

POPULAR MECHANICS MAGAZINE

WRITE TO UNDERSTAND IT

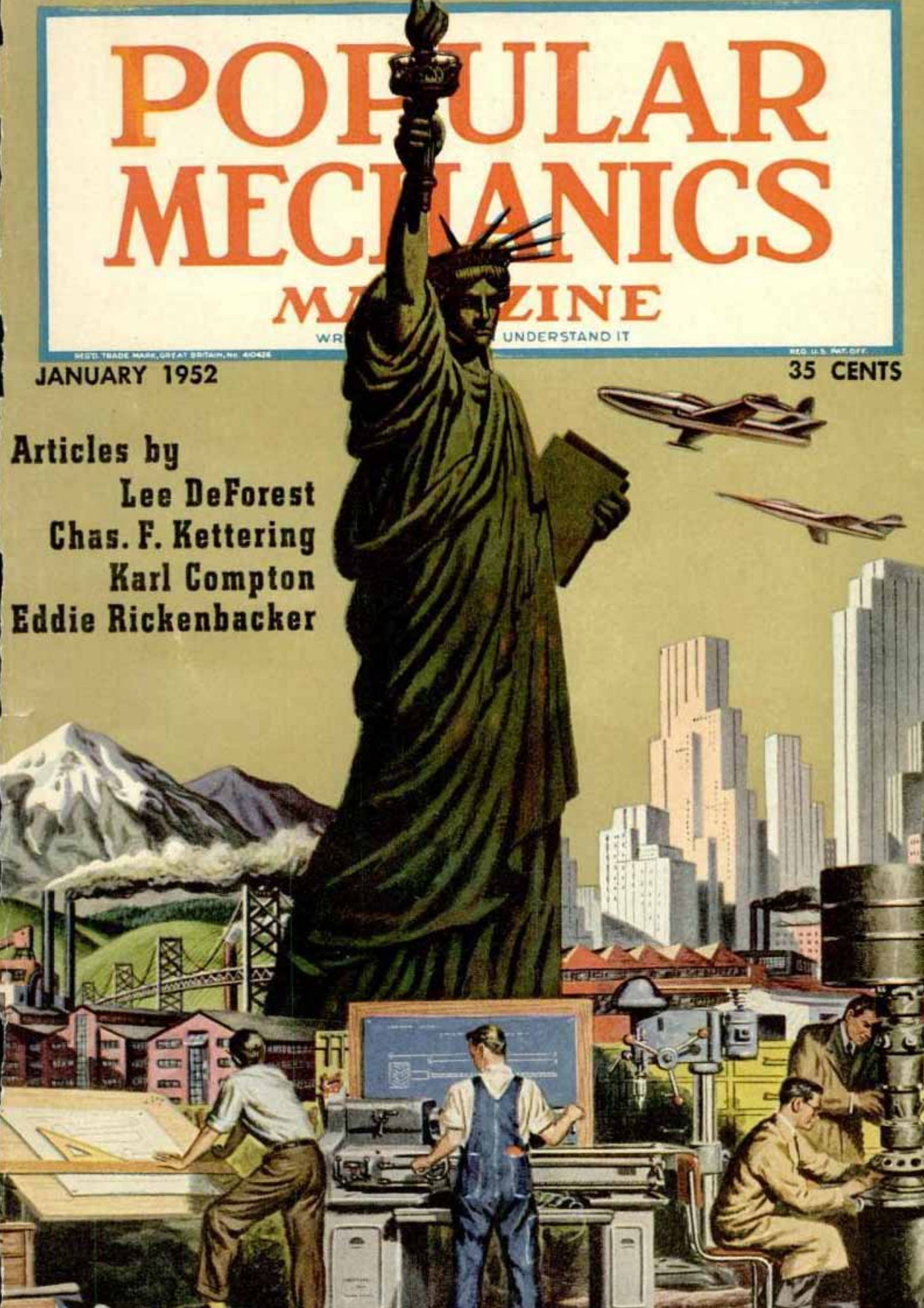
REG. TRADE MARK, GREAT BRITAIN, NO. 40428

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JANUARY 1952

35 CENTS

Articles by
Lee DeForest
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MONTA MOWER

Story



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NEW FORD PARTS DEPOT at Cincinnati is typical of warehouses Ford is building all over the country. From a depot like this, Ford Dealers will order almost any part for your Ford!

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Ford's \$500,000,000 expansion program will make Genuine Ford (FoMoCo) Parts easier to get than ever. The depot (above) is only one of ten new parts depots built or being built. Nineteen others are being expanded. This expansion program, designed to triple stock space, is part and parcel of Ford's "Look Ahead" policy to better serve Ford owners.



MADE RIGHT for Fords, Genuine Ford Parts, like this muffler, are specified by wise motorists to save time, money and trouble. They're *right* because they're duplicates of the parts in your Ford—they keep Fords *all Ford*.



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KEEP YOUR FORD ALL FORD!

This One



Your voice in Davy Jones' locker

To strengthen voices in the newest submarine cables between Key West and Havana amplifiers had to be built right into the cables themselves. With the cables, these amplifiers had to be laid in heaving seas; and they must work for years under the immense pressure of 5000 feet of water.

For this job, Bell Laboratories engineers developed a new kind of amplifier — cable-shaped and flexible, with a new kind of water-tight seal.

To serve far beyond reach of repair, they developed electron tubes and other parts, then assembled them in dust-free rooms.

The two cables — each has but two conductors — simultaneously carry 24 conversations as well as current to run the electron tubes.

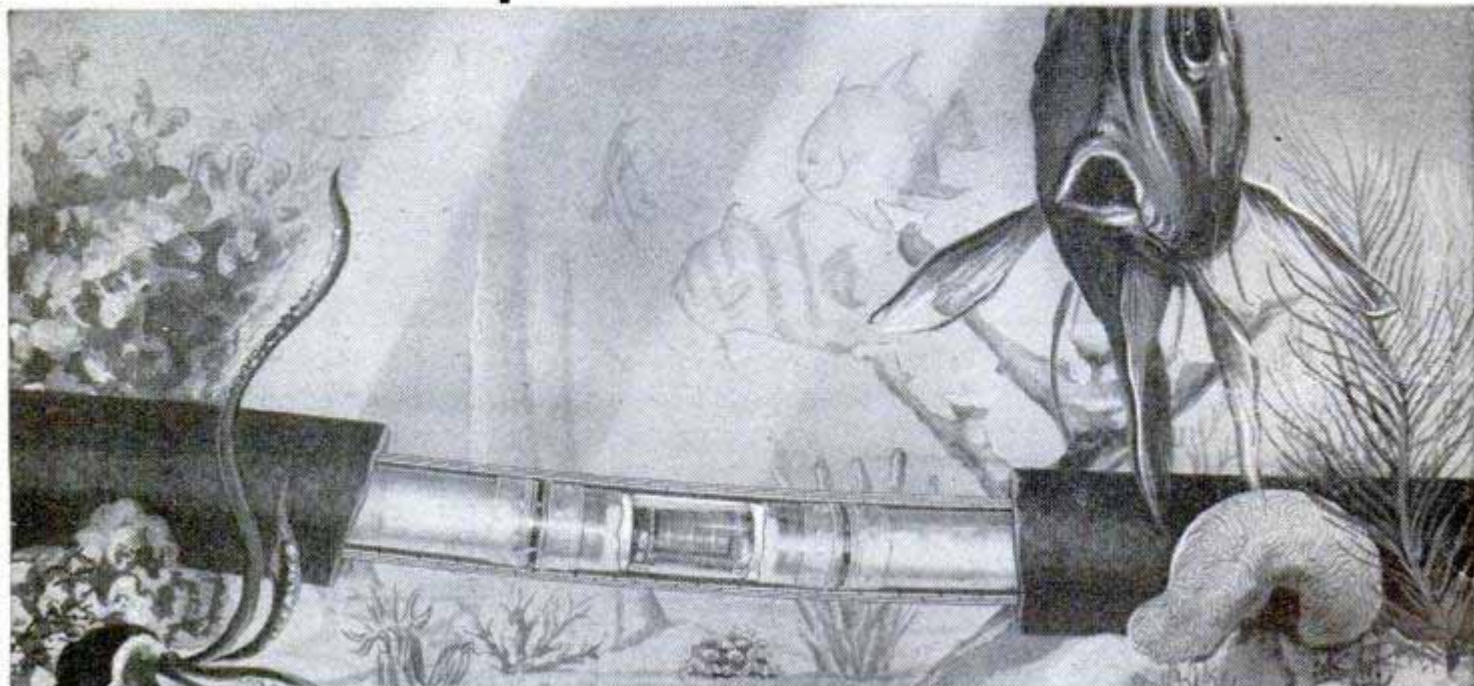
With these deep-sea amplifiers, submarine cables carry more messages . . . another example of how research in Bell Telephone Laboratories helps improve telephone service each year while costs stay low.

BELL TELEPHONE LABORATORIES

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Cutaway view of deep-sea amplifier. Tubes and other elements are housed in plastic cases then enclosed in interleaved steel rings in a copper tube. Glass tape, armor wire and impregnated fiber complete the sheath.

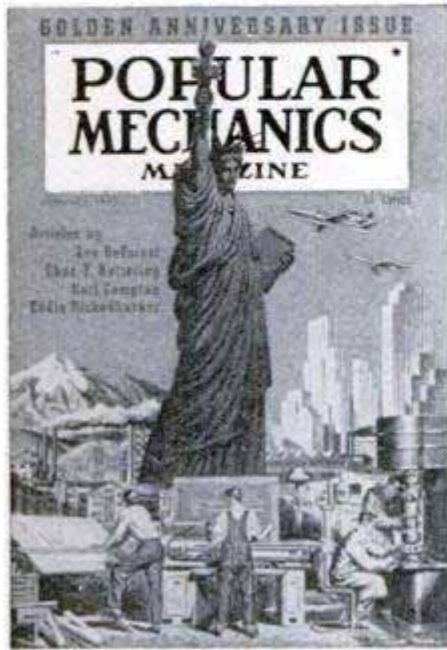


Popular Mechanics Magazine

Registered in U. S. Patent Office and Canada

H. H. WINDSOR, *Founder*

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



this month's cover

THE AMERICAN WAY OF LIFE symbolized on our cover speaks in many ways—in the crack of bat against ball, the scream of a jet in the sky, the giggle of a child in school. It's the squeal of tires on a boulevard, the rustle of a ballot in a booth. In the most turbulent half century of man's history, spanning the life of this magazine, the American Way has made its power known in the mighty roar of a tank-assembly line, the scratch of a designer's pencil and the whir of a lathe. It has spoken in the tattoo of a rivet gun and the lonely voice of a ham radio operator; the swish of a reaper through a wheat field and the heavy hiss of a river of molten metal. We believe, too, that it speaks of peace through the rustle of wood shavings in a basement workshop and the silent voice of a statue holding one hand high in welcome.

Published monthly by Popular Mechanics Company, 200 E. Ontario St., Chicago 11, Ill. H. H. Windsor, Jr., president; William Harrison Fetridge, vice president; D. F. Windsor, vice president and secretary-treasurer; H. H. Windsor III, vice president; Clover L. Perkins, advertising manager; Alan M. Deyoe, circulation manager. Single copy in the United States and Canada, 35 cents; subscription rates in United States and possessions, Canada, Philippines and countries of the Pan-American Postal Union, 1 year \$3.50; 2 years, \$6.00; 3 years \$8.00. To all other countries add \$1.00 a year over United States prices for overseas postage. If you plan to move, notify us at least 30 days in advance so you will not miss an issue. Give both your old and new addresses. Entered as Second Class Matter, September 15, 1903, at the Post Office at Chicago, Illinois, under Act of March 3, 1879. Entered as Second Class Matter at Post Office Dept., Canada. Registered as Second Class Matter at the Post Office at Mexico, D. F., Mexico, June 20, 1950. Copyright 1952 by Popular Mechanics Company, Copyright under International Copyright Union. Copyright in France. All rights reserved under Pan-American Copyright Union. Printed in the United States of America.

JANUARY 1952

Volume 97

JANUARY 1952

Number 1

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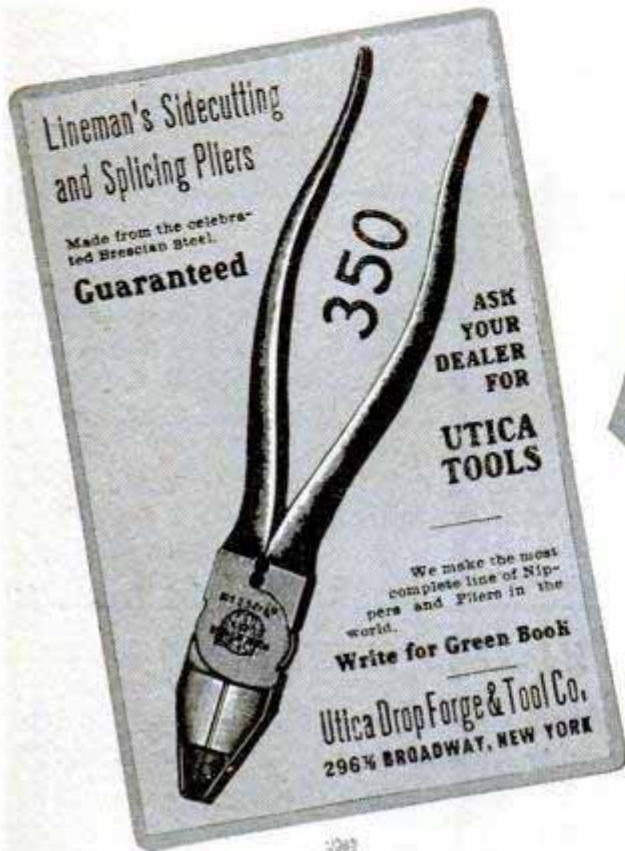
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- The pliers of 1952 are available (on order) with special handles that cushion fatigue or provide insulation against electrical shock.

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1952

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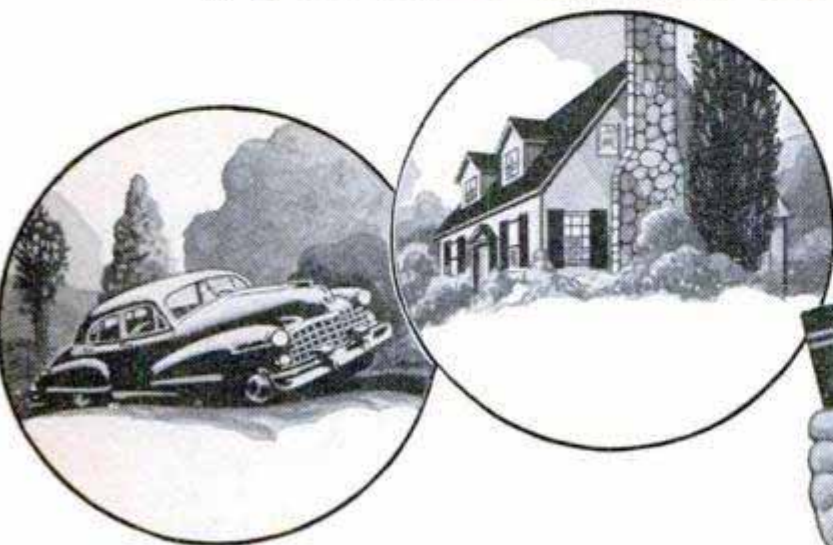
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WHAT Every AUTO MECHANIC Wants to Know

A motor vehicle is a machine of many parts, each part designed and constructed for its own special function. All good mechanics, like good doctors, should know the working theory and operation of each part and understand what causes trouble and how to remedy it.

