

AVERTING DEATH FROM THE SKIES

POPULAR MECHANICS

MAGAZINE

WRITTEN

REG. U.S. PAT. OFF.

MAY

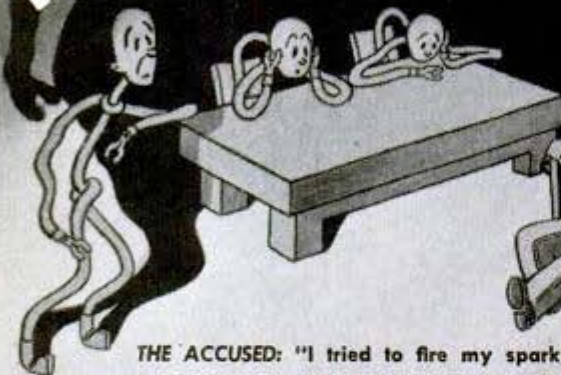
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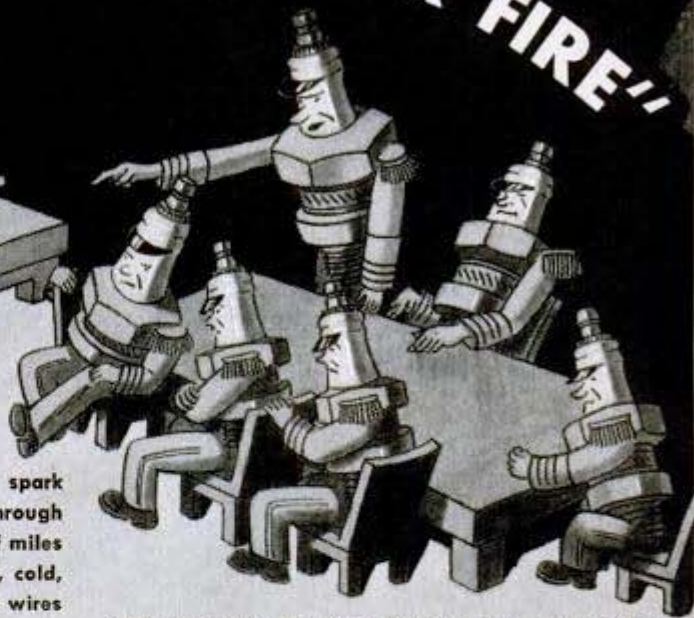


SEE PAGE 645

COURT-MARTIALED FOR DESERTION "UNDER FIRE!"



THE ACCUSED: "I tried to fire my spark plug when my turn came, but the 'juice' jumped through a weak spot in my insulation. For thousands of miles I've stood up under the attack of heat, hot oil, cold, moisture, vibration and corona. We spark plug wires can't keep going forever!"



THE ACCUSER: "We aren't blaming you, but we must stick to the facts. You failed to do your duty in delivering the high-voltage current to your spark plug. You and your companions are sentenced to be replaced with a new set of Packard spark plug wires."

Let CERTIFIED RE-WIRING SERVICE Put More Pep in Your Car

Nearly everyone realizes that cracked, brittle insulation on spark plug wires can cause an engine to "miss" under load, and that these worn-out wires should be replaced. But the important thing to remember is that defective spark plug wires are just *one* of the possible "bottlenecks" in the electrical system. *All* the wires . . . *all* the electrical units . . . need checking—and that's what a Packard Certified Re-Wiring check-up does for you.

Ask for a Packard Certified Re-Wiring check-up at your regular service station. If

the dealer cannot provide it, have him get in touch with his Packard jobber for complete service instructions. Packard Electric Division, General Motors Corporation, Warren, Ohio.



Packard

REG. U.S. PAT. OFF.
TRADE MARK

THE STANDARD WIRING EQUIPMENT OF THE AUTOMOTIVE INDUSTRY

We took a honey of an engine and ADDED Fluid Drive!



*Try it...
See what a difference
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CHRYSLER engineers might have said, "We've got the greatest engine in history in our new Spitfire. It's got thrills enough for anybody." But what they did do was to take that power-packed honey of an engine . . . and *add Fluid Drive to it!*

They knew that there is no substitute for *Fluid Drive!* They knew that *Fluid Drive* and Vacamatic transmission could add factors of smoothness, economy, driving ease

and thrills beyond anything that could be put inside an engine.

The result is the greatest combination of *engine and drive* that the motoring world has yet seen.

You can drive for hours without touching clutch or gearshift. Glide up to traffic lights . . . put on the brake . . . stand still without touching clutch or gear lever . . . then slip away again simply by touching the throttle! Vacamatic transmission gives you the power you want when you want it.

Don't you owe it to yourself to try this before you drive any new car? Frankly, we don't see how you could possibly buy a new car without it! Your Chrysler dealer invites you!

★ Tune in on Major Bowes, CBS, Thursdays, 9 to 10 P. M., Eastern Standard Time

**BE MODERN
WITH FLUID DRIVE
and Vacamatic Transmission**
Buy Chrysler

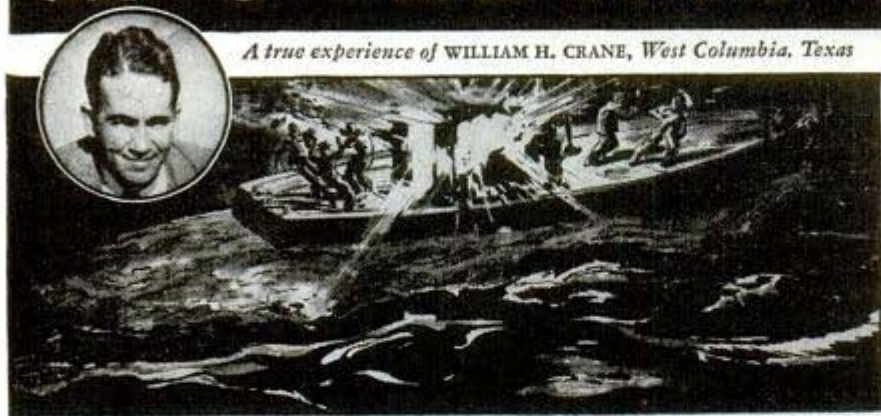


**SPITFIRE ENGINES
WITH MULTIPLE-
JET CARBURETORS**



"FLAMES DROVE US INTO THE INKY SEA!"

A true experience of WILLIAM H. CRANE, West Columbia, Texas



"A TERRIFIC EXPLOSION rocked the boat on which we were riding out to an oil drilling rig in Galveston Bay," writes Mr. Crane. "Instantly, the six of us—a drilling crew and the skipper of our craft—were surrounded by flames.

"FIGHTING THE FIRE was hopeless. As tongues of flame seared us, we strapped on lifebelts. Our driller grabbed a flashlight. Then we hurled ourselves overboard into the black water.



"AFTER HOURS OF SIGNALLING, the piercing white beam of the flashlight guided a searching party to us. Without the flashlight and its dependable 'Eveready' fresh DATED batteries it could have been 'curtains' for us.

(Signed) *William H. Crane*

The word "Eveready" is a registered trade-mark of National Carbon Company, Inc.

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Popular Mechanics Magazine

H. H. WINDSOR, Founder

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

May, 1941

Vol. 75, No. 5

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Trailer Blazing in Africa

NEXT month you'll start a summer safari deep into Africa in an air-conditioned trailer "jungle yacht." You'll visit the secret sect of Baboon-Men, watch the Wagenias paddle a 60-foot canoe in boiling rapids to tend their fish traps, meet Watussi princes eight feet tall and go hunting with pygmies. You'll cross crocodile-infested rivers on ropes of vines and face a stampeding herd of buffalo. All these are thrilling incidents of the Tenth African Expedition of Commander Attilio Gatti, related in three installments beginning in the June issue.

Science Looks You in the Eye

KEEP right on reading, driving cars at night, going to the movies and concentrating on close work and a million years or so hence your descendants may be part of a one-eyed race. Most people use only one dominant eye today. What's happening to the human eye, and what science is doing about it, are told in the eight-page Coloroto section next month.

Next Month

ROLLING over the old Santa Fe trail at the head of a string of 70 freight cars is a blue and yellow streamline locomotive—very fancy for a freighter. But inside the handsome package is the most powerful Diesel on wheels, able to pull 100 cars at 75 miles an hour for 500 miles non-stop. First main-line freighter of its breed, with an electric brake never before tried, it does the work of two or three steam engines on mountain grades. Read about its first run next month.

Rainbow of Steel

THIRTEEN times the ripping winds and crushing ice of Niagara Gorge have forced reconstruction or major repairs of the Rainbow Bridge. Now a new Rainbow of steel is rising, a bridge built from the sky without the help of caissons or scaffolding from below. This summer they will cap the world's longest hingeless arch with a tiny 11-inch keystone supporting 11,000,000 pounds of concrete and steel. A June feature tells of this mechanical marvel.

Man's Metal Robots

SINCE the first man found he could dig faster with a clamshell than with his fingers, men have been substituting mechanical robots for their feeble arms and legs. There is the coal digger that reaches out 110 feet to scoop 35 cubic yards, the 10-mile belt conveyor, the million-pound drop hammer. Read of them in "Man's Robots of Metal" next month.

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"Hi, Ed! How'd Your Fishing Trip Come Out?"



1. I had talked of nothing but my coming fishing trip, the first week-end of the opening season. Were the boys at the office envious?

3. But late that night, the blow fell! I was fighting a terrific storm far in the woods when my car broke down.



In small town or big city—north, south, east or west—garage and service men know that Pyroil's *prevention of acid-corrosion* can offset breakdown of vital engine parts, just like this! Pyroil does far more. It protects your engine against the danger-inviting effects of sticky gum, sludge, hard carbon and other serious contaminations. It keeps your car powerful, smooth running. *It keeps a clean engine clean!*

Only Pyroil, the *balanced* additive, gives Pyroil results. So use it *regularly*. Just a few ounces in gasoline tank and crankcase. Your service man will add it, today! Manufactured and Guaranteed by Pyroil Company, W. V. Kidder, Founder, 55 Pyroil Bldg., LaCrosse, Wisconsin, U. S. A.



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PYROIL COMPANY,
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 I would like to know more about Pyroil—especially *what car manufacturers have to say about its use.*
 Please send me Free Literature.
 Send details of your plan for Distributors.
 Name.....
 Address.....
 City..... State.....



2. At last, time to go! Now for those hard-to-get ones hiding in the cold northwoods streams. I promised the boys a mess of 'em!



4. A stopping hike to the nearest phone. A tow to the village garage. Then—can you beat it!—tied up for the whole week end! "Gotta send to the city for a new bearing." was the verdict. "Corroded bad. Just wouldn't take it pullin' on them tough hills. . . . Say, I'll bet you don't use Pyroil!"

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YOU TEST A COIN BY ITS RING . . .



YOU JUDGE A FLY ROD BY ITS ACTION . . .



**THE BETTER THE GAS,
THE BETTER YOUR CAR**

**AND WHEN YOU STOP TO BUY GASOLINE, THIS EMBLEM
TELLS YOU WHICH PUMP CONTAINS THE BEST**

THE ETHYL EMBLEM on a gasoline pump stands for *extra* quality in anti-knock (octane) and all-round value. Samples are double-checked by your oil company and the Ethyl laboratories.

In your car, "Ethyl" means a cooler-running engine in summer; a quicker-starting engine in winter; extra power and smoothness all year. When you stop for gasoline, the Ethyl emblem tells you which pump contains the best. ETHYL GASOLINE CORPORATION, NEW YORK



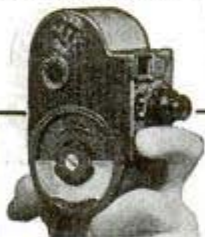
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WANT YOUR VACATIONS TO LAST FOREVER?

THEY will, in Filmo movies! For with a Filmo you can bring your trip home with you . . . to be enjoyed again and again . . . to be shared with your friends.

It's easy, because Filmos are built by the makers of Hollywood's preferred studio equipment to give professional results with amateur ease. Just press a button, and *what you see, you get!* And it's inexpensive, too, even when you take full-color pictures.

Save by getting your ultimate camera first—a Filmo. See Filmos at better photographic dealers', or mail coupon. Bell & Howell Company, Chicago; New York; Hollywood; Washington, D.C.; London. *Established 1907.*



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Streamlining the circus.....	695
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Indoor golf course.....	699
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go from **HERE???**

ing program, especially into the key and supervisory jobs which demand most and pay best. This spells real opportunity for the man who can meet the test—but heaven help the man who still tries to meet today's problems from yesterday's standpoint! Out of the multitude still jobless there are sure to be many frantically eager to prove him wrong and take his place.

Some Men Have Found the Answer

Seeing these signs, many aggressive men and women are quietly training at home—are wisely building themselves for more efficient service to their employers. They are studying with us because our training courses are as fresh, vital and up-to-the-minute as the problems that face you today.

You naturally ask, "Has your training helped men withstand conditions of the last few years?"

Our answer is to point to a file of letters from thousands of our students reporting pay raises and promotions while business was at its lowest ebb—together with a myriad of others telling of greater success during these recent months of recovery.

Convincing evidence is ready for your investigation. We have assembled much of it in a booklet that is yours for the asking, along with a new and vitally interesting pamphlet on your business field.

This is a serious study of the possibilities and opportunities in that field. It is certain to contain an answer to vital questions bothering you today about your own work and earning power.

Send for these booklets—coupon brings them free. Be sure to check the LaSalle training that interests you most. We will tell you also how you can meet and take fullest advantage of today's situation. No cost or obligation—so why not mail the coupon now?

YOU'RE like a million other men today—you're facing a big question. The last ten years turned business topsy-turvy and now the rebuilding period stares you in the face. The Defense program, new world conditions and the business pick-up offer new opportunities, but also new problems.

Where you are "going from here" is a question you want answered right if you expect to get ahead—progress—grow instead of standing still.

Are the things that are happening today going to help or hinder you—what will they mean in your pay check? Where will they put you five—ten—twenty years from now?

How can you take full advantage of this period of opportunity? We believe you will find the answer here—a suggestion the soundness of which can be proven to you as it has been to thousands of other men.

The whole trend today—legislation—spirit—action—is upward, up to higher business records than ever before. New factories, enlarged plants, new products are calling for more men.

Business organizations are rebuilding—organizing and expanding for the new conditions. Employees are being studied, judged as to how they fit in the expand-

LASALLE Extension University A Correspondence Institution

Please send me—without cost or obligation—full information about how I can, through your training, equip myself for the new problems and opportunities in the business field I have checked.

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| <input type="checkbox"/> Higher Accountancy | <input type="checkbox"/> Business Management | <input type="checkbox"/> Business English |
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Position Age

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OWN a Harley-Davidson and get in on the thrills motorcycle riders are enjoying! Take in club rallies, gypsy tours, races, hillclimbs — go on glorious week-end and vacation trips at little cost. Pack every spare hour with action, adventure and exciting good times. Visit your Harley-Davidson dealer — see the latest, improved models — get the whole-pleasure filled story of this great sport — and **SEND THIS COUPON NOW!**



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Send FREE copy of big 24-page "Enthuslast" magazine filled with thrilling motorcycle pictures and stories. Also literature on the latest Harley-Davidsons. Stamp is enclosed for mailing cost.

Name _____

Address _____

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To men of draft age:

★ High number, low number — eventually your number will come up, and you'll be called to help out Uncle Sam in the Army.

But today's Army is a different one from the Army of 1917. Today's Army wants and needs *specialists* — men who are *trained* for more important and better paying jobs than mud slogging or spud peeling!

Thus, the selectee who is a Draftsman, a Radio Expert, a Stenographer, a Machinist, a Surveyor, an Automotive Technician, an Electrician, or who has *training* in some other field, stands a far better chance of reaching quickly "non-com" or "Specialist" grades than the man without training in any phase of Army work.

Where do you fit into this picture?

When your number's called, will you be another "Rear Rank Rudy," drawing the lowest base pay — or will you be qualified through *sound, modern training* for the much higher "N. C. O." or "Specialist" pay rates?

If you've ever thought of getting the training you lack—*now's the time!* For a few dollars a month, you can study an I. C. S. Course in your spare time, at home, and prepare yourself — not just for a more important Army job — but for *success* in civil life!

This coupon will bring you complete information, at no cost or obligation. For thousands of successful men, mailing it has been the most important act in their lives! Will you invest a 3c stamp—*now*—to learn how you can benefit?

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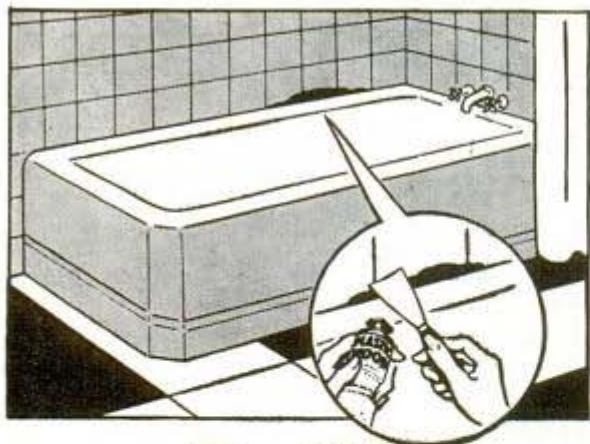
BOX 5601-J, SCRANTON, PENNA.

★ Without cost or obligation, please send me a copy of your booklet, "Who Wins and Why," and full particulars about the course *before* which I have marked X: ★

- | | | |
|---|---|--|
| TECHNICAL AND INDUSTRIAL COURSES | | |
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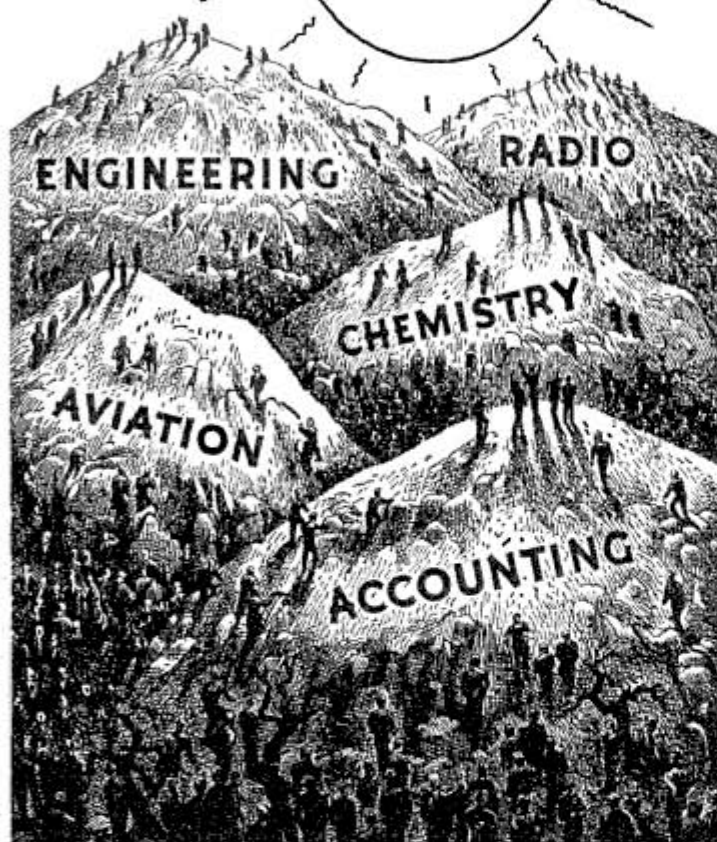
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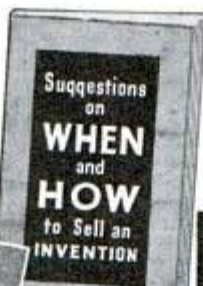
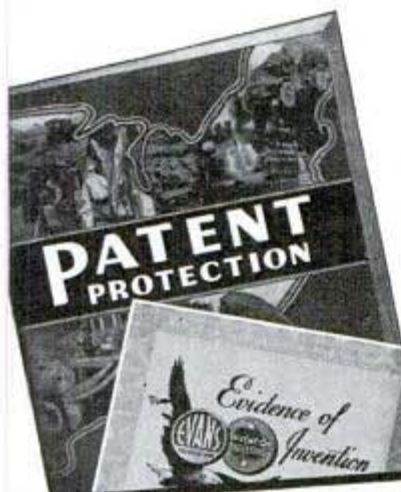
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Bamboo Porch Table Has Inner Storage Space



One of the new pieces of porch furniture is a serving table made of bamboo, pumpkin-like in shape. Hinged at the center, it swings open to disclose storage space for dishes or magazines, and a drawer to hold silverware or smoking accessories. Rollers under the table make it easy to move or to open.

Bowl on Agitator of Washer Holds Small Articles

Fitting on top of the agitator of one of the new model electric washing machines is a plastic bowl to hold small articles like handkerchiefs and socks, easily lost in the washer. This removable bowl forms a separate washing compartment, and fins on its outer surface give additional scrubbing and agitation to clothes that rise to the surface in the tub.



Vacuum Cups Hold Bath Curtain To Prevent Splashing on Floor

Small clips with vacuum-cup attachments may be fastened at the lower edge of the shower-bath curtain to keep it inside the bathtub so water cannot splash onto the floor or run down outside the tub. The clips may be spaced every few inches to hold the entire width of the curtain.

(More Popular Inventions on page 29A)



WHERE-TO-BUY-IT INDEX FOR THIS DEPARTMENT IS ON PAGE 29A

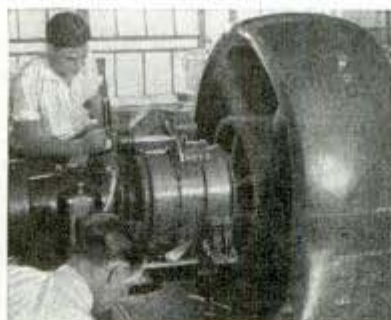
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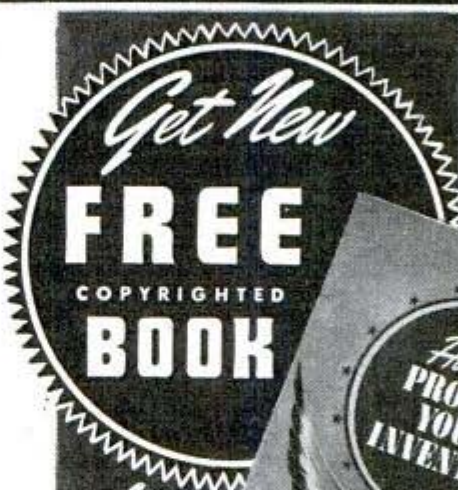
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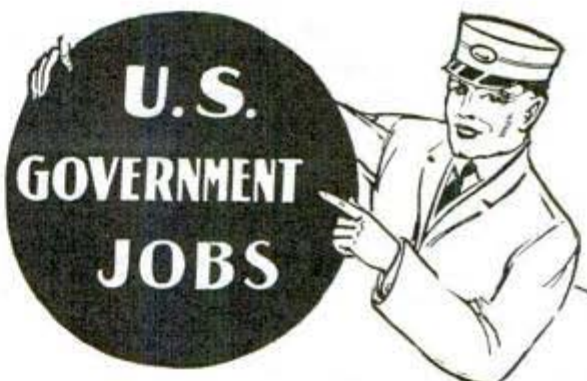
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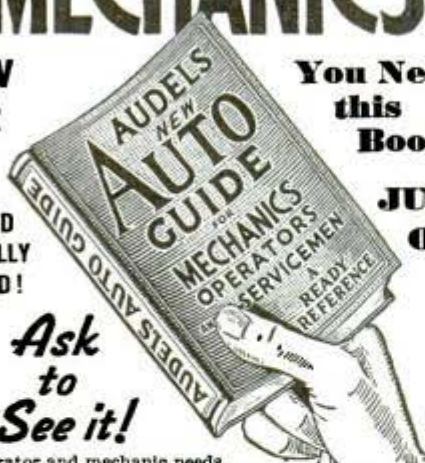
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WILL Pay \$15 each for certain Lincoln
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We send you another book of equal price
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Calif.

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ish North American, United States, for-
eign, free. Gray Stamp, Dept. PM, To-
ronto, Canada.

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MAKE Money with your camera! Thousands of dollars paid for pictures. Our big 136 page book tells you what to shoot and where to sell your pictures. Complete information on 2,000 different buyers of photographs. Arranged by market and alphabetically for quick reference. Have fun. Make money with your pictures. Send 50c for your copy or write for free details. Photo Markets, 112 Exchange Place, Hanover, Penna.

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16MM. Film, projectors, cameras. Zenith, 308 W. 44th Street, New York.

175 16MM. Sound features, reasonable. Programs, Largest 8mm. library. Free list. Asha Films, 785 St. Johns, Brooklyn, New York.

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FREE Formula catalog. Anything analyzed \$10.00. Western Chemical, Salem, Oregon.

ICELESS Ice! Colder! Cleaner! Cheaper! Instructions 25c. Duffy, Covington, Ky.

LET Me help? Formulas. Development. Consultant Chemist, Box 74, Claymont, Delaware.

MAKE Fast selling products. "Chemist Approved Formulas." Catalog free. Kemico, 12-P, Park Ridge, Illinois.

SINGLE-INGREDIENT Formulas! No manufacturing! A. Kinford, Fort Lauderdale, Florida.

CONFIDENTIAL Chemical service. Improving formulas, processes or developing new ones. Analyses. Thirty-five years experience. Central Laboratories, David Whitney Bldg., Detroit, Michigan.

ELITE Formulas and plans; make and sell your own products. Descriptive booklet free. Elite Co., 214 Grand St., New York.

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

DETIN Junked tincans, luminous paints, watered chemicals keeps food cold, building paint 5c gallon, watered chemical gardening, coal saver. Above instructions, 6 for 25c coin. D. Kirk, Box 930, Harrisburg, Penna.

FORMULAS: 15 Proven moneymaking formulas \$1.00. (Not stock-formula catalogue stuff), real unusual offers. List free. Marvel Laboratories, 6629 No. Maplewood, Chicago.

STATE Licensed chemist, 25 years experience, formerly in employ of the British government. Will furnish high grade formulas, processes and trade secrets. Ask for lists. Dr. W. L. Cummings, 230 Gordon Ave., Syracuse, N. Y.

CHEMISTRY

FREE! Catalog chemicals, laboratory supplies for students, new idea chemical-kits, apparatus-outfits. Scientific books at discounts, telescopes, microscopes, biological needs, photographic chemicals, scales. Write Winn Mfg., Dept. JES, 124 W. 23 St., New York.

CHEMICALS, Laboratory supplies, literature 1c. Malloy's Products Co., Arlington, Mass.

FREE Catalogue. Chemistry, mineralogy, biology, microscopes, telescopes. Tracey Laboratories, Evanston, Illinois.

HANDBOOK For Chemical Experimenters, hundreds of experiments, illustrated, 50c. Experiment booklet 15c. Free catalog. Reading Scientific Company, Reading, Penna.

FREE Chemistry catalog. Supplies at 5c! Equip complete laboratory. Kemkit Scientific Corp., 397P Bridge St., Brooklyn, N. Y.

CHEMICALS, Laboratory, glassware, apparatus. Send 3c for catalog CPI. Biological Supply Company, 1176 Mt. Hope Avenue, Rochester, N. Y.

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

CHEMICALS In 5c quantities, Catalog 5c. Fleischer's Laboratories, Medford, Mass.

HELP WANTED

PERMANENT Representative wanted for Hoover uniforms to call on restaurants, hotels, beauty parlors, doctors, nurses, others. Excellent income. Leads furnished. Equipment free. Hoover, Dept. SK-10C, 251 W. 19th, New York.

GROCERIES Free! Just agree to show friends, neighbors, others and I'll give you \$5.00 assortment foods, groceries, etc., free. Amazingly simple way to make good money. Send no money—just name and address. Zanol, 2282 Monmouth, Cincinnati, Ohio.

NEW Field offers unlimited earnings to aggressive men! Large national organization wants interested hard working men to represent them in a new expanding field of work. Twenty years ago little was known about selling. Today salesmen the country over are making fabulous sums of money. Today collecting is a little known, and little understood field. Those in it know how to collect only by asking or threatening. Our scientific approach to collecting problems has enabled our men to become leaders in this field. We are interested in training more men to represent us from their own communities and in helping them develop businesses of their own. Businesses that will have unlimited earning possibilities for ambitious men. No capital investment except your own car. Write today. A. Hutchinson, Interstate Collections, Inc., 1061 W. 35th St., Chicago.

WE Will start you in the Bible business. Real opportunity for advancement. Also selective setup for Masonic men. Write particulars to Roll of Honor Bible Club, 1211 Chestnut St., Dept. 603, Philadelphia, Penna.

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

AGENTS WANTED

NEW Kind of man's shoe zips on and off, pays salesmen ready cash every day. New big direct-to-wearer line of 250 styles includes amazing air-cushion insole shoes for men and women. Complete sales outfit sent free by sales division of manufacturer established 38 years. No experience needed. Factory-fitting shoe service training furnished. Write today for valuable sales kit. Consolidated Shoe System, Dept. CC-30, Chippewa Falls, Wis.

EXCLUSIVE Territories to producers. We sell Beauty Tone "Glaze" and "Cleaner" to U. S. government, state of California W.P.A., national corporations, stores, homes. Fastest automobile, furniture polish on market. B. T. Manufacturing Company, 171 2nd Street, San Francisco, Calif.

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

NEW, Novel cosmetic bracelet complete with secret compartments containing lipstick, powder, rouge, puffs, mirrors. Sensational! \$1 seller! Write: Gifthouse, Box 2008-E, Miami Beach, Fla.

STARTLING New novelty! Liberal commissions! Recorded Easter, birthday, Mother's day greetings, etc. Investigate! Ray Turner, 211 W. Hill, Champaign, Ill.

SELL Individualized belts, buckles. Over thousand emblems to choose. Fast money maker. Repeat business. Write today special outfit offer. Hook-Fast Specialties, Box 1425, Providence, Rhode Island.

COSMETICS, French quality, laboratory guaranteed, \$2.50 order \$1.00. Samples 10c. Elone Laboratory, 2540 Belmont Ave., New York Bronx.

REVOLUTIONARY Tieless shoelace sells instantly—300% profit. Samples 10c. Mercer, 307-G East 105th, New York.

AGENTS. Champion belts, suspenders, for all who wear. Sample 25c. Institute, 664 W. Baltimore St., Baltimore, Md.

"SWANKY-SERVERS" Easy to sell. Circulars and details free. The Oster-Bauer Shop, Rockford, Illinois.

FREE Water and our concentrates make 72 products. We supply labels, bottles. Enormous profits. Qualco, E-20030 Russett, Detroit.

HOSIERY In liquid form. Jar makes 5 pairs. Sample 25c. \$1.00 per dozen. Western, 201 Climax Bldg., Cleveland.

MARVELOUS New product! Every woman uses household tints and dyes. Sell in tablet form to homes, stores. 30 beautiful colors. Sample package 10c. Fast reporter. Dye-Ana Dyes, Inc., 2946 Lake Street, Chicago, Ill.

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

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

SAVE Time and postage finding the right proposition. Your name on a postal brings you 20 to 30 good deals from as many different firms. No charge. Agents Association, Box 38, Palo Alto, California.

GENEROUS Size popular-priced sensational new antiseptic pine cleanser. Unlimited uses. No competition. Permanent profitable connection. Sample 25c. J. Melady, Room 1622, 9 Rockefeller Plaza, New York, N. Y.

AMAZING Zipper clothesline. Instant demonstration. Sells on sight. Dunn Mfg. Hemstead, N. Y.

AGENTS, Pitchmen, amazing new 10 cent seller. Make \$4.00 to \$8.00 daily. Lovely, 1734B Washington, St. Louis, Mo.

445% PROFIT. Year round sellers. Not sold in stores. Agents, distributors get details. Hub Specialty Co., Box 1005, M. Yakima, Washington.

WILL You give us 5% first \$600 you make? Afternoons free! Work home, \$1,000 month reported (exceptional—full-time). Expect surprise. National, Box 1240-R, San Bernardino, Calif.

SPLENDID Profits selling Miracle Radio Control. Write Miracle Manufacturing, Conshohocken, Penna.

NEW Sensational no leak toilet tank valve. Sells on sight. Big commission. Get territory and become independent. Every house a prospect. The Elhar Manufacturing Company, So. Glenn Falls, N. Y.

DIFFERENT! Artistic personalized book-plates. Sell fast. Splendid profits. Pocket size catalog free. Warren Knitter, 3307 Eastwood, Chicago.

EARN \$10.00-\$15.00 Daily applying beautiful silver and goldlike sign letters. Cost 1c. Free samples. Modernistic Sign, B-3000 Lincoln, Chicago.

FREE "Service Signal" demonstrator. Post card brings details. Knipp, Long Beach, California.

PHOSPHOLENE Cleaning crystals 1c package; bleach 2c gallon; glass spray 3c gallon; hand soap 2c pound; shampoo 25c gallon; and others. Samples 25c. Literature free. Western, 401 Climax Bldg., Cleveland, Ohio.

"FREE" Mexican curios, novelties, 100% profit! Marquezp, Apartado 1176, Mexico City.

SENSATIONAL Revolving colorful motorless window display. Every merchant a prospect. Sells for \$2. Geller, 1532-P University Avenue, New York City.

WINDOW Sign letters. Penny each. Large sizes. New styles. Absolutely beautiful. Free samples. Atlas, 7941 Halsted, Chicago.

GOOD Sideline for printing and advertising salesmen. Decalcomania name plates in small quantities. Great demand. Also make money applying initials on automobiles. Free samples. "Ralco," 727 Atlantic Ave., Boston, Mass.

WE Pack products under your label. Cleaners, food products, etc. Big profits, low prices. Samples free. Bestco, 5007 Irving Park, Chicago.

AGENTS: Smash go prices! Santos coffee 12c lb. 4-oz. vanilla 8½c. Razor blades 10 for 8½c. 100 sticks chewing gum 12c. 150 other bargains. Premiums. Experience unnecessary. Carnation Company, P.O. St. Louis, Mo.

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

AGENTS Make big profits on food products, bargain deals. Low wholesale prices. Rush name for trial outfit offer. Ho-Ro-Co, 2810-U Dodier, St. Louis, Mo.

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

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

ENGRAVED Name plates, numbers, signs, etc., easily sold, profits large. Brett Bros., Winthrop, Mass.

GOOD Paying business silvering mirrors, plating autoparts, reflectors, bicycles, bathroom fixtures by late method. Free particulars and proofs. Gunmetal Co., Ave. N. Decatur, Ill.

AGENTS—Opportunity make money; book containing 127 successful business plans; home-office; send for free introductory booklet. Elite Co., 214 Grand St., New York.

AGENTS—To mail our literature. Good profits. Home business. Maywood, 1105-1107 Broadway, New York.

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

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

HIGH-GRADE SALESMEN

REVOLUTIONARY Loud speaking inter-communication system. Talk privately, back and forth, to one or any number of stations, even 2,000 feet away. Any station originates calls. One electrical connection. No servicing. Easily installed. Guaranteed. Technical experience unnecessary. Two-minute spectacular demonstration. Thousands prospects, factories, offices, stores, auto dealers, lumber yards, restaurants, etc. We carry the accounts. Free trial to customers—sells itself. New low price. Men earning high as \$150 week. Protected territory available. Free demonstrator offer. Inter-Communication System of America, Dept. 313, 2440 Lincoln Ave., Chicago.

MUSIC Course salesmen. Best proposition in United States. Steady work, large earnings, pleasant surroundings, national organization where honest, reliable producers have a future. Give full particulars. Oahu Pub. Co., 1200 Film Bldg., Cleveland, Ohio.

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

SELL Bargains! Novelties, paper specialties, greeting cards! Big profits! Catalog free! Elfco, B-438 North Wells, Chicago.

SELL Printing at lowest prices. 5,000 5½x8½ statements \$5.50; 5,000 24 lb. envelopes \$6.50; 2,000 business cards \$1.50; 1,000 envelopes or statements, etc. \$1.75; 25 printed sales books \$1.50; 1,000 process embossed cards \$1.50; 2,000 two-color labels, free holder \$1.50. Big cash comm. Free outfit. Bargain Prtg. Co., 189-F W. Madison, Chicago.

SELL To every business absolute necessities—over 2,000 items. Lowest prices. Beats competition. Commissions advanced. Experience unnecessary. Samples free. Federal, 301-CJ South Desplaines, Chicago.

SELL Business cards, stationery, book matches, gummed tape, restaurant necessities, salesbooks, advertising specialties, pencils, picture cards, tags, pricing sets. Lowest prices. 40% commission. Experience unnecessary. Free deals. Sales portfolio free. Willens, 2130 Gladys, Dept. 45, Chicago.

LEGAL Collection service; established 1914; commissions; bonus; retainments; permanent. 2024 Calvert, Baltimore.

ADVERTISING Book matches. America's largest manufacturer of union label book matches. Fast selling line. Large sales producing kit. Sample matches. Complete cut catalog. 13 color combinations makes selling easy. Commission in advance. Superior Match Company, 7530 Greenwood, Dept. M-5, Chicago.

400% PROFIT Selling Glo-Brite signs to stores, restaurants, taverns, J. A. Baxter, Cambridge, Ohio.

"GALLOPING Ivories"—Nicknamed by salesmen. It's really hot! Plenty immediate - repeat commissions. Every retailer - service station wants it. Hurry! Universal, 2222 Diversey, Dept. C505, Chicago.

SALESMEN—Distributors! New amazing office invention. Sells on sight. Enormous need. Cash commissions advanced. Sample offer. Big profit deal. Prevue, A-440 South Dearborn, Chicago.

CHRIST Is coming; get absolute proofs. Scheall, 263-X, Duluth, Minnesota.

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

TIRE Accessories, guaranteed 10,000 mile Tiger Grip tire patch, and fast-selling line tire accessories. Salesman-distributors over 100% profit, selling garages, service station, etc. Protected territory. Economy Rubber Products, 710 Burkhardt, Dayton, Ohio.

SALESMEN Calling on farmers; sell new plow attachment. Covers corn stalks, weeds, tall sweet clover. Saves discing, time, money. Photographs, literature free. Overall Co., Lapel, Indiana.

MAKE More money selling Red Comet Fire Control Products. Write today for free facts. Red Comet, 704 Comet Building, Littleton, Colorado.

NEW Specialty—Sells every business and professional man. Four \$15 sales daily pay \$280 weekly. Full cleared over \$1,000.00 monthly. Write F. E. Armstrong, President, Dept. PM, Mobile, Ala.

ADVERTISING Book matches—World's largest "direct selling" book match factory offers advance cash earnings calling, on every type of business. Experience unnecessary; full, part time. Low prices for high quality; quick deliveries, help you get orders. Good repeat profits. Free kit, instructions. Match Corp. of America, 3343 West 48th Pl., Dept. E-5, Chicago.

MIDDLE Aged salesmen. Sell Killohock, 100% profit. Protected territory. Buskett, Joplin, Mo.

AGENTS' Buying Guide reveals first-hand manufacturers of thousands new, fastest sellers. Amazingly low prices now. Folder free. Glass Publishing Company, Ellwood City, Penna.

MOTOR carbon harmlessly removed in 7 minutes, automatically while motor idles. Pyro-ex has amazed 100,000 users. Motorists, truck tractor, aircraft operators, motor manufacturer, racing drivers, service stations highly endorse. Immediately increases power, lastingly, 15% to 40%. Eliminates carbon knock. Cleans gummy valves. Frees inactive rings. Operating economy unsurpassed. Sells wholesale on startling demonstration, service stations, fleets, garages. Richfield station sold 1500, profit \$600.00. Delighted users repeat regularly. Permanent opportunity, extra profitable. Send 30 cents today for two treatments, automatic outfit, literature, endorsements, proposition. Approved for sale major oil company stations. Pyro-ex Company, 1014 South Santee, Los Angeles, California.

BLADES—Big profits. Best quality. Factory prices. Postpaid. Ace Blades, Buffalo, N. Y.

EXCELLENT Opportunity selling our complete line of brushes, largest commissions. Write for sales plan. Wire Grip Sanitary Brush Company, 2300 5th Ave., New York.

EDUCATIONAL AND INSTRUCTION

STAMMER? Investigate! Dynamic process of emotional readjustment by home study. Write today. No obligation. Murphy Method of Speech Improvement, 846 W. Nelson St., Dept. 2, Chicago.

LEARN Watchmaking. Material instructions for start and wholesale supply catalog, all \$1.00. Refund not satisfactory. Stewart's, 721 Olive, St. Louis, Mo.

WELDING—Electric arc. Learn profitable trade quickly through actual practice. Individual welder instruction at bare cost of materials. Full particulars free. Valuable welding lessons book 50c. Hobart Welding School, Box M-511, Troy, Ohio.

NEW Opportunities in air conditioning, electric refrigeration and auto body-fender including metal work, welding, painting. Many trained men earn up to \$35-\$50 weekly. Start preparing now. Get free facts. Utilities Engineering Institute, 1314 Belden, Dept. 115, Chicago.

\$105-\$175 MONTH. Men-women. Get government jobs. Prepare now for 1941 examinations. 32 page civil service book, full particulars—list jobs free. Write today. Franklin Institute, Dept. S3, Rochester, N. Y.

WATCH Repairing is steady profitable work. Experts usually in demand. You can learn watchmaking trade at home, spare time. New original instruction system. Script engraving course included. Write for free details today! Nelson Co., 500 Sherman, Dept. E-2001, Chicago.

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

DESIRABLE Salary for capable shorthand writer and typist. Learn to be expert quickly at home. Independent, 2623 East Fourth Street, Los Angeles, California.

TYPISTS Find and hold jobs easier. Complete 6-lesson home course \$1.00. Box 532, Columbia, S. C.

METAL Layout, Drafting, Blueprints, Mathematics, Bookkeeping, Davidson Tech, 7 Grand Avenue, Detroit.

OCCULT Teaching, incense, supplies. Maha Devalata, 532 West 47th, Chicago.

BE A drugless practitioner. Home study. Particulars free. Box 172, Tama, Iowa.

AMAZE, Astound, succeed with Super-Memory. Write DR, Info Company, Box 1122, Chicago.

LEARN Watchmaking. Material instructions for start and wholesale supply catalog, all \$1.00. Refund not satisfactory. Stewart's, 721 Olive, St. Louis, Mo.

LEARN A good trade now. Big demand for welders and mechanics. Complete practical courses in arc and acetylene welding, auto and aviation mechanics, body and fender bumping, spray painting, metal finishing, etc. Low rates. Pay after graduation plan. Write today for big illustrated catalog. Michigan Trade School, 3754 Woodward, Detroit, Mich.

LEARN Auto finance business. Inexpensive home course. Nebraska Finance Co., Lincoln, Nebraska.

CLINICAL Laboratory technic taught in your own home. Practice outfit supplied. Bulletin free. Imperial Technical Institute, Box 494-E, Elkhart, Indiana.

LEARN Figuring the new fast way. Frederick Smith, Consulting Engineer, 2410 Bernard St., Chicago.

LEARN Big pay trades in a few weeks. Decorating, paperhanging, graining, marbling, sign and pictorial painting. Catalog free. Chicago Painting School, 102 West Lake Street, Chicago.

LEARN Auto mechanics, body, repairing, welding electricity, refrigeration. Diesel, Stevinson's, 2008A Main, Kansas City, Mo.

LEARN Telegraphy! Opportunities now available to beginners due to new railroad retirement act. Expenses low. Catalog free. Dodge's Institute, Hiatt Ave., Valparaiso, Ind.

U. S. Gov't jobs pay up to \$40 a week to start. Get ready for next examinations; railway postal, rural carrier, mail carrier, office help and others. Free book tells how you may qualify. Write quick. Patterson School, Dept. P. M., Rochester, N. Y.

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

CARTOONING, COMMERCIAL ART, SHOWCARD WRITING, SIGN PAINTING

MONEY in portrait sketching. 20 lessons \$1.98. How to sell your work. Harold Parks, Ypsilanti, Mich., R. 3.

CARTOONING Course:—30 illustrated lessons, over 500 sketches, drawing paper, pens and pencils. \$1.00 complete postpaid. Montes Studio, Box 985, Pasadena, Calif.

HAVE Your own money making business. Learn show card writing, sign painting. Write for details. Begley Specialty, 1472PM Broadway, New York.

MAKE \$30 Weekly with the new National Cartoon Originator. Free trial. National Artists, 801 North Marsalis, Dallas, Tex.

AMATEUR Cartoonists earn big profits, duplicating comical advertising cartoons. Komic-Ads, Argyle, Wisconsin.

ILLUSTRATING Lettering reasonable. Samples free. Trapkus, 349 Tenth, Moline, Illinois.

PEN And ink drawings. Let us draw your advertising and catalogue illustrations, from photos, copies or objects. Best work and fair prices. Heraldic Studios, 1914P Oakdale Avenue, Chicago, Ill.

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

PLAYS, STORIES, MANUSCRIPTS

PUBLISHERS Want stories! Details free. Hursh, Box P1013, Harrisburg, Penna.

STORIES, Books, poems wanted for publication. Many eager markets. Author will help you sell. Manuscripts marketed, revised, typed. Christopher Carr, 3636A Chestnut, Philadelphia, Penna.

BOOKLENGTH Manuscripts wanted for publication. Renseb-PM, 30 Church, New York City.

ADVERTISING AGENCIES, LETTER WRITERS, FOR ADVERTISERS

ADVERTISE Profitably: \$15 reaches 5,000,000 Sunday newspaper readers with 24-word ad. Newspaper, magazine, mailing-list ratebook, free. Chicago Advertising Agency, 20-PA West Jackson, Chicago.

ADVERTISING Placed all magazines, newspapers U.S.A., Canada, Mexico, Central-South-America, West-Indies. Lowest rates. Free service. 54 page catalog free. Baker Advertising Agency A-189 West Madison, Chicago. Established 29 years.

SELL Your product through agents, mail order, special combination newspaper rates. Write for free rate book. United Advertising Agency, 287-P Broadway, New York City.

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

QUICK-ACTING Sales letters. "Hutzletter," 41-44 Davies Building, Dayton, O.

20 WORDS in 10 magazines \$2.00. Good-all, 628 Montomery, San Francisco.

LEARN Advertising at home. Easy practical plan. No text books. Common school education sufficient. Interesting booklet and requirements free. Page-Davis School of Advertising, 1315 Michigan Avenue, Dept. 3431, Chicago.

INCH Display advertisement fifty magazines, year \$15. 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.

BUSINESS SERVICE

PERSONAL And business mail received and re-forwarded. Dunn Mail System, Box 42, 216 West 69th Street, New York, N. Y.

FOR Outright sale—100,000 original letters of agents and mail order buyers. Sample letters and advertisement clippings free on request. Reiffe, 160-E Monroe Street, New York.

YOUR Mail received and re-mailed, showing Washington, D. C. postmark. Hawkins Mail Service, 908-A 14th.

TYPEWRITERS, DUPLICATORS, OFFICE DEVICES

INCREASE Business now. "Xcellograph" Rotary Stencil Printer reprints thousands everything you typewrite, hand-write, draw or trace. Colors \$19.75 to \$44. Terms. Illustrated literature free to business or professional men. Pittsburgh Typewriter Supply, Department K-2, Pittsburgh, Penna.

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

RUBBER STAMPS AND OFFICE SUPPLIES

CUSHIONED Indexed, 3 lines 35c. Lentz, Box 402-P, Youngstown, Ohio.

CUSHION Stamps, 1 line 25c, 2 lines 35c. Signatures \$1.50. Stamp Works, Hastings, Nebr.

3 LINES, Cushioned, 28c; 2 stamps 52c; pads 10c. Stamprite, Wauwatosa, Wis.

OURS Have all outstanding features, 3 lines 35c. 24 hours service. Simon Jr., 2005 Menard, St. Louis, Mo.

SUPERIOR, Cushioned, indexed, two lines 25c; three 35c. Army, navy, regulation, indelible clothes markers, \$1.00. Slocum, 814 Bradley, Peoria, Illinois.

KNOB Handle, cushioned, 2 lines 25c. 3-35c. Stamp Works, Centertown, N. Y.

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

PRINTING, MULTIGRAPHING, MIMEOGRAPHING, GUMMED LABELS

100 LETTERHEADS 8 1/2 x 11, And 100 envelopes 6 1/2, printed three lines (only) \$1.00. Additional lines 10c each. Acme Printing Shop, Jacksonville, Alabama.

LETTERHEADS, Envelopes, billheads, statements 250—\$1.00 postpaid. F. Gilbert, Morristown, N. J.

PRINTING, Attractive prices. Requirements please. Bliven Print, 3046 Meredith, Omaha, Nebr.

\$1.00 EACH—150 Letterheads, 250 envelopes, 225 statements. Bus Hearn, Mt. Vernon, Ohio.

PERSONAL Mailing cards; sample 3c. Ted's Print Shop, Jonestown, Penna.

THOUSAND Business cards \$1.00. Send for samples, Eaton Press, 1321 Main, Gardner, Kansas.

5,000 PRINTED Envelopes \$5.25. Combination 1,000 letterheads—envelopes \$4.85. Economy, 116 West 14th, New York City.

100 8 1/2 x 11 LETTERHEADS, 100 Envelopes 7 1/2 postpaid. Fowler Press, RFD 4, Concord, N. H.

100 ENVELOPES, 200 Notesheets \$1.00, 1000 business cards \$1.75. Beechwood Press, North Berwick, Maine.

100 8 1/2 x 11 BOND Letterheads; 100 6 1/2 envelopes. Both printed \$1.00 postpaid. Bennville, 907 West Roosevelt, Philadelphia, Penna.

10,000 3x4 1/2 RESTAURANT Checks \$1.75. American Ticket Co., Brooklyn, N. Y.

HAMMERMILL Letterheads, envelopes, all colors, 32 styles type. Free particulars, Woodruff's, 217-A Lewis, Duluth, Minn.

50 HALF-SCHOOL LETTERHEADS, Cards or envelopes 35c. Atlantic, Box 653-H, Rock Hill, S. C.

100 8 1/2 x 11 BOND Letterheads, 100 6 1/2 envelopes, 4 lines, \$1.00. F. C. Cramer, Box 993, Chicago.

PERSONAL Stationery, 200 bond sheets and 100 envelopes printed \$1.00. Wayne Stationery, Maumee, Ohio.

DODGERS, Handbills, 6x9, 1000, \$2.50. Kav. Printer, Little Falls, Minnesota.

PRINT Anything reasonable. Particulars free. Hamilton Press, 4341 P. Meade, Chicago.

\$2.75—1000 BOND Letterheads, 8 1/2 x 11, postpaid. Expert multigraphing. Cables, Nerton, Kansas.

1000 BUSINESS Cards \$1.95 prepaid. Tirone, 2617 W. Huron, Chicago.

250 8 1/2 x 11 BUSINESS Letterheads or 6 1/2 envelopes \$1.00. Both postpaid \$1.75. Sovevaprint, Wood, Virginia.

115 8 1/2 x 11 LETTERHEADS, 100 Envelopes. Both postpaid \$1.00. Evans Print, 44 N. Tenth, Reading, Penna.

LABELS, Stickers for professional, amateur photographers, clubs. Dobbs, Williamsburg, Kansas.

BETTER Printing—Faster service—Lower prices. Thousand business cards \$1. Chesley Printing Company, Prairie du Sac, Wisconsin.

\$1.85—1000; LETTERHEADS, Envelopes, statements, circulars. Samples, Midwest, 1018P Essex Street, Minneapolis.

SPECIAL! \$1.50 Each—2000 midget labels, business cards; 1000 shipping labels, embossed cards; 500 envelopes, notecards, half letterheads, billheads; 100 personal match books; 25 salesbooks. Econoprint, Box 31, Kokomo, Indiana.

BUSINESS Cards 1,000—\$1.00, 2,000—\$1.40, 5,000—\$3.00. Print anything reasonable. Merit Press, 3303 Neptune, Brooklyn, N. Y.

5000 ELEGANT Envelope slips, \$3.50; 6x9 circulars, postcards, envelopes, letterheads, \$9.45. Typewriter letters, folders, all printing low prices. Samples. Goodprint, Harrisonburg, Va.

1,000 LETTERHEADS (8 1/2 x 11), Envelopes (6 1/2). Both printed, \$4.85, prepaid. Coronet, 158 W. 27th St., New York.

QUALITY Printing—unsurpassed. Low prices. Samples free. Fame Press, Lathrop, Calif.

HAMMERMILL Bond at new low prices. Samples. Western Stationery, Topeka, Kansas.

500 3 1/2 x 2 1/4 FOUR Line gummed stickers, 25c. Moritz Printery, Saginaw, Mich.

PRINTING OUTFITS AND SUPPLIES

INEXPENSIVE Printing cuts. Send time for sample and catalog. Neeka, 305 North Ave., Chicago.

SUPER-VALUE Halftones 2x3" 69c; free list. Stafford Engravers, Wheaton, Illinois.

NEW Simplified stereo-caster \$6.50. Casts cuts, forms, big type. Economy, B351, Pontiac, Mich.

WE Buy hand presses. We carry full line supplies. Write now—stamp. T. Frank's Supply, 4335 Roosevelt Rd., Chicago.

MAKE Photo-engraving outfit yourself. Particulars, sample engraving 10c. Nu-Ides, Carrollton, Illinois.

PRINT Your own cards, stationery, circulars, advertising. Save money. Simple rules furnished. Print for others, nice profit. Junior outfit \$8.25, senior outfits \$16.55. Details free. Kelsey, Inc., T-11, Meriden, Conn.

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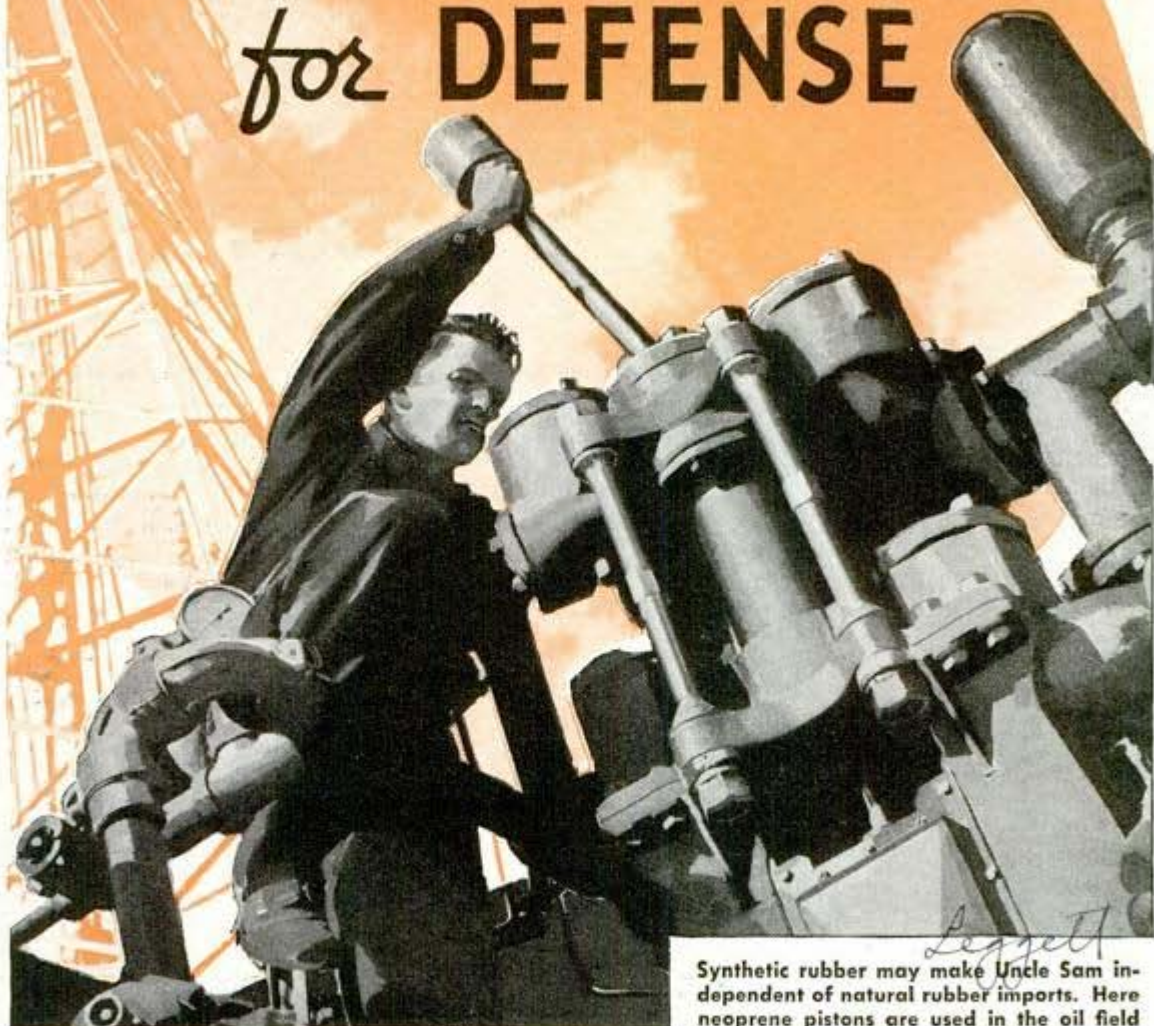
WRITTEN SO YOU CAN UNDERSTAND IT

Vol. 75

MAY, 1941

No. 5

AMERICA STORES UP *for* DEFENSE



Synthetic rubber may make Uncle Sam independent of natural rubber imports. Here neoprene pistons are used in the oil field

By Robert F. Martin

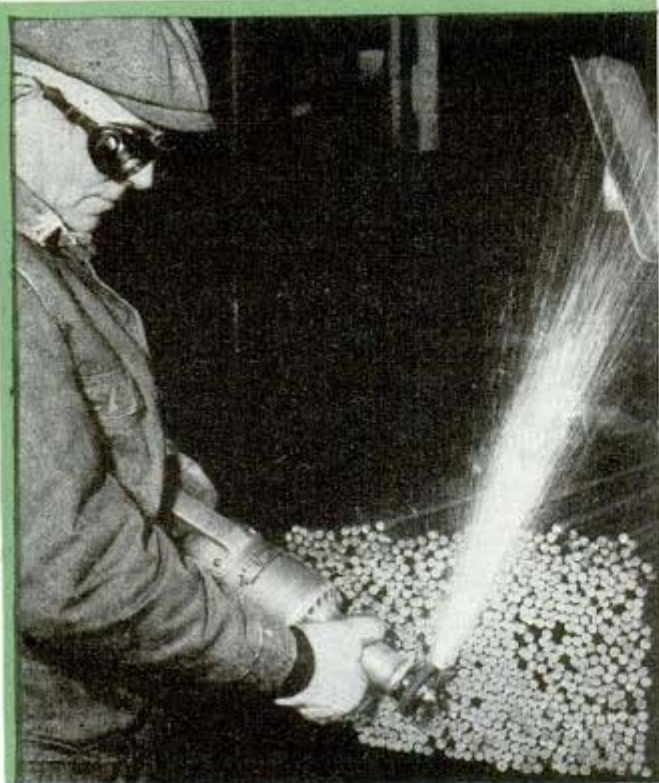
Chief, Division of Industrial Economy, U. S. Department of Commerce

IF THE United States were cut off suddenly from the rest of the world—an extreme case of complete isolation that is highly improbable though we are already cut off from some areas—we could view the situation with far less alarm than was felt in 1914 when blockades began pinching

off the supply of materials flowing to this country.

While it would be gross exaggeration to say that this nation could get along indefinitely on its present scale of essentials without imports, it is safe to predict that few would be missing from our scheme of

2256



Courtesy Buick Motor Div.



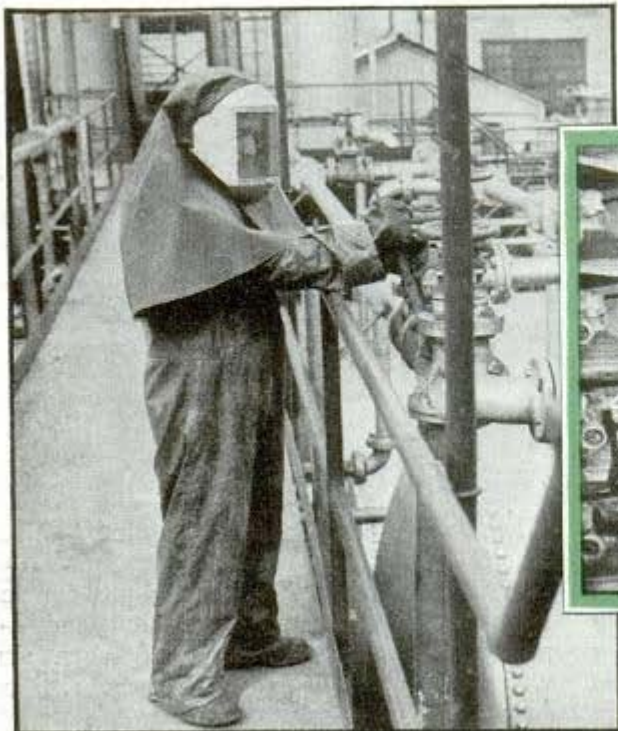
Above, storage pit of Freeport sulphur mine after molten sulphur has been pumped up. America produces plenty of sulphur

Left, testing alloy steels by sparking. Several minerals which this country lacks are used in making alloy steels

living for a year, perhaps two, if this imaginary wall were erected.

Of course we are assuming that only peacetime or moderate defense activities would be necessary; prosecuting a war always calls for civilian sacrifices to keep the armed forces supplied and moving. That

is why we had sugarless, meatless and gasolineless days in the World War. Even today, this most self-sufficient nation on earth would have to forego luxuries and some necessities in time of war, and to a lesser degree during an all-out defense effort. But the picture is much brighter



Left, neoprene, synthetic rubber, coats fabric of this suit which protects workers against dangerous acids and fumes

Courtesy The du Pont Co.



Above, aluminum, supply of which is being regulated, is important in manufacture of airplane engine cylinder heads

than it was a quarter century ago. This is because we have uncovered new natural resources, found substitutes for some of the materials which we cannot produce, built up industries freeing us from dependence upon foreign sources of supply in certain lines and begun laying in vast reserve stocks of metals, rubber and other materials.

Back in 1921, with the World War experience as a guide, General James G. Harbord listed 42 mate-



Checking instruments used in maintaining chronographs, which record bullet velocity. Optical glass is essential in making fire-control instruments

Left, hoeing feldspar into conveyor. Feldspar is the heart of porcelain, 170 pounds being quarried to make one 20-pound insulator

Below, hanks of nylon, synthetic fiber which promises to make Uncle Sam independent of silk supplies



Courtesy Westinghouse Elec. & Mfg. Co.

rials necessary to national defense and which had to be imported wholly, or in part, from sources outside the continental United States. Of the 42, only 14 remain today on the Army and Navy Munitions Board's "strategic" list. Nine are minerals: antimony, chromium, manganese, mercury, mica, nickel, quartz crystal, tin and tungsten. The others are coconut-shell char, used in gas masks; manila fiber for rope virtually indispensable to the Navy; quinine for protecting fighting men from malaria; silk for parachutes and for powder bags used in loading large-caliber guns; and rubber.

Substitutes for coconut-shell char and quinine are being worked out; synthetic rubber already has appeared on the American market and plans are

(Continued to page 142A)



2209. Isarmer Products
 P.O. Box 60, 73; Metropolitan
 Station, Los Angeles

Cable Release for Movies Permits Remote Control



Cable release adapted to movie camera can be locked in action, allowing photographer to appear in scene

Home movie cameras can be fitted with a cable release with an adapter that permits installation on any camera. By using the plunger, the moviemaker can start and stop the camera with the least possible jar, thus promoting smooth filming. The cable release also permits remote control. Once the camera is sighted on its object and fixed on a tripod, the operator can watch the action and "take" a scene without touching the camera. A locking device also allows the photographer to move in and out of the picture.

"Fire Ax" for Autos or Trucks Withstands 12,000 Volts

Protected with rubber insulation on the handle, a "safety" tool for use in case of accidents or fire makes a valuable emer-



Combining several tools in one, this hatchet is efficient for rescue work in case of highway accident

gency hatchet for the automobile or truck. It comprises many tools in one, performing functions of an ax, pickax, chisel, crowbar, sheet-metal ripper, spanner wrench, fire-hydrant wrench, and electric-wire cutter. The tool is said to withstand a shock of 12,000 volts.

Portable Fireplace for Backyard Used in Outdoor Cooking

Outdoor cooking is simplified by a portable fireplace that may be stowed away while not in use. Made of sheet metal and wire, the stove provides adjustable heat control by means of raising and lowering the level of the fire pan on three sets of runners. Pulling the front part of the oven down so it covers the open grill gives a solid cooking surface, eliminating the need



Outdoor fireplace has an oven at the back and cooking plate on top; pan beneath fire catches ashes

for frying pans. A "spit" for barbecuing is also furnished, and the oven may be used for baking or to keep food warm. Under the fire pan there is a pan that catches any falling ashes so the stove will not damage the grass when used in the yard.

W.S. Harley & Co.
 2810 W. Ashington Blvd.
 Chicago

2100 / 435 Sixth Ave. Pittsburgh Pa.

Men in "Armor" Open Power Line Switches

Easily mistaken for men from Mars, power line workers at Duquesne Light Company clothe themselves for safety in protective helmets, heavy chrome leather coats, and two pairs of gloves, one of rubber and the other horsehide. Long, hooked poles are used in opening overhead disconnect switches. Ordinarily a safe operation, this might prove hazardous if through accident the oil breaker is not opened first, since it may create an arc generating high temperatures, and even explode insulators hurling bits of porcelain at the speed of shrapnel fragments. In such cases, the "armor" shields the workmen from



Though accidents are rare, danger always lurks around power stations, so these men take precaution by wearing heavily insulated hoods and clothes

high-tension currents, flying porcelain and the terrific heat generated by the arc.

Room-Size Aquaplane "Lounge" Carries Several Riders



Several riders may lounge lazily on this smooth-riding aquaplane as it is towed over the ocean surf

Large enough to carry several passengers, a spacious aquaplane introduced in Florida by the Miami Outboard Club rides with velvety smoothness, unlike its bounc-

ing, one-man brother. More like a raft, it has a deck 20 by 12 feet, which includes a snack bar, a "worry club" for checking woes, and a powder room for the ladies.

THE "WHERE-TO-BUY-IT" INDEX—A NEW SERVICE FOR YOU

Beginning with this issue, Popular Mechanics Magazine offers you a new service—a "Where-to-Buy-It" index—enabling you to write direct to the manufacturer or distributor of any commercial product described in our pages. To find the name of the maker or seller of any article, simply note

the page on which it is described and turn to the "Where-to-Buy-It" index starting on page 4-A in the front of the book. If the product is commercially available, the name and address of the seller appear under the indexed item. To get quick action—Say You Saw It in Popular Mechanics.

at Dravosburg sub station
Voltage detector sticks - Schudtger & Conrad Co. 4435 N. Riverside

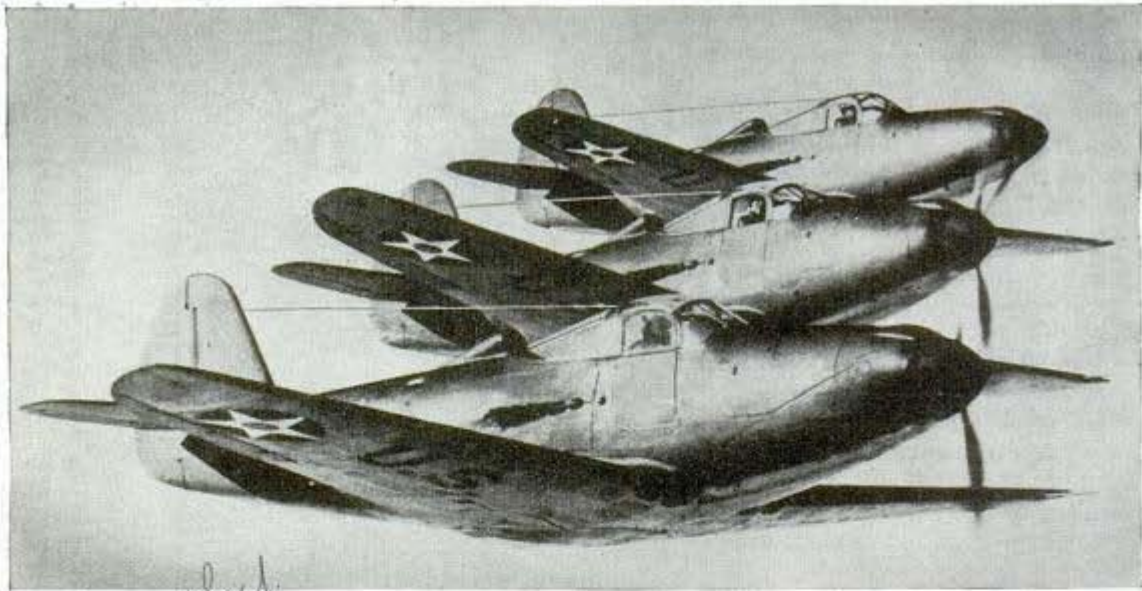
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sub.

meane

2176

Warplanes Ferried in Groups as Output Grows



Three interceptor pursuit ships flying in formation from factory to army air field with army pilots at controls

Pursuit planes are rolling off assembly lines in such large numbers that army pilots fly them in formation to the air field. Recently the new Airacobra appeared for the first time in formation when three of the deadly sky fighters, designated as P-39 interceptor pursuit planes, made their way

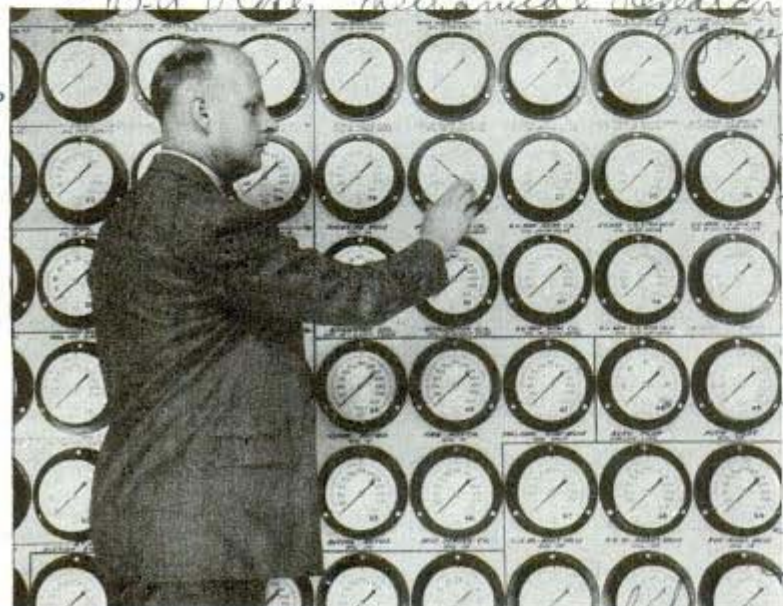
from Bell Aircraft Corporation plant in Buffalo, N. Y., to Selfridge Field located at Mt. Clemens, Mich. The Airacobra is a cannon-carrying ship, with its single engine located behind the pilot's compartment. Many of the airplanes will be delivered to the British Royal Air Force.

2050 Elmwood Ave

Story of New Airplane Test Told on Board of 100 Dials

When a new army airplane undergoes tests at the Lockheed research laboratory, 100 gauges mounted on one instrument

board indicate the reactions of operating parts of the plane. A permanent record is preserved by photographing the dials.



Some of the 100 gauges used in recording reactions of planes under test

Skiing Found Better Near 32 Degrees Than Zero

Temperatures slightly below the freezing point are much better for skiing than the zero temperatures usually considered ideal for winter sports, according to the findings of two English scientists, F. P. Bowden and T. P. Hughes, who made studies in Switzerland. Dr. C. Guy Suits of the General Electric research laboratory explains that if the temperature drops about 20 degrees Fahrenheit be-

Burbank, California

Lockheed Mechanical Research

2159

Lockheed

.. 2204

low the freezing point, the friction more than doubles; and the friction nearly doubles again if there is a drop of 40 degrees. A mystery still unexplained is the subject of ski wax. Experiments show that the friction of dry hickory skis may be reduced to one-third by the use of ski wax. One possibility set forth by scientists is that the wax prevents wetting at the point where frictional heat melts snow crystals.

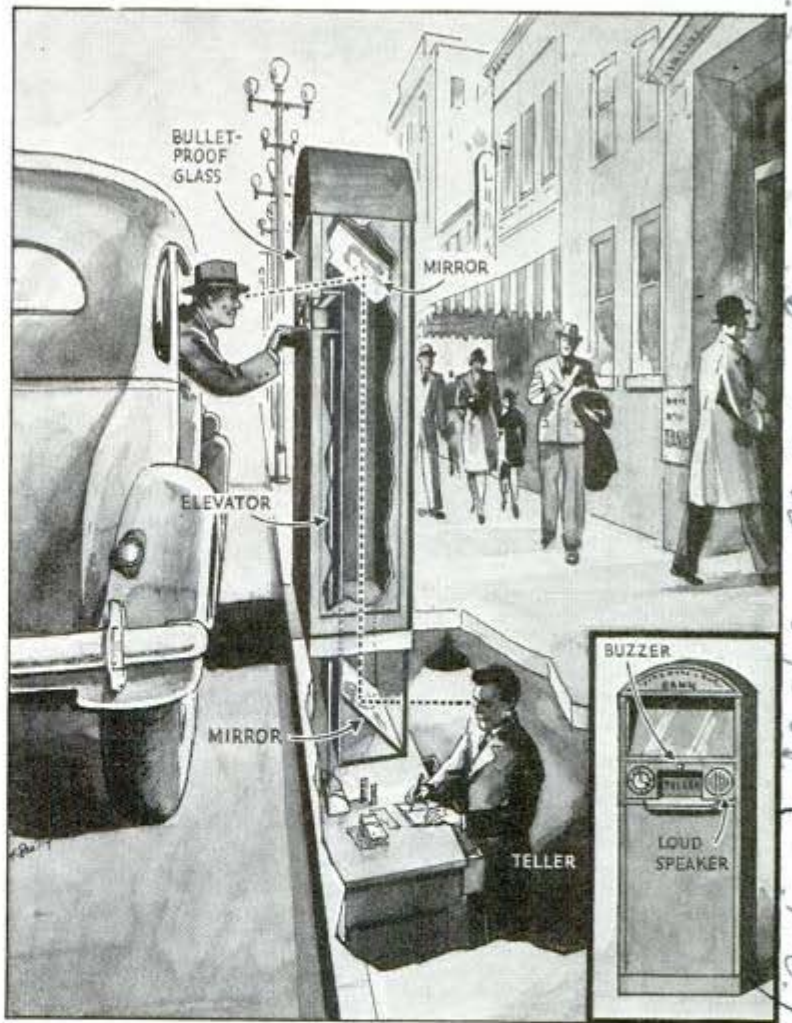
"Sand Gun" Blasts Designs in Glass Or Marble

Small enough to be held in one hand and pointed like a pistol, a portable sand-blast gun finds many a task in etching letters and designs on a variety of surfaces. It can be worked on ceramics, plate glass, wood or marble. Letters can be blasted into store fronts and theater lobbies, display windows and mirrors. The little sand pistol has been used for blasting monograms on automobile windows. There is a half-pint gravity feed cup over the air brush, and the tip is of extra-hardened steel. It is operated by a one-fourth horsepower air compressor.



Above the sand-blast gun, which is handled like a pistol, is a half-pint cup feeding sand to the nozzle

Bank Teller Under Walk To Serve Autoists at Curb



Bank teller underground and patron at curb do business through mirrors

An outdoor "drive-in" teller's window at the curb will solve the parking problem for motorist patrons of the American National Bank of Portsmouth, Va. The teller, located underground where he is safe from holdup men, will conduct business with customers through a series of mirrors, a small elevator and microphone system. To make a deposit, the customer will drive up to the window, push a button to attract the teller by either a light, buzzer or bell, and from the car window will send the deposit down via the elevator, by which the deposit book will be returned after the entry has been made. The teller and patron can see each other in the mirrors during the transaction and may carry on a conversation.

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

Paarhe Carbruch Co, Inc 1909 Liversey Parkway
New York City

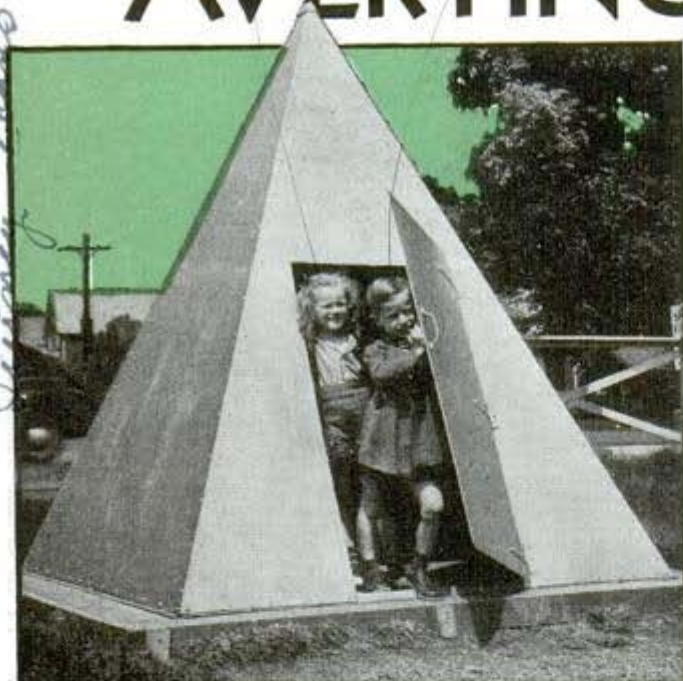
Mr. J. Duplex Electric Co. New York City

263

Shirley Wright John Boucher

AVERTING DEATH

Brooklyn Banner Co. G.C. Shire. Technical Director. Powell by Austin Co.



Mass production of quarter-inch-steel tepees like the bombproof tent above is proposed by an American firm. Unable to withstand direct hits, it would stop flying debris



Above, an air-raid shelter being studied by U. S. housing officials. Below, a windowless factory that sets a standard for "blackout" plants with fluorescent lighting

AMERICA has had plenty of time to learn from the grim experience of Europe how best to gird its cities against the air raider. Every bomb that spills flame over homes and factories and blasts stone and steel skyscrapers into rubble has given both a warning and a lesson in self-preservation to this country.

Yet with thousands of miles still intervening, insulating America from destruction by air, few on this side of the ocean have given serious thought to the problems of blackouts and bomb shelters and gas masks.

Fortunately there are a handful of men—engineers, scientists, architects, university professors, government and private housing experts—who have been giving practical thought to what would happen if tons of explosives begin raining on crowded American communities like New York City where, in the Bronx, there are 33,400 persons to the square mile and in Brooklyn, 32,800. Or in Boston, with 17,500; Chicago, with 16,575; Philadelphia, with 15,000 and San Francisco with 14,950 potential victims to the square mile.

In and around New York City, which is the most expensive bomb target in the world today, they have been doing a lot of thinking and have turned up some interesting mechanical and structural ideas. To cite one, Emil Bie, a

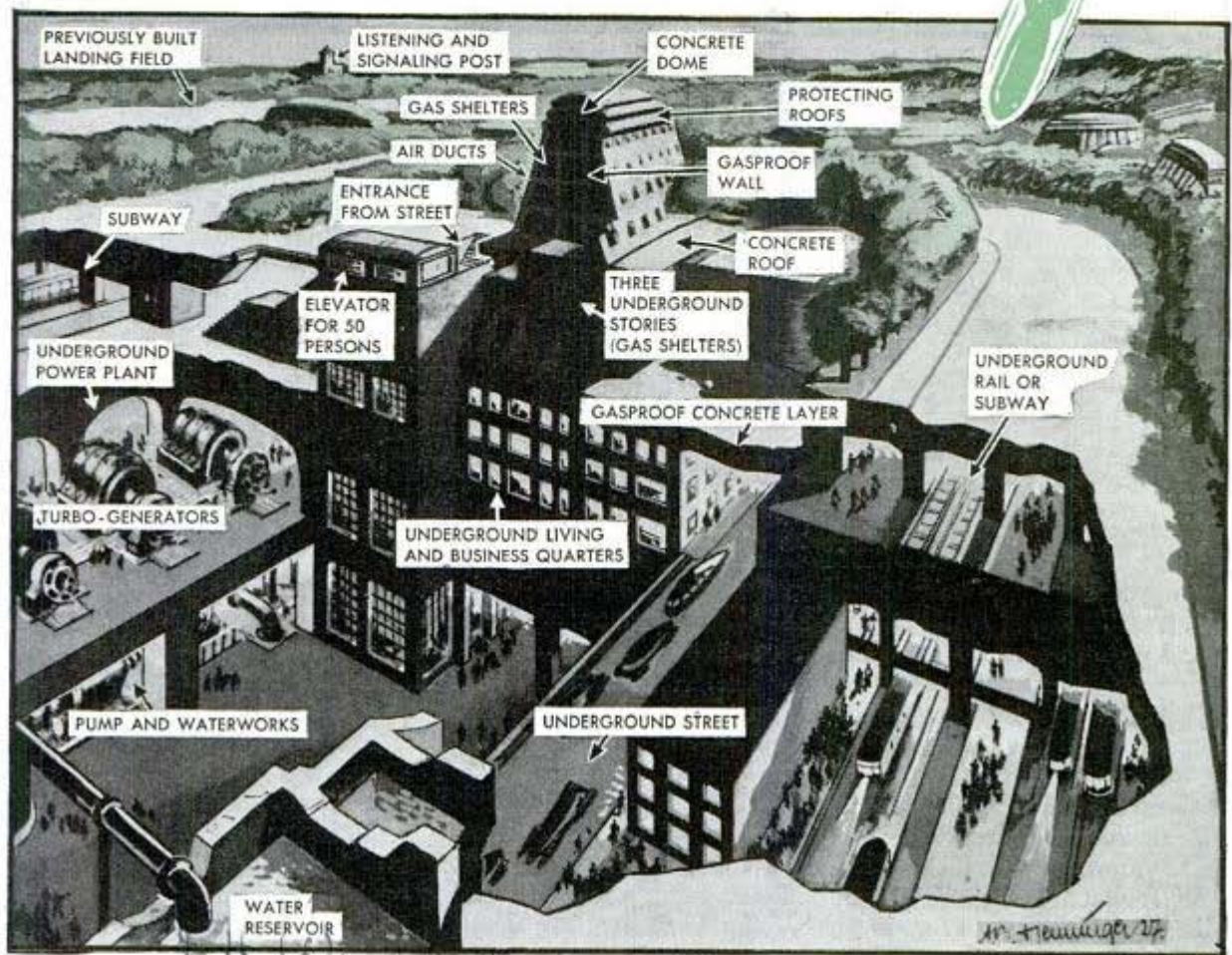


Simonds Saw & Steel Co. Distelburgerman

*Cont: Alden Warren Elliott
343 E. 83rd New York City*

L 63

from the SKIES



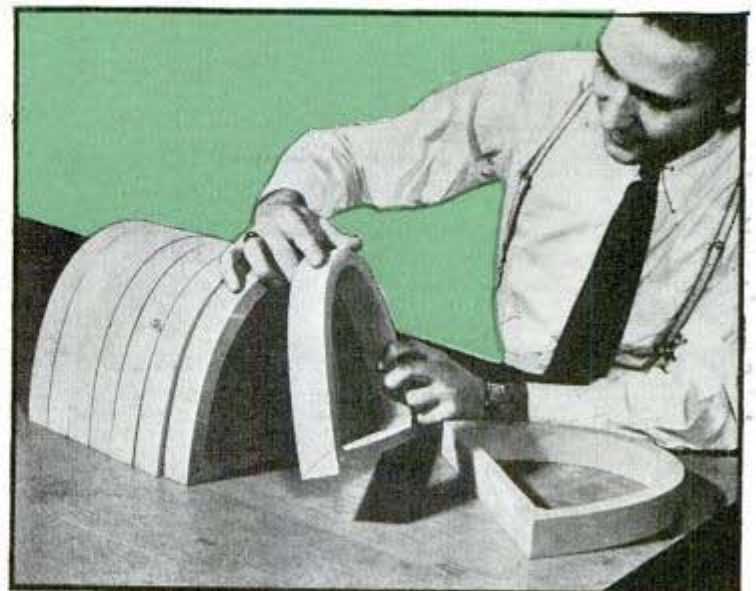
© Kerston, New York *1109 42 11*

Above, sectional drawing of a bombproof underground "skyscraper" proposed in Germany for business and living quarters

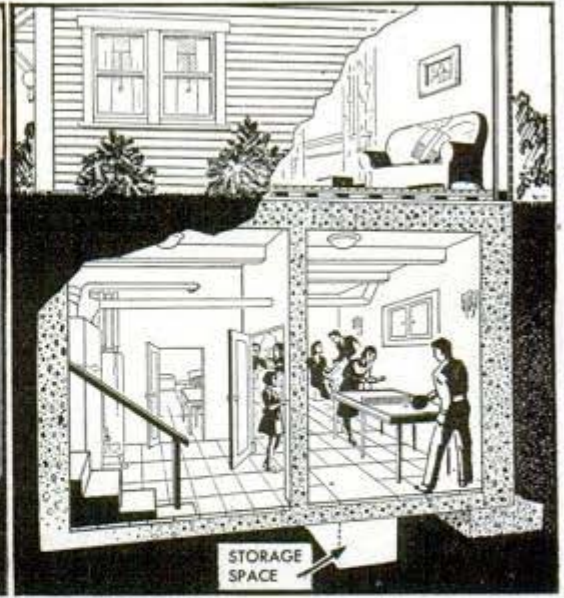
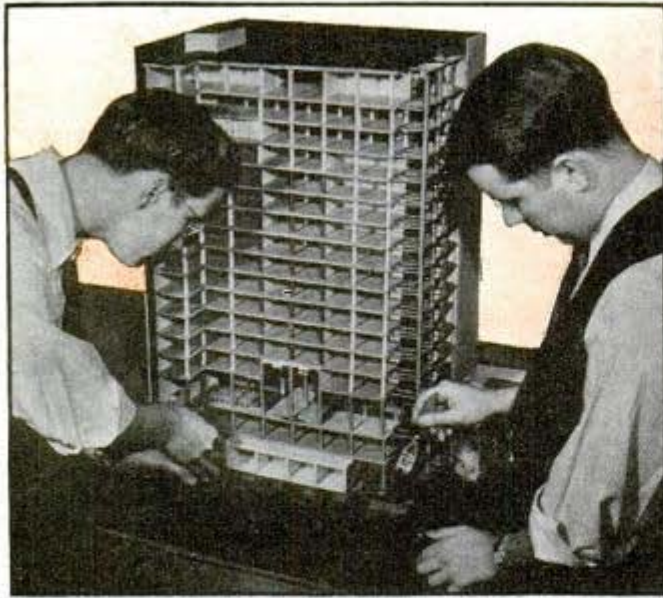
R-808
Board of Transportation engineer who heads the defense committee of the New York Civil Service Technical Guild, has turned up a scientific discovery 35 years old and long forgotten because so few uses have been found for it. As result, the employment of common sand could convert miles of the city's thinly roofed subways into air-raid shelters for 3,500,000 persons.

