

Two Days in the Hornet's Nest

POPULAR MECHANICS

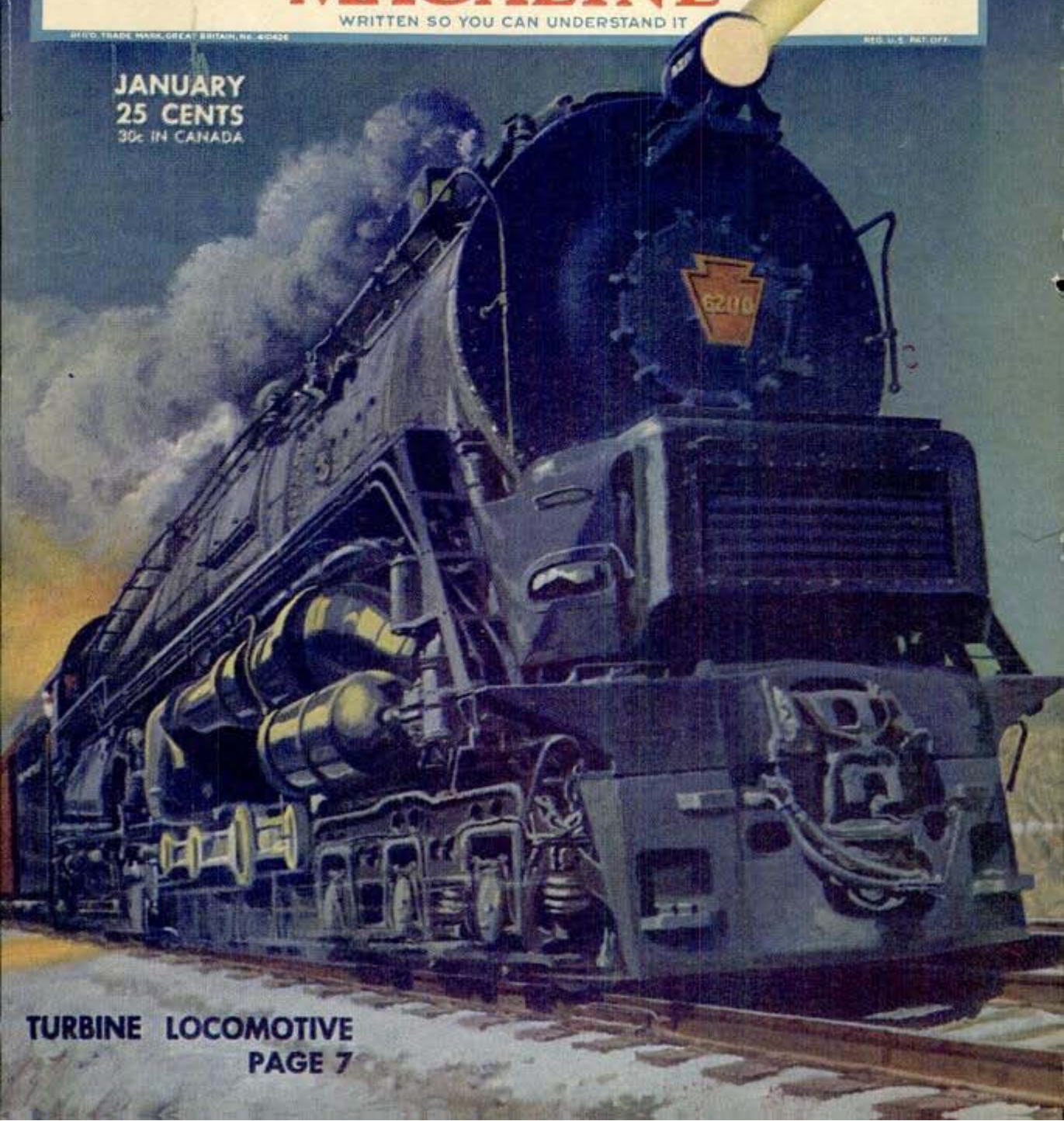
MAGAZINE

WRITTEN SO YOU CAN UNDERSTAND IT

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JANUARY
25 CENTS
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TURBINE LOCOMOTIVE
PAGE 7



MESSAGES GOT THROUGH

ON THE "BANANA NET"

THERE is many an exciting story about how amateur radio operators now in the services have helped extend the lines of victory around the world. There's the one about the "Banana Net"—the name the boys gave to the radio network down in the Panama jungle. As the G. I.'s have it, "it rains continually during the rainy season but only once a day in the dry season". The "Banana Net" is just one link in the vast network set up by the AACS—Army Airways Communications System. The AACS safeguards tens of thousands of lives by relaying weather reports, coordinating information on enemy ship and plane movements and by bringing home or locating flying ships that are down or in trouble.

The ranks of the far-flung AACS are filled with one-time amateur radio operators. Amateurs have always found in Hallicrafters equipment the perfection they themselves have been seeking. For these exacting technicians Hallicrafters made superior equipment long before the war. As a matter of fact thousands of pieces of privately owned Hallicrafters equipment were drafted into the services right along with the amateurs who once operated them. After the war Hallicrafters will have a new kind of radio ready. You will want the radio man's radio—the radio that has an amazing range and performance on all bands, short wave and regular broadcast. There will be a set for you in our post-war line.



This is Hallicrafters new Model SX-28A, latest version of the famous Super Skyrider. It is a 15-tube communications receiver operating on a frequency range of 500 kc to 42 Mc, continuous in 6 bands including the regular broadcast band.



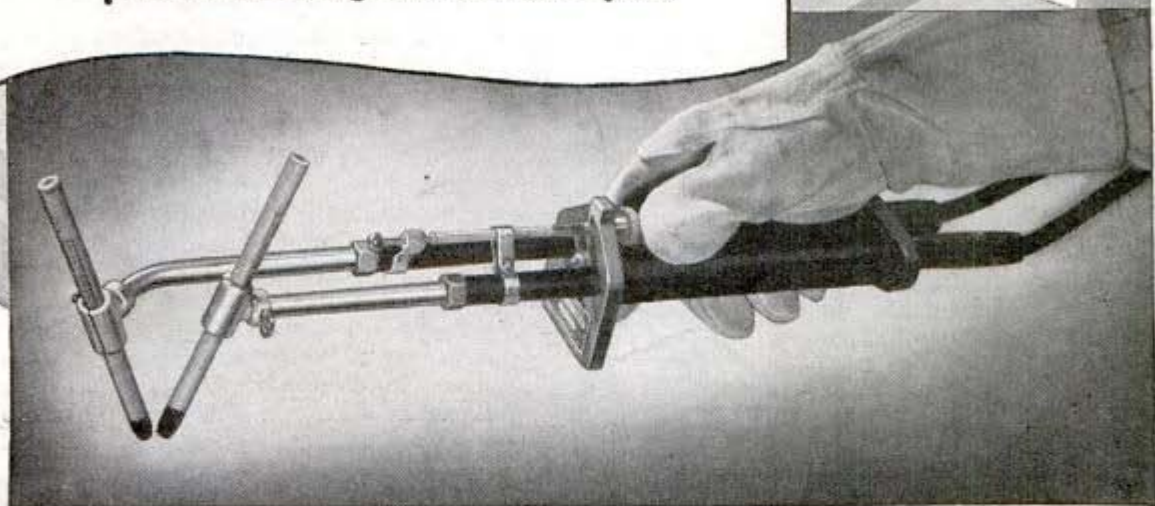
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prove interesting and useful to you.



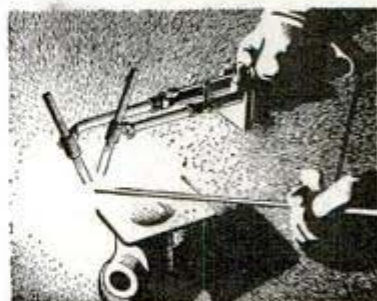
NEW 9000° ARC TORCH CAN BE USED FOR WELDING AND BRAZING ALL FERROUS AND NON-FERROUS METALS AND ALLOYS

Now an arc torch that makes it possible to do most jobs *electrically* that previously were thought possible only with gas. This attachment for arc welders provides an independent source of heat by means of two carbons. It is capable of producing intense heat, approximately 9000° F., over 2000° hotter than an oxyacetylene flame. Pure heat, no oxygen or gas to contaminate the weld. No pressure to force the molten metal away or blow holes in light sections.

Developed to capitalize to the fullest on the time-saving advantages of electric welding, the new Mid-States 9000° arc torch can be used with any AC or DC electric welder. It opens up new horizons of service in this field, never before possible with an electrically operated instrument.

New uses are being found every day for products that have been familiar to us for years. Wrigley's Spearmint Gum, always enjoyed for its chewing satisfaction, is now proving with the fighting men overseas many benefits which will be useful to you in peacetime. One of the big factors in mass production is the alertness and efficiency of the man on the job. The chewing of Wrigley's Spearmint will help keep you alert and wide-awake during those work periods that, while seemingly dull and monotonous, call for watchfulness in order to get perfection in the final assembly.

You can get complete information from Mid-States Equipment Co., 2429 So. Michigan Ave., Chicago 16, Illinois



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For HEATING to Straighten or Bend, etc.

JANUARY, 1945

This One



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1A

BELL TELEPHONE LABORATORIES

Exploring and inventing, devising and perfecting for our Armed Forces at war and for continued improvements and economies in your telephone service

RESearch, in the Bell Telephone System, has always been an expanding activity, growing with the scientific knowledge of the times and contributing to that knowledge.

The telephone, itself, was invented in the laboratory where Alexander Graham Bell was carrying on researches in speech and hearing and laying the foundation for the electrical transmission of speech. As time went on the telephone research program expanded to cover every science which gives any promise of improved telephony.

These researches and development studies now include electrical communication of speech—both by wire and by radio—the transmission of pictures (television)—and many important projects for war.

There Is No End to Progress

Every new research gives rise to new inventions and to new lines for development and design. New inventions indicate new lines for more research. In the early years, this work was carried in part by the American Telephone and Telegraph Company and in part by the Western Electric Company, the manufacturing unit of the Bell System.

For many years, however, the work has been assigned to a specialized unit, Bell Telephone Laboratories, Incorporated. Theirs is the responsibility for the technical future of the telephone industry.

The policies and procedures of Bell Telephone Laboratories are distinguished by two characteristics. In the first place the Laboratories design for service. The consideration is not the profit of a manufacturer, but the production of equipment which will give the best service at the lowest annual cost when all factors are considered, such as first cost, maintenance, operation, and obsolescence. The Laboratories make no profit and the equipment they design is owned and used by the telephone companies; and the emphasis is upon that use.

Organized Co-ordinated Research

In the second place the Laboratories design always with reference to the complete communication system in which the equipment is to play a part.

Reliable, economical telephone service, which is the product of its efforts, is not so much an assemblage of excellent apparatus as it is an excellent

assembly of co-ordinated equipment—all designed to work together.

4600 People in Bell Laboratories

Bell Laboratories contributions to the Armed Forces derived in large part from the technical background that the Laboratories had acquired through their steadily maintained program of research. The Laboratories had special knowledge and skill which could instantly be diverted to war problems.

At the time of Pearl Harbor, over a quarter of the 4600 people in the Laboratories had twenty or more years of service. This breadth of background made possible many engineering developments outside the strict field of communication and these have been of value to the Armed Forces. So far the Armed Forces and the O.S.R.D. have engaged the Laboratories on over a thousand major projects.

Most of the Laboratories developments, of course, have been in the field of electrical communication. Communication, not simply between individuals as in ordinary telephony, but between mechanisms—as in the electrical gun director.

Leader in Electronic Development

The Laboratories techniques and electronic researches have produced many secret weapons for our country's Armed Forces. In World War I, they pioneered by developing radio telephone systems for talking between planes and between planes and ground stations. They also contributed methods and devices for locating enemy planes, submarines, and artillery.

In this war, Bell Laboratories have pioneered in the field of electronics. The Western Electric Company, which manufactures the designs of the Laboratories, is the largest producer of electronic and other war communication equipment in the United States and is now engaged almost exclusively in the manufacture of this equipment.

In war, Bell Telephone Laboratories devote their work to the needs of our Armed Forces. In peace, they are constantly exploring and inventing, devising and perfecting for continued improvements and economies in telephone service. Centralized research is one of the reasons this country has always had "the most telephone service and the best at the least cost to the public."

BELL TELEPHONE LABORATORIES



Popular Mechanics Magazine

Registered in U. S. Patent Office and Canada

H. H. WINDSOR, Founder

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

January, 1945

Vol. 83, No. 1

Next Month

IMAGINE a football game with a scrimmage line 1,500 miles long. On one side of this line are two U. S. teams, and on the other side three Jap teams. The teams are composed of the fastest and most powerful warships in the world. Reduced to terms of football, the Second Battle of the Philippine Sea makes crystal-clear reading, and contains more trick plays and grandstand thrills than an Army-Navy game. The Japs tried four major plays—each of which ended in disaster. In the February issue, a correspondent with the Fleet gives a play-by-play account of "The Battle That Won the Pacific."

War Wonders

DON'T think for a minute that the jeep is the only Army product which will be at your disposal in postwar years. There are walkie-talkies for radio calls to the folks from the 15th green, rubber boats for sportsmen, and a thousand little things like waterproof matches, shaving soap that lathers in the coldest water and a super raincoat. Unbreakable shoestrings are an item. Read "War Wonders for You" next month.

Mexico Calling

WHEN you get that shiny new car after the war (which we hope will travel about 35 miles on a gallon of gas) a vacation trip to Mexico should be in order whether your home is in Maine or Texas. Modern roads are being built south of the border to bring Mexico's beauties within reach of American tourists. A preview of what you will find is told next month in "Around the World in 2,000 Miles."

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The Latest in Color Photography

WITH the new color films which will be available after the war, you can take photographs in natural color with almost any camera. It won't be a rich man's hobby either, for quantity production of the color materials may reduce prices to a fraction of prewar figures. After the film is processed into positive color transparencies you can make your own prints or enlargements on color paper. Some of the prints have exceptionally sharp detail and create an impression of three dimensions. A February article brings you up to date on color photography.

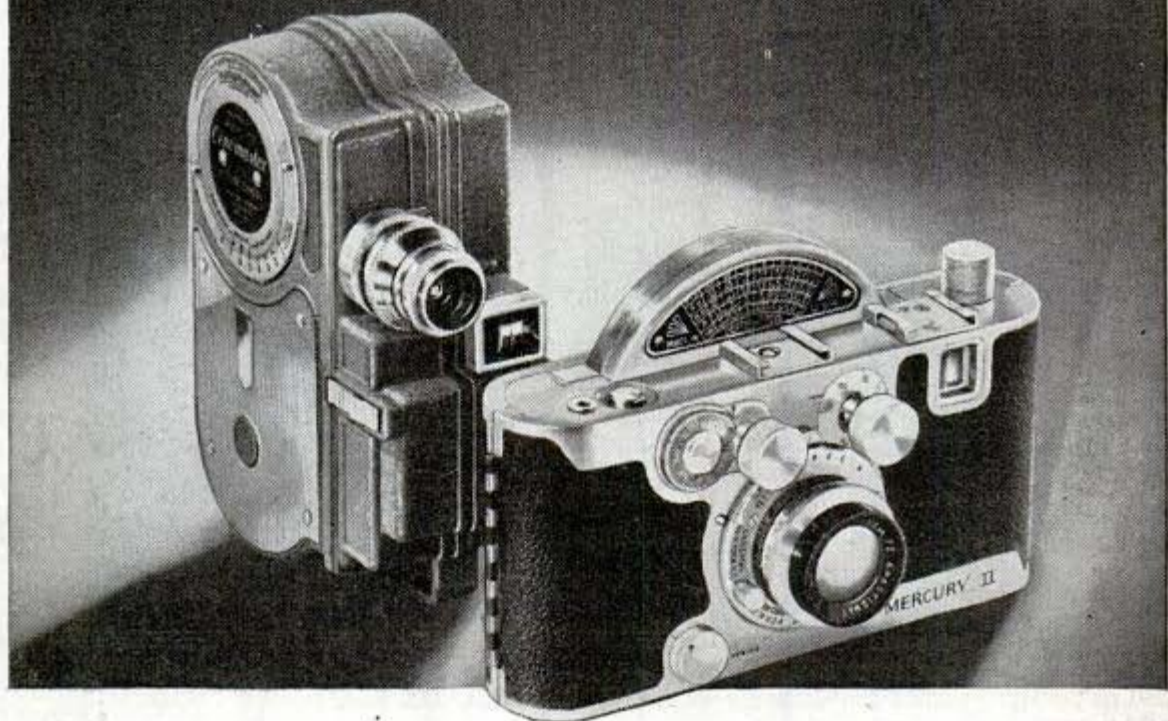
The Army's Navy to the Rescue

IN A wood shack on one of the small islands that dot the Caribbean Sea a radio man talks to the pilot of a C-54 en route from Florida to Puerto Rico. He makes a note that this plane, identified by number, has safely passed by. The island is a "check point" for the Army's Air Transport Command, and is part of a rescue system which maintains its own small navy and operates Catalina flying boats. A February article reveals a little known chapter of the ATC.

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TWO GREAT NAMES

for the new age of color photography



Universal **CINÉMASTER**

The famous Cinémaster 8 mm. Movie Camera and Projector will soon be available. Thanks to Universal's wartime experience in producing precision optical instruments for the armed forces, Cinémaster will boast many important new improvements.

There will be no finer 8 mm. camera and projector on the market!

Watch for preview announcement of a complete line of Cinémaster Home Movie Equipment.

BUY THAT EXTRA WAR BOND TODAY!

Universal **MERCURY II**

The new MERCURY II is the world's first candid camera specially designed for the new color films. It will give you color shots that are sharp, clear and color-true in every part of the picture—both foreground and background—and do it every time. It will give you better color shots at only a fraction of the usual cost. MERCURY II will use any make of 35 mm. film in color or black-and-white, in standard cartridges. And it will be one of the fastest candid cameras ever made!

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... as you'll get from her
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On battle fronts throughout the world, Motorola Military Radio has performed brilliantly. The famous "Handie Talkie," an exclusive development of Motorola Radio Engineers, is affectionately called the "fight-

ingest radio" in the army. These same engineers, pioneers in electronics before the war and through it, will have exciting new developments in F-M and A-M radio for your Home and Car.

You have a right to expect improved radio performance in your Post War set and you can depend on Motorola to deliver it soon after Victory in Europe!

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THE GREATEST
POWER ON
EARTH !



The Magic of Mind

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

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

One of America's foremost psychologists and university instructors, says of his experiments with thought transference and the powers of mind—"The successes were much too numerous to be merely

lucky hits and one can see no way for guessing to have accounted for the results." *Have you* that open-minded attitude of today which warrants a clear, positive revelation of the facts of mind which intolerance and bigotry have suppressed for years? *Advance with the times*; learn the truth about your inherited powers.

Let this free book explain

The Rosicrucians (NOT a religious organization) have been leaders in introducing the ancient wisdom of mental phenomena. Established throughout the world for centuries, they have for ages expounded these truths to those thinking men and women who sought to make the utmost of their natural faculties. Use the coupon below—avail yourself of a pleasing book of interesting information which explains how you may acquire this most *unusual and helpful knowledge*.

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

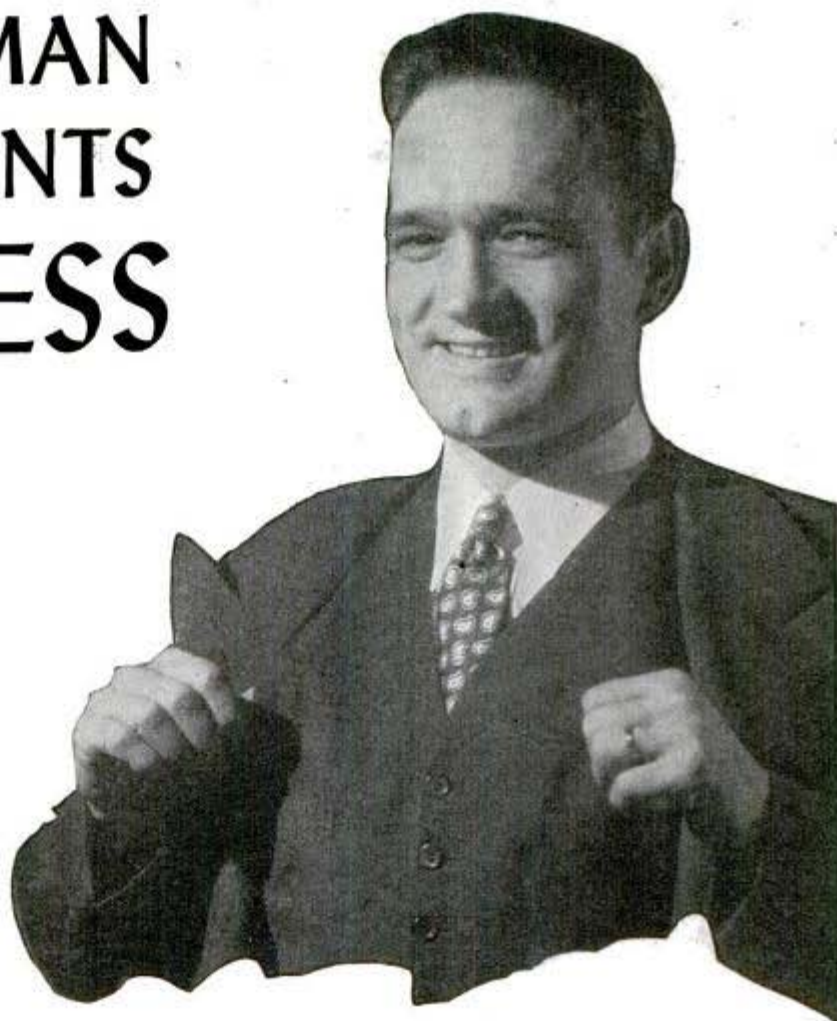
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after the WAR!



If you want success and security when peace comes, prepare for it now. Make sure that you have the trained ability that employers will want and pay for in the post-war adjustment.

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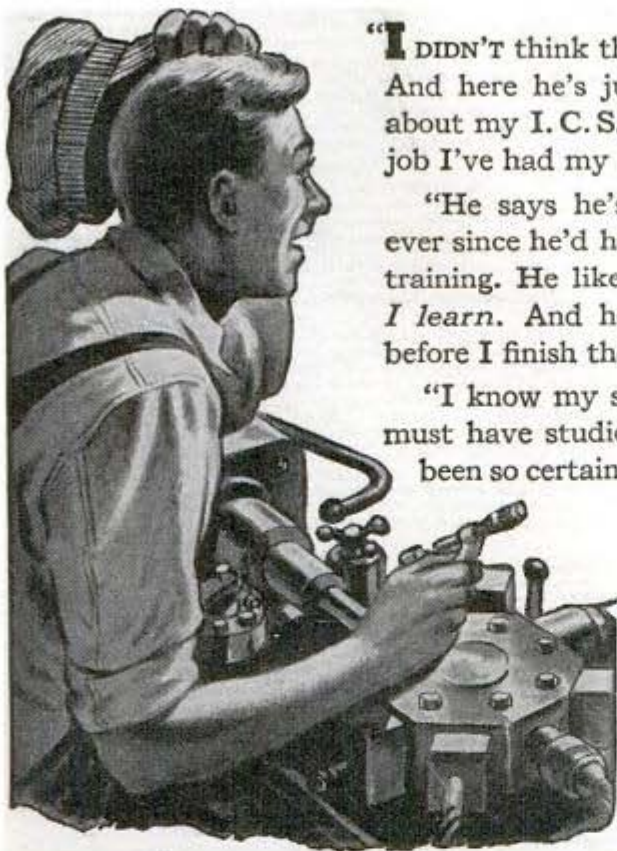
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"Why, he knows all about me!"



"I DIDN'T think the boss knew my name. And here he's just stopped by to talk about my I. C. S. Course and the bigger job I've had my eye on.

"He says he's had *his eye* on me ever since he'd heard I was getting that training. He likes the idea of my applying what I learn as *I learn*. And he says there'll be good news for me even before I finish the course.

"I know my studies showed in my work. But I guess he must have studied with I. C. S. himself or he couldn't have been so certain about just where I was getting my training."

Quite possibly the boss is an I. C. S. graduate. Thousands of employers are. Whether he is or isn't, however, he knows about your studies. I. C. S. regularly reports student progress to superiors. Letters of employer appreciation for this service are a regular part of our mail. So are student and graduate letters telling us of advancements—600 a month on an average. There *must* be a connection. Mail the coupon for full information.

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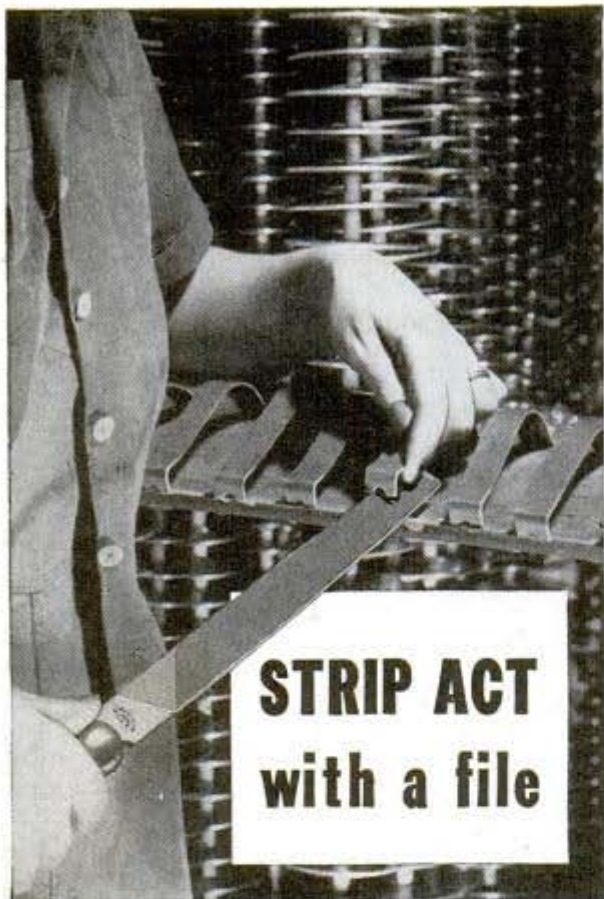
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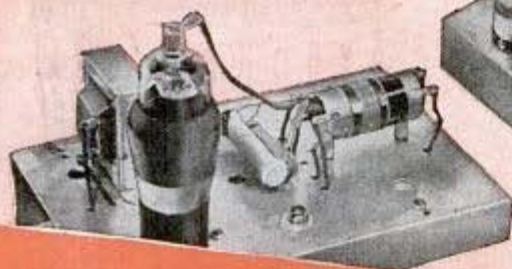
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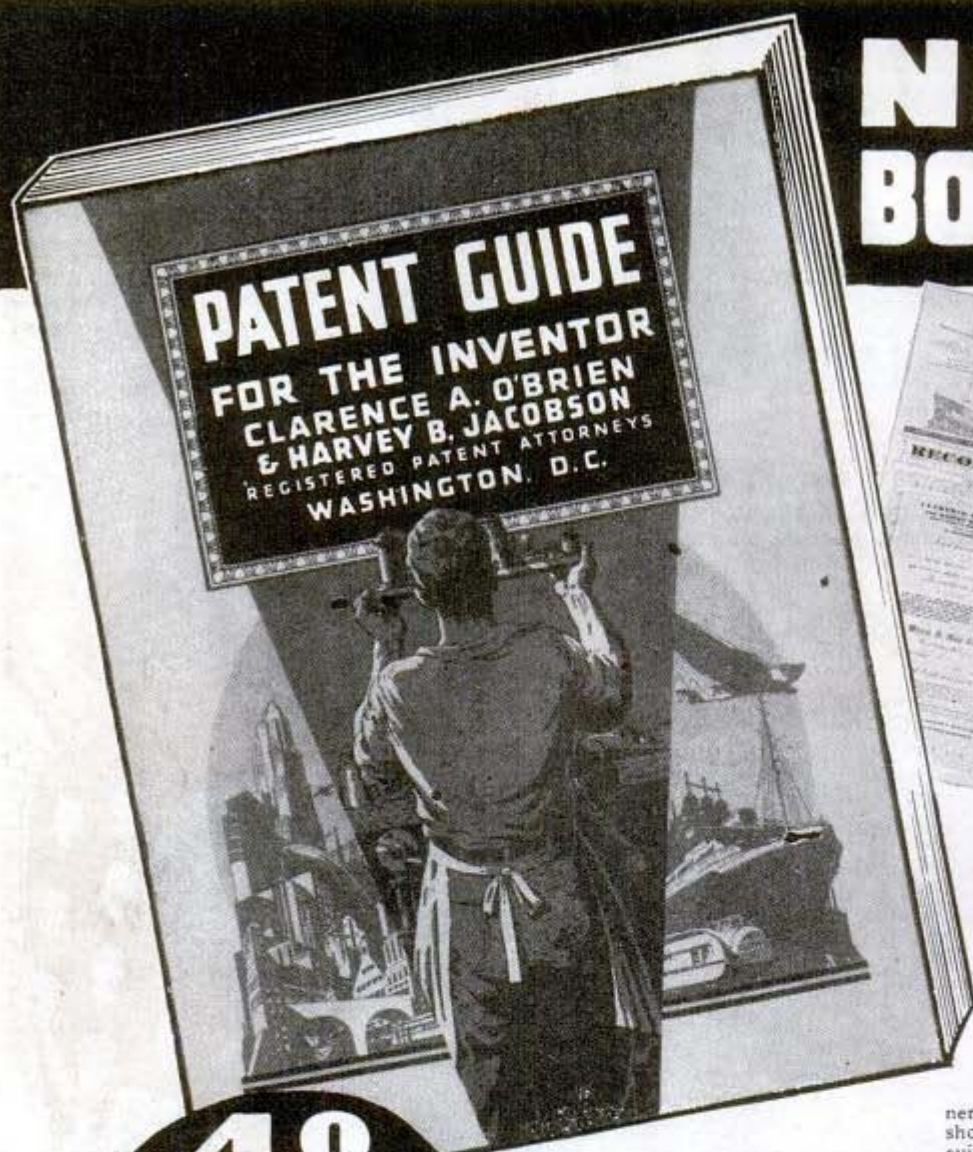
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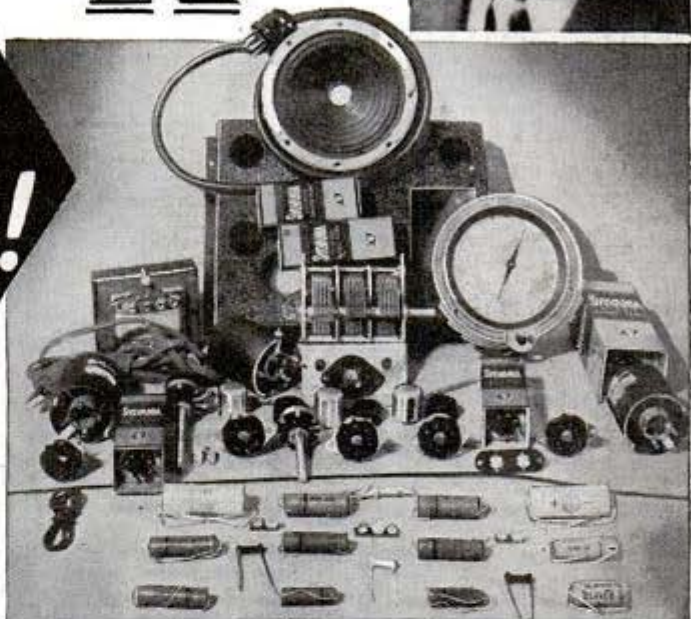
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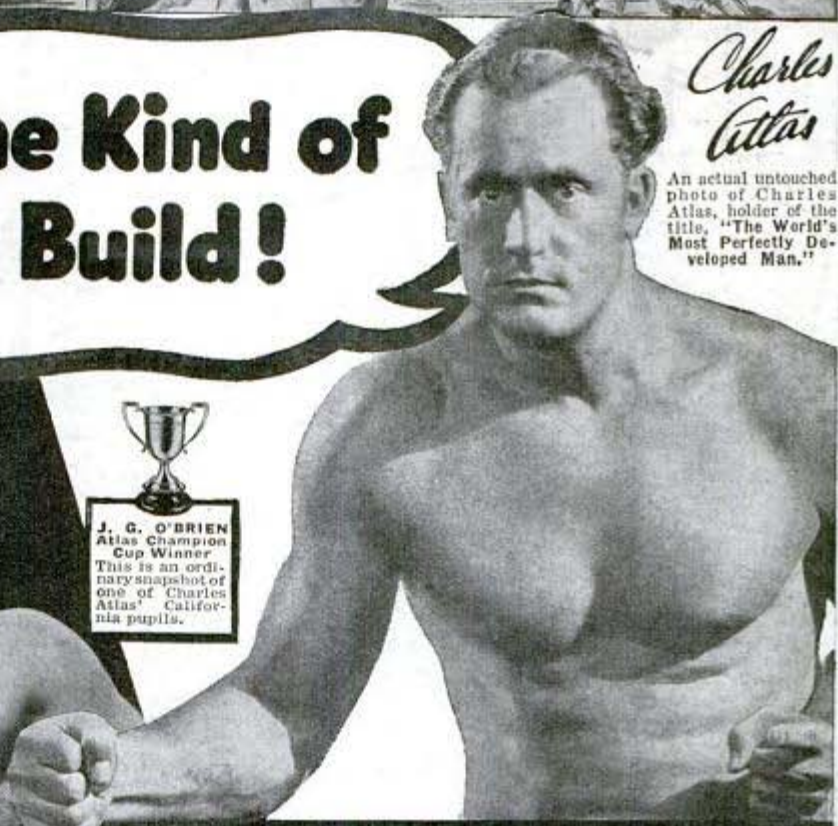
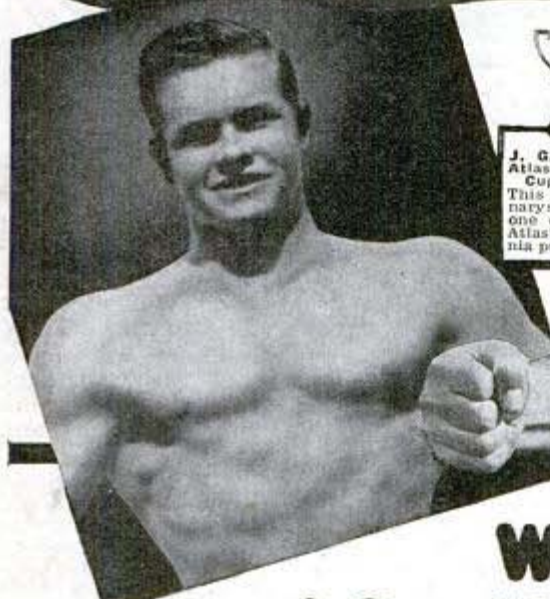
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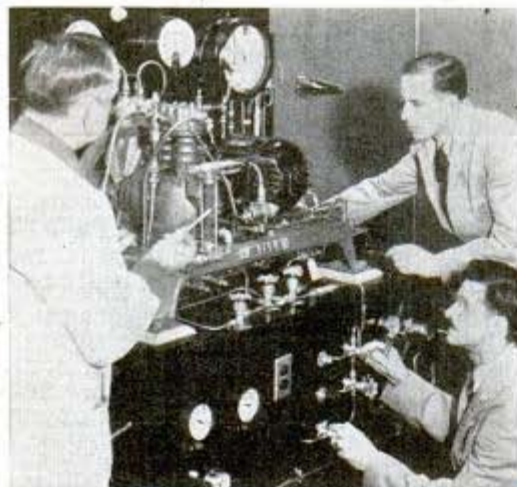
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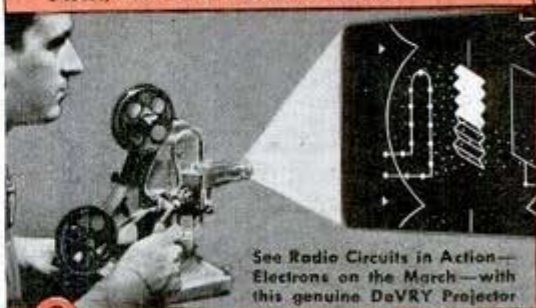


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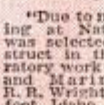
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By S. T. CHRISTENSEN

the "Fix-it Man"

WELL, I guess I'm the fellow to see, for I've repaired thousands of refrigerators (home and commercial both), vacuum cleaners, radios, washing machines, irons, fans, lamps, mangles, motors, etc. In fact, many of my customers call me their "electrical appliance doctor." And, "doctoring," I might add, has paid me a good substantial income for quite a few years. Funny, in a way, how I got started. Always liked to tinker and by experimenting around I found that most electrical appliances had many things in common. That, regardless of what the appliance was used for, or who the manufacturer was, the basic principles were much the same. From fixing my own appliances to fixing friends' and then for strangers at a fee, seems now to have been but a small step.

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For a while, repair parts (needed on some

jobs) were a little difficult to get. But that situation seems to have adjusted itself for many repair parts have today the high priority rating of AA2. After all, we must provide for the health and well-being of our civilian population.

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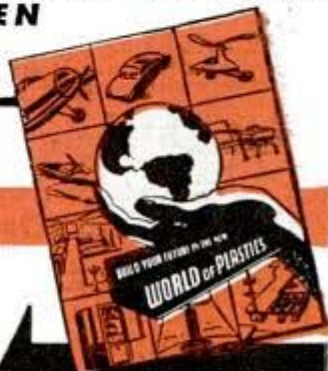
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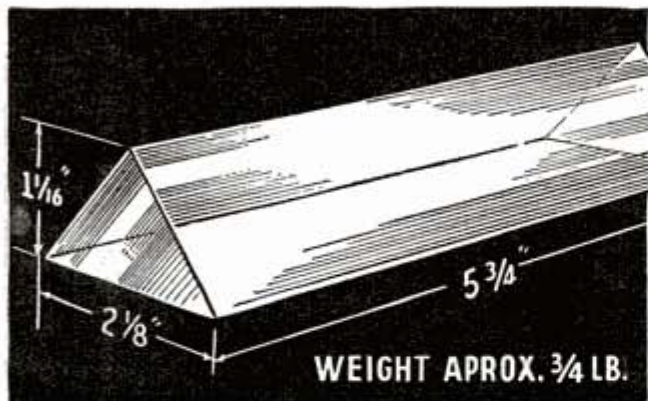
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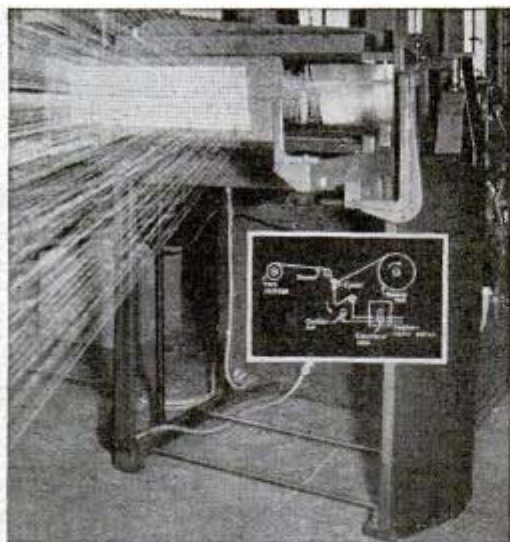
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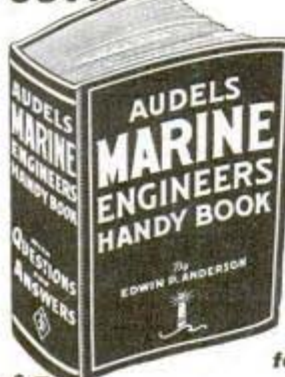
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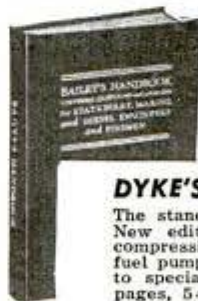
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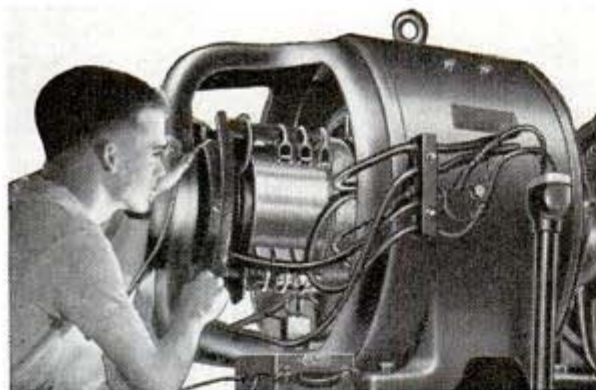
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Well, I guess you can see I'm pretty well "sold" on this whole idea. It's fun, it's healthful, it saves you money, you eat better, you feel secure and independent. That's why I've told the whole story about it in my "Have-More" Plan, and why I'm offering my Plan for sale. (Price \$1.00.) I wish I could give it away to everybody that might be interested, but of course I can't, and after all one dollar isn't very much.

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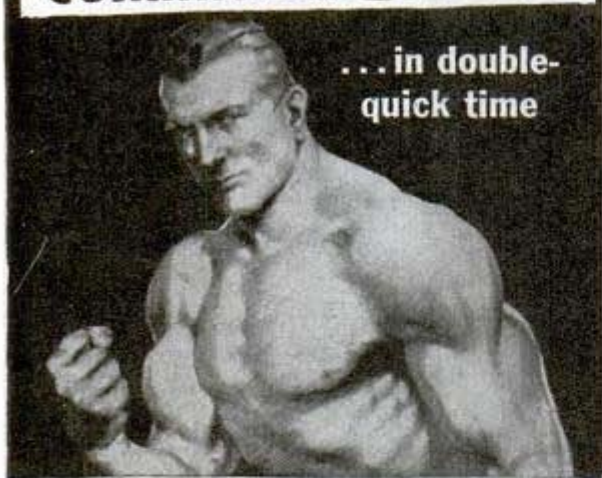
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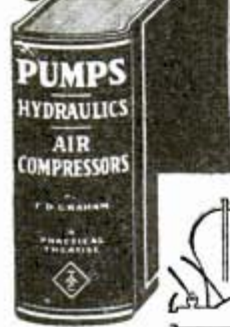
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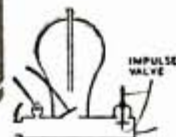
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ADS Placed in out of town newspapers and magazines. Low rates. Catalogue free. Ideas that pay. Baker Advertising Agency, Successors Ankrum Agency, 189 W. Madison, Chicago 2.

INCH Display advertisement, 50 magazines, year \$16. Wood's Popular Services, Atlantic City, (N. J.)

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

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PHILADELPHIA Mailing address in business section or highest calibre personal representation. Christian, college graduate, highly rated, excellent business and political connections. Legitimate contacts only. Modest cost. Art Dyer, 5214 Walnut St., Philadelphia 39.

HOLLYWOOD Business, sales, publicity representation. Mailing and forwarding. Formerly with chambers of commerce, better business bureaus, etc. Write Jeff Daniels, P.O. Box 2266, Hollywood, California.

TO Whom it may concern: I will represent you in Cleveland. Personal or business assignments \$1 per hour. James W. Farley, Citizens Bldg., Cleveland 14, Ohio.

NEWPORT, Rhode Island, mail forwarded, telegrams, errands, etc. Box 86.

DETROIT, Mich. Mail forwarded. Confidential. 25c per item. ADJ Service Bureau, Suite 2120, 1150 Griswold St.

HOLLYWOOD, California, mailing address: Reformatting service, single letters 25c, monthly service, \$2.00. Dan, 1507 Kenneth Road, Glendale, Calif.

OREGON Mailing address—Coast resort; letter 25c; month \$2.00. J.B.M., Box 225, Rockaway, Oregon.

MIAMI Forwarding address for business or personal use. \$1.00 per month or 10c per letter. Miami Merchandise Mart, 1631 Douglas Rd., Miami 35, Florida.

TWIN CITY reformatting service. \$2.00 monthly. Steffen, 810 Pioneer Building, St. Paul, Minn.

MAIL Letters from 10,000 lake state. Prompt forwarding. \$2.00 monthly, 25c individual letter. R. Hamstad, St. Peter, Minnesota.

\$2.00 MONTHLY Maintains Washington, D. C., office address. Your business, personal mail forwarded when wanted. Hawkins, (Established 1917), 7-e Randolph Place.

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3 LINE, Cushioned, indexed, 35c. Signatures \$1.50. Stamprite, Wauwatosa, Wis.

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\$2.00 POSTPAID: 150 8½" x 11 Good bond letterheads and 150 6¾ envelopes. 500 of each \$5.75 postpaid. Mero Products, Box 344A, Punksutawney, Penna.

500—\$2.25. LETTERHEADS, Envelopes. Mango, 555A South 20th, Newark 3, N. J.

GUMMED Perforated address labels, 3300 for \$1.00. Keller, Michigantown 2, Ind.

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100 PERSONAL Letterheads, 100 envelopes to match. Rippletone \$1.25. Clarion Press, Richland, Iowa.

EMBOSSER Business cards reasonable. Samples. Spada, 10 Lexington, Wethersfield 9, Conn.

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ENVELOPE Printing bargain—1000 6¾, \$3.90; No. 10, \$5.00. Postpaid. Guaranteed quality. Joseph Adams, 30 W. Washington, Chicago 2.

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LOW Prices—Fast, quality service. Estimates, samples free. Wilson Printers, Dowagiac 2, Mich.

PRINTING—Mimeographing, free estimates, samples. Washah Print Shop, 1444 Webster, Washah, Indiana.

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INEXPENSIVE Home-made printing press. Details free. Novelty Shop, Downs-ville, Louisiana.

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C. A. SNOW & Co., M-427 Snow Bldg., Washington 1, D. C. Registered patent attorneys. Established 1875. Literature mailed on request.

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INVENTORS—The Lion Manufacturing Corporation of Chicago, a highly rated concern doing an annual business of \$20,000,000 is interested in inventions for their plant and affiliated companies. Our interest is in patented or patentable electrical or mechanical devices for post-war development in the following fields: Radio and television, sound and recording, household appliances, vending machines, coin operated amusement devices, in fact almost anything of metal or plastic. We invite inventors to send us details concerning their patented inventions. If your invention is not patented, tell us in a general way what you have to offer. If we are interested, we shall inform you how to communicate details without endangering your rights. Lion Manufacturing Corp., 135 South LaSalle Street, Dept. A, Chicago 3, Ill.

WANTED—Patented items for manufacture on royalty basis. Decker Manufacturing Co., Rockford, Illinois.

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AUTOMOBILE Parts and accessories. McConnell-Petermann, 16114 Burt, Detroit 19, Mich.

ATTENTION. Cash or royalty. Always moist antenna. Home or car. Five claim patent. Wilbur White, 312 State Street, Salamanca, New York.

PATENT. Sell outright. Garden rake and marker combined, to space rows for planting. Can be punched and formed from sheet metal. Inexpensive to make. E. Ernst, 1857 E. Pacific St., Philadelphia 34, Penna.

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CATALOG 50 Engines, model railroad supplies, 25c refunded. Simonsen Model Supply, A-3054 North Greenview, Chicago 13.

RAILWAY Models, complete line, information catalog HO and O gauge, 79 pages, 15c. Walthers, 247 Erie, Milwaukee, Wisconsin.

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FLOUORESCENT Lights. How to make your own 20 watt lights for less than \$1.00 each. Complete, guaranteed, detailed instructions \$1.00 M.O. or war stamp. Specialty Sales, Box 1086, Muncie, Ind.

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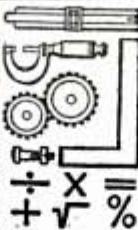
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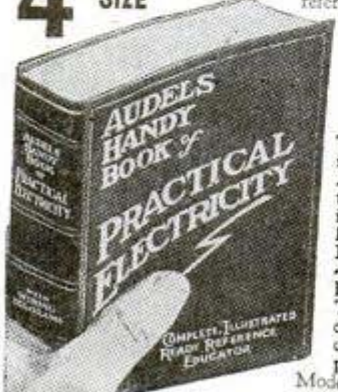
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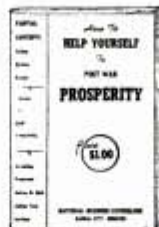
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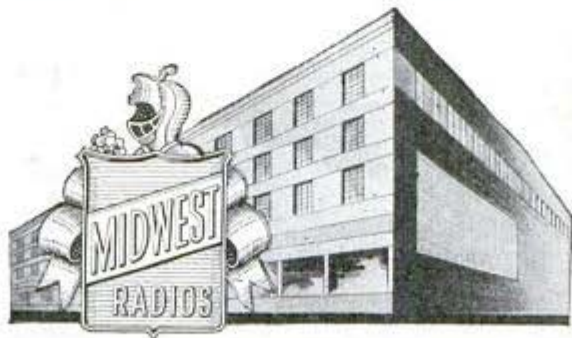
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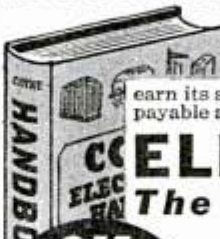
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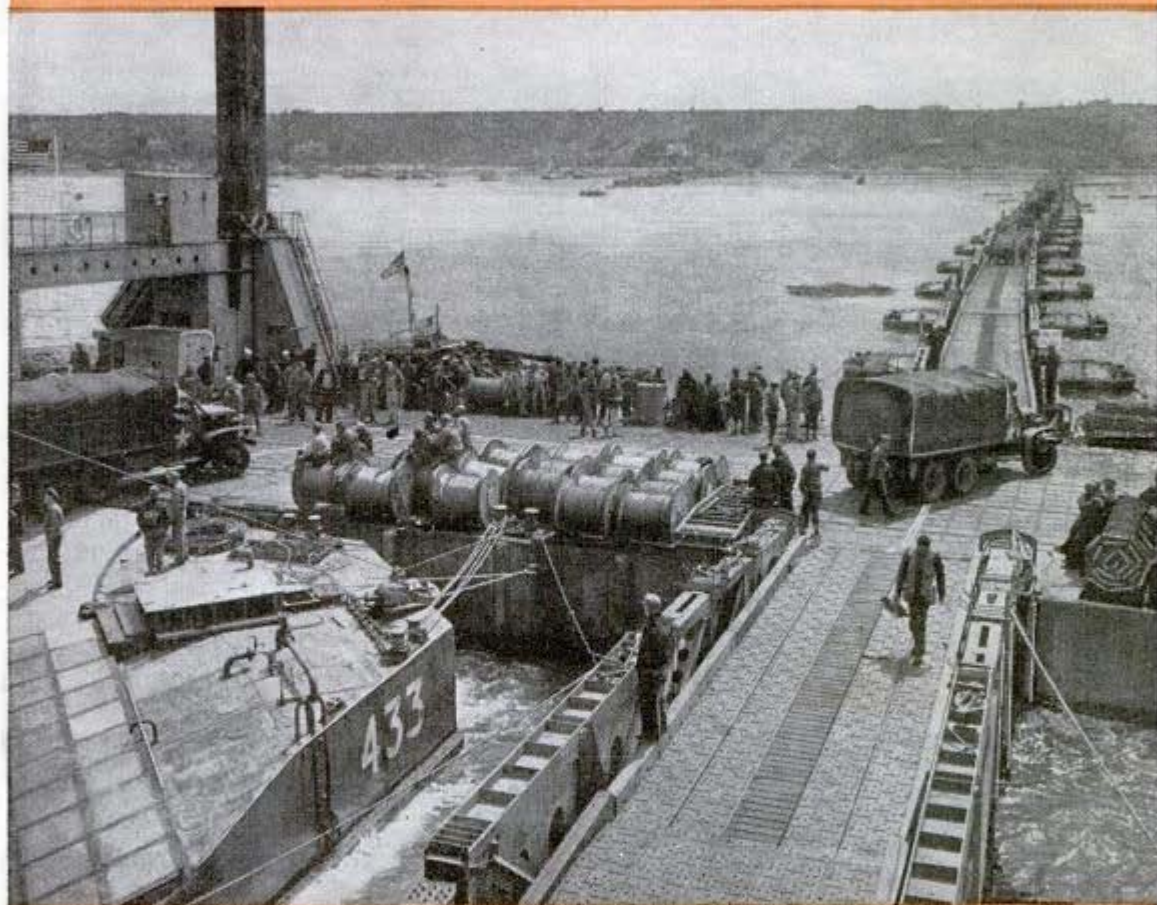
WRITTEN SO YOU CAN UNDERSTAND IT

Vol. 83

JANUARY, 1945

No. 1

GANGPLANK *to* HITLER'S DOORSTEP



Cargo rolls from ships to floating harbor's pier, from which it will be transported to Omaha beach

By Wayne Whittaker

"**A**CH HIMMEL! It looks like Noah's Ark with the roof blown off and a Bofors mounted amidships!"

The eyes of German reconnaissance must have popped on D-day if they saw one strange segment of the invasion armada inching its way across the English Channel.

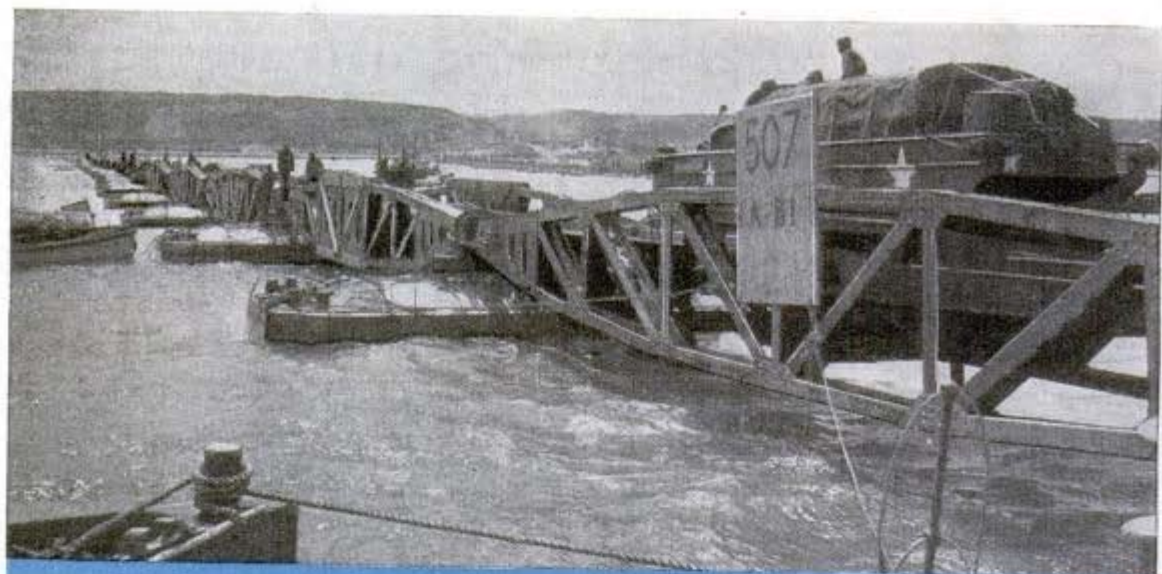
Aside from the ark-like ships, the like of which had never been seen on any sea, there were 200-foot floating monsters of steel, and long sections of what appeared to be bridges resting on queer-looking pontoons. All were being towed by tugs through the choppy waters at four knots.

Then, adding insult to mystery, Nazi reconnaissance might have spotted 60 decrepit freighters and warships heading toward the invasion coast. They looked out of place among the sleek invasion craft and modern warships, but they seemed to know where they were going.

Martial history was in the making, for the invasion forces advancing against the heavily fortified beaches of Normandy were bringing their own harbors with them. This feat, which has been called the eighth wonder of the world, will be recorded as one of the greatest military engineering achievements despite the fact that it was not an unqualified success.

JANUARY, 1945

1



Supplies stream steadily ashore over pontoon bridgeway linking floating harbor with the beach



Above, one sector of breakwater created by line of sunken ships near "U. S. Mulberry" harbor off the Normandy coast. Below, panoramic view of Omaha beach before the Mulberry was set up. Barrage balloons hover over mighty assemblage of shipping as Allies pour an unending flow of supplies ashore



The building of the pre-fabricated ports was one of the most closely guarded of invasion secrets. Everything pertaining to the project was in code. It was decided at the Quebec conference in 1943 that there should be two synthetic harbors—one for the British and one for the American forces—to be known as “Mulberries.”

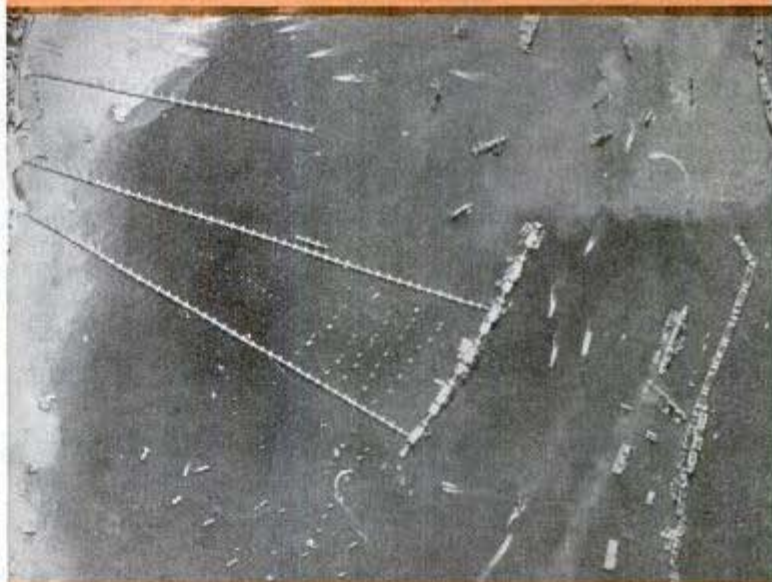
Each of the harbors was designed to move an estimated 12,000 tons of supplies and 2,500 vehicles per day for the first 90 days of fighting.

The plan for the ports was prepared by a joint committee of technical experts working under the Joint Anglo-American Chiefs of Staff, and the units were constructed in England and Scotland.

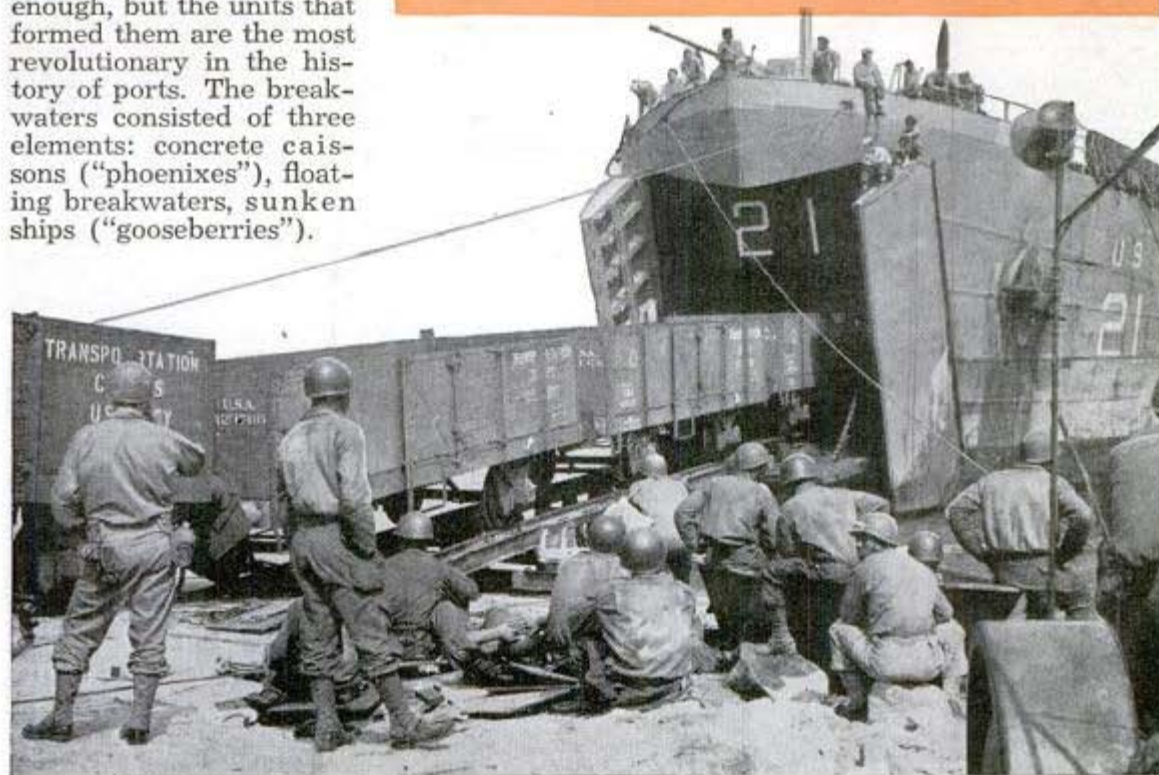
The general plan called for a system of breakwaters in the lee of which were to be piers with docking facilities for the rapid unloading of the big LSTs, Liberty ships and other craft. The requirements—breakwaters and piers—were conventional enough, but the units that formed them are the most revolutionary in the history of ports. The breakwaters consisted of three elements: concrete caissons (“phoenixes”), floating breakwaters, sunken ships (“gooseberries”).

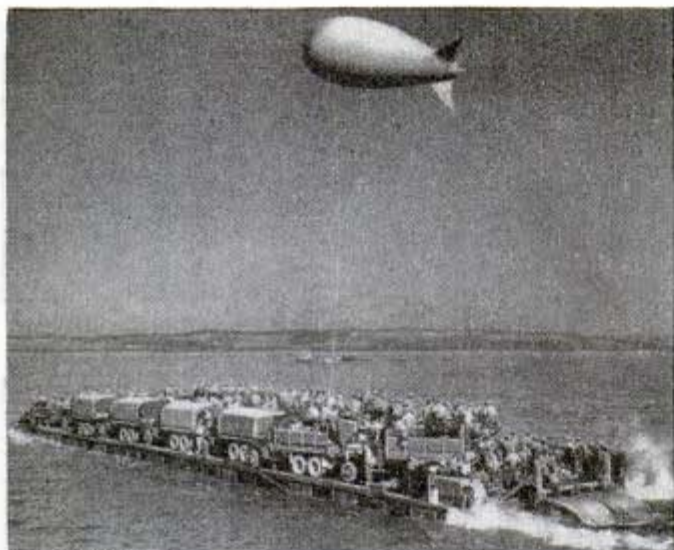


Tugs jostle the concrete caissons into position. Note anti-aircraft gun mounted amidships. Below, aerial view before storm wrecked harbor



Below, railroad cars rolling from the mouth of an LST onto the beach. Depth of water near shore greatly facilitated unloading of big LSTs





U. S. Navy photo
Barrage balloon flies over Navy "Rhino ferry" made of pontoons

"Obtaining those 60 ships just to take out and sink was no mean task in itself," said Capt. H. Hickling of the Royal Navy, who worked on the project from its inception. "At first the Admiralty turned us down cold, particularly in view of the fact that we were then on the last lap of licking the U-boats."

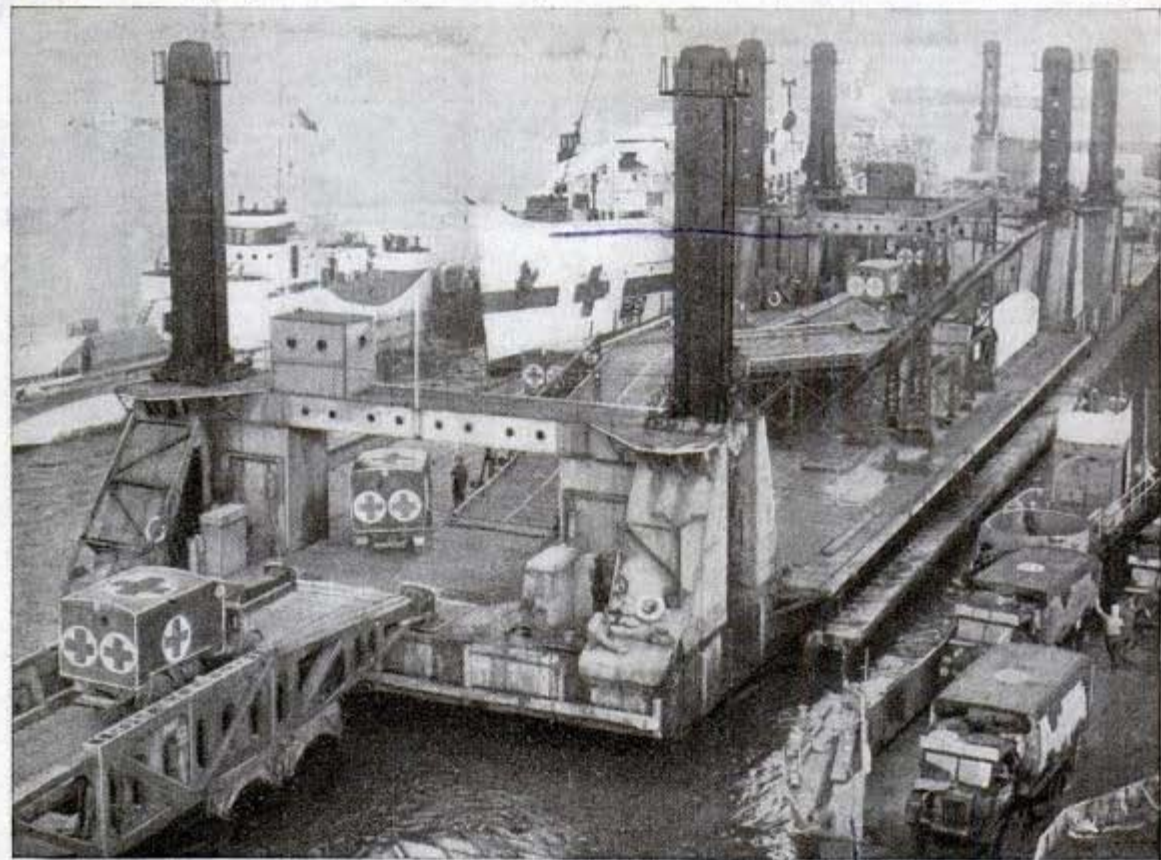
The ships earmarked for sinking included several antiquated battleships and

cruisers. In the lineup of blockships, which were to furnish more than four miles of breakwater, were 22 United States freighters and obsolete warships.

The blockships were sunk parallel to the beaches in 30 to 40 feet of water and were all in place by D-day plus three. These ships, with the upper parts of their hulls and superstructures above water, inspired German claims of "scores of Allied freighters sunk."

The concrete caissons, or phoenixes, which resembled roofless arks, were built in six sizes. The largest caissons had a displacement of 6,044 tons. They were sunk in water up to 33 feet in depth. The caissons were shaped like an inverted T with the interior divided into cells. The T construction helped give them equilibrium while afloat. Valves in the outer walls served as sea cocks. Space at the ends of each caisson was decked over to form quarters for the crew during the tow across the channel. The caisson's "superstructure" consisted of a platform amidships on which was mounted a 40 mm. Bofors. These weapons, along with those on the decks of the sunken ships, formed a vital part of the port defenses.

Ships unloading at pierhead directly onto Army trucks. Piers went up and down with the 21-foot tide



H.M.S. Roberts
Page 365, The Spher 9/16/44

Range of Guns Extended by Firing at Top of Roll



When the British monitor, Roberts, was bombarding German coastal forts during the invasion of Normandy, some of the 15-inch shells began falling short, although the guns were being fired at maximum

range. But it was noticed that the ship was rolling from earlier salvos, so the fire control officer decided to time the firing with the apex of the roll. This gave the guns increased elevation to exceed normal range.

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Interior of Inactive Ships Is Kept

Rustproof by Air-Drying Units

Many years are added to the usefulness of reserve and inactive ships by the Navy's rustproofing technique. Based on the knowledge that steel doesn't rust in the desert, the dehumidifying technique keeps the air inside the ships very dry by means of mechanical units. A thin film of rust preventive is used to preserve metals and machinery, while mildew and decay pre-

ventives are used to preserve wood, life jackets, cordage and other nonmetallic equipment. Silica gel or activated alumina is used in the driers which take the moisture out of the air. Two beds of these compounds are employed. When one becomes saturated with moisture, electric heat dries it out, making it ready for use while the other is being operated.

338

0642

Bureau of Ships - U.S.N.B.

"Jeep Model" Tank Built by Yanks Near Front

With pieces of captured German vehicles, as well as French and American parts, ordnance men of the American 9th Air Force Command built a midget tank. Although this midget weighs four tons, it has the agility of a jeep. The tank was used to creep behind hedge-rows in France, and can crawl in and out of craters or make an about-face with ease. It holds 3 men.

Three-man crew of "home-made" baby tank used in France includes a gunner

0681

"Service Station on Wheels" Feeds Oil to Planes

Most of the 146 caissons were built in specially excavated tidal basins. When the lower part of a caisson was completed, a channel was dredged to the crude dry dock and the "ship" was floated out.

One difficult engineering problem was the construction of portable pier equipment that would withstand a 21-foot tide. The piers consisted of steel roadways supported on special floats. These floats were designed to sit down on rock or sand as the tide receded. Sections of the pier were towed across the channel in lengths of 480 feet.

The pierhead consisted of a steel barge, or platform, about 200 feet long and 60 feet wide, partially supported by steel columns resting on the sea bottom. The columns supported only enough of the load to anchor and steady the structure. They extended above the pierhead, and an ingenious arrangement of sheaves, cables and power-driven winches raised or lowered it with the tide.

It required 500 tows from ports scattered all along the coast of England and Scotland to assemble the 600 harbor units, which weighed about a million tons. A fleet of more than 150 tugs towed the ports across the channel—by far the greatest towing job in history. One large tug would handle either one caisson, a unit of six bridge sections, or one pierhead.

A timing schedule for the arrival of various units along the beaches was carefully worked out. At noon on D-day plus one the blo or gooseberry units, began ing at the two American b Omaha and Utah. Omaha be the site of our prefa port. The caissons were se to arrive on D-day plus 7 were maneuvered into flooded and sunk.

Moorings for many of t ing breakwaters were D-day plus one about 3,20 shore. The installation 200-foot steel giants, whi cruciform in shape, began day. They were placed of the caissons and bl One arm of the floats v with air and the other th water to give them stabi

On D-day plus 12, Jur worst gale in 40 years ble

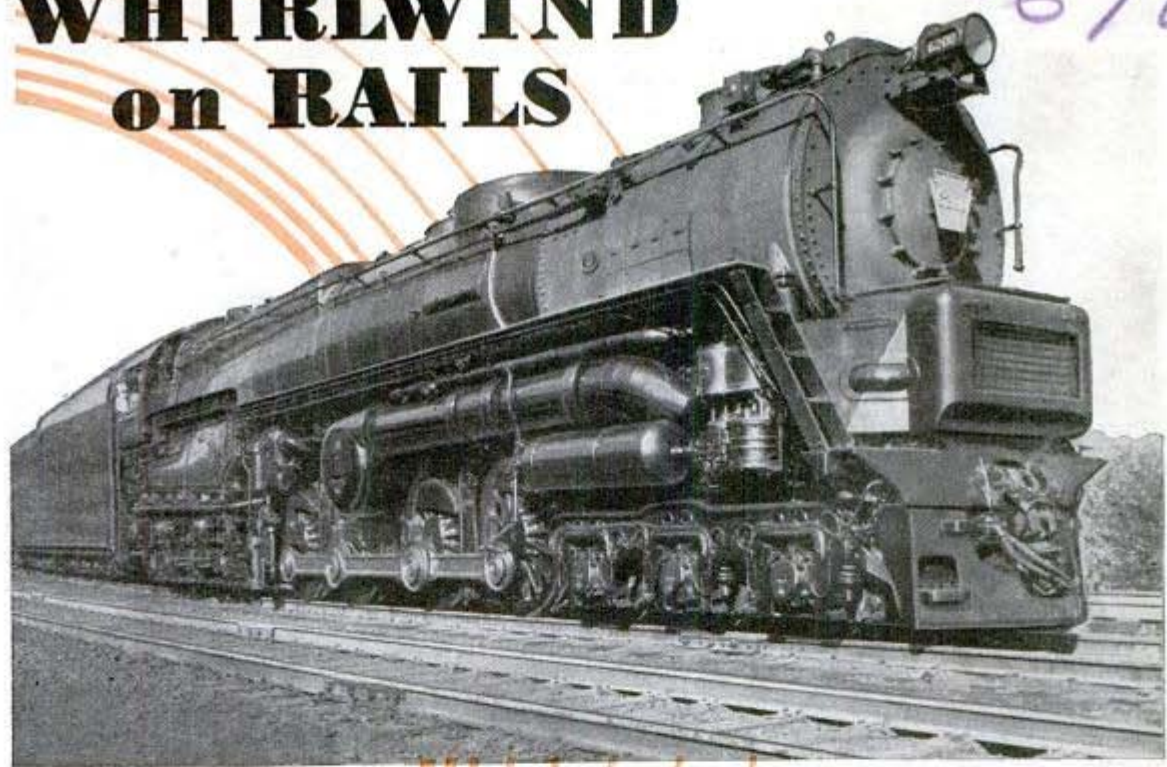


Quick servicing for plane engines is possible with a "service station on wheels"—a small trailer unit which holds two barrels of oil and requires only one operator. The unit can supply aircraft with motor oil at a rate of six gallons a minute from barrels sealed to insure against sabotage. The barrels are tilted by a lever that locks the barrel and also acts as a brake on the trailer to facilitate loading of the barrels by one man.

Armstrong Equipment Co., 9339 Santa Anita

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WHIRLWIND on RAILS



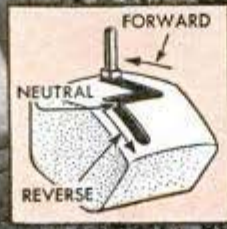
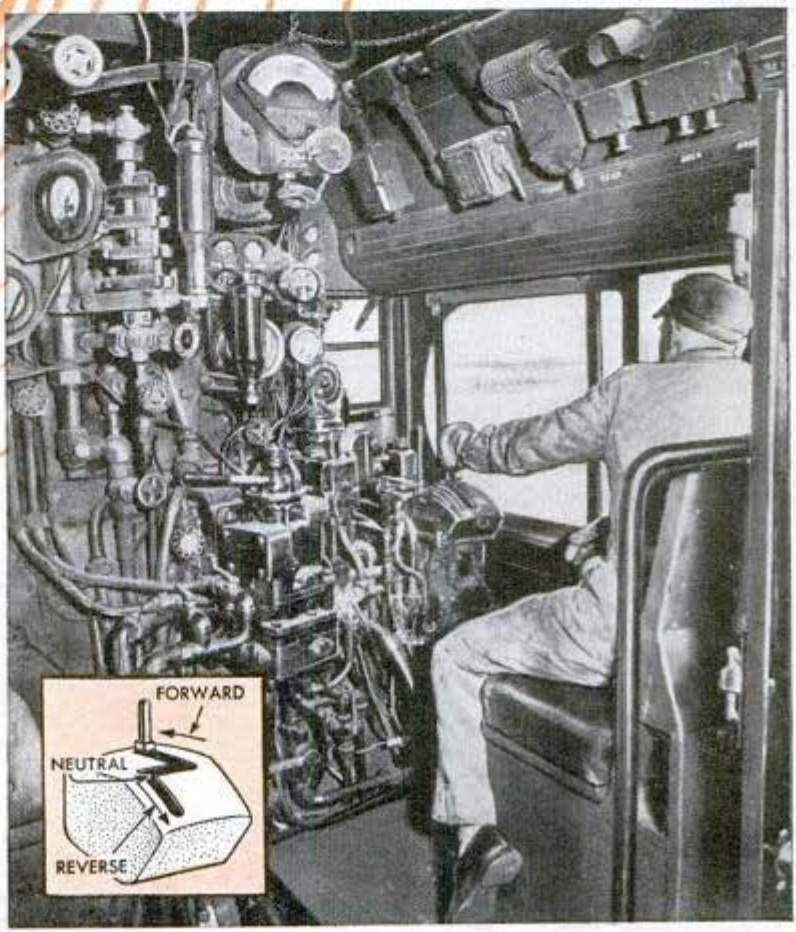
By
Roderick M. Grant

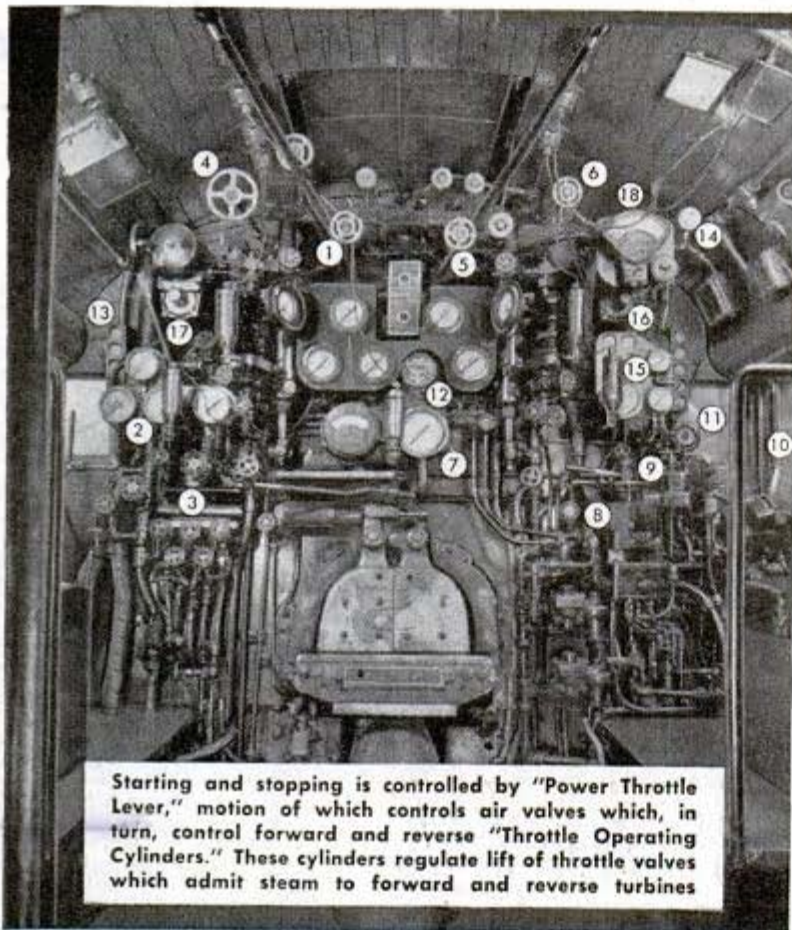
First thing new in locomotives since the Diesel-electric, Pennsylvania's "6200" has direct steam turbine drive. Pistons and cylinders are absent. Inset below shows control lever which is forward and reverse throttle

ALL ALONG the line from Philadelphia to Pittsburgh and Chicago folks glanced from their kitchen windows curiously as the big engine lumbered past.

What was this, anyway? Was the Pennsylvania putting a million-pound rocket on rails? The brand new giant rolled by with a steady "who-oosh" strangely devoid of resemblance to the pulsating "chuff-chuff" of the conventional iron horses whose faces had been familiar along this road for a hundred years.

Those who looked sharply noticed another peculiarity about this newcomer. There was no plume of steam escaping from the cylinders as the pistons pounded in and out at mile-a-minute tempo. In fact there were no pistons, nor cylinders. And the bright steel driving rods, unlike those of





Starting and stopping is controlled by "Power Throttle Lever," motion of which controls air valves which, in turn, control forward and reverse "Throttle Operating Cylinders." These cylinders regulate lift of throttle valves which admit steam to forward and reverse turbines

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| 10—POWER THROTTLE LEVER | |
- Cab diagram from Baldwin Locomotive Works

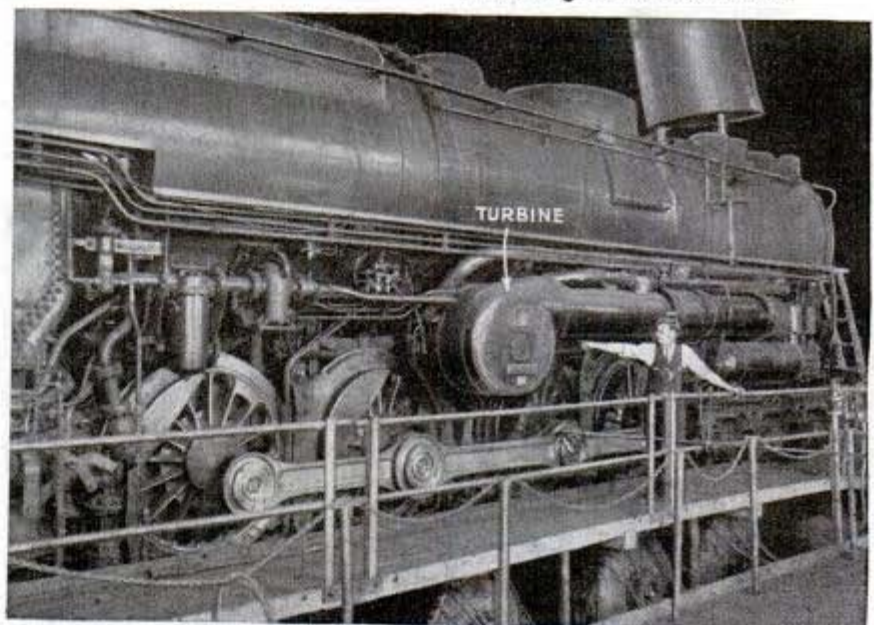
two center driving axles. These gears operate continuously in an oil bath and mesh with so little friction that 97 percent of the turbine's power reaches the driving wheels. Since the conventional locomotive is notoriously inefficient in its utilization of the energy in coal, despite tremendous engineering improvements in the last generation, the potentialities of this fundamentally new type of coal-burning steam engine are vast but unknown. Exactly what No. 6200, designated type S-2 by the Pennsylvania, will do is an unknown quantity to be solved in road tests just beginning.

Designed to develop 6,900 shaft horsepower, the S-2 has capacity to pull a full length passenger train at 100 miles an hour and high class heavy freight trains at high speeds. Completed recently at Philadelphia, the engine was sent into service on the Chicago-Crestline, O., division to determine its adaptability to high speed passenger and freight hauls. That division is the scene

Below, the turbine locomotive on running test rack at Altoona

the traditional steam locomotive, remained on a true horizontal line as they revolved with the wheels; while above them was a huge horizontal tube, akin to nothing in the experience of veteran railroaders. What kind of engine was this, anyway?

