machine tool created by Delta engineers during the past 15 years. Adaptable, portable, stripped of every useless ounce, these new fighting-trim Deltas outperform ponderous machines *costing three to four times as much.*

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tode tube and any antenna coil that can be used with the condenser specified. When all four units are used together, the antenna is connected to the clip mounted on the R. F. unit, and the only tubes left in the power supply sockets will be the 25Z6-GT/G and the Clarostat ballast resistor tube L-49-B. Although a single-section tuning condenser may be used in the R.F. unit, a wave trap action for eliminating powerful interfering locals is obtained by using a 2-gang condenser, as shown in photos A and C, also diagrams Figs. 6 and 8. The wave-trap coil can be any old broadcast antenna or R.F. coil; remove about 6 turns from the secondary and connect as shown in Fig. 6. No alignment is necessary since the condensers in the detector and R.F. stages are tuned separately. Please note that no external ground is used with this student set in any of its operating forms. You will find this circuit demonstrates many text book lessons and permits numerous tests and checks. The blueprint number for the complete 4-tube set is R-309.

Cloth Covered Radio Cabinet

(Continued from page 158)

control knob shafts are cut as indicated in Fig. 3.

This plywood, and the top and bottom trim strips were soaked in warm water, on a shower bath floor, over night. The material was then bent easily around the cabinet frame and nailed every 4 inches; the trim strips are nailed temporarily over the plywood so that they will retain their shape when nailed over the cloth covering. This cloth covering may be a remnant of satin damask, or a piece of loosely woven tapestry that will match other furnishings. Line up the cloth when the cabinet is thoroughly dry, and begin tacking inside the rear upright; stretch and tack at top and bottom. Cut neat openings for the control shafts and dial but not for the speaker grill.

The top of the cabinet is covered with a piece of 1/4-in. mahogany or walnut finished plywood 1/8 of an inch larger than the top board. A matching stain or finish is given to the trim strips, after which they are nailed over the cloth, covering the tacks that hold the cloth in position. Round head brass tacks are used every 5 inches. The set installation is shown in photo B.

The Age of Air

(Continued from page 5)

on the leading edge of its wings, it can be molded and faired so that its nose resistance is one-third that of an airplane. Because it does not carry an engine with all of its inherent strains, it can be built much lighter. But with its wing spread and with heavy wing loading, the glider can carry a gross weight equal to the transport plane, which would be approximately twice the payload the transport plane would carry. In other words, the weight normally consisting of fuel, engines and the heavier bracing in the transport plane could be replaced by payload in the glider.

General railroad freight at present costs slightly under one cent a ton mile. This cost includes coal, ore, grain, sand, gravel, stone and other bulk commodities. Personally I do not believe air freight will ever be able to compete in this particular field. Its place is for the higher grades of freight.

We would be remiss if we confined our thinking to the North American continent. Once in the air, great planes and gliders can span the oceans in a few hours. Freight that now takes 10 to 14 days to deliver by cargo ships will be safely brought to its destination by air in as many hours. The world will shrink to a size where we can look upon the Fiji Islander as a next-door neighbor. We will then be able to take our vacations in the South Sea Islands with much greater ease than we used to go to the Riviera.

Airplanes and gliders will be built with wing spans of over 300 feet; methods will be developed which will insure greater safety than any present mode of transportation; speeds will accelerate to 500 miles an hour; the stratosphere will become a highway; ships will carry internal air pressure for comfort of the passengers. Future generations will look upon our present modes of transportation as we look upon the high-wheel ox cart.

An interesting evolution brought about by modern modes of transportation will be the shifting of forwarding or port centers. If we study a map of the Arctic, we see that the cities of the middle west are as near Europe and nearer to Asia, than those on our own coast. Brought up to accept the conventional projections used by the

(Continued to page 185)



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mapmakers, we have become misinformed as to directions and distances between the great centers of the world. No projection on a flat surface can more than approximate the round surface of the globe. When we use the globe and the great circle measurements we find the Arctic Ocean, not the Atlantic, is the sea to be flown over. The Arctic becomes a Mediterranean between the Eastern and Western hemispheres. Chicago, Detroit, Cleveland, Cincinnati and other western cities are going to come into their own as great shipping centers and I can vision the day when America will have a great port in Alaska which will supersede in importance our present great shipping centers. It could be the New York of tomorrow.