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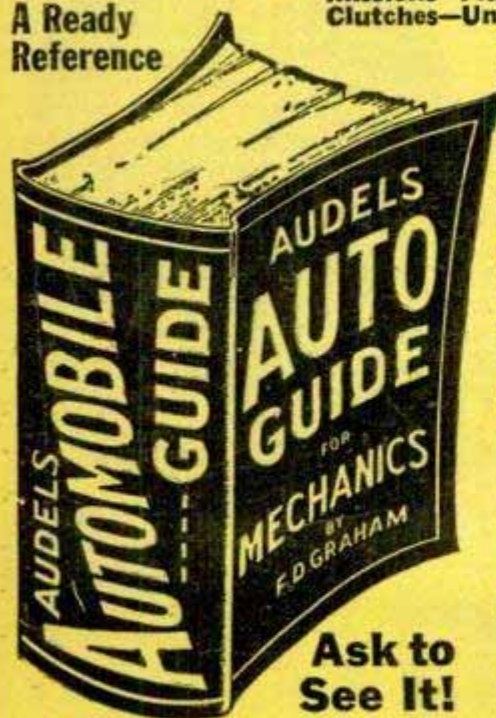
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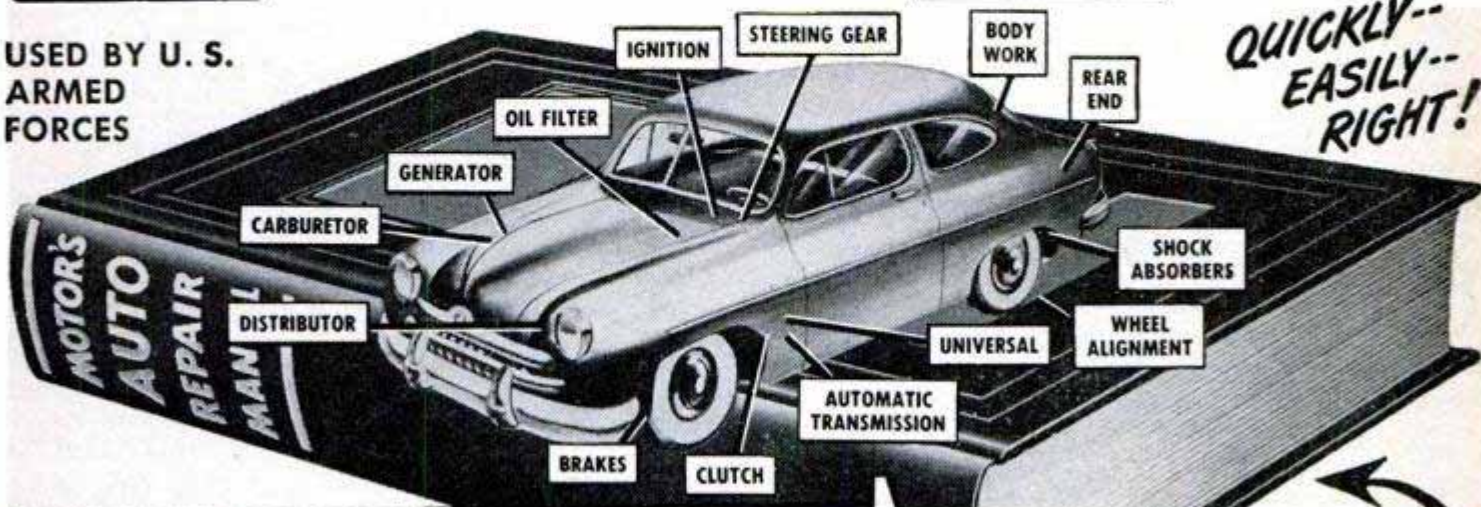
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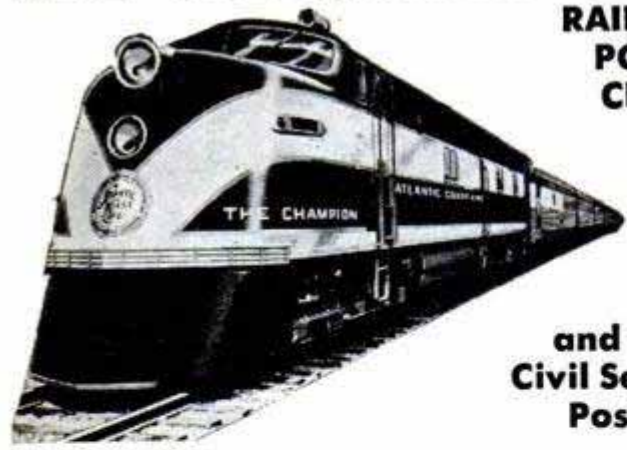
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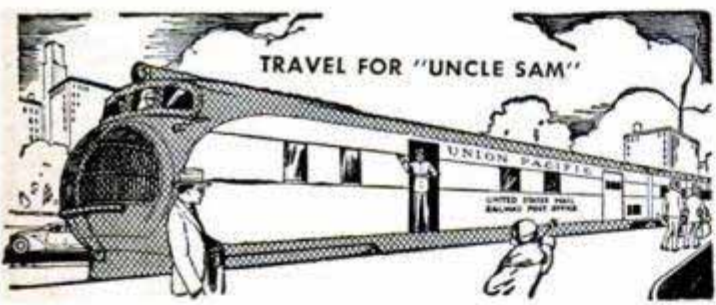
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**THE
EDITORS**



AS THIS GOLDEN Anniversary issue goes to press, we acknowledge gratefully the many salutations that have come to us from long-time readers. We present here as many excerpts from these letters from old friends as space permits:

The first copy of *Popular Mechanics* I ever saw contained an account of the Wright brothers' exploits at Kitty Hawk. My files are fairly complete, going back about 35 years. I will always remember and greatly admire the name of H. H. Windsor, this being the name signed to the letter of acceptance for the first article of any kind I ever wrote for publication. I have contributed numerous articles and used the classified ads beginning about 1908. It is needless to say I am intensely devoted to your magazine; feel almost like it is *my* magazine; feel like every issue is published on my individual account, and that the spirit of Mr. Windsor lives on in the handsome format and interesting pages of the book. I take great pleasure in giving a salute to *Popular Mechanics* and the staff on this their Golden Anniversary, and speeding you along on another half century of great accomplishments.

A. W. Phillips,
Clemmons, N. C.

(Continued to page 22)



Charles La Plant of Crystal Lake, Ill., has read *PM* since it started in 1902 and has saved every copy

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This big fire-proof building is occupied entirely by Coyne.

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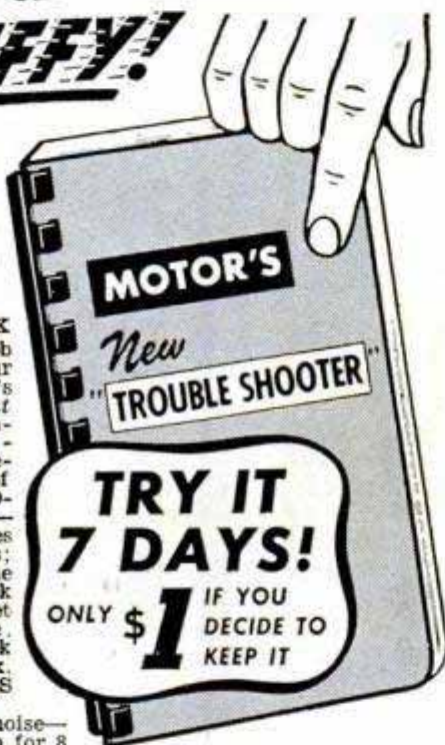
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In the fall of 1902 my first *Popular Mechanics* was purchased. This, I believe, was one of the best investments I have ever made, for I have had *Popular Mechanics* nearly every month since. The results have been much pleasure, education and quite a lot of profit. . . . I am getting old now but will continue to read *PM* as long as I can see.

Frank R. Sprague,
La Canada, Calif.

★ ★ ★

I have been a regular subscriber for nigh onto 50 years . . . still look forward to the new issue every month.

K. M. Becker,
Sparks, Nev.

★ ★ ★

I do not believe that I have missed reading a single copy since 1907. . . . *Popular Mechanics* is first on my reading matter.

Harry Radzinsky,
New York City.

★ ★ ★

I have always felt that there was at least one idea in each issue that was worth more than the price, and I wish you many more successful years.

Dan I. Porter,
Berrien Springs, Mich.

★ ★ ★

We thoroughly enjoy your magazine. Our boys, ages 13 and 15, are as anxious for its arrival as my husband and I. Not one of us can part with a book. We all send our thanks for many hours of enjoyment.

Mrs. A. P. Carter,
De Ridder, La.

★ ★ ★

. . . Have read it almost from the beginning. I am now 74 years old . . . and still operate my own cabinet shop with power machinery. In my work I find *PM* a great help.

Fred MacLaren,
Olympia, Wash.

★ ★ ★

I have been reading *Popular Mechanics* since 1905, and have all editions from 1909.

C. G. Langrill,
Mayor,
Yorkton, Sask., Can.

★ ★ ★

Let the good work continue!

Herbert L. Phillips,
Watertown, Mass.

(Continued to page 24)

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Please attach letter stating age, occupation and name and address of employer, and at least one business man's name and address as reference. Men in service also please give home address.

Have been reading *PM* since 1904 . . . have never thrown away or destroyed a copy. . . . I practically grew up on *Popular Mechanics*.

J. N. Parker,
Bedford, Va.

★ ★ ★

I have been a regular reader of *PM* for the past 45 years, and expect to continue for the remainder of my life.

Joseph Sherman,
Chicago.

★ ★ ★

I began with the first issue and have not missed any since. . . . I am 72 years young.

J. W. Thorndike,
Ripon, Wis.

★ ★ ★

It [*PM*] has had a good deal to do with the increase in alertness of the public to new ideas. . . .

A. P. Connor,
Baltimore, Md.

★ ★ ★

I have been reading *PM* for the full 50 years. . . .

Thomas W. Sommerville,
Harrisburg, Ore.

★ ★ ★

Do hope you have many, many more years of keeping Mr. and Mrs. Public up on the happenings of the day.

Elmer D. Klopfer,
Washington, D. C.

★ ★ ★

I do not remember when I ever missed an opportunity to read an issue of *PM*.

R. I. Babbitt,
Scottsbluff, Neb.

★ ★ ★

. . . A great magazine.

W. A. Richardson,
Maitland, Mo.

★ ★ ★

I well remember the day in 1902 when a local grocery-store clerk named Leon Hutchins left a copy of *PM* with my father. . . . It was just out, an entirely new venture in the magazine field, specializing in mechanical objectives. Both my father and I were intrigued with it and he subscribed that same week. . . .

Congratulations on 50 years of splendid service and success!

Lee R. Robbins,
Norwich, Conn.

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Your future deserves and needs every advantage you can give it! That's why you owe it to yourself to find out about one of the most COMPLETE, practical and effective ways now available to prepare AT HOME for America's billion dollar opportunity field of TELEVISION-RADIO-ELECTRONICS. See how you may get and keep the same type of basic training equipment used in one of the nation's finest training laboratories... how you may get real STARTING HELP toward a good job or your own business in Television-Radio-Electronics. Mail the coupon today for complete facts — including 89 ways to earn money in this thrilling, newer field.

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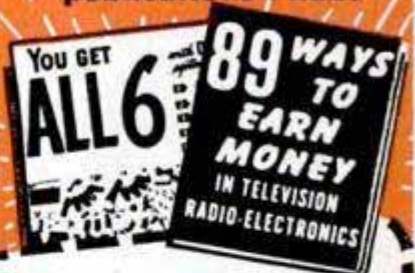
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publications FREE!



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You do all your training with me AT HOME in spare hours. Keep right on with your present job and income while learning—and earn extra cash besides! The day you enroll I begin sending you plans and ideas for doing profitable spare time Radio-TV work. Many of my Sprayberry students pay for their entire Radio-TV training this way!



YOU KEEP THIS VALUABLE EQUIPMENT

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TRAINED, QUALIFIED TECHNICIAN IN JUST MONTHS OR LESS!

New "Package" Unit Training Plan—PAY AS YOU LEARN—YOU SET THE PACE! TRAIN AT HOME IN SPARE HOURS!—No Monthly Payment Contract to Sign!

Now . . . be ready for Radio-Television's big pay opportunities in a few short MONTHS! Frank L. Sprayberry's completely new "Package" training unit plan prepares you in just 10 MONTHS . . . or even less! Equally important, there is NO monthly payment contract to sign . . . thus NO RISK to you! This is America's finest, more complete, practical training—gets you ready to handle any practical job in the booming Radio-Television industry. In just 10 months you may start your own profitable Radio-Television shop . . . or accept a good paying job in this fascinating expanding field in work you've always wanted to do. Mr. Sprayberry has trained hundreds of successful Radio-Television technicians—and stands ready to train you in less than one year, even if you have no previous experience. You learn by DOING . . . actually working with your hands with equipment of special design to illustrate basic theory instead of relying on books alone. Your training is very interesting because it's really practical.

The Sprayberry 10 MONTH TRAINING PLAN includes, Radio, Television, FM (Frequency Modulation), Public Address Systems . . . everything you need to make big money in this fast moving industry. This new Sprayberry "package" plan includes many kits of genuine, professional Radio-Television equipment. While training at home in spare hours you actually perform over 300 demonstrations, experiments and construction projects. In addition, you build a powerful 6-tube standard and short wave radio set, a multi-range test meter, a signal generator, signal tracer and many other projects. All equipment is yours to keep . . . you have practically everything you need to set up your own service shop. The interesting book-bound lessons, manuals, bulletins . . . all are yours to keep. If you expect to be in the armed forces later, there is no better preparation than good Radio-Television training. These are sound, logical, money-in-the-bank reasons why this training is the best training of all for you.

Be Ready for Top Paying Radio-Television Jobs!

Radio-Television is growing with amazing speed. More than 2000 broadcasting stations PLUS an additional 102 Television stations are now on the air. Radio sets and TV receivers are being made and sold in record breaking numbers. If you enjoy working with your hands . . . if you like interesting and varied work . . . YOU BELONG IN RADIO-TELEVISION. But you MUST have good Training to "cash in" . . . the training that starts with basic fundamentals and carries through every circuit and problem of Radio-TV.

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Training Leads to Good Radio Job

"Got a job in local radio shop soon after enrolling. Very satisfied with training."
— Stanley Clemmons, Kansas.

Radio Profits Pay Cost of Training

"I have more than taken in the cost of your training doing spare time radio repair work. See bright future ahead."
— Thomas Shearer, N. Y.

Earns Easy Spare Time Cash

"While training I made about \$180.00 in spare time. Thank you for wonderful Radio-TV training."
— Herbert Burroughs, W. Virginia.

No Previous Experience Needed to Succeed

My Training in Radio-Television is so complete, so down-to-earth that previous experience is not necessary. I start you with basic fundamentals and carry you in easy, practical steps through one Radio-Television subject after another. You will be amazed at your rapid progress and your knowledge of Radio-Television. Best of all, you put this knowledge to work making spare time cash soon after you enroll! You may train as fast or as slowly as suits your convenience. Each of my students receives individual training!

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Please Check Below About Your Experience

Are You Experienced?

No Experience

In your Mind's Eye

The Secret of MENTAL CREATING

IF you just like to dream, read no further. There comes a time when your fancies *must be* brought into light—and stand the test of every-day, hard realities. Are you one of the thousands—perhaps millions—whose thoughts never get beyond the stage of *wistful wishing*? Do you often come to from a daydream with the sigh, "If only I could bring it about—*make it real!*"

All things begin with thought—it is what follows that may take your life out of the class of those who hope and dream. Thought energy, like anything else, can be dissipated—or it can be made to produce actual effects. *If you know how to place your thoughts* you can stimulate the creative processes within your mind—through them you can assemble things and conditions of your world into a happy life of accomplishment. *Mental creating* does not depend upon a magical process. It consists of *knowing how* to marshal your thoughts into a power that draws, compels and organizes your experiences into a worth-while design of living.

ACCEPT THIS *Free* BOOK

Let the Rosicrucians tell you how you may accomplish these things. The Rosicrucians (not a religious organization), a world-wide philosophical fraternity, have preserved for centuries the ancients' masterful knowledge of the functioning of the inner mind of man. They have taught men and women how to use this knowledge to *recreate their lives*. They offer you a free copy of the fascinating book, "The Mastery of Life." It tells how you may receive this information for study and use. Use coupon opposite.

The ROSICRUCIANS
(AMORC)

SAN JOSE

CALIFORNIA

SCRIBE: C.S.R.
The Rosicrucians (AMORC),
San Jose, California.

Please send free copy of "The Mastery of Life,"
and I shall read it as directed.

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City.....

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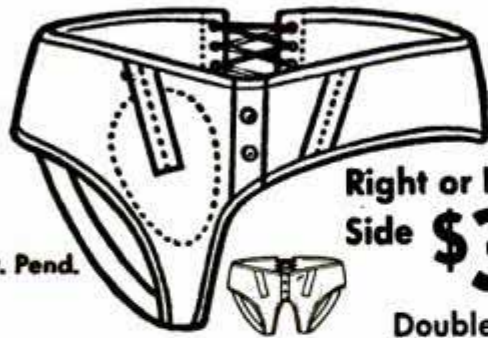
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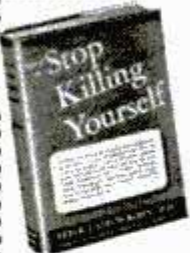
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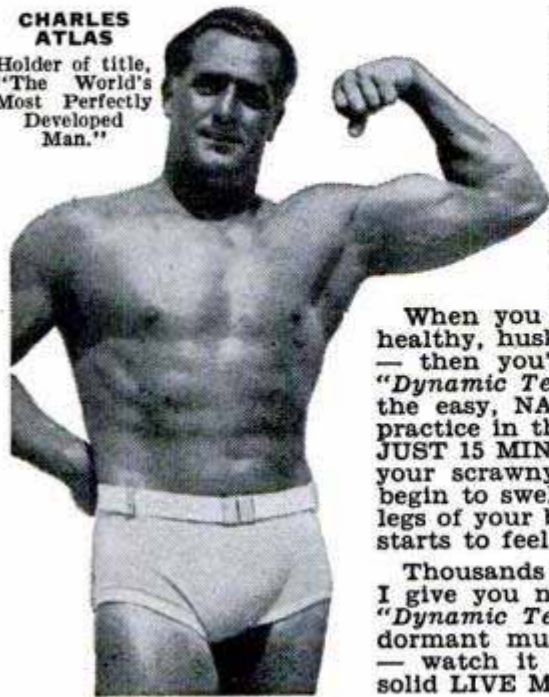