No. 6200, just starting out on her career, is America's first direct drive steam turbine locomotive. Instead of harnessing the power of steam to the reciprocating pistons in the cylinders, the turbine shaft feeds power in steady flow to heat treated alloy steel reducing gears on



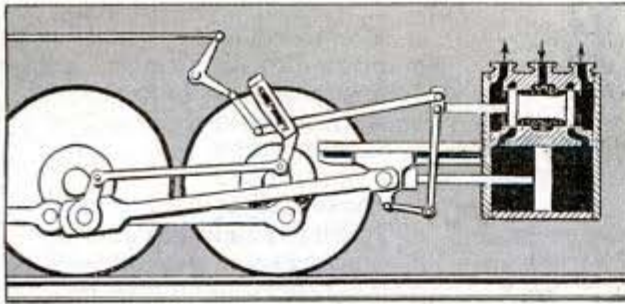


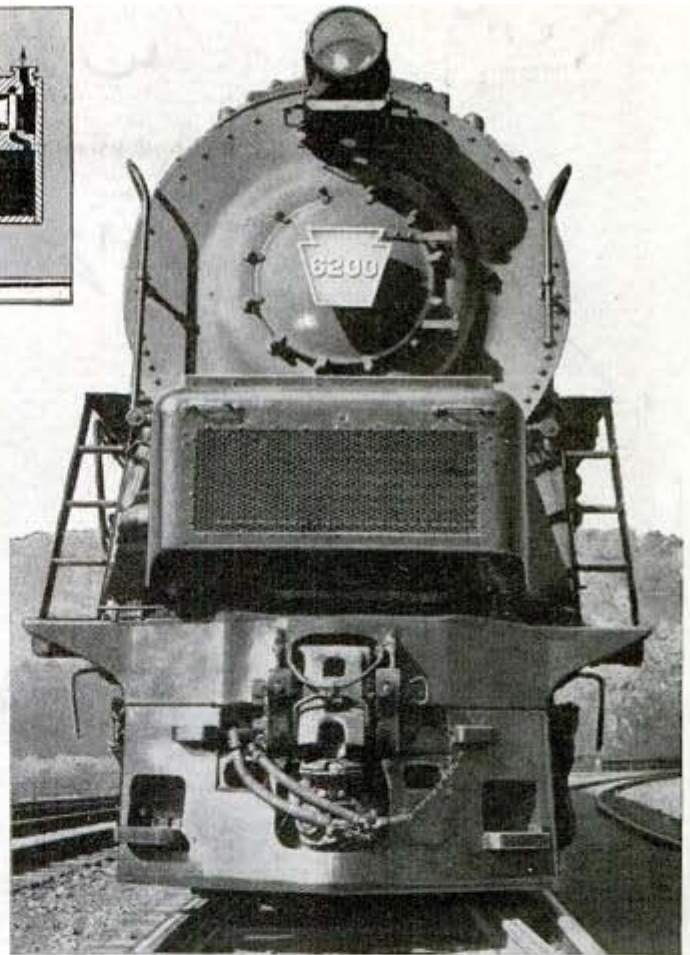
Diagram shows the typical valve and cylinder arrangement of a conventional type steam engine

where world records in train speed have been set.

One of the first things you notice about the turbine locomotive is its quietness. There is no snorting as it gets under way with the smoothness of an electric drive, no chugging as it speeds down the track in a vibrationless glide. At rest, it is virtually silent; moving, its steady hiss of steam is that of a giant breathing.

The engine was designed and built by the Baldwin Locomotive Works and the Westinghouse Electric and Manufacturing Company, in collaboration with the Pennsylvania Railroad. The purpose was to eliminate the reciprocating parts of the conventional steam locomotive, obtain a uniform flow of power to the driving wheels and secure the economies inherent in a turbine for railroad motive power.

The turbine shaft is rotated by the pressure of jets of steam against the vanes of the turbine wheel, and its power is transmitted continuously to the driving wheels

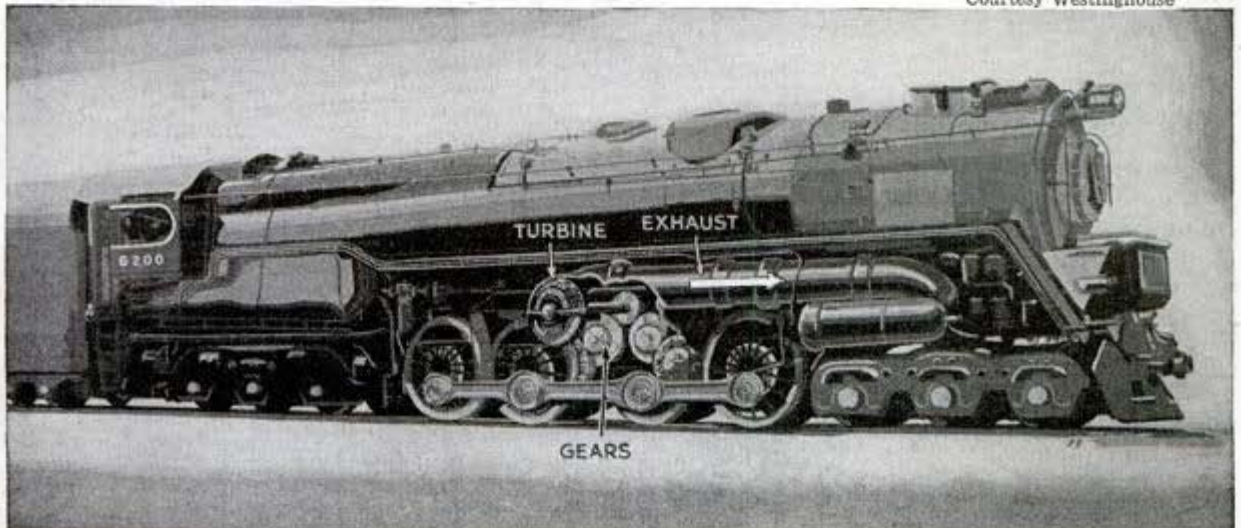


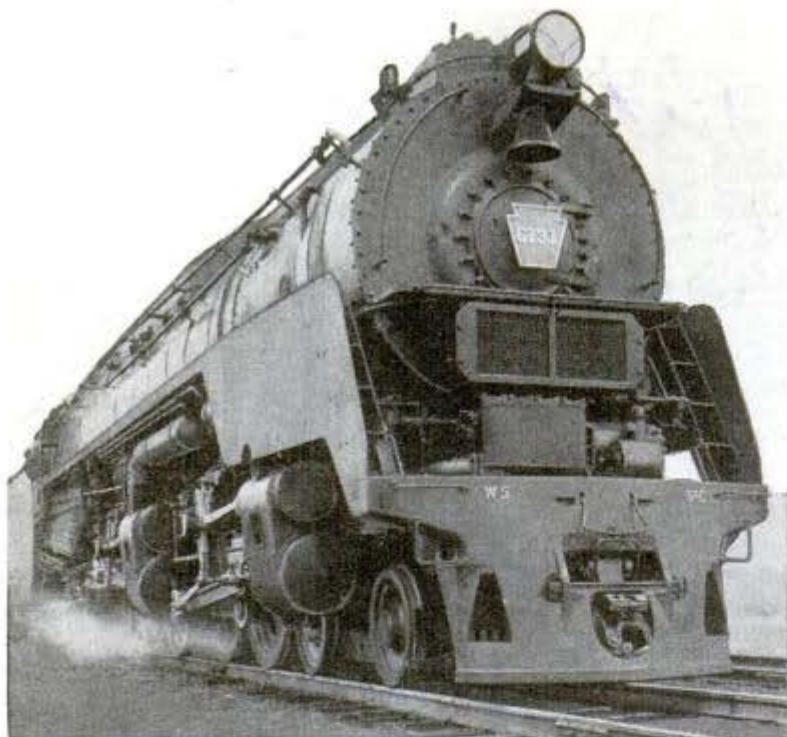
The "radiator" on No. 6200's nose cools compressed air pumps

through speed reducing gears. In operation the turbine engine is the simplest ever constructed. Forward and reverse movements are controlled by a single lever actuating special pneumatic control apparatus. Automatic devices make it impossible to handle the mechanism incorrectly.

Cutaway drawing reveals turbine and gears which deliver power to center pairs of drive wheels; connecting rods drive front and rear pairs. Exhaust steam flows forward through long tube

Courtesy Westinghouse





The Pennsylvania has pioneered several new types recently: at top, the new four-cylinder freight hauler; center, the world's longest and fastest passenger engine; bottom, the "T-1" streamline passenger locomotive

At rest, the engineer's control lever stands in neutral. To go forward, he moves it slightly to the right and then forward, rather like the automobile gearshift. To reverse, he moves it left and back.

There are separate turbines for forward and reverse travel. The main, or forward drive turbine is mounted at the right side of the locomotive and accounts for less than one percent of the engine's total weight of nearly a million pounds. It is only about 3 feet 9 inches in diameter. The smaller turbine, on the left side, is designed for reverse speeds up to 22 miles an hour and is brought into operation by engaging a clutch.

The forward turbine contains more than 1,000 chromium steel blades,



some of them less than one inch long. From the conventional boiler, carrying 310 pounds of steam pressure and fired by mechanical stoker, steam travels through the entire battery of turbine blades, expending all its energy but about 15 pounds, which produces a non-pulsating draft through the firebox and boiler.

The whirling turbine shaft imparts its power directly to two center pairs of driving wheels.

International News Photo
235 E. 45th St.

Robot Tank Can Fire a Bomb Charge By Remote Radio Control

Connecting rods from these wheels transmit the power to two additional pairs of drive wheels. Thus the S-2 has a 6-8-6 wheel arrangement: six leading wheels, eight drivers and six trailing wheels. It has roller bearings throughout.

Together with its tender, the S-2 is 123 feet long—only 17 feet shorter than the Pennsylvania's No. 6100, rated the world's longest passenger engine, familiar to many as an exhibit at the New York World's Fair in 1939-1940.

The S-2's colossal tender carries 18,000 gallons of water and 37½ tons of coal—44% more fuel than even No. 6100 holds.

Product of years of research, the Pennsylvania's new "baby" is frankly an experiment but one of the most significant in a long line. Several other new types of steam engines have been introduced in the last five years, notably the "6100," the new four-cylinder "Q-2" freight haulers and the "T-1" streamlined steam passenger engines introduced two years ago.

Several turbo-electric locomotives have been developed in Europe, and one was tried experimentally in this country several years ago. Pennsylvania's No. 6200 is the first in America to omit the electric generator and harness the turbine directly to the wheels. Railroad men throughout the world are watching this new 100-mile-an-hour whirlwind on rails with keen interest.



Much larger than the unsuccessful "doodle-bug" remote control tank used by the Nazis in Italy is the German radio-controlled "bomb tank" employed more recently. This robot tank is driven close to Allied positions, whereupon the driver gets out and by radio directs the machine to a place nearer the lines. At that point he releases bomb charges which are fired from a front compartment and then directs the robot back to him. The Allies captured many of these tanks intact and smashed others as they approached.

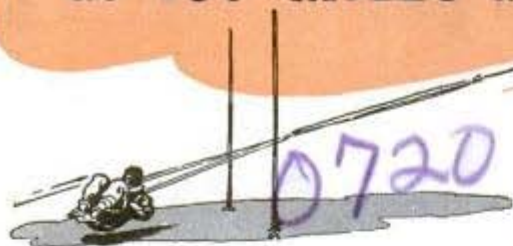
Electrical "Brain" Shuts Off Current When Lamp Starts to Flicker

To prevent the flickering of fluorescent lamps during their dying hours, Westinghouse engineers have devised a tiny electrical "brain" which fits into the lamp receptacle and automatically shuts off the current when the lamp has passed its useful

stage. This is done by adding a resistor to the starter, a small, glow-discharge tube which heats up when the lamp begins to function unevenly, activating a bimetal switch which halts the tube's operation almost immediately.

Bureau Public Rel.
War Dept.

HUMAN TAKEOFF at 130 MILES an HOUR



Maj. H. C. Hodges
A.C. Army Air Corps

"THE only sensation is a smooth whirl of air around you and then the ground disappears underneath. If I hadn't heard the wind I wouldn't have known I was moving."

Those were the words of Lt. Alexis Doster, the first man in history to be picked off the ground by an airplane in the same manner that mail sacks are lifted into the air. Lt. Doster rode a nylon rope into the sky behind a Stinson monoplane traveling at 130 m.p.h. That was on Sept. 5, 1943.

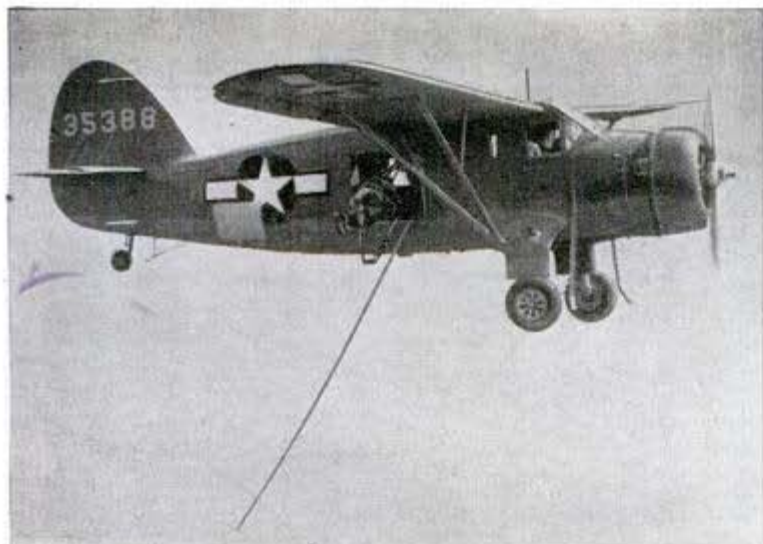
Since then three other men have been picked off the ground by light planes. After the fourth successful test conducted recently in secret, the "human pickup" was pronounced practical by the Air Technical Service Command at Wright Field. It may make possible a revolutionary means of rescue for stranded airmen forced down in inaccessible locations.



Sgt. Harry C. Conway, second man to demonstrate human pickup, is ready for takeoff in special harness which holds his knees against his chest. He wears a winter flying suit

Below, Lt. Alexis Doster, first aerial hitchhiker, takes off with little shock as plane hook catches pickup loop suspended between the poles. Note the tension of the observers





Man climbs in doorway of plane after rope is reeled. Right, dangling from plane in midair after knee strap is unsnapped

The first human pickup followed a year of experimentation by Army Air Force engineers at Wright Field. This included the development of special equipment and 126 trial pickups of cargo, dummies, and live sheep. The Aero-Medical Laboratory, Parachute and Glider branches, all took an active part in the project.

A standard parachute harness with additional supporting straps was worn by Lt. Doster for the first pickup. Inside the cabin of the plane was a reel with 185 feet of $\frac{1}{2}$ -inch nylon rope. At the free end of the rope was a hook. The hook was held by a release mechanism at the end of a long wooden pole used to guide the hook into the pickup loop. This loop hung above the ground between two poles to permit the plane to make contact.

Special braking equipment pays out the nylon rope to avoid any jerking effect until the subject is moving at the same speed as the plane. At the moment of contact a man is lifted into the air about eight inches and gains altitude like a glider while the plane climbs. Reeling in by electric motor begins as the plane levels off. Two minutes and 45 seconds after the man leaves the ground he is in the plane.

Experiments are continuing with the goal of eventually using a cargo plane or fighter. A rescue kit, to be dropped by parachute, contains pickup loop, poles and a harness.

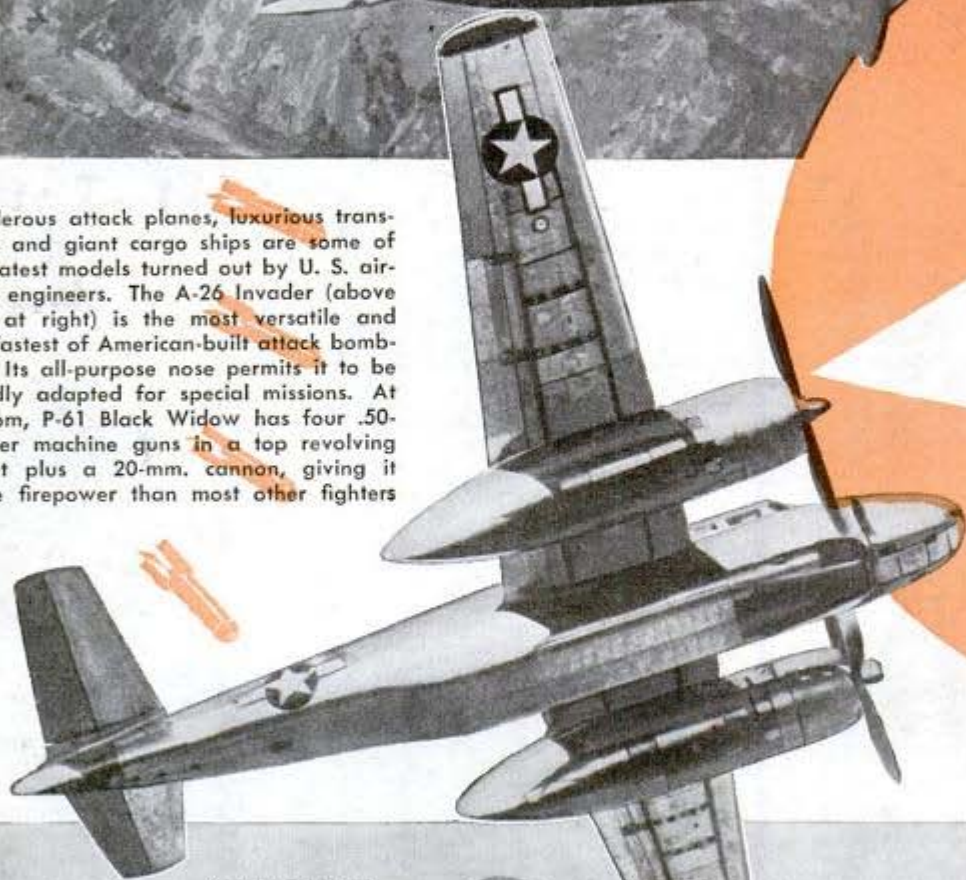
Sgt. Conway climbs aboard $2\frac{3}{4}$ minutes after takeoff



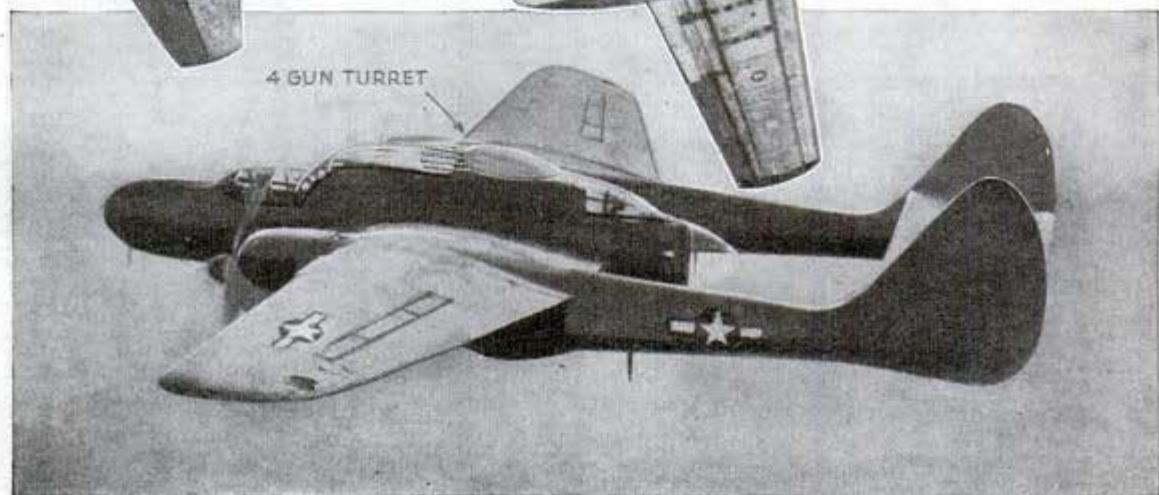
NEW PLANES *for* WAR



Murderous attack planes, luxurious transports and giant cargo ships are some of the latest models turned out by U. S. aircraft engineers. The A-26 Invader (above and at right) is the most versatile and the fastest of American-built attack bombers. Its all-purpose nose permits it to be rapidly adapted for special missions. At bottom, P-61 Black Widow has four .50-caliber machine guns in a top revolving turret plus a 20-mm. cannon, giving it more firepower than most other fighters



4 GUN TURRET



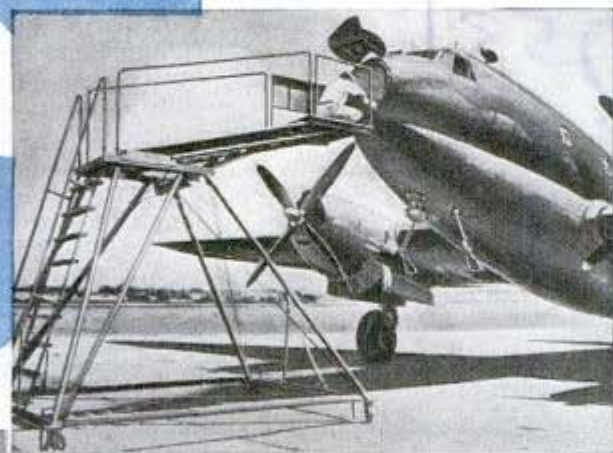
- and PEACE

0630

Pan American Airways has ordered 26 of these DC-7 Clippers which will carry 108 passengers at over 300 miles per hour



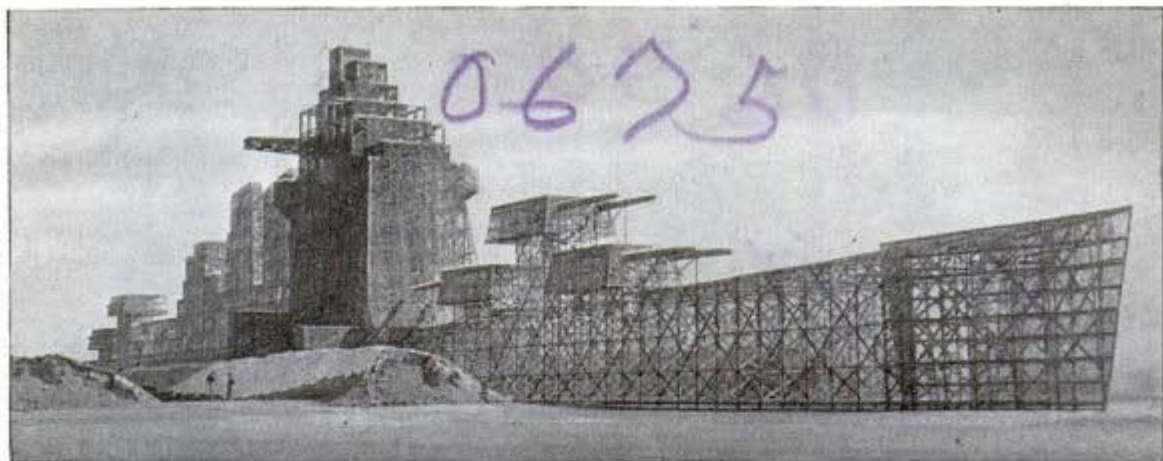
Below, the new hinged nose cone in commercial version of the Curtiss Commando, which has a new "waistline" and recessed cockpit with better visibility. Right, sketch of interior. Biggest twin-engine transport, the postwar Commando has already been flown



Below, Fairchild C-82, U. S. Army freight carrier which opens at rear



*Muroc Army Air Base
Muroc, Calif.*
Skeleton "Cruiser" Is Practice Bombing Target



Of all the Japanese cruisers belabored by Allied bombers none has received nearly as many direct hits as the skeleton of one planted in the center of a California desert. The naked-looking reproduction is made

of lumber and chickenwire and serves as a target for dive bombing and skip bombing by flyers of the Air Forces' "finishing school" at the Muroc air base. The flyers learn to hit vital parts of Jap ships.

H. J. Heinz Plant Pitt, Penn.
"Roller Coaster" Conveyor Speeds Delivery of Tomatoes



To hurry the unloading of bushel baskets of vegetables for canning, the H. J. Heinz plant in Pittsburgh, Pa., has constructed a super-conveyor belt which has almost as many twists and grades as a roller coaster. Starting at the main loading platform on the street, the baskets, carried by steel arms hanging from the conveyor, move across the yard and into the plant building with their loads and out via another route after they have been emptied. The baskets are used for all fruit and vegetable products received at the plant.

0472
Superfuel Developed for Heavy Bombers Surpasses 100-Octane Gas

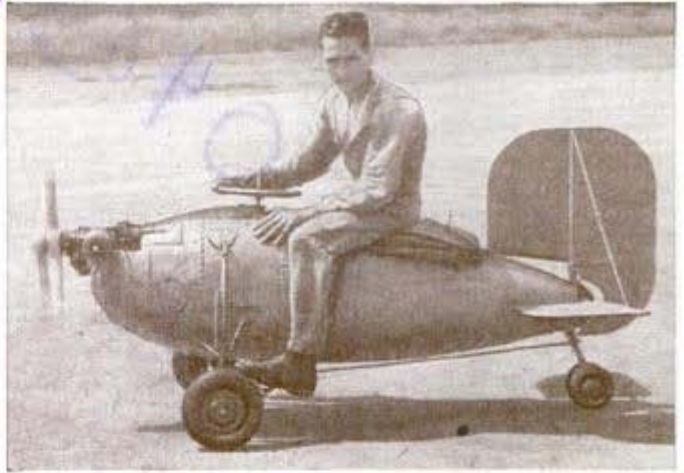
To rebuild chemically 100-octane aviation gasoline into 100-octane-plus is like improving on perfection. This has been accomplished by American chemists, according to the Petroleum War Council, and the superfuel is so potent that it will permit maximum bombing of distant targets. It is designed for use in superbombers, such as the Boeing B-29 and Consolidated B-32, and the latest types of fighter planes. Tests conducted in standard military aircraft show that the superfuel gives maximums

in sustained speed, short takeoffs, combat radius and load carrying. To produce the improved high-octane gasoline, scientists and technicians worked for two years analyzing its composition. Infrared, ultraviolet and mass spectrographic processes were used. The new gasoline can be produced by 80 percent of the refineries now turning out 100-octane fuel when military authorities give the "go ahead" signal. It is said that it will permit the bombing of Japan on a "suburban service schedule."

Pvt. Albert M. DeCaprio
N. Haverly, Contractor

Salvaged Gas Tank Taxi for Antiaircraft Crews

Christened the "tin swish," a motorized auxiliary gasoline tank from a P-39 serves as a makeshift taxi for crewmen at an antiaircraft firing point of the Panama Coast Artillery command. The one-man contraption looks like a cross between a land-locked torpedo and a miniature airplane without wings. Except for the discarded tank, through which its inventor, Pvt. Albert De Caprio, cut a hole for a cockpit, all the main parts were salvaged from "rat" target planes shot down in ack-ack drills. These include the three-point landing gear on which the belly is mounted, the bullet-riddled two-cylinder engine hitched to the fuselage nose, the six-volt battery, the fins, the rudder, the dual tail wheels, the twin contra-revolving propellers recovered from the ocean and a bullet-peppered, five-quart gas



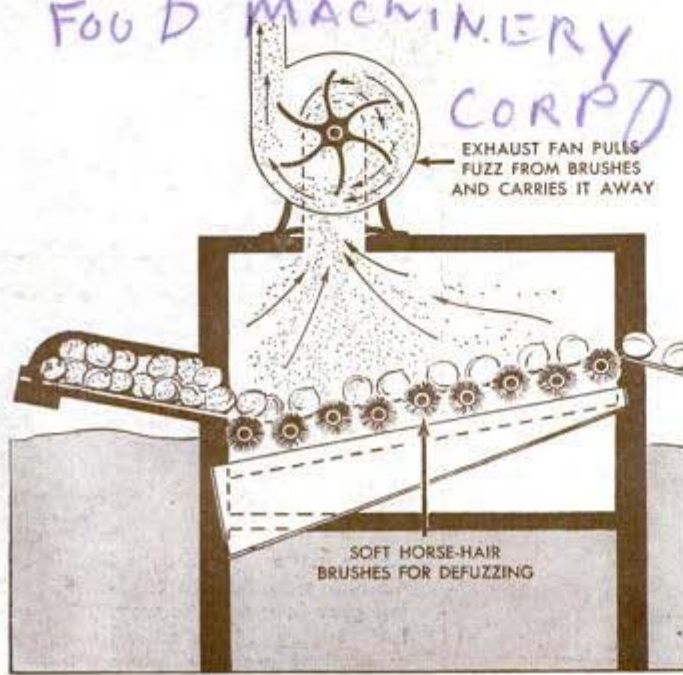
tank that keeps the vehicle in locomotion for one hour. The ignition coil came from a motorcycle, the front wheels from a "rat" plane catapult, and the steering wheel from the pulley of a power generator.

Runless Hose, Non-Shrink Wool Made by Treating Fibers

Stockings that won't run, wool that won't shrink, serge trousers that won't shine, wool trousers that won't lose their crease, and cotton and wool with double their usual wearing quality are possible as a result of developments in the chemical treatment of fibers by the Monsanto Chemical Company, St. Louis, Mo. The technique involves treating either the surface or the heart of the fibers without affecting the feel or texture

of the material. In some cases the treatment involves the deposit of a submicroscopic film of plastics. To prevent runs in stockings it involves the deposit of silica or submicroscopic grains of sand which prevent the fibers from slipping out of the positions into which they were knitted. The research into chemical treatment of textiles also will bring greater water-repellent qualities for many fabrics.

Machine Removes Fuzz From Peaches With Line of Rotating Brushes



A "facial massage" for peaches is provided by a "de-fuzzer" introduced by the Food Machinery Corporation, Hoopston, Ill. This five- by six-foot device, which includes horsehair brushes, conveyor belts and an exhaust fan, scrubs the rosy cheeks of 15 tons of peaches every hour by moving them in single file over the soft, rotating brushes. The fan, located at the top of the compartment, sucks the fuzz up and out through an opening.

American soldiers in New Guinea play night baseball by the light from 60-inch arc searchlights attached to coconut tree poles and directed upward on white board reflectors placed at the top of the poles, with four 750-watt floodlights around home plate.



TORTURE TESTS *for* SKY RANGERS

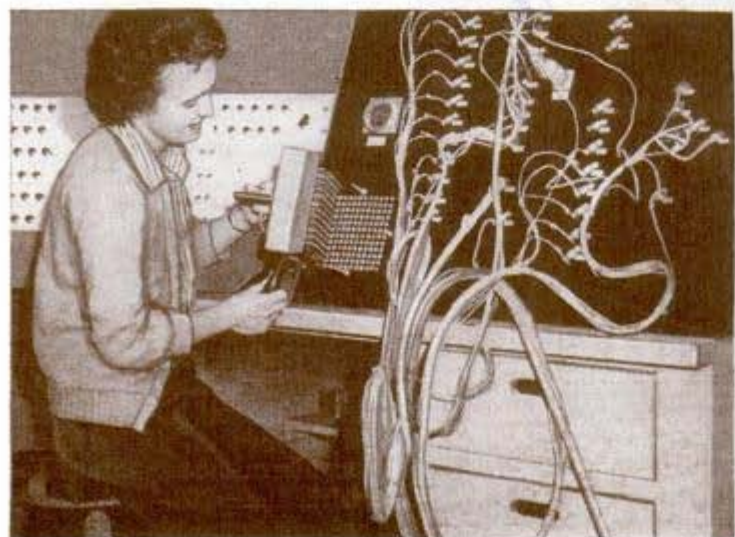
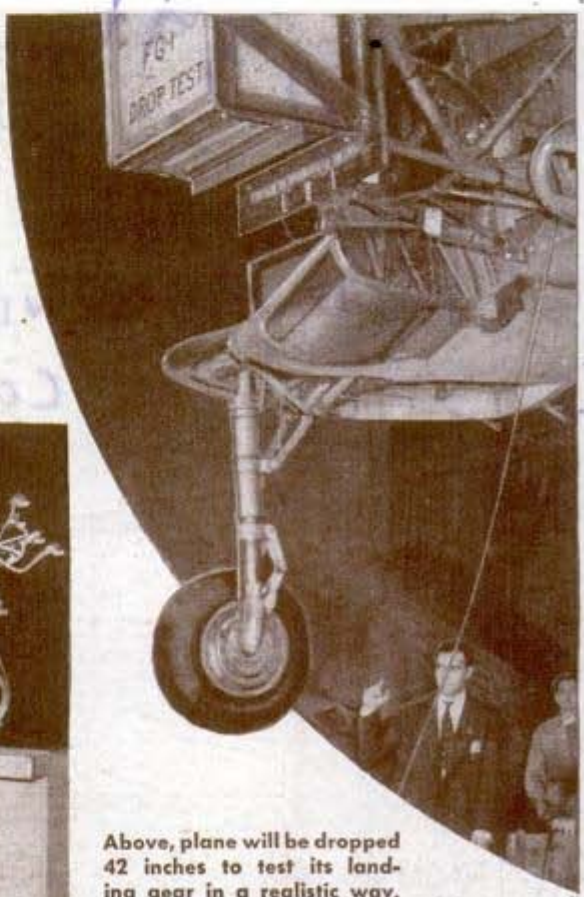
By Allen Warren Elliott

Complete 1,600-horsepower engine (above) is hoisted to nacelle of Pan American Clipper

THE THICK metal skin and plate glass and plastic eyes of the huge B-29, the world's first pressurized bomber, are being tested by Boeing engineers. Sure, it will fly, but how much punishment can it take? What will collapse first? Better find out in the laboratory instead of over Tokyo.

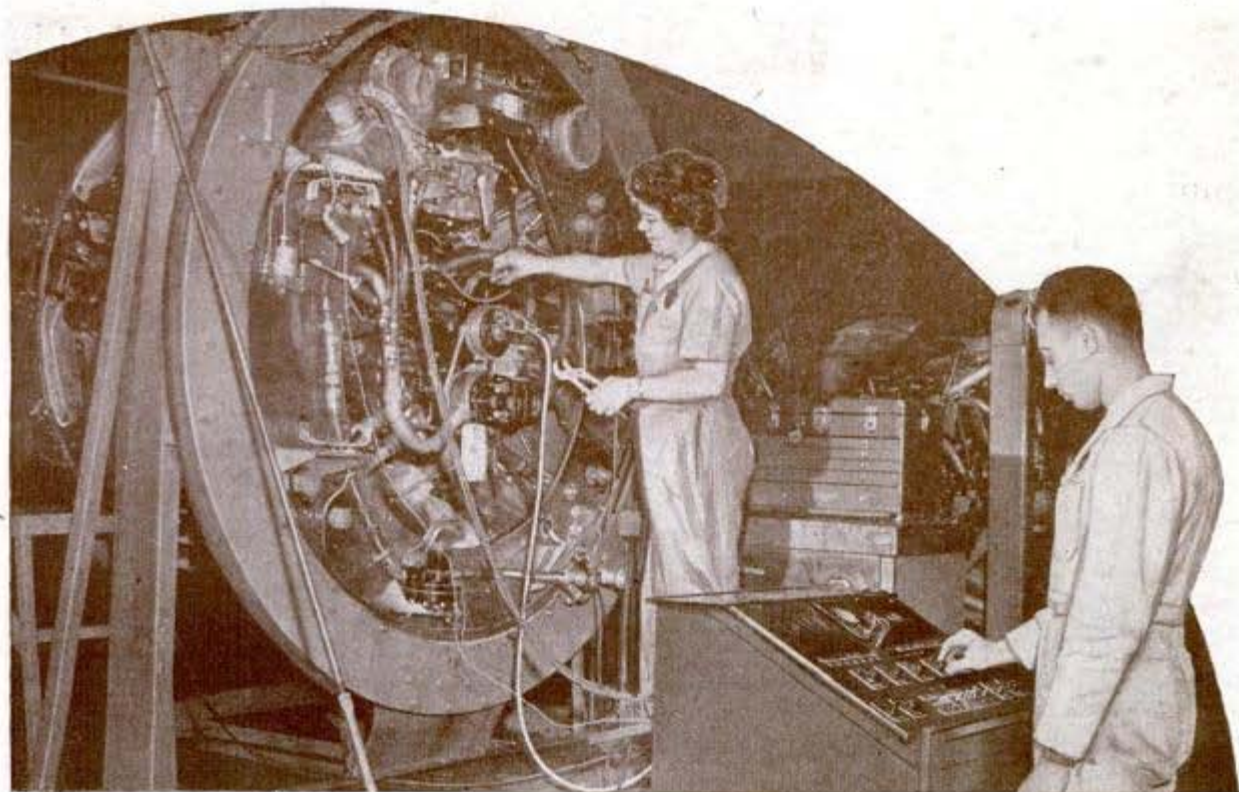
Tremendous air pressure is exerted against the tip of the plane. Suddenly there is an ear-shattering crash. The long nose turns inside out, like the finger of a lady's glove.

Part of the nose is re-designed and the new one installed. This time the blowers pump the



Above, plane will be dropped 42 inches to test its landing gear in a realistic way. Left, testing 144 electrical connections in one operation

one, N.Y. 16 N.Y.



Pan American Airways photo

Above, check box tests all electrical wiring and accessories before the Clipper's engine is installed. Below, naval air experimental station crew at Philadelphia prepares landing gear drop test



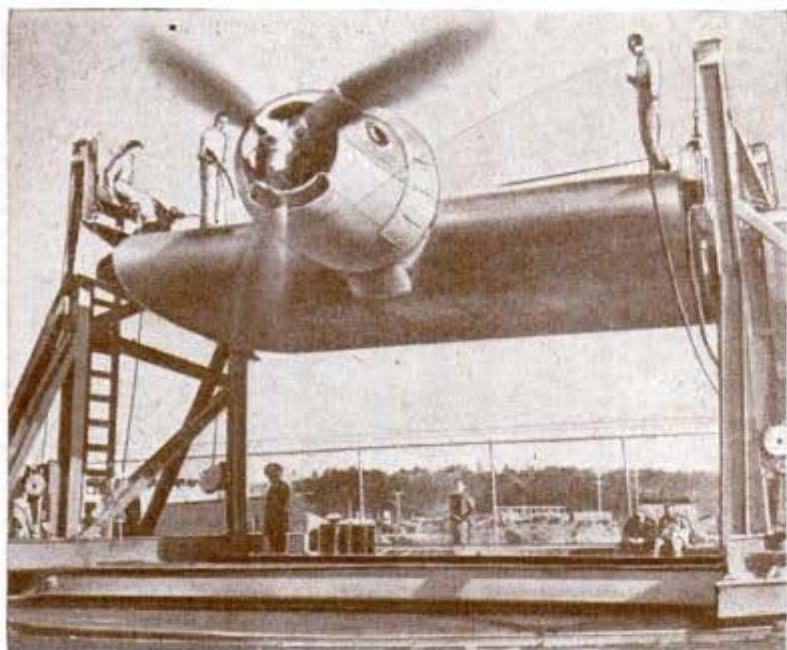
U. S. Navy photo

cabin full, pitting their power against the resistance of the spherical lines which equalize pressure. The air strains the cabin. The word goes out: "Everybody clear! Steady now! The window is holding!" And—wham!—the cabin itself blows up. Never mind, this was expected, an engineer tells you. It's torture testing.

Okay then, someone says, let's have another fuselage pressurized and bring on the 20-mm. gun. Someone else asks: "Ready? Fire a burst into the skin near the nose!" Air escapes with a hiss, but the gauges show the ship can take it. "Blast that window!" The cabin deflates. "Let's have a crack at the tail gunner's compartment!" Chunks fly. The Boeing engineers read their dials and smile.

Finally a B-29 gets a high pressure test in the air. The blowers are at it again. The nose gunner leans against the plastic "fish bowl." Bang! Out goes the window, gunner and all, tumbling into space, the plastic window a glinting jewel catching the sun, the man a plunging black speck swaying under a parachute.

The engineers—there are 3,600 at Boeing—go to work again. Sections of the plane are pounded, crushed, stretched, bent, burned, blasted and pierced. In the end there is success and a turning point in the war. But many of man's mechanical birds die before they are born; only the fit live.



Boeing's engine test laboratory is mounted on wheels which run on a track, permitting the engine to be shifted to take advantage of wind

Let's go to the Glenn L. Martin plant in Maryland and see them crack the wing of a Navy "Mariner" patrol bomber. The torture test takes only six seconds, but it takes around 25 weeks to prepare for the wing test. What it costs would set you up for life.

During the six-month wait for the crucial six seconds, 150 drawings have to be made, 11,099 man-hours spent in design, 31,395 man-hours in construction and wing preparation and 2,118 man-hours in actual operation of the test apparatus, which requires 77 experts drilled in special roles.

Concrete foundations are laid, a 50-ton steel framework erected and the wing, in three sections, is moved by four cranes and

strain on the inverted wing.

"The next load is 100 percent," states the test conductor over the public address system. "Prepare to load at the next light signal."

This may be the payoff. It is 100 percent of ultimate design strength. Now the strain is going up. Computers are plotting data. The wing is losing its gull-like grace.

Somebody says the wing is holding a load equal to 100 standard passenger automobiles. But the test must reach the maximum load imposed by centrifugal force in

Directional gyros (right) are given a "rocking chair" operational test at a Sperry plant



the pull-out from a dive.

Men pump the jacks. Others tighten turnbuckles. Still others adjust tension jacks. Some 258 strain-gauge measurements are taken, using fine-resistance wire 1/1000 inch thick. Seven miles of other wire connect the strain gauges. The movements of the wing are observed from 21 stations.

The wing is now like a spring compressed under a 100-ton weight. The metal skin begins to wrinkle. The six crucial seconds are ticking off. Warning cries go up.



OWI photo

Above, engineers figure their calculations as to probable performance of a new plane. Left, engineers about to install over 100 strain gauges on the pilot's enclosure of a pressure test specimen

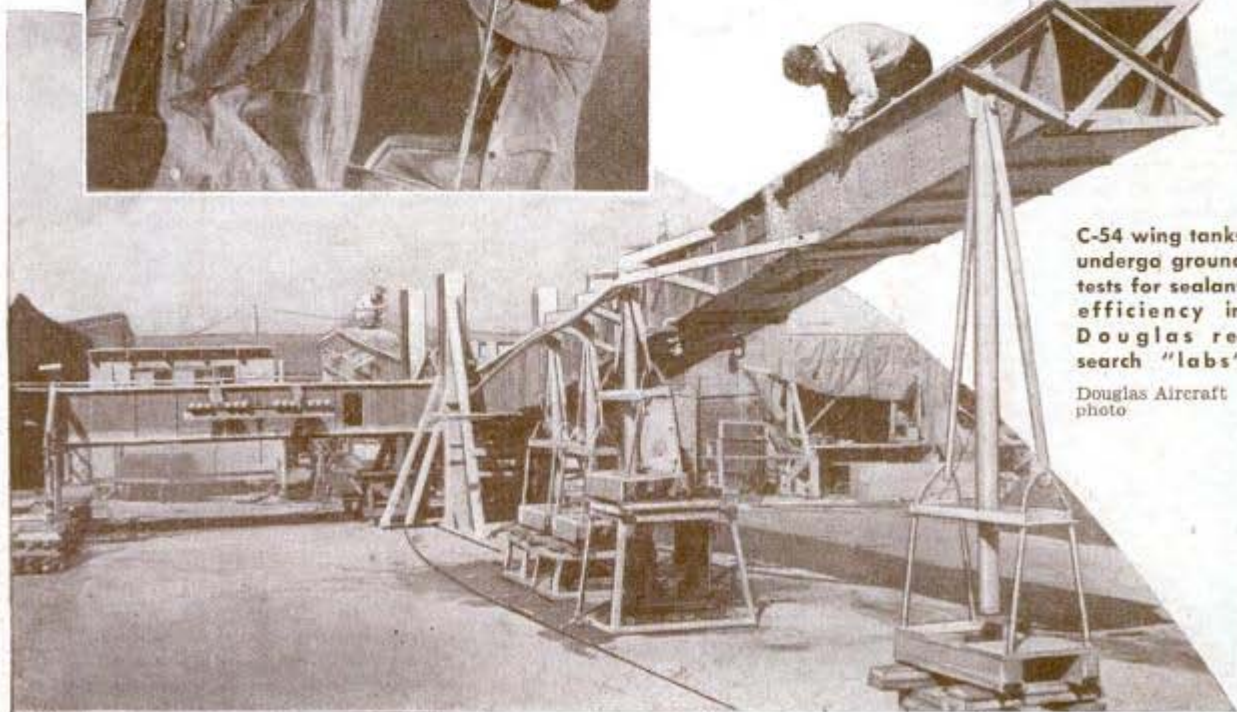


There is a sharp explosion. A shower of rivets, bolts and metal fragments fills the room as everybody ducks. A steel safety frame catches the bulk of the shattered wing. The announcement comes:

"The wing stood up under 238,000 pounds!"

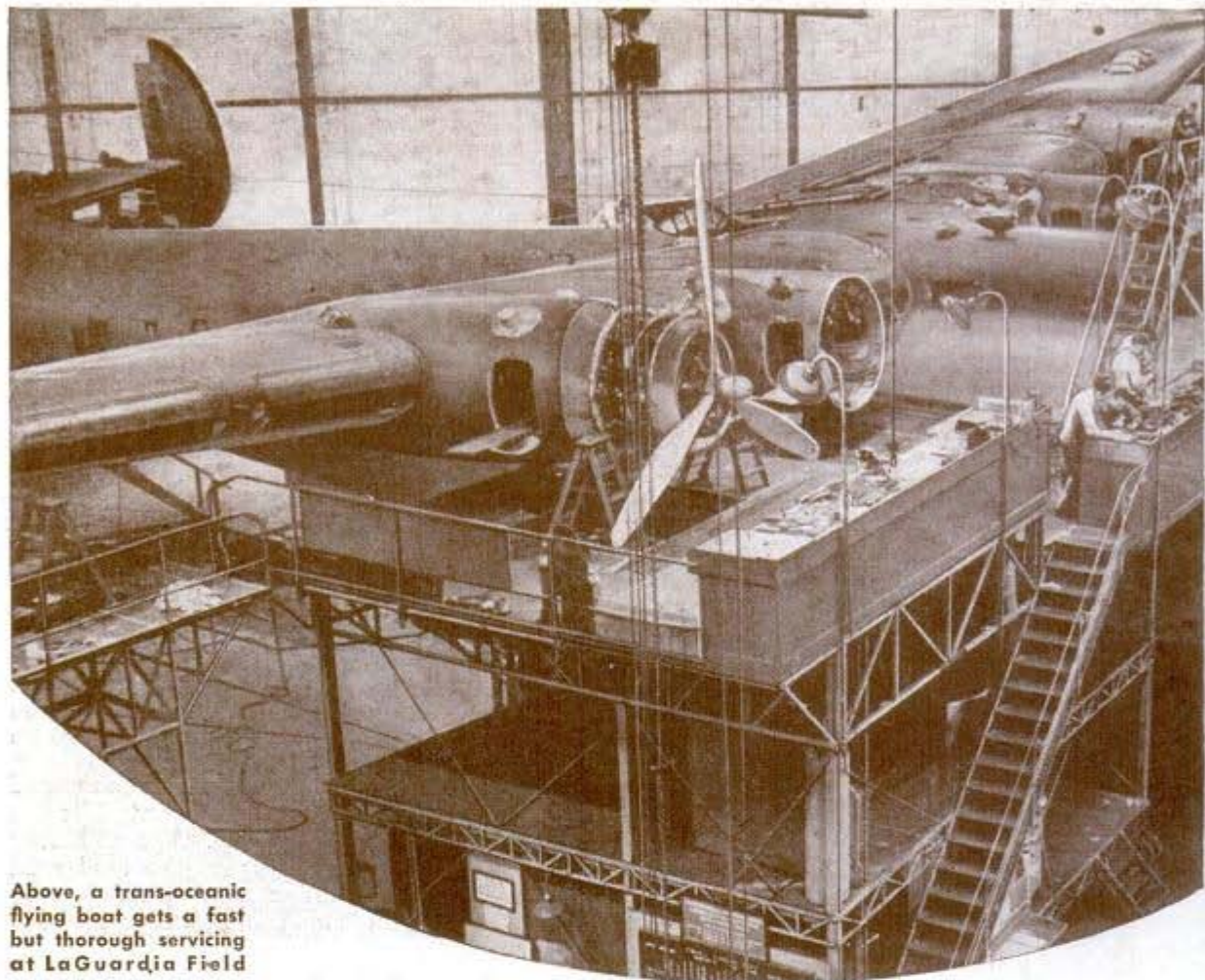
There is a happy babble of voices.

You ask: "Why go to all this expense and trouble? The ship flies all right."



C-54 wing tanks undergo ground tests for sealant efficiency in Douglas Aircraft research "labs"

Douglas Aircraft photo



Above, a trans-oceanic flying boat gets a fast but thorough servicing at LaGuardia Field

The answer: "The Mariner has complied with exacting Navy specifications, but war often demands 'better-than-specification' performance. Lives may depend on an airplane's ability to carry a few hundred extra pounds of food, medicine, or munitions. Pilots of Mariners have had to rescue ship-

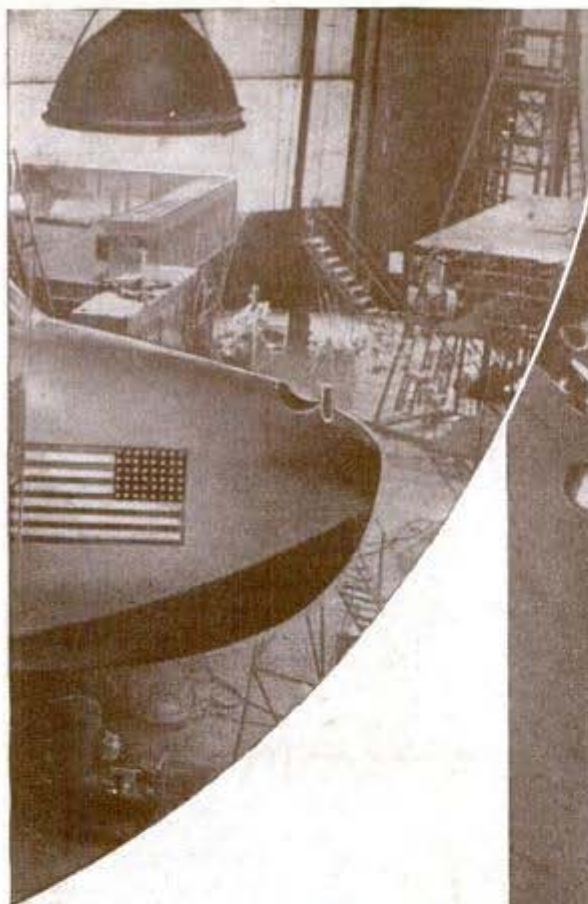
wreck survivors, packing them into already fully loaded airplanes. The amount such a flying boat can be safely overloaded depends mainly on the strength of its wing. Where lives are concerned, we take no chances."

Where lives are concerned they take no chances at the air experimental station in Philadelphia Navy yard—unless it's necessary to risk their own in behalf of pilot safety.

In comes a new fighter plane. Looks nice, acts sweet, but how will its landing gear stand the jolt if a pilot, worn out fighting Japs, sets her down heavily on a carrier's deck? The way they find out is to load one of the ships to the limit, suspend it in the laboratory, and



Left, master control table of the Martin wing test. Data and observations are phoned to it
Glenn L. Martin photo

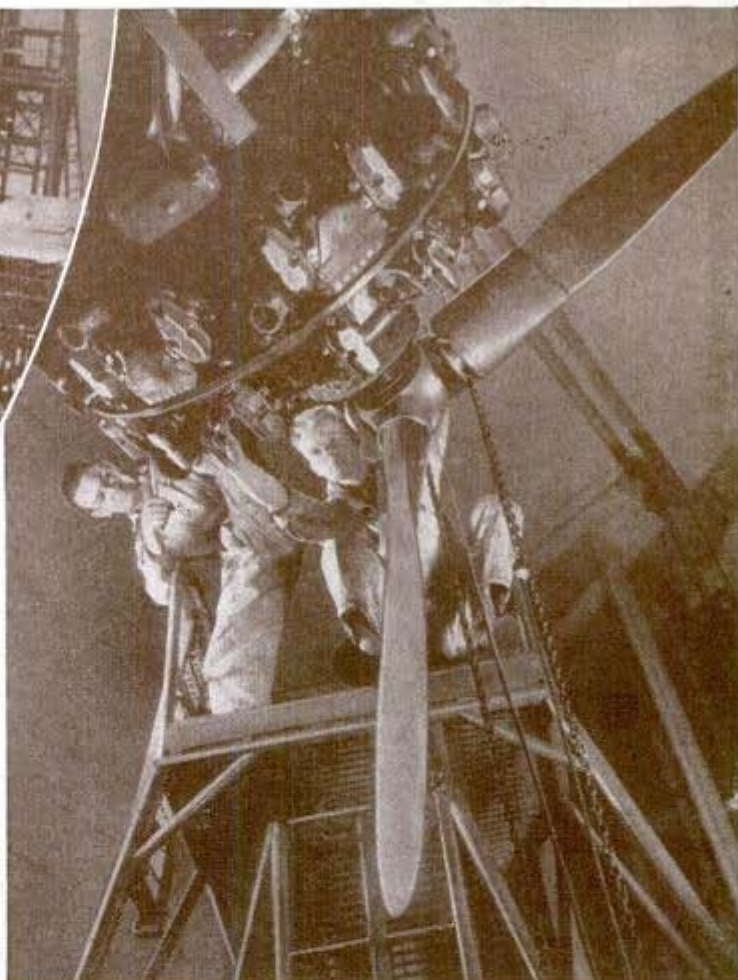


then let it drop with a crash to a concrete floor.

Suppose the pilot fumbles a landing and the plane noses over? To find out what will happen, they suspend a fuselage slanting nose downward and — smack! — it does a header onto the hard floor.

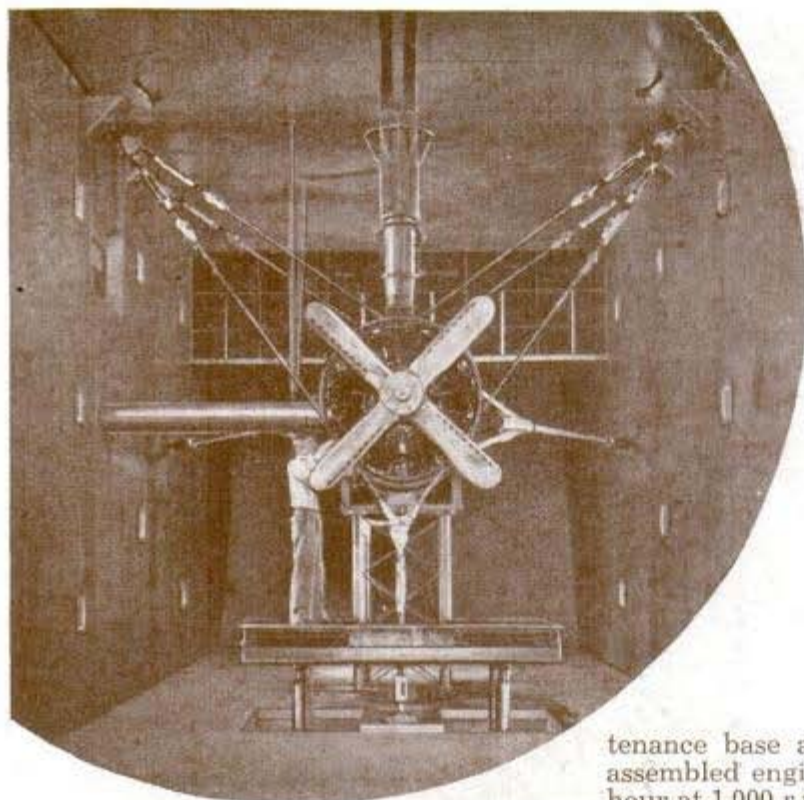
A separate section of the station tests textiles for parachutes, for parachute harness webbings, glider cords, flyer's clothing. Machines test yarns as thin as a hair and as thick as a pencil. Magnetos get the vibration test, a "rough ride" which lasts 300 hours while a motor jiggles the mechanism ceaselessly. In fact, at the naval air experimental station everything that goes into a Navy plane is subjected to strenuous tests of speed, heat, cold, vibration or other ordeals.

In scores of test cells around the country, aircraft engines take their first breath of high octane gas and air and come to roaring life. Then they are torn down to the last part and each part is carefully



Above, engine is adjusted before being tested on a horizontal engine stand. Below, oleo strut is tested at 65 degrees below zero





Studebaker-built Cyclone engine (above) about to get test run in a large cell made for special jobs

examined. If it passes this check-up, the engine is put together again and shipped to an airplane plant where a fuselage is waiting. The engine test laboratory at the Boeing plant in Seattle is mounted on

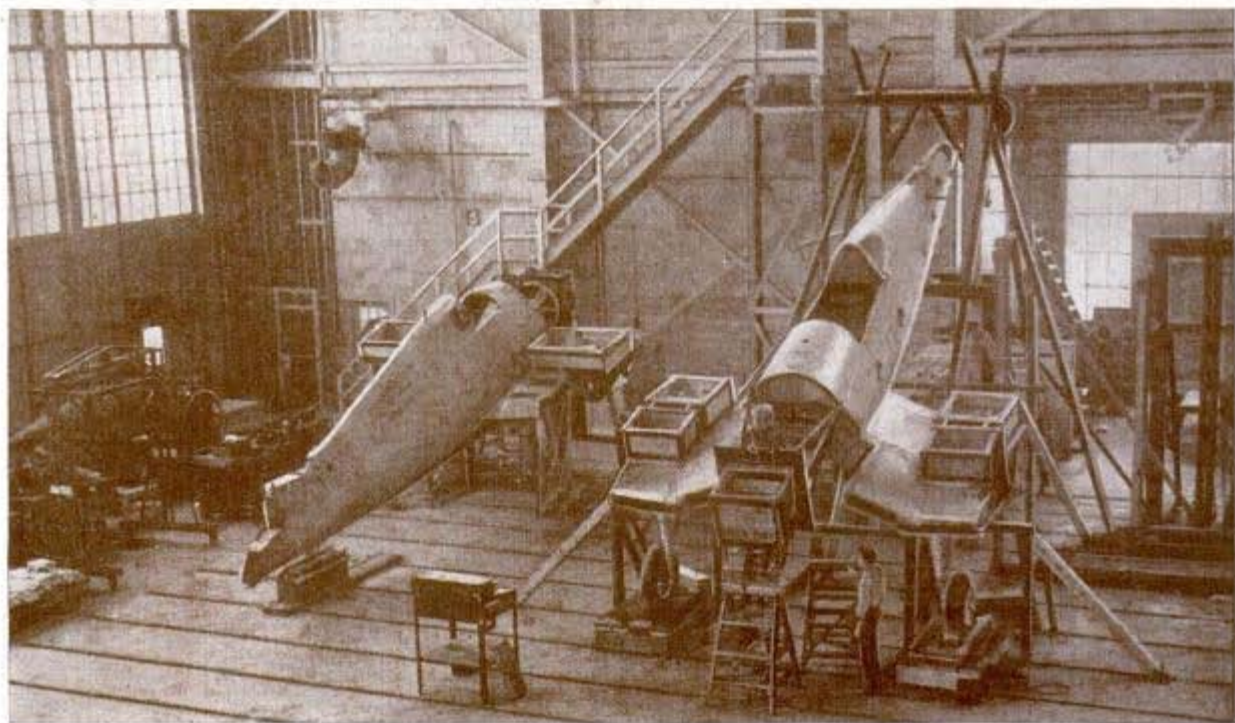
wheels which run on a track, permitting the engine to be shifted to take advantage of wind from any direction.

No military plane gets more rigorous tests than does the passenger transport plane. United Air Lines puts out what they call a "new" plane every 725 hours. The planes are not new, but such rigid tests are conducted, such careful overhaul accomplished that "new" efficiency is obtained from perfect or brand new parts. The 14-cylinder, twin-row Pratt & Whitney Wasp engines are given thorough test runs after disassembly, cleaning and reassembly at United's central main-

tenance base at Cheyenne, Wyo. Newly assembled engines are run in for the first hour at 1,000 r.p.m.; for the second hour at 1,400 r.p.m.; for the third hour at 1,600 r.p.m., and for the fourth hour at 1,800 r.p.m. The engine then is checked and run for the fifth and sixth hours at 1,900 to 2,500 r.p.m.

But the story of the torture tests of the B-29 is the epic of the aviation industry because this craft took off almost "from drawing board to sky." More than 8,000

Planes (below) are loaded for drop tests which determine strength of landing gear and fuselages



hours of scale model tests were made in wind tunnels. Models of parts were tried out in other planes. Yet there were plenty of gremlins left.

The 50 tons of one test plane made a belly-landing at around 100 miles an hour when a tiny screw came loose, jamming an electrical control. The plane made it all right and lived to fly again.

The first test plane ever to take to the air was not so lucky. It crashed, killing the whole crew who had spent months on the job of building her. A second had a narrow escape from the same fate. Two more were deliberately destroyed in torture tests.

The final tests of the assembled equipment, only three weeks before the B-29 went to war, were so strenuous that it was called "the battle of Kansas." Thousands of technicians went from war plants all over the country to a blizzard-swept Kansas airfield. In three weeks' time they did several months' normal work, installing and testing equipment in frantic haste.

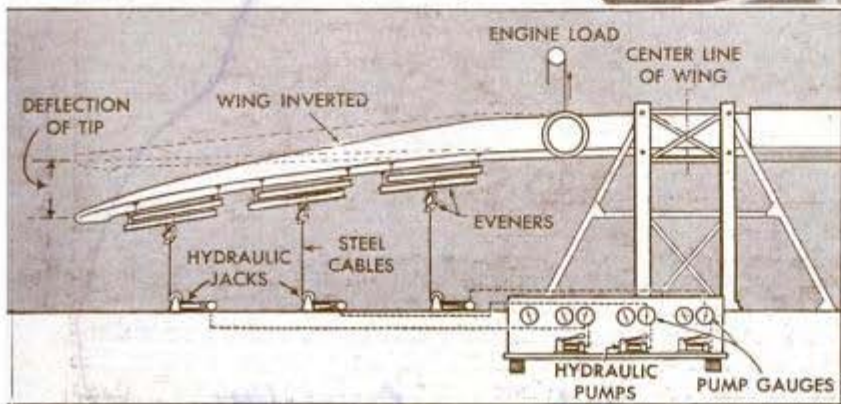
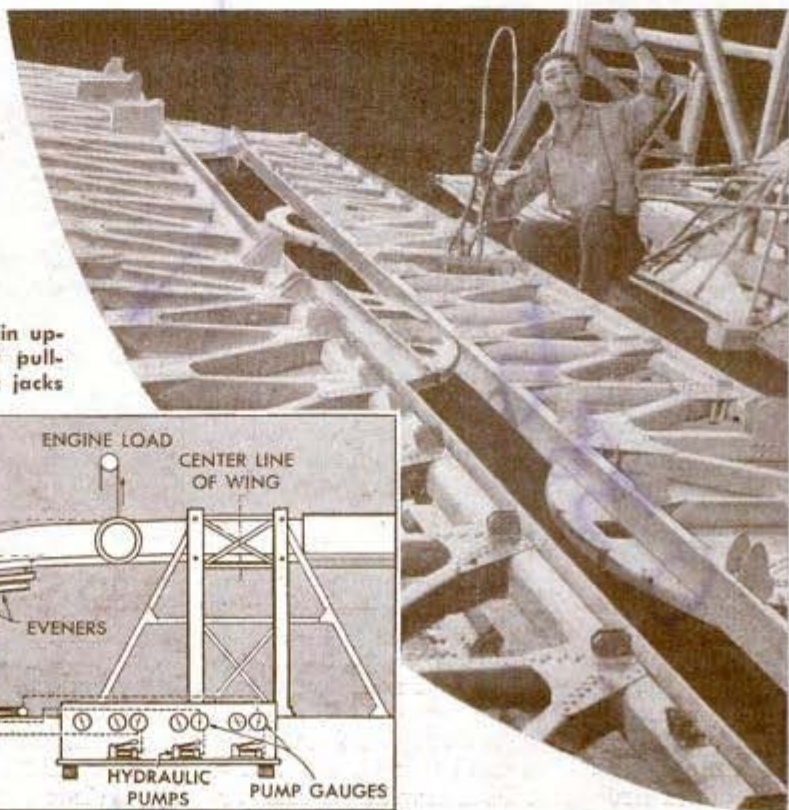
Both the men and the plane took plenty of punishment before the B-29 job was through, but now American airmen are flying them over the towering Himalayas on the China supply route with more comfort than some folks back home enjoy.

That is what torture tests for man-made birds make possible—and safe.

Below, wing test diagram. Wing, in upside-down position, is broken by pulling down with the two hydraulic jacks

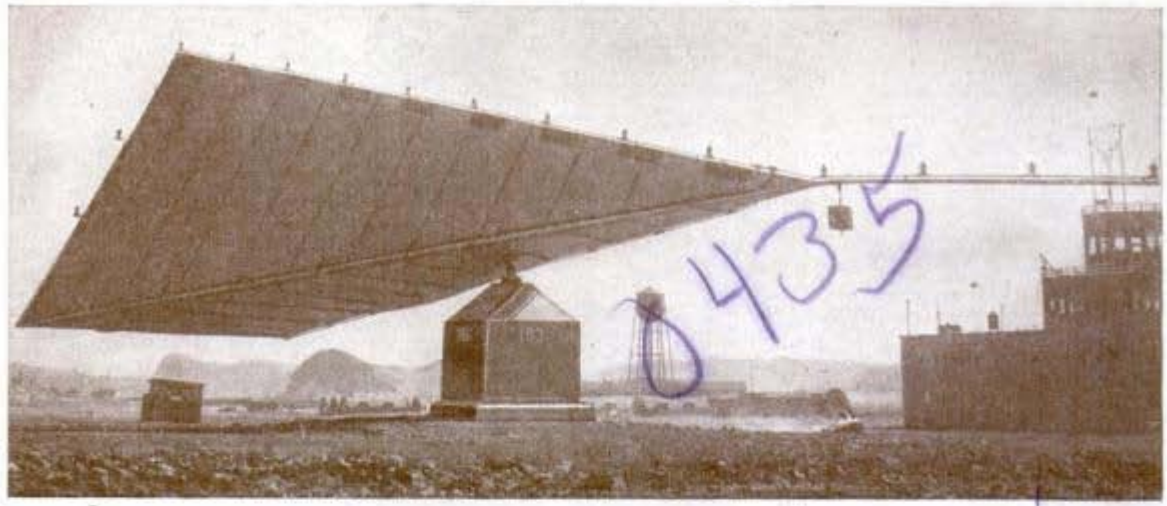


Above, de-nitrogenized trainees, in full flying equipment, enter Boeing strato-chamber. Below, massive wing spars of the Boeing Flying Fortress



4611
3111 Road, Arlington, Va.
Kite That Never Flies Measures Wind Velocity

U.S. Army
 47, 48, 49
 Chemical Warfare Service
 B3
 SKY-MARKER Development
 C. H. BREEDLOVE



On the bleak, exposed coast of Newfoundland the direction and velocity of the wind may greatly determine the extent of military operations. Since it is the hop-off spot for air and naval craft en route to the United Kingdom, and the site of an eternal vigil against German submarines, the Newfoundland base is of high strategic importance. But more than that, it is invaluable as a "weather outpost" for the North American continent. A huge and novel wind gauge there in the shape of a monster kite is one of the devices utilized by the military weathermen in their efforts to assure that Allied flyers and seamen are prepared for any of the vagaries of climate that may ensue.

Pathfinder Marks Bomb Target With Colored Smoke

Targets which cannot be seen with the naked eye are bombed accurately through the clouds by means of the Pathfinder navigation instrument, which "sights" the target, and colored smoke bombs, which mark it for the bombardiers. One plane in each formation of bombers carries the instrument and a technically trained crew to operate it. When the target is located by the instrument, the Pathfinder plane drops colored smoke bombs, if it is daytime, or colored smoke flares, if it is at night. This leaves a ring of colored smoke in the clouds through which bombardiers drop their "eggs." Details of the working of the Pathfinder instrument, which was invented by the Office of Scientific Research and Development, have been kept secret, except for the fact that it is the "eyes" of the plane from altitudes as high as 25,000 feet. The technique has been used also in the landing of paratroopers. Planes with Pathfinder

equipment go ahead of the troop carrier aircraft to select a suitable place for the paratroopers to drop, beyond the range of enemy anti-aircraft fire, and guide them to the exact spot with colored smoke.

Grenade Launcher Casts Line For Yanks Fishing in Pacific

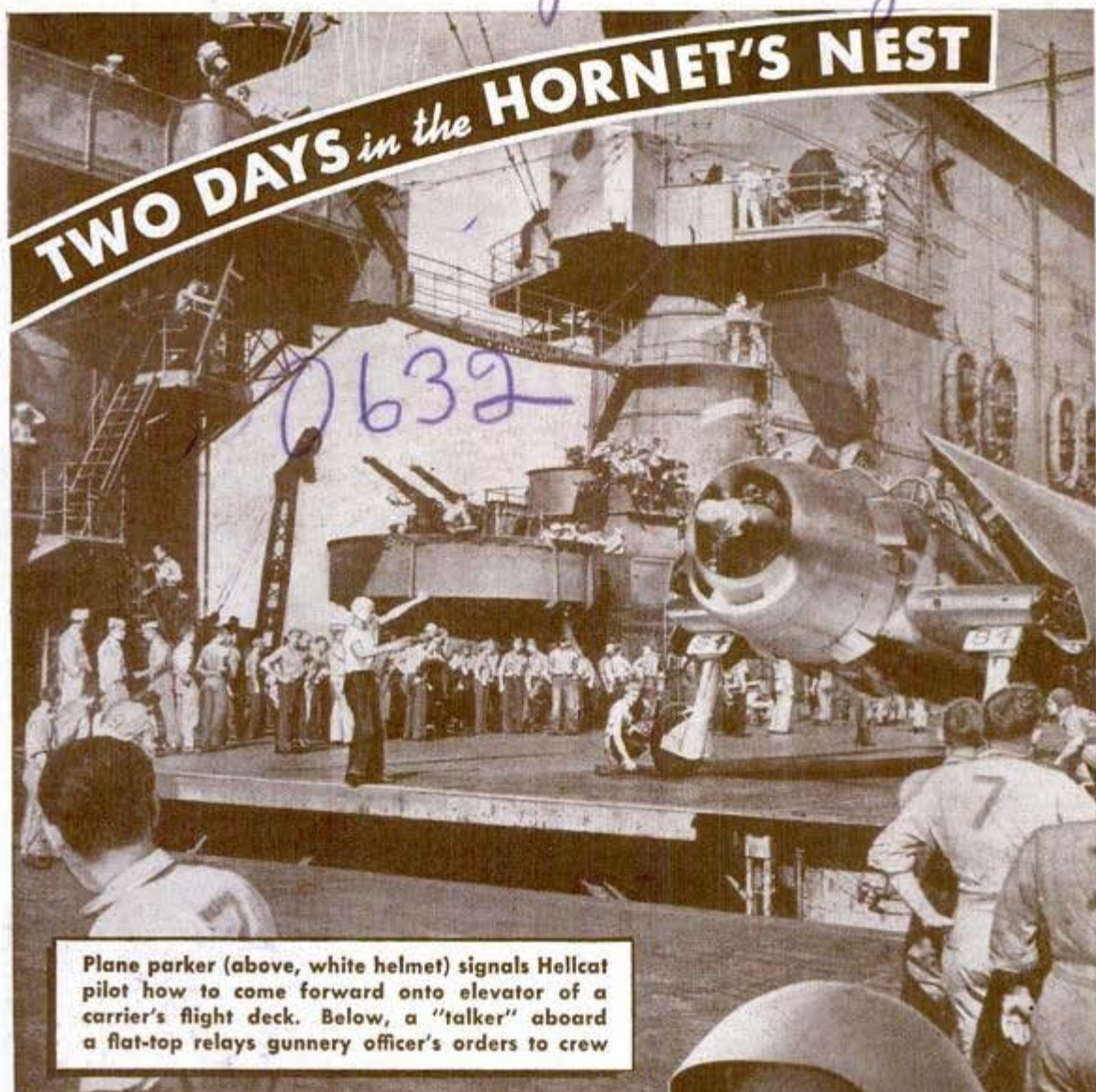
Deep sea fishing, wartime style, at an Air Force base in the Mariana islands is accomplished by adapting the line-carry-



ing wooden float to a regulation grenade-launching rifle and shooting it out into the surf. The discharge of the combination hunting-fishing weapon carries the baited hook and line 200 yards.

Thomas P. Whittemore
 Paducah, Ky.
 POPULAR MECHANICS

Lt. William McKechney, U.S.N.R.
6634 No. Newguard, Chicago, Ill.



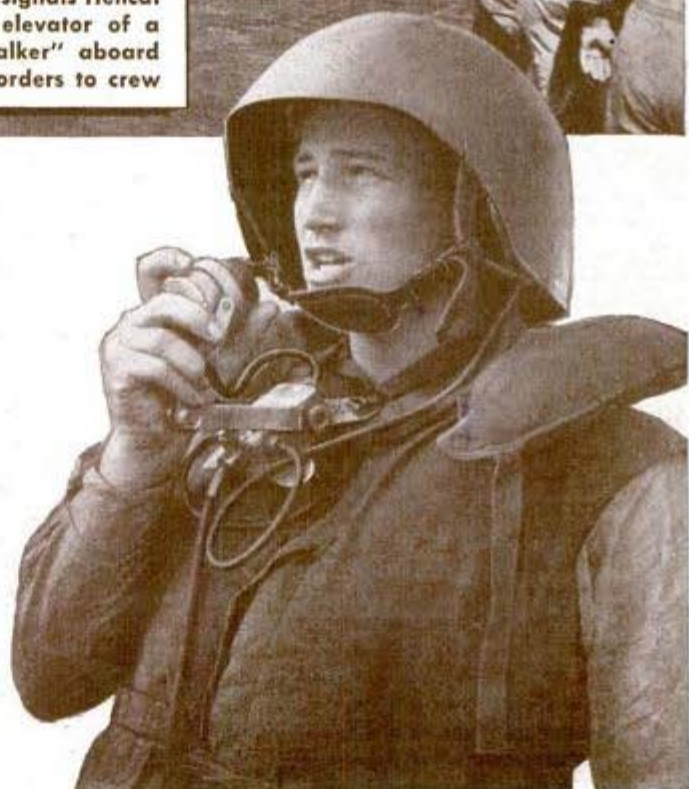
Plane parker (above, white helmet) signals Helicat pilot how to come forward onto elevator of a carrier's flight deck. Below, a "talker" aboard a flat-top relays gunnery officer's orders to crew

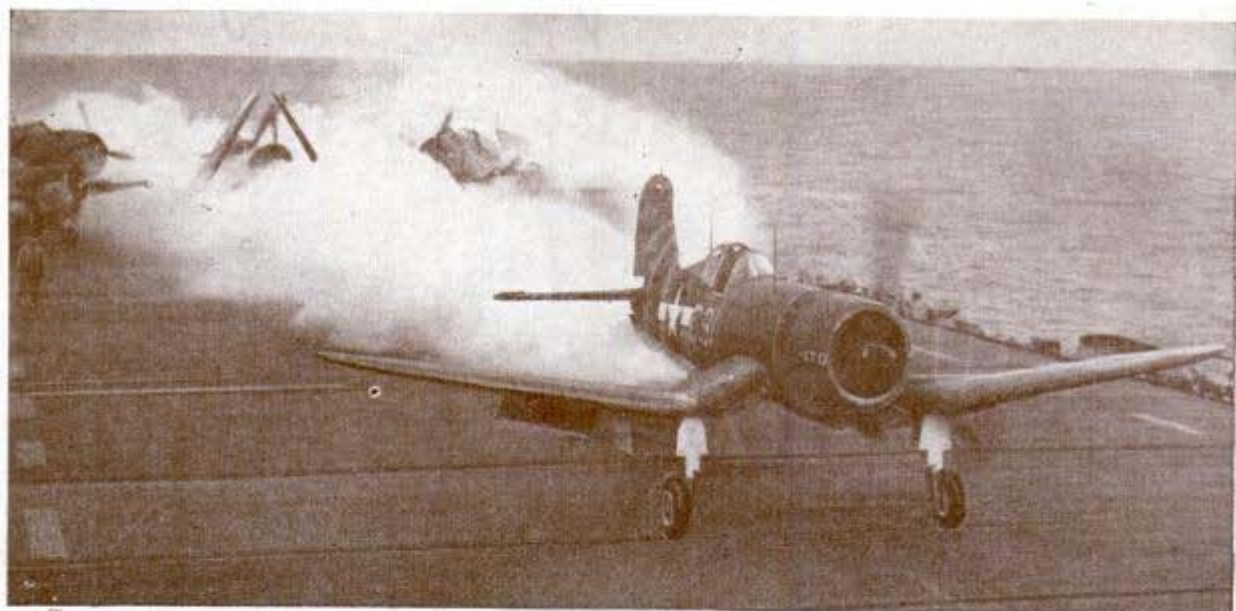
By Lt. William McKechney

U. S. Naval Reserve

FOUR days before the Battle of the Eastern Philippines, in which our carrier, the new U.S.S. Hornet, helped intercept and shatter a Jap fleet racing to the aid of the beleaguered garrisons on Saipan, our task group was in the Bonin Islands bombarding Jap air fields. Suddenly Vice Adm. Marc Mitscher, directing the task force supporting the army and marines invading Saipan, ordered us to a rendezvous near Saipan. There we were to join other task groups and hunt a mammoth enemy force reported steaming toward them from the Philippines.

We reached the designated point the following morning but it was





Aided by a jet engine attachment for takeoff, a Corsair roars across the deck



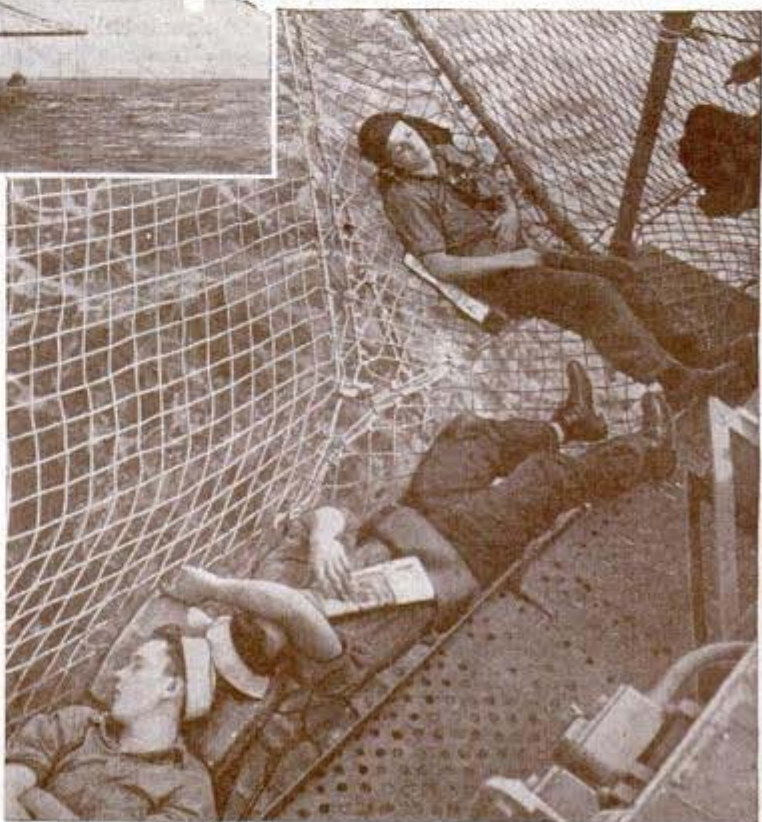
Director 2 from which I controlled the after 5-inch batteries.

On the flight deck the plane handlers were already scurrying around, re-spotting fighters, bombers and torpedo planes so that the maximum number could take off at a given moment. The pilots were running toward their planes from the ready room,

Above, "full face" portrait of U.S.S. Hornet. Right, "caulking off"—some carrier crewmen napping in the nets of a catwalk

not until the night of June 18 that a Coronado flying boat notified us the Jap armada had been sighted only 350 miles away. We scented action, and an undercurrent of excitement was at once noticeable. Up to this time our carrier, which was of the 26,000-ton Essex class, had been exposed only to some prowling Jap night fighters.

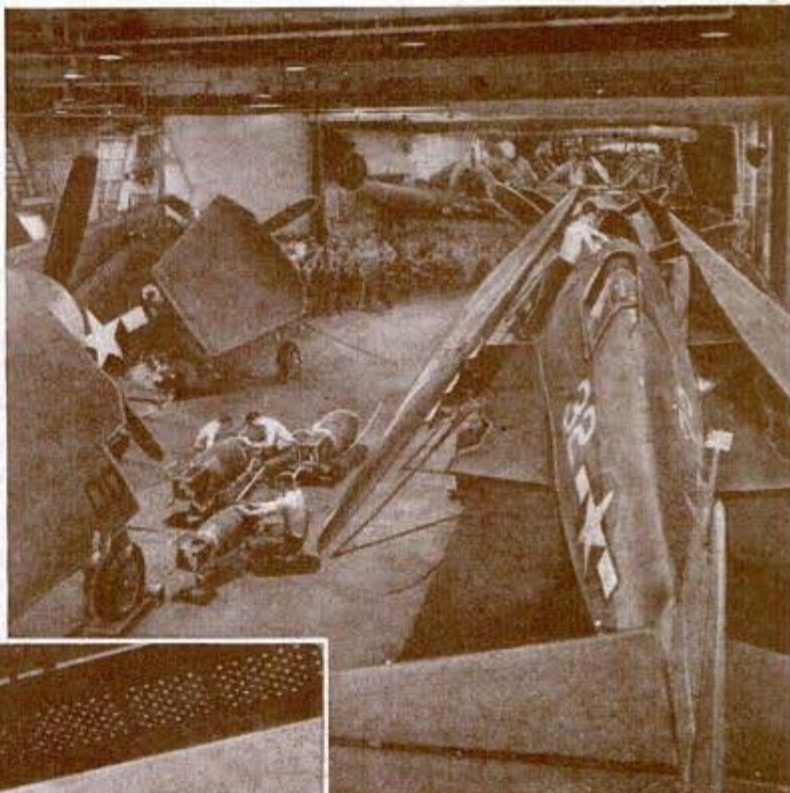
At 10:20 a.m. June 19 I was in my room writing a letter when I heard over the loudspeaker the boatswain's pipe whistling, "Attention all hands!" My guess was that it was just a false alarm but nevertheless I leaped from my cabin, grabbed for the ladder and started for my battle station in



while the plane captains stood by to warm engines.