We are reaching an age where ocean travel as we have known it is going to disappear. There will be no more Leviathans, Queen Marys, or Normandies; freighters will be used much as our coastal freighters are used today to take the slow, cheap, bulky freight. All of the freight taking higher ratings will go by plane.

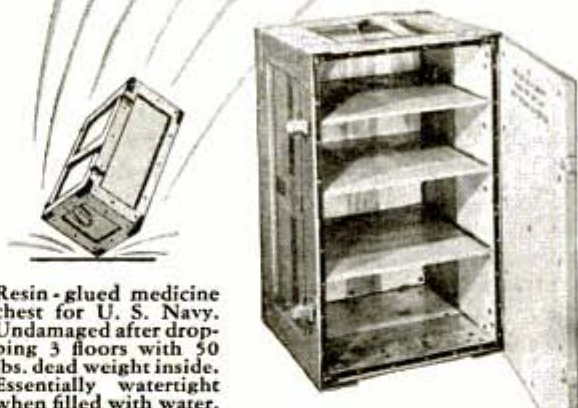
It is a human tendency to say "it can't be done." I like to look back to thirteen years ago, to a speech made before the United States Chamber of Commerce, in which I said: "I believe that we are going to see great airliners, perhaps with a speed of 90 miles per hour, carrying 50 to 100 tons, which will be used to transport our freight." Those prophecies have been more than fulfilled. The statements that I make today are even more practical than were the prophecies made in 1929, because our experience and the development in aircraft, engine and glider design has made such progress that these prognostications are self-evident. Those planes will burn low-priced fuel, and they will transport that freight cheaply enough for the business men of the country to use them, because one of the greatest losses in business today is the carrying of inventories.

Only yesterday the building of seaplanes in shipyards was deeply controversial. Within another year air transports will be rolling out of shipyards in such quantity as to confound the "authorities" who opposed the idea.

As former president of the Lockheed Aircraft Company that built plywood airplanes which were the most successful of

(Continued to page 186)

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(Continued to page 189)

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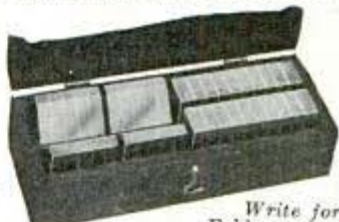


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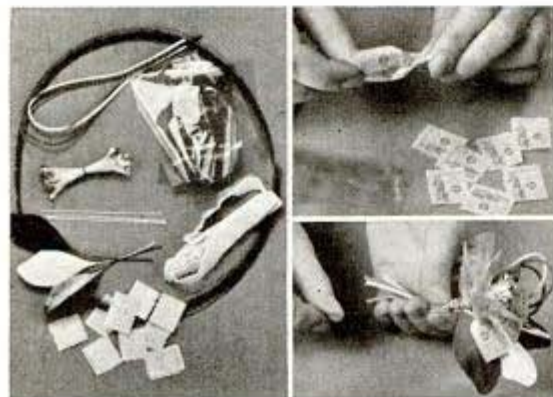
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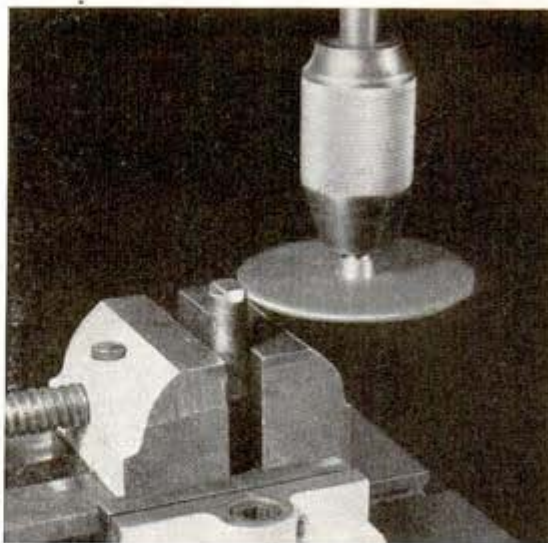
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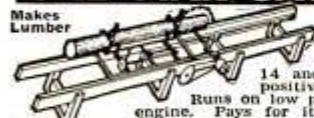
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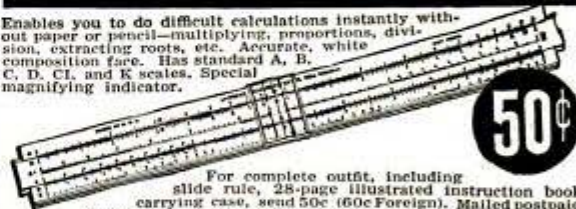
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HOW TO GET THE MOST OUT OF YOUR LATHES