Below, model of prefabricated bombproof shelter of concrete, designed by architectural students at Pratt Institute, Brooklyn

The neglected theory behind the proposal goes under the technical term of funicular polygon thrust, but it is much simpler than its name. It seems that sand has the same properties as anyone's lazy relative. As long as it



Bernard Fabry



The light section being placed in basement of skyscraper model at left is a bomb shelter. At right is a sketch of a bombproof cellar with reinforced concrete ceiling 12 inches thick

is supported, it is no stronger than the support. But if the support is removed, the sand packs down, forms an arch and supports itself.

Sand is shoveled onto a thin, bending corrugated metal sheet which only keeps it from sifting through. The area above the metal sheet for a foot or so has been divided by vertical walls of ordinary fly screen and an occasional "I" beam. Above this, horizontal walls of the same fly screen divide the sand into layers for four or five feet. Whereupon the sand produces a remarkable phenomenon.

Laboratory experiments have shown that a slab of loose sand and fly screen three feet wide and four to five feet deep,

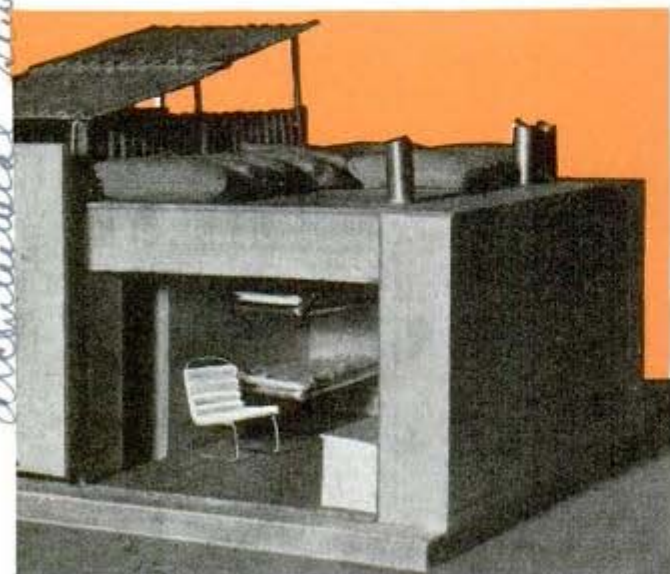
confined at the sides and unsupported from beneath, can resist a vertical load of more than 3,000 pounds per square foot and is more valuable in resisting concussion than a foot of reinforced concrete.

It happens that many subway stations have an intermediate, or mezzanine, floor between the platforms below and the streets above. Installing rows of 14-inch "I" beams, laying strips of corrugated metal, soldering in fly screen and shoveling sand into the mezzanine of compartments promises to be a cheap method of saving thousands of lives if the need arises.

Another practical, but costly, suggestion for the protection of millions has been put forward by architectural students of Pratt

Institute in Brooklyn. This contemplates the digging of caves under the towering cliffs along the Hudson river which go by the name of The Palisades. No bomb yet developed is powerful enough to affect these rock formations to any great degree.

The school has become a center for the development of air-raid protection devices because of a course of study under the direction of Erling F. Iverson, architect, who won the Prix de Rome in 1938 and studied concussion effects under a severe teacher, the



This model shelter has an entrance stairway covered with galvanized iron, sandbags on roof and ventilating pipes at right

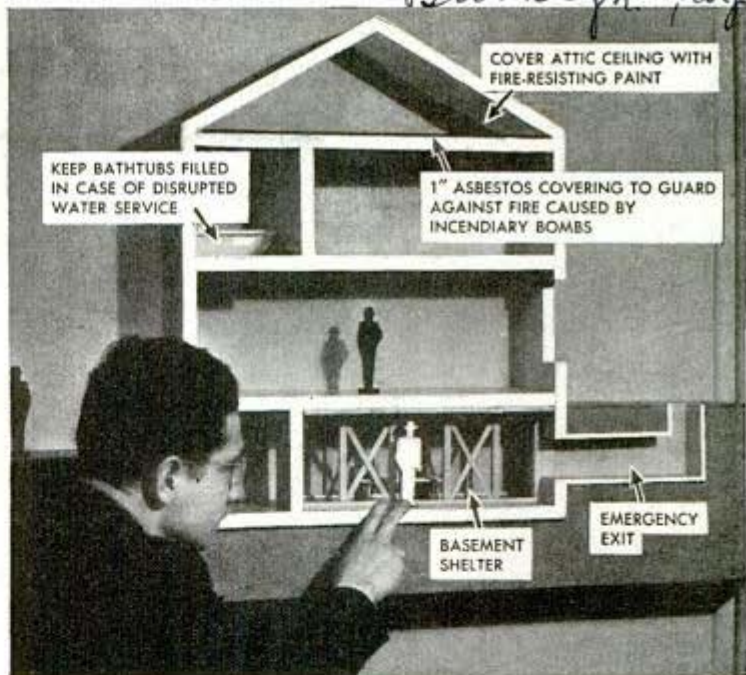
Designer: Charles Keegan Pratt, Architectural Student

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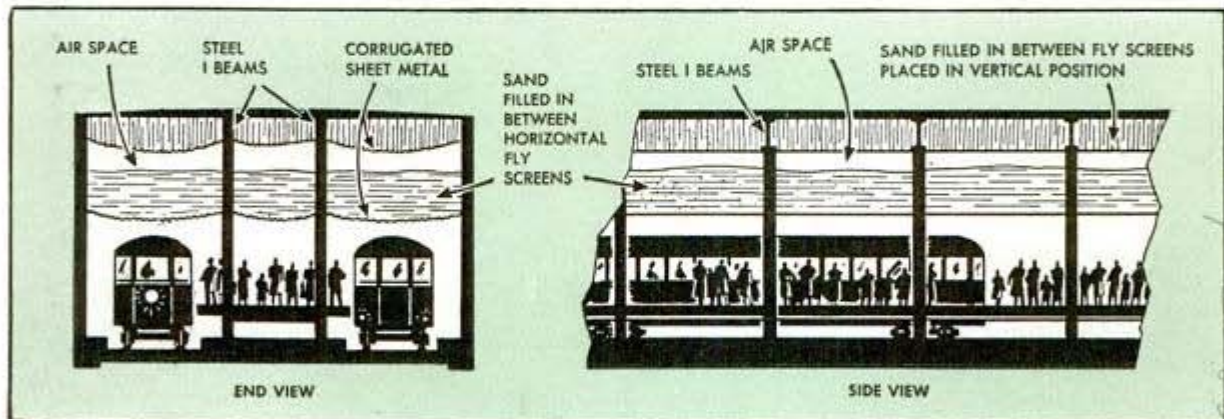
Pratt Institute
Brooklyn N.Y.

very same bombs that have torn European cities apart. Professor Iverson has developed a novel shelter which would hold 1,000 persons in comparative safety, he says, as the result of inspecting the damage done by horribly efficient German bombs in London. Solid walls of brick or concrete near bomb craters are almost always shattered, but tree trunks are hardly affected at all, he points out.

So his suggestion for the protection of mass populations is the erection of seven-story towers—man-made, rectangular tree trunks to all purposes—topped by concrete roofs eight feet thick to resist direct hits. The roofs would support anti-aircraft guns



The section of a two-story house, above, shows a few simple methods of guarding against fire and explosive bombs. The basement has been reinforced to resist collapse of upper stories



and the thick, windowless walls would keep bomb fragments from penetrating to the rooms within. These towers could be placed alongside apartment houses and factories.

Two of his students devised models of prefabricated bomb shelters composed of roughly triangular concrete forms something like three-cornered doughnuts. These would be easy to transport by rail or truck and could be put together in rows to any desired length.

(Continued to page 149A)

MAY, 1941

Sketches show proposed use of sand held together by fly screens to form an arch more bomb-resistant than a foot of concrete.



Installation of machine guns on fire trucks for anti-aircraft work when not fighting flames is an experiment of the Boston fire department

Commissioner. William Arthur Kelly 651

Fire Chief Samuel J. O'Keefe

National Research Council, Committee on Food and Nutrition

Riding Pickaback Down Ski Slide Adds to Thrills of Sport

Sun. Marshall, Henning, New York City



Try this on your skis if you find the sport getting dull, but remember that the spills may be doubled as well as the thrills.

Hans Kaiser, Sun Valley, Idaho
An instructor at the Sun Valley ski school has shown ski enthusiasts how he doubles the thrills of skiing by carrying a passenger on his back. The rider clings tightly to the shoulders of the skier who must provide the balance and locomotion.

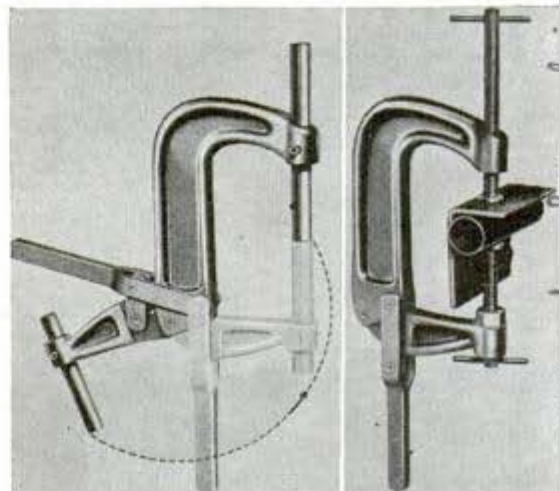
ods. Bread, rolls, cake or other food made from enriched flour produced by the new process will give as much of the morale vitamin B₁, or thiamin, as much of the pellagra-preventing nicotinic acid, and as much blood-building iron as our grandfathers got from their stone-ground flour. Their coarse, dark bread represented about 85 per cent of the wheat berry's contents, while our modern white flour includes only 60 to 70 per cent. Lost with the missing 30 to 40 per cent are thiamin, nicotinic acid and iron, besides other members of the vitamin B complex. Most of these vitamins will be put back into the flour without any increase in the price of a loaf of bread. Where they are added to ordinary white flour, it will not make any change in taste or color. However, if vitamins are left in the flour by the milling process, the flour will not be quite as snowy white, but may have a creamy color.

Jaw of Clamp Swings Free With Toggle Release

When a lever of a new "C" clamp is thrown, a toggle movement permits the entire lower jaw of the clamp to swing free of the work. This action makes it unnecessary to adjust the jaws individually for repeated clamping and releasing of work of the same size.

White Flour to Be Enriched With Health Vitamins

Soon we all may be eating bread made richer in vitamins which will be added to purified white flour or left in the flour by new milling processes. This revolution in America's bread and flour, instituted through cooperation of millers and government agencies, is designed to bolster morale as well as health. Some 45,000,000 of our population now suffer from a lack of certain vitamins. For economic reasons, their diet consists mainly of bread and cereals from which these vitamins are missing because of present milling meth-



Left view shows how jaw swings down when released

2 165

Twelve-Lane Super-Highway to Run 400 Miles



Here is a section of 12-lane highway as it would appear where it passes through the state of New Jersey

Plans for a super-highway to stretch from Washington, D. C., to Boston, Mass., recently submitted to the United States Administration of Public Roads, call for an express route 12 lanes wide and 400 miles long which will run through seven states.

From Camden to a point north of Perth Amboy in New Jersey, there would be 12 elevated lanes—six in the center for express traffic and six on the outside for slow traffic. The cost of building such a highway is estimated at \$250,000,000.

212 Washington

Fireproof Air-Raid Clothing Combines Safety and Style

How British women may satisfy their desire to be fashionably attired and yet provide protection in the face of air raids, is demonstrated by an air-raid costume designed by Mrs. Frances Ruskjn of New York City. It is made of fiber material resembling khaki, rendered fireproof by a du Pont process. Slacks are worn instead of skirt, and a pointed hood hanging from the shoulders has slits for vision when it is pulled down over the head, completely protecting the face and eyes. The non-inflammable garment, light in weight and easy to put on, guards against heat from incendiary bombs. The blouse has pockets front and back in which are inserted plastic plates a quarter-inch thick, protecting the vital organs from flying objects.



Light and dark colored air raid costumes show hood adjustment

Firewood still produces one-eighth of the world's power.

MAY, 1941

Copie Israel News

2138.

Built by Milton
Cronkite, Pasadena

Calif

\$100,000 MODEL RAILROAD

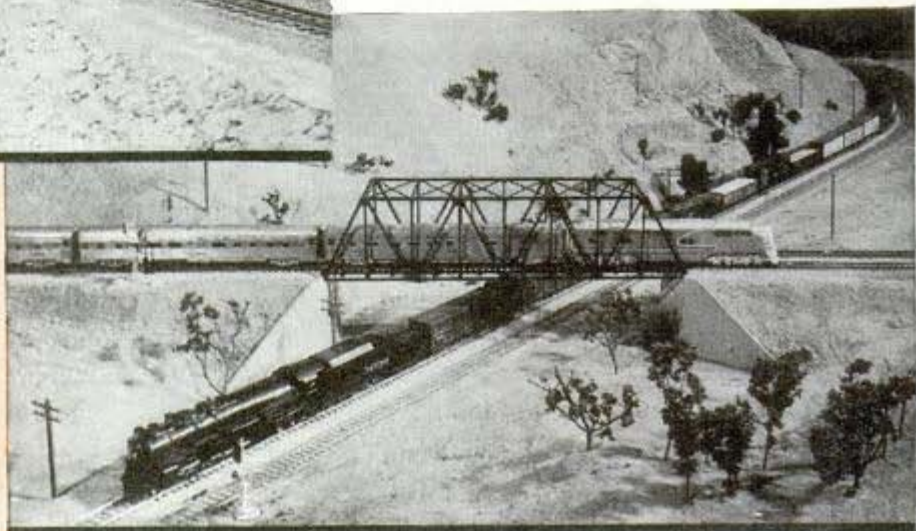


Leaving the "Museum & Santa Fe Railroad" to run itself safely with its block system, the operator climbs into the miniature Grand Canyon to adjust a bit of scenery. It took six months to build the railway



Above, the Super Chief emerges from a tunnel stained with the "smoke" of steam trains. The tiny trees and shrubs are made of natural growth

Right, the stainless steel Super Chief with its 3,600-horsepower Diesel-electric locomotive passes over a freight hauled by exact copy of "5,000-class" steam engine

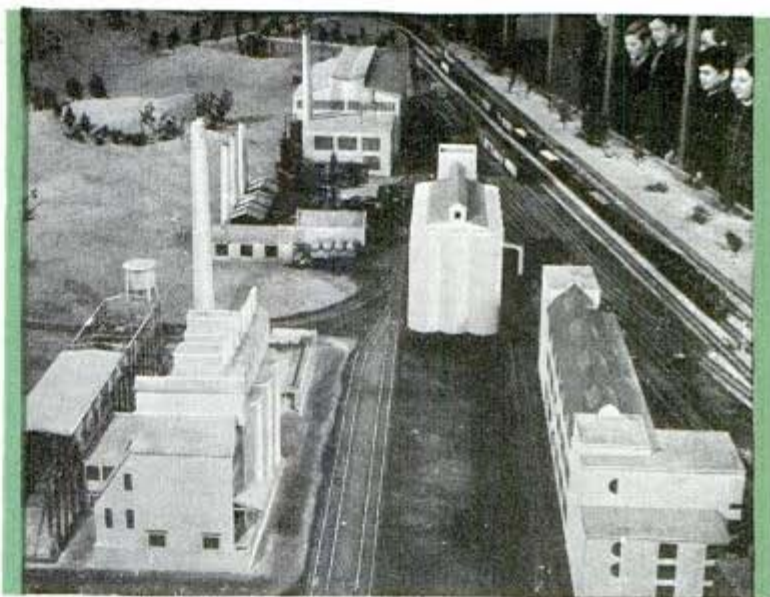


AT THE master switchboard of a thousand-foot miniature railway stands the dispatcher, a dozen locomotives and a score of electric switches answering his fingertips. The \$100,000 model railroad he operates is governed by centralized traffic control, the same electric system used in modern railroading. Lights on the diagram before him show the position of every train and switch. Built for the Santa Fe Railway as a permanent exhibit at Chicago's Museum of Science and Industry, the model presents the operations of a transcontinental railway on a scale of one-quarter inch to a foot, with Diesel and steam locomotives, cars and many working exhibits specially built as exact copies of the originals. The line covers 3,000 square feet. Building the scenery,

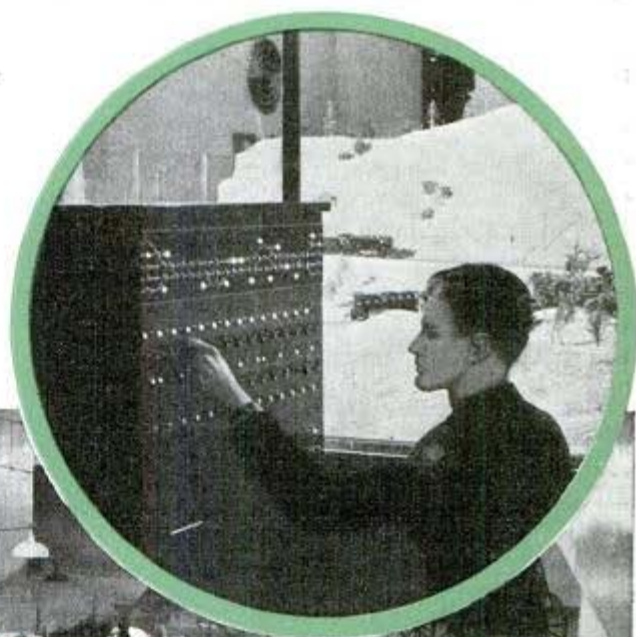
including mountain, desert, plains, Grand Canyon and orange grove scenes, required five tons of plaster and 1,000 pounds of coloring. More than 5,000 trees stud realistic hill-sides. A tiny bulldozer moves back and forth spreading dirt from a main-line cut; a pile driver pounds piles for a new bridge; a steam shovel is digging a cut, shoveling dirt into dump cars. The trains run on a two-rail "Q" gauge track, generators supplying 12-volt direct current to re-lays, trains and signals.

In addition to the centralized traffic control there is the standard block system of the Santa Fe. Immediately behind the miniature train there is a red light, and current is cut from the block. The block behind the red light shows a yellow light, and trains run at reduced speed; the next block shows two yellow lights, the next green. Sidings serve a number of industrial areas typical of the Santa Fe lines.

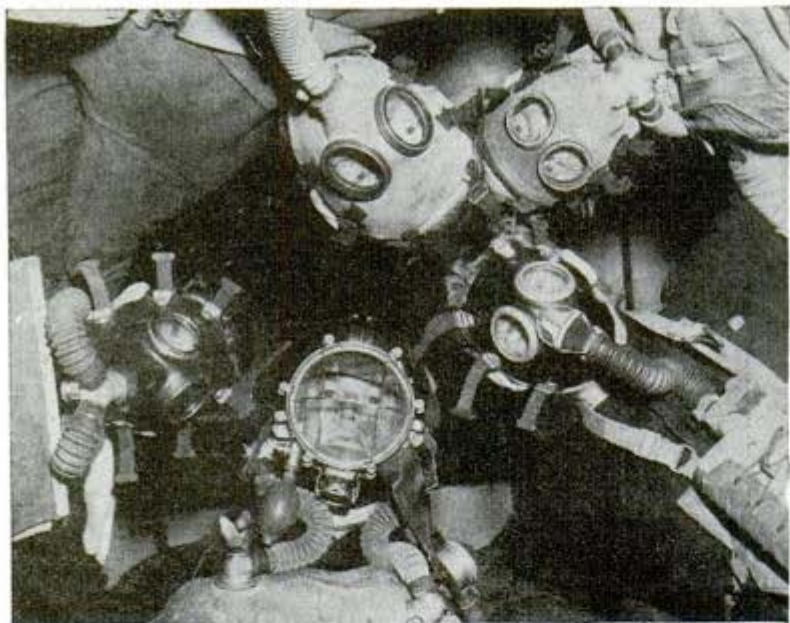
Below, a view of the 50 by 60 foot layout from gallery. In the corner at left of control board are oil wells, tanks and citrus groves



Top, the railroad serves a cement plant and grain elevator; elsewhere are factories, car shops, mines, roundhouse, cotton gin. Below, centralized traffic-control board



Firemen Taught Defense Uses of Gas Masks



Five firemen, left, in huddle over camera lens, demonstrate some of the gas masks they learn to use while taking special course

Below, emerging from test room filled with sulphur gas where the men are trained to perform various tasks in presence of gas fumes

At the Fire College in Long Island City, all of the 11,000 members of New York City's fire department are given thorough training that includes special emphasis on the use of various kinds of gas masks and operations in the presence of war gases. Although defense in war is not the primary purpose of the training, the men are being prepared to meet any emergency that may occur. For practical experience, the masked firemen are trained to perform a variety of tasks in a special test room filled with sulphur gas.



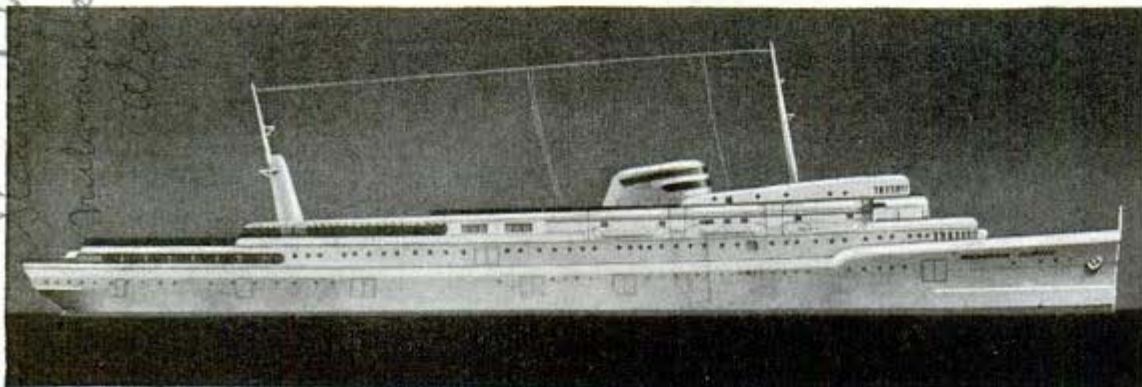
Acme

Wisconsin and Michigan
2154

Fast Streamline Lake Liner Ferries Autos and Riders

Given an ultra-modern streamline dress, and equipped with oil-burning engines, a rebuilt lake passenger ship will go into service this summer on Lake Michigan as

the Milwaukee Clipper, plying between Milwaukee, Wis., and Muskegon, Mich. The vessel will make two trips daily, accommodating 900 passengers and 200 autos.

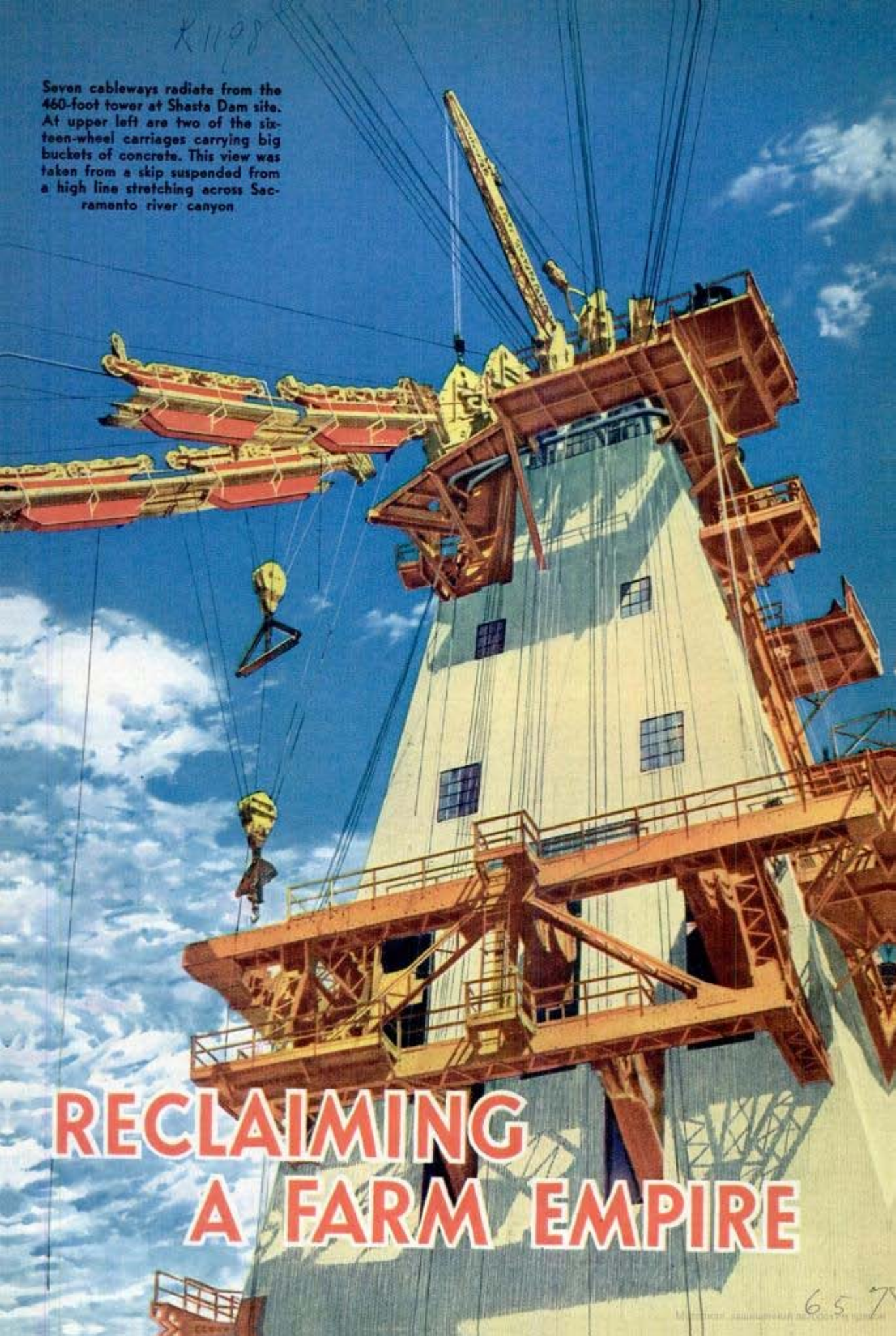


Fast streamline beauty of Lake Michigan will cut more than an hour from time required to cross lake

Acme

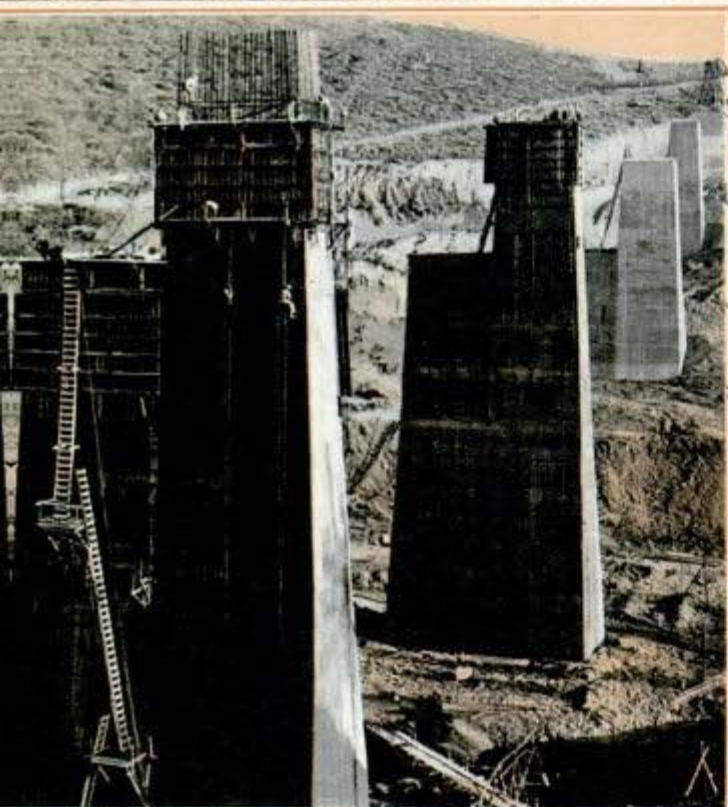
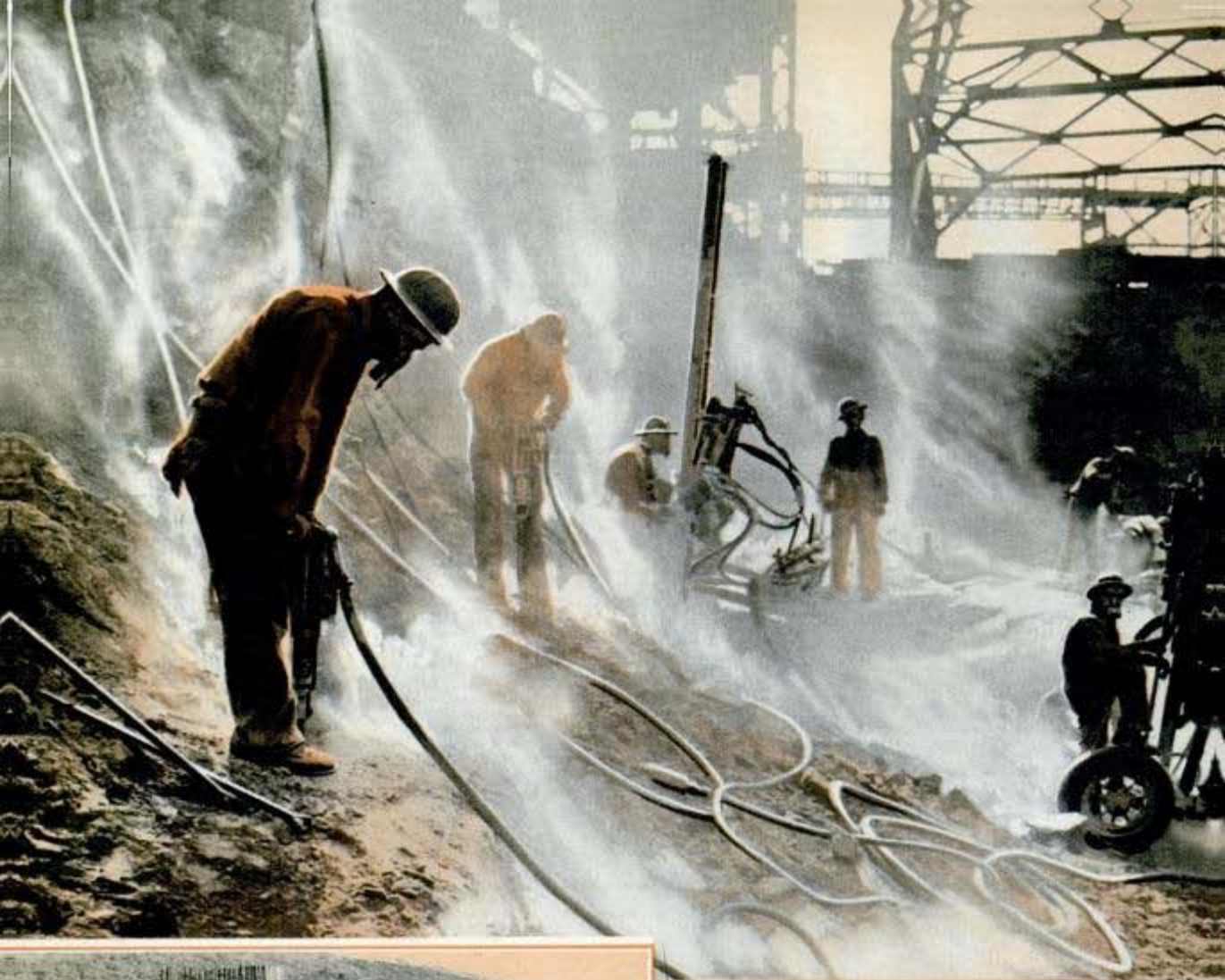
K1198

Seven cableways radiate from the 460-foot tower at Shasta Dam site. At upper left are two of the sixteen-wheel carriages carrying big buckets of concrete. This view was taken from a skip suspended from a high line stretching across Sacramento river canyon



RECLAIMING A FARM EMPIRE

657



Washington, D.C.

Dept. of Interior
TO save California's Central Valley from both flood and drought, the U. S. Bureau of Reclamation is performing the biggest river trans-fusion operation in all history. Mar-tian in scope, this 500-mile long water-way system involves the recourcing of two mighty rivers and the construction of the two highest overflow dams ever built. Between the two great masses of masonry are being built 250 miles of main canals, 200 miles of transmission lines, dozens of major bridges and tunnels, siphons, pumping plants, power stations and scores of auxiliary works, all part of the \$228,-000,000 Central Valley Project.

Altogether, it's the greatest water control and conservation system ever conceived. One river, now flowing north, will be dammed at its source and diverted by canal and water bridges over three other streams to a new bed 160 miles to the south. Water from the second river will be forced to flow backward up the dead river's

Top, drilling dynamite holes in rock at Friant Dam, using compressed air piped as far as 3,000 feet. Below, a bridge on thirty-mile railroad relocation

658 Cont. Charles F. Berry, 41 Mirabel Ave. Ball Ball

K1198

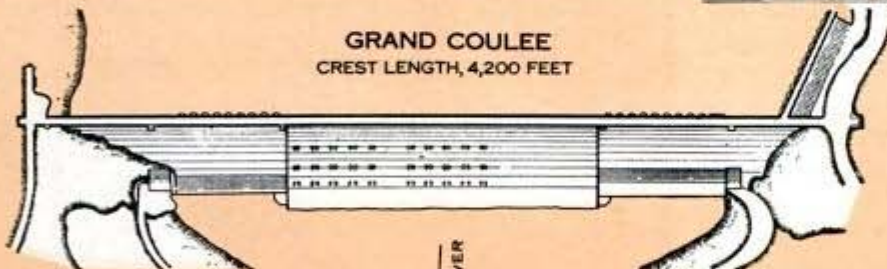
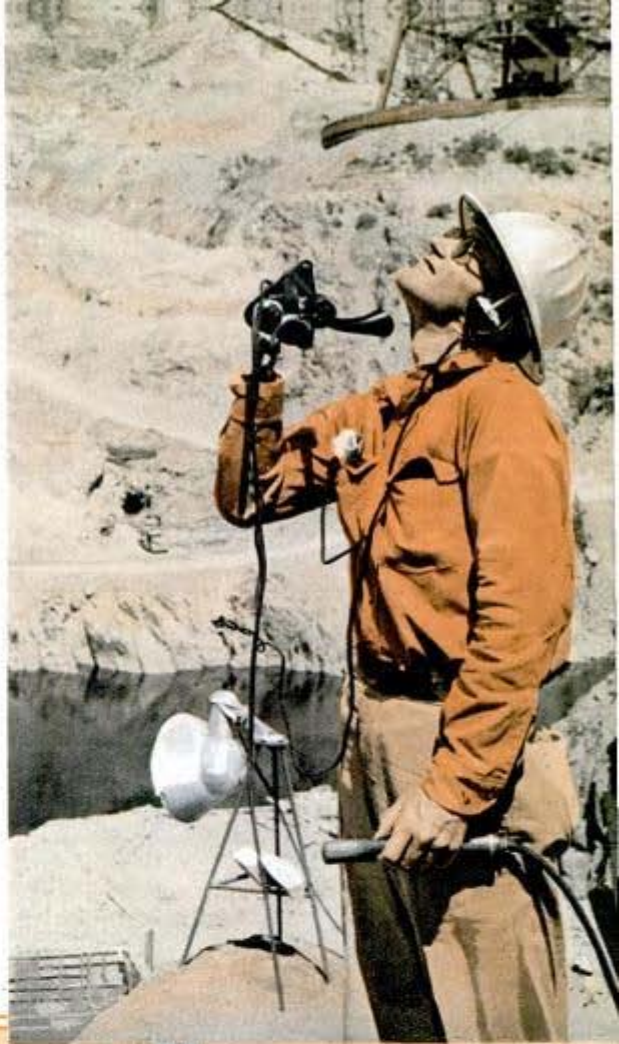
659

channel. Not content with such minor miracles, the engineers will push the ocean from the common delta of these rivers back into San Francisco bay.

As nature originally planned it, the two rivers provided ample drainage and irrigation, but man himself upset the balance. By denuding the forests of the rainswept watersheds of the Sacramento in the north, he brought floods. By over-pumping the water wells in semi-arid San Joaquin Valley, he brought increased drought.

To restore the water balance and to rescue a two-billion-dollar agricultural empire, the entire river system is being revamped. Already, 50,000 acres of fertile farm land have been abandoned, and another 1,000,000 acres threatened. In some regions wells, which a score of years ago flowed freely from a twenty-foot depth, are running dry at 300 feet. In view of such conditions, work on the vast reclamation project is be-

At the right a Shasta Dam signalman uses radio telephone to direct placement of an eight-yard bucket of concrete, calling orders to the cableway operator in the head tower a half mile away. The drawings below compare dimensions and masses of four great dams in the western reclamation areas



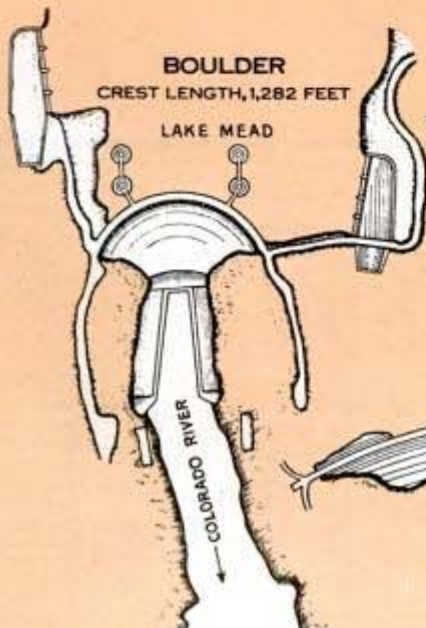
GRAND COULEE
CREST LENGTH, 4,200 FEET

553 FT. HIGH

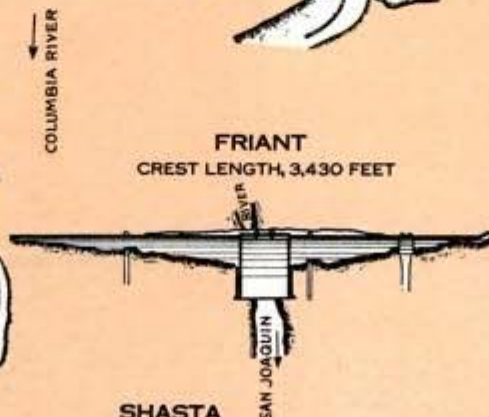
GRAND COULEE



10,200,000
CU. YDS.



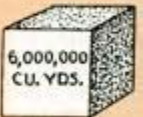
BOULDER
CREST LENGTH, 1,282 FEET
LAKE MEAD



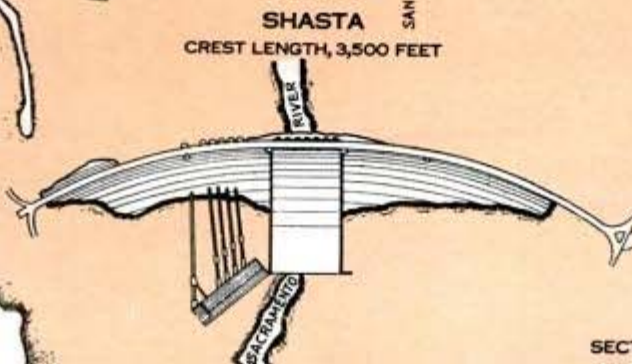
FRIANT
CREST LENGTH, 3,430 FEET

560 FT. HIGH

SHASTA



6,000,000
CU. YDS.



SHASTA
CREST LENGTH, 3,500 FEET

726 FT. HIGH

BOULDER



3,250,330
CU. YDS.

320 FT. HIGH

FRIANT



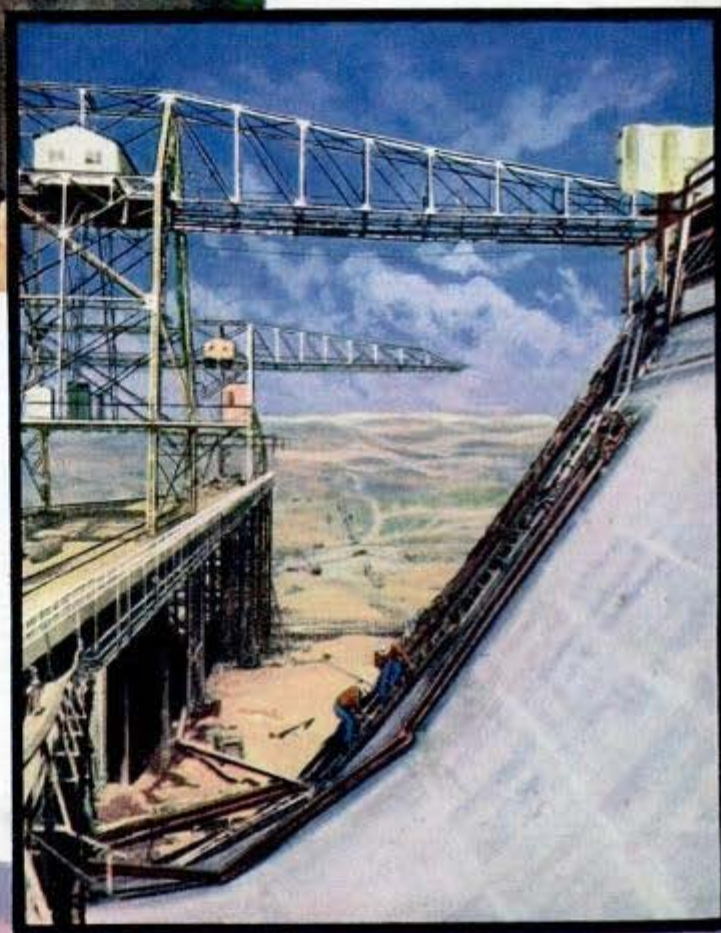
2,200,000
CU. YDS.

X1198

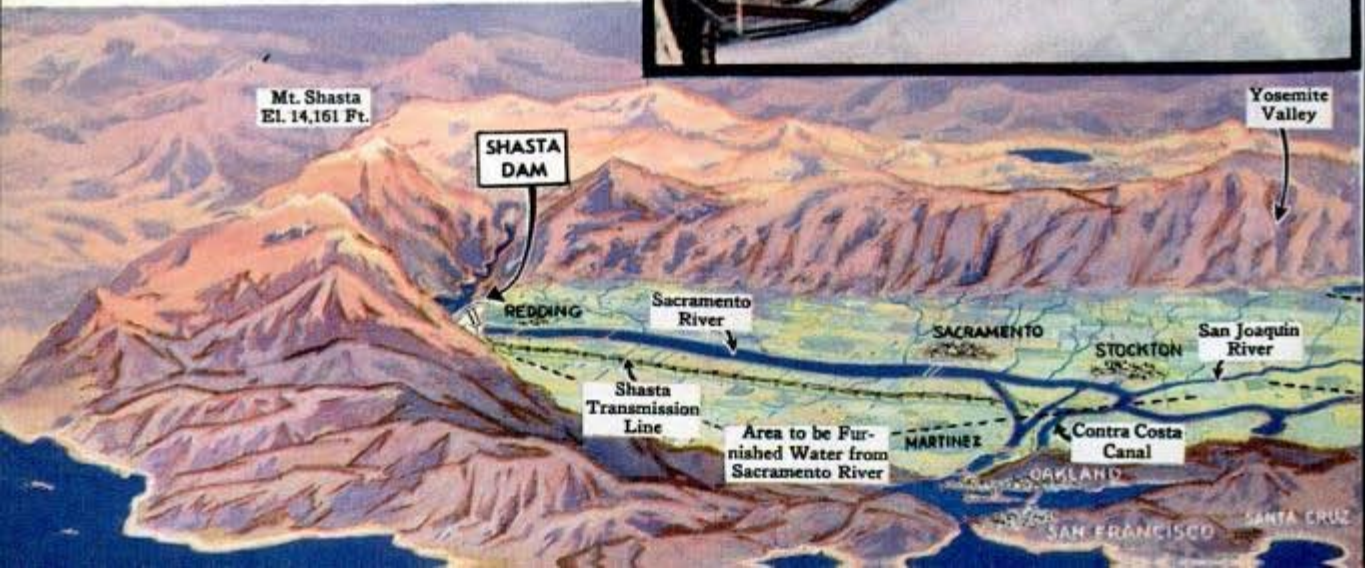
660



Portable wall and arch form at left is used in concreting tunnels on railroad relocation around Shasta reservoir; concrete is poured through windows from inside to form foot-thick walls and roof. Below, the downstream face of Friant Dam, from Fresno county abutment. Across bottom of pages is a sketch of the entire Central Valley project of California



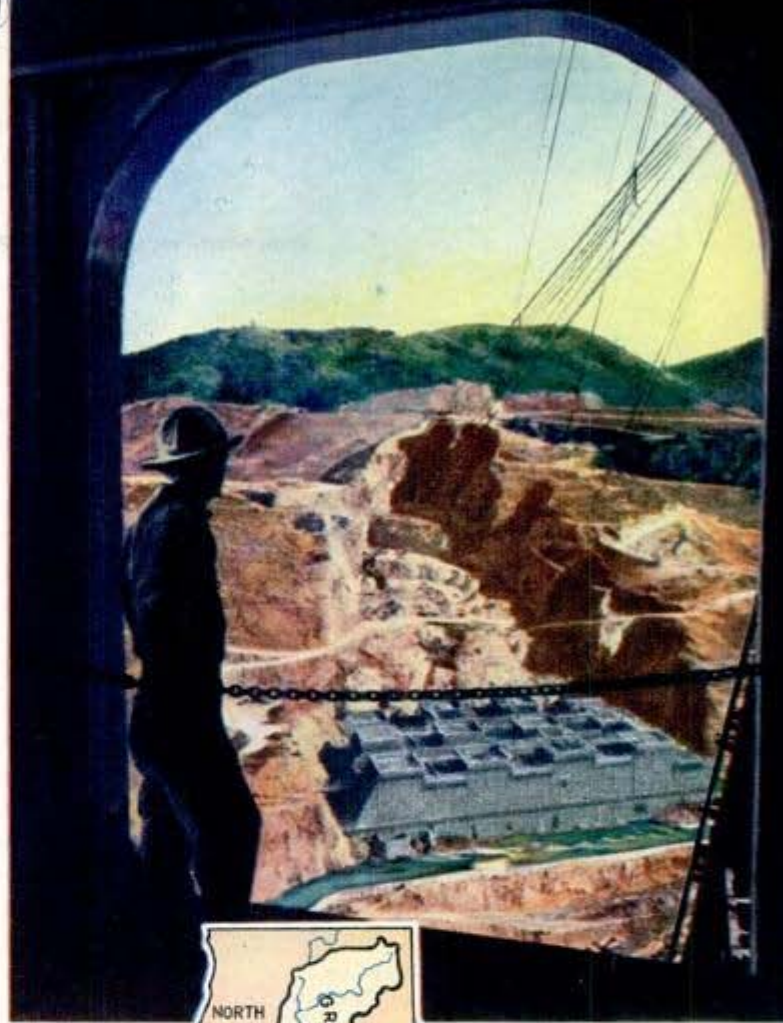
ing rushed ahead with all possible speed. Speedup in construction is being accomplished by the greatest array of building machinery and material-handling equipment ever assembled. Gigantic belt-conveyor systems, huge cranes and derricks, hundreds of power drills, compressed-air pipe lines for delivering cement, specially designed canal-digging machinery and a vast radio-controlled cableways system are only a few of the devices employed on the project. Keystone of the whole project is the \$55,000,000 Shasta Dam near the head of the Sacramento. Rising 560 feet from



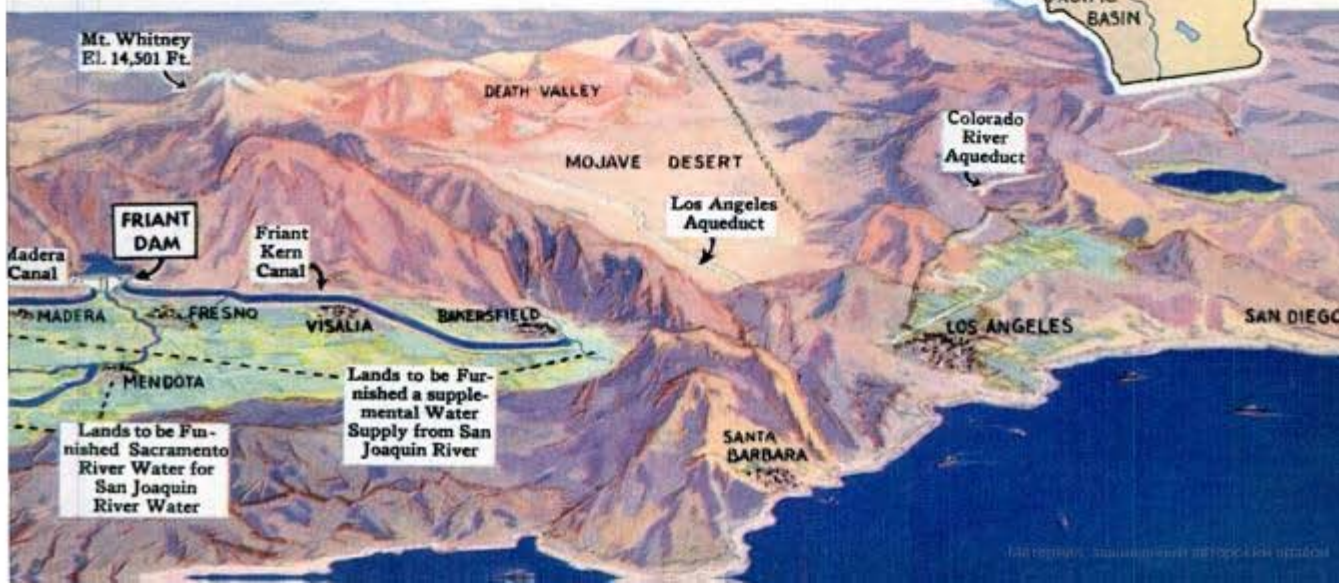
K1198 664

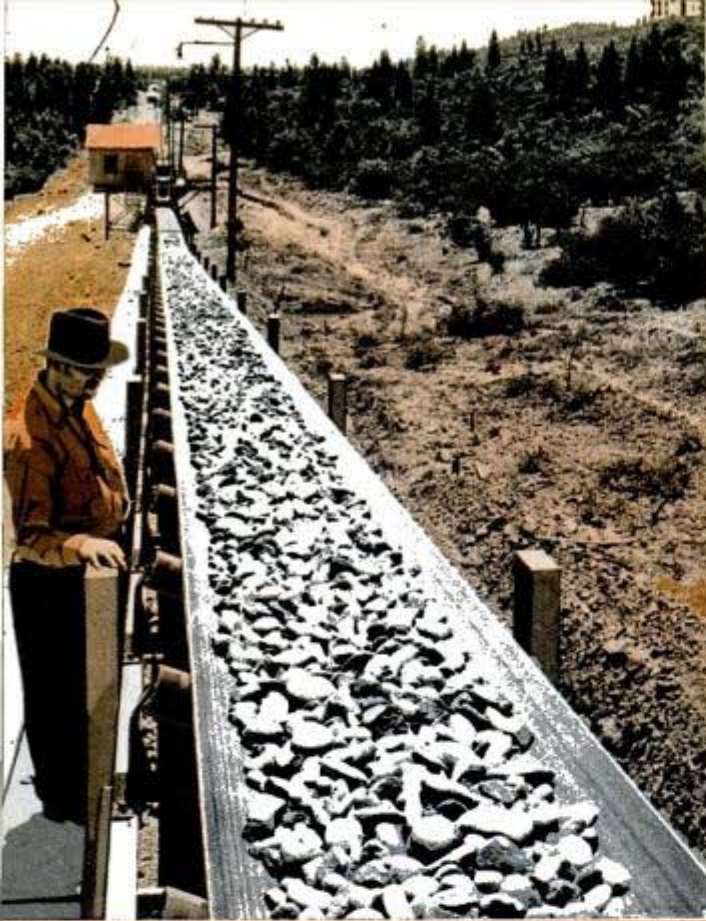
the river bed, this slightly curved structure, 580 feet thick at the base, will extend 3,500 feet along the crest. Higher than Grand Coulee and far exceeding Boulder in mass, it will be easily the world's second largest masonry structure. With its 480-foot spillway, three times the height of Niagara Falls, Shasta will have the unchallenged distinction of being the highest overflow-type dam ever built.

In creating a thirty-five-mile reservoir, Shasta Dam will control the rampageous Sacramento river with a recorded spring run-off of 610,000 second-feet, exceeded in the United States only by the Mississippi, Columbia and Ohio rivers. Not only will millions of dollars of flood damage be prevented annually, but the river will be made navigable inland for 150 miles. Also, by maintaining a minimum all-year flow of 3,200 second-feet at the mouth, the ocean will be pushed back and the rich delta lands flushed of their salinity. In addition, power and municipal water will be supplied to a dozen cities and a heavy flow of sur-



Upper right, looking down on concrete beginnings of Shasta Dam from cableway tower, 700 feet above river. Balancing of water resources of Sacramento and San Joaquin basins (map, right) is main object of undertaking





Gravel flows in never-ending stream on ten-mile conveyor belt to Shasta Dam workings, above. Movable tail towers, below, support the seven cableways radiating from central head tower. View at lower right shows how dam is built in blocks fifty feet square, raised in successive five-foot lifts in alternate rows

K11-98

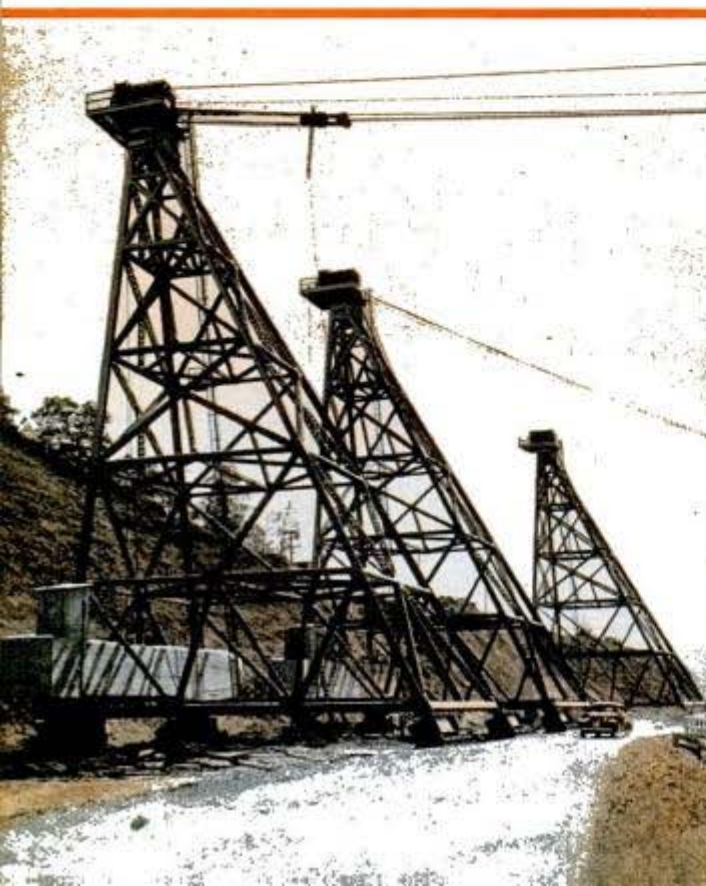
665

plus water conserved for the parched lands to the south.

Originally scheduled for completion in 1945, Shasta Dam is expected to be finished months early. With nearly twice the mass of masonry of the great pyramid, which required 100,000 men a full generation in its building, Shasta will be constructed in four years by less than 5,000 men.

Most noteworthy of the machines to speed construction is the 9.6-mile conveyor system, which is transporting 10,400,000 tons of aggregate from the gravel pits at Redding over the hills to the dam site. For the more than twenty miles of thirty-six-inch six-ply belting, almost 1,000,000 pounds of rubber and 1,000 bales of cotton were required, and 50,500 malleable castings and 83,000 roller bearings were needed for the idlers.

Erected in twenty-six flights, the conveyor belt travels at 550 feet per minute. Each flight except the last four operates on a 200 horsepower motor. The final four flights, which have a down grade of twenty-five per cent, utilize the kinetic energy of the loaded belt to generate power to help pull the gravel over the hill on preceding flights. Requiring one hour and forty



663 K1198

minutes in transit, the material is delivered at the rate of 1,100 tons per hour to meet maximum daily construction requirements of 22,000 tons. Sodium-vapor lights illuminate the system by night.

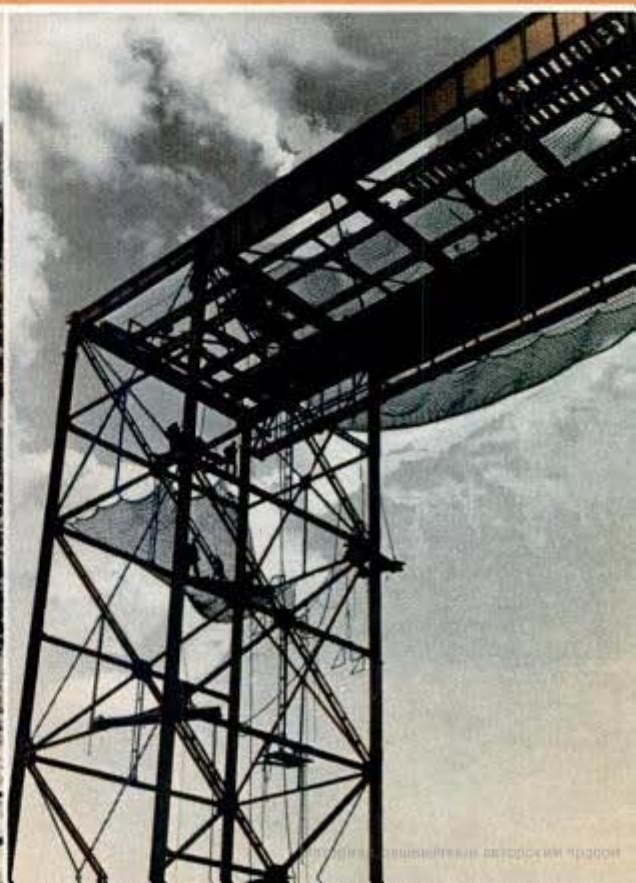
At the storage yards, draglines on 140-foot booms feed eleven yards of material at a time into a skid-mounted vibrator hopper discharging by pendulum belt conveyor into the processing plant. Here oversized rock is reduced by a jaw crusher to a six-inch maximum, and the material is washed by water sprays, scraped off, then delivered to a scrubbing trommel. Banks of classifying screens separate the gravel into grades, and the less than three-sixteenth-inch residue is processed into sand. Finally the processed aggregate is carried by another mile-long conveyor to the cement mixing plant at the dam site.



Cement (5,800,000 barrels are required) is pumped by compressed air from boxcars into storage silos. Subsequently, it is blown through a ten-inch pipe a half mile up the hill to the cement mixing plant.

For trouble shooting along the ten-mile

Rear tires of the huge carryall scraper (top) which scoops, carries and dumps earth and rock on railroad relocation job weigh 1,600 pounds each; the scraper loads about thirty-five tons. At left, below, 200-foot cut for new railroad around Shasta reservoir. Nets protect workmen from falls (lower right)



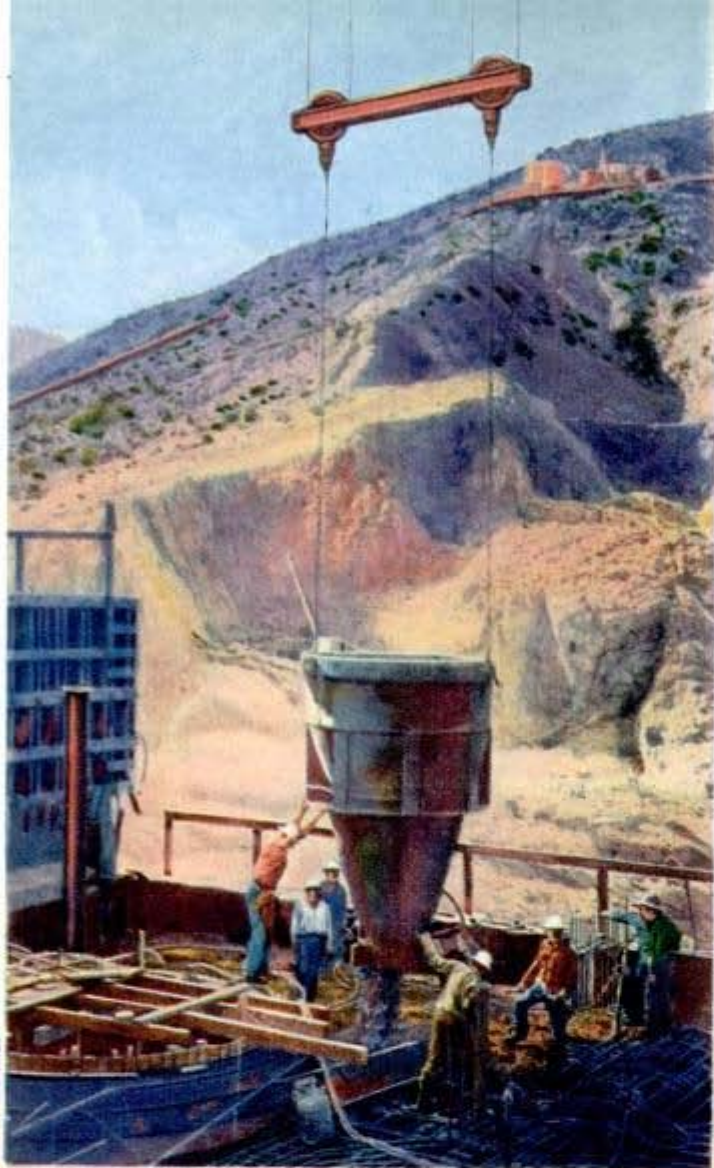
K1198

664

conveyor, a dial radio telephone system, only one of its kind, has been installed. By the mere act of dialing "O," any telephone in the system becomes a radio microphone and the speaker is on the air, tuned in with twenty-seven stations and three fifteen-watt two-way radio patrol cars. Should a break occur, the conveyor automatically stops and multiple squawkers give warning. A meter at the construction company's fifty-watt radio station, KQOK, operating on a frequency of 28,000 kilocycles, locates the trouble.

One feature in the aggregate handling is the gold recovery mill, a gig mill to extract the precious metal from the 10,000,000 tons of gravel going into the
 (Continued to page 128A)

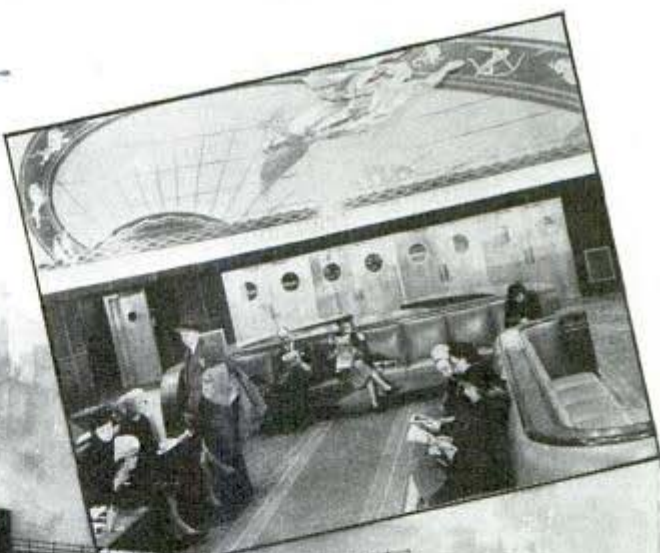
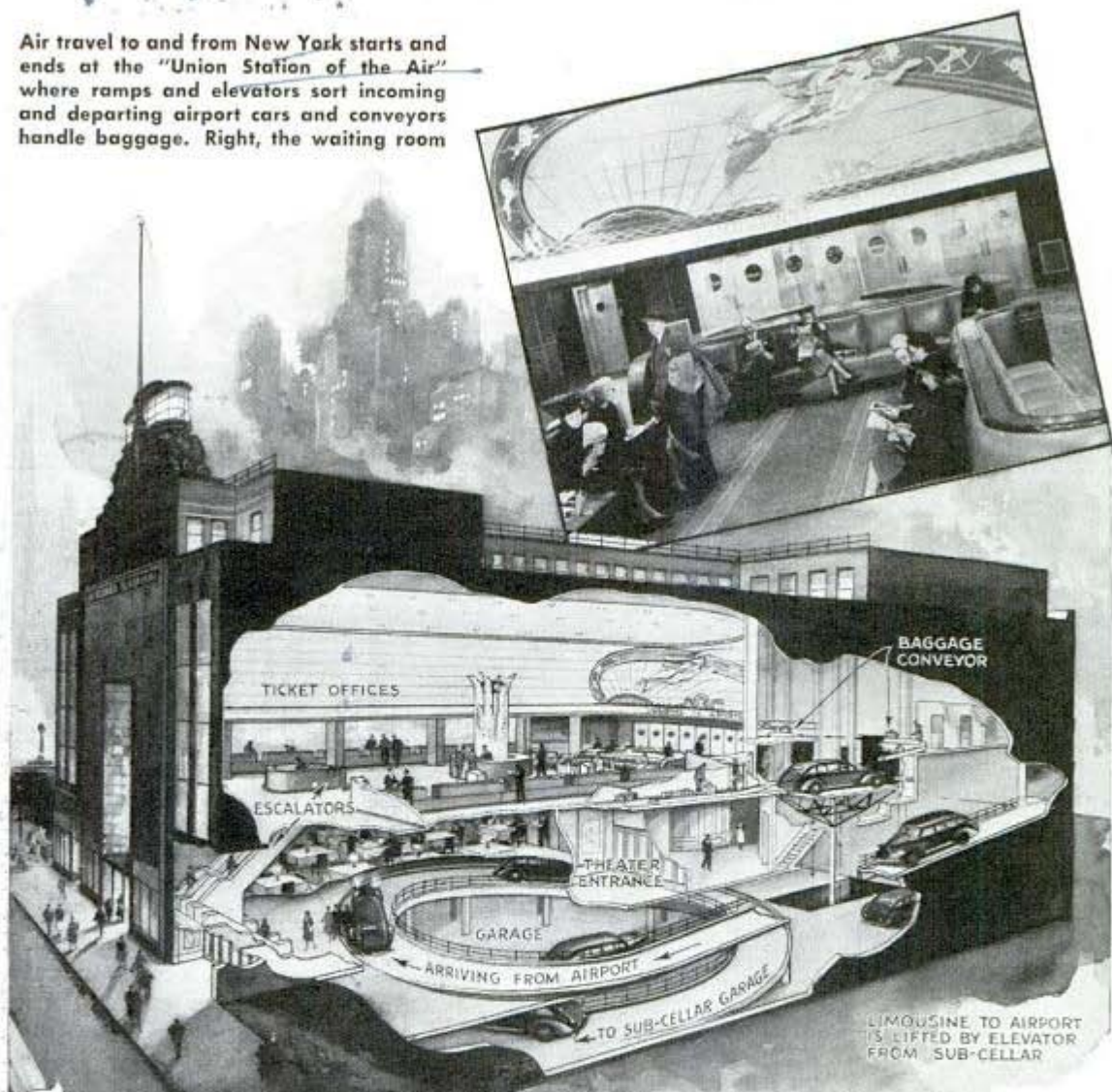
At left, pouring a four-yard bucket at Shasta Dam. Below, lining the Contra Costa canal with hot asphaltic concrete agitated in mixer



L137

Sky Trips Start from 'Union Station of the Air'

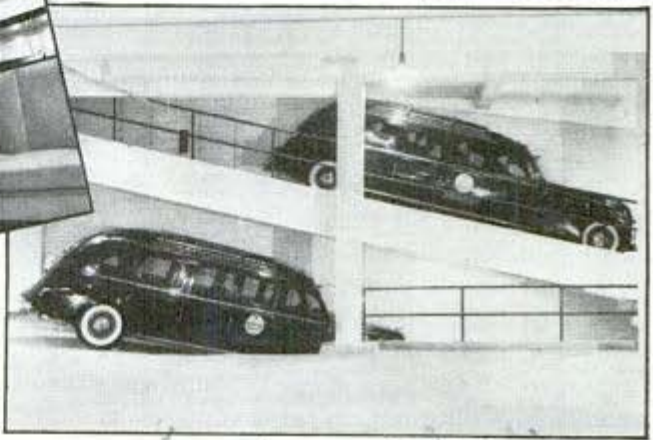
Air travel to and from New York starts and ends at the "Union Station of the Air" where ramps and elevators sort incoming and departing airport cars and conveyors handle baggage. Right, the waiting room



Photos from American Airlines, Inc.

New York City

Below, limousine descends to basement to unload passengers from airport; empty car proceeds to second basement to be lifted to loading platform for airport



Information desk, above, is dominated by clock supported by sculptured wings of Plexiglas emitting light along their edges. The terminal houses a cafe and theater

L175.

Gigantic Snow Figure Depicts Old-Time Skier



Hanover, N.H.
To supply the "theme" for a winter carnival at Dartmouth College, a huge ski jumper was sculptured in snow. Said to be the tallest snow figure yet attempted at the carnival, the snowman is the work of "Chick" Weisker of Newbury, Vt., and portrays the famous Heyderdahl, a ski jumper in the Norwegian army.

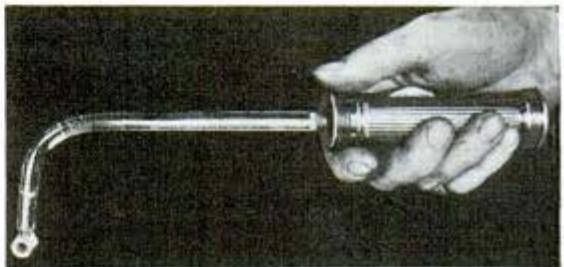
Alloy to Seal Tubes Expands at Same Rate as Glass

Cart. Dartmouth - Pa.
Glass radio tubes, X-ray tubes and other similar electronic tubes can now be sealed permanently with a new alloy, called Kovar, on which patent has been issued to Howard Scott, Westinghouse research engineer. Glass and metals expand when heated and shrink when cooled, but each kind of glass and metal has a different rate, called the coefficient of expansion. Kovar is an alloy with the same coefficient of expansion as the type of glass used in making the tubes. Therefore, when these two substances are fused together under heat and allowed to cool, no strain is caused between the metal and glass surfaces.

L239
Imposing figure represents one of Norway's famed ski-jumping soldiers

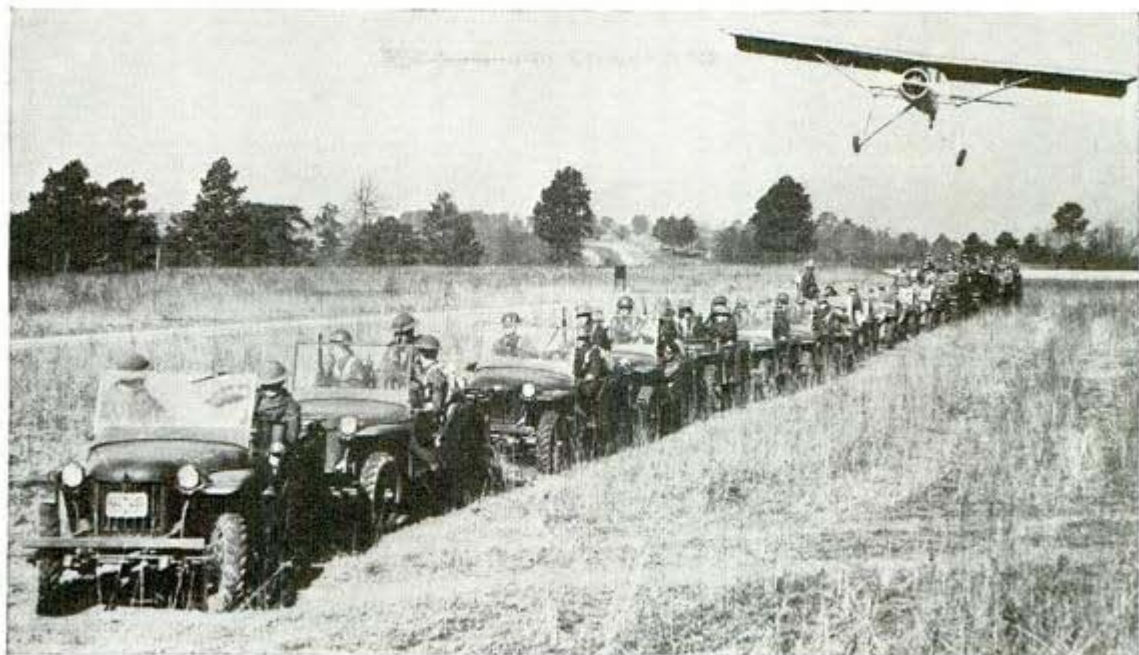
Curved Flashlight With a Magnetic Tip Can Pick Up Screw or Nut

One of the new "curved light" flashlights has a magnetic tip that will pick up an object weighing three-fourths of an ounce. Thus a mechanic or repairman can apply screws or nuts with the same hand that holds the light. The extension tip is of Lucite, which carries the light around corners. Tips of different shapes are available.



2180

Hovering Plane Convoys Scout-Car Column



Scouting plane, upper right, flies at speed sufficiently slow to accompany a line of midget army scout cars

Able to literally hover in the air, a scouting plane flew slow enough to accompany a column of midget army cars of the 29th

infantry during recent maneuvers at Fort Benning, Ga. The airplane is said to be as stable in flight as the autogyro.

Enlarger With Built-In Table Provides a Tilting Easel

With a table built onto the stand, a photographic enlarger may be set up quickly at a comfortable working height. Provision is made for tilting the easel to correct distortion or to create distortion where odd effects are desired. The enlarger can be extended more than six feet for ordinary work, or swung into horizontal position for mural enlargements. Removal of the enlarger head permits the stand to be used as a camera or movie projector tripod.

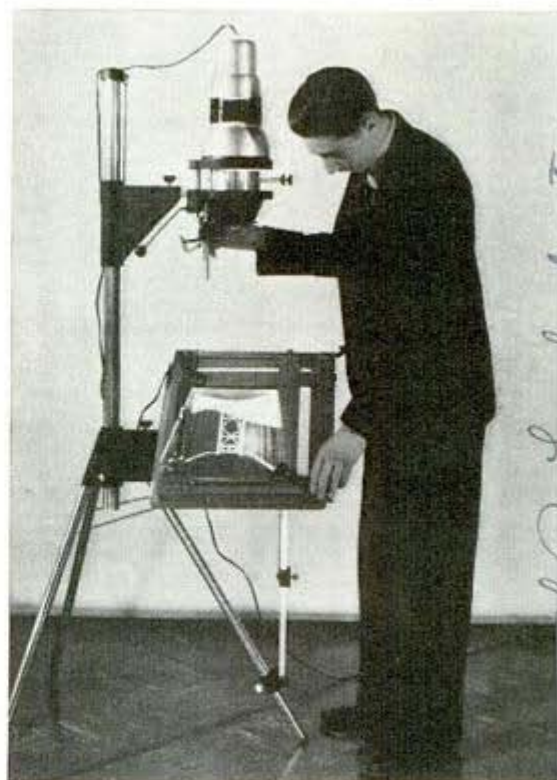


Table attached to enlarger stand can be tilted

Frozen Dough Stored a Year Bakes Into Tasty Cookies

Dough stored for a year under the quick-freezing process may be used just like a freshly mixed batch to make cookies. In like manner pie pastry may be kept nine months, and batter for making rolls six weeks. If stored longer, however, "off" flavors were detected after baking. These experiments, conducted at Purdue University, point to the prospect that frozen doughs may soon be added to the list of frozen foods sold in groceries.

Science Service. 2/9/41

L227

L190

Lafayette, Ind

L.O.R. Industries 310 1/2 Park Ave. N.Y.

L 284 Carl Thomas E. Stinson, Jr
3872 J. Rayburn
Los Angeles

SUPERCHARGING



Pilot spends 30 minutes supercharging himself, breathing oxygen and pedaling bicycle



Helping pilot into flight suit. Below, portable oxygen tank in use as he completes dressing in heavy suit and helmet



SEVEN miles above the earth a man-made cloud of vapor, 50 feet wide and miles long, was stringing out behind the Lockheed P-38, up for a high-altitude test. In the plane's cockpit Milo Burcham lifted his eyes from the whirlwind dance of four pith balls in a small transparent cage and reached for the radio microphone. He spoke as rapidly as he could:

"Burcham in YP-38. 35,000."

He made his message short and he didn't sign off as he was supposed to, because he was too exhausted. At 35,000 feet a pilot dare not interrupt his breathing for long and even the few words that Burcham spoke robbed him of a whiff of precious oxygen. Another sentence might have killed him. Starved of oxygen, he might have passed out and possibly suffocated, or the plane might have gone into a screaming dive from which Burcham would not have had time to pull out after he finally regained consciousness at a lower altitude.

Man is literally a fish out of water in the stratosphere. He must keep warm against the 60 degrees below zero cold that he may encounter. Gases in his system expand four times normal volume and he suffers excruciating pains unless he has chewed charcoal tablets ahead of time. He has to supercharge himself before he leaves the ground to avoid the dangerous "bends" during his fast climb and after he has landed again he breathes a helium-oxygen mixture to relieve the head pains caused by the rapid changes of pressure.

A cigaret won't burn at 35,000 feet, so low is the oxygen content of the thin air, and the pilot has to breathe bottled oxygen while he is aloft. If moisture in the oxygen freezes, if the supply becomes exhausted, or a line plugs, the pilot dies.

That's why, to Burcham, the most important instrument in the cockpit is the small Lucite cage that contains the bouncing pith balls. As long as the balls keep dancing, Burcham knows that oxygen is passing through his homemade flow meter and that he can continue to breathe.

A few pilots have climbed higher than 35,000 feet in special airplanes built for setting records. Instead of trying to create records Burcham is going about the

Lockheed Aircraft Corp
Burbank Calif.

L 284.

THE PILOT

prosaic business of learning what a modern military airplane, ready for action, will do at high altitudes and what the effect is on the pilot. Up in the thin air where the speeding wings sometimes leave clouds of condensed water vapor trailing behind and where the pilot's reactions are slowed down, even a slight exertion may cause him to collapse. The work of recording the readings of the numerous dials on the instrument board is turned over to an automatic camera that takes a picture every 15 seconds.

Breathing oxygen, a pilot can fly at 25,000 feet in comparative safety because at that altitude his reactions are close to normal and he is not too high above the safe breathing level. Two miles higher and safety is more critical. Before Burcham was ready to test the Lockheed interceptor he spent some time in Rochester, gaining high altitude experience in the Mayo Clinic's low pressure chamber. One test that Burcham set for himself was to simulate bailing out of a disabled plane at 35,000 feet. In the low pressure chamber he rapidly disconnected his oxygen tube and raised his hands to pretend that he was sliding back the transparent cockpit cover of his imaginary airplane. That's as far as he got. At once the watchful attendants outside the chamber valved in enough air to bring him back to consciousness. Burcham had discovered that if a pilot has to leave his plane at 35,000 feet he will never have a chance to pull his ripcord unless he first switches his breathing mask to a portable bottle of oxygen and carries the bottle with him over the side.

Pilots can't fight at 35,000 feet, not because the planes don't handle well at that altitude but because the pilots themselves are slow. In a dogfight the pilots would wander all over the sky and do little damage to each other. But, cruising up against their ceilings, the pilots are still very valuable because from there they can watch for oncoming bombers and dive down to intercept them, recovering strength and ability as they descend.

If pilots are ever to fight at the seven-mile level or are called upon to go still higher for guard duty, they will have to fly in supercharged cabins that give them the



Pilot on way to plane, with helper carrying the tank supplying the oxygen



Pilot ready, with oxygen tube hooked up to supply in plane. Below, dancing pith balls in small cage show if oxygen is flowing

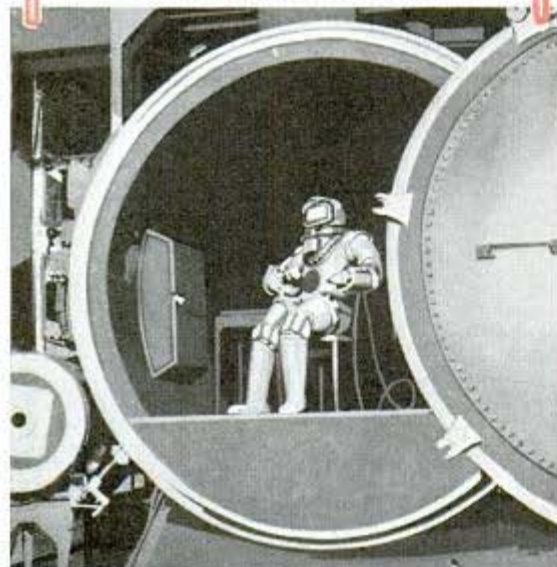




Lockheed P-38 from above, with pilot in cockpit ready for flight into high altitudes



P-38 in air. Below, pilot undergoes a high altitude test in pressure chamber which simulates pressures at various levels



pressure of lower altitudes. Air liners of the future will fly in the stratosphere because of the tremendous boost in speed that thin air permits. The planes will be equipped with pressure cabins and Transcontinental and Western Air has already made the first step in this direction with its supercharged Boeing stratoliners. The first military experiments with a high-altitude pressure cabin were conducted in a special "leakproof" transport plane that Lockheed built for the Army Air Corps several years ago.

The twin-motored P-38, in level flight in the stratosphere, is reported to have flown faster than any airplane ever flew before although its actual speed is a military secret. Several hundred of the single-seat interceptor pursuits are being built for the Army Air Corps and nearly 1,000 of the export model have been ordered by Great Britain.

To be at all useful in high altitude maneuvers, pilots have to be supercharged before they leave the ground and the suggestion is that when the new planes are put in active service their pilots will remain on call in a decompression room where they breathe pure oxygen. Half an hour is required to supercharge a pilot so that he can climb rapidly and be at his best at a high fighting altitude.

In the past, pilots were pretty well supercharged by the time they reached 30,000 feet because the planes they flew climbed slowly. Rapid ascent in a fast-climbing modern plane releases nitrogen bubbles in the bloodstream the same as happens to a deep sea diver who ascends to the surface too rapidly. Divers call it the "bends" and it can produce temporary paralysis or unconsciousness. In aviation it is avoided by "supercharging" the pilot before the climb by having the pilot breathe pure oxygen long enough for the nitrogen content of his blood to be reduced to a safe point. The pilot, wearing a nose breathing mask attached to the oxygen supply, exercises mildly while he is being supercharged by riding a stationary bicycle. After half an hour of treatment he disconnects his breathing tube from the main oxygen tank, connects it to a portable tank that he carries under his arm, and continues to breathe pure oxygen as he walks over to the plane. Once in the cockpit he attaches his tube to the plane's oxygen supply and he is ready to take off.

2216

'Iron Cavalry' Assembly Shows War Strength



War tanks, scout cars and army trucks, passing in review, indicate strength of mechanized forces

Fast growth of the United States Army into a formidable fighting machine was illustrated recently in a mass parade of about 2,000 motor vehicles, tanks, trucks

and scout cars at Fort Benning, Ga. These are mechanized units of the Second Armored Division. Ten thousand men participated in the review.

Photocell Helps Make Copies of Writings and Drawings

Copies of written matter, sketches or blueprints can be made automatically with a new facsimile apparatus similar to the automatic telegraph, by means of which identical copies of telegrams are transmit-

ted. It prepares metal master plates, paper stencils, hectograph master copies or tracings direct from originals, saving time and expense in reproducing text that is complex, containing tabulations, maps or intricate drawings. Master copies 8½ by 11 inches are made in 12 minutes, and those 11 by 17 inches in 24 minutes. The apparatus includes a long metal cylinder around one end of which is wrapped the original to be reproduced. This is scanned by a beam of light moving laterally across the rotating cylinder. A photoelectric cell picks up the reflected beam, and relays impulses to a stylus poised to strike the surface of the material upon which the master copy is to be reproduced, the latter being wrapped about the opposite end of the cylinder. As dark areas are scanned the stylus is forced against the surface, and light areas cause the stylus to retract. Operation of the machine is simple.



Apparatus uses stylus controlled by "electric eye" to make facsimile copies of original paper

See index, page 4-A, to find where to buy articles described in this magazine. Say you saw it in Popular Mechanics.

The Western Union Telegraph Co. New York City

2245.

Vaporized Solvent Cleaner Flushes Auto Gears



Garage attendant demonstrates the cleaning of gears with a can of solvent vaporized by electric heater

It takes just nine minutes by the automatic timer that turns off the electric heating unit to clean the transmission and differential of an automobile with a vaporized solvent cleaner just developed. The can of solvent is connected to the filler plug hole under the car and the heater plugged in. The solvent vaporizes, flows in and liquefies as it strikes the cool metal, washing out the old lubricant.

2202

Stove Burning Smokeless Pills Handy for Camping Trip

Handy for outdoor use and easy to carry, a tiny metal grill packed in a metal box burns small, round tabs made of a patented



One pill is sufficient fuel to heat can of beans

combination of chemicals that are non-poisonous and give off no odor or smoke while burning. The pills ignite quickly and burn at maximum intensity until completely used up. It is said that one pill provides enough heat to prepare an eight-ounce can of soup or beans, but if more heat is needed, two or three can be burned at once. The unit adds little weight to equipment of hikers, campers and hunters.

2207

Trolley Helps Beginner to Skate And Exercises the Crippled



Installed on a straight or circular track at skating rink, this trolley gives the beginner confidence

Skating rinks are installing a mechanical "trainer" to give beginners a start at roller skating or ice skating without a fall. It is an overhead trolley to which the novice can cling until he becomes proficient. The trainer can also be used in hospitals where patients crippled by disease or accident must learn to walk again, or to give them safe exercise while recuperating.