Climbing the narrow ladder leading from the flight deck to "sky aft," I noticed the motors on the 40-mm. guns had been started and the 5-inchers had been trained to starboard. I scaled the final barrette, entered the control station and relieved the officer on watch.

"There's nothing phony about this one," he yelled above the din. Jap planes had been sighted about 275 miles west. I manned my phones and established communication with gun crews and plotting room. Over another



In the midst of Hellcats, ordnancemen work on bombs. Left, with wheels, hook and flaps down, Hellcat comes in to land

station. One by one our planes began to streak down the deck and weave into the sky.

I told my gun crews to check their motors, fuse-setters and ammunition train, and ordered the men on the open mounts to put on their protective clothing and helmets. We tried to appear

casual and trade wisecracks. Suddenly our carrier's C.I.C. man (combat information center) cried, "Second group of bogeys sighted!" The Japanese were on their way in! Soon he told us our fighters had "tally-hoed Raid 1." They had contacted the first wave of 50 or 60 enemy dive bombers and fighters.

Then a lookout shouted, "Gunfire on the starboard beam!" I could make out a tiny

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Profile of the 26,000-ton Hornet, second U. S. carrier to bear the name during World War II





Marine honor guard and bandmen await a visiting flag officer who is arriving by plane

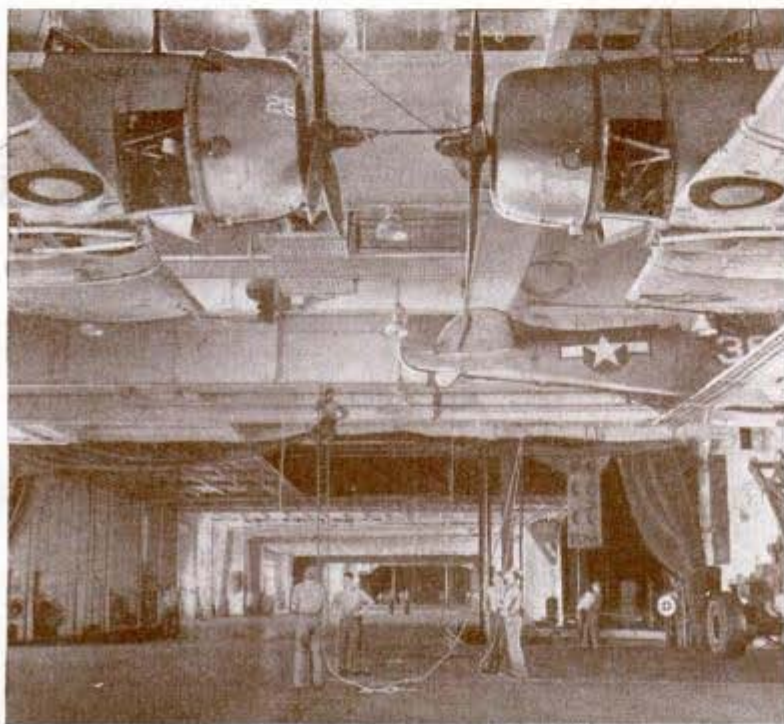
dot no bigger than a fly going into a steep dive over a fellow carrier. Instantly I said, "All hands on alert," into my speaker and ordered my crews to throw their guns into automatic.

Ten or twelve thousand yards to the west the sky was spotted with angry black puffs

as the target carrier's ack-ack tried to defend it from the plummeting dive bomber. Seconds later the bomber burst into flames, veered off the target out of control and exploded in the ocean. A terrific geyser of water spouted near the carrier.

About noon, during a fifth attack, a lookout startled us once more with the cry, "Gunfire to port!" Soon we made out two bogeys about 23,000 yards away, headed hell-for-leather in our direction at very low altitude. Our pickets, two destroyers, were bracketing them with shell bursts but the ragged evading course of the Japs thus far had prevented anyone getting a good solution on them.

At 16,000 yards it was apparent they were going to make a run on our carrier. Just then one of our fighters appeared, dove right through our own ack-ack onto the back of one of the Japs with guns spurting, and sent him slanting into the water, a



Hangar deck of a large carrier showing spare planes overhead

blazing comet. At 14,000 yards I told the port battery to stand by. When the range closed to 12,000, I ordered, "Commence firing!" Almost the instant we opened up, the lone Jap—hit many times by our task group—fell in flames several thousand yards out.

At 3 p.m. the last attacker was shot down, but we stayed at battle stations until after sundown. The returning flyers were jubilant. Our carrier had lost only three fighters, while our pilots had accounted for between 50 and 60 enemy planes. The overall score for our task force planes was 369 Japs shot down against a loss of only 27.

Early next morning all carriers sent out search planes after the fleeing Japs. They were sighted at 3 p.m. 275 miles west. All ships immediately were ordered to launch two strikes with the idea of crippling the fleet so it couldn't slip away from us that night. The first wave was launched at 4 p.m. and as a matter of safety the crew

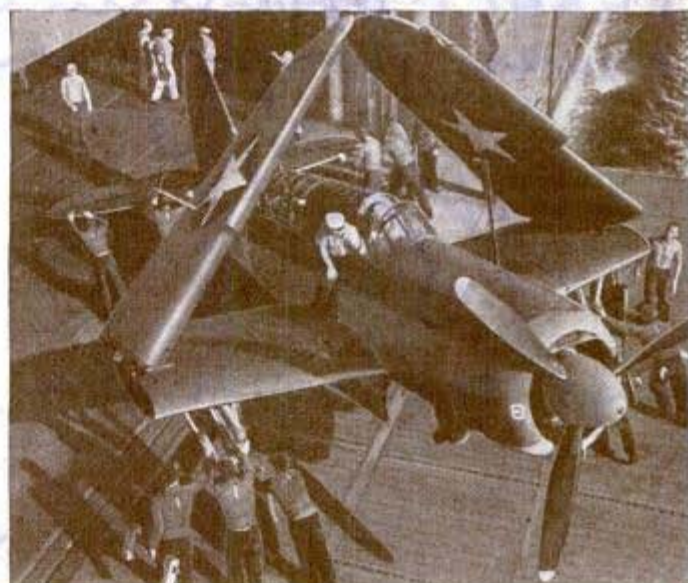
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Below, Jap torpedo plane braves curtain of carrier antiaircraft fire near Truk. It crashed shortly after picture was taken

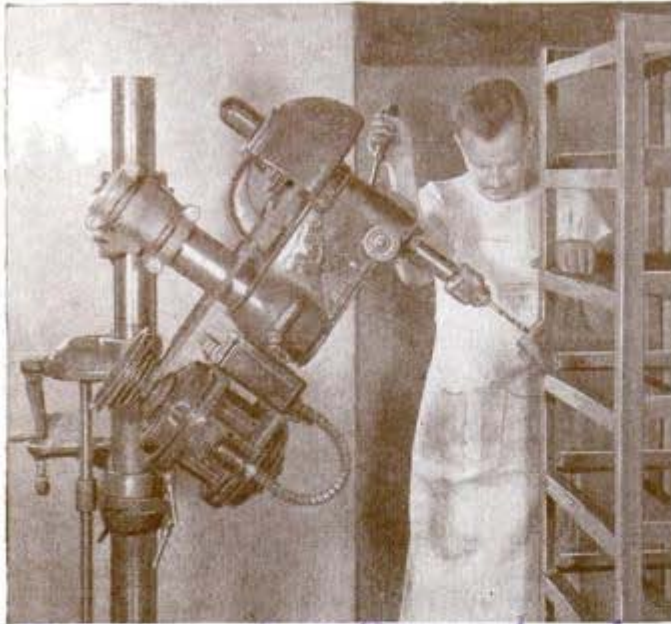
U. S. Navy photos



Above, with wings folded, a warbird goes to roost in the hangar deck, while other F6F Grummans wait their turn on flight deck. Below, Helldiver being taken aboard carrier at a U. S. port



Angle Adapter for Drill Press Gives Versatility



Drill presses can be converted into multiple-purpose machines by an angle adapter which permits working at any angle and height. Fitting almost any drill press with a round tubular column, the unit prepares a drill press for angle drilling, polishing, buffing, sanding, rotary filing, wire brushing, tapping, reaming, burring, grinding and honing. Besides angle and height adjustment, the adapter allows horizontal and vertical control. It also affords a more comfortable position for the operator and encourages faster work.

Left, adapter permits operator to adjust drill press to whatever angle and height is desired

FRANCE *Oppenheimer of Michael Reese Hospital in Chicago* Germs Killed by Ultraviolet Light Provide More Powerful Vaccine

More powerful vaccines are likely to result from the development of a method of killing germs almost instantly with ultraviolet light, says a report to the Journal of the American Medical Association. Bacteria and viruses, numbering about one billion in a teaspoon of fluid, are killed in less than one second when exposed to a specially constructed ultraviolet lamp. Vaccines prepared from light-killed bacteria for typhoid fever, pneumonia type 1, and

Salmonella enteritidis, one of the germs that causes food poisoning, were prepared by research scientists, who said they appeared to be equal or superior in antigenic potency to vaccines prepared by heat-killing the same bacterial suspensions. They asserted that rabies vaccine produced by the new technique consistently induced a higher degree of immunity in mice than vaccines in which the germs had been killed by phenol.

Temp INC. 230 E Ohio, Chicago, Ill 'Exploded View' of Engine Parts Makes Complicated Assembly Simple

0540 By eliminating all guesswork and tinkering, a visual aid known as an "exploded view" makes assembly of a complicated engine part quick and easy. The "view," a photographic chart, shows all parts in a machine individually down to the last nut and bolt and makes plain their exact inter-relationship, which helps to simplify maintenance problems for mechanics. In a test case at the Bendix Aviation plant in Chicago, Jack Butler, an 11 year old boy, assembled the 500-odd parts of an injection carburetor fuel regulator in approximately 90 minutes.



TEACHING the GI WAY

0523

TWO French language experts visited a class of GI's who had graduated from a nine-month course in that tongue conducted under the Army Specialized Training Program at the University of Chicago.

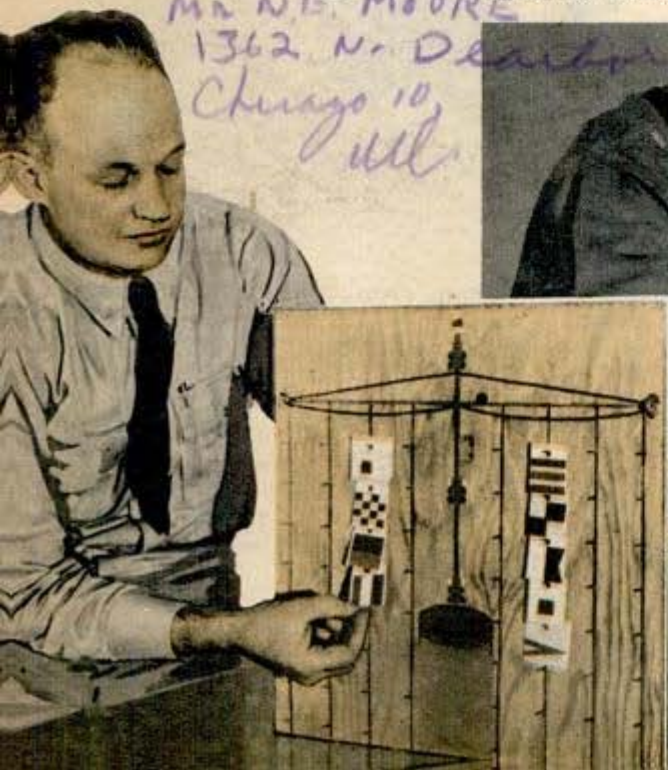
To their astonishment, they found the top third of the class had a better command of French than most candidates for university master degrees under conventional methods of teaching, that the middle third was as good as the best candidates for bachelor degrees, and that the bottom third did as well as the average candidates for bachelor degrees after four years of study.

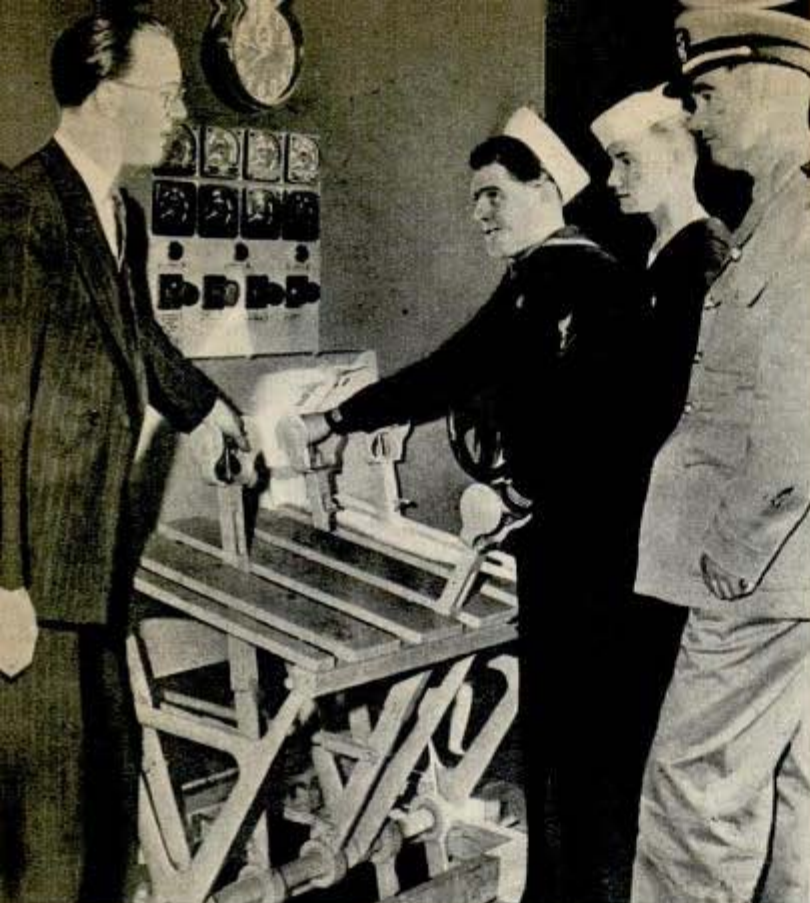
This accomplishment didn't surprise the Army instructors, nor does it surprise many leading educa-

MR. N.B. MOORE
1362 N. Dearborn
Chicago 10,
Ill.



Above, aerial gunners are trained by the use of electrically geared guns which fire at motion picture projected targets, presided over by WAVES. Below, left, training aid for teaching signal recognition. Below, toy vehicles help in training GI's to regulate troop traffic





Above, simulated equipment for teaching ship operation. Right, miniature German M-IV tank with hatch door being opened to show its construction

tors, for similar results are being attained in hundreds of other foreign language classes of the specialized training divisions of the Army and Navy.

With new techniques, practically every foreign tongue or dialect is being taught the men in the service with incredible speed and thoroughness. The Army alone teaches about 40 languages. The Navy has a program which includes one school in Boulder, Colo., where students get a good working knowledge of



classes, even an illiterate can read and write. The Navy has more than 550 different schools to give the types and degrees of training its men require.

A vast, speeded-up teaching and training program was necessary to turn out the millions of specially trained men needed quickly by both the Army and Navy in World War II. So traditional teaching



Left, miniature ward tent and pyramidal tent aid training at Camp Robinson, Ark.

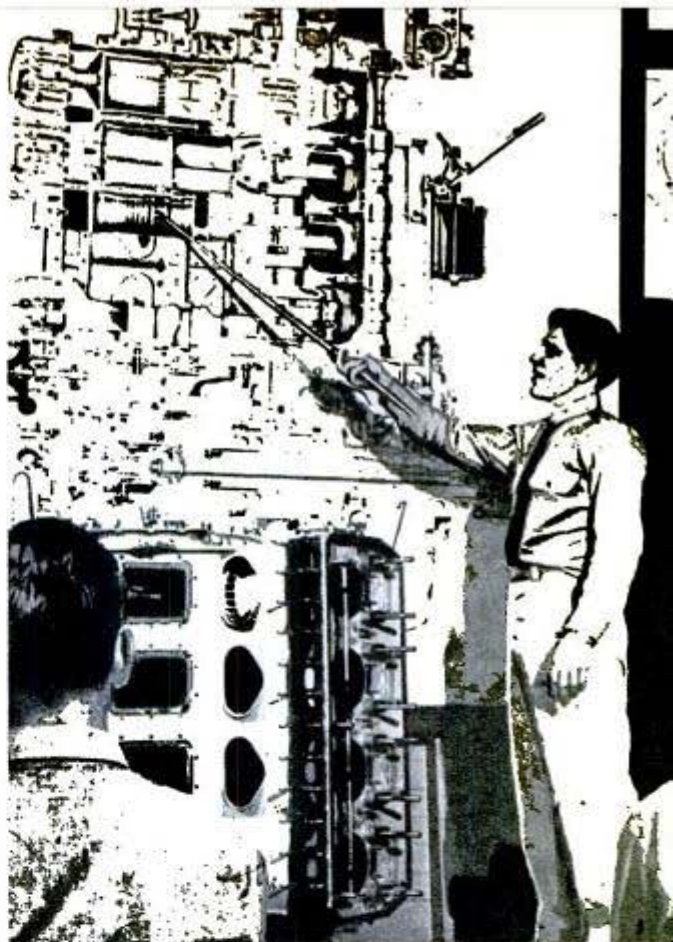
methods have been combined with new and improved techniques involving the use of a seemingly endless variety of teaching aids, including sound and silent movies, film strips, slides, recordings, charts, diagrams, mechanical devices of all sorts, cut-away and transparent models, miniatures of equipment, large scale models, topographic models, even toys and sand tables.

Probably the best term to describe the Army and Navy teaching system is audio-visual education. It is said that 95 percent of all learning is absorbed through the eyes and ears. This is the basis for most of the new teaching techniques.

Take the teaching of foreign languages, for example. Students start speaking the language from the first class day and actually live the scenes which might take place in a foreign land through movies and the acting out of playlets. There is frequent use of recordings and sound motion pictures in the language being studied. There are few students in each group and many teachers are rotated among the groups. Natives are brought in to converse with the students whenever possible.

So effective have recordings become in language instruction that they can be used to teach the essentials of a foreign tongue in 8 to 12 hours. Sometimes soldiers on troopships in an invasion fleet learn the rudiments of the language of the country they will invade while they are en route, using only recordings and guide books. In classroom studies, the students cut their own records for review.

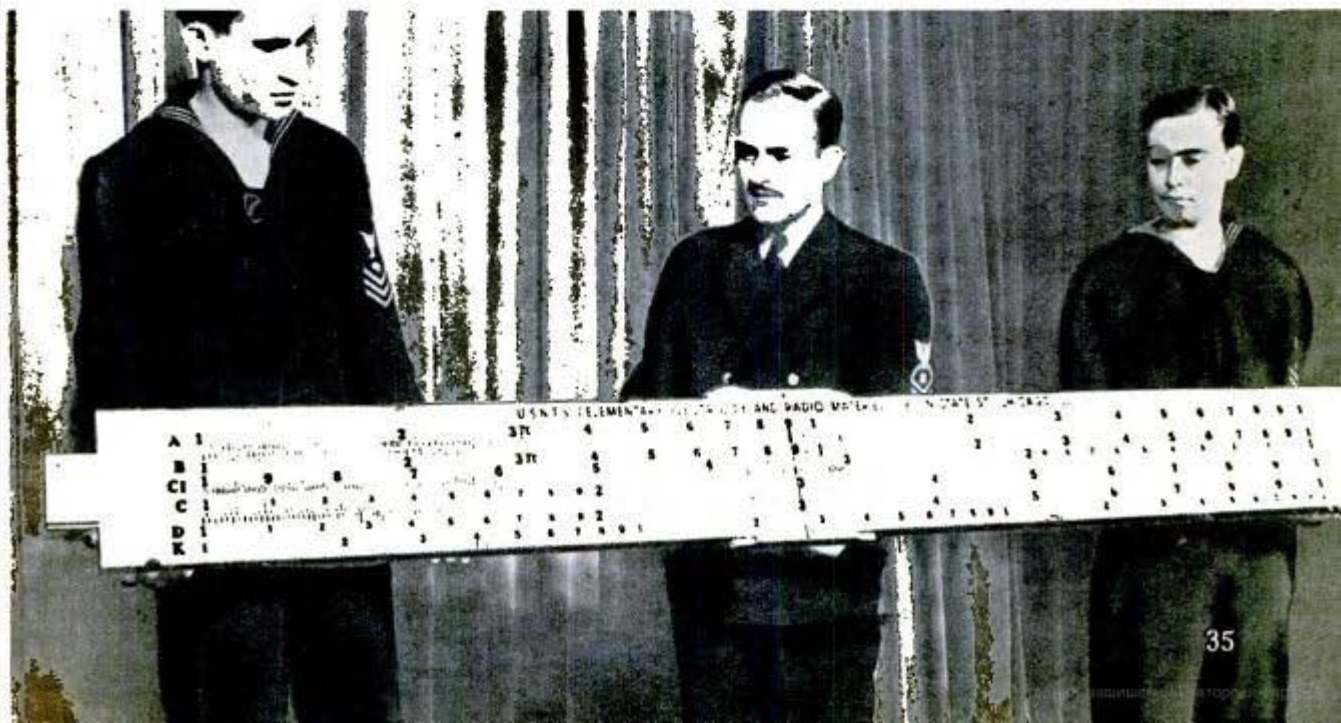
Probably the most versatile and widely used of all teaching aids is the motion picture, with which might be combined the

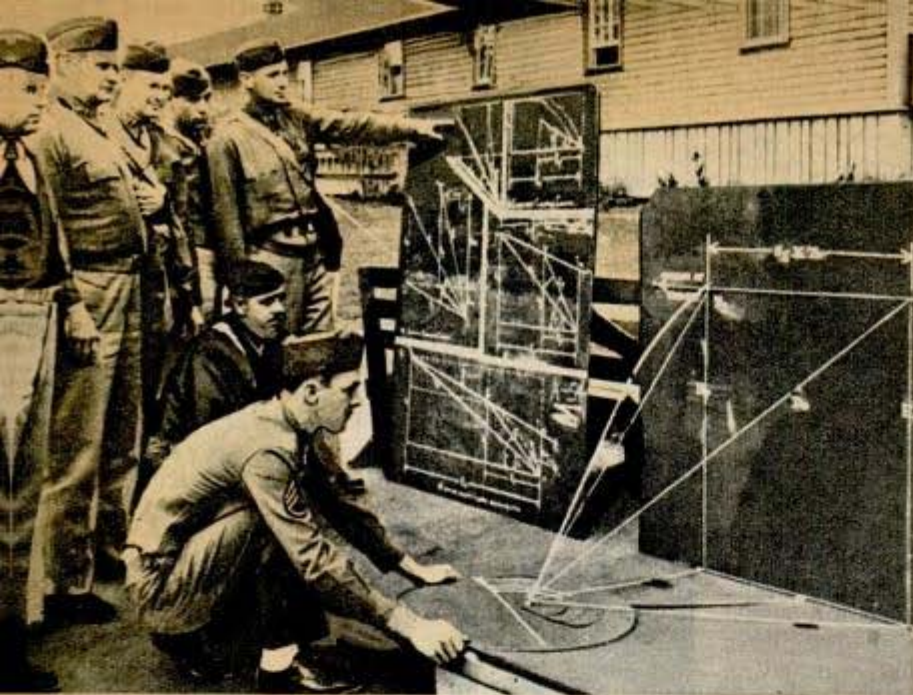


Above, charts supplement real equipment in teaching engine operation to a class of naval trainees

film strip (a succession of stills), film bulletins and slides. Most of the movies are sound, and some of them are in color, though silent films often are used independently or in conjunction with recordings. Thousands of subjects are covered, one War Department basic field manual alone listing more than 700 pages of films.

Below is oversize model of slide rule used in teaching slide rule operation in radio training
U. S. Navy photo





This visual set-up helps to teach the operation of the anti-aircraft director. Device at right illustrates some ack-ack firing problems

Motion pictures enable students to learn up to 35 percent more in a given time, and tests show that the facts learned are remembered up to 55 percent longer, according to the training division of the Bureau of Naval Personnel.

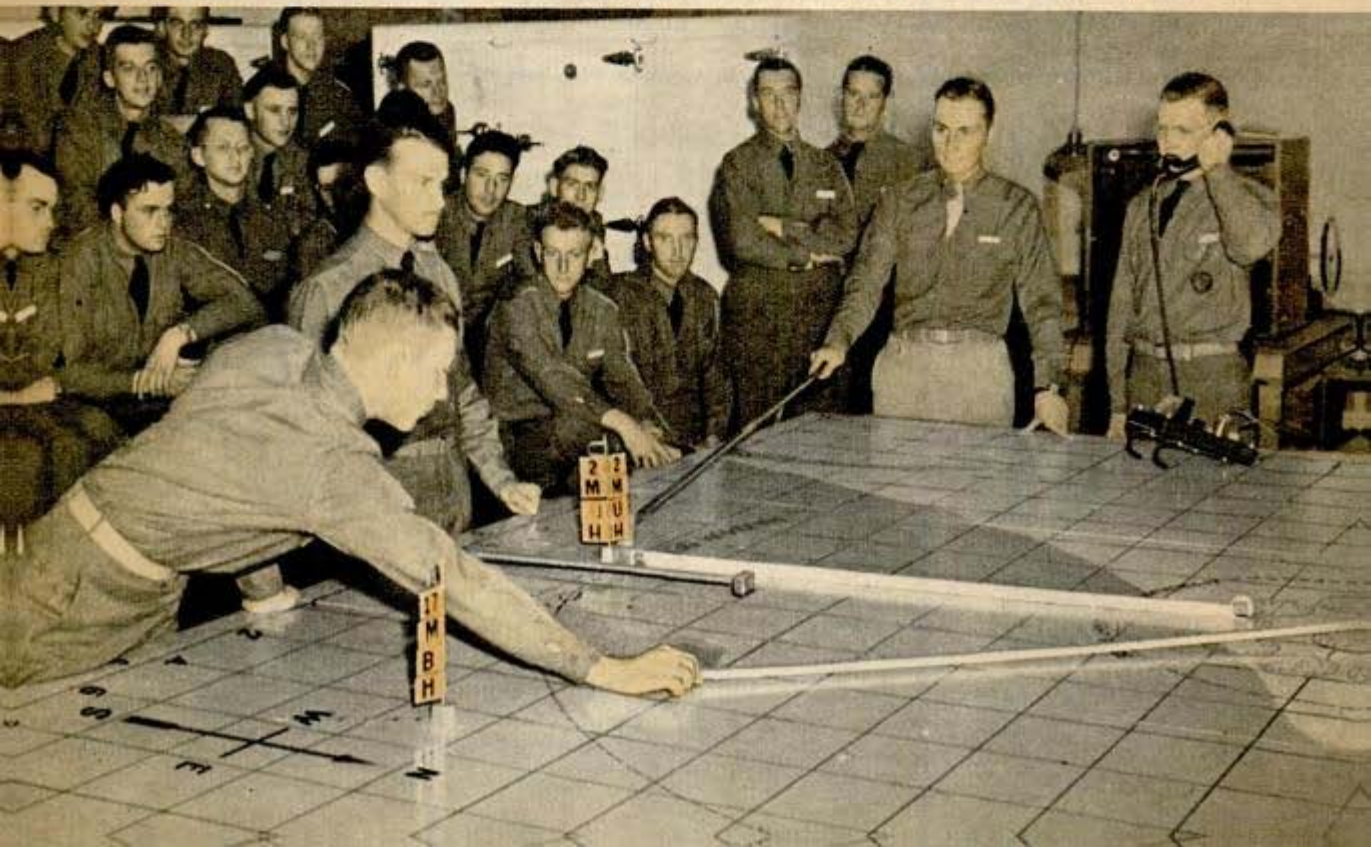
The types of movies used range from animated cartoons and Hollywood-staged productions to highly technical subjects which show, for example, how to use a slide rule. In addition, movies have been combined with mechanical and electrical devices to achieve unusual effects and re-

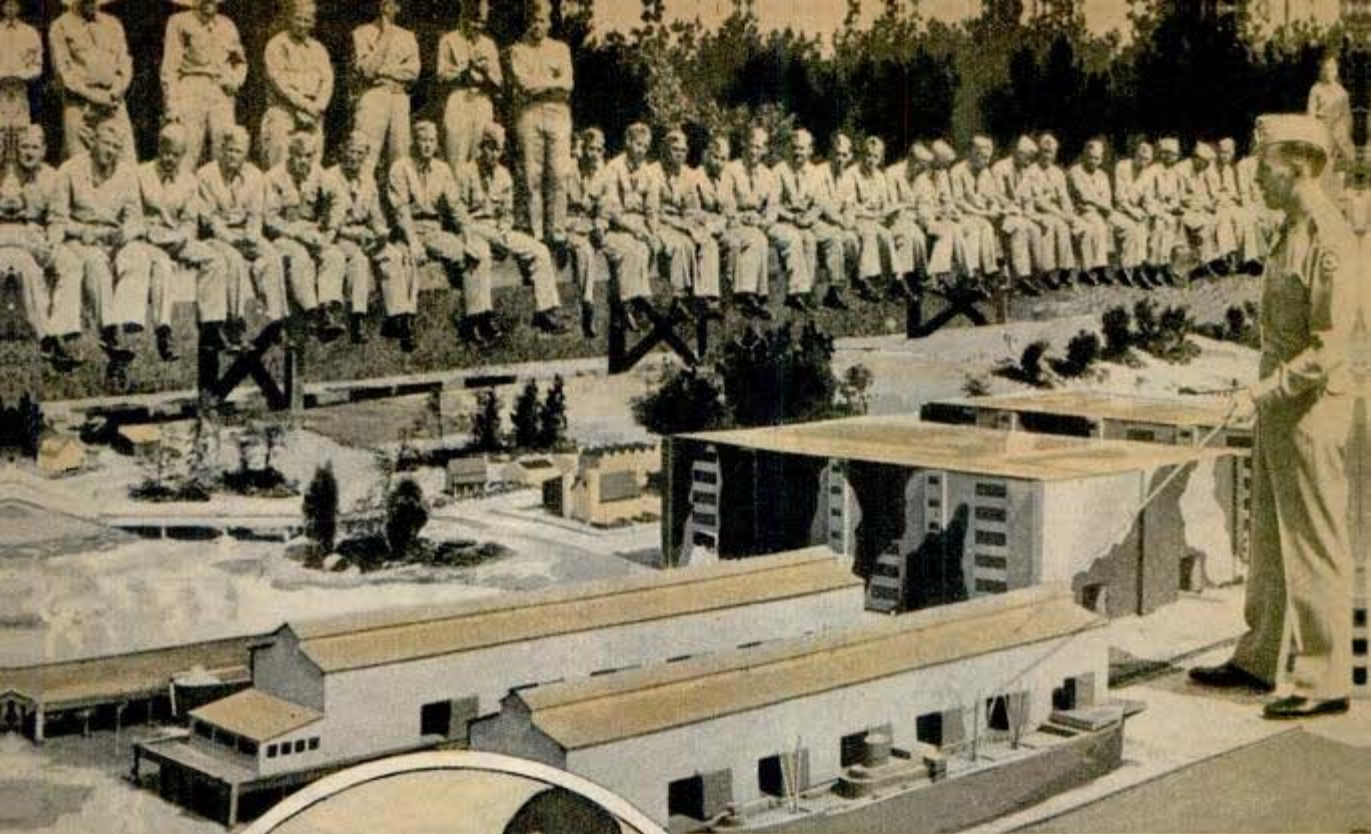
sults. Student aerial gunners at the Lakehurst Naval Air Station are trained by the use of electrically-gearred guns which fire at motion picture projected targets.

Toy-like, small-scale models of tanks, guns, ships, buildings and other equipment have been found especially useful in many fields of study. The complex problems of supplying the modern army are "solved" and explained in Army Quartermaster Schools where piers, camouflaged warehouses, ships and highways were used in tiny model form, along with miniatures of trucks and other vehicles. To teach military maneuvers and systems of regulating military traffic, the Army uses complicated topographic models in which sand, water, clay, plasticene, sponge, paper, cardboard, wood and metal are used for various types of construction. The theory and methods of bridge construction are taught with miniatures scaled one inch to one foot.

In some model work, the terrain is formed on a canvas, and tiny tanks, scout cars, artillery pieces and men, made of metal, are propelled by man-powered magnets beneath the canvas. Sometimes the

Below, officer candidates learn to use ack-ack information board to check on enemy aircraft





Army Signal Corps photo

Above, miniature theater of operations for solving problems at a quartermaster school. Left, model tanks for identification study



The Navy has a fully equipped and staffed training aids development center. Drafting and design rooms, a complete woodworking shop, engineering department and illustrating division are operated by skilled layout men, engineers and mechanics, woodworkers, metal workers and pattern makers.

One of the latest products of this center is a ship-to-shore demonstration panel for specialized am-

(Continued to page 156)

models are several times actual size. A wooden model of one machine gun is enlarged three times, but functions the same and has the same number of parts as the gun it represents.

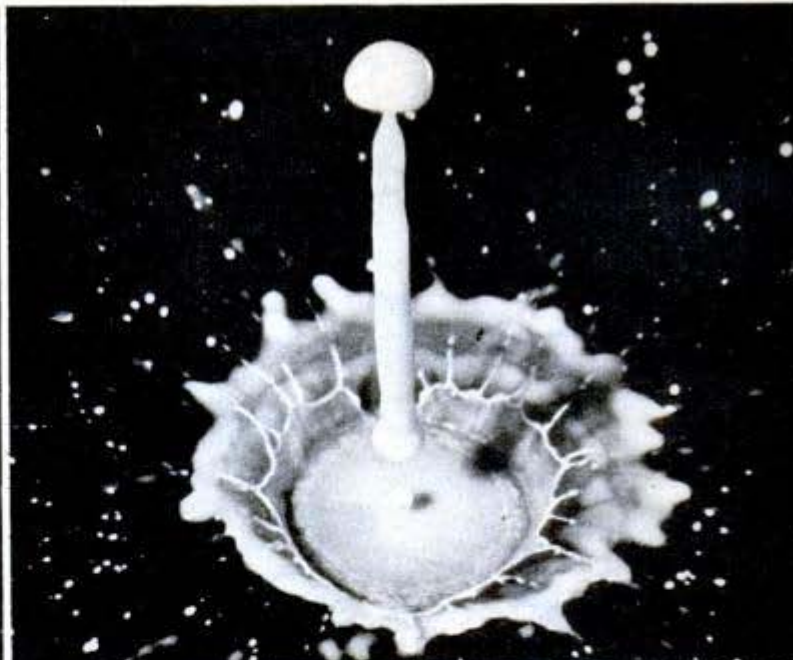
Considerable use, too, is made of cutaway models of equipment and mechanical training devices. The latest full-sized models of valves, pumps and other types of equipment are made of crystal-clear plastics which are machined to size and accurately shaped.

A model sewage treatment plant is used to teach construction and operation to students at U. S. Army engineers school



David M. ...

Camera "Freezes" Spilled Milk in Weird Designs



Left, milk overflowing around glass; above, a drop of milk is "frozen" by the camera as it hits flat surface

One person who does not cry over spilled milk is the man behind a stroboscopic camera with a high speed shutter. The result is "frozen" milk in fantastic patterns. A camera with a shutter speed of 1/30,000 second gives the spilled milk a semi-solid appearance.

Anti-Glare Goggles Reveal Submarines When the Lenses Are Rotated

Goggles which can control light are helping the Navy lick the submarine menace. Developed by the American Optical Company specifically to locate underwater craft, the goggle is equipped with a pair of special anti-glare lenses. When the lenses are rotated by hand in an arc of 180 degrees, blimp and plane crews find it possible to spot submarines or periscopes otherwise obscured by water or light reflections. The rotation is accomplished by a

sliding bar in the upper part of the goggle frame. The range of rotation is enough to eliminate concealing glare for any position of the observer with respect to the sun and water. In any adjustment the lenses transmit the same amount of useful light but cut out reflections. The goggle also has been used successfully to locate survivors from torpedoed ships, to spot enemy planes from airplane carriers and to protect the eyes against glare when scanning sunny skies.

"Gadabout Auto" Weighing 1,100 Pounds Gets 40 Miles to the Gallon



The "Gadabout," a 3-passenger automobile built largely of aluminum, magnesium and Duralumin on an 80-inch wheelbase, has been developed by the Detroit Industrial Designers' Association as a postwar possibility. Weighing only 1,100 pounds, it is powered by a two-cycle, air-cooled engine with a fuel injection system instead of a carburetor and gets 40 miles to a gallon of gasoline. A steel tube at bumper height surrounds the body.

Ray Russell Pres., Detroit Industrial Designers Ass.

660 Y T... #62751

GI's "Bamboo Inch" Saves Metal Pipe On Chinese Front

Native wood found growing in a wild bamboo thicket was used by U. S. Army Engineers to build a 600-foot water line down a mountain slope back of the ground fighting in Yunnan Province, China. Calling their span the "Bamboo Inch," the soldiers cut large bamboo stems, joined and caulked them, fashioned bamboo trestles to support the line across the defiles and suspend it over jagged rocks, and then watched spring water flow from the spring to their mess hall. The bamboo eliminated the need for 678 pounds of metal pipe and the cargo space required to bring it from this country.

Upper right, bamboo line is supported by a bamboo trestle. Right, engineers knock pith from bamboo

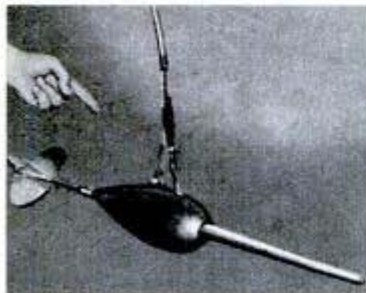


Vultee - Sandberg

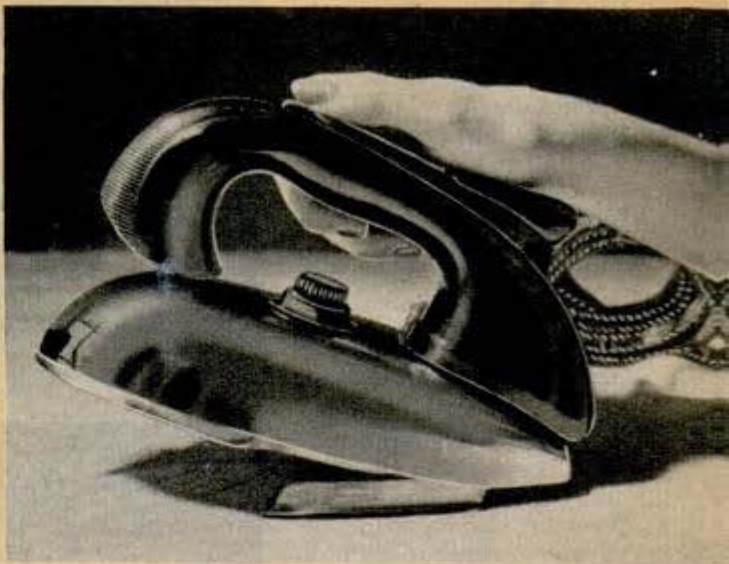
"Speed Bomb" Trailed by Plane Helps Eliminate Testing Hazards

Airspeed instruments on new aircraft are checked at a safe altitude with an airspeed "bomb" lowered by cable and winch. It is accurate at speeds in excess of 300 miles an hour. Formerly, airspeed instruments were calibrated by flying the plane at danger-

ously low altitudes over a speed course on the ground. The bomb, developed by Consolidated Vultee Aircraft Corporation, resembles a metal lure used by fishermen. It has a streamlined lead body, a static pressure head for a nose, and four stabilizing tail fins. The bomb is 12 inches long and weighs 25 pounds. Airspeed indicators must be adjusted on new planes because the pitot-static tubes from which they receive pressure impulses are situated in the turbulent air close to the body of the aircraft. It is almost impossible for engineers to estimate the effect of this air on the tube. The trailing airspeed bomb sends accurate electrical impulses to a special indicator on the plane through connecting wires, and from this indicator the plane's regular airspeed instruments are calibrated.



*Only News
Photos*
Preview-



Here's a preview of what's promised you—postwar.

Loaded with a few ice cubes and a little salt, the midget refrigerator (upper left) will cool a quart of liquid in a few minutes. It's known as a "Fahr-heitor" and is designed to save space in your postwar refrigerator. The stream-lined iron (above) is called a "never-lift" because it springs back on its own "heels" and does not have to be lifted by the housewife during the entire ironing process



The small television receiving unit (in circle) is a far cry from bulky prewar devices. Incorporated in this set, designed by Barnes & Reinecke, will be a radio and a wire recorder which records broadcasts on magnetized wire instead of phonograph records. Below, that yen to put your feet on the desk is satisfied by this chair of revolutionary type made of tubular steel. It raises the feet above head level





D625

The plastic cups and saucers (above) were made originally for the Navy. They will not break as easily as china cups and they won't topple over if stacked up high. The new cups are said to be "nontiltable." The table model radio set of unusual design (upper right) has the tuning dial in a band around the speaker. It was designed by a student at California Institute of Technology. It is a compact radio and said to be efficient



Right, it looks like a radio and stove combination at first glance and is exactly that. This is how your "airtronic" high frequency cooker is going to look. Simple dials control the voltage and a cake can be made to rise in four seconds. Instead of cooking in the conventional way from the outside surface inward, food cooks uniformly inside and out. Airtronic units were developed for quick heating of plastic molding materials



*Arbomex Devel Corp.
131 E 3rd St
Dayton, Ohio*



Left, inflated "upholstery" for chair is made of flexible plastic. Frame consists of an aluminum ring with four legs which support cushion. When deflated and taken apart it fits into a briefcase

*Bureau of Ships
U.S. Navy*

Transport Fights Own Battle Carrying Troops

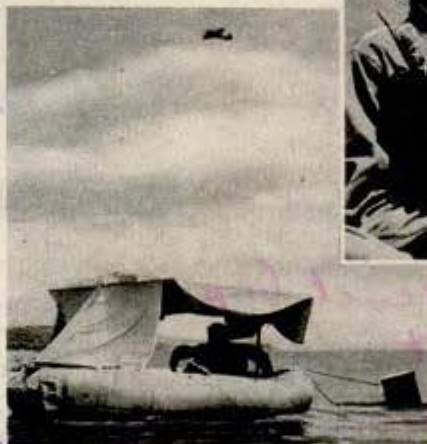


Able to defend itself from attack by air or sea, the Navy's newest combat transport is designed as a complete fighting unit within itself. The ship, with the official Navy designation BD-1, incorporates many revolutionary features developed from experience in amphibious operations. Many of our landing craft are equipped with rocket-launching devices. The heavily armed and expertly camouflaged ship carries a large number of fully equipped men.

Chicago News Photo 326 W Mack

Cloth "Sweats" Drinking Water in Life Raft Experiment

Drinking water was "sweated" from a cloth by Air Force volunteers cast adrift off Hawaii to test new life raft equipment. One of the crew held the solar still in position as the sea water entered through the funnel and tube in his hand and soaked the heavy black cloth under a large shield in a square frame which he held to his chest. The steam resulting from the heat of the sun on the damp cloth condensed on the shield and trickled down into the fresh water retaining tube. The raft contained a canopy for protection from the sun. The men also experimented with a new type of mirror for signaling.



Above, soldier holds the still in position while it creates fresh water. Left, men on sun-shaded raft signal to a plane

Daily News Press Wire N.Y. N.Y.

"Ducks" Equipped to Throw Smoke Screen to Hide Troops on Beach



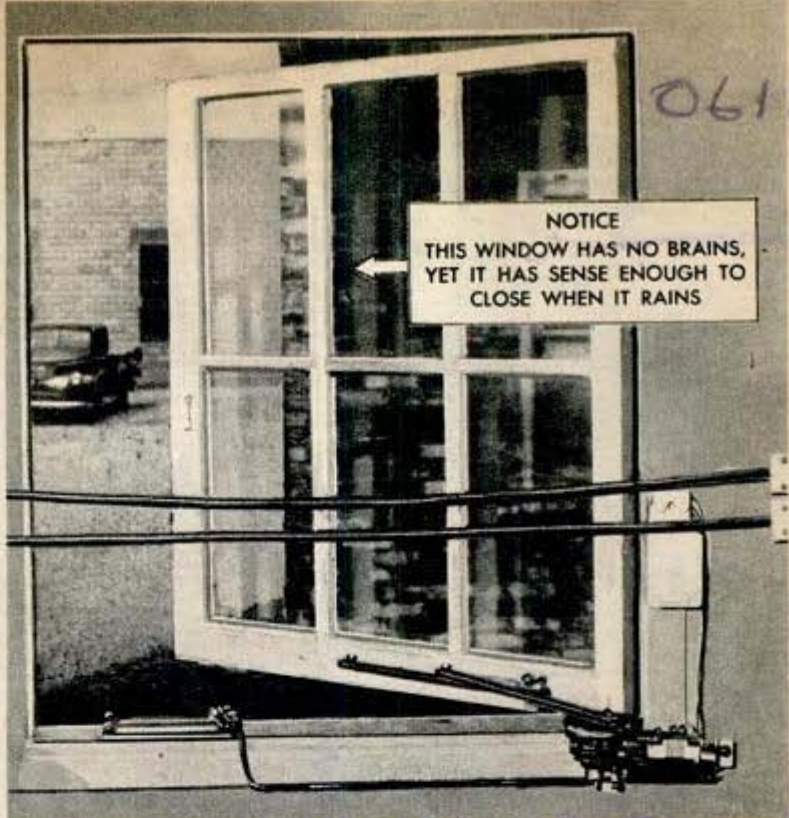
Smoke generators which spout artificial fog are mounted on ducks, the Army's amphibious trucks, to cover their operations and hide troops on beachheads. The GI designation is "Smoke Drake." The amphibious vehicles haul three tons of supplies and travel at five knots through water and 40 miles an hour on land. These vessels carried thousands of tons of equipment into France.

See with ... Piqua, Ohio

Electronic "Brain" Closes Window When It Rains

Lazy people will be delighted to learn that a window has been invented which will close automatically when it rains. It is in use at the Lear Aviation plant at Piqua, O. Motivating power is a Lear midget motor with reduction gears or power unit plus a Lear linear actuator. The company has kept the nature of the "brain" a secret, except to say that control is exercised through an electronic relay.

Right, window with electronic device that shuts it when rain comes down



E. D. Reilly G. E. works

Wires Measured in Plastic Mold To Millionth of an Inch

Fine wires are measured to a millionth of an inch in the General Electric works laboratory. The method consists of molding a plastic block with a series of V-shaped grooves in its upper surface. Short pieces of wire are placed in the grooves, molding powder is poured over the wires and pressure and heat are applied until the whole block is hard. The powder grips the wires firmly so the block can be sawed across the wires without distorting them. The face of the block, which exposes a cross section of the wires, is then carefully polished and examined under a microscope with a micrometer eyepiece. Two threads are visible. Moving them until they seem to touch diametrically opposite parts of the cross section of the wire, the diameter is determined to a millionth of an inch.



Coast Guard Phila, Pa

'Floating Monitor' Combats Pier Fires With Water Spray

A "floating monitor" has been devised to help the Coast Guard fight fires under piers. The device, which looks like a toy boat, is floated near or under the blazing pier, where it sprays water into the air with great pressure. It is jet-propelled and operated by remote control from the fire boat.

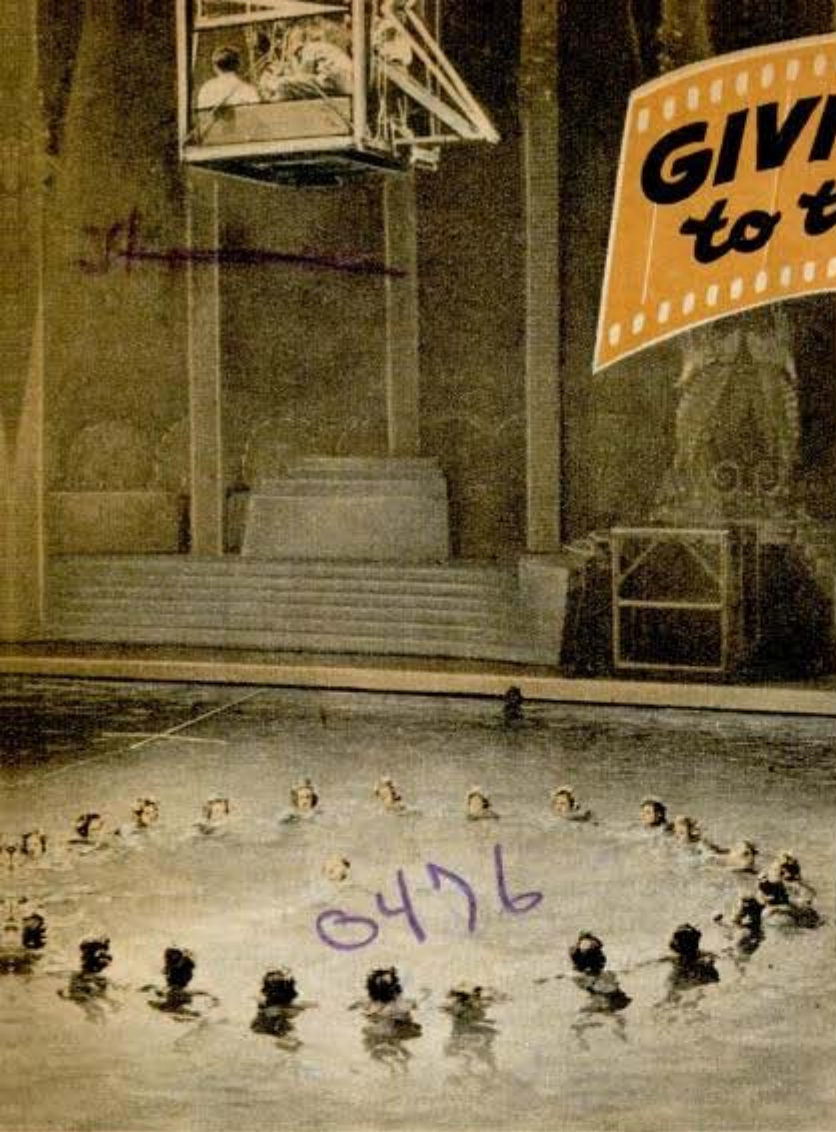


GIVING DEPTH to the MOVIES

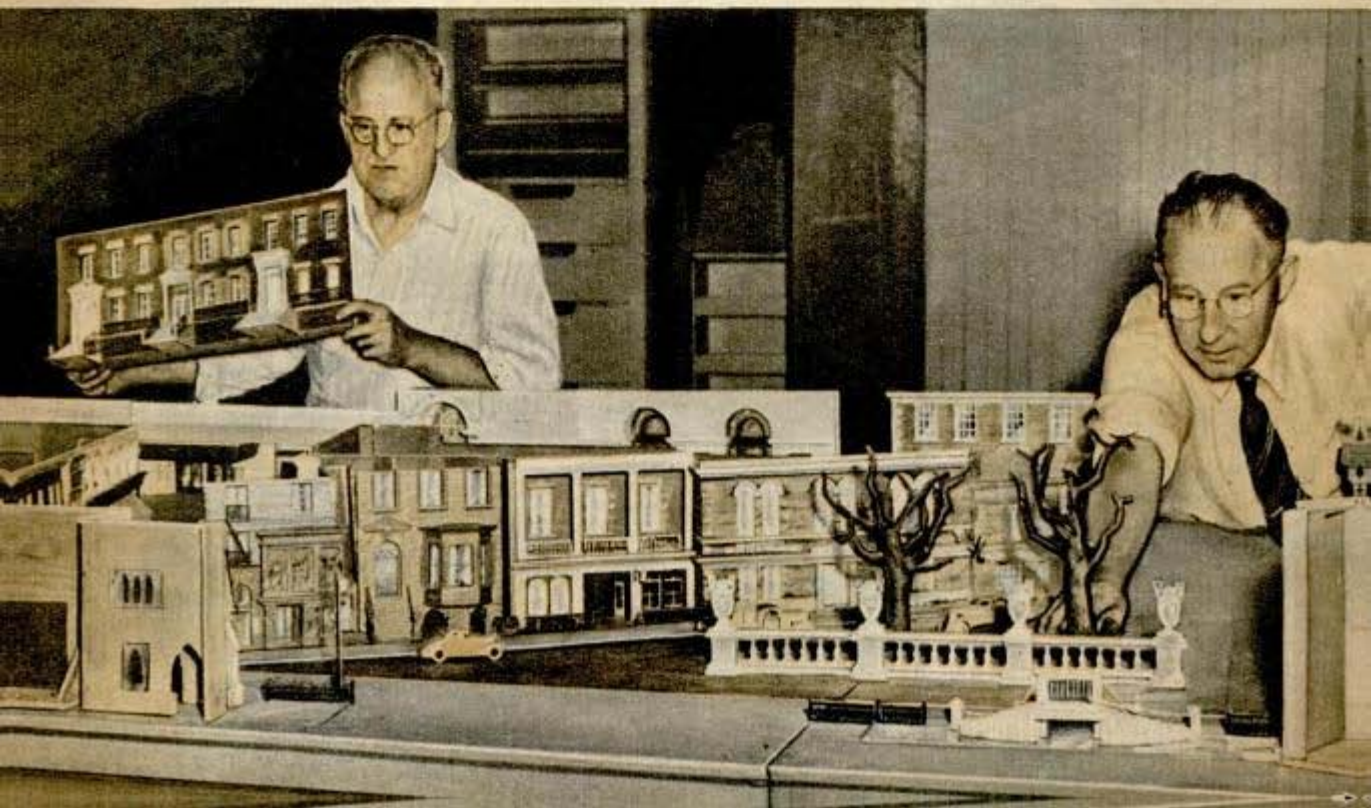
HOLLYWOOD will pay you one million dollars in cold cash if you can devise a satisfactory third-dimensional effect for motion pictures. Possibly you could get a better price than that.

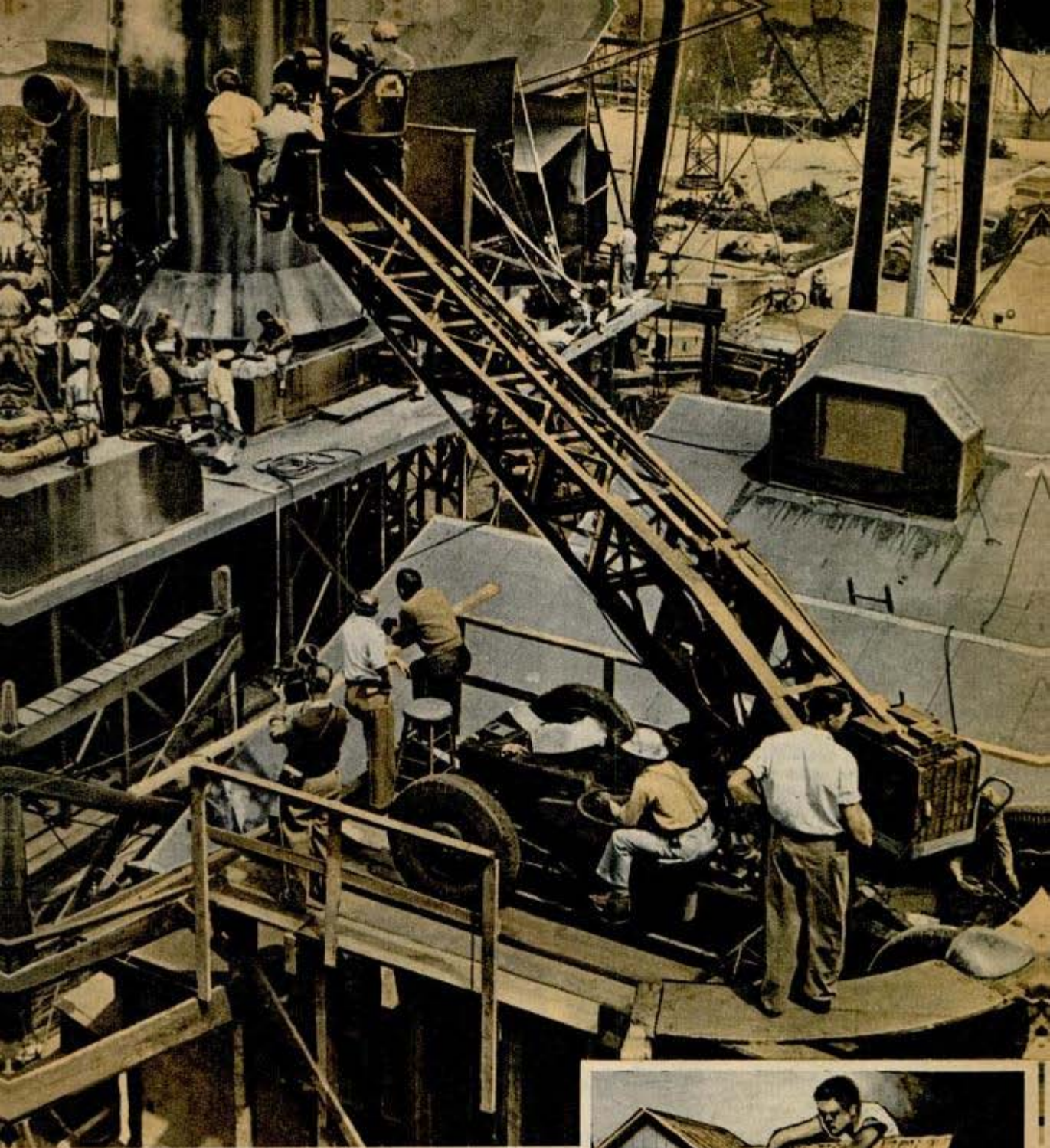
The vivid impression of depth and distance that you get when looking at pictures through a stereoscope is the effect the cinema industry would like to duplicate on the screen. Hundreds of schemes have been proposed for creating this illusion and hundreds of engineers have worked on the problem without success.

One way to achieve it, of course, is to project a double picture on the screen and provide the audience with stereoscopic spectacles. Another way, demonstrated as far back as 1912, is to tint alternate frames of a motion picture in red and green and to provide the audience with spectacles that have a red filter for one eye and a green filter for the other. The spectators see one frame with one eye, the next with the other, obtaining stereoscopic vision. A polaroid screen and



Above, scaffolding suspended from roof gives camera a bird's eye view of girl swimmers. Below, model of city streets will correct errors in perspective before full sized set is built

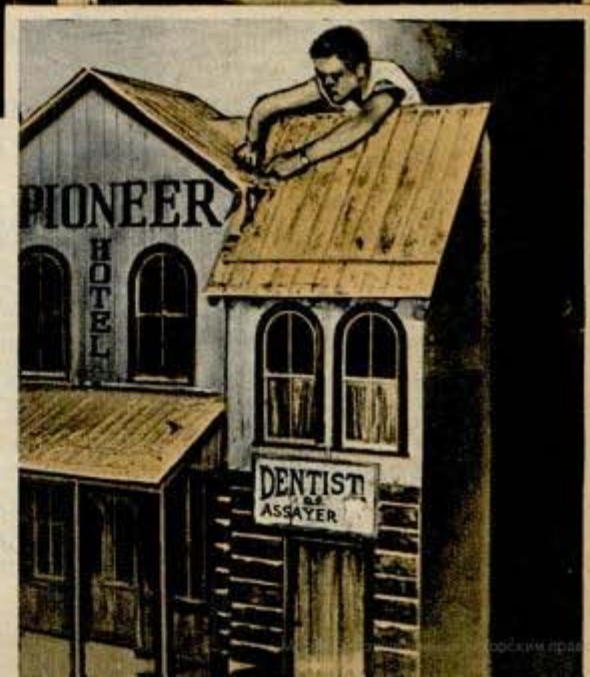




Crew on end of camera boom films synthetic shipboard scene. Right, scaled down buildings will give an illusion of depth

polaroid spectacles give the same effect. All of these methods work but none has been adopted. Audiences find it too much of a nuisance to wear spectacles in the theater.

The Army Air Forces get a kind of third dimension in motion pictures that are used for training aerial gunners. The screen is curved in the form of a paraboloid. Five different motion pictures are projected on different parts of the concave screen simultaneously, producing one complete composite picture. Even this arrangement doesn't provide a perfect sense of depth. The projection apparatus,





Above, side lighting for actors comes from standards to which a dozen or more lights are attached. Right, the concave projection screen in background provides three-dimensional illusion for aerial films used in training Air Force gunners. Below, touching up model of old house. In background of set it will seem to be some distance from camera



consisting of five synchronized projectors, would be too complicated for ordinary theater use.

As much as the studios would like to produce stereoscopic movies, they are doing quite well without them. During the last few years the movie technicians have developed methods that provide an impression of three dimensions that is quite realistic.

Ten years ago motion pictures seemed to be just as flat as the screens on which they were projected, though occasionally a scene would appear in which each actor seemed to stand out in relief. A third-dimensional quality had been achieved by accident. Cameramen studied the causes, then changed their lighting systems. Flat lighting from behind the camera was dropped and now actors are lighted from the sides as well as from the back and front to model them and make them stand out more sharply from their surroundings.

Sharpness of the film image, all by itself, helps create the third-dimensional illusion and so the new fine grain film that the studios are using



contributes to the effect. Color film is more third-dimensional than black and white because the colors themselves sharply separate all the objects in the scene. Recent improvements in color include the use of single strips of film of the Kodachrome type that may be exposed in any motion picture camera. The expectation is that after the war practically all motion pictures will be filmed with this color "monopack."

Another way in which the effect of three dimensions has been approached is to increase the depth of focus at which pictures are filmed so that more of the scene from foreground to infinity is seen in sharp detail.

Like three dimensions, a method of achieving universal focus has been sought for a long time. One idea was a split lens with half of it focused on the foreground and the other half focused on infinity; another idea was a lens that moved or vibrated back and forth, alternately placing the

foreground and then the background in sharp focus and giving an over-all effect of sharpness. Mechanical difficulties seem to have precluded wide use of these devices.

Greater depth of focus is being obtained through use of new fast film emulsions that are more sensitive to light, allowing smaller diaphragm openings that provide the depth to be used. The new so-called coated lenses that transmit more light than do untreated lenses also allow smaller apertures to be used, and the coated lenses likewise reduce halation and lens flare, helping to provide sharper film images. The newest professional cameras have improved shutters that stay open longer, then chop off more sharply than did the older shutters. More light is admitted to the film during each exposure, again allowing the use of a smaller aperture that increases the depth of focus.

These are the mechanics of the three-dimensional effect; there is also an art in simulating it. In Hollywood it is often best to film an exterior scene inside a sound stage instead of outdoors. Houses, lawns, and streets are assembled indoors. Even distant mountains and villages are provided for backgrounds, or seascapes that stretch out to the horizon. The camera records a realistic picture of a scene that appears to be miles in depth, though actually occupying no more than 100 feet or so of stage.

The effect is achieved by following the laws of perspective. Robert O'Dell, one of the art directors of Paramount, explains that objects such as houses that are to appear in the middle distance may be built in three dimensions, but scaled down to a half or a tenth of their normal size to create the illusion of distance. Mountains or other background scenery are often painted on canvas backdrops, shaded to match the shadows that will be cast by objects in the foreground and painted in neutral tones with a lack of sharp definition to match the impression one usually receives of distant scenery. Tremendously enlarged photographs are printed on sensitized canvas for use as backdrops.

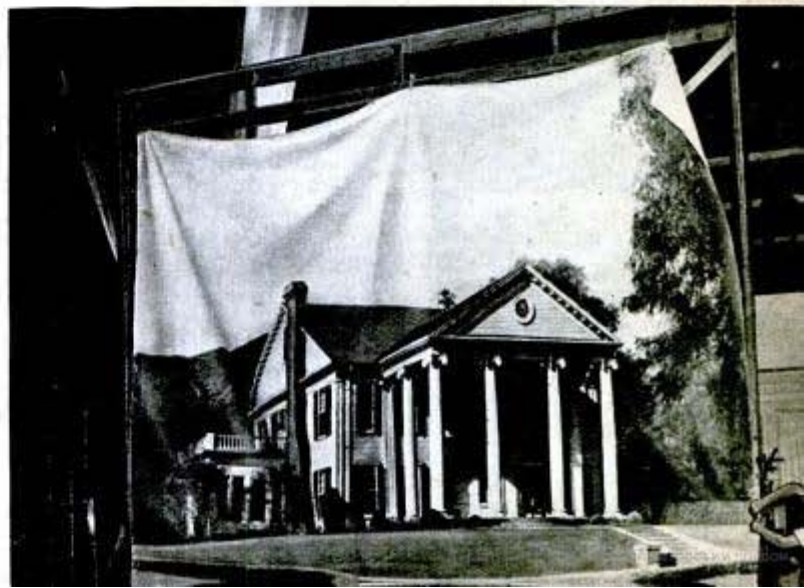
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Above, mountains painted on canvas backdrop are expertly shaded so that shadows conform with shadows in foreground



Above, miniature of hall's ornate walls and ceiling, suspended in the air in front of the camera, appears to be full sized in finished movie. Below, photo of house used as set background



0579



BIG GUNS of INDUSTRY

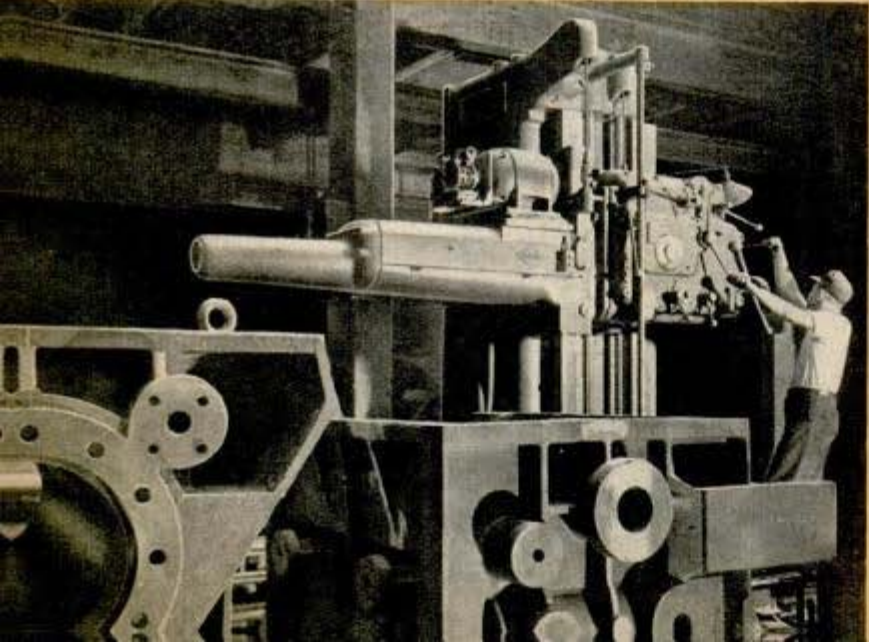
*mark
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Though they look like death-dealing weapons, these instruments are some of the big guns of industry—machine tools used to prepare the real fighting weapons for the front. Above is machine tool used to finish off crankcases and cylinders for engines and to machine gun mount cradles

Right, water-cooled condensers for industrial refrigeration



Below, steel shafts which bore the holes in the cylinders of powder presses and ammonia compressors



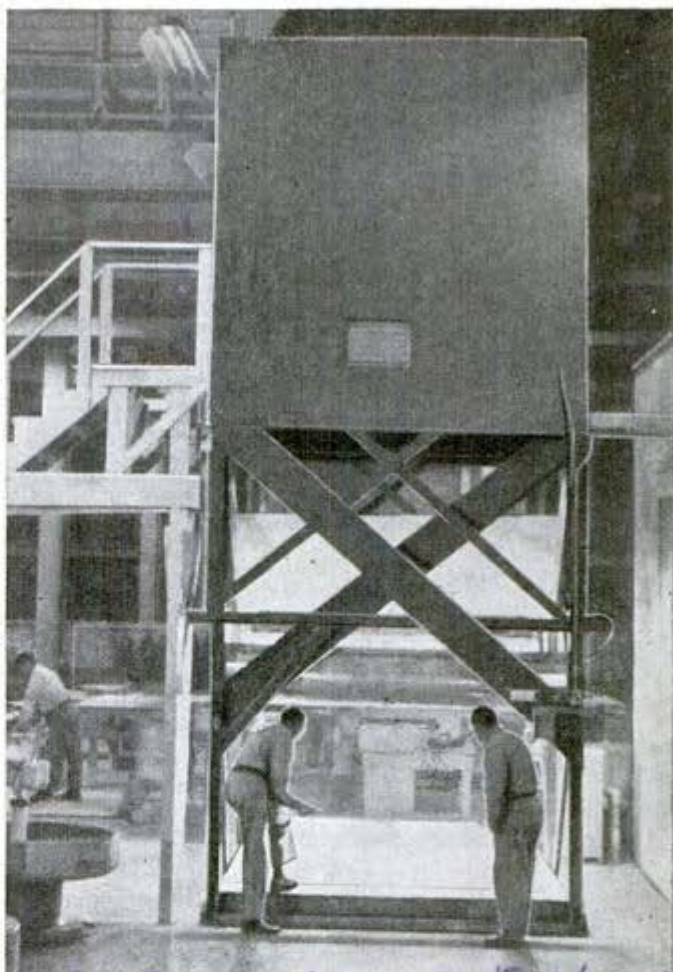
Rocket gun? No, the boring mill at left is used for machining gun mounts and milling high altitude chambers

Vultee - Fort Worth, Tex.

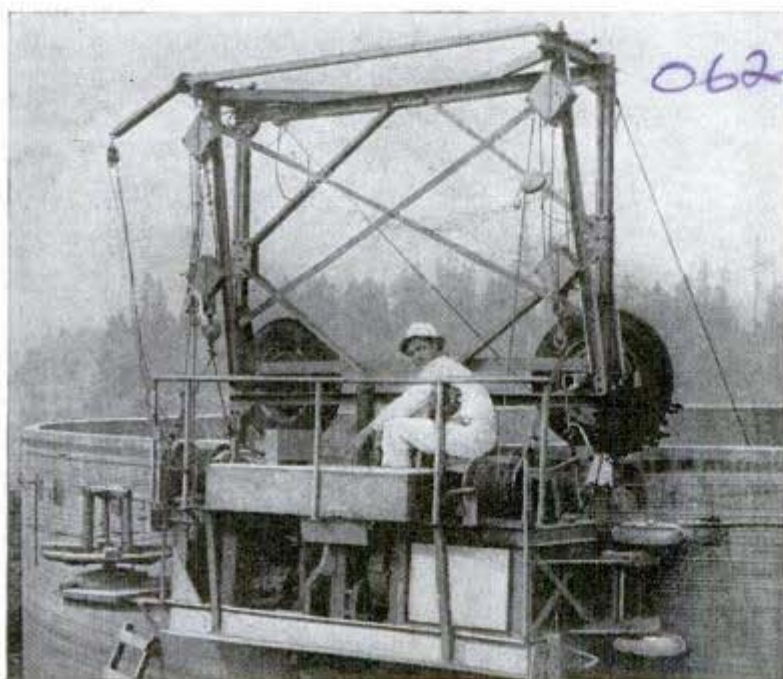
"Boxcar" Camera Speeds Airplane Designing

Three persons can work inside the giant engineering camera in the plaster pattern shop of Consolidated Vultee Aircraft Corporation's Fort Worth, Tex., plant. The camera has a base 8 by 14 feet and its box is 36 feet high. This huge camera, which is believed to be the only piece of air-conditioned photographic equipment, photographs seven square feet of surface. Full-sized master design layouts drawn by engineering draftsmen are photographed one-half size on film held to the top of the camera by a vacuum. The film is printed on 4- by 8-foot sensitized photographic paper or transparent tracing cloth. This paper or cloth is then developed, fixed and washed in the same fashion as ordinary photographs are processed. The camera eliminates countless hours of tracing in the production of blueprints, and is one of the many photographic aids which speed war production.

Photographing a full-sized master design layout in Consolidated Vultee Aircraft's Fort Worth plant with giant box camera. It is said to be the world's largest box camera. Three persons can work inside the air-conditioned box which is speeding the preparation of aircraft blueprints



"Merry-Go-Round" Winds Wire Around Huge Tanks



Heavy wire is wound spirally around concrete tanks with a "merry-go-round" machine that travels around and around the rim. The wire, which is stressed to 150,000 pounds per square inch, prevents the tank from cracking due to shrinkage of the concrete or from pressure within. This method of reinforcement is said to save 88 percent of the steel ordinarily used in reinforcing.

Motorized wire-winding machine travels around rim of a concrete tank at rate of three miles an hour. Wires prevent cracks

SEVEN TRILLION DOLLAR



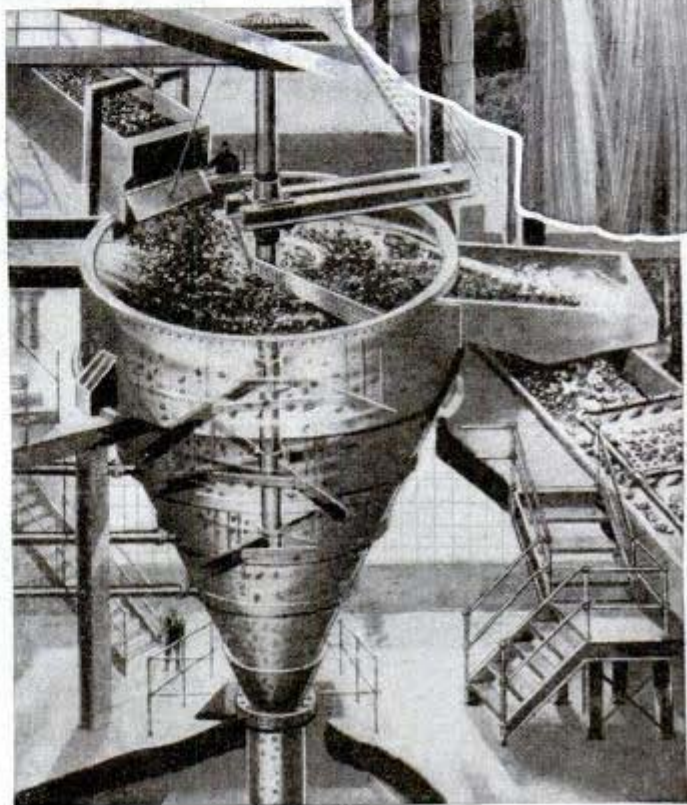
By Roderick M. Grant

THERE are several good reasons for boasting that America is the most powerful nation on earth. One of the reasons is coal.

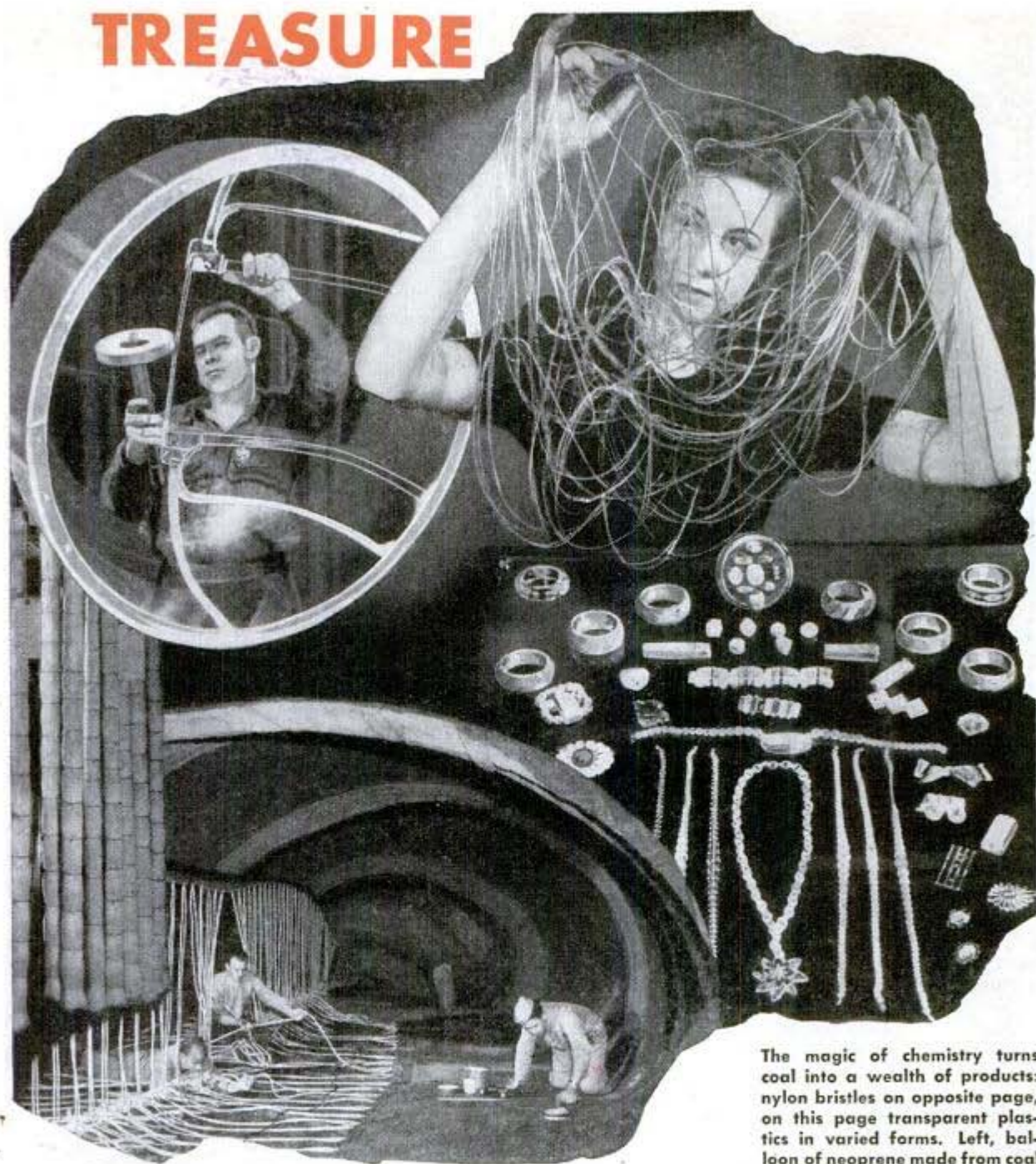
For coal is power, and heat, and a treasure house of chemicals, and we have more of it in our mines than all the rest of the world. In our spendthrift way we dig upwards of 600,000,000 tons of coal every year and think nothing of it unless a war or a strike comes along and threatens us with empty bins in midwinter. As a matter of fact we can afford to be spendthrift. We have coal to burn.

In 200 years we have dug over 20 billion tons of bituminous coal alone. Yet 98 percent of our reserves lie in the ground. We have more than 3,175,000,000,000 tons of anthracite, bituminous, lignite and intermediate grades still in the mines, worth above seven trillion dollars wholesale. A comfortable bank balance. The next generation may see the end of our petroleum and natural gas. We have coal for 3,000 years.

Top, Caterpillar tractor and shovels in strip mine. Below, cleaning coal in cone at a Hudson Coal Co. (Pa.) mine



TREASURE



The magic of chemistry turns coal into a wealth of products: nylon bristles on opposite page, on this page transparent plastics in varied forms. Left, balloon of neoprene made from coal

Primarily, of course, coal is energy. Our railroads alone burn 115 million tons a year, and 53 percent of their freight cars carry nothing but coal. More than half the nation's mechanical energy is derived from coal, 65 percent of our electricity has its origin in the coal mines, and coal is the staff of life to our gigantic steel industry which is dependent on coke from 100 million tons of coal a year. It takes a ton of coal to make a ton of steel.

Prodigious as is the quantity burned for power, coal is going high hat over its chemical importance. The coal tar from coke

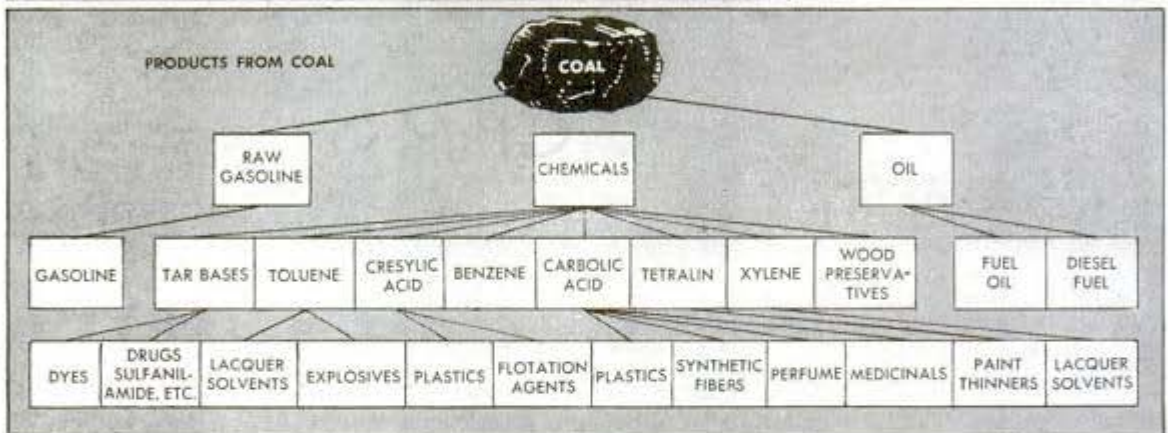
ovens eventuates in such end-products as TNT and aspirin, sulfa drugs and vitamins and insect poison, paints and paint removers, perfumes and plastics and parachutes. The once-wasted gases and liquors and coal tar distilled in coke ovens are so precious today that a drastic cutback in steel production would have a serious effect on industries dependent upon the by-products of coke.