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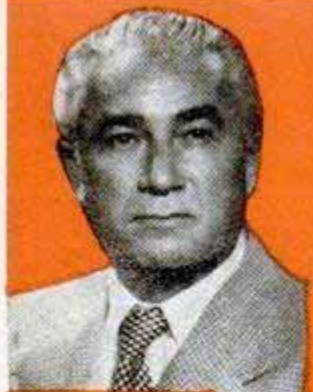
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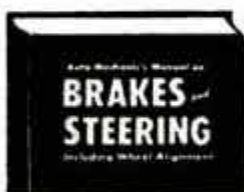
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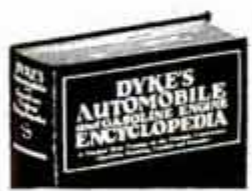
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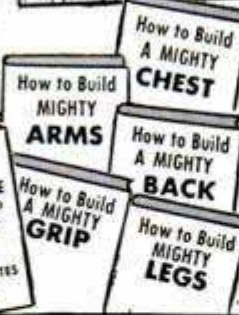
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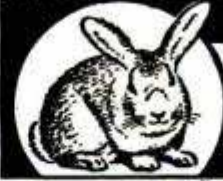
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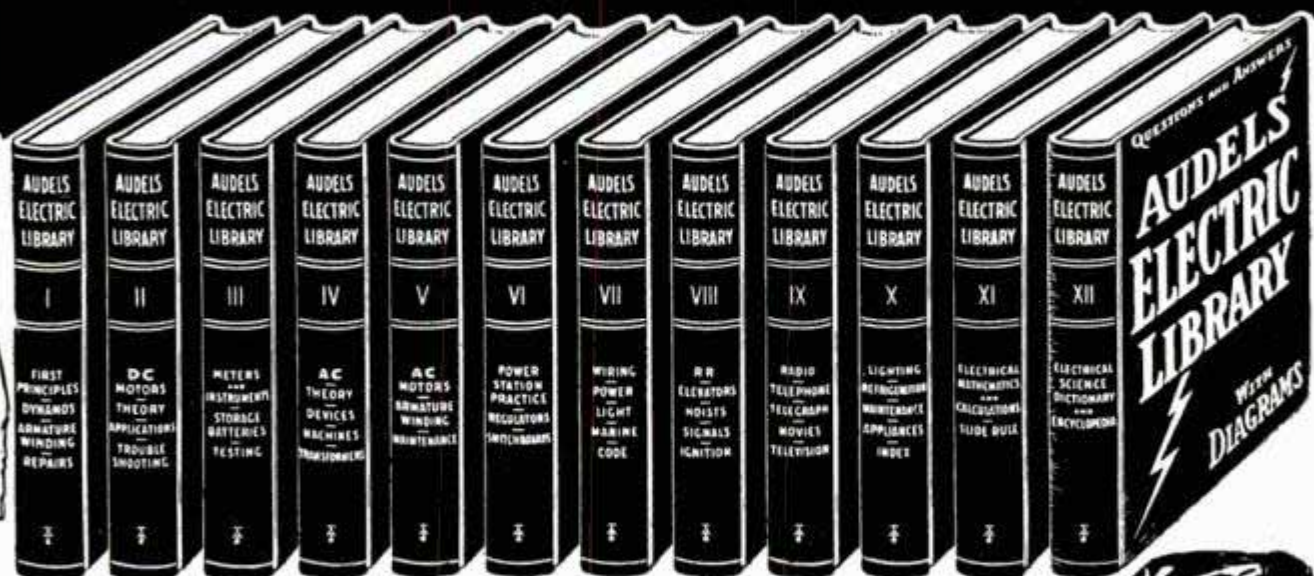
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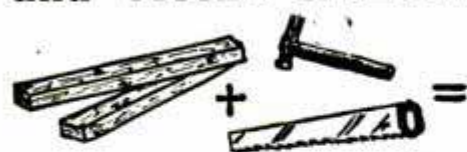
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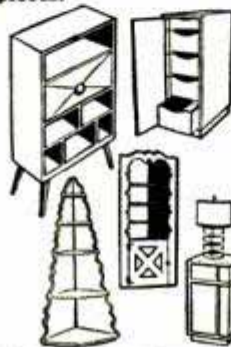
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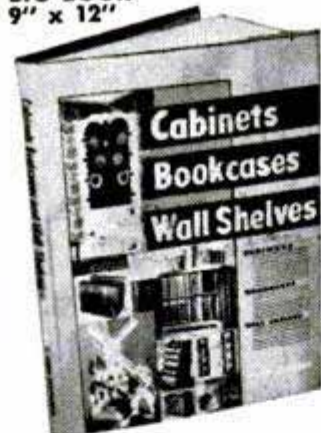
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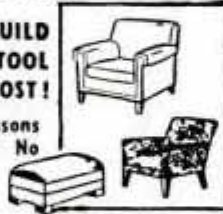
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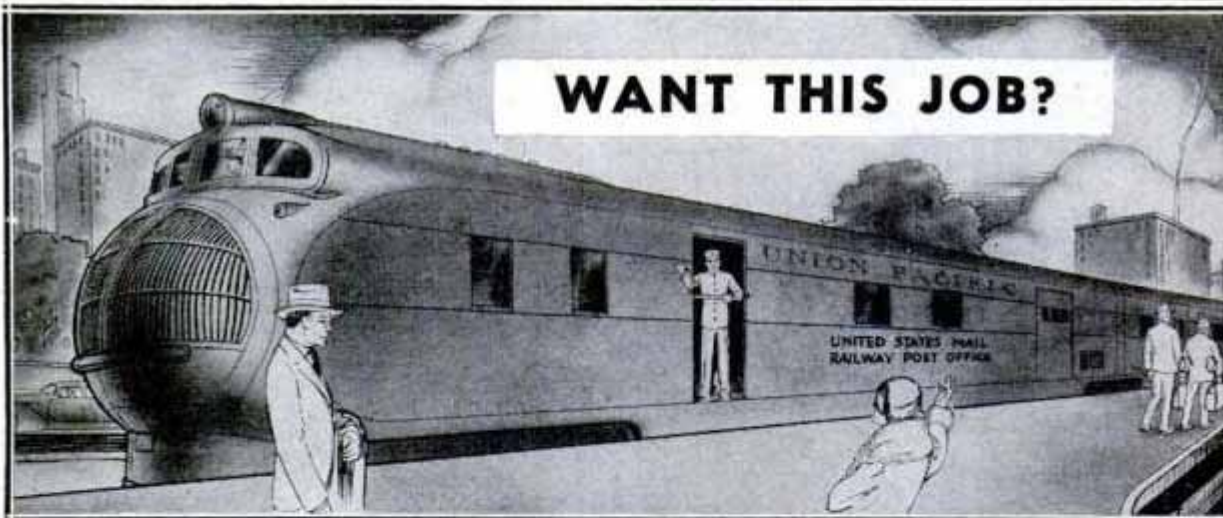
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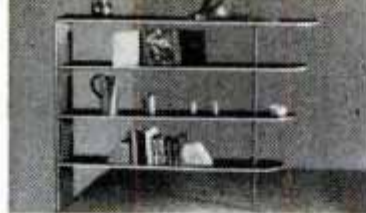
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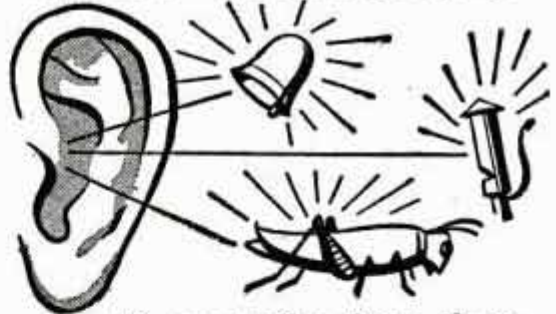
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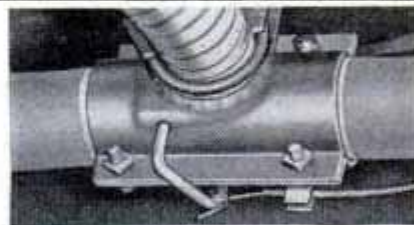


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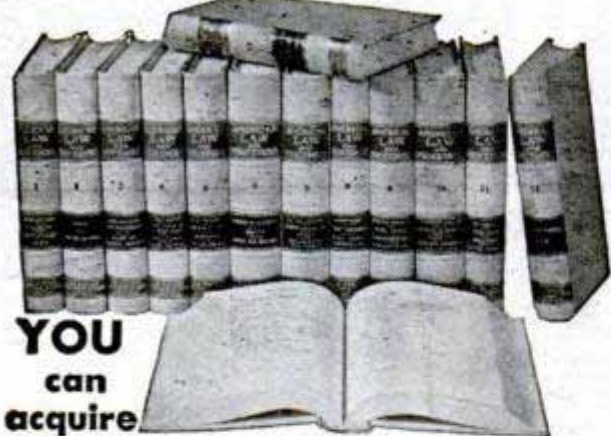
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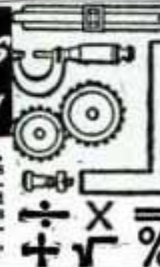
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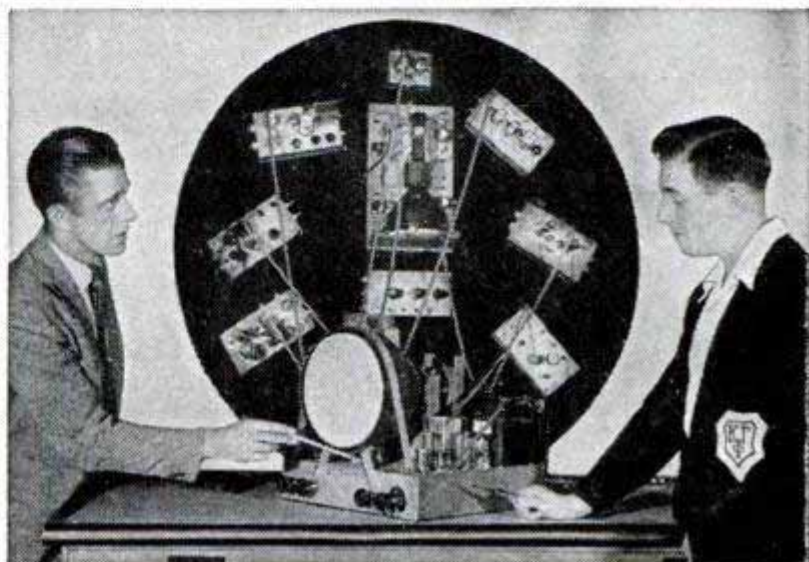


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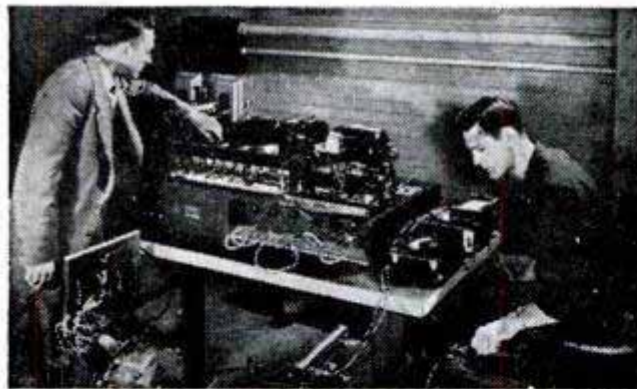


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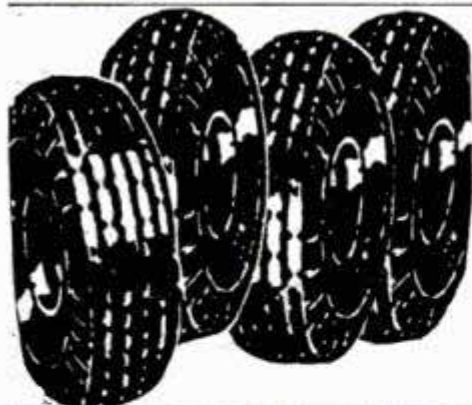
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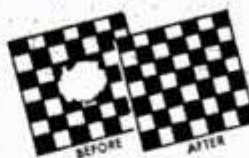


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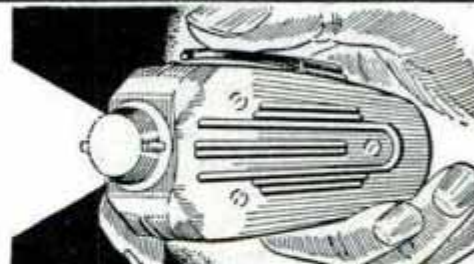
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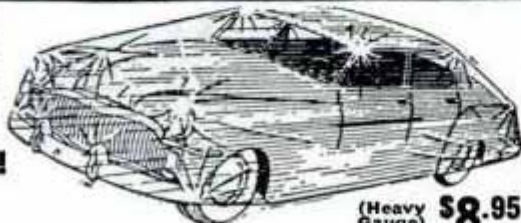
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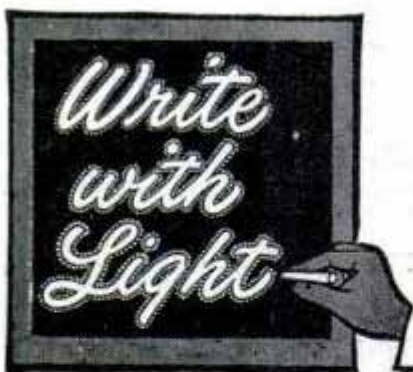
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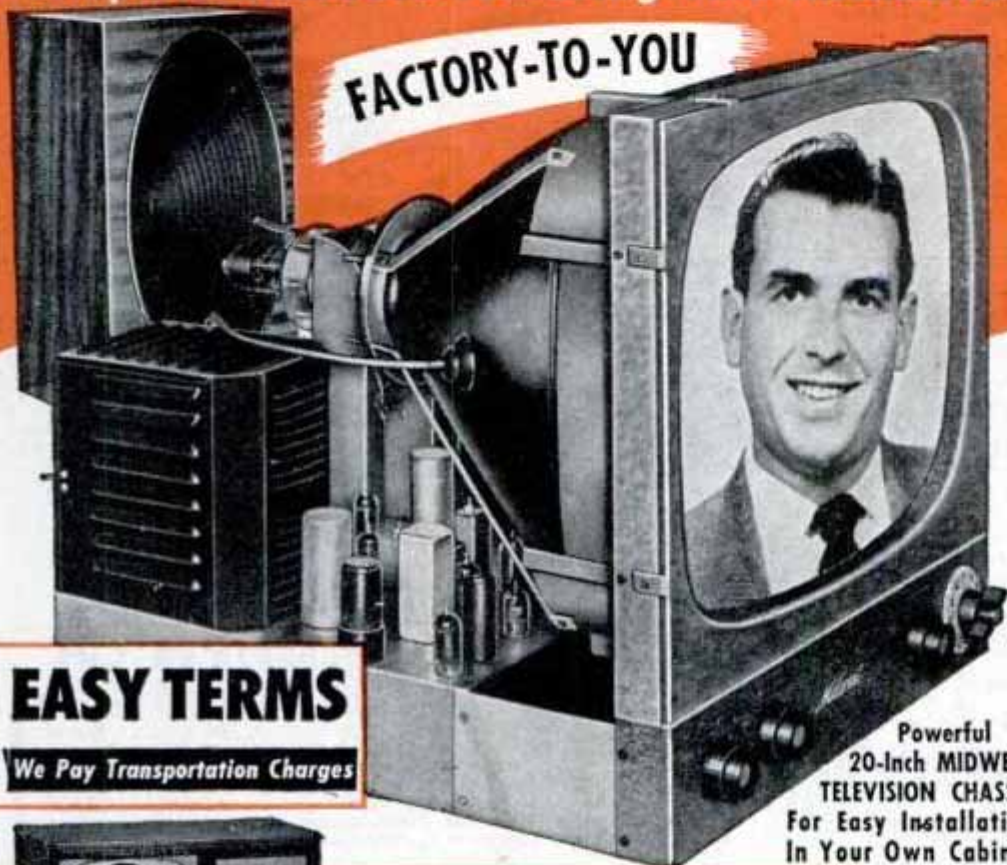
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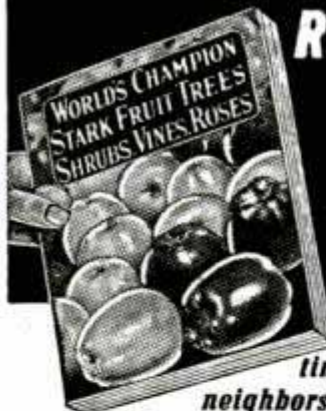
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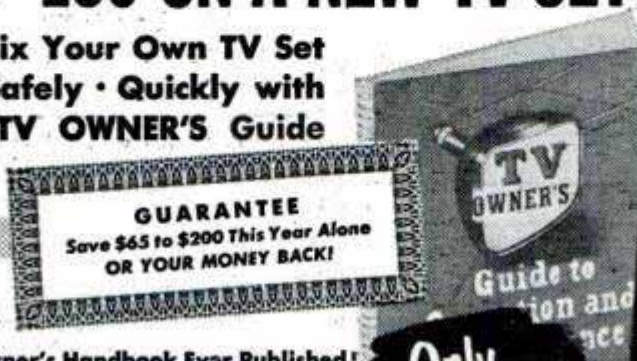
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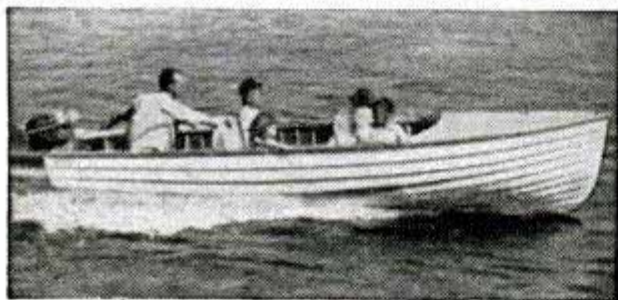
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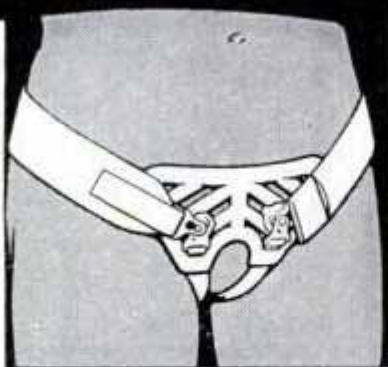
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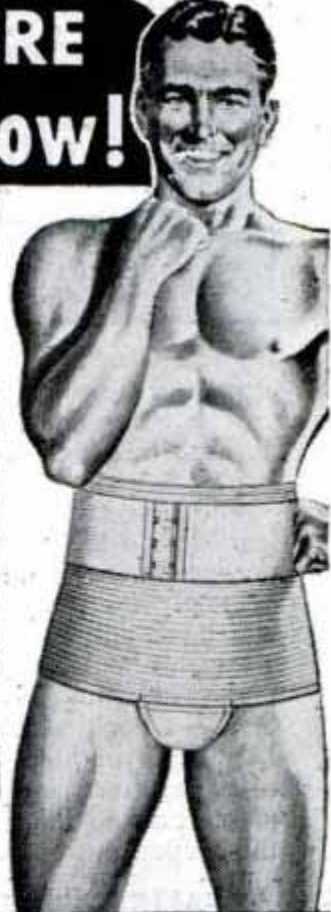
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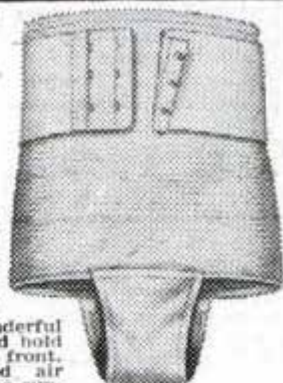