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

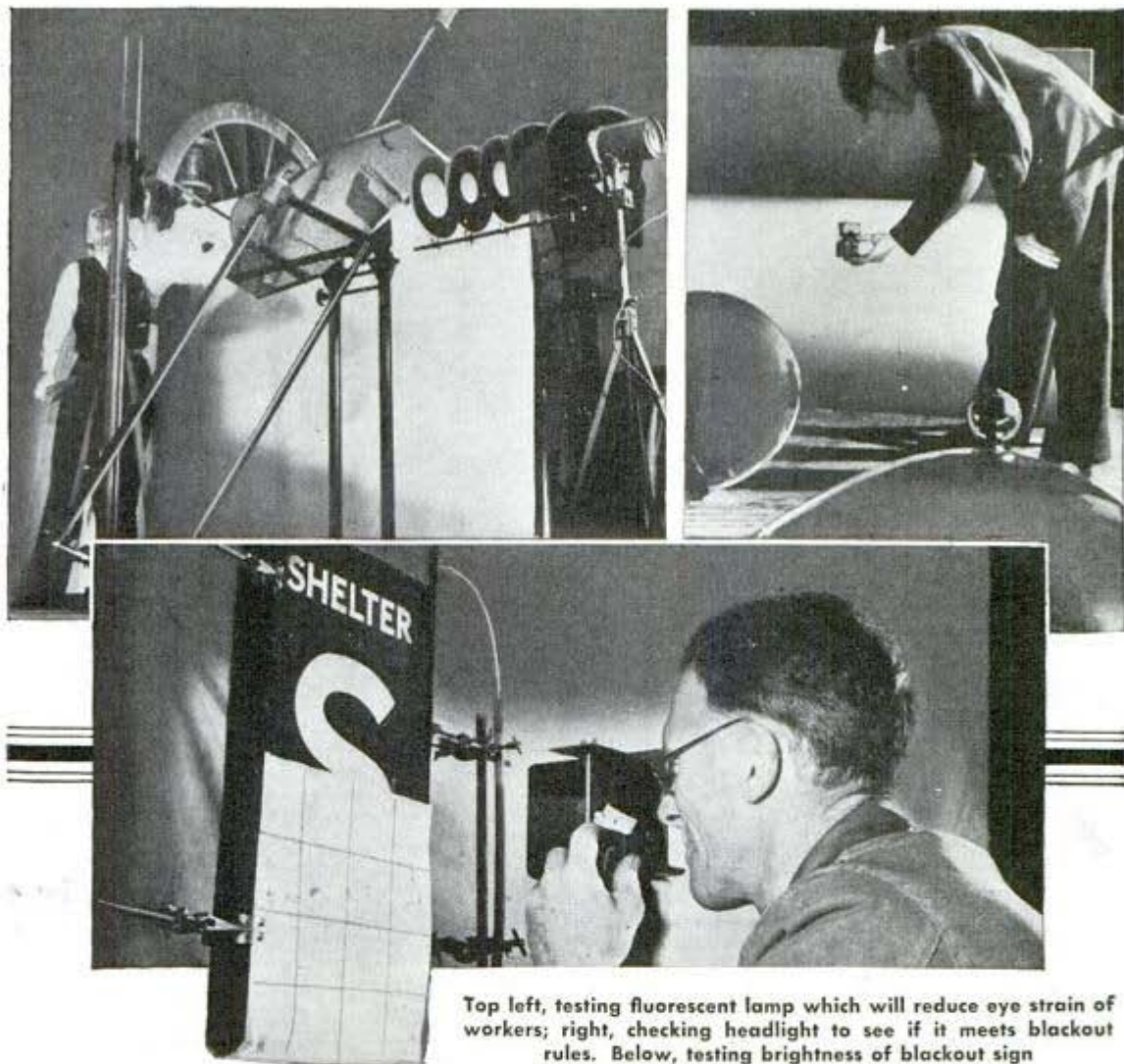
Cisco Products Co. Cincinnati
3088 W. 106th St. Ohio

Seatab Cookstove

W. and W. Patent + Franchising Co. Anderson, Ind.

2183. Cont. Revue W. P. Leonhardt
122 E. 42 nd. New York

Lighting Wizards Help Brighten the Blackout



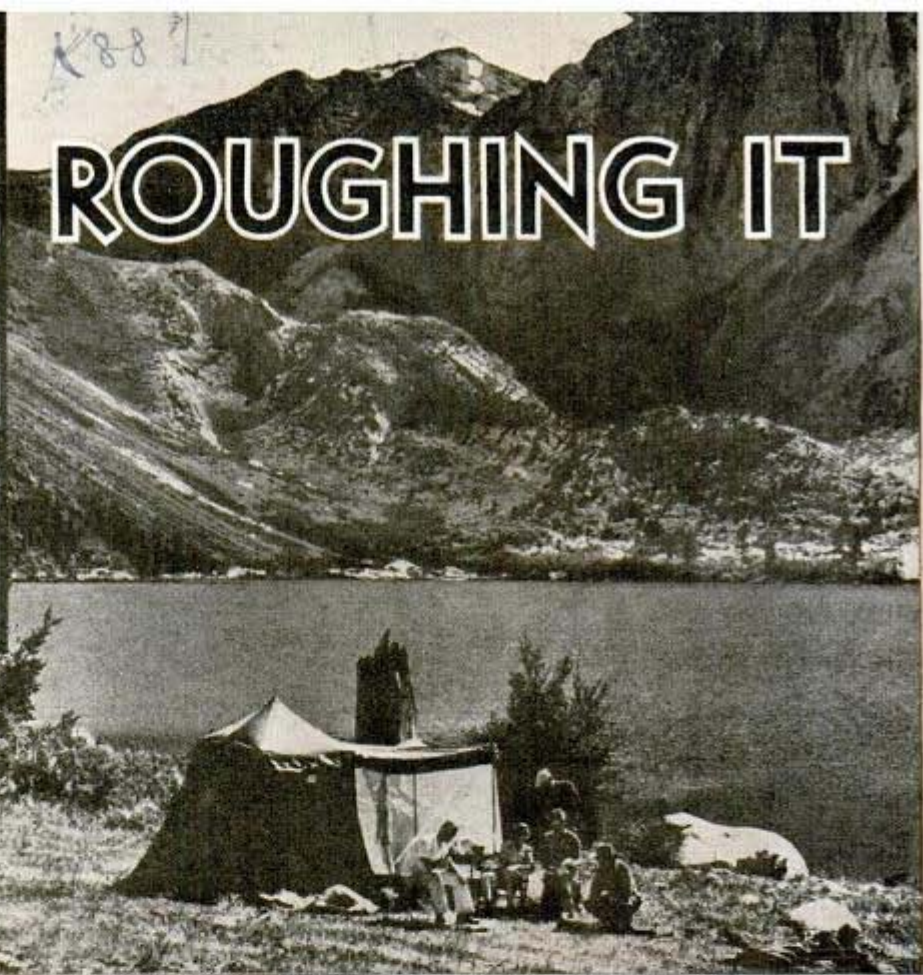
Top left, testing fluorescent lamp which will reduce eye strain of workers; right, checking headlight to see if it meets blackout rules. Below, testing brightness of blackout sign

Tough problems have been put to the lighting engineers of England in the effort to brighten the blackout on the ground without brightening it for the enemy bomber overhead. A number of eminent men have given time voluntarily to designing "light locks," study of luminous paints, planning and testing traffic lights and the illumination of railroad yards and docks where work must go on all night, regardless of air-raid hazards. "Artificial starlight" on the streets enables pedestrians to avoid obstacles, but is invisible from the sky. Research into human vision, one project assigned to a subcommittee of the Illuminating Engineering Society, has developed that the human eye does not function in darkness as in normal light; in the blackout people develop a "blind spot" at the center of the pupil and see "around

the edges." This means that small objects are not seen, and the air-raid signs must be of a certain minimum size if they are to be of any value in the dark. The blackout entrances to stores are scientifically light-trapped to prevent any escape of light from indoors; a group of English engineers cooperated with a photographic firm to design these light locks. Light-trapped windows have also been developed, and ventilators that circulate air without letting out light to attract an invading airman. The British intend that a dark exterior shall not mean a dim interior.

Write to the manufacturer or distributor listed in the index starting on page 4-A to learn where to buy commercial products described in this magazine. Say you saw it in Popular Mechanics.

ROUGHING IT



Above—Campers beside a lake in the western mountains have a tent with a screened "front porch" for shelter. The two girls at the upper left are cooking supper on a portable gasoline stove



By C. B. Harrison

Manager of the Outing Bureau
Automobile Club of Southern California

2601 S. Figueroa St. Los Ang.
A FRIEND of mine was thoroughly disgusted when he returned from a camping trip. No wonder, for he was sore and stiff and worn out. He was sunburned and mosquito-bitten and had blisters on his feet. It didn't help when I told him it was his own fault.

These days you can live and sleep out of doors nearly as comfortably as you do at home. Now that the mountains and back country can be reached by good roads more than 60 per cent of vacationists are camping out, carrying their equipment by car and driving right to the spots where they wish to camp. Good transportation and proper equipment take all the hardship out of camping and in many parts of the country you don't even have to buy the things you need. You can rent a complete camping outfit for as little as \$10 for two weeks.

Let's see what you get for your money. First, a tent of the umbrella type, except that it has no center pole and a flat in-

Small gasoline cookstove at left also serves as a tent heater when the sheet-metal top is used

Col. Thomas E. Stinson, Jr. K887
3872 Franklin Ave. Los Angeles
"similar" rubber boat - June 1940 - 894
Saw in Automobile Club of Southern California

the EASY WAY

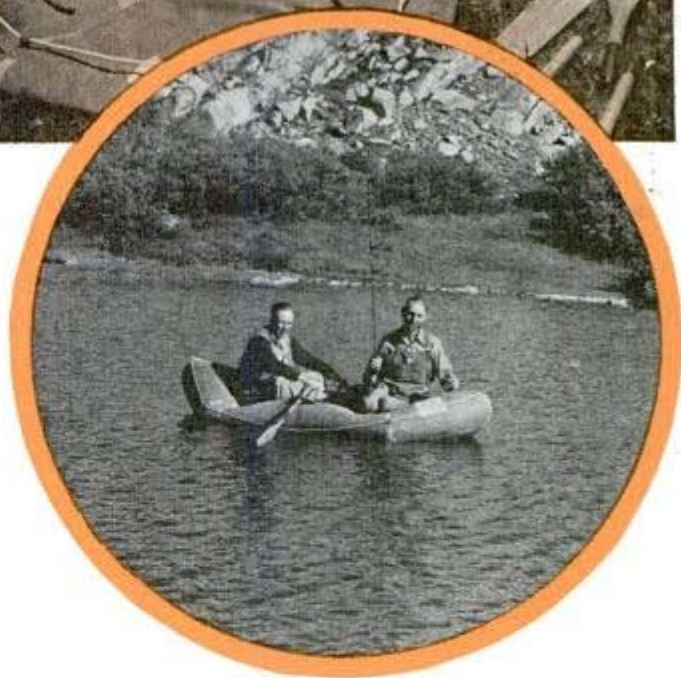


A fisherman pumps up the rubber boat at trail's end. Notice the oars and seats

stead of peaked roof. Without a peak no hot air can gather under the roof and the tent is actually 10 per cent cooler during the day. Its canvas door zips closed and it has a screened window for ventilation. There is room for four people inside.

A gasoline stove and a gasoline lamp are included in the rental outfit, along with a small icebox, the shovel and ax that you are required to carry in national forests and parks, collapsible chairs and cots, and a table. The only other things you need are food and clothes, bedding and kitchen ware.

You may also rent one of the new one-burner stoves that makes a handy tent heater on cold nights and can even be taken out in a boat to prepare a cup of hot coffee on an early morning fishing trip.



Photos from Automobile Club of Southern California

Here two anglers are out in rubber boat to catch their supper

How are you going to carry all this stuff? One good way is to attach a carrying platform to the top of your car, using four or six large suction cups to hold the platform safely in place. Smear glycerin over the

R887



Camping outfit like above can be rented by the week
Angler's deerfly net, below, has hole for cigarette

body finish to anchor the cups to the car and to prevent them from marring the paint. Most of your camping gear can be roped to the platform, where it is out of the way and perfectly secure.

Incidentally, if you are going to drive through hot country you might invest in one of the new inexpensive car coolers that reduces the inside temperature of the car as much as 15 or 20 degrees while you are moving. The cooler is a metal box that projects out of one of

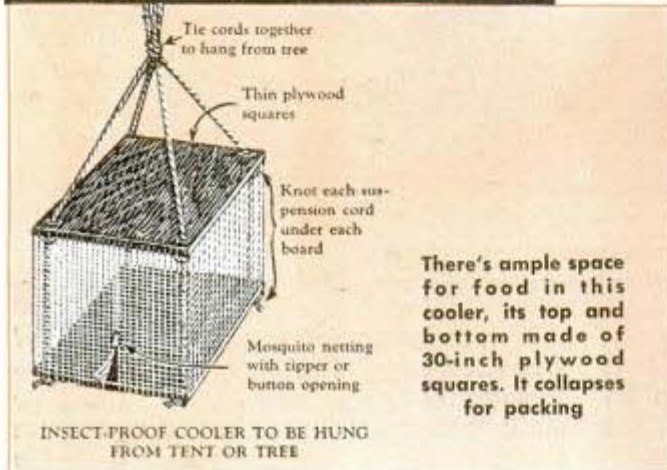
the windows and you run the window glass up under it to hold it in place. Wind that enters the front of the box passes through a water-saturated pad and is cooled by evaporation before it enters the car. Evaporation of the water is so rapid that on the desert you may need to refill the one and a half gallon reservoir every three hours.

Your trip will be more fun if you protect yourself against insects. Keep yellow-jackets and hornets away by burying your camp garbage instead of throwing it over your shoulder. Examine your clothes and limbs for ticks every few hours if you do much hiking through brushy country. A new odorless and greaseless brand of mosquito dope is inexpensive and effective. It is better to watch out for rattlesnakes than have to use an anti-venom outfit after you've been bitten. Use a little caution

New type fishing reel, below, attaches to butt of rod to prevent line from wrapping around butt

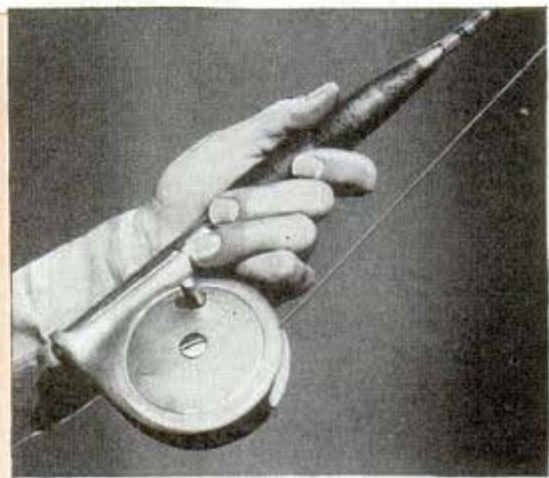


*Don Lengerke + Quintane,
9th Wabash, Chicago.
Lead net, smoked
style. 9 cent*



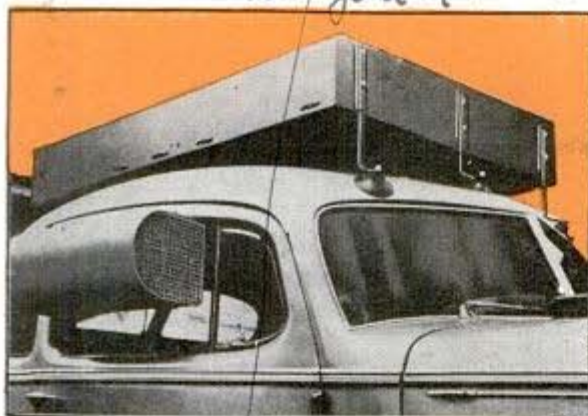
There's ample space for food in this cooler, its top and bottom made of 30-inch plywood squares. It collapses for packing

INSECT-PROOF COOLER TO BE HUNG FROM TENT OR TREE



make entrance.
see Jan 1940, 90.

X887



Above—Metal platform attached to car top by sturdy rubber cups carries camping gear; car cooler is mounted in side window

while climbing around rocky ledges and other places where you might expect to find them and don't trust the old belief that rattlers don't exist in high country. I've found them at 10,000 feet.

You can protect beds and tables against ants by placing the legs of the furniture in discarded tin cans filled with water. One of the best ways to safeguard food against ants and flies is to keep it in a cooler that you can build yourself and hang from the tent or a tree. For a large cooler, make the top and bottom out of 30-inch square pieces of thin plywood. Bore holes at the corners of each square. Run a cord through each pair of corners and if you want the cooler to be a foot high, hold the top and bottom apart by knots in the cords at that distance. The cooler collapses like an accordion for carrying. With the top and bottom extended, tack on sides of strong mosquito netting with either a zipper or a button opening.

Don't make the mistake of wearing riding pants when you go horseback riding. Such pants are usually tight around the knees and after awhile your knees and feet may go to sleep. Wear loose pants instead. For long riding trips you need a broadbrimmed hat against the sun and a neckerchief to protect your face against the dust. Long underwear becomes pretty uncomfortable on a riding trip.

(Continued to page 130A)



Dry ice in heavy canvas chest, above, will keep fish or game cold for a week. Food cooler, below, has cloth sides, a mosquito-net back and front flap that buttons down



coolie bag - uses ice & dry ice
Van Sengerke & Strydahl

2. 105

Ultraviolet Ray Kills Germs In Hotel Bathrooms



Trained operator turning on the germ-killing power of an ultraviolet-ray machine in one of the bathrooms

Germ-free bathrooms are assured for new guests at one New York City hotel, where specially constructed, portable ultraviolet-ray bacteria-killing machines are in daily use. As soon as a guest checks out, the machine is wheeled into the bathroom by a trained operator, the current turned on and the room sterilized. A timer keeps the machine operating long enough to make sure every germ is killed. Then the bathroom door is sealed with Cellophane stickers to preserve the room's cleanliness for the next guest.

Double-Edged Hacksaw Blade Lasts Twice as Long

Two cutting edges on a single hacksaw blade, imitating double-edged razor blades,



When one edge of this hacksaw blade becomes dull, it may be reversed to bring new cutting edge into use

are claimed to give twice the usual length of service. Teeth of the first edge are fractionally wider than those of the second to keep the trailing edge from dragging in the slot. A new technique in heat treating hardens the teeth but leaves the ends and center soft, thus making the blades virtually unbreakable according to the manufacturer. The new blade costs about 50 per cent more than the single-edge type.

One Man Loads Boat on Trailer With Winch and Rope

Anchored to the frame of a boat trailer now on the market, a small winch enables one man to load the boat without lifting or moving it on the beach by hand. The bow of the boat is raised to the trailer cradle by using the long frame as a lever, and



Top, winch permits man to load boat on trailer unassisted; bottom, launching boat in water is also easy

then the boat may be drawn onto the trailer by turning the crank. If there is an embankment at the water's edge, the rope and winch are handy for pulling the entire unit uphill to a tree or other object to which the rope may be attached. One trailer may be adapted to carry any shape of boat, since the cradle is removable.

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

General Electric Co. New York City

2171
\$84.50
\$49.55

Greenfield Electric Co. Greenfield, Mass.

Millers Falls Co.
Greenfield, Mass

2183 Ref: Mr Robert H Burns,
Dept of Agriculture,
Laramie, Wyoming

Sheep Wear Coats of Cotton to Protect Wool

From one shearing time to the next, many sheep may be seen dressed in cotton coats to protect their growing fleece from ravages of weather. This has stepped up the yield of cleaner and heavier wool with lower shrinkage, since the coats keep sand and dirt from working its way into the wool. Another result has been the improved health of coated ewes during cold winter months. The cotton jackets weigh about a pound, including roping. Provision is made for letting them out if needed. Originated with a view toward finding new uses for cotton, the experiment now being conducted at Flag Ranch, south of Laramie, Wyo., bids fair to have an effect in other sheep raising centers.

Cotton coats, like the one being fitted to sheep at top, are worn to keep wool clean and increase the yield. At right, 500 sheep in flock of 1,000 are wearing the coats.



See section on shearing -
Wool Dept. of Wyoming, Laramie

Army's Eight-Inch Rail Gun Hurls Shell Eighteen Miles

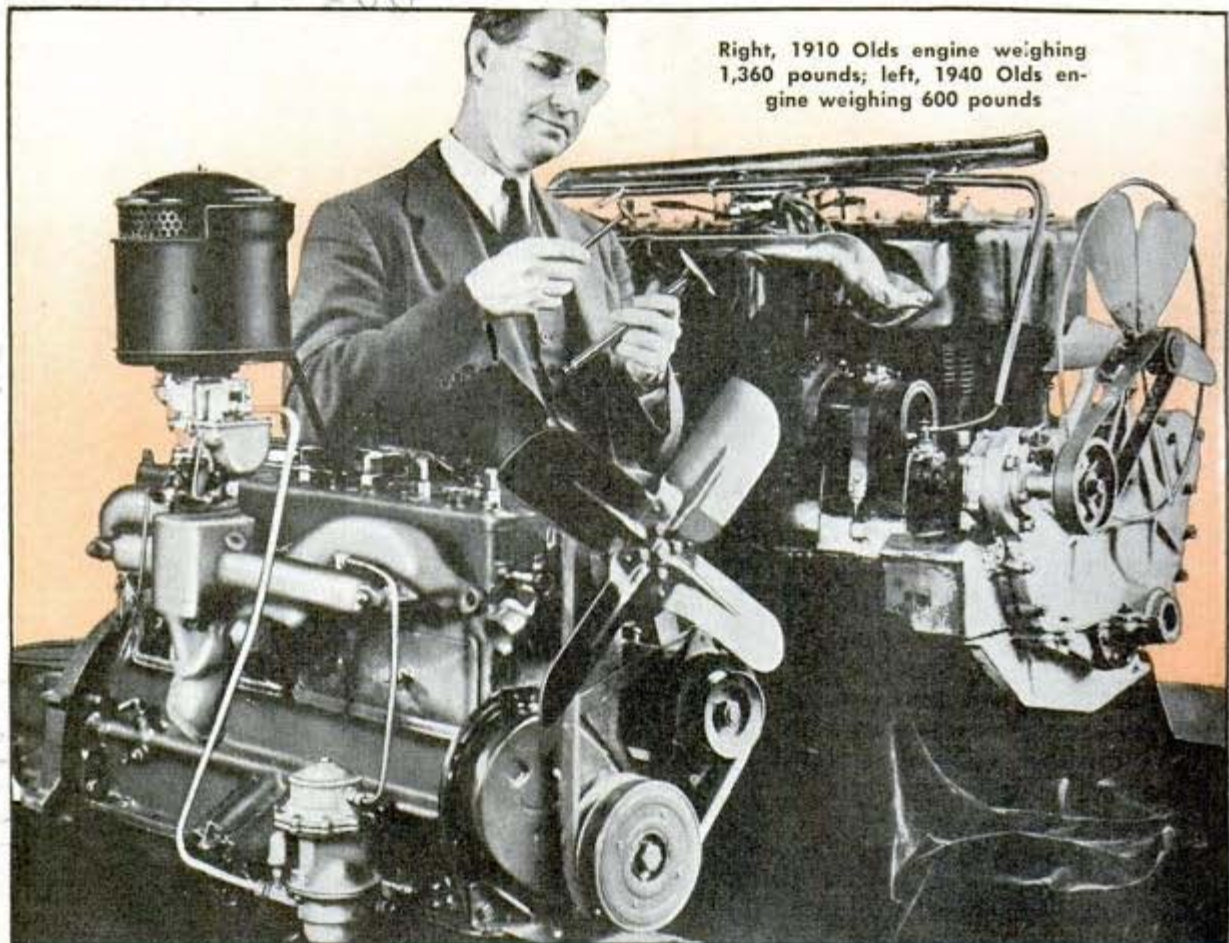


Army officers making preparations for test run of eight-inch railway gun

Capable of hurling a 260-pound missile 18 miles, an eight-inch railway gun recently delivered to the United States Army is the first made by American industry since 1918. The 225,000-pound mobile cannon, the car for which was built at the Baldwin Locomotive Works plant at Eddystone, Pa., was taken on a 250-mile railroad touring test before going to the Aberdeen proving grounds in Maryland where it received a series of trials.

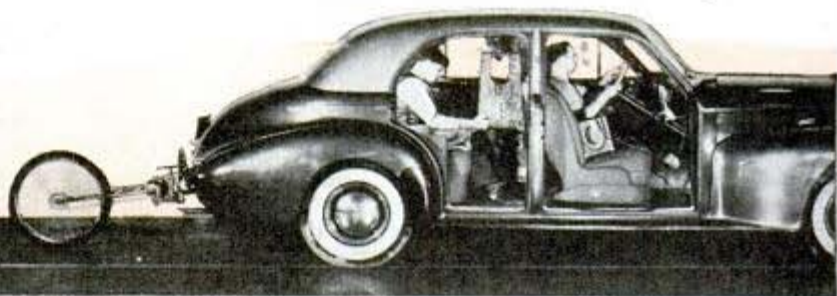
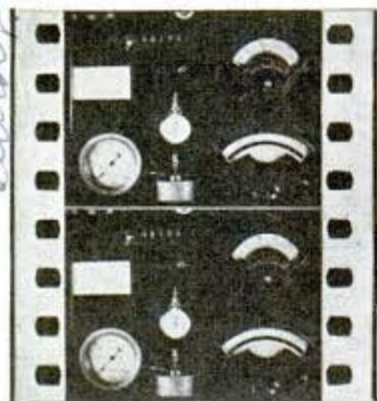
K 7488. Leggett

Right, 1910 Olds engine weighing 1,360 pounds; left, 1940 Olds engine weighing 600 pounds



"BABY" ENGINES

723 E. Inglewood Ave. section 1, huch



Doors removed from road test car used by Ethyl Gasoline laboratories reveal some of testing equipment. Note "fifth wheel." Left, strip of movie film showing readings made on vacuum gauge, stop watch and two tachometers during test

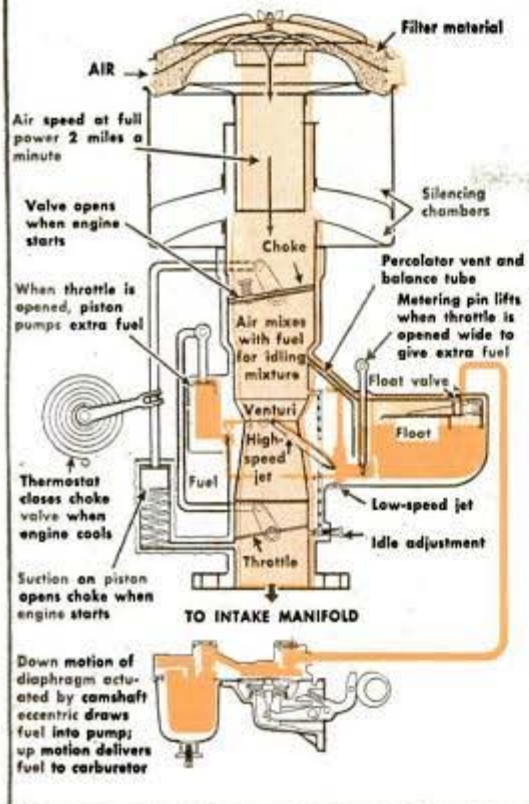
SMALLER engines with higher compression ratios, substantially greater power output and much higher efficiencies than are known today may be expected in the 1950 automobiles.

That is the prediction of Earl Bartholomew, director of the engineering research laboratories of the Ethyl Gasoline Corporation, who further forecasts that we prob-

ably will have gasoline of 95 road octane number for our cars within the next five years. These fuels, when used in engines designed to take advantage of this high antiknock quality, will probably improve economy 35 per cent or more, with performance superior to that of today.

These engines of the future, producing more power and consuming less fuel, will

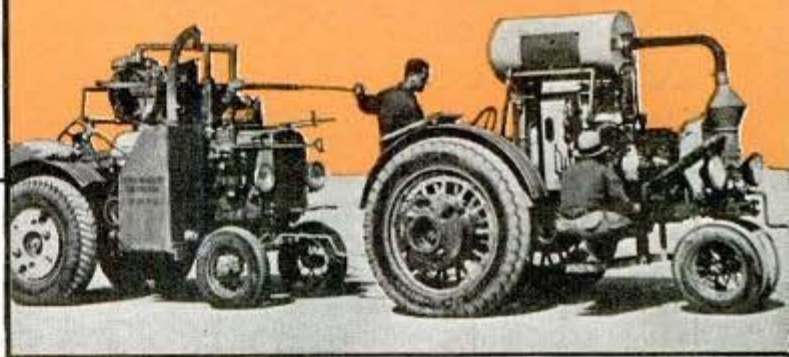
R1488



Above, drawing shows what happens as gasoline is pumped to carburetor, mixed with air and passed on to engine. For economy and maximum power, the carburetor must be kept in good condition



Above, research workers measuring temperature of exhaust valves. Man on left is using optical pyrometer and looking through quartz window of exhaust manifold. Below, second tractor tests first by creating resistance



and SUPER FUELS

come as a result of research and development work now under way in laboratories of both the petroleum and automotive industries all over the country. For example, the Ethyl research laboratories, in exploring higher compression ratios, are testing engines with ratios of over 11 to 1, far higher than the ratios now used in cars and trucks.

The forecast of 95 road octane number gasoline possibly being available within a few years is significant, as progress in engines is dependent upon the type of fuel that will be on sale throughout the country. Gasoline quality is determined by a number of scientific tests, one of the most important being octane rating which measures the ability of the



Studying resistance of spark plugs during operation of auto engine. Cathode ray oscillograph traces on screen the pattern of electrical circuit. Resistance is shown on panel, center

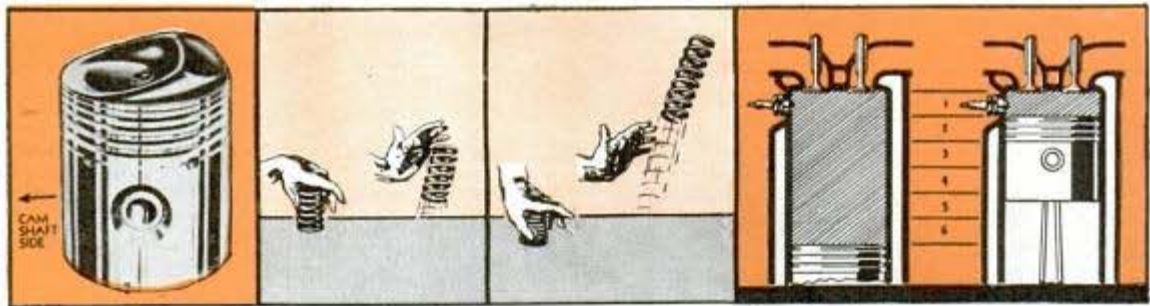


If your engine is not efficient, perhaps it is clogged. Note foreign matter, weighing one and one-quarter pounds, removed from oil by filter in 8,000 miles

"Regular" grade gasolines have increased from a 60 laboratory octane rating in 1925 to an average of 74 laboratory octane rating now. Premium grade fuels now are about 80 laboratory octane rating as against the forecast of 95 road octane fuel within five years.

With higher octane fuels, what are the means for utilizing such gasolines in engines producing more power and greater economy? Research work now underway in laboratories indicates these means may be either higher compression ratios or supercharging. Compression ratios have been increasing over the years as the fuels were improved, and supercharging now is utilized extensively in aircraft engines.

Compression ratio refers to the compressing of the fuel charge inside the cylinder before ignition occurs.



Left to right: Buick piston has contoured top; compressing spring gives it rebound force, doubling compression increases force; drawing shows compression ratio—number of times fuel is compressed in cylinder

fuel to burn properly under the pressures and temperatures existing inside the engine. Petroleum technologists devised the octane number scale to determine anti-knock qualities of fuel by a comparison with mixtures of two pure chemical compounds, iso-octane and normal heptane. Iso-octane is knockless in all ordinary engines and is rated as 100 octane number, whereas normal heptane knocks quite readily and is rated as zero octane number. The octane number of a fuel is determined by running the fuel in a special knock-test engine, and comparing the knock it produces with the knock produced by mixtures of iso-octane and normal heptane. If the fuel knocks with the same intensity as a mixture containing 80 per cent iso-octane and 20 per cent normal heptane the fuel is rated at 80 octane number.



Taking reading with optical pyrometer during road test

K-14-88

2163

Back in 1925, when the petroleum and automotive industries began seeking greater power output with higher compression, the average ratio for automobile engines was about 4.4 to 1. In other words, 4.4 volumes of the original fuel charge were squeezed down to 1 volume before the mixture began to burn.

For some time it has been known that by squeezing the fuel mixture tighter the engine produced more power, providing gasoline of high enough octane number was available to withstand the additional pressures and temperatures created during the burning of the charge. As the octane rating of gasoline increased the compression ratios of engines were raised to utilize such fuels. In some makes of automobiles there are marked advances in a single year, but the average for all makes of engines moves ahead as the quality of the fuel is improved. From the 4.4 to 1 ratio of 1925 the average advanced to 6.43 to 1 for 1940 and 6.6 to 1 for 1941 models.

The higher ratios, up to 11 to 1, being investigated at the Ethyl laboratories are values well into the future, but extensive tests conducted with 8.6 to 1 compression ratio, with fuels of the type likely to be commercially available in the near future, have shown important improvements in fuel economy. By increasing compression ratio from 6.2 to 1 to 8.6 to 1, and changing the rear axle ratio so as to give the same vehicle performance at low speeds, gasoline consumption was reduced by approximately 35 per cent.

Greater economy, without sacrificing performance, is part of the prediction for the engine of the future. Motorists so far have placed performance ahead of economy, asking for fast acceleration, good hill-climbing ability, high road speeds, comfort, and safety. On account of higher compression ratios in present-day cars, advances in fuel economy have not been apparent to motorists as improvements in engine efficiencies have been reflected principally in satisfying the better performance demanded by the public. The higher compression ratios which will be possible with future fuels may be used to provide substantial increases in either performance or miles per gallon, or somewhat smaller increases in both performance and fuel mileage, depending on public demands.

The first and most generally used meth-

(Continued to page 122A)

Heater Under Coffee Table Warms Chilly Room



Fan blows air downward to pass it over heating unit

Comfort on cool days is radiated by a heater-equipped coffee table that delivers generous heat when the occasion requires. The heater is installed in the bottom section with an electric fan above it to spread the warmed air about the room.

Streamline Electric Automobile Driven in "Gasless" France

To supply transportation without gasoline, which is scarce in Europe, a new type electric car made its appearance in Paris. It has a streamline body.



Here is the French electric auto with streamline body

Knapf-Monarch Co. merchandise mark - Chicago

L181

Faurel

Wide body

2178

Tankman's Wool-Lined Suit Repels Wind and Water



Soldiers of armored units will wear this type suit to fight off wind and rain during wintry weather

Four-piece khaki winter combat suits, consisting of trousers, blouse, jacket and helmet, will keep the army's armored forces warm and dry in bitter weather. Made of cotton cloth lined with 20-ounce wool, the fabric is specially treated to repel wind and water. The top of the trousers comes well over the chest; the legs are baggy for freedom and comfort. The blouse is of the pull-over type. A high collar is provided by the jacket, which has elastic at the wrists and waist. At the back of the helmet a flap keeps the neck warm.

Growing Use of Plastics in Home Will Call for More Metals

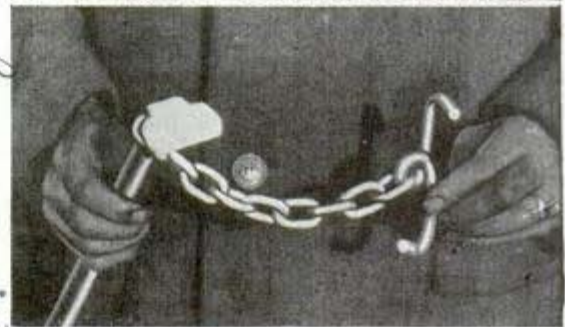
Instead of decreasing the use of metals, wider application of plastics in the home is more likely to cause a boost in the demand for metal, according to Dr. A. A. Bates of Westinghouse. He reasons that the substitution of plastics for metals in certain parts of commercial and household machines

A. A. Bates
1414 S. Wabash
Chicago

will reduce costs of production, and as a result there will be increased demands for machines, leading to a greater volume in production of metal parts which plastics cannot replace.

Tires Pried From Safety Rims By Bar-and-Chain Tool

Safety rims, like those used on 1941 Chrysler-made cars, resist the removal of tires with ordinary tools since the rim flanges are designed to hold the bead of a flat tire firmly on the wheel in case of a blowout. A special tire tool now available meets this problem by "breaking loose" tires from all drop-center wheels regardless of make or size. A chain attached to the "business end" of the tool hooks into the center of the wheel while the broad bit, bent at right angle, is levered down inside the rim flange by an outward pull on the handle. When the bit has been forced all the way in, a sidewise push will pry the casing head out of the safety channel and start it into the drop center. Then the heel of the foot is pressed down on the casing where the tool is engaged and it becomes a simple matter to finish removing the tire.



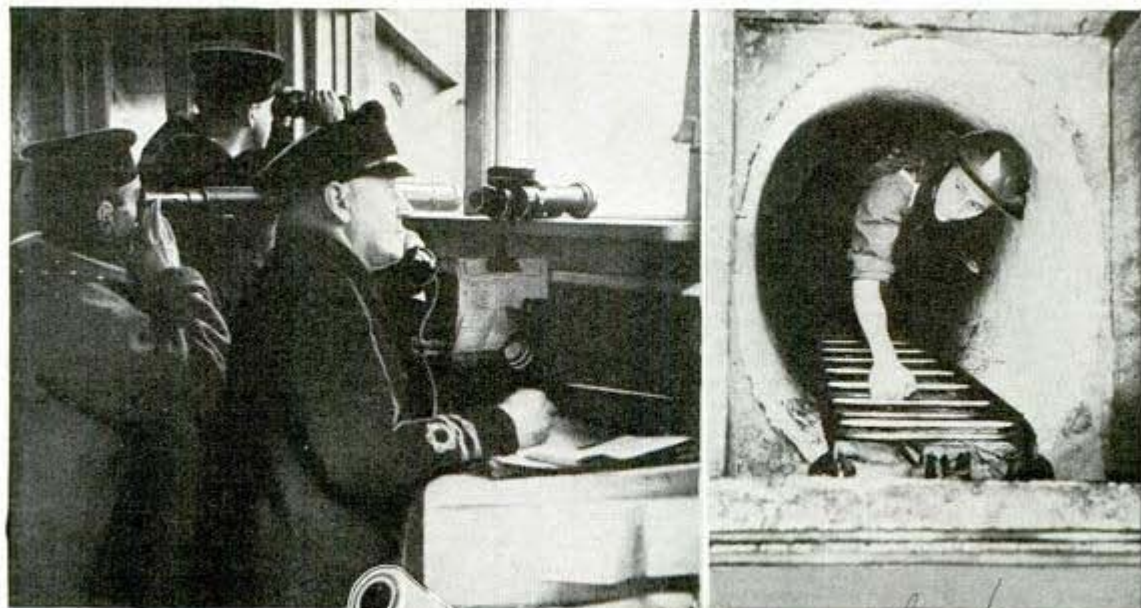
Strong leverage, top, removes tire. Bottom, chain is made shorter by slipping one end of hook into a link

Pittsburgh Pa

Philadelphia Quartermaster Dept.
Chemical and Metallurgical Research
145
Diene-Semmelman 1937

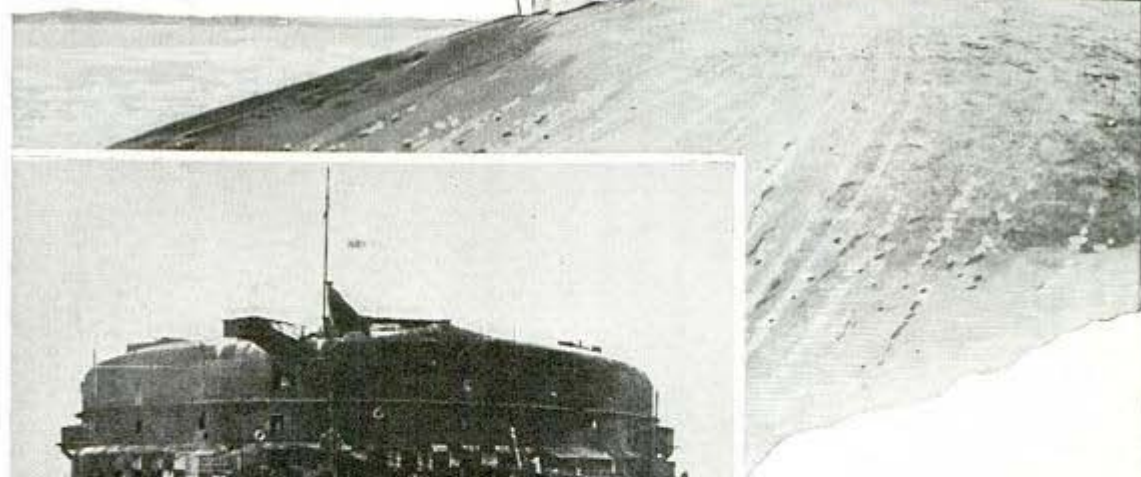
Wedge. De Soto, Plymouth

Floating Concrete Fortresses Girdle Britain



On watch (above) in one of the chain of floating, anchored fortresses encircling Britain, army and navy lookouts stand constant guard against any invasion attempt by the enemy. Massively built to withstand the heaviest bombs and shell-fire, these forts of concrete and steel bristle with big guns. Living and working quarters are deep within

acme *climb*
Above—A soldier climbs up the deep hole from his quarters to take his turn of duty



Above—A sentry, a 12-inch gun and a lookout scan the horizon for signs of the enemy. The gun can take care of any hostile warship that ventures in range. These forts also protect passing supply-ship convoys

Left—Approaching one of the fortresses on the southern shore, a tender brings supplies and a relief crew to take over a tour of duty on "the rock." The outposts are a new departure in warfare for Britain

ARMY ENGINEERS



Chub.
Army engineers preparing to cross river in assault boat. Below, first stage in the construction of a portable steel bridge. Recently the engineers erected a 10-ton span in 75 minutes



IF Uncle Sam's Army needs a bridge built, mines laid, trenches dug, roads constructed or a power system set up, its own specialists do the job—and do it fast. Just the other day, one unit of the Corps of Engineers—the specialists—assembled a 10-ton steel bridge across a ravine in 75 minutes, demonstrating in peacetime what could be equaled, perhaps bettered, in wartime.

There are plenty of jobs for the engineers in war. They build, repair and maintain buildings, bridges and structures of every kind, except telephone and telegraph systems and other means of communication for the use of troops. They dig tunnels under enemy fortifications, lay explosives and set them off. They blow up bridges, viaducts and roads that

Below, preparing to pull steel bridge span across ravine. Note armored vehicles (upper left) waiting to cross



K1330

PRACTICE for WAR



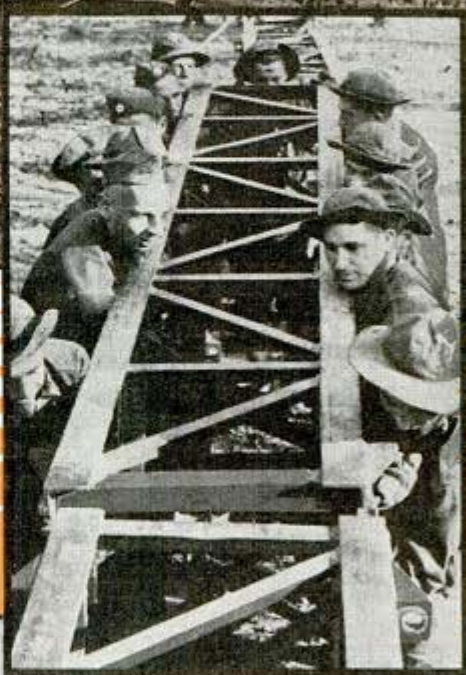
Inf. Engineers, Fort Calhoun, Ia.

Above, crossing footbridge which engineers erected in quick time. Right, joining sections of steel bridge in demonstration of speed with which engineers work

the enemy might use and they destroy captured guns, stores and other materials with explosives when necessary.

Back in World War days, trenches were dug with hand shovels—slow, back-breaking work for the soldiers. Today the engineers speed up the job with power shovels that can move tons of earth in the same time that a shovel-wielding company would move a few hundred pounds. Engineer units are largely motorized. All have modern and efficient equipment, such as portable air compressors which supply the power to operate cross-cut saws, stone-breaking hammers and pile drivers. Because road-building is one of the engineers' most important

(Continued to page 127A)



Right, more practice for the engineers—constructing a log barrier in the path of "enemy" vehicles

L-10.2.

Coin-in-Slot Sells Ice Cream Packed in Cups



Revo. chs. 1/4/22 E. Church
Admitt. purch.

When coin is inserted, slot machine delivers cup of ice cream from chamber cooled by refrigerator unit

New markets are created for ice cream by an electrically operated vending machine that works 24 hours a day and may be installed wherever electricity is available. The ice cream is sold in bars or in cups with a spoon. The machine contains a refrigerating unit, storage magazine, flasher sign to attract customers and a rejector that returns slugs.

Wide-Pocketed Sportsman's Belt Opens by Slide Fastener

Handy for matches, tobacco, package of lunch, a small camera and perhaps a thin



Pouch in sportsman's belt, closed by slide fastener, carries small items needed on an outing

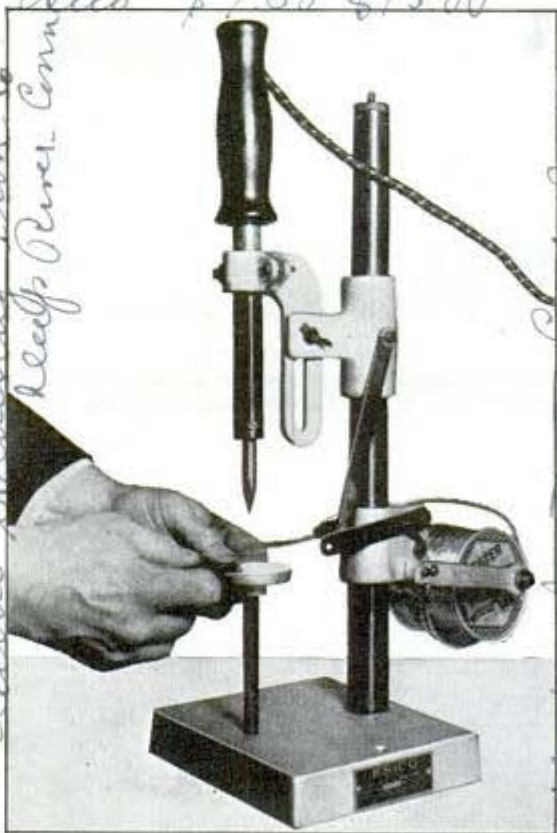
David J. Abernethy & Co.
311 Broadway
N.Y.C.

raincoat, a waterproof duck belt for the sportsman provides a "pocket" 18 inches wide, four inches high and two and one-half inches deep. It weighs only four ounces and is so streamlined that when filled it is no tighter than when empty. Two slide fasteners meet in the center so one side may be opened at a time.

L30.

Foot-Operated Soldering Tool Feeds Solder to Work

Both hands are left free to hold parts being joined when a foot-controlled soldering machine is used. Pressure on a chain treadle lowers the soldering iron to a disk platform and solder from a spool mounted behind the tool feeds forward as the iron returns from the work. Solder up



To operate automatic-feed soldering iron by foot, a treadle chain is attached to sleeve holding the iron

to one-eighth inch in diameter may be used, and the amount to be fed is regulated easily. Most soldering irons fit the machine. Spring suspension in the mechanism cushions the tip as it contacts the work.

There are approximately 3,000 cross-ties per mile of railroad track.

no data

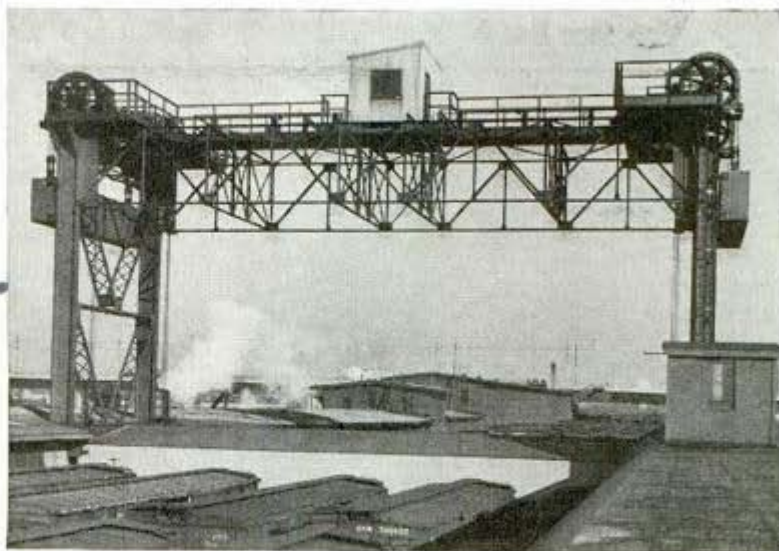
Handolph. Chicago
Sut: Jensen Co 618 W.

Electric Soldering Iron Co.
Reaps River Conn

Jan 20, 61

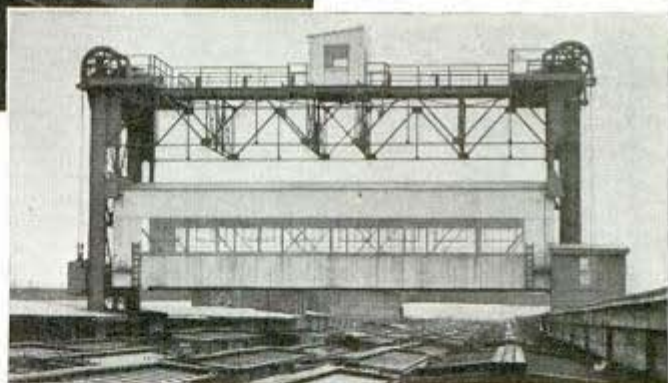
Freight Drawbridge Lifts to Let Trains Pass

Hazardous trucking of freight over gangplanks and through boxcars from one loading platform to another has been eliminated by construction of a drawbridge in one freight yard of the Milwaukee Railroad at Chicago. The bridge forms an enclosed passageway



Above, the passageway is lowered across the tracks for the transfer of freight from car to car by trailer trains. Below, it is lifted to let cars be coupled and trains hauled through. At left, the controls

between the shipping and receiving platforms, through which tractors haul trains of small trailers loaded with freight to be transferred from one track to another. When a train must be moved, the bridge is lifted above the tracks.



194.

Folding Kerosene Camping Stove Fits in Coat Pocket



Three upright wires hold pans and pots over flame

Collapsing to a size small enough to fit the pocket—5¾ by 4½ by 2½ inches—an outdoor kerosene stove will meet the needs of campers, fishermen and hunters who live in states which prohibit open fires in certain areas. The complete stove weighs one and three-fourths pounds, and it carries fuel without spilling. The flame generates as in a blowtorch, being shielded so an ordinary wind will not blow it out.

See index, page 4-A, to find where to buy articles described in this magazine. Say you saw it in Popular Mechanics.

Edward J. Abercrombie Co.
311 Broadway, New York City

R 1472. Cook Allen Warren. Elliott
343 E. 33rd. New York

CLEARING *the* RAILS

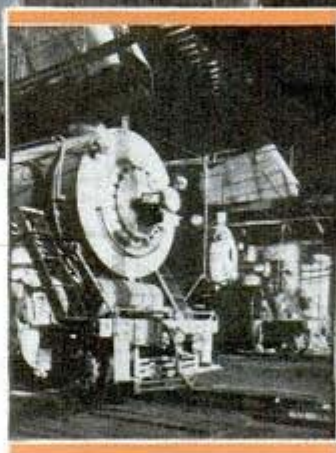


By J. F. Deasy

Vice-President, Operations, Pennsylvania Railroad

THINK of this nation's preparedness effort as the operation of a widespread, complex and synchronized industrial machine with moving parts interlocked but scattered throughout hundreds of cities and towns, and you will be able to visualize the railroad's function in the emergency. It is to help keep the gears of the mechanism running in watchlike unison.

If you consider that modern blitzkrieg warfare is based on the swift transporta-

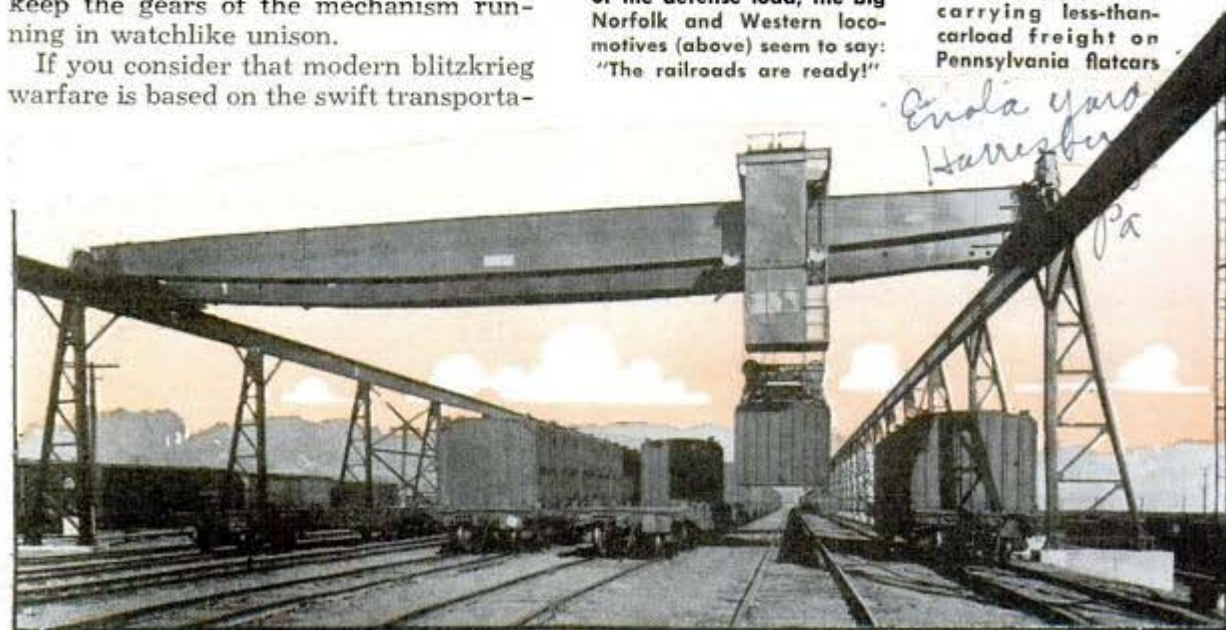


Waiting to carry their part of the defense load, the big Norfolk and Western locomotives (above) seem to say: "The railroads are ready!"

U. S. Army
Signal Corps Photo

Above, unloading 155-millimeter guns and tractors from flatcars at the Fort Benning, Ga., railhead

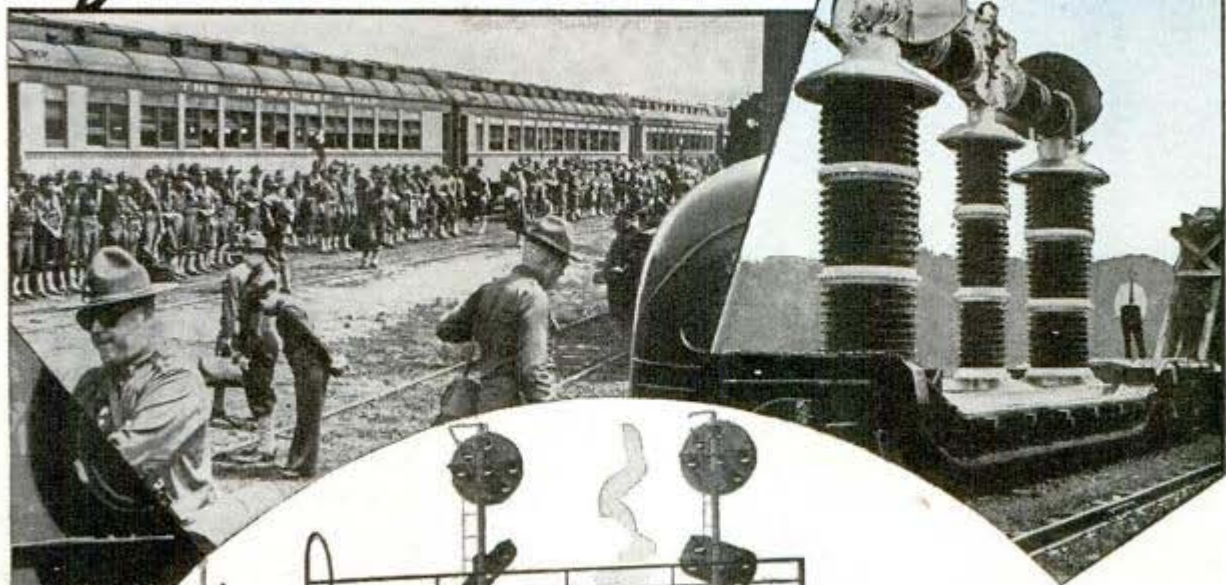
Below, cranes assemble steel containers carrying less-than-carload freight on Pennsylvania flatcars



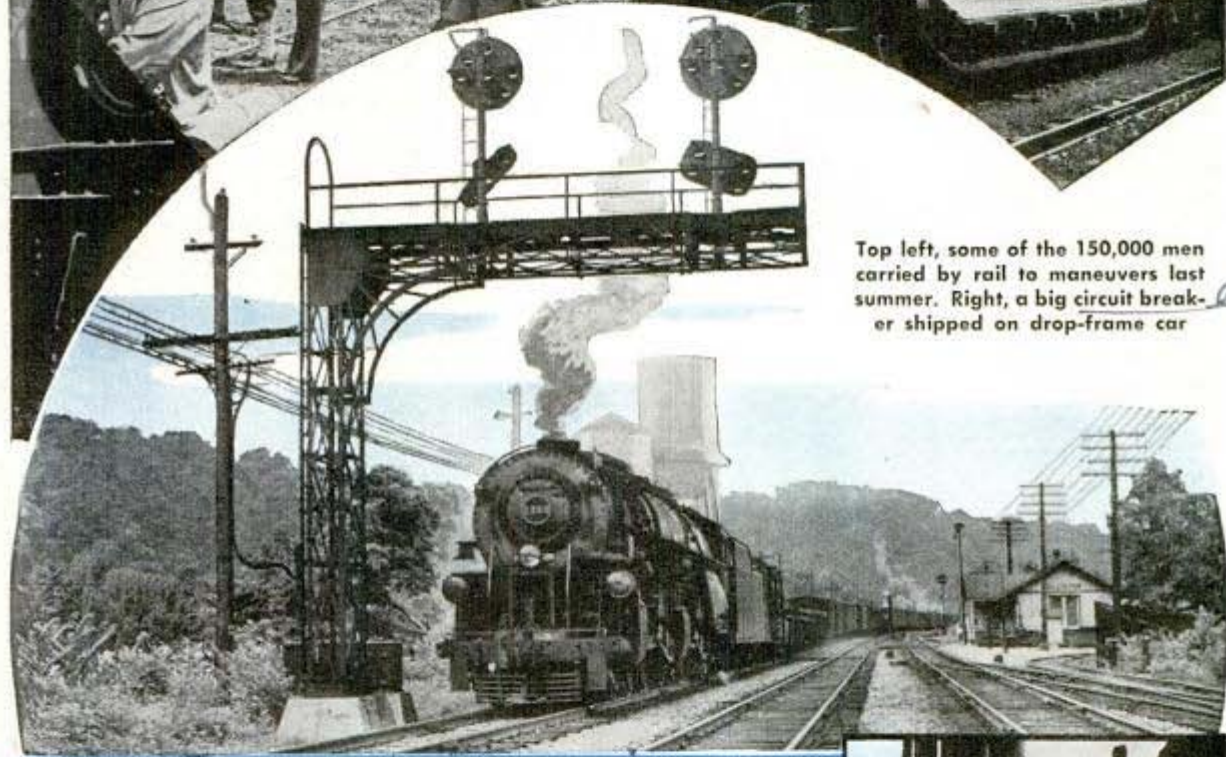
*Enola yard
Harrisburg*

K1472

for UNCLE SAM



Top left, some of the 150,000 men carried by rail to maneuvers last summer. Right, a big circuit breaker shipped on drop-frame car



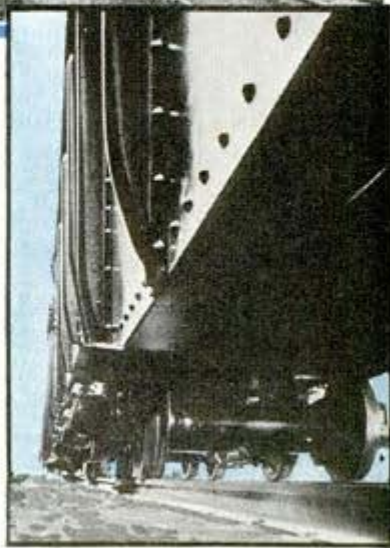
Norfolk and Western

Above, two-position light signals give the "come ahead" to a freight. Tough wheels of new steel freight cars click over the rails (right)

tion of another intricate but destructive machine—the mechanized army—then you can see that in America the railroads are virtually the mainsprings of defense.

We Americans have two seacoasts, 3,000 miles apart and two international boundaries 1,200 miles apart, any one or all of which might have to be defended should war come to us. If the wheels of defense are going to turn efficiently in such a far-flung land, the railroads must supply the impetus which will make the whole thing tick.

You may begin to wonder if the railroads are ready to carry this important load for defense. In behalf of the railroad men of the nation, from crossing watchman to chairman of the board, I give you the answer.



K 14 72



ing years, which would take us back to the era when the long bow was surrendering to gunpowder. Indeed the factors which now chiefly determine the outcome of war do their work far behind the actual battle line in the great plants where the devices and munitions of mechanized warfare are turned out in endless streams.

Today, the basis of assured military supremacy is capacity for immense and sustained industrial production. War is destruction and its implementations of destruction are themselves destroyed in fulfilling their deadly mission. The nation which can turn them out and replenish them the fastest—the one whose mines and furnaces, mills and factories can keep up the highest rate of output—will wear down any less prolific foe, provided, of course, other factors are on anything like a comparable basis.

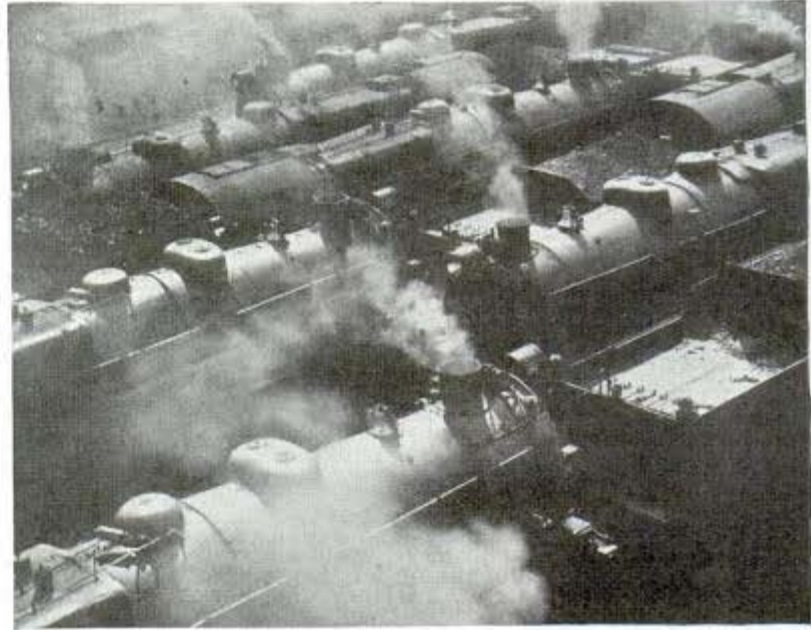
All of this has operated to increase the impor-

The railroads are ready. Throughout the history of warfare, transportation has been one of the principal concerns of military leaders. In ancient times, the principal problem was to keep up an adequate supply of food for men and animals in the field or on the march. With the introduction of firearms came additional transportation requirements. Even in the days of the flintlock a soldier could shoot away his own weight in lead in a comparatively short time. Artillery consumed powder and missiles still faster. Every improvement in weapons increased the needs for ammunition transport.

Today the conduct of war, defensive or offensive, is completely industrialized. The character of military art has changed more completely in the last third of a century than in the entire 500 preced-

Even boats must travel by rail. Here a coast guard vessel is lifted aboard a Florida East Coast flatcar by a special crane

Giant steam locomotives of the Pennsylvania Railroad crowd the rails, below, in mass array ready for any emergency duty

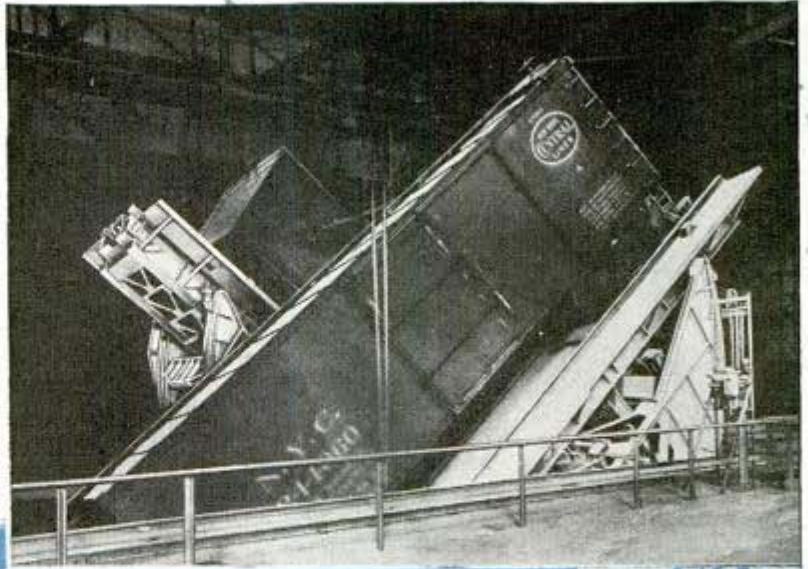


K 1472

tance of the railroads as a military arm, because the continuous functioning of industry rests on swift, sure, efficient mass transportation.

Especially is this true in our land of vast distances. For the war industries to go on uninterruptedly, there must be a rapid and uninter-

Tilting platform unloads eight grain cars per hour



Baby tractors hauling strings of trailers load merchandise into cars at freight terminals or transfer shipments between cars



Left, U. S. Army tanks move in on Fort Knox, Ky., on a 70-car freight train after maneuvers in the south

rupted flow of products to distant points for use. Stoppage would spell disaster.

Only railroads furnish mass transportation by land which is at once swift, sure and adequate, which reaches everywhere, and which can be counted upon for continuously dependable operation, every day in the year and practically regardless of weather. Railroads are supreme and irreplaceable in this field and will continue to be, in peace or war.

In physical condition and capacity to move traffic at high speed and in great

(Continued to page 118A)

200.

Combination Lock on Case Saves Carrying Key



57 d of Peoria, Ill. Chicago

Keyless lock prevents tampering with brief case by unauthorized persons who do not know combination

Annoyance caused by misplacing the key for the brief case has been eliminated by installing a combination lock on the bag. The keyless lock is opened quickly by "dialing" the correct numbers.

national Brief Case Mfg. Co. Chicago

Midget Farm Tractor Pulls Plow Ten Hours for 75 Cents

Powerful enough to do the work of a heavy team, a tiny tractor designed for use



Dr. Paul V.S. Mather, Peoria, Ill.

This tiny farm tractor will do a day's work at cost of 75 cents, running three to four miles an hour

built by machine commission

with a mowing machine, plow, farm wagon or harrow, will work a ten-hour day for less than 75 cents. Its working speed is three to four miles per hour, and it travels ten miles an hour on the road. The tiny machine weighs 675 pounds, it has a tread width of only 36 inches and an overall size of 76 inches. A pivotal front axle permits smooth riding even on rough ground.

2126

Bananas Help Launch a Ship By "Greasing" the Ways

Three and one-half tons of bananas were used to "grease" the ways for launching the Cape Lookout, a 7,400-ton cargo vessel, recently at Beaumont, Tex. This was the first ocean-going vessel built in Texas since the World War.

2142

Typewriter Roll Transmits Light To Illuminate Stencil



250-5th Ave. New York

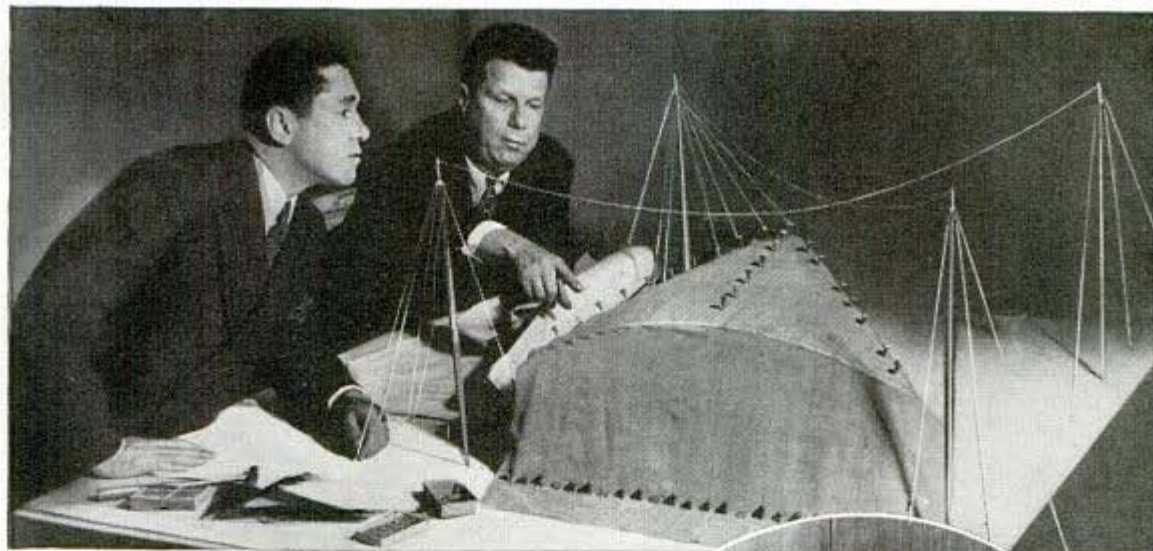
Transparent roller, illuminated by lamp behind stencil, permits easy reading of words as they are typed

Stencils may be read easily while they are being written on an illuminated typewriter roll of transparent Lucite. Light from a lamp fixture above the roller causes the Lucite to glow, making the line clearly visible as it is typed. The roller retains its original smooth surface after long use, as the type does not indent the plastic.

Lucimrol Co 1775 Broadway, New York City

L 169. Cont. Allen Warren Abbott
 343 E 63rd Street New York

Streamlining the Circus in a Suspension Tent



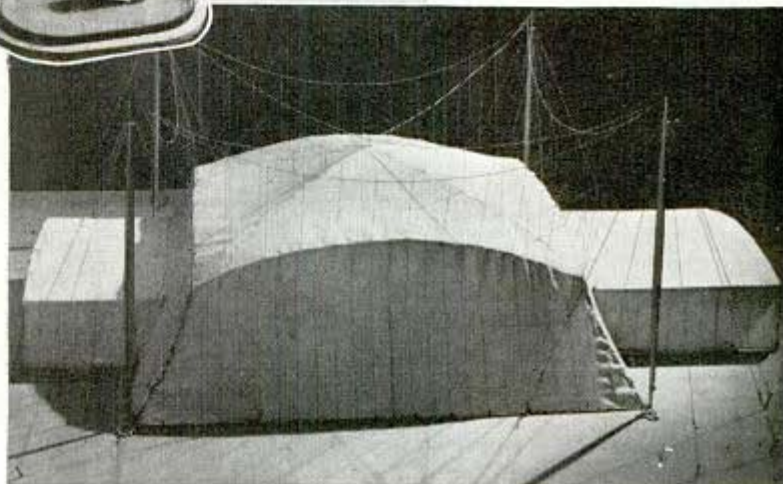
Top, first stage of model of suspension tent for Gargantua and Toto, circus gorillas. There are no inside poles



Above, John Ringling North, circus president, and the designer inspect model of sideshow tent

Norman Bel Geddes, noted designer, has planned a "streamlined" circus for Ringling Brothers & Barnum and Bailey. In the "big top" no inside poles will obstruct view; the canvas will be hung by cables from four 160-foot towers. These pictures show the circus in model form

Right, suspension tent with entrance and exit canopies houses air-conditioned gorilla cages



Photos © Norman Bel Geddes

In circle, the designer explains details of menagerie tent; at left is a monkey mountain, at right a giraffe enclosure

co. dw. 50 Rockefeller Plaza New York

K1303.

BLIZZARDS



Top, snow gun in operation snowing under portion of movie set. Circle, big refrigerating unit, one of several used to cool "ice box" in which movies are made

457 S. Grand
 By R. DeWitt Miller
 Los Angeles, Calif.

"GIVE that actress some hot soup before the steam from her breath hides the leading man!" barked the director. "See that the Snow Men keep the temperature below freezing."

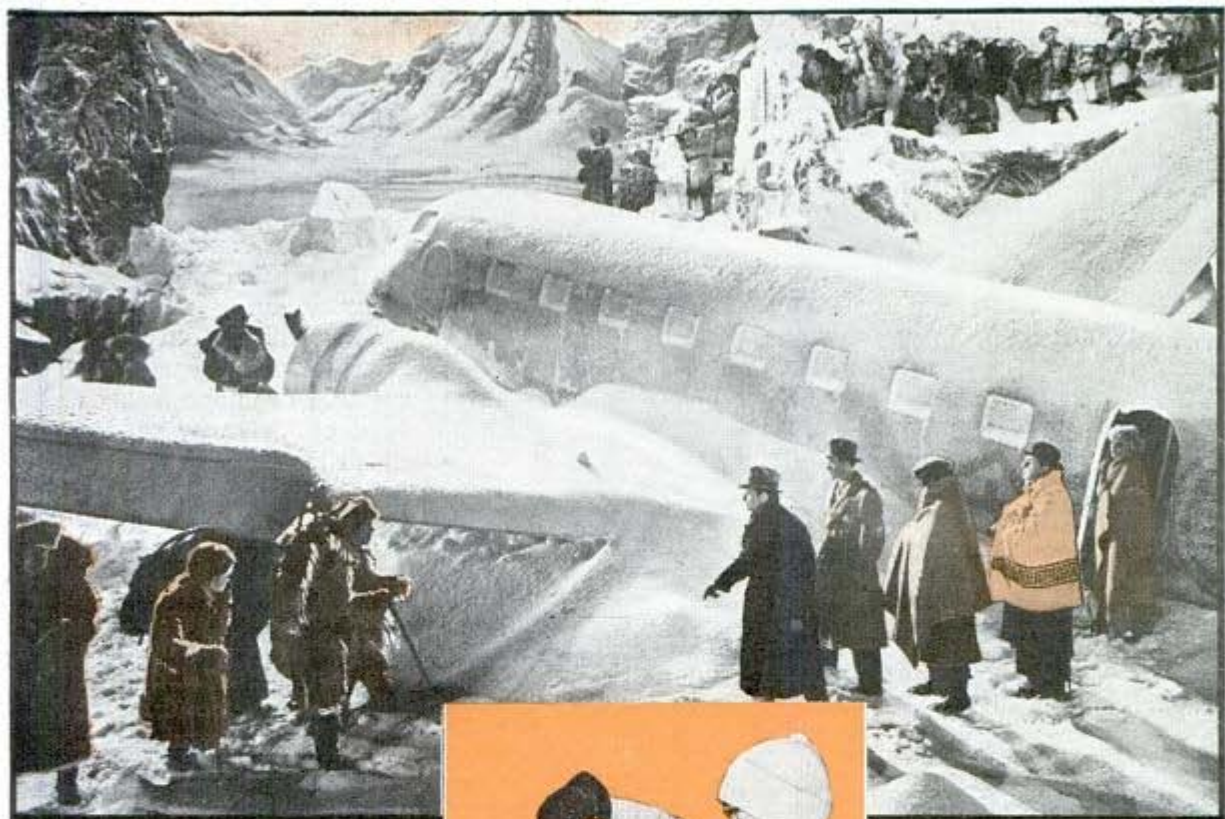
Voices echoed across the snow: "Soup wanted!" "Snap into it!" "Soup over here!" "Hey, don't let that lens get hot, it'll fog!"

Property men and electricians moved stiffly in the numbing cold. A bit player sat cracking the ice off his beard. As the actress had swallowed the last of the soup, the director waved his hand. Instantly motors coughed into life. A 50-mile-an-hour wind came howling out of a battery of fans driven by giant engines. Snow-gun crews began to feed 100-pound ice blocks into their machines. Men holding the snow hoses braced themselves as they directed streams of powdered ice into the blast of wind.



Controlling a writhing snow gun, which fires 10 to 15 tons of snow an hour, is not easy

MADE TO ORDER



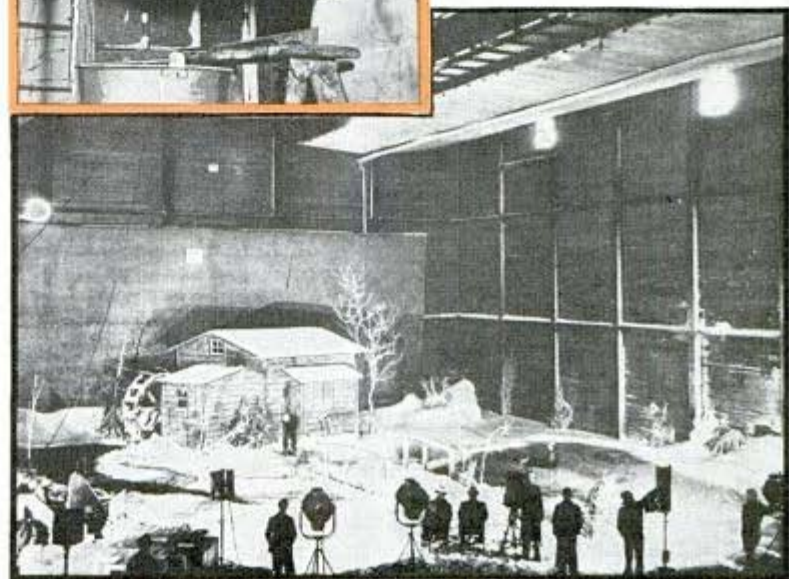
Note how natural is this scene created with aid of snow guns

Left, icicle taken from refrigerator is frozen to set with water

Below, interior of "ice box" during filming of a motion picture

At the center of action the blizzard struck in full force. Actors leaned into the wind, as the flying snow stung their faces. Cameramen kept one eye on their lenses. The actress spoke her lines. The director grunted satisfaction. Motors whined to a stop. The blizzard ceased. The cast went into the "de-freezing" room, where the temperature would be gradually brought up to the 90 degrees of the sweltering streets outside. The day's work was over—except for the Snow Men.

They were left with the job of keeping the "ice box" below freezing until the next day's shooting. That meant that the giant refrigeration engines would have to be kept





to give a realistic Swiss Alpine party. She called up the Snow Men: "Can you cover half a mile of road with snow? I want my guests to drive up to the door in sleighs." Out into the blazing California sunlight went trucks loaded with snow guns. Following them came a long line of vans carrying ice blocks to supply the ammunition.

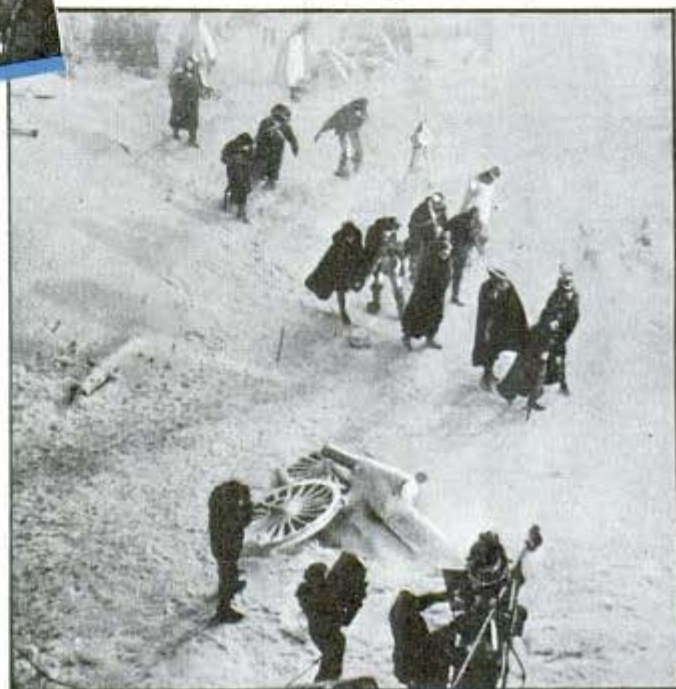
First, the half mile of road was surveyed and suitable drainage ditches laid out. Snow melts much more slowly if the water is carried away. Next the road was covered with a layer of crushed ice. This cooled the ground and acted as a foundation for the snow.

On top of the ice, the guns laid down a thick coating of powdery snow. Although this snow is in reality finely ground ice, it acts and looks exactly like natural snow. It also has the same photographic texture.

As a finishing touch, a few deep drifts were added on the sides. The snow guns can build drifts with amazing speed. Once

(Continued to page 139A)

Below, movie scene being filmed in "blizzard" created by snow guns and large fans



Top, ski slide being built with snow guns.
Center, blocks of ice being fed into crusher, thence into snow guns

going all night. Snow-gun crews would have to patrol the set, adding snow where needed, removing footprints, deepening drifts.

But such jobs are all in the day's work for the professional blizzard makers. Founded originally as an aid to the creation of realistic movie snow effects, the California Consumers Corporation, or the Snow Men, soon discovered there were snow-making jobs in many unusual places.

Not long ago an actress decided

R. Van Slyke
 230 W. Jefferson Blvd
 Los Angeles

L109

New York City Information Center
Perseus Square
Mrs. Edward Higgins

Doll Helps Show How "Iron Lung" Operates

Placed on exhibition in New York City, a working model treated the public to secrets of how the "iron lung" works. The model, attended by a nurse, consisted of a "breathing" doll partially enclosed within a transparent iron lung, illustrating how an infantile paralysis patient would use the respirator.



"Breathing" doll, supine in transparent "iron lung," is being exhibited in New York City so general public may see how apparatus is manipulated

L86

Acme

Variable Hazards on Indoor Course Give Golf Practice



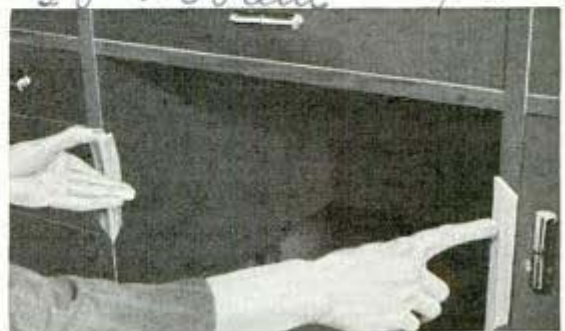
Adjustable hazards are the special feature of an indoor golf practice apparatus upon which nine holes of golf may be played in seven feet of space in your home. To obtain different playing surfaces, the hazard disk is turned. After each shot, the ball is returned automatically to the player whether "holed out" properly or poorly played. Regulation balls and clubs are used. The game packs into a size 33 by 33 by 6 inches for storing.

Disk in center should be turned after each stroke to provide new hazard

L162

Rubber Guards for Corners of Desk Protect Hosiery from Damage

Corners of wooden desk legs frequently become splintered, and if left unprotected may damage the secretary's silk stockings. To do away with this annoyance, rubber corners now on the market can be attached to the desk to prevent damage to hosiery.



Guards are applied to desk legs with rubber cement

Write to the manufacturer or distributor listed in the index starting on page 4-A to learn where to buy commercial products described in this magazine. Say you saw it in Popular Mechanics.

The Chardon Rubber Co. 699
15 E. 26th. New York City

master
The Puth. Product Co.
880 Atlantic Ave.
Atlantic City, N.J.

Buses Hasten Mail Service Where Trains Do Not Run



Resembling a passenger coach outside, but containing complete equipment for handling mail, highway bus will augment service to wayside stations

Highway postal service is being introduced by the United States Post Office Department. Manned by picked crews and equipped with the same facilities for sorting, handling and dispatching mail as found in railway postal cars, a fleet of buses will provide swift and efficient mail service to post offices along routes heretofore inadequately covered by existing methods and to points where train service has been discontinued. It is pointed out that the service is not to be used in competition with railway mail service.

Cross-Country All-Cable Phone Starts on Last Link

Laying of the last link in the country's first all-cable transcontinental telephone line has been started on a 1,600-mile stretch from Omaha, Nebr., to Sacramento, Calif. It is being buried underground nearly its entire length by special tractor-

hauled "plow trains," along a right-of-way that avoids highways and assures protection to the cables. The line consists of two cables, and when completed will supplement "open-wire" aerial phone lines, increasing transcontinental circuits initially by about 50 per cent and ultimately may almost triple present facilities. Bell Telephone System is spending nearly \$20,000,000 on the new underground link.

Waterproof Pliofilm Socks Keep Feet Warm and Dry

Waterproof, transparent socks made of thin Pliofilm are offered for industrial workers, outdoor sportsmen and others who are frequently exposed to cold and dampness—such as firemen, delivery men and mail men. Lightweight and pliable, but tough, these foot-shaped slippers are intended to be worn between the stockinged foot and the boot or shoe.