Bituminous (60-75 percent carbon), the coal of power, of heat and chemicals, is mined in 25 states and represents 90 percent of our coal tonnage. Anthracite (90

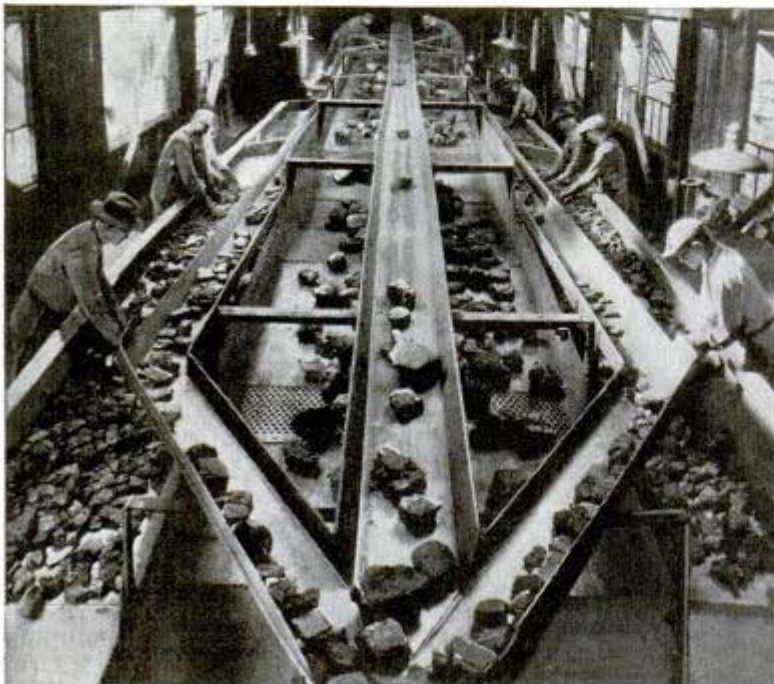


percent carbon) constitutes less than one-tenth of our production and is used principally for heating and cooking in the northeastern states. Most of the coal workings are underground, with West Virginia and Pennsylvania the leading producers; one Pennsylvania pit has a 1,200-mile underground railroad with 500 electric locomotives moving coal in 24,000 cars to shafts where it is hoisted to the surface. Destined to be

Automatic dumper upturns a carload of "black diamonds"
 Bituminous Coal Institute photos



The wide range of coal derivatives is shown in this Bureau of Mines chart
 Coal traveling down chutes and moving belts is sorted by hand at tippie



the biggest producer in the world is the Robena mine, south of Pittsburgh, a wartime development which at full capacity will deliver 20,000 tons daily. Most of this goes to the Clairton coke ovens, where every 45 seconds an oven disgorges 12 tons of white-hot coke, while the by-product gases, coal tar and ammonia liquors are piped away to be processed into 200,000 different products.

A 330-foot coal seam near Cologne, Germany, is the world's thickest. But there are profitable seams only a few inches thick, particularly in strip (surface) mining. Colossal electric shovels, some with booms 325 feet long, make it possible to shovel away 50 feet of soil profit-



ably to reach coal seams less than three feet thick. Probably the most powerful is the gigantic shovel in an eastern Ohio strip mine; it can scoop up every minute a 60-ton bite of soil.

There are still thousands of miners toiling with pick and shovel in underground labyrinths. There are still subterranean coal carts drawn by mules that never see daylight until they retire. But the mining companies have spent more than \$20,000,000 a year for the last 20 years on mechanical equipment and safety apparatus, and today bituminous coal is mechanically extracted in nine out of ten mines, loaded mechanically in two of every five.

Since it costs about as much to transport coal as to mine it, the

(Continued to page 150)

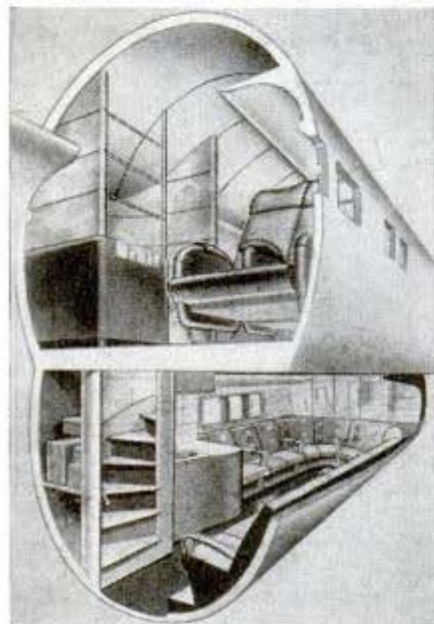
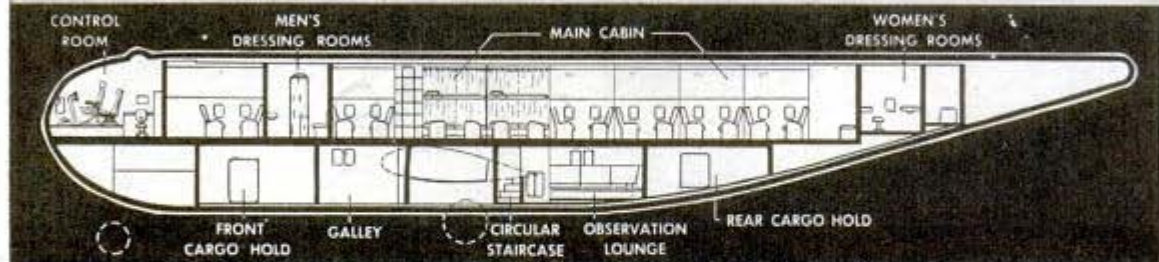
Coal of various sizes, consigned to various destinations, is loaded direct from the mine trestle into railway coal cars

Bituminous coal is extracted mechanically in nine out of ten mines. Below, power saw cuts into horizontal vein of coal

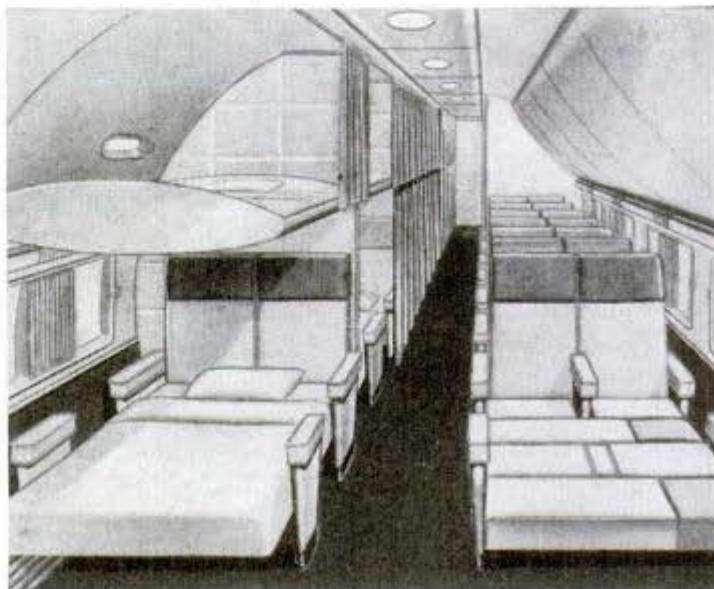


Boeing Co. Sec. 14, Wash. D.C.

Stratocruiser to Span Oceans With 100 Riders



First of the postwar super-transport actually built in a military version is the two-deck Boeing Stratocruiser, an adaptation of the B-29. It will be powered by four engines of 3,500 horsepower each at takeoff (the largest ever made). Cruising speed will be 340 miles an hour and the operating range will be 3,500 miles. There is room for 100 passengers



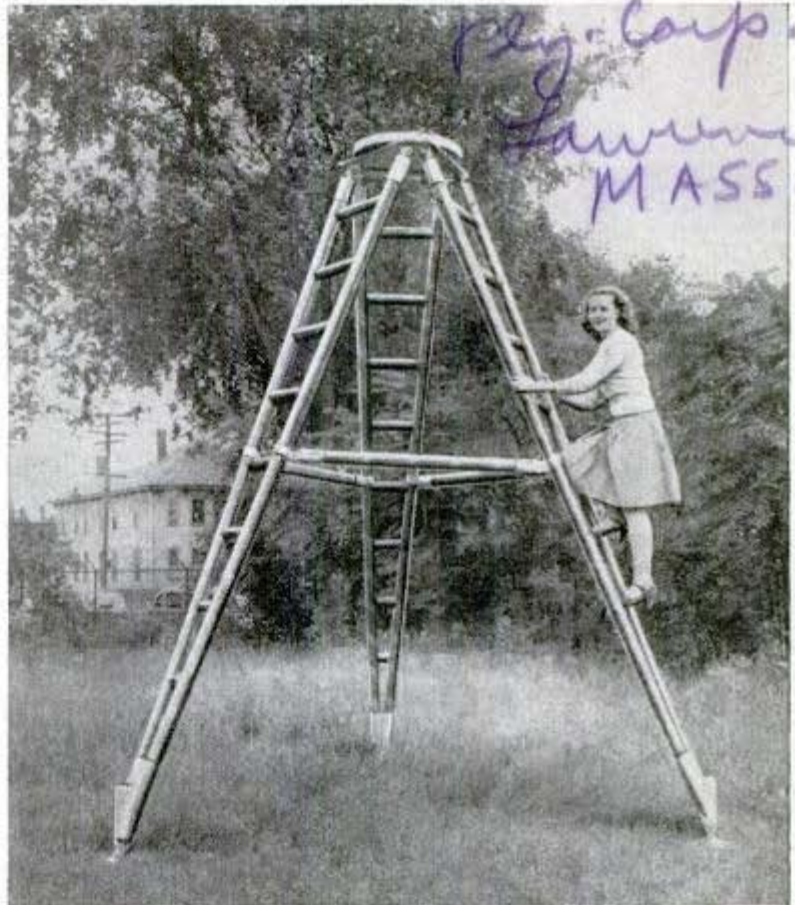
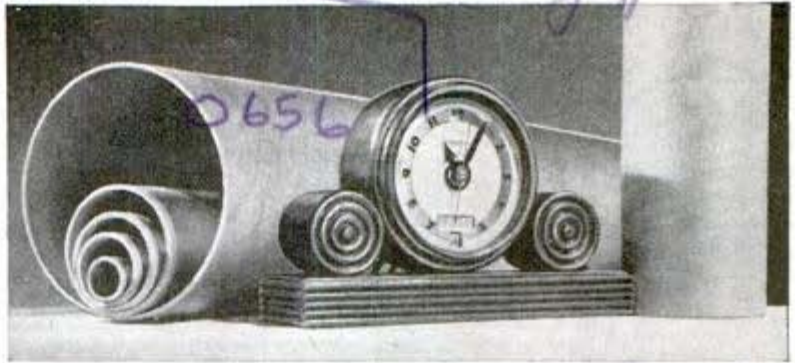
Above, cutaway shows day seats convertible to berths in upper deck and cocktail lounge below. Right, 36 roomy berths in the main cabin

*Swissburg Chas. F. ...
Lewistown, Pa.*

Tubes of Plywood Make Clock Cases Or Stepladders

Many new postwar products will be made of plywood tubing which is lightweight, strong and decorative, and which lends itself to a thousand different applications. Beautiful grain effects make it suitable for clock cases, lamp bases and similar items. It can be used for radio masts, stepladders and as reinforcing members in prefabricated construction. One manufacturer predicts sectional radio masts that will telescope from 90 to six or eight feet. The tubing is made in sizes ranging from less than an inch in diameter to a foot, and wall thicknesses vary depending on strength requirements. War uses of the product, which is made of various types of wood, include sectional poles, radio masts, and some rugged floats.

Clock case (top) is made of plywood tubing, samples of which are shown along with it. Stepladder (right) built of lightweight tubes shows another of the many postwar uses



0348

Sanitary and Frostless Refrigerator Will Have Built-In Freezing Unit

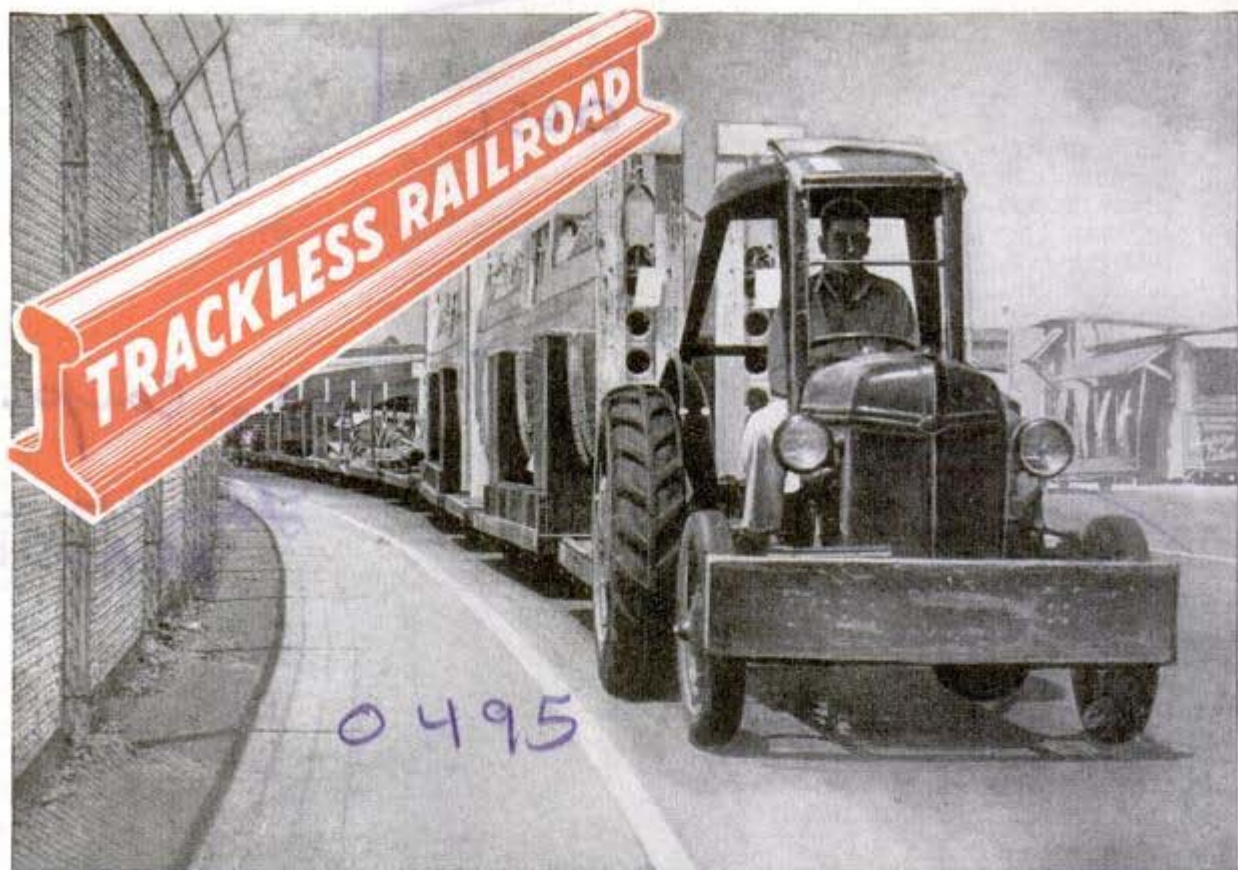
For keeping food fresh for months and freezing your own food at home, a refrigerator with a built-in freezer and without a frost-covered evaporator will be marketed in the postwar period by the Admiral Corporation. The freezer, a separate compartment, will have room to store two bushels of frozen foods and will maintain a temperature of 22 to 32 degrees below freezing. There also will be a large purified moist cold air compartment for the storing of regular foods and no defrosting will be required. The top and back panels of the moist compartment will be chilled to the right degree to insure high humidity, preventing frost. The food will be kept fresh and wholesome for a longer time by

a Sterilamp, which destroys bacteria on exposed surfaces and in the surrounding air by ultra-violet ray action.

U.S. Bureau of Mines Horizontal Drill for "Dry" Wells

Drilling holes horizontally from a chamber at the foot of a shaft sunk deep in the ground is the latest method for the recovery of oil from partly depleted fields. At an experimental project in Pennsylvania, the first two horizontal holes are nearly half a mile long. A 10-foot shaft was dug 388 feet down and a 27-foot circular chamber was constructed at the base. Equipment was lowered and the holes were drilled through portholes in the concrete walls.

*Admiral Corp. 3800
Counthold Sh. Chicago 47, Calif. 55*



Above, "trackless train" delivering sub-assemblies from Convair plant to final assembly line at San Diego. Below, dispatch supervisor hangs tag on board showing that truck has just left Plant 1 for assembly line



DOWN at the San Diego plants of the Consolidated Vultee Aircraft Corporation the "move men" are helping fewer people build more airplanes than anyone dreamed was possible a few years ago.

The "move men" make up the transportation gang. They operate their own indoor-outdoor railroad, using trackless trains made up of tractor units and trailers. They have their own control towers in the form of control points, their own freight handling yards, their own system of tickets, and hundreds of stations.

They even have their own time tables. A routing tag attached to a bundle of aircraft parts may read "Deliver to Station 2510 at 10:21 a.m." The color of the tag shows the building in which the station is located. A paper flag attached to the tag tells the day of delivery by its color, and the design of the flag indicates the shift during which the de-

Art., Los Angeles, 27, Calif.

livery time occurs. Convair's entire system of manufacture is based on punctual deliveries all through the plants.

Most manufacturing establishments stock-pile all small parts and sub-assemblies as they are completed. Units that are needed on the assembly lines are then removed from these reservoirs. Convair has eliminated all stock bins and stock rooms with one or two unimportant exceptions. Parts that are manufactured are picked up at once and begin to move to the places where they will be used in larger assemblies.

Conceived and put into operation by H. L. Smith, general supervisor of production control, the system is one of the reasons why Consolidated Vultee claims the best man-hour efficiency record of any aircraft plant in the United States. A couple of years ago it took 1,000 workers more than a week to turn out one B-24 bomber. Today the same 1,000 workers are building a B-24 in one shift with time left over to start another.

This method has the advantage of allowing a plant to operate at full speed on practically no inventory. Construction changes or even a complete switch to a new design can be made almost at once and there never are expensive stock piles of excess parts on hand.

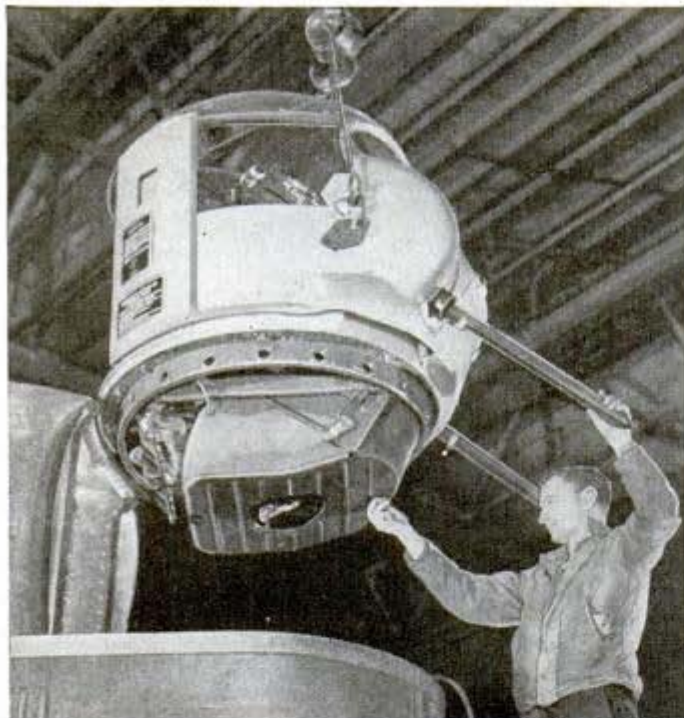
Too, all the confusion and unavoidable mistakes in trying to keep track of parts in storage are eliminated, an important factor because some 1,200,000 different kinds of parts for four models under pro-

Below, an example of one of Convair's many odd-looking "trackless trains" used to transport equipment



Trays full of small parts are moved from station to station by a "lifting dolly" (above) at Consolidated Vultee Aircraft. Below, a truck hauls wing center section of a Liberator bomber from a sub-assembly plant





Overhead crane (above) lowers a nose machine gun turret into a B-24. Right, monorail crane takes sub-assembled hull of a Catalina PBY-5A flying boat to a final assembly line at Consolidated. Below, a small "lifting dolly" picks up a huge Pratt & Whitney engine for transfer to the Consolidated plant's final assembly line for installation in a Liberator. The company's intricate and efficient transportation system allows it to operate at full speed without stock piles



duction would need to be kept on hand.

Smith's control of scheduling extends even to suppliers of materials and parts whose plants are possibly thousands of miles from San Diego. He tells them how much to ship and when to ship it, by air, rail, or truck, so that the goods will reach the assembly plants precisely as needed. Movements en route are checked by telegraph.

Each operation of each department inside the plants is plotted ahead of time by the production control department. Full schedules are prepared for each working day in a 26-day cycle, the orders go out to the control cen-

ters, and the "move men" deliver the materials on schedule.

What happens if there is a breakdown in transportation? Wouldn't a delay in the delivery of even one necessary part hold up the whole manufacturing process? The answer is no, because a delay or shortage is detected in the records before it actually occurs. Threat of a shortage is observed at a control point. At the same time that the cause of delay is being found and remedied, additional parts that were scheduled for later delivery are speeded up and moved along in time to maintain the schedule. The system works so well that on a typical day there were paper

shortages of only three parts out of the hundreds of thousands that were being manufactured and assembled, and actual shortages of none.

The rolling stock used around the plants includes 37 gasoline-operated tractor units, 34 standard trailers, 45 specially-built trailers, 56 car loaders, 36 battery-operated elevator trucks, 113 hand jack trucks, 131 power scooters and 650 bicycles. In addition, much floor space is served by overhead conveyors.

The flow of materials through the plants runs like this: Finished aircraft parts in the fabrication buildings are inspected, are loaded into pans or metal tubs for convenience in handling, are weight-counted and then are moved through inventory control centers where each batch of parts is provided with a routing tag that indicates its destination and time of delivery. The loaded containers move over a roller conveyor to a freight assembly point, where they are picked up by a switch engine in the form of a car loader and are deposited on the proper trailers of an inter-building trailer train. This train pulls out on schedule to make the rounds of buildings at the different plants. One or more trailers are left at each building, and the tubs are removed by car loaders and are then transported by elevator truck or hand truck to the station shown on the routing tag.

Consolidated Vultee has other plants in other parts of the country, where it is turning out cargo versions of the B-24, flying boats, special Model 39 four-motored transports, and the new giant B-32 bomber, details of which are a military secret.

JANUARY, 1945

*Efficient and Business
Machines Corp. 55 Liberty
St. N.Y.C.*

Students Get the Feel of a Bomb Run Without Leaving the Ground



Student bombardiers in the Navy and the Air Forces are given the illusion of making an actual bombing run in a realistic but stationary mock-up of a bombardier's compartment, known officially as the 7A-3 Horizontal Bombing and Dead Reckoning Trainer. The trainer, fitted with regulation instruments, affords practice in bombing accuracy, intercommunication procedure, dead-reckoning navigation, evasive action and other problems of actual combat flight. An optical projector on the floor below the student shows him the image of an actual target area. The image moves according to the altitude and speed set for a particular problem and gives the effect of drift according to a desired crosswind. Mechanical devices reproduce the noise and vibration of the bomber's engines and a refrigerating system produces below-freezing temperatures to accustom the student to working in flying clothes. He releases his bombs exactly as if he were on a real bombing mission. An instructor at a control desk just outside the mock-up keeps track of the instrument settings made by the student and can stop, or "freeze," the trainer at any moment to emphasize a point or analyze errors. After an interval representing the falling of the bombs, a ring and spot of light are flashed onto the target to indicate the point at which the bombs theoretically landed.

ONE-BULB PICTURES



GET the flash bulb away from the camera—that's the rule on which many photographers base techniques which enable them to get around the wartime shortage of bulbs. By aiming the flash gun from a strategic position, one bulb often can be made to do the work of two and in some cases one bulb will produce artistic, "contrasty" effects superior to those obtained with multiple flashes.

All that is needed is a piece of insulated wire long enough to extend the cord which connects the shutter tripper to the battery case from its usual 12 to 15 inches to a total of from three to five feet. In addition to this cord, which frees the bulb from the camera attachment, the photographer can make use of available secondary lighting sources, such as incandescent and window light. Newspapers, white cardboard, bright walls and other light-reflecting materials also will help. Add to these ingredients an alert imagination and you will have an enlarged photographic world to explore with your flashlamp.

After discovering that a "roving bulb" often gives the details, highlights and crispness of multiflash photography,

Above, flash gun was held behind camera on ring apron so as to improve flesh tones. At upper right, flash gun was high, taking advantage of reflecting towel and wall. Below, roving flash gun highlights fast-moving legs



FLASH GUN BEHIND CAMERA



Mr. Warren Elliott, 7, Park Ave.
N.Y. 16, N.Y.

many fans will go a step further and use a 20-foot extension cord and auxiliary socket and reflector for the single bulb. When bulbs become more plentiful, many also will use multiflash with a new appreciation of lighting values gained through one-bulb operation.

If the camera is usually used without a tripod, a

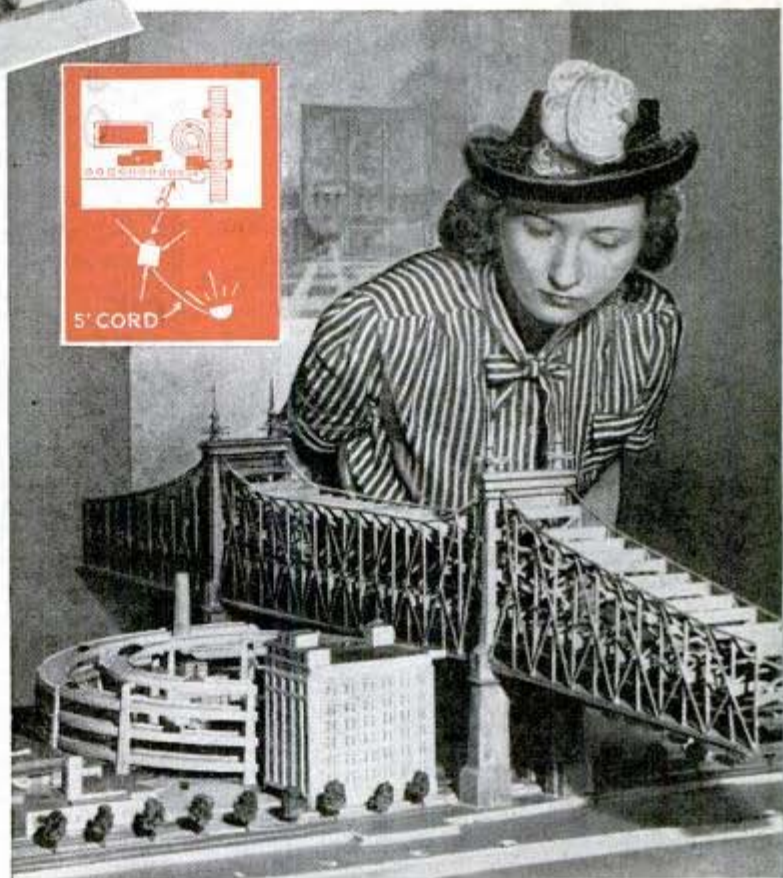


Left, prize-winning one-bulb photo taken with flash aimed from above to catch rope. Above, preparing for an off-the-camera shot. Below, lighting emphasizes building and ramp



three-foot cord is long enough for the one-bulb system. To obtain the extra lighting effects, the flash gun is kept attached to the camera until preliminaries are completed. Then the photographer disconnects the flash gun and moves it above, below or to either side of the lens and backward or forward from the camera. The reflector may be tilted up or down.

When a tripod is used, a five-foot cord will practically double the opportunities to angle-light the subject. Also, the area of movement permitted by this cord will allow photographers who customarily make two shots at different apertures to in-





Above, experimenting with placement of light. Below, reflective surface gives two-bulb evenness here

sure a good negative, to walk forward or backward up to 10 feet, thereby controlling the density of the negative by the distance of the light from the subject without disturbing the aperture. This leeway is advantageous, too, in trying two one-bulb shots of the same subject with entirely different lighting.

Here are some "don'ts" in regard to one-bulb operation listed by Philip Sperry, chief of the phototechnical division of the Wabash Photolamp Corp.:

Don't forget that the cord is not too firmly attached to the tripod; unless you are careful, you can jerk it loose. Don't forget that where the camera formerly directed your light automatically, your hand is doing the job now. Be sure the reflector is aimed exactly where you want it.

Don't forget that when you begin to move your flash bulb around you are more likely to shine the flash into your lens; a lens shade is handy. And don't get the light too close to the subject merely because it's easier to do so with a free-moving flash gun.

The farther the light is held to one side the greater is the resulting contrast and the darker the shadows are likely to be. Unless a bizarre effect is sought, the bulb ordinarily should be held above the lens. Even lighting is accomplished by holding the flash equidistant from portions or sections of the subject.

Sperry also warns beginners against aim-



ing the flash gun at the brightest and therefore most prominent feature of the subject, such as the face. He says this leads to overexposure of the face with details blasted out and underexposure of the garments, which usually are darker and have less reflective quality.

"Another common mistake is to anchor a

subject too close to a wall," he asserts, "unless it is alongside a wall which will reflect light and give a three-dimensional effect. A good rule of thumb is to leave a space equivalent to the height of the subject between the subject and the background, thereby eliminating harsh shadows which usually prevail in close-to-wall exposures."

To obtain multiple-light depth and tonal qualities with only one bulb, the open flash is suggested as a solution. This requires a comparatively long exposure to capture incandescent or indoor daylight, followed by the flash of the single bulb. To the combinations which can be made of fixed incandescent or daylight sources, the flash gun's removal from the camera adds a light source whose distance and angles can be controlled.

The mobility of the flash permits one bulb to be used either as the principal light, with flash gun held fairly close, or as fill-in light, with the gun held at some distance and the reflector removed or the bulb covered by some thin but opaque material, like a handkerchief.

For one-bulb efficiency in general the standard reflector is better than the narrow-beam type which "spots" the light, or the wide and shallow type which spreads illumination over a wide area. The reflector should be between 2½ and 4 in. deep. It should be kept clean and the flash

bulb centered in the reflector. An easy way to check this is to look at the bulb and reflector from a head-on position. When it is centered, the entire reflection of the bulb's bulge can be seen clearly in the shiny surface of the reflector.

Shot at left was made with gun fixed to camera outdoors; right, extension bulb was indoors, camera outside



With gun at photographer's right, flash was made to travel upward, catching both men but subduing unimportant details



*Public Relations
Oahu, Hawaii*

"Stratosphere" Galley for B-29 Keeps Meals Hot for Crew



Piping hot meals can be served to cold, tired Superfortress crews any time they get hungry, thanks to a specially-designed galley only two feet high. The food tray warmer, which keeps pre-cooked meals hot in high-altitude cold, was developed after it was discovered that food cannot be cooked practically at 10,000 feet or higher. Inside its insulated cabinet is a thermostatic heat system which plugs into the plane's electric circuit. It contains six metal trays for holding pre-cooked meat, vegetables and soup, each in a separate compartment; 12 metal cups for fruit juices and coffee; and drawers for bread, rolls, fruit, silverware and straws. Complete, standardized menus of energy-producing foods are prepared for packing in the warmers.

Sky Map Assists Lost Pilots

To eliminate lengthy computations by fighter pilots in a hurry to return to their carrier or land base, a three-part air navigation instrument which takes bearings automatically has been proposed by Dr. T. A. Jaggard of the University of Hawaii. The device consists of a mirror, a lens, and a small star map showing each star in its correct relation to the other stars. By adjusting the mirror so that it reflects images of the actual stars onto the stars of the printed map, and then looking through the lens, the pilot can determine his field of vision. Next, by referring to a special graphic chart and to his watch, he can read almost immediately his exact location in latitude and longitude. By the usual method it takes several minutes to do the figuring, and an error made by a tired pilot may have serious results.

*176. A.I.A.T.
H.I.Q.*

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*Science
Oct 1944*

10,000 H. P. Gas Turbines Predicted for Aircraft

Gas turbine engines capable of 10,000 horsepower may be used in aircraft within the next decade, according to G. W. Vaughan, president of the Wright Aeronautical Corp. Vaughan pointed out that in the high power range the gas turbine offers a large saving in weight and fuel consumption for long range operation and high altitudes. On a giant transport plane the gas turbine engine could mean a saving of as much as 8,000 pounds over current engine types, which would permit 40 or more extra passengers per flight or four more tons of cargo, he said. He added that this might mean reductions in both passenger fares and cargo rates.

*MERECO
101 FALLING CREEK*

Screwdriver Has Offset Shank

By employing a new principle, a war worker in Kaiser's Swan Island shipyards, Portland, Ore., has invented a screwdriver with an offset shank and a rotating handle which greatly speeds up his work. Operated by an easy twist of the wrist, the tool exerts tremendous pressure for tightening screws.



0499

IT'S ALL ELECTRIC *but the HORSES*



0488

This business of betting which horse can run the fastest around a race track—a diversion so old that even George Washington was an addict—has reached the status of a billion dollar a year industry in the United States.

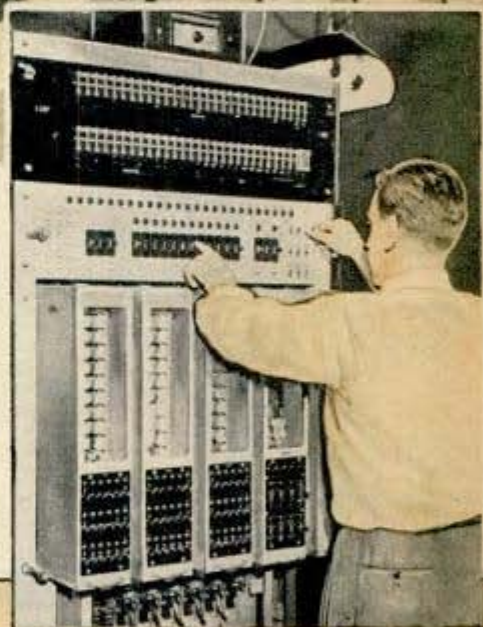
Like all giant American industries, its growth has been made possible by Yankee ingenuity in making machines do the work. Human nature with respect to gambling is the same as it was in Washington's day. It's the electrical devices which have made the difference.

Today, nearly everything on a race track runs mechanically—except the horses. Race tracks employ the biggest adding machines in the world, the biggest timepieces in the world and some of the most accurate cameras in the world—to add and calculate the money, to find out how fast the horses run and to decide beyond the possibility of human error which horse won.

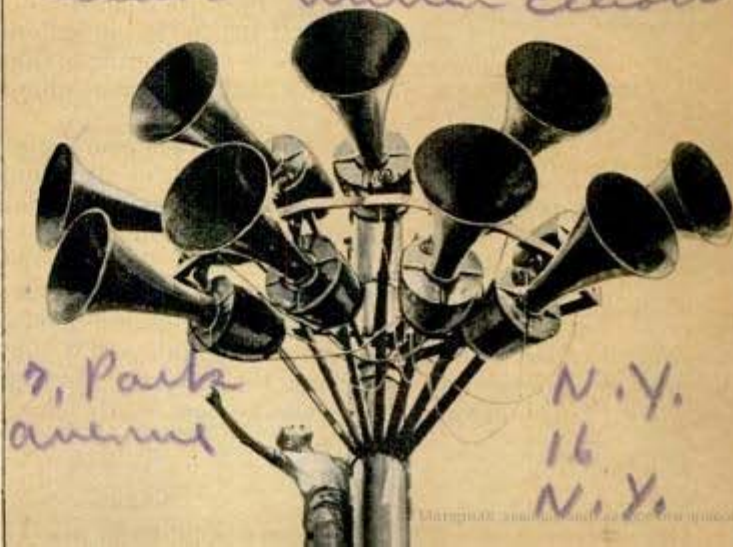
The more the public feels the human element has been removed from management of the horses by use of gadgets and machines, the more it risks its money. And the more machines are installed, the more money can be handled efficiently.

So great has this industry grown in

Crowding the rail, a field of two year olds is off to a flying start. Right, operator of "Totalisator" signals for a "crash test" of all mutuel machines to make certain they are in order. Below, cluster of loudspeakers tells fans who is ahead



allan Warren Elliott

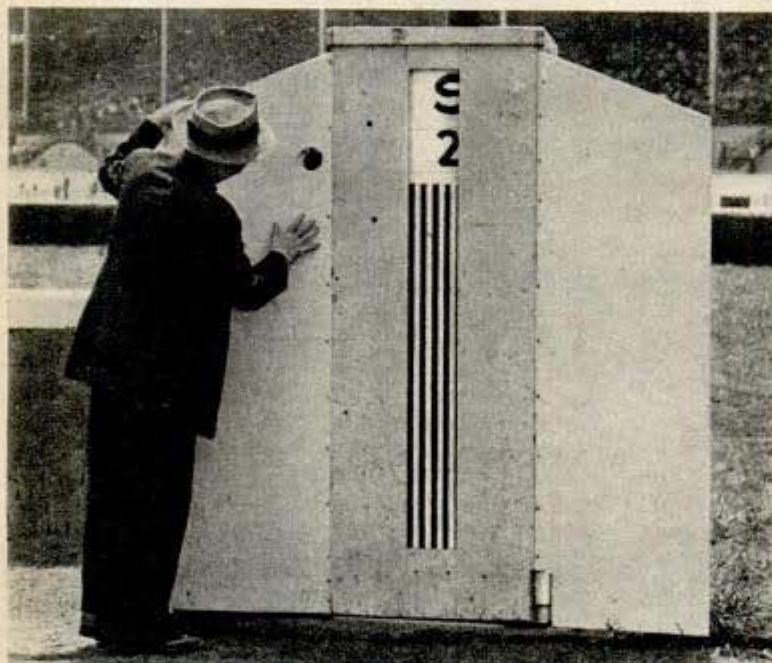


7, Park Avenue

*N.Y.
16
N.Y.*



This typical photo-finish picture was developed, fixed, enlarged, printed and delivered to placing judges in 38 seconds. Below, photoelectric eye catches finish for Teletimer. Camera views slit revealing revolving drum



New York, for example, that the cash drawers of a race track contain \$1,100,000 in sorted currency every morning before the opening of business. This is merely for the making of change for the first races.

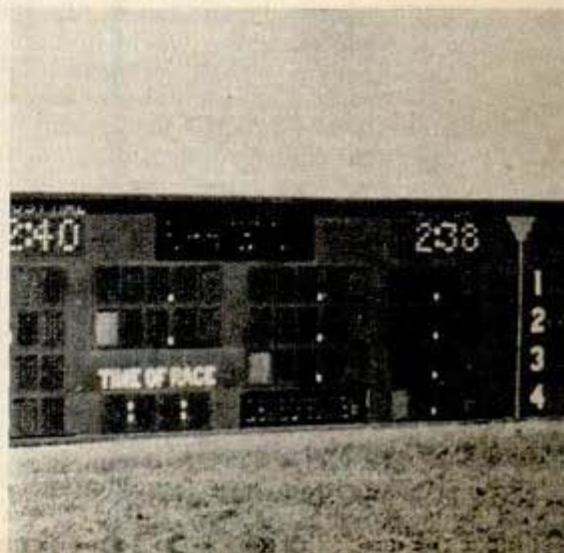
Most of the money taken in on these races is in one or two dollar denominations. If a long-shot won the first or second race and a daily double of, say, \$400 results, it would take so long to hand out small currency that the races would be delayed. Most of the bets are for two dollars, also, and if the gigantic adding machine called a Totalisator were not employed, it would be physically impossible to register the bets and still find time to run the horses.

At a race track like Belmont Park, in New York, more than \$500,000, mostly in small bets, is often wagered within 23 minutes between races. While this is going on, the great calculating machines continually add up the totals electronically for win, place and show and automatically flash them every 90 seconds in clusters of lights on a mutuel board extending as long as some city blocks.

Simultaneously, a score or more of expert calculators figure the winning odds on from three to 30 horses, changing them every 90 seconds as the board flashes new totals.

It takes 730 employees to handle the torrent of money which sometimes reaches \$3,000,000 a day. It takes electrical equipment weighing over 100,000 pounds, including 300 ticket machines and the relays and circuits which carry the totals and flash them to the tote board facing the grandstand. It takes between 600 and 700 miles of wire just to hook up the ticket machines, the adding devices and the tote board where the figures are shown in 3,624 electric lights.

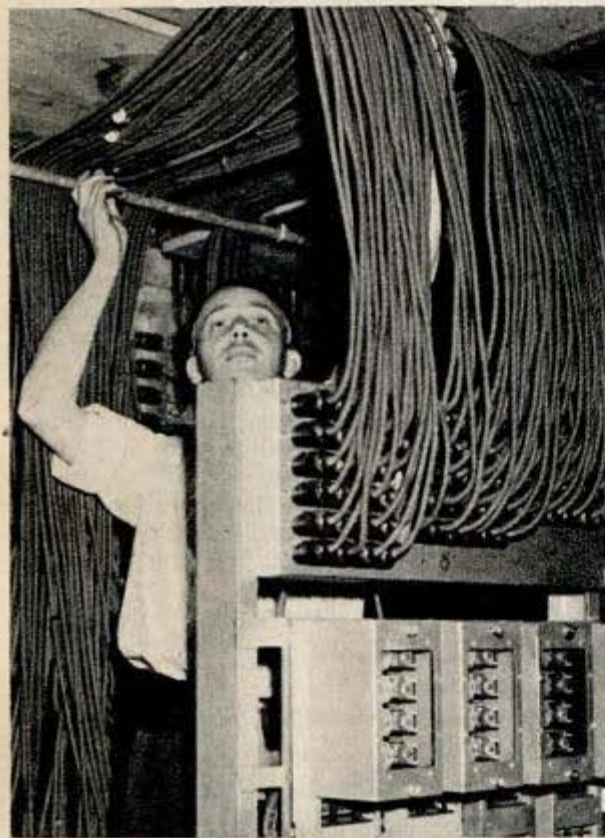
The Totalisator is so completely electrical that, unlike a mechanical adding machine, it does not carry figures, but merely combinations of electrical relays, which in turn light



certain electric bulbs. Only in the bulbs is the result reduced to readable figures.

The giant device is set in motion when a bettor pays for a ticket. The seller punches a key on a machine. An impulse speeds to a row of distributing boxes which set up circuits. In a jiffy this impulse, a weak one, reaches the distributing boxes and finds out if they are too busy with other bets. If they are, the weak impulse dies when it can't crowd in and nothing further happens. The ticket machine does not work.

If there is room for one more bet at that instant, the weak impulse enters, is magnified, registers the bet and in 1/30,000 second flashes back to the ticket machine which then operates.



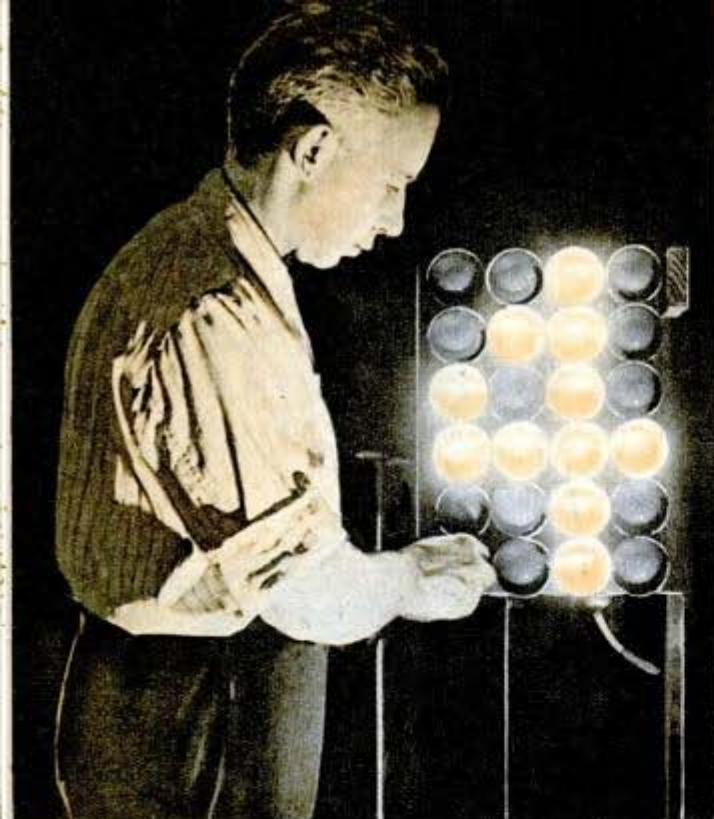
Starter holds a "baton" containing starting button. Cables at left lead to mutuel board

The ticket machine now acts as a printing press, printing a fresh ticket each time. To prevent counterfeiting, one section of the type, with a code known only to one man, is replaced just before each race. The code is an erratic and meaningless combination of figures and letters.

Smaller but just as remarkable is the Photochart camera. This camera can photograph the finish of a race, the film can be removed, developed, fixed, washed, an 8 by 10 print exposed, developed, fixed, washed and delivered by messenger to the stand of the placing judges in 38 seconds. The judges can

Below, view of infield mutuel board which is part of the largest adding machine in world





Operator of tote board flashes figure "4" to test section of bulbs—there are 3,624 in the entire board

examine the print before the horses slow down, turn and run back to the finish line.

In this arrangement nearly everything moves—film, horses and a revolving drum set behind the finish line so that only a strip of it shows. Film and drum are synchronized to the speed of average race horses at the finish, about 37 miles per hour.

The camera, set on the top of the grandstand, 247 feet from the revolving drum at

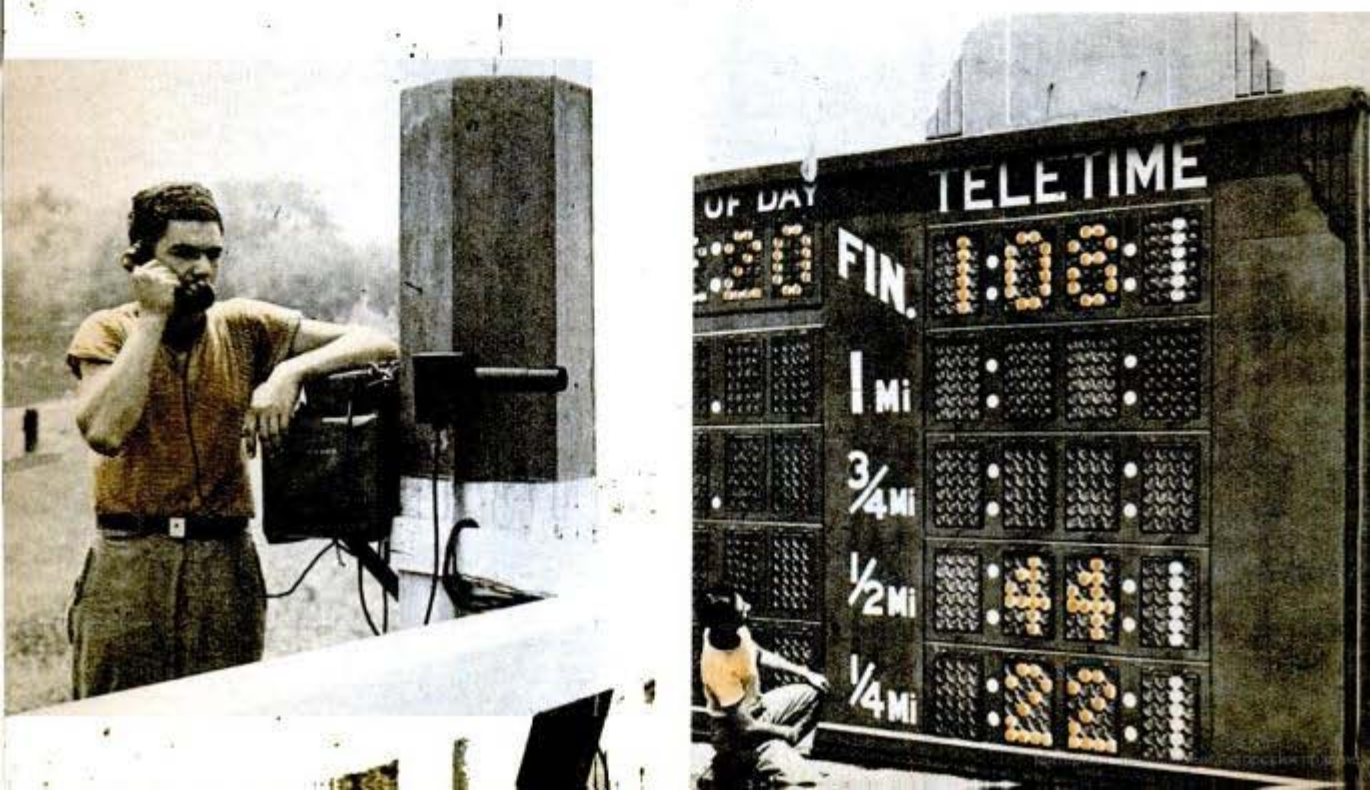
the finish line, has no shutter. A slit $\frac{8}{1,000}$ inch wide opens as soon as the device begins to operate. This slit permits only a three-inch section of the revolving drum and a three-inch section of the race track to register on the film. As each horse crosses the line, he is photographed in continuous, three-inch sections. The name of the track, the number of the race and the date are shown on the drum and repeated on the film as the horses speed past the line.

The timing of the races is accomplished by a Teletimer. A photoelectric eye is set at the start and finish of a race. The first horse to break the invisible beam starts the machine working at the beginning of a race. The same thing occurs at the finish to stop it.

An operator is stationed at a telephone behind the photoelectric unit at the start, so that if an unruly horse breaks out of the starting gate, setting off the Teletimer, notice can be given to reset the device for the real start. As in the Totalisator, there is no room for tampering or human error since the time of a race, by fractions of the distance, is not reproduced in figures in the machine, but is merely carried in relays until the machine is impelled to post the figures by flashing on electric bulbs in the tote board.

The starting gate is another successful attempt to remove the human element from the operation of races. Here horses are taught to stand in stalls with doors closed in their faces until a bell is rung. When the starter presses a button in his lofty perch above the track, the bell clangs and an electrical contact is broken. This releases a magnetic lock which has held the gates

Tube at left holds photoelectric cell to register start of race. Right, Teletimer operator checking board





Starting gates work on principle of magnetic lock. When gate is released, bar drops and springs pull doors back

closed and they are flipped back, out of the way, by springs.

Opening of the gate is usually a signal for an outburst of wild yells by the jockeys who startle the horses into a fast run. The riders must keep an eye on a flag held by a man near the starting gate. Unless he drops the flag the start is not official.

Mechanical devices and gadgets have their places in the lives of these jockeys, too. Electric "hot boxes" are available in the jockey rooms to sweat down their weight. Heat, ultraviolet, diathermy and other machines which tend to eliminate soreness and the effects of injuries are constantly employed.

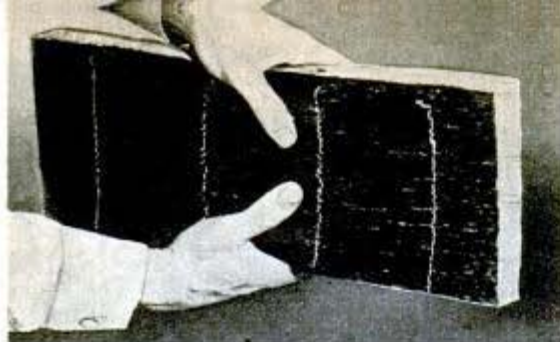
Other methods of automatically safeguarding the public's money include a system of identification by photographs and distinc-

(Continued to page 162)



Above, demonstrating how gates are closed on horses. The bar above controls a catch which holds them shut. Note padding which protects nervous thoroughbreds. Left, a jockey selects numbered blanket for horse





Insulation Opens Like Accordion To Five Times Its Bulk

Insulation material, which is compressed to save shipping space, expands like an accordion to more than five times its bulk when installed. A special process for obtaining dead-air spaces makes this new insulation thicker when expanded.

Hard Metals Get "Screen Test" With Electronic "Projector"

Hours spent in making chemical tests are saved by checking the hardness of metals with an electronic cyclograph, which does the job in seconds. A piece of metal of known type and hardness is first dropped into a small magnetic coil attached to the cyclograph and a reading is made on two cathode ray screens. Using this reading as a guide, any number of pieces of metal can be inserted into the coil and checked with

70 *Passaic, N.J.*

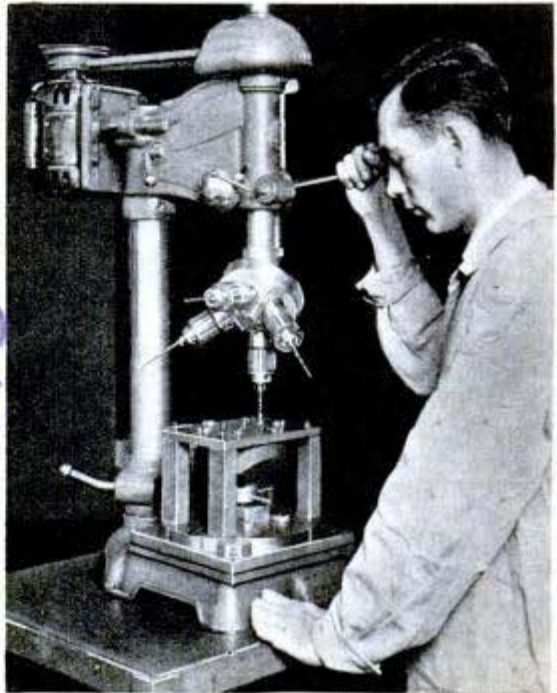
the instrument. In cases where the kind and hardness of metal are not known, it can be identified by placing it in the coil, taking a reading and referring to specially designed charts. The cyclograph helps to eliminate soft shell cases which, if fired, would ruin the gun.

Better Chairs and Sagless Hose Promised in Super-Plastics

Super-plastics turned to civilian uses after the war will result in furniture which will not break under sudden blows, plastic combs which will not crack or become soft when heated, and rayon stockings which will not sag at the knees and ankles, according to predictions made at a joint meeting of the Society of Rheology and the Polytechnic Institute of Brooklyn. As an example of the newer plastic materials, polythene, a waxlike substance produced from coal and oil, was cited for its outstanding toughness and resistance to stresses. During the war it is used to make vital radio and radar parts; in the postwar period it will be used for television sets, telephones, radios, and other equipment.

Drill Press With Turret Head Is Four Times More Useful

By attaching a turret head, the usefulness of a drill press can be quadrupled. The turret head can be used for all drill press operations—drilling, counter-boring, sinking, reaming and spot-facing—when the tools can be held and driven in an ordinary drill chuck. The head is attached easily and a new tool can be brought into position quickly by fingertip control. Only the tool in working position rotates. It is held in position rigidly to avoid slipping.



Ala. 1. Ave of Chicago 3.

Chicago 949 N. W. 16th St.

*Press Ass. Inc. 51 Rocky Center
Pleasant N.Y. N.Y. 05876*

Twin Ducks Form Catamaran for Carrying P-38



P-38 fighter planes are transported from ship to shore overseas aboard "ducks" which are lashed in pairs, to form cata-

marans. This method of unloading from vessels makes it possible for planes to be delivered to remote airports ready to fly.

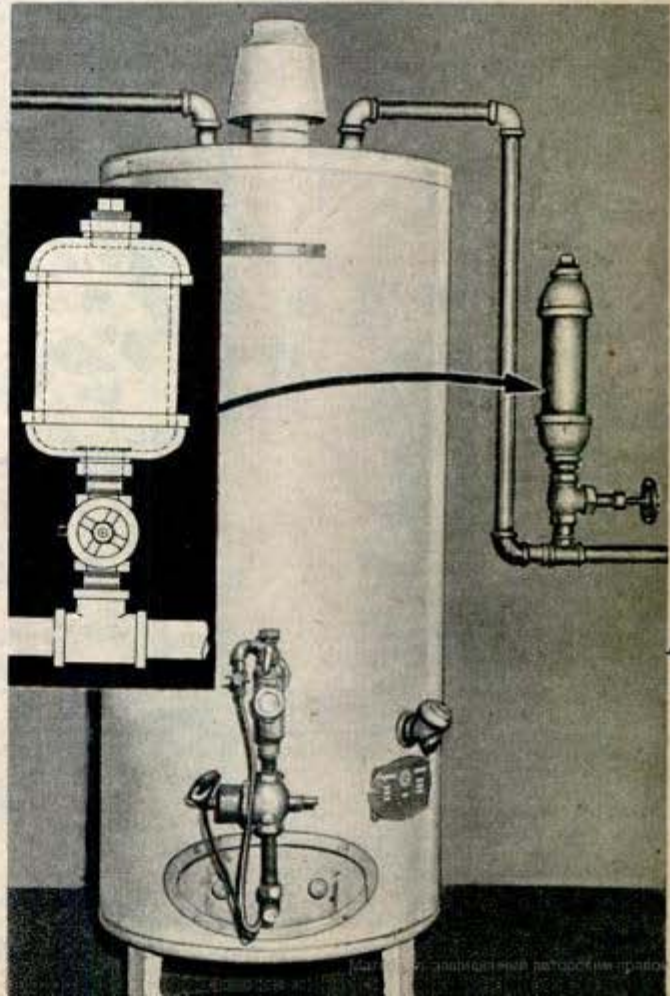
*Calgon Inc. Hagen Bldg. 323 Fifth
Pills. 22 Pa.*

Minerals in Water "Locked" to Protect Tanks and Pipes

Lime-scale deposits and rust inside hot water tanks and in pipes are eliminated with a chemical which ties up the minerals in water so they cannot form a scale. The chemical is made from food-grade phosphoric acid, and it takes only one-fourth of a pound for each 6,000 gallons of water. A simple feeder, made from pipe fittings, can be attached to the main water line of an ordinary hot water heater. A removable plug or gate valve is used at the top.

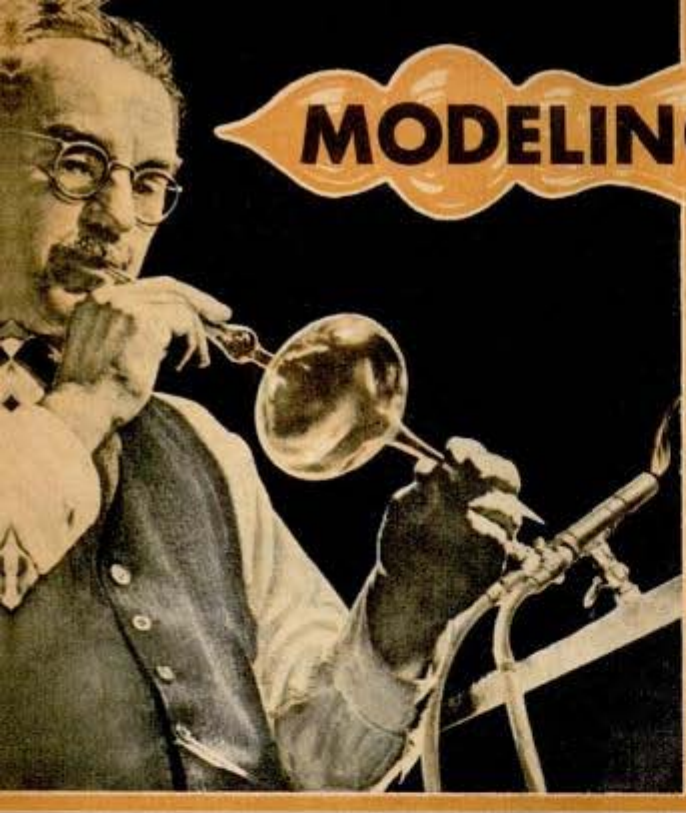
Electric Control Speeds Milling From 13½ Hours to 5 Minutes

Five minutes rather than 13½ hours are now required to machine aluminum spar beams used as internal supports for airplane wings, thanks to General Electric's Thy-mo-trol, an electronic control installed on a traveling-carriage milling machine in a Cleveland aircraft plant. The machine provides four cutters which operate at speeds of 3,600 and 10,800 revolutions per minute. The Thy-mo-trol automatically adjusts the speed of the carriage along the table, providing low speeds for heavy cuts and high speeds for light cuts and thus greatly reducing the time required to perform the various milling and beveling operations on each spar beam.



0446

Machining works, lines 3910, with Palmer St. Chicago



MODELING MARINE LIFE

*Blown by
Herman Mueller*

*American Museum of Natural History
New York City*

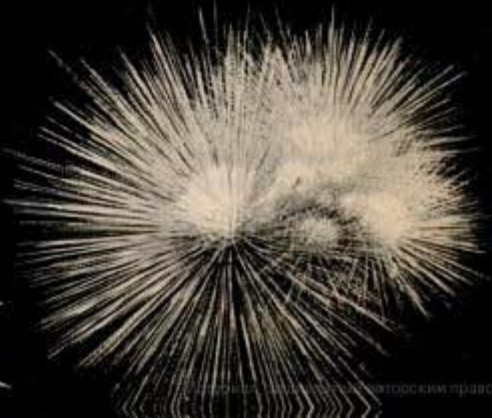
Herman Mueller is forever blowing glass bubbles in complicated shapes. Some of his blown-glass gems depict marine life forms magnified many, many times and are displayed by New York's American Museum of Natural History. He works almost entirely from water-color drawings or sketches and a single model sometimes requires 100 different views. Scientifically accurate to the smallest detail, the models are blown from glass tubes an inch in diameter, or glass rods a quarter inch thick. They are painted with an air brush

Below, nucleus (left of center) and other particles inside the larger glass "egg" of this single-celled animal were blown separately before being attached with adhesive or wire



What appears to be fancy lace work (above) is another protozoan model blown out of glass from drawings

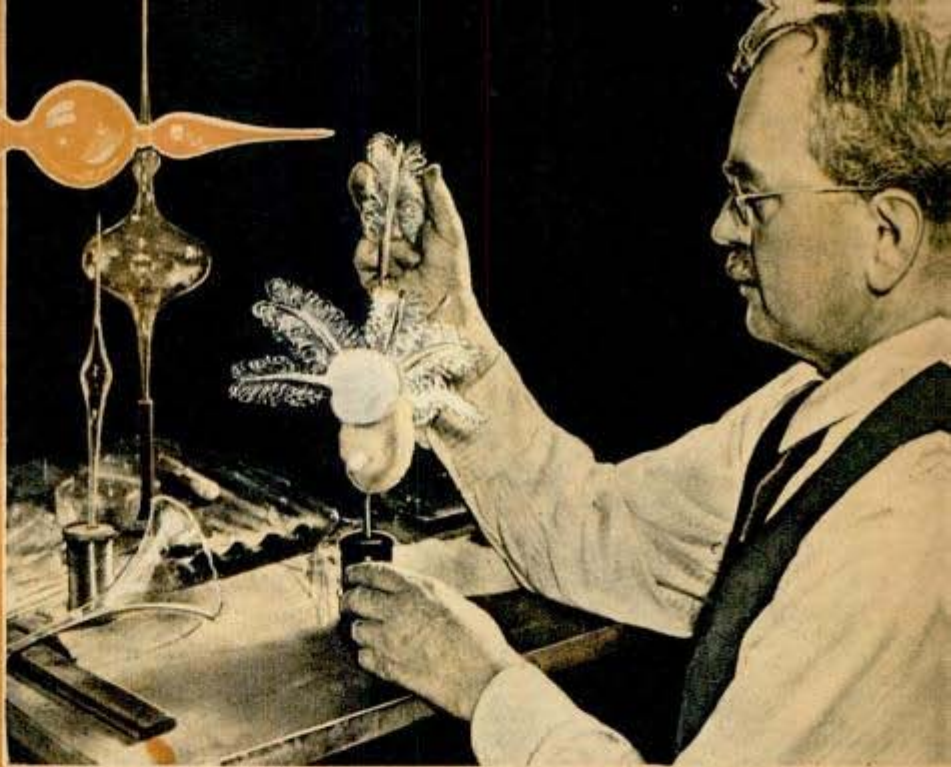
Below, a protozoan model with hundreds of spicules looks difficult but is one of the easiest to make



0561

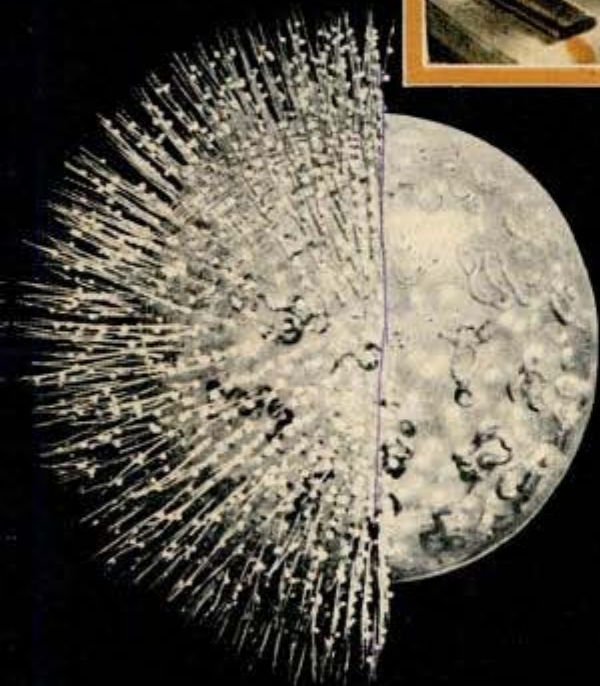
in GLASS

Right, Mueller fits tentacles on a Cephalodiscus model. Colorings are sometimes natural but often go according to an arbitrary chart so that by following one color through various organisms a student can trace the development of the skeleton, nervous structure, circulatory system and any other parts

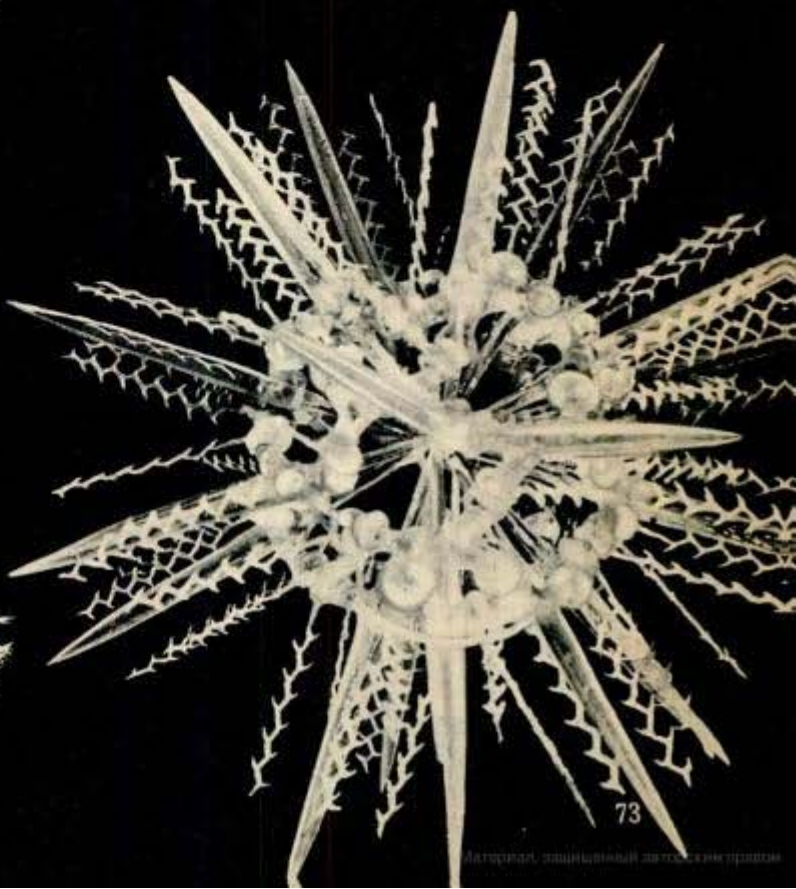
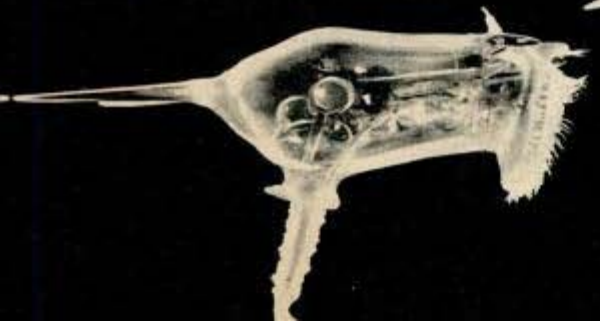


Left, a Canary Islands protozoan which has spicules all over its surface. The organism is shown half-denuded so the part underneath is visible

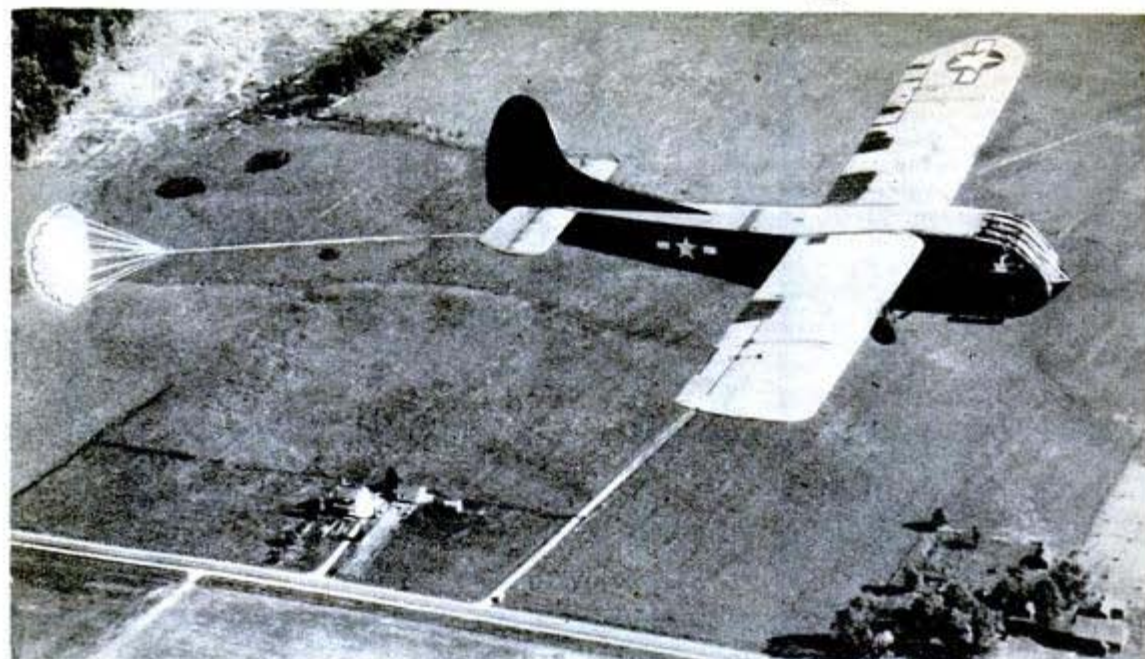
Below—frozen lightning? No, just another radiolarian, a tiny organism barely visible to the eye, but which, like the other marine models, has been magnified tremendously in the glass reproduction



Actually this rotifer (below) is about as big as a mote of dust seen in a sunbeam, perhaps 1/50 of an inch long. The glass model, about six inches long, enlarged this marine animal eight million times



Parachute Acts as Brake in Landing Giant Glider

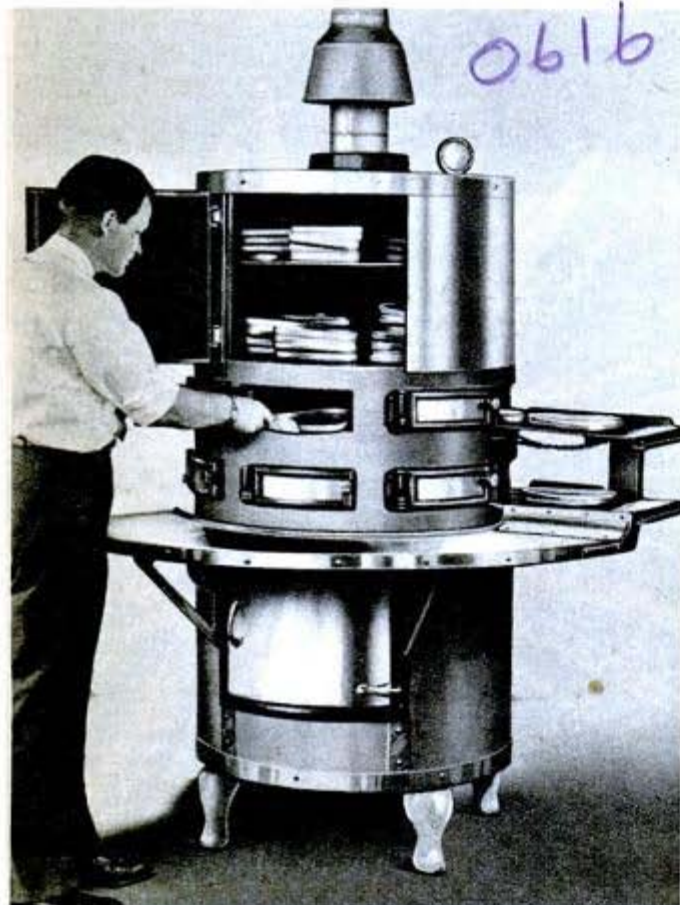


Giant troop-carrying gliders can land in smaller areas and with less danger of cracking up when they are equipped with a parachute "air brake." Ten-foot nylon drag parachutes were used in successful

tests conducted recently at the Clinton County Army Air Base, Wilmington, Ohio. The parachute can be kept open during the entire landing operation, or released at any time by controls in the cockpit of the glider.

Greeth Mfg. Co. 126 N. Union Ave. Chicago, Ill.

Steaks Pop Out of Rotary Cooker Like Automatic Toaster



0616

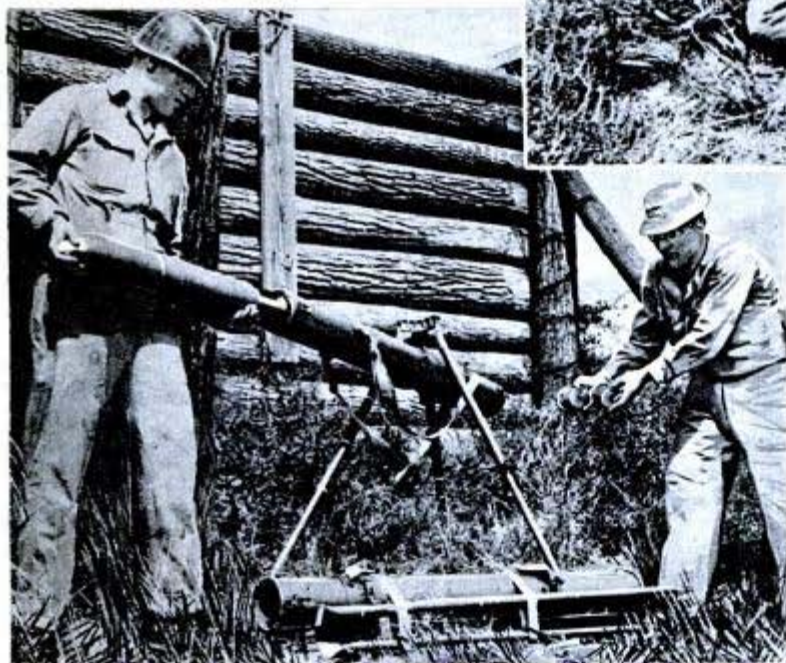
"Cooking with gas" is given a revolutionary twist with a rotary cooker employing reflected heat. Designed for restaurant use, it can turn out 200 steaks an hour and cooks chicken in only eight minutes. There are compartments for cooking meat either rare, medium or well done, and when the meat is done it is automatically ejected "toaster style" onto a ramp where it can be picked up for serving. Casseroles are preheated in an upper compartment kept at a temperature of about 450 degrees. By reducing the temperature, this space can also be used for baking or roasting. The cooking chamber, which has six compartments, is kept at a temperature of 850 degrees. Specially constructed fire brick encircles the gas burner, and the heat is reflected from the bricks to the food. The intense heat seals the vitamin-rich juices in meat, and the process is said to eliminate smoke, grease and odor. The inside of the cooker never has to be cleaned. It is 63 inches high and weighs 1,200 pounds.

Ⓢ Lignin extract, which is obtained in abundance in Canada as a by-product of the pulp and paper industry, has been used successfully as a stabilizing material in road construction in Quebec.

0312

One-Man Bazooka Is Fired by Remote Control

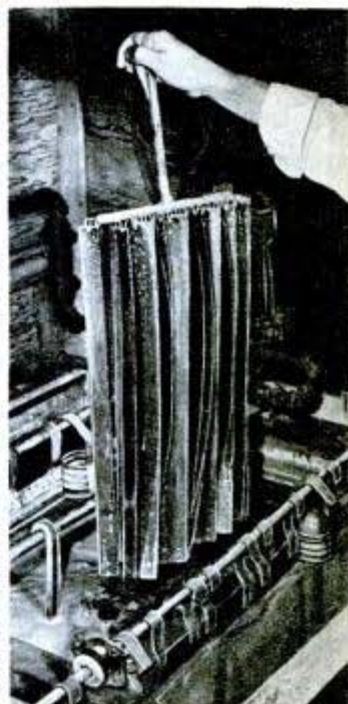
Light enough to be carried and fired by one man, the Rocket Launcher M-12, a new type bazooka, was designed as the infantryman's artillery. The big brother of the original bazooka is more than two inches larger and packs as much destructive punch as a 105-mm. howitzer. The equipment consists of a four-foot tube and a tripod on which the tube is mounted when ready for firing. The 4.5-inch projectile for the 35-



pound gun is three feet long to provide a maximum wallop for enemy gun emplacements. The gun is easily set up for quick use by unstrapping its tripod mount and fastening the rocket launcher on it. Wires lead to a safe distance where the battery to detonate it is located. After they tumble over backward upon being fired, the rocket launchers and tripods can be picked up and used over again.

New Plating Slows Corrosion on Electrical Instruments

Bright Alloy, a three-metal, weather-resistant plating process which scientists have sought since the last century, has been developed by Westinghouse. From copper, tin and zinc the process evolves a compound which provides a tough, protective coating for instruments in war machines. The coating not only resists corrosion and tarnish, which are very difficult to combat in tropical regions, but its nonmagnetic quality also improves the electrical performance on which the calculations of the fighter pilot or the beachhead radio operator depend. The process permits much thinner coatings than do conventional anticorrosives. After the war Bright Alloy probably will be used to cover many items of general hardware subject to corrosion.



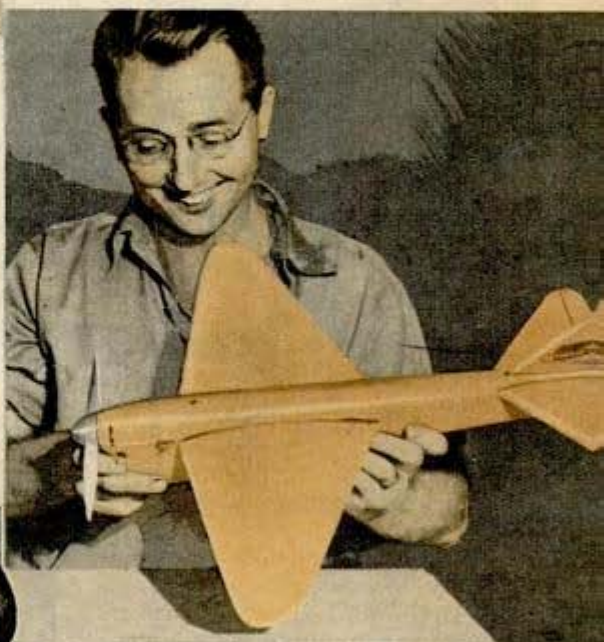
FLYING *the* POWER MIDGETS



Above, model builders and their planes. Below, a speed plane which holds 112 mile an hour record has deep rooted stub wings and enclosed engine

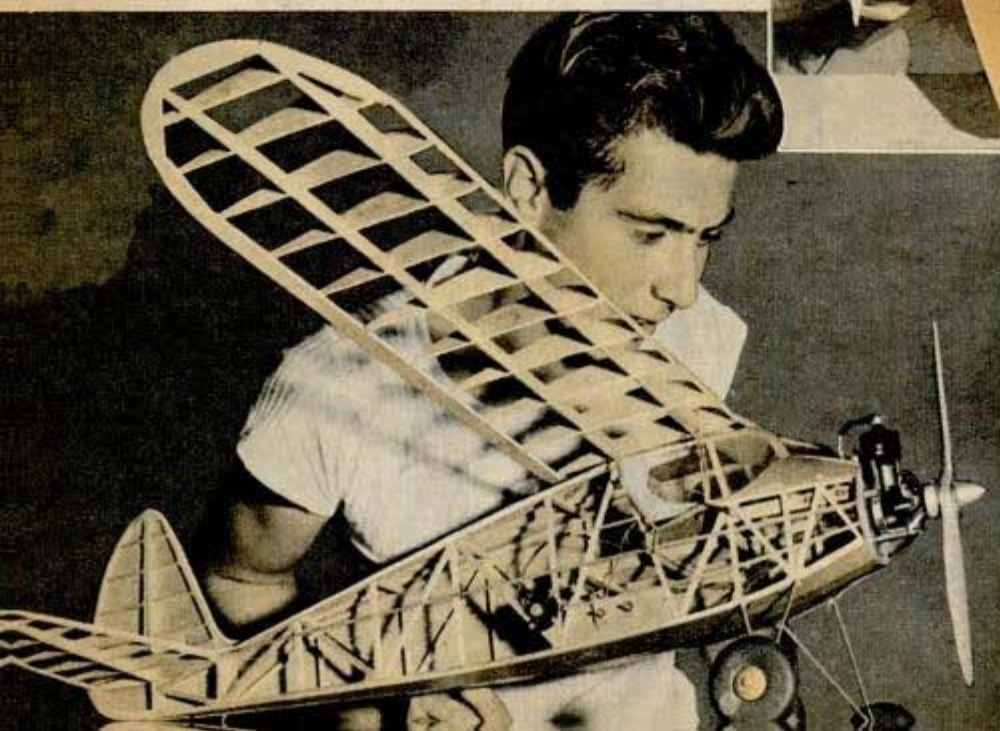
THE flying of powered model airplanes is a 25 million dollar a year sport in the United States today and enthusiasts who have flown their tiny aircraft at better than 100 miles per hour confidently expect to reach speeds above 200 miles per hour within the next 12 months.