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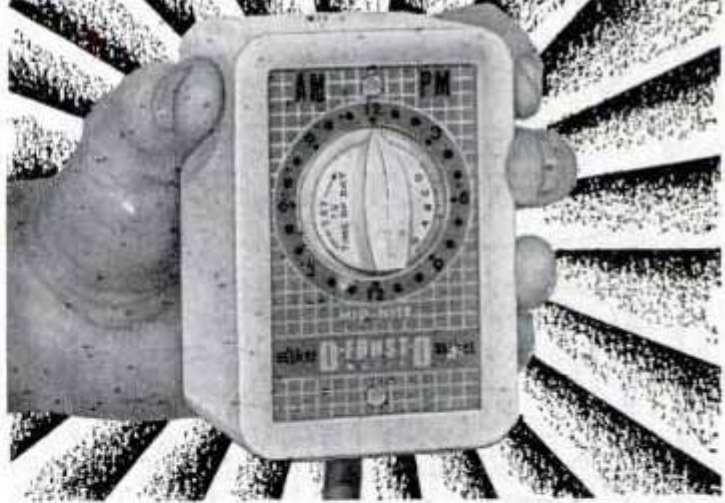
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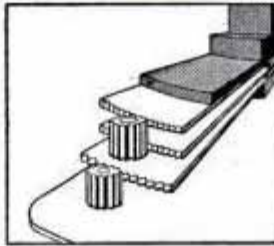
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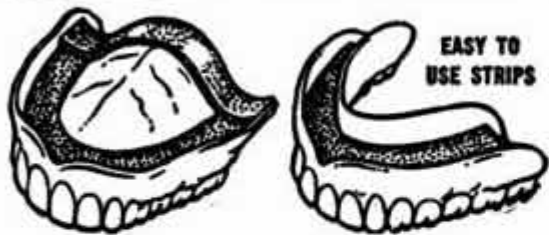
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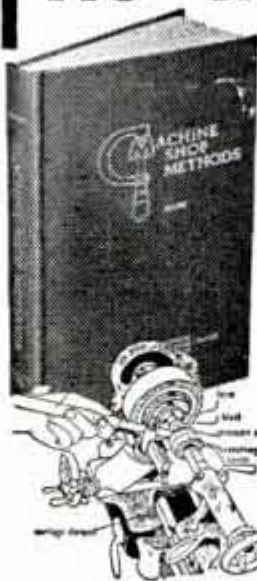
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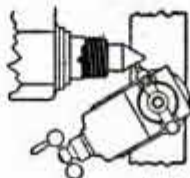


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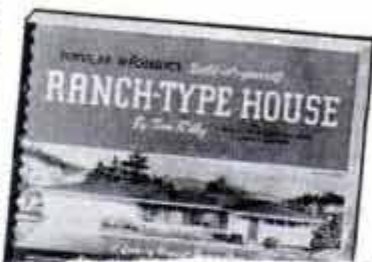
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GET Into high paying new sewing machine field! Save \$100 on a brand new electric portable sewing machine by assembling yourself. Complete parts cost only \$48. Can be completely assembled in less than an hour. Same machine retails for \$169.50. Builds into beautiful full-size round bobbin machine. All parts brand new. Make up kit contains following parts: 1 Star round bobbin head, completely assembled, \$30. Motor \$6.00. Foot control \$2.00. Light \$1.50. Wire 50c. Leatherette portable case \$8.00. Total complete kit \$48.00. Build one for your wife or mother. Assemble and sell these machines at big profit. Buy direct from manufacturer. Send cash, check or money order to: Star Sewing Machine Wholesalers, 1130 S. Western Avenue, Los Angeles, Calif.

COMMERCIAL Deep frying course. Mock chicken legs, potatoes. New and proven methods. Learn about this money-making field. \$2.50 p.p. Concession, Toledo 13, Ohio.

MADE \$24,500 Using money making plans from Schemer Magazine, world's oldest mailorder publication. Box 275M, Canfield, Ohio. Year \$2.00. Sample 20c.

MINK Raising information free. Complete. Lake Superior Mink Farm. Superior, EE1, Wisconsin.

COPUBLISH Leading m.o. paper. Latest copy Mail Sale Advertiser, details, dime. Vanrov Shirk, Lebanon, Penna.

products, novelties, ties. Basement leak-sealing. Money-making projects. Booklet, details free. Men only. National Potteries Company, Grand Rapids, Minnesota.

READ "Advance"—The voice of mail order. Offers money-making opportunities, sources of supply, personal guidance, etc. Issued monthly. Sample copy 25c. Yearly subscription \$2.00. Advance Publishing Company, 313 East 21st Street, Suite 450, New York 10, N. Y.

LIQUID Rubber. Make flexible molds. Free sample. Chaney, 1130 E. 16th St., Jacksonville 6, Fla.

MAILING Postcards selling repeat merchandise is profitable. Everything supplied. Details free. Gordan Publishers, Box 23, Pawtucket, R. I.

MEN—Women. Everybody likes candy. Learn to make professionally. Our 40th year. Ragsdale Candies, D5, East Orange, New Jersey.

MONEYMAKING OPPORTUNITIES

EARN Money at home—Steady income. Make jewelry, shellcraft artificial flowers, novelties, dolls. Sell on sight. Business plan. Profitkraft catalog 10c. Cleveland Model, 4508TC207 Lorain, Cleveland, Ohio.

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

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

"MAGIC-Mousie" Tricky! Funny! Makes you money! Sample 25c. Unicraft, 4932 Eighth, Philadelphia.

"HOW To Make Money With Simple Cartoons"—A book everyone who likes to draw should have. It is free; no obligation. Simply address Cartoonists' Exchange, Dept. 91-CM, Pleasant Hill, Ohio.

HOME Mail business supplies, lists free. Lincoln, Box 449, Irwin 4, Penna.

PROFITABLE Sideline! Supply dealers with books! Thousands wanted! Full professional instructions \$1. Paramount Book Service, 39-P Hopedale Street, Allston 34, Boston, Mass.

CHOP Suey bean sprouts, amazingly profitable spare room income. Growing, selling, plus 30 delicious sprout recipes. \$5.00. Texas Health Products, Box 23, Beeville, Texas.

INCOME Tax consultants earn \$100 daily. Easily prepared for. Details free. Universal, Box 664-M, Springfield, Mo.

MAKE Money at home or travelling. Full particulars free. Emly Enterprises, Box 319, North Hollywood, California.

UNPAINTED Plaques, bookends, novelties. Stamp brings list. Umlauf, 239 S. Luther, Detroit 25, Mich.

BUY And sell surplus. Tremendous profits. Big copyrighted report tells how. Price \$1.00. Satisfaction guaranteed. S. & S. Publications. Goldthwaite 1, Texas.

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

WORRIED About a job? Learn how to make \$5000 a year. Yes, anyone can operate this plan successfully in United States no matter how old they are—Man or woman. Free information. DeSpain Products, Box 473, Port Huron, Michigan.

BIG Money jobs in foreign employment for construction men, building trades, helpers, office men, others, interested in foreign projects. High wages, quarters, transportation. Listings of firms actively working on U.S., foreign, intercontinental projects. Send \$1 for foreign construction compendium and application forms. Foreign Service Bureau, Dept. M, Box 295, Metuchen, N. J.

OLD Phonograph records wanted—Paying up to \$300. Complete price list of over 1500 records and details \$1.00. International Mart, 6912-M, Hollywood Blvd., Hollywood 28, California.

FREE Nationwide advertising, publicity! Advertise your products to 51 million readers thru 77 national magazines, free of charge! Broadcast on 400 radio stations without risking a penny! Send 25c (refundable) for details today! Treasury, 149 Storer, New Rochelle 3-L, New York.

SELL Box tops! Information 25c. Everett Turlington, Box 587, Dunn, N. C.

EARN Money. Send 25c. Box 71, Sta. D, Atlanta, Georgia.

LEARN Mailorder selling. Free details. Greenlawn Enterprises, 15378-X Greenlawn, Detroit 21, Michigan.

"HOW To Build Your Own Mail Order Business." Facts that save losses for beginners and mail-dealers, 25c postpaid. Satisfaction guaranteed. Bennett Enterprises, 1215 Central, Louisville 8, Kentucky.

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

SELL Repeat item to all stores, gasstations, garages. Soldax, Hoosick Falls, N. Y.

SAWDUST Can put you in business—easily. 25c and secret yours. "Income," 1156 Greenfield Ave., Pittsburgh 17, Penna.

TOOL Men—Solder paddle sideline pays your expenses. All garages, body shops buy. Natural repeater. Fairwood Products, Station AA, Alliance, Ohio.

50,000 ARTICLES Wholesale. Source directory, dime. Nelko, Box 3462-DR, Chicago 54.

START A profitable subscription business in spare time! We need men and women (young or old) as representatives for all leading national magazines. Liberal commissions paid for new and renewal subscriptions. Start earning money in this pleasant work at once! Clip this ad and send with your name and address to: International Circulation Division, Dept. PM, Hearst Magazines Inc., 250 W. 55th St., New York 19, N. Y.

\$100-\$200 WEEKLY. No selling or manufacturing. Part or full time. Mahaffey, 3032-B Weldon, Los Angeles 65.

580 MONEY Making secrets, \$1.00. Book Service, P.O. Box 453, Port Chester, New York.

HOBBIES That make money. Free details. Cornell, 421 Ocean Ave., Lynbrook, New York.

TIE-Breaker picture puzzles exposed, \$1.00. Wenograd, Box 1495, Philadelphia 5, Penna.

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BE Appointed State Notary Public now! Details: Stationers, Helotes, Texas.

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PUBLISH Your own magazine. Handsome 52 page format, well edited, illustrated. Cost low as \$1.00 month. Brings you prestige, profits. 25c brings sample, details. National, Ord, Nebr.

READ Progressive Mailtrade, the magazine that tells how to make money by mail. Dime brings sample and special offer. Progressive Mailtrade, Box 357, Sheboygan, Wisconsin.

FORMULAS, PLANS, ETC.

REAL Manufacturing formulas. Lists free. Cummings, Chemist, Gordon Ave., Syracuse 4, N. Y.

112 FORMULAS \$2.00. One- and two-ingredient. Sensational Disinfecto formula, sample and plan included. Pharmacist, 750 East 225th, New York 66, N. Y.

ANY Formula \$2.00. Satisfaction guaranteed. Jack, Chemist, 4292 Parkside, Philadelphia 4.

ANY Formula \$1.00 or refund. Write Doctor Paul, 11559 Kling, North Hollywood, California.

FORMULAS; All kinds. Latest, best. Literature free. Kemixal, Park Ridge, Ill.

YOURS. Free catalog profitable formulas. Consultants, Box 201, Cincinnati 14, Ohio.

LATEST Manufacturing formulas, for profitable, easy to make chemical specialties. Lists free. Automotive Chemical Laboratories, Box 393-A, Hicksville, N. Y.

FORMULAS For big profit, fast-selling products. Free literature. Majestic, 530 1/2 S. Main, Elkhart, Indiana.

FORMULAS, Trade secrets, for nearly everything. Catalog free. Creative Publishers, Winnetka 6, Illinois.

TESTED Formulas. Interesting descriptive booklet free. Pont, Box 635-PM, Terre Haute, Indiana.

NEW Liquid casting plastic. Clear, colors. Embed flowers, insects, coins. Saw, drill, carve. Send 25c for wholesale catalog and new sales manual showing how to make money at home. Castolite, Dept. A-101, Woodstock, Illinois.

ACETATE, Cellophane, Plexiglas. Folders, specialties. Acetate assortment \$1.00. Major's, 3510-W Palmer, Chicago 47.

HI-Profits—Gifts, jewelry. Free catalogue, details. Pilot Plastics, 67-C, Fulton St., New York City 38.

STRIPKRAFT Plastics for profit. See our ad under "Home Craftsmen."

LEARN Plastics at home. Small cost, spare time. Dime brings sample plastic, three experiments, full details. Plastic Projects, Box 5151, Detroit 35, Mich.

LUCITE, Plexiglas. Any size sheets, masked. Square foot (12 x 12) cost, 1/16", \$1.20; 1/8", \$1.40; 3/16", \$1.75; 1/4", \$2.08. Include 10% postage. Almac Plastics, 230 Fifth Ave., New York 1, N. Y.

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

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OH Boy! New book of science. Experiments, formulas, secret processes, together with catalogue of laboratory supplies, only 25c. National Scientific Company, Dept. 16, 2204 North Avenue, Chicago 47, Illinois.

SAVE Money! Supplies catalog 15c, refundable. Laboratory Sales, Box 161-A, Brighton, Mass.

CHEMICALS And apparatus for industrial, analytical, and private laboratories. Catalog 20c. Dept. M-50, Biological Supply Co., 1176 Mt. Hope Ave., Rochester 20, N. Y.

CATALOG Of chemicals, apparatus, kits, minerals, uranium ore, 10c. Rex Laboratories, 2849-A Birchwood, Chicago 45, Ill.

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SPECTROSCOPE For quick chemical analysis \$3. Kutting Sons, Los Altos, Calif.

NEW Idea chemical and apparatus outfits for home experimenting. Photo-scales, microscopes, chemicals, biological and laboratory supplies in small quantities. Catalog 25c. Established 1931. John H. Winn, 124A West 23rd Street, New York, N. Y.

ILLUSTRATED Catalog: Chemistry, mineralogy, biology. 10c. Tracey Laboratories, Evanston, Illinois.

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TIRED Of no money, second rate jobs? Like to start a real career with a lifetime of high salaries? Write me about two growing fields that really need men. Ed. Howes, Chief, 456 W. Santa Barbara Avenue, Los Angeles 37.

AGENTS WANTED

PHOTO-Salesmen, agents. Sell beautiful hand colored plastic enlargements and sensational new photo compacts, rings, bracelets, lockets, etc. Collect deposit, we deliver. Profitable sideline. Send card, for free sample kit. Novel Portrait Co., 3343 North Ave., Chicago, Ill.

MEN! You can make a fortune if you join us now. We are introducing Kantlash. Greatest fishing equipment accessory ever manufactured. Sales already pouring in. We want distributors immediately! Retails \$2.95. Big, easy profits. Write today! Kantlash, Evanston 7, Illinois.

ALL-Occasion greeting cards that are such terrific sellers all you have to do is show them. 21 boxed sell for \$1.00. Over 100 other wonderful boxes including birthday, get-well, etc. Profits to 100% plus bonus. Write for free samples. Kit on approval. Regal Greeting Card Co., Dept. 34, Ferndale, Michigan.

ABSOLUTELY Free! Big package actual sample fabrics and style presentation of dresses, lingerie, hosiery, etc. Take orders. Commissions big. Send no money. Melville Co., Dept. 6616, Cincinnati 25, Ohio.

I'LL Put a "shoe store business" in your pocket! Nation's leader trains you to make big money! Fit men, women. Free sample outfit. Write today! Consolidated Shoe System, Dept. C1-98, Chippewa Falls, Wis.

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

MAKE Money fast—Sell big value greeting cards. Four new 21 card \$1.00 all-occasion assortments, birthday, Easter, novelty cards. Gift wrappings, stationery, notes. Unusual gift items. Over 100 fast-sellers. Amazing profits. Write for samples on approval and "get-started" plan. Hedenkamp, 361 Broadway, Dept. PM-17, New York.

BE A money maker. Use your home as magazine headquarters. Liberal commissions. No experience—No capital needed. Everything furnished. Write for free catalog. McGregor Magazine Agency, Dept. 500A, Mount Morris, Ill.

DO You need money? \$40.00 is yours for selling only 50 boxes of our 300 greeting card line. And this can be done in a single day. Free samples. Other leading boxes on approval. Many surprise items. Experience unnecessary. Free samples personalized stationery, napkins. Write today. It costs you nothing to try. Cheerful Card Co., 425 White Plains, New York.

MAKE Money introducing world's cutest children's dresses. Big selection adorable styles. Low prices. Complete display free. Rush name. Harford, Dept. G2341, Cincinnati 25, Ohio.

WHOLESALE Deal. Power mowers. Extra profit. Sell other dealers. Rotacut-PM, Excelsior Springs, Mo.

SELL Amazing value greeting cards—For less than 5c each. Show friends, neighbors gorgeous box assortments. Experience unnecessary. Big profits. Bonus. Surprise gift offers. Request feature all-occasion assortments on approval, free samples name imprinted stationery, napkins, towels and free catalog. New England Art Publishers, North Abington 604-D, Mass.

CALENDARS, Advertising novelties, matches. All styles, including religious, varnished. 12 sheet, girls. Hundreds of advertising novelties, book matches, etc. Fleming Calendar Co., 6539 Cottage Grove, Chicago 37, Ill.

MAKE Money calling on friends. Show nationally advertised greeting cards—New all-occasion assortment and laugh-packed barrel-of-fun. Also sensational pinafores and parasols personal notes. All three dollar sellers. Up to 50c profit for you. Big line, includes gift wrappings, stationery, gift items, etc. Get three assortments on approval. Write Wallace Brown, 225 Fifth Ave., Dept. G-4, New York 10.

SELL New automatic floor waxer. Retail \$2.95. Profit 125%. Write J. Smith, Inc., Greenfield 35, Mass.

SELL Sunshine exclusive everyday cards and make big money the easy friendly Sunshine way. Complete selection greeting cards, stationery, gift wraps, novelties, etc. 21 deluxe miniature everyday cards—75c. Many others. Send postcard today for your Sunshine sample kit on approval to: Sunshine Art Studios, Dept. PM-1, 115 Fulton St., New York 38, New York.

"FOG-Stop" Windshield cloth. Instantly removes blurry mist, frost, sleet, snow. Stops windshield fogging. Samples sent on trial. Kristee, 140, Akron, Ohio.

NEED Extra cash?—Get it selling Blair's unusual line of household and food products. Every housewife a prospect. Send for samples free. Write Blair, Dept. 31HA, Lynchburg, Va.

DOUBLE Edge blades \$7.50 1,000 post-paid. Agents wanted. Schmieder, 1402 Cass St., Saginaw, Mich.

QUALITY Merchandise wholesale, small lots. Warren Wallace, Kittell Road, C, Fayetteville, N. Y.