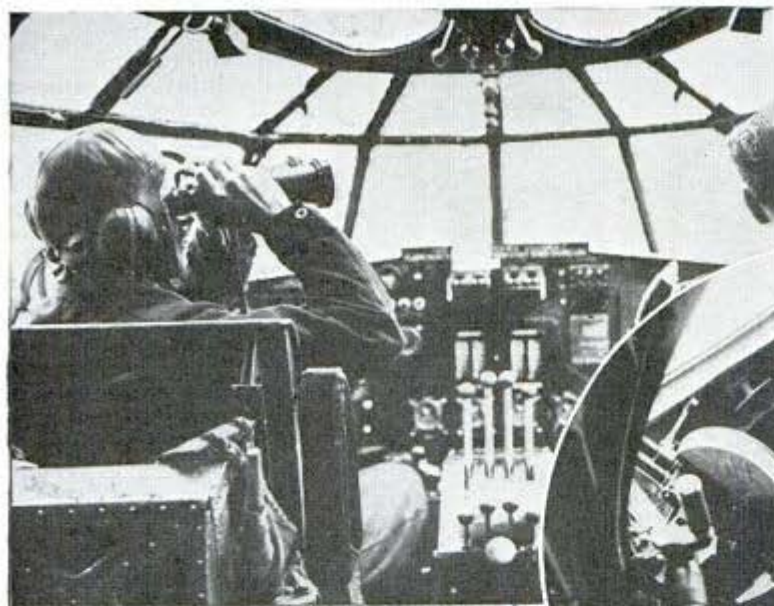


Worn over the sock and inside the shoe, these transparent Pliofilm "slippers" keep out cold and dampness

214
The White Motor Co. Cleveland Ohio
American Tel. & Tel. 1950 roadway New York
125
Proter Products, 61 Onehop, Jersey City, N.J.
Dept. shoes
Pedettes 12 Janis

L 121

Flying Battleships Patrol the Seas for Britain



Scanning the skies and the seas with his glasses, the second pilot (left) of a Sunderland flying boat watches for signs of the enemy as the big ship escorts a convoy of merchant vessels toward England. The first pilot is at the controls to his right



In the circle at right, one of the Sunderland's gunners, alert for a fight, sits in one of the upper fuselage turrets. These sky battleships are heavily armored and formidably armed



The massive proportions of the flying boats, which have flown millions of miles over the North Sea and Atlantic on patrol duty, can be realized by examining the gun turrets, fore and aft and in the upper fuselage, on the craft at left, shown as it swoops to inspect waters where a submarine may be lurking

From his bridge, known as the "control position" (right), the captain of a British Sunderland gives orders to the gunners. Besides meeting and bringing in ocean convoys, this ship goes out in all weather to hunt down and attack submarines, to watch for enemy warships and perform general reconnaissance work. Its four "Pegasus XXII" engines develop 3,600 horsepower and the craft can cruise 2,000 miles

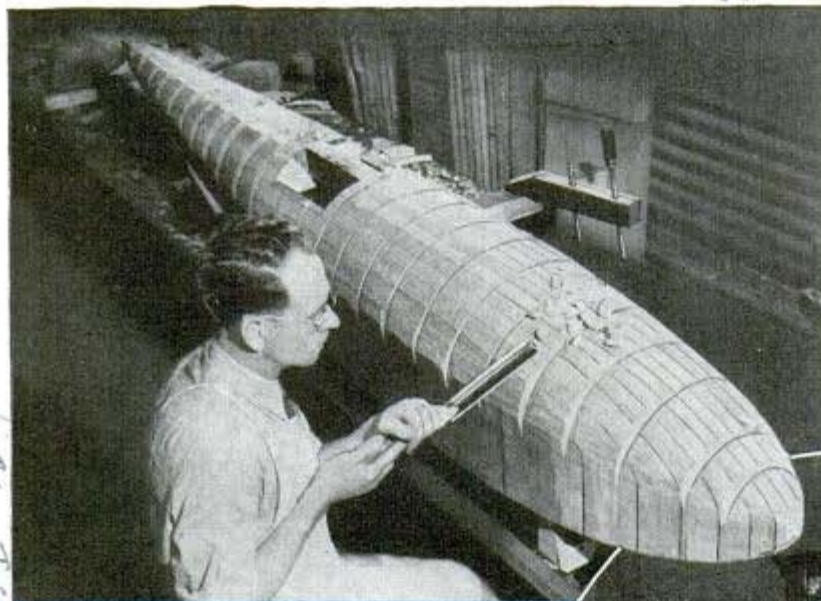


R 1475

U.S. Navy, *England*
W. Taylor Testing

"LITTLE NAVY" TESTS

Basin



In a miniature ocean—a 1,200-foot basin at Carderock, Md.—America's "little navy" consisting of models of warcraft is put to tests that will show how the full-size battleship will operate

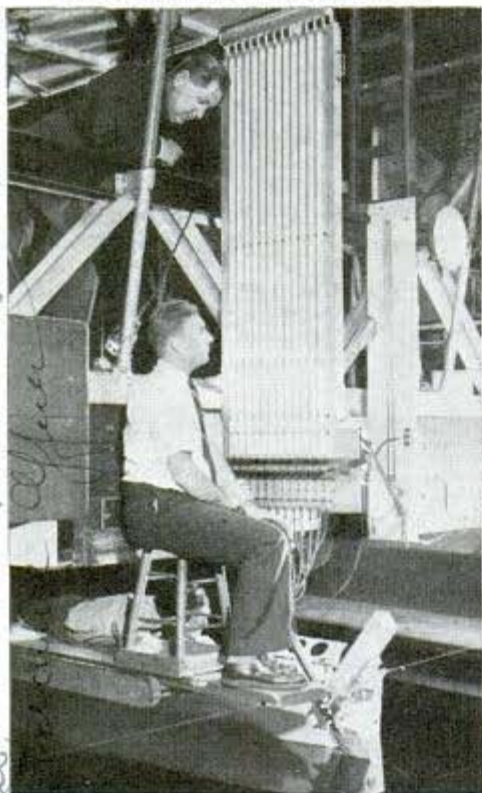
Circle, below, two engineers on carriage towing a model in the basin record data pertaining to ship design characteristics. The 20-foot wooden models are made from ship plans

© Harris and Ewing

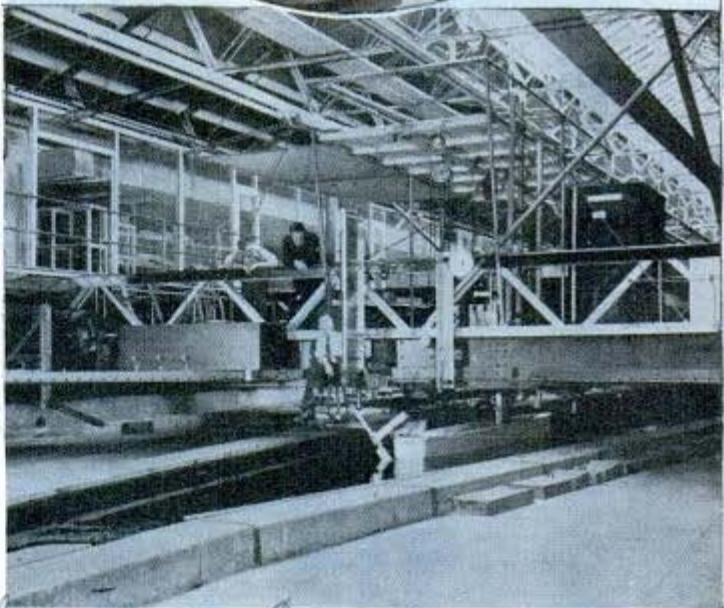
350 Madison Ave. New York



Above, modelmaker fairing seaplane pontoon for test in the basin. Operations at Carderock are conducted by the Navy



Above, ready for test of model hull, shown just beyond seated engineer. Right, view of mighty test carriage, weighing 33 tons, which travels without deviation exceeding 1/1000 inch in up and down or side motion at speeds up to 10 knots

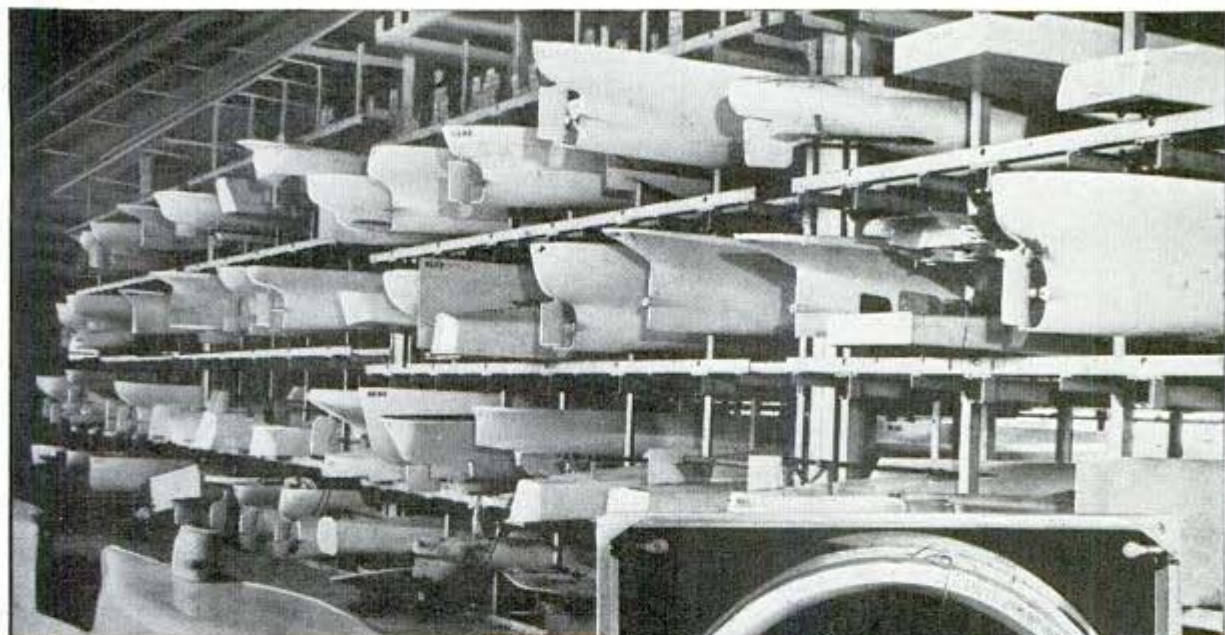


*Commander Bull by Machinery Builder, due-
Irving P. Daniel
1301-27th Av. Astoria, O. T. N.D.*

*Rails - Bethlehem Steel Co
Bethlehem Pa*

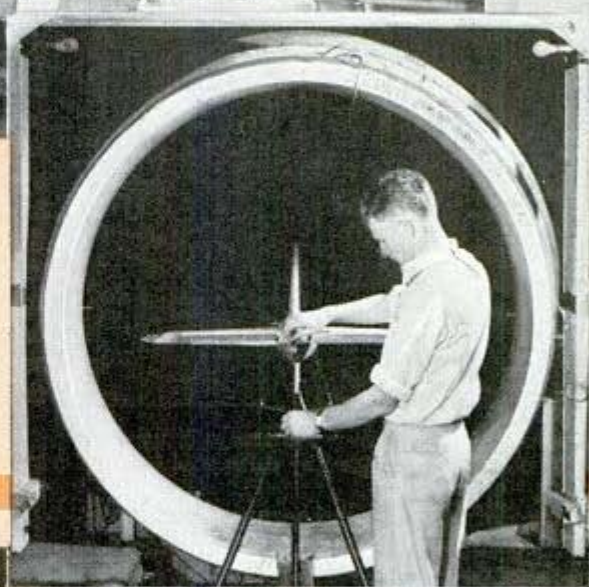
R 1475-

OUR FUTURE FLEET

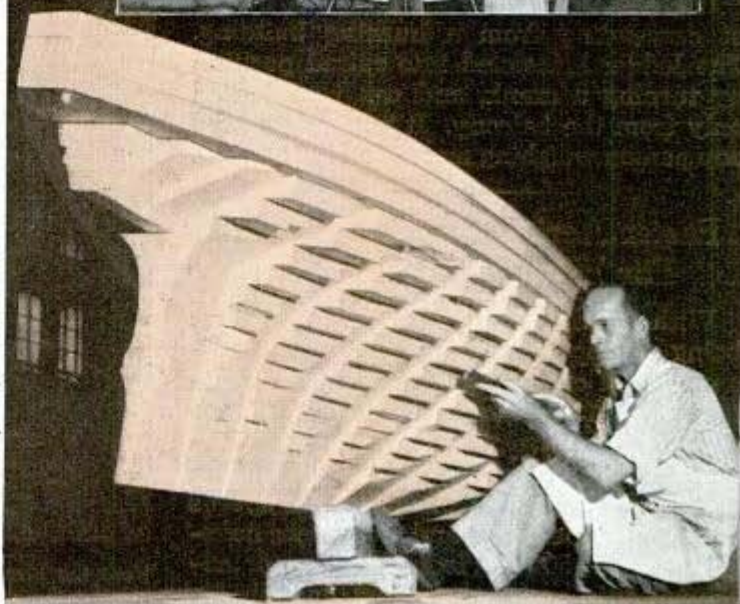


Above, 10 and 20-foot models of ships that have been tested. Right, setting navy plane model for test in wind tunnel at Carderock

Below, models of navy planes. Wires from model in wind tunnel to recording instruments show strain and stress a plane can take

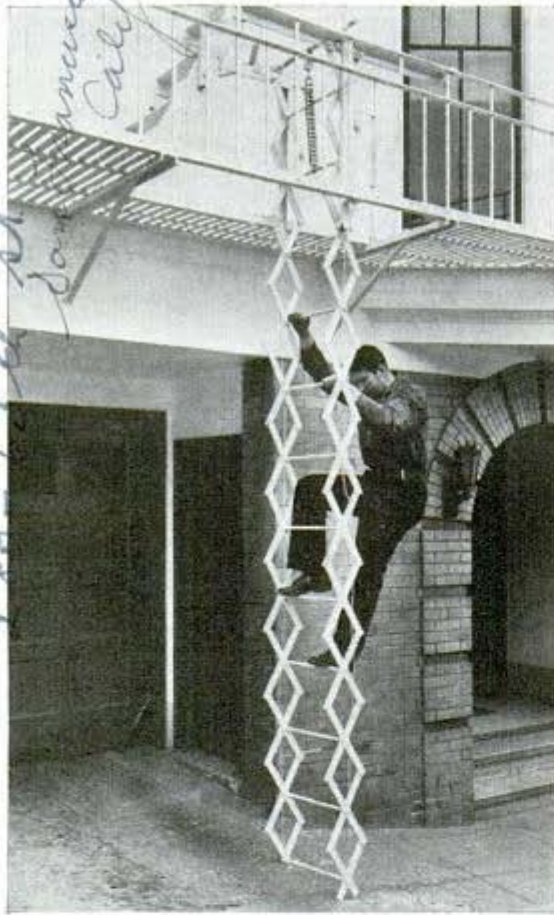


Right, model hulls are made of sugar pine, glued and doweled. In shaping and smoothing the hull, accuracy to 1/100 inch is required



Science Service
Jan 23, 1941

Folding Fire Escape Ladder Lowered by Trip Handle



Quick means of descent from fire escape balcony of burning building is provided by collapsible ladder

Lowered from the fire escape by releasing a trip handle that locks it in place, a collapsible ladder provides a quick means of descending from a burning building. The ladder is hoisted into raised position by turning a crank, and can be released only from the balcony. It will safely hold any person weighing more than 200 pounds.

Faster Aerial Cameras Needed For High-Speed Bombers

With speedy bombers and pursuit planes being equipped for taking pictures, ordinary aerial cameras with maximum shutter speed of $\frac{1}{150}$ of a second are much too slow for effective work, according to Revere G. Sanders, of the Fairchild Aviation company, since such planes attain speeds of 400 miles per hour and sometimes operate as low as 500 feet from the ground. Although this exposure is fast enough for

pictures from greater altitudes, or from lower heights with slower planes, faster shutter speeds are needed for today's military planes. Assuming that movement of the image on the film amounting to one twenty-fifth of an inch would be the greatest permissible, Mr. Sanders recommended, after experiments, that cameras be made with a speed of $\frac{1}{500}$ second to give satisfactory results at 500 miles an hour from 500 feet.

Screw Changes Tractor Tread With Power From Engine

To do something about the hard work involved in changing the tread of his wide-axle farm tractor, Otto Dekker of Granger, Wash., developed a left-hand and right-hand threaded axle which saves jacking up the machine, releasing the clamps and then driving the big wheel along a tight-fitting "splined" axle. Under the new system, the wheel, having a special hub, is run onto the right-hand thread, and then a split block, which catches a flange on the hub and fits the left-hand thread, clamps the wheel firmly to the axle. To change the tread, the split block is unbolted, the tractor side brake is set and the drive axle is revolved forward or backward, thus screwing the wheel toward or away from the tractor chassis, as desired.



Here the inventor is holding half of the lock block against threaded axle to show how it clamps on hub

Patterson + Koster Iron Works

Jamaria, F. I. New York

2156

Nothing But Lightning Can Stop a Steeplejack

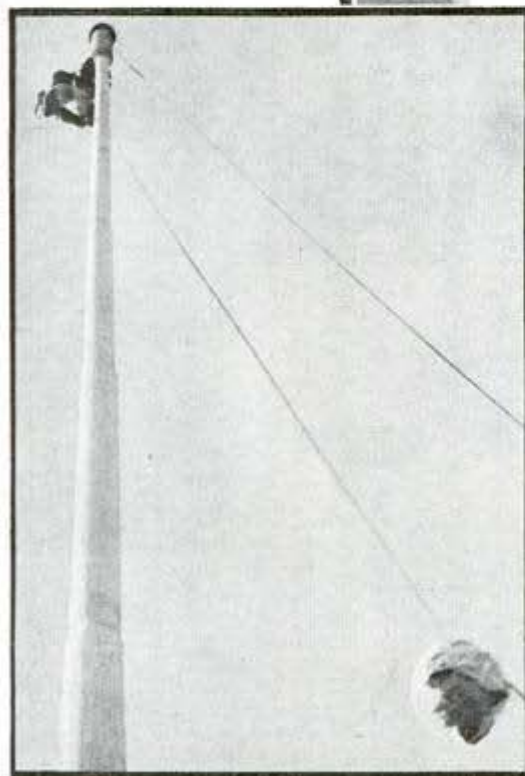


Steeplejacks start at top and work down. Here's a new coat of paint for a flagpole



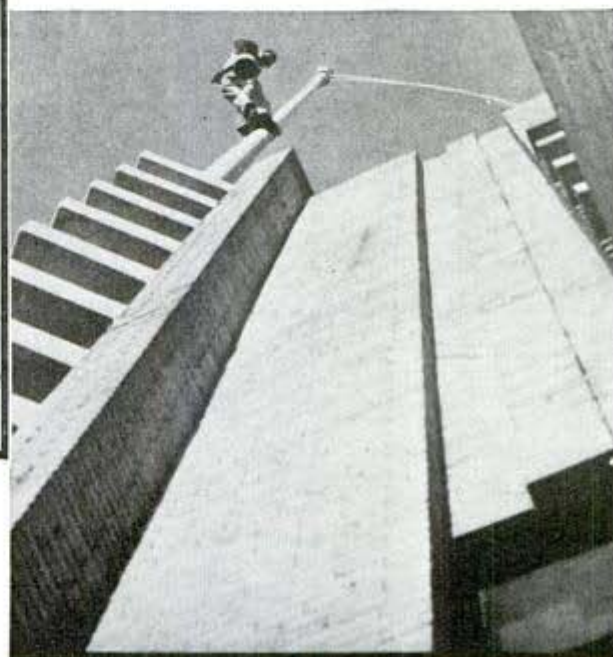
Chrysler

Empire State



Precariously perched atop a skyscraper flagpole, the steeplejack (above) waits while ball is sent up by means of halyard. Used to perilous places, these men really fear only lightning; they'll work in wind and cold, but never rain. Notice the pole is made of graduated steel sections, welded at the overlaps

Andy Collins
Above, climbing a 75-foot flagpole by inching up first the top rope, then the lower. Below, nearing the bottom after the day's work; what appears to be steps is really a series of cornices supporting the tall flagstaff



Acme

K1302 Cmt. W. L. Wright
580 Market St.
San Francisco
Calif

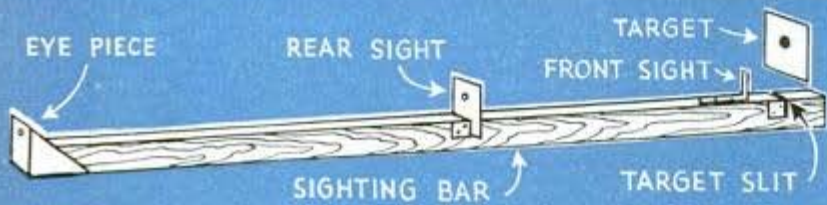


AMERICA'S DEFENDERS

FIRST they send all the student buglers deep into the woods around camp, lest their snortings disturb a serious business. Then the Army settles down to its problem of turning hundreds of thousands of young Americans—volunteers, who chose soldiering as a career, and “selectees” who registered last October to train for the looming emergency—into straight-shooting riflemen.

“A soldier’s a soldier, whether for one year, three years, or a lifetime,” said a major thoughtfully, referring to the salesmen, bank clerks, barbers—the young men of every trade and no trade who are pouring into mushrooming army camps the country over, to learn defense as a second trade.

Left, sighting a Garand immovable in rifle rest; target is moved until pupil is satisfied, then coach checks aim. Right, firing at fixed silhouettes and pendulum target



Above, learning rudiments of marksmanship with “sighting bar”; bull’s-eye in alignment appears in peephole as at right

At left, the sighting bar, a wooden stick with four pieces of tin. After aiming, it is “frozen” for check by the instructor

21302

on the FIRING LINE



Firing at aircraft, the marksman (upper right) starts on left knee, pivots smoothly to follow target through 180-degree arc, finishes on right knee. Target at lower left simulates a diving or climbing plane

Note perfect three-point support of rifleman's body in kneeling position, "hasty" sling adjustment, with Garand rifle

"We've got to teach these fellows to shoot, and we've found only one best way. In three weeks a man can get all the mechanics of marksmanship, and gain confidence. After that we can get him into the finer points. They won't all qualify as sharpshooters in a year, but many will. And they'll all be real riflemen."

So the selectees are going through Course A of the Basic Field Manual for U. S. Rifle Caliber .30 M1, generally known as the Garand. The Army believes with reason that it has one of the best marksmanship courses of all the world's armies, and one

of the best rifles. Training begins with intensive physical drill—calisthenics, ball games and boxing for wind and limb, so that a man can hold firing position steady-on, without fatigue. It ends with mastery of a self-loading rifle, gas-operated and air-cooled which will fire eight straight shots in two seconds.

Save for preliminary lectures the Army likes to train its marksmen man-to-man, rather than in large classes where inatten-

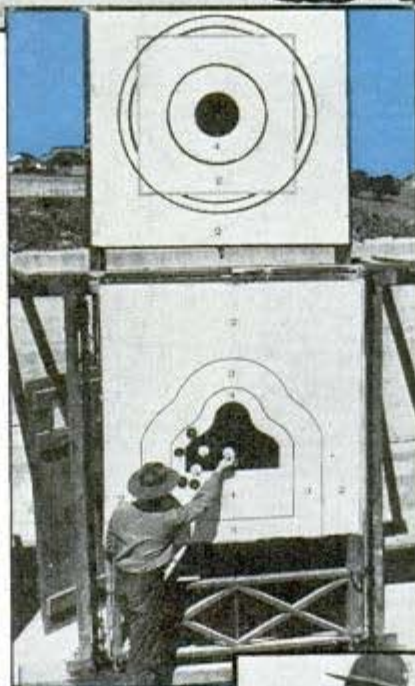


Prone, kneeling and standing positions are demonstrated, above, on 500-yard range. Right, placing "spotters" in hits on rapid-fire target representing enemy in prone position; upper bull's-eye is usual 500-yard target

tion comes easy. Divisional or regimental commanders may decide whether recruits are first trained in "awkward squads," or absorbed immediately into their companies for instruction by veterans of the front rank. Both systems are in use, but under either, a coach is preferably detailed to each raw recruit. Officers and non-coms supervise their groups of paired soldiers.

As soon as the recruit receives his rifle, before a shot is fired, he must learn it well as a piece of machinery. The name of every part, disassembly, reassembly, care and cleaning, functioning and operation (with dummy cartridges), immediate cures in case of stoppage, all are drilled into him. He learns how a part of the expanding gas that drives the bullet is diverted, to eject the empty cartridge, load a live one, and cock the piece for the next shot—until the eighth is fired. Then the empty clip flies out, and the chamber automatically yawns to receive a fresh clip.

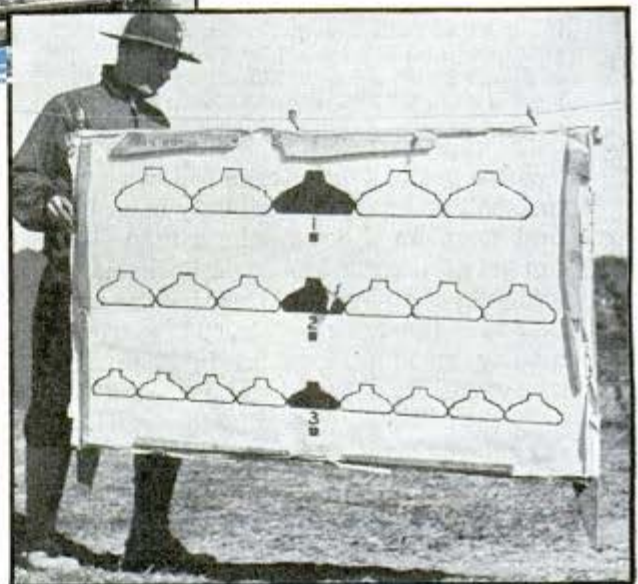
Instruction in the various types of ammunition—ball, tracer, armor-piercing,



gallery-practice, guard, blank, dummy—prepares the soldier to learn marksmanship, but the fundamentals come first as usual. He stacks his rifle, deserting it for a wooden "sighting bar" which magnifies minor errors and reduces the science of drawing-a-bead to basic principles. It's a four-foot wooden bar and four bits of tin—a fixed peephole; exaggerated front and rear sights, and a movable bull's-eye which is wiggled in its slot (by an assistant) until the pupil thinks he has hit it. The coach takes his turn at the peephole to approve or criticize the pupil's "frozen" aim.

Now the soldier returns to his rifle, which is fixed immovably in a slotted box or rifle rest. The assistant is fifty feet away with a larger movable bull's-eye, contrasted against a sheet of paper pinned to a box. Sighting along the rifle without touching it, the pupil di-

The target below travels on wire to simulate a moving vehicle



K1302

Coaches drill pupils (right) in sighting, loading, trigger squeezing and holding breath in rapid fire with dummy cartridges

rects the moving of the bull's-eye. When he's satisfied, the coach peers through the sights to check his aim, or a pencil point through a hole centered in the bull's-eye gives a readable "group" of several "shots." A good group at fifty feet should be covered by the end of an unsharpened pencil.

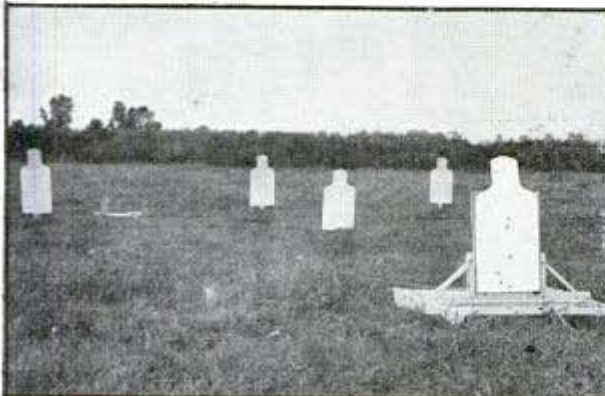
Still, not a shot has been fired—nor is one, until the recruit has mastered the prone, sandbag-rest, sitting and standing positions for firing, with sighting exercises in each. He must learn the "loop" and the "hasty" methods of steadying his rifle with its leather sling. He must learn to hold his breath, and above all he must learn the gentle trigger-squeeze.

A marksman must never know exactly when his cartridge is to explode. If he knows, he will flinch from it and spoil his aim. A quick jerk at the trigger would spoil the aim anyhow, by its muscular spasm alone. Steady aim, a steady increase of trigger pressure add up into high scores, unmarred by flinching, shoulder hunching to meet the recoil, and finger jerking at the critical instant of discharge.

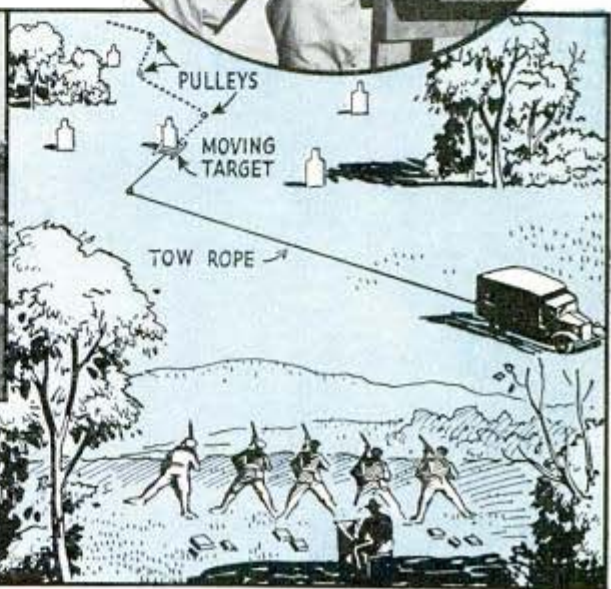
To cure "flinchers," after they've been
(Continued to page 116A)



One telephone (right) connects with ten targets, keeping the firing points and the pits synchronized



The sled targets, above, represent moving soldiers on the combat field. They are pulled across the range by a truck



Drawing at right shows how target sleds are drawn in zigzag course at varying speeds by means of staggered pulleys

296.

Sliding Bracket on Dresser Adjusts Height of Mirror



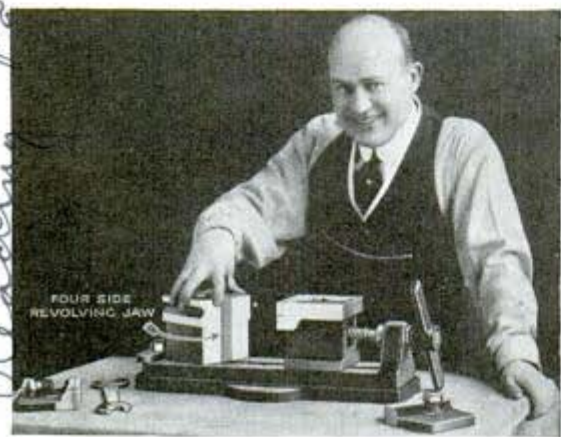
With this sliding holder installed on dresser, mirror may be raised or lowered to any desired height

So simple to attach that anyone can install it, a sliding holder for dresser mirrors has been patented. The bracket fits virtually all dressers and chests, permitting the mirror to be placed at any desired height.

150

Four-in-One Vise Is Converted By Turning Four-Sided Jaw

By turning the revolving jaw of a new universal vise, it can be converted instantly to hold work in a horizontal or vertical



Jaw at left turns to hold the work at desired position

Reported by L. Mc Bertholf
Bureau of Entomology and
Plant Quarantine
position. Actually its four-sided jaw makes
it four vises in one. It will hold round,
square, octagonal, flat, rectangular or an-
gular pieces without special rigging, and
can also be used as a jig.

Safe Orchard-Spray Kills Worms But Does Not Harm Bees

Dealing death to apple worms, but harm-
less to bees, a new poison-spray material,
phenothiazine, is being tested by U. S.
Department of Agriculture. In contrast,
arsenical sprays commonly used in con-
trolling the codling moth, whose larvae
are the "worms" found in apples may be
deadly to bees gathering pollen from
sprayed orchards. In tests, bees which
were given heavy doses of phenothiazine
showed no apparent ill effects.

117

Legless Driver Operates Auto With All Hand Controls



Bell-shaped housings beneath steering wheel contain levers to operate clutch and brakes by vacuum power

Fitted with hand-operated vacuum con-
trols, a standard automobile has been
changed so that a legless driver may op-
erate it safely. The changes involved instal-
lation of an upward extension from the
throttle and operation of the clutch and
brake by engine-generated vacuum. Two
bell-shaped housings under the steering
wheel contain the extra levers, the mech-
anism being designed for and installed in a
1941 fluid-drive Dodge by H & H Wheel
Service of Detroit, Mich. A reserve vac-
uum tank provides power to operate the
controls while the engine is stopped.

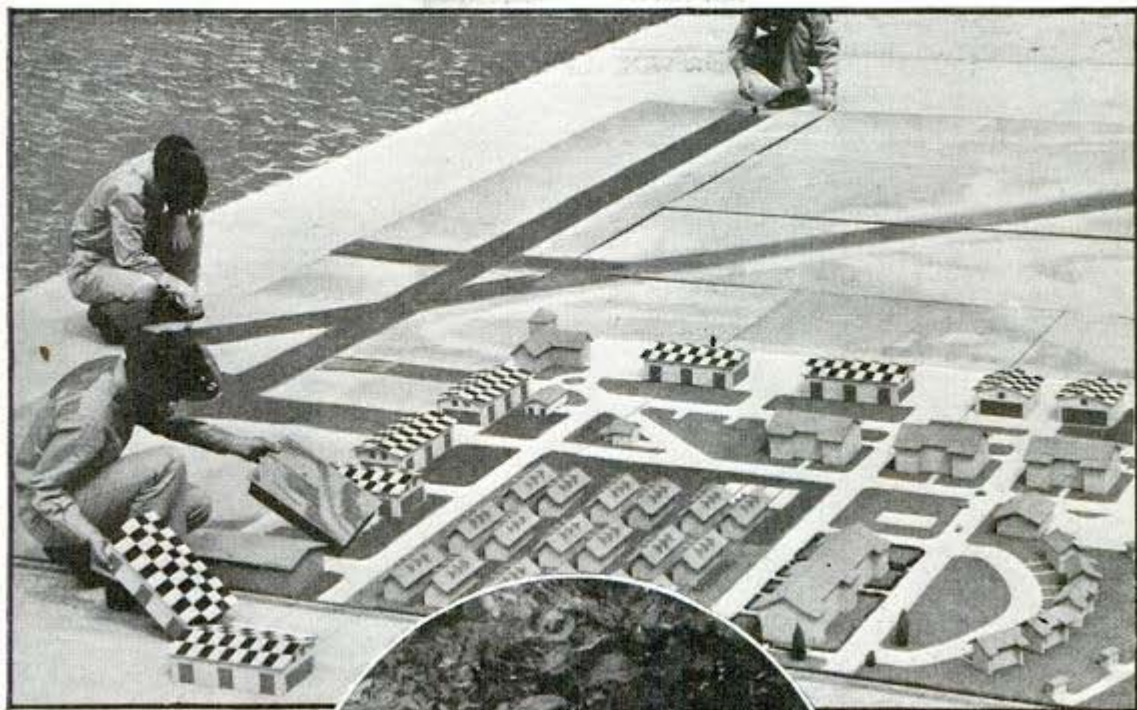
Jack Barrett, Hotel Baymels
Came to 217
Brown Engineering Co.
Reading, Pa.
1237
710
Third

and 15 Plus
and other materials
190
part made by Midland Steel Products Co.

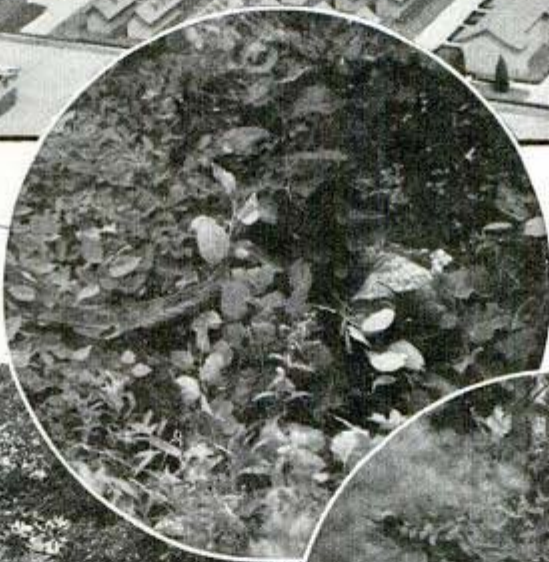
29
Stimie

L147 Engineer Board Headquarters
at Fort Belvoir, Va

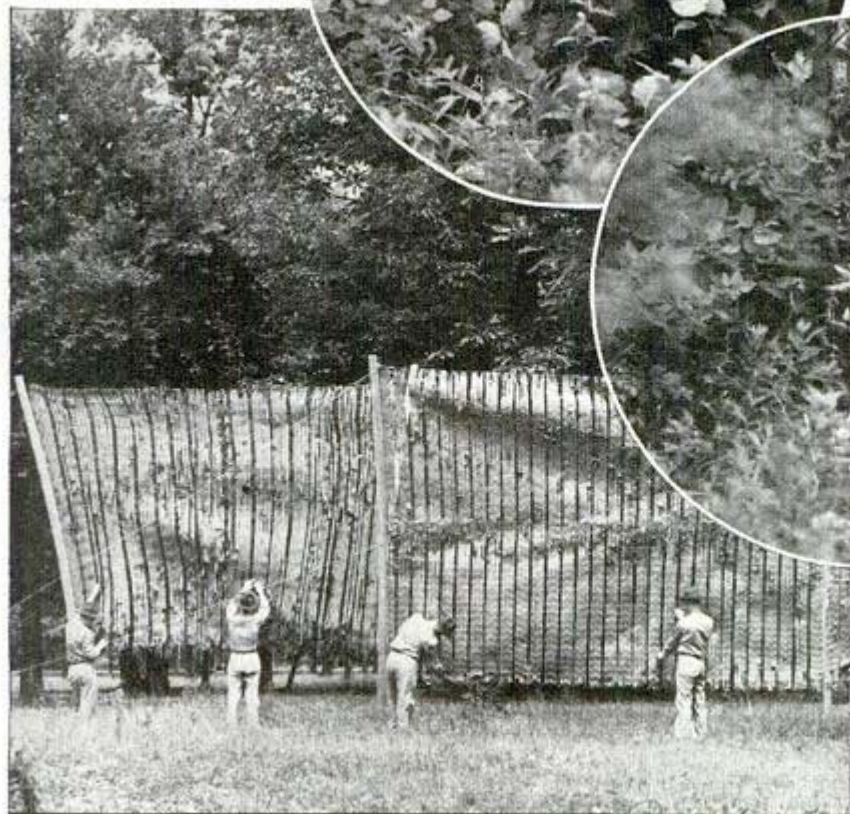
War Paint and Screens Veil Army Movements



Using an airport model (above), U. S. Army engineers are testing visibility of conventional coloring and "war paints"—camouflage. Object, to confuse enemy airmen



In the circle below a soldier in regulation khaki is an easy mark for enemy guns. In upper circle the same man is skillfully hidden by a net garnished with foliage



The art of modern camouflage calls for varied treatments, requiring imagination on the part of every soldier. The curtain at left betrays existence of a road, but conceals from the enemy the movement of traffic

R960
Cont. by La Tour
35 N. Raymond St.
Pasadena Calif

STREAMLINED



THE buzzer echoed through the small office that served as Life Saving Headquarters at Balboa, Calif. The operator on duty plugged a cord into the P B X board beneath the flashing light labeled "23rd Street."

"Send the rescue car down here, someone's in trouble in the surf and I'm going after him."

The operator flicked over the switch of the radiotelephone.

"Headquarters calling beach rescue car, get down to Twenty-Third street, there may be a drowning."

"Okay, we're on our way. This is Bill."

Thus starts the sequence of streamlined lifesaving and rescue work on the Pacific coast where telephone, radiotelephone, and surfboards are reducing to a minimum the toll of lives lost in the surf.



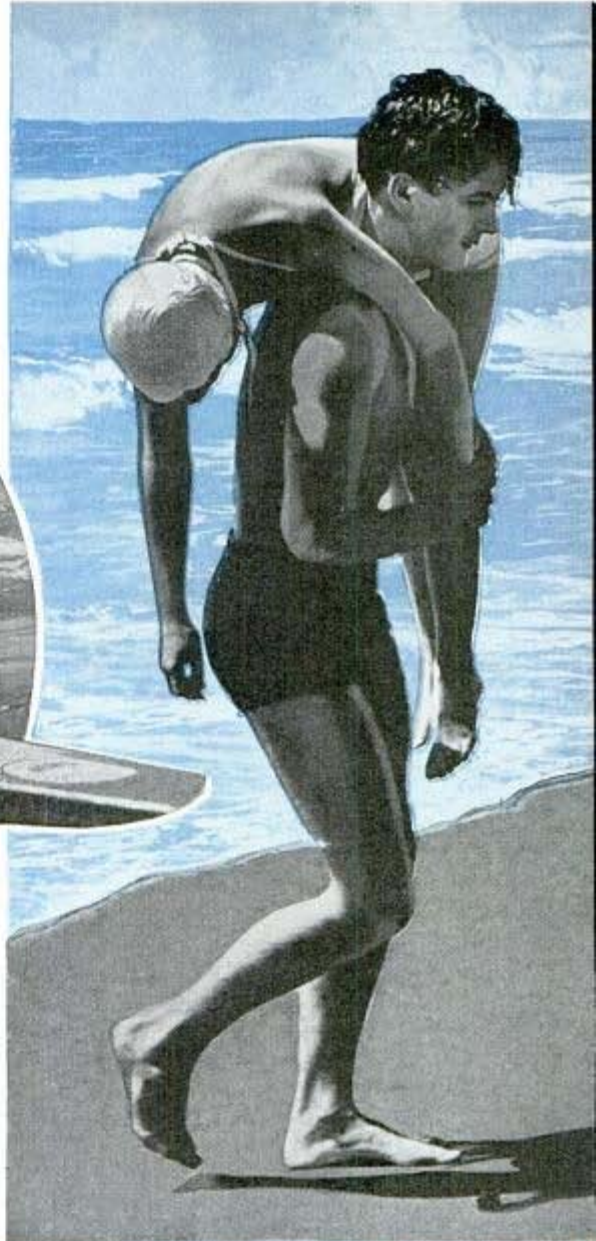
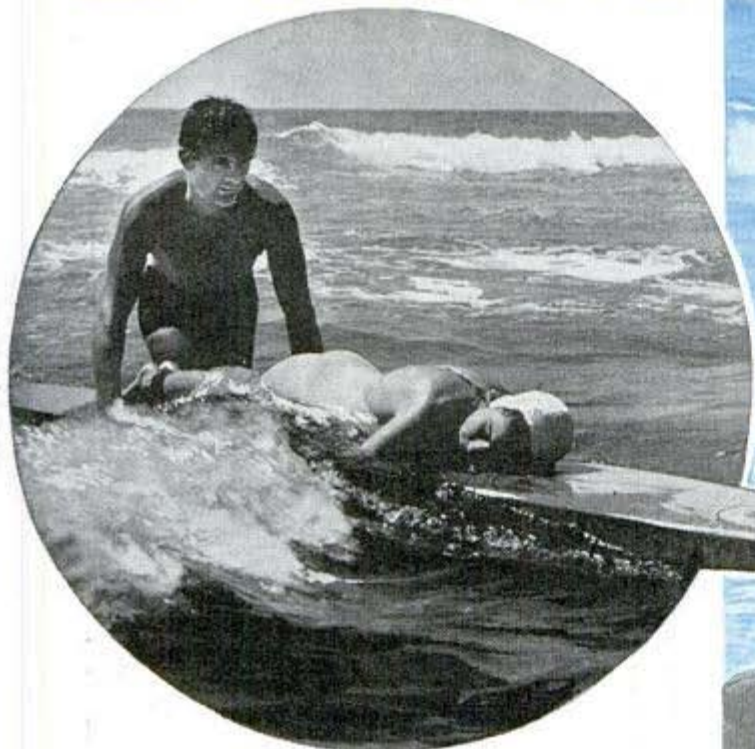
At upper left, a guard in a "crow's nest" sights trouble and telephones to lifesaving headquarters. Above, another lifeguard, spotting the distressed swimmer with binoculars, leaps down and races for the surf



Lifeguard's surfboard (left) slaps the water and is swiftly propelled into the waves for a rescue. "Streamlined" technique is revolutionizing lifesaving

R 969

LIFESAVING



Above, bringing in an exhausted swimmer on a surfboard.
Right, the victim is carried to the resuscitation crew

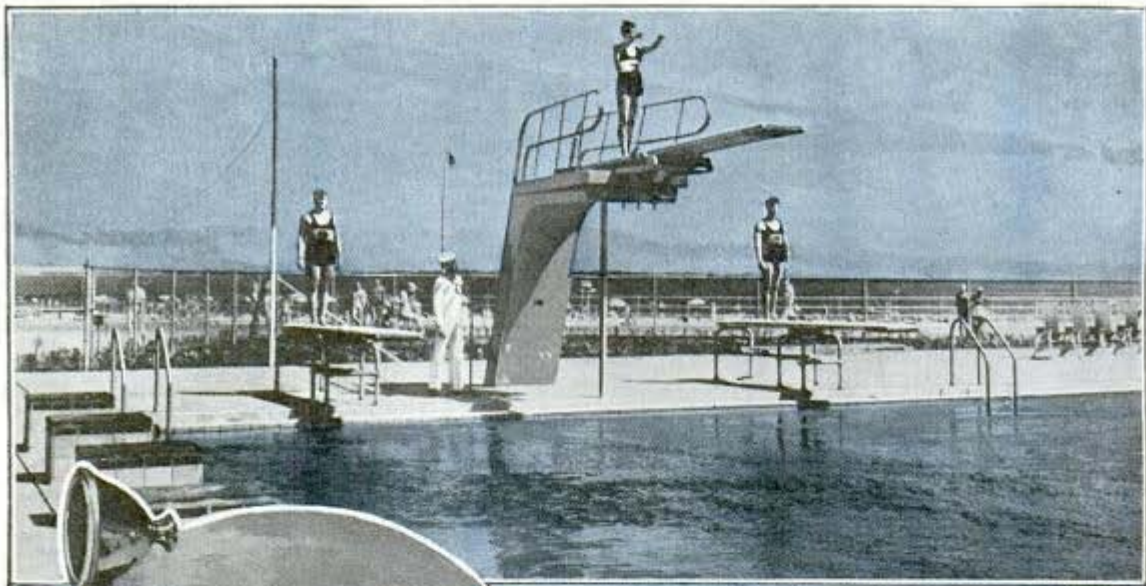
There's a complete change in the technique of rescuing persons from the water. Persons approaching exhaustion while swimming are detected by the lifeguard through his binoculars, from the crow's nest of the lookout tower, and are removed from the water before they are overcome from their own exertions. Bathing in the surf from a protected beach is almost as safe as in a tile-lined swimming pool.

At one resort on the southern California coast last summer more than 50 persons were rescued in a little more than four hours. Four lifeguards using surfboards effected the rescues. It was a record for the streamlined system, and attests to its speed and efficiency.

In the requirements for lifesaving work, as set forth on the applications for beach guards by the Civil Service Commission of Los



Right, rendering first aid by inducing pressure on back while oxygen is supplied through inhalator cup over nose and throat



Above, all set for a triple dive into Olympic Pool at the new Ocean Beach Park, New London, Conn.



Above, reporting to headquarters over the Beach Rescue Car's radiotelephone. Below, revived on the beach, a victim is taken to headquarters for a rest

Angeles, emphasis is placed on ability "to handle paddle-boards, rescue tubes, torpedo cans, and to operate a two-way radiotelephone"; no mention is made regarding the handling of a lifeboat or dory.

Many resorts still use lifeboats manned by two and three-man crews. In some localities this is necessary. But at their best, the big white dories are slow. It is not unusual for these dories to be catapulted into the air when an attempt is made to launch them in a boiling sea. Sometimes lifeguards are injured in the launching. If nothing more, this slows up the work of rescue at a time when seconds may mean life or death.

Let's follow through the sequence of a modern streamlined rescue.

There's a white painted mast, complete with yardarm and crow's nest erected at a vantage point on the beach. The mast stretches skyward 30 feet. From the yardarm two flags fly, one the red and white flag of the Red Cross and the other bearing the insignia of the resort city. Built like a barrel, just below the yardarm, is the crow's nest. This is the lifeguard's station. From here he has an unob-



2969

2191 Duplex Desk Co
280 Madison Ave
New York

Double-Top Desk Can Be Closed Without Disturbing Papers

structed view of a vast expanse of beach and tumbling surf in which thousands of persons are bathing. With binoculars he continually watches the bathers at a point where the crest of waves starts thundering toward the beach.

Just beyond the breakers there's a black speck—a swimmer barely visible to the unaided eye. Intently the guard watches the bather through his binoculars, studying his facial expression. Suddenly he lowers the glasses, picks up the receiver of his direct wire to headquarters and says, "Send the rescue car. There's a fellow in trouble and I'm going after him." Then he vaults over the top of the crow's nest to the beach, grabs his surfboard and runs toward the water. Racing out with the board until he is knee-deep, the guard springs forward to launch it in deeper water. He takes a crouching position, just a few inches back from the center of the board, and paddles swiftly to the bather. He maneuvers to approach from in back and by tilting his surfboard slightly, "floats" the distressed swimmer onto the board, face down. Then, climbing back to the stern of the board, the guard paddles back to the beach, taking advantage of the waves. In shallow water, the guard slides off the board and, using the "fireman's carry," slings the victim over his shoulder and starts up the beach.

The telephone call for help from the crow's nest meanwhile has been relayed over the radiotelephone, and by the time the guard returns to the beach with the rescued man, the cruising beach rescue car is on hand with its resuscitation crew and equipment.

Chief Frank Crocker of the Balboa, Calif., station was among the first to recognize the possibilities of this streamlined method of saving life. Since the inauguration of this system along the vast reaches of beach for which he and his men are responsible, not a life has been lost there from drowning.

(Continued to page 124A)



Rolling desk cover forward leaves top clear as shown in inset

When the day's work at the office is done, a patented two-top desk may be covered and locked without removing papers or other material. The extra top rolls across from behind the desk, and a hinged flap in front closes it completely.

2184

Garage in Trailer Carries Midget Car

Not content with only a home in their trailer, Mr. and Mrs. J. H. Van Blois, of Fennville, Mich., have converted the dining room into a garage in which a midget car may be carried. When they pause to camp Mr. Van Blois adjusts portable runways to the trailer and drives his car in and out.



Midget car enters and leaves "garage" on portable tracks

2107

Spotlight From Floor Lamp Illuminates Reading



If extra light is needed for close work or reading, this spotlight can be directed at the desired place

To provide extra illumination whenever light from the lamp is insufficient for a special purpose, a reading lamp is equipped with a spotlight that also serves as a night light. A universal joint permits the beam to be shifted. The spotlight has a separate switch located below it.

112

Dial Shows Vibration of Motor With Micrometer Accuracy

Motor vibrations can be measured with extreme accuracy by means of a 19-pound



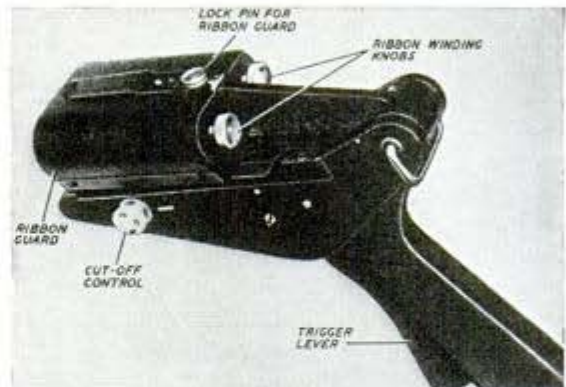
Here an electric fan performs while its vibrations are "read" on the dial of the portable meter

portable meter just introduced. A direct reading is given on a nine-inch dial. The instrument is suitable for measuring stress on castings to determine the breaking point, for checking relative efficiency of various lubricants and for determining the dynamic balance in rotating, reciprocating or vibration machines.

2153

Identification Tags Print Names To Avoid Errors in Army

To reduce the chance of clerical errors occurring in army personnel records, soldiers will be issued identification tags which print like an addressing machine plate. Each tag will bear the name and



"Pistol," at top, imprints identification plate, bottom, on army records to help reduce chance of errors

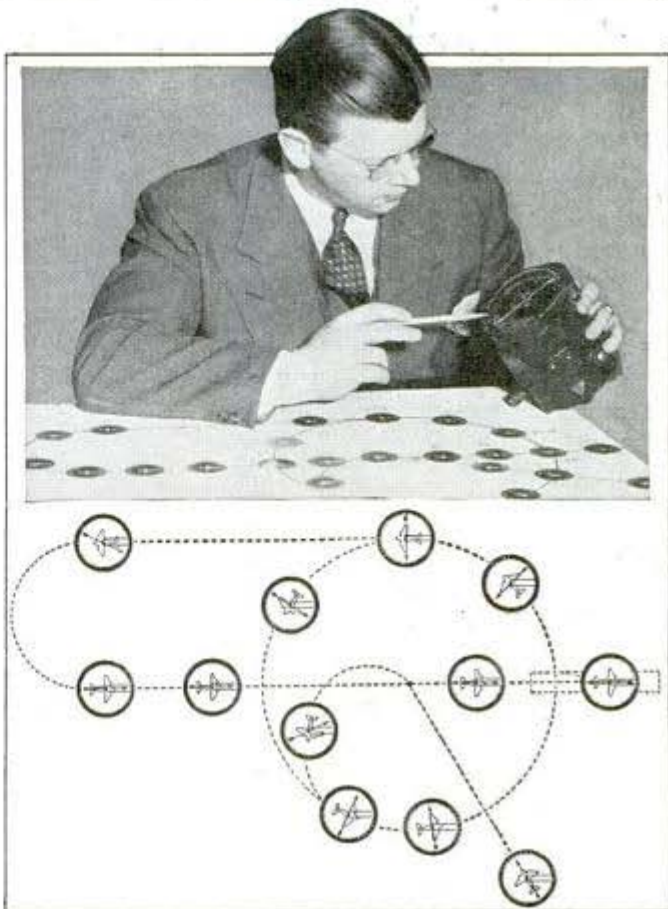
number of the wearer, as well as the name and address of his nearest of kin, in embossed letters that serve as type in reproducing the information on casualty and other records, thus eliminating hand copying. Clerks and medical workers will place the tag in a pistol-like "printer" to stamp the inscription on record forms.

Write to the manufacturer or distributor listed in the index starting on page 4-A to learn where to buy commercial products described in this magazine. Say you saw it in Popular Mechanics.

K1486. Lear Avia, Inc.
Dayton, Ohio

Course and Direction Finder Aids Blind Flying

Many navigational problems of flying are solved automatically by a new "gyromatic navigator" which shows the pilot at a glance his desired course and direction of flight with respect to the desired course, thus enabling him to fly in a straight line toward or away from the radio transmitting station despite drift conditions. The instrument, invented by William P. Lear, combines on a single dial the functions of an automatic radio direction finder and a directional gyro. A double-ended pointer, actuated by the radio direction finder, automatically points toward the transmitting station at all times. The desired course is indicated by a double line etched in a transparent disk actuated by the gyroscope in the base of the instrument. Etched in the glass cover is the outline of an airplane which aids the pilot in visualizing his flight problem and gives its solution. The 360-degree scale can be adjusted manually to show bearings off the plane's heading off magnetic north, or off true north. Besides making possible a straight-line flight without



Top, pointing to instrument dial. Diagram, bottom, shows dial action as plane approaches, circles, then lands on runway

visual references outside the airplane, the "gyromatic navigator" permits rapid instrument approach and, with the aid of an altimeter, a blind landing if necessary, using a single non-directional marker located on the runway. Briefly, here is how landing is accomplished. Before the pilot reaches the airport he sets his desired-course indicator in line with the exact direction of the runway, and before descending for his final approach he flies directly over it. As soon as the ship passes the sta-

tion, the double-ended pointer reverses, showing that the station is now astern. Then the pilot turns toward the left until the radio station is shown to be directly to his left. He continues to circle, keeping the station in that relative position, while he loses altitude. At the proper altitude, he makes the final approach to the runway, guided by the desired-course indicator, and when the radio indicator again reverses to show that the ship has passed over the station, he levels off for a landing.

Trigger-Operated Soldering Iron Leaves One Hand Free



Feeding solder at the pull of a trigger, a one-hand electric soldering iron leaves the other hand free to manipulate the work. Solder comes from a spool mounted behind the handle, a spring returning the trigger to "feeding" position after it has been tripped. Made in England, the one-hand iron operates on 200 or 250 volts alternating or direct current.

Rumbaker Electrical Products
71 Oxford Road, Manchester, England.
no. 22...
717

L159 62nd Coast Artillery
 Anti-Aircraft, Fort Totten NY
 Fort Totten New York 2nd Battalion, Major R.G.

SHOOTING 'EM

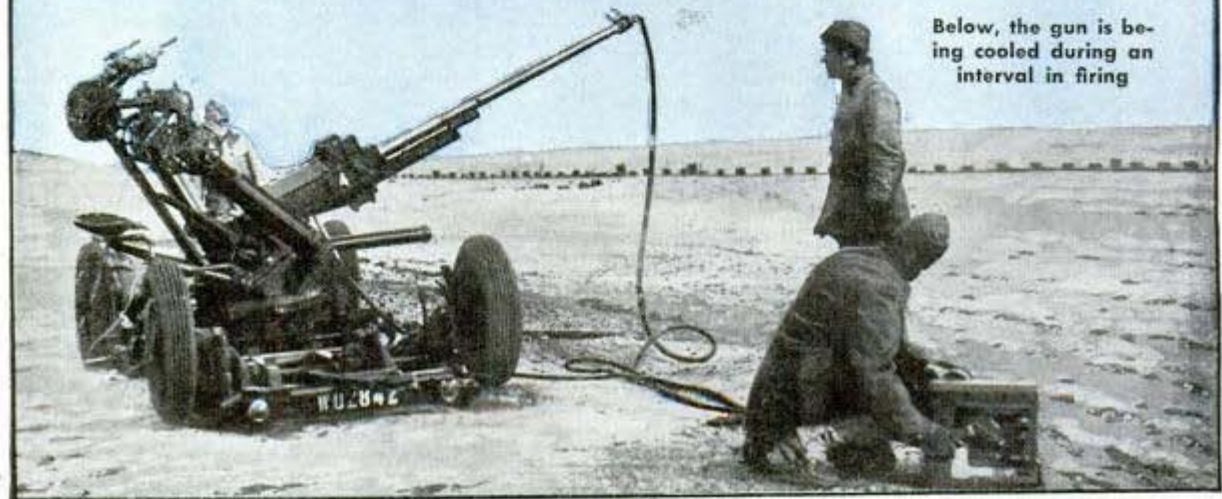


- | | |
|-------------------------|-----------------------------------|
| 1. Vertical gun pointer | 6. Chauffeur of ammunition detail |
| 2. Lateral pointer | 7. Gun commander |
| 3. Assistant loader | 8. Platoon commander |
| 4. Loader | 9. Observer |
| 5. Relay | |



By means of a two-way radio telephone, this man is instructing the pilot towing an aerial target

In the circle, the crew of a 37-millimeter rapid-fire anti-aircraft gun stands ready at battle stations



Below, the gun is being cooled during an interval in firing

2159

on the WING



The loader (above) is kept hopping to feed clips of ammunition into the anti-aircraft gun. Its rate of fire is 120 rounds per minute

In the center, below, orders are being telephoned to the radio truck, which in turn relays the messages to the target-towing plane

In the din of action the crew might miss "cease firing" command. Below, rope is tied to trigger foot of man firing; man behind him, alert for signals, yanks the rope at "cease fire"

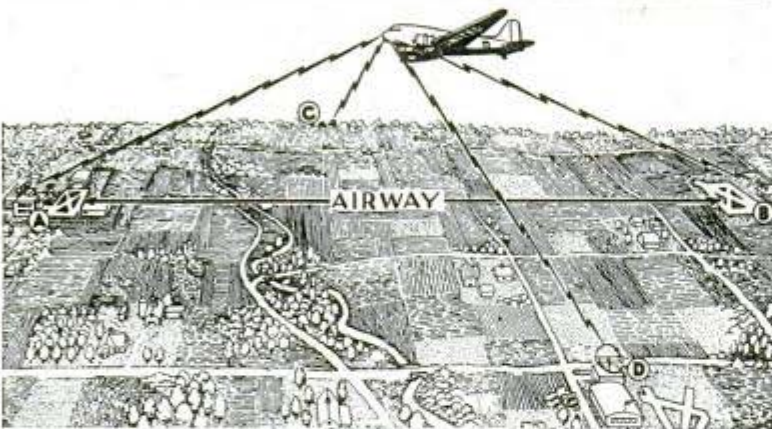
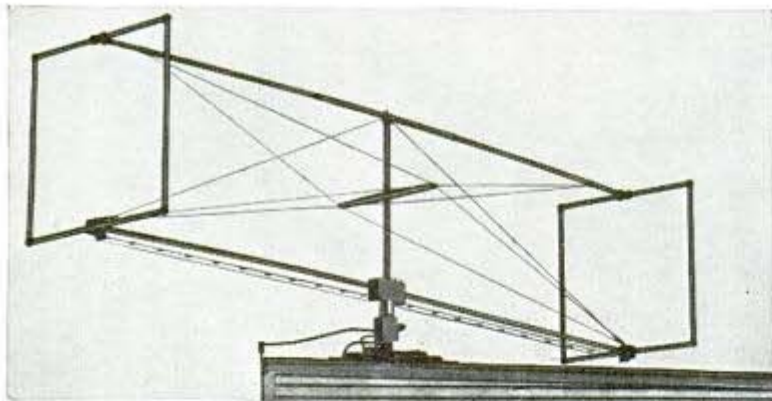


Lateral tracker, above, points weapon from side to side in azimuth, keeping the sight continually on the target

Below, relay loader stands by with clip of 10 shells, which can be shot away in a few seconds of rapid fire



Location of Plane in Flight Graphed by Radio Stations



Top, rotating antenna that receives signals. Sketch at bottom, stations A and B, on airline, work with C and D in plotting position of airplane

With the aid of direction finders operating in reverse of the usual practice, ground stations can inform the pilot of his airplane's location within a mile or two. Each time the plane's transmitter is used, the directional apparatus on the ground records the bearings on the plane. The radio waves are picked up by a large antenna rotated constantly by a motor, and a standard radio receiver amplifies the signal into energy that operates a moving pen on a scroll chart unrolling beneath it. By tracing a vertical zigzag line the pen indicates the maximum and minimum strength of the signal. Bearings are figured on the minimum signal, or "null," as radio engineers call it, the null being recorded when the antenna is at right angle to the direction from which the signal comes. Then, using a trans-

Chicago Supply Co. 4322 W. Lake - Chicago

parent plate graduated in degrees that is placed over the chart, the radio operator is able to plot the null and read the bearing of the airplane in degrees. Two or more stations receiving this signal and communicating it to the dispatcher's office by telephone or radio, enable the dispatcher to triangulate the airplane's position and locate it exactly on the map.

265

Coin Machine Tells How Fast You Can Pedal a Bicycle

One of the "babies" of the coin-machine industry is a bicycle on a test rack to try your pedaling ability. For a penny you can pedal for a half minute while you watch the needle on a large dial mounted above the front wheel of the stationary bike. The dial shows the rider his speed in miles per hour up to sixty.



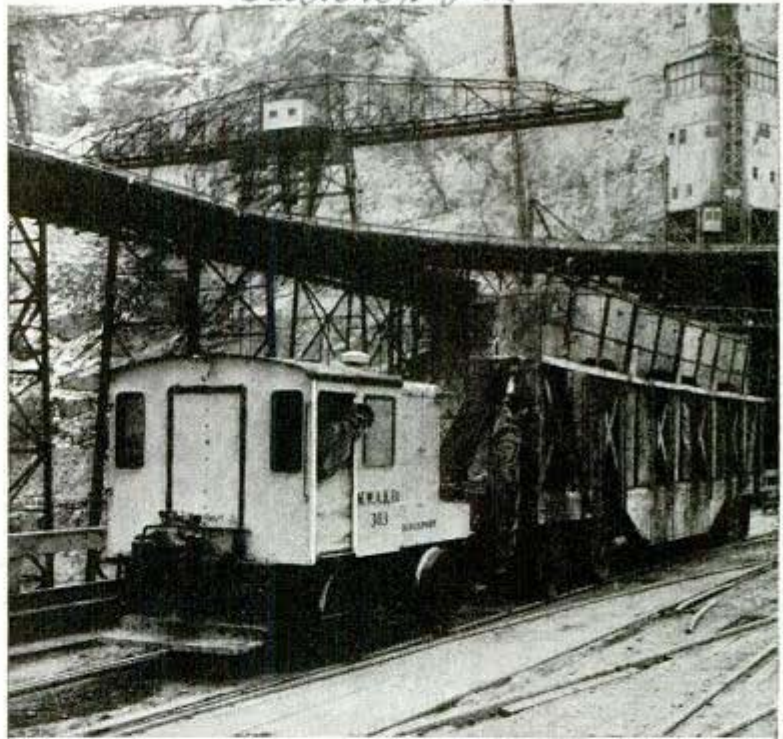
A customer tries her pedaling ability on the penny-a-ride bicycle. The dial indicates speeds up to 60 miles an hour

L94 Caterpillar Tractor Co.
Peoria, Ill.

'Baby' Diesel Hauls Concrete on Dam Railway

classmate's note

Infant brothers of the big Diesel-electric streamline locomotives are playing an important part in the building of Grand Coulee Dam. On a four-track "railroad" that is perhaps the world's shortest, running 1,000 to 1,600 feet from the mixer to the pouring crane, a fleet of little four-cylinder locomotives of standard gauge, powered by Caterpillar Diesels with electric drive, haul the concrete trains over the dam. The "train" consists of four concrete buckets on a single flatcar. The engines are equipped with multiple controls so that the operator can drive his load from six different points on the cement car or from the engine cab.



On a railway only 1,000 feet long this little Diesel, one of a fleet of locomotives operating on four tracks, hauls a four-bucket concrete car

Cherry

Herman - Miller Co. Merchandise

Chair Patterned After Auto Seat Slants Back for Comfort

Taking a tip from the automobile manufacturers who have been studying the problem of seat comfort for years, a furniture maker has designed a chair with the

backward pitch of a car seat. The front edge is high to accommodate the knees, while the seat slopes back to about half the thickness of the front part.



This chair brings home the comfort of an auto seat

Ammunition Meter for Airplanes Shows Rounds Left Unfired

Gunners on airplanes determine how much ammunition they have left by glancing at dials of a new electrical indicator installed in the instrument panel.



As the guns are fired, electric impulses turn down the dials regardless of where the guns are located in the plane. One of the instruments has four dials which show the amount of ammunition remaining for two thirty-caliber and two fifty-caliber guns, the former holding 500 rounds each and the latter 200, making a total of 1,400 rounds.

General Electric Co. 721
Schenectady, NY

K1321 Cmt: Andrew Hamilton
10999 Wellwood

MEET the

Los Angeles

Directional antenna for a television receiver installed in an automobile. Amateurs contribute much with experimental work



TELEVISION is in about the same stage of development as radio was in the 1920's when receivers were expensive and many thousands of mechanically minded men and boys built their own sets. You can buy a television set today ranging in price from \$100 to \$800, but those prices are beyond the average man's pocketbook.

So right now in basements, garages and attic workshops in America's major television areas, mechanically minded men and boys are building their own sight-and-sound sets. Most of the television "hams"—amateurs—have had some sort of experience with radio, for constructing a television receiver is far more complicated than was putting together a crystal set.

Los Angeles and New York are the two main television centers of America today and it is in these areas that most of the television hams are to be found. W6XAO, the Don Lee television station in Los Angeles, has been telecasting for nine years, and W2XBS, the RCA station, and W2XAX, the Columbia station in New York, are actively cooperating with amateurs. Recently it was announced that \$8,000,000 would be spent in New York and Los Angeles, as well as several other American cities, in a program of research and experimentation.

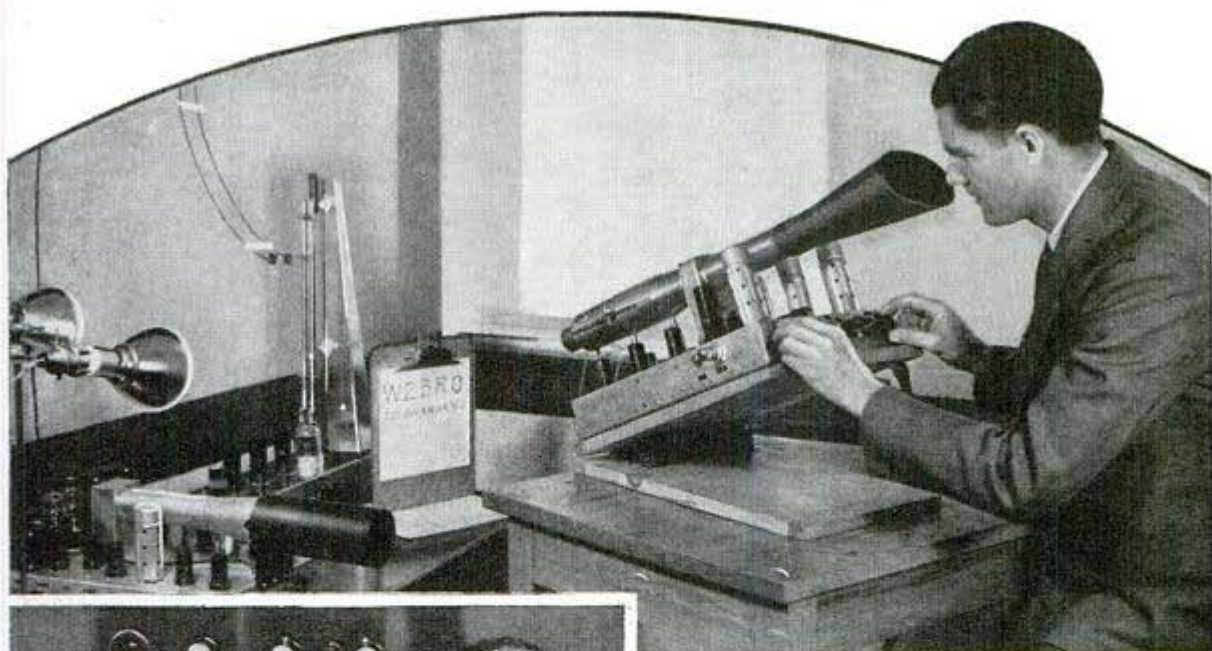
How many television amateurs there are



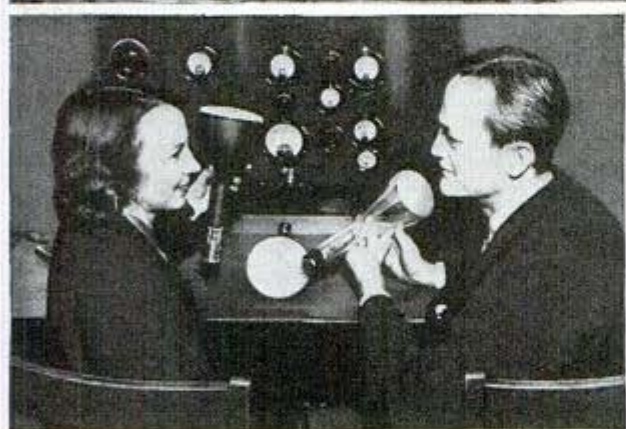
Device used in the field to measure the wave that carries the television image

R1321

TELEVISION "HAMS"



New tube which allows television amateurs to broadcast as well as receive images



Heart of the television receiver is the cathode-ray tube which creates the picture



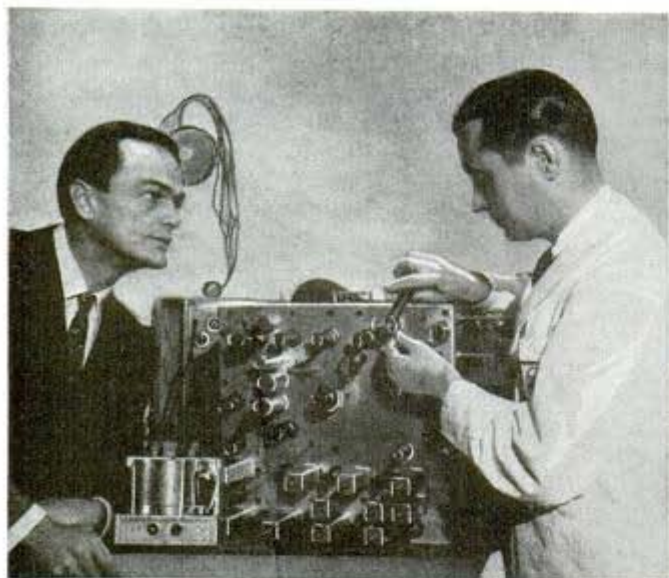
Miniature telecasting station (top cabinet) tests reception of receiving set below

in the United States is a question hard to answer. The Los Angeles and New York areas each boast around 200. In other cities such as Boston, Philadelphia, Camden, Kansas City, Chicago and San Francisco there are smaller groups.

In the beginning the television hams annoyed the professional engineers. They snooped around to watch television demonstrations, they asked foolish questions, and only clamored for help when their homemade sets wouldn't operate. Finding they could not get rid of the hams, the engineers began to cooperate with them. They furnished diagrams and advice on how to build sets; they appeared at meetings of the amateurs and explained telecasting. The results were amazing. Engineers found that the amateurs could be extremely helpful. The hams checked on the programs and sent in reports and comments. This cooperation has been an important factor in making Los Angeles and New York the leading television centers.

Television amateurs have also contributed important information on television reception. In Los Angeles, a group of amateurs has plotted the entire city for miles in various directions. They know what sort of reception can be expected and how

K13-24



Amateurs building set. Right, testing for proper location of antenna

powerful a set is needed to pick up W6XAO. They have also learned how to eliminate interference from automobile ignition systems and physicians' short-wave diathermy machines. Many experiments have been made with different antennas.

Sometimes "ghosts," double images, appear on the television screen. They are thought to be caused by high-frequency waves which bounce off the sides of large buildings and produce not one but two images in the receiver. The amateurs have learned how to eliminate these "ghosts."

Not long ago a television amateur, greatly excited, phoned engineers at Los Angeles' W6XAO: "Say, what's the matter with you fellows? You're sending out your program upside down!"

A couple of engineers jumped into their car and drove to the ham's workshop. Maybe this was some new trick of the high-frequency television beams. They discovered, however, that the amateur had merely put in his cathode-ray tube upside down. When it was righted, everything was O.K.

Candid camera fans have turned to television as an interesting source of picture material. They train their lenses upon the television receiver screen and snap photographs of the actors. Not long ago a University of Southern California anthropology professor was pictured—holding a gleaming white skull against a black background.

Telephone calls poured into W6XAO:

"Keep the professor before the television camera a little longer so we can get a good candid camera picture."

Television hams are continually experimenting with various types of receivers. Several types of portable receivers have been built and Thornton Chew, in Los Angeles, has built an automobile receiver.

Television amateurs have been building



Portable television receiver. Below, testing television wave strength



K1321

2205 Bell & Howell
Co., 1801 Larchmont Ave

Movie Camera Attached to Ski Films Its Ride Over Snow

Chicago

receiving sets for several years. But until recently, telecasting was out of the question because it was too expensive. Now a new inexpensive television camera "eye" tube has been perfected by the RCA laboratories which, for the first time, will open up the field of electronic telecasting as well as receiving. The new tube is actually a small, much simplified version of the more familiar "iconoscope" television-camera tubes used in television studio cameras. It is being placed on the market to sell at slightly less than \$25.

With the new iconoscope, it is practicable for the first time for amateurs to build a complete electronic television transmitting and receiving system at a total cost of approximately \$300 or less, depending on the equipment at hand. This cost compares favorably with the cost of a medium-power amateur radiophone system. In fact, amateurs who now have two and one-half meter transmitters will find it relatively simple to adapt them for sending television signals alternately with sound broadcasts.

The iconoscope is the "eye" of television, changing light into millions of infinitely small electric impulses which are amplified and then flashed through the ether to the receiving antenna. While performing much the same function of the larger commercial iconoscope, the new tube does not resemble it in appearance. Measuring about seven inches in length as compared with the other's 20-inch length, it looks like a tapered drinking glass with the top sealed.

In operation, the new tube is placed behind a small lens which focuses the scene upon the front surface of the mosaic. The light strikes through the transparent surface to the back surface which is scanned by an electron gun shooting a stream of electrons across it in horizontal lines at the rate of 300 miles an hour. Scanning the mosaic a line at a time, the electrons transmit thirty com-

(Continued to page 133A)

MAY, 1941

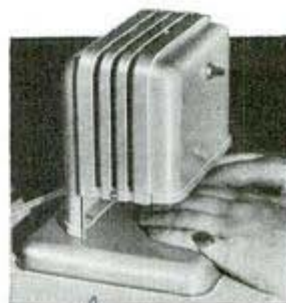


Lower picture was taken by movie camera shown on ski above

Thrilling action shots of a ski ride were produced by mounting the movie camera on the ski itself. The result was a "ski's eye" view of the skier gliding down the slope. A special bracket on the rear end of one ski held the camera firmly, and at the moment of the "takeoff" it was locked in operation to grind out the motion picture.

2127 Tiny Electric Heater Dries Nail Polish

Just big enough to receive the fingertips, a tiny electric heater is now on the market for drying newly applied fingernail polish. It is compact and sufficiently small to fit into an overnight bag, makes a neat appearance on the dresser, and plugs into any outlet.



list: Kenney, Inc.
19th floor merchandise

Mark - Chicago

2134. Div. Ray E. Sheldon - Ocean Park Wash

Motorized Horse Pulls Rig or Carries Rider



Hobbyhorse on wheels, controlled by reins and driven by a marine engine, pulls buggy or carries rider

Parts taken from an old automobile, a cream separator, washing machine, lawn mower and a sheep-shearing machine make up the mechanism that operates a mechanical horse that may be ridden astride or driven as a buggy horse. The

horse, driven by a marine engine, has five "gaits," going forward and back, and is fully controlled by reins from the driver's seat. The body is hand-carved from a spruce log, the legs being of yew. Pneumatic-tired wheels came from a toy wagon.

2131

Nested Coffee Tables Separated If Extras Are Needed

Two types of coffee tables which may be used singly or pulled apart in case extra

tables are required, are now on the market. One of semicircular shape has a smaller pull-out table nested in the center, the latter being handy for holding plates or for use by a guest. This table also houses a hideaway copper ash tray which can be drawn outward. The other coffee table has an oblong top and conceals two smaller tables, one at each end. They disappear from sight when pushed under the main table where they fit into grooves.



Top, two coffee tables slide under ends of long one; semi-circular table, bottom, holds small-size unit

2124

Slight Immunity to Electric Shock Comes From Repetition

After being subjected to repeated electric shocks, a person tends to develop some immunity, according to findings at University of California Medical School. Tests were made to find the peak current which subjects could withstand and still release an electrode carrying the current, the voltages used ranging from 20 to 75, and the amperages being increased gradually from 1/1,000, the lowest that can be felt, to a point where the person could no longer

Reward - Prof Charles J. Balgull

John D. Sagers School of Medicine

Crash in "Torture Tower" ²¹²² Tests Plane Landing Gear

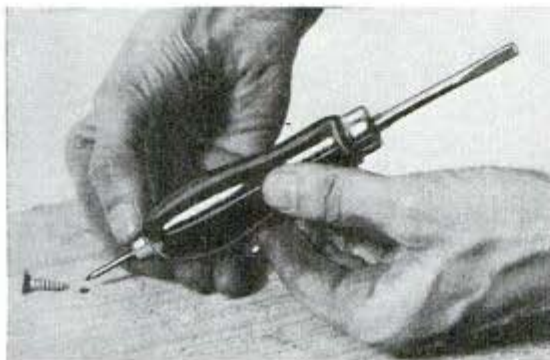
Joe L. Thurston

release his grip. One subject was able to release the electrode at about 1/50 ampere, but the average was about three-fourths as much. As amperage increases, the sensation of tingling in the hands and wrists becomes intensified. Then follows an involuntary tightening of the muscles in the fingers, hands and arms. At 6/1,000 ampere and above, the discomfort from severe muscle contraction is noticed more than the sensation of tingling, and may even be painful. At this point it is possible, with a determined effort, to release the electrode. Higher currents affect the shoulders and the external muscles of the chest so respiration becomes somewhat difficult.

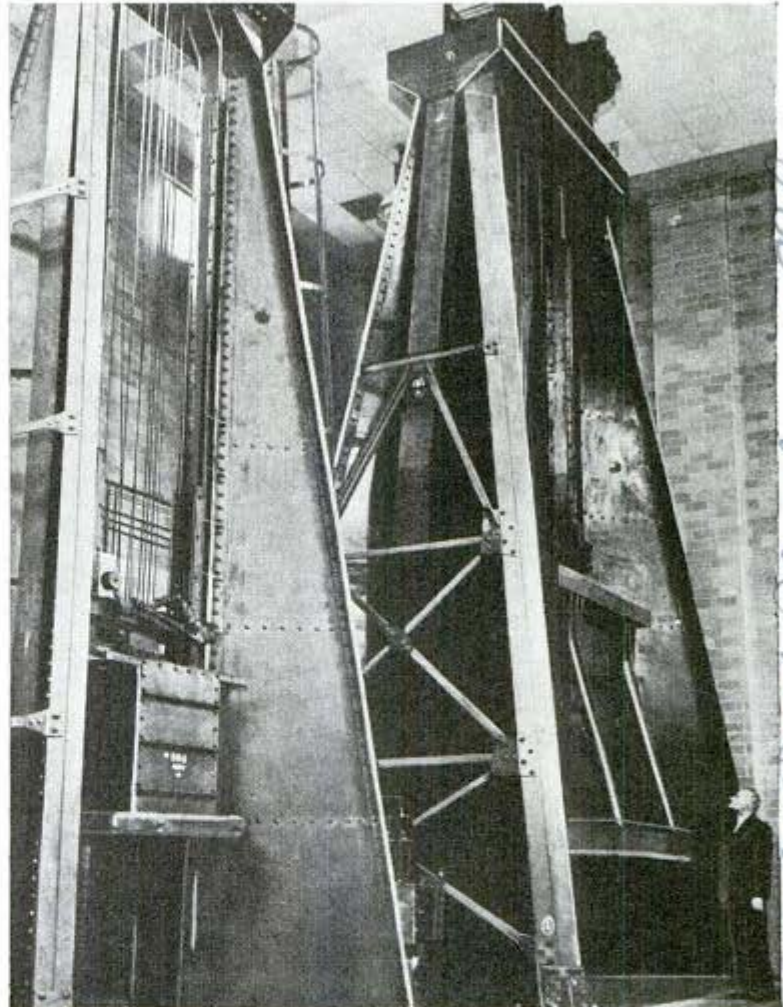
2129

Awl in Screwdriver Disappears After Piercing Hole

Carrying an awl in its handle, a double-purpose screwdriver is equipped to make small starting holes for screws. When the screw is set to be driven, the awl can be retracted into the handle by turning a ferrule. This saves the bother of changing tools in starting and driving screws.



Awl pierces hole for screw, then retracts into handle



Landing gear for huge airplane is tested in this tower by mounting it on a carriage loaded with pig lead and dropping it from various heights

Landing gears constructed for super-dreadnaughts of the air, such as the Boeing B19, are tested in a tower 35 feet high built at the Cleveland Pneumatic Tool Company. Fitted to the tester on a special carriage loaded with pig lead, the landing gear is raised to a predetermined height and dropped. It is all over in two-tenths of a second, but within that time special instruments act quickly to record the performance of the gear. With this type of apparatus a test which formerly required two hours can be completed in about four minutes.

Names and addresses listed in the index, page 4-A, show where to buy manufactured products described in this magazine. Say you saw it in Popular Mechanics.

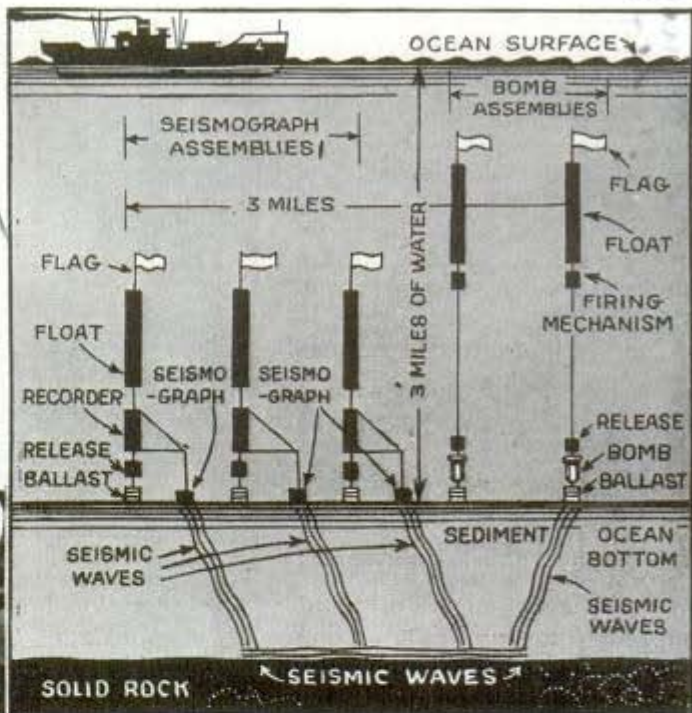
Ballard Co. 1140 Franklin Ave.

Columbus Ohio

3744 E 78th Cleveland Ohio

U1351 Cont. Clon. Jesup Woods Hole Mass.

MAPPING the OCEAN



Above, diagram showing how ocean floor is mapped. Below, bomb-exploding device with float going over the side of research vessel

Above, the seismograph equipment used in exploring the ocean bottom. Here the mechanism is shown exposed

BERTHED at her home port, Woods Hole, Mass., the research ship Atlantis was taking on cargo for another trip to sea. It was a most peculiar cargo.

Heavy aluminum-alloy cylinders about three feet long looked warlike, but turned out to be harmless. Inside were complicated seismograph instruments, tightly water-sealed, later to be lowered three miles down to ocean bottom. Nearby on deck was another pile of cylinders, also harmless. But each had a running mate which if handled with undue carelessness might mean sudden death. They housed batteries and time clocks. And to each before lowering will be attached a deadly bomb.