A world record of 112 miles per hour was recently set by a bullet-like "Williams-Clark Special" that has a wing span of 18 inches and a gross weight of two pounds. The model is powered by a 12 ounce, one cylinder aircooled engine that develops one horsepower at 16,000 r.p.m. Its hollow balsa wood wing and fuselage are built up of tiny



planks $\frac{3}{4}$ inch wide and $\frac{1}{16}$ inch thick. Its speed record is equivalent to a scale speed of 1,700 miles per hour in a full sized version of the model, an absurdity that nevertheless indicates the skill and care with which

Cutaway model of a free flight plane that shows the interior construction





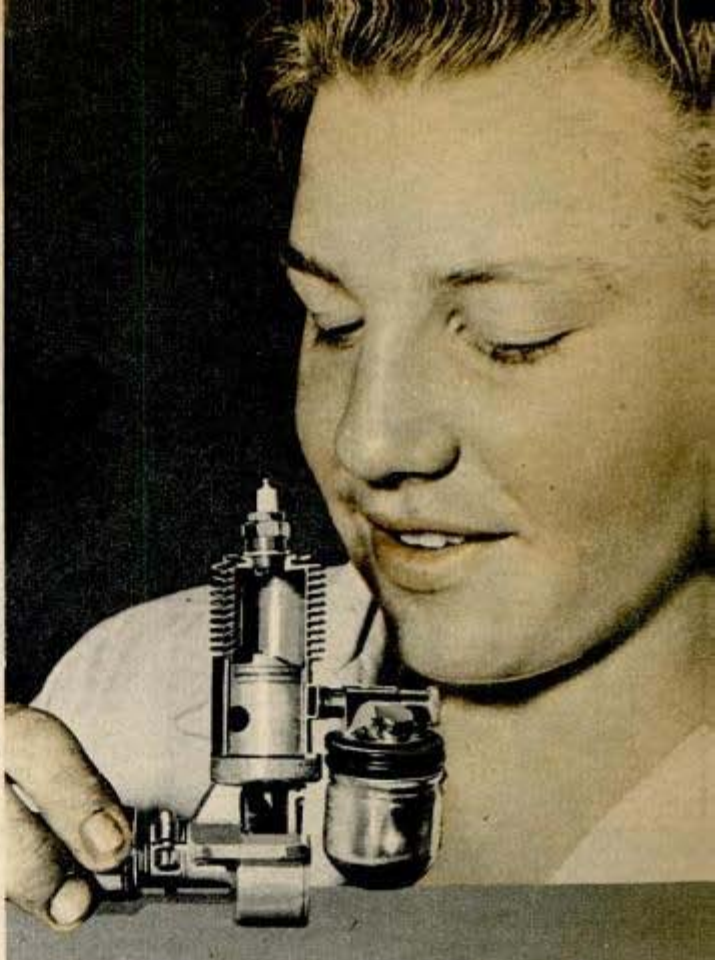
Above, flying wing's landing gear retracts into hull due to centrifugal pull when it is flown on a control wire. Right, interior of tiny motor

model racing planes are designed and built.

Model racing enthusiasts suggest that it is entirely possible that the research they are doing with models will contribute to the efficiency and speed of tomorrow's large aircraft. They point out that a scale model of a German Messerschmitt has been clocked at 106 miles per hour, an indication of the efficiency of this particular plane, but that models with tapering, deep rooted wings designed by themselves are considerably faster than models of Messerschmitts or other fast combat planes.

Model speed planes are flown at the ends of two 70-foot piano wires that the operator holds in his hands and by means of which he can dive or climb the plane while it travels in a circle around him. Several planes can be flown from the center of the same circle and can be made to dog fight, perform loops, and fly upside down. Even greater speeds than the present record have been made by attaching the control lines to the end of a four-foot rod that the operator whirls around his head in slingshot fashion.

Free flight models that rise off the ground or that are launched by hand compete for endurance records instead of for speed. An automatic timer cuts the engine at the end of 20 seconds of flight, after which the plane glides gently toward the earth. Miniature free flying planes have remained aloft



Launching model plane at start of endurance test





Above, substituting a propeller of a different pitch. Some propeller tip speeds reach 45,000 feet a minute



Left, record breaking speed plane. Note the air scoop below propeller which admits carburetor and cooling air to the enclosed engine

Below, high speed scale model of Messerschmitt that does 106 miles per hour, held above its takeoff dolly from which it rises into the air



plane consists of a glider with a commercial firecracker attached under the fuselage. The fuse end of the fire cracker is opened up so that the powder burns like a squib instead of exploding when ignited. A large cracker of the "half inch steel turning" type provides a few seconds of terrific thrust during which time the rocket plane attains a speed of around 100 miles per hour, after which it glides gently to the ground.

Moderately large models that are controlled during flight by means of radio signals were being experimented with before the war and work will be resumed on this type when material is available.

Model builders have their own national organization, the Academy of Model Aeronautics, whose chapters consist of various local clubs. One such chapter, the Los Angeles Aero Modelers, has several hundred members ranging in age from 10 to 60 years. The Aero Modelers maintains its own model airport, laid out with flight and contest areas, spectators' parking, public address system, and other facilities.

The club holds semiannual contests for both free flight

for more than an hour when caught by an uprising thermal current.

Dozens of odd types of aircraft have been built, including gliders with wing spans of up to seven feet, flying wings, helicopters of various designs that rise off the ground under their own power, wing flapping ornithopters, and tail-first aircraft. Jet propulsion aircraft are of current interest and many builders are working on designs for free and controlled flight. One simple rocket



endurance records and wire controlled speed flying. Each type of competition is divided into three classes based on the engine displacements of the models. War bonds and similar prizes go to the winners of the events. Spectators pay 10 cents for admission. For safety, no one except contestants and judges is allowed on the field. A two pound model flying 50 miles per hour is a dangerous missile and could knock a man down. A person might be killed or gravely injured if hit by a model plane flying above 100 miles per hour.

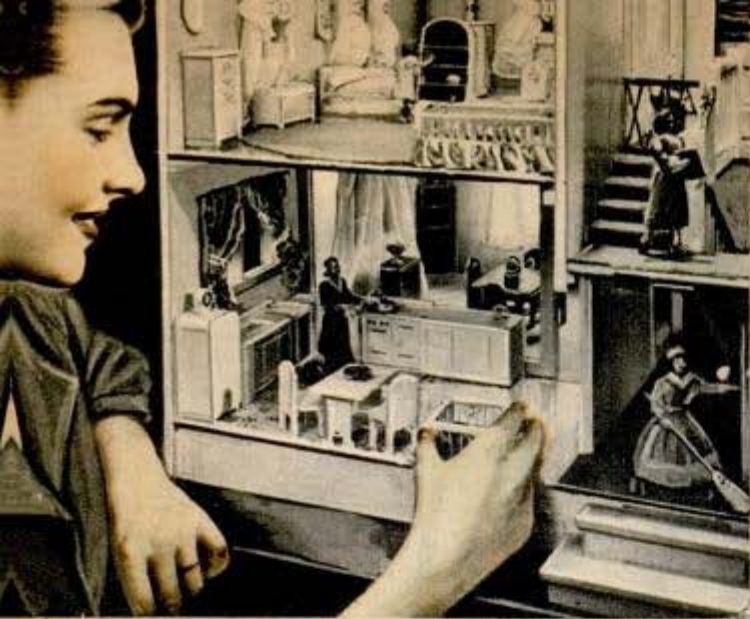
Some "speed jobs" are valued at more than \$500 but most model builders assemble their planes from factory kits that sell for only a few dollars. The cost of a free flight miniature airplane, including engine, may total \$25, while the cost of a controlled speed plane is about \$75. Lightweight balsa wood is a universal material. Bamboo paper doped with nitrate is a practical covering for the wings and fuselages of free flight model planes.

(Continued to page 158)

Below, this model lands on one wheel and skid. Elimination of other wheel reduces wind drag and increases the speed

Twin boom endurance plane (above) similar to P-38 Lightning is ready for launching test. Below, weighing model plane. This one has a gross weight of just under fifteen ounces





National Safety Council, 20 N. Wacker Drive, Chicago 6, Ill.
BUILT-IN Safety
 0627

Every year accidents in the home reap a death toll of 32,500. The miniature house shown here stresses safety features for your home—from the outside steps of not over three risers (unless handrail is provided) to a locked cabinet in the bathroom for storing poisonous medicines. The kitchen (above) features rounded corners on cupboards and counters, doors that slide, non-skid floor and well-lighted work area. The nursery (right) has a cabinet for storing those toys that grownups trip over. Below, furniture in the bedroom is arranged to prevent stumbling accidents, and carpets in all rooms are sized to be slip-proof. This no-accident home was built by the National Safety Council



0579
N.A. So Lakehurst N.J.

Plane Drops "Pararaft" to Shipwrecked Flyers

Two steps make up the Navy's sea-air rescue system for flyers forced down in the ocean. First, a plane throws the castaways an AR-1 unit for their protection and then they are picked up by either a blimp or helicopter. The AR-1 consists of two containers connected with about 20 feet of floating line. A "pararaft" with paddles is stowed in one container; in the other is a small amount of survival equipment. In a recent demonstration it took the "survivors" only 70 seconds to inflate the raft and paddle in the direction of safety.



Shuss a T.B.F.
Hellcat drops line and two containers holding a "pararaft" and other survival equipment to "castaways" in practice rescue. Left, helicopter drops tow line so sailor can pull himself up from life raft

Mister MAYER Co. 255 McCornie Pl.

Spray for Stripping Wall Paper Attached to Garden Hose

Wall paper is easily peeled off in large strips down to the bare walls, once it has been watered with a sprayer which can be attached to the garden hose. The hose's regular nozzle is removed and the special spray nozzle is screwed tightly in place. Then the water is turned on about one-eighth of the way and when all the air is out of the hose a fine mistlike spray of water can be seen coming from the tiny hole in the nozzle. Holding the nozzle 15 to 18 inches away from the surface of the ceiling or wall, the sprayer moves the nozzle over the paper slowly enough to dampen it thoroughly but fast enough so that the mist will not form drops of water and fall. After repeating the operation two or three times, the paper can be peeled off. When the mist is too fine or the nozzle stops up, new holes can be opened up with a very fine needle.

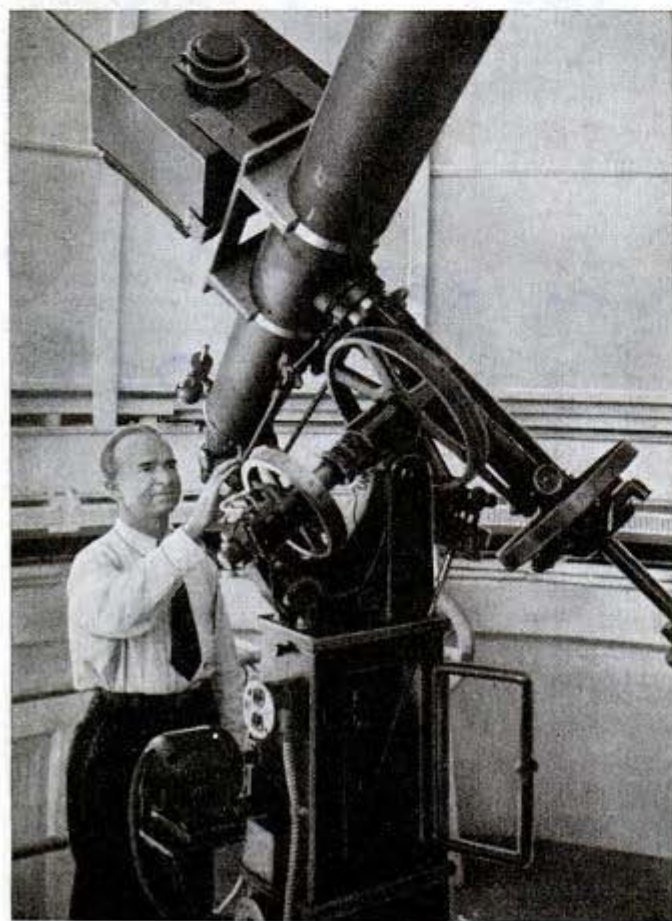


0522
Concord, Ohio

SHARPER EYES *for* STARGAZERS



Space between the stars is filled with clouds of dark obscuring matter which astronomers must penetrate. Below, box on telescope tube at Mt. Wilson Observatory holds camera



By Robert S. Richardson

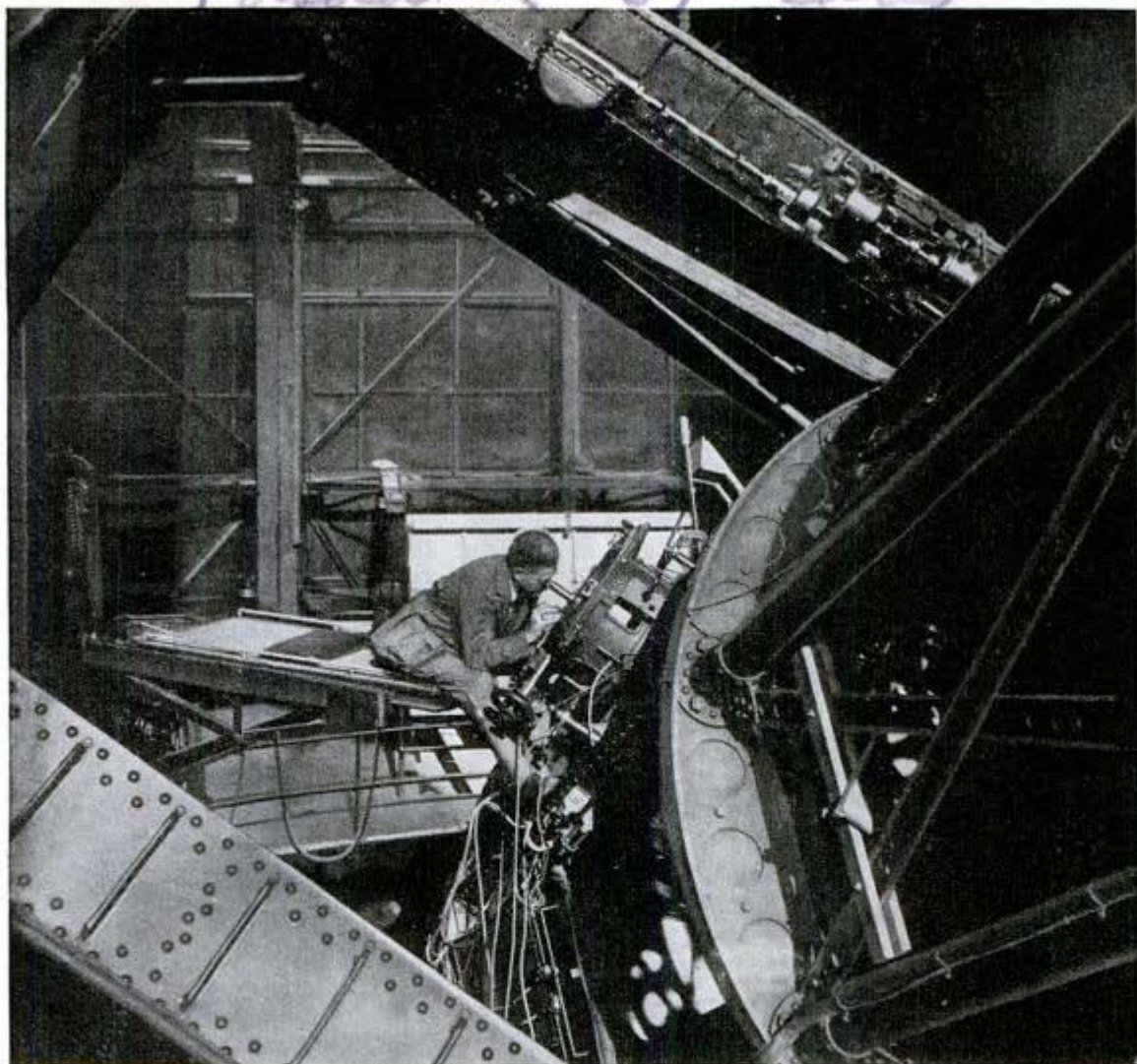
WHAT new wonders will the 200-inch telescope reveal?"

Not many years ago that was one of the biggest questions in science. Today the answer seems more remote than ever. Work on the 200-inch is halted. The machine shops that once turned out instruments for astronomy now are the source of secret weapons for the Allies.

However, we already know many wonders that the 200-inch would have revealed. Owing to improvements in optics and photography, the 100-inch telescope of the Mt. Wilson Observatory has more than surpassed the gains expected of the 200-inch. These gains can be applied to the 200-inch when finally completed. Some of these improvements have been achieved by simple methods that amateurs could use on their home-made telescopes.

How these phenomenal improvements have been possible is easy to see if you think of a telescope, not as a device for magnify;

1244 N. Holliston Ave. 01
Pasadena 6, Calif.



ing distant objects, but as a device for gathering more light from distant objects than your eye can grasp. An astronomer never thinks of his telescope as a magnifying glass; he thinks of it as a giant camera. A telescope might be compared to a water funnel that catches light instead of raindrops at the wide end and gathers them into a narrow stream where they emerge at the bottom. If you wanted to catch more raindrops you would build a bigger funnel, and the most obvious way to catch more light would be to build a bigger telescope.

Another way to improve a telescope is to make the most of every ray of light. A telescope is an inefficient sort of a funnel that lets a lot of the light escape before it ever reaches the eye or photographic plate.

An astronomer spends very little time merely looking through his telescope. He does spend a great deal of time working with various optical in-

Largest telescope in use today is the 100-inch (above) on Mt. Wilson. Work on 200-inch telescope on Mt. Palomar, Calif. (below), has been suspended for duration
Photo by Edison R. Hoge, Mt. Wilson Observatory

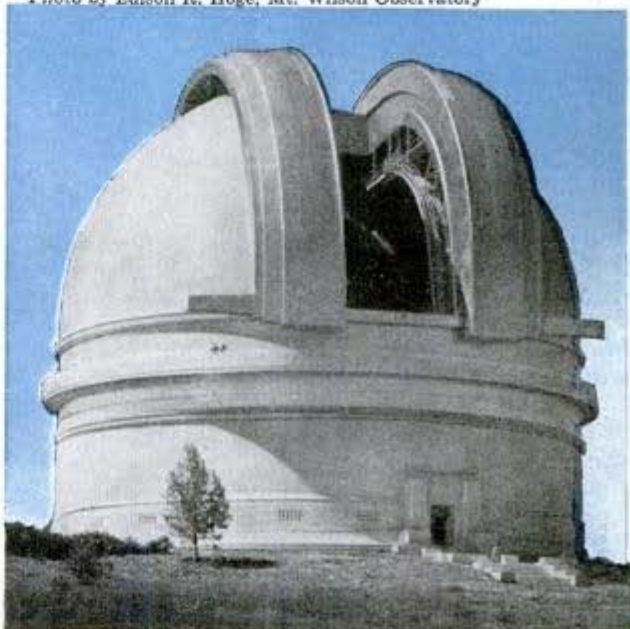


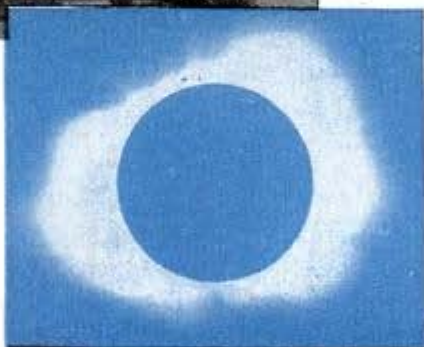


Image of sun is projected from high tower to disk in the foreground. Right, a total eclipse

struments which he attaches to it. By far the most important of these instruments is the spectrograph, which spreads the white light of a star out into a rainbow colored strip or spectrum. From studying the spectrum of a star an astronomer can tell you its temperature, the chemicals in its atmosphere, how fast it is moving toward or away from us—even the distance of the star from the earth!

In order to photograph the spectrum of a star, its faint light may have to traverse as many as six air-glass surfaces. The clearest lens will not transmit all the light that strikes it. Usually about 5 percent is lost by reflection. This means that

Baking blue sensitive plates in oven reduces time of exposures



perhaps 25 percent is lost before it reaches the photographic plate.

Astronomers have found a way of increasing the transparency of their lenses by coating them with a metallic film. If a film of lithium or calcium fluoride four-millionths of an inch thick is deposited upon the surface of a lens it will then transmit light practically 100 percent. Remember those intensely black spots that appear on a soap bubble when it is blown up so big and thin it is about to burst? Those spots appear black because all the light striking there is going on through the bubble. None is being reflected back to your eye. The same principle applies to a lens coated with a non-reflecting film.

As an example of what can be found with the spectrograph, there is a star invisible to the unaided eye in the direction of the Pleiades or Seven Sisters known to astronomers as RW Tauri. This star is one of the most curious objects in the heavens, for it has a

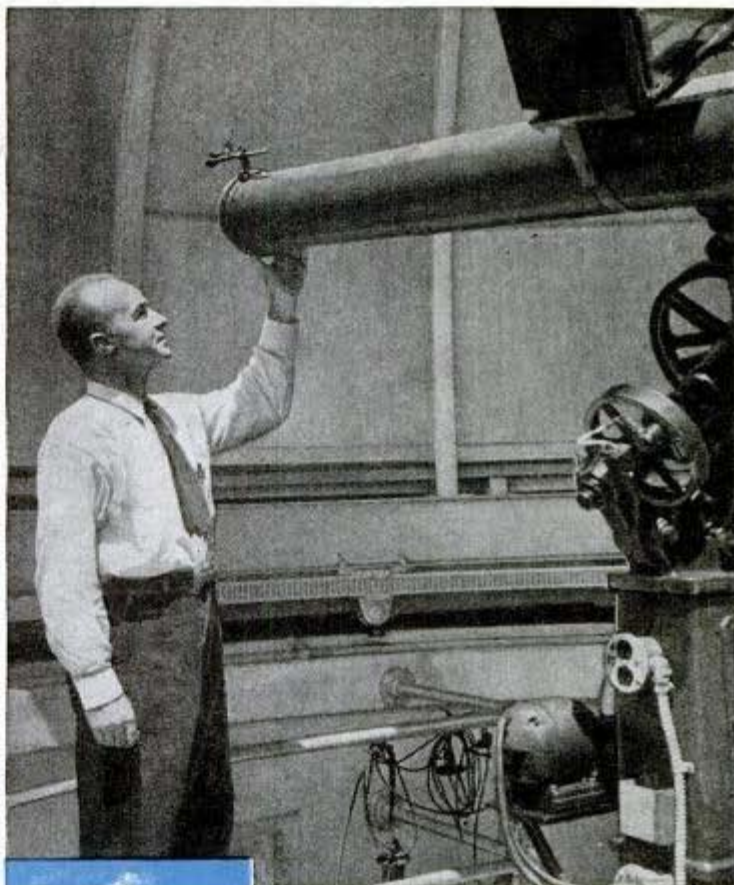
ring around it. Not a ring composed of cold meteoric fragments, but a ring of fiery scarlet hydrogen gas.

Nobody has ever actually seen this flaming ring for it is beyond the reach of the most powerful telescope. But from the spectrum of RW Tauri we know it must be there.

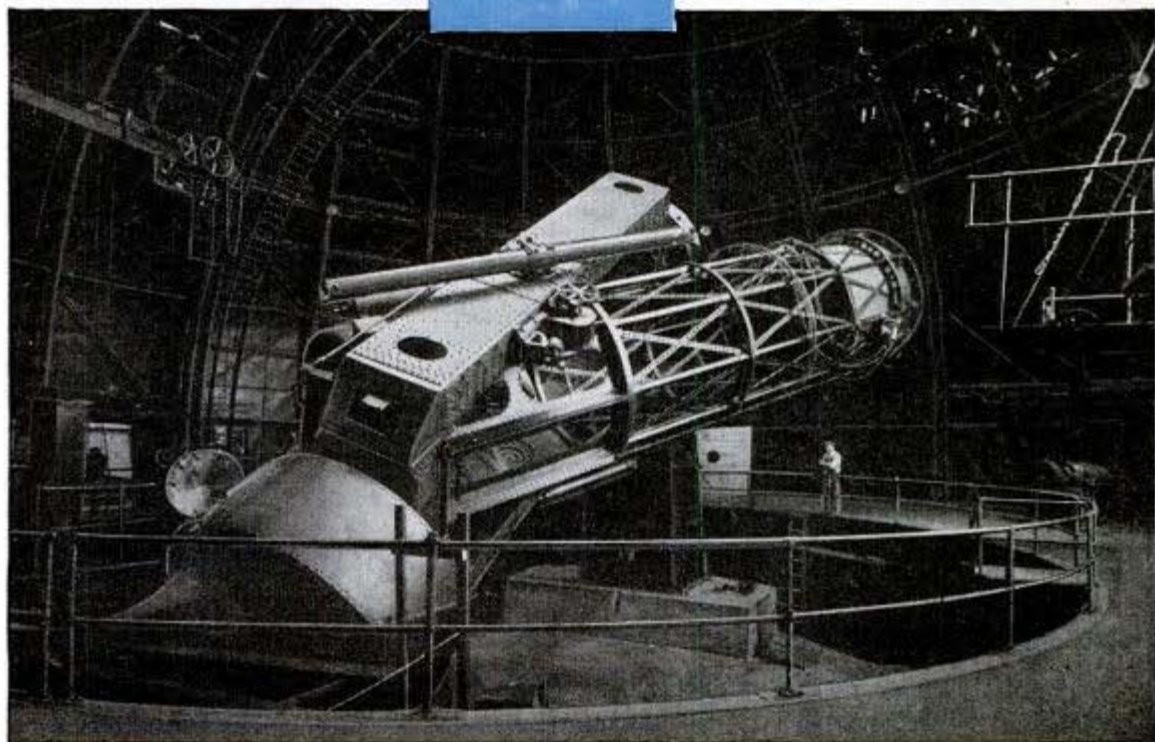
Photography has so completely superseded the eye that almost the only time an astronomer bothers to look through his telescope is when he takes a peek to make sure it is still pointed in the right direction. Suppose the proper exposure time on a faint cluster of stars with the 100-inch telescope is four hours. Because the 200-inch is twice as big and therefore has four times as much mirror surface or light gathering power, we should expect the proper exposure time with it to be about one hour. But if instead of building a telescope twice as big we could speed up the photographic plate four fold virtually the same result would be attained by a much simpler and cheaper method.

This is what has been accomplished in the case of photographic emulsions sensitive to red and the invisible infra-red light. As every camera fan knows, the advantage of using a red sensitive plate is that it will penetrate or "see" through haze that would be like a blank wall to a blue sensitive plate.

(Continued to page 148)

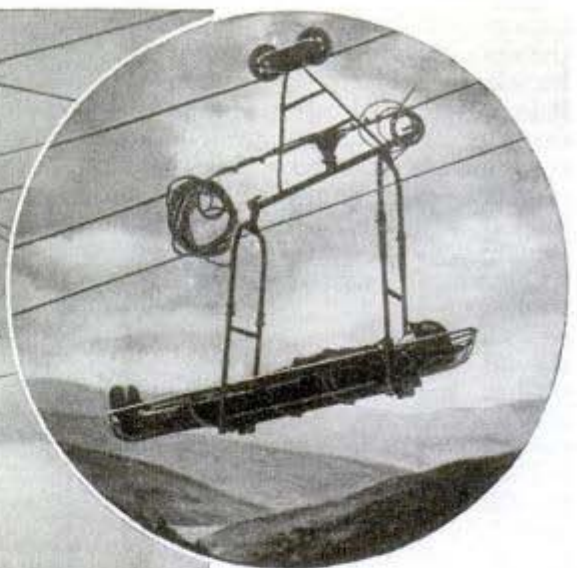
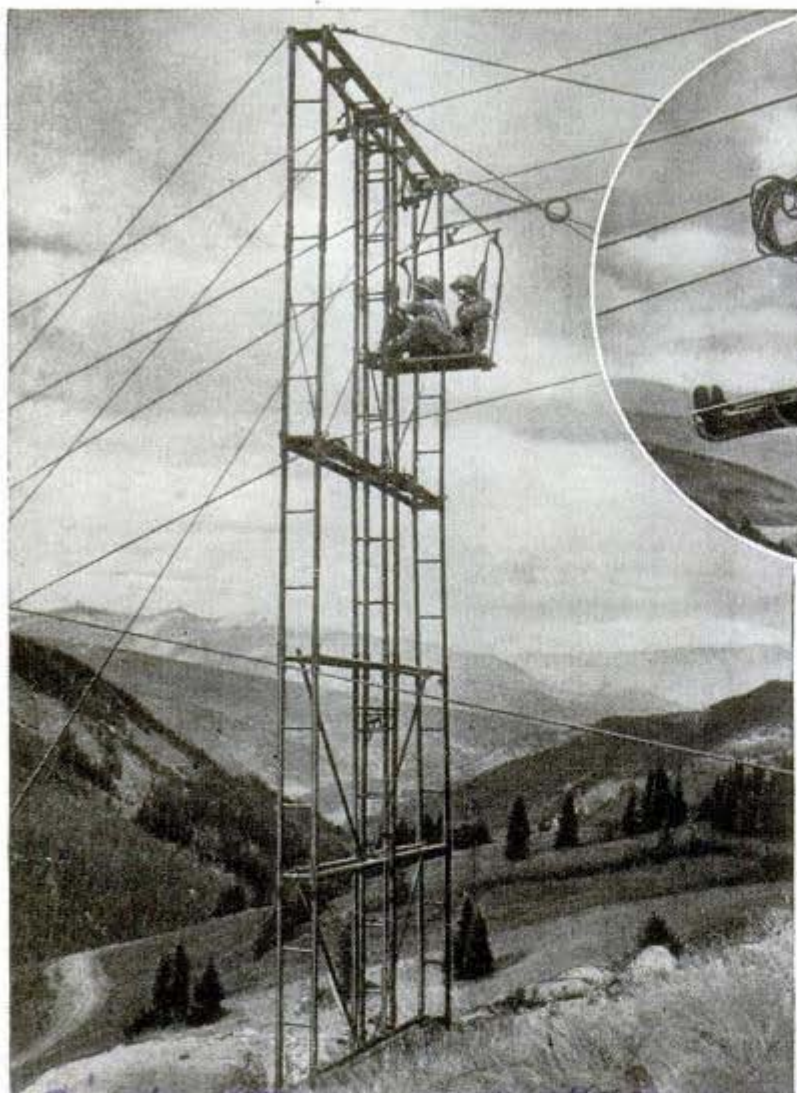


Inspecting lens coated with thin non-reflecting metallic film which transmits nearly 100 percent of light. Loss was formerly about 25 percent. Below, massive framework of 100-inch telescope hides giant mirror near the base



Camp Hale, Colo.

Aerial Trams for Wounded Also Carry Supplies



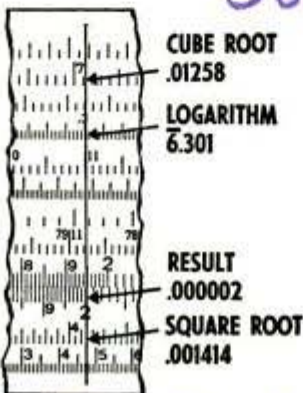
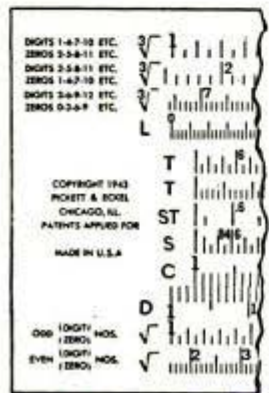
Mountain fighters operating in terrain too rough for pack animals are linked to base positions with an aerial tramway. This lightweight tramway, recently demonstrated by the mountain warfare section of the Army's Engineer Board at Camp Hale, Colo., carries wounded soldiers, ammunition, food, guns or other vital cargo. The wounded are carried on litters. The towers can be taken down quickly and moved to new positions.

Slide Rule Places Decimal Point in Problem of 19 Digits

Since the invention of the slide rule 300 years ago, placing the decimal point has been a stumbling block. A recently devel-

oped decimal point locator and slide rule not only "points off" up to 19 places, but with one setting gives the square root, cube root and logarithm. Persons with limited mathematical knowledge can use it.

FOUR READINGS WITH ONE SETTING OF HAIRLINE



0665

0469

Noses and Ears Made of Plastic Are Flexible and Lifelike

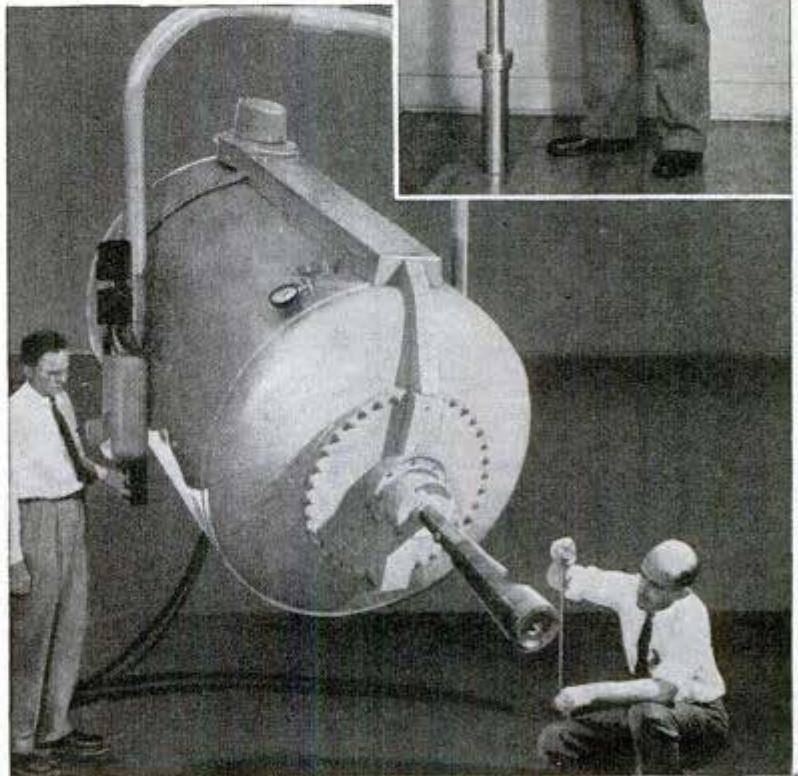
Similar to the flexible plastic in "glass" belts and suspenders, a new material for making noses, ears, fingertips and other parts of the human body has a texture similar to skin and can be colored to blend with the complexion of the individual. It already has been used successfully on scores of persons, including a war worker with a mutilated ear, a taxi driver whose nose was disfigured, and a woman who lost an index fingertip.

X-Ray Through 12 Inches of Steel Made With 2,000,000-Volt Units

Two-million-volt X-ray tubes, twice as powerful as those now used for the examination of metal sections, can penetrate a foot of steel to produce satisfactory pictures. The high-voltage tubes greatly reduce the amount of time required to make an exposure. One 2,000,000-volt unit, developed by the Machlett Laboratories, Inc., Springdale, Conn., is sealed like an electric light bulb. This eliminates pumping to maintain the high vacuum within, and is said to achieve extremely fine focusing. A unit of the same voltage, built by General Electric, weighs 5,000 pounds and also makes pictures through a foot of steel. Formerly, it took about four and a half hours to make a picture through an eight-inch steel casting with a million-volt unit. With the new unit an exposure can be made in three and a half minutes. It is predicted that the new precision tube brings to the field of X-ray radiography the same sort of improvement in definition that the electron microscope brought to the field of optics.



Right, R. R. Machlett, president, and his company's new 2,000,000-volt tube. Below, a 2,000,000-volt outfit made by the General Electric Co.



"Darts" Are Bombs And Target Is Japs

Playing a lethal dart game with 100-pound spike bombs as darts and Japanese railways and bridges as targets is a favorite sport of Air Force flyers in the India-Burma theater. Ordinary bombs showed a tendency to ricochet and explode harmlessly a few feet away from the target, so the airmen took the nose fuse out of each bomb and replaced it with a long spike made from an old axle. The flyers continued to make the bombs by hand until the new weapons began to arrive in quantity from this country.

Chicago Tribune 8/19/44

Microphone and Film Show Hidden Illness While Listening to Heart

Subtle changes in the body's circulation which signify the beginning of an illness are recorded by a heart-sound detector developed at the Du Pont laboratories in Wilmington, Del. The instrument, which is portable and easy to operate, flashes signs of trouble long before the patient himself notices any symptoms and before real damage has been done. These disturbances,

which do not necessarily mean something is wrong with the heart, are too slight to be noticed by the electrocardiograph and often too faint even to be caught by standard blood-pressure measurements. The meter consists of a sensitive microphone strapped to the patient's chest and a dial or a photographic film on which the microphone's "pick up" is registered.

0296

Mr. Chester Hope 345 W. 86th St.
N. Y. City

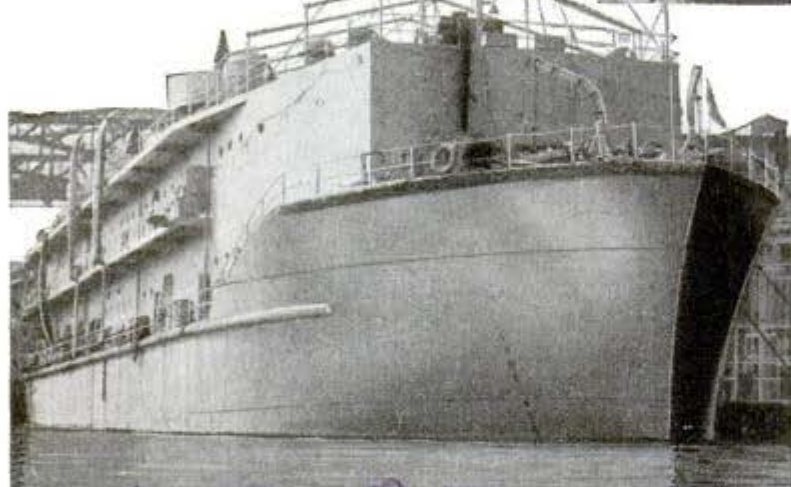
Floating Hotels Towed Overseas for Mechanics

Ships which will serve as hotels large enough to house 800 mechanics each are being built by the Navy for use in any part of the globe. The sea-going boarding houses, known as auxiliary personnel lighters, have no motive power of their own and are towed to overseas ports, where skilled shipfitters, carpenters, machinists, electricians, metalsmiths and painters live in them while operating repair shops 24 hours a day. Besides three decks of sleeping quarters, each ship includes a 15-bed hospital, a dental clinic, a cafeteria, public utilities, a post exchange, recreation rooms, a super laundry, and a Butcher Boy band saw which



U. S. Navy photo

Above, signalman tidies up a 4-tiered bunk aboard a Navy barracks ship. Left, exterior view of the "floating hotel"



cuts sides of beef into steaks and roasts. The lighters are armed with 20 mm. anti-aircraft guns and machine guns and also carry two motor-driven whaling boats. Some of the ships may be used as floating barracks for troops "island-hopping" in the Pacific.

Honolulu R. Transit Co. Honolulu

Rolling Magnet Made of Scrap Picks Up Nails From Road



To reduce punctures in valuable tires in Honolulu, the Rapid Transit Company joined with a Westinghouse engineer to invent a gasoline-electric-magnetic scrap-retriever made largely of material from the storeroom and scrap pile. Welded to the trailer-like chassis of the retriever is a small, air-cooled gasoline motor, an electric generator converted from a Westinghouse motor which was in service in 1905, and some magnet coils salvaged from old street car equipment. Turning at 1,310 revolutions per minute, the generator produces direct current at 200 volts to energize the magnet coils. When the current is turned off, metal scraps collected drop off and are easily swept up.

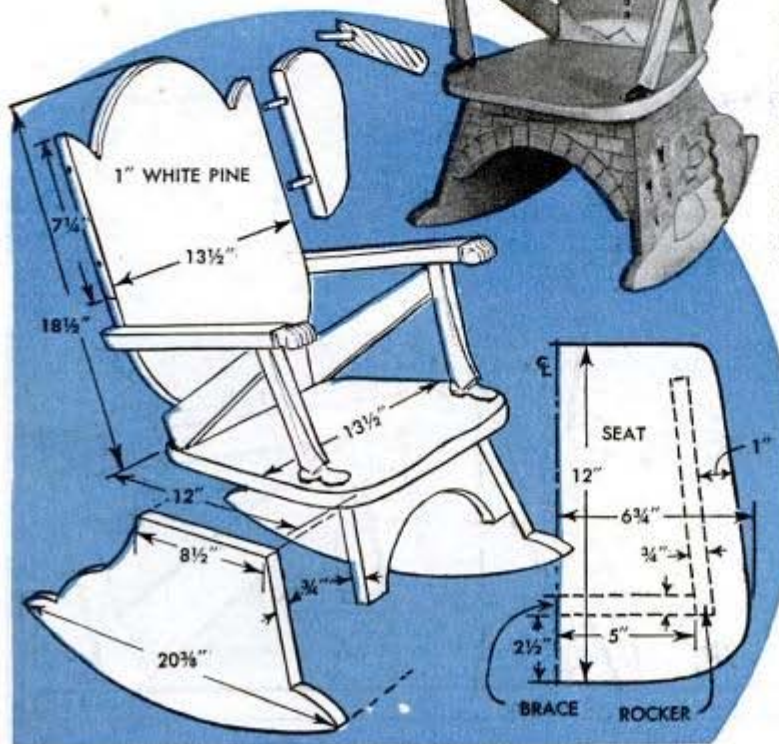


Fairyland ROCKING CHAIR

By E. J. Tangerman

ALL the king's men couldn't put Humpty Dumpty together, but you can do it easily with a few hand tools and some spare time. As the chair is to be carved, 1-in. white pine is suitable, although maple, while more difficult to carve, is stronger and more attractive.

The only extensive carving job is the back, which is glued up to size from standard widths and sawed, leaving ear and thigh projections. Outlining cuts



for the features are made with a V-gouge, but the carving should be not deeper than 1/8 in. to avoid causing discomfort to the chair's occupant. Holes for eyes and mouth are drilled and the latter is cut out with a scrollsaw and smoothed to shape with a rasp. Ears are set forward at an angle and are assembled with dowels and glue. The back is attached to the seat with dowels, glue and screws, the lower edge being beveled to set at a comfortable angle.

Now the rockers and brace are joined to the seat. The rear rocker tips should be separated about 8 3/4 in. and the front tips about 12 in. so that the chair does not "walk" across the floor or tip over so easily. The bottom edges are shaped to bear flat on the floor. Screws driven through the seat

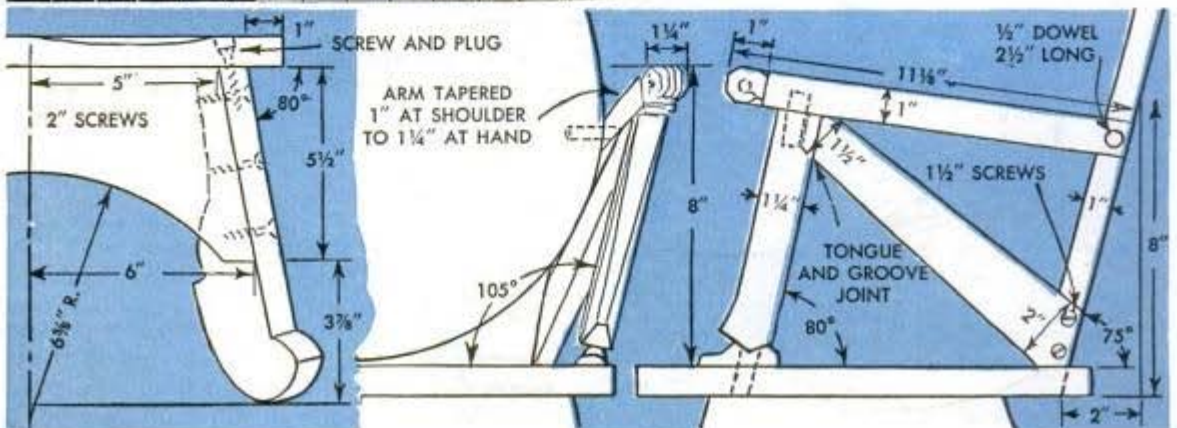
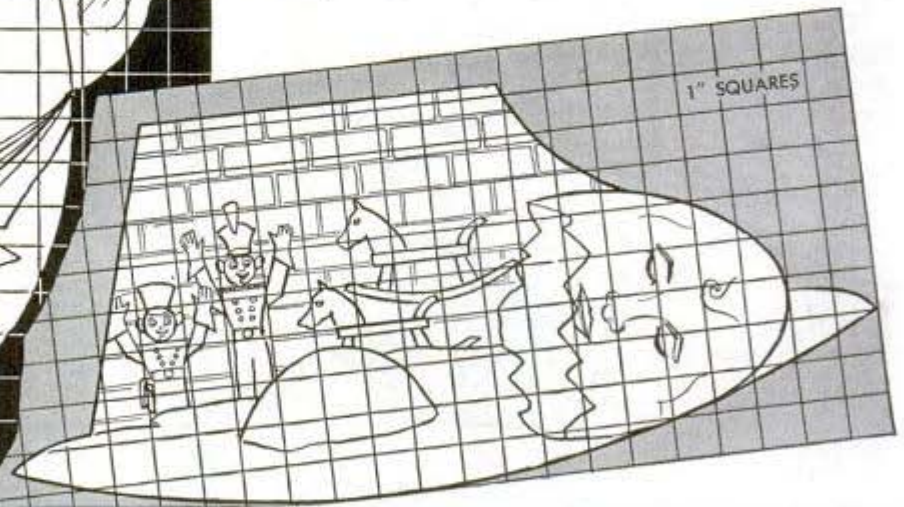
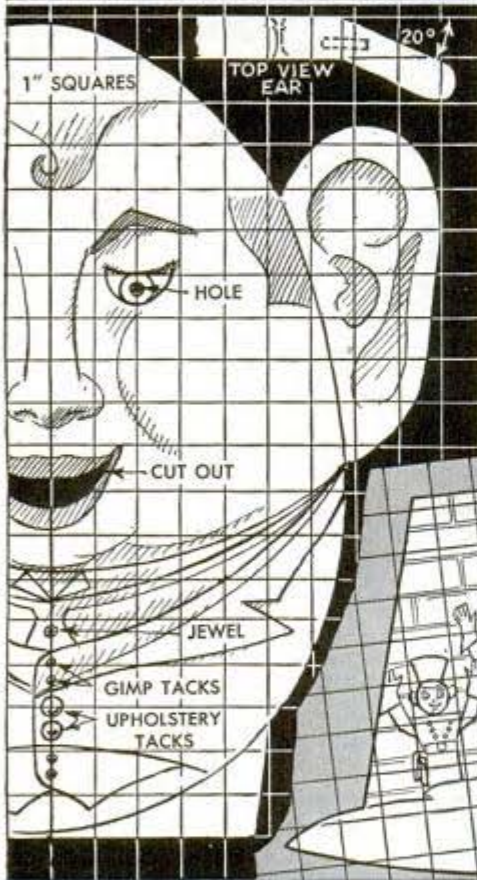


are countersunk and covered with wooden plugs. The picture design is outlined with a small gouge on each side and across the brace.

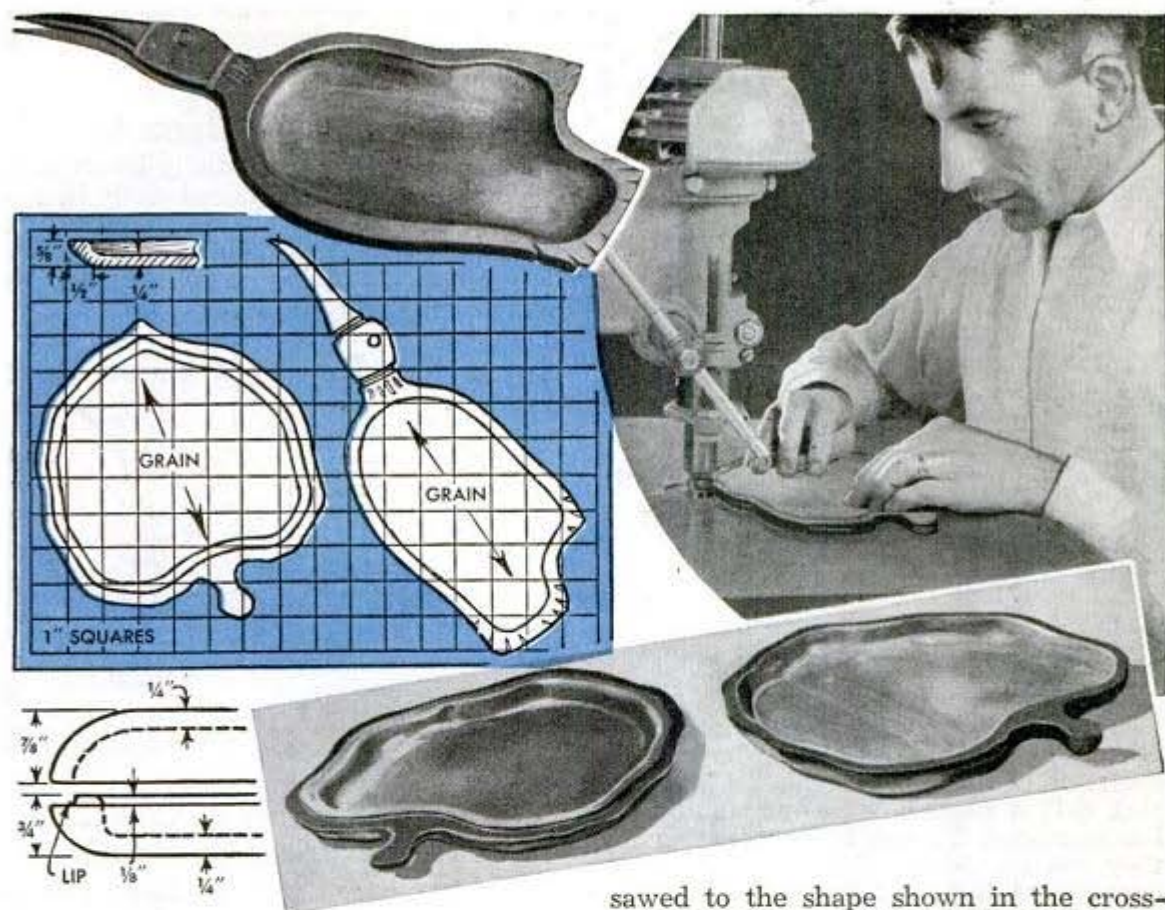
Shoes are whittled and the arms are rounded on top, the ends being carved to resemble closed hands. Leg sections are tapered toward the edge to simulate a trouser crease, and the thigh is fitted by tongue-and-groove joints. In setting the lower legs, the dowel holes should be drilled so that the legs will tilt outward as shown.

After the chair has had a coat or two of linseed oil, it is painted by rubbing in oil pigment mixed with drier. Details can be brushed on, but the color should be rubbed off until only a tint remains, to allow the grain to

show and to avoid a pasty, painted appearance. However, the black hats, white gloves and candy-striped shirt should be solid color. The pigment should dry for about a week before final finishing. Then two or three coats of hard wax may be applied, rubbed in well between coats to protect the chair from the knocks and hard usage to which nursery furniture is usually subjected. For buttons and decorations on the sides and back, ornamental tacks can be used, and a piece of costume jewelry or colored glass will serve as a tie pin as indicated.



Two Wooden Tidbit Dishes of Unusual Design

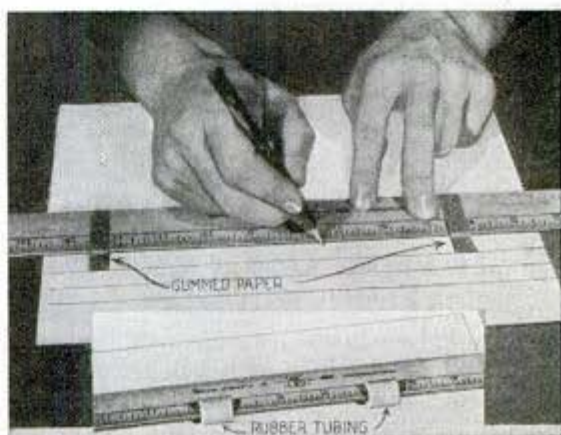


To many an outdoorsman, this curlew dish will bring back memories of salt marsh or windswept dune. The Puritan-style double dish, on the other hand, has a homely, rustic appeal. Both dishes are suitable for serving nuts, candy and other tidbits, or they may be used as cigarette trays. Any close-grained wood may be used, but maple, whitewood, mahogany or birch are especially attractive. The dishes are jig-

sawed to the shape shown in the cross-hatched detail, and the edges are undercut. Holes are drilled to rough out the hollow, which then is routed to shape, and a gouge is used for finishing. On the double dish, a lip is left on one section, and the other is recessed to fit so that both sections nest together snugly. After they are sanded, the dishes may be stained and varnished or waxed. However, the inner surface of the double dish should be lighter in color than the outer surface for pleasing contrast.

Guides on Ruler Aid in Drawing Uniform Lines on Paper

When you want to draw a number of uniformly spaced lines, two strips of gummed paper on your ruler will enable you to do the job quickly and accurately. The strips are stuck to the ruler as indicated and then cut so that when the ends touch the line above, the ruler is in position for drawing the next line. When the lines must be of uniform length, a couple of pieces of rubber tubing slit along one side and slipped over the ruler edge will serve as stops. Of course, the paper strips will serve the same purpose, but the pieces of tubing provide adjustable stops that can be set for lines of different length by merely sliding them along the edge of the ruler.

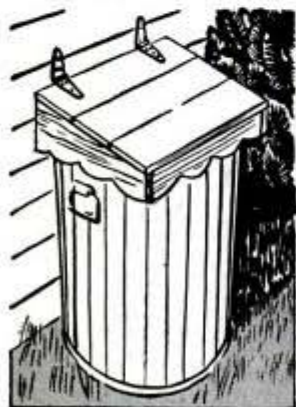


Hole Drilled in Hammer Head Used for Clinching Nails



When nails are clinched to provide greater holding power, they should be bent as indicated in the upper detail. To facilitate this, drill a small hole in one side of the hammer head. Then, if long nails are used, they can be given a double bend in one operation, as indicated, and the points driven back into the wood across the grain, leaving no points projecting on which clothing or hands can be caught.

Hinged Cover Prevents Dogs Upsetting Garbage Can



You can keep dogs or other small animals from upsetting your garbage can by hinging a wooden cover to the side of a building and setting the can under it. Put skirt pieces on the front and sides of the cover and the can cannot be pushed over.

Ruler Taped Under Glass Desk Helps Draftsman Draw Lines

To help him in ruling measured lines and yet keep the surface of his board free for unhampered use of the straightedge, one draftsman fastens a plastic rule to the un-

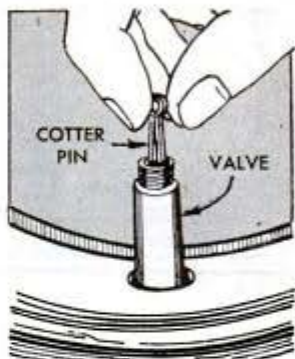
derside of the ground glass of his transparent table with cellulose tape. The same idea can be adapted to use with a mimeoscope in drawing lines or measuring on a duplicating stencil.

Repairing Broken Alarm Springs

Alarm-clock springs usually break near the ends and can be repaired easily by removing the spring, heating to draw the temper and then forming a new eye or hook. A piece only half as long as the original spring will make a workable repair.

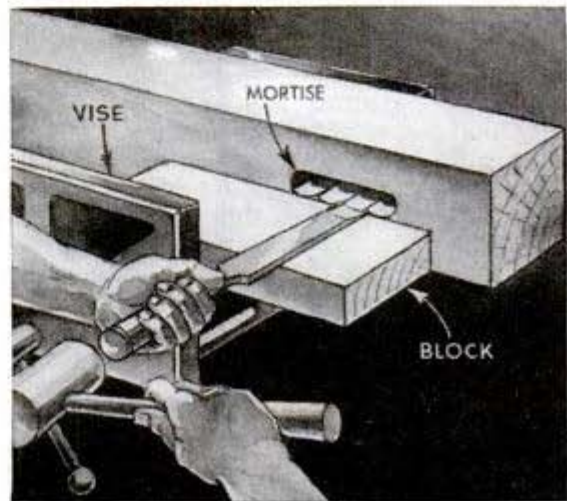
Cotter Pin Removes Valve Core

When there is no tool at hand for removing a valve core from a tire, do the job with a cotter pin. Spread the legs of the pin slightly, insert it into the valve stem and then squeeze the legs against the core to unscrew it.

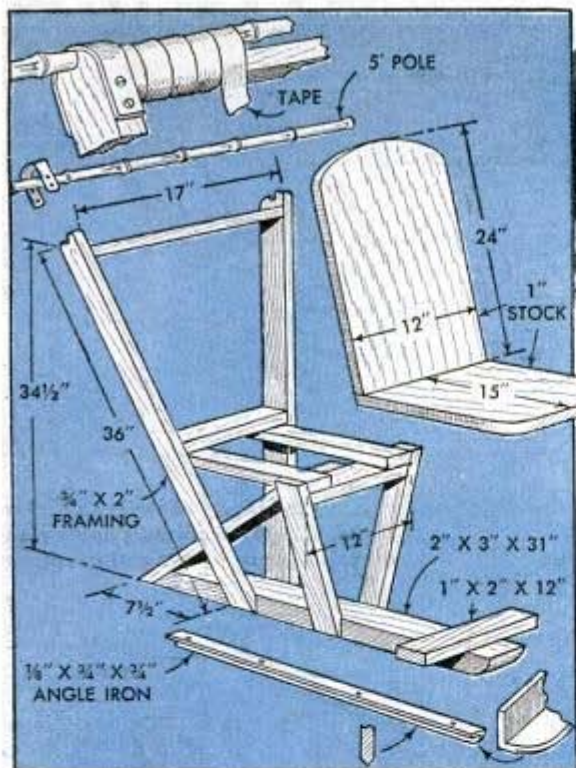


Guide Block Aids in Chiseling True Mortises by Hand

When cutting mortises by hand, an accurate job can be done easily if you use a block to guide the chisel. After boring a number of holes to remove most of the waste stock, clamp the work and block in a vise as indicated. The inner edge and top surface of the block must be at a true right angle, and the upper surface of the block must be directly in line with the intended edge of the mortise. Now, to get the mortise accurate, all you have to do is hold the chisel flat against the block as you cut away the remaining waste stock.



Mono-Runner Ice Scooter Gives Thrilling Ride



Pushed by two skaters, this lightweight scooter skims over the frozen pond to give its passenger a swaying ride. The frame is so sturdily braced that it will support even a heavy person safely, and the single angle-iron runner, which is rounded at the forward end and beveled along the lower edge

as shown, is designed to slip over the ice with the least possible friction. A bamboo pole for pushing the scooter is set in notches in the corner posts where it is held with galvanized-iron straps and tape.

Arm Sling Placed Over Shoulder to Avoid Neck Strain

When it is necessary to carry one's arm in a sling for several days, the weight of the arm, if suspended in the usual manner as shown in Fig. 1, sometimes causes strain

on the neck which may become quite painful. A better way is shown in Fig. 2. Here the sling is carried around the body and over the shoulder opposite the injured arm so that the neck is free of strain.

—Mrs. Hal Geihm, Aurora, Ill.



Eraser and Paper Clip Hold Pencil In Your Pocket

An ordinary pencil can be held in your pocket by an improvised clip which can be put on in a moment. This consists of a paper clip secured by an eraser of the type shown, slipped over the end of the pencil. —Wm. Swallow, Brooklyn, N. Y.



Solving HOME



If the weight of bed clothes on a patient's feet causes discomfort, it is easy to provide an emergency support by using a card table on the foot of the bed as shown at the left

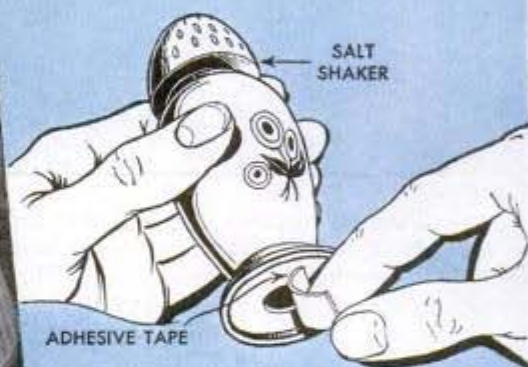


If a waxed-paper container lacks a metal edge to tear the paper, glue abrasive paper at one end as above

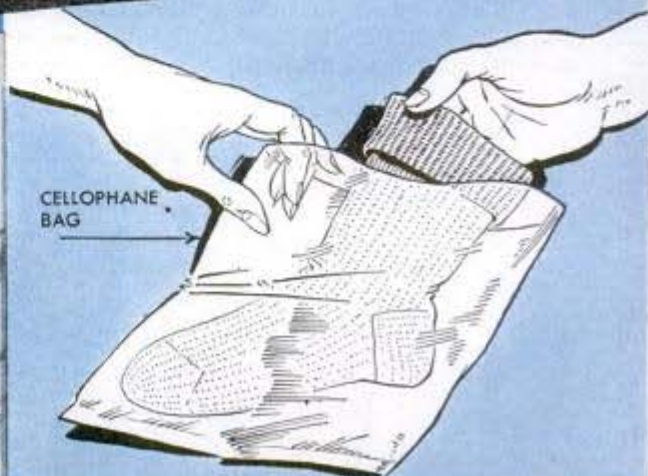
The next time you have to dry small garments quickly and the usual artificial heat is unavailable, just place them on a rack above a floor lamp as at the right. A small rack from a refrigerator is ideal



Lack of a ring mold need not hinder your culinary efforts because you can improvise one by inverting a cup inside a pan of suitable size as shown below. The cup should not have a handle to interfere



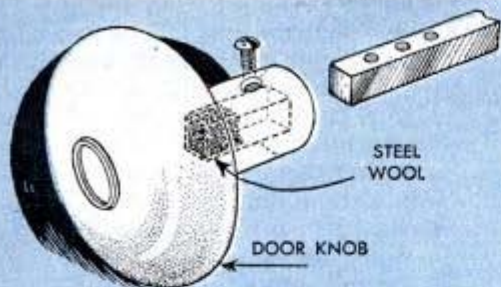
Because it is less likely to work loose, a strip of tape is better than a cork for stoppering the hole in a salt shaker



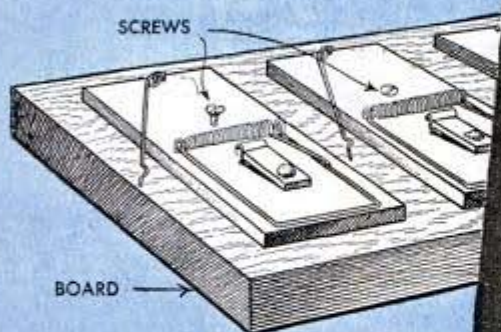
Cellophane bags such as those used in 1-lb. tobacco cartons, are handy to store woolen socks and other small articles of clothing that are likely to be damaged by moths

PROBLEMS

An endless clothesline is easier to operate from an upper floor if you attach the pulley in the center of the window as shown at the right instead of fastening it at one side



Loosening of the screw in a door knob can be avoided by putting steel wool in the socket as shown above

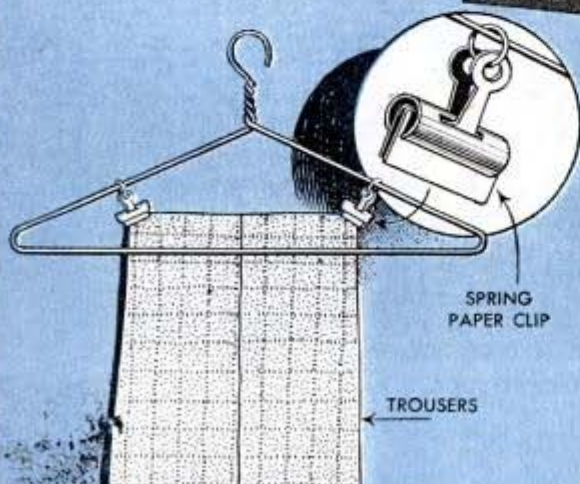


Set mouse or rat traps in gangs by screwing them to a block as above; they can't be dragged and baiting can be done easier

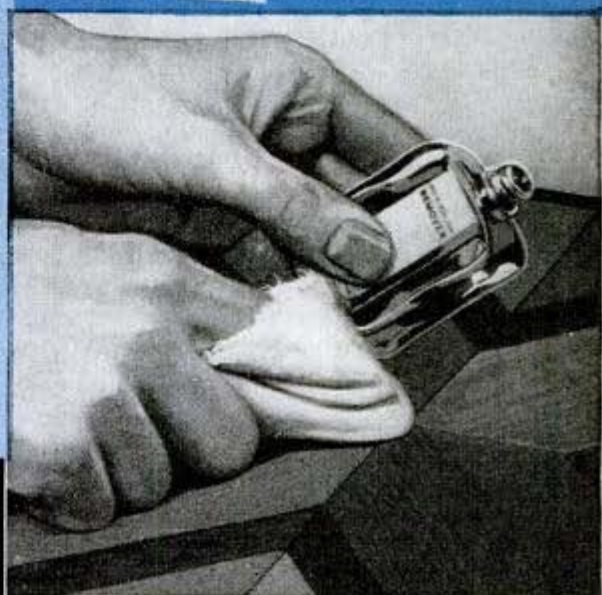


It's easy to remove a cork from a bottle if you use a button tied to a string. Insert the button and then tip the bottle to move the cork into the neck. Now, pull out the button and the cork together

Paint spots on your linoleum and no remover at hand? Nail-polish remover will do the trick. Just put a little on a cloth, and rub the spots as below. They will disappear in a very short time



Fastened to a wire clothes hanger with rings as above, spring type paper clips will enable you to put your trousers on the same hanger as the coat without wrinkling them



Strong Clamp for Wide Work Improvise From Screw Jack



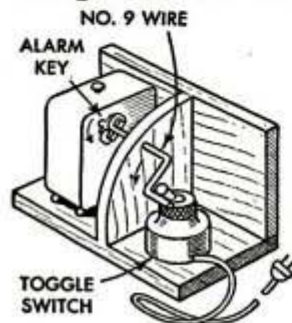
With a screw type jack and a length of chain you can improvise a strong clamp that will have many uses. As shown here, the clamp was used to straighten warped parts of a diving board. A clamp of this type also would be handy when gluing up large panels, for straightening heavy pipe, etc. When used on planed or sanded work, blocks of wood should be placed under the jack and chain to prevent damaging the edges of the work.—R. R. Busch, Chicago.

Plugging Rat Holes With Cement

Rat holes in stone or cement basements can be filled quickly by using a funnel to which an extra length of spout has been soldered. This is placed as far in the hole as possible and a very thin cement mixture, of high cement content, is poured in to fill the hole.

—Victor Dieffenbach, Bethel, Pa.

Simple Time Switch From Clock



An effective switch for turning on lights or appliances at a given time can be made easily by using an alarm clock and an ordinary toggle switch. The clock and switch are mounted on a right-angle frame,

after which a piece of heavy wire bent to the shape shown is attached to the alarm key and run through a wood bearing so

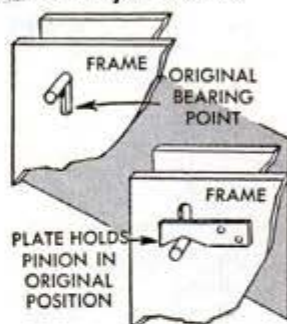
that the crank end moves the switch toggle when the alarm key turns. Thus when the alarm goes off at the designated time the alarm key turns the crank, throwing the switch and closing the electrical circuit.

Cleaning Cigarette-Lighter Wheel To Assure Quick Ignition

Cigarette lighters often fail to work because soft material from the flint clogs the file wheel. When this occurs, clean out the wheel with a "file card," a strip of heavy canvas material having short lengths of wire projecting through it, about 30 to the inch. This is available at most hardware stores.—S. A. Pease, Wauwatosa, Wis.

Worn Pinion Bearings in Clock Held in Position by Plates

Clocks in which the pinion-bearing holes have worn as indicated in the upper detail often can be repaired by riveting small plates over the holes to keep the shafts in their original positions.



A careful examination of how the small gears mesh will enable you to determine whether or not the original position of the pinion was at the top or bottom of the elongated hole.

—Geo. A. Childs, Somerville, Mass.

Large Tin Can Serves as Oven For Toasting Marshmallows



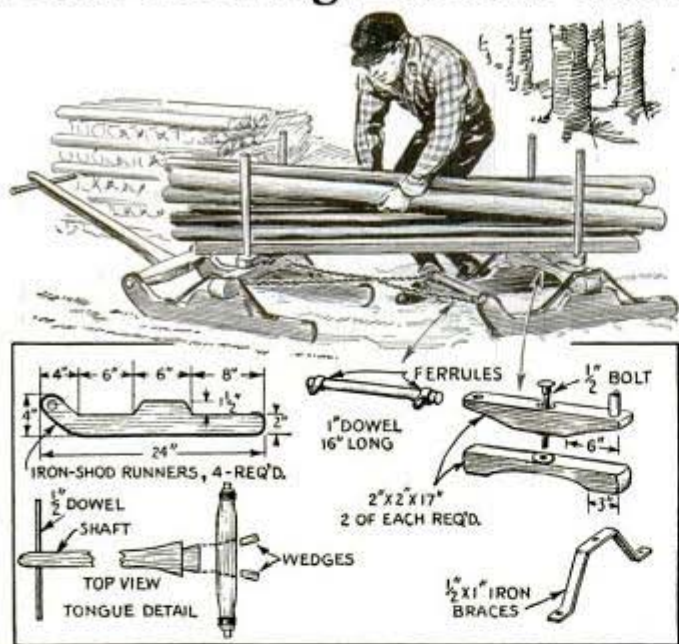
To toast marshmallows to a golden brown in a campfire, without scorching, use a large tin can as an oven. Remove the ends of the can and place it on the fire so the flames do not reach the marshmallows.

Inserting Carbons in Typewriter

Inserting a number of carbon sheets in a typewriter is easier if a large envelope is placed over the sheets at one end. They can be lined up straight with the bottom of the envelope and then rolled into the typewriter, envelope and all, far enough to slip off the envelope.

—Pvt. Sam Greenberg, Atlanta, Ga.

Dual-Steering Bobsled Turns in a Short Radius



This handy little sled, which steers at the rear as well as the front, will have many uses around the farm because it can be turned in a very short radius. Also, if desired, it can be fitted with a steering wheel and a wide plank and used for coasting. And, since the bobs are connected by two crossed chains, which are responsible for the dual steering feature, the sled can be adjusted easily to suit the length of the load. The sled consists of four iron-shod runners assembled in pairs or bobs as shown, and then pivoted to two bolsters which carry the load. A tongue assembled as indicated in the lower left-hand detail is pivoted between the runners of the front bob so that it may be raised in pulling.

—Edwin C. Norlin, Chicago.

Brick Enclosure Keeps Sand Clean

You can provide children with a neat sand pile and at the same time keep the sand clean for odd cement jobs if you make an enclosure about 8 ft. square for the sand, the enclosure consisting of three or four layers of mortared brick. A floor of loosely fitted bricks keeps the sand from being mixed with dirt.

Scrap Pieces of Sponge Salvaged By Using Them in 'Sponge Bag'

Instead of discarding worn sponges, or the small pieces that break off as the sponge wears, save them in a coarse mesh sack or bag. When you have enough almost to fill the bag, sew it together at the top and use it in the same way that you would a regular sponge. Such a bag will



be especially handy on rough work, such as removing calcimine, where a good sponge would wear out rapidly. When the mesh bag wears, the scrap sponges can be put into another one.

Tracing-Cloth Strip on Triangle For Testing Inking Pen

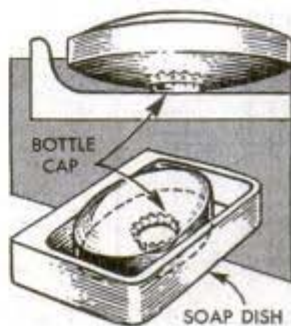


In order to have paper always at hand for testing his drawing pen for width of line, or to start the flow of ink after refilling it, one artist taped a strip of tracing cloth to his triangle as indicated. In this position, the cloth is not in the way, yet is always close to his work when needed.

—Iver Johnsen, Jr., Michigan City, Ind.

Bottle Cap Improves Soap Dish

Much soap is wasted by the water at the bottom of a soap dish. This waste can be reduced by cementing an inverted bottle cap to the dish to hold the soap off the wet bottom as shown.



A SMOKING STAND

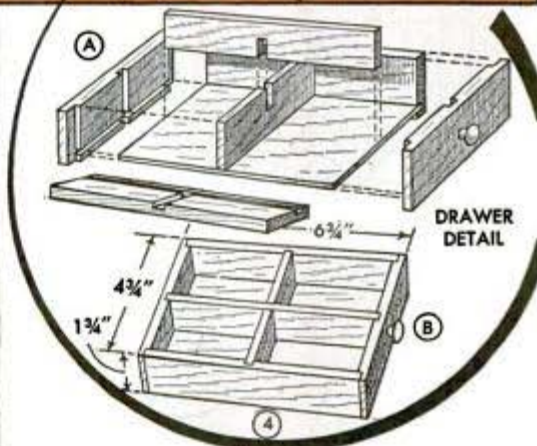
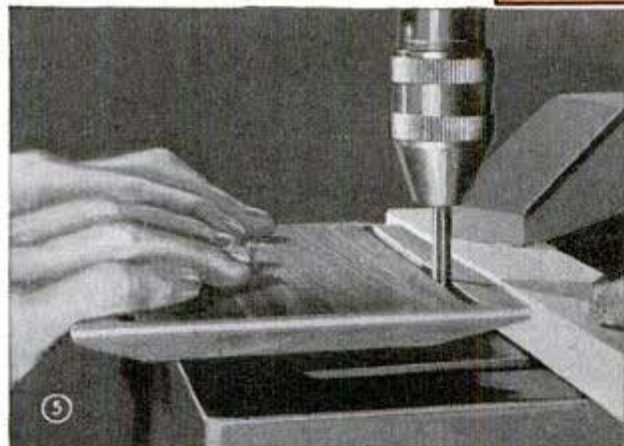
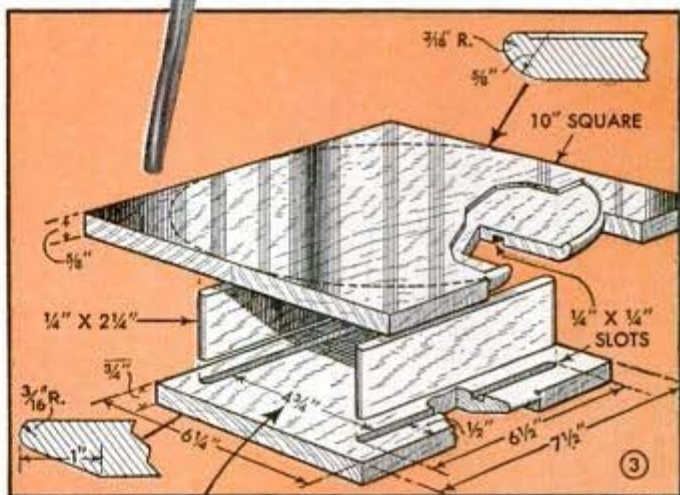
at your easy chair

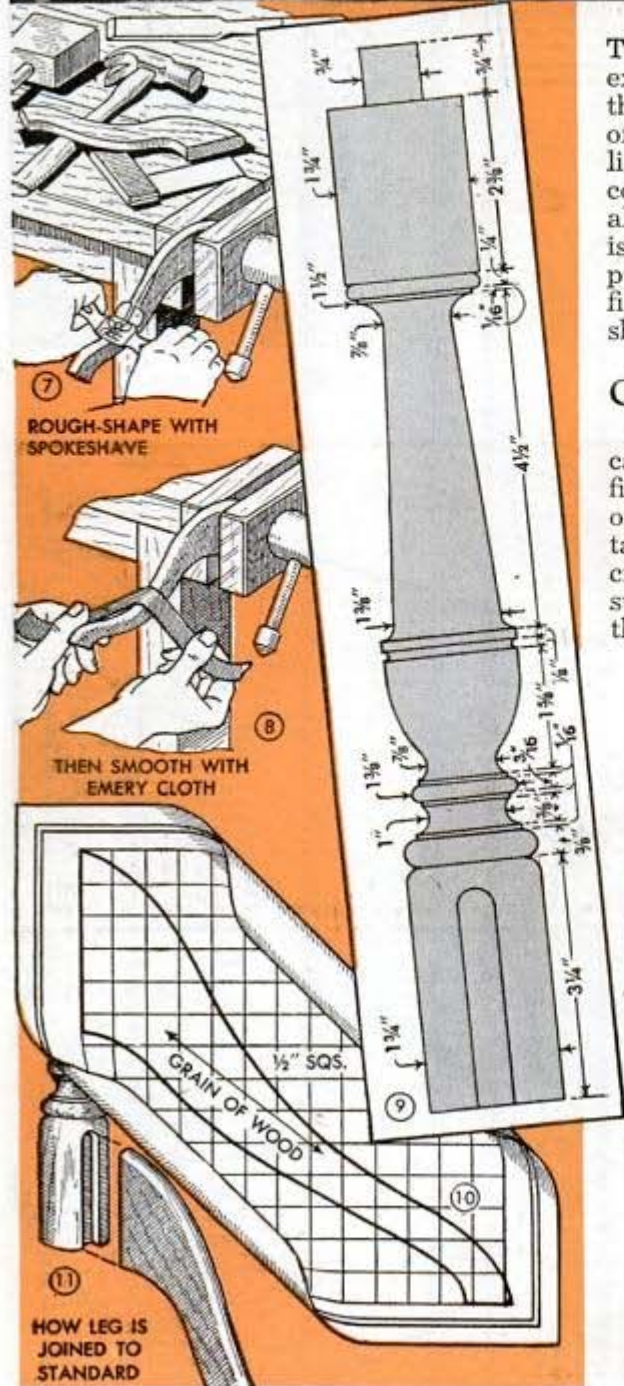
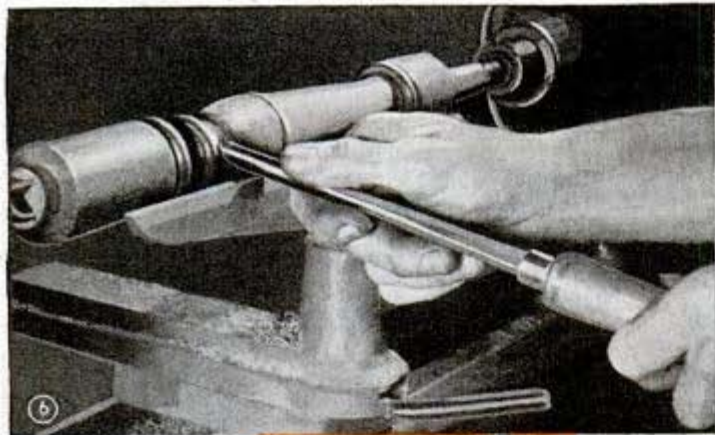
By Wallace W. Buffmire

ALTHOUGH designed for smokers, this little table, shown in Figs. 1 and 2, also serves with equal propriety as an end or chairside table. As a smoking stand it is particularly useful, since it has a large drawer to hold accessories. By dividing it into sections as shown in detail B of Fig. 4, various brands of cigarettes as well as matches and other items can be kept neatly separated.

Walnut, oak or any other hardwood is suitable. The top and sub-top first are cut square to facilitate accurate routing of grooves for the sides as shown in Fig. 5. Grooving should be completed before the top is turned to the dimensions given in Fig. 3. Then all necessary turning is done, a hole is drilled through the sub-top for the tenon of the standard shown in Fig. 9, and the edges are beveled as shown in the details of Fig. 3. Round the edges of the side members and sand all surfaces smooth before assembling and gluing.

The drawer is constructed as shown in detail A of Fig. 4, all parts being glued and clamped together. Note that knobs are placed at both ends so that the drawer may be pulled from either side. The standard is turned as in Fig. 6 according to the pattern, Fig. 9, three slots being cut equidistant about $\frac{1}{4}$ in. deep in the lower end





for inserting the legs, Fig. 11. Their design is shown in Fig. 10. The grain should run lengthwise, and the edges are chamfered with a spokeshave, Fig. 7, then rounded and smoothed by using strips of fine emery cloth as in Fig. 8. The standard is glued in place, care being taken to set the top level, and, when dry, the bottom edges of the legs can be trimmed so that the table will stand true.

For finishing, apply a stain and filler combination, allowing it to remain on the wood until the gloss has disappeared.

Then, with a piece of burlap, wipe off the excess, rubbing across the grain, and allow the stain to dry for 24 hrs. Two thin coats of lacquer sealer are applied and sanded lightly between coats, after which several coats of clear gloss lacquer are put on and allowed to dry for a day each. If a dull finish is desired the table is rubbed with fine pumice and water, but for a gloss finish, fine pumice and oil, such as paraffin oil, should be used.

Cement to Repair Laundry Tubs

Cracked and leaky laundry tubs often can be made practically as good as new by filling the cracks with a cement consisting of litharge and glycerin, which are obtainable at most paint stores. Likely the cracks will have to be grooved on their surfaces in order to work the cement into them. This can be done with a small, sharp chisel and a hammer. Cracks that reach through the tubs should be grooved on both sides, and all of them should be cleaned thoroughly of dried soap or grease residue, which would prevent the cement from making a good bond. The tang of a small file can be ground down to provide an ideal tool for cleaning the cracks. After the cracks have been prepared, mix the cement to a consistency slightly thinner than window putty. Force the cement into the cracks with a putty knife, working it in thoroughly and smoothing it to make a neat job. Allow the cement to dry at least 24 hrs. before using the tubs.