NAMEPLATES For homes, desks, etc. Free sample. Whitney Co., West Springfield 22, Mass.

WHOLESALE Catalogue free! Appliances, cameras, watches, etc. Cam Company, 1717—58th, Brooklyn 4, N. Y.

FREE Samples, and amazing plan, giving you gorgeous dress without penny cost. Rush name today with dress size. Harford, Dept. G-235, Cincinnati 25, Ohio.

"NEW Products and Services." 600 products, 80 pages, 75c postpaid. Max Saltzman, 748 East 179 Street, Bronx 57, New York.

BUY Wholesale—25,000 items. Catalogue 25c. Matthews, 1472-B6 Broadway, New York City.

CALIFORNIA Sweet smelling beads. Sensational sellers. Free particulars. Mission, 2328PM West Pico, Los Angeles 6, Calif.

AT Last! Something new and sensational in everyday cards, 21 for \$1. Make extra money fast! Show satin, velour, metallic cards. Get orders easy. Big line \$1 assortments, scented stationery, personal matches, kiddie books. Imprints free. Two \$1 boxes on approval. Puro Co., 2801 Locust, Dept. 240-A, St. Louis 3, Mo.

PLASTIC Party demonstrators, 300 household items. Free catalog. Esty, 888A River, New York 52.

3c SIGNS! Samples 25c. McConnell, 1051 North Main, Akron 10, Ohio.

SELL Beautiful chenille flowers and novelties. Free catalogue. Midwest Supply Co., Box 2193, Casper, Wyo.

MAKE Wedding profits. Sell invitations, napkins, matches. Samples free. Dunbar's, Middlebush 3, N. J.

"DRY" Wallpaper cleaner. No messy liquids. No sticky "dough." Simply wipe wallpaper, painted walls. Samples sent on trial. Kristee 141, Akron, Ohio.

SPILL-Proof baby feeding cups and dishes—Ideal for training baby to feed itself. Sell fast to every young mother. Excellent gifts. Good profits—full or spare time. Details free. Write Keeler Products, 1703-K North Albany, Chicago 47.

MEXICAN Feather pictures. Sell on sight; 200% profit! Free details; sample 10c stamps. Sylvia PT, Apartado 9036, Mexico City.

LUNCH Counter game. Gigantic profits! (Skill.) Start route. \$59.40 dozen, samples \$7.50 each, prepaid. Industries, 15, Box 929, Long Beach 1, Calif.

MEXICAN Feather pictures. High profit! Fast sellers! Adelphi, Box 57-B, Belle-rose 6, N. Y.

\$50 WEEKLY Selling finest razor blades, other items. Free details. Edisons, Box 274, Far Rockaway, N. Y.

EMBOSSSED Business cards, lowest prices. Velazquez, 696-P Elton Avenue, New York 55.

MEXICAN Feather pictures, unusual novelty, \$1.00 (stamps) brings \$2 worth samples. Refunded if unsatisfied. Aztec Art, Apartado 762, Mexico City.

BIG Profits, fast sales with 7 sensational new items! Free samples! Durever, 2781-D Atlantic Avenue, Brooklyn, N. Y.

\$60 RING And valve job for \$6.00—While you drive! Guaranteed for life of car! Increases mileage, stops oil pumping. Patented. Nerlino, Box 7, Inglewood, Calif.

NEED Money? \$50-\$100 and more is yours—easily, pleasantly, quickly. In spare time just show friends irresistible Elmira assortments of all-occasion greeting cards, wrappings, personalized stationery, napkins, matches, many other exclusive, profitable specialties. No investment. No experience. Success assured. Bonus. Special prizes. Promptest service. Write today. Free samples, assortments on approval. Elmira Greeting Card Co., Elmira 109, N. Y.

3 BILLION Greeting cards bought yearly. You can cash in on this million dollar market. Make 100% profit easily with Fanmour greeting, imprint stationery, napkins, gifts. Complete selling outfit on approval. Fanmour Corp., 200 Fifth Avenue, Dept. PM-1, New York 10.

BUY Wholesale thousands nationally advertised products at big discount. Sent free "The Wholesale Plan." American Buyers' Service, 629-P Linden, Buffalo, N. Y.

WORLD'S Best hair dressing! 100% profit! Won't rub off on upholstery, etc.! Good repeater. Everyone wants it. Sample, details free. Hikell Products, 1220 Burbank Blvd., Burbank, Calif.

HUGE Profits. Assemble rhinestone jewelry. Sample kit \$1.79. Sells for \$6.50. Giant 56 page idea packed wholesale cat. only 25c. House of Hobbies, Box 790B, Evanston, Ill.

SELL Perfumes. Sample outfit furnished. Tropical, Box 5652, Chicago, Ill.

"GLASS Tabs." Amazing new discovery. Small tablet dropped in water makes 1 quart glass cleaner. Whirlwind seller. Quick repeater. A gold mine for profit. Exclusive territory. Write immediately.

ULTRA-Blue stock signs—7c, sell 50c. 2000 slogans, 7" x 11", comedy, religious, general. 15 samples, \$1.00. Lowy, 812 Broadway, Dept. 646, New York 3.

NYLONS! New! Fancy heels! Guaranteed! Earn \$1.00 box. Roma Hosiery, 833 Columbus Avenue, New York City.

MAGIC Words give you daily cash! "Kendex nylons are free unless satisfactory." New style 300 only 98c including your commission, bonus and postage. If these wonderful sheer DuPont nylon stockings run, snag or are not satisfactory within 1½ months of receipt, we refund the full 98c so they will cost nothing! What woman will hesitate to wear fine nylons at our risk? Just write orders. We deliver and collect. Advance cash plus huge bonus. Spare or full time. No experience necessary. Postcard brings you sample stocking and money-making outfit free and prepaid. No obligation. Kendex Corporation, Babylon 43, N. Y.

\$500 MONTHLY Possible. Free catalog. Bava, 3655 E. Canfield, Detroit 7, Mich.

BIG Profits selling ties. (\$2.00 values) \$6.50 dozen. Free catalog. Empire Cravats, P648 Broadway, New York 12.

AMAZING Miracle auto polish—Plastone! New scientific discovery contains pure Carnauba wax, genuine plastic plus silicones! Sensational money maker! Nationally advertised! Sold by leading firms. Used by America's largest organizations. Only \$1 retail. 100% profits. Sales experience unnecessary. Exceptionally easy sales. High repeat sales. Choice protected territories. Once in a life time opportunity for large steady earnings. Only limited number of agents accepted. Write today. Plastone Company, 2950 W. Grand, Dept. PM-1, Chicago 22, Illinois.

PRINTING—Salesbooks, envelopes, tags. Free illustrated catalog. Ersco, Bronx 72, N. Y.

SCHOOL Seniors! A postal will bring you our wonder, Kwick-Sell Cardalog of popular graduation name cards. Biggest profits! Only firm giving free Golden Memory Book and Souvenir Chest. Don't miss out. Hurry that postal! Craftcards, Box 235L, Pittsburgh 30, Penna.

YOUR Own business—Used overcoats 50c; mackinaws 34c; shoes 12½c; ladies' coats 30c; dresses 10c. Enormous profits. Catalog free. Moro, 558-AA Roosevelt, Chicago 7.

SCHOOL Seniors—Earn sensational profits selling classmates America's most beautiful graduation name cards. Largest selection. Outsells all others. Free sample kit. Printcraft, Dept. M, 1425 E. Elm St., Scranton 5, Penna.

NEED Extra cash? Take orders for personal initialed belts and buckles, cap badges, tie holders, etc. Choice of 3000 emblems. Free sales kit. Hook-Fast, Box 1425PM, Providence, R. I.

EXCELLENT Sideline for printing and advertising salesmen. Decalomania name plates in small quantities. Great demand. Also, make money with our line of automobile initials and sign letters. Free samples. "Ralco" XL-Roxbury, Boston 19, Mass.

AGENTS: Stamping names on key protectors. Sample 25c. Stamping outfits, checks, social security and name plates. Hart Mfg. Co., 303 Degraw St., Brooklyn, N. Y.

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

WANTED—Purchasing agents. No money or experience required. Write Dept. C, Purchasing Manager, 2719 Lawrence, Chicago, Ill.

SELL Big money-maker to men and women. Easy handwork makes fast-selling useful articles. Sunmade Company, Brockton 64, Mass.

GOLD Lacquered and silver sign letters. Windows, doors, trucks. Standard sizes. Penny each. Free samples. Atlas-P, 544 West 79th, Chicago 20.

SALESMEN, Distributors, fast selling costume jewelry direct from factory. Big picture catalog, free. Pickcraft, M19 Bank, Attleboro, Massachusetts.

DRESSES, Used 18c; Coats \$2.00, blouses 35c. Free catalog. Crown, 164-P Monroe Street, New York.

GET Into million dollar work clothes business! Earn big money now, unlimited future! Sell finest-quality, embroidered uniforms and work clothes to factories, garages, service stations, lumber yards, everybody! Huge profits possible. No experience needed. Gorgeous selling kit, actual fabric samples, everything free! Write Topps, Dept. 531, Rochester, Ind.

UP To \$50.00 in a week spare time and tailored suit for yourself without paying one cent. Write for plan and free sample case. Progress Tailoring Company, Dept. B-217, 500 S. Throop, Chicago 7, Ill.

ANYONE Can sell Hoover DuPont nylon uniforms for beauty shops, waitresses, doctors, nurses, others. In white and colors. Exclusive styles. Top quality. Low priced. Exceptional income. Real future. Equipment free. Write fully. Hoover, Dept. A-100, New York 11, N. Y.

ADVERTISING Book matches—Cash in on big demand; sell union label matches. Cuts for all businesses and political parties. Free powerhouse selling kit, low prices, protection guaranteed on repeat orders. Cash commissions. Superior Match Co., Dept. 152, 7530 Greenwood, Chicago.

MAKE Money with fast-selling Bostonian shirts. Blouses too. Spare time, full time. Sales kit free. Bostonian, 89 Bickford, Dept. M-10, Boston 30, Mass.

SPARE Time—Full time. \$20.00 day easy in commissions working only few hours. No experience needed. Sell iron entrance railings to new home owners. Easily self-installed. Write: K. Jerome Co., 740 W. Superior, Cleveland 13, Ohio.

MAN To earn \$100 week up. Long needed invention. Advertised Saturday Evening Post, Colliers. Prospects everywhere. Full or part time. Exclusive. No investment. Free samples. Write Red Comet, Inc., Dept. 80-A, Littleton, Colo.

WANT To make real money? You can positively make \$50.00 a day and up selling a brand new item going to every type of food and beverage store, factories, laboratories, hospitals, etc. First time advertised. Write for free details today. Johnson-Hartmann, 53 West Jackson Blvd., Dept. PM-01, Chicago 4, Illinois.

TOOL Salesmen. Buy tool specialties wholesale. Catalog free. Mechanico, 3561 Lakeshore, Oakland 10, Calif.

TWO Little water squirts cleans windshields. Guaranteed. Sample \$2. Big profits. Free particulars. National, B552, Memphis 1, Tenn.

REPRESENT America's largest factory selling advertising pencils. High commissions. Attractive line. Send \$1.00 for pencil kit (refundable). Union Pencil Company, 389 Broadway, New York City.

"GLASS Tabs." Amazing new discovery. Small tablet dropped in water makes 1 quart glass cleaner. Whirlwind seller. Quick repeater. A gold mine for profit. Exclusive territory. Write immediately. Tennessee Supply Co., Greeneville, Tenn.

AMAZING Discovery, Master Glaze, puts brilliant glass-like surface on cars. Free sample, information. Big commissions. Master Glaze, Dept. 732, 7720 Harwood, Milwaukee, Wis.

AD Matches! Sell amazing designs—20, 30, 40 and 240-light book matches. Bigger spot cash commissions; every business a prospect. Low prices for high quality. Repeats. Start without experience; men, women; full, part time. Buy nothing! Sales kit furnished. Match Corp., Dept. PM-25, Chicago 32, Illinois.

RICH Opportunity for men in their 50's. Healthful, pleasant occupation. No investment needed. 150 of our men made \$500 to \$3,000 in one month; many just beginners. Heckman made \$104 first 2 hours! Crowley made \$224 first day; exceptional earnings. Openings available. Write President, Dept. PM, Box 711, Fort Worth 1, Texas. (If you live in Canada, write President, P.O. Box 88, Postal Station J, Dept. PM, Danforth, Toronto Six, Ontario.)

MAKE Money showing neighbors how to beautify yards with glorious flowering shrubs and trees. Quick-bearing dwarf fruit trees; world-famous Stark patented varieties produce abundant harvests champion-quality apples, pears, peaches, other fruits. Even small plots produce fruit for family-use and to sell. Beautiful sales kit free. Stark Bro's, Dept. 30182, Louisiana, Mo.

Show nylon, lingerie, men's socks with amazing free replacement guarantee against runs, snags, tears. Write for free sales kit. Group organizers invited. Rosalee Hosiery Co., Clifton 58, N. J.

NEW Jobs open in selling! Send name, address for five free issues of Opportunity Magazine's money-making guide, listing hundreds of companies who'll pay you well, full or part-time. No experience needed. Opportunity, 28 E. Jackson, Dept. 17, Chicago 4, Ill.

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MINERALOGY Course, \$5.00. Western School of Mineralogy and Mining Inc., Box 1130, Long Beach, California.

MEDICAL Laboratory technicians in great demand. We train you in your own home. Catalogue free. Imperial Technical Institute, Box 973-J, Austin, Texas.

START A collection agency business. Very profitable. Quickly learned. Write Cole & Associates, Syracuse 2, N. Y.

BOOKKEEPERS! Free! "What You Should Know About a Bookkeeping Service." James, Box 1281, Lubbock 2, Texas.

USED Correspondence courses and books sold and rented. Money back guarantee. Catalog free. Courses bought. Lee Mountain, Pisgah, Alabama.

BE A real estate broker through home study or classroom instruction. Write for free book. Approved for Veterans. Weaver School of Real Estate, Suite 300 Law Bldg., Box CP-1, Kansas City, Mo.

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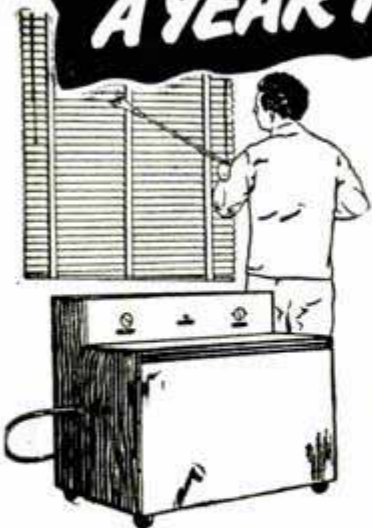
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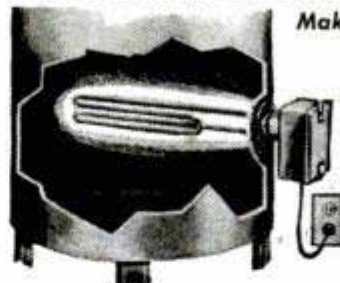
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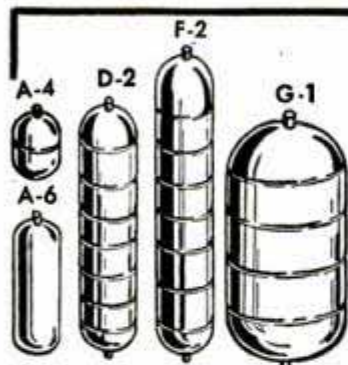
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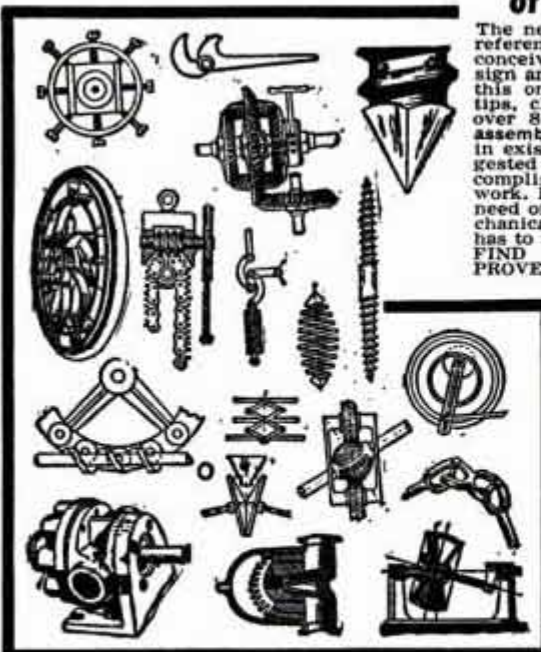
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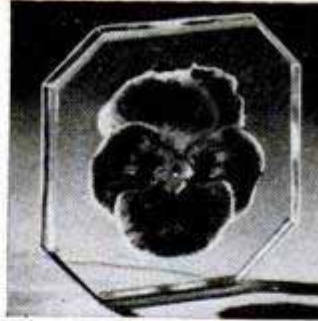
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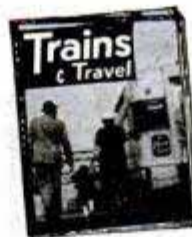
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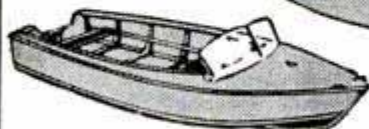
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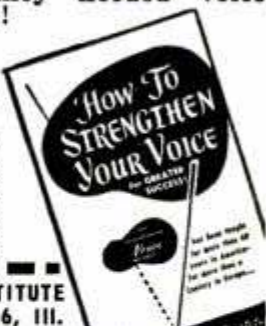
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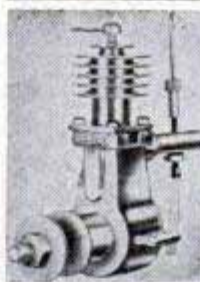
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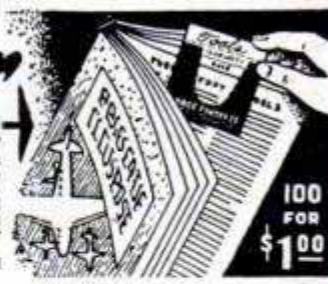
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Piston Ring Progress

1945



The life of tank and aircraft engines early in the North African campaign was measured not in terms of months, weeks, or days . . . desert heat and sand wore out cylinders, pistons and rings in a matter of *hours!* Prolonged efficient operation was a military necessity and it was achieved through the application of solid chrome plate to the piston rings.