When the Atlantis reaches suitable experimental waters out at sea she will heave-to. At stated intervals apart, the heavy and expensive equipment is lowered piece by piece to bottom. Presently, Dr. Maurice Ewing,

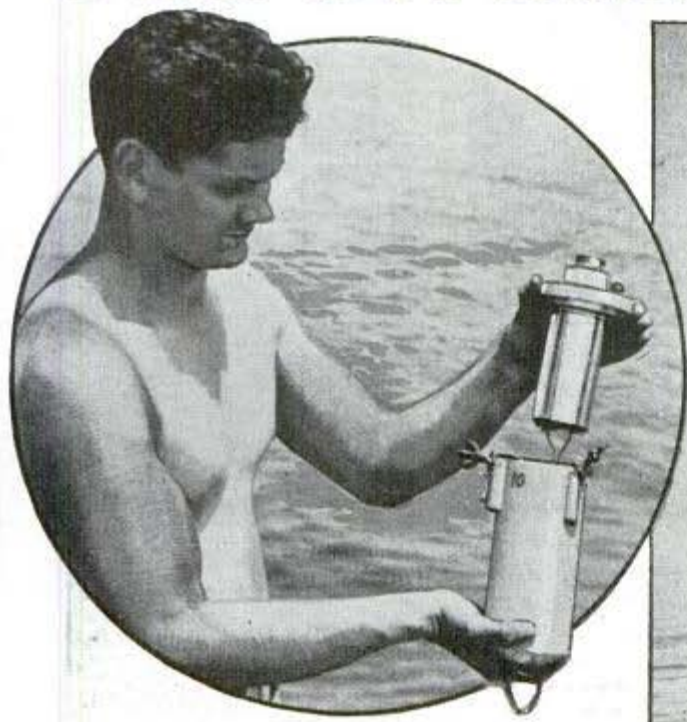


April 1938 - 545

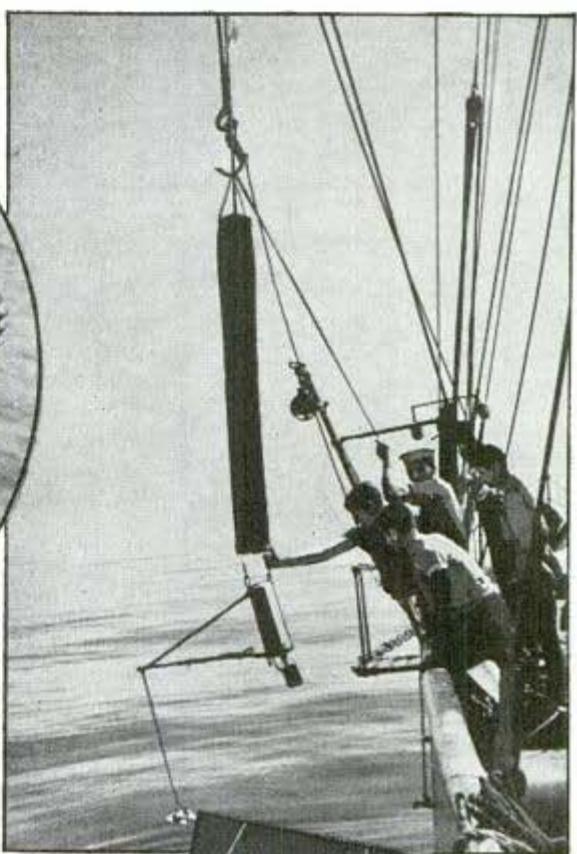
Copyrighted material

R1357

FLOOR *with* BOMBS



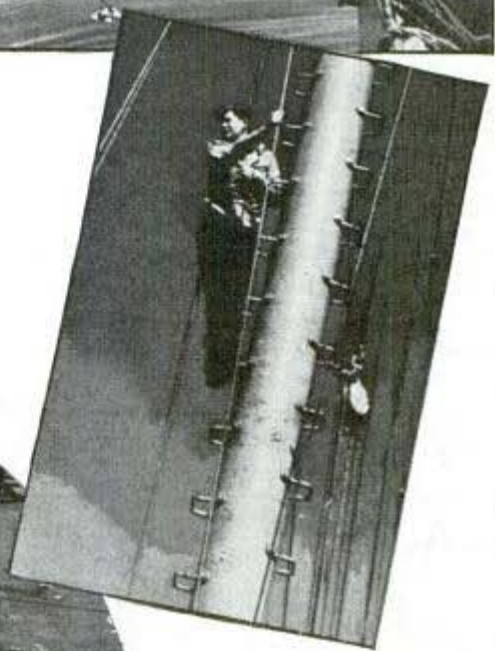
Above, member of the research ship's staff holding a timer used in setting off the bombs



pioneer in development of the new seismic method, demonstrates that the arts of seismography and bombing can apply themselves to ends less destructive than earthquakes and war. Explosions three miles down can't do any harm. The whole point of this unusual proceeding is to

(Continued to page 114A)

Below, ballast assembly employed to hold down the floats. A special device releases the ballast after the explosion and permits the floats to rise



Top, float with seismograph attached going over the side of research ship. Below, member of the crew looking for float and attached apparatus after the explosion

273

Flag Waves in Blast of Air From Tubular Staff



Breeze blowing steadily from vents in flagstaff keep American flag stretched outward in a lively flutter

Air forced out through vents at the top of a decorative flagstaff keeps Old Glory fluttering in a constant breeze. In the home, show window, club room or lodge it adds a patriotic note. A motor-driven blower, enclosed in a metal housing at the base sends a continuous blast of air up through the tubular staff.

Shelf on Pliers Catches Nut When Working Overhead



With a ledge added beneath the jaws, a pair of pliers now on the market catch the released bolt or nut when operating overhead. The ledge is of metal,

with a dip toward the center and turned up slightly around the edges so the nut will not slip off. Made in several sizes, the tool is especially handy for working under the car.

Meter Hooks on Electric Line To Read Volts or Amperes

Testing an alternating-current line is reduced to extreme simplicity by a combination volt-ammeter that hooks around the line, whether insulated or bare. An instantaneous reading is given on the dial. Voltage measurement requires only the connection of two leads and the flip of a thumb-manipulated selector switch.



Editing Set for Amateur Movies Enclosed in Compact Case

All the essentials for editing amateur movies in either the sixteen or eight-millimeter size are contained in a compact, portable case just put on the market. The various accessories, including the film viewer, are arranged for "straight-line production," so that working space is condensed to a width of about twenty inches.



Movie film viewing and editing set is ready for work as soon as case is opened. Inset, it closes compactly

Ballard Co. 1141 Franklin Ave. Columbus, Ohio
D.A. Pachter Space 1142
Merchandise Mart, Chicago

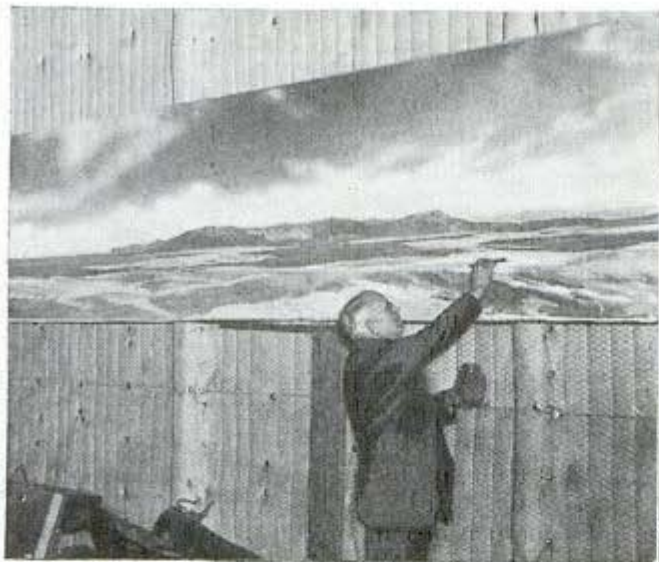
General Electric Co.

Chemulap Co.

Amman, Boston

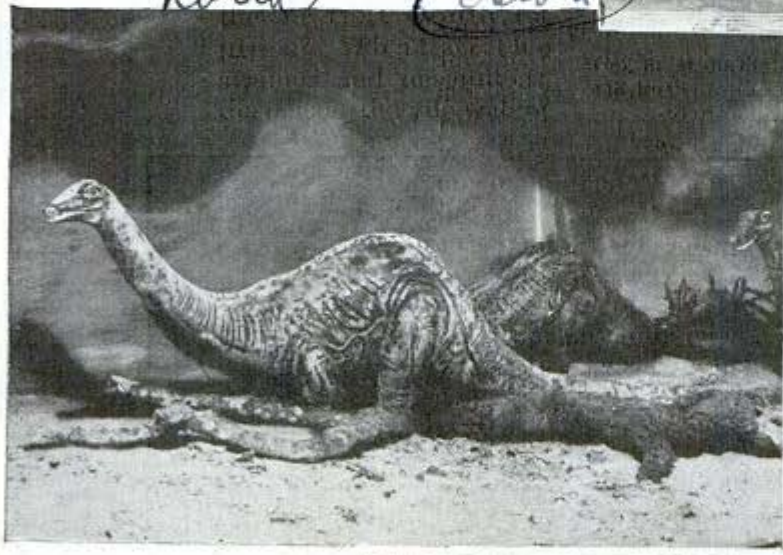
297 Cmk Marshall Perham,
1128 Stearns Drive
Los Angeles

Prehistoric Scenes Come to Life in Miniature



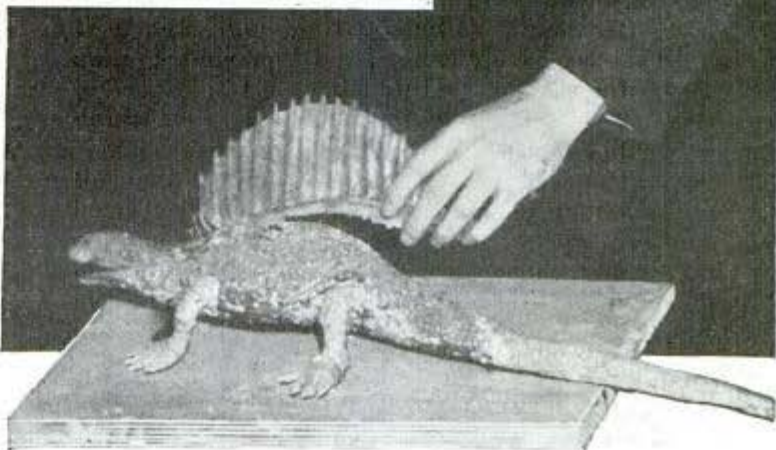
11333 Chandler
What the world looked like some half a million years ago is what Lou Bedford, a Hollywood "special effects" man, has tried to duplicate in his "Sands of Time," a miniature reproduction of animated dinosaurs and the conditions under which they lived

north (Block)



Before models were constructed, a vast amount of research was undertaken to learn their true form and relative size. Since it is believed that ultraviolet light predominated in those days, special paints that react weirdly under this light are used on animals and scenery. Upper left, landscape backdrop being painted in pastel shades which take on strange appearance when illuminated. Above, attaching a foot to one of the models

Above is probably the largest animal ever to tread the earth, but despite its size it was herbivorous and is believed to have been gentle. Right, two sections of a body are joined to complete a dinosaur. Animated by a secret process, the models are first built of clay, around which plaster casts are made. Into each cast, a small amount of rubber is poured, heated, and then removed in the form of rubber film. This is molded around stuffing to the shape desired, and finally the parts are assembled into a finished model



Engineers, Ltd.
San Francisco

BATTLING *the* JUNGLES

*Marchall Perham, 11288 learn else
Los Angeles
Cnd*



Here is a pipe bender in operation. Deep in the jungle, where remoteness and hopeless transportation bar heavy machinery, crude tools like these and human muscles become a necessity

FAR UP the Magdalena river in Colombia lay the great oil lake. Men dreamed of the wealth it would bring to this land of "manana" if it could be tapped by a pipe line: schools, roads, hospitals, sanitation for an impoverished people who had been too long without them.

But between that lake and civilization lay an impassable barrier—250 miles of jungle, full of poisonous insects and snakes; mountains with sheer, rock sides; swamps, darkened by malarial mosquitoes, and reeking with air so foul that it would rot metal and poison food.



Down on a muddy landing field comes a twin-motored airplane bearing engineers and workmen ferried over jungles and swamps from the coast

Then there was Magdalena river, which drained the country. In rainy season, it would flood out pipe lines and communications faster than men could repair them. It was the only source of drinking water, and one might as well drink cyanide, for all the garbage, sewage, and corpses in the region were dumped into it.

For OIL

And finally, there were heat and humidity in which no man could work. Beasts and plants sickened and died from it, meats and vegetables were made unfit to eat. It seemed that nature had thrown her strongest defense about this treasure.

So men dreamed of the oil, and then forgot it—until American engineers surveyed the land, and said, "We can run a pipe line in there."

"Impossible!" cried skeptics in every engineering camp in South America. What of the terrible heat, the diseases, the air that would rot pipes? What of the swamps and mosquitoes, the poison, the vile water?

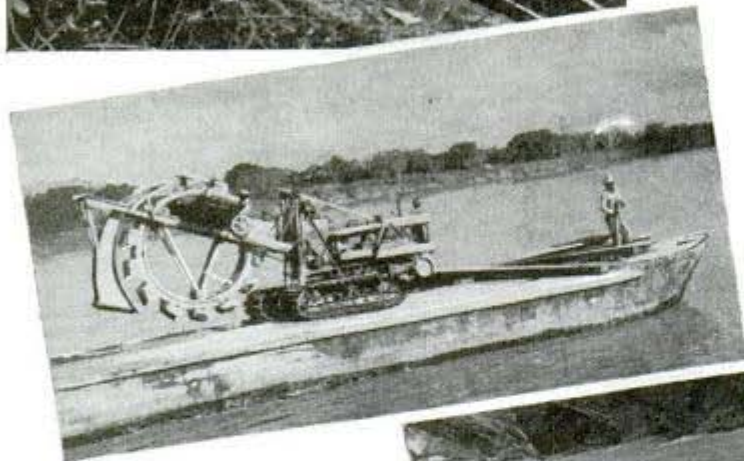
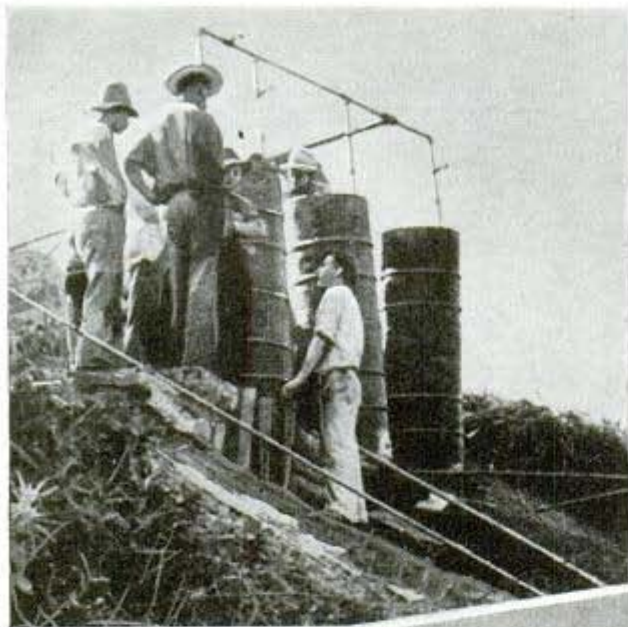


Top, meat on the hoof, imported for tomorrow's dinner, gets mixed up in construction. The truck plowing over a flooded road was a familiar scene after rain, when the Magdalena river would wash out bridges



Laying a section of the pipe line through heavy jungle growths

X1334



Top, installing the purifying plant which provided plenty of fresh water for the crews. The giant ditching machine, above, is being floated up the Magdalena river on a flat-bottomed barge



Crews isolated by storms which washed out roads and bridges had to get back to camp as best they could (above). For want of safe food, cattle (left) had to carry their own lunch



The costs were tremendous. Why, Engineers, Ltd. had an investment of \$700 in every man. Wait until they started to die, and see what became of profits from the job.

"They can't eat any meat or vegetables without getting sick," was the next dire prediction. "And they'll get just as sick eating preserved stuff in that climate."

But two Americans stood pat, determined to bring out that oil. They were Alfred B. Swinerton, of Engineers, Ltd., in San Francisco, and Jack G. Baker, whom Swinerton had obtained from the San Diego health department.

"They'll never even take a crew through those swamps alive," said the skeptics.

"Stand by to fly in," was Baker's retort.

A fleet of transport planes carried 500 men over the diseased areas, where half their number might have perished on an overland journey.

"Wait until they get typhoid and dysentery from that water," was the next prediction of the unbelievers.

But a filtering plant was set up, and 16,000 gallons of pure water were refined daily. This meant not only safe drinking water, but regular baths—unheard of among construction rough-necks in that part of world.

K1334

L196

Boats began arriving from the United States, carrying fresh refrigerated vegetables and live cattle. The astonishment that was apparent when it was found the camp was to have electric refrigerators was exceeded only when Baker was asked what he intended to do with the cattle.

"Take them to camp on the hoof to furnish fresh meat and milk," he replied.

Baker got those cattle through swamps and jungles, twice fording the swift Magdalena, and delivered them safely. Baker's vaccines and serums, his constant vigilance over food and water, his endless guard against mosquitoes, brought the herd through alive and healthy.

Meanwhile, tests of local food indicated that fruits and vegetables which had to be peeled could be eaten safely if properly cooked. Refrigerators would preserve them, age meat, even provide ice cream.

Swinerton was now ready for his part of the task. He imposed a discipline that would make a dictator wince; harsh, arbitrary, and perhaps cruel—but necessary.

No man could venture outside after dark without his mosquito netting. All were to lie down for half an hour before meals and sip hot tea. Salt tablets were to be taken regularly to prevent sunstroke. Alcohol was forbidden. So were fraternizing with anyone outside camp, drinking anything but purified water with a paper cup, or eating uncooked foods. Running water was to eliminate all wastes. The first violator of these rules would go home without ado.

Swinerton announced a seven day week, which is plenty tough in such a country, even with lots of good overtime pay. The purpose was two-fold: to keep men occupied and tired, and therefore disinclined to break rules, and to lay the pipe before two rain seasons could attack construction.

Amid sweltering heat, the crew struck that pipe line across country. A great swamp blocked them, mucky, diseased, impassable. Came the order, "Clear and drain it."

Machinery on crawler treads wallowed through the morass; even non-powered bearings, such as on trailers, had to be equipped with crawlers. Knee deep in muck, men followed. Day after weary day, in a sun that seemed about to boil moisture-laden atmosphere, work continued.

Keen observers were beginning to notice that these healthy men were not being

(Continued to page 121A)

MAY, 1941

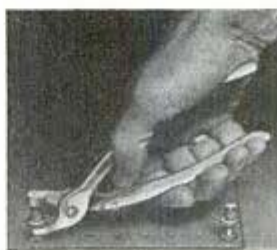
Spotlight on Battery Case Revolves in Full Circle



Self-contained spotlight and battery unit permits the lamp to be rotated in complete 360-degree circle

Attached by means of a universal ball joint to the case that holds the battery, a portable spotlight revolves 360 degrees and throws a beam 300 yards. A two-filament bulb is used, the battery lasting from six to eight hours with the light burning at full brilliance, and from 18 to 24 hours if it is burned dimly.

Sheets of Metal Held for Riveting By Locked Spring Clamp



Holding sheet metal together under a pressure of 50 pounds for riveting, a spring-actuated clamp is locked quickly and firmly in place by a plunger. It is

applied with a pair of special pliers furnished with the clamp, which locates the riveting holes accurately. According to the manufacturer the tool saves 80 per cent of the time required when ordinary bolts and nuts are used for the purpose.

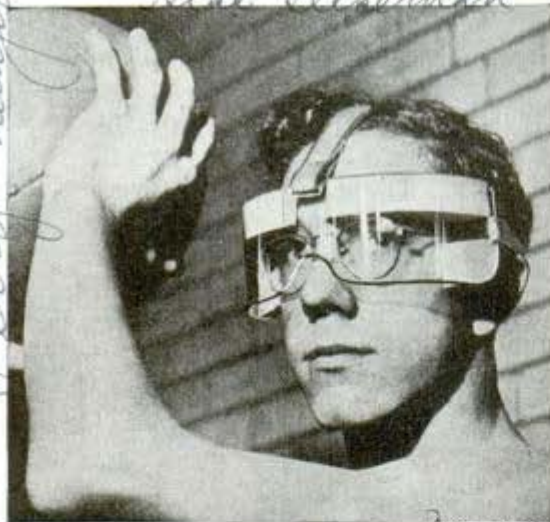
Cleveland Pneumatic Tool Co.

General Electric Supply Co. 5-8-41 Anderson St. Memphis

L123

Athlete Uses Plastic Mask To Prevent Eye Injuries

like Sherman



This basketball player thinks of safety for his eye-glasses, so he protects them with new plastic guard

To protect his glasses from damage and his eyes from injury, a Detroit high school basketball player wears a special mask made of plastic material. The guard, held in place by straps passing over the head, does not interfere with vision.

Chemical Kit for the Cameraman Is Complete With Instructions

All the basic chemicals, and all the equipment needed for photochemistry are included in a photographer's kit just put on the market. In addition there is a 130-page booklet of instructions and directions for experimenting. It is intended to give an amateur the right start in darkroom



Mixing chemicals from the photographer's supply kit

*Isreene mfg Co
Racine, Wis*

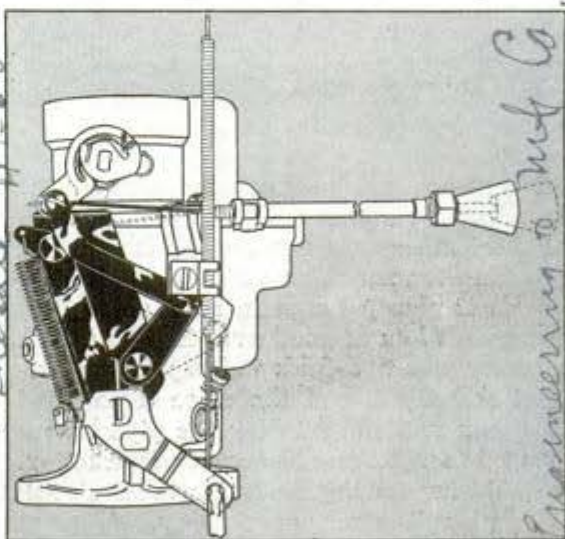
processes and to help the advanced photographer improve his technique. An auxiliary set of ordinary darkroom apparatus, such as printing paper, trays, safelight and thermometer, can be had separately.

Clip-On Footrest for Rear Riders Protects Auto Upholstery

Upholstery in the back part of the car, usually the first to show signs of wear, can be guarded by stainless steel footrests made to fit most present-day models. They are clipped on at the base in back of each front seat. Spring clamps hold the footrests in place.



Choke Attachment Speeds Idling to Keep Engine Running



Installed by removing and replacing two screws, this "fast-idle" attachment keeps cold engine running

An automatic "fast-idle" choke attachment now available for Chevrolet cars and trucks steps up the idling speed of a cold engine to approximately fifteen miles per hour when the choke is out. It is claimed to save gasoline that would be wasted by excessive choking and racing of the engine during the warming-up period. By keeping the engine running after the first explosion, it helps make starting easier.

*Manifold Photo Research Laboratories Aircraft. Conipans
Berry - Humbert
L101
Le Salt. Chevy
7-01
Engineering & Mfg Co
1/23 n. main st. Bluffton, chad*

The

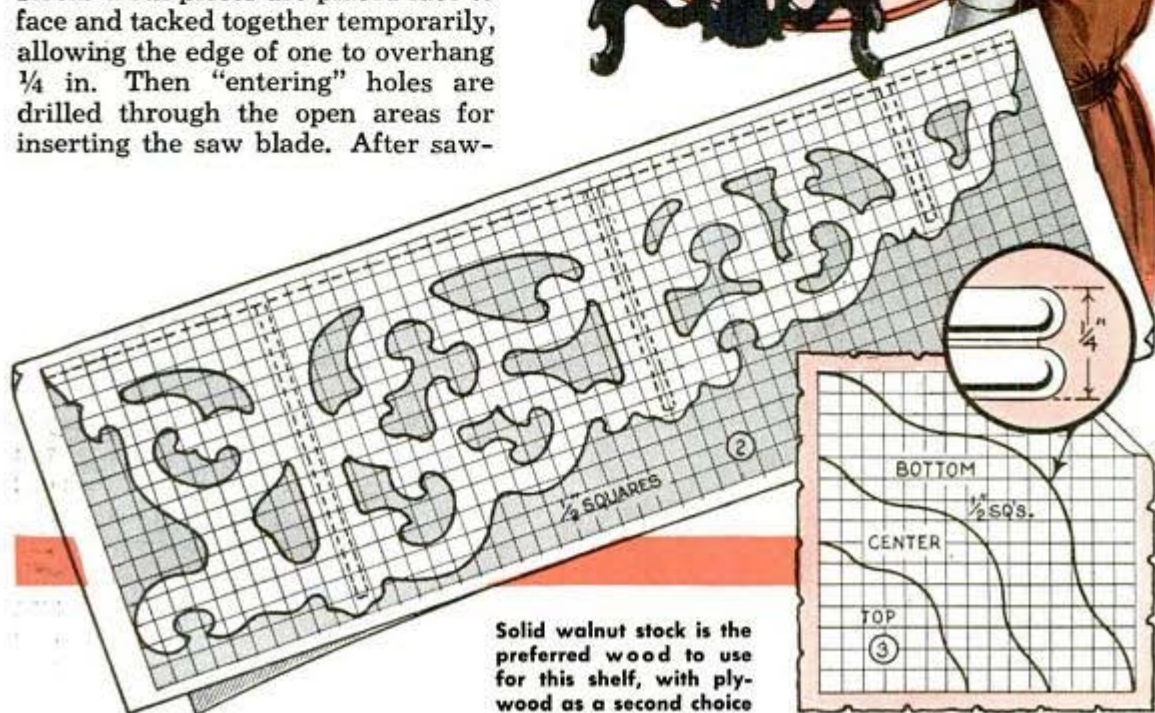
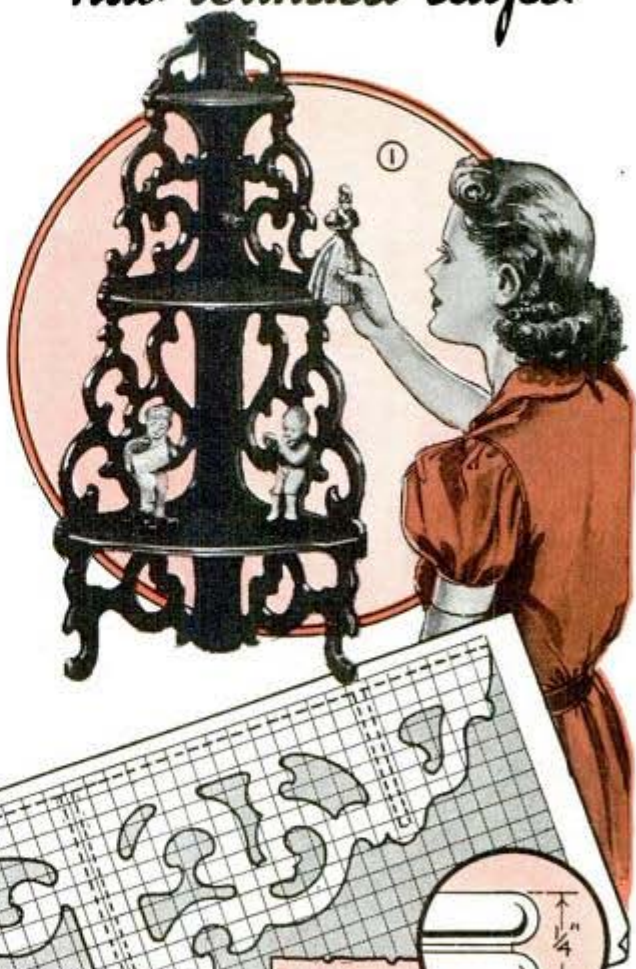


CRAFTSMAN

"Black Forest" CORNER SHELF *has rounded edges.*

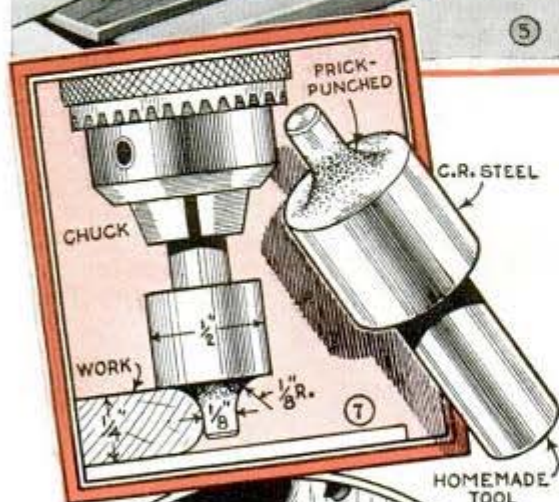
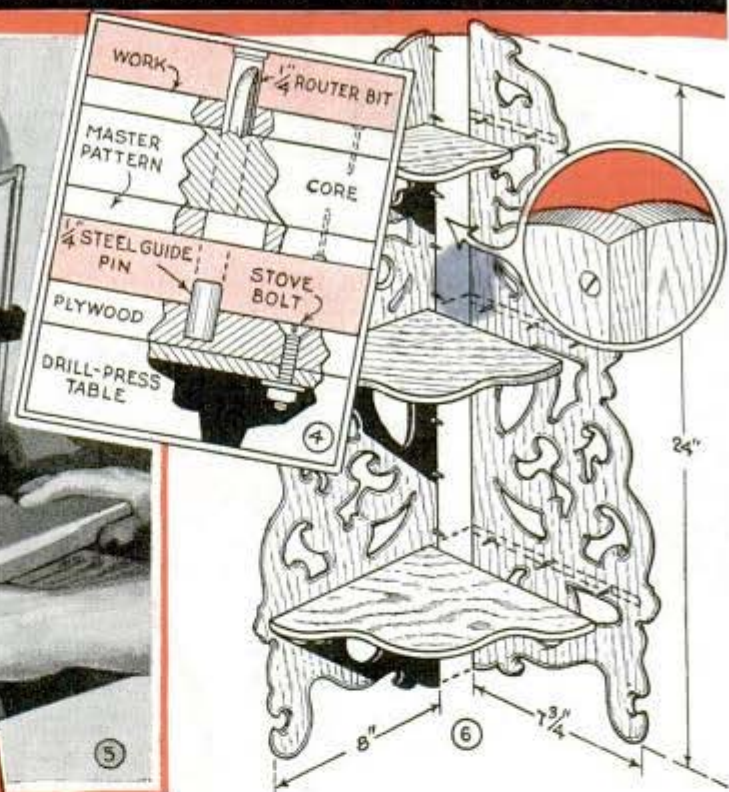
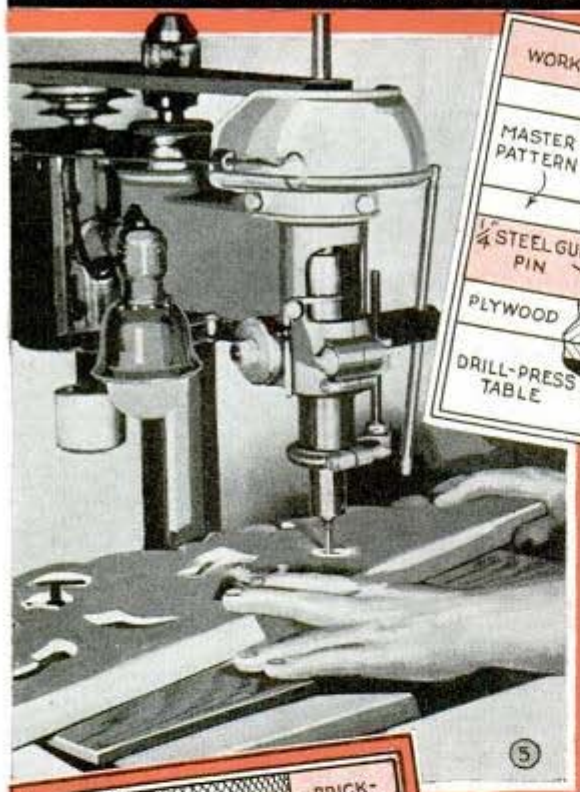
FOR ADDING a refining touch to the tasteful room, why not consider the beautiful corner shelf shown in Fig. 1? Its graceful design will add a friendly charm to a corner where nothing else seems to do. You can reproduce this shelf using a hand scrollsaw, or it can be produced in number quickly by using the pattern-routing method.

For a truly fine piece of work, solid walnut stock is preferable to plywood as it is difficult to conceal the plies of the latter when the edges are rounded. Patterns of the sides and the three shelves, Figs. 2 and 3, are enlarged full size on paper ruled off in $\frac{1}{2}$ -in. squares, after which the outlines are transferred to $\frac{1}{4}$ -in. stock. Both pieces are placed face to face and tacked together temporarily, allowing the edge of one to overhang $\frac{1}{4}$ in. Then "entering" holes are drilled through the open areas for inserting the saw blade. After saw-



Solid walnut stock is the preferred wood to use for this shelf, with plywood as a second choice

TEMPLATE ROUTING PRODUCES IDENTICAL UNITS



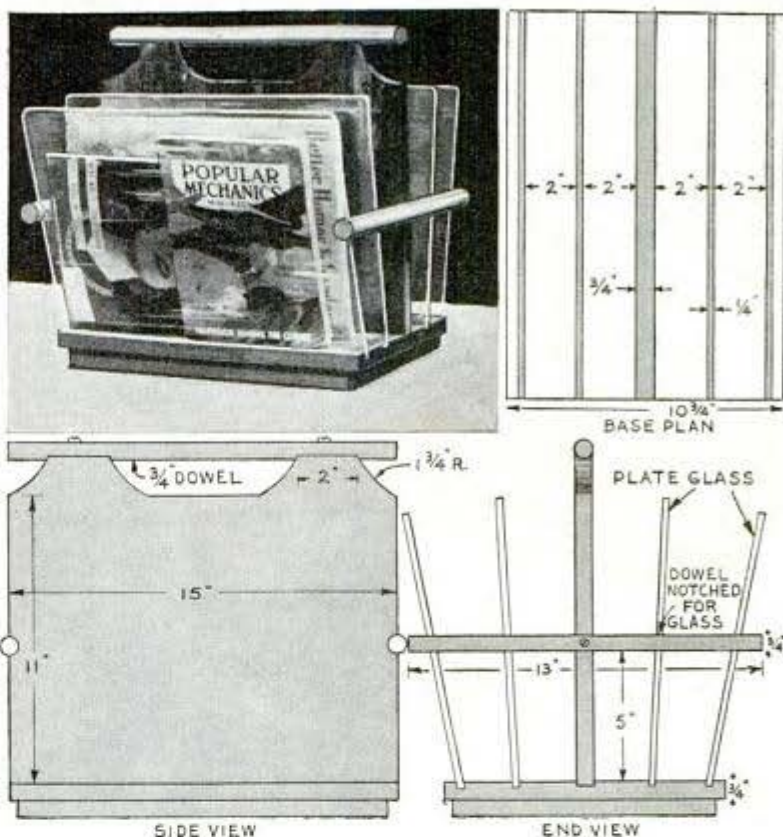
ing out the work carefully, the edges are rounded slightly with a strip of sandpaper, Fig. 8. If you wish, the edges of the shelves may be beaded as in the circular detail of Fig. 3. Slender screws hold the parts together as shown in Fig. 6. The position of the shelves is given in Fig. 2.

For producing the shelves in quantity, Fig. 5 shows a simple production method which can be used for cutting any number of scrolled side pieces exactly alike. Here a drill press is used to rout out the fretwork instead of sawing it. A master pattern of the scroll design, Fig. 2, is jigsawed carefully from a piece of fir plywood. Then this pattern or template is nailed to a softwood core as in Fig. 4. The drill press table is fitted with an auxiliary plywood table in which a 1/4-in. steel pin is inserted directly below and in line with a 1/4-in. router bit placed in the chuck. As the pin follows the opening in the template, the router bit will make an exact duplicate cut in the walnut piece bradded to the core.

Fig. 7 shows a simple tool to speed up the rounding of the edges. Revolving at high speed in the drill press, the tool is run around the routed opening, first on one side and then the other, after which the edge is gone over with fine sandpaper.

Glass Gives Magazine Rack Modern Touch

This magazine rack with its glass sides and partitions is just the thing to match your glass-top coffee and occasional tables. The double base, and the center piece which carries the handle, are made of $\frac{3}{4}$ -in. stock, the base being grooved $\frac{1}{4}$ in. deep to take the lower edges of the glass. Two dowels notched to take the ends of the glass are screwed to the wood center piece to support the glass vertically. The edges and corners of the glass should be rounded slightly to prevent sharp edges on which to injure the hands. This can be done on a fine grit grinding wheel, taking care to avoid heating the glass which might crack.—LeRoy Miller, Glendale, Calif.



Freezeproof Hose Connection in Outside Wall of House

Instead of running a pipe through an outside wall for connecting his garden hose, where it would have to be drained during cold weather, one home owner used

the method shown. The pipe was run almost to the wall in the basement and a valve installed on the end. From the valve, a short length of hose was run through a wall at an angle so that it would be self-draining. Then a crank was shaped from small pipe, run through the wall and keyed to the valve stem in place of the usual handwheel. With this arrangement, there is no danger of the pipe freezing.



Good Footing for a Stepladder Provided by Broomstick

Tipping of a stepladder by having one side sink into soft ground, can be avoided by slipping a length of broomstick through holes near the lower end. Rivets from edge to edge of the ladder sides under the holes will prevent splitting. It takes only a second to insert or remove the stick as needed.

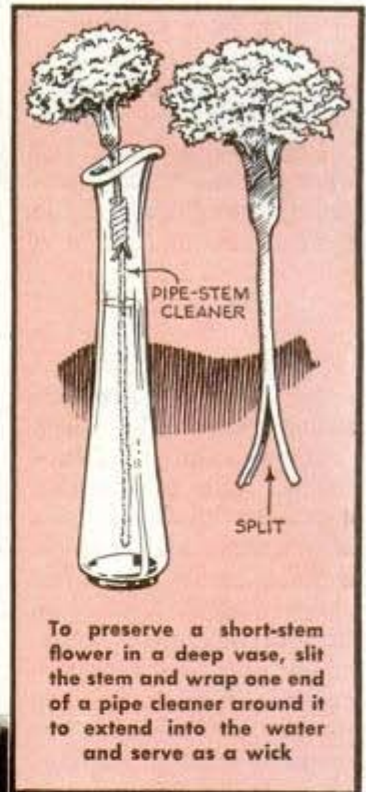


Solving HOME

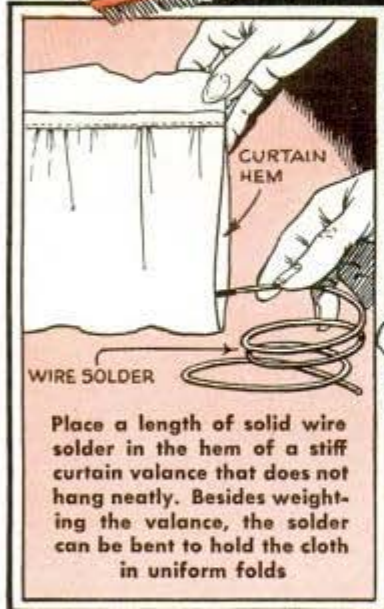


When a baby is playing on the floor, drafts from an open door can be deflected by placing a card table between the door and the child, opening two of the legs of the table vertically

CARD TABLE



To preserve a short-stem flower in a deep vase, slit the stem and wrap one end of a pipe cleaner around it to extend into the water and serve as a wick

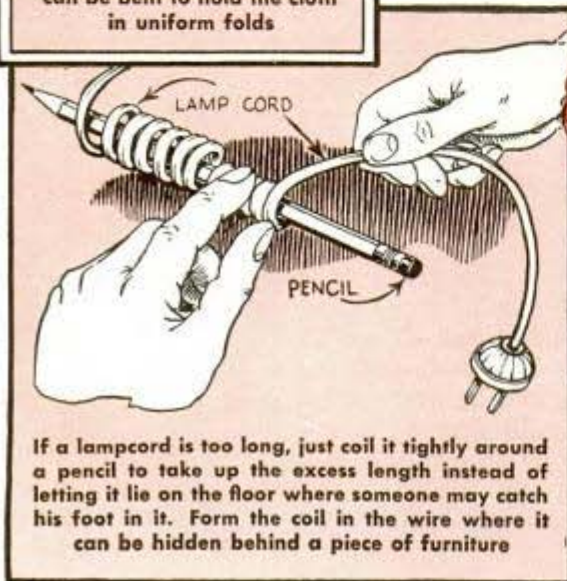


Place a length of solid wire solder in the hem of a stiff curtain valance that does not hang neatly. Besides weighting the valance, the solder can be bent to hold the cloth in uniform folds



FUNNEL

A funnel will support dishes on edge in a pan, for scalding and draining. Below, there will be no danger of a small child burning its hands on a hot iron if you invert a saucepan over the iron when you leave the work for a moment or two to go to some other part of the house



If a lampcord is too long, just coil it tightly around a pencil to take up the excess length instead of letting it lie on the floor where someone may catch his foot in it. Form the coil in the wire where it can be hidden behind a piece of furniture

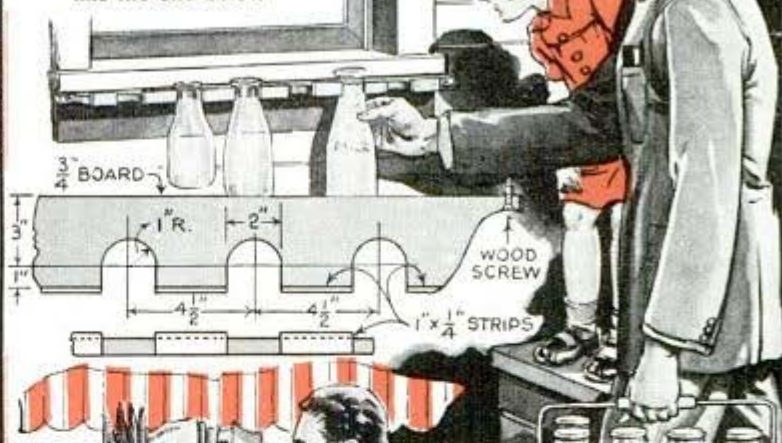


PROBLEMS

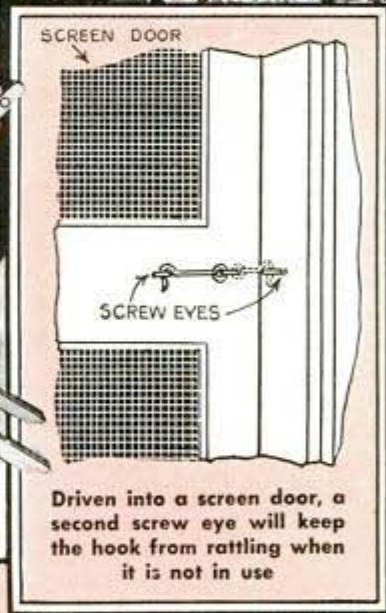
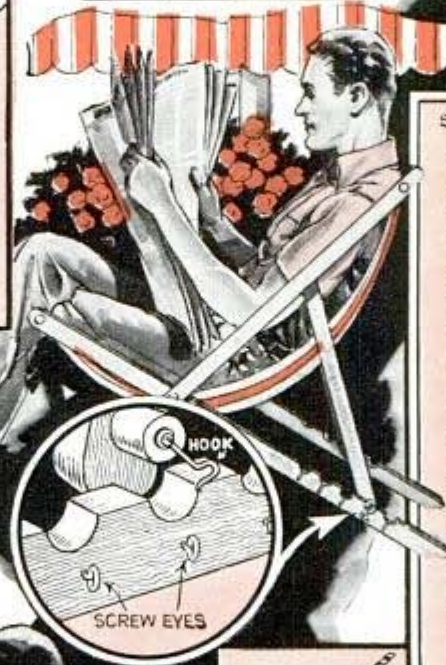


Mice will not steal cheese bait from a trap if you sear the bait with a lighted match. The heat will melt the cheese to the bait pan and the odor of cooked cheese is attractive to mice

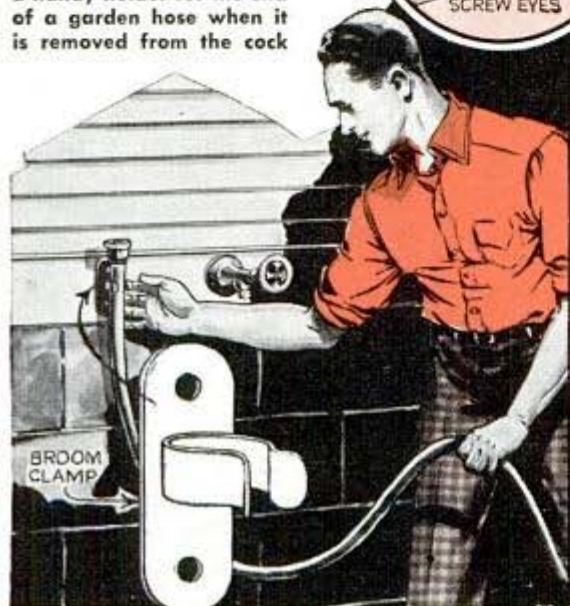
Empty milk bottles will be out of the way when cleaning a floor if kept in a rack like the one below



A lawn chair cannot fold when being moved if you attach a screen-door hook to each end of the adjusting bar to engage staples or screw eyes driven into the notched legs upon which the bar rests. Screwed to a wall near a sill cock, a broom clamp is a handy holder for the end of a garden hose when it is removed from the cock

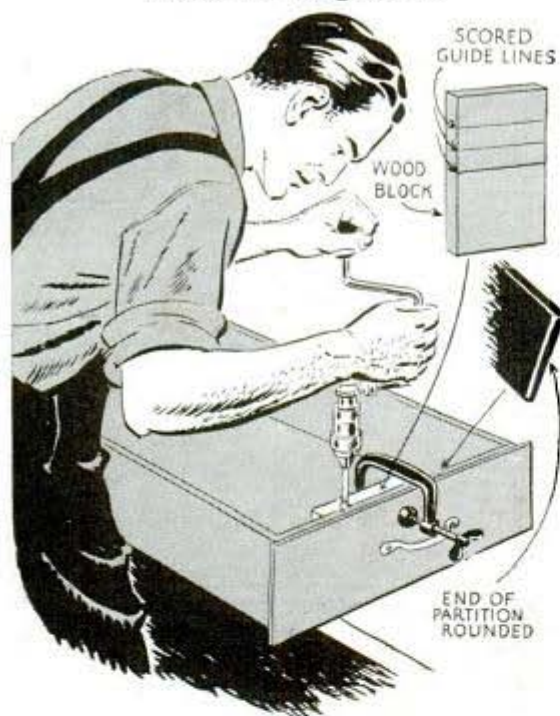


Driven into a screen door, a second screw eye will keep the hook from rattling when it is not in use



Roman numerals formed with small staples on screens and storm sash and their respective window openings, are a good way to identify them. Neither weather nor subsequent paintings will obliterate the numerals

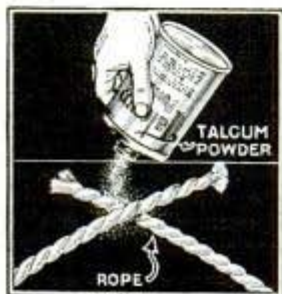
Drawers Grooved for Partitions With an Auger Bit



Grooves in the sides or ends of drawers to take the ends of partitions, when the drawers are already assembled, can be formed with a wood auger and this jig or guide block. First make shallow saw cuts in one side of the block and then clamp it over the drawer end with one of the saw cuts at the point where the partition groove is to be made. Next insert the auger point into the saw cut and drill a hole, allowing the auger to cut half of the hole in the drawer and the other half in the block. When the jig is removed, there will be a half-circular groove in the drawer for the end of a partition. The partition, of course, should be rounded at the end with sandpaper to fit the contour of the groove.

—D. A. Taylor, San Diego, Calif.

Sprinkling Talcum on Stiff Rope To Tie Knot Tightly



When you wish to tie a knot tightly in a stiff rope, sprinkle the portion to be tied with talcum powder. This will tend to reduce friction so that the rope

pieces can be pulled up together tightly. Soaking in water after the knot has been tied, will dissipate the talcum. Talcum is also an aid in untying a knot that is hard to loosen. Just force it into the strands of rope with a small insect-powder blower.

Small Opening in Seed Packet Sows Seeds Uniformly

Tiny garden and flower seeds that come in packets, can be planted uniformly without waste by making an opening in one corner of the packet, which is then used as a sifter. The opening in the package should be just slightly larger than the seed so that only one can pass through at a time.



Hemming of Garment Simplified By Using Cardboard Guide

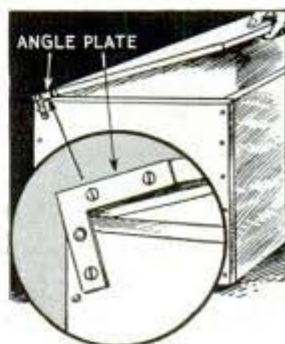


If you experience difficulty in hemming a garment uniformly, use a strip of cardboard as a guide. Make the strip the desired width of the hem and then fold the cloth over the strip and sew

it, moving the guide along as the hemming progresses.—Wm. Swallow, Brooklyn, N. Y.

Angle Plate Is Used as a Hinge

For attaching light lids to small boxes, flat angle mending plates will be found to provide excellent improvised hinges. One plate is attached to each end near the rear corner. Each plate is fastened to the edge of the lid with two screws and to the box with one screw which serves as a pivot.

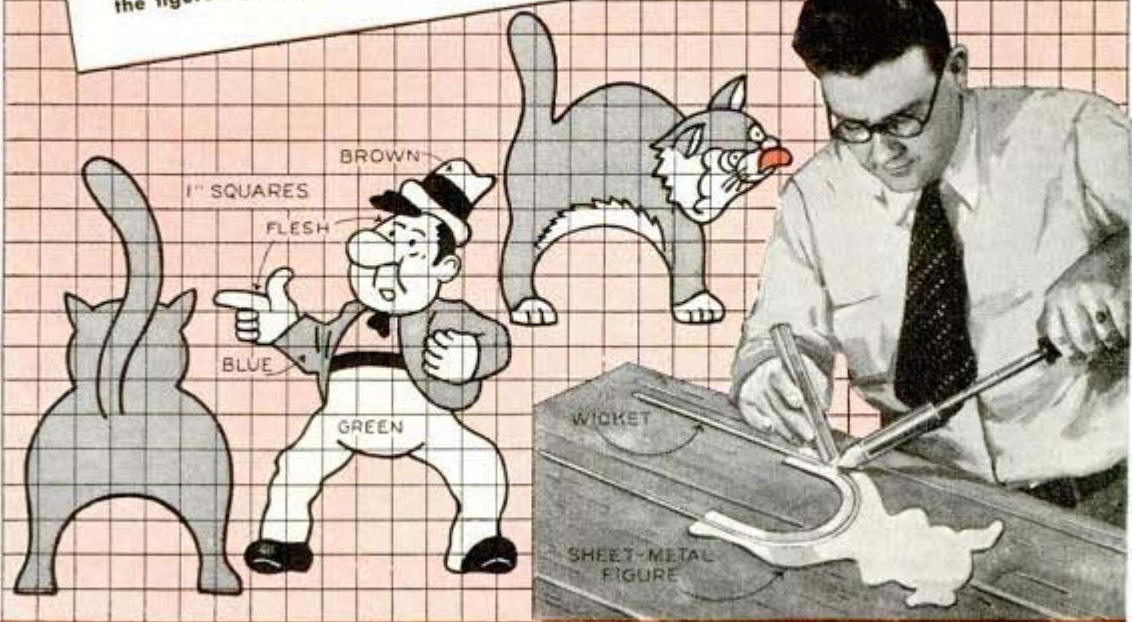
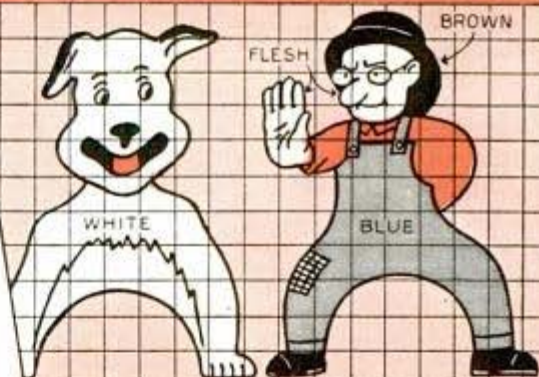


"Figure" CROQUET WICKETS

of sheet metal are easily seen



Soldered to your croquet wickets, these gaily colored figures not only add a touch of novelty to your court, but they also make it easy to see the wickets, especially if you are playing in the evening when the light is poor. While only five figures are given here, they will help suggest others, such as a policeman posed as though directing traffic, a hitch hiker with his thumb motioning for a ride, etc. It is best to use sheet metal of a fairly heavy gauge so that the figures will not be bent out of shape if you brush against them while playing. Also round all pointed corners and be sure there are no rough edges left on the figures on which to tear your clothing

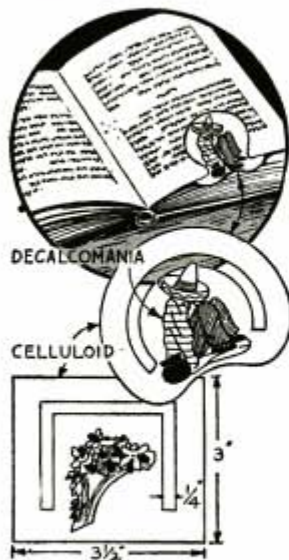


Vacuum Cup on the Putty Knife Aids in Glazing Sash



Instead of prying out a pane of glass from a sash, when fitting it, attach a small vacuum cup to the end of your putty knife handle. This will permit the glass to be lifted or lowered more easily and with less possibility of breaking.

Novel Bookmarks of Celluloid



Celluloid bookmarks of almost any desired shape are easy to make by anyone. After cutting the celluloid to the over-all shape desired, remove a narrow strip to form a flap as indicated in the drawing. You can do this with a sharp knife. Then curve the two parts—the flap and the body—in opposite directions, holding them in

this position while they are submerged in hot water for a few minutes. Bits of wood can be used to hold the celluloid in the desired curved positions. This will soften

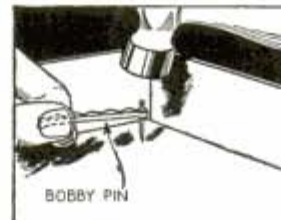
the celluloid slightly so that when it is dipped into cold water it will assume the curved shape. This gives the bookmark an action similar to that of a paper clip when slipped over a page of a book. A decalcomania transfer will add to the appearance of the finished work.

Pattern of Boat Key Is Preserved In Flattened Lead

After losing a boat key, which he was unable to replace because he had no pattern of it, one sportsman made an impression of the new one in a lead sinker and stored it for reference in case the key was lost again. From such a pattern, any locksmith can produce a duplicate.



Bobby Pin Holds Nails or Brads For Easy Driving

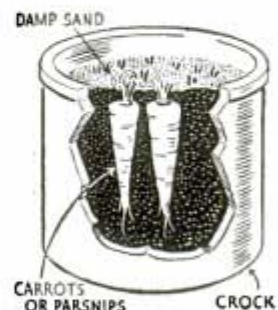


When using brads, tacks, nails, etc., where it is difficult to hold them with the fingers, while driving, just put the nail in the open

end of a bobby pin. Put the head down close to the pin and you can drive it easily.

Carrots Kept Fresh in Damp Sand

To keep carrots or parsnips as fresh as when you pulled them from the ground, pack them in a crock of clean, damp sand. Part of the tops should be left uncovered so they can be pulled out.

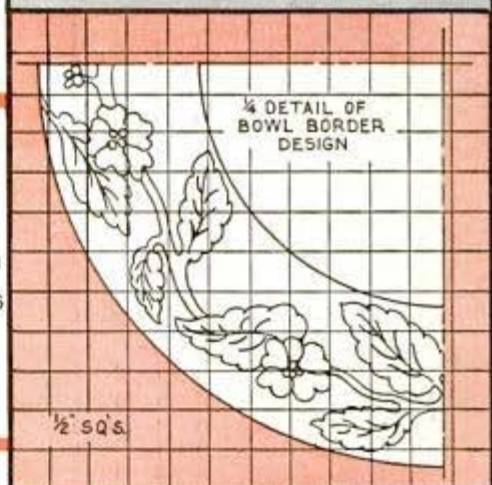
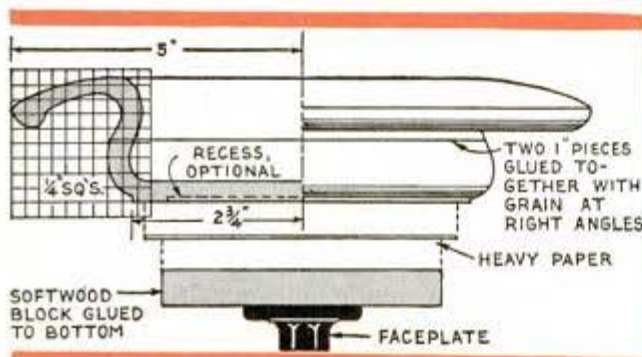


❑ If bread is wrapped in waxed paper and stored in your refrigerator instead of the bread box during the warm, damp weather, it will stay fresh and free from mold.

Walnut Bowl Has Border Carved in Relief



This simple bowl with its trailing rose border is just the thing for the amateur woodworker who wants to try his hand at carving. Begin by gluing up the blank from which to turn the bowl; this consists of two 1-in. walnut blocks glued together with the grain running at right angles. At the same time, glue a soft-wood disk to the bottom of the blank with heavy paper between them so the disk and bowl can be separated easily after the turning has been com-



pleted. The disk is for attaching the blank to a faceplate so that there will be no screw holes in the bottom of the bowl. After sanding the turned bowl to a smooth finish, you are ready for the carving. On the original, this was done in relief, although surface carving or veining will show up just as effectively. After drawing or tracing the design on the bowl, just use simple tools and work away the waste wood. Finish may consist of wax or shellac as desired.

☛ A strip of Cellophane folded and placed under the inside band of a hat will help to prevent perspiration and oil from staining the ribbon around the outside.

Killing Algae in Pools

Algae of the type that grows in swimming pools may be killed with copper sulphate. For each 100 cubic feet of water, copper sulphate, 1/2 oz., will be required. The chemical should be weighed out carefully, then placed in a cloth sack or bag and dragged back and forth across the bottom of the pool until completely dissolved. Copper sulphate should not be used in aquariums containing fish, as it is likely to be fatal to them.



①
SPADE
TO A
DEPTH
OF 1 FT.
OR 18 IN.

The YEAR 'ROUND

Preparing the bed



Dig in well-rotted horse manure for heavy soils; cow manure for light soils

②



Work in bonemeal, 10 lbs., and muriate or sulphate of potash, 2 lbs., per 100 sq. ft.

③



When buds form, work in tankage, 4 lbs., or cattle manure, 10 lbs., per 100 sq. ft.

④

BY FOLLOWING a simple routine of culture, anyone can grow roses successfully. Roses require a deep, rich soil. A soil somewhat on the heavy side is ideal, but a sandy soil can be supplied with the essential plant foods it usually lacks by adding either fresh or rotted cow manure. Heavy soils can be lightened by adding well rotted horse manure.

Preparing a rose bed: Roses are gross feeders and send their roots far down. Figs. 1 to 3 show the essential steps in preparing the bed. Spade at least a foot deep; 18 in. if your soil has a thick top layer. Dig in plenty of humus such as well rotted grass cuttings or soil from a compost heap. Thoroughly work into the surface area bone meal, 10 lbs., and either muriate or sulphate of potash, 2 lbs., per 100 sq. ft. Do not use nitrogen fertilizers at planting time but delay this until flower buds form, then cultivate into each 100 sq. ft. about 4 lbs. of tankage, Fig. 4. Tankage is a clean, non-burning packing-house product. About the first of August, but never later, you can apply fertilizer, but use only one-half as much as already mentioned. Thereafter dispense with fertilizers, for it is dangerous practice to send sappy wood growth into winter quarters. In good soil, these amounts of fertilizer will suffice for a year. In poor soils add a few more pounds of bone meal and a pound or two of tankage.

Yearly fertilizings: In general, continue the same applications each year. However, in the soil, bone meal holds over for a 2 to 3-yr. period; therefore cut-

Courtesy
Conard-
Pyle Co.



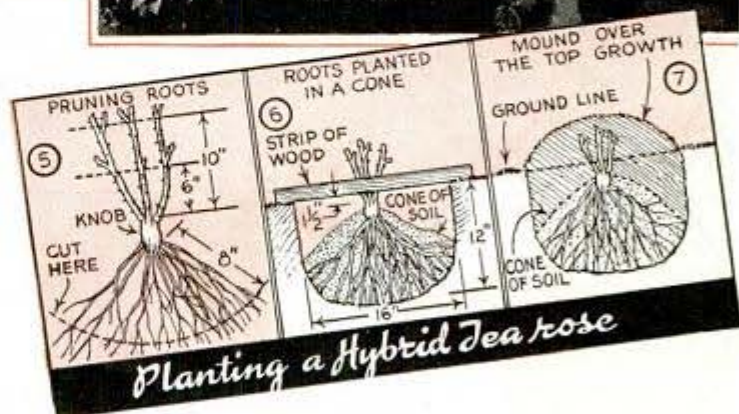
"Pixie," shown above, is one of the hardy miniature roses that are easy to grow anywhere, and are especially suitable for edgings and rock gardens



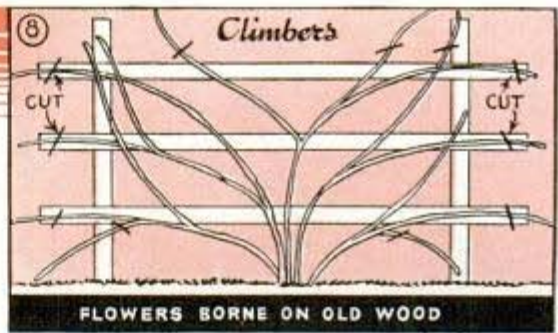
with ROSES

ting future applications to 6 or 7 lbs., will keep the supply of phosphorus constant. This and a pound of potash may be applied in early winter after the plants are hilled up with earth. Alternate freezes and thaws will work it into the soil. Make no change in the nitrogen supply, but hold off application until early spring to avoid loss by leaching.

Planting: Set hybrid teas 15 to 18 in. apart; hybrid perpetuals, (old fashioned June roses) 24 to 36 in. In general, set firmly in well packed beds. Thoroughly water newly set plants at three-day intervals for ten days. In the nursery, buds taken from known varieties of hybrid tea roses are grafted to husky root stocks of various rose species. Then the grafted plants are grown in fields for two years. Fig. 5 shows a hybrid tea rose bush as received from a nursery. The long arrow shows the knob made by the bud union when budded at the nursery. Growth above the union is of excellent rose sort; that below the roots is wild but vigorous. Prune the roots in the proportions indicated by the dotted lines. Cut the tops no



longer than 6 in. for first year's growth. Later yearly prunings may be made higher if quantity rather than quality of bloom is wanted. To plant, dig a generous size hole as in Fig. 6, including a high cone of unfertilized soil as shown to spread the roots down and out naturally. Tamp the earth down firmly around the roots so no air pockets are left. Placing a strip of wood across the hole aids in locating the bud union at the proper depth, 1 in. below the soil when planting is done. Do not plant too deep. Next, fill in with about a 4-in. layer of unfertilized soil, tamp firmly, and fill the hole with water. When absorbed, fill with earth, but do not tamp any more. Then mound the plant over with



soil as indicated in Fig. 7. If mounding over is not done, the top growth may be completely dried out before the roots take hold. Also, when planting, the roots are not allowed to contact fertilizer as they will "eat it up," and as the plant has no leaves to assimilate the nourishment, it may get "acute indigestion" from which recovery is doubtful. After ten days, gradually remove the soil down to ground level. Planting may be done in late fall or very early spring, the former preferred. Dormant plants should be used, but good potted plants are always available from rose growers for planting in May or June. Potted roses do not need pruning. The paper pot is not removed until the plants have been watered thoroughly. Then the paper is removed and the ball broken slightly,

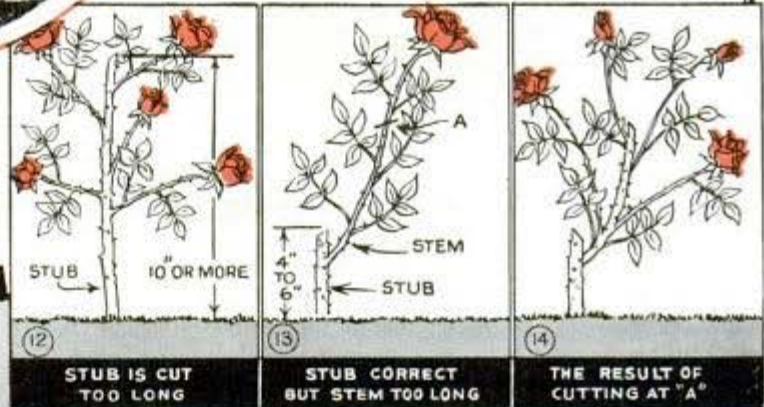


Before pruning



and after

Some causes of



STUB IS CUT TOO LONG

STUB CORRECT BUT STEM TOO LONG

THE RESULT OF CUTTING AT "A"

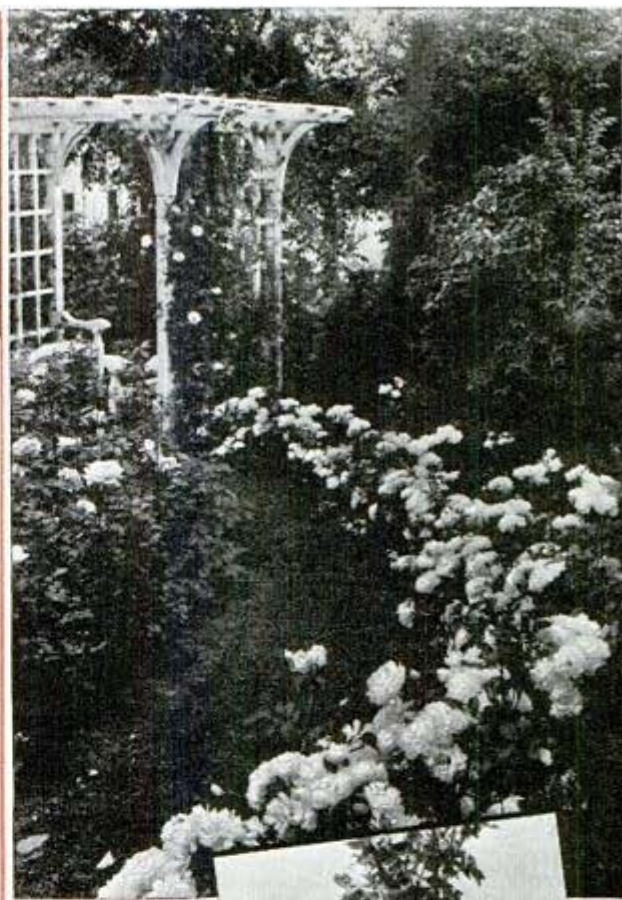
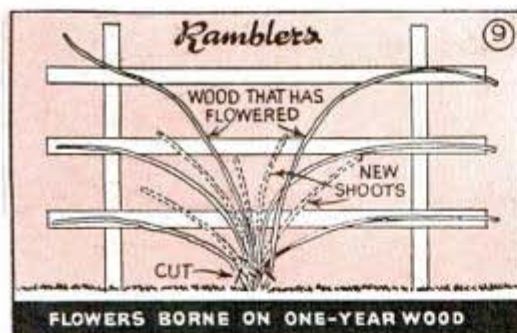
HYBRID TEA ROSE -- HECTOR DEANE



Courtesy Jackson & Perkins

straightening the roots at the bottom so that they will obtain nourishment from the rose bed.

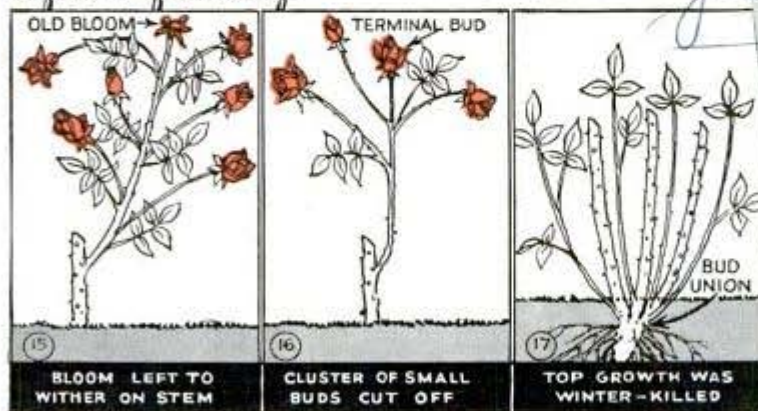
Pruning: In spring pruning, a hybrid tea rose is transformed as shown in Figs. 10 and 11. All weak shoots should be cut out and injured wood removed to a good "eye" below the point of injury and uninjured shoots are kept down to 6 or 8 in. above the ground. Throughout the season the plants undergo constant pruning, which if neglected, will cause inferior flowering. See Figs. 12 to 17. These details show only a single stub and stem, for the



purpose of clarity. Fig. 12 shows the stub cut too long at spring pruning. Long stubs produce too much wood growth and frail stems. Early flowers will be of fair size, but later ones will be small. Later pruning control is difficult. In Fig. 13 the stub is of correct length, but the stem was cut too short at point "A," the result of which is shown in Fig. 14. Sometimes only a single flower is produced just below cut. Often the "eyes" break all along the stem as shown. Fig. 15 shows bloom left to wither away. The result is much the same as in Fig. 14. A rose left on the bush should be cut immediately when petals begin to fall. Make the cut as shown in Fig. 22. Occasionally

Courtesy Jackson & Perkins

inferior flowering



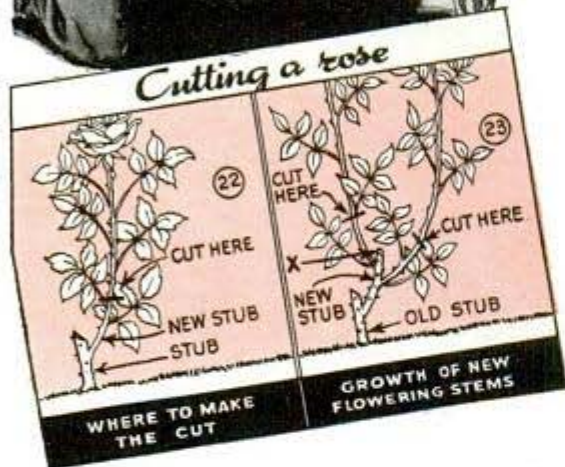
a cluster of rosebuds will form as in Fig. 16. When they are the size of peas, snip off all of them except the terminal bud. Fig. 17 shows top growth winter-killed, or dead from some other cause. Growth now springs from below the bud union, and is worthless. Use a good pair of pruning shears and keep them sharp. Make clean cuts, as bruised wood invites decay.

Pruning requirements of climber and rambler types of roses are simple. Figs. 8

and 9. On the climber, better flowers are borne on old wood. In early spring, cut back the main branches and laterals short enough to keep them within bounds and to prevent the growth from becoming too dense. Ramblers bear their best flowers on year old wood. In summer, wood that has flowered should be cut back to the ground, or close to the new shoots, immediately after the petals have dropped. Then train the new shoots to the trellis.

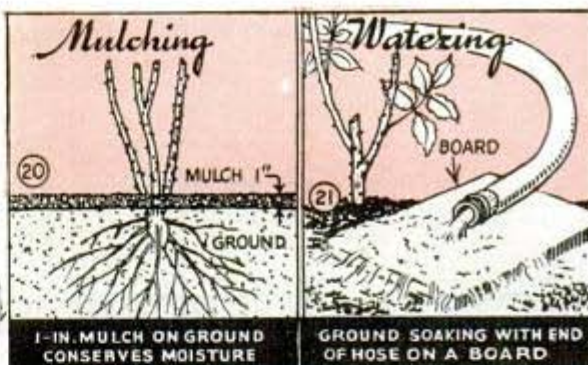


19
SPRAY OR DUST POWDER
ON THE
UNDERSIDE OF LEAVES



Cutting a rose: Make the cut two sets of leaves or two buds (small fleshy knobs) above the point where the stem joins the stub. See Fig. 22. New flowering stems immediately begin growing as in Fig. 23. If extra large flowers are desired, prune off one stem as shown at X. Follow this simple pruning routine throughout the season and your roses will grow to full size on long, sturdy stems.

Diseases and insects: The most prevalent diseases, mildew and black spot, attack in the form of spores, which are carried to your garden by the wind. The three most troublesome insects are aphids (sucking insects), leaf eaters and beetles. Aphids are controlled by either nicotine or pyrethrum contact sprays. Leaf eaters are killed by adding arsenate of lead powder, 1 part, to dusting sulphur, 9 parts (not flowers of sulphur). The sulphur controls spore diseases, the arsenate gets the leaf eaters. Spraying and dusting intervals should be no longer than ten days; weekly ones are better. Spray during the heat of the day; dust toward evening a few days later when the air is still. Apply either



20
1-IN. MULCH ON GROUND
CONSERVES MOISTURE

21
GROUND SOAKING WITH END
OF HOSE ON A BOARD

spray or dust from the ground up as in Fig. 19 to contact the underside of the leaves, where disease and insects attack. Soap is used with nicotine, and as a soap-arsenate combination is poisonous to foliage, let three or four days elapse between spraying and dusting. Two beetles that eat through young flower buds, are the rose chafer, which is best picked off by hand early in the morning, and the rose curculio, which is controlled by arsenate.

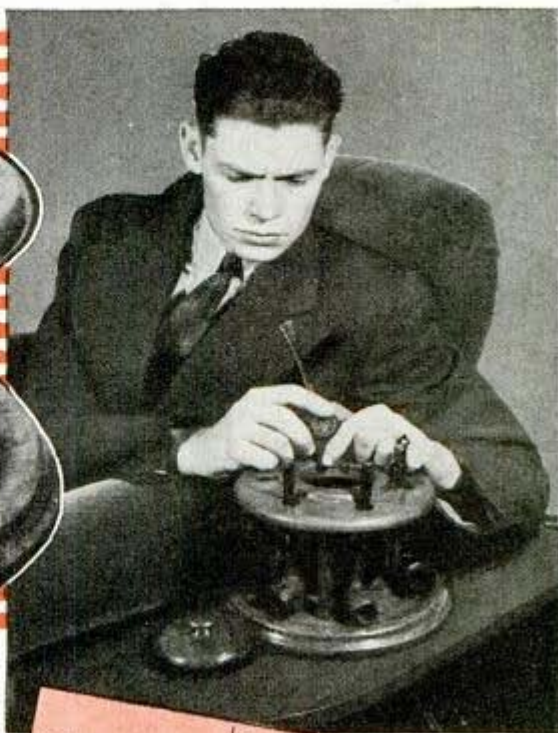
Watering and cultivating: Watering can be done by ground soaking; laying an unnozzled hose on a board as in Fig. 21. If overhead watering is done, do it early on a sunny morning so that foliage will dry quickly. Wet foliage encourages disease. Begin cultivating in early spring and don't let up throughout the season. Get busy with the hoe as soon as the ground dries after soaking from hose or sky.

Mulching: A 1-in. layer of peat moss over the bed, as in Fig. 20 will conserve moisture and check weeds. Apply winter mulch as shown in the photograph, Fig. 18. Wait until the second or third hard frost, then mound the mulch up 8 or 10 in. Tie the top growth to a stake because winds will whip the canes and cause a hole through which killing frosts may enter. Do not dig holes in the rose bed, but bring in soil from other parts of the garden. Do not prune the top growth at this time, because at springtime the roots will force too much tender low growth, which late frosts will likely kill. Don't remove the mulch too early in the spring. Wait until the period of hard frosts is over, then remove mulch gradually over a three to four-day period, preferably during cloudy weather. If at any time a frost or freeze threatens, mound over the tender growth with peat or soil but remove this immediately the following morning, unless temperature continues at freezing point.

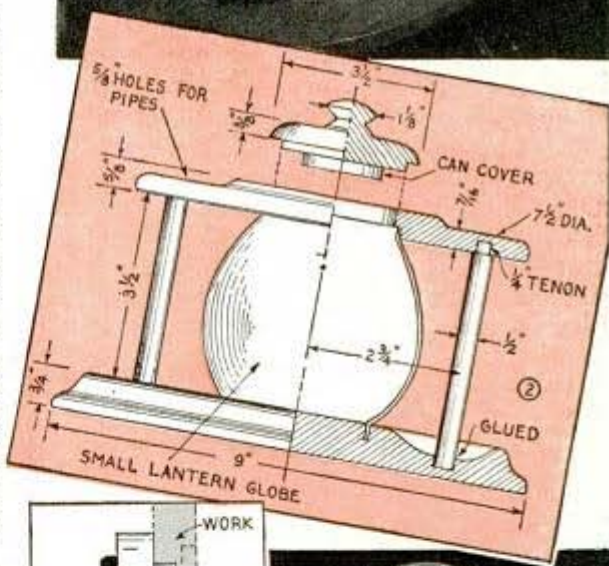
Humidor and Pipe Rack Combined in One



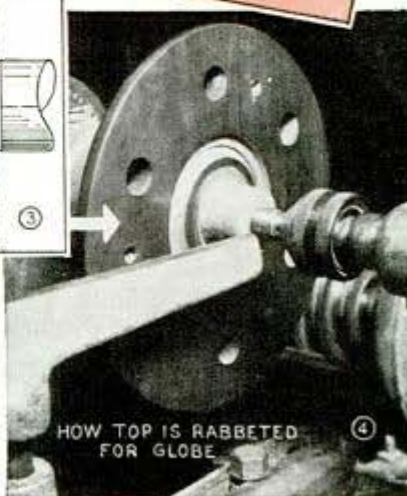
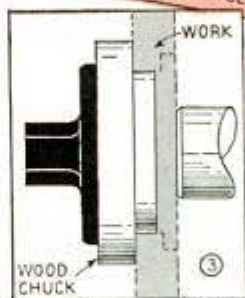
①



Appropriate for the discriminating pipe smoker, this combination humidor and pipe rack accommodates six or more pipes and a good supply of tobacco. The unit consists of a turned wood base and top, and a colored lantern globe, which serves as the humidor, three dowels being used to space the wood parts and hold them on the ends of the globe. Fig. 1 shows the completed unit, while Fig. 2 gives the assembly. Openings are made in the top for the pipe stems and the humidor lid. Fig. 3 shows how a wood chuck is used to hold the top disk on a faceplate. Notice that the lid opening is rabbeted on the underside to take the globe end and that the base is grooved for the same purpose. The rabbet is turned while the disk is still on the improvised chuck as in Fig. 4. The groove should be slightly oversize to prevent shrinkage of the wood from breaking the glass. The globe can be cemented in the groove if desired, although this is unnecessary if the top and base are held tightly on the globe ends by the dowels. A little melted paraffin poured in the bottom of the humidor will prevent tobacco from contacting the wood. A humidifier is provided for the tobacco, and consists of a can cover screwed to the underside of the lid and filled with plaster of paris, which is moistened with water occasionally. Either wax or shellac provides a nice finish for the wood parts of the unit.



②



HOW TOP IS RABBETED FOR GLOBE

④

Grinder Folds Under Workbench Out of the Way



Craftsmen who like their grinder on the bench but do not have room for it, can solve the problem by simply cutting out a portion of the bench and bolting the grinder to it. The cutout piece is then hinged as shown, which permits the grinder to be folded out of the way when not in use. Two 2 by 4-in. cleats screwed to the underside of the bench are strong enough to hold the average grinder.

Easy Way to Heat Mortar Water When Weather Is Cold

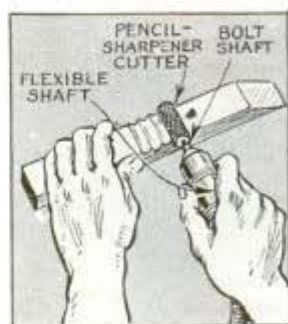
Here is the way water from a hydrant was heated for mixing plaster mortar during many cold months last winter. Two sections of hose were used with an 8-ft.



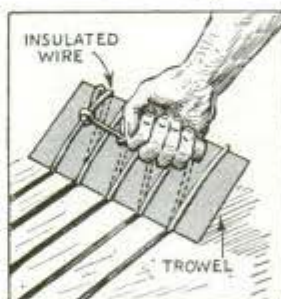
length of steel conduit or pipe between them. This was supported on stones at each end and a fire kept burning around it. By slowing down the flow of water the temperature increased. In fact, it was no trick to obtain water rapidly near the boiling point.—D. R. Van Horn, Lincoln, Nebr.

Cutter From Old Pencil Sharpener Serves as Carving Tool

A single cutter from an old pencil sharpener makes a handy carving tool when chucked on a flexible shaft. By passing it lightly over an oilstone the spiral cutters are kept sharp. The fast shaving motion of the knives slices off wood with or against the grain without splintering.



Trowel Wrapped With Wire Is Scoring Tool for Concrete



Where the slope of a new concrete walk is such that it must be scored to provide a footing when the surface is slippery, and no special scoring tool is at hand, you can use

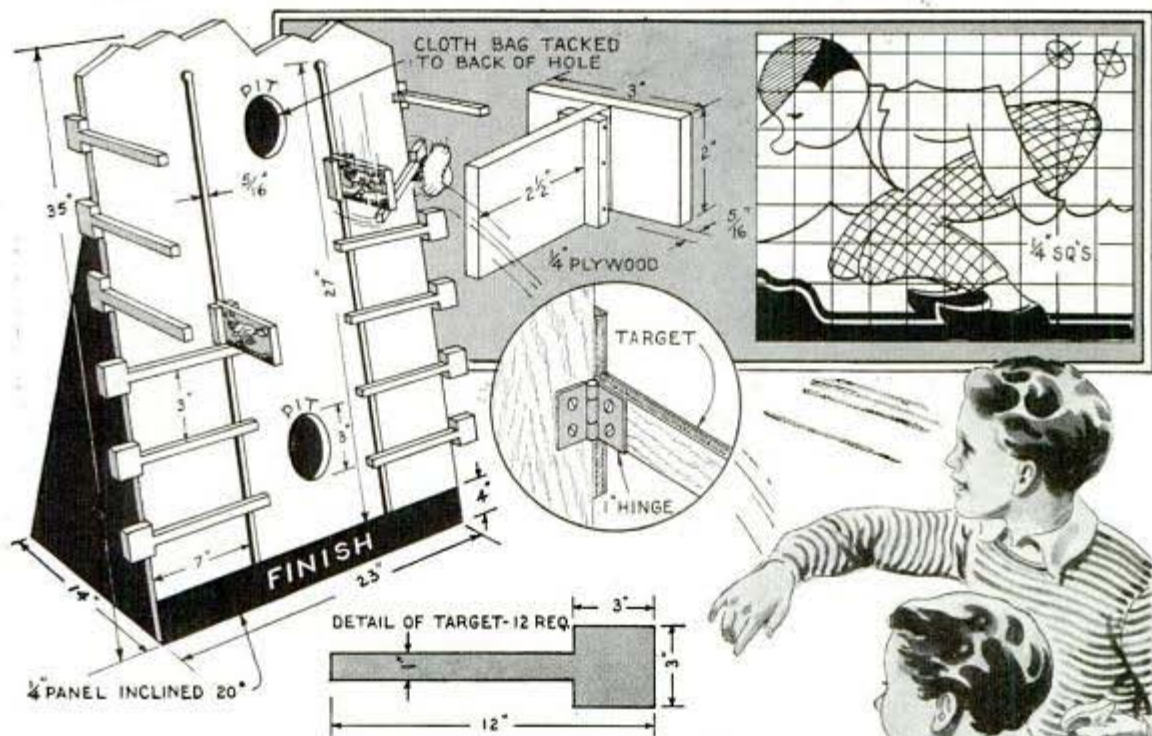
your regular trowel for the purpose. Just wrap it with insulated wire or heavy cord as indicated and pull it across the surface of the concrete before it hardens.

Peroxide Renders Scorch Spots On Cloth Less Noticeable

Scorched spots on clothes can be minimized in appearance with hydrogen peroxide. Apply it with a wad of cotton or a piece of cloth and allow it to dry before ironing.



Midget Skiers Jump When Targets Are Hit

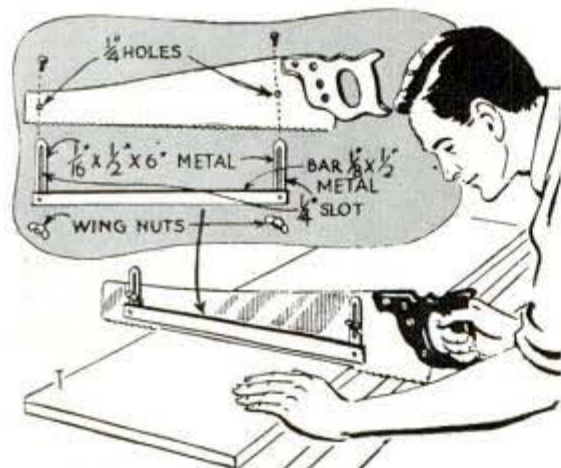


Every member of your family will have fun with this game in which a series of targets must be hit progressively from top to bottom with a bean bag to move indicators to the finish line at the bottom. The players alternate their throws, each one throwing two bean bags. If a player throws a bag into one of the pit holes, he forfeits his next turn at throwing. The game consists of a plywood panel having six targets hinged to each outer edge as indicated in the circular detail. The two indicators slide in slots in the panel and have figures of a ski jumper painted on them. As the indicators must slide easily, it is a good idea to lubricate the grooves with soap or paraffin. A piece of cloth tacked behind each pit hole makes it easy to retrieve a bag thrown into one of them.—R. L. Fairall, Los Angeles, Calif.

Depth Gauge on Handsaw Cannot Slip Out of Adjustment

Easily removed from a handsaw when not in use, this depth gauge is adjusted

merely by loosening and tightening a couple of wing nuts on bolts, which hold the gauge securely in place. It will be necessary to drill a pair of holes through the saw blade, but this will not weaken the blade enough to make any difference in most cases.—A. H. Waychoff, Phoenix, Ariz.

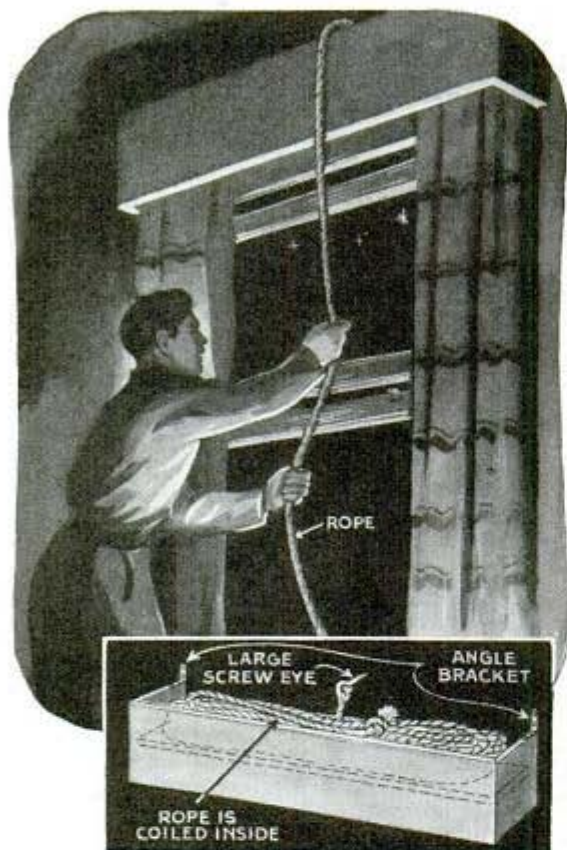


Croquet Wicket and Stake Holder

Driven flush with the ground, short lengths of pipe spaced properly on the lawn to hold croquet wickets and stakes, will eliminate measuring the court for each game. Such holders do not interfere with the lawnmower and are hardly noticeable.