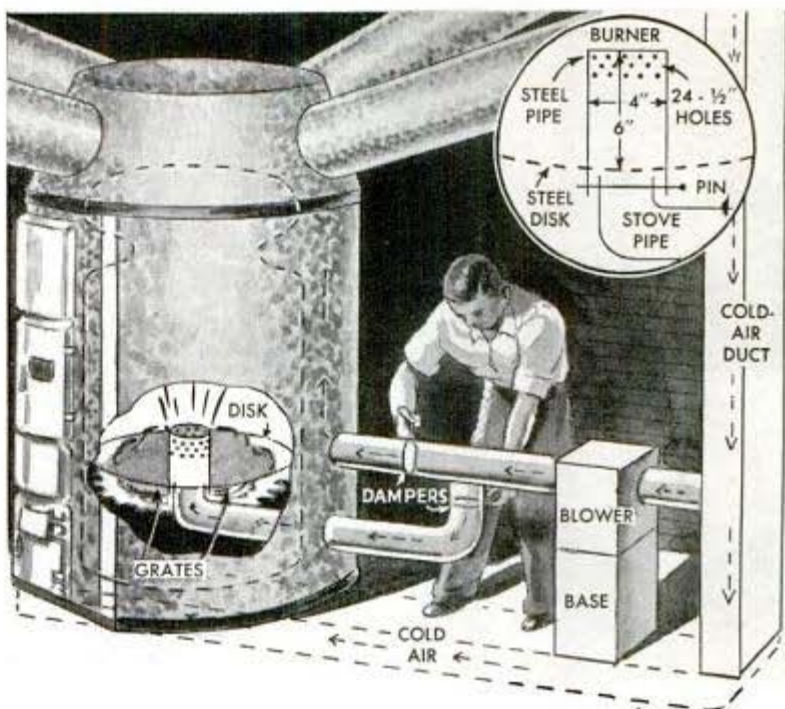
—J. R. Magill, Washington, D. C.

Blotter Cleans Typewriter Keys

Rapid cleaning of typewriter keys can be done by placing a blotter in the machine and striking each key with the ribbon released for stencil cutting. Each key is struck several times until it leaves a clear impression.

Forced Draft in Furnace From Circulating Fan

One home owner makes the blower on the forced-air circulating system of his furnace do double duty by also providing forced draft. As shown in the drawing, a pipe tapped into the circulation system between the blower and furnace carries air to the burner. This is a 6-in. length of 4-in. steel pipe which projects through the grates into the firebox. Three rows of eight $\frac{1}{2}$ -in. holes distribute the air through the fuel bed. To control the amount of air entering the burner, dampers are installed in the pipes as indicated. Once the air flow is adjusted, the fuel will burn thoroughly, producing maximum heat and forming clinkers that can be removed easily through the fire door. The grates are covered with a steel disk to keep the fine fuel



from falling through them. All openings below the grates should be sealed or dust may escape.—A. J. Rich, Aurora, Nebr.

Glass Brick Provides Shade for a Kitchen Pin-Up Lamp

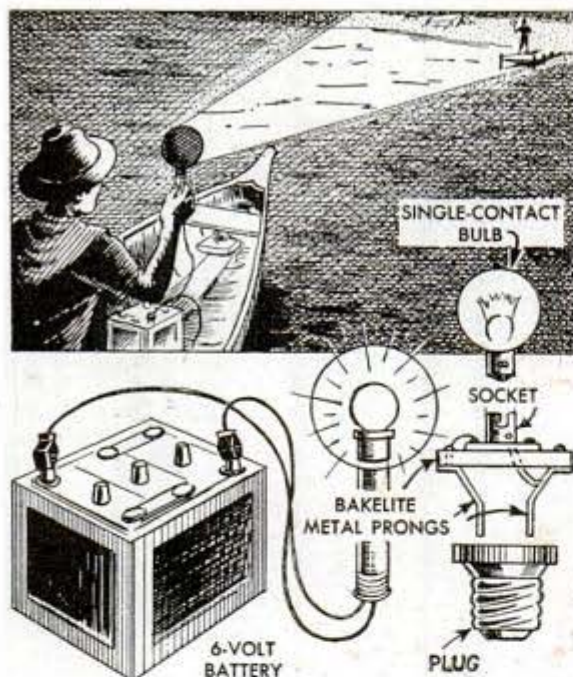
You can have an unusually neat pin-up lamp that provides excellent illumination for your kitchen or dinette for the price of

a glass brick, a bulb and a socket. The brick is of the type used as a vase, having an opening in one end as indicated in the large circular detail. To assemble the lamp, mount the socket in the center of a wood block by means of a $\frac{1}{8}$ -in. pipe nipple as shown in the small circular detail. The block, which serves as a base, should be just slightly larger than the brick, and has a short piece of spirally grooved molding attached to the underside near the outer edge to rest against the wall and serve as a brace. The lamp is supported on the wall by two screw hooks, which are fastened to the block to engage L-hooks or screw-eyes driven into the wall. The lamp is wired with an extension cord to a nearby wall outlet. It may be necessary to drive three or four short nails into the base to project into the opening of the brick and prevent vibration from working it off the base. The nails will be invisible from the outside. Or, the base surface could be grooved to take the brick.

—A. W. Elliott, New York, N. Y.



Portable Code-Signaling Blinker Uses Photo-Flash Gun



Boy Scouts and other boys' groups desiring a code blinker will find this one ideal and inexpensive. Under normal conditions, it will be visible over several miles of water or flat terrain. A small photo-flash gun and a 6-volt battery, wet or dry, are all you need to make it. To start, substitute a single-contact auto bulb for the flash bulb. To do this, mount the auto-bulb socket on a Bakelite disk, which is then fitted with two metal prongs as shown for insertion into a common receptacle plug which is screwed into the gun socket. Use a couple of short wires to connect the socket to the prongs as shown. In making the alteration, be sure that the bulb is high enough to center in the gun reflector. Next, drill a small hole in the bottom cap of the gun for two wires which connect the gun to the battery. In most guns, one wire can be soldered to the case and the other to the switch. However, your particular type of gun will determine the method of wiring it. If the switch on the gun is not suitable for closing and opening rapidly with thumb pressure, you can devise a simple spring contact for the purpose. Now, put a couple of spring clips on the projecting ends of the wires for connection to the battery and you are ready to try out the blinker.

—L. B. Robbins, Harwich, Mass.

Reglazing Paper After Erasure

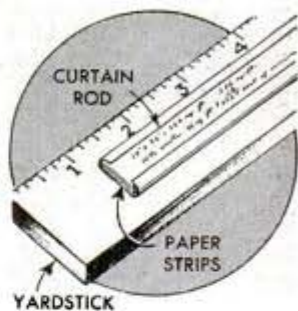
Erasing on tracing cloth or paper generally takes away its finish and makes the erased portion so thin it will not take a

good line. However, difficulty can be avoided if a glaze-stick made from a piece of soapstone is rubbed over the erased surface. This restores the glaze so that the spot will take ink readily without blotting and permits fine, sharp lines to be drawn.

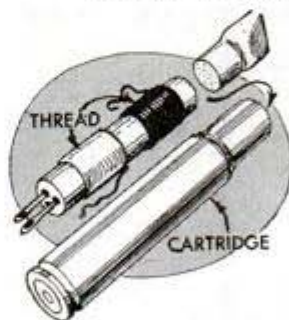
—J. H. Newberg, Brevard, N. C.

Small Note Pad on Yardstick Is Always at Hand

You will always have paper available for taking down notes when figuring a job if a note pad is attached to a yardstick as shown. To do this, screw a short section of telescoping curtain rod to the yardstick and then slip strips of paper, cut to the proper size, into it. When a strip of paper is filled, it is easily removed to expose a clean strip.



Sewing Kit for Your Pocket From a Rifle Cartridge



A 30-30 rifle cartridge with a small, round piece of wood to slip inside it will provide a handy sewing kit to carry in your pocket. A couple of yards of black and white thread can be wound around the

wood, which also is drilled lengthwise for the insertion of two needles. A tightly fitting stopper, either cork or one whittled from wood, completes the kit.

—Floyd McCracken, San Diego, Calif.

Non-Tip Base for Ink Bottle

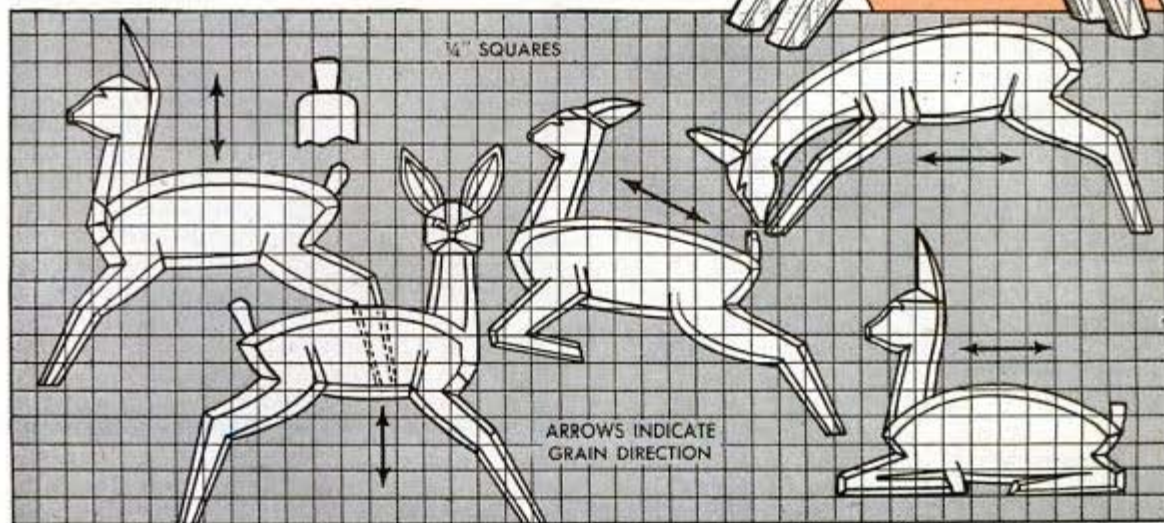
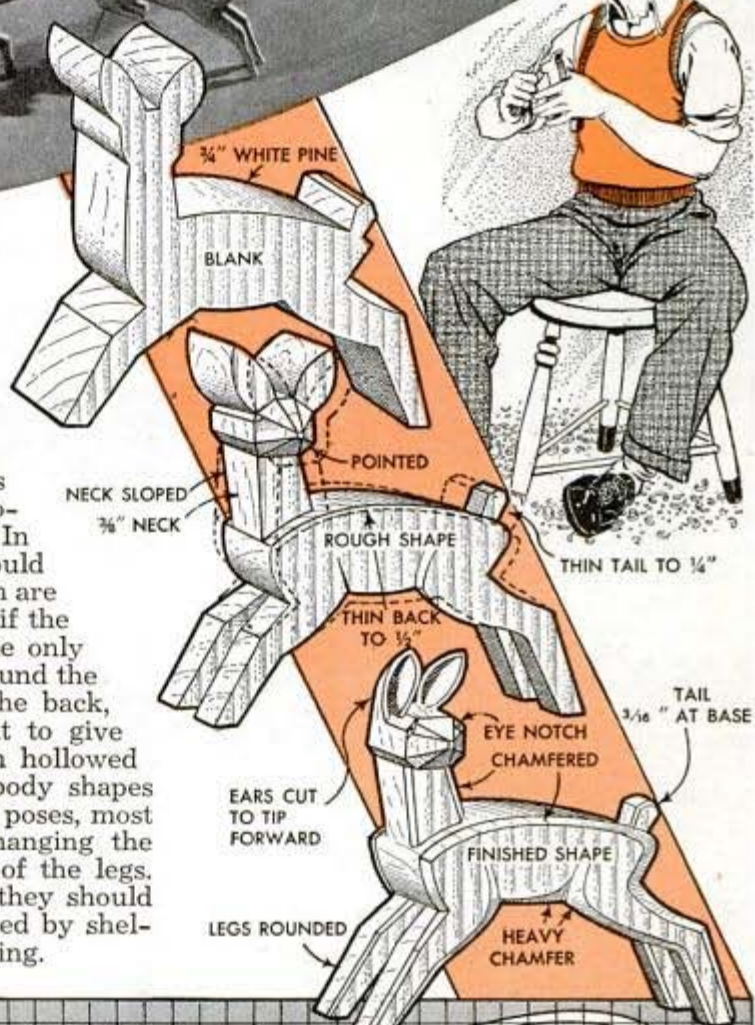
Have you ever spilled India ink over your work because the bottle was small and easily tipped? Such accidents can be avoided if you cement a heavy base to the bottom of the bottle. A glass caster cup, fastened with rubber cement, is ideal.



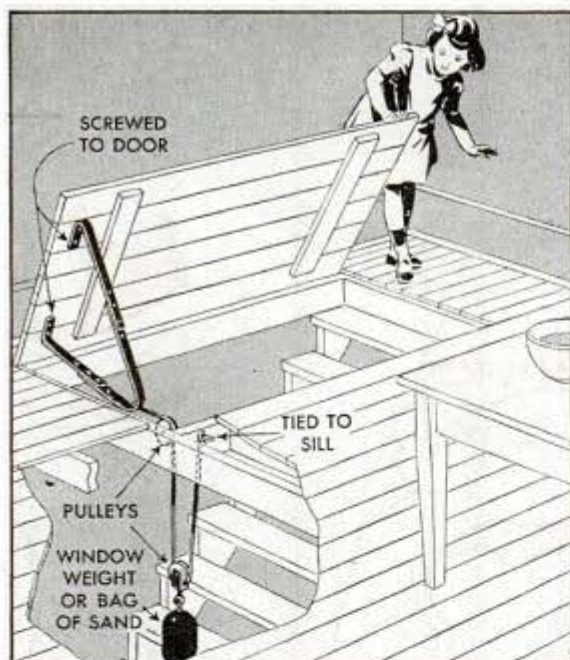
Whittle This Deer in Five Poses



HERE is an attractive little figure that even the most inexperienced carver can make with ease. Most of the work can be done on a jigsaw to produce a blank, which then is chamfered along the edges. The legs are now rounded and tapered toward a blunt point at the hoof. In general, the wood grain should follow the line of the legs which are fragile and likely to break off if the grain runs across them. The only careful carving required is around the ears, which are rounded at the back, undercut at the base in front to give them a forward tilt, and then hollowed out at the front. Head and body shapes are practically the same in all poses, most of which are obtained by changing the angle of the neck and shape of the legs. After the figures are carved, they should be sanded carefully and finished by shellacking and waxing or varnishing.



Counterweighted Basement Door Is Easy to Open and Close



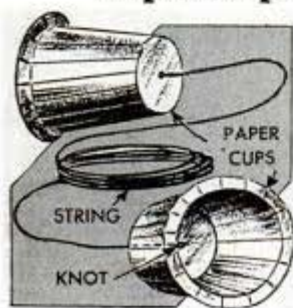
If you have a heavy trap door to your basement, here is a simple method of counterweighting it so that it can be opened or closed easily. Just bend a piece of flat iron to a long V-shape and screw this to the door near one end. At the lower end of the iron attach a rope and run this over a pulley attached to one of the sills, then through another pulley carrying the counterweight and on to a sill where the rope is tied. The weight will depend on your door; usually a window-sash weight will be sufficient, or you can use a sandbag.

—J. Frank Watson, Wheatland, Wyo.

How to Prevent Rusting of Tools

Excess moisture, which often rusts the tools in a tool box, will be absorbed by a few cones of carpenter's blue chalk kept in the box. Drying the chalk thoroughly in an oven every two months will renew its effectiveness.

Play Telephones Are Made From Paper Cups and String



Children will have a lot of fun with this simple set of play telephones, which will transmit their voices for a distance of several feet. All you need is a couple of stiff paper cups of the

type shown and a suitable length of string. A tiny hole to receive the string is punched in the bottom of each cup, the string inserted and knotted. In use, when the string is held taut by pulling lightly on the cups, speaking into one of the cups sets up vibrations which are transmitted through the string and reproduced in the bottom of the other cup. Of course, the string must not touch anything to dampen the vibrations.

—H. R. Alley, Northbrook, Ill.

Ammonia Cleans Lettering Pens

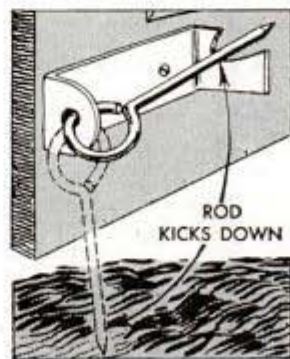
Those who use lettering pens can avoid the annoyance of India ink drying on them in a heavy crust by dipping the points after use in a bottle of dilute ammonia. The pens should be shaken vigorously to remove the surface moisture.

Bottom of Garage Water Can Shielded Against Wear

Sliding a water can on the floor of a garage or on the concrete around a filling station soon wears a hole in the bottom of the can. To help avoid this, the owner of one garage puts a rubber shield on the can. The shield is cut from an old inner tube and is tied on the bottom of the can with a stout cord so it can be replaced easily.



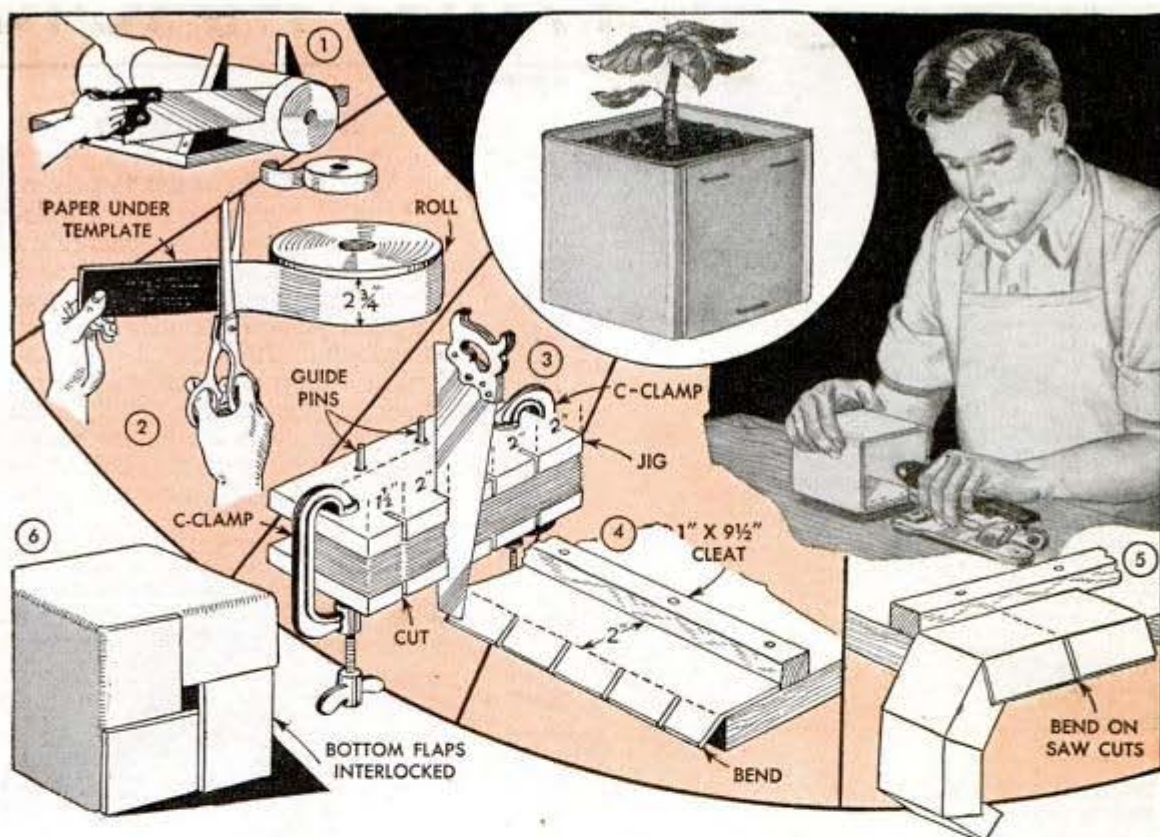
Stop on Garage Door Operated Without Stooping or Bending



When you need a stop to keep a garage or other large door open, this one is positive in action, can be made at practically no cost and can be operated with your foot. The stop consists of a metal bracket shaped as shown to take a length of $\frac{1}{4}$ or $\frac{3}{8}$ -

in. iron rod which is pointed at one end and has an eye formed on the other. In use, the rod can be dropped into position with the toe of your shoe. When you want to release the stop, push slightly on the door and flip the rod back onto the bracket with your foot.

Paper Pots Made in Quantities to Start Plants



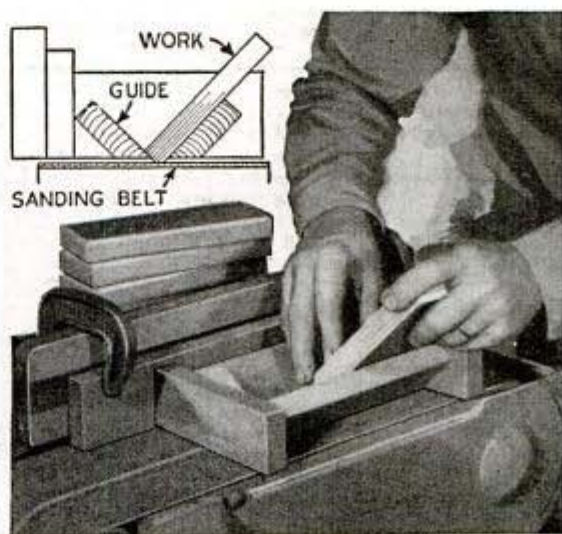
Making a number of pots for starting plants indoors is a simple job if you have a roll of building paper, preferably the red rosin type. To begin, saw from one end of the roll a slice $2\frac{3}{4}$ in. wide as in Fig. 1 if you want pots 2 in. square, or $4\frac{1}{4}$ in. wide for pots 3 in. square. Then, using a template, unroll the slice and cut the paper into strips $9\frac{1}{2}$ in. long for 2-in. pots or $14\frac{1}{2}$ in. long for the larger size as in Fig. 2. Three

or four dozen of these strips can be slotted to form the bottom flaps if you use a hand saw and a clamp as indicated in Fig. 3. The slotted edge of each strip is folded down as shown in Fig. 4, and then is folded crosswise as in Fig. 5. This done, ends of the strips are overlapped and stapled or glued together to form the pot, which is completed by folding over and interlocking the flaps at the bottom as in Fig. 6.

Jig Aids in Chamfering Small Work on Your Belt Sander

Clamped to the fence of a belt sander, a simple trough-shaped jig with sides at 90-degree angles will enable you to sand chamfers quickly and accurately. It is particularly suited for very small work that is difficult and dangerous to chamfer on a jointer or shaper. In use, the work is pushed into the guide, which has a narrow opening at the bottom, and is held in contact with the belt. It is impossible to overcut the work, and the fence can be reset as needed to utilize the full width of the sanding belt.

Ⓜ A narrow strip of rind from a slab of bacon may be used temporarily to pack a water pump on a car when regular packing cannot be obtained. A coat of graphite will improve this emergency packing.



PAINT MAGIC

By Sam Brown



TREATMENT OF WALLS BEFORE PAINTING is important and should not be neglected. Torn paper in corners can be patched easily with gummed tape

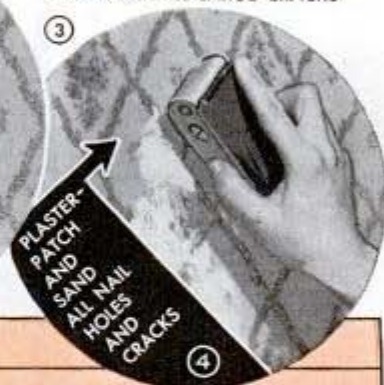
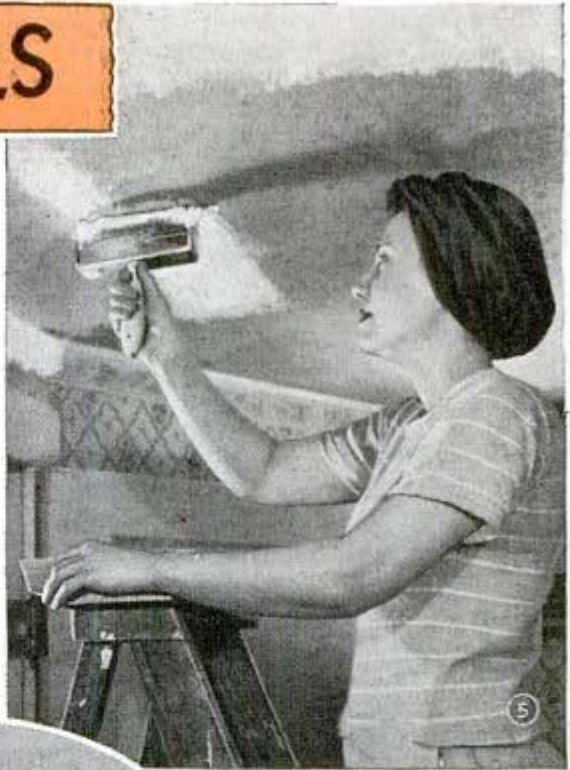


TABLE No. 1		CHARACTERISTICS OF WALL PAINTS					
Kind of Paint	Where Used	How to Thin and Apply	Coverage		General Features		
			Cost per 100 sq. ft.	Drying Time			
POWDER-FORM WATER PAINTS	Calcimine	Ceilings, walls—Any firm, dry surface. Walls should be glue-sized	5 lbs. with ½ gal. water covers 300 sq. ft.	10c	1 hr.	Cheapest. Excellent for all ceilings. Not durable. Not washable. Cannot be double coated. Washes off easily with warm water	
	Casein Wall Paint	Ceilings, walls—Can be applied on almost any surface. Suitable for upper part of both or kitchen	Powder form—Thins with water. Do not size unless walls are very porous	5 lbs. with 1 gal. water covers 500 sq. ft.	12c	1-2 hrs.	Smoother, longer lasting than calcimine. Will stand mild washing after 30 days. Takes second coat okay
PASTE-FORM WATER PAINTS	Casein Wall Paint	Ceilings, walls—Can be applied on almost any surface. Suitable for upper part of both or kitchen	Paste form—Thins with water. No sizing required. Apply with brush, roller or spray gun	1 gal. with ½ gal. water covers 600 sq. ft.	37c	1-2 hrs.	One coat will cover most surfaces. No primer needed. Best paint for light reflecting value. Tends to be lumpy and is harder to mix smooth than resin base
	Resin-Base Wall Paint	Ceilings, walls—Can be applied on almost any surface. Suitable for upper part of both or kitchen	Paste form—Thins with water. No sizing required. Apply with brush, roller or spray gun	1 gal. with ½ gal. water covers 600 sq. ft.	48c	1-2 hrs.	Most durable, most washable of water-mixed paints. High hiding. Can be second coated. Excellent light reflection. Mixes easily
READY-MIXED OIL PAINTS	Flat Wall Paint	All interior walls	Use at can consistency. Thin with turpentine if needed. Apply with brush or spray. Needs undercoat except on surfaces previously painted	500-600 sq. ft. per gal.	42c	4-18 hrs.	More durable, washable than any water mix paint. Pleasing flat surface
	Semi-Gloss Paint	Excellent for woodwork and for walls in kitchen and bath	Use at can consistency. Thin with turpentine if needed. Apply with brush or spray. Needs undercoat except on surfaces previously painted	500-600 sq. ft. per gal.	60c	Overnight	Best for kitchen or bath where frequent washing is necessary. Usually requires undercoats which add to cost. Too "hard" for living and bedroom walls
	Gloss Enamel	Excellent for woodwork and for walls in kitchen and bath	Use at can consistency. Thin with turpentine if needed. Apply with brush or spray. Needs undercoat except on surfaces previously painted	500-600 sq. ft. per gal.	65c	24-48 hrs.	

for Your WALLS

Treatment of walls before painting: Water-mix paints can be applied on almost any clean, dry surface. Finishing over wallpaper is popular, but don't depend too much on one coat to hide the pattern. A weak pattern can be covered nicely but strong designs usually show through, not so much because the paint is at fault but because certain wallpaper colors either bleed into or repel water-mix paint. An example is paper with gold or silver metallic printing. Often it is necessary to coat such a paper with a pigmented wall size before the water paint will take. On the average, 50 percent of all papers will cover with one coat; 45 percent will require two coats and 5 percent will require a primer coat. All loose edges of paper should be pasted down, Fig. 2. Don't tear them off, as a torn edge will be plainly visible. An exception is corners, where it usually is necessary to strip the paper

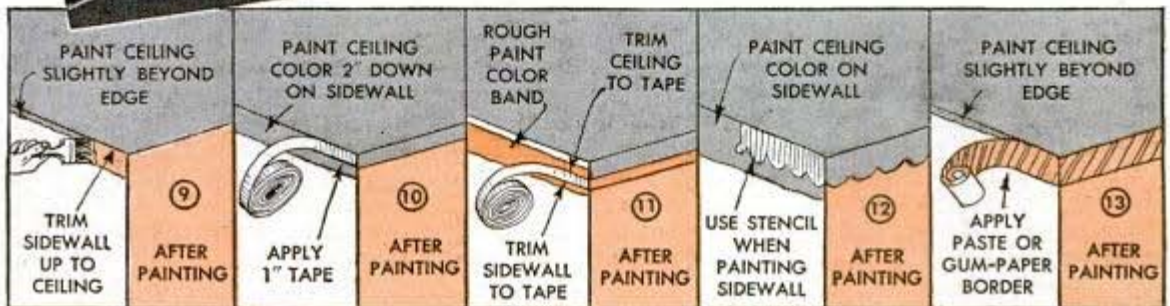
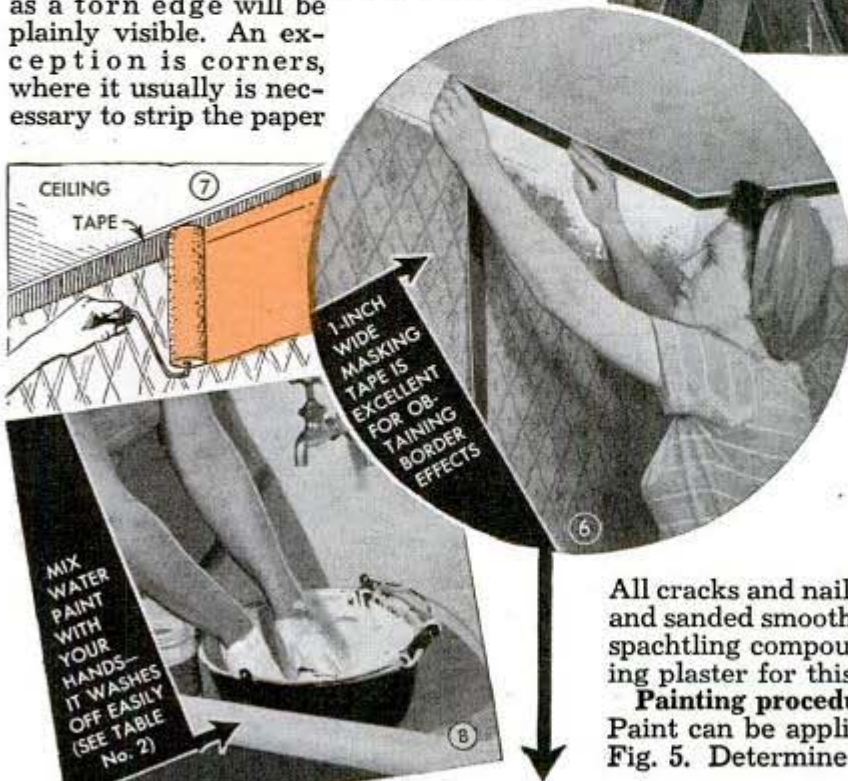


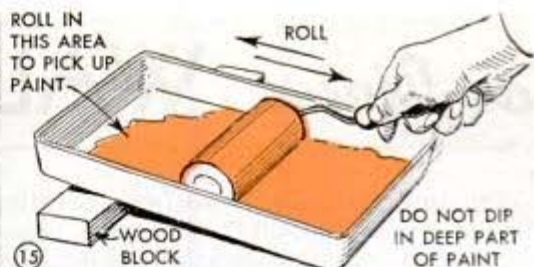
APPLICATION is simple with either brush or roller. Use masking tape to set off the borders

back about an inch. Patch the corner with two strips of 2-in. wide gummed-paper tape, turning the corner $\frac{1}{4}$ in. with the first strip and butting right into the corner with the second as in Fig. 1. Wet the plaster before applying tape and run the tape through water to get it really wet.

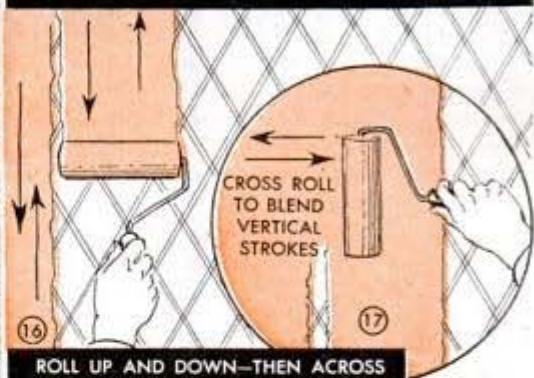
All cracks and nail holes should be patched and sanded smooth, Figs. 3 and 4. The finer spachtling compound is better than patching plaster for this work.

Painting procedure: Ceilings come first. Paint can be applied with brush or roller, Fig. 5. Determine the type of border you





A FLAT TRAY OR PAN IS ESSENTIAL



ROLL UP AND DOWN—THEN ACROSS

ROLLER COATER is faster and smoother than a brush. Use as above; practice with the coater a little before you start on actual work

want before starting so that you will know whether or not to extend the ceiling color down the sidewall. Cheap masking tape is excellent for laying off borders as in Figs. 6 and 7. Two 8-ft. strips can be used several times and thus cover a whole room. Various ideas for borders are shown in Figs. 9 to 13. Mix the paint in a pan or pail as in Fig. 8, following the proportions given in Table No. 2. The roller coater, Fig. 14, is much faster and smoother than brushing. Break in your roller by washing in warm water and rolling dry on newspaper to remove loose fuzz. A flat tray (you can buy paper ones) is essential, Fig. 15. Apply paint with vertical strokes, leaving a slight space between the paint strips as in Fig. 16, then roll crosswise as in Fig. 17 to blend. Don't load the roller with too much paint until you have had a little practice, and don't press heavily on a roller freshly filled with paint. To reach low spots in the surface, increase pressure as the roller becomes dry. Don't worry about sags in the paper, as they will flatten out when the paint dries.

Special colors: You can buy water-mix colors in solid deep tones. Use these to tint white or any of the light pastel shades the color you desire. Mix the tinting color in a separate container with a little water, Fig.



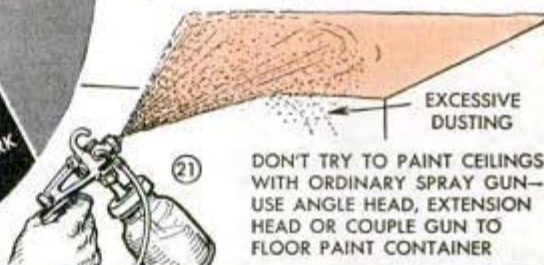
18, then add gradually to the slightly thinned paint. A casein base product will mix with a resin base product. Add water gradually, stirring as you go, especially if you are using a casein paint, which will be lumpy and hard to mix if all the water is poured in at once. If you are going to brush on the paint, it is a good idea to add a small quantity of glycerin. This holds the coat open (wet) longer so that you have plenty of time to paint a strip and still have a wet edge for a smooth blend when you paint the adjoining strip. If you can't get glycerin, use boiled linseed oil, and work it in while the paint is in paste form. It emulsifies nicely with the paste but is hard to work in after the paint has been thinned.

Spray application: Water paints spray nicely but are dusty. Be sure everything is out of the room before you start. Cover the floor with newspapers. Mask all trim with masking tape as in Fig. 19, and then use a shield while spraying, Fig. 20. Go over all woodwork and glass with a damp rag as soon as dust has settled. Dusting is held to a minimum by using the paint as thick as the gun will take. It can be sprayed with exceptionally heavy body by using a pressure feed gun coupled to a small compressor. Don't try to spray the ceiling unless you have suitable equipment, Fig. 21.

Mottle finishes: These are attractive, especially if the surface is a little too rough to look nice in a single flat color. First, apply a



IF YOU SPRAY, use paint at heaviest body gun will handle to minimize dusting. Use masking tape for clean edges. Go over woodwork with damp rag as soon as paint dust has settled



DON'T TRY TO PAINT CEILINGS WITH ORDINARY SPRAY GUN—USE ANGLE HEAD, EXTENSION HEAD OR COUPLE GUN TO FLOOR PAINT CONTAINER

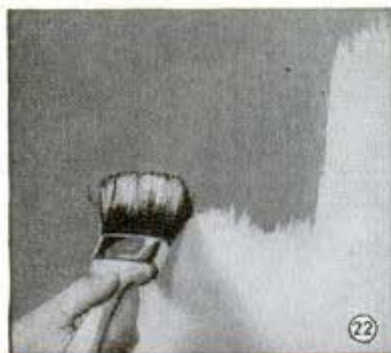
ground coat of water-mix paint, Fig. 22, let dry overnight, then mottle with roller or sponge as shown in Figs. 23 to 28. A two-color mottle usually is the most attractive. Rules for using color are given in Table No. 3. Do a couple of practice panels on paper or wallboard before you start.

News roll: The ground coat for this is preferably a pigmented wall paint or other hard-finish undercoat. Applied over a water-mix paint base, the effect tends to be soft and fuzzy. This makes a nice finish and is easy to do as shown in Figs. 29 to 31. The news roll makes a good base for a mottle finish when redecorating.

Spatter finish: This is obtained by tapping the surface with a fiber brush loaded with paint as in Figs.

MIXING PROPORTIONS FOR PASTE WATER PAINT			TABLE No. 2	
Surface or Finish	Method of Application	Water		Other Ingredients
		Per qt.	Per gal.	
Paper, Wall-board, Plaster, Flat Paint	Brush	16 oz. (1 pt.)	4 pts.	Recommended but not essential: 2 oz. glycerin per gal. of paste for smoother brushing and slower drying. Boiled linseed oil can also be used.
Oil Paint—All Non-porous Surfaces	Brush	12 oz. (¾ pt.)	3 pts.	
All Surfaces	Roller	12 oz.	3 pts.	
All Surfaces	Spray (suction feed)	12 oz.	3 pts.	None
All Surfaces	Spray (pressure feed)	8 oz.	2 pts.	None
Sponge or Roller Mottle	Sponge or roller	10 oz.	1 qt. 8 oz.	4 oz. glycerin per gal. of paste
Streak Glaze	Brush on—wipe with cloth	24 oz.	3 qts.	None
Flat Stipple	Brush	8 oz.	2 pts.	1 pt. spar varnish per gal. of paste. Add water last
News Roll *	Brush on—wipe with newspaper	18 oz.	2 qts. 8 oz.	6 oz. glycerin per gal. of paste

* Works best over ground coat of pigmented wall size



GROUND COAT is required for all two-tone finishes. Let water paint dry overnight before applying color coat

32 and 33, or by snapping the color onto the wall as shown in Fig. 35. A widely spaced spatter in two colors is effective if the paint dots are brushed out with a dry brush before they dry hard. Fig. 34 shows the result.

Streak glaze: It is a simple matter for anyone to imitate the appearance of wood grain with this finish, which is easy to apply. First, apply a coat of white or cream water paint and allow it to dry overnight. Then, brush on a thin coat of colored water paint and immediately wipe the color with a crumpled soft cloth. You will get the streaked, wood grain effect shown in Fig. 36. Although any colored paint can be used over a white or cream ground coat, good color combinations for this finish are brown over a cream ground coat, or green over a white ground coat. It may take a little practice



ROLLER MOTTLE—Pick up color on roller, Fig. 23, then apply roller to wall, being careful not to overlap. Two times over makes a heavier mottle, as shown in Fig. 25. Use a stippling roller, not a roller coater



SPONGE MOTTLE—Trim sponge so that it has a flat side. Dip in water to soften, then wring dry. Press onto the color slab, Fig. 27, then transfer the paint to the wall. Two color mottles are very effective



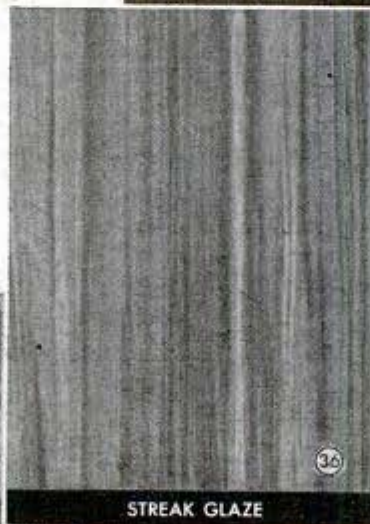
NEWS ROLL—Use a pigmented ground coat for this, not water paint. When dry, apply color coat of water paint. Crumple a sheet of newspaper, Fig. 29, and roll this over the fresh paint, Fig. 30. Change the paper as often as may be necessary. Fig. 31 shows a heavier pattern obtained by double rolling



SPATTER FINISH—This novel effect can be obtained in three or four different ways, as shown above and described in the text. Two or more complementary colors may be spattered on one ground coat if desired

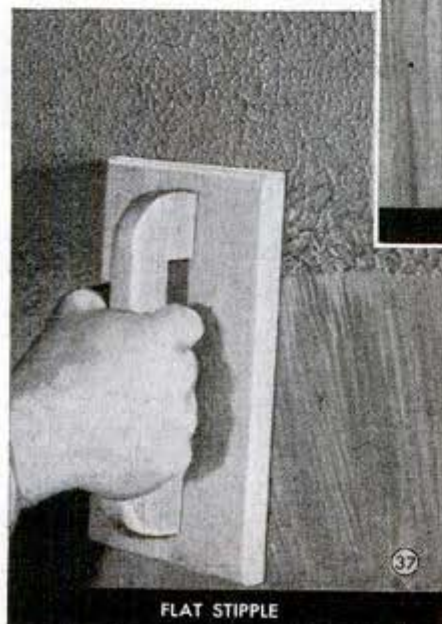
to produce the desired effect, but if any particular area does not please you, just apply a new coat of colored paint and try wiping again. You will find that it is not necessary to wipe in continuous strokes from the ceiling to the floor as the strokes can be blended together easily.

Flat stipple: Mix the paint for this according to Table No. 2. This is a single-coat finish and does not require the ground coat common to other novelty finishes described. Just brush it on, let it stand about 5 min., and then stipple. This can be done with a brush, preferably a stippling brush if available, by merely tapping the surface with the face or bristle end of the brush.



STREAK GLAZE

Or, it can be done with a wood float as shown in Fig. 37. The float is merely applied to the surface and then pulled straight out as indicated. The mild texture is effective in a single color, or it can be highlighted by applying a thin coat of contrasting color and immediately wiping with a cloth.



FLAT STIPPLE

COLORS FOR TWO-TONE FINISHES

TABLE No. 3

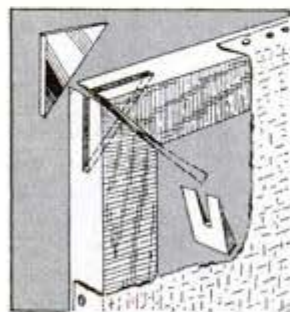
Finish	General Rules	Examples
Mottle or Spatter	Tints of same color	Light blue over dark blue
	Any color on cream or white	Blue over cream
	Contrasting colors (Not too strong)	Rose over blue-green
	Two mottle coats are usually more pleasing	White and light blue over orange
News Roll	Any color on cream or white	Green over white
	Complementary colors	Orange over blue
Streak Glaze	Any color on white or cream	Brown over cream Green over white

Tape Small Flashlight to Trumpet To Illuminate Music at Night



When marching at night or when playing where the light is poor, musicians often can avoid eye strain by attaching small flashlights to their instruments to illuminate the music. On trumpets and cornets, the flashlight can be taped to the back curve of the instrument as shown.

Metal Corner Pieces and Wedges Tighten Artist's Canvas on Frame



A good way to expand the frame of an artist's canvas is to cut diagonal slots through the mitered corners, insert a triangular piece of sheet metal to fit each slot and then slip over it, from the inside of the frame, a wooden wedge in which a cut as thick as the metal has been made. After tacking on the canvas and squaring the frame, tap the wedges lightly to force apart the joints and expand the frame.

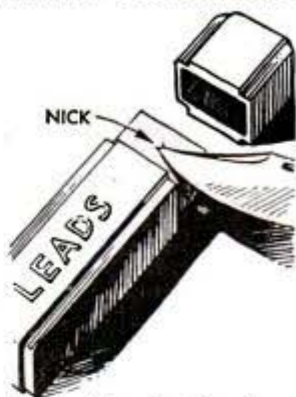
Chemical Test for Polarity

A simple polarity test of an electrical circuit which will indicate the negative terminal quickly is prepared by soaking filter paper in a solution of 1 gram of phenolphthalein dissolved in a small quantity of alcohol, to which has been added 100 c.c. of 10 percent solution of potassium chloride. After it has dried, the paper is cut

into small strips which are used for the test. When a strip of the paper is placed in contact with each terminal, the paper at the negative terminal will show a bright red stain.—Arthur Beiser, New York City.

Fitting Lids of Plastic Containers

Small plastic boxes containing pencil leads and similar articles frequently have loose-fitting lids that may come off unexpectedly and spill the contents. If a small nick is made in the box with the point of a knife as shown the lid will fit tightly. Press the knife point into the plastic, then give it a slight turn in order to raise the surface at one point.



Bundles of File Cards Identified By Lettering on the Edges



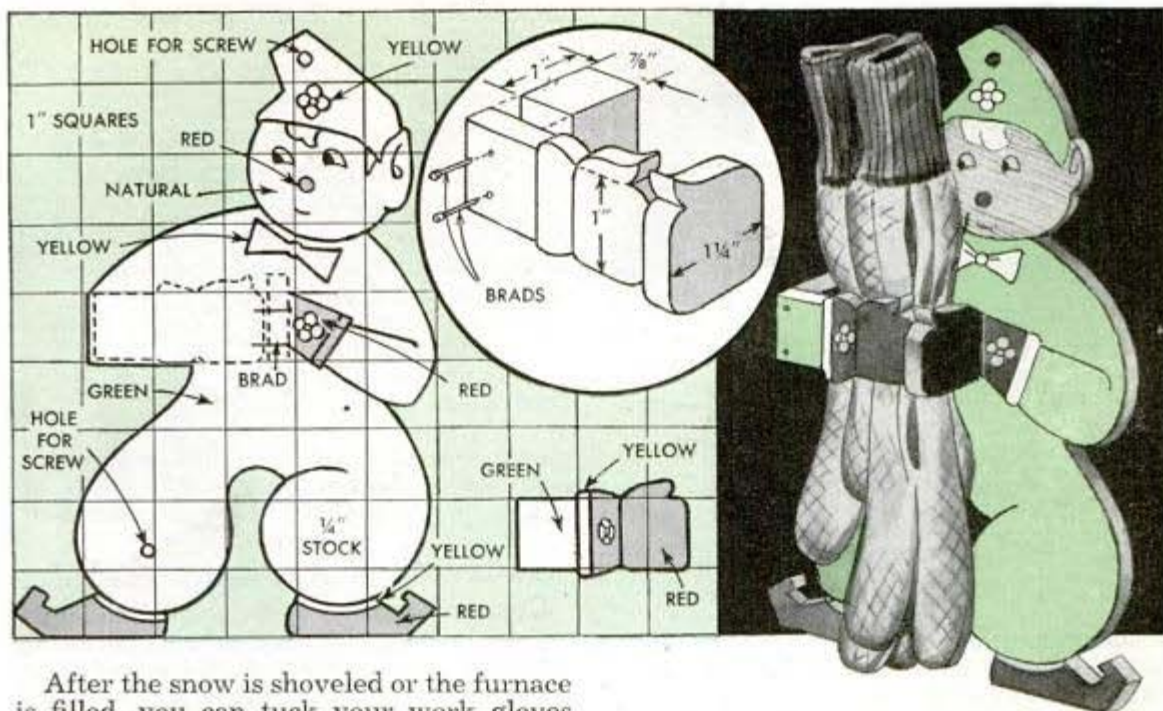
Packages of file cards can be identified easily in storage if they are marked along the edge according to date, subject or other classification used. In order to mark them, hold or clamp the edges together firmly and print the necessary information on them with ink or colored pencil. —Mildred Anderson, Chicago.

Cushioning Porcelain Socket Against Breakage

Porcelain sockets of the type shown often are broken accidentally when they are mounted because one of the screws was pulled down too tightly, especially if the mounting surface is slightly uneven. To avoid this trouble, slip a piece of inner-tube rubber under the socket before driving the screws. The rubber will allow the socket to adjust itself to any slight irregularity.



Your Gloves Always at Hand in This Holder



After the snow is shoveled or the furnace is filled, you can tuck your work gloves away in the crook of this little figure's arms where they will be handy for the next day's work. The figure is traced on plywood or hard-pressed board and jigsawed, and the right arm and left hand are assembled as shown in the circular detail. Small holes

through one leg and the peak of the cap permit screwing the figure to a wall or other convenient place. Suggestions for painting are given, although the figure may be finished in any color combination.

—R. L. Fairall, La Crescenta, Calif.

Counterweighting Pickup Arm Reduces Record Wear

Some phonograph pickup arms are so heavy that they cause excessive record wear even with ordinary steel needles, and especially when a long-life sapphire needle is used. By reducing the arm's weight, record wear will be reduced without noticeably affecting the tone quality. This can be done by counterweighting the pickup arm as shown. To determine the weight needed, a beam scale is improvised. This consists of a stick, such as a length of

dowel, with a piece of string tied at each end and equidistant from the center. One of these is tied to the pickup arm at the needle position and the other holds an envelope or piece of paper in which BB shot or similar small weights can be placed. The beam is supported at the center by a looped string. Then, by filling the container until it exactly balances the arm, the weight of the latter can be found by weighing the shot. If they weigh more than 1 oz., the pickup arm probably is too heavy. To reduce its weight to about 1 oz., the arm should be counterbalanced in a specific proportion. This is determined by measuring the distance from needle to pivot and from pivot to a point on the mount where a weight can be placed so as not to strike any object when the arm moves. If the former distance is five times the latter, a counterweight of 5 oz. is required to reduce the weight of the pickup by 1 oz. This counterweight, which can be made from sheet lead or other suitable material, is attached by a metal strap screwed to the arm as shown.

—Willard Allphin, Danvers, Mass.



Rain Kept From Soiling Windows With Strips Nailed to Roof



On summer cottages and other buildings not fitted with eaves, small strips of wood nailed above windows in the manner shown prevent rain water from running down to soil them. When only light rains are falling, the strips are sufficient to turn all the water to either side of the windows so that it does not drop onto the panes.

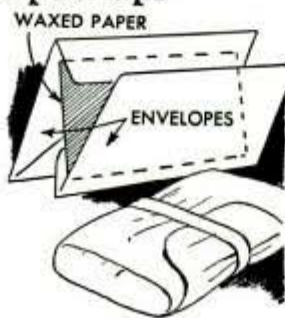
Rubber Heel Serves as Pedal Pad



A rubber heel will make a serviceable and easily replaced substitute for a worn rubber pad covering the clutch or brake pedal of your car. Drill two holes through the heel and the pedal plate and insert bolts to hold them together.

Wax Paper Prevents Sticking Of Envelope Flaps

In humid climates or when carried in your pocket, envelopes sometimes become sealed. To avoid this trouble, I arrange them with pieces of wax paper next to the adhesive on the

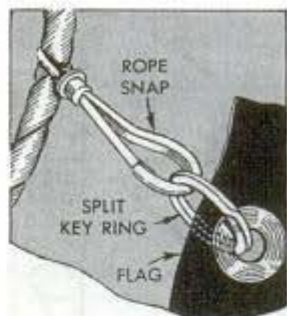


flaps as shown. A number of envelopes can be prepared in this way and then bundled in waxed paper. The paper can be used repeatedly without replacing it.

—Pfc. Andrew Vena, New York, N. Y.

Key Ring on Grommet of Flag Provides Easy Attachment

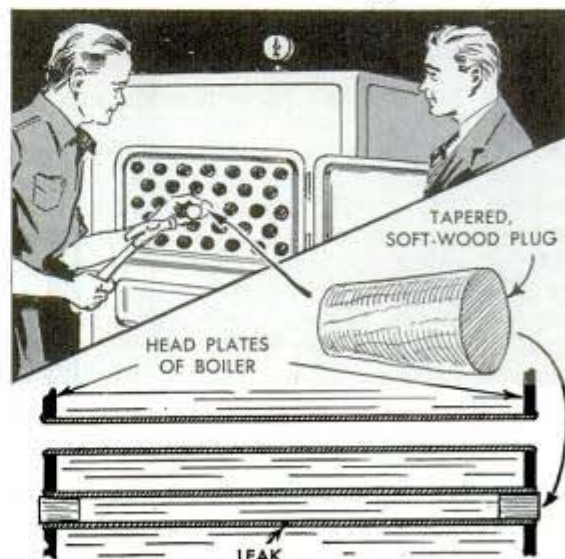
When you can't place a snap fastener in the grommet of a flag because the latter is set in too far for the snap to engage, place a split key ring in the grommet and attach the fastener to the ring.



Common Bleach Removes Ink

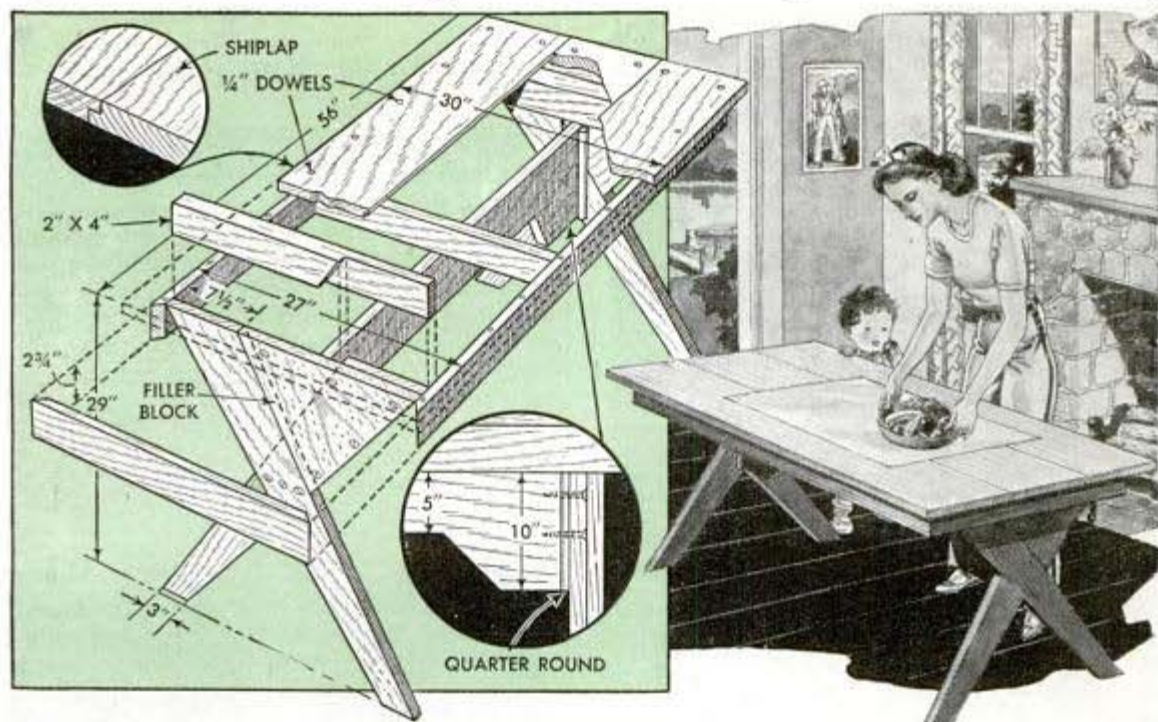
Common bleaching solutions of the laundry variety can be used as an eradicator that will remove inks of all kinds except indelible. It is convenient to place the remover in an empty bottle of the type which has a glass rod attached to the cork, since this can be used in applying the eradicator.

Wooden Plugs Stop Leak in Boiler Of Home Heating Plant



Having a leak suddenly develop in one of the flues of his horizontal steam boiler, one home owner repaired it temporarily by carefully driving tapered softwood plugs into the ends of the flue. As soon as the flue filled with water from the leak the plugs swelled tightly in place and were kept wet so that there was little danger of their becoming ignited under a medium fire in the boiler.

Reinforced X-Legs Make Cottage Table Sturdy



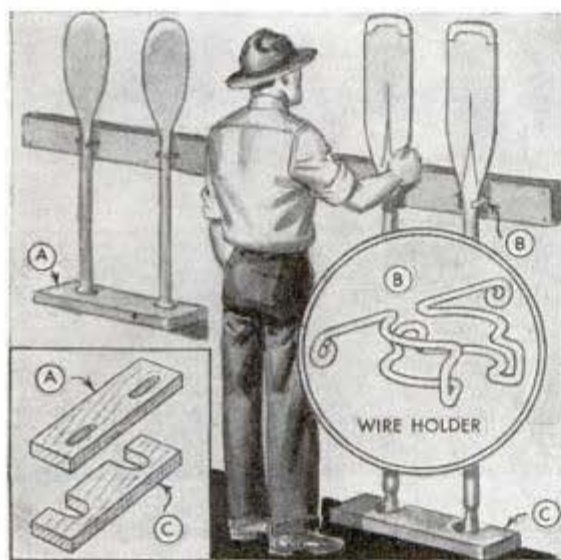
Built of pine or other common lumber, this sturdy table is doubly reinforced for use in cabins or summer cottages. Construction is simplified by using X-type, tapered legs, which are made flush across the table ends by a triangular filler block. A cross brace, cut as shown in the lower detail, assures rigidity. Seasoned lumber should be used for the top, which is dow-

eled in place. If unseasoned lumber is used, the boards may shrink and leave openings. Therefore, they should be nailed on temporarily until completely shrunk, after which dowels are substituted for the nails. After the table has been well sandpapered, the application of two coats of shellac and one or two of liquid wax will prevent stains from soaking into the grain.

Rack Holds Oars and Paddles Upright to Prevent Damage

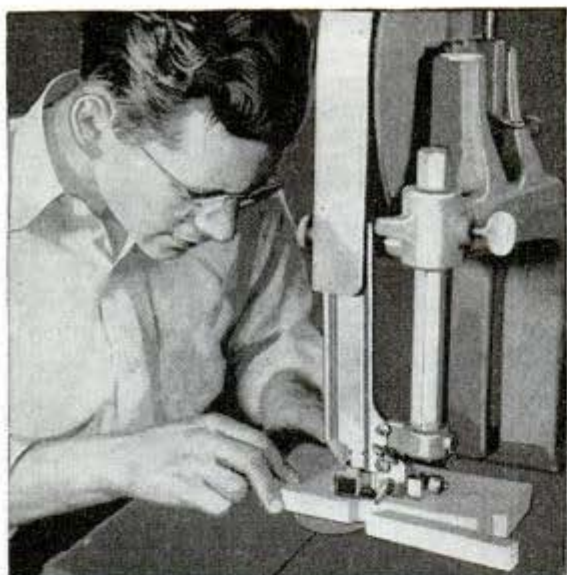
Instead of leaning oars and paddles in a corner of the boat house as is often done, you can set them in a neat rack like the

one shown, where they are less likely to become nicked or split. The rack has a wire holder for each oar and paddle and butt blocks into which the ends fit. The wire holder shown at B, bent from heavy-gauge wire, is shaped so that an oar shaft can be pushed into it and retained by spring action. Instead of using a wire holder, the oars can be retained by a block, like that shown in detail C, equipped with wooden latches pivoted to drop across the slots. Butt block C is slotted for oar handles and block A is recessed to take the ends of paddles.—Pfc. Harry Mack, St. Louis, Mo.



Nail Polish Mends Torn Curtain

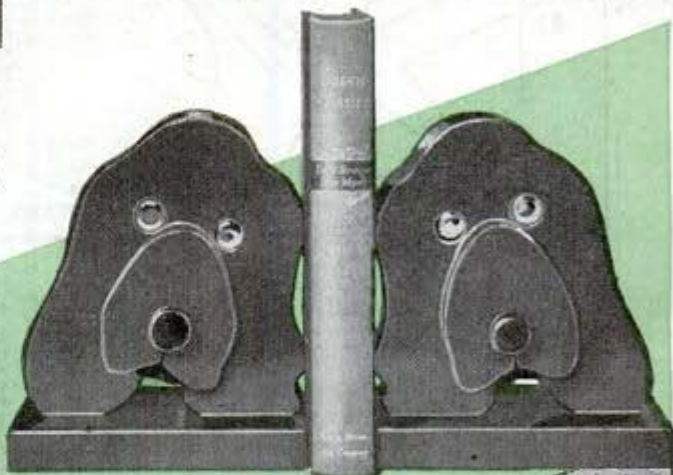
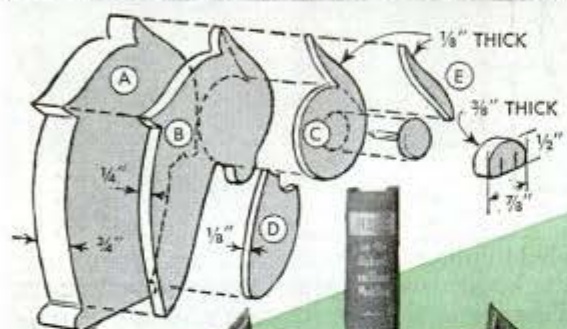
You can make an almost invisible mend for tears in net curtains by applying a thin coat of colorless nail polish to the tear and pressing the frayed edges together with the fingers until the polish dries. Curtains mended in this way should not be stretched after laundering them.



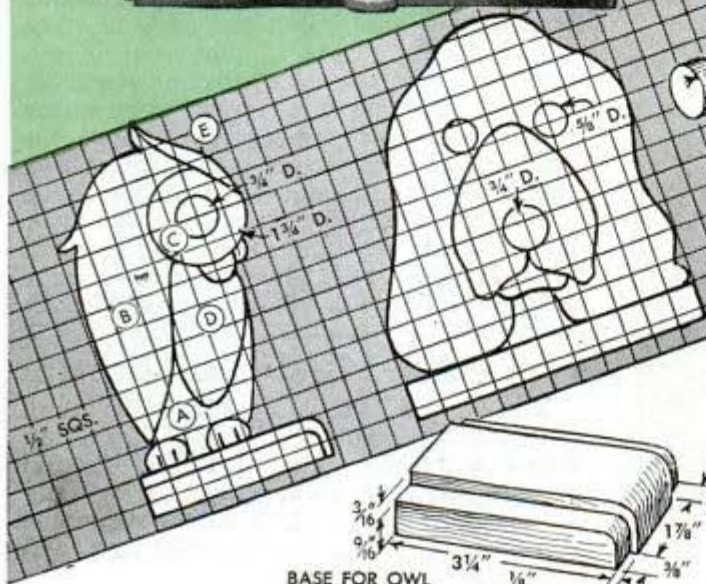
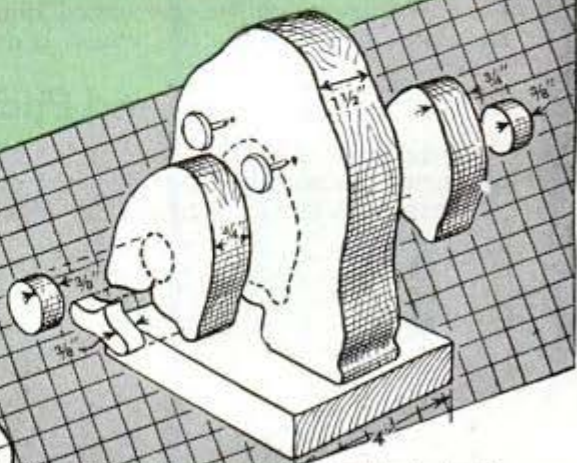
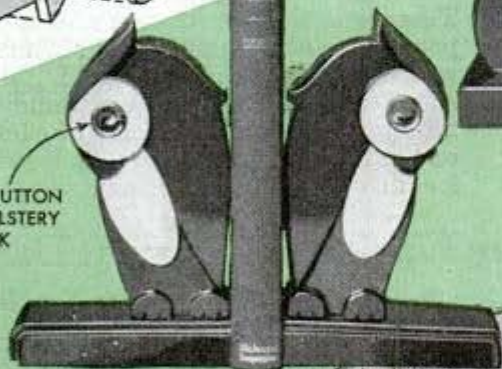
Six Styles in

By W. T. Warde

ATTRACTIVE book ends like these make ideal gifts, as the design can be suited to the recipient's tastes—even to his initial. For instance, instead of the spaniel you can use a likeness of another dog—a bulldog is particularly effective. The horse-head book ends are made of three laminations, the long curve of neck and mane being cut first, after which the pieces are glued together and the head and inside of the neck cut as one piece. In the spaniel



PLASTIC BUTTON OR UPHOLSTERY TACK

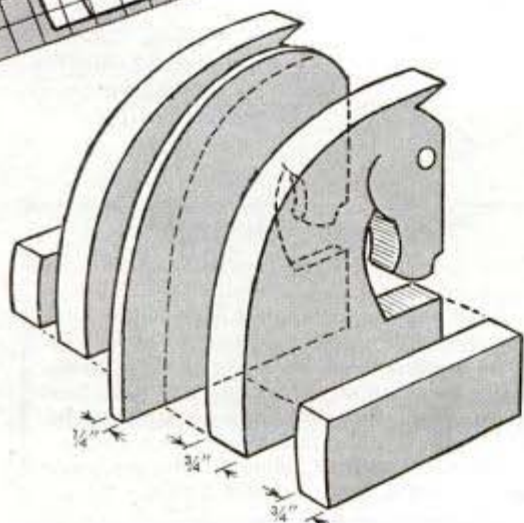
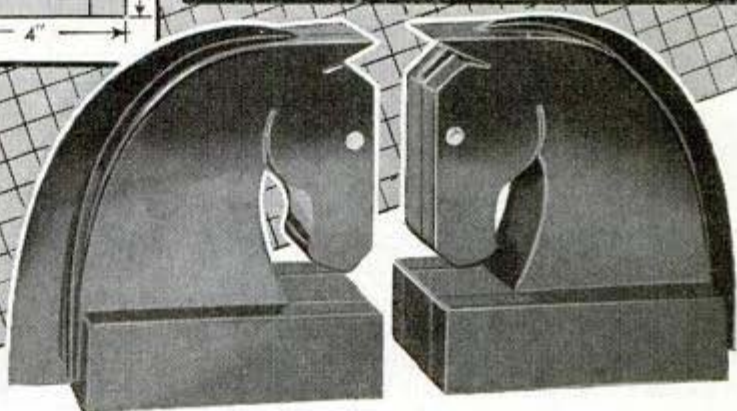
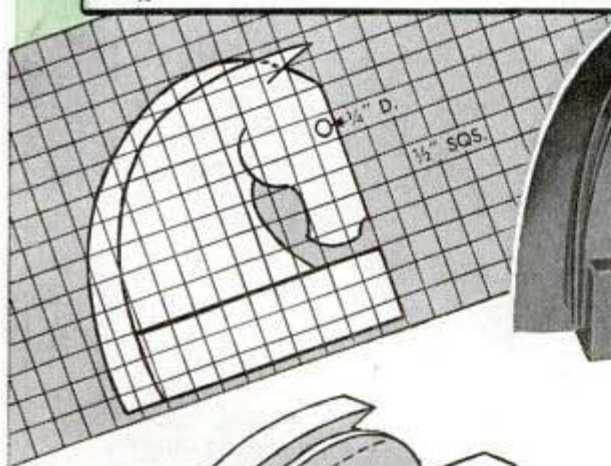
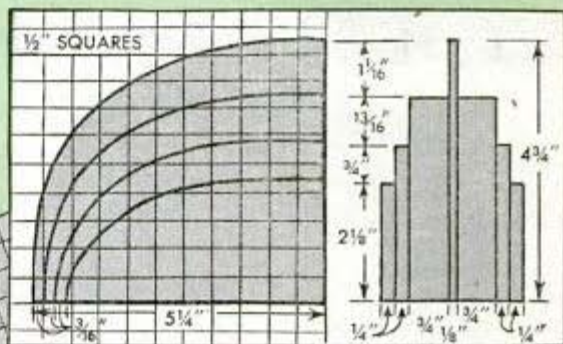
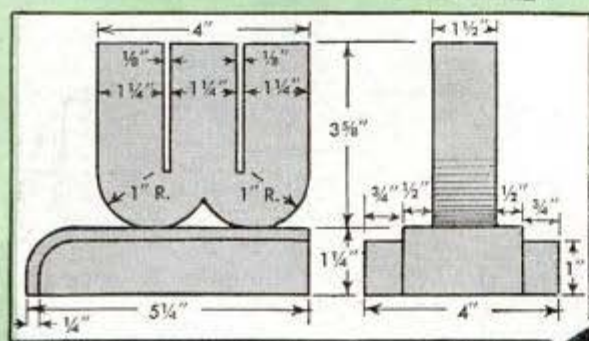
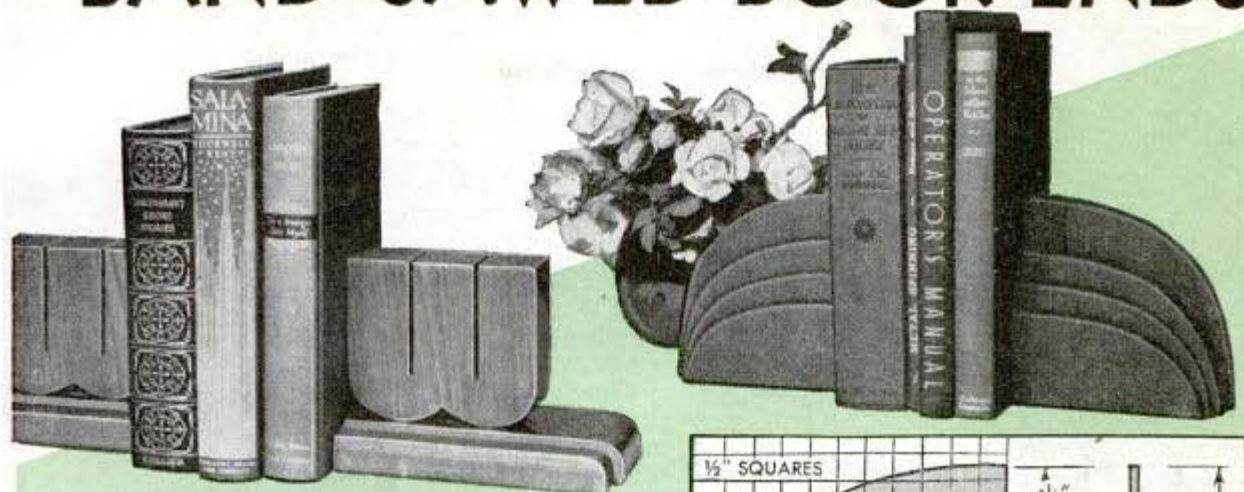


BASE FOR OWL



SUGGESTION FOR BULLDOG BOOK ENDS

BAND-SAWED BOOK ENDS



and owl designs, all inside curves are cut in pairs, and after these are glued in place, the contour of the body or head is cut. The completed book ends can be left in natural finish, some unusual effects being obtainable with just the grain. Or they can be enameled, the horse-head in black, the spaniel in golden brown with a black nose, and the owl in brown, white and black. The curved design can be dusted with fine sand while the paint is wet and then spray-painted with any desired color. For eyes use transparent plastic, either solid pieces or separate small lenses, holes for their insertion being drilled all the way through after assembly. Finally, holes are cut in the underside of the base and filled with melted lead to add weight, the bottom then being covered with felt.

Blade of Shovel Used as a Gauge To Determine Grade Level



Inconvenience of having a low chalkline in the way, or of having it covered by dirt when making a grade, can be avoided simply by raising the line above the predetermined level of the grade a distance equal to the length of a shovel blade. The grade level now can be determined by lowering or building it up until the shovel will just pass between the grade and line.

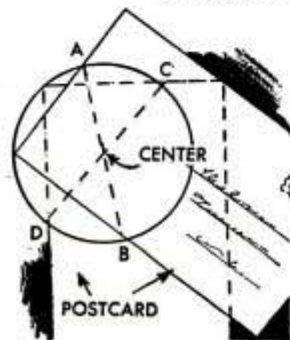
—Michael Ligocki, Gary, Ind.

Oil Thins Mimeograph Ink

When mimeograph ink will not flow freely through the stencil because the ink has thickened, it will make better copies if a small amount of light motor oil is added as a thinner, taking care not to add so much that the ink will "creep" through the paper. Other solvents are not practical as they tend to break down the pigments of the ink.

—Corp. Darrell Roberts, Flora, Miss.

Center of Circle Located Easily With a Postcard

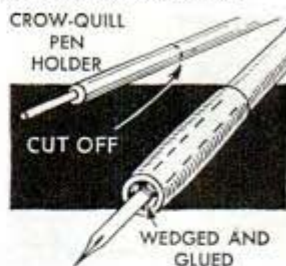


The next time you want to locate the center of a circle and have no instrument at hand for the purpose, just use a postcard or other card that has one side and end at true right angles. Place the card on

the circle with the true corner just touching it as shown, and mark positions A and B. Then swing the card a little and mark positions C and D. Now, draw lines from A to B and C to D. The center of the circle will be at the point where the lines intersect.—N. Bogoch, Winnipeg, Man., Can.

"Crow Quill" Is Easier to Use When Inserted in Penholder

If your work requires the use of a crow-quill pen, cramped fingers caused by gripping the small holder of the pen can be avoided by cutting off the holder and inserting it into a regular penholder. In some cases it may be necessary to wedge or glue the pen in place.—C. T. MacFarlane, Moncton, New Brunswick, Can.



Wax Paper Smooths Game Board

Faster, smoother play can be obtained in such games as caroms, crokinole and shuffleboard by rubbing the playing surface with waxed paper. This makes the playing surface smooth and slick so that shooters will slide more easily.

Using Regular Pen Point to Ink Straight Lines on Paper



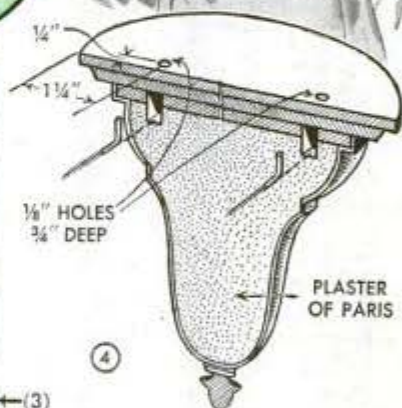
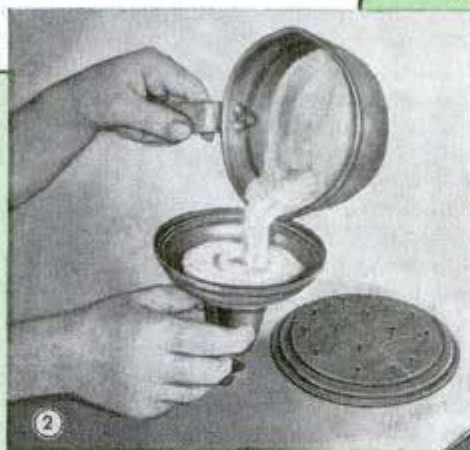
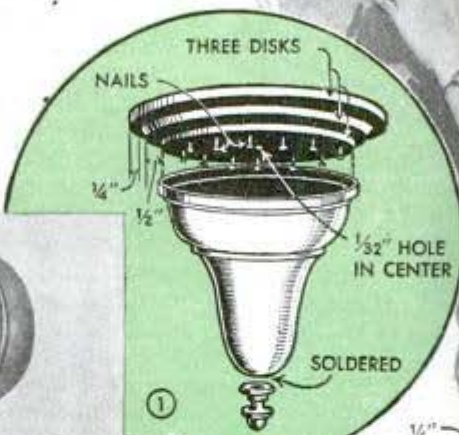
With an ordinary writing pen, an extra pen point and a ruler you can ink straight lines as easily as with a ruling pen. To do this, insert the extra pen point up, into the holder as shown, to serve as a guide which will follow the edge of the ruler.

WHAT HAVE YOU DONE?

Have you solved some troublesome everyday problem of a mechanical nature pertaining to your home, work or occupation, your hobby, play or recreation? If so, why not send us a short description accompanied by a sketch or a photograph? Many other readers may benefit from what you have done. We pay promptly for accepted material and return that which we cannot use. Address Homecraft Editor, Popular Mechanics Magazine, 200 E. Ontario Street, Chicago, Illinois.

From LIGHT FIXTURE to WALL BRACKET

TURNING a light fixture into an attractive wall bracket like that shown in Fig. 5 is a simple project in home decoration. All you need is a ceiling-fixture canopy, plaster of Paris, a brass ornament, some thin wood, a hack saw and a few brads. First, the ornament is soldered to the tip of the canopy. Then three wooden disks are cut so that the second projects $\frac{1}{2}$ in. beyond the bottom disk, and the top extends $\frac{1}{4}$ in. over the second, as in Fig. 1. This one should be



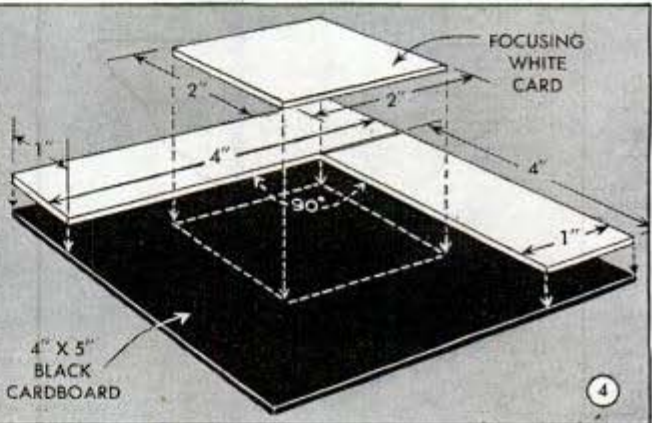
beveled. The disks are lined up by drilling a $\frac{1}{32}$ -in. hole through the centers and inserting a small nail, and then are glued, after which they should be shellacked. Next, brads are driven into the bottom disk as a key for the plaster. This should be thin, and poured to within $\frac{1}{4}$ in. of the canopy's edge, as in Fig. 2. The top section is pressed in place and the plaster allowed to set for 24 hrs. When it is hard, a center line is scribed across the top disk and over the canopy and the assembly is cut into halves as in Fig. 3. Light-gold bronze then is applied to top and backs, after which the brass is buffed and the complete unit is lacquered. The brackets hang on two screw hooks which engage holes drilled through the top as in Fig. 4, and slots are cut through the plaster and lower disk to meet them.

—Otto Merker, Chicago.

LANTERN

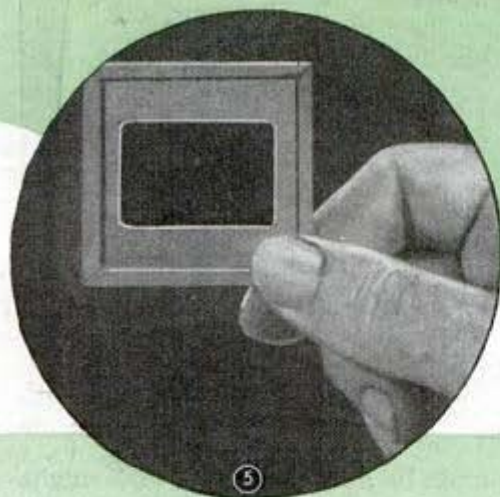
LANTERN slides made from your own negatives show fine shadow details and delicate gradations of tone better than paper prints because, unlike paper prints, slides are viewed by direct instead of reflected light. To make lantern slides, any good negative can be used. In projecting images to the slides, it is advisable to use an enlarger having double extension bellows, Fig. 1, to decrease the image to the desired size. However, an enlarger not so equipped can be used if a portrait lens is employed as in Fig. 3 to shorten the focal length. Sometimes it may be necessary to mount the lens and portrait attachment on a cardboard tube in order to reduce the picture to required proportions. In any case, as the projected scene most likely will come into focus only a few inches below the lens, books can be used to elevate the easel, Fig. 2, if the enlarger housing cannot be lowered sufficiently. Instead of using your regular easel, which is too large for the working space, a smaller one, designed for this kind of work, can be made as shown in Fig. 4. For focusing, a 2-in. square card as thick as the slide plate will do. This is set in place on the easel, which then is moved around on the book platform until the desired portion of the negative is positioned for printing. However, the picture should not be composed in the form of a square because the mask, Fig. 5, which is bound with the print in making the slide, has a rectangular opening.

In making the exposure, remember that slide plates are extremely high speed—almost three times as fast as bromide paper. Therefore, exposure time is critical. It should be computed as accurately as possible before making the print by using ordinary bromide paper as test strips and dividing by three the time required for printing these. Also, it is advisable not to



SLIDES *from Your* NEGATIVES

By ALEXANDER MAXWELL

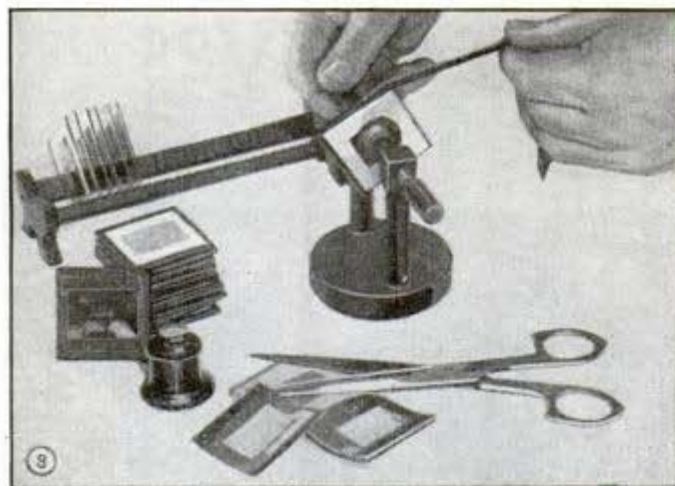


stop down the lens beyond $f:8$, otherwise dust in the enlarger or bubbles in the condensers may be brought into focus. To prevent movement of the enlarger caused by manipulating the switch, and to avoid overexposure by a possible delay in turning off the light, a piece of black cardboard should be used as a safety shield as in Fig. 2.