1946-50



The experience with chrome under the most severe operating conditions was applied by Perfect Circle engineers to peacetime service in tractors and trucks. Improvements were made in ring design and plating techniques . . . astonishing records were established for economy, piston ring and cylinder life.

1951



The advantages of solid chrome plating on both oil and compression rings were then made available to car owners everywhere in the Perfect Circle 2-in-1 Set. And, to assure peak performance regardless of cylinder condition, two springs were supplied with each oil ring . . . normal pressure, for new, rebored, or slightly worn engines . . . HiPressure for badly worn engines or known oil pumpers.

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PISTON RINGS

The Standard of Comparison



Fifty Years ago this month the first issue of *Popular Mechanics* made its appearance. It was an innovation in magazine publishing. For the first time, it presented in simple language and with graphic illustrations the progress of mechanics, science and discovery.

Between that first issue and this, the Golden Anniversary issue, *Popular Mechanics* has been privileged to record and report a half century unmatched in history for dramatic achievement in science and industry and human welfare. It seems appropriate, therefore, that on this occasion we should not only look forward but look back as well over the stirring events of our lifetime.

To help us in this genuinely important task, some of the men whose greatness has enhanced all civilization have contributed to this issue. We are proud to present them to you. After reading their messages, I am sure you will join with us in finding new faith and confidence that human destiny will surmount all obstacles and that in the years ahead civilization will reach new heights.

Editor and Publisher

THE WHITE HOUSE
WASHINGTON

August 2, 1951

Dear Mr. Windsor:

I am pleased to congratulate Popular Mechanics Magazine upon its Fiftieth Anniversary.

America is known through the world for its mechanical genius, and I am glad that translations of your magazine are available in various foreign countries.

America's mechanical genius has played an important part in raising the standards of living and in assuring victory in war. Our hope today is that this warranty will continue to improve our standard of living on the one hand and make us so strong on the other hand that the threat of war will be ended forever.

I realize that your publication is limited to the mechanical field. However, I think America ought to be even more famous for the ideals which have made our lives worthwhile. Invention can be helpful in preserving our freedom, but it is freedom that is the goal without which invention may not be worthwhile.

Very sincerely yours,

Mr. Henry H. Windsor, Jr.,
Editor and Publisher,
Popular Mechanics Magazine,
Chicago, Illinois.

Los Pinos, D.F. a M.
de septiembre de 1951.

Correspondencia Particular
del Presidente de los
Estados Unidos Mexicanos

Señor H. H. Windsor Jr.
Popular Mechanics Co.
Chicago, Ill.- E. U. A.
Muy señor mío:

Me es grato felicitar a usted y unirme a su regocijo y al de esa Institución, al celebrarse el Aniversario de Oro del POPULAR MECHANICS MAGAZINE, que ha llegado a sus cincuenta años de vida, desarrollando una encomiable labor de difusión y cultura entre el público de habla inglesa.

Asimismo, me es muy satisfactorio presentarle mis -- congratulaciones con motivo del Quinto Aniversario de MEXANICA POPULAR, la versión en Español, que ha venido a traer a México y en general a los países Latino Americanos, una magnífica información que los mantiene al día sobre los últimos adelantos en esa multitud de pequeños conocimientos en que se basa el saber y desarrollo de los pueblos.

Ruego a usted que haga extensivas mis felicitaciones a todos y cada uno de los elementos de esa Editorial, cuya labor en conjunto es tan meritoria, al elevar en forma práctica el nivel cultural de los pueblos.

Salúelo cordialmente.

Translation of letter from President
Miguel Aleman of Mexico:

"It is a pleasure to congratulate you upon the Golden Anniversary of Popular Mechanics Magazine and to join in your celebration of fifty years of publication devoted to such praiseworthy diffusion of knowledge among the English-speaking public. At the same time, it gives me great satisfaction to add my congratulations on the Fifth Anniversary of MEXANICA POPULAR, the Spanish edition, which is providing Mexico, and Latin America in general, with a wonderful source of information which keeps them up-to-date on the latest advances of that multitude of facts upon which the knowledge and progress of peoples depend. I beg you to extend my congratulations to each and every member of your company who is performing the meritorious duty of elevating in practical form the cultural level of nations."

The Waldorf Astoria Towers
New York 22, New York
August 5, 1951

My dear Mr. Windsor:

Please accept my sincere
congratulations on the occasion of
this fiftieth anniversary of Popu-
lar Mechanics Magazine.

The vital contribution
your publication is making in the
field of scientific journalism is
most praiseworthy. May your or-
ganization continue to grow and
prosper.

Yours faithfully,

Mr. Henry H. Windsor, Jr.
Editor and Publisher
Popular Mechanics Magazine
Chicago, Illinois

LE PRÉSIDENT
DE LA
RÉPUBLIQUE

Les progrès chaque jour accélérés de la
science et de la technique ne valent que dans la
mesure où ils servent l'Homme et la Société.

Il importe donc non seulement d'informer
et d'éclairer un public de plus en plus large sur les
possibilités nouvelles qui lui sont offertes d'améli-
orer ses conditions d'existence mais encore de mettre
à sa portée, d'une manière pratique, accessible à tous,
les inventions - même les plus modestes - qui contri-
bueront à accroître son bien-être.

Translation of statement by
Vincent Auriol, the President
of France:

"The ever-accelerated prog-
ress of science and technol-
ogy is only valuable in the
measure that it serves man-
kind and society. Therefore
it is important not only to
inform and educate an ever-
growing public about the
new possibilities offered to
them for improving their
standard of living but also to
place within their reach in a
practical form, understood
by everyone, the new inven-
tions—even the most modest
ones—that contribute to their
welfare."

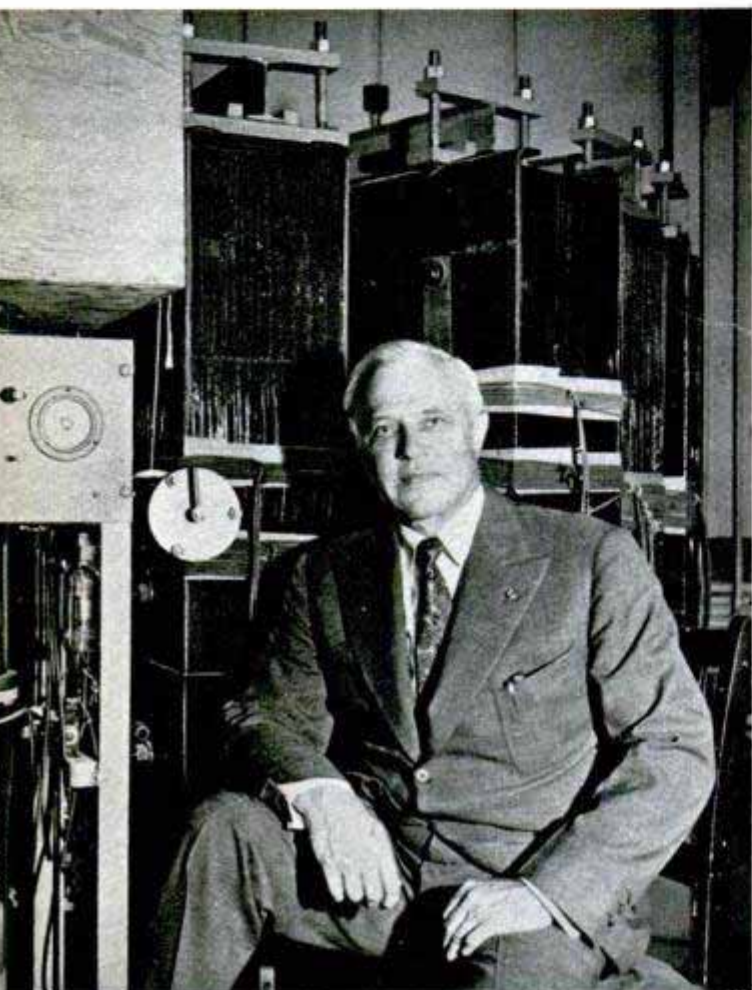
SCIENCE ON

By **Dr. Karl T. Compton**
Chairman of the Corporation,
Massachusetts Institute of Technology

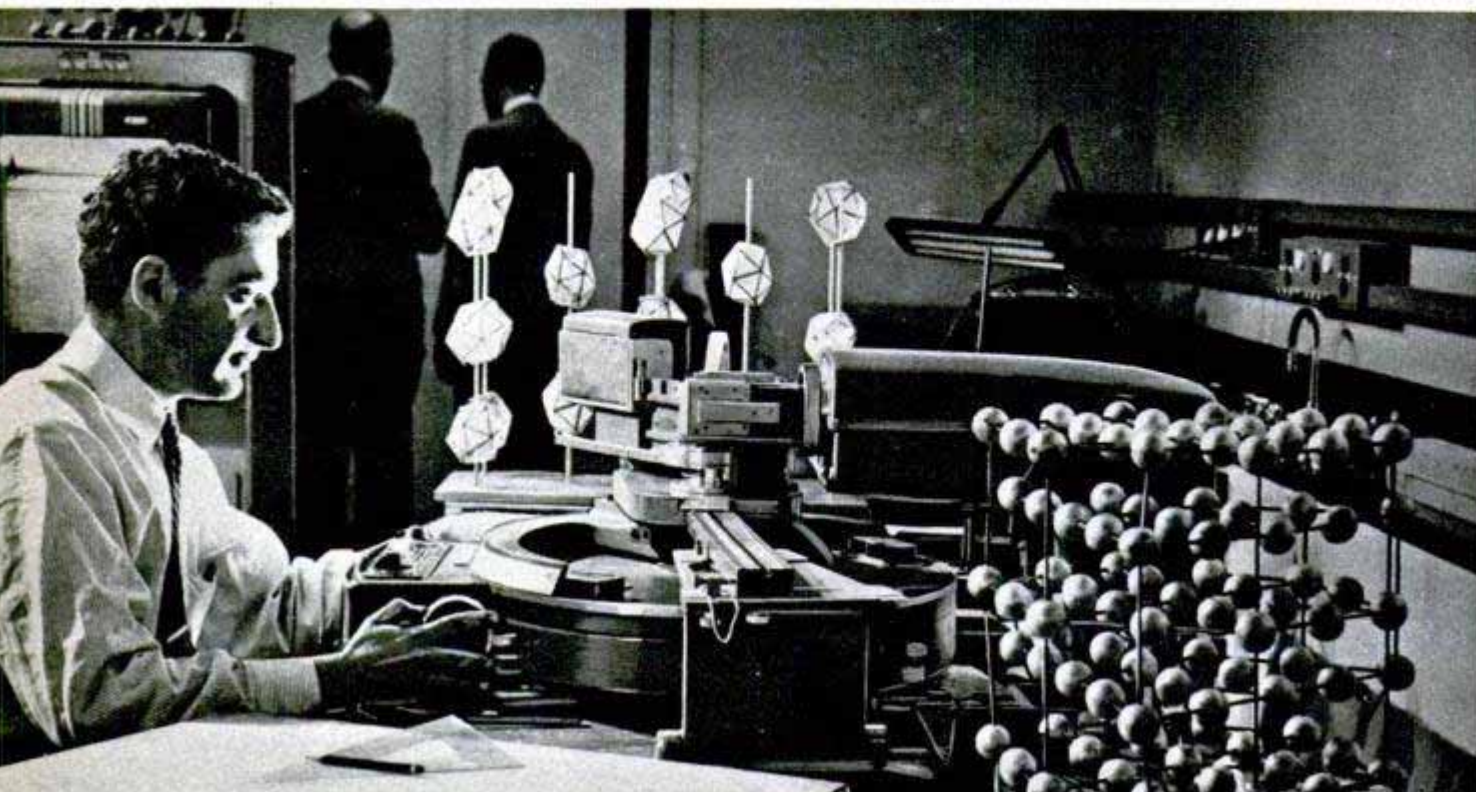
THE AMERICAN TRADITION of mechanical skill and inventiveness, often called "Yankee Ingenuity," goes far back of the turn of this century. It grew out of the challenge of pioneer life to a people of high native intelligence engaged in forging a new way of life in an environment of rich but undeveloped resources. But our development of scientific knowledge and its useful applications is, despite a few notable predecessors like Benjamin Franklin, Joseph Henry and Thomas Edison, essentially an achievement of the last 50 years.

During the last five years of the preceding century, three epoch-making scientific discoveries had been made in Europe: X rays, radioactivity and electrons. As we shall see, these underlie much of the enormous scientific progress since that time. But first look at some of the general indices of scientific progress.

Fifty years ago the American Association for the Advancement of Science, with which are affiliated practically all the professional scientific groups, had a total membership of about 1900; today this membership has grown to 46,000. The first edition of *American Men of Science*, in 1906, contained the biographies of 4000 scientists;



Dr. Karl T. Compton, noted physicist and educator, posed for this Anniversary Issue photo in an M.I.T. laboratory. Below, GE scientist studies crystals by measuring the angles at which they scatter X rays



THE MARCH

the latest edition, in 1949, contained 50,000.

In 1901, in an old barn in Schenectady, the General Electric Company established the first modern industrial-research laboratory. Its staff consisted of Dr. Willis R. Whitney and one assistant. Today there are some 2800 industrial-research laboratories, with aggregate staffs of at least 70,000.

I have been unable to locate any estimate of the national expenditure for research in the United States at the beginning of the century. The amount was probably too small to induce any agency to go to the trouble of assembling the figures. In 1920 it was about \$60,000,000. In 1930 it was \$166,000,000; in 1940, \$355,000,000; at present, certainly over \$2,000,000,000.

What are some of the influences which have contributed to this remarkable increase in America's scientific activity? Basically, it is part and parcel of the similar worldwide trend. Every investigator who starts out to study one problem finds a half dozen new ones. Every scientist who publishes the results of his research stimulates critical and constructive thinking about his subject by thousands of fellow scientists all over the world, and many of them take his work as their starting point for new discoveries. Every development of a new scientific instrument or method opens the way for its application in new areas by the entire scientific fraternity. Thus scientific activity proceeds in compounded geometric progression. But there have been several stimulating influences which have been particularly effective in the progress of science in America during the past 50 years.

The first of these influences was the departure from almost total dependence on the old European universities for postgraduate training in research. When I did

my postgraduate work in Princeton University in 1910-1913, I was one of the first substantial group of ambitious young scientists who sought their higher education in America, instead of going for it to Germany, England or France. To be sure, most of our professors had themselves been trained in, or imported from, Europe. But from about that date it became increasingly possible to secure in this country a quality of postgraduate education and indoctrination into the spirit and methods of research which was on a par with what had previously been available only to those few who had been able to seek them in Europe.

A second influence was the stimulus provided by the exigencies of war. We were then faced with the necessity of mobilizing every resource to meet and overpower a highly skillful and technically competent adversary. Scientists and engineers were mobilized in teams and their abilities were extended to the limit to develop methods for handling chemical warfare, control of artillery fire, the submarine menace, air combat, communications, new explosives and new materials for war production.