—John J. Cornwell, Newark, N. Y.

Life Rope Kept in Cornice Board Is Always at Hand if Needed



It is always a good idea to keep a rope on an upper floor of your home as a means of escaping through a window in case fire should shut off escape by the stairway. A good place to keep the rope is in a cornice board above a window. A bottom is provided about the center of the cornice to support the rope, which is coiled carefully in place so that it can be removed quickly without tangling. One end of the rope is tied securely to a strong screw eye driven into a stud above the window. Locate the rope at the window farthest from the stairway so there is little possibility of escape being prevented by fire at both places.

Small Labels Typewritten Neatly



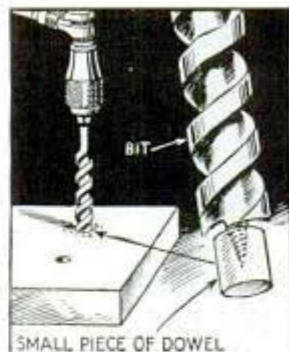
When typing labels that are too small for the guide rollers to hold in place, a neat job can be done by sticking art corners on a sheet of ruled paper and

inserting the labels under them, as shown. In this way, the labels will not slip and several can be typed without removing the paper from the machine.

—Raymond Shipman, Washington, D. C.

Holes in Wood Enlarged Easily By Using Pilot on Drill

If it is necessary to enlarge a hole in a block of wood, you can do the job by merely using a larger auger bit. Just slip a dowel that is approximately the same size of the hole over the point of the bit to serve as a pilot. This will guide the larger drill so that the enlarging will be uniform in respect to the hole already drilled.



—Sigmund Sameth, New York.

Excavation Is Made Symmetrical With Aid of a Rod and String

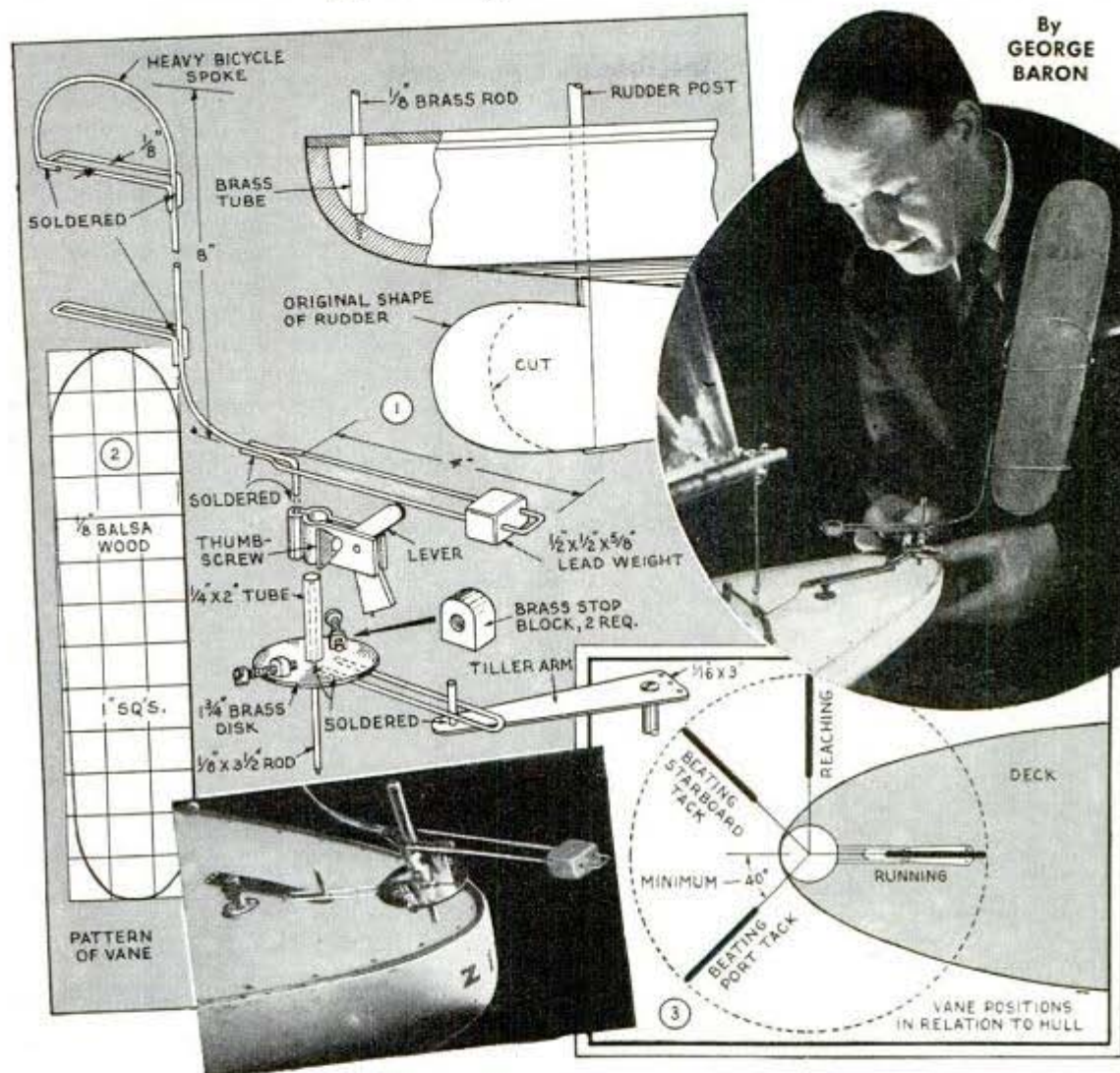
In excavating for a cistern, it was found that the opening could be kept symmetrical as the work progressed by measuring with a string from a rod driven into the ground on the centerline of the excavation. The measurements were taken at regular intervals, and the rod was driven down as the soil was removed.

—F. H. Peterson, Monroe, La.



'Vane Steering' Keeps Model Yacht on Course

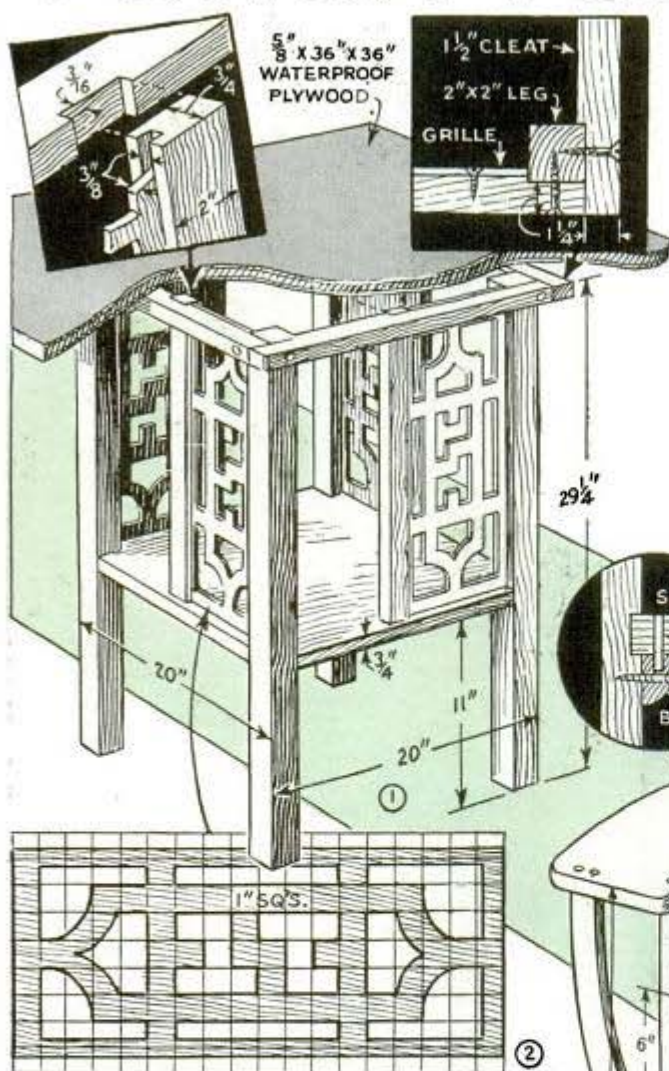
By
GEORGE
BARON



"Vane steering" sails your model yacht on a fixed course in relation to the wind. If a puff of wind changes the course of the boat, the vane is then out of line with the wind, and will swing back into position, turning the rudder, which brings the boat back on her course. With vane steering you can sail your boat to windward with the mainsail hauled closer than usual, and the jib relatively free, which causes the boat to sail closer to the wind and foot faster than with the jib jammed hard amidships to hold her off the wind. The vane is held by a wire frame attached to a brass friction clip and is counterbalanced with a lead weight. The clip fits over a brass tube, soldered to a disk, which is pivoted on a pintle $4\frac{1}{2}$ in. aft of the rudder post. A wire arm on the disk connects to the tiller arm. In use, point the yacht

where you want her to go, and, with the rudder held straight, move the vane in the direction of the wind. Then make the clip tight, and start. The screw stops are for windward work, to help in setting the vane quickly for the next tack, they having been adjusted beforehand. Each screw may have to be set differently. When changing tacks you pull the end of the balance arm until the lever on the clip hits the stop. For running or reaching, this lever is raised to pass over the stops and is set at the desired position. As backstays cannot be used with a vane, it may be necessary to add other side stays leading farther aft. Also, the rudder area is reduced about one half by cutting down the length and leaving the depth the same. The size of vane as given is for a Marblehead-class yacht. Larger vanes are used in light winds.

PORCH FURNITURE

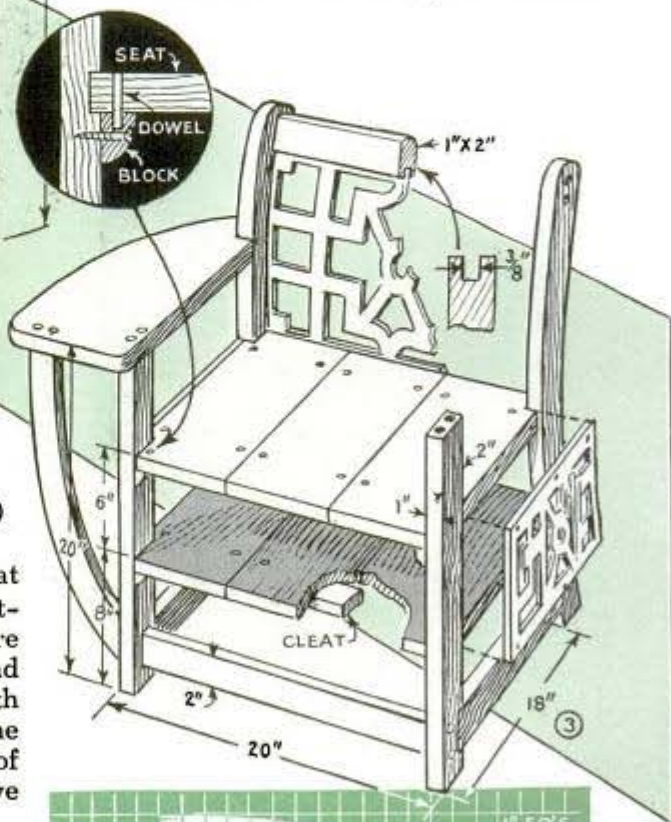


HERE is a weatherproof garden set that will be equally attractive either painted or unfinished. The panels or grilles are sawed from $\frac{3}{8}$ -in. outdoor plywood, and the entire structure is assembled with dowels and waterproof glue, such as the new resin-type glue. The Chinese motif of the panels will be particularly effective against shrubbery.

Fig. 1 shows the table, which is 3 ft. square and has a top of $\frac{5}{8}$ -in. plywood. A lower shelf is provided, each side of which is screened with a half panel of plywood, Fig. 2. These grilles are set in grooves in the vertical member, but not in the shelf or legs. The top edge is screwed to cleats under the table top, the cleats being glued and screwed to the top. If necessary, stability of the table may be increased by

screwing a scrollsawed foot to each leg. Provision for an umbrella is made by boring a hole in the center of the top and installing a "mast step" or socket below.

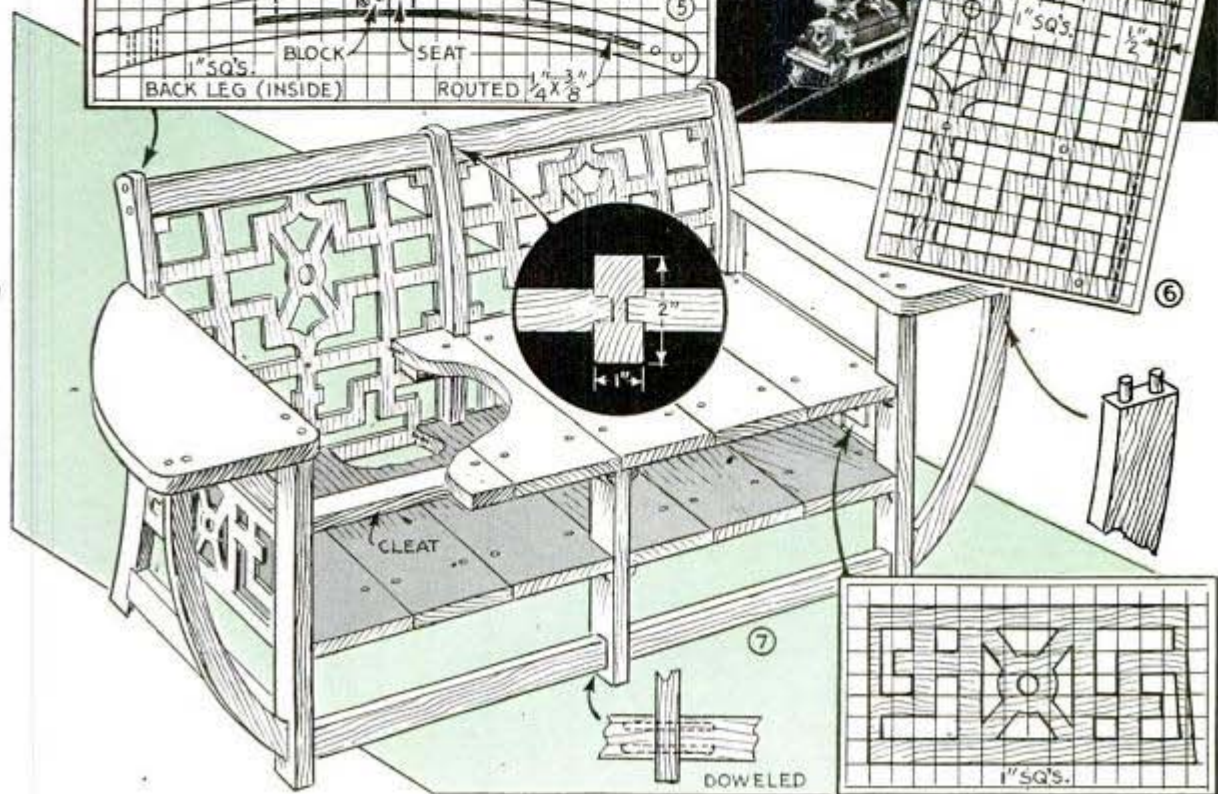
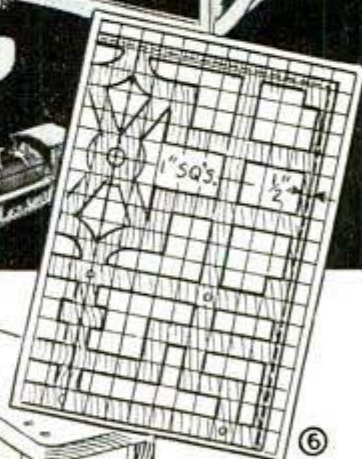
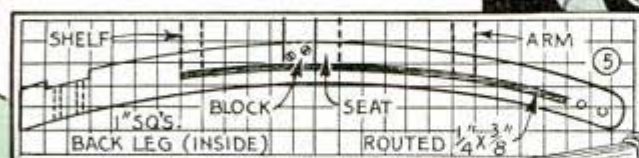
General dimensions and assembly for the chair are given in Fig. 3. Spacious arms accommodate books, magazines or a snack tray, with the compartment below the seat serving for newspapers, cushions, etc. Fig. 4 gives the pattern for the arms and their supporting brackets. Three grilles are used, one in back and two small ones at the sides. The back grille extends



has scrollsawed panels

from the top cross member to the shelf under the seat to which it is doweled. On the sides, the grilles are screwed to the edges of the seat and the shelf. A pegged effect can be had by countersinking the screws and plugging the holes. A molding or rabbeted cover strip can be used to hide the edge of the plywood. A short block is screwed to each leg to support the seat and a similar one for the shelf.

A settee is made as in Fig. 7 by doubling the width of the chair plus the thickness of the center frame. By using $\frac{3}{4}$ -in. plywood, seats can be made in one piece as well as the shelf and the arms. In the settee, the center back leg is routed on both sides to receive the grilles instead of only one side as in the chair. Patterns for the back grilles and the rear legs are given in Figs. 5 and 6.



Simple Ski Holder Between Studs Permits Easy Removal



To store a pair of skis in shape between the studding of your garage or workshop, nail two cleats across the studding to hold the tips and centers of the skis. Then attach stub cleats near the heel ends as shown, which permit the skis to be sprung easily into place or removed in a jiffy.

—G. E. Hendrickson, Argyle, Wis.

Countersink for Tight Places Is Made From Nail

When you have a hole to countersink on the underside of a curved surface or other place where a regular countersink cannot be used, you can make one for the job from a nail.

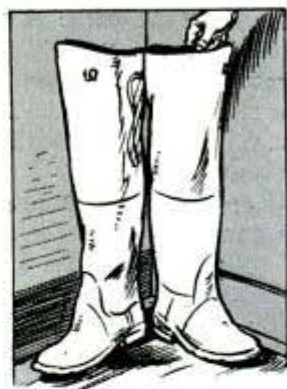


The head of the nail is first trued up. Then notches are filed in the head to produce four segments, beveling the edges slightly to produce cutting edges on the surface side of the head next to the shank. With a pair of pliers, twist the segments slightly to raise

these cutting edges. In use, insert the nail from the underside of the work and chuck it in a drill. Rotating the nail and pulling up on it at the same time will countersink the hole.—Harry M. Childs, Mobile, Ala.

Cracking of Hip Boots Avoided
By Standing Them in Corner

Hooks or clamps are unnecessary to hold a pair of hip-type rubber boots in a vertical position to prevent the top from folding and cracking when stored away. Simply stand the boots in one corner of the closet in the position shown



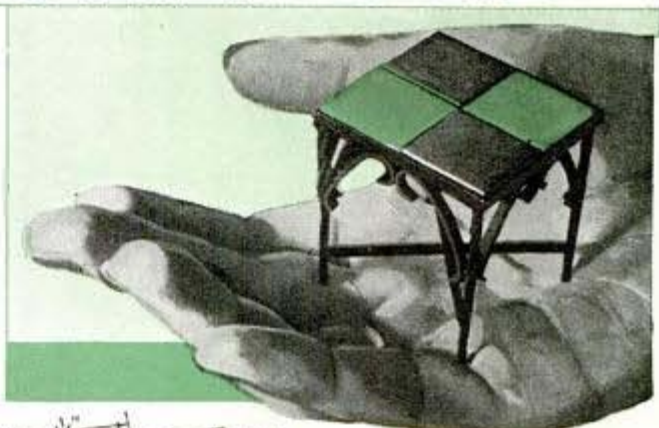
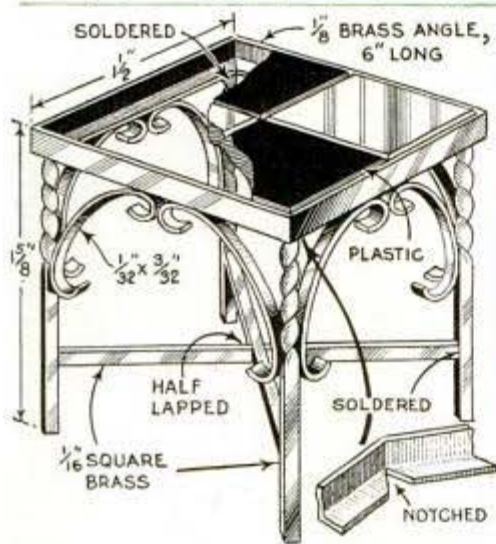
and one will support the other so that both of them will remain in a vertical position.

Novel Gate on Private Boat Pier Keeps Out Intruders

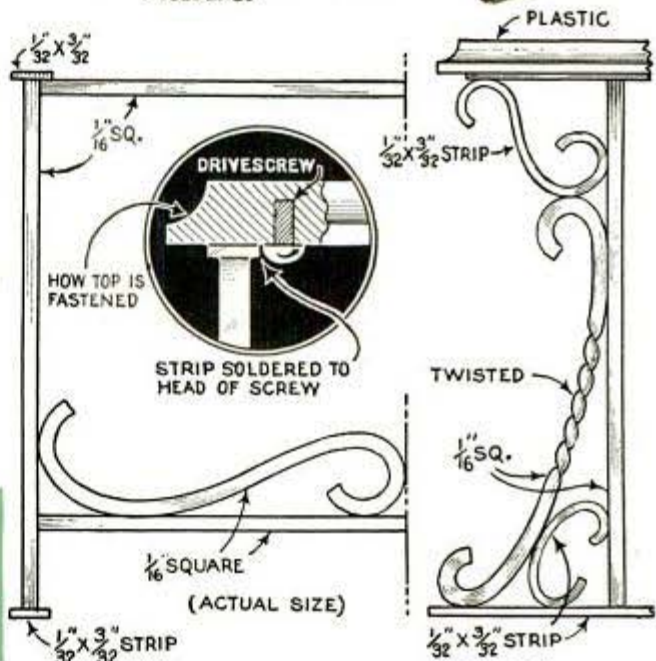
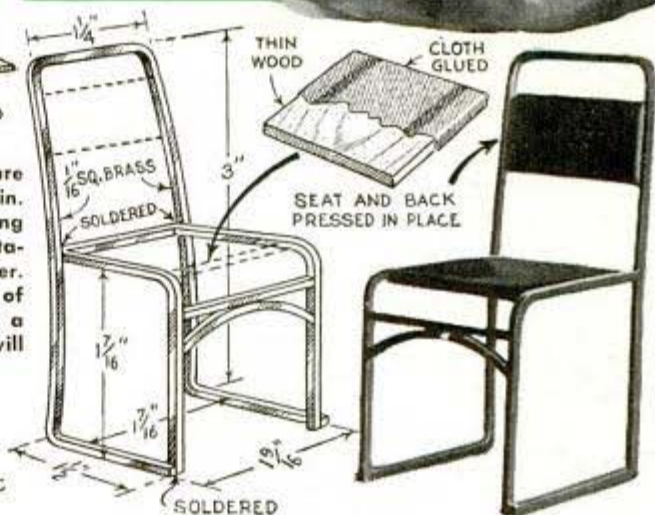
Finding that wharf space at a popular beach resort was in such demand that it was difficult to keep his pier open, one owner fitted it with a gate at the outer end. This was made of pickets as indicated, and effectually discouraged picnickers—only the very agile being able to get around it when the gate was locked.



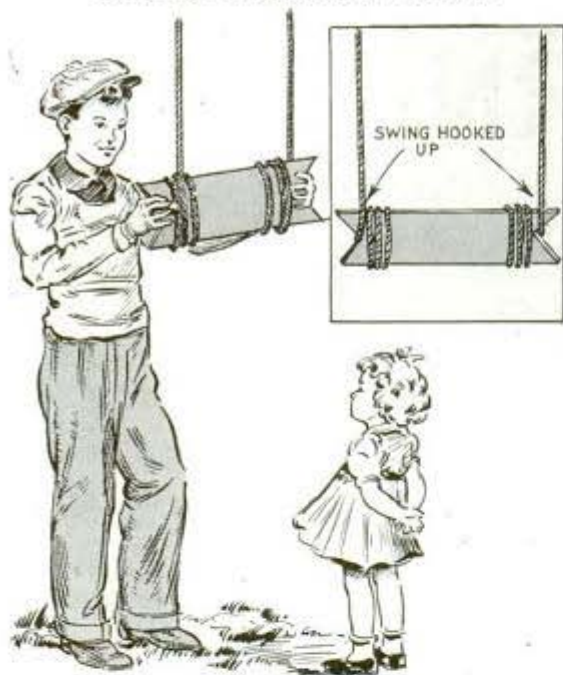
Wrought-iron styling in DOLL FURNITURE



Miniature replicas of fine wrought-iron furniture for a dollhouse can be made from 1/16-in. square brass and 1/32-in. brass strips, using plastic to simulate tile and marble tops on tables. All parts can be assembled with solder. The assembled parts are cleaned of all traces of flux by boiling them in a soda solution for a few minutes, after which a flat black paint will give a satisfactory dull iron finish



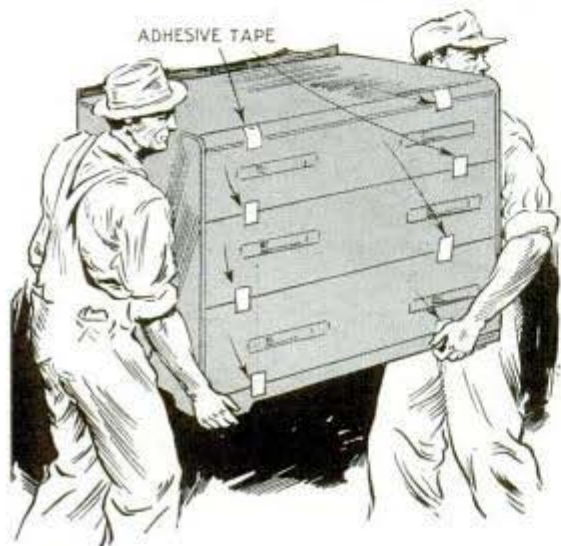
Swing With Notched Seat Rolls Up Out of Children's Reach



You can keep a swing out of the way when not in use, or above the reach of small children who might be injured in playing with it, by notching the seat so that it will serve as a reel upon which to wind the ropes. By rolling up the seat and looping each rope over one corner as shown, it will stay at any desired height.

Tape Keeps the Drawers Closed While Moving Dresser

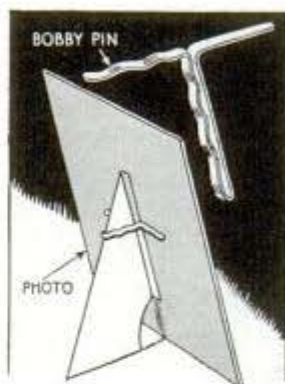
When moving a dresser or chest of drawers in or out of a home, the drawers can be prevented from sliding out by merely



sticking pieces of adhesive tape to the drawer fronts and to the dresser frame. When the furniture is put in place again, the tape can be stripped off, any adhesive remaining on the varnished surface being rubbed off with a dry cloth.

Collapse of Photo Easel Avoided By Bracing With Bobby Pin

If you have a large photo on which the easel has a tendency to fold over when moving the picture, you can brace it with a bobby pin. To do this, bend the legs outward at right angles and slip it over the easel as shown.



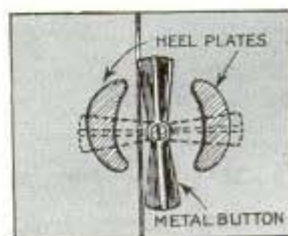
Paper Cones Hold Boiled Eggs For Peeling and Eating



The next time you boil eggs while out camping or on a picnic, handy servers for them can be improvised quickly by rolling squares of newspaper into cones and using them as holders. The cones will prevent burned fingers.

Heel Plates Prevent Turnbutton From Marring of Door

Metal turnbuttons on doors that are opened frequently can be prevented from wearing the wood by putting shoe-heel plates on the surfaces contacted by the button.

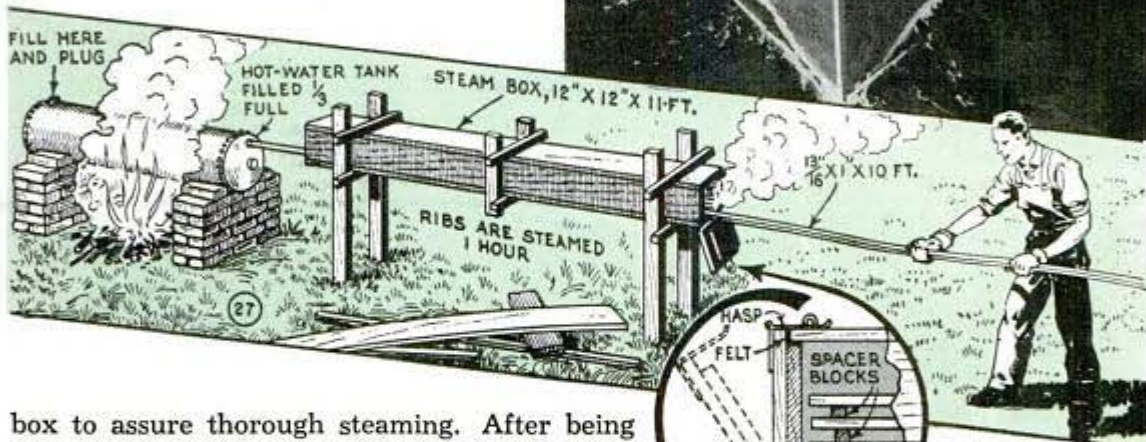
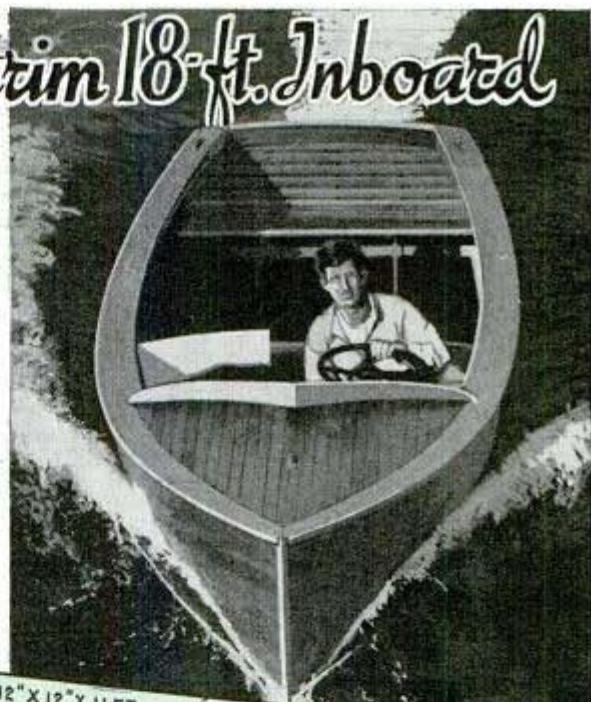


If necessary, a slight depression can be made in the wood to sink the plates sufficiently to avoid hard turning of the button.

"FALCON"—a trim 18-ft. Inboard

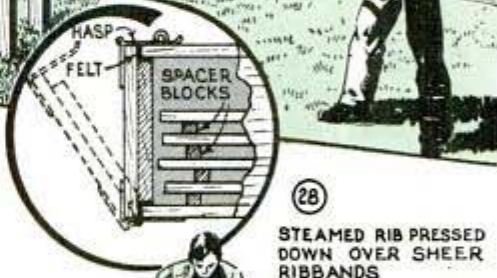
Part II—Installing the Ribs and Engine Stringers

WITH the construction completed as far as described, you are now ready to install the 25 oak ribs inside the ribbands. These are cut from thoroughly seasoned, straight-grain white oak to measure $1\frac{3}{16}$ by 1 in. by 10 ft., with both inside edges rounded slightly. To make them pliable for bending, a tight-fitting box like the one shown in Fig. 27 must be made in which they can be steamed. Note how the ribs are spaced inside the

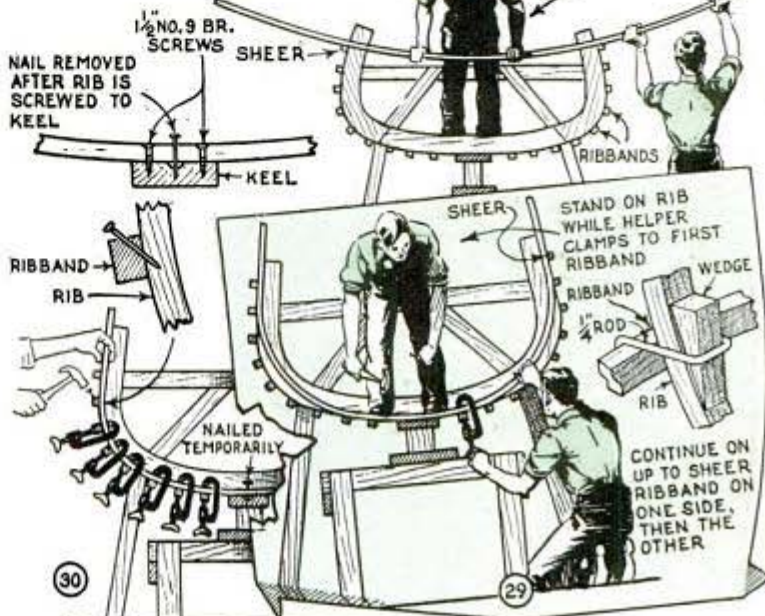


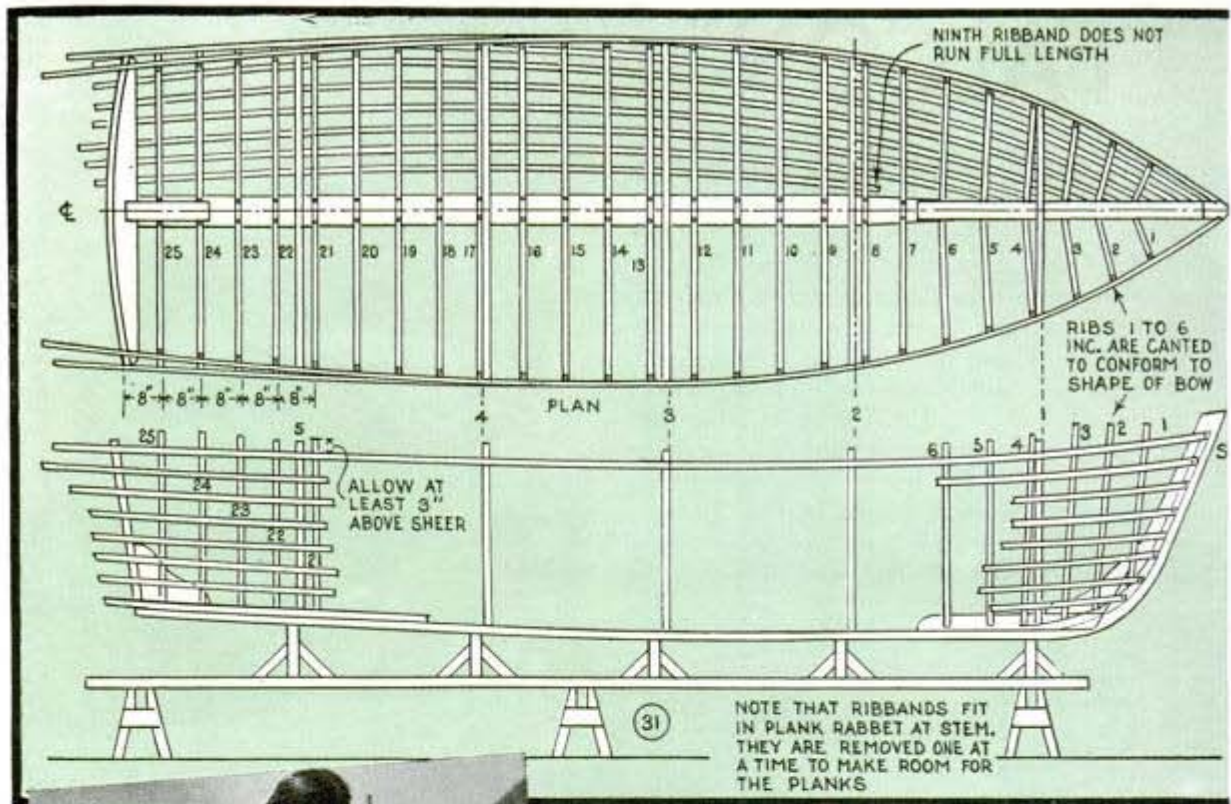
box to assure thorough steaming. After being steamed for about 1 hr., the ribs are removed one at a time and installed immediately in the form while they are hot.

From the profile and plan views given in Fig. 31, mark the position of the ribs on the sheer ribbands and the keel. All are spaced approximately 8 in. apart. The procedure to follow in installing each rib is shown in Figs. 28, 29 and 30. Working from the transom forward, the steamed rib is laid across the sheer ribbands and forced downward as in Fig. 28. Then while standing on the rib over the keel as in Fig. 29, have an assistant draw the rib down to the ribbands on each side of the keel with a C-clamp. Use blocks under the clamps to avoid marking the ribs. Now

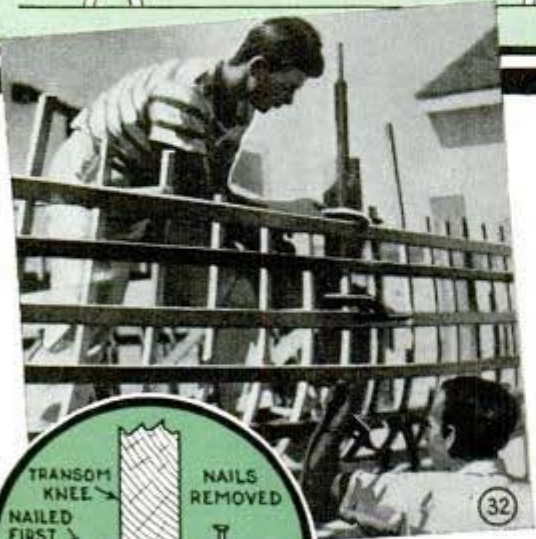


28 STEAMED RIB PRESSED DOWN OVER SHEER RIBBANDS

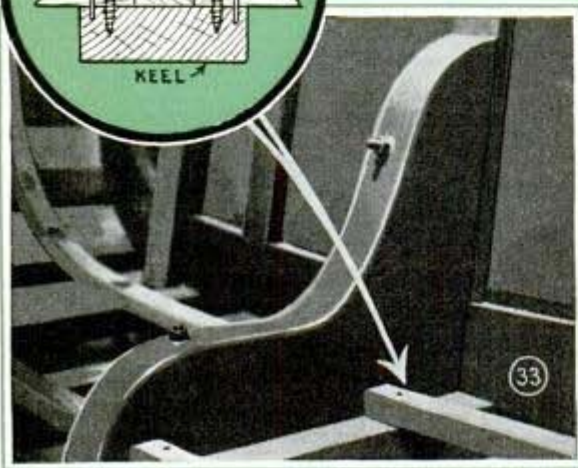




NOTE THAT RIBBANDS FIT IN PLANK RABBET AT STEM. THEY ARE REMOVED ONE AT A TIME TO MAKE ROOM FOR THE PLANKS

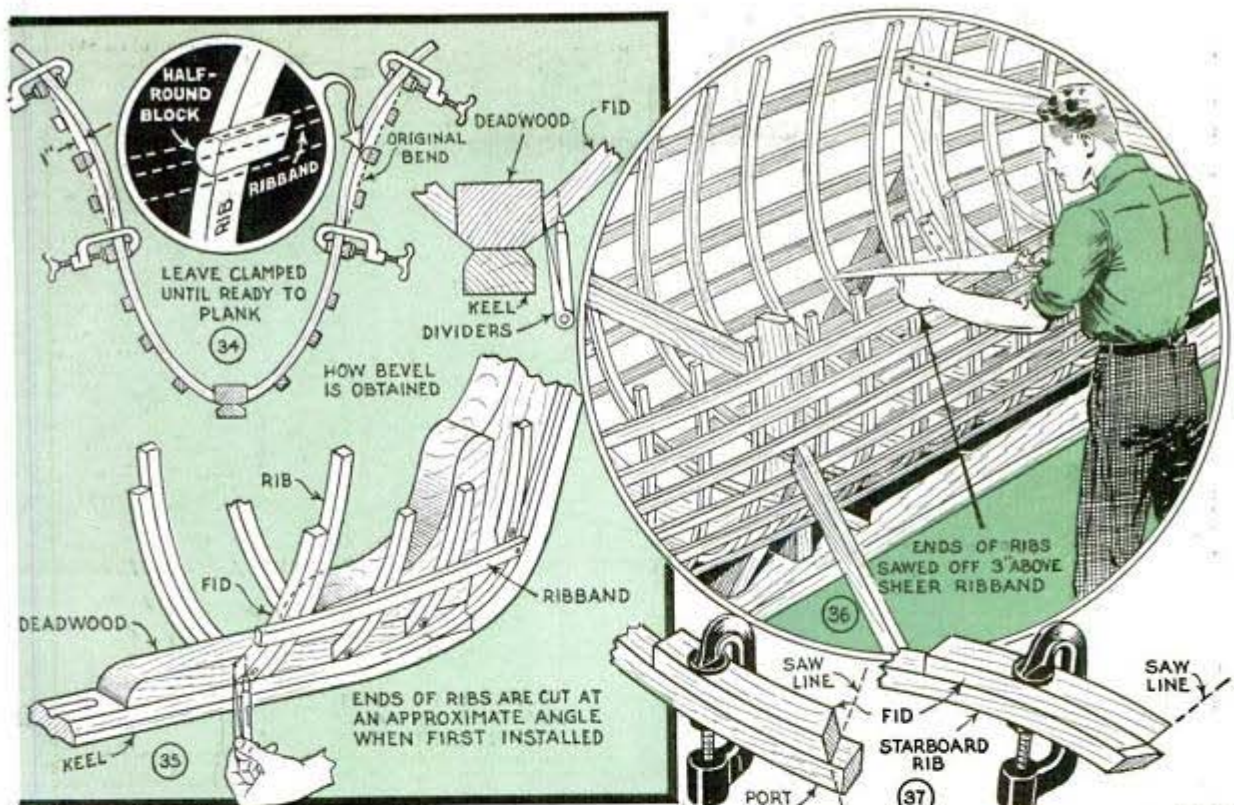


32



33

the rib is nailed temporarily to the keel, after which clamps are applied on up to the sheer, working alternately on one side and then the other as in Fig. 32. When the rib has set, the clamps are removed one at a time after the rib is toenailed as shown in the upper detail of Fig. 30. If you lack a sufficient number of clamps, a dozen or so yoke-and-wedge assemblies can be made to hold the ribs snugly against the ribbands. (See Fig. 29.) As each rib is installed, check to make sure that it is at right angles to the keel, and parallel with the adjacent rib. Two brass screws are used to fasten each rib to the keel, after which the nails, previously driven, are withdrawn. The two ribs next to the transom are divided at the knee as shown in Fig. 33 and the sectional detail. The lower ends of these ribs are nailed temporarily to the keel first, and then drilled and screwed before removing the nails. The first six ribs forward also are divided. (See Fig. 31.) These are canted to conform with the shape of the bow, the degree of cant being determined when installing. The lower ends of these ribs will be approximately 8 in. apart, but farther apart at the top, though evenly spaced. Rib No. 6 will

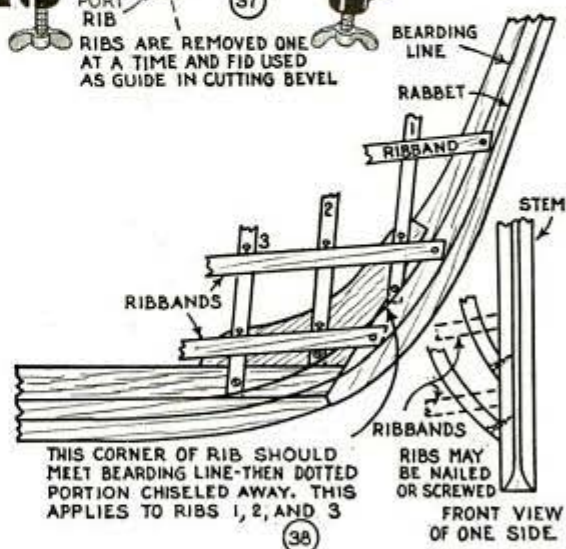


be canted only slightly, and the angle will increase successively on forward ribs. Any slight variation in the distance between the ribs makes little difference as long as both port and starboard ribs correspond. In case a station mold interferes with the proper location of the rib, nail a thwart across the sheer ribbands close to the mold before removing the latter. However, before this is done, all ribs fore and aft should be in place. You will note that the flare of the bow gives ribs Nos. 1 and 2 a reverse curve and because these ribs curve both inward and outward, there is a tendency for them to straighten out somewhat when the ribbands are removed. Therefore, it is a good idea to accentuate the reverse curve by placing a 1-in. half-round block between the rib and the ribband and clamping them above and below as indicated in Fig. 34. These blocks are left in place until the rib is dry, after which the rib should assume a normal curve.

Cutting the compound bevel on the ends of these divided ribs so that they will butt perfectly against the stem, knee and deadwood, and flush with the

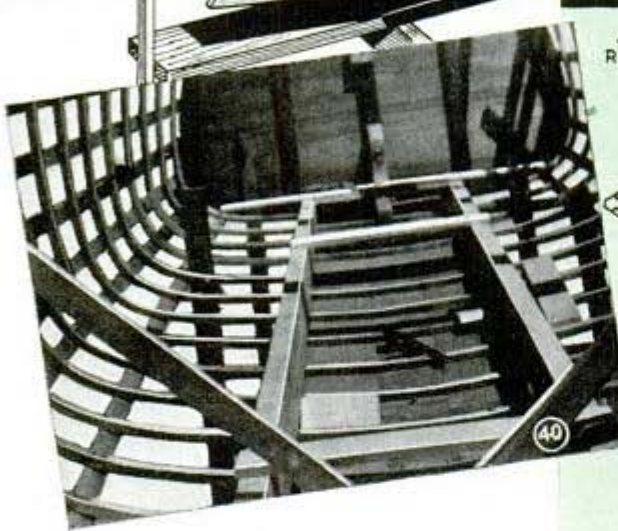
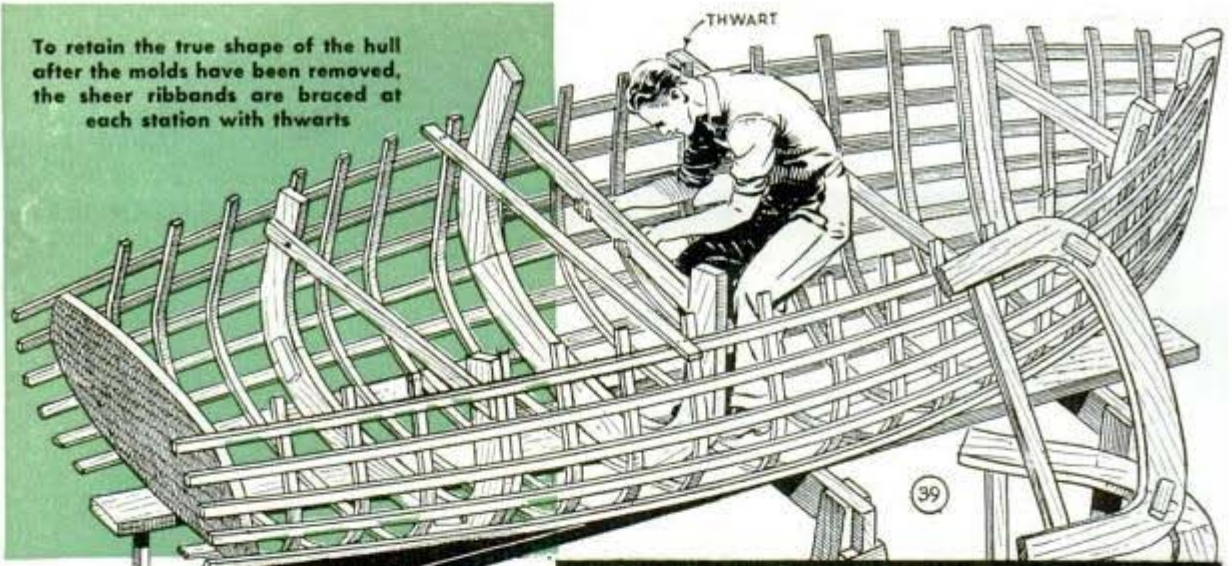
GLUE FOR BOAT BUILDERS

For boat-building purposes the new resin-type glues now available, are greatly superior to other waterproof glues formerly used. Besides being waterproof, they produce joints of amazing strength and durability. Many dealers in marine glues now offer this product, or you can obtain it from dealers in paints, hardware and woodworkers' supplies

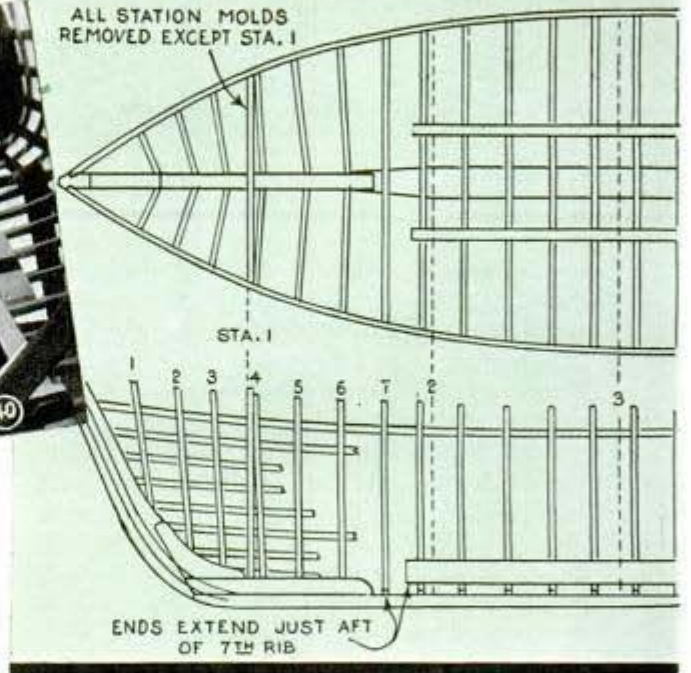


bearding line is a rather tricky job. Figs. 35 and 37 show how this is done. First the ends of the ribs are cut roughly as close to the correct angle as possible. Then they are steamed, clamped in place and finally nailed at the lower end flush with the bearding line. Next a fid or a short block is cut the same size and curve of the lower end of the rib. This block is held against the aft side of the rib and

To retain the true shape of the hull after the molds have been removed, the sheer ribbands are braced at each station with thwarts



ALL STATION MOLDS REMOVED EXCEPT STA. 1



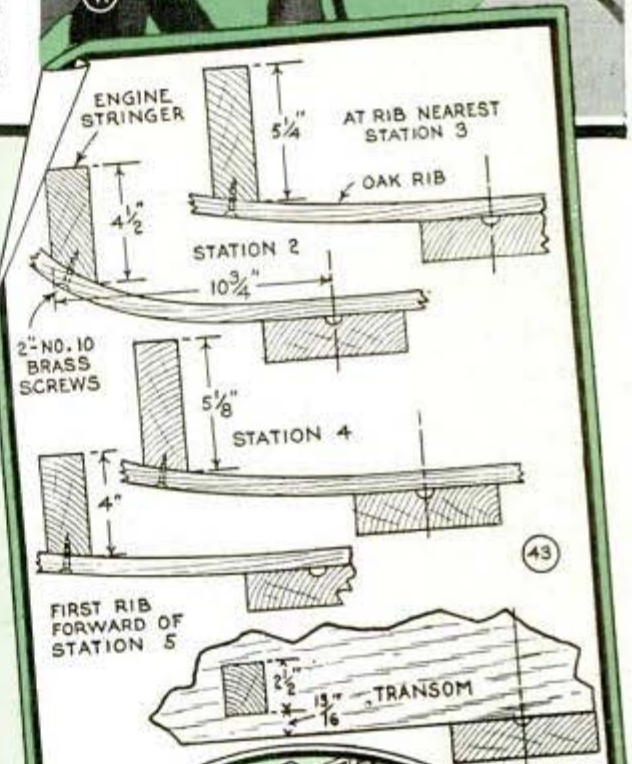
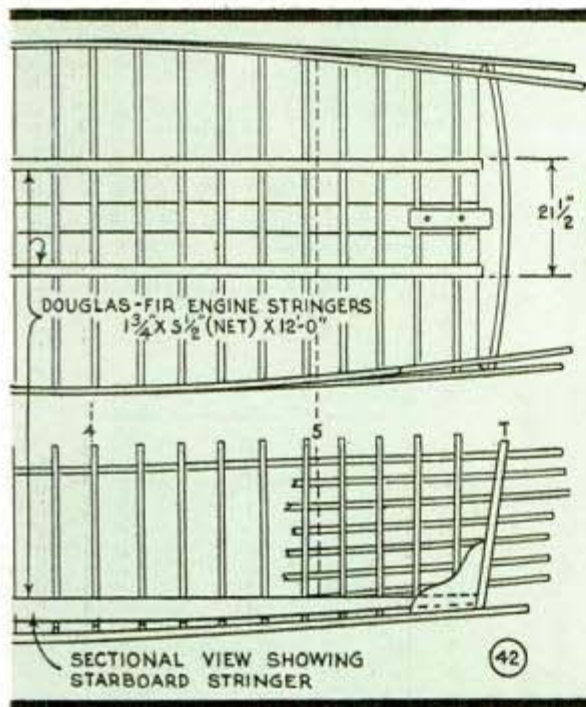
marked with a pair of dividers as in Fig. 35 and then it is held against the fore side of the same rib and marked, after which it is cut at these marks. Now remove the rib, clamp the fid to it as in Fig. 37 and saw the end to correspond with the fid. This takes care of the starboard rib. By reversing the process for the port rib, you will obtain a corresponding left-hand angle. While this method presents the most accurate way of fitting these ribs, it is possible to simplify the work somewhat and still obtain a fair degree of accuracy, by cutting the ends before steaming the wood. To do this, a short length of rib stock is held even with the bearding line and against the eighth ribband and marked with dividers at the angle at which it meets the stem or deadwood. Then with the end cut according to the marks, the stick is used as a guide in making a corresponding cut on the end of

the straight rib. Fasten the ribs as in Fig. 38, so that the aft corner is exactly on the bearding line. Then chisel away the dotted portion at a slight angle to permit the planks to lie flush over the ribs at this point. Holes in the ends of the ribs prevent splitting when fastening them with brass screws.

The method of bracing the sheer ribbands with thwarts when removing the station molds is shown in Fig. 39. As vertical braces extending to the ground must necessarily be removed in doing this, the hull should be braced securely to some solid object nearby. The upper ends of the ribs are sawed off 3 in. above the sheer

ribbands as shown in Fig. 36. This extension is necessary to care for an extra ribband which is required in fitting the sheer plank. If you are building your boat outdoors, a coat of varnish or linseed oil applied to the wood will prevent checking of the latter if exposed to the sun.

At this stage the engine stringers may be installed. Their location is given in Fig. 42. A light batten clamped as in Fig. 44 is used as a straightedge to mark the position of the stringers on the ribs, at which points holes are drilled for screws. Fig. 43 gives the approximate bevel along the bottom of the stringer



at five station points, and also shows how it tapers toward the stern, becoming only $2\frac{1}{2}$ in. high at the transom. Two or three temporary cross-pieces nailed to the top of the stringers as in Fig. 40, will keep them in line while fastening them to the ribs from below as shown in Fig. 41. Use 2-in. No. 10 brass screws and draw them up tightly. If the faces of any ribs are uneven when checked with a straightedge, fair away the wood at these points. The important thing here is to obtain a symmetrical form over which the planking will assume a natural sweeping curve.

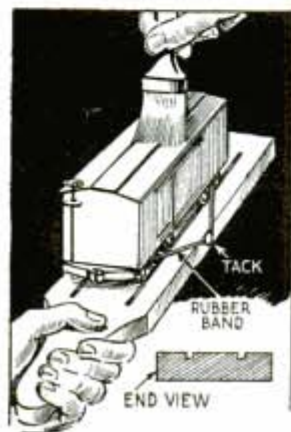
(To be continued)

Hopper Mounted on Lawnmower Spreads Fertilizer Evenly



An inexpensive spreader for applying commercial fertilizer on a lawn or small garden can be made in a few minutes by removing the roller on your lawnmower and attaching a V-shaped hopper in its place. Made of thin wood, the hopper has an opening at the lower side which is adjusted for size by raising or lowering one of the sides. This side is a snug, sliding fit in grooves cut in both of the endpieces. When the mower is pulled along, the fertilizer is shaken through the hopper onto the rotating blades, which spread it evenly. The cutting bar of the mower should be loosened so the blades can rotate freely.

Slotted Paddle Holds Model Cars For Easy Painting

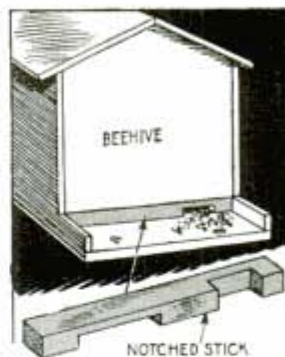


Model-railroad fans who assemble and paint their own cars will find this simple jig handy. It consists of a wooden paddle, which is slotted lengthwise, the slots being spaced to the gauge of the track so that the wheel flanges will drop into them. A

rubber band, attached to each side of the paddle, snaps over the trucks to hold the car securely in place so that it may be tipped from side to side for painting.

Entrance of Beehive Adjusted By Stick to Suit Weather

To reduce the entrance of snow and sleet into his beehive, without restraining the bees from their necessary cleaning flights, one keeper uses square sticks, which fit easily into the entrance opening. Each stick is slotted on two sides, as indicated, to produce large or small doorways. The sticks are adjusted to bring either size of notch into use as the weather demands.

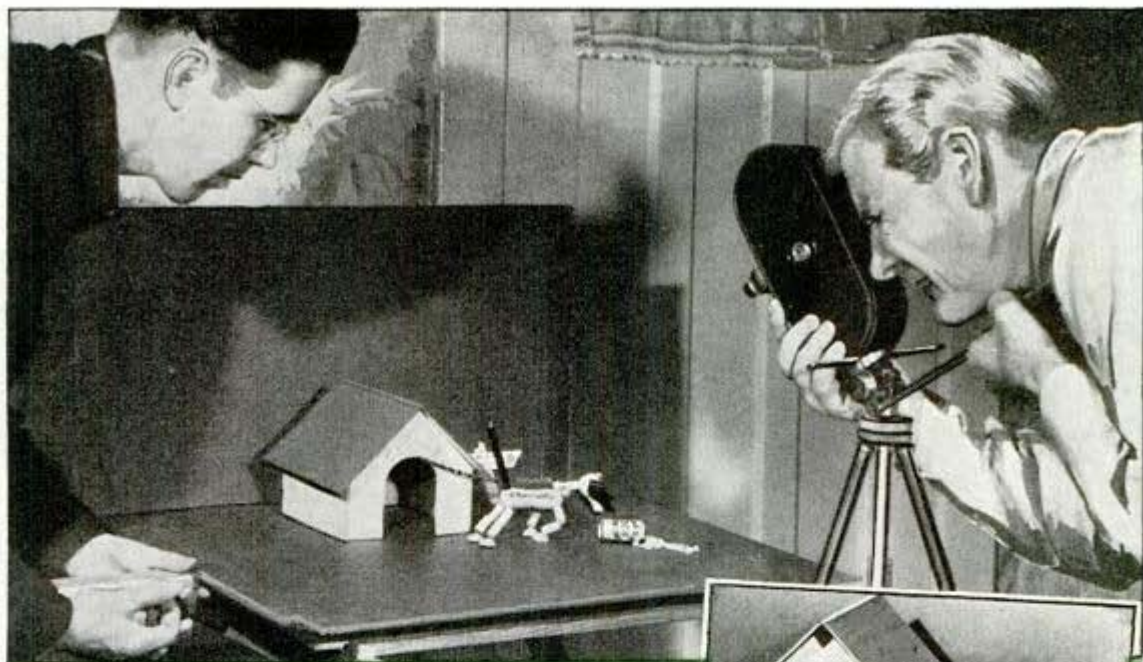


Folding Minnow Net Is Umbrella Covered With Cloth Mesh



Covered with fine cloth mesh, such as mosquito netting, an old umbrella frame provides a handy minnow net. The umbrella handle makes it easy to use the net, which can be folded to take little space.

Set potted hydrangeas outdoors as soon as the weather is good and warm, and they will very likely bloom again.

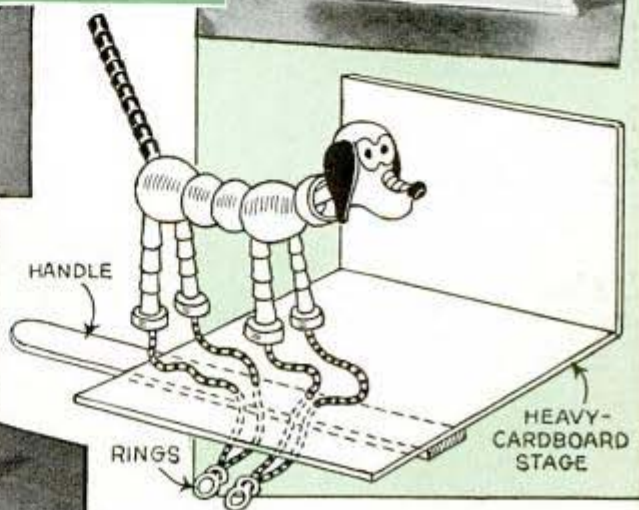
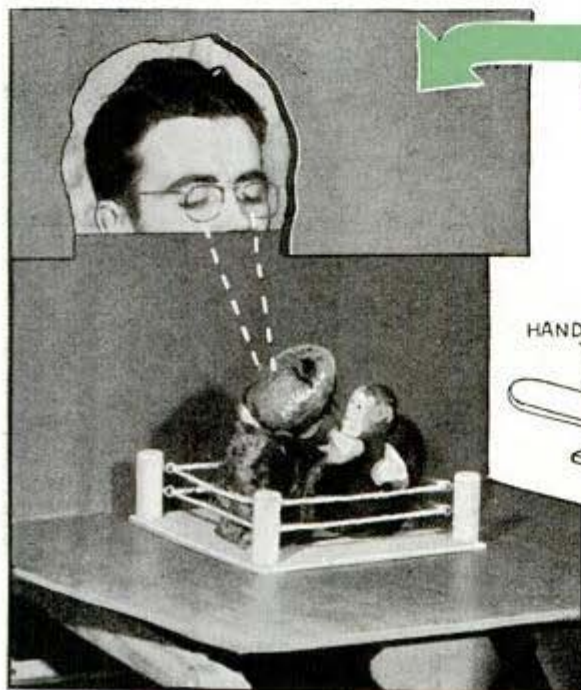


PUPPET ACTORS

in your comic movies

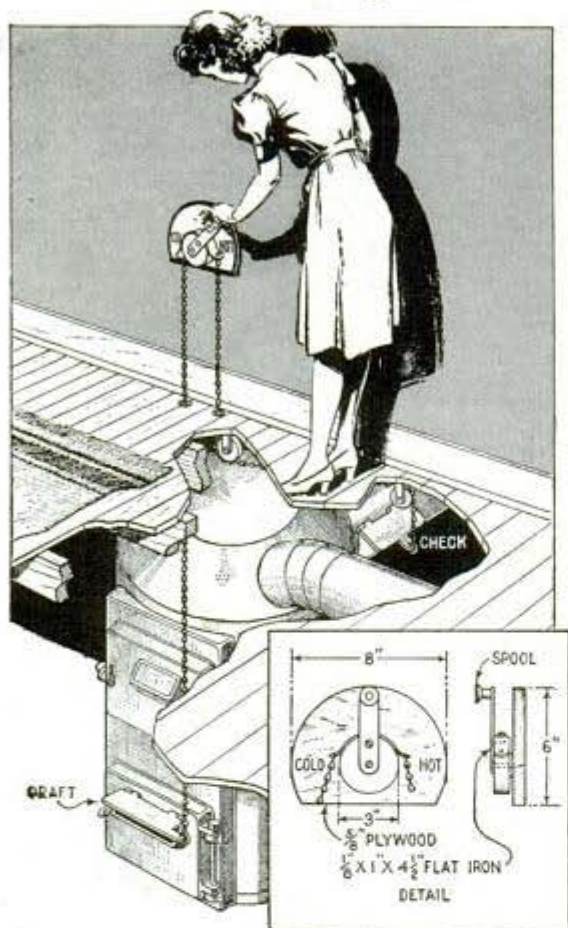


Puppet actors in a table-top theater provide amusement for young and old and provide comic material for home movies. Results of shooting sets above and below are shown at the right. You can get jointed figures like the dog, which comes on a stick and is operated by strings. The strings go through the stage floor and extend to the side beyond camera range



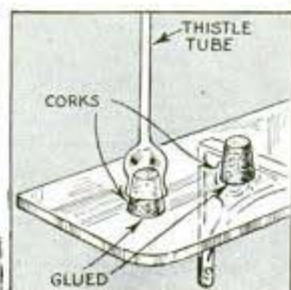
Left: Split backdrop enables operator to observe puppets without being seen himself. In this setup finger-operated puppets were used, these being set over small holes cut in the floor of the "stage"

Variable Control for the Drafts on Home Heating Plant



If the draft controls of your heating plant are of the type where rings in the chain ends are hooked over knobs on a wall plate, so that the drafts are either closed or wide open, altering the controls as indicated will give variable adjustments, to admit air to the fire as desired. Allowing the fire to pick up slowly with a partly closed draft permits the castings of the furnace or boiler to absorb more of the heat produced, with a saving in fuel.

Thistle Tube Slipped Over Cork Held Safely on Shelf

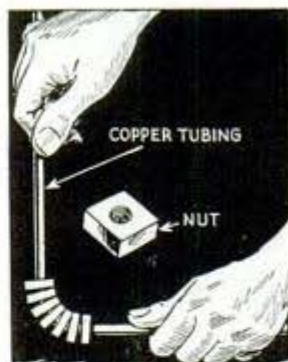


You can store thistle tubes safely on a shelf if they are slipped over corks attached to the shelf as indicated. The corks can be stuck to the shelves with

ordinary glue, although a good household cement will probably hold better, especially if the shelf is made of glass.

Tubing Bent Without Kinking With Aid of Nuts

Small copper tubing sometimes can be bent without kinking if a number of nuts are slipped over the portion to be bent. The nuts must be a free, sliding fit over the tubing, and must be close together.

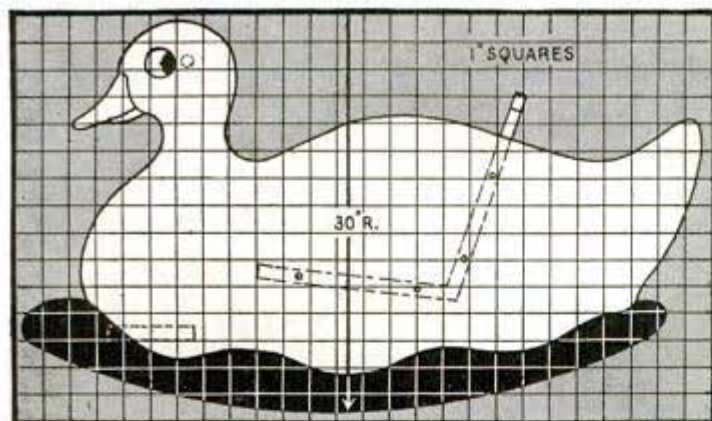


Hinged Rails on Magazine Rack Prevent Torn Covers

When straightening up the magazine rack in his store, one druggist noticed that several covers had been torn by customers who jammed the magazines back in place after looking at them. To overcome this, he hinged the front rails on the rack and fastened a small coil spring to the end of each rail as shown. When returning a magazine to the rack, this arrangement makes it a simple matter to pull the rail forward and set a magazine in place without damaging the cover.



Saucy Ducks Flank This Small Child's Rocker



Painted in bright colors, this duck rocker will be a prized possession of your small child. The cutouts are of $\frac{3}{8}$ -in. plywood, and the seat and footrest are of $\frac{1}{2}$ -in. stock. Round-head wood screws are used in assembling the parts, which are positioned as indicated in the squared detail. To protect little hands, all edges should be rounded slightly. A few wood rings colored brightly and slipped over the dowel that ties the duck heads together will be appreciated by your youngster.

—Stephen Buyl, Chicago.



Magnifying Glass on Hand Grinder Reduces Eyestrain



Eyestrain when using a hand grinder on small delicate work can be avoided by clamping a reading glass to the grinder so that it is directly above the end of the tool bit being used. A strip of sheet metal bent as shown will provide a suitable bracket.

—Allen Fiske, Chicago.

Radio Batteries Supply Current For Electric Shaver

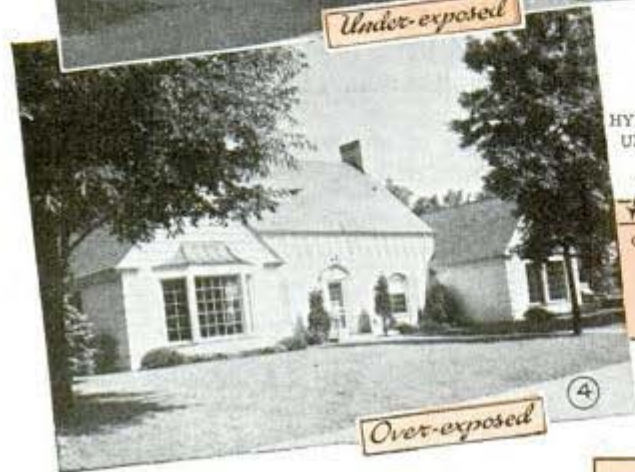
A vacation away from any source of electricity need no longer be marred by shaving irritations for the man who uses an electric shaver. All you need are two 45-volt radio batteries connected in series to operate the shaver. While this method is somewhat expensive, it is convenient when one has no 110-volt supply at hand.

—V. R. Hathaway, Youngstown, Ohio.

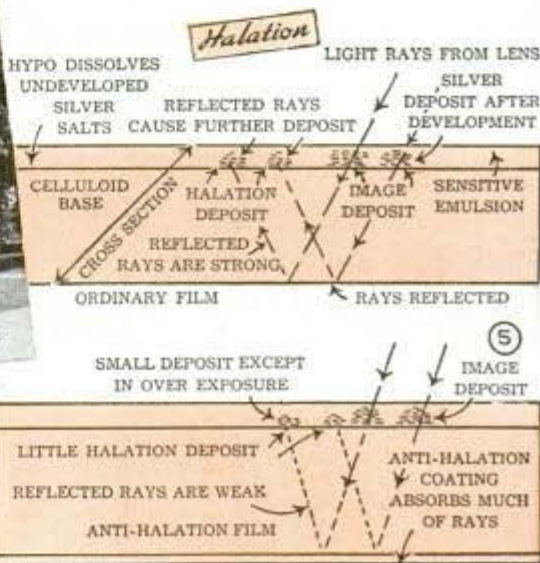


By Thomas P. Lake

FOR GOOD photographs, the first requirement is proper exposure. An exceptionally accurate test to determine whether or not a negative is exposed properly, is to lay a group of negatives, emulsion side down, on a printed page of a magazine or newspaper as in Fig. 1, to see how much of the printed matter can be read through the negative. In an underexposed negative the type can be read through most of the area. If type is visible through most of the area but it is readable through only about 75 per cent of the area, the exposure is good. When the negative is overexposed type will be visible



An overexposed photo like the one in Fig. 4 lacks detail in highlighted portions such as the brick wall. Absence of small shadows to bring out such detail is caused by halation. Fig. 5 shows difference between ordinary and anti-halation film



3

Simple Steps to

GOOD PHOTOS

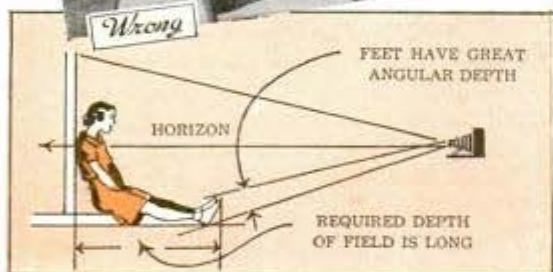
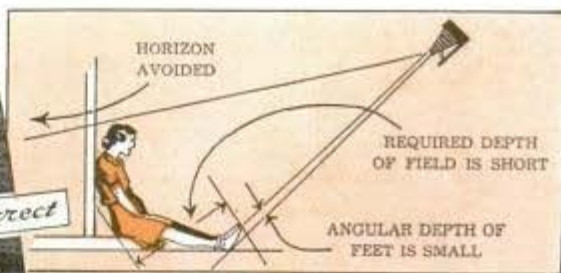


through only about 25 per cent of the area.

You can make three test negatives of a like subject, with which to compare others. One negative is given one half of the exposure called for by an exposure meter, a second negative is given the proper exposure, and the third twice the necessary exposure. If the subject has severe contrasts of sunlit white walls and also trees or shrubbery with deep shadows, you will notice that the underexposed photo shows a fair amount of detail in the white wall, but almost none in the trees and shadows. See Fig. 3. The print of the negative that has been properly exposed, Fig. 2, will show excellent detail in the highlights, the grass and trees will have good contrasts and the sky (if a filter such as Wratten G was used) will have a gray tone. The negative receiving twice the normal exposure will produce a print like that in Fig. 4, which shows little detail in the highlights but considerable detail in the shadowed portions of the trees. While it is quite obvious that the underexposed negative is not acceptable, the differences between the normal and overexposed negatives are not always so great that they are easy to distinguish. If a picture of the trees were wanted, the overexposed negative would be the best. But, as the picture is one of a house in its surroundings, the normally exposed negative is best, even though it does slightly underexpose the darker portions. The overexposed negative shows lit-

tle detail in the white walls. When a bright object such as a white wall is overexposed, the fineness of detail is often obscured by halation, which is caused as illustrated in Fig. 5. Here the difference is shown between ordinary and anti-halation film. Various means to absorb the light that penetrates the emulsion on the film are used; usually the back of the negative base is coated with a color, but some types of material have the base itself impregnated with a slight color.

The second step in obtaining good pictures is satisfactorily relating focusing to the lens diaphragm setting (lens stop). Fig. 6 shows a typical scene that is also excellent for experiments in this subject. This photo was taken with the focus set at 30 ft., with the lens stopped down to $f:32$, a very small opening. In this picture everything is in focus—the foreground, middle-ground and the extreme background. The extreme depth of field (distance for which sharp focus exists) illustrates why professional and advanced amateur cameramen so often use tripods. Extreme depth of field requires small lens stops, and this in turn requires longer exposures, especially when filters are used. Experienced photographers use tripods when composition must be exact and when exposures are longer than $\frac{1}{25}$ second. A series of similar test negatives made with your own camera will give data that will make it possible to obtain far better pictures than before.



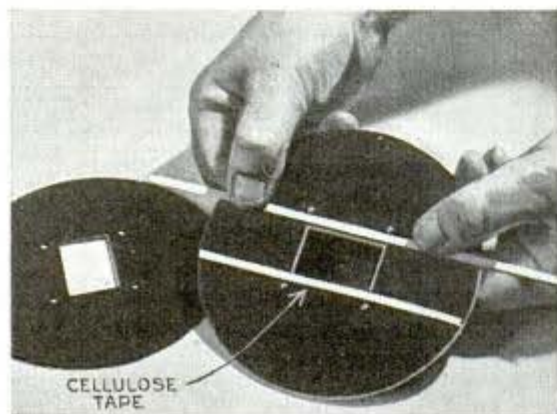
The third step in obtaining good photographs is the necessity of obtaining the correct point of view for the camera. Figs. 7 and 8 are examples of the right and wrong points of view as applied to a type of personal picture that has an important place in every photo record. While a low point of view has its uses and advantages, there are times when it gives distinctly bad results, as in Fig. 8. Here, a low point of view has given undue prominence to the feet and also has placed the background line in a poor position. Another disadvantage of a low point of view is the depth of field required to make the whole figure sharp. If the light had not been bright or the film had not been quite fast, a larger lens stop would have been required, and the foreground would have been fuzzy. In Fig. 7, a high viewpoint was used to eliminate these disadvantages. Notice that from this angle the figures are in a comparatively shallow plane (which requires less depth of field,) and that the awkward background has been eliminated.

Tape Strips on Negative Carrier Prevent Scratching of Film

Scratches on 35-millimeter film, caused by the emulsion touching the negative carrier of the enlarger as it is pulled through, can be avoided by placing two strips of

adhesive or cellulose tape on the carrier. Stuck on the carrier in the position shown, the strips will raise the film just enough to keep the emulsion free of any contact.

—Kenneth Murray, Colon, Mich.



Salt Sprinkled in Developer Improves Print Quality

Sprinkle a few grains of ordinary table salt in your developing solution and notice how it gives rich, velvety blacks to your prints. The salt acts as a restraining agent and keeps the lighter portions of the print from getting too dark before the blacks have been developed fully. The same result can be obtained by using a pinch of potassium bromide in the developer.

Typewriter Table Is a Sturdy Enlarger Stand

Sturdy steel typewriter tables, like the one shown, make good enlarger stands for home photographers. They are inexpensive and one having a 14 by 18-in. top will accommodate the average enlarger. Casters make the stand easy to roll in and out of the bathroom or kitchen darkroom.

Lens Brush in Lipstick Container Can Be Carried in Pocket



Protected by a discarded lipstick case, a small camel's hair brush can be carried in your pocket where it will be always at hand for brushing dust from the lens, shutter or other parts of your camera.

After removing all traces of lipstick from the case with gasoline, cut the handle of the brush to the proper length and anchor it in the case with sealing wax.

—George C. Lau, Hong Kong, China.

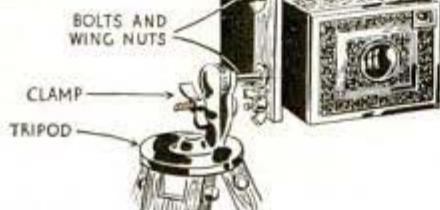


Frame to Hold Box Camera on Tripod Is Easy to Make

Box-camera owners need not be without the advantage of tripod mounting if they will build the simple frame shown. Two strips of wood are held on the camera with

bolts and wing nuts. A nut to engage the tripod screw is embedded firmly in a counter-bored hole in one of the strips.

—David V. Buchanan, Denver, Colo.



Distance Scale of Camera Changed To Show Feet Instead of Meters

Those who find the distance scale of a foreign-made camera hard to read because it is marked in meters, can convert it to feet by sticking a narrow strip of adhesive tape alongside the scale and penciling in the different distances in feet. The tape is then removed and the numerals typed or inked in and the strip returned to the camera. In making up the new scale, remember that one meter is equal to 3.28 feet.



Films Washed and Fixed in Crocks Instead of Developing Tank



Greater speed and convenience in tank development of roll films will result if the film is transferred from the tank to a receptacle filled with water and then to another filled with hypo instead of pouring each solution slowly in and out of the tank. Two-pound butter crocks are just the right

size for most tank reels. With the light off, remove the developed film from the tank, rinse it in the water and place it in the hypo. If your hypo is fresh the light can be turned on again in a couple of minutes.

—E. F. Whiteside, Wilmette, Ill.

Match Book Used as Sun Shield Leaves Both Hands Free

Placed on a box camera as shown, an ordinary paper match book will shade the view finder so that the image can be seen clearly. This method leaves the left hand free to aid in steadying the camera.



⚠ Never let a stream of water fall directly on prints while washing them, as this may cause breaks in the fiber of the paper.

“Skipper”—Low-Cost, 14-ft. Outboard Runabout



At an expenditure of only \$30 to \$40 you can build this trim, five-passenger runabout, which is powered by a 4 to 24-hp. outboard motor. Its speed ranges from 9 to 24 m.p.h. depending on the size motor used. The boat has a 54-in. beam, 15½-in. freeboard, 24-in. depth, a 5-in. draft at 725 lbs., and a weight of about 275 lbs. Six plans (Nos. 1018 to 1023 incl.) showing details of building besides sheets giving material list and outline of procedure will be sent postpaid on receipt of \$1.50

Other Boats You Can Build

16-Ft. Canoe—811 and 812: Canadian type. Cedar planking covered with canvas. 33-in. beam, weight 70 to 80 lbs. Two plans 50c.

Canvas-Covered Kayak—928 and 929: 17 ft. in length and weighs about 40 lbs. Two prints 50c.

“Sea Saucer”—893: Lightweight sailboat. Length 9½ ft. Beam 4 ft. Deck, bottom and sides are 3/16-in. plywood. 25c.

15-Ft. Rowboat—644: Flat bottom, all purpose. Covered forward deck. Has three seats. 25c.

12-Ft. Utility Rowboat—707: Flat bottom, four seats. Very sturdy design. 25c.

“Arrowhead” Sloop—944 to 951: A fast and able sailboat. Over all length 21 ft., beam 5 ft. 11 in. Accommodates up to 10 persons. Set of 8 prints \$2.00.



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

“Hi-Ho,” 14-Ft. Family Runabout—840 to 845: Powered by 11 to 22 hp. outboard or light inboard motor. Beam 58 in. Set of six prints \$1.50.

Address—Dept. 262, Popular Mechanics Press, 200 East Ontario Street, Chicago



TUNING-EYE SET TESTER

By M. N. Beitman

THIS highly sensitive vacuum-tube voltmeter and simplified signal-tracing instrument can be built by any experimenter or serviceman for about \$4.00. A type 6AB5 cathode-ray tuning indicator tube, commonly known as a "magic eye" serves as the sensitive indicator, and voltage readings from a volt up to 500 volts may be taken from any circuit without upsetting the operation of the radio under test.

Wiring of the visual indicator section is simplified by the

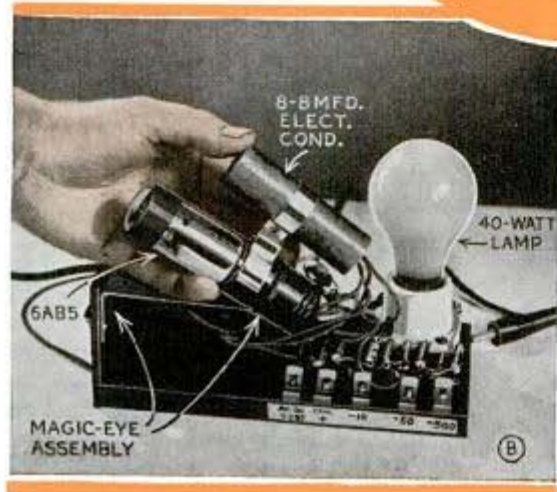


use of an Amphenol No. MEA-6 magic-eye assembly which includes all the necessary parts except the tube, the metal encased socket being completely wired with a 5-wire color-coded cable. This socket includes a 1-megohm target-to-plate resistor within the metal shell; this resistor must be removed

and replaced with the 250,000-ohm resistor R_4 shown in diagram Fig. 1.

All parts except the toggle switch and the tuning eye assembly bracket are mounted on a 1/2 by 4 by 8-in. wood baseboard. Photos A, B and C show various views of the instrument arrangement. Five Fahnestock clips provide the necessary terminals, and the small fixed resistors are mounted on two 8-lug terminal strips which provide 6 insulated terminals on each strip. An Amphenol octal socket in cup base is supplied for the type 117Z6-GT tube which is a twin diode rectifier and

(Continued to page 134A)

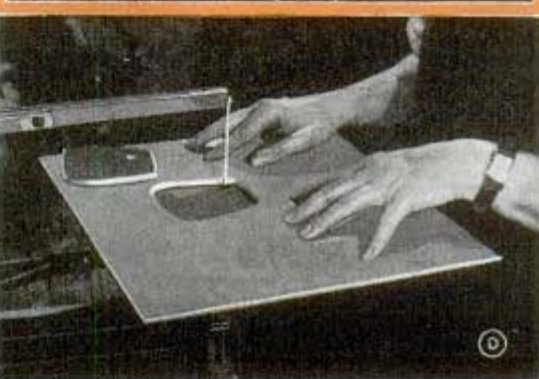
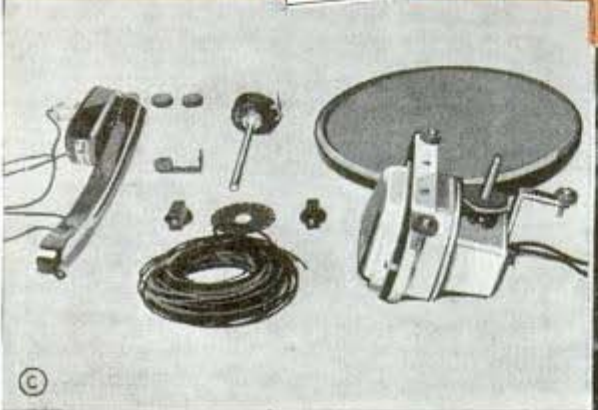
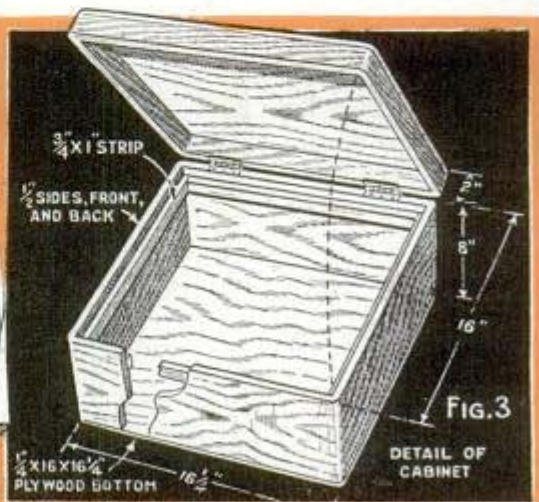
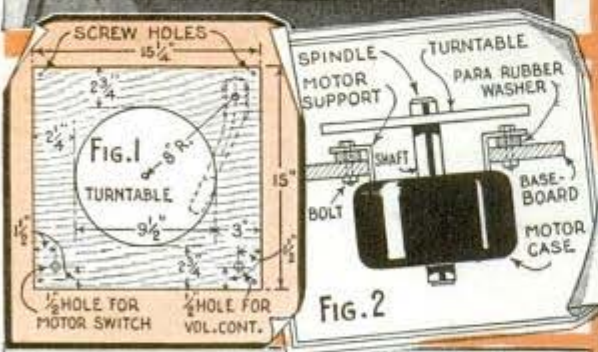


HI-FIDELITY

By Tracy Diers

ASSUMING that you have a fairly good radio receiver, which may or may not be equipped with phono pickup jacks, you can build this high-fidelity record player and use it in combination with the audio amplifier in your set. With the parts specified, high quality reproduction is only limited by the efficiency of the audio section in your particular receiver. In case your radio set is one of the small "midget" types not practical for use with a record player, you can build a good inexpensive audio amplifier and speaker to use with it. Several amplifiers of this description have been described in previous issues.