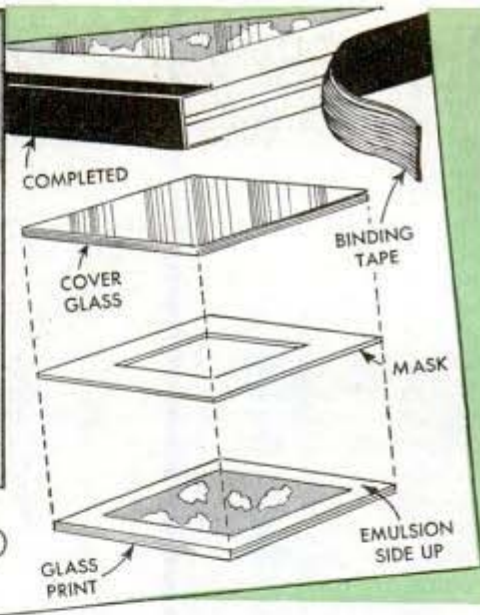
In developing the print, temperature should be carefully maintained at 68 deg. F. or as close to this point as possible. If it falls below 60 deg., action will be retarded, and if it rises much above this point, the emulsion may loosen. All solutions—developer, wash and hypo—must be of uniform temperature. Any standard bromide-paper developer can be used, diluted according to directions enclosed with the package of plates. Instead of using a standard tray, you will find a 3-in. glass ash tray, like that shown in Fig. 6, ideal for this purpose as only a little solution is needed to cover the plate. The tray should be rocked gently and continuously throughout development to break up air bubbles and prevent dust from settling on the emulsion.

After development, the print is washed and fixed in the same way as paper prints, except that greater care must be taken to avoid exposing the emulsion to the direct flow of wash water, which may tear it. If the print is to be left untinted, it may be dried and bound now. However, beautiful effects can be obtained by coloring the picture with a liquid dye or toner, sev-





eral varieties of which are available at most photo-supply shops. The dye is applied with a camel's-hair brush as in Fig. 7, a puddle being allowed to remain for 10 or 15 min. on the print, which then is immersed in clean water to clear the light portions. After drying the print, a second dye wash of a different color may be applied and even a third may be added for special effects. Care must be taken, of course, to avoid getting the dye on a sink or table as it leaves a stain difficult to remove. Prints can be dried rapidly by being immersed in alcohol which, on evaporating, takes with it much of the wash water. Then



they should be allowed to stand overnight edgewise in a rack as in Fig. 8, to give the emulsion time to harden, after which they are ready for assembling into slides.

Before binding, dust specks and lint are removed with a soft brush. Then the mask is placed silvered side up, and the cover glass is laid on top as in Fig. 9. The assembly is held in a vise as in Fig. 8 while binding tape is applied around the edges to hold the parts together.

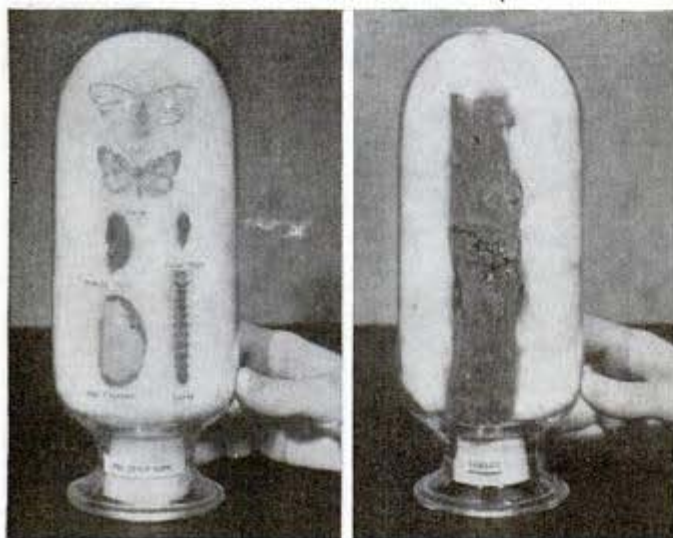
Filling of Display Jars Simplified by Paper-Backed Cotton

For displaying various collections, such as insects, rocks and minerals, inverted display jars of the type shown are ideal. Before placing the specimens on the cotton, lay a sheet of paper under it to provide a smooth surface, so that when the specimens are placed in the jar, more cotton or other filling can be packed into it to keep the

display securely in place, after which the paper is removed. If labels are needed, they may be pasted to the inside of the jar before it is filled. If desired, specimens can be placed on opposite sides of the jars and thus utilize more of the display surface. When this is done the jars should be placed so they can be viewed from both sides.

These display jars generally can be obtained in many sizes from biological or bottle-supply houses.

—John Karlovic, Chicago.



Metallic-Powder Finishes

Professional looking finishes with bronze or other powdered metallic paints are possible if the surface to be covered first is coated with a good grade of plain varnish, left to dry until tacky and then dusted freely with the powder. A soft powder puff or piece of cotton makes a good applicator. After the varnish has hardened, the surface should be buffed gently with the same puff.

—Jack Bronte, Nevada City, Calif.

Tapeline Determines Exposure for Close-Ups

If you use an exposure meter, here's a faster and more accurate method of determining exposure for close-ups than multiplying by factors or counting extra stops to compensate for the change in f values. These are correct as marked on the lens only at distances equal to or greater than ten times the lens's focal length, because with the lens racked out for close-ups, the light reaching the plate is less at the longer extension. All you have to know is the focal length of your lens. To find this, focus on some distant object and measure the bellows extension from the front of the lens to the ground glass. If the distance is 8 in., you have a lens of 8-in. focal length.

Assuming that you are using an 8-in. lens, with the bellows racked out 14 in., to determine the correct exposure, use the meter in the usual manner. At 130 lumens of light, the meter will appear as in the top diagram. Then, substituting the focal length of the lens (8 in.) as the f value (in this case f 8 on the meter scale), read the exposure that appears opposite the figure corresponding to the bellows extension—which is 14 in. in this case, read as f 14. The correct exposure, under the given con-



NORMAL SETTING



SETTING FOR CLOSE-UP

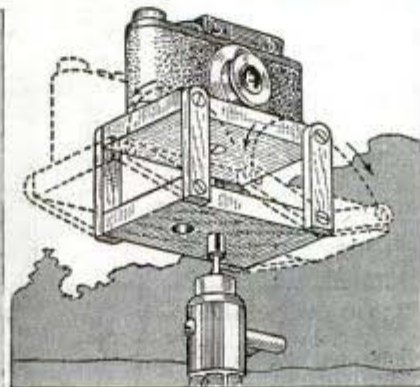


ditions, is now indicated as 1/12 sec. and not, as before, as 1/40 sec. Now rotate the scale until the figure representing the lens's focal length (as f 8 for 8 in.) has taken the place of the figure representing the bellows extension (14 in.), as shown in the lower diagram. With the scale so set, the light reading is now correctly shown as 40 lumens instead of 130 as before, and all the f stop figures will be positioned to read correctly for a close-up at the determined bellows extension.

Camera Set on Pivoted Platform to Make Stereo Photos

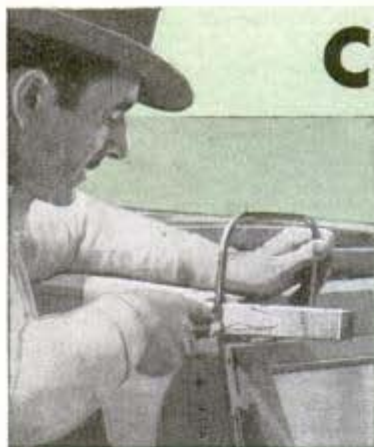
Set on a pivoted platform, any camera can be used for making pairs of stereo negatives. Perfect positioning is assured because the camera and platform are firmly attached to the tripod, being moved only laterally for the required separation. Two

pieces of wood of identical dimensions are used and the four metal links, which provide the shifting movement, also must be identical in size, the holes being drilled through all of them at once to assure uniformity. A distance of about 1½ in. be-



tween holes in the links provides a separation of approximately 2½ in. in the picture. The camera can be attached to the upper platform with a countersunk stove bolt reached by a screwdriver through a hole drilled as shown. A nut soldered to a large washer and countersunk in the under surface of the lower platform engages the tripod stud.

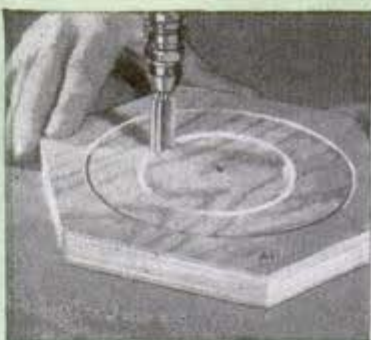
CRAFT QUIZ



1. He is using a—
 (a) Hack saw (c) Curve saw
 (b) Keyhole saw (d) Coping saw



2. This wood will require—
 (a) Sanding (c) Stain
 (b) Filler (d) Backing



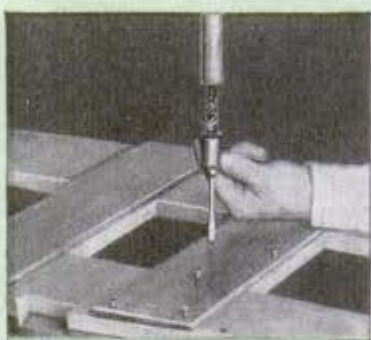
3. Best speed for this job is—
 (a) 5,000 r.p.m. (c) 10,000 r.p.m.
 (b) 1,000 r.p.m. (d) 4,000 r.p.m.



4. This knife is used to cut—
 (a) Basswood (c) Thin brass
 (b) Linoleum (d) Cloth



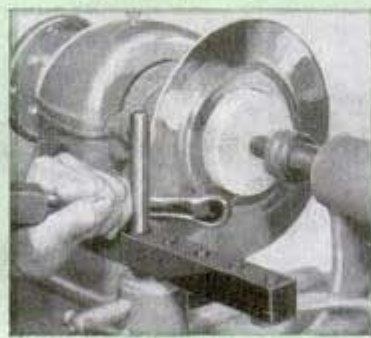
5. For this cutout you can use—
 (a) Basswood (c) Oak
 (b) Yellow pine (d) Walnut



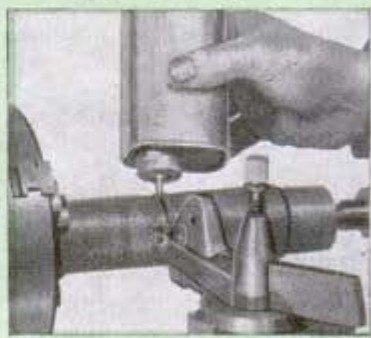
6. Best size screws for this job—
 (a) No. 0 (c) No. 20
 (b) No. 14 (d) No. 6



7. This worker is using a—
 (a) Spokeshave (c) Trimmer
 (b) Drawknife (d) Scraper



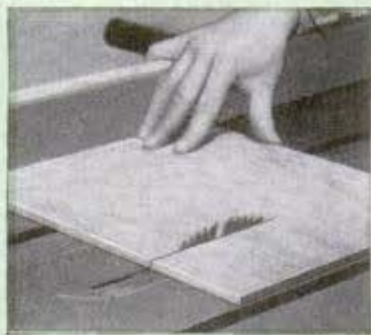
8. Best for this spinning job is—
 (a) Pewter (c) Soft brass
 (b) Aluminum (d) Mild steel



9. On this cut-off job you use—
 (a) Threading oil (c) Machine oil
 (b) Heavy oil (d) Olive oil



10. He will not need a—
 (a) Trowel (c) Straightedge
 (b) Calipers (d) Mortar

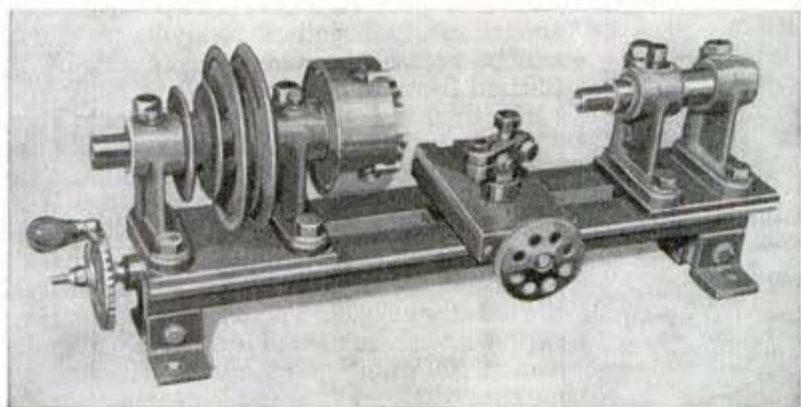


11. This sawing on plywood is—
 (a) Ripping (c) Crosscutting
 (b) Mitering (d) Chamfering

ANSWERS: 1-d; 2-b (Note wide, open grain); 3-c; 4-b; 5-a; 6-d; 7-b; 8-a; 9-a; 10-b; 11-a; (Note wood has no definite cross-grain. Here ripping is right as the work is being guided by ripping fence)



SHOP NOTES



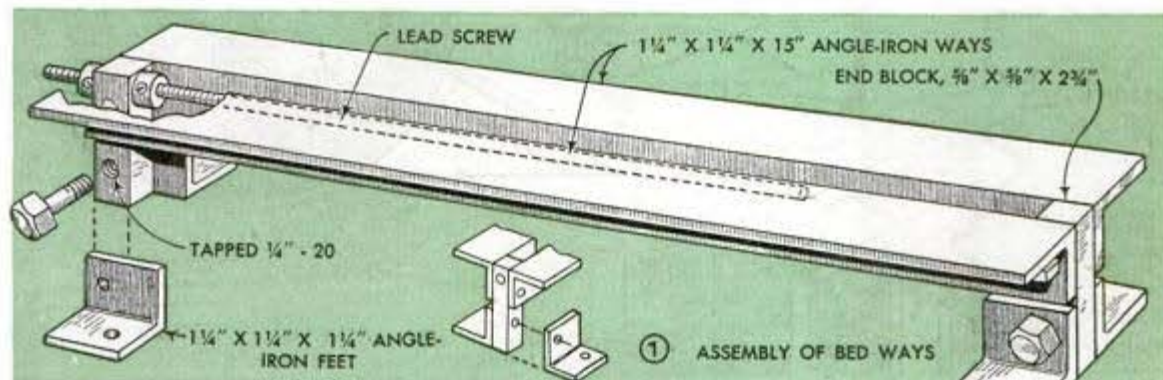
MIDGET *Metal-Turning* LATHE

by A. D. Mayo

CRAFTSMEN, modelmakers and others who need a small metal-turning lathe can make one almost entirely from scrap material available in junk or auto-wrecking yards. A chuck may have to be purchased, but many turning jobs can be done between centers or on an improvised faceplate. The lathe shown here has a swing of $4\frac{1}{2}$ in. A larger one, of course, can be made by changing the proportions.

In making the ways, Fig. 1, select straight

lengths of angle iron. These can be filed on the inner surfaces so that the slide block, Fig. 7, will travel true to within about .001 in. For finishing them smooth, a piece of fine emery cloth wrapped around a file or block is rubbed over the ways as in Fig. 2. One of the end blocks is drilled for a lead screw as shown in Figs. 6 and 7. This should not be done, however, until the carriage and slide block are positioned on the lathe, to assure locating the lead screw at the

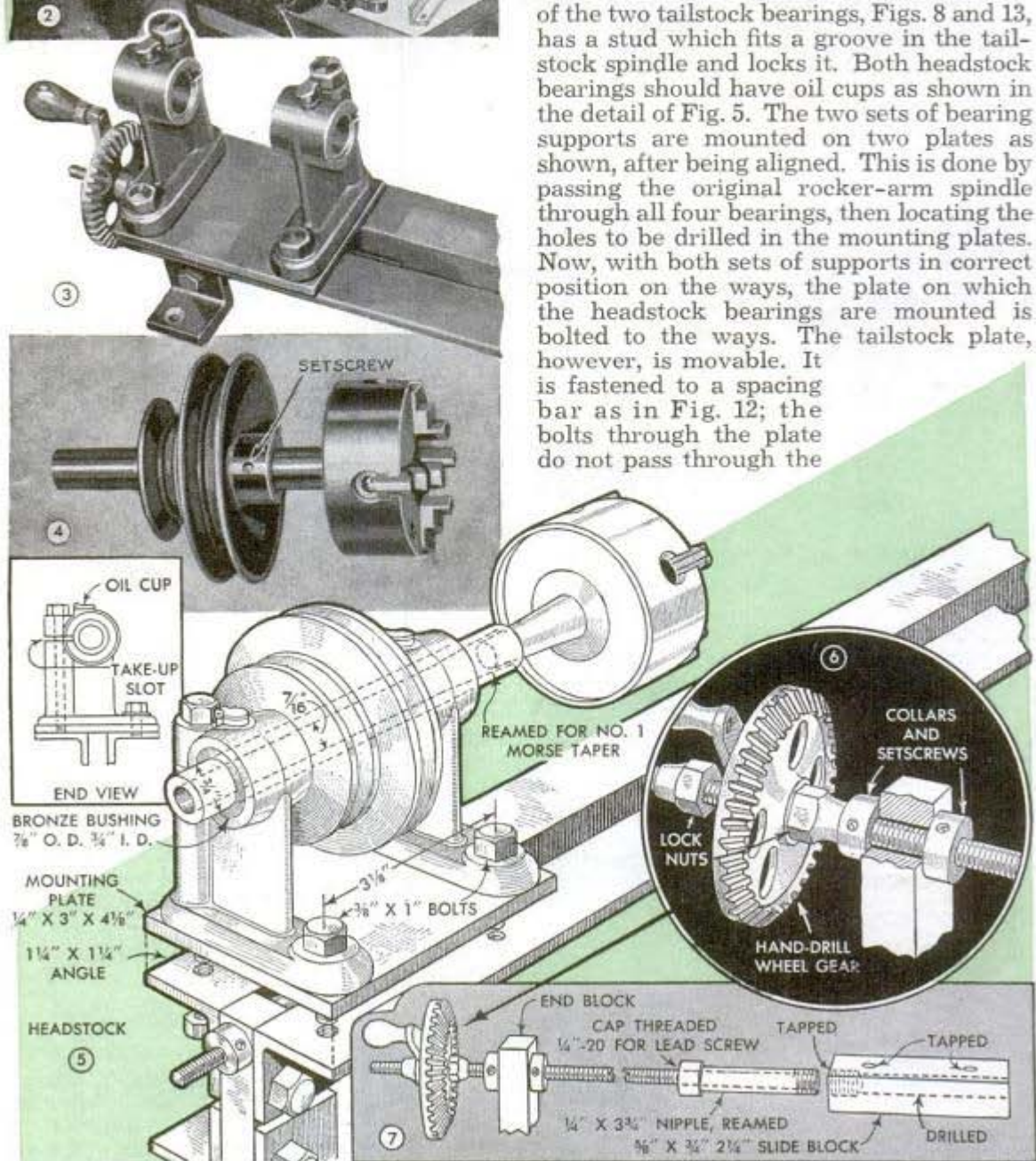


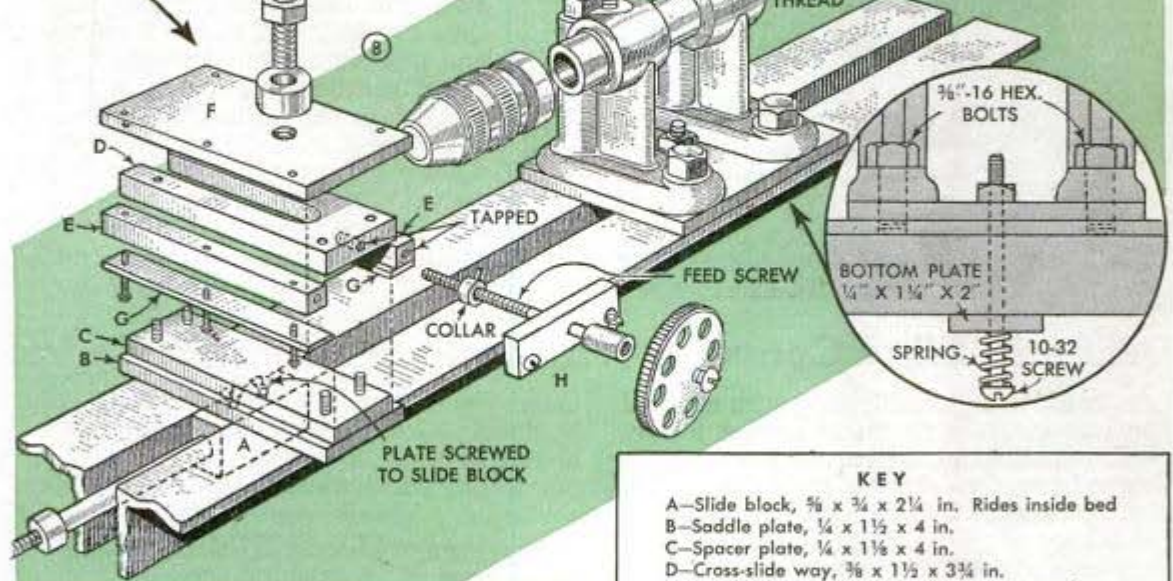
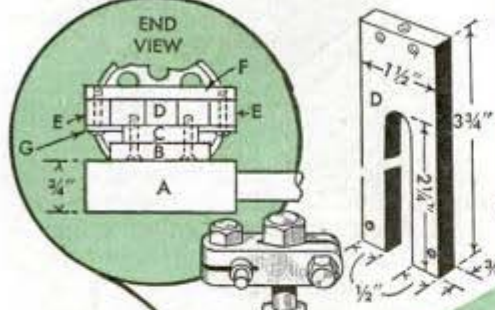
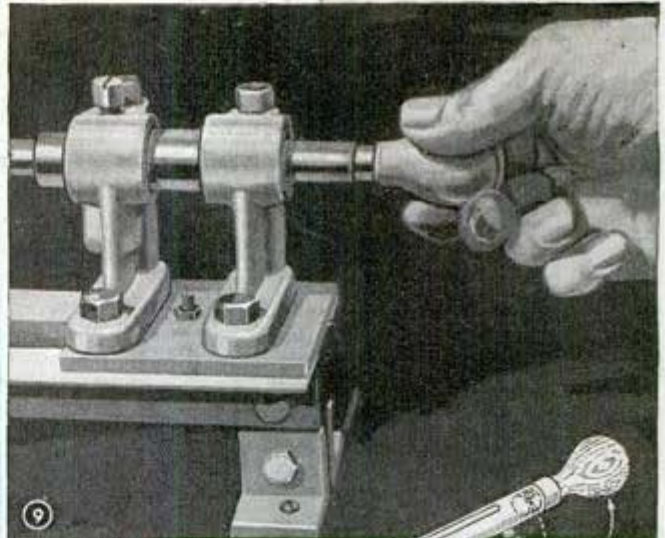
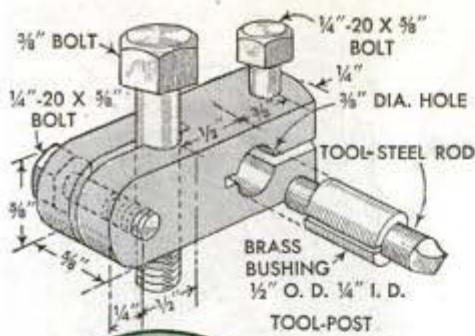


proper height. The screw is secured by collars and rotated by a gear wheel taken from a discarded hand drill. Or, almost any small crank or a wheel fitted with a knob will do. To allow maximum travel of the carriage, the screw should not be cut to length until all other working parts are in place and ready for use.

The carriage is shown in Figs. 8 and 10. For the small work done on a lathe of this size, the feed-screw thread should be fine. The tool post can be raised, lowered or turned in any direction. Even the tool itself can be rotated because it is round, being formed from an old drill bit.

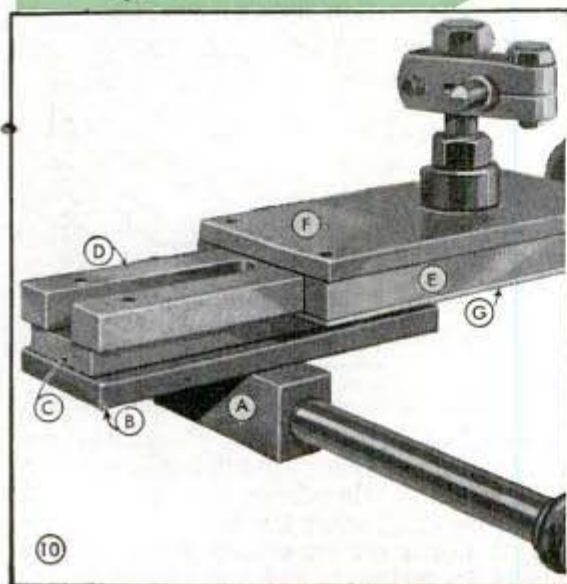
For the head and tailstock, shown in Figs. 3, 9, 12 and 13, overhead-valve tappet assemblies from an auto motor are used. One of the two tailstock bearings, Figs. 8 and 13, has a stud which fits a groove in the tailstock spindle and locks it. Both headstock bearings should have oil cups as shown in the detail of Fig. 5. The two sets of bearing supports are mounted on two plates as shown, after being aligned. This is done by passing the original rocker-arm spindle through all four bearings, then locating the holes to be drilled in the mounting plates. Now, with both sets of supports in correct position on the ways, the plate on which the headstock bearings are mounted is bolted to the ways. The tailstock plate, however, is movable. It is fastened to a spacing bar as in Fig. 12; the bolts through the plate do not pass through the





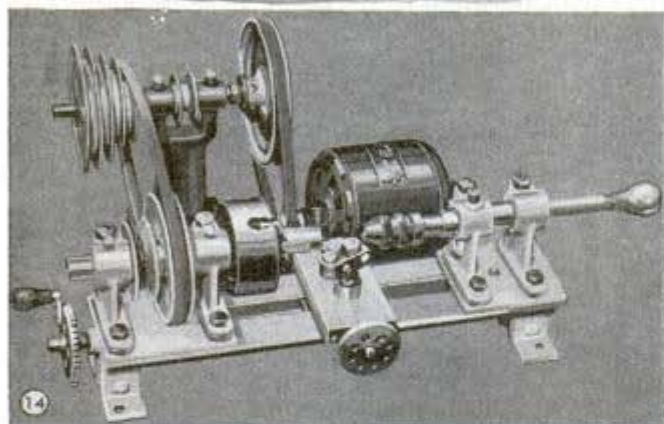
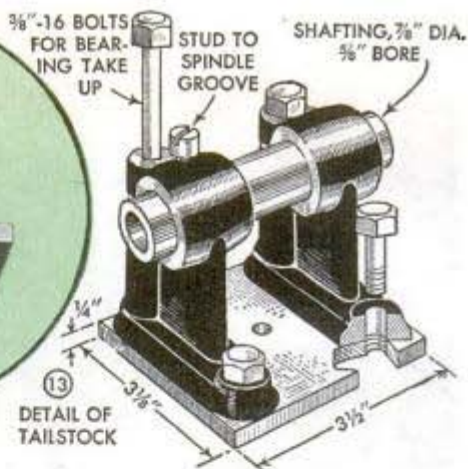
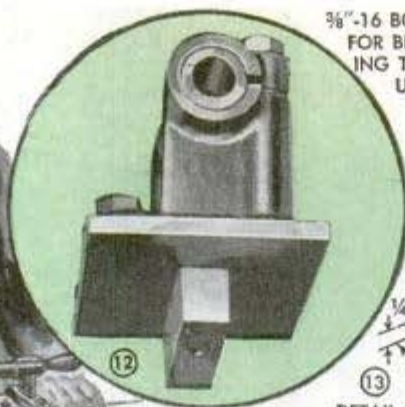
KEY

- A—Slide block, $\frac{3}{8} \times \frac{3}{4} \times 2\frac{1}{4}$ in. Rides inside bed
- B—Saddle plate, $\frac{1}{4} \times 1\frac{1}{2} \times 4$ in.
- C—Spacer plate, $\frac{1}{4} \times 1\frac{1}{2} \times 4$ in.
- D—Cross-slide way, $\frac{3}{8} \times 1\frac{1}{2} \times 3\frac{3}{4}$ in.
- E— " gib, $\frac{3}{8} \times 4$ in. key stock; 2 req'd
- F— " top plate, $\frac{1}{4} \times 2\frac{1}{4} \times 4$ in.
- G— " retainer, $\frac{1}{8} \times \frac{1}{2} \times 4$ in.
- H—Front panel for cross slide, $\frac{1}{4} \times 1\frac{1}{8} \times 2\frac{1}{4}$ in.



ways. The assembly can be locked by a screw through a bottom plate as shown in the circular detail of Fig. 8. To check the alignment, the carriage can be used as illustrated in Fig. 11: with the tool touching the spindle near the headstock, the carriage is moved toward the tailstock. If the bearing supports are in alignment, the tool will touch the spindle uniformly throughout its travel from end to end.

After using the rocker-arm spindle to align the bearings, suitable lengths are cut off, one for a sliding fit of the tailstock spindle, Fig. 9, and the other, for the headstock, reamed at one end to take an adapter on which the chuck is screwed. The tailstock

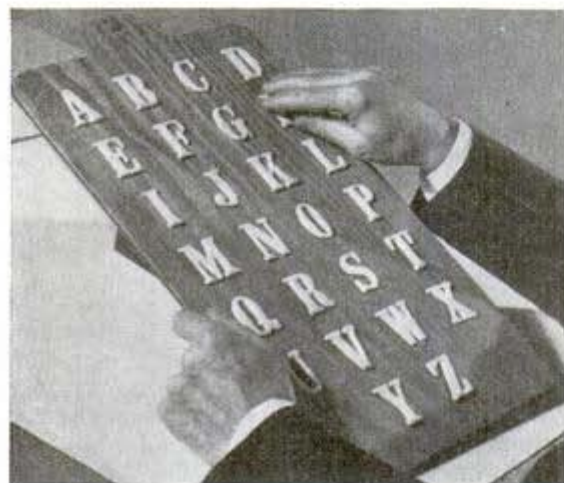


spindle is fitted with a small chuck and a wood handle. In order to use a tailstock center and other attachments having a No. 1 Morse taper, you can make an adapter which screws on the spindle. Bronze bushings are inserted in the headstock and pulleys are fitted on the headstock spindle as in Fig. 4. A countershaft as shown in Fig. 14 is necessary and may be mounted conveniently on the bench behind the lathe. With a four-step cone pulley as shown, it is possible to provide a considerable range of speed as required for various turning jobs.

Deaf and Blind Converse With Help of Alphabet Board

As an aid in communicating with a friend who was entirely deaf and almost totally blind, one man glued raised letters on a plywood board as shown. By directing his friend's hand to letters spelling the words which he wished to communicate, he could carry on a conversation even in a darkened room. The spelling board also can be used in conversing with deaf people who are not blind, as there is no need for writing out

each statement on a pad of paper as usually is done. Also, if the letters are coated heavily with zinc sulfide phosphorescent paint, they will remain visible in dim light.



Mousetrap Holds Ribbon Badges While Lettering Them

When homemade badges or streamers are made up for a banquet or other gathering, a mousetrap will hold the ribbon for lettering. Place the work across the trap under the jaw as indicated.



Mixers From Broken Glass Rods

Instead of throwing away pieces of glass towel rods, use them for mixing liquids or stirring chemicals where metal or wood cannot be used, after the broken ends are ground down on an emery wheel. Rods having flanged ends make good pestles.

Protecting and Servicing Your Worn Grindstone



Grindstones are likely to become water-soaked and soft at spots where water is allowed to drip when they are not in use. Likewise, if a water trough is mounted under the stone, the water should be drained immediately after use, otherwise the wet portions of the stone will wear down faster than the dry portions, causing the wheel soon to become out of round as shown in Fig. 1. However, if this happens you can true up the wheel without a wheel dresser. To do this, hold one corner of an old file against the rotating stone and groove along the high portions as in Fig. 2.

Then, with a cold chisel, chip away the ridges thus formed as in Fig. 3. The roughed-out circumference can now be dressed smooth as in Fig. 4, using a sharp-edged, hard field stone.

—J. Modroch, Danbury, Conn.

Tarred Burlap Stops Leaks in Livestock-Watering Tank

Having a livestock-watering tank that had rusted so badly that several small leaks developed, and not being able to replace it, one farmer repaired it temporarily by lining it inside and out with burlap and tar. Regular road tar or asphalt was applied hot to a small area of the tank at a time,

and pieces of burlap were pressed firmly into it. After both inner and outer surfaces had been covered in this way with tar and burlap, another coating of hot tar was applied all over as a sealer coat, thus making the tank watertight.

—A. H. Waychoff, Phoenix, Ariz.



Scraper to Clean Bevel Gears

On some machines, bevel gears are operated uncovered, the gears being lubricated by regular applications of cup grease. In such cases, dirt and other foreign matter mix with the grease and form a hard gum that soon fills the spaces between the teeth. To remove this gum, you can make a scraper from a 10-in. length of clock spring. Double the spring and insert the ends into a suitable handle. This will give the spring a loop shape that will slip between the teeth easily and clean both sides.



Pipe Cleaner Picks Dust or Lint From Mimeograph Stencil



Instead of risking damage to a mimeograph stencil by picking paper lint from it with the point of a pencil or a matchstick, use a pipe cleaner. If the cleaner seems too flexible to remove some of the lint that adheres tightly, use a pointed stick, but wrap cloth around the end as shown in the detail. The cloth will prevent minute holes from being gouged into the stencil.

Leaking of Oilcan Spout Stopped With Rubber Gasket



While looking for a gasket to prevent leaking around the spout of an oilcan, I found that a rubber hose washer was just the thing. This was slipped over the threaded section of the spout base as indicated. The washer also serves as a means of hanging the can on a shelf. This was done by notching the shelf edge, the notch being slightly smaller than the diameter of the washer.

—Jule E. Koehler, Maplewood, N. J.

Cleaning Gear-Shift Air Filter

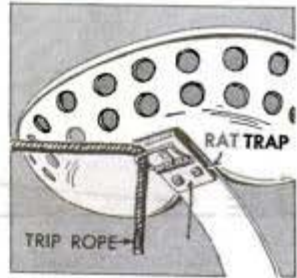
It is important to clean the air filter of the Chevrolet vacuum gear-shift cylinder every 10,000 miles. This can be done by

disconnecting the flexible hose inlet, removing the filter, washing it in kerosene, then dipping in engine oil and replacing.

—Hal Geihm, Aurora, Ill.

Ratrap Provides Safety Release For Trip Rope on Tractor

If the trip rope leading to a machine pulled by your tractor is broken often when a machine is accidentally uncoupled, or when you forget to disconnect it when unhitching the implement, this trouble can be avoided by using a ratrap as a safety release. The trap is bolted under the tractor seat and the end of the rope is held by the trap jaw. The rope end should be wrapped with twine to prevent raveling instead of the customary method of tying it in a knot, which would not let the rope slip from the trap.

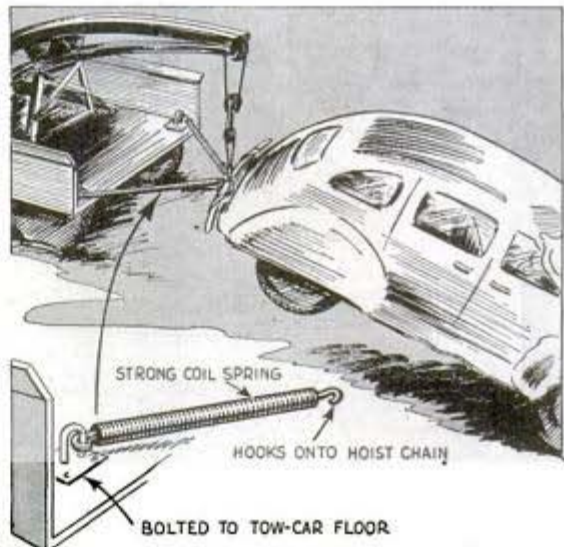


Retrieving Linotype Matrices

Retrieving a flat matrix from a linotype is easy if you wrap a rubber band around the end of the wire hook supplied with the linotype. This prevents scratching and gives a firm hold on the matrix.

Swaying of Towed Car Prevented By Stabilizing Springs

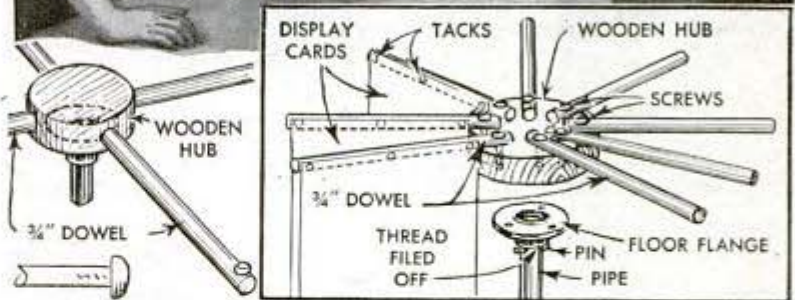
When a car is hoisted at one end for towing, a tendency to sway from side to side on the road can be prevented by using two strong springs. These are attached to the tow-truck body and are fastened to the eye of the hoist hook, or into a link of the hoist chain near the hook.



POPULAR MECHANICS

Rotating Counter Racks Save Time in Store

To avoid wasting his clerks' time while waiting for customers to make selections of small parts, and also to aid customers in determining the size and shape of the parts desired, one hardware merchant uses counter display racks of the types shown. Each has a pipe standard fastened to the counter by means of a floor flange, the racks differing only in the way the radial arms are attached to the wooden hubs. The latter on both types are screwed to floor flanges which have the threads filed off so they can rotate on the standards, pins being driven through the standards to keep the flanges in position. The rack shown in the lower right-hand detail has the arms attached to the hub by means of screws and



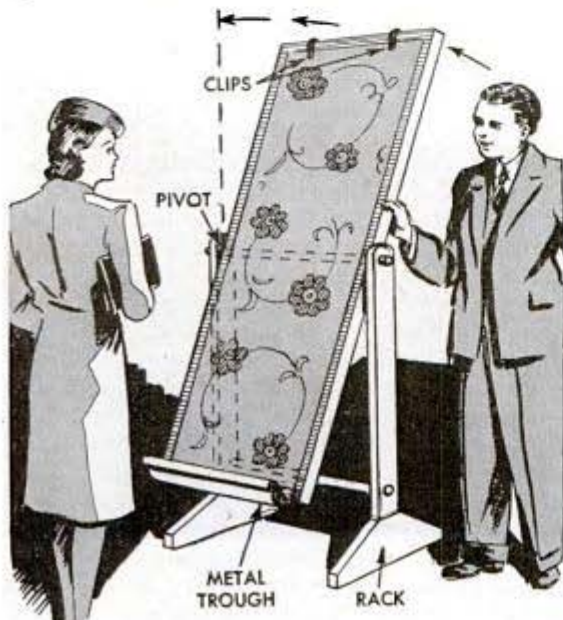
is intended to hold display cards of light items, the cards being tacked to the arms. The other rack, shown in the upper and left-hand details, has the arms glued into

holes in the hub and is used to support heavier articles, which are attached to endless pieces of canvas or other strong, heavy cloth hung over the arms.

Tilting Table Rolls and Unrolls Wallpaper for Display

Difficulty of unrolling and re-rolling wallpaper on a counter to display it in lengths sufficient to enable customers to

visualize the pattern on a wall led one merchant to devise this tilting display table. It consists of a light frame about 6 ft. long pivoted between the uprights of a supporting rack. The frame is provided with a metal trough across one end and two metal clips at the other. In use, the roll of paper to be shown is placed on the table with the free end under the clips. The frame then is tilted so that the paper rolls down to stop in the trough, thus displaying a 6-ft. length in normal, vertical position. The paper is re-rolled by tilting the table the other way. If the paper does not re-roll straight, guide strips can be added.

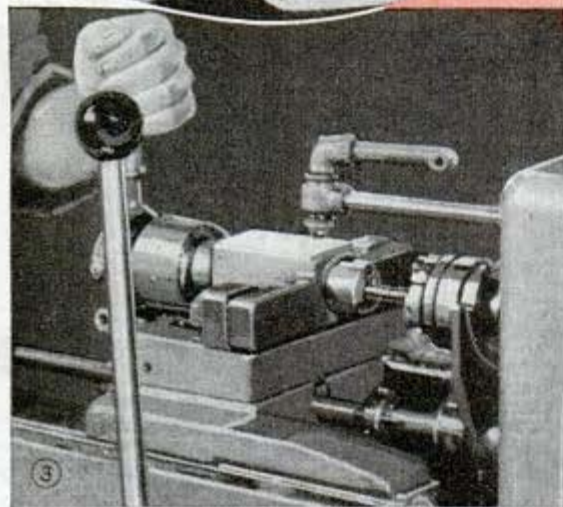
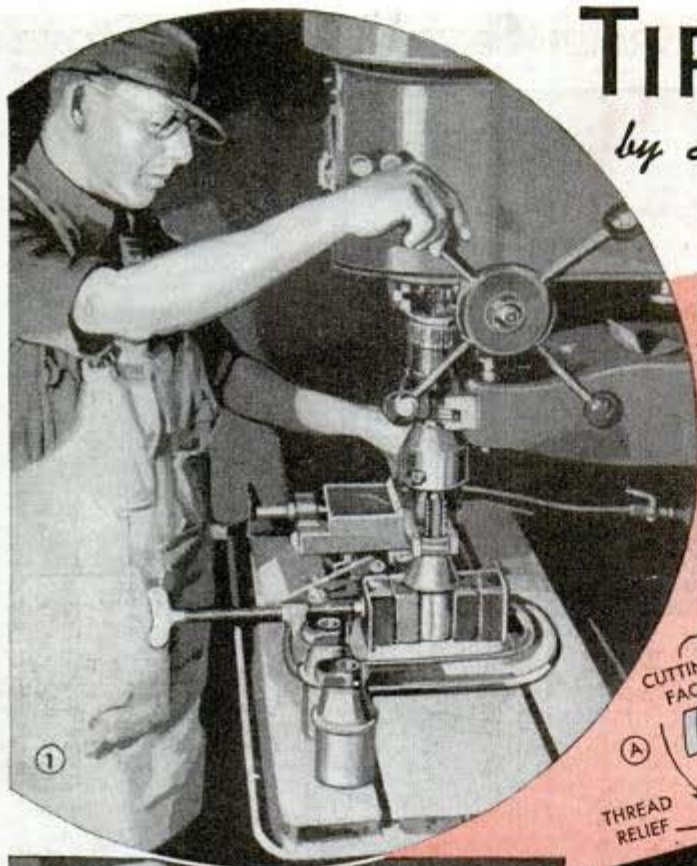


Holes at Ends of Cuts and Tears Prevent Their Spreading

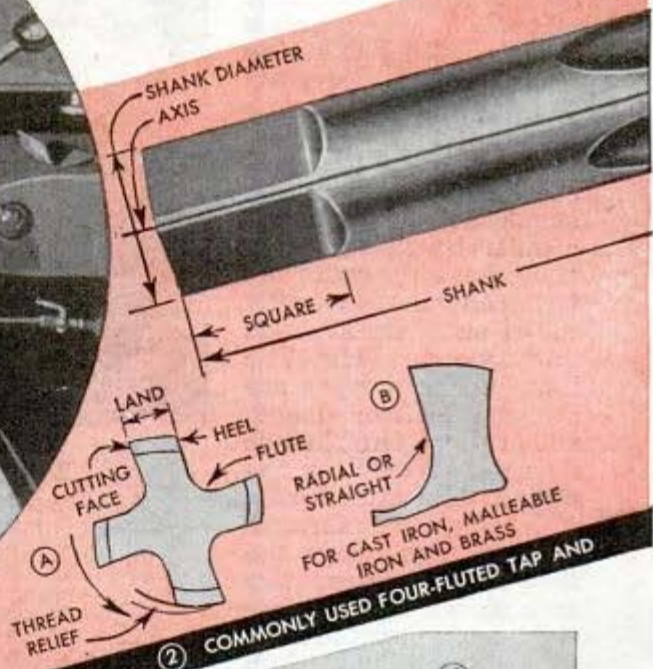
A small hole punched at each end of a long cut in an inner tube before the patch is applied will prevent the cut from extending under pressure. Likewise, a tear in metal, as in fenders or aprons, will not spread beyond small holes drilled at the ends of the tear.

TIPS on TAPS

by H. J. Chamberland

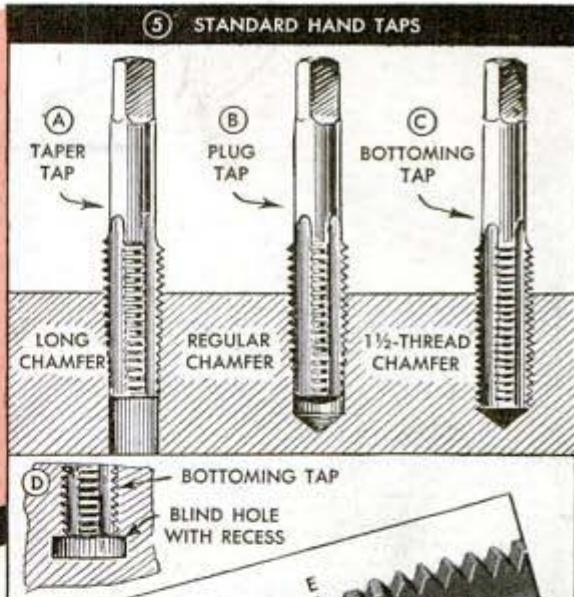
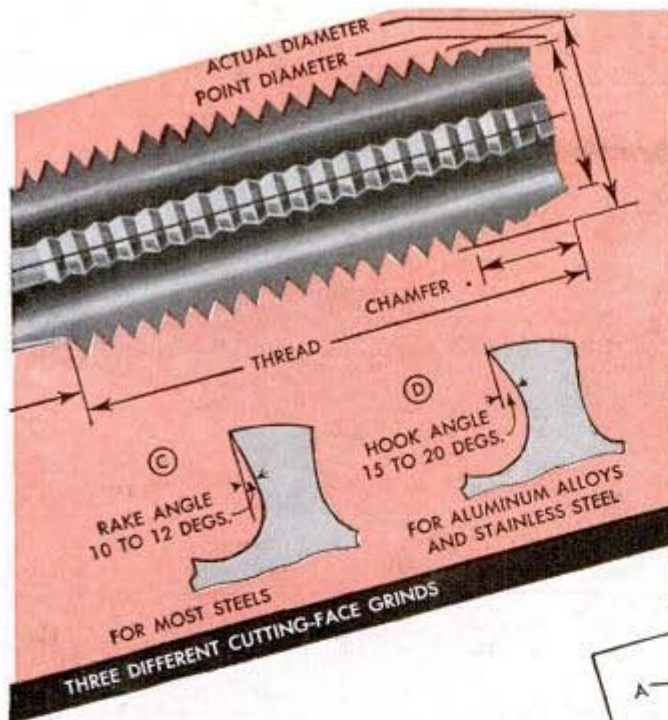


A TAP cuts a screw thread internally, in a hole, and differs from a threading die, which cuts a thread externally, as on a shaft. Taps are used more extensively than threading dies for quantity production because most external threads are produced either with automatic die heads or thread-milling machines. As shown in Fig. 2, a tap consists of a shank squared at one end and a threaded section into which flutes are milled to provide the necessary cutting action and chip passage. The shape of a flute and its relation to the cutting face varies with the material to be cut. Three standard face grinds are shown in details B, C and D of Fig. 2.



Most important are the chamfers at the entering end of a tap. These do most of the work by removing metal progressively. Very few taps have a thread relief as shown in detail A of Fig. 2 because they must be sharpened on the face and this gradually reduces the diameter of those having thread relief. Shops making their own taps in small quantities thread them in a lathe, mill the flutes and occasionally relieve the threads. However, this is too slow for production work so threading machines as shown in Figs. 1 and 3 are used. The machine in Fig. 3 has an automatic die head fitted with chasers illustrated in Fig. 4.

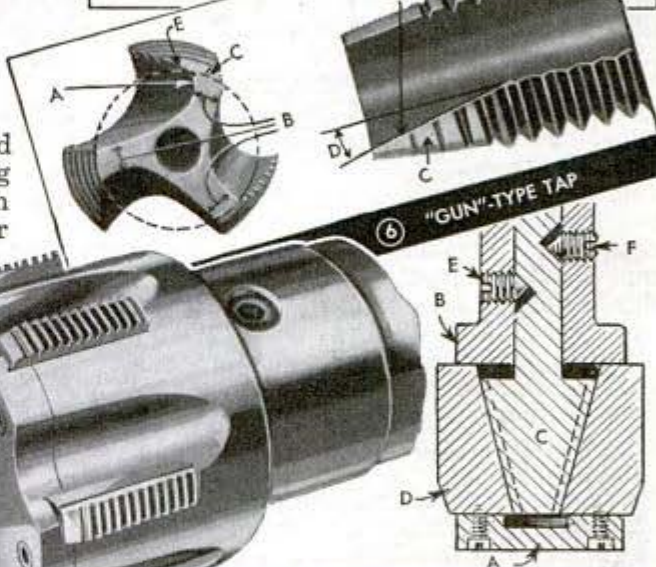
Taps commonly used: Types of taps used most frequently in shop practice are standard hand taps, serial hand taps, "gun" taps, adjustable chaser taps, collapsing taps, standard and stub machine-screw taps and nut taps. Standard hand taps are available in sets of three as shown in Fig. 5. The one in detail A has a long chamfer angle com-



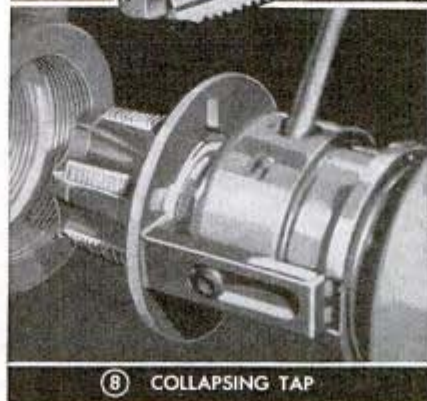
prising some seven or eight threads and is used to tap an open hole. The plug type in detail B has the regulation chamfer angle and is used to tap either an open or a blind hole. Detail C shows a tap that has only a 1½ thread chamfer and is used for a blind hole with a flat bottom or a blind hole with a recess as shown in detail D. This type is marked in fractional sizes from ¼ to 2 in. in diameter.

Serial hand taps, which come in fractional sizes up to 1 in. in diameter, are similar to the standard type but all three are necessary to obtain full thread diameter. No. 1 is undersize and is used to rough in the thread. No. 2 is a little larger and cuts a fuller thread and No. 3 finishes the thread to size. Chamfers of serial taps are shorter than those on standard hand taps.

The "gun" tap shown in Fig. 6 is a three-flute, plug type for threading open holes only. It is the strongest and most productive tap to select when it can be used. The angular cutting edge produces a long curling chip similar to that from a lathe tool. The flutes are not as deep as those of other taps,



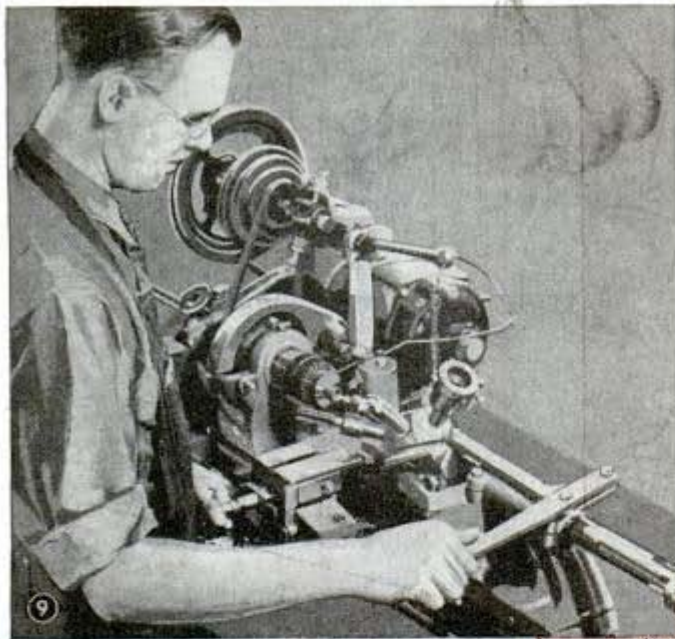
⑦ ADJUSTABLE CHASER TAP



which results in greater strength. The flutes should never have to be ground if due attention is given the point.

Solid taps are seldom over 2¼ in. in diameter. Therefore, adjustable chaser taps such as shown in Fig. 7, or collapsing taps as the one in Fig. 8, are used for larger dimensions. Adjusting chaser taps is very simple.

Screws holding cap A are loosened and the body B, which is bored for steep taper plunger C, expands to contact chasers D by means of adjusting screws E and F. These screws provide ample adjustment due to vees in C and also act as a locking



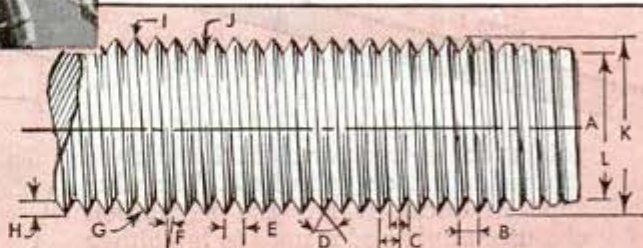
medium. A, when tightened, binds D against shoulder of B. Chasers D are interlocked with plunger C.

Standard machine-screw taps for automatic tapping are similar to standard hand taps except that the chamfer end has an external or male center. These taps are not made in sizes over $\frac{1}{4}$ in. and are listed by numbers as 3, 6, 10, etc., with their respective number of threads per inch. Stub machine-screw taps are much shorter than the standard and are used to tap thin materials. Nut taps have shanks approximately twice as long as the threaded sections and have especially long chamfer angles for angle load distribution and to make them free-cutting.

Screw-thread terms and forms: Although all terms defined in Fig. 10 are important, there are several more worth recognition. There are three classes of taps designated as follows: The "cut" tap is an ordinary one for average work and has threads polished only before hardening. Any distortion in pitch or lead due to defective heat treatment is transferred to threads produced therewith. The "commercial-ground" tap is one with threads ground to make allowance for heat-treating distortion, yet is not guaranteed to produce threads for certain classes of fit requirements. "Precision-ground" taps are finished to three varying degrees of precision to meet all demands of limits and tolerances. There are four classes of fits in connection with screw-thread assembly, Nos. 1, 2, 3 and 4, which indi-

cate, respectively, a loose, medium, free and close fit.

An "allowance" provides for variations in fits between mating threads. Maximum allowance is the difference between a minimum external and a maximum internal part; minimum allowance is the difference between a maximum external and a minimum internal part. An overlap or interference between the dimensions of mating parts is called a "negative" allowance. The term "tolerance" means the amount of variation permitted in the size of a part and is the difference between "limits," or maximum and minimum dimensions of a given part. A tolerance may be expressed also as "plus" or



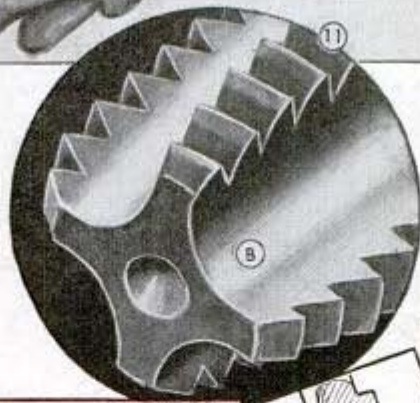
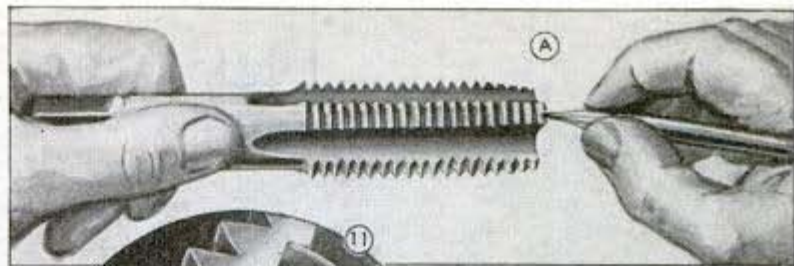
TERM	SYMBOL	DEFINITION
Axis of screw	A	Longitudinal center line.
Pitch	B	Distance from one point on thread to corresponding point on next thread. Pitch equals 1 divided by number of threads per inch.
Pitch diameter	C	Equal distance between width of thread and width of space between thread.
Angle of thread	D	Included angle, between sides of thread, measured in an axial plane.
Lead	E	Distance a screw thread advances axially in one turn. Lead E and pitch B are identical with single thread. (See note.)
Helix angle	F	Angle made by helix of thread at pitch diameter with a plane perpendicular to axis.
Side of thread	G	Surface of thread which connects crest with root.
Depth of thread	H	Distance between top and base of thread, measured normal to the axis.
Crest	I	Top surface joining the two sides of a thread.
Root	J	Bottom surface joining sides of two adjacent threads.
Major diameter	K	Commonly known as outside diameter, largest diameter on screw or nut.
Minor diameter	L	Commonly known as core or root diameter, smallest diameter of screw or nut.

Note: Single thread means a thread in which lead is equal to pitch. In a double thread the lead is equal to twice the pitch, in a triple thread the lead is equal to three times the pitch.

10

SCREW-THREAD TERMS AND THEIR DEFINITIONS

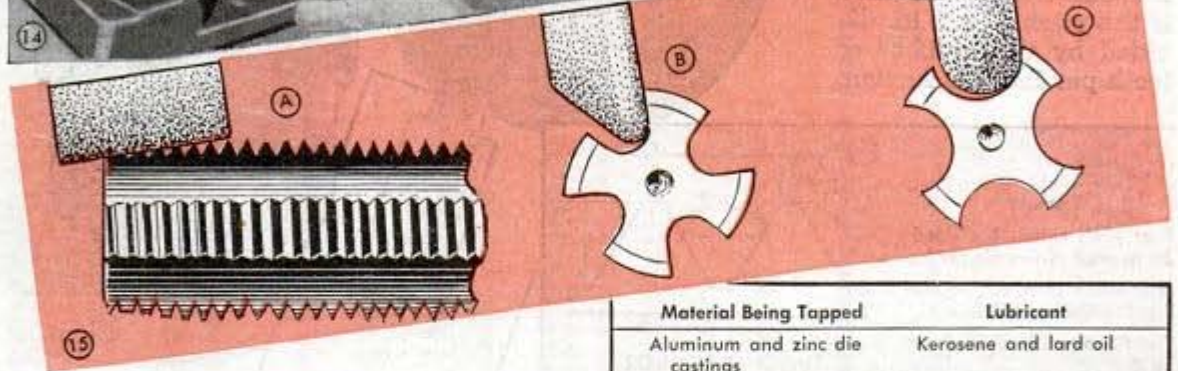
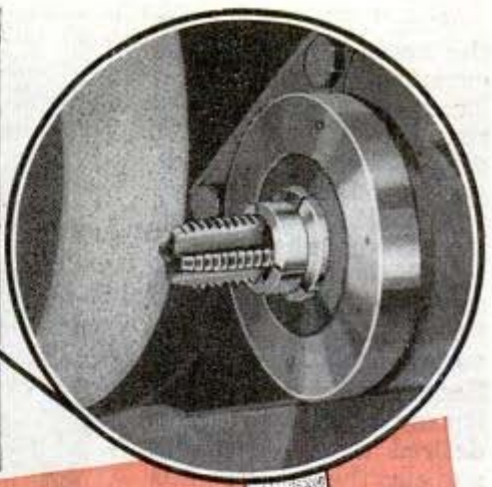
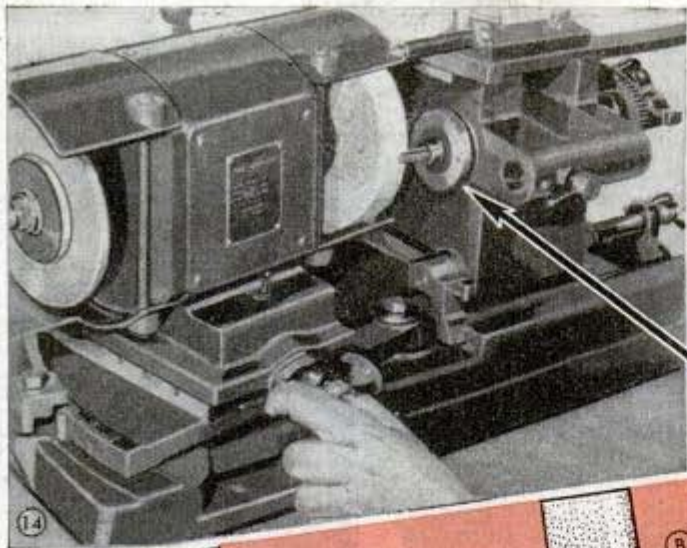
"minus." Fig. 13 shows the four thread forms covering American and European screw thread requirements. Forms A and B are widely used and form D is best where an exceptionally strong thread is required to carry substantial loads such as is the case with screw jacks. The included angle varies with all four forms. Respective formulas make it easy to compute any desired depth of thread and also the flat or radius if the pitch (1.000 in. divided by the number of teeth per inch) is known.



<p>Formula</p> <p>P or pitch equals 1 divided by number of threads per in.</p> <p>D or depth of thread equals P multiplied by .649 in.</p> <p>F or flat equals P divided by 8</p>	<p>(A)</p> <p>NATIONAL FORM OR FRENCH AND INTERNATIONAL STANDARD</p>
<p>Formula</p> <p>P or pitch equals 1 divided by number of threads per in.</p> <p>D or depth of thread equals P multiplied by .640 in.</p> <p>R or radius equals P multiplied by .137 in.</p>	<p>(B)</p> <p>BRITISH STANDARD OR WHITWORTH FORM</p>
<p>Formula</p> <p>P or pitch equals 1 divided by number of threads per in.</p> <p>D or depth of thread equals P multiplied by .600 in.</p> <p>R or radius equals P multiplied by 2 and product divided by 11</p>	<p>(C)</p> <p>BRITISH ASSOCIATION STANDARD</p>
<p>Formula (Approximate)</p> <p>P equals 1 divided by number of threads</p> <p>D equals major diameter of screw minus P</p> <p>F equals .370 divided by no. of threads. Minor diameter of screw equals its major diameter minus twice depth of thread</p>	<p>(D)</p> <p>AMERICAN NATIONAL ACME</p>

Drill-hole and tap sizes, lubrication, etc.: A hole to be tapped must be of correct size, clean and concentric. If the hole is undersize, the tap will break or the first full threads will be stripped when it enters the hole. If the hole is substantially oversize, rough or out of round, the thread cut will be of little value. The National thread form has a 75 percent depth of thread, meaning that the drill hole is 25 percent larger than the minor or root diameter of the tap to be used. It is well to bear in mind that a 75 percent depth of thread requires only one third the tapping power of a 100 percent depth, but has 5 percent less strength.

For maximum economy in tool cost, power and production speed, the depth of thread should be not less than 62 percent or more than 83 percent. The tougher the material and the deeper the hole, the more you must favor the diameter of the hole. Misalignment between the tap and the work results in a poor thread; the thread will be oversize and off as to



lead and pitch diameter. The correct lubricant and plenty of it is very important with threading due to the delicate cutting edges. Fig. 16 gives general recommendations.

As a tap has a positive lead and feeds itself, the operator cannot control feeding pressure. If a turret is used as in Fig. 9 it must be capable also of free horizontal movement. Tapping in a drill press requires an attachment such as shown in Fig. 12. This attachment does not rotate; the housing or shell is clamped to the drill-press quill so that the spindle itself operates the mechanism of the tapping head. The tap is driven by a friction clutch which automatically regulates tap driving power by pressure applied through the spindle. The clutch slips instantly when the tap strikes the bottom of a blind hole or sticks from loading of chips. This device permits reversing the tap at a higher speed to back it out of a threaded hole. Most manufacturers recommend a safe cutting speed but the safest method is to select a slow speed and increase it, rather than to cut down a high speed after the damage has been done.

Grinding taps: If the chamfers of a tap are kept properly ground (detail A of Fig. 11) it is seldom necessary to grind the flutes as in detail B. Special tap grinders make it possible to keep taps in perfect condition. All taps originally have an eccentric relief on the chamfers and this should be reproduced with each grind if a

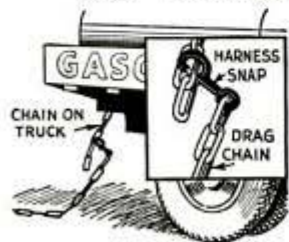
Material Being Tapped	Lubricant
Aluminum and zinc die castings	Kerosene and lard-oil
Bakelite and most plastics	Dry
Brass and bronze	Good cutting compound
Duralumin or dural	Kerosene and lard oil
Cast iron	Dry or compound
Malleable iron	Compound or sulphur-base oil
Fiber	Dry
Monel metal	Sulphur-base oil or kerosene and lard oil
Manganese bronze	Light-base oil
Nickel silver	Kerosene and lard-oil
STEELS	
Cast - - - - -	Sulphur-base oil
Chromium - - - - -	" " "
Machinery - - - - -	Kerosene and paraffin
Manganese - - - - -	Sulphur-base oil
Molybdenum - - - - -	" " "
Nickel - - - - -	" " "
Stainless - - - - -	" " "
Tool - - - - -	Kerosene and lard oil
Tungsten - - - - -	Sulphur-base oil
Vanadium - - - - -	" " "

tap is to perform properly. Fig. 14 shows how a tap to be ground on chamfers is held in a split collet fitted to the work head of the tap grinder. This equipment has adjustments for left- or right-hand taps, any number of flutes, extent of angle and amount of relief. Such a grinder is also useful for producing a similar relief on countersinks, lead of reamers, step drills and three or four-fluted drills, etc.

When a dull tap needs regrinding, start at the chamfered end as in detail A of Fig. 15, using an aluminum vitrified wheel, 80-J. Grind it exactly the same angle, covering the same number of threads as is the case with an identical new tap. Grind just enough to remove the dulled edges of the threads, being sure that the point diameter is the same as the root diameter of the thread. All cutting lands must be the same height and must be equidistant. The flutes are ground only if the edges of the unchamfered teeth are dulled and nicked. A saucer-shaped grinding wheel is used if the cutting face of the flute is straight as in detail B of Fig. 15, but a formed wheel is needed if the cutting face is hooked as in detail C. An aluminum vitrified wheel, 60-R, is recommended for grinding flutes of small taps while a 46-L wheel of the same kind is best for large taps. Broken teeth of a tap should be removed by grinding as they cause damaged threads when tapping.

In grinding gun-type taps, first have a new tap of the same size at hand to help in keeping the ground tap to the same form in regard to the angle of flutes and the cutting edges. The grinding wheel is formed to exact fit for flute to keep the identical hook shape—detail E of Fig. 6. After the ends of the lands B have become thin from repeated regrinding, grind the end of the tap straight back until the lands again are of normal thickness, after which the cutting edges and flutes are ground, and the hook is reformed, keeping a straight cutting edge. When chamfer C is reground, the relief is ground carefully, leaving cutting edge A gradually receding toward the heel. See the end view of the tap in Fig. 6. Also keep the angle D for shearing.

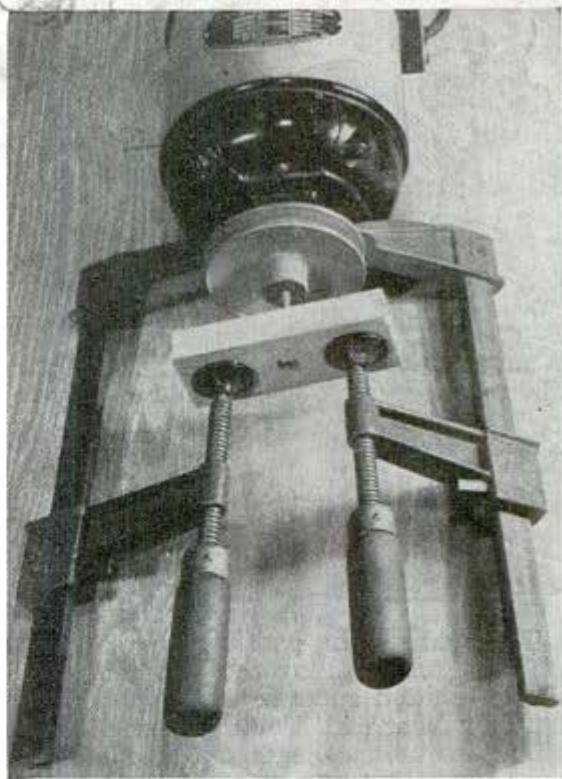
Adjustable Safety Ground Chain For Use on Tank Trucks



Because of the frequency with which drag chains on gasoline tank trucks have to be changed due to rapid wear, they sometimes are neglected and wear so short that they do not make good contact with the ground. To make changing the chain an easy job, one truck driver uses two lengths of chain, one being fastened to the truck to reach almost to the ground and the other being fitted with a harness snap at one end. With this arrangement, the chain is lengthened merely by dropping the snap one link on the chain.

—James H. Gosch, Scotia, N. Y.

Bar Clamps Used to Force Pulley Jammed on Shaft



Pulleys can be removed easily, when jammed on a motor shaft, by using a pair of bar clamps as shown. With the stationary jaws placed behind the pulley, a bolt driven through a block of wood and secured with a lock nut is set against the shaft and the screws turned with equal pressure.

Water Expands Shrunken Gasket

When installing a new cork gasket on a valve cover or oil pan and the gasket has shrunk, making an oil leak likely, first place it in warm water for a few minutes. This will expand it to about normal size and assure a good fit.—C. Swope, Danville, Pa.

Several Pieces of Round Stock Faced in One Operation

Next time you want to face several short pieces of round stock, use a split bushing as shown and you can do it in one operation. When clamped in a universal chuck on a lathe, the bushing will grip the pieces firmly, even if the lengths vary.



Shield Protects Finish of a Car When Filling Fuel Tank



To avoid getting gasoline on the finish of a car when filling the fuel tank, one service-station operator uses a shield cut from a rubber mat. For cars that have the tank filler tube projecting, a hole is cut in the shield near one end to slip over the tube. For cars that have small doors covering the tube, the opening is made large enough to slip over the door when it is raised. The operator soon found that he was more than repaid in customer satisfaction for the few seconds required to attach and remove the shield.

Lacquer Protects Index Tabs



Index tabs on reference books often are soiled quickly because of frequent use, and may in time become so worn that they are totally illegible. Clear lacquer applied with a small brush on each tab will form a thin protecting film that not only will withstand wear, but can be washed repeatedly as the tabs become soiled.

Honey Boxes Secured in Beehives With Horse-Collar Pad Clips

If you have no regular springs at hand for fastening honey boxes in a beehive super, spring clips taken from an old horse-collar pad will serve the purpose. The springs are inserted at one side of the super

to press the boxes and separators together to prevent the bees from propolizing them—working wax down between them so they are difficult to separate.

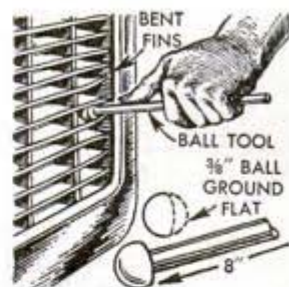
—Herbert Nevesin, Rock Creek, Ohio.

Ball-End Tool Straightens Fins In Car Radiators

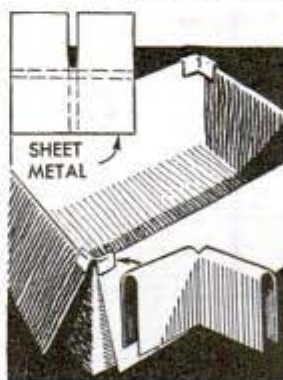
Straightening fins in a radiator is a simple job if you use a tool like the one shown. It consists of a $\frac{3}{8}$ -in. steel ball ground flat on one side and soldered to a length of rod, which serves as a handle.

In some cases, it may be possible to make a tool by grinding the head of a carriage bolt to suitable shape. In use, merely dip the head of the tool in oil or light grease and run it horizontally between the fins. If the fins are bent badly, it may be necessary to make several passes with the tool between the same fins to straighten them.

—H. W. Swope, Danville, Pa.



Carton Held Open for Packing By Sheet-Metal Clips



completed clip, which is shown in the lower detail, slips over the corners of the carton as indicated.

Packers and others who fill cardboard cartons will find these clips ideal for holding the carton flaps out of the way. The clips are made from light sheet metal which is slotted and bent as indicated by dotted lines in the upper detail. The

Moisture Drained From Muffler To Prevent Corrosion

Car mufflers sometimes corrode from moisture collecting as the result of incomplete combustion when the motor does not run long enough to heat sufficiently on short drives. Corrosion can be prevented by drilling a $\frac{1}{8}$ -in. hole in the bottom of the muffler to drain off the accumulating moisture.

—H. F. Rogers, North Branch, Minn.

Cordwood Held Steady on Horse By Weighted Chain



The difficulty of keeping a log steady in the sawhorse while cutting it into stove wood is eliminated by attaching one end of a chain or rope to the horse and placing a weight on the other end. After the log is placed on the horse, the weighted end is thrown over it, keeping it firmly in place.

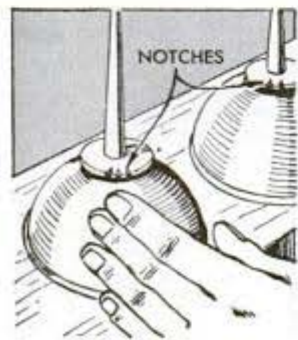
—F. P. Schofield, Ardsley, Pa.

Number of Revolutions Counted On Lathe Thread Indicator

Having several bobbins to wind a certain number of turns, I geared the lathe for 40 threads. Then as the thread indicator passed the fifth point there were 100 turns on the bobbin. In this way any required number of turns can be figured.

—E. M. Fellows, Morrison, Ill.

Viscosity of Oil Can Be Identified With Notches on Can



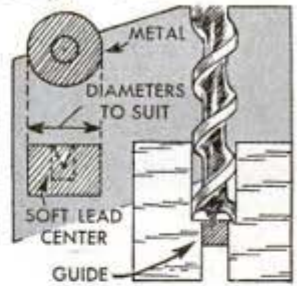
One mechanic whose work required the use of oils of various viscosities cut notches in the lower part of the oil can spouts to identify the oil. This was better than painting the cans different colors, which could not be seen when the cans became dirty. Furthermore, the notches permitted identification even when the light was poor.

Each notch indicates a viscosity of 10. A can containing oil of 10 viscosity had one notch, oil of 20 viscosity two notches and so on.—Ken Murray, Baltimore, Md.

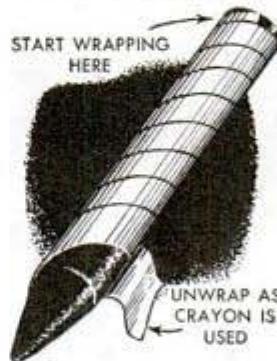
Auger-Bit Guides Are Helpful In Reboring Holes

To enlarge a number of holes by reboring them, I used a guide like the one shown for the auger bit. The guide is made of brass or steel to a sliding fit inside the original hole and has a lead center to receive the screw point of the bit without damaging it. If you have many reboring jobs to do make up several guides in various sizes and keep them on hand.

—Louis R. Filas, Buffalo, N. Y.



Lumber Crayon Is Strengthened By Gummed-Paper Wrapping



A lumber crayon is protected from breaking and chipping, and is less apt to soil the hands when given a spiral wrapping of heavy gummed paper. This may be unwrapped as necessary and torn off at the desired point.

Rubber Shield Protects Threads Of Wash-Rack Hose

Threads on the hose used at a car-washing rack often are damaged by dropping the hose on the floor, or by letting it lie without a nozzle. To prevent this trouble, one mechanic formed a cone-shaped shield from inner-tube rubber and attached it to the hose as shown to protect the threads.





Speaker Replacements

By Robert Oelrich

OBTAINING certain types of new speakers for midget and small table model receivers is proving to be quite a problem for the average radio service man. To speed up the repair of a large number of these sets, the service man can make practical substitutions with speakers of the same size but of different field impedance, and use the original output transformer.

A permanent-magnet (P.M.) speaker can be used to replace practically all 2,500- to 3,000-ohm field speakers found in a.c.-d.c. sets. These speakers are usually connected from B positive to ground; the field serves only to energize the pole piece of the speaker and does not have a choke effect; therefore, it may be removed from the circuit completely as shown in Fig. 1. P.M. speakers may also be used where a 450-ohm field was connected across the filter. Here an a.c.-d.c. choke of from 300 to 500 ohms may be used to replace the old speaker field.

Where the field resistance is higher, for example 1,000 to 1,800 ohms, the same choke may be used and a 10-watt resistor added to make up the necessary resistance, as in Fig. 2.

A P.M. speaker may be replaced with a dynamic type in practically all cases. Disconnect the filter choke and check its resistance value; then replace this choke with a field of similar value on the new speaker.

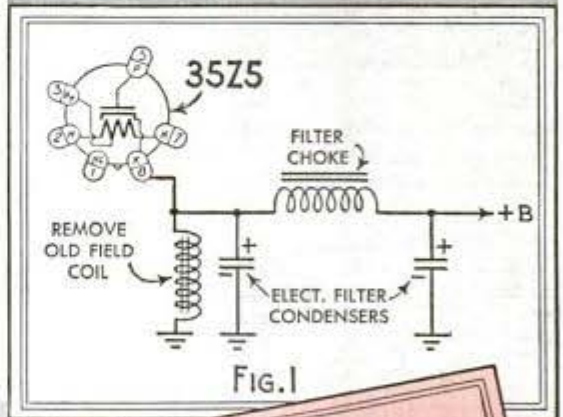


FIG. 1

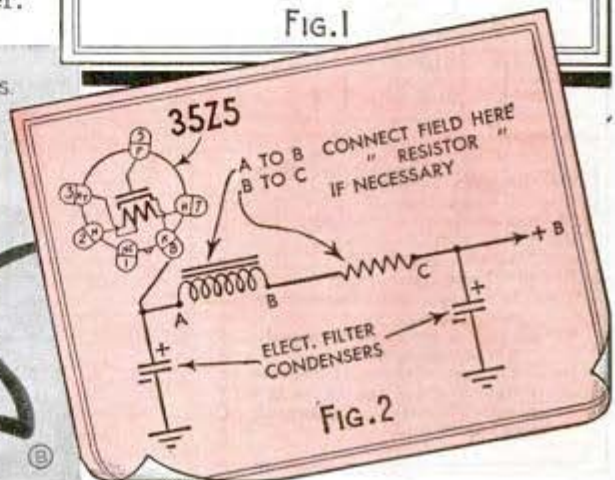
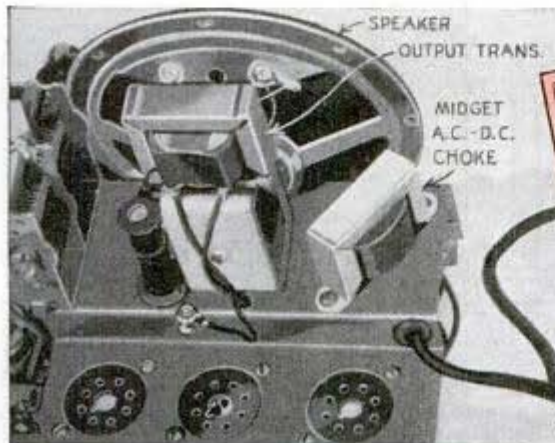


FIG. 2

"SEVEN SEAS" A.C.-D.C. SHORT-WAVE



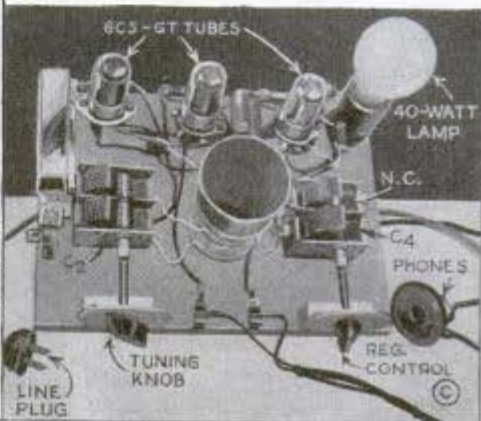
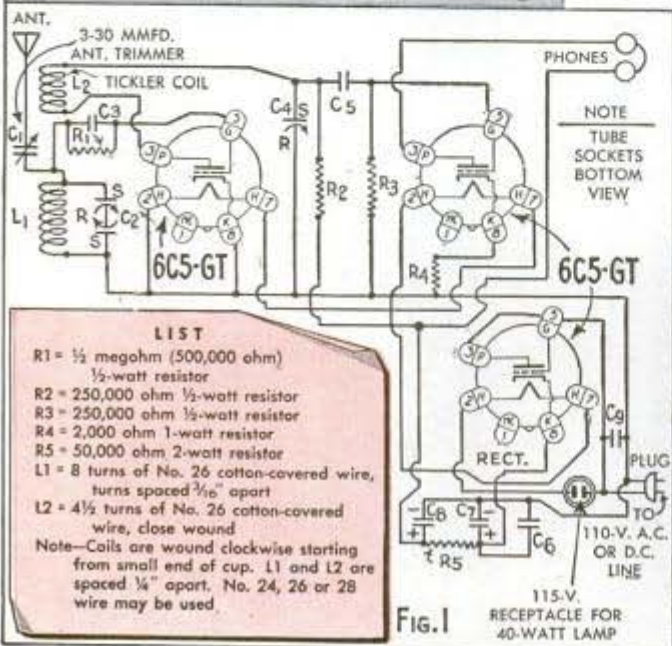
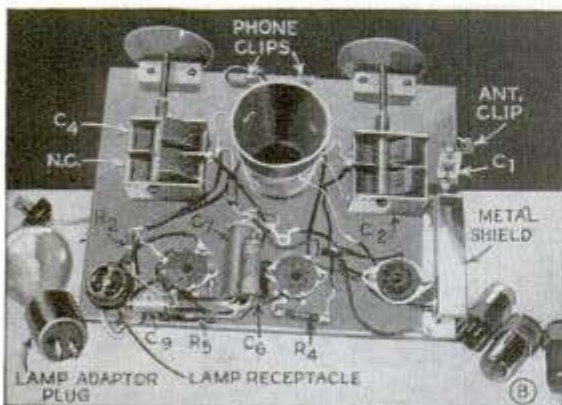
TUNING in the cream of short-wave signals from approximately 23 to 45 meters including the popular 25 and 31 meter bands, without plug-in coils, this simple three-tube is sensitive enough to receive stations many thousands of miles away. Although made from used radio parts and a few "dime" store stock items, it is an excellent performer.