Balloons for cosmic-ray research are released at University of Chicago at scene of first atomic pile

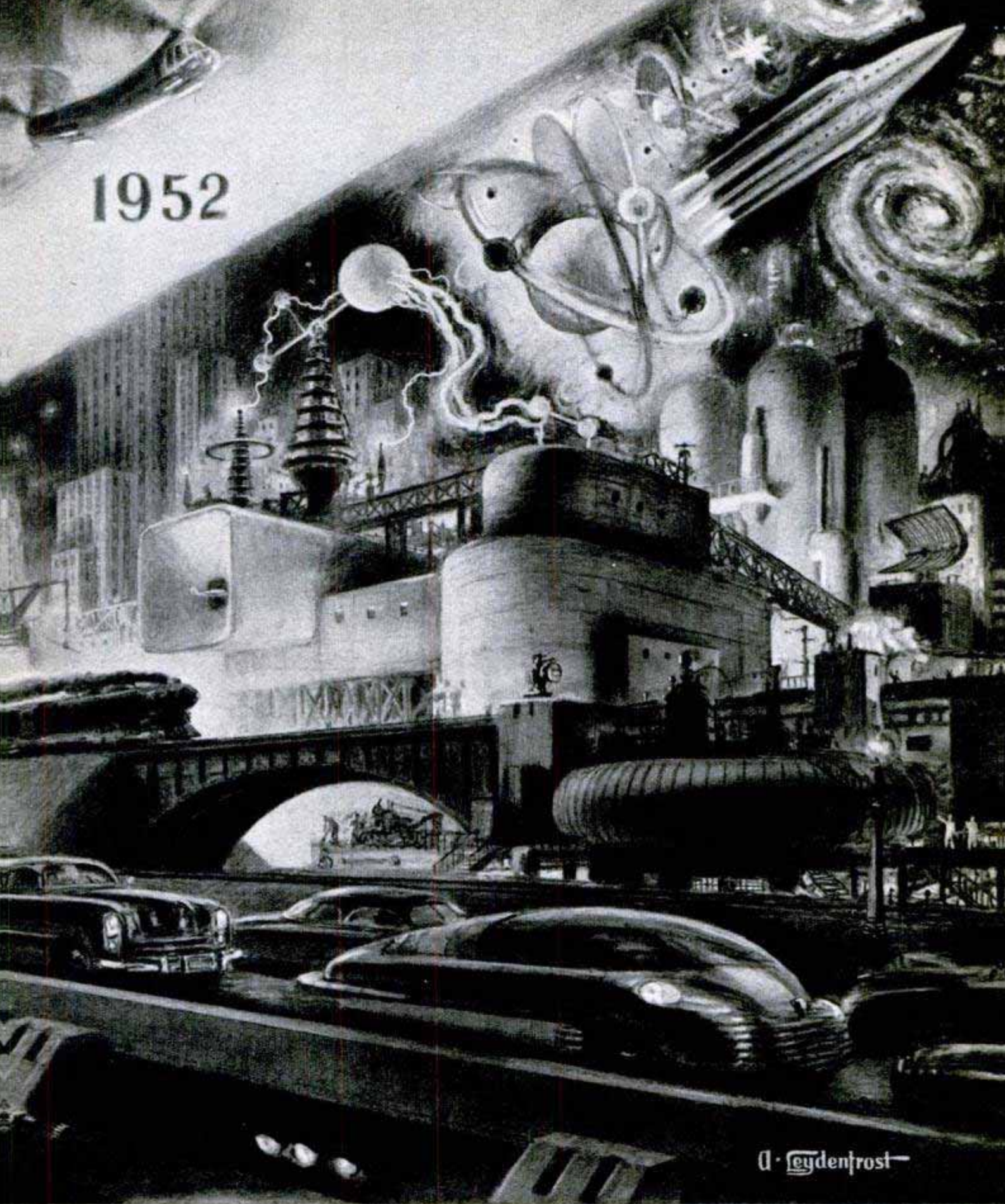


This symbolic drawing by A. Leydenfrost, the noted illustrator, traces the progress during *Popular Mechanics'*

To do these things, every resource of science and technology was drawn upon and further developed. The results were so strikingly important that, for the first time in our history, the public became convinced that science was a resource worth exploit-

ing for the national welfare as well as for the intellectual joy of discovery. The result was a significant increase in the prestige of science, and its financial support by government, industry and educational institutions. By and large, it can be stated that

1952



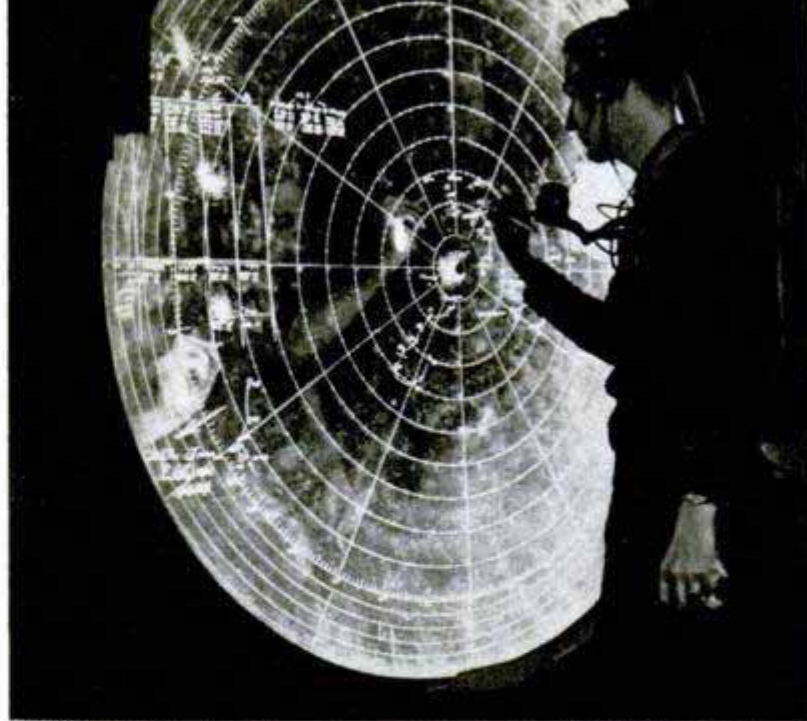
A. Leydenfrost

half century in the fields of mechanics and science. See explanatory chart of the drawing on page 125

the great development of American chemical industry dates from the World War I period.

This type of stimulation of systematic group attack on technological problems was even more pronounced during World

War II, with complete mobilization of the nation's scientific resources under the Office of Scientific Research and Development and the military departments. Guided missiles, radar, bombsights and fire-control instruments, penicillin and hundreds



Navy photo

The radar-plotting screen of an aircraft carrier. Compton points out that radar evolved from wireless

Left, a guided missile streaks skyward, steered by electronic controls developed in Bell Laboratories

of other developments culminating in the atomic bomb, are too freshly in mind to need comment. But the result of these successes is reflected in the great postwar movement to amplify still further the development of science and its applications for defense, industrial, agricultural and medical research. Recent evidences of this trend are the formation of the National Science Foundation and the doubling of the military appropriations for research and development. Other evidence is found in the strong support which many industrial corporations are now giving to scientific research and the training of research workers in our educational institutions.

One further important influence is the support given by the great foundations to the development of science through the education of outstanding young scientists. No small part of America's progress in aviation is due to the opportunities created by the Guggenheim laboratories for aeronautical engineering at a selected group of universities and engineering schools. The Guggenheim fellowships and research grants from the Carnegie Corporation and others have been very helpful. Most significant of all was the establishment in the early 1920s by the Rockefeller Foundation of a great program of postgraduate fellowships, on a nationwide scale, in the physical, biological and medical sciences. This kind of program was undertaken for the purpose of building up the strength of the country in pure science, since World War I had interrupted the normal educational program and had diverted many scientists

from their fundamental scientific fields into the work of practical applications. One proof of the effectiveness of this fellowship program is the very large proportion of the present heads of research organizations and university science departments, as well as the predominant leadership in World War II scientific work, supplied by former holders of these National Research Fellowships financed by Rockefeller.

With this background of the general progress of scientific activity during the past half century, especially in the United States, and of some of the contributing factors, we pass to the more specific consideration of major achievements. Whole libraries could be written, and have been written, on this subject. The story is told of a distinguished physicist of Oxford University whose large study is lined on all four walls with scientific books from floor to ceiling. A lady visitor, on being shown his study exclaimed, "Professor, how do you ever find time to read all these books?" He replied, "Madam, I don't read them. I write them." How can I hope to do justice to this subject in my few remaining remarks?

In August 1912, *Popular Mechanics* polled

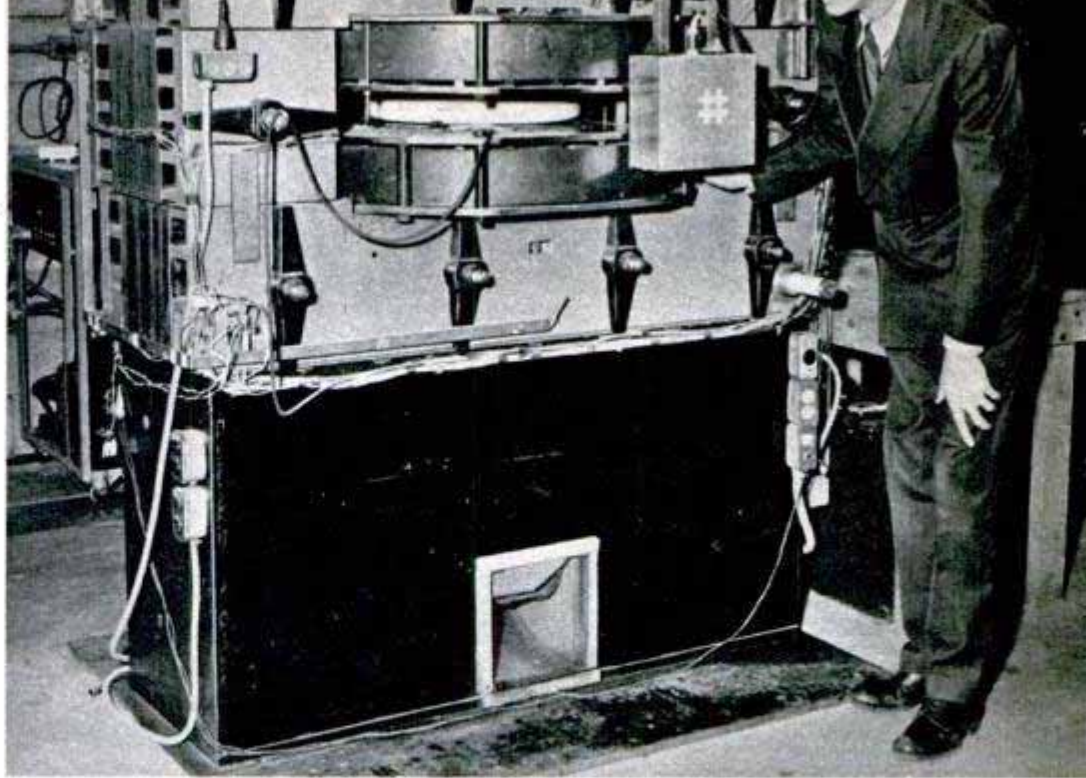


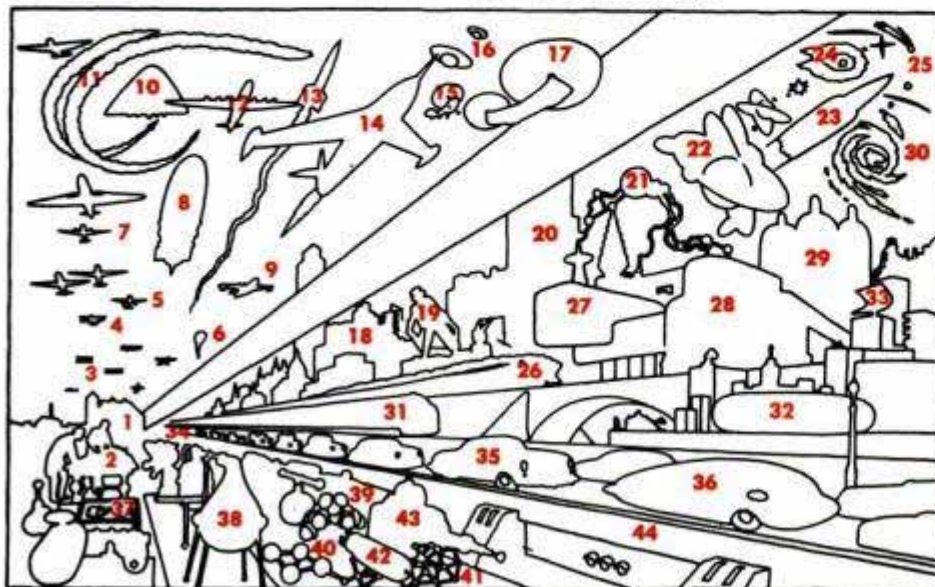
Photo courtesy of the University of Illinois
Dr. Donald W. Kerst, inventor of the betatron, inspects the 20,000,000-volt machine used in medical research for cancer. It reduces damage to tissue

nearly a thousand scientists from all over the world to select The Seven Wonders of the Modern World. In the order of votes cast, these were selected as wireless telegraphy, telephone, airplane, radium, antiseptics and antitoxins, spectrum analysis and X ray. In 40 years' retrospect, we can applaud the insight which then led to these selections, for much of scientific progress since those days has been by amplification of these scientific wonders.

Take, for example, the wireless telegraph
 (Continued to page 400)

CHART BELOW indicates symbolic advancements of the past 50 years depicted in the Leydenfrost illustration on pages 122-123: 1. G.E.'s first research laboratory located in a barn; 2. Early scientists at work; 3. Experimental biplanes and triplanes; 4. World War I aircraft; 5. First rigid-wing monoplanes; 6. Experimental balloon; 7. Two-engine plane; 8. Huge dirigible; 9. Flying boats; 10. Flying wing; 11. Jets; 12. Multiengine plane; 13. Experimental rockets; 14. Age of jet aircraft; 15. Helicopter; 16. Meteorological balloons (flying saucers); 17. Transport helicopters; 18. Dawn of steel building construction; 19. Astronomical instruments; 20. Skyscrapers; 21. Manmade bolts of lightning; 22. Atomic construction of matter; 23. Rocket ship; 24. Ring-shaped nebulae; 25. Comet; 26. Steam locomotive; 27. Wind tunnel; 28. Modern research laboratory; 29. Factory for synthetic products; 30. Spiral nebulae; 31. Diesel train; 32. Cyclotron; 33. Radar; 34, 35 and 36. Evolution of the automobile; 37. Laboratory rabbits; 38. Research in chemistry; 39, 40 and 41. Atomic composition of matter; 42. Electronic tube; 43. Instruments for electronic research; 44. Elevated concrete highway for high-speed traffic

KEY TO LEYDENFROST ILLUSTRATION



Aeronaut's Hair-Breadth Escape

By
Prof. Carl E. Meyers



That careful aerial navigation is not essentially dangerous is proven by the fact that I am before you today, alive and unharmed

—after a quarter century spent in aerial travels ranging over thousands of miles, twenty-one of these United States, the District of Columbia and the Canadas. During all this time the only real danger that I seem to have run was from a single possible collision between my airship and a railroad locomotive. I had made a flight with my skycycle from Pittsburg, Pa., in the presence of 300,000 spectators, gathered at one Fourth of July celebration when the temperature was 105 degrees in the shade on the ground. It was a great relief to get up in the cooler air, and the scene below me was the most wonderful of my experience, for three great rivers united beneath me, dividing a labyrinth of winding roads that circled the hillsides, making the whole territory visible as an enchanted landscape garden, flat as any map or mosaic. After I had strolled about in the air half an hour tracing the paths below me, I sought a safe

place for a landing, away from the mob, which would have destroyed me in their excitement had I landed in their midst. The only space clear from trees or people in my vicinity was the railroad track. I hovered close over it while two long trains met and passed, and then dropped just behind on the clear rails and began emptying my gas, when along came a wildcat locomotive with a terrible racket of bell and whistle and I almost lost my life through fright before I could hustle my half-empty gas spindle off the track. What would have happened to me and that careless locomotive had my wasting gas suddenly exploded I can't think.

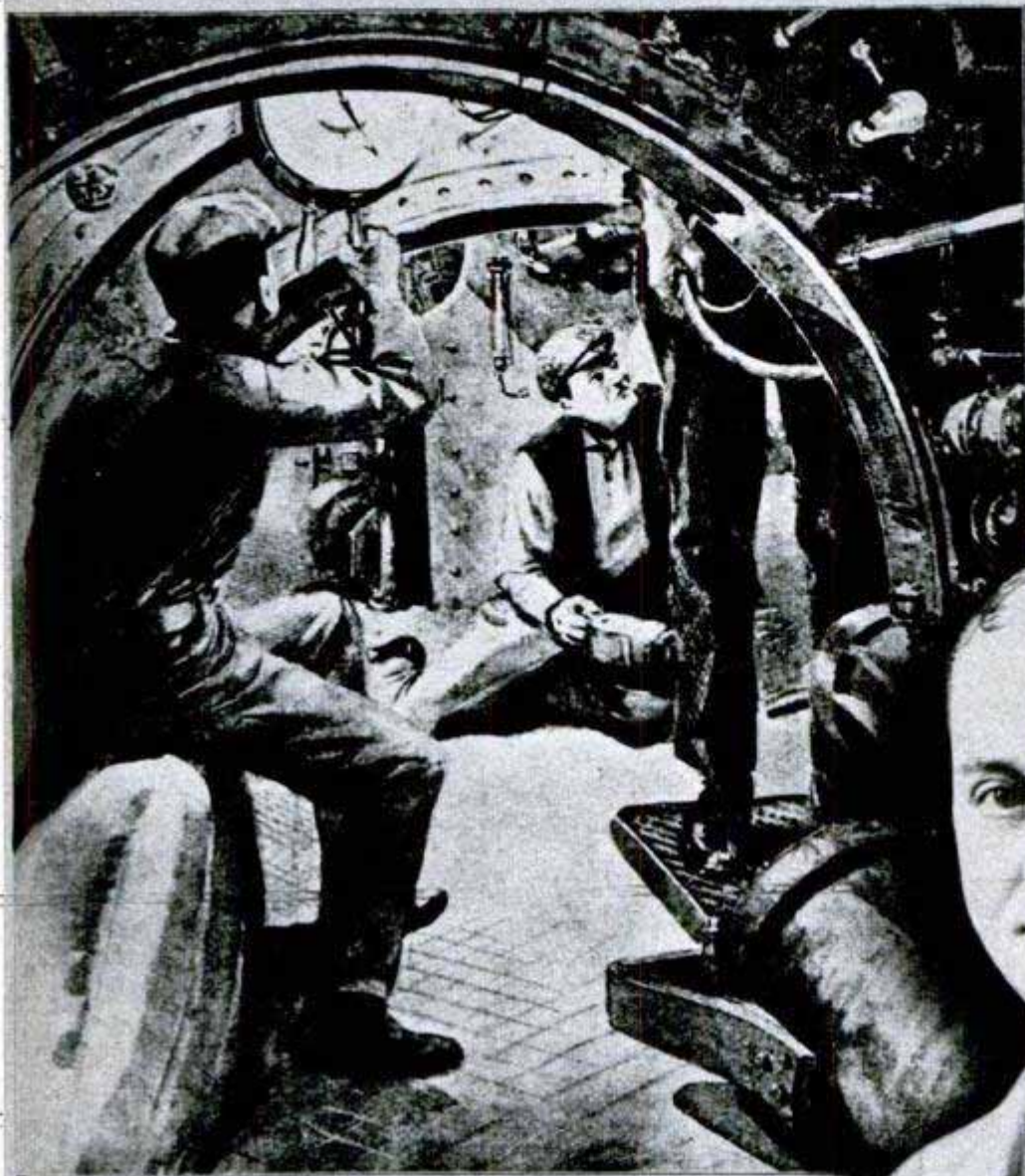
This is the only time in my high career that I have been "real scared," but at another time I nearly frightened to death a young Cannuck farm hand near Lewiston, Me., one November day when I landed in freezing weather and a 30-mile wind and the only person in sight ran away screaming when I called for help to check my skycycle. He ran into the farmhouse yelling, "Oh Lord, come quick, the devil is after me big as a house and talks like a man!"