Although high quality parts are necessary in any record player for reproducing symphonic recordings, the cost of this record player can be reduced by substituting cheaper parts for ordinary music. When purchasing the parts be sure to get a motor suitable for your line supply, a.c. or d.c.

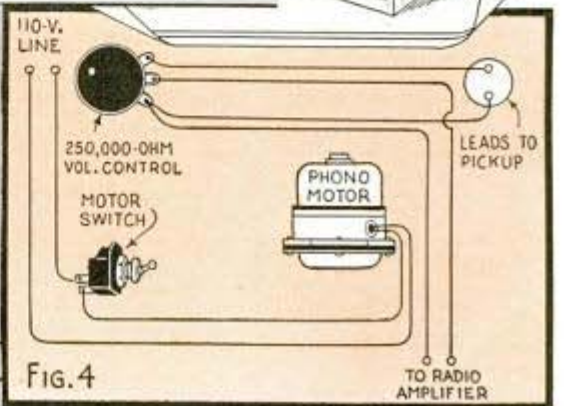
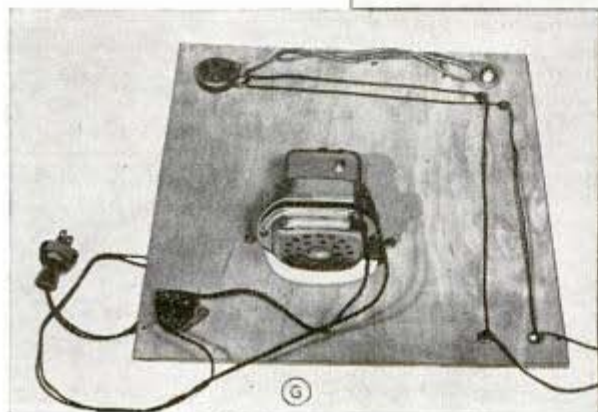
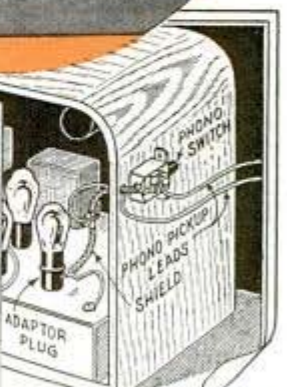


RECORD PLAYER

The "Green Flyer" model-A, or similar type, used in this unit costs about \$7.92. The crystal pickup is an Astatic type-FL58 listed by parts houses for \$7.94. A volume control of the carbon variety is available for around 60 cents. Other parts such as hookup wire, knobs, screws, motor switch, etc., cost about 90 cents. Construction details for the motor board and cabinet are given in Figs. 1 and 3. In preparing the ½-in. plywood motor board, place turntable on the board as shown in photo (B) and lay a 12-in. ruler on top. The ruler represents a 12-in. record; move the turntable until you have it in the correct position for proper clearance and mark for drilling a small centering hole. Check the necessary depth for clearing the motor and turntable so that the supporting strips in the cabinet may be fastened at the correct height. All mechanical and electrical parts are shown in photo (C). Now cut the hole for mounting the motor as indicated in photo (D) and mount as shown in Fig. 2. The motor shaft, and shaft of the volume control, are cut off to a length of about 1¼ in. with a hacksaw. Mount all parts as shown in photo (G) and wire as detailed in circuit diagram Fig. 4.

Details for mounting pickup are indicated in Fig. 1. Adjust pickup so that the stop will prevent arm from going closer than ¾ in. to spindle. Check the pickup location with a disk of paper. Slip piece of pencil graphite in needle holder of pickup and lightly draw line on

(Continued to page 136A)



Color Code for Identifying Resistor Values



TWO simple color-code methods were developed by the Radio Manufacturers Association (RMA) to provide permanent standard markings on fixed resistors for identifying ohmic values. Both are now in common use. The chart given below is self-explanatory and easily followed.

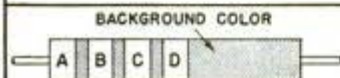
Method No. I, usually applies to resistors having leads coming straight out from the ends. The color bands are equal in width and may or may not be touching each other. In Method II markings are identified by the fact that the color bands or colored areas are of different widths. This method is

always used on resistors with leads out the sides, and often on end-lead resistors.

Missing color bands in Method I markings are assumed to be the background color (brown or black). A missing end color (B) or dot color (C) in Method II markings is assumed to be the same as the body color (A). Wattage ratings are indicated approximately in the comparative sizes illustrated. Careful experimenters also verify values, where tolerance limits are critical, by means of an inexpensive ohmmeter of the type shown in the inset photo.

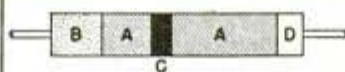


RMA COLOR CODE FOR RESISTORS



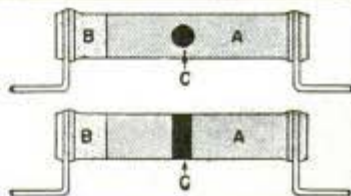
METHOD I

COLOR BANDS A, B, AND C GIVE VALUE.
GOLD OR SILVER BAND D, USUALLY OMITTED, INDICATES TOLERANCE.
BLACK BACKGROUND—UNINSULATED.
TAN BACKGROUND—INSULATED.



METHOD II

BODY COLOR (A), END COLOR (B), AND DOT OR BAND COLOR (C) GIVE VALUE.
GOLD OR SILVER BAND D, USUALLY OMITTED, INDICATES TOLERANCE.



Color	Figure
BLACK	0
BROWN	1
RED	2
ORANGE	3
YELLOW	4
GREEN	5
BLUE	6
VIOLET	7
GRAY	8
WHITE	9

COLOR A GIVES FIRST FIGURE OF RESISTOR VALUE.

COLOR B GIVES SECOND FIGURE OF RESISTOR VALUE

COLOR C GIVES NUMBER OF CIPHERS FOLLOWING THE FIRST TWO FIGURES.

COLOR D: GOLD BAND INDICATES $\pm 5\%$ TOLERANCE.
SILVER BAND INDICATES $\pm 10\%$ TOLERANCE.
NO BAND INDICATES STANDARD $\pm 20\%$ TOLERANCE.

Courtesy National Radio Institute

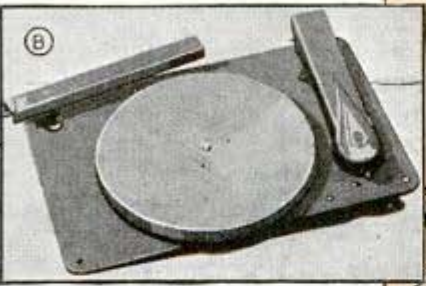
POPULAR MECHANICS

*Flush Wall Radio Co.
57 State St. Newark, N.J.*

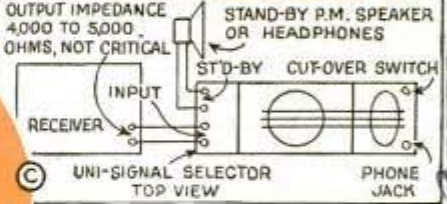
Helpful RADIO HINTS

Missionary Inf. Co. Inc. Newark, N.J.

(A) Flush-wall 5-tube radio for builders to specify in new homes. Housed in steel box between studing and installed while house is under construction, these sets are convenient in kitchen, bathroom, playroom or bedroom. All wires are concealed; panels come in colors or plain for painting

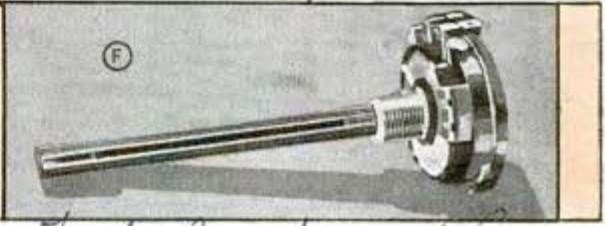
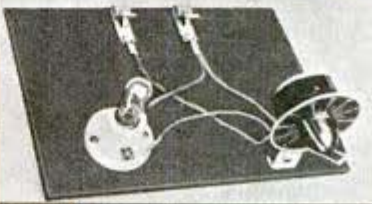
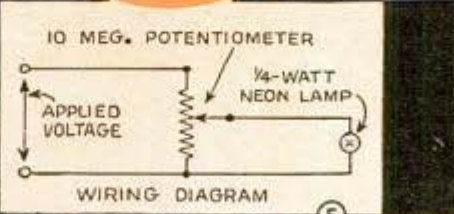


(B) Complete phono-recorder mechanism for experimenters. Easily installed in any suitable cabinet, it includes balanced and weighted cutting head and a crystal pickup on separate arms. Motor operates from 110-volt 60-cycle power line. Steel motor board is 10 by 15 in.; constant speed heavy-duty synchronous motor gives positive drive through turntable to worm-gear mechanism for operating recording arm. Unit requires only 2½ in. below mounting surface, and 3 in. above



(E) Neon-bulb emergency voltmeter for d.c. or a.c. Unit is calibrated by connecting across known d.c. voltage sources and recording the dial setting of the potentiometer at which neon bulb just starts to glow. After several points have been determined a chart is prepared. For a.c. voltages, the d.c. readings are multiplied by .71. Minimum voltage measurement is the 90-volt d.c. "striking" voltage of the bulb. Accuracy is about 10% on d.c. and 15% on a.c. in the 100 to 500-volt range. (F) Replacement volume control which has a-slotted shaft for slip-on knobs

(C) "Single-signal" selector unit for amateurs operating on the crowded CW bands. Isolates weak CW signals otherwise blanketed. (D) Battery-operated pen-sized oscillator for servicemen and experimenters. Signal easily applied at all points to locate faulty stages or parts

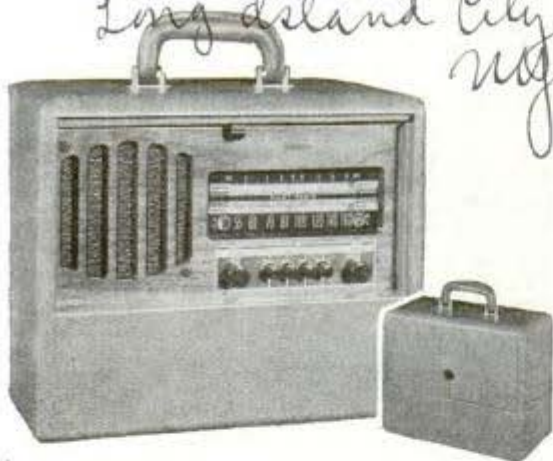


*General Test Equipment Co. 779
213 Crosby Ave. Kenmore, N.Y.*

Pilot Radio Corp
3706 36th St

Push Buttons Control Operation Of All-Purpose Portable

*Long Island City
N.Y.*



Available in two models, one for broadcast and short waves, and another for broadcast and marine bands, this set has four push-button controls at the front of the cabinet. By means of these buttons the owner can control the operation for battery, a.c.-d.c. or any of the above bands. Designed for distance and sharp tuning, it employs a 3-gang condenser and a stage of tuned r.f. amplification. Other features of the receiver include iron-core i.f. transformers, a.v.c. and instant changeover from battery to a.c.-d.c.

Compact Radio Direction Finder



Suitable for off-shore cruising and a valuable safeguard for any boat, this small self-contained radio direction finder is claimed to have a 200-mile range on class A stations. It covers the range of from 275 to 325 kilocycles for all radio marine beacon stations. Built of non-magnetic materials, it does not affect compass. Five low-drain tubes are employed for economical battery operation in a cir-

Lafayette Radio
100. 6th Ave

cuit which is said to have extreme sensitivity and selectivity. A 7-in. compass card is provided for easy reading.

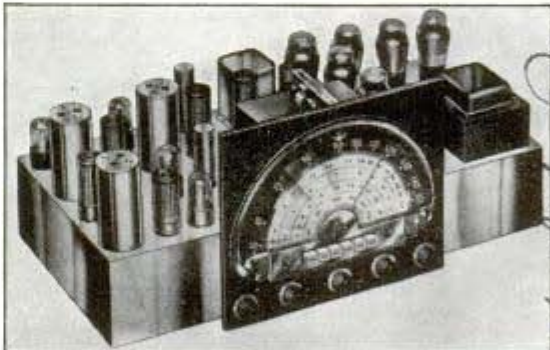
Low-Power Audio Amplifier

Designed for low-power sound jobs such as restaurant order systems, call systems, or wherever a small easily installed audio system is indicated. Housed in neat cabinet, fully louvered for ventilation, its output is 6 watts continuous, and 8 watts on peaks. One "mike" and one phono input channel are provided.



Eighteen-Tube 5-Band Chassis

Super power and world-range ability are claimed for the receiver in which this 18-tube chassis is installed. Advanced circuit design includes several unusual features such as 25-watt power output, organ



phonic filter, dual speakers, tone adjuster, adjustable loop antenna, static reducer and microphone jacks. Stepped up output offers reserve for faithful crescendo reproduction even when played at home levels.

Blueprints covering 80 simplified radio construction articles in this and past issues are available for 25c each. Original parts lists, names of manufacturers and dealers, can be obtained from Popular Mechanics Radio Department upon receipt of postage.

NEXT MONTH—How to Build a Twenty-Watt Amplifying System for Summer Camp. A modern high-power amplifier with many new features. Easy to build, and completely housed in a single split-type carrying case with two 12-in. P.M. speakers. Provides 3 input channels. Also—Crystal Receiver Built in Headset.



SHOP NOTES

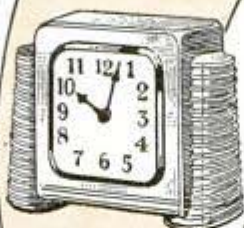
Thin, Decorative PLATING by dipping process

By C. A. Crowley

DIP PLATING on metal is quick and simple, and although the plated coatings are not durable, they serve for decorative purposes where wear and corrosion are not a problem.

Preparing the metal: Metal to be plated must be freed from dirt, grease, and rust or corrosion by careful cleaning. First is a liberal scrubbing, Fig. 2, with hot soapy water containing washing soda, and then rinsing in first hot and then in cold running water, Fig. 3. Steel or iron should be "pickled," Fig. 4, by dipping it in a solution of sulphuric acid, 1 part by volume, in water, 10 parts, prepared by carefully adding the acid, while stirring, to the water in a stoneware crock.

FORMULA
(Copper on steel)
Copper sulphate, 2 oz.
Sulphuric acid, 1 fl. oz.
Water, 1 gal.



CLOCK DIAL



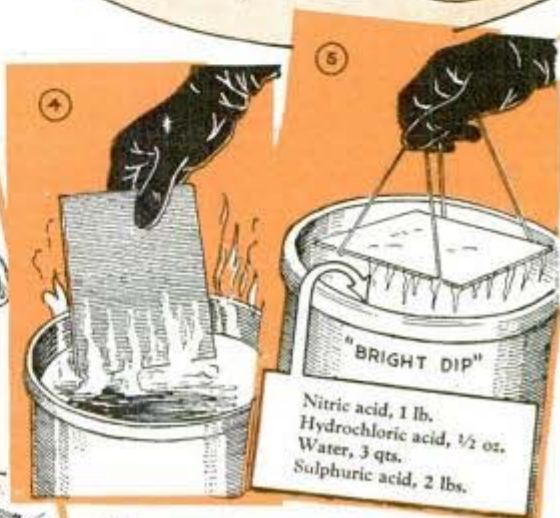
ASH TRAY



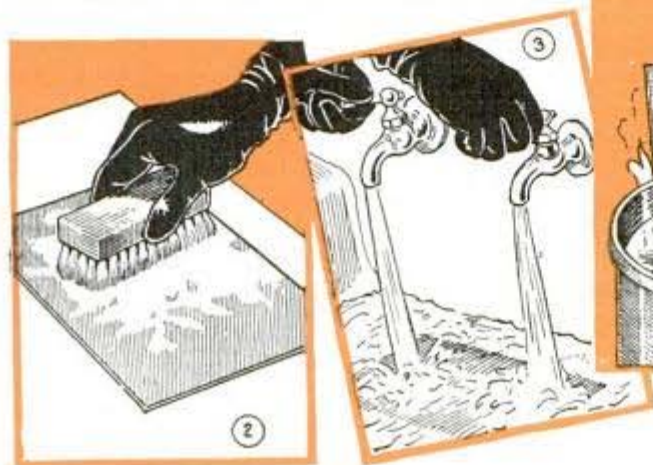
SERVING TRAY



SPUN-COPPER URN



"BRIGHT DIP"
Nitric acid, 1 lb.
Hydrochloric acid, 1/2 oz.
Water, 3 qts.
Sulphuric acid, 2 lbs.



Preparing the work



A glass jar should not be used as enough heat is given off in mixing to crack glass. After dipping the article long enough to remove rust and leave a clean, bright surface, remove and rinse it thoroughly again in hot and cold running water.

After removing grease, brass and copper articles are given a "bright dip," Fig. 5, in a solution prepared by adding nitric acid, 1 lb., and hydrochloric acid, $\frac{1}{2}$ oz., to water, 3 qts., in a stoneware crock, and then adding sulphuric acid, 2 lbs. The solution should be cool before using, and the work is dipped into it for only a few seconds, then rinsed in hot and cold water. Always wear rubber gloves when doing work of this nature as acids can cause severe burns. In case acid should get on the skin, immediately wash off under running water.

Polishing: As the brightness or luster of the plated metal depends on the brightness before plating, the work should be polished, using a motor-driven buffer with cloth buffing wheels, as in Fig. 6, and polishing compounds in the form of grease-base sticks. Fine emery is used if necessary, followed by tripoli, fine silica or lime, and jeweler's rouge is used for the final

polishing. All polishing grease is removed by scrubbing with a hot solution of soap and washing soda. Then the work is rinsed thoroughly in hot and cold running water, and is ready for plating.

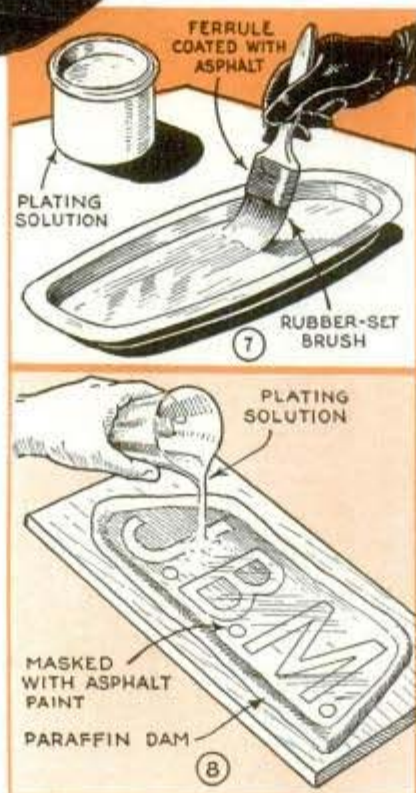
Plating methods: Copper can be plated on steel or iron by immersing the work for a short time in a solution of copper sulphate, 2 oz., and sulphuric acid, 1 fl. oz., in water, 1 gal., Fig. 1. If work is immersed too long, the copper will not adhere. Another method to apply plating solution is to use a rubber-set brush as in Fig. 7. The metal ferrule of the brush must be protected against the solution by covering it

with asphalt paint. A third method of application is to form a pool on the face of the metal around the area to be plated, as in Fig. 8. Paraffin, melted with a little gum shellac, can be used to form a "dam." Designs can be plated by masking off the areas not to be plated with asphalt varnish. If copper is used for plating the design the rest of the metal can be plated with nickel, which will not plate over the copper by this process.

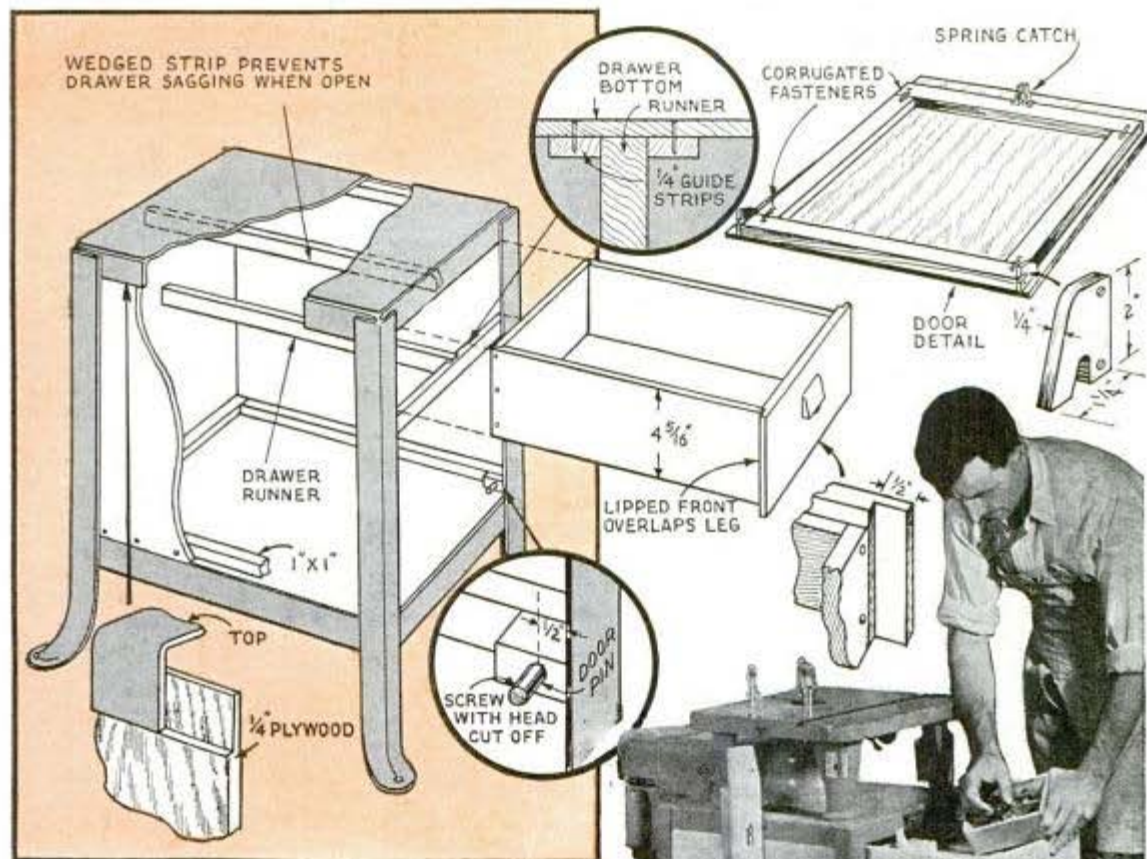
Nickel will deposit on steel from a solution of nickel ammonium sulphate, 7 oz., and boric acid, $3\frac{1}{2}$ oz., in water, 1 gallon. Tin can be plated onto copper or brass with a solution of stannous chloride, 4 oz., and potassium hydroxide, 12 oz., dissolved in water, 1 gallon.

In using this solution, the work is immersed in the solution, and while immersed it is touched with a strip of zinc metal. The zinc should be touched to various spots on the work and held for several seconds on each spot to assure a uniform tin coat. Silver can be deposited on copper or brass by immersion in a solution of silver nitrate, 2 oz., ammonium chloride, 1 oz., and sodium thiosulphate (hypo), 4 oz., dissolved in water, 1 quart.

If silver is to be applied to iron or steel, the work should first be given a copper plate, after which it is silver-plated in the above solution.

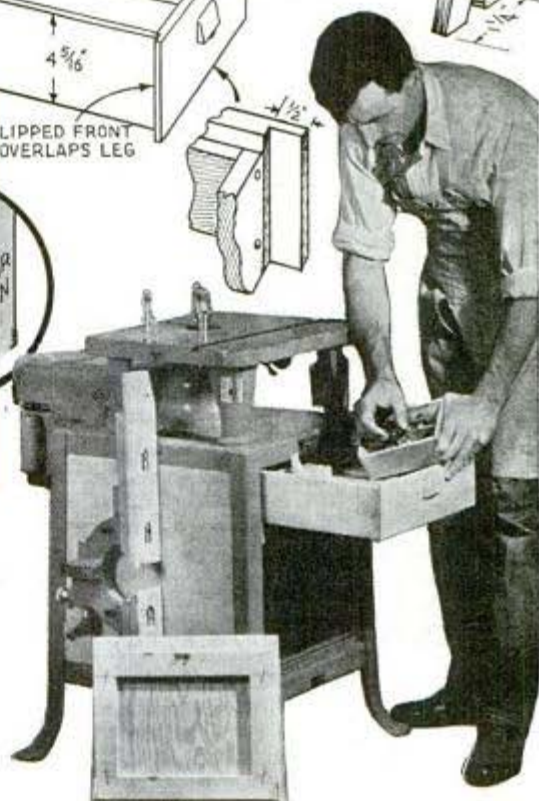


Accessory Cabinet Built Into Machine Stand

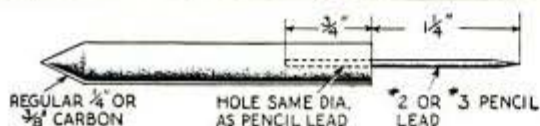
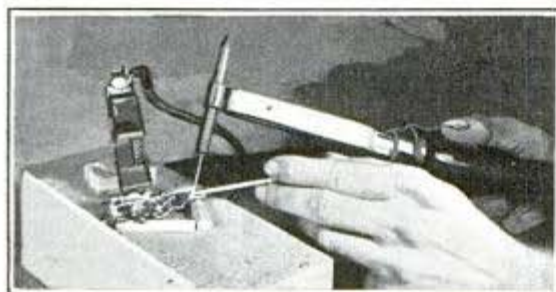


By closing in the steel stands of some woodworking machines where the motor does not interfere, you can provide cabinets for tools and accessories. Just panel all three sides of the stand with plywood, using hardwood strips at the top and bottom to wedge the panels against the legs. A drawer and door are provided as indicated in the details.

—Edwin M. Love, Monterey Park, Calif.

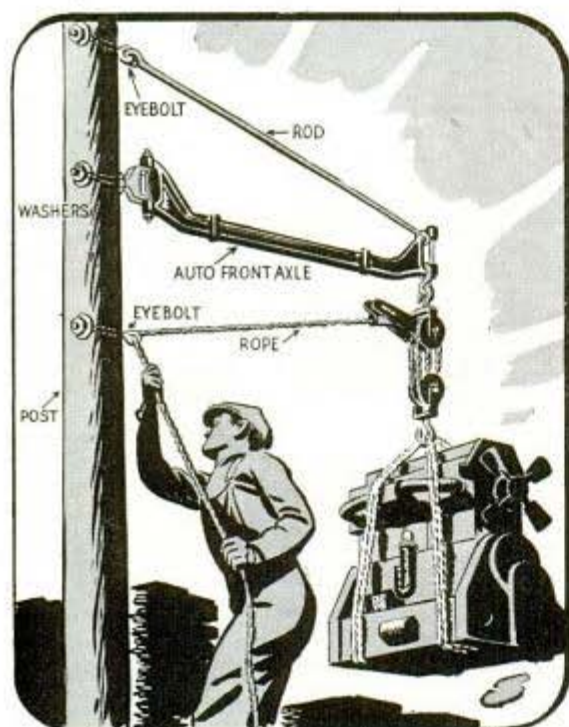


Repairing Jewelry and Small Parts With Carbon Welder



A battery-operated carbon welding outfit is excellent for repairing jewelry and other delicate work as the carbon electrode is light and easy to handle, and there is no flame to damage the surrounding areas of the work. The tool will be more useful if a piece of pencil lead is inserted into a hole drilled in the end of the carbon. This provides still a smaller electrode to get into places that could not be reached by the larger carbon. A No. 2 or 3 lead is best for this work as an extremely hard lead has a tendency to shatter or split when it heats quickly.

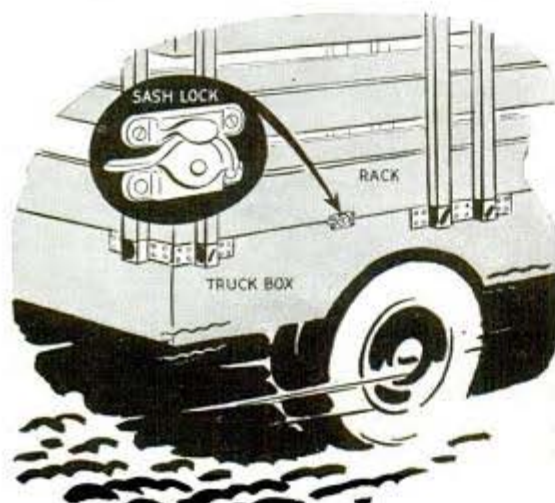
Hoist for Heavy Loads Improvised From Front Axle of Car



Pivoted to a tall post, tree or side of a building, the front axle of an old car provides a strong, swinging arm for a block and tackle used in lifting heavy loads. This hoist is especially useful on farms for lifting out tractor and truck motors, for suspending heavy animals at butchering time, etc.—E. R. Gorton, Maryville, Mo.

Stock Rack on Large Truck Body Anchored With Window Locks

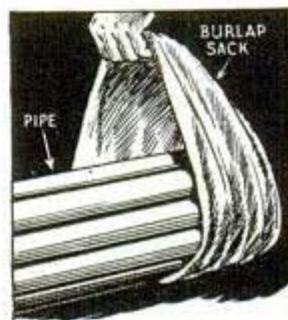
On trucks used to transport livestock, the racks or sideboards can be anchored to the



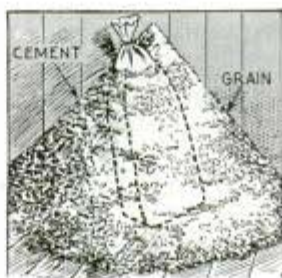
lower part of the body by merely using heavy window-sash locks. One half of each of these is attached to the body and the other half to the rack in a manner similar to that in which they are attached to a window. The racks can be removed instantly by giving each lock a flip of the hand.

Burlap Bags Make Good Handles For Carrying Lengths of Pipe

A plumber who has to carry lengths of pipe to and from the shop and warehouse uses small burlap bags as handles for this work. The bags are of the type in which pipe fittings are shipped. With this method two men can carry a number of lengths of pipe at one time and thus save many trips between the shop and warehouse.



Sacks of Cement Are Kept Dry in Grain Bin



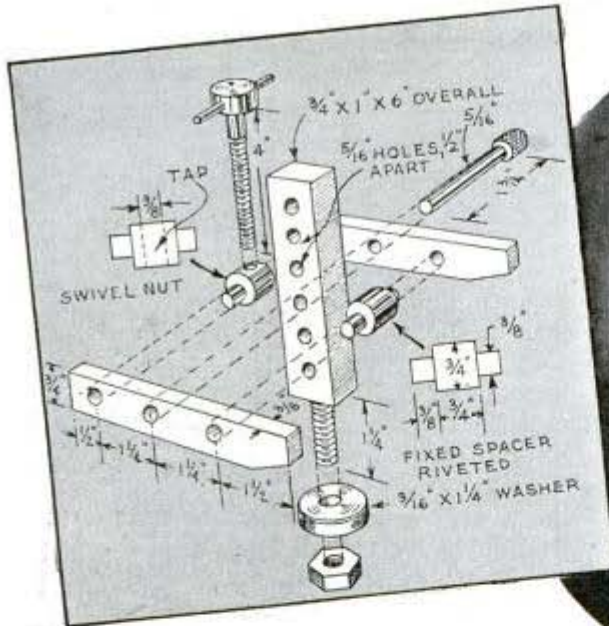
To keep a partly empty sack of cement dry and free of moisture, one farmer merely places the sack in the corner of his granary and shovels loose grain around it. The dry grain will take up moisture on humid days and prevent it from damaging the cement.

Nonskid Hammer for Roof Work

Annoyed by his hammer sliding off the roof when making some repairs, one workman solved the problem by driving a nail in the end of the handle. The nail was bent over, the head cut off and the end sharpened with a file so it would dig into the roof.



Drill-Press Clamp Handles Irregular Work



When work of certain shapes cannot be held in V-blocks or in a drill-press vise, this clamp will do the job. It holds the work securely with fingers on both sides of the drill bit, and is adjustable in height. The clamp is particularly useful where there are a number of similar pieces to be drilled one after another, as it can be loosened, the piece changed and the clamp tightened again without the assembly falling apart. The clamping arm consists of two pieces of steel, one swivel nut and one

fixed spacer. The trunnions on the swivel nut are a snug, turning fit in the arm pieces so that the clamping screw can be set in a vertical position. The spacer, however, is riveted in place so that the arm is held together as a unit. Note that the lower corners of the arm are rounded to give as long a bearing surface as possible.

—R. T. Tilden, Chicago.

Wall Reel Coils and Measures Rope Dispensed in Store

Although rope of various sizes is sold by the pound, the purchaser often requests certain lengths, which must be measured out for him. To save time in doing this, one merchant devised this reel, which is pivoted to a wall. The space between the two handles of the reel is 2 ft. so that one turn measures 4 ft. of rope. A sharp nail projecting through one handle, near the cross bar, allows the rope end to be attached for winding.

Emery Powder Kept in Spice Cans

Shop mechanics whose work requires the use of emery powder of different grits, will find empty spice cans of the shaker type ideal for storing the powder. It can be shaken onto the work as required and the possibility of spilling it is avoided.



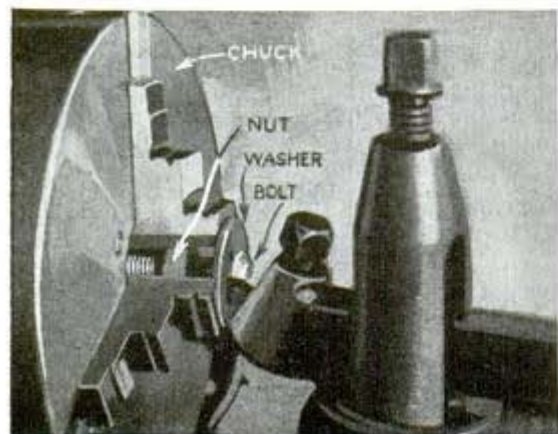
Concrete Forms Lined With Paper Make Finished Work Smooth



When using old lumber as concrete forms you can give the finished work a smooth surface by lining the forms with roofing paper. This will make it unnecessary to chip off high spots or plaster indentations in the concrete work to provide a smooth surface. The paper is easily removed from the concrete after the forms have been taken down.

Bolt "Arbor" for Facing Washers

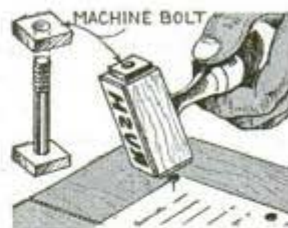
The next time you have some washers to face in a lathe, you can mount them on a universal chuck by using a small bolt as shown in the photo. Select a bolt having a hexagon nut and a head just slightly larger than the opening in the washer. Grip the nut in the jaws, locating it back some distance from the jaw faces. Then



slip the washer over the bolt, and screw the bolt into the nut. This will pull the washer up tightly against the jaw faces. It is a good idea to make a slot in the head of the bolt so that a screwdriver can be used in tightening it.

Rubber Stamp Used as Hammer To Apply Shipping Tags

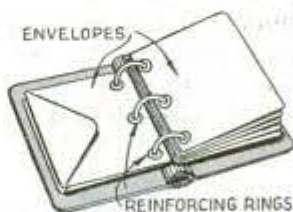
Instead of carrying a small hammer in his pocket to tack tags to boxes and barrels in a shipping room, one clerk tacks them with the



large rubber stamp which he uses for lettering the packages. The stamp was given the necessary added weight by drilling transversely through the body and inserting a machine bolt as indicated.

Small Envelopes in Note Book Serve as Pocket Card File

Salesmen and others who often carry a number of different cards and memo sheets can keep them arranged neatly by using this pocket file. It consists of the cover of a small loose-leaf note book in which envelopes are substituted for the usual pages. A simple index printed on the envelopes will aid the user in selecting the desired memo or card.

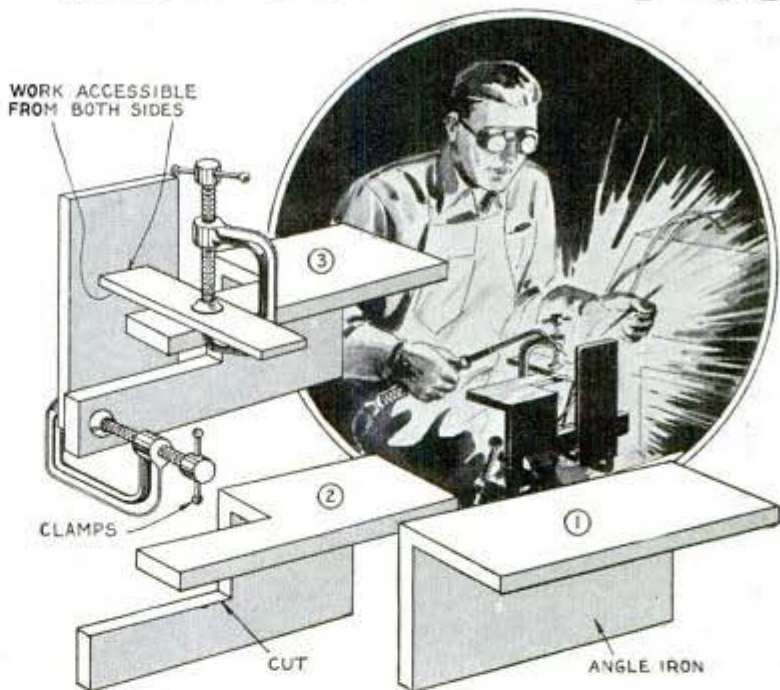


Repairing Gate and Globe Valves Without Removing Them

Due to uneven cooling of thick metal, leaks sometimes develop near the base of the packing gland or wheel supports in gate and globe valves from 4 in. and up. These sand holes or shrinkage flaws, which do not usually show up until the valve is several years old, can be repaired without removing the valve, by one or the other of two methods which have been used successfully on pressures up to 300 lbs. First, it is necessary to let the pressure out of the line, or lower it to 10 or 15 lbs. If the sand hole is a very small one, it can be

closed by using a pin punch about $\frac{3}{16}$ in. in diameter. Starting about $\frac{1}{4}$ in. from the hole, peen in a spiral toward the leak, drawing the metal in until the hole is closed. Another method is to insert a small wire to get the general direction of the hole through the casting. A $\frac{1}{8}$ -in. hole is then drilled about $\frac{1}{4}$ to $\frac{3}{8}$ in. deep to take a piece of lead or babbitt, which is driven firmly into the hole with a small pin punch until the hole is filled. The edge of the hole is then peened slightly to hold the lead or babbitt in place. Several repairs of this kind have been in service for a number of years with no sign of a leak. This system also can be used on cast-steel tees and other fittings. On cast iron, however, it is advisable to use the second method as the metal will not usually draw enough to close even a small hole without chipping.

Parts Welded at Right Angles When Held in This Simple Jig



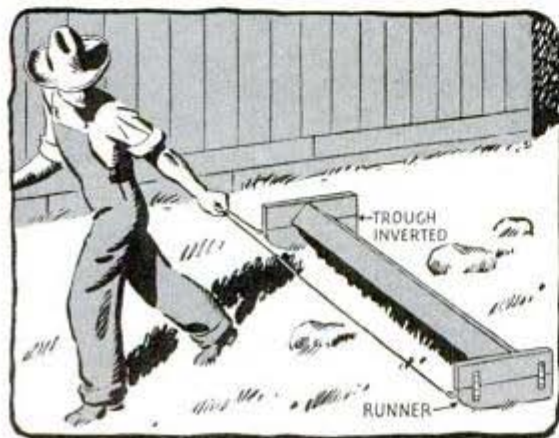
Parts to be butt-welded or soldered at right angles can be held accurately in this jig. It consists of a length of angle iron, Fig. 1 having a section cut out of it as shown in Fig. 2. In use, the work is held in the jig by C-clamps as indicated in Fig. 3. This jig has an advantage over some others in that the work can be approached with a torch from any side without moving either the jig or the work.

—I. Swidler, Philadelphia, Pa.

Inverted Hog Trough Moved Easily On Sled Runners

By merely attaching a couple of runners to the end boards of his hog troughs, one farmer solved the problem of making them easy to move. When the troughs are to be moved, they are inverted to rest on

the runners which lift them high enough to clear ordinary obstructions. They can be pulled about by means of a rope hooked into large screw eyes driven in the ends of the runners.



Protecting Sign Writer's Sleeve

To protect the sleeve of his coat from contacting fresh paint of sign backgrounds or letters, one artist carries a bicycle trouser guard which he slips over his folded sleeve when working.



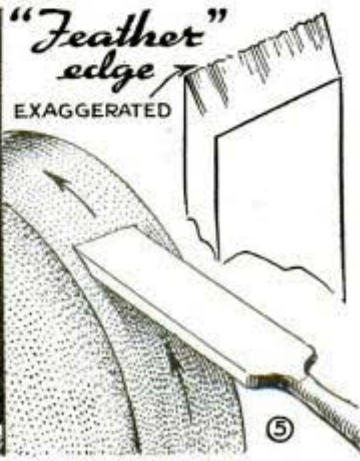
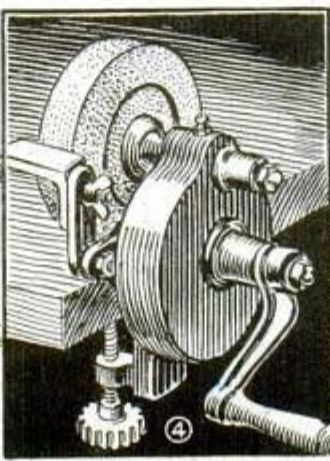
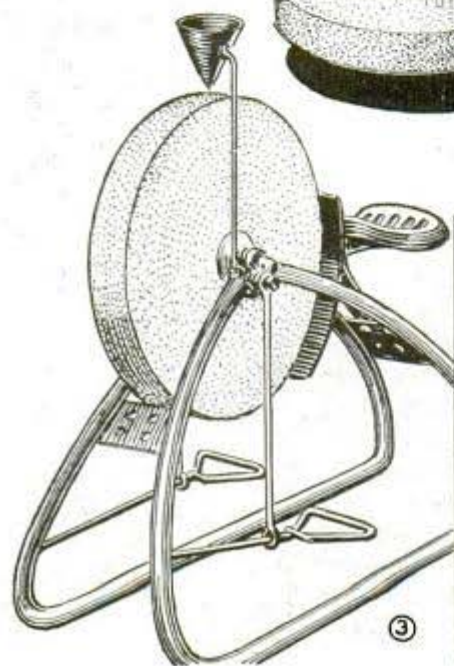
TOOL GRINDING

By W. C. Lammey



FREEHAND grinding of small tools, holding them against, or moving them over a stone with the fingers without the aid of a clamp, can be done by anyone after a little practice. In this work, you depend largely on the sensitivity of your fingertips. Of course, what you can see is important, but it's really the sense of touch that counts. By it you control pressure on the grinding surface, degree of bevel, straightness of the edge and, on certain tools, the amount of metal removed. Much depends on how the tool is held.

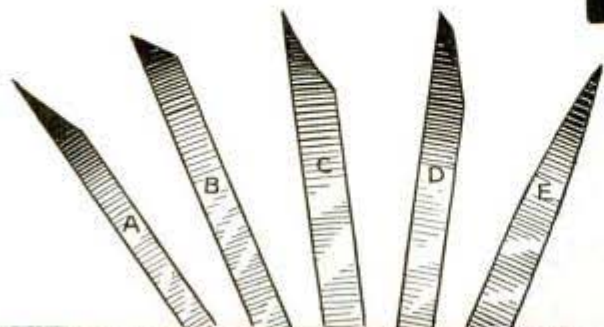
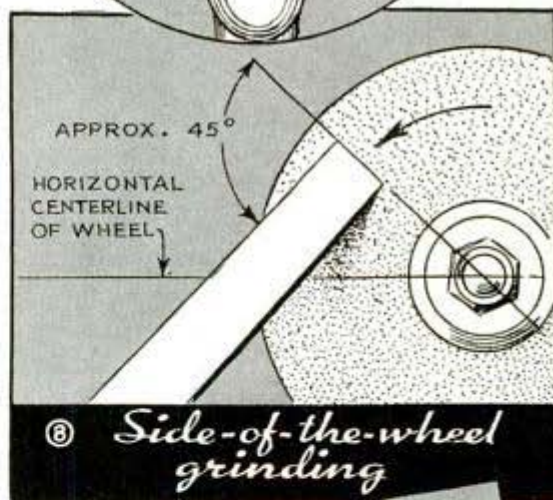
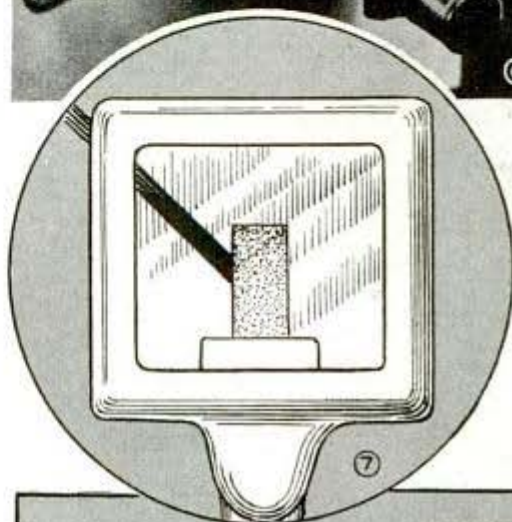
To produce a smooth razor-sharp edge, three or more operations must be delicately coordinated. Sharpening a pocket knife, Fig. 1, is an example. If you hold the knife lightly in one hand and the stone in the other as shown, you can even close your eyes and still know just how much pressure is being applied, whether the blade is riding flat on the grinding surface or at the proper angle, and whether the stroke is taking in the full length of the edge. Some carvers and others who are "fussy" about sharpening a pocket knife, claim that they get a smoother and keener edge by simultaneously imparting a rotary motion to both knife and stone. Woodsmen frequently use the same motions in sharpening an ax with a round stone as in Fig. 23. Fig. 2 shows only four of the almost innumerable sizes and shapes of common hand stones available, the four being those most generally used. In Fig. 3 is a newer type of the old familiar foot-driven grindstone



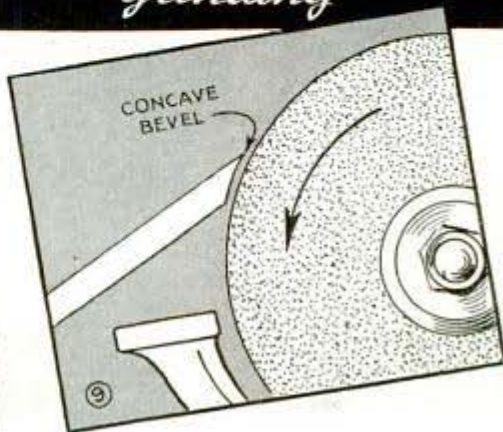
- FREEHAND

which still has a place in sharpening technique due to slow surface speed and fine cutting properties. Another well known type of hand grinder is shown in Fig. 4, while Fig. 6 pictures an electric grinder with high-speed dual wheels, lights and eye shields.

A common error in hand grinding is applying undue pressure to the tool. This natural tendency must be avoided as too much pressure causes the grinding surface to be clogged with comparatively large particles of metal. Also, the tool heats up rapidly when grinding on high-speed wheels and, in most cases, the finished edge will be unduly "wiry" or ragged. Tool rests on power grinders have a very definite purpose when grinding is done on the face of the wheel, but for light grinding of a variety of small-edge tools skilled craftsmen generally agree that better results are obtained by grinding on the side of the wheel as in Figs. 6, 7 and 8. Reasons for this are that on the side of the wheel the cutting action is slower, the tool has no rigid support, which means that the control is entirely freehand. About the most important advantage in side-of-the-wheel grinding is the ease of holding a true bevel and a square edge. It is unnecessary to move the tool back and forth as must be done when sharpening on the face of the wheel, the flat side of the latter assuring a true edge even on a wide blade as you see from Figs. 7 and 18. Fig. 8 shows the approximate position and angle of the tool with relation to the horizontal centerline of the wheel. Only a close approximation is necessary when grinding common tools.

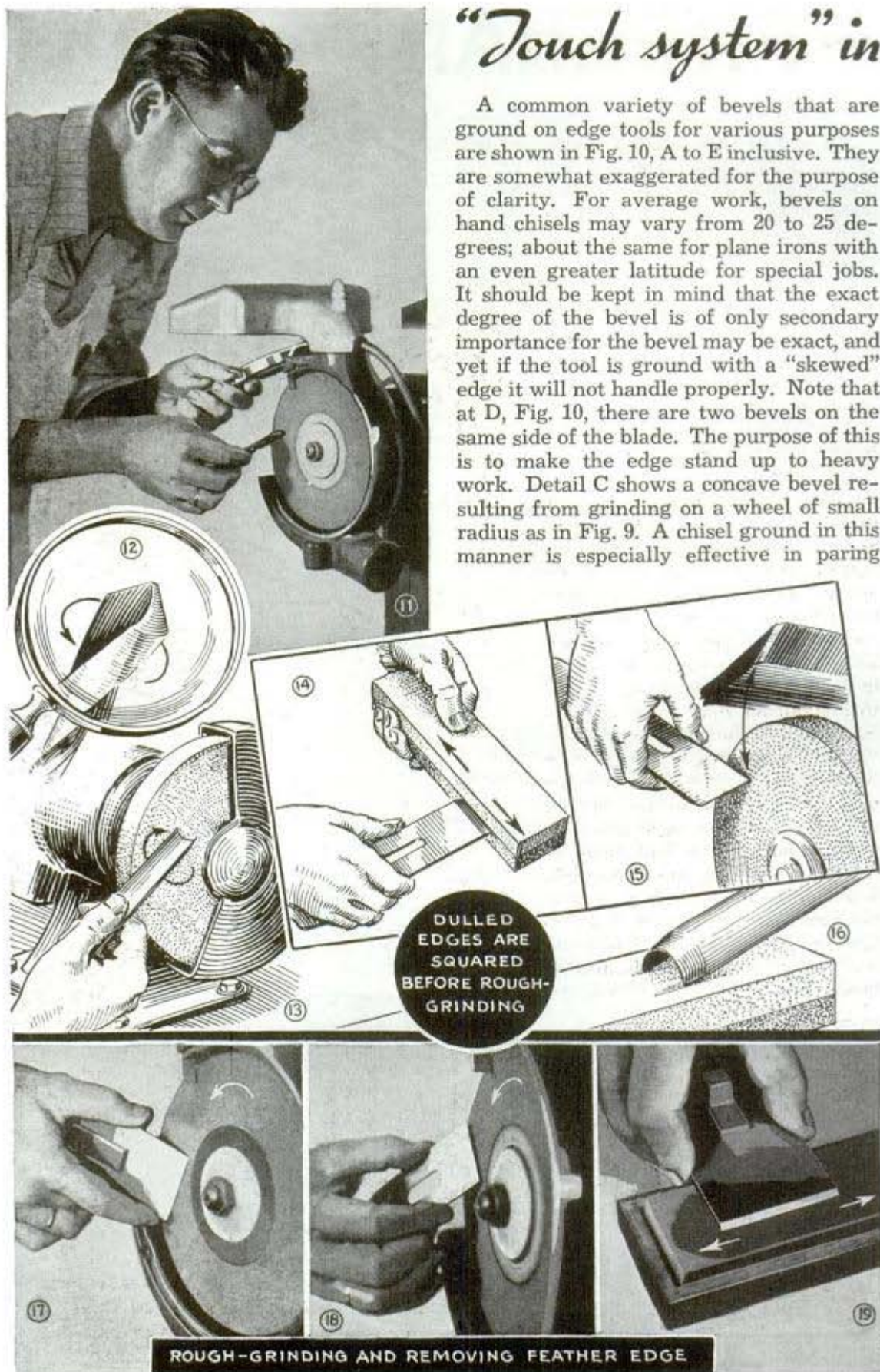


⑩ Degree of bevel can be changed to suit work



"Touch system" in

A common variety of bevels that are ground on edge tools for various purposes are shown in Fig. 10, A to E inclusive. They are somewhat exaggerated for the purpose of clarity. For average work, bevels on hand chisels may vary from 20 to 25 degrees; about the same for plane irons with an even greater latitude for special jobs. It should be kept in mind that the exact degree of the bevel is of only secondary importance for the bevel may be exact, and yet if the tool is ground with a "skewed" edge it will not handle properly. Note that at D, Fig. 10, there are two bevels on the same side of the blade. The purpose of this is to make the edge stand up to heavy work. Detail C shows a concave bevel resulting from grinding on a wheel of small radius as in Fig. 9. A chisel ground in this manner is especially effective in paring

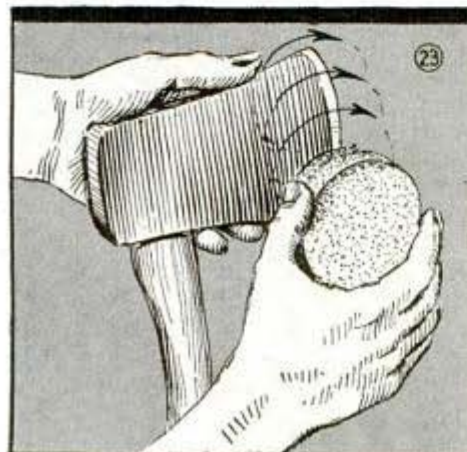
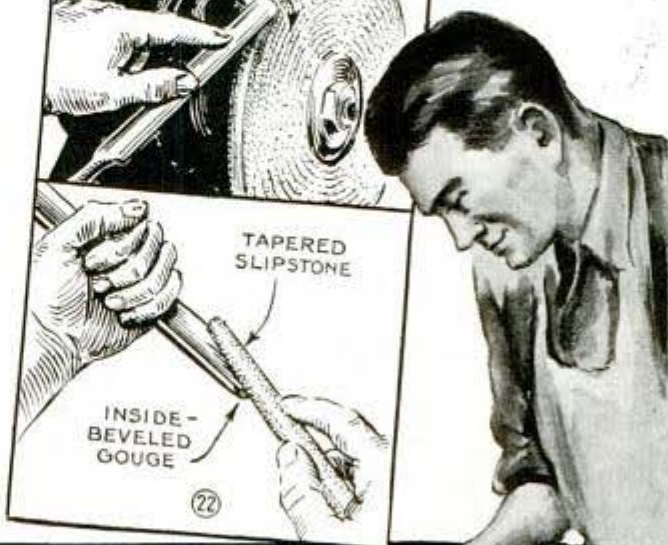
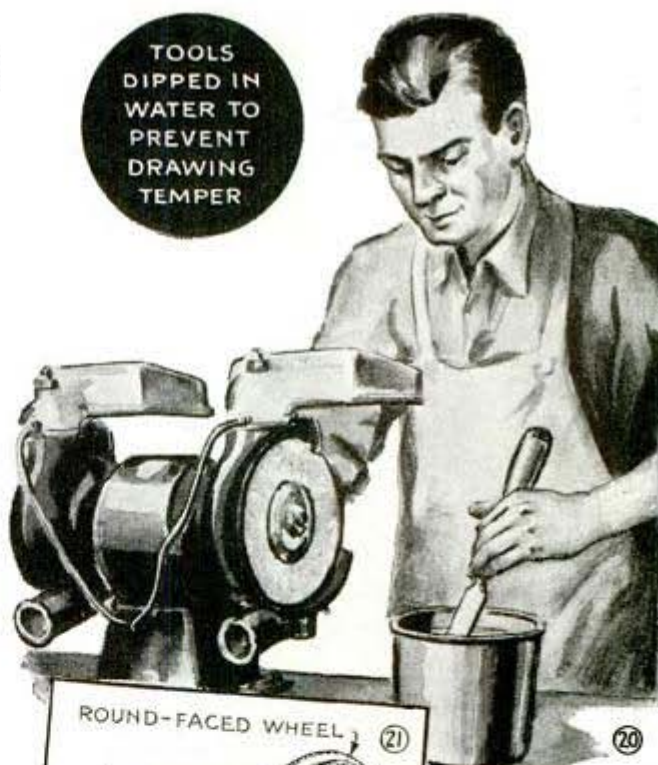


hand grinding

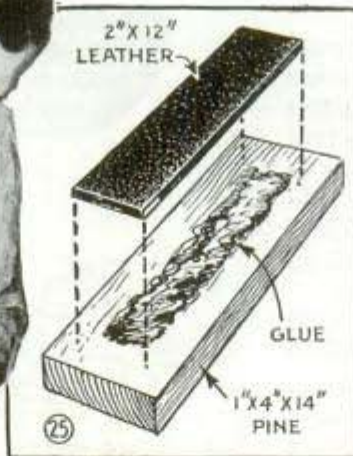
cuts but the edge will not stand prying. "Feathering" of the edge results when you grind with the wheel running away from the tool as in Fig. 5. Sometimes this is necessary, especially on grindstones, but care should be taken to avoid feathering as much as possible.

Now for a grinding job that's tricky but entirely practical. Only a few craftsmen and small shops have available a precision grinder attachment for sharpening twist drills. So the job must be done freehand. Take the drill bit between the thumb and index finger, allowing the middle finger and third finger to rest lightly on the body of the drill. Then bring one cutting lip up to the side of the wheel. Now, right here is the first critical point in the whole business. The correct angle depends on touching the lip to the wheel in just the right position. To do this stand so that your sighting eye is directly over the work as in Fig. 11. A reading glass will help by magnifying the point of the drill. As soon as the lip touches the wheel with no light showing, turn the body of the drill slowly to the right, Fig. 12, simultaneously drop your elbow slightly and at the same time pivot your hand to the right at the wrist. That's all. And after you have duplicated these movements in grinding the

TOOLS
DIPPED IN
WATER TO
PREVENT
DRAWING
TEMPER



Careful honing



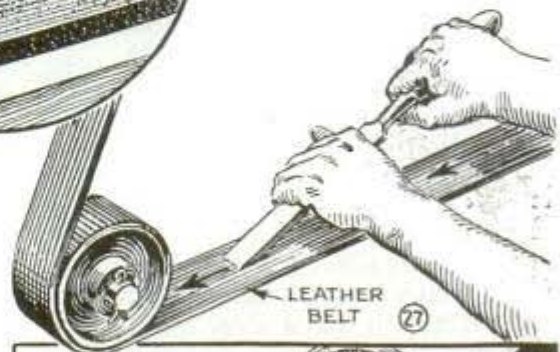
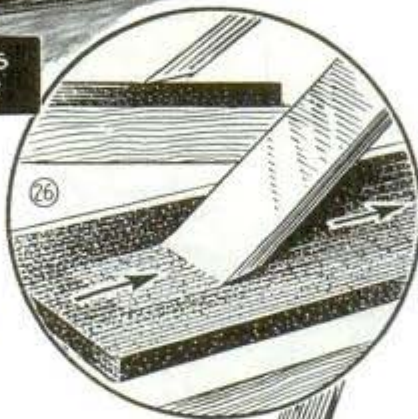
grinding on the side of the wheel. When grinding any tool on a wheel don't forget to dip the edge in water frequently to prevent heating, Fig. 20.

If a floor or bench grinder is not available, Fig. 24 shows how you can rig a drill press for the work. While the picture shows a pedestal-type drill press with the head inverted, the job can be done in almost any drill press simply by gripping the grinding-stone mandrel in the chuck. There will be sufficient clearance on most drill presses so that you can hold practically all hand tools on the rotating stone. A grinding wheel, a flanged adapter to fit 1/2-in. shafting and a 2-in.

HONED CUTTING EDGES STAY SHARP LONGER

second lip, check with a drill gauge. You'll probably be surprised at the accuracy of the job. If it's a little inaccurate, just a slight touch to the wheel will correct it. Although one can hardly expect to equal the work of the precision jig, a drill bit ground in this fashion will serve very well where the job does not require reamerlike accuracy.

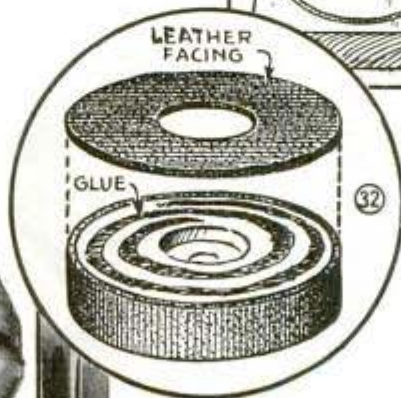
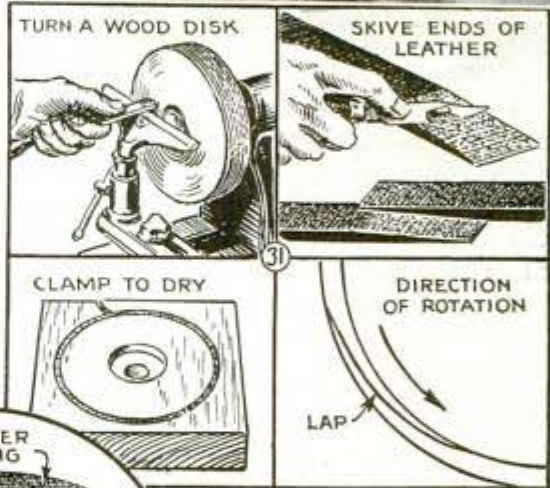
Grinding a gouge, Fig. 13, is done in much the same way as grinding a drill. First, true up the edge as in Fig. 16. Gouges with an inside bevel should be ground on either a round-faced wheel as in Fig. 21 or a tapered slipstone as in Fig. 22. A plane iron requires several steps as in Figs. 14 and 15 and 17 to 19 inclusive, first squaring the edge as in Fig. 14 and then beveling the corners as in Fig. 15. Unless the iron is badly nicked, omit the step shown in Fig. 17, where the nick is removed somewhat more quickly by feathering the edge then removing the feather by grinding against the wheel as in Fig. 18. Fig. 19 is the finish step to remove the wire edge. Some users prefer a slightly rounded cutting edge on a jack plane for rough work. This is formed easily by rocking the blade slightly while



finishes the job

length of the latter are all you need. Finally, most tools used for the finer work should be finished by honing or stropping, either of which can be done in a number of ways. As an example, craftsmen in wood and pattern shops sometimes strop hand tools on a moving leather belt as in Fig. 27, a handy and quick method that does the job nicely. A length of leather belting glued to a wood block, Fig. 25, with the hair side up and coated with polishing rouge rubbed in with the palm as in Fig. 28 does very well. A length of leather belting 2 in. wide, or an old razor strop, Fig. 30, is just the thing for stropping a pocket knife or any similarly bladed tool. Some even strop edge tools on the palm of the hand but most craftsmen who are particular about keen edges on chisels, plane irons and turning tools make a leather-faced honing wheel as in Figs. 31 and 32. To make a honing wheel, first turn a hardwood disk to the desired size, drilling it centrally to slip over the spindle of your grinder or buffing head. Then cover the

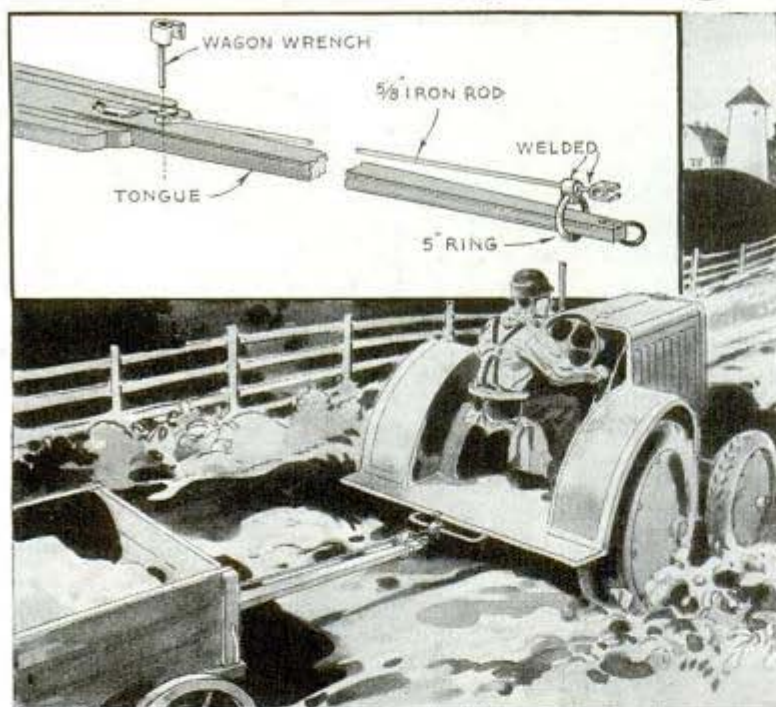
OLD RAZOR STROP MAKES A GOOD "HONE"



outer edge with a strip of leather, which is skived as indicated in Fig. 31, and glued in place, using a specially made wood clamp to hold it until the glue dries. Next, cut a leather facing, coat one side of the wood disk with glue and clamp the facing

to it. Be sure the wheel is balanced carefully to avoid vibration. Such a wheel is most efficient for honing to a smooth edge after grinding and for touching up the edge between grindings. As shown in Fig. 26, the tool should be held with the heel of the bevel raised slightly so that only the extreme edge contacts the leather. In using the wheel, first coat it with polishing rouge as in Fig. 29. Fig. 33 shows how to hold the tools, and the direction of rotation.

Hitch for Tractor Trailer Fits Over Wagon Tongue



For towing loaded wagons behind his tractor, a farmer used this hitch. It is easy to attach and all the pull comes from the whiffletree clevis, the end of the wagon tongue being supported by a ring at the outer end of the hitch. In this manner, the wagon does not run up under the tractor or throw any undue strain at the outer end of the tongue when going down grade. Furthermore, it takes only a few seconds to attach the wagon to the tractor. The hitch consists merely of a length of iron rod with an eye formed at one end to receive the whiffletree clevis pin and a clevis welded at the other end to fit on the drawbar of the tractor. The ring supporting the tongue is attached by forming a U-shaped piece of iron around the rod and welding it.

the operator's hands free. The can is attached to the machine by means of a bracket so it will hang directly above the work at the point the oil is to be applied. A valve made as shown in the detail provides an adjustable vent for admitting air to the can to control the flow of oil.—S. J. Gancher, Richmond Hill, N. Y.

Pipe and Fitting Are Marked for Easy Starting

When assembling a line of heavy pipe, especially where long lengths are used, difficulty experienced in getting the threads to "catch" can be reduced greatly if each part is marked where the threads start. Then, when the parts are butted together with the marks opposite each other, the threads will start engaging the instant one part is rotated.

Cutting Oil Used in Machining Is Applied by Drip Can



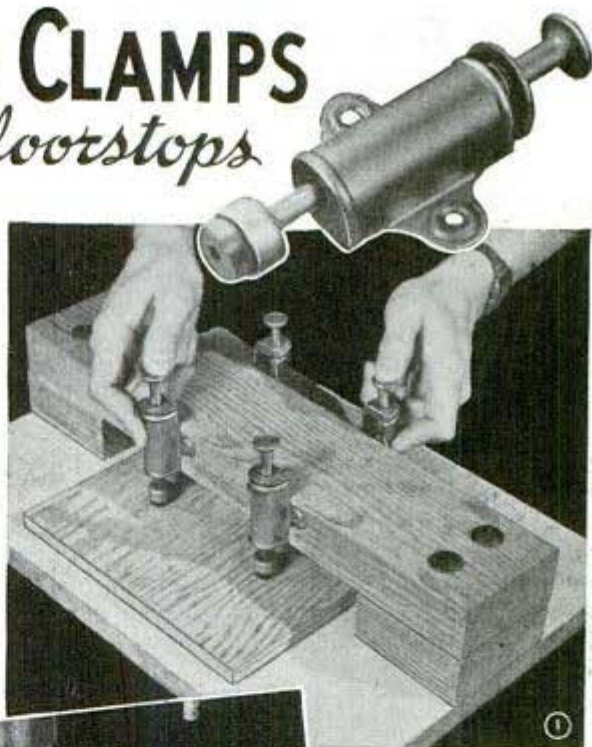
Using this drip can to apply cutting oil when working with a lathe, drill press or milling machine, does away with the messy brush commonly used and leaves both of



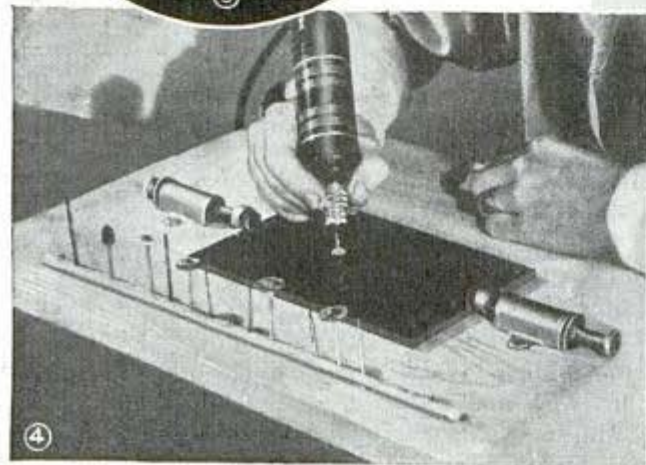
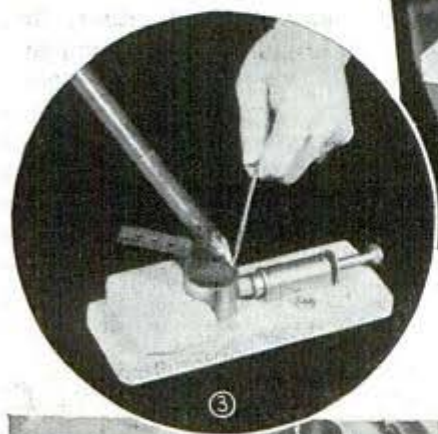
QUICK-ACTING CLAMPS

from spring doorstops

ORDINARY spring doorstops can be used as clamps to hold work securely under light pressure, and their size and spring action make them more convenient to adjust than screw-type clamps. The stops are screwed to blocks, boards or a framework as the particular job requires. Fig. 1 shows a simple photo press using four doorstops to exert pressure. A single stop used as in Fig. 2, permits rapid clamping of duplicate parts for production drilling. The application shown in Fig. 3 utilizes a stop to hold small parts for soldering, while stops mounted to bear against the edge of the work as in Fig. 4, provide an excellent method to hold sheet plastic, glass or wood flat. Fig. 5 shows the stops holding a figure while it is being carved.



As the stops are rubber-tipped, they can be pressed against finished work without marring it. Their plunger action enables rapid adjustment and instant release on either flat or irregular surfaces



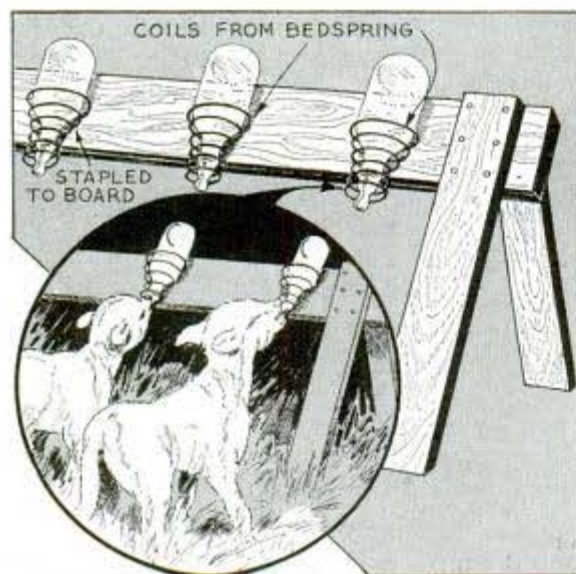
Friction Tape Holds Small Parts On Top of Stepladder



To prevent the loss of screws and other small parts when moving his stepladder, one electrician merely unrolls a strip of friction tape and places the parts on it. The tape provides sufficient adhesiveness to keep the parts from rolling around, yet they can be removed easily when needed.

Nursing Bottles for Pet Lambs Held in Bedspring Coils

If you have two or three lambs that are being fed with a bottle, the tedious job of holding the bottles while the lambs are feeding can be simplified by using a rack



of the type shown. This consists of a sawhorse with coils from a bedspring nailed to the cross member to take the nursing bottles in an inverted position. The bottle nipples project through the lower end of the spring so that the lambs can reach them without difficulty.

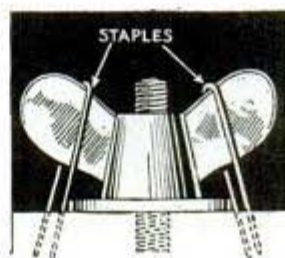
Lid Hung on Edge of Barrel By Knob on Underside

In a store or warehouse where wooden barrel lids must be removed and replaced frequently, a knob on the underside of each lid will provide a means of hanging them on the edge of the barrel. With this arrangement,



there is no need to look for a place to lay a lid or stoop to put it on the floor.

Two Staples Lock Wing Nut

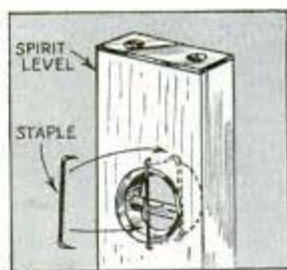


Next time you want to lock a wing nut in place, just drive a staple over each wing at a slight angle so it will enter the wood just outside the washer as indicated.

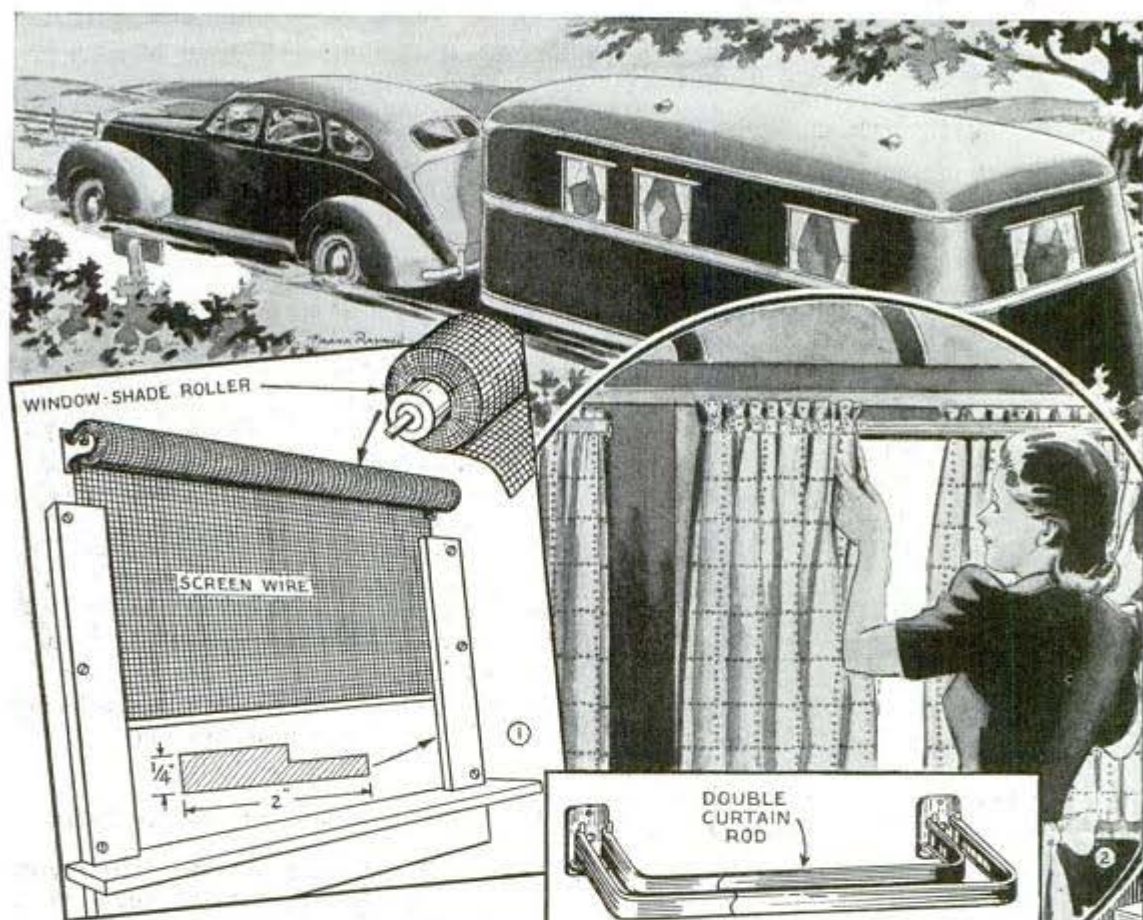
Although these staples provide a positive lock, they can be pried off so that the nut can be turned.

Wire Over Glass of Spirit Level Protects It From Breakage

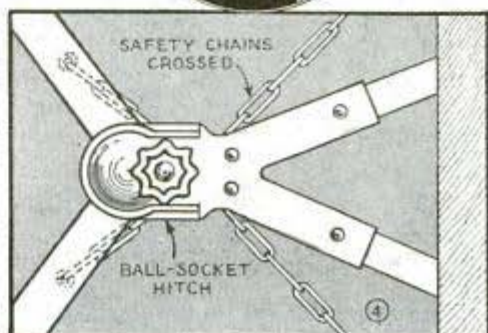
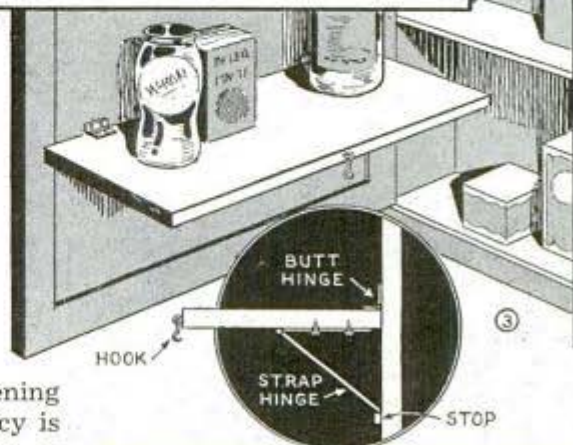
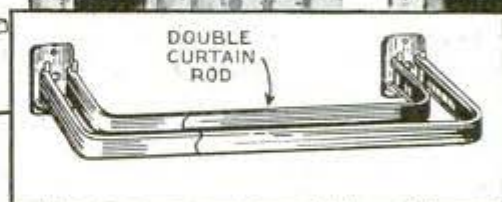
The glass tube on your wood level can be protected easily from accidental breakage against other tools by driving two homemade wire staples over the glass as shown. If the staples cross the exact center of the glass, they will also make it easier to read.



Four Ideas to Improve Your House Trailer



Insects cannot get into your trailer if you fit each window with a screen like the one shown in Fig. 1. It can be raised or lowered like a window shade. In fact, it is nothing more than screen wire tacked to a shade roller, rabbeted strips being used at the sides of the window frame to serve as guides. Paper wrapped around the roller will increase its diameter to avoid bending the wire sharply. Curtains are made to overlap when pulled together if double curtain rods are used as in Fig. 2, hanging a curtain from each rod. This prevents an opening from showing between them so that privacy is better assured at night when the lights are turned on. In order to have as much shelf space as possible in tiny kitchenettes of trailers, you can hinge shelves to the cabinet doors as in Fig. 3. The shelves can be used while preparing a meal and folded against the doors when not in use. A screw eye and hook keep the shelves in the folded position. Fig. 4 shows safety chains crossed so they can be used with less slack than when attached straight. This prevents an excessive drop of the trailer front in case of a hitch failure.



Curved Block Shields Muffler While Pounding Out Carbon



When pounding the muffler on your car with a hammer to loosen carbon, which has accumulated inside the shell, it's a good idea to use a wooden block, with one side sawed to the curvature of the muffler. As the block covers a large area, the striking force of the hammer is distributed and the shell is not likely to be damaged by blows heavy enough to loosen the carbon.

Mechanic Protects Upholstery By Covering With Cloth

Whenever he has to work inside a car, one mechanic covers the upholstery on the seats and sides with cloth so that there is



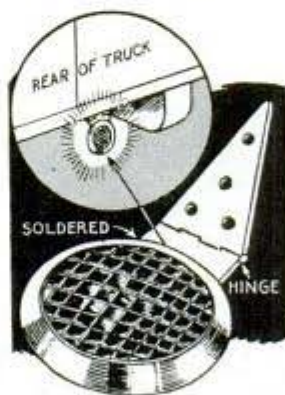
no possibility of smudging it. The cloth is held in place with vacuum cups stuck to the windows. Each cup is fitted with a paper clamp for gripping the cloth.

Half Rubber Ball on Accelerator Compensates for High Heel

The inconvenience of operating the accelerator pedal while wearing high-heeled shoes caused one woman to employ half of a sponge-rubber ball as a compensator. This was attached to the front end of the pedal by means of a stout rubber band, thus building up this end of the pedal so that the foot remained in a more natural position.



Hinge Mountings for Reflectors



A regular barn-door hinge will provide a good mounting for reflectors on the rear ends of trucks. By mounting reflectors on one half of the hinge and fastening the other half on the truck, a mounting is provided that will prevent the reflector from breaking if it strikes some object when the vehicle is backing up.

—William C. Acker, San Francisco, Calif.

Garage Doors Held Open by Stop

Foot-operated doorstop of the type used in homes will keep garage doors open. The stops are attached to the bottom rails of the doors as indicated. If the doors swing



out over a concrete driveway, holes can be drilled in the concrete to take the stop plungers. If they swing over bare ground, stakes with holes drilled in the ends to take the plungers and driven deeply into the ground will serve the purpose.

Oil Data Card Kept in Envelope Attached to Sun Visor



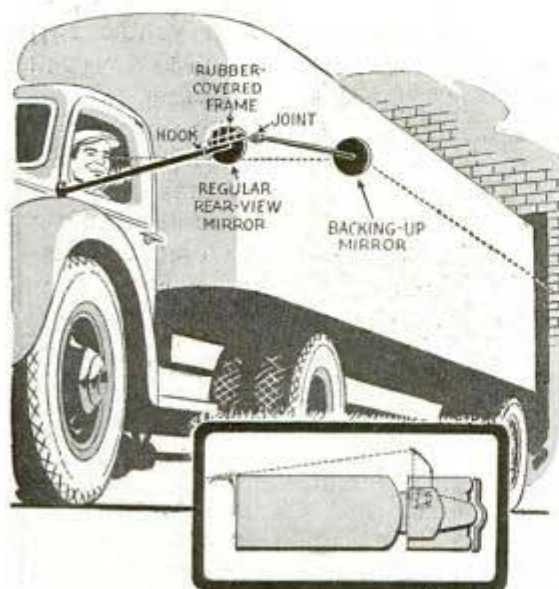
Attached to the rear side of the sun visor, a small celluloid envelope is a handy place for the card on which changes of oil and lubrication are marked. Rubber cement is ideal for attaching the envelope in place on the visor.

Dripping Umbrella Kept in Tube To Protect Car Interior



A length of an old inner tube provides a handy "sack" in which to carry a wet umbrella in your car. One end of the tube can be cemented together to close it, and the sack can be rolled and kept under the seat when not needed.

Mirror Extension on Large Truck Aids Driver in Backing



The driver of a large semi-trailer truck uses this extension rear-view mirror to aid him when backing into tight places. The mirror is fastened to an arm having a joint near one end for adjustment, the free end being fitted with a heavy wire-mesh frame, which slips over the regular rear-view mirror. With this arrangement, it takes only a second to reach out and slip the mirror in place or remove it.

Shock Absorber for Tow Chain

To minimize shocks on a tow chain when pulling a car behind a wrecker truck, one mechanic fastened a shock absorber on the chain as indicated. This consisted of a strong coil spring fastened in the center of the chain. Slack was allowed in the chain to equal the length of the extended spring.

—James Vick, Church Road, Va.



End of Garage Creeper Raised For Comfortable Position



Finding it desirable at times to raise the head end of his creeper for a more comfortable working position while under a car, one garage mechanic fitted a wooden block with casters for the purpose. Size of the block is determined by the height de-

sired to raise the end of the creeper. The upper side of the block was slotted to take the regular creeper casters, which tended to hold it in place. Fitting the block to the creeper was just a matter of lifting it and inserting the casters in the slots.

—Opie Read, Jr., Chicago.

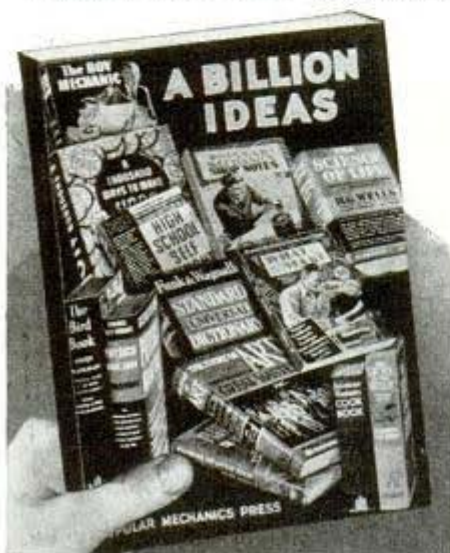
Extra Hook for Trouble Lamp Permits Hanging From Side

By soldering an extra hook to the side of the frame of a trouble lamp, it can be hung in many places where it would be difficult to use the hook on the end of the lamp and have the latter out of the way. The extra hook is especially handy to hang a lamp so that light will be directed where it is needed most when working underneath a car. The hook is a length of fairly heavy wire bent to shape.



Hide an extra set of car keys under the hood to avoid loss of time in case your regular set is misplaced.

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of a back-breaking job

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Mapping the Ocean Floor With Bombs

(Continued from page 729)

record the sound vibrations sent out by each of several submerged explosions. Called seismic waves, they are the same sort of vibrations which on a larger scale are so widely distributed by an earthquake.

Dr. Ewing wishes to learn in each case the direction in which the seismic waves travel, where they go and more particularly, how long it takes them to get there. He may discover in a certain instance that after having traveled at a velocity of about 20,000 feet per second they have suddenly slowed down. Then, after having penetrated the earth's submerged crust for some distance at this lower velocity they have quickly picked up speed again and proceeded at the original rate.

Nor does he have to wait long to read an illuminating travel-log of these speedy seismic waves. All the time a ticker tape in each deeply submerged seismograph has been steadily taking it down. Dr. Ewing reels off a few yards of seismogram and plots a graph. He then knows where the seismic waves have gone and the varying velocities of speed at which they traveled.

"There are two distinct methods of recording the waves," he explains. "One is the seismic reflection method, sometimes termed reflection shooting. These are the vertical waves. Following an explosion on sea bottom they take a course directly downward. Then, upon encountering changes in rock strata, they are reflected, bounced upward. Aboard ship we get an echo. It is the water wave meeting surface of water. In fact there is a series of echoes. This means the sound from the explosion is being bounced back and forth between water's surface and the bottom.