The tuning coil is wound on a bright colored plastic drinking cup $3\frac{3}{4}$ in. high and $2\frac{3}{4}$ in. wide across the top. This coil is tuned by the 2-gang condenser (C_2) with both 350 mmfd. sections in series to provide about the same low capacity as a hard-to-get midget single section variable ordinarily specified for short waves.

Designed to operate right off the 110-volt a.c. or d.c. house lighting line, a 40-watt Mazda bulb is employed to reduce the line voltage for the tubes. The bulb can be in a lamp on an extension cord, as shown in photo A, or it may be plugged directly into the baseboard receptacle as illustrated in photo D. The set consumes less than 8 watts, the remaining power going to the bulb which also serves for lighting purposes. Three type 6C5-GT (6C5 or 6C5-G) tubes are employed, or any combination of the three types. A breadboard having a bright red edge was selected to match the red plastic cup and the pointer knobs.

A schematic circuit diagram appears in Fig. 1 and the simplified wiring diagram in Fig. 2; photos B, C and E show various views of the completed set. The 2-gang condensers are mounted on the baseboard

by means of 6-32 machine screws on the underside. Cotton-covered wire is used for coils L_1 and L_2 ; wind each coil tightly and coat the turns with fingernail polish, the only household "coil dope" that seems to stick to plastic. The plastic cup may be slightly larger or

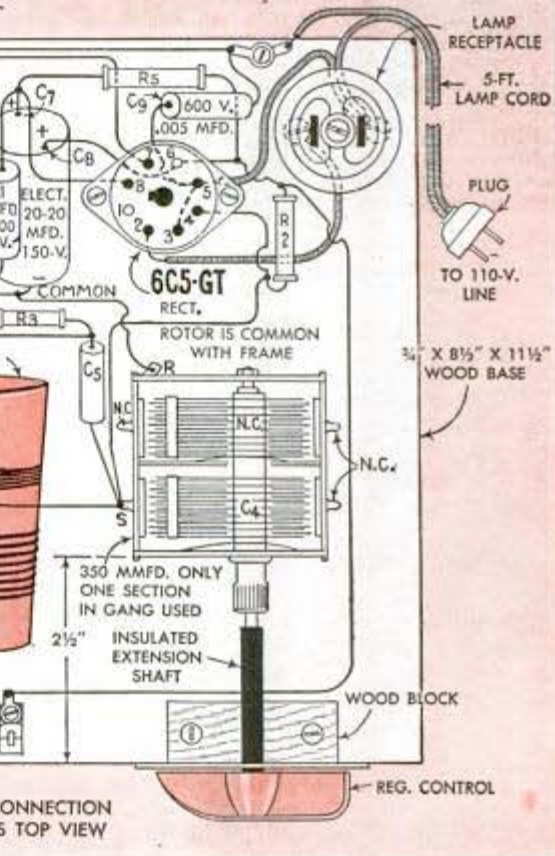


THREE TUBER

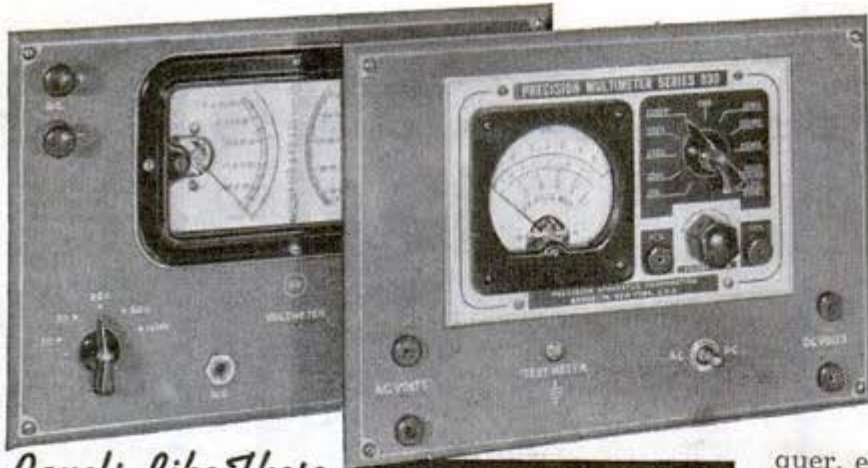
smaller than the one shown without affecting the performance of the set. A 50- or 75-ft. high and well insulated antenna should be used. The distance range will depend upon the antenna and your skill at tuning.

To tune the receiver, first adjust C_4 until the set oscillates throughout the entire tuning range of variable condenser C_2 . Then adjust condenser C_1 until "dead spots" begin to appear in the tuning range; now back off C_1 until there are no dead points, then you are ready to tune in short-wave stations. Hum is kept quite low on a.c. by means of the unmarked fixed coupling condenser C_5 . A .00025 mfd. 200 volt paper type is used here for minimum hum; however, when operating the set on d.c. line C_5 can be a .001 mfd. or larger in order to increase audio output. On a.c. try reversing the wall plug for lowest hum.

A detailed student material list, R-330, is available from Popular Mechanics radio department upon receipt of postage.

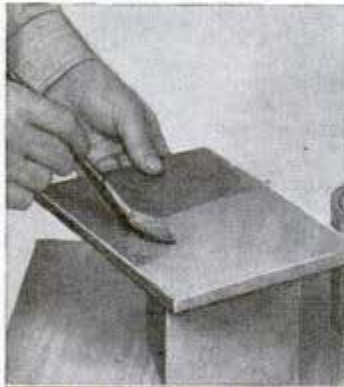


Give Your Panels That "Professional" Look

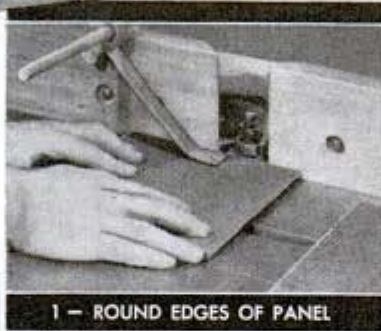


Panels Like These

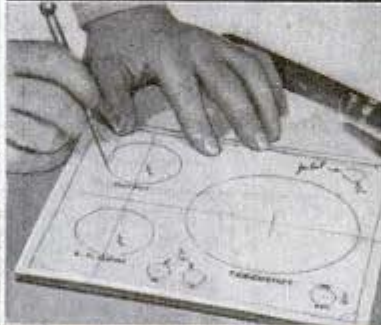
can be made by any radio student, experimenter or service man who cares to spend a few dollars for lettering scales. The same method may be employed for making small receiver panels



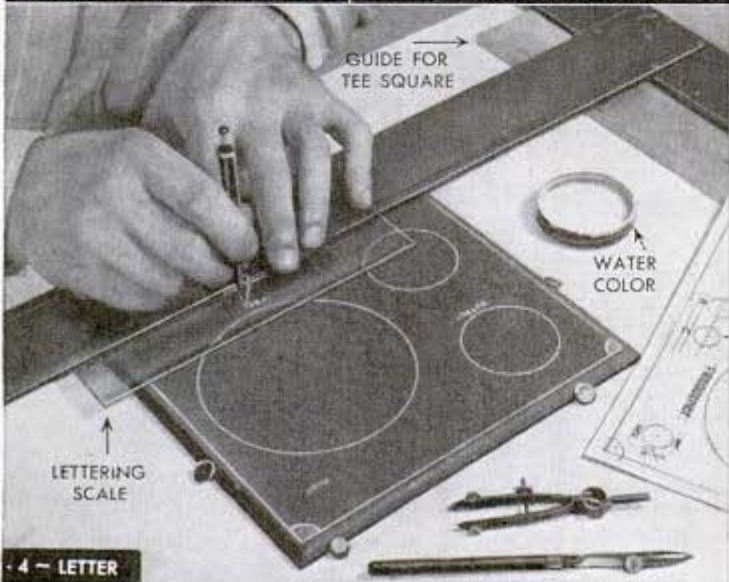
2 - PAINT WITH WRINKLE LACQUER



1 - ROUND EDGES OF PANEL



3 - TRANSFER PLAN FROM PAPER



4 - LETTER

NEAT control panels for meters and electronic testing equipment can be made from $\frac{5}{16}$ -in. composition board of the hard variety. Cut the panel to size and then round the edges on a shaper as shown, or use a file and sandpaper. Second, apply one fairly wet coat of mild wrinkle lacquer, either dark gray, green or black, then place the panel in an oven and bake about 20 minutes at 125 degrees. Remove and air dry for about 6 hours.

The next step, No. 3, is to make a paper pattern of the panel and use this to transfer the necessary guide marks to the painted surface. Now the panel is ready for the final and important job of marking and lettering. Use ordinary water or poster color diluted slightly with carbon tetrachloride. Run all straight lines with a ruling pen, and circles with an inking compass. If you have much lettering to do, it is a good idea to invest about \$4.00 in a celluloid lettering scale and a special pen that will enable anyone to do good work, as illustrated in photo 4.

Use white or bright yellow water color as before, mixing the color as heavy as the pen will flow to prevent running. Dry thoroughly and then carefully spray the entire panel with a light coat of clear lacquer. If you do not have facilities for spraying, brush the water color areas with banana liquid or sizing (not banana oil) to protect the lettering and lines. It will be invisible when dry, and can be applied to the entire surface, depending upon the material. Finish by drilling and cutting the necessary holes for the meter, binding posts, jacks, switches, variable resistors and similar controls.



Tough

BUT OH SO GENTLE

● Worn-out piston rings cause needless wear *inside* your engine, where you can't see the damage. And if they're not promptly replaced, the wear grows worse and worse—until, finally, your engine may quit you for keeps.

But, fortunately, piston rings warn you when wear becomes critical. Your engine smokes, wastes oil and loses its power.

At the first sign of ring wear, it will pay you to have your motor specialist install a set of Hastings Steel-Vent piston rings. They *stop* oil-pumping, *check* cylinder wear and *restore* engine performance.

HASTINGS MANUFACTURING CO. • HASTINGS, MICH.

Hastings Mfg. of Canada, Ltd., Toronto

HASTINGS STEEL-VENT PISTON RINGS



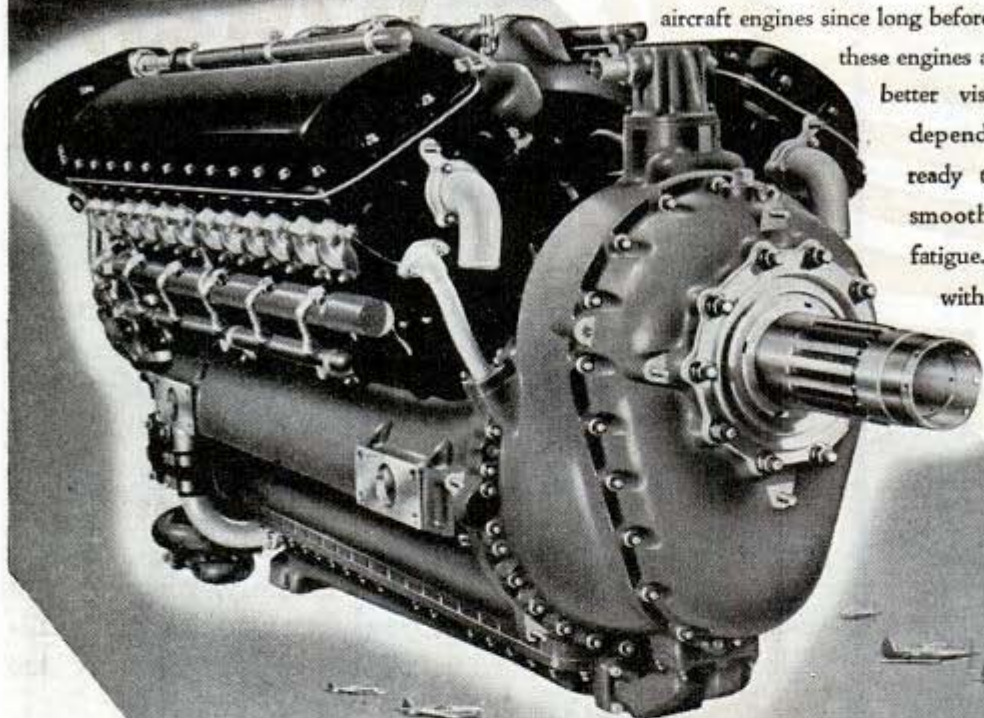
TOUGH ON OIL-PUMPING GENTLE ON CYLINDER WALLS

★
IT'S A PRIVILEGE
TO BUY WAR BONDS



DISTINGUISHED SERVICE

Everywhere they have performed distinguished service — powered the craft of valiant flyers as they won coveted decorations. ★ They've blasted Germans and Japs, and have served the Russians and British. ★ They've been America's own liquid-cooled aircraft engines since long before Pearl Harbor. ★ Because these engines are streamlined, pilots have better visibility. Because of their dependability, they are always ready to go. Because of their smoothness, there is less pilot fatigue. Because of their economy with fuel, their range is wide. ★ These are engine qualities that will be important to you in the days of far-flung air transport to come.



POWERED BY ALLISON

P-38—Lightning
P-39—Airacobra
P-40—Warhawk
A-36 and P-51—Mustang
P-63—Kingcobra

Allison has already furnished more than 75,000,000 H. P. for use in these planes.

LIQUID-COOLED AIRCRAFT ENGINES

Allison

DIVISION OF

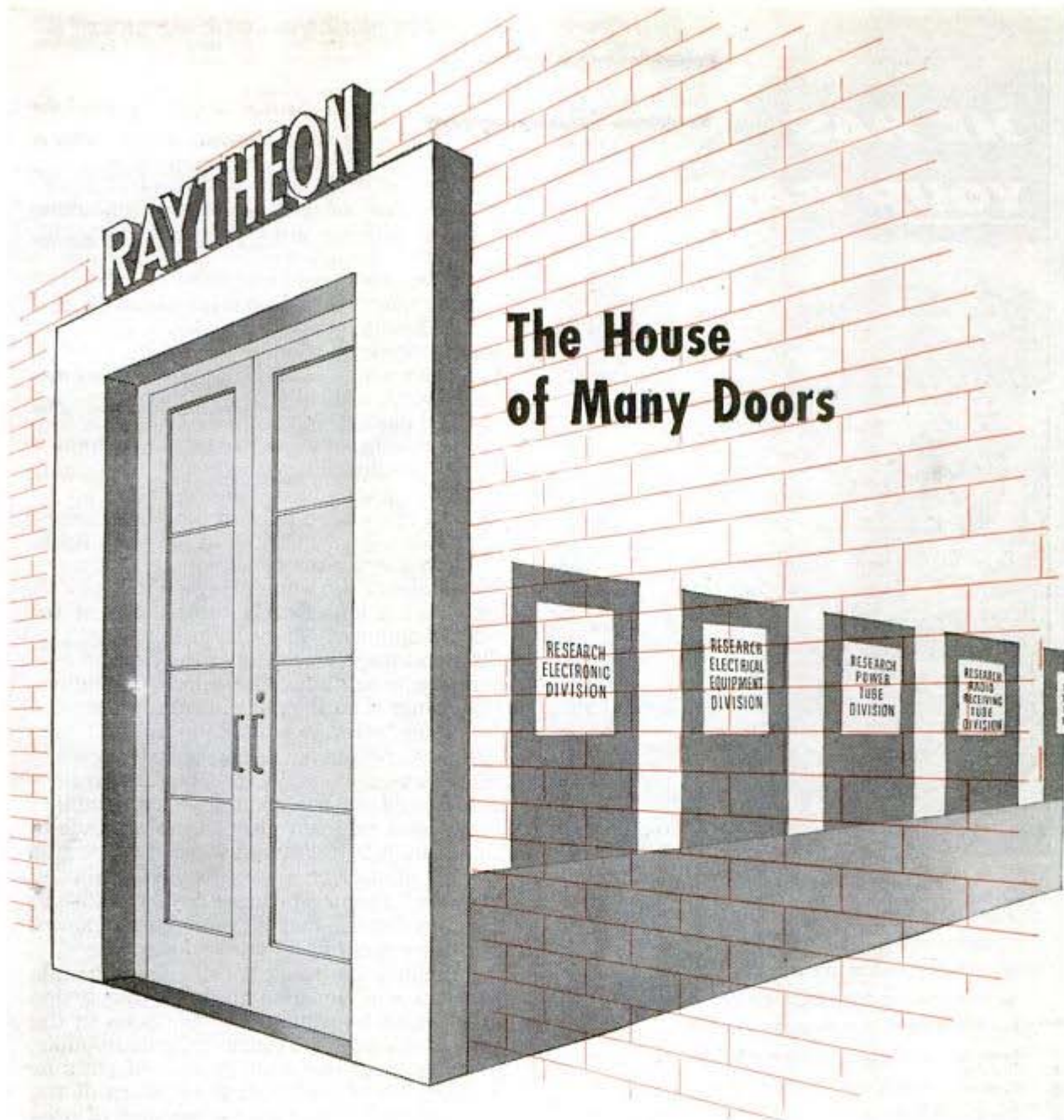
Indianapolis, Indiana



**KEEP AMERICA STRONG
BUY MORE WAR BONDS**

Every Sunday Afternoon —

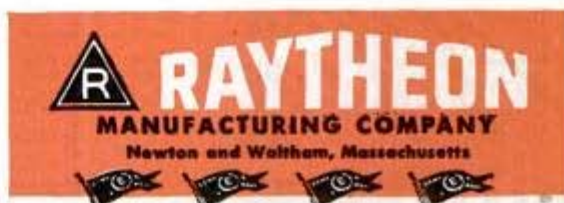
GENERAL MOTORS SYMPHONY OF THE AIR—NBC Network



RAYTHEON is truly a house of many doors . . . doors that lead to many research, engineering, and production groups which have made great contributions to the quality and quantity of electronic equipment and receiving and transmitting tubes now helping the armed forces.

Today, behind these closed doors over 16,000 men and women are devoted to war work. Tomorrow, these doors will be wide open and through them will come new developments in all phases of electronics.

Time in the Raytheon radio program: "MEET YOUR NAVY," every Saturday night on the Blue Network. Consult your local newspaper for time and station.



Devoted to research and manufacture of complete electronic equipment; receiving, transmitting and hearing aid tubes; transformers; and voltage stabilizers.

**HE HAS
YOUR BATTERY**



Jap pill-boxes and gun emplacements are "knocked out" fast when deadly bazookas go into action! It takes a trained two-man team and battery-power to keep these portable weapons firing. Batteries that once were made for homes and farms are now sent to serve our fighting men. Use your available Burgess Batteries sparingly... keep them cool and dry. For Free Battery Hints—Write Dept. E-5, Burgess Battery Co., Freeport, Ill.

Write to Your Serviceman Today!



**BURGESS
BATTERIES**

IN THE NATION'S SERVICE



Sharper Eyes for Stargazers

(Continued from page 85)

Red sensitive plates are important in astronomy because the space between the stars is not really empty. The emptiest cubic yard of inter-stellar space contains millions of hydrogen atoms and electrons and dozens of sodium atoms. Looking through billions and billions of such cubic yards the obscuring effect of the gas within them begins to add up.

With new fast red sensitive plates astronomers have recently been able to penetrate to the nucleus of stars around which all the stars we see and billions more are revolving. A radically new technique in infra-red photography will eventually attack the mysteries of the sun's infra-red light.

Within the last decade ordinary blue sensitive plates have been speeded up by getting more blue light to the plate and by increasing the sensitivity of the plate itself.

Take the first method of getting more blue light to the plate. Huge telescopes do not have a lens in the outer end as most people suppose. They have a 100-inch or 200-inch mirror resting at the bottom of a massive mounting. The mirror is slightly dish-shaped so that light striking the surface is reflected to a common point.

Formerly the surfaces of astronomical mirrors were coated with silver. Now they are coated with a thin layer of metallic aluminum which reflects blue and violet light much better than silver.

The plates have been speeded up by "baking" them for three days at 122° F. This produces a considerable gain in speed for exposures of an hour or longer.

Probably the most spectacular example of what can be done through purely instrumental improvements has been in the photography of the extra-galactic nebulae, lying beyond our own system of stars or galaxy. To photograph the spectra of the most distant would take exposures of prohibitive length. Astronomers either had to wait until the 200-inch was finished—or get a faster lens in their spectrograph.

By a "fast" lens is meant one with a big aperture compared to its focal length, or a small *f* value as photographers express it. Such a lens was finally designed by Dr. W. B. Rayton of the Bausch and Lomb Optical Company that gave excellent definition with a focal ratio of *f*:0.6. With this lens, exposure times on the spectra of the extra-galactic nebulae were cut by half.

One of the most remarkable features about the extra-galactic nebulae is that they all seem to be flying away from us, as

(Continued to page 150)



Here's why you get the most happiness from your homecraft hobby

..by enjoying the accuracy, dependability and safety of

Delta Homecraft Power Tools

Quality counts, in giving you the satisfaction you expect from the power tools you buy

There are lots of reasons why you have more homecraft happiness, when you're a Delta Homecraft Power Tool owner:

The Delta Power Tools you work with are *accurate*. And accuracy means you turn out parts that fit together according to plan, to form good-looking work you're proud of!

They're *dependable*, too. And dependability means the long, trouble-free, economical performance you have every right to expect!

They're *safe*. And safety means you feel free in letting other members of your family join in the fun!

They're Quality Tools!

Delta Homecraft Power Tools give you this all-around satisfaction, because of "hidden" values in construction — called *quality*.

You can't always see *quality* with your eyes, yet *quality* determines whether or not you get your

money's worth!

Quality is an important reason why Delta has become the world's largest manufacturer of power tools for home use.

"Good enough" construction isn't good enough for Delta Homecraft Power Tools—it's got to be the best for the price!

Industrial-type Construction!

Examples of the quality advantages you get in various Delta Homecraft Power Tools are:

- (1) *Double-sealed ball bearings* you don't have to worry about oiling, because they are *lubricated for life*;
- (2) *Precision-bored bearing seats* that assure accurate alignment of parts;

New Free Delta Book!

"Happiness Is In Your Hands" shows you how to get started in homecraft. Beautifully illustrated in full colors. Contains a reprint of a Reader's Digest article telling how manual hobbies aid mental health. For your free copy, fill in the coupon and mail today!



- (3) *Bearings that are preloaded* — an extra manufacturing operation that insures longer bearing life;
- (4) *Precision-ground shafts*, to assure true, accurate performance;
- (5) *Dynamically-balanced pulleys*, to cut down annoying vibration of your power tools.

Compare Before You Buy!

The care you take now *before* you buy power tools — to make sure you get real quality for your money — can mean a lot to your homecraft happiness *after*.

Right now, War Bonds are the soundest investment for you. When peace comes, reinvest your accumulated savings wisely in Delta Homecraft Power Tools—for a full measure of the fun and healthful recreation that homecraft offers you.

Tear out and mail today!

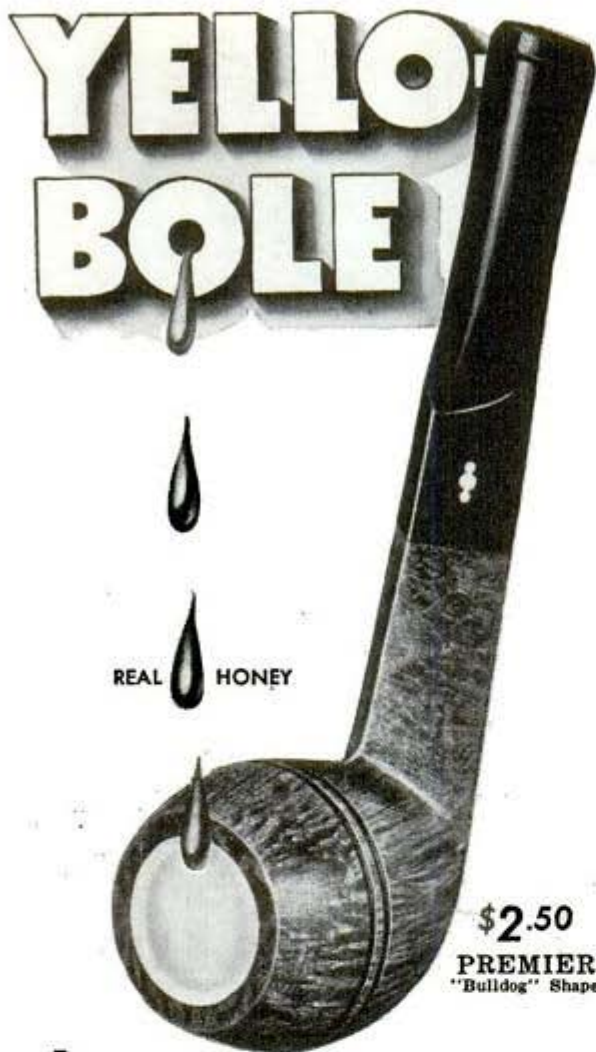
THE DELTA MANUFACTURING CO. HM-21
680A E. Vienna Avenue, Milwaukee 1, Wisconsin.

Please send me my free copy of "Happiness Is In Your Hands" picturing the ideal creative hobby and showing how to get started in it.

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the honey-cured smoke

Real Honey, in the bowl, cures the smoke of any trace of harshness (no "breaking-in"!) and gives a fragrant character wholly different from other pipes. This has endeared these Yello-Bole Pipes for 11 years to thousands of pipe smokers. It's always mild and agreeable. The pipe-bowl itself is Nature's best burl Briar, not ordinary lumber covered with artificial painting. If you don't find Yello-Bole at your dealer's, it's because our boys on every fighting front need them, and are getting them, first. Your dealer will have your pipe soon.

YELLO-BOLE PREMIER \$2.50
YELLO-BOLE IMPERIAL \$1.50
YELLO-BOLE STANDARD \$1

YELLO-BOLE A NAME TO REMEMBER, WHEREVER YOU ARE—
 AND WHEN YOU COME HOME

if the earth were at the center of a balloon which was blowing up all around us. Nebulae close to the earth are receding at the rate of 500 miles a second. The question astronomers wanted answered was: What are the most distant nebulae doing?

With the Rayton lens the answer was soon forthcoming. Spectra of the most distant nebulae showed that they too are receding like the nearer ones, only much faster—at the rate of 12,000 miles a second, which is 43,200,000 miles per hour.

Seven Trillion Dollar Treasure

(Continued from page 53)

industry is studying various proposals for solutions of the freight problem. Pulverized coal can be carried by pipe line for distances up to a mile or so, suspended in air or liquid. Another proposal is to burn the coal right in the mine and pipe its energy away in the form of gas. Russia has six such installations in which air is pumped down one shaft and coal gas is forced to the surface by another.

In efficient utilization of coal we have a long way to go. Probably the highest efficiency in use of coal's energy is 40 percent, but since it is such a cheap source of energy the problem has never been critical. However, engineering advances in the last generation enable a locomotive to haul the same load as a World War I locomotive with 40 percent less coal; an electric utility company to generate 1 kilowatt with 1.34 pounds of coal against 3.39 pounds of coal in 1920; and a steel company to produce a ton of pig iron with 20 percent less coking coal than 25 years ago. Still, the overall efficiency of coal utilization is only about 20 percent.

It is in the field of chemistry that the most amazing strides have been taken. The coal chemicals got their start by accident. Like Columbus, who sought the Indies and

(Continued to page 152)

Model Builders Attention!

	V	V-2	V-3
Hex	1/2"	3/8"	5/16"
Thread	3/8"-24	1/4"-32	1/4"-32
Thread Length	7/32	7/32	5/32
Weight, Grams	8	3 1/2	2 1/2

Actual Size V-Plug

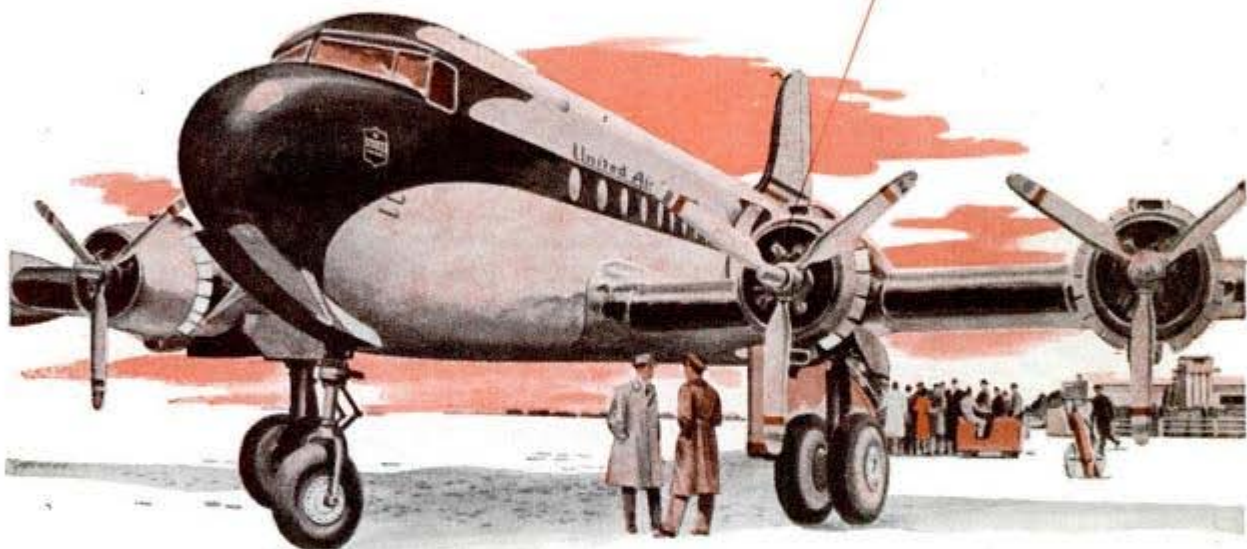
Champion spark plugs for model gas engines give the same dependable performance as regular Champions. Silliment sealed. Sillimanite insulator. Alloy needlepoint electrodes for easy starting. One piece construction.

CHAMPION

SPARK PLUG COMPANY • TOLEDO 1, OHIO



**WHERE MAINTENANCE OF SCHEDULES
REALLY COUNTS . . .**



.. CHAMPION SPARK PLUGS

INSURE MAXIMUM DEPENDABILITY

Looking ahead to the days of peace, United Air Lines recently announced placement of orders for 50 four-engined Douglas luxury liners for immediate postwar use. Meantime United has set exceptional performance records in the service of the nation, both military and civilian, by operating almost 100,000 schedule miles daily with less than two-thirds the number of planes used to fly 81,000 schedule miles

in 1941. Champion Spark Plugs now used exclusively by United on its Mainliners and Cargoliners have contributed substantially to this outstanding service record. Thus once again Champion Spark Plugs demonstrate in an exceptional way the inherently high caliber of their dependability—dependability that has established Champions as the preferred spark plug for all types of service on land, water and in the air.

Buy More and More War Bonds



Until the Day of Victory

CHAMPION SPARK PLUG COMPANY, TOLEDO 1, OHIO



**TO SAVE
GASOLINE
—KEEP SPARK
PLUGS CLEAN**

A New Blade Makes a New Knife

X-ACTO... KNIFE OF A THOUSAND USES

X-ACTO knives are always sharp... for at the first sign of dullness, you instantly re-blade to re-sharpen! That is why, in

all arts and crafts, whenever it is important to have a knife with a keen, precision cutting edge, X-ACTO'S prove best by test. They are always factory-fresh... always sharp!

The new deluxe all-metal Knife Chest will give you an ease and skill in cutting you've never known before.

Get this new X-ACTO Knife Chest today. Discover the joy of working with knives that have better, sharper, surgically keen blades... with knives of a thousand uses, X-ACTO!

New! No. 83 X-ACTO deluxe all metal knife chest. The finest in knife sets complete with 3 solid aluminum handles and 12 interchangeable blades, in handy wooden chest. Price \$5.00 complete. Other knives and sets from 50c to \$2.50.

RE-BLADE TO
RE-SHARPEN

Write for 32
page Handbook
"How to Build Solid
Scale Model Warplanes"
—10 cents



On sale at Hobby and Model Dealers, Hardware and Dept.
Stores or order direct from
X-ACTO CRESCENT PRODUCTS CO.
440 Fourth Ave., New York 16, N. Y.

X-ACTO
EVERKEEN
knife



found America, an 18 year old English student, William Henry Perkin, 88 years ago sought a coal-tar substitute for quinine and found instead the aniline dyes. He never found the quinine substitute, but American chemists did, three generations later. It is atabrine, the G.I. malaria preventive obtained from coal via toluene. Only recently two Harvard chemists accomplished the synthesis of quinine itself.

Perkin missed atabrine and synthetic quinine, but he started something bigger. His aniline dye was the first of the 10,000 colors derived today from coal tar, the value of which is manifest in the single instance that indigo from India once cost \$4 a pound; the identical dye from coal costs four cents. And Perkin had started a whole family of chemicals.

Bake a ton of coal and you get about 1,520 pounds of coke and coke breeze (for briquets, etc.); 11,000 cubic feet of gas; 10 gallons of coal tar; 3.5 gallons of light oil and 28.4 pounds of chemicals. Most of the coke goes to iron and steel makers, some into home furnaces, chemicals, Carborundum and artificial graphite, fertilizers, acetylene and explosives. The brown smoke that goes up the chimney is condensed, and what does not emerge as fuel or illuminating gas is processed into cyanides, antiknock elements for motor fuel, benzene, toluene and other chemicals. Liquors precipitated from the gas become ammonia refrigerants and fertilizers.

But it is in the coal tar branch that the chemists have achieved the most fruitful results. In the field of medicine they have given us synthetic quinine and atabrine; the sulfa drugs; nicotinic acid, one of the B complex vitamins; vitamin K (for blood clotting); procaine, the anesthetic; phenobarbital and allied sleep-producers; aspirin, arsenicals, cathartics, hormones, food preservatives and such antiseptics as hexylresorcinol, phenol and creolin.

The prolific plastics family is an offshoot of the coal tar clan. Eighty-five percent of the war plastics formed into transparent blisters and noses of bombers, into shell cases and telephones, radio equipment and instrument panels, waterproof packaging, gas masks, pontoons and life rafts and lacquers, had bituminous coal as their base. From benzol come such strange relatives as explosives, phonograph records and perfumes; from xylol, inks and soaps, paints, antiseptics and depth bombs. Into every pound of neoprene synthetic rubber goes 1.1 pound of coal. Nylon, the stuff of parachutes and glider tow-ropes and, if you remember, hosiery, is descended from coal,

(Continued to page 154)



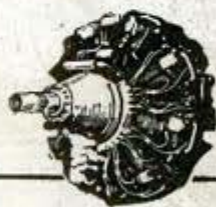
F.O.B. *Air Terminal*

Today, as an international market for our machine output looms ahead, the familiar, qualifying "F.O.B." on price lists no longer means delivery only to a freight siding or pier, but to the airport as well. Smart merchandisers will not only design and package their products for air shipment, but quote "F.O.B. Air Terminal." The establishment of an airport-to-airport rate, with allowances for pick-up and delivery, would enable large volume shippers to offer

a worth while saving and a service to their customers.

Another economy, of particular interest to the operator, comes from the weight and fuel economy of Wright Cyclones. On a four-engine transport, the basic weight saving provides a half-ton bonus — fuel economy on a ten-hour flight saves another half-ton. And Cyclone operation over billions of miles has demonstrated distinctly lower maintenance costs.

Wright Cyclones pay their way.



Cyclones Save 3 Ways

LESS WEIGHT—MORE PAYLOAD
LOWER FUEL CONSUMPTION
REDUCED MAINTENANCE

WRIGHT

Aircraft Engines

Wright Aeronautical Corporation
A Division of Curtiss-Wright Corp.
Paterson, New Jersey, U. S. A.

W R I G H T P O W E R S T H E T O N N A G E O F T H E A I R

A LESSON FROM THE WAR

Every engine in every tank, "Duck," truck, jeep, or other fighting vehicle, is protected by adequate oil filters. Many of these are AC Military Oil Filters.

You, too, can prolong engine efficiency and life with an AC Oil Filter or Element—retard the clogging of piston rings—check carbon formation—get more work from your engine, at less expense.

If you now have an oil filter, choose improved AC elements for replacement.



BUY WAR BONDS • BRING VICTORY QUICKER

air and water. You can protect your worldly goods against mildew or rain or moths or flame with coal chemicals, one of the youngest being DDT, the insecticide that saved Naples from the plague. Coal's toluene is the father of both TNT and saccharin, the sugar substitute, and on the same branch of the tree grow perfumes, antiseptics, dyes and solvents. And from tar and pitch the chemists give you macadam roads, insulation, floorings, paints and roofing.

We may, before we realize it, face the necessity of hydrogenating coal to obtain gasoline, as Europeans have done.

It begins to look as though Aladdin didn't rub a lamp. It was a lump of coal, packed full of power and warmth and magic.

Two Days in the Hornet's Nest

(Continued from page 31)

went to general quarters. Watching the young pilots tumble from the ready room to board their planes, I noticed that many were fidgety. A couple of the boys who lived next door to me in the officers' ward-room grinned and waved at me, as they always did, but they were plainly on edge. This was to be their first fleet combat.

Because the attack was launched at extreme range the flyers weren't due back until after sunset and we knew how the pilots felt about trying to land on carriers closely bunched at night. It was almost nine o'clock before they came back but we felt a little more optimistic when we were ordered to light up, despite the fact that we would be exposing our position dangerously. Vertical searchlight beams appeared to identify the carriers and glow lights flickered along flight decks. The flyers were told to pick any convenient carrier.

Still, it was a precarious and a nerve-racking undertaking—even for us safely aboard—because the carriers were so near one another that planes circling one flat-top often overlapped with those circling the next. Two or three planes sometimes would try to land on a flight deck at the same time; others made erratic landings in the poor visibility, skidded wildly and crashed into the island superstructure. Whenever an accident occurred, the pilot was helped out and the damaged plane shoved overboard to clear the deck.

I could make out many planes crash-landing in the sea, out of fuel. One pilot who landed near a destroyer saved himself by blowing so fiercely on a little penny whistle that he attracted the attention of the crew and was rescued. The destroyers picked up survivors for several days.

(Continued to page 156)

**POST-WAR MECHANICS WILL
WANT THESE WAR-TESTED**

Crestoloy Pliers

Representative of the better tools which American industry and Mechanics will have post-war, is this improved Crestoloy Diagonal Cutting Plier.

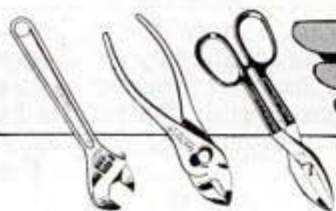
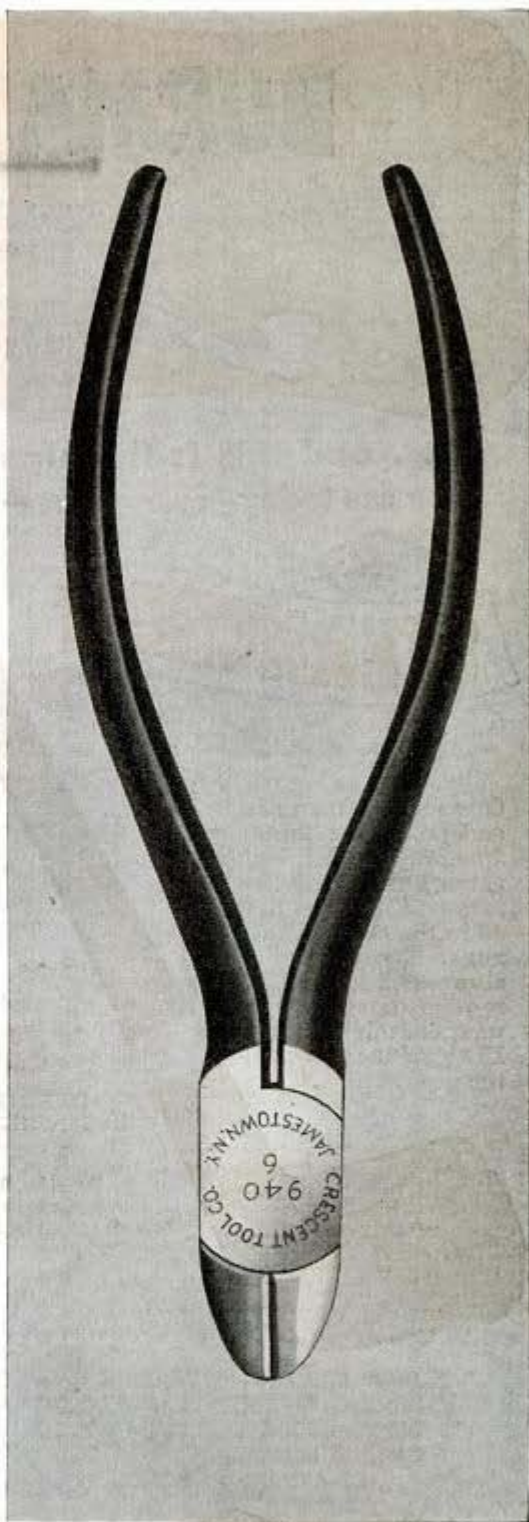
No. 940-6 was developed just prior to the war to meet the severe requirements of the Air Corps. It is a light-weight, heavy-duty cutter, with generous handle leverage and stubby nose, providing clean, easy cutting right at the cutter ends.

The experience we have gained in making millions of them has resulted in design perfection which normally would not be attained in many years of peacetime production.

Today the whole output of this improved tool must necessarily go to our *fighting mechanics*: tomorrow they will be available for mechanics everywhere.



CRESCENT TOOL COMPANY, JAMESTOWN, N. Y.



CRESCENT TOOLS
Give Wings to Work



IN BURMA

this is the pipe they
used to smoke



... and this is the pipe
you see today—everywhere—



Our service men are in Burma, and on all the far-flung battle-fronts of the world—along with them have gone the same mellow LHS pipes they puffed in the states. That's the reason you may not always find just the LHS model or style you want, but if it's an LHS, it's "the sign of the perfect pipe."



\$5

DOZENS OF
HANDSOME MODELS

Model No. 6
Antique Finish
Also Smooth Finish

IMPORTED BRIAR

Other LHS Pipes of Imported Briar
Sterncrest Ultrafine . . . **\$10.00**
Sterncrest 14K **7.50**
Certified Purex **3.50**

AT ALL GOOD DEALERS



Send for your copy of "Pointers on Pipes"—FREE
L. & H. STERN, INC., Dept. Z, 56 Pearl St., Bklyn 1, N.Y.

But the flyers had had a "field day." Three of Hirohito's largest carriers were among those hit—one sunk, one probably sunk, one damaged, while a light carrier was probably sunk and another damaged.

Proudly, we learned that one of our squadron leaders had dropped a 1,000-pound bomb squarely on the bridge of a carrier, his men following with hits on the deck. In two days we had helped ward off a mighty counterblow at Saipan, our springboard for a smash at Japan itself.

Teaching the GI Way

(Continued from page 37)

phibious training. This is a wired panel, 8 by 4 feet in size and 4½ inches deep, which demonstrates the assembly and progressive movement of small boats in a landing operation. Beneath the translucent plastic face of the panel, recurring light flashes set in motion from a control board simulate boat movements.

The U. S. Office of Education has taken the lead in the preparation of training films available to industry, and many companies have produced their own. So far the Office of Education has supervised the making of nearly 500 films. Some 33,000 prints of these films have been made and put in use, and officials estimate that they have cut 25 to 30 percent from the time required for teaching workers new skills.

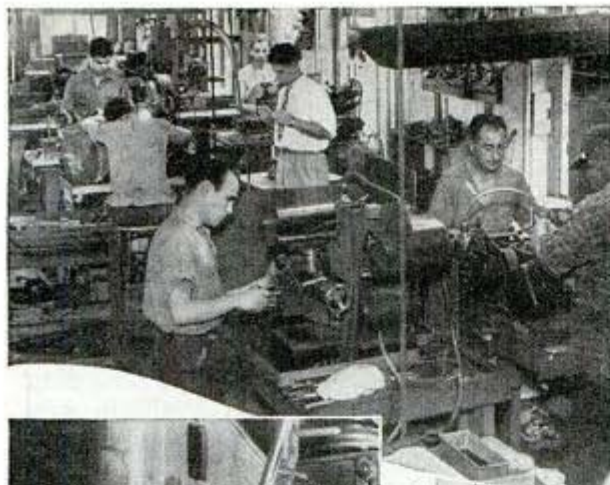
But how will the new methods and techniques affect the nation's schools and colleges after the war? Will any of them be incorporated in our educational system?

Many authorities, such as E. P. Peterson, acting dean of the College of Education, University of Iowa; Dr. Samuel N. Stevens, president of Grinnell College, and Ralph W. Tyler, professor and chairman of the Department of Education, University of Chicago, answer in the affirmative.

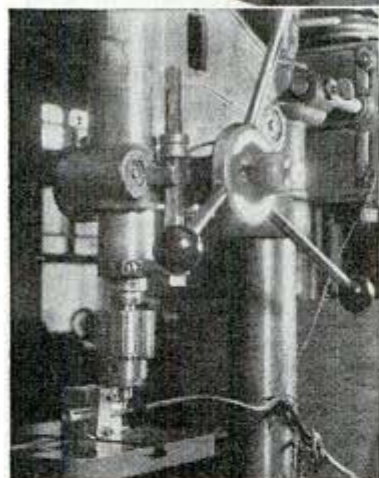
Already several schools, including the College of the City of New York, Yale, University of Wisconsin and others, have adopted the War Department's foreign language curriculum for their civilian students. In the last year, students in the Chicago public schools have viewed more than a million showings of educational films purchased at a cost of more than \$200,000. It is estimated that 20,000 16-mm. projectors are in use in school systems.

Educators are quick to point out, however, that the results attained by the Army and Navy in their training procedures can scarcely be compared with the results in schools or colleges, because of the vastly different conditions which prevail. In the

(Continued to page 158)



Success with Atlas



Atlas No. 63 drill press, in Triex plant, used with No. W68 Universal Vise in a vertical milling operation. Thousands of pieces have been made with this jig.



**From 2 LATHES and 1 DRILL PRESS
To 30 BUSY MACHINES**

Starting five years ago with three machines and lots of ambition, Mr. A. L. Moss and his unusual cohorts of The Triex Machine Tool Company of New York City have made an amazing precision production record. They turn out gauges within 1/10 of .001. Work in quantities from two pieces to 60,000, all within extremely fine tolerances—on over 30 Atlas lathes, drill presses, milling machines, and shapers.

There are few machinists in the shop. Most of the men come from the professions—musicians, artists, accountants, teachers—men who a few years ago didn't know the difference between a lathe and a micrometer but today work to a tolerance of half a thousandth.

The success story of Triex—typical of hundreds founded on Atlas equipment—is a hopeful sign to men of vision and ability who plan to build businesses of their own after the war. If you have such ambitions, you can build soundly on a foundation of modern Atlas tools.

SEND FOR LATEST ATLAS CATALOGS

Although all Atlas production is on high priority and will be until war needs are filled, it is not too early to start making your postwar equipment plans. Send for latest catalogs. Tell us which tools—lathes, drill presses, milling machines, shapers—interest you most.



ATLAS PRESS COMPANY

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NEW ATLAS PATTERN SERVICE FOR WOOD CRAFTSMEN. See ad on page 168

fluid power



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Engineered by **PARKER**

Fluid Power, the modern way to get things done, is carried wherever you want it to go through tubes, and controlled by valves.

You think of Fluid Power as a three-link chain; Source—Circuit—Utilization.

The *key link* is the Circuit—straight line, around corners, into tight places, under direct or remote control. That *key link* is vital, for the successful operation of any Fluid Power application depends on it!

It's Parker's business to engineer this vital link—to design it, build it, install it—to build the precision valves and fittings that make it function, and the tools to handle them. We've been at it for twenty years.

A Parker Fluid Power engineer will gladly discuss these interesting ideas with you. Write to The Parker Appliance Company, 17325 Euclid Avenue, Cleveland 12, Ohio.

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A. A. F. SURPLUS WAR STOCKS

Parker has been selected by Metals Reserve Company to market surplus A. A. F. war stocks of valves and fittings. Immediate delivery assured. For specifications and for installation recommendations, write, wire or phone. Parker Service Agency, Division of The Parker Appliance Company, Cleveland 12, Ohio, U.S.A. Agent for Metals Reserve Co.



armed forces, the men are motivated by discipline and patriotism, and the intense desire to learn quickly. And, as one Army officer said, "The Army trains men—it does not educate them."

Flying the Power Midgets

(Continued from page 79)

The smallest engine on the market is an "Atom." It develops $\frac{1}{10}$ horsepower. This tiny power plant is smaller than your thumb and weighs two ounces, including fuel tank, propeller hub, ignition, and spark plug. It can be used in models having wing spans of up to 30 inches and gross weights of 10 ounces. Larger engines that develop up to one horsepower are also manufactured, including a $\frac{1}{2}$ horsepower twin cylinder aircooled model for heavy moderate speed models.

Some enthusiasts build their own miniature magnetos but the most commonly used sources of current are tiny dry or wet cells. One wet battery, of special materials, produces 2.8 volts from its single cell and has a gross weight of $2\frac{1}{2}$ ounces. It may be removed from its plastic case and flown as a dry cell to save weight, then replaced in its case and electrolyte for recharging from an automobile battery. Midget high tension coils for the engines weigh less than two ounces and are an inch and a half long. All the engines are fueled with a high octane menthenol racing fluid.

As in large aircraft, speed or endurance of the model aircraft depends on cleanness of design and workmanship and on the efficiency of power plants and propellers. Like professional aerodynamicists in the wind tunnels, the model builders try every new idea that might reduce drag. Factory built engines are hopped up to deliver extra power. Factory construction kits are modified to produce cleaner wing and fuselage shapes. Many speed model builders enclose their engines to reduce resistance, introducing carburetor air and cooling air by means of an air scoop. Most free flight models have fixed landing gear, but to reduce this drag some builders use one landing wheel alone. The plane lands on the one wheel and a wing skid. Eliminating the second landing wheel may add more than five miles per hour to the plane's speed.

The high speed jobs that are flown from the ends of control wires dispense with landing wheels entirely. They make their takeoff runs on wheeled dollies, then rise off the dollies when they attain flying speed. These planes skid to a stop on their bellies in landing but rarely damage a pro-

(Continued to page 160)



Bill Day, newspaper photographer, and Hank Werner got these 17 bass on Hawaiian Wigglers in Arkansas.

Hit Jack Pot with HAWAIIAN WIGGLERS

Frank Vestal, Memphis sports writer, reports the experience of Bill Day, left, and Hank Werner with Hawaiian Wigglers at Horseshoe Lake, Ark.

"They boated their way to the brush, stumps and moss beds where they cast their Hawaiian Wigglers. After a practice shot, Hank got a five-pounder on his No. 2 Hawaiian. It was Day's turn next and he landed one of equal proportions. The fun was on! The lucky anglers nabbed 17 bass, 2 to 5½ lbs., before setting out for home."

Write for Literature



No. 2
Hawaiian Wiggler \$1.10
FRED ARBOGAST, 1601 North St., Akron 3, Ohio



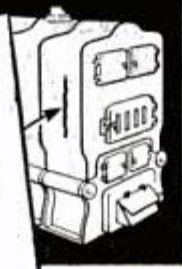
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PELLER. Some of the models have been equipped with landing gear that retracts into the wing by clockwork. One model builder retracted his landing gear by means of the centrifugal pull that develops when the plane reaches moderate speed at the end of its control lines.

Factory built wooden racing propellers, eight or nine inches long, can be turned at tip speeds of up to 45,000 feet per minute but the greatest efficiency is usually found at about 30,000 feet per minute. Contra-rotating twin propellers have been used on a few models. Slight modifications to the propeller may give a racing plane 20 or 30 miles per hour of additional speed. The model builders are ceaselessly experimenting with propellers, engines, and airfoils to fly their models faster or longer.

Giving Depth to the Movies

(Continued from page 47)

The success of all such effects lies in the art director's skill in laying out the scene. The apparent horizon line must be established ahead of time in relation to the camera position, and all parts of the scene are then planned with reference to the horizon. Usually the scene is first sketched on paper, then a realistic three-dimensional model of it is built. Errors that appear in the model are corrected, then the scenery is erected on the stage.

Skillful use of perspective helps the technicians to play many kinds of tricks on the one-eyed camera and still preserve their third-dimensional effect. A scenario may require that the interior of a vast cathedral be shown. Such a set cannot be built below a sound stage roof and yet the movie magicians have a way of creating it in spite of the stage's physical dimensions. They build the cathedral's floor and the first 10 or 15 feet of its walls, full size, inside the stage building. The upward continuation of the walls and the cathedral's ornate ceiling are then built in miniature and this small scale portion of the set is suspended in the air close to the camera, lined up to match the rest of the set. To the camera the full scale and small scale portions match exactly.

Even more ingenious is the device of joining such a combination scene with a painting. That is, it may be necessary to show the great pipes of a pipe organ against the rear wall of a cathedral. It is often best to do this by what is called the matte-shot technique, an exacting double exposure process. First the scene is filmed in the usual manner but with a small mask in front of the camera that blanks off the area

(Continued to page 162)

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to be occupied by the pipe organ. Next, the same film is run through the camera again, this time shooting through a mask that blanks off everything except a painting of the pipe organ that has been lined up in front of the camera so that it exactly fills the area occupied by the original mask. With careful attention to detail and scale, matching up different elements to form one composite scene provides a convincing illusion of the interior of a cathedral.

It's All Electric but the Horses

(Continued from page 69)

tive markings on horses. These descriptions follow the horses wherever they are shipped to run on the major tracks.

The practice of stimulating horses to make them run faster has about died out, thanks to scientific methods by which stimulants may be detected in their saliva. The changing of types of horseshoes to alter the manner in which an animal runs also has been eliminated. All horses' shoes are examined before a race and the type they are wearing is posted on public boards.

Like other giant industries, race tracks have found that the more honest and scientifically efficient they can be made, the greater the profits. Everything runs with precision except the element which cannot be mechanized—the "nags" which pound hoofs around the tracks.

Gangplank to Hitler's Doorstep

(Continued from page 5)

unloading of LSTs directly onto the beaches, by the Army's amphibious ducks and the Navy's pontoon "Rhino ferries," by sunken causeways built by the Seabees, and by the sweat of thousands of GI Joes.

These hardworking Yanks set a record that must have amazed the Allied Chiefs of Staff. During the week following the storm there moved across the open beaches 50 percent more long tons and 50 percent more vehicles than had been moved ashore the week before the storm.

Although the American port came to a tragic end, it played a vital though short-lived part in moving men and supplies in the crucial early days of the invasion. Recently, at a showing of the port models in Washington, a British naval officer paid this tribute to the undertaking:

"This gigantic project which cost a hundred million dollars was worth every cent of it. Without the prefabricated ports to insure a flow of supplies over the beaches the invasion of Europe would never have been attempted."



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**Save Fingers
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has flexible metal doors which close
off the entire unit when not in use.*

Everything Shipshape

Smart, compact and shipshape as the galley of a modern warship is the inviting, space-saving pre-fabricated kitchen unit for small dwellings, portrayed above. Defoe presents this design as one of many that postwar America may expect from the pre-fabricated housing industry. The goal of this industry will be to improve living standards and provide widespread employment. Today, Defoe's only job is to build dependable fighting ships for the Navy. But after Victory, the experience, skill and ability required by this exacting work will be devoted to building quality products for peacetime America. Our postwar work will reflect the same heart and pride we put into our present crucial job.

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*Four White Star Renewal Citations
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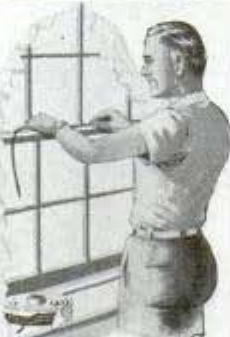
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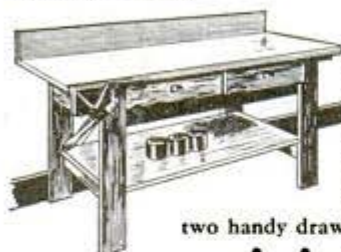
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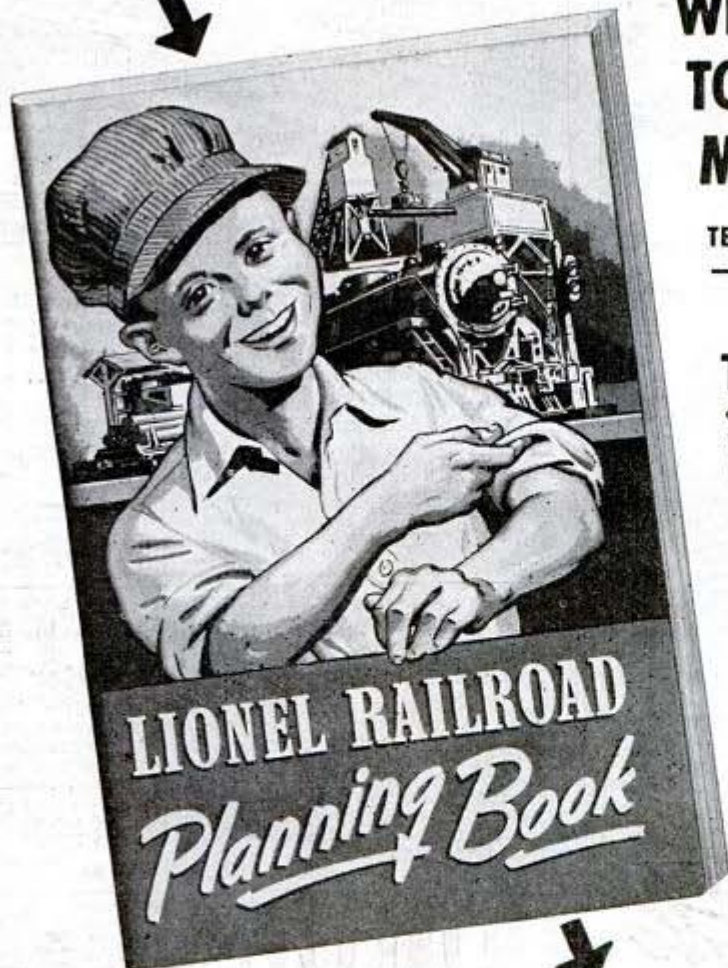
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WHEN THE WAR IS OVER**



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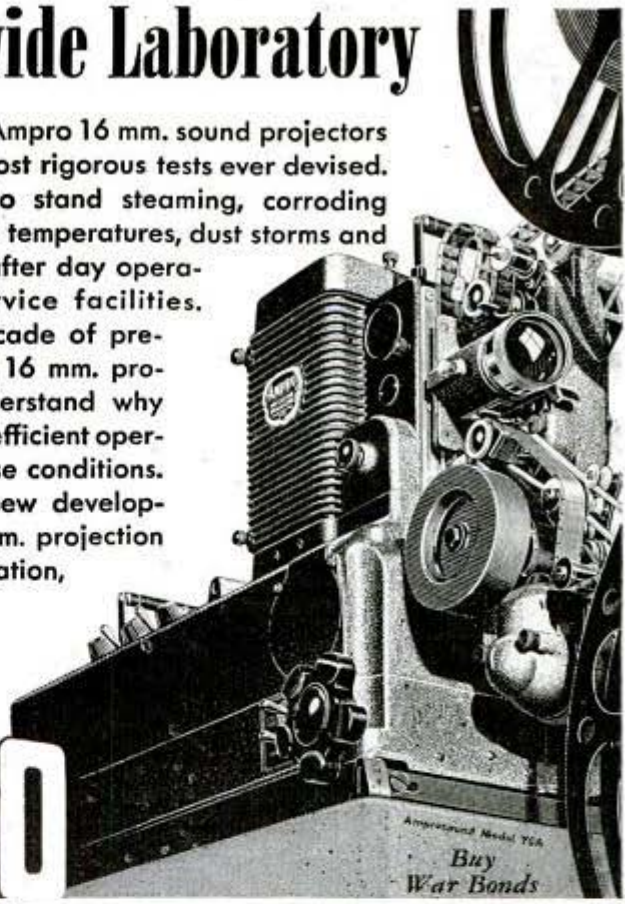
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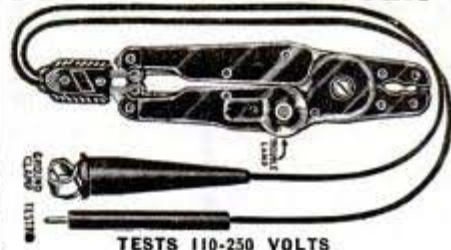
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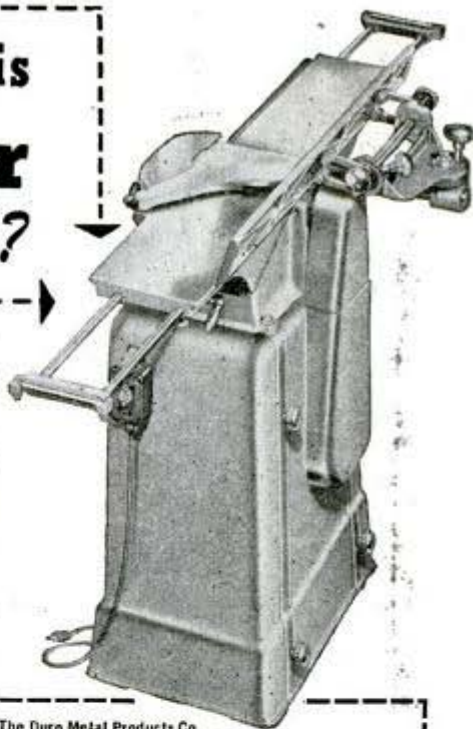
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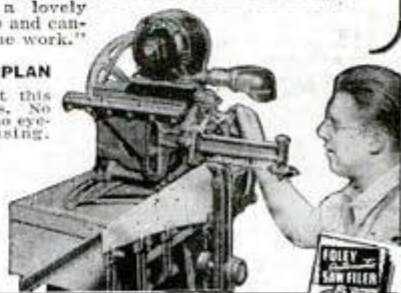
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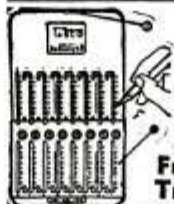
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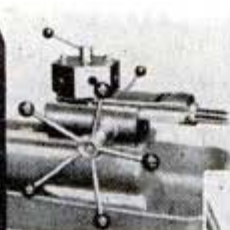


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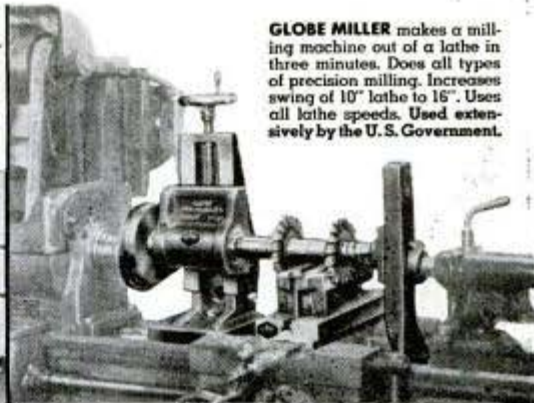
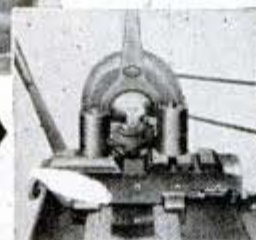
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JANUARY, 1945

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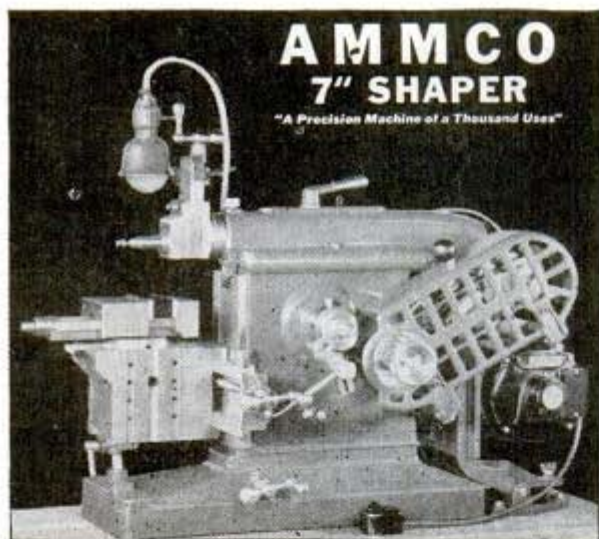
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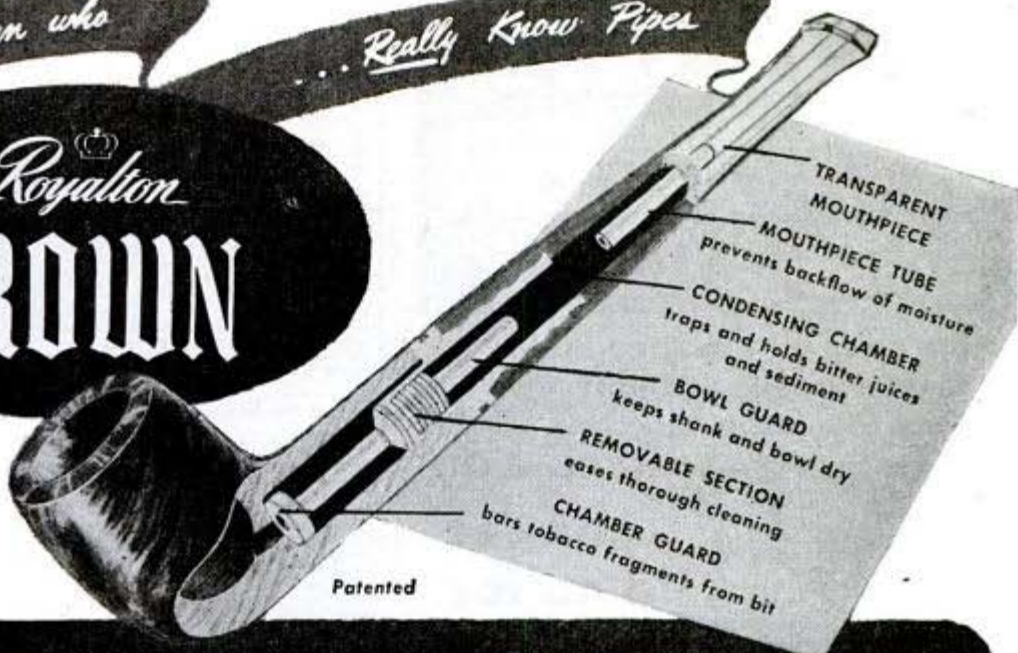
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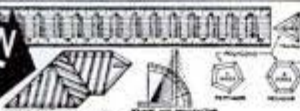


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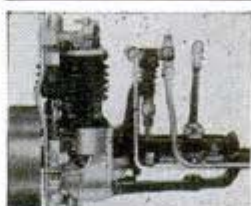
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BETTER AND FASTER
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Moto-Tool owners are constantly discovering new jobs that these mighty little mid-gets can do more expertly in less time to speed the war effort. In fact, every new purchaser finds dozens of uses in addition to the ones for which he bought his Moto-Tool. So great is the time and labor they save, thousands of mechanics and craftsmen would find it difficult to get along without their Moto-Tools.

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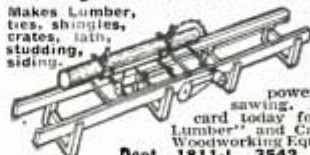
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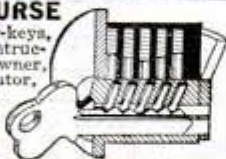
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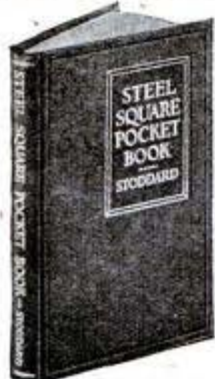
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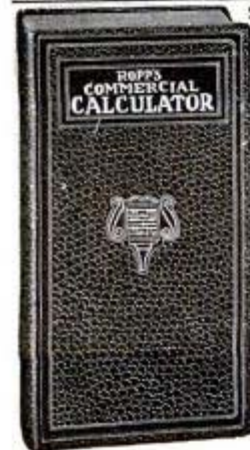
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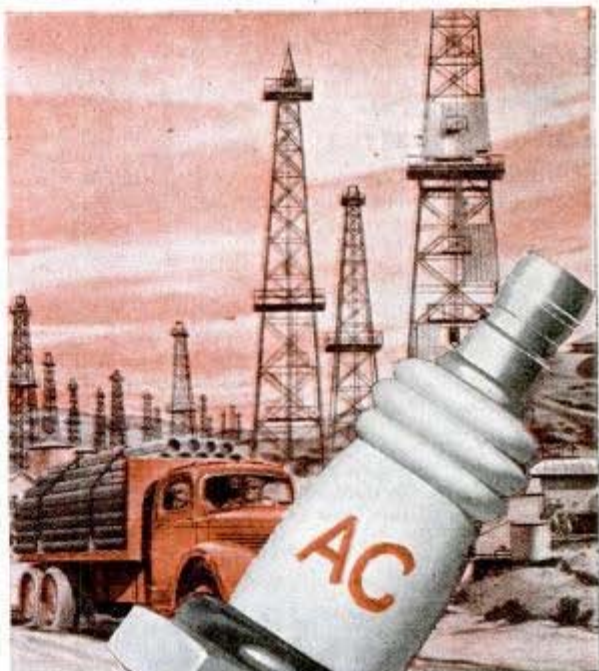
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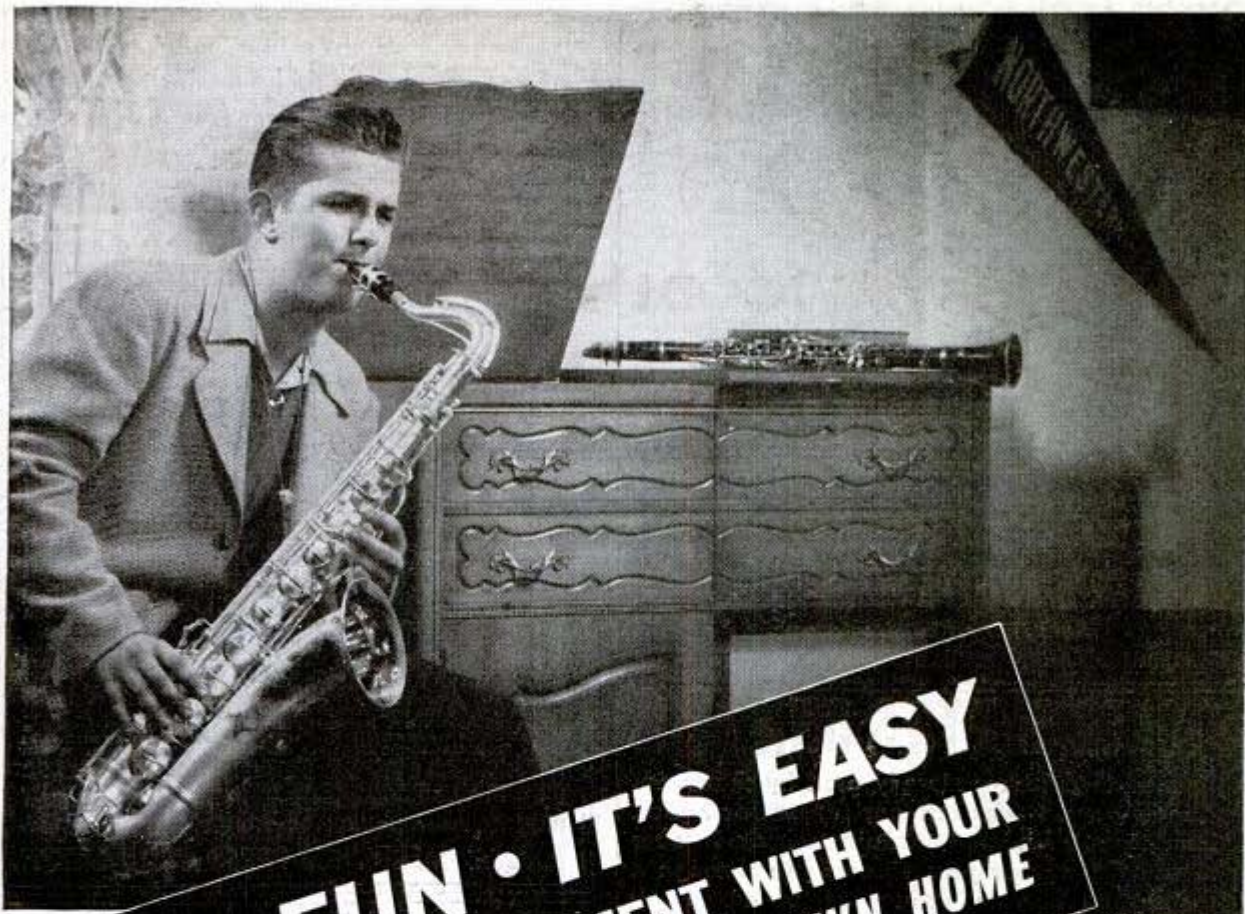
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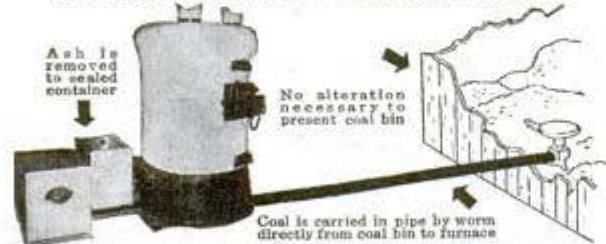
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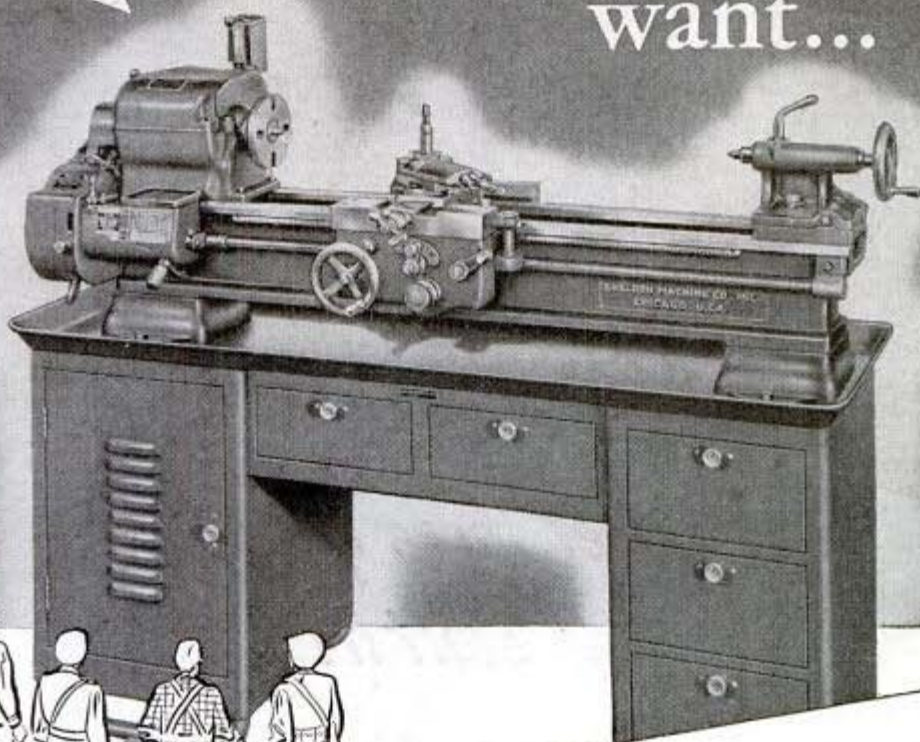
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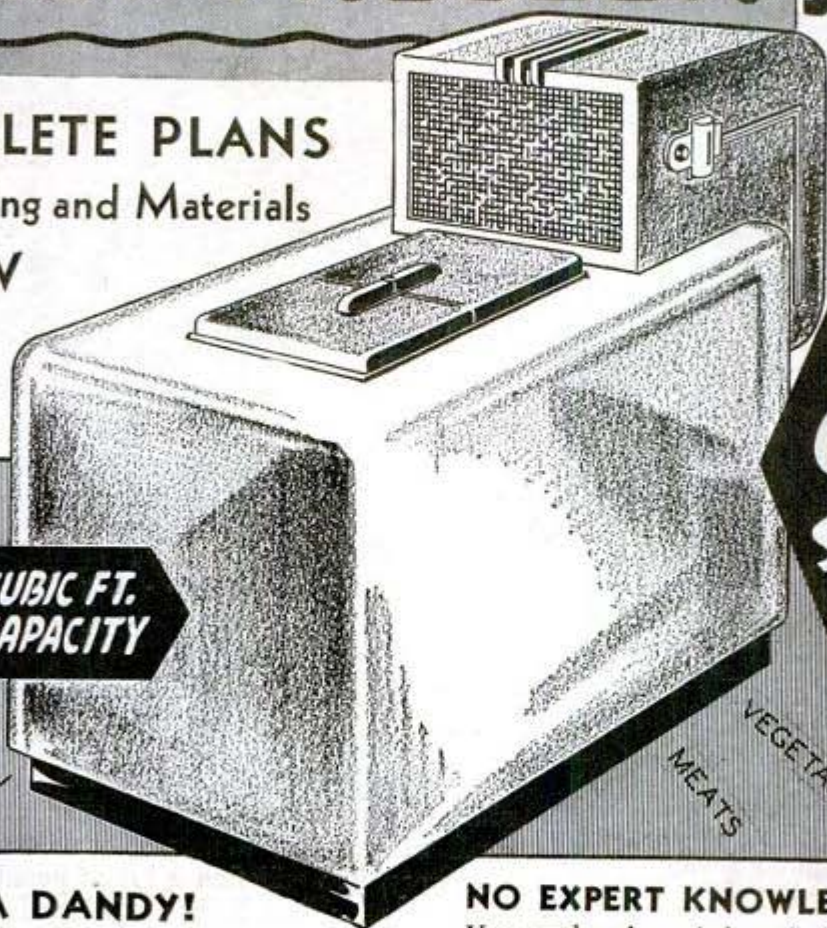
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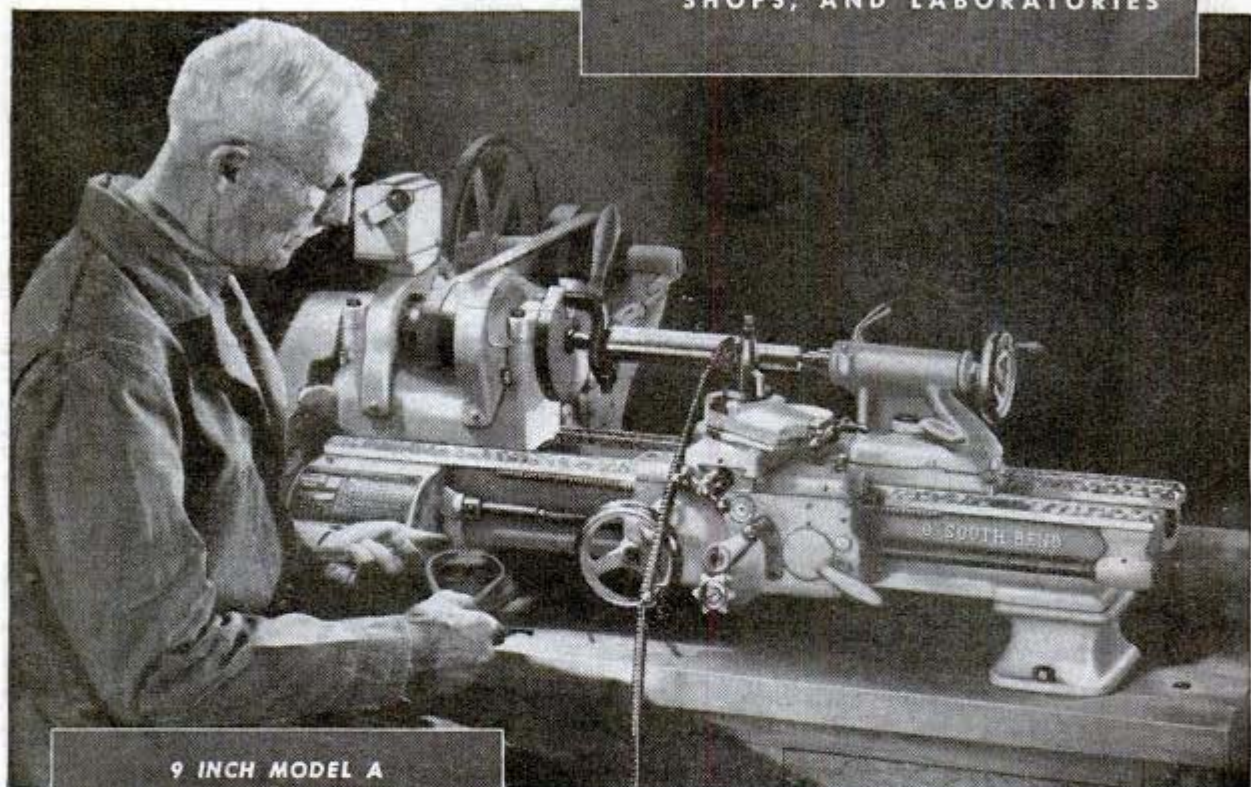
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"Yeah, but who took you men to where you were going?
The Navy!"

"Okay, wise guy, but who went in and took over from there?
The Army!"

"Answer me this, chums... who's always in there pitching, land or sea?
The Marines!"

... at least they all agree on

GET a "flatfoot" (a soldier's term for a sailor), a "gravel agitator" (infantryman), and a "gyrene" (marine, to you) all together and they'll sound off about everything! But they'll agree on that pack in their pockets. Camels, first in the service from the Philippines to the Rhine. It's on the record... "With men in the Army, Navy, Marines, and Coast Guard, the favorite cigarette is Camel, based on actual sales records." Flavor and mildness make Camel a favorite wherever you go!



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