No. 2 in a series of suggestions made by the South Bend Lathe Works in the interest of more efficient war production.

Keep Them Well Oiled

*For lack of oil the bearing was lost;
For lack of a bearing the tank was lost;
For lack of a tank the battle was lost;
All for the lack of a film of oil.*

Cleverly paraphrasing the ancient rhyme about the horseshoe nail, a young army officer is said to have used the above verse to emphasize the importance of lubrication in mechanized warfare. And this thought is just as applicable to the battle of production in American shops as it is to the tank battles in distant lands.

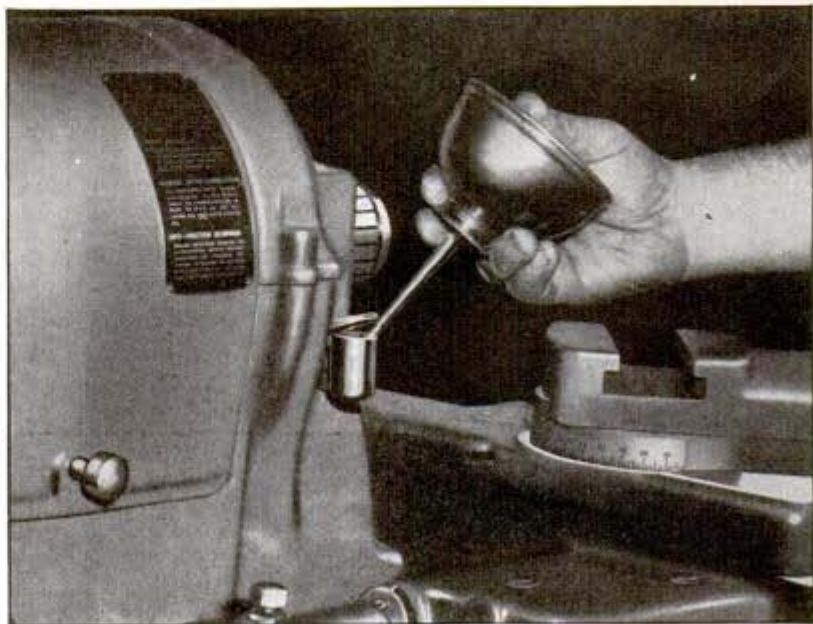
The proper lubrication of lathes and other machine tools will contribute much to our total war effort by preventing unnecessary interruption of production. It will also save scarce strategic materials and highly skilled technical labor by reducing to a minimum the demand for replacement bearings, parts, and machines.

South Bend Lathes, like other fine machine tools, have large oil reservoirs, felt wicks, and oil retainers to guard against lack of oil due to temporary neglect or oversight. But for best results the lathe should be oiled at regular intervals. Even a camel must have an occasional drink.

Make Oiling a Habit

All oil holes and oil cups on the lathe should be filled at least once a day — oftener when the lathe operates day and night — or when top speeds and feeds are employed. The best method is to fill each oil hole in a regular sequence so that oiling becomes a habit and no oil holes are overlooked. When the lathe is in service on two or more shifts, oiling the lathe should be the first daily task of each operator.