"The other method of recording waves is known as the refraction method. The waves in this case are essentially horizontal in character. That is to say, they penetrate downward for a certain distance, but before coming to the water's surface they travel horizontally for quite a considerable distance. More important results have come from these refraction measurements than from reflection shooting. However, both methods have proved satisfactory."

The heavy and expensive apparatus must be retrieved from three miles down on ocean bottom before the story told by the waves can be learned.

"Until recently we used a cable from ship for lowering and hoisting," says Dr. Ewing. "It proved a constant source of trouble. Roll of the ship was the chief difficulty. This was transmitted down the cable to seismographs resting on bottom. We would pay out excess cable to better matters but a slack cable takes kinks when hoisting begins and is quickly damaged. The only satisfactory solution, we realized, was to do away with wires and cables."

After much experimentation, the eventual solution was found in the invention of an unusual type of float. These consist of black rubber casings seven feet long, each filled with about 25 gallons of gasoline to make for buoyancy. To the float is attached sufficient ballast to overcome buoyancy and to sink the float together with the attached apparatus to bottom. After explosions are over a release drops the ballast, and the float brings them up again to water's surface, where they are retrieved.

Early experiments conducted by Dr. Ewing in an old limestone quarry served as beginnings for important results to follow. He discovered that seismic waves would travel through limestone with a velocity of 19,600 feet per second until encountering a zone of irregularity where they would slow down. The slower zone meant softer material. The harder the material, the greater their velocity.

These experiments have provided geologists with much valuable data. In the economic field a new science known as "seismic prospecting" has taken a definite and firm hold. If you plan to drill for oil or even dig a deep ditch it may prove an asset to know the relative hardness or softness of the material you will get into.

As for the high seas, it is only five years since the first experiments aboard the Atlantis were launched. Yet, geologic findings have already been noteworthy. The seismic method has scored as a proved working tool in a field where proved working tools are few. Considerable attention has been devoted to instruments for under-sea exploration. An outstanding achievement of the past was developed because of the U-boat menace during the last war—the sonic system of sounding for ocean depths, now of inestimable value to all navigators.



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America's Defenders

(Continued from page 709)

exposed by bad scores in firing, the Army may slip them dummy cartridges—just often enough so they won't know whether the piece will fire or not—and can't flinch from it. Or the coach, prone beside his pupil, may squeeze the trigger, getting better scores from that pupil's aim than the flincher gets by himself—until he's cured.

But that comes later, after drill in rapid-fire technique, windage, elevation, light and mirage has readied the selectee to smell powder. All this preparatory training has gone on for about two weeks on the company street, the parade ground or anywhere, but now a target range is required. Here's a bottleneck, for the safety precautions only begin with a vast empty danger area in line of fire. Ranges are busy seven days a week, dawn to dusk, and range capacity is being doubled and redoubled so fast that today's statistics would be ancient history next week.

During instruction practice with known-distance targets, the coach remains at the pupil's elbow. It begins at 1000-inch range, often with .22 caliber equipment, progressing into ranges of 200, 300 and 500 yards with the M1 rifle. It begins with unlimited time to fire four shots, and gets tougher until a man must drop from standing to prone and pump sixteen shots into the 300-yard target within sixty-five seconds. It includes all four body positions; it burns at least 140 rounds of ammunition, with careful marking and scoring of each shot and constant correction of errors—and it prepares the selectee for his record practice.

Now he's on his own, with no coach, to prove himself a rifleman. In Course A he fires twenty shots slowly, forty-eight rapidly, using all four positions, and ranges of 200, 300 and 500 yards. He stands or falls on this record. If he falls, he returns to his coach. If he stands, he goes on into field training under simulated combat conditions—unknown ranges, moving targets, antiaircraft firing, in all their finer points. He learns to find a small target in a big landscape, by verbal description or tracer bullet. He learns to "lead" a moving target, firing at the forward half of a man walking at close range, and five lengths or more in advance of a hostile airplane, depending upon the angle.

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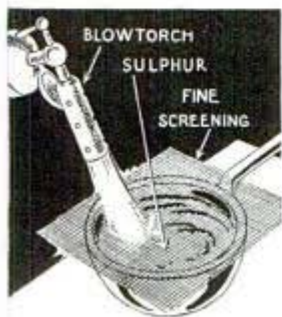
Vehicles are simulated by boxlike targets mounted upon sturdy sleds, towed across the combat range by hidden trucks. A series of staggered pulleys and a trip knot in the tow rope give the target-carrying sled a zigzag course at momentarily varying angles.

Antiaircraft marksmanship, essential in modern warfare, requires a new firing position. Erect (not squatting) on one knee, with the other foot well advanced, the rifleman can swing his body smoothly to "hold" on the target for an arc of 180 degrees as it flashes past, ending on the other knee. Targets at first are silhouettes on a miniature range of 500 inches. They travel on overhead wires at fifteen to twenty feet per second, simulating overhead, non-overhead, diving and climbing planes. Firing is by groups, and obviously the range must have a huge danger area. Even more elaborate safety measures are required for the final phase—group firing into a sleeve target towed by an airplane.

So runs the course of training America back into the Daniel Boone sharpshooting tradition. "Any man physically and mentally capable of being a soldier can be taught to shoot well," says the Army. "This for many years has been the basic principle of rifle marksmanship in the Army, and experience has proved it correct. It is not unusual for an organization to qualify every single man, in the course of a training season, with a high percentage of experts and sharpshooters among them."

Many a mechanic, technician or bugler may put in his year of training without ever drawing a bead with a Garand, it's true. But the backbone of this man's army is the able, self-reliant rifleman still, and the Army knows how to face this crisis with a sturdy backbone in the old American way.

Sulphur Melted Safely in Ladle



To melt sulphur in a ladle quickly and without igniting it, cover the ladle with a piece of fine screening and pass the flame of a blowtorch over the contents, as shown.



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Clearing the Rails for Uncle Sam

(Continued from page 693)

volume, the railroads are at their peak. Within the last 20 years, our railroads have been practically rebuilt and in their essential features are actually new, though the art of rail transportation itself has a century of experience behind it. When transportation service is required in astronomical quantities, whether in war or in peace, the railroads leave other agencies almost out of the picture.

Let us assume the army of the United States is increased to a million and a half men actively under arms. That means the railroads must carry a million and a half soldiers where and when the authorities direct. It will be a big job and no one realizes it better than we railroad men do.

What is not generally realized, I believe, is the fact that in everyday work our railroads are thoroughly experienced in handling immense mass movements of civilian passengers, larger in volume than any individual movement likely to be required even in actual war.

To illustrate, at recent Presidential inaugurations we have operated from 90 to 100 trains to and from Washington, and handled 50,000 passengers in and out of the capital in one day. The annual Army-Navy football game at Philadelphia averages 80 special trains and more than 45,000 inbound and outbound passengers on our rails alone. Every inviting weekend of the summer we carry to and from seashore resorts of Southern New Jersey 100,000 or more passengers—50,000 to the beaches and 50,000 back—requiring nearly 300 trains, and mostly concentrated from Saturday noon to Sunday evening. Over the last Labor Day weekend, three-quarters of a million traveled on 2,000 trains shuttling between Washington, Baltimore, Philadelphia and New York, the summer resorts along the North Atlantic and points to the west and south. At Pennsylvania station in New York City, over 69,600,000 passengers arrived and departed during 1939, an average of more than 190,000 a day.

These great civilian mass movements are all army-size, some of them much more than army-size. They are concentrated for the most part into shorter periods than army movements ordinarily require and, except in the case of Pennsylvania station,

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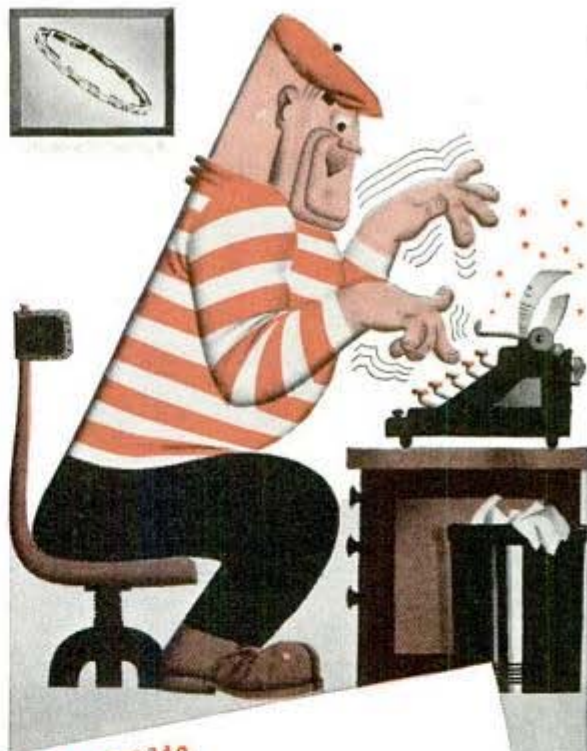
they are movements over only one railroad out of many in the country.

Last summer the nation witnessed an impressive demonstration of fast troop movements by rail. The Regular Army and National Guard training maneuvers in northern New York, Wisconsin, Louisiana, Minnesota and Washington involved assembling 150,000 men from every state, traveling over practically every Class 1 railroad. In one period of three days 105,000 men were moved by rail, which considerably exceeded in volume anything carried out in the most active period of the first World War, when this nation mobilized 4,000,000 soldiers and sent 2,000,000 overseas.

I realize, of course, that these training maneuvers were not a test of the capacity of the railroads to handle a modern mechanized army on a war footing, while at the same time maintaining the transportation service necessary for munition factories working at wartime outputs. I realize also that conditions have changed since the last World War; but so have our railroads.

The average power of freight locomotives in that time has increases 44 per cent, the capacity of freight cars 20 per cent, and the speed of freight trains by nearly two-thirds. The output of transportation service—the ton-miles per hour of train operation—has considerably more than doubled. Freight cars of greatly improved types have rendered loading and unloading faster and more efficient. In the first nine months of 1940, American railroads put 52,658 new freight cars in service.

These factors bespeak tremendous gains in capacity to move freight promptly, and progress in passenger transportation has been fully as great. It may be of interest to know that passenger cars of American railroads could seat 1,738,645 passengers at one time; that the 1,700,000 freight cars in service, coupled with the necessary locomotives, would make a train 17,000 miles long and capable of carrying 84,000,000 tons. Every day 33,200 freight and passenger trains operate in the United States, so that somewhere in the country a train is starting on its run every two and two-thirds seconds. Figures such as these may help to visualize the tremendous capacity which the railroads of America have available for the service of the nation in war or peace.



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R1334
Battling the Jungles for Oil

(Continued from page 735)

devitalized, and were in no mood of defeatism. They attacked the swamp and licked it. When pipe rotted faster than it could be placed, they brought in a special machine which cleaned off the oxidized scale, and put on a protective coat, which in turn was re-coated with asbestos before the pipe was buried.

Still, a great enemy lay in ambush—rain, devastating and deadly, beyond any North American's imagination. Tropical storms hit like a blitzkrieg. Up swelled the Magdalena and its tributaries, and out went roads, communications, bridges. Camps were flooded, pipe and equipment were buried in silt and water, men were marooned and had to fight their way back to camp on rafts, or on perilous high lines that crossed raging torrents.

Often contact with the outside world was only by plane; and two aviators, struggling to keep that vital thread unbroken, gave their lives in a jungle crack-up. But the order was, "Carry on," and it was grimly obeyed.

Pipe laying continued, rain or not.

Men worked in downpours of steam. Trucks plunged across bridgeless streams. Airplanes took off, heedless of ceiling. Crews struggled desperately to keep all arteries of supply repaired and open. Even crawler vehicles sometimes had to be pulled from the muck, but they never quit.

When the rains were gone, and men had withstood the assault, heat came again. More mountains, jungles, swamps lay ahead. Working against time, knowing they must beat the next rain, men attacked them. Growths that sprang up almost as fast as they could be cleared were mowed down, and pipe was hustled into the rapidly closing breach. Often these pipes had to be dug from tons of silt.

And finally the end was in sight, and one tepid day, the last mile was laid and buried. The job which could not be done was finished. Men who should have left three times their original number in graves along the way were there—disease had taken not 1,500 lives, but only one.

The impossible was accomplished, and American engineers again have said, "It can't be done? There it is!"

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"A TON OF STRENGTH IN EVERY DROP"

"Baby" Engines and Super Fuels

(Continued from page 683)

od of expressing higher engine efficiencies in terms of improved fuel is in a reduction of the rear-axle ratio. If the power of an engine, for example, is increased 10 per cent on account of a higher compression ratio, and it is not considered advisable to use this extra power as performance, the axle ratio can be reduced and the engine allowed to operate at lower speeds while still producing the same acceleration originally attainable with the higher axle ratio. Naturally, with the engine operating at a lower speed the fuel economy of the car is improved. In the final analysis, however, the high compression ratios probably will be utilized by means of smaller engines producing the same power as larger, low-compression engines. With such small engines the gain in economy will be two fold; first, because of the inherent high efficiency of high compression, and second, because the smaller engine has less dead weight to be carried around.

Supercharging has not been used to any great extent so far in the automobile field, although research laboratories are studying its application for greater economy and power output. In aircraft engines supercharging has demonstrated that the best fuels available can be utilized. In supercharging the fuel charge is forced into the cylinders of the engine, pressures are high, and again the octane rating of the fuel is a limiting factor. Fuels as high as 100 octane ratings are available commercially for aircraft engines, and in the laboratories research work is being conducted with fuels of substantially higher rating. Hence, the importance of high-octane-rated fuels that are foreseen for automobile engines.

The added power obtainable by supercharging was determined by laboratory tests conducted with a commercial passenger car engine. The first tests were run with the engine operated on 78 laboratory octane rating fuel, without supercharging. Then the engine was supercharged and operated on 90 laboratory octane rated fuel, and the power output was increased about 80 per cent.

One of the possible applications of supercharging is to obtain greater fuel economy. Engineers have compared the fuel consumption of a large engine, unsuper-

K14 PV

charged, with that of an engine of half the displacement that has a supercharger cutting in when maximum power is required. At maximum power the fuel consumption of both engines was found to be identical, yet at less than maximum power the economy of the smaller engine was considerably better.

Most of the operations of an automobile engine call for only a fraction of the power the engine is capable of delivering. The difference between the power the engine can develop and the power required to move the car for any given speed is a reserve that can be put to use in hill climbing or for rapid acceleration. The supercharger can be arranged to be inoperative except when full power is demanded. For normal operation on highways a small engine without supercharging would show excellent fuel economy. When full power was required, as on hills or for acceleration, the supercharger would come into operation, and the automobile would have the same power as could be delivered by an engine of twice the size but unsupercharged.

It has already been stated that engines of higher efficiency place greater demands on the fuel. In addition to this, such engines also demand more of the various parts which go into the engine, and it is generally agreed that the designing of the engines of tomorrow will call for many hours of long, tedious research work before they eventually reach the motorist. Engineers of the automotive and petroleum industries have recognized this fact and already many laboratories are busily engaged in the further improvement of such essential engine parts as spark plugs, exhaust valves, pistons, piston rings, bearing materials, and engine lubricants.

Mr. Bartholomew, who directs Ethyl's engineering laboratories, back in 1930 said that "the possibilities of the internal combustion engine have not been exploited to anything like their ultimate limits." Mr. Bartholomew then predicted that by 1940 compression ratios would be 6 or 7 to 1, and fuels to operate such engines satisfactorily would be available. The forecasts of 1930 have been fulfilled, and in predicting better engines, of greater power output and economy, he says, "Progress during the next 10 years will dwarf the achievements of the last decade."



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K 969

Streamlined Lifesaving

(Continued from page 715)

"We anticipate the danger here," says Chief Crocker. "We get them out of the water before the situation becomes serious. There's not so much actual lifesaving today as there was a few years ago. Our work today is chiefly accident prevention.

The surfboard used for rescue work is a revision of the Hawaiian board. It differs from the native board of the islands, in that it is of hollow construction and not as wide. Paddle-board is the proper name. The rider crouches near the stern end and uses his hands as paddles. The average board weighs from 35 to 55 pounds, and is easily launched even through a heavy sea.

An actual test recently proved the surfboard offered the fastest means of rescue. An experienced guard using a surfboard, starting from scratch against men using torpedo cans, rubber ducks, rescue tubes and boats, not only reached a "victim" ahead of the field but was able to load the man onto his surfboard and be well on his way to the starting line before the others had arrived at the point of rescue.

The lifeguards, with few exceptions, are men who have just graduated from high school or who are attending college and seek a summer job on the beach. There are, however, some who follow the work as a career. A lifeguard on full time, receives \$160 per month. Part-time guards are paid 62½ to 70 cents per hour.

What type of man makes the best life guard? Chief Crocker says the ideal guard is "a combination of fish and bull, strong as a bull and swims like a fish."

"Big hands and feet are also a valued asset," he says, "while brains are just as necessary as brawn." Other qualifications are: Height: 68 inches; weight, minimum 155 pounds. Obviously, a rigid physical examination is necessary.

An interesting department of lifesaving along the Pacific Coast is that of the Junior Life Guards. Boys of 16 years of age, and over, are eligible. There is no compensation, but the boys serve as assistants to the beach guards who, in turn, teach them lifesaving, the use of surfboards and first-aid work, all of which will later qualify them as full-fledged lifeguards. At the end of the season, the Junior Guard, if he merits it, receives a badge and certificate.

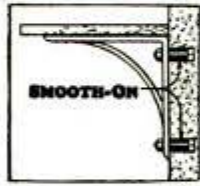
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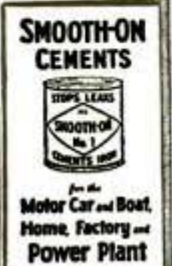
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Army Engineers Practice for War

(Continued from page 687)

tasks, road scrapers and other highway construction machines are included.

Instead of doing their work in comparative safety—behind the lines—the engineers operate in war in the forward part of the combat zone—mainly to assist the other fighting arms. In emergencies, when the need for reserves is more pressing than the need for engineering work, units of combat engineers go into battle against the enemy. Often the combat engineers have the hazardous task of clearing the way for bridge-building units to throw a pontoon span across a stream or ravine—and that means fighting if the enemy is inclined to contest the advance. The combat troops launch their small assault boats and move out on the water, eyeing the opposite shore and keeping weapons in readiness.

Another important phase of the engineers' work is surveying and mapping. This includes not only preparing maps, but producing them in quantities by printing or other means, and distributing them to the other arms and services.

There are also special units, such as camouflage, pontoon, railway, water supply, dump truck and shop companies. All these many tasks have two simple purposes in time of war. One is to make the movement and supply of Uncle Sam's Army easier. The other is to hinder the movement of the enemy.


In peacetime the engineers direct rivers and harbors improvement, flood control and other public works. In the early days of this nation's expansion, Army engineers located, constructed and even operated railroads, such as the Baltimore and Ohio, the Erie, the Boston and Albany, and were in a large measure responsible for completing the first transcontinental lines. In the course of his life career in the Army, an officer of the Corps of Engineers may spend a full half of his time on civil works duties. Such work is invaluable in training the engineers for the huge tasks of construction required of them in war. They built and maintained, in the World War, railroads, roads, bridges, wharves, docks, warehouses, barracks and hospitals, and water supply, electric power and other utilities systems needed in France for an army of 2,000,000 men.

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Reclaiming a Farm Empire

(Continued from Colorado Section)

dam. Large-scale handling of low-grade ore is said to be proving profitable.

Since construction progress hinges on the rate of pouring, an ingenious cableways system was devised to handle the 6,000,000 yards of concrete. Complete bucket coverage of the job is provided by seven high cable lines radiating from the top of a 460-foot head tower to seven smaller movable tail towers traveling on curved runway tracks at various locations. Eight-cubic-yard buckets are dumped on an average two-minute schedule.

In the construction of the 460-foot head tower, 60-foot steel columns, weighing 54 tons, were trucked over mountain roads. Holding up the other end of the cableways are the 200-foot tail towers nearly a half mile away. To give mobility, the tail tower legs are mounted on 12-wheel trucks, riding on super-elevated tracks in front and on level tracks in the rear. These curved tracks, swinging in an arc from the head tower, allow the contractors to reach all parts of the job with the cable buckets.

Because of the distance from the pour to the head tower, from 500 to 2,000 feet, each signal man has a radio headphone so that he may talk with his cable operator.

As the dam rises, more than 1,200 miles of one-inch pipe are being embedded in the concrete for a cold-water cooling system to prevent cracking. This network of pipes at five-foot intervals will reduce the temperatures 50 to 90 degrees within five weeks, completing the cycle of expansion and contraction so that the contraction joints can be filled with grout to make the structure a solid monolith. Without such a system, the cooling would continue for perhaps a hundred years with shrinkage and cracking throughout that period.

No small item in the Shasta contract is the 30-mile relocation of the railroad and highway, involving eight major bridges and twelve tunnels. The Pit River bridge, extending 500 feet above the present river level, will be the tallest double-deck bridge ever built.

Second massive structure in the Central Valley Project is Friant Dam at the headwaters of the San Joaquin river, 400 miles to the south. This dam, 3,400 feet long, will be the fourth largest concrete structure ever built. Towering 320 feet, it will

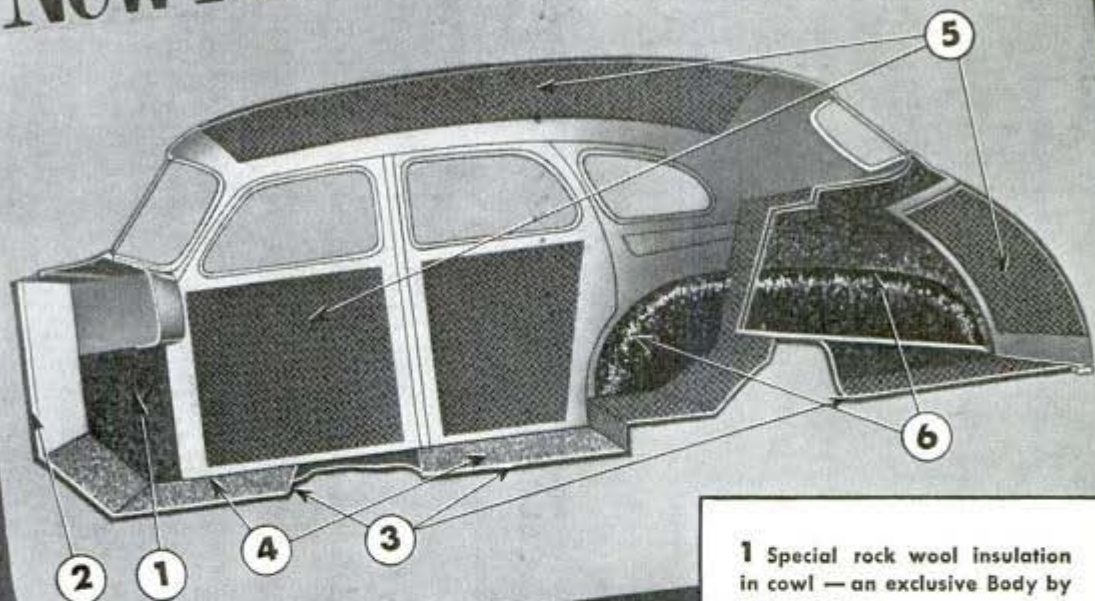
be the world's second tallest overflow-type dam, topped only by Shasta. Its 2,200,000 cubic yards of masonry will impound 520,000 acre-feet of water. Diverted by a cement-lined canal, a flow of 3,500 cubic feet per second will be carried by water bridges over the Kings, Kaweah and Tule rivers to empty into the dying Kern river 160 miles away. A second canal flowing in the opposite direction will cross the Fresno river to empty into the also dry Chowchilla river 40 miles away.

As at Shasta, a mechanized industrial army operates scores of wagon drills and jack hammers for blast drilling and grouting. Huge scrapers and 28-yard carryalls remove the excavated material. Instead of the cableways system for handling concrete, a virtual forest of derricks and big hammerhead and whirly cranes mark the skyline. Buckets of concrete, carried by Diesel trains along a 2,200-foot-long steel trestle, are picked up by the giant cranes and lowered into place.

Another unit in the Central Valley Project is the Contra Costa canal system, bringing fresh water from the mouth of the Sacramento to a dozen cities along San Francisco bay. Designed to save time in building this 38-mile waterway were ingenious trimming and lining machines mounted on steel frameworks spanning the canal prism. The trimmer machine had two chain bucket conveyors extending across the bottom of the canal and up the side slopes, trimming the dragline cut to exact dimensions. A lining machine, mounted on a similar V-frame, automatically surfaced the canal with concrete.

Final unit of the vast project is the canal system transferring surplus water from the regulated Sacramento river up the San Joaquin river to replace the original stream now diverted to the parched lands far to the south. Taking 3,000 second-feet of water from the delta region of the Sacramento, a series of pumping plants, operated by power from Shasta Dam, will lift the water 200 feet to a high line canal following along the old river bed uphill for a hundred miles. Dumped into the Mendota pool, the water will be allowed to flow back down the San Joaquin river bed to the delta whence it came, thus completing the greatest irrigation cycle in history.

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"BEST BUICK YET" is the popular way to describe this 1941 beauty. And one reason for that is its sleeker yet roomier new Body by Fisher—shown here on the Buick SUPER 4-door Sedan. It's a wider, longer body with rear doors hinged at the front for greater safety and may be had in two-tone body colors, if desired, at no extra cost.



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Roughing It the Easy Way

(Continued from page 677)

Aluminum cooking and tableware are very satisfactory but it's a mistake to use metal cups for hot drinks. Use crockery cups or some other ware that won't burn your lips. Some of the new table sets made of plastic material are light and ideal for camping. Square frying pans are good for cooking strips of bacon and are easy to pack. Some of the new lightweight ice chests carry a supply of Dry Ice and stay cold for more than a week, allowing you to bring fish or game home in excellent condition.

For overnight hikers there is a new pup tent of waterproof balloon cloth that has floor dimensions of five by seven feet and that weighs only three pounds. Folded up, you can almost conceal it in two hands. The tent closes with a zipper in front and has a screened window.

For hunters, a number of new guns of different calibers are on the market. One interesting development is the double-deck shotgun that has one barrel below the other instead of side by side, for ease in aiming. An outgrowth of this is a combination rifle and shotgun, one barrel under the other, that makes a lightweight weapon useful against many kinds of game. So far the gun is available only as a .22 and .410 combination although heavier calibers probably will soon be made. There have also been new developments in shells. One improvement is a soft-nosed bullet that mushrooms properly in spite of the high-powered charge behind it instead of shattering to pieces when it strikes the target. Shotgun shells that are crimped shut instead of being closed with a wad are on the market and these seem to make the shot spread in a more even and effective pattern.

There are all sorts of new gadgets for fishing, including lifelike lures and baits. Transparent Nylon leaders and lines are on the market and the leaders need not be soaked in water before using, although they must be tied with a double figure-8 knot to prevent slipping. Many fishermen are wearing Polaroid glasses to stop glare from water and enable them to see under the surface.

An entirely new type of fishing tackle that was developed in Europe is now being

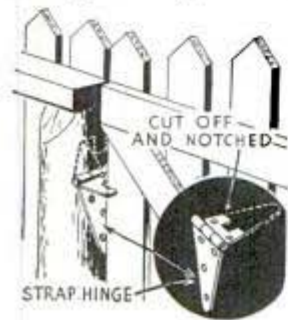
1887

tried out in this country for everything from trout to salmon. It's called thread line spinning. The spool of line in the reel is attached at right angles to the rod and the spool does not revolve. Line simply strips off the spool without any drag when a cast is made. You can cast with a flick of the wrist and without a back cast. Since the spool doesn't revolve there is no chance of a backlash. The line is retrieved by a crank similar to the ordinary reel. Another new development in reels is a conventional reel that is mounted at the butt of the rod instead of a few inches above it. The advantage is that loose line can't wrap itself around the butt when you are retrieving by hand.

Rubber boats that can be inflated with a bicycle pump are being carried by fishermen for working lakes that are difficult to reach. Some of the rubber boats are sturdy enough to mount an outboard engine on the stern. A new baffle plate that is attached behind the propeller of an outboard cuts down its speed for slow trolling if the motor won't throttle down enough. One of the latest innovations in small boats is a Dowmetal canoe that is a third lighter than aluminum. It has the advantages of lightness and strength, is nonsinkable, and doesn't deteriorate.

If you catch a lot of fish and you want to bring them home in good condition even without icing, clean them as soon as possible, wash and hang up to dry out. Don't put any more water on them. Pack them well in willow boughs or dry seed grass and roll them up during the day in a damp gunny sack. Lay them out each night to air and cool. If you wish to use ice, wrap the fish in oiled paper and be sure that no water can reach them when you pack ice around the bundle.

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Meet the Television "Hams"

(Continued from page 725)

plete pictures in the form of electrical impulses every second. Each picture is actually millions of tiny dots, each of which is transmitted separately.

The 120-line pictures transmitted by the iconoscope, while not of the same quality as the 441-line television images being broadcast in New York, are remarkably clear and sharp—being equivalent to newspaper half-tone reproduction. The new iconoscope transmits a television picture about one and one-half inches square which may be enlarged at the receiver. The receiver may show a picture having many times the iconoscope picture area.

Two-way television was demonstrated for the first time last summer at the New York World's Fair amateur radio station W2USA. An amateur-type television camera and receiving set, furnished by RCA, flashed pictures with voice between the Communications Building at the Fair and the New York Daily News building eight miles away. Successful reception was reported by other amateurs up to thirty miles. One feature was the two-way conversation carried on by two deaf-mute girls using their sign language over the picture channel.

In its research and development work, RCA collaborated with the American Radio Relay League, which has been seeking for several years to make it possible for the amateur radio enthusiasts to enter the television field. All the necessary equipment has been available for some time for amateurs, with the exception of the iconoscope.

The opening of the electronic television field to amateurs will serve to widen existing popular interest in the new art, and at the same time accelerate progress in television development. The radio industry today points to a number of important steps pioneered by American amateurs, including the development of new circuits. Radio amateurs were among the first to demonstrate the enormous possibilities of short waves—a region which at the time was not highly regarded for radio purposes.

☐ See index, page 4-A, to find where to buy articles described in this magazine. Say you saw it in Popular Mechanics.

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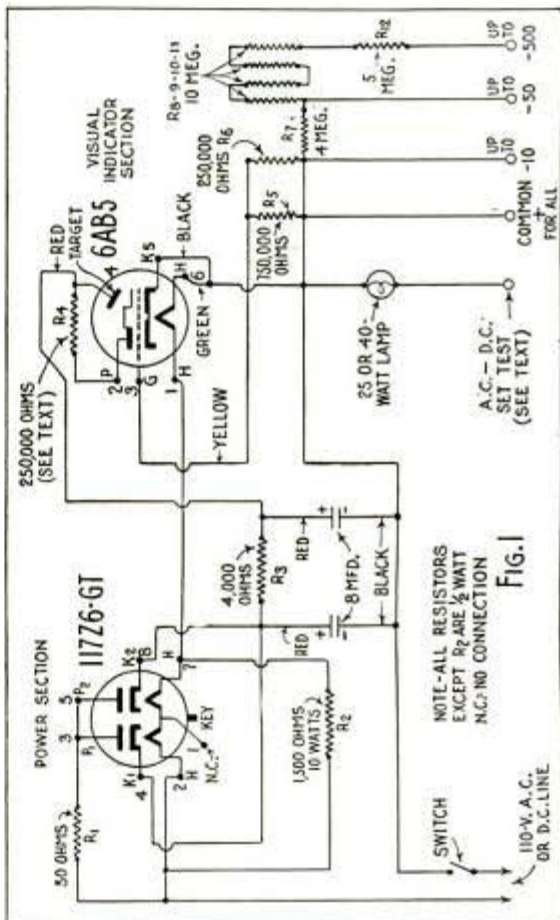
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Tuning-Eye Set Tester

(Continued from page 775)

voltage doubler. Other parts include an Edison base socket, 40-watt 110-volt lamp and a dual section electrolytic tubular type 8-8-mfd., 250-volt condenser which is mounted on top of the magic-eye assembly bracket by means of a strap clamp. All fixed resistor and condenser values are given clearly in diagram Fig. 1. The only accessory is a pair of test leads.



In case you are servicing sets of the a.c.-d.c. type make this test first: Connect one lead to the a.c.-d.c. "test" clip and touch this lead to the chassis of the set to be tested. If the bulb of the tester lights, you must reverse the connecting power plug of the test unit. Now the bulb will no longer light and the real testing of the set may begin. The same test procedure will apply to all sets except when the set is an a.c. type using a power transformer; in this case no preliminary test is required.

The unit is essentially a very sensitive

(Continued to page 136A)

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PM-5

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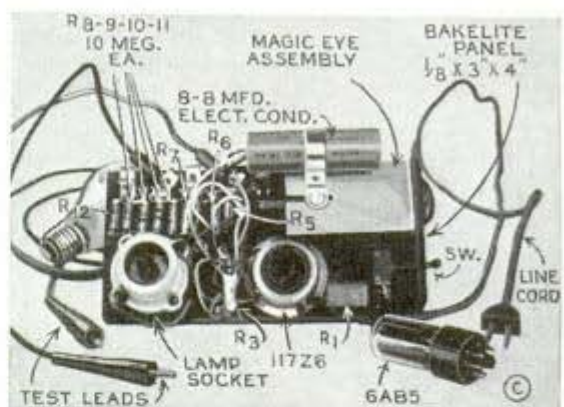
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Speed work. Save money. Steel-Grip Welders' Gloves have entire back cut in one piece from our special tanned, heat resisting, shrink-proof leather. No seams in back. No burning through seams, no ripped seams. Wool breaker sewed inside insulates hands from heat. Finger seams welded at points of greatest wear. Wide strap reinforcement at thumb seams. Try a pair. Built to outlast several pairs of ordinary gloves. It costs less to have the best. Order now. Ask your dealer or order direct. Order No. 13475. Only \$1.55 a pair. 10% discount on dozen pair orders.

INDUSTRIAL GLOVES COMPANY 733 Garfield Blvd. Danville, Ill.

(Continued from page 134A)

voltmeter and for radio service work should be used as such. Usually the common terminal is used in conjunction with another terminal which provides the correct scale shadow movement. Unlike meter-type testers, an over voltage will simply remove the shadow completely, but



will not damage the equipment. The negative terminal used is connected to the chassis of the set (which is usually negative) and the lead connected to the common positive terminal is used to make the various tests. Only d.c. tests can be made, however, if you touch a source of a.c. voltage, no damage will result.

When the dark shadow forms an angle of 90 degrees, or a right angle, the voltage is zero. When the shadow vanishes, the voltage being tested is maximum of the scale being used, that is, either 10, 50, or 500 volts. Other voltages can be approximated by knowing what scale you are using and watching the shadow angle.

Hi-Fidelity Record Player

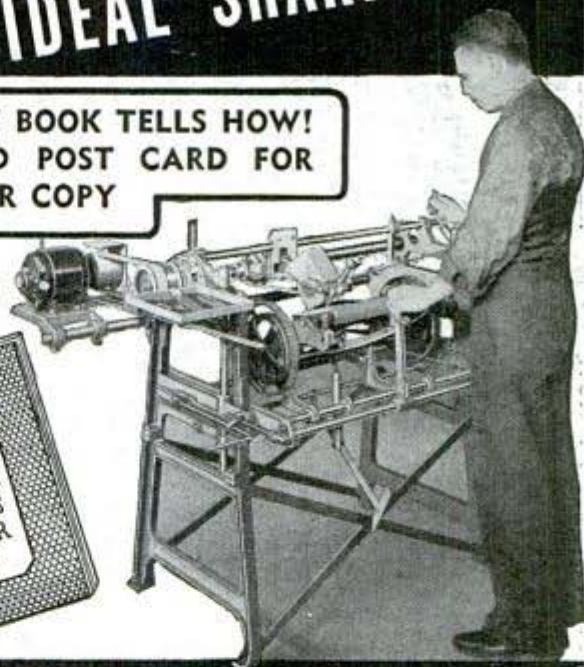
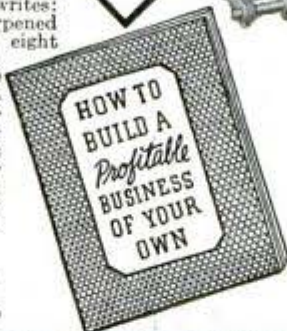
(Continued from page 777)

paper so that path of needle travels through center of turntable spindle as illustrated in photo (A). Photo (E) shows the completed unit. If your radio receiver is not equipped with phono pickup jacks, you can use one of the standard phono adapter units of the type shown in photo (F) and the accompanying sketch. This plugs into the second detector tube socket in your set. The blueprint number for this article is R-290; no additional detailed material list is supplied as only a few parts are required and these are clearly specified. R-239 is suggested as a separate audio amplifier for ordinary purposes.

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The Ideal Lawnmower Sharpener offers you an opportunity to make MORE money in your spare time. Yes, it will even build up a permanent business for you. Every home is a prospect for business, year after year. The Ideal Lawnmower Sharpener is a machine that grinds all makes of lawnmowers in 15 to 20 minutes. The usual charge, \$1.00 to \$1.50 per mower. Easy and simple to operate. Just plug into a light socket in your basement or garage, and you're on the road to success. When lawnmowers are sharpened on the Ideal, they run like new. Every customer is satisfied. G. A. Blanchard, Mass., writes, "I sharpened 300 mowers in two months." Walter Roth, Mich., writes: "I bought my Ideal in May 1939 and sharpened 867 mowers that year, and 893 mowers in eight months of 1940." Howard Hellen, Minn., writes: "I sharpened 745 lawnmowers, sold 60 used mowers and grossed \$1,100.00 from Apr. 5 to Sept. 15." The Ideal Lawnmower Sharpener is heavily constructed and will last for many years. It is designed to sharpen all reel knives and straight blades accurately. Write today for the book that tells you HOW you can earn MORE money and establish a PERMANENT business with the Ideal Lawnmower Sharpener.

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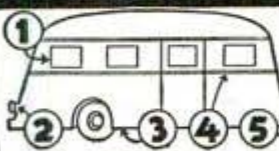
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MOWER ATTACHMENTS for all SHAW models are available . . . either cutter Bar for hay, weeds or tall grasses, or Cylinder type for lawns, estates, golf courses, cemeteries, etc.

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with this New
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ARC WELDING"**

**LIBERAL TRIAL
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Easy "Pays for itself" terms**

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"Simplified" operation of Hobart Arc Welders enables you to weld faster, with the right current for every job. 1,000 combinations of welding heat give the exact voltage and amperage for all kinds of work. It's as easy to get on the right station on your radio!

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With a liberal trial on your own work, at our risk, you prove to yourself that extra earnings and savings make it easy for you to own your Hobart with almost no actual cash outlay. Easy, monthly installments let you pay for it from extra profits!

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You can build your own portable gas drive welder by coupling a Hobart generator to a used auto engine and chassis. This portable unit lets you operate any place, especially on the profitable outside jobs. Mail coupon for details.

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In a Few Days At Home

Make big money on each 20 lb. Mead Ki-Yak you easily assemble at home from complete cut-to-fit kit at amazing Low Factory Price! Portable, seaworthy, Fast 3 Ki-Yak sizes for paddling or sailing — 2 OUTBOARD KI-YAK models for rowing, sailing, motor (up to 9 h. p.) Patented metal-ribbed construction guarantees successful, quick, beautiful job. Write for FREE, lavishly-illustrated Circulars, Low Prices.

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Ask today for your set of 8 complete plans. Easy and inexpensive to follow. Fun for the whole family to build and use. Enclose 10¢ for handling.

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BUILD THESE PROJECTS

For garden or lawn. Easy to build. Easy to sell. Detailed blueprints Model B-25 Dutch Windmill 50¢; Model OSM-60 Old Mill, 55¢. Lawn Figure Patterns—Sunbonnet Girl, Dutch Boy, Tulip Girl, Holland Pair, 35¢ each, all 4—\$1.00. Catalog illustrating many models, send 10¢ today.

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Always write your name and full address clearly when answering advertisements.

Blizzards Made to Order

(Continued from page 698)

for a movie set it was necessary to build a drift deep enough to bury a horse. This was done in less than an hour.

Perhaps the most difficult job ever tackled by the Snow Men was the covering of a ski slide in the Los Angeles Coliseum. The slide was 600 feet long, 200 feet high, and ran from the top of the great concrete bowl. Moreover, the day on which the snowing was to be done dawned with sweltering heat.

All day six snow guns roared. Scrapers carried the snow from the lower portions of the slide to the higher levels. Everything was going fine—until it was discovered that the scrapers could not reach the top of the slide. And without snow at the beginning of the "take off," the slide would be worthless. There was a huddle. There were suggestions. None of them worked. Then three Snow Men appeared, lugging behind them 200 feet of tin pipe. This they lashed to the framework of the slide. The top end of the pipe was placed on the snowless spot at the beginning of the take off. The lower end of the pipe rested at the highest spot to which a snow gun could be brought.

The hose from the snow gun was inserted in the lower end of the pipe, and the gun started. Channelized by the pipe, the snow gained sufficient pressure to carry the 200 feet to the beginning of the take off. Half an hour later the job was done. And an hour later, a rain squall started. In another hour the snow was gone and the ski exhibition had to be postponed.

The following week the Snow Men tried again and this time the slide was snowed under perfectly. Two hundred and fifty tons of snow were used.

Although the Snow Men often create a storm on an ordinary movie set, the majority of extensive snow scenes are shot in the "ice box." This is a giant, insulated sound stage maintained by the California Consumers Corporation. It is so large that three ordinary five-room houses could be placed in it.

This stage is surrounded by refrigeration pipes, which will lower the temperature of the entire stage to nine degrees above zero. Three large ice bunkers con-

(Continued to page 141A)



AN IDEA THAT MODERNIZED TODAY'S PRODUCTION METHODS

"WHAT machine tools does industry need?"—asked Atlas engineers a few years ago.

THEN they made an important discovery. They found that industry had many excellent machine tools. But in plant after plant, studies showed that larger machines, *often costing thousands of dollars*, were operated much of the time *on small parts*.

THERE was an opportunity—a need for smaller, *inexpensive, precision tools* to bring sensible efficiency in machining small parts.

ATLAS 10" Lathes were followed by Drill Presses, then the sensational 7" Shaper, 6" Lathes, and Multiple Drilling Machines. Today these Atlas Tools are modernizing production methods in many plants—playing an important part in the nation's defense program.



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Lathes • Drill Presses
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FLUORESCENT LIGHTS!!
 Shop lights \$1.95 up!
 Sells for \$4.95 up!
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 Big 48" Store Lights \$5.50 up!
 Sells for \$12.95 up!
 General Electric equipped too!!

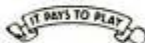
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- Has shockproof bakelite case
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Here's guaranteed quality! The handiest tool in the shop or home. Use it daily for model making, repairing, carving wood or plastics, etching glass or metal, touching up discs, sharpening, routing, sanding, drilling, and on a hundred other jobs. Higher speed does better work and saves cutters. **Model One**, wt. 6 oz., with chuck and 1/8" collet, only \$2.85. **Model Two**, wt. 13 oz., \$16.50. **10 DAY TRIAL—Money-Back Guarantee.** If your dealer does not have Moto-Tools, order direct... we pay postage if you send cash. Or, send only \$1. pay postman balance plus postage. Catalog of Tools, Special offers, **FREE.**

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Modern Craftsman's Kits
 KIT NO. 1 with 23 high grade accessories and Model 1 Moto-Tool in hard—\$17.50 wood rasp...
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This MACHINE WILL DO YOUR SANDING FASTER & BETTER



Don't waste your time with tedious hand sanding or with a tool less versatile than this Duro Six Inch Belt Sander.

Use it for sanding long or short pieces over the table; curved surfaces over the rubber covered drums; irregular surfaces on the unsupported side of the belt; inside corners on the supported side of the belt. Use the tilting table and the mitre gauge for compound angles.

Adjustments are easy and practical. Sander can be used in horizontal or vertical positions.

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DURO Belt Sander



OUT TRIMS 8 MEN JARI POWER SCYTHE

Cuts all grass, weeds, brush where other mowers won't. Write for details and prices. Jari Products, Inc., 2938 Pillsbury Avenue, Department E, Minneapolis, Minnesota.



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(Continued from page 139A)

cealed in the walls are capable of dumping hundreds of tons of snow onto the stage. This snow is used to supplement that thrown by the guns. The bunkers are also used to create snow slides for both miniature and full sized sets.

Speaking of miniatures, one of the scenes filmed with the aid of the Snow Men utilized a huge miniature in which icebergs twenty feet high broke away from a glacier. The bergs were built up by repeated blasts from the snow guns. During the filming, the bergs were dynamited loose and fell into a vast tank of water. Each of the bergs weighed four tons. The scene appeared in the Paramount picture, "Spawn of the North."

During the filming of "Lost Horizon" the cooling plant worked day and night for a month. A full-scale transport plane was placed in the icebox and gradually covered with snow. The windows of the plane were swabbed with ice water, which quickly formed frost crystals. As the surface of the snow had to be kept virgin, there was a standing rule that anybody who thoughtlessly walked on the fresh surface would be ducked in a pail of ice water. One set of misplaced footprints necessitated a complete re-surfacing of the drifted snow.

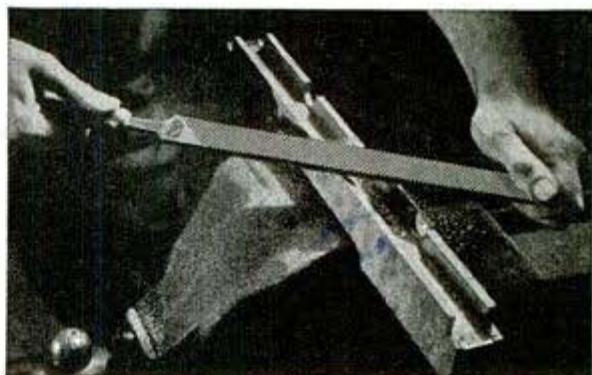
Ice making is a highly specialized job. An icicle is made by pouring water into a mold. The mold is then frozen, the icicle removed and stored in a refrigerator. In storage, icicles are suspended in long lines by means of wires frozen into their bases. When a director needs an icicle, all he needs to do is to specify size and shape and one is brought from the refrigerator. It is then frozen in place.

Combating heat from the lights is one of the major problems of the Snow Men. When a scene is being filmed in color hundreds of thousands of watts are used. The heat generated is terrific. If a careless electrician leaves a spotlight pointed at a snow bank, it takes but a short time for the concentrated light from the spot to burn a hole in the snow.

There are now 1,226 separate passenger-train runs daily on the railroads of the United States and Canada where an average speed of 60 miles per hour or higher is maintained, compared with 997 such runs one year ago and only 579 in 1936.

no data

MAY, 1941



SEE THOSE CHIPS!

"Get it going and get it done!" is the order of the day on national defense production in thousands of foundries and machine-shops. Here's a file that can "step along" under that sort of command! . . . It's the special-purpose Nicholson or Black Diamond Shear Tooth—a long-angle single-cut file that combines fast metal-removing speed with excellent finishing qualities.

The mechanic who masters the proper filing stroke of this distinctive file can certainly "make the chips fly"—thus becoming more valuable to his employer *and to himself!* The Shear Tooth file is particularly efficient on aluminum, copper, brass and similar soft metals—and even on plastics, hard rubber and wood. Tough enough, too, for cast iron and steel. Obtainable from mill-supply houses and through good hardware dealers.

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(2 files in one) is being specially featured by hardware dealers during NATIONAL HARDWARE OPEN HOUSE—May 1 through May 10. Double-cut on one side; single-cut on other—for smoothing and edged-tool sharpening. For householders, farmers, mechanics.



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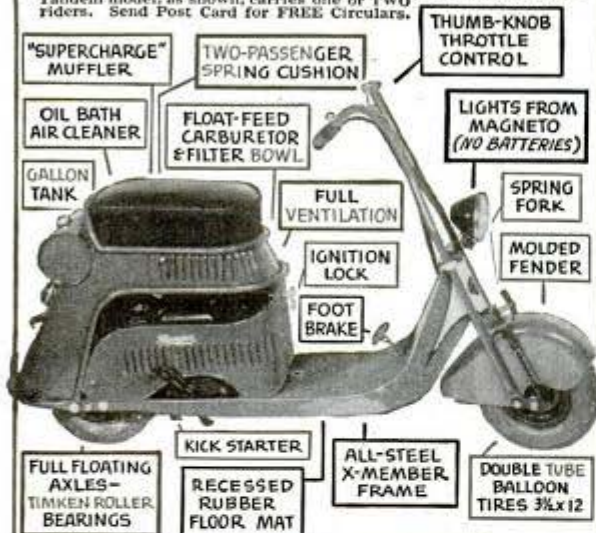
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These new 1941 models are selling like hot-cakes—but order your Demonstrator while territory is still open! Make big money selling to stores needing quick, cheap delivery—sell to messengers, mechanics, garages, canvassers, friends—or rent for easy hourly profits at beaches, resorts, etc. World's CHEAPEST transportation! Or FUN for you—cross U. S. on 50 gas!

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Go 30 m.p.h.—get 120 miles per gallon. Easy terms now available in most states permit you to actually pay as you ride! Write us quickly for full FREE CIRCULARS, new LOW prices, Easy Terms. Our complete RANGER SCOOTER LINE of 8 new models gives you the most for your money. Write now for details!

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Mead Cycle Company has been selling fine wheel goods to Americans for over 51 years! We are specialists in this business—and it pays to deal direct with headquarters. Write today for complete details, prices on RANGER SCOOTERS. Hurry!



CYCLE CO.
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Ranger Bicycles
for 51 Years!

DEPT. W-1, CHICAGO, U. S. A.

America Stores Up for Defense

(Continued from page 643)

under way to produce enough to meet one-sixth of our annual needs; and a substitute for silk—nylon—is being manufactured but not in quantities sufficiently large to supplant the imported material immediately. In an emergency it might be possible to step up our production of tungsten to a level close to requirements—at least for a limited time. Fifty per cent of the tungsten necessary for peacetime has been produced from domestic mines during the last five years. In the high speed tool steel field where tungsten has been used as an alloy, molybdenum has been found a satisfactory substitute. Domestic output of mercury, which normally supplies about 40 per cent of our consumption, has been increased sufficiently to take care of all our needs and allow some export to England.

With the possible exception of tin, the outlook for supplies of the nine strategic minerals for at least a year, and in most instances two years, is good, due to the foresight of industry in building up large stock piles and to the government's policy of laying in vast reserves. A subsidiary of the Reconstruction Finance Corporation, the Metals Reserve Company, is financing imports of reserve stocks of tin, 75,000 tons within one year, manganese ore, 1,000,000 tons within three years, chromium, tungsten and antimony. Purchases for 1941 and 1942 probably will be double those for 1940, which were higher than usual for most of the five minerals. Total imports of tin increased notably during 1940, exceeding 1939 receipts by a large margin.

Arrivals of crude rubber reached a record level during the third quarter of 1940 and the year's receipts were about 50 per cent above those for 1939. By the end of this year, provided there is no interruption of shipping, government-held stocks are expected to total 416,000 tons, over and above current requirements. At the same time private stocks are expected to increase to a point where this country will have more than a year's supply, roughly 600,000 tons. This does not include an anticipated production of 200,000 tons of reclaimed rubber and an increasing quantity of synthetic rubber.

Of the 28 items removed from the Har-

(Continued on page 144A)

Whiz to and From California on **EL CAPITAN**



**The Only All-Chair-Car De Luxe Streamliner
Between Chicago and California**

EL CAPITAN glides between Chicago and Los Angeles as swiftly as the fastest all-Pullman streamliner (in only 39¼ hours!) . . . and saves you days and dollars!

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The one way fare on El Capitan between Chicago and California is only \$39.50, plus \$5 extra fare; round trip, only \$65, plus \$10 extra fare . . . and you may include Los Angeles, San Diego, and San Francisco in your trip via Santa Fe at no extra ticket cost!
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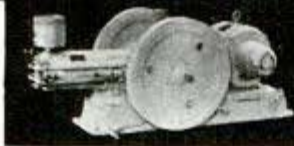


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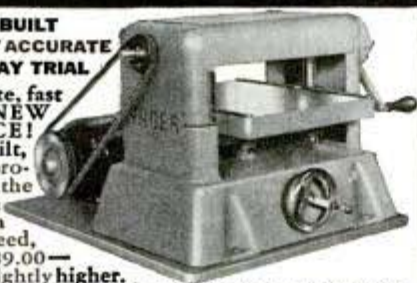
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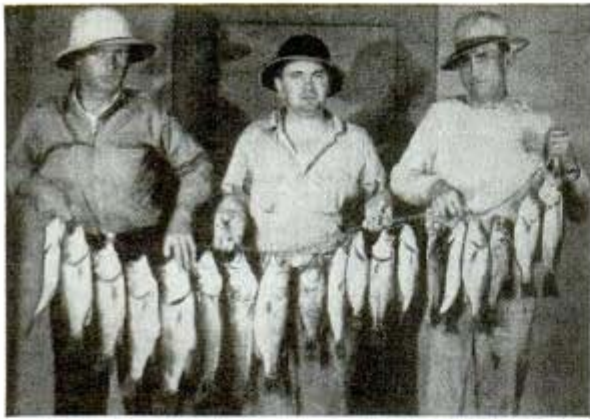
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(Continued from page 142A)

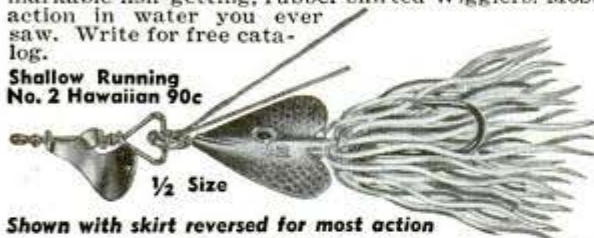


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bord strategic list, chemistry has made it possible for us to produce about 25 per cent of them from domestic raw materials and developments in metallurgy and other sciences are responsible for our self-sufficiency in others. Among those which, thanks to the chemist and metallurgist, are no longer regarded as strategic are: camphor, nitrates, iodine, optical glass phosphorus, potash and vanadium. Others taken from the list through development of replacement materials, discovery of adequate domestic sources of supply, or for other reasons such as building up large reserves of imports include: arsenic, asphalt, balsa wood, coffee, cork, graphite, hemp, hides, jute, kapok, linseed oil, opium, palm oil, platinum, sugar, sulphur, shellac and uranium. Coconut-shell char and quinine may be removed soon from the list of today.

Optical glass, so essential to defense because it is used in field glasses, cameras, fire-control and range-finding instruments, microscopes and lenses with which any modern army and navy must be equipped, now is listed as a "critical" material—equally essential as strategic materials and which may offer some difficulty in obtaining an adequate supply, but does not present as great a problem as the strategic materials. The World War found the United States entirely dependent upon foreign sources for this glass so a study was inaugurated at the Bausch and Lomb plant in 1917. This effort resulted in producing a few essential types of optical glass and in expanding facilities. By August, 1918, five plants were turning out enough to meet all military and naval needs. Since then many new types have been developed and now the United States is considered independent of outside sources for its peacetime supplies. However, reserve stocks have been acquired from abroad to meet all requirements of an emergency until domestic production could be stepped up to satisfy all demands.

Similarly this nation has been freed of dependence upon outside supplies of sulphur, so widely used by the petroleum, iron and steel, fertilizer, pulp and paper, rubber, dyes, coal-tar products and chemical industries. This has been achieved by development of vast domestic resources such as the Freeport Sulphur Company's

Grande Ecaille mine in the Louisiana marshlands near the Gulf of Mexico. Here sulphur is mined by forcing superheated water down pipes to the sulphur-bearing formations. The sulphur melts and is pumped to the surface. Better than 99½ per cent pure, it is then pumped to huge storage vats where it cools and solidifies, later to be broken up and shipped. In 1912 Freeport produced 636 tons; today the company's annual output exceeds 750,000 tons a year.

Manganese, one of the nine minerals of which we have insufficient supply for peacetime needs, is the starch that goes into the laundering of steel. This country uses about 1,000,000 tons per year, about 14 pounds going into every ton of steel. Without it, modern steel rails soon would crumble or spread under the impact and weight of big locomotives. Since manganese is vitally necessary for special purpose steels, such as those found in large army and navy guns, it is highly essential to national defense. A different grade is employed in making dry batteries. Our present stocks would be sufficient for nearly two years at the current rate of consumption.

Cuba has been supplying part of the manganese ore purchased recently by this country. Although the island's ores are low-grade, special concentration treatments result in a product suitable for making steel. This activity is carried on by the Cuban-American Manganese Corporation which was awarded a contract to supply the U. S. government with the first 25,000 tons of the mineral purchased under legislation authorizing the piling up of strategic material reserves for national defense. In an emergency the Cuban process might be applied to low-grade manganese deposits in this country.

Chromium, too, is highly essential in the manufacture of alloy steels, as well as in the tanning of leather, the making of pigments and in electroplating. Our imports are chiefly from southern Africa, the Philippines, New Caledonia, Cuba and Turkey. Domestic resources of metallurgical grade ore are virtually nonexistent and reserves of lower grade material are extremely limited. In Canada processes are being developed and tried to make ferrochrome, which contains 65 to 72 per cent chromium, from lower grade ores but these are not yet

(Continued to page 146A)

MORE ENJOYMENT with this **THREE-WAY** AUTOMATIC .22 RIFLE



This .22 rifle has everything! Instant adjustment of the cross-bolt enables you to use it as (1) automatic, (2) bolt action repeater, (3) single loader. As automatic, it shoots all .22 Long Rifle and .22 Long Cartridges; also High Speed .22 Shorts. Operated by hand, it shoots all of the above, plus Regular .22 Shorts. You'll enjoy every feature of it: Barrel of traditional Savage accuracy. Action simple, positive, easily dismantled without tools. Stock of handsome American walnut, man's size, well proportioned for excellent balance and steady holding qualities.



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(Continued from page 145A)

commercially successful. If they should be they will contribute to making the United States self-sustaining.

Tin presents one of our serious strategic mineral problems because it is indispensable for so many uses and there is very little production in this country. The metal serves as the protective coating on steel from which our tin cans are made and is employed in making bearings, solders, bronzes and gun metal. Under normal conditions, this nation's consumption is 75,000 long tons per year, or about 45 per cent of the world output. In order to reduce our consumption and thus become more self-sufficient, synthetic resin enamels have been tried as coatings for certain types of cans and chemically treated cardboard containers have been produced for various products. In addition, work has been done looking toward the use of silver and aluminum as substitutes for the coating of tin cans. Tinless alloys for machine bearings also have been used to some extent. The world's principal producers of tin ore are the Malay States, Dutch East Indies, Bolivia, Siam and China. Bolivian ore has had to be sent to Europe for refining because there are no important smelting facilities in the western hemisphere. However, in connection with an agreement with Bolivian tin producers and their government, plans are being made to provide smelting facilities in the United States.

For military purposes, antimony combined with lead is used to make bullets, both for small arms and as shrapnel. It is also employed in the manufacture of storage battery plates. Mexico is one of our principal sources of the metal and a smelter established at Laredo, Tex., treats Mexican ores and sells the product in the United States. During the past 10 years, roughly 10 per cent of our requirements have been met by domestic production.

Quartz crystal, particularly of the grade employed to control the frequency of radio transmitters, comes to us from Brazil, since we have none of a quality suitable for that purpose. Even the Brazilian product is far from ideal, only about seven tons out of 250, the approximate annual output, being suitable for radio equipment. Cutting crystals for this purpose requires great accuracy with reference to thickness and

(Continued to page 149A)

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Without previous welding experience you can make for yourself as much as \$5.00 on a repair job that can be done in less than one hour. Many welders make as much as \$15.00 to \$20.00 a day. The Dynamic Welder is light and easily portable.

AGENTS WANTED!
 Get our big profit plan and 10-day trial offer. Send for it TODAY.

Wagemaker's WOLVERINE BOATS

BOATS FOR EVERY PURPOSE

50 Models—canvas or all wood. Sailboats, Outboards, Rowboats, Small Inboards and sensationally new Weldwood Skiffs. Priced from \$40.00 up. Write for catalog.

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 Dept. X Grand Rapids, Michigan



ATTENTION Toolmakers, Modelmakers, Machinists

Now you can bore accurately those real small holes with Simplex (the smallest boring tool on the market). Make your own boring bars in lathe to fit Simplex holder. Harden with blow torch or gas plate. Small bars for the delicate jobs—large bars for the ordinary work. Price, complete with one small boring tool bit, \$2.25, postpaid in U.S.A. See page 512 April issue Popular Mechanics. Send for circular.

SIMPLEX TOOL WORKS, OTTAWA, ILLINOIS

CIRCULAR SAW \$3 POST PAID

(Outside U.S. or C.O.D. \$5.25)



FREE CATALOG Illustrating complete power tool line: Jig Saw, \$1.50; Jointer, \$6.50; Shaper with oilless bearings, \$3; Drill Press, \$2.50; completely equipped Lathes, \$2 and \$4.90; Sander, \$1; etc. Sold direct only. Order today or send card for Catalog.

J & H Metal Products Co. 5 Commercial St. Rochester, N. Y.

110-VOLT AC LIGHT PLANTS

& generators furnish AC same as city current. Ideal for stand-by. Will keep oil burners, stokers, refrigerators, etc. going when power line goes off. Also converters, frequency changers, Diesels, DC motors with AC take-off. Sizes 80 to 10,000 watts. Write to

KATOLIGHT, 16 Elm St., Mankato, Minn., U.S.A.



Standard GARDEN AND SMALL FARM Tractors

Powerful 1 and 2 Cylinder Tractors for Small Farms, Gardeners, Florists, Nurseries, Fruit and Poultrymen.
FOUR MODELS
 Ample Power for Field, Haying and Truck Crop Tools. Run Pumps, Saws and Belt Machines.

Steel or Rubber Tires
 High Wheels—Enclosed Gears
LOW PRICES
 Write for Easy Terms Plan and **Free Catalog**

STANDARD ENGINE CO.
 Minneapolis, Minn. New York, N.Y. Philadelphia, Pa.
 3221 Como Ave. 617 West 26 St. 2546 Market St.



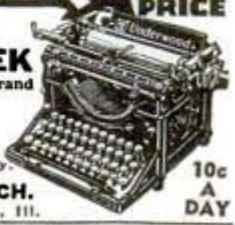
USE YOUR BENCH SAW

With Our six in. tool steel cutters. Make mouldings, casings, drop-leaf tables, grooves heading & jointing 1" wide \$1.25, 1 1/2" \$1.50, Postpaid. State size hole, List & folder free.

J. A. Sandstrom Co., D.4., Jamestown, N.Y.

TYPewriter 1/3 PRICE

STANDARD OFFICE MODELS 1/3 MFRS. ORIG. PRICE
Easiest Terms 60¢ A WEEK
 as low as
 All late models completely rebuilt like brand new. FULLY GUARANTEED.
No Money Down - 10 Day Trial
 Free price-smashing catalog shows all makes in colors. **FREE COURSE IN TYPING INCLUDED.** See catalog before you buy.
SEND NOW.
INTERNATIONAL TYPEWRITER EXCH.
 Dept. 501, 231 W. Monroe St., Chicago, Ill.



BUILD YOUR GRANDFATHER CLOCK
 Send 25c for Simple SHOP TESTED COPYRIGHTED BLUEPRINT. The Simple Sensible Red-Kut way as thousands have. **DIME** brings PLANS and sixty picture "HOW" Book pricing many fine brass weight Westminster, tube chime, electric and battery movements showing also beautiful colonial grandfather cases. **Build now and save half.**
KUEMPEL CHIME CLOCK CO., Bldg. 52, Guttenberg, Iowa.

ARSENAL OF FRICTION KILLERS



DIXON'S GRAPH-AIR GUNS stop squeaks, remove rattles, ease binding. Squeeze them and shoot. Only Dixon's Guns are filled with world's best Dixon's Microfyne Powdered Graphite - the quick-acting pow-

dered lubricant that cannot burn, wash out, drip or gum. Nothing better for endless uses in work, in car, in home, in sports. Most dealers sell them, or write for booklet CG 26.

JOSEPH DIXON CRUCIBLE CO. · JERSEY CITY, N. J.

L256

(Continued from page 146A)

also in the direction of the various axes of the crystal. The average size of the finished radio crystal is about one by one by one-tenth inch. Tourmaline, a mineral found in California, might be a possible substitute in an emergency, since it possesses desirable properties of this type.

Nickel, a silvery-white metal, finds usage in armor plate, armor-piercing projectiles, gun barrels, recoil cylinders. An alloying ingredient in steel to give increased hardness, toughness and strength, nickel is produced in only small quantities in the United States, most of our supply coming from Canada. Our annual requirements in the near future may be assumed at 45,000 to 50,000 tons under normal conditions.

On all these, and sheet mica, too, which is used as armature winding tape, commutator segments, rings, cones and transformers, Uncle Sam is stocking up, looking to the day not far away when this nation will have a two-year supply of things necessary to defense which cannot be produced at home. Given that much leeway in an emergency, there is a good chance that the Bureau of Mines, the Geological Survey and other governmental agencies, working together with private research experts and industrial management, will be able to develop our own sources of supplies or substitutes that will make us self-sufficient as long as may be necessary.

L63

Averting Death From the Skies

(Continued from page 651)

Another school producing ideas for bomb shelters is the Newark College of Engineering, where Professor Odd Albert has designed what he calls the "Bompus-Rumpus Room" because it is a place where "bombs won't raise a rumpus." He suggests that every new home be equipped with such underground rooms. The cellar could be utilized to the full area covered by the building. The ceiling of the shelter could be reinforced concrete, 12 inches thick, with beams of the same material, 12 inches wide and 24 inches deep. This bomb-proof cellar might be divided into three parts, one for living, one for sleeping, the third as the utility room.

Such construction would be fireproof. It would carry a load of over 1,000 pounds

(Continued to page 151A)

Here you are!
The sportiest 22
rifles ever built by
Marlin



Illustrated—
Marlin's Model 101—22 cal. self-cocking, single shot rifle. Features NEW military type one-piece buttstock, with fluted comb and semi-beaver tail forearm. Best looking low price rifle ever built and only **\$6.25**

Send 6c for handsome new catalog to →

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BIG NEWS FOR THE NEWCOMER IN AMATEUR RADIO!



Build your own CW Rig. The Thordarson Beginners' Transmitter provides maximum power output using only one 6L6-G tube. "Straight through" on all 5 amateur bands from 160 to 10 meters. FULLY DESCRIBED ON PAGE 618 OF THE APRIL ISSUE OF POPULAR MECHANICS. Price \$13.50 (less accessories) for complete kit including large circuit diagram. Write today for full particulars.

THORDARSON ELEC. MFG. CO.
502 W. Huron Street, Chicago, Ill.

Go Where The Big Ones Are Striking!



CAMP ON THE TRAIL WITH Ta-pat-co SLEEPING BAG

FREE

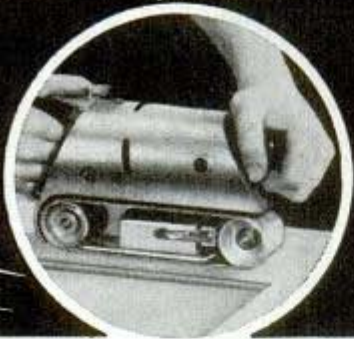
Outdoors With Ta-Pat-Co... Colorful, illustrated camp tricks—trail secrets—that add fun, pleasure and comfort to your outdoor trips. Includes styles, prices of Ta-Pat-Co Sleeping Bags.

Write for Your Copy Today!

AMERICAN PAD & TEXTILE CO. Dept. A-1 GREENFIELD OHIO

SANDS 10 TIMES FASTER!

*Do Better Sanding
this Easy way!*



New Guild Sander

Now get finer, easier sanding 10 times faster with this sturdy portable power sander. Turns out expert work in minutes—instead of hours of hand-sanding drudgery!

Powerful motor PLUS high-speed abrasive belt assures uniform finish on flat surfaces—handier around curves—leaves no swirls—no cross-grain scratches. Sands, planes, polishes. Works on wood, metal, stone, plastics, compositions.

Sells at popular price—weighs only 9 lbs. Completely guaranteed. Try it at your hardware dealer's. WRITE us for full details.

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AMAZING TRIAL OFFER
DRAW-O-MATIC

Automatic Sliding Parallel Bar
DRAWING BOARD



Draw with Ease—Accuracy—Speed
Endorsed by leading authorities and used by thousands, DRAW-O-MATIC is fast replacing the old fashioned "T" Square and costly mechanical boards. DRAW-O-MATIC is a quality, portable board with new, practical features. The patented self-aligning steel bar with celluloid edge, slides easily up and down—stays where put—cannot warp—always remaining square with board, assuring precision work with free use of both hands. Order one today on 5 DAYS TRIAL! See it! Try it! At our risk!

- Models
- C12x17—\$3.95
 - C16x21—\$4.95
 - C20x25—\$5.95
- Other models \$1.95 to \$19.95
Slightly higher in foreign countries. Write for circular.



FREE PROTRACTOR or MULTI-USE GAUGE

Your choice of these \$1.00 stainless steel precision tools given free with order for DRAW-O-MATIC. Offer limited! Send check or money order. Postage or Express Collect. State also wanted. Satisfaction GUARANTEED or money refunded on return of goods. Order NOW! Don't Delay!

ROLLIN INSTRUMENT CO., Inc. 216 N. Clinton St. Dept. PM-5 Chicago, Ill.

LOG SAWS

Make Money—Wood now in big demand—start a sawing business. Turn timber into cash. Low factory prices—Easy Terms. Write for Log Saw and Engine Catalogs.



WITTE ENGINE WORKS 4745 OAKLAND AVE. KANSAS CITY, MO.

In answering an advertisement with a coupon, be sure to write name and complete address clearly.

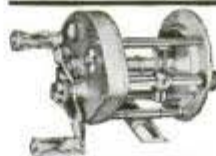
WORLD'S LOWEST PRICED ADDING MACHINE BEST POCKET SIZE FREE TRIAL

IDEAL FOR BUSINESS OR PERSONAL USE. GUARANTEED ACCURATE. Not a toy. Operates with only a finger flick. Adds, subtracts, multiplies, divides. Counts up to ten million. Pays for itself over and over. Ideal Gift—for Business, Income Tax and School use. MONEY BACK GUARANTEE. Send name and address. Pay postman only \$2.50 plus postage. (Send full cash if outside U.S.) Money back in 10 days if not delighted. AGENTS WRITE.

ONLY \$2.50 TOTAL COST \$2.50 NO MONEY

ADDITION SUBTRACTION MULTIPLICATION DIVISION

CALCULATOR MACHINE CO. (INC.) DEPT. 117, P.O. BOX 1118, CHICAGO, ILL.



Pflueger SUPREME
Price \$25.00



New Pflueger SKILKAST
Level Wind with Mechanical Thumbar
No. 1963 \$7.00



Pflueger AKRON
No. 1899—60 Yard \$6.00
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—Light Spool . . . \$6.50



Send for
PFLUEGER POCKET CATALOG NO. 161

Every fisherman should have this book. Gives facts about game fish—feeding habits—food value, and tackle for taking. Also a catalog of

PFLUEGER FISHING TACKLE

(Pronounced "FLEW-GER")
Reels, Balts, Hooks, Lines, Rods, Leaders, Spinners, Flies—everything in tackle for fresh or salt water fishing. Sold by dealers everywhere. Catalogues FREE.

THE ENTERPRISE MFG. CO.
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Ask Bass for His New CINE BARGAINGRAM

Fascinating collection of thousands of bargains in 8-16 and 35 mm SILENT AND SOUND equipment . . . Get your free copy by writing to Department P

Bass CAMERA CO.
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STAR METAL BOATS

Safer WITH NEW SPRAY RAILS!
LOW PRICES!
Non-Sinkable

New full length STAMPED-IN SPRAY RAILS. Eliminate spray — make STARS speedier, easier to handle, steadier and stronger with no added weight. Offered on car top models, outboards with rocker keel, row-boats, fishing and resort boats. Air chambers make them unsinkable. Leakproof seams—no wood to rot—no upkeep cost. Sturdy, lightweight.

STAR METAL BOAT CO., 185 Cottage Ave., Goshen, Ind.

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TO MAKE THIS UNIQUE GAS SAVING TEST

Will you permit us to send you to our risk the Vacu-matic, a device which auto owners everywhere are praising? Install it on your car. Test it at our risk. Unless it trims dollars off your gas bills by saving up to 30% on gasoline consumption, gives more power, quicker pickup and faster acceleration, the test will cost you nothing.

Automatic Supercharge Principle
Vacu-matic is entirely different! It operates on the supercharge principle by automatically adding a charge of extra oxygen, drawn free from the outer air into the heart of the gas mixture. It is entirely automatic and allows the motor to "breathe" at the correct time, opening and closing as required. Saves up to 30% on gas costs, with better motor performance.

AGENTS Get Yours FREE!

FOR INTRODUCING. Here's a splendid opportunity for unusual sales and profits. Every car, truck, tractor owner a prospect. Send name and address now for big money making offer and how you can get yours Free.

The Vacu-matic Co., 7617-575 W. State Street, Wauwatosa, Wis.

(Continued from page 149A)

per square foot as compared with a required design load of 60 pounds per square foot, which is the strength of present-day floors. Therefore, even if a building with a bomb cellar is wrecked or burned down to the ground, the cellar will be intact, as the ceiling construction is strong enough to carry the load of debris of a caved-in building three or four stories high.

Factories are especially vulnerable to air attack and are also very important to defense production. Many architects turned their attention to designing efficient wartime production plants, only to discover that this country has been constructing about what would be needed during conflict—low, windowless buildings with fluorescent "daylight" and air conditioning.

The new North American Aviation Company plant in Dallas, Tex., adds a couple of innovations to this type of structure. It is only 21 feet high for the most part and the walls are only three inches thick. They are composed of a layer of concrete and two layers of steel, so constructed that they will bend and warp rather than break if bombed. Entrances are through slide doors and a concrete screen in front of each door protects the interior from bomb fragments.

The General Electric Company has perfected a trailer-mounted portable substation complete with protective and switching equipment for supplying service quickly at any point on distribution circuits where emergency service is required.

And the Boston fire department is experimenting with machine guns mounted on fire trucks so that they may be rushed to fight off planes when not busy fighting fires. In New York, fire authorities are studying a trailer fire pump designed to meet the threat of incendiary bombs.

The advice given to civilians in a city under an air raid is to avoid panic and get in off the street; walk to the nearest subway or the lobby of a steel or concrete building. Top and bottom stories and elevators should be avoided; cellars are safe only in low, well constructed buildings. If you're at home, the best advice is to close the windows, pull down the shades, extinguish all lights—turn off gas and electric connections—and don't smoke, light matches or eat until danger is past. America is far from the danger zone, but the time to prepare is before the emergency.



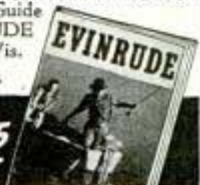
only
EVINRUDE
GIVES THIS SMOOTHER
4 cylinder
PERFORMANCE

S-M-O-O-T-H! . . . here's silky smoothness . . . surging responsiveness . . . thrilling performance that packs more pleasure into every mile! And now you can choose a *four-cylinder* Evinrude right in the same price range with "twins" of comparable power. Evinrude offers 4 great "fours" — see them at your dealer, or write for new catalog!

NEW FULL REVERSE! Now yours in two famed light motors, Evinrude's advanced development of *Full Reverse!* Steer in any direction . . . reverse the course . . . back away from crowded docks . . . the last word in complete *maneuverability* is built into these two models.

CATALOG FREE! Handsomely illustrated, full-color catalog of 9 Evinrude models—also catalog of 6 Elro models priced as low as \$26.50 —handy Boat-and-Motor Selector and Boat Guide of Leading Builders—Free. Address, EVINRUDE MOTORS, 4731 N. 27th St., Milwaukee, Wis.
All Prices F. O. B. Factory and subject to change.

AN EVINRUDE
FOR AS LITTLE AS **\$29.95**



SAW FILING



MAKES A GOOD LIVING

With a Foley Automatic Saw Filer you don't need to have experience to do expert work easily, quickly, without eyestrain. "Last year I sharpened 2309 hand saws, for which I got \$1151.40. The Foley Saw Filer has made a good living for me"—John Joseph, Calif. Louis P. Wadwick says: "I have filed 764 saws in spare time." The Foley files hand, band and circular saws better than the best hand filer. The new Model F-16 is the result of 40 years' experience in building saw filers, and is unequalled for accuracy, ease of adjustment and long life. Patented jointing principle brings uneven teeth back to uniform size.

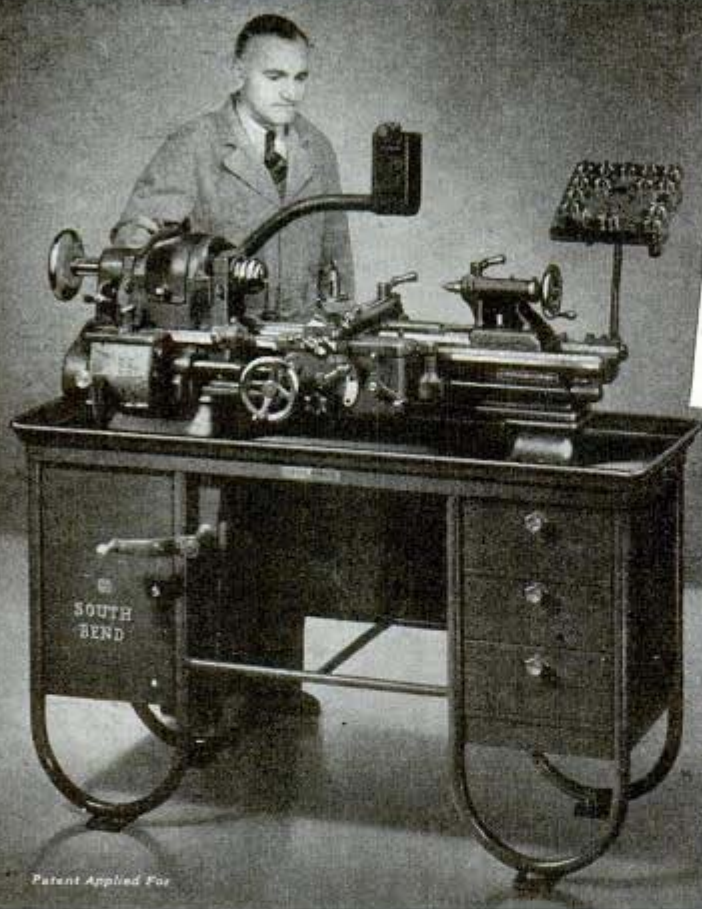
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NEW SOUTH BEND 10-INCH LATHE



Patent Applied For

1" Collet Capacity
1 $\frac{3}{8}$ " Spindle Hole
50 to 1400 R. P. M.
Spindle Speeds
Power Cross Feed
Power Long. Feed
Screw Threads
4 to 224 Per Inch



Hand Lever Draw-In Collet Chuck



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For Precision Tool Room Work and for Production Operations

THIS new 10-inch swing 1-inch collet capacity back-g geared, screw cutting precision lathe has the time saving features of an engine lathe combined with the sensitivity and accuracy of a fine precision collet lathe. It is capable of the most exacting tool and instrument work, and has the power and rigidity for taking heavy cuts on high speed manufacturing operations.

Manufacturing attachments available include hand lever draw-in collet chuck, semi-automatic hand lever bed turret, double tool rest, automatic carriage stop, four-way tool post, hand lever tailstock, oil pan, oil pump and piping.

Tool Room attachments include hand wheel draw-in collet chuck, telescopic taper attachment, micrometer carriage stop, thread dial indicator, and collet rack.

SOUTH BEND LATHE WORKS

LATHE BUILDERS SINCE 1906

904 E. Madison St., South Bend, Ind., U. S. A.



The *New* CROSLLEY CAR is Here

With Greatly Improved Acceleration, Hill Climbing, Economy, Brakes and Starting

Deluxe
Convertible
*
SEDAN
\$385.00



Small in Size and Cost - Big in Performance and Value

After two years of rigid testing, constant proving and continuous study of the cars on the road, we now offer the new Crosley with hundreds of changes and improvements.

THESE many developments include even greater economy than heretofore. Acceleration and hill-climbing ability have been stepped up as much as 40%. A positive constant mesh self-starter assures quick starting - even on coldest mornings. Other important improvements include completely self-equalizing four-wheel brakes, large crankshaft, bigger bearings, new and conveniently located parking brake, all of which mean for

Crosley owners longer life, minimum service, increased satisfaction, more conveniences. The Crosley Car now takes its place as an outstanding achievement in both passenger and commercial fields because of its mechanical developments, its low first-cost, and its low operating costs.

Over 50 Miles on a Gallon of Gas!

The amazing transcontinental run of Cannon Ball Baker in a regular stock model Crosley Car established an all-time record for economy. Baker drove from Cincinnati to Los Angeles, back by way of New Orleans, Jacksonville and then New York and Chicago. He covered 6517.3 miles, averaging 50.40 miles per gallon, proving that for passenger or commercial use, the lowest operating cost is now available with the Crosley.

Druggists, florists, grocers, and other businesses, delivering loads up to a quarter ton - salesmen, business men, school teachers, R. F. D. carriers, and others who want low-cost delivery and transportation, find the Crosley Car pays for itself in a short time through the savings effected. It makes an ideal second car. Young people love its snappy performance. Parents appreciate its safety features and excessive speed limitation.

Special Introductory Limited Offer!

We have a special introductory offer for users interested in either the passenger or commercial vehicles where there is no Crosley dealer in your community. Write a letter, attaching the coupon below, for details of this special offer.

THE CROSLLEY CORPORATION • CINCINNATI, OHIO
Powel Crosley, Jr., Pres. • Home of WLW - The Nation's Station

*Convertible Sedan in standard blue \$375.00. All prices F. O. B. Richmond, Ind. Excise Tax and car loading additional. Prices do not include transportation to destination or any state or local taxes.

MAIL THIS COUPON FOR OFFER

The Crosley Corporation
Dept. AD - Cincinnati, Ohio

I AM interested in owning a Crosley Car (state which model). In my letter attached, I am giving you the names of dealers in my locality and I would like to receive your special offer.

Name _____

6
Other
Beautiful
MODELS



\$325

CONVERTIBLE COUPE



\$399

PARKWAY DELIVERY



\$399

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\$425

COVERED WAGON



\$449

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STATION WAGON

Dealers,
Garages,
Service Sta-
tion Owners

WRITE

Dealers are now being rapidly established throughout the U. S. and foreign countries. If no dealer has been established in your territory and you are interested, send coupon below attached to your letter for special introductory agency offer.

DEALERS: Mail This.

The Crosley Corporation,
Dept. ADD - Cincinnati, Ohio

THE Crosley Car is not represented in my territory and I am interested in your special introductory agency offer.

Name _____

THE SMOKE OF SLOWER-BURNING CAMELS GIVES YOU
EXTRA MILDNESS, EXTRA COOLNESS, EXTRA FLAVOR

AND

28%
LESS
NICOTINE

than the average of the 4 other largest-selling brands tested—less than any of them—according to independent laboratory tests of the smoke itself

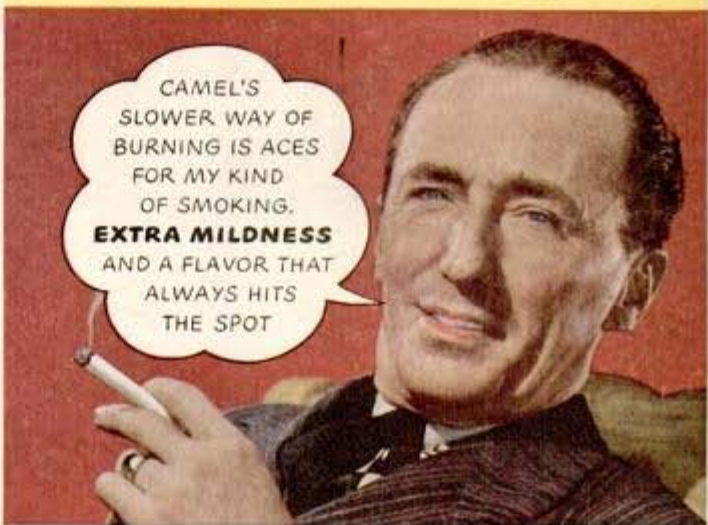
IT'S NEWS! Not the picture kind—but *news* of first importance to smokers like you.

Independent laboratory findings as to Camels and the four other largest-selling brands tested—the four brands that most smokers who are not Camel "fans" now use—show that Camels give you less nicotine *in the smoke*. And, the smoke's the thing!

But that's only the start of the story! Camel brings you the extra mildness, extra coolness, extra flavor, and extra smoking of slower-burning costlier tobaccos. Get Camels your very next pack. Why not get a carton—for economy and convenience?



HOT AFTER HISTORY! It's Donahue of Pathé who follows the news the world over with camera... with Camels! He's off again for more exclusive pictures. Below, you see how Bob Donahue gets exclusive "extras" in his smoking. He smokes Camels, of course. Only Camels give you those "extras" of slower-burning costlier tobaccos.



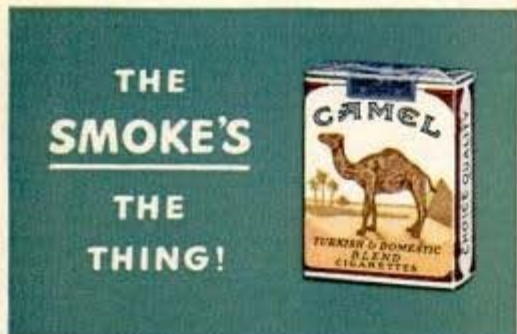
CAMEL'S SLOWER WAY OF BURNING IS ACES FOR MY KIND OF SMOKING. EXTRA MILDNESS AND A FLAVOR THAT ALWAYS HITS THE SPOT

R. J. Reynolds Tobacco Company, Winston-Salem, North Carolina

"I'LL TELL YOU," said Bob when he got his picture *taken* (above), "I smoke a good bit in my job. And my cigarette has to be more than mild—it has to be *extra* mild. Camel is the one brand I've found that gives me extra mildness and at the same time a flavor that doesn't go flat on my taste."

Try Camels. Enjoy that famous Camel flavor with extra mildness and extra freedom from nicotine in the smoke.

By burning 25% slower than the average of the 4 other largest-selling brands tested—slower than any of them—Camels also give you a smoking *plus* equal, on the average, to 5 EXTRA SMOKES PER PACK!



CAMEL—THE SLOWER-BURNING CIGARETTE