To help the inexperienced operator find the oil holes, a circle of brightly colored paint may be applied around each oil cup. Different colors



All bearings should be oiled at regular intervals

of paint can be used to indicate different grades of oil.

Use Correct Grade of Oil

When the correct grade of oil is used in a well designed bearing there is little or no metal to metal contact and practically no wear. However, when the wrong grade of oil is used, or if the oiling is neglected, the oil film will break down and the fine finish of the bearing surface may be damaged in a short time.

The V-ways of the lathe bed, and the dovetails should be oiled as often as is necessary to maintain a good oil film. Touching the bed way with the tip of the finger will indicate whether or not it is coated with a film of oil.

Motors should be lubricated according to the motor manufacturer's instructions which are usually at-

tached to the motor. Care should be taken to avoid getting oil on rubber V-belts or flat leather belts, as it is injurious to both.

Clean Lathe After Oiling

After the oiling has been completed, the excess of oil should be wiped off with a clean cloth. The lathe should be kept clean. Dirt, chips, or rust should not be allowed to collect.

Write for Bulletin No. H2

Bulletin No. H2 giving more complete information on oiling the lathe will be supplied on request. Oiling charts for South Bend Lathes, and reprints of this and other advertisements in this series can also be supplied. State quantity wanted, also serial numbers of lathes for which oiling charts are needed.

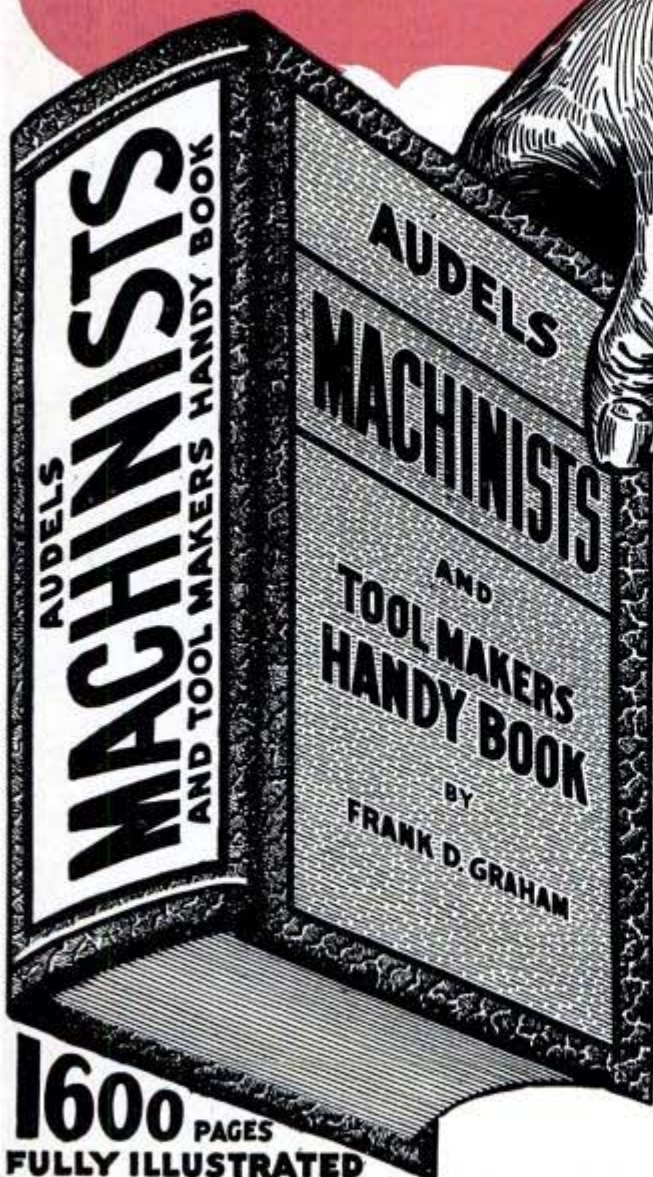


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