America's First Railroad Track Built 100 Years Ago

1909—According to Frank H. Taylor of Philadelphia, the first practical railway track built in America was constructed in Philadelphia in 1809. At that time, remnants of the line of defenses erected against the rebel colonists by British troops in 1777 still remained, and here a civil engineer named John Thompson, and a Scotch millwright named Somerville, constructed a track of wooden rails while the staid citizens of Philadelphia looked on in amazement. The rails rested on sleepers eight feet apart and the roadbed had a grade of $1\frac{1}{2}$ inch to the yard. When completed, this experimental piece of railway track extended 180 feet. Upon this a car with grooved wheels was placed, and it was found that one horse could pull a heavy

load upon these rails with more ease than could several horses upon a wagon road. Thereupon John Thompson secured a contract to build such a line from a quarry to a river landing, 10 miles distant. This line, the first of its kind in America, was operated for 19 years, horses being the motive power. The son of this engineer, John Edgar Thompson, afterwards had an important part in the building of the early railroad lines which now form part of the Pennsylvania system, and later he became president of that corporation.

1905—Several railway systems are considering the installation of a wireless telegraph system for communication between moving trains and stations at large cities



INTERIOR FIRST SUBMARINE BOAT FOR BRITISH NAVY.

H. H. Windsor, founder of *Popular Mechanics*, and first issue of the magazine, Jan. 11, 1902

The Story of POPULAR MECHANICS

By **Wayne Whittaker**

Assistant Managing Editor

DURING THE LAST 50 years, the pages of *Popular Mechanics Magazine* have told the story of civilization's advance during the greatest half century of progress the world has known. It has been a tumultuous period with life revolutionized by the achievements of this challenging technical age. *Popular Mechanics* has not only reported but shared in the tumult and participated in the progress. It has grown from a handful of subscribers in 1902 to many millions of readers in 1952. It is known and read in every country of the world. Its

readers include the mighty and the humble, but they all share a devotion for this magazine that makes its editors ever respectful of their responsibility.

In these 50 years, *Popular Mechanics* has become an American institution.

Staff members of the magazine are constantly asked about the magazine: "How did it start?" "Where do you get all the varied material?" From the vantage point of 50 years, it seems proper to tell its story. It begins appropriately with its founder, Henry Haven Windsor, for it was he who

dreamed the dream that was to be fulfilled on January 11, 1902, when the first edition of *Popular Mechanics* was published. It had five subscribers and a few hundred newsstand buyers. And it was his faith during those difficult early years which overcame doubt and debt, disappointment and discouragement, to establish the magazine firmly as a part of the American scene.

He was born in a log cabin in Iowa, the son of a Congregational minister, the Rev. William Windsor, who had come West in a covered wagon. The Windsor family moved to Marshalltown, Iowa, when Henry was a small child. At the age of 12, the boy had acquired a printing outfit and was doing a flourishing business in handbills for local merchants. As he grew older his interest in printing, publishing and writing increased with every year.

After high school and Grinnell College, young Windsor went to work on the Marshalltown *Times-Republican* and soon became city editor. He learned about the "who, what, when, where and why" of a news story, about deadlines and some of the problems of printing a newspaper. He was born with an instinct to recognize what was newsworthy. He was born, too, with a burning ambition to edit and publish a

magazine of his own and he determined early never to be satisfied until that ambition was realized. His key to success was: Study.

Before coming to Chicago, Mr. Windsor spent a brief period in St. Paul, working for the Northern Pacific Railway. He came to Chicago in 1883 to accept a position with the Chicago City Railway, and in his spare time he founded the *Street Railway Review*. He also started a magazine called *Brick* for the building trades. You could not keep printer's ink off his fingers.

The years slipped by, and slowly his savings grew toward the realization of his dream. A new century dawned.

Windsor studied the magazines of the day and found them stodgy, particularly those in the mechanical and scientific fields, where his interest was strongest. With the new horseless carriage, balloon flights, telegraphy and all this talk about man trying to fly, he could see a mechanical age awakening. There was a great need, he thought, to tell the public about the interesting things developing every day.

One bright morning during the autumn of 1901, fortified with his life's savings and his never-failing courage, he determined that the time had come to start the magazine he had decided long before to call *Popular Mechanics*. Fortunately, in those days it did not take a huge fortune to start a national magazine.

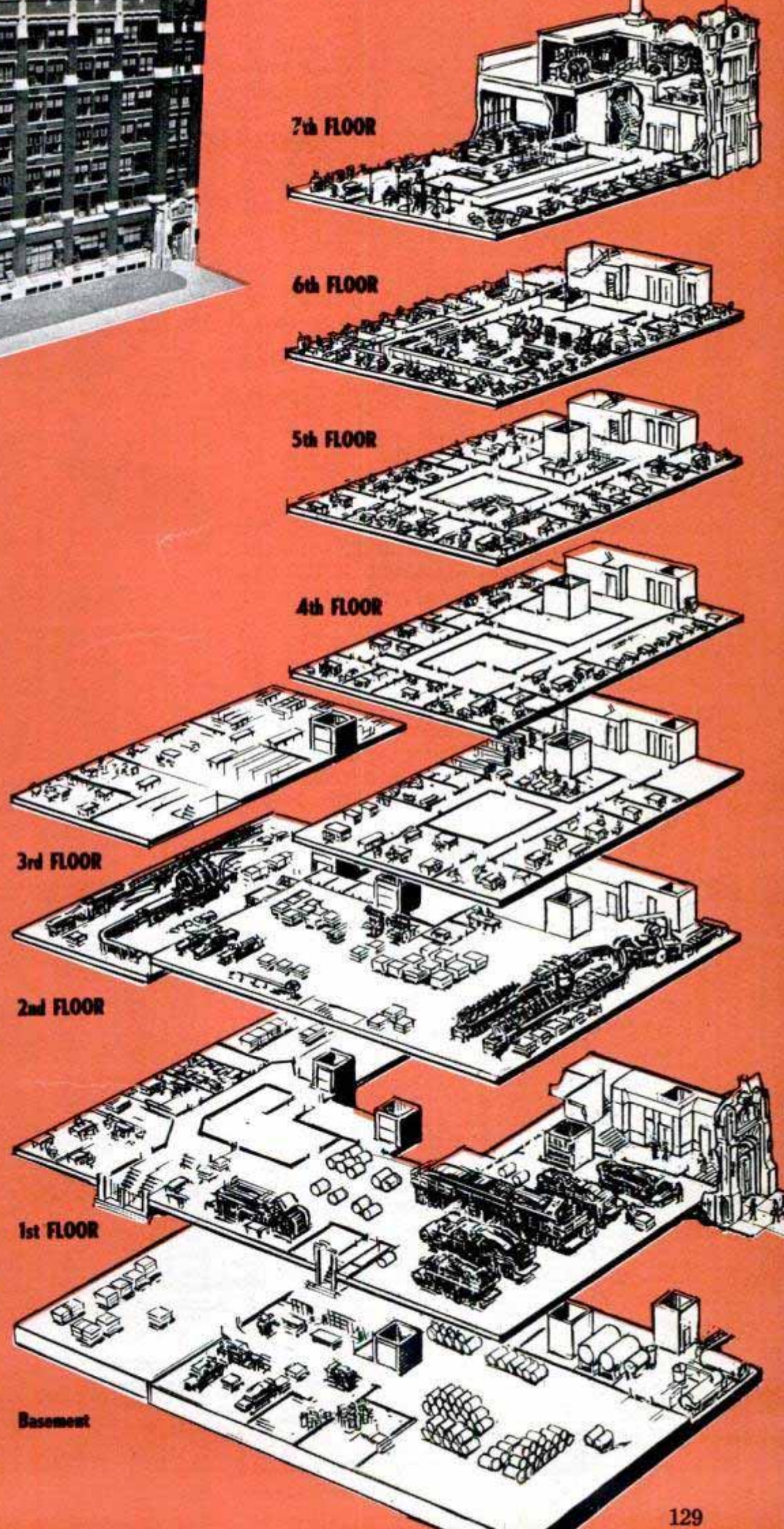
He promptly quit his job, rented an office in an old building on Washington Street

Magazine's top executives are H. H. Windsor, Jr., editor and publisher, seated beside his wife, Dorothy F. Windsor, vice-president and secretary-treasurer. Standing, H. H. Windsor III, left, and William Harrison Fetridge, right, vice-presidents of the corporation





The Popular Mechanics building in Chicago was specially built to house all activities of the magazine, including its printing. Drawing at the right shows (from bottom up) the basement where tons of paper are stored and location of small presses that print the Spanish edition; first floor is the pressroom where, for this anniversary issue alone, the modern high-speed presses printed over 400 million pages; at either end of the second floor is the bindery equipment with storage and mailing space in the center as shown; the third floor houses the advertising, subscription and the book departments; on the fourth floor are the executive offices, accounting and circulation departments; editorial department, bureau of information and the library are located on the fifth floor; the art department, the composing room, the photo studio and classified-advertising department are on six; on the seventh floor are a big photo studio, workshop, offices for the Spanish edition as well as for Science Digest, which is also published by Popular Mechanics Company



7th FLOOR

6th FLOOR

5th FLOOR

4th FLOOR

3rd FLOOR

2nd FLOOR

1st FLOOR

Basement

and hired a mail clerk. This, of course, was putting the clerk before the mail but he was positive there would be mail soon. Then he hired an experienced young bookkeeper, Miss Helen Elizabeth Toole, who obviously was not impressed with the small office of her employer. She agreed to try the job "for a few weeks." She stayed 45 years. Now retired, Miss Toole lives only a few blocks from the magazine plant in Chicago and still "keeps track" of the business.

"Those early days of the magazine were such a struggle," she said recently, "that I hate to think of them. That first week the magazine came out our subscribers barely outnumbered the three employees. It began as a weekly and sold for five cents. Mr. Windsor had scurried around and found a few advertisers and wrote the entire magazine himself.

"Then came years of losing money, with the loans dwindling away and the bills piling up. Many a time we could not meet the slender payroll, and with notes falling due it was a bookkeeper's nightmare. I was as positive that bankruptcy was just around the corner as Mr. Windsor was convinced that success lay just over the horizon. He was the most fearless and courageous person I have ever known. Frequently, late in the day he would pat me on the shoulder and say, 'Don't worry, Nellie, I'm sure some money will arrive in the morning mail.' His optimism was usually rewarded. Never once did he lose faith in the magazine."

Henry Haven Windsor knew his magazine idea was sound. *Popular Mechanics* was the first magazine to present mechanical and scientific material with a popular approach—in language that was easy to understand. In a day of highly technical writing, Mr. Windsor advocated simplicity and clarity. He coined the phrase "Written So You Can Understand It." It still is the motto of the magazine.

It was a revelation to the public that technical subjects could be handled in simple everyday words. Every issue of the magazine carried numerous photographs; in fact, the entire first page of the first edition was given to a picture of the interior of a British submarine.

Popular Mechanics became America's pioneer picture magazine. From its first issue it was national and international in scope. The magazine was dedicated—and still is—to happenings in the present and glimpses into the future, with hardly a backward glance. It ignores the political

The montage shows some of the many operations for producing *Popular Mechanics*. In upper-left corner are rolls of paper before a big press and at lower right is the finished product. Other scenes are from the art, photographic, editorial and composing rooms







Norman Guess, book manager, inspects an array of numerous books issued by Popular Mechanics Press and Windsor Press

covered Britain's first submarine, a new electric headlight for locomotives, an electric car that ran a mile in 63 seconds and the rapidly growing use of the telephone (2,278,717 installations) in the U. S. Another up-to-date item told of the startling innovation of telephones being installed in every room at Chicago's Auditorium Hotel. For the craftsman there was the beginning of a series, "Elementary Studies in Electricity," ar-

and the controversial and through the years has been a show window of the American way of life, reporting man's accomplishments in the fields of mechanics, science and discovery.

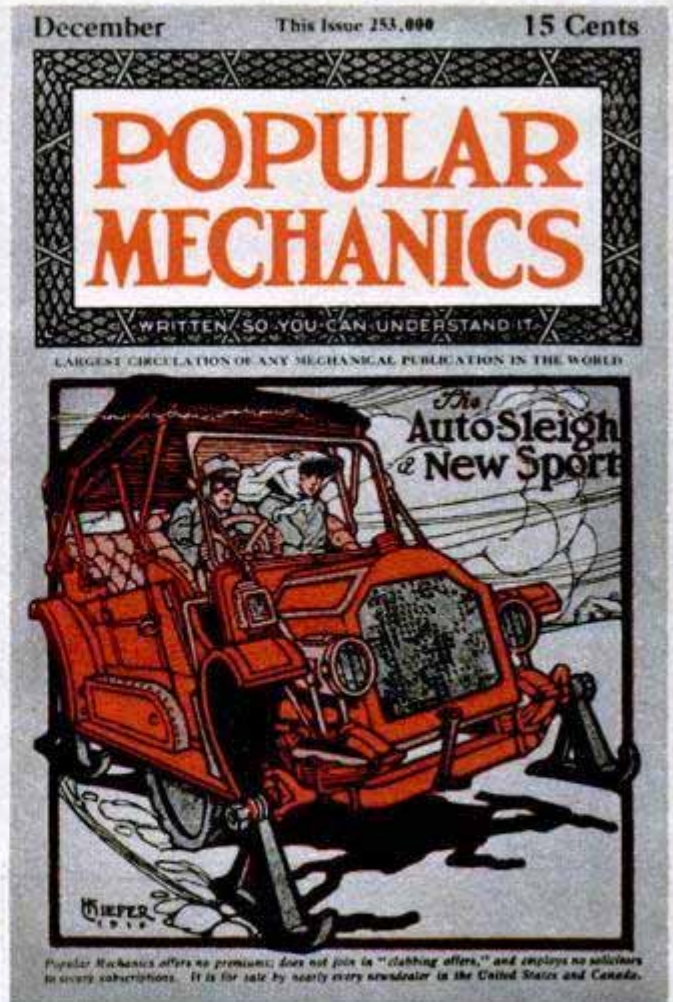
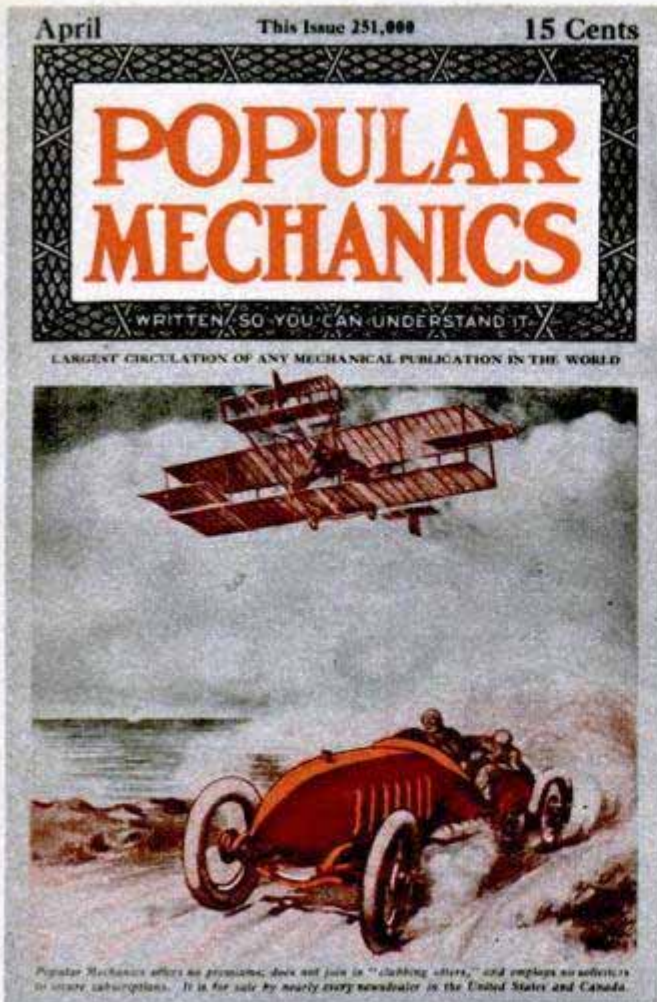
From the beginning the magazine has been divided into two general sections, one devoted to news and the other to craftsmanship. News items in the first issue

ticles on how to clean sponges, how to prepare cement for repairing cast-iron tanks and a new way to etch on glass. It was obvious from the first that H. H. Windsor had given long and careful thought to the format of his magazine. He set the pace that the magazine has followed through the years and others have copied.

(Continued to page 366)

The April 1910 cover (below) featured an exciting race between auto and a newfangled flying machine

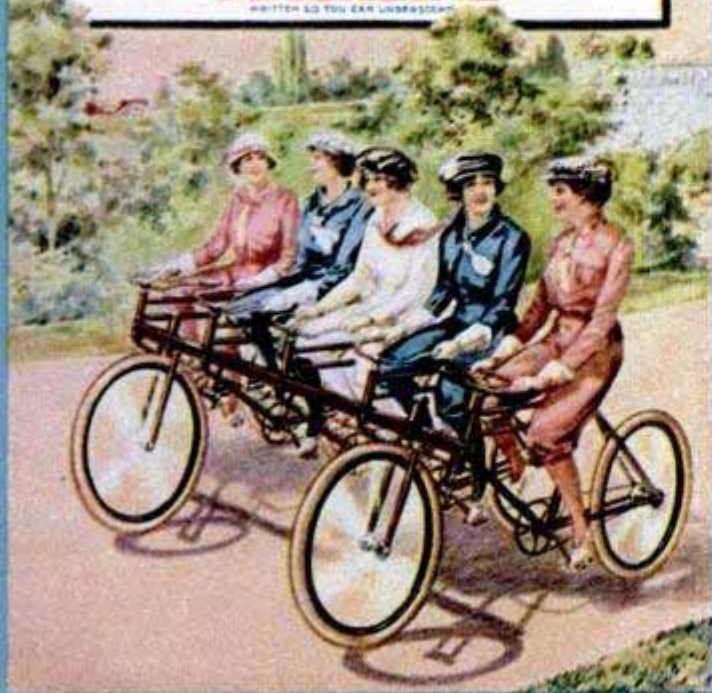
Another 1910 two-color cover shows an early auto rigged up with runners for a spin through the snow



POPULAR MECHANICS

MAGAZINE

WRITTEN SO YOU CAN UNDERSTAND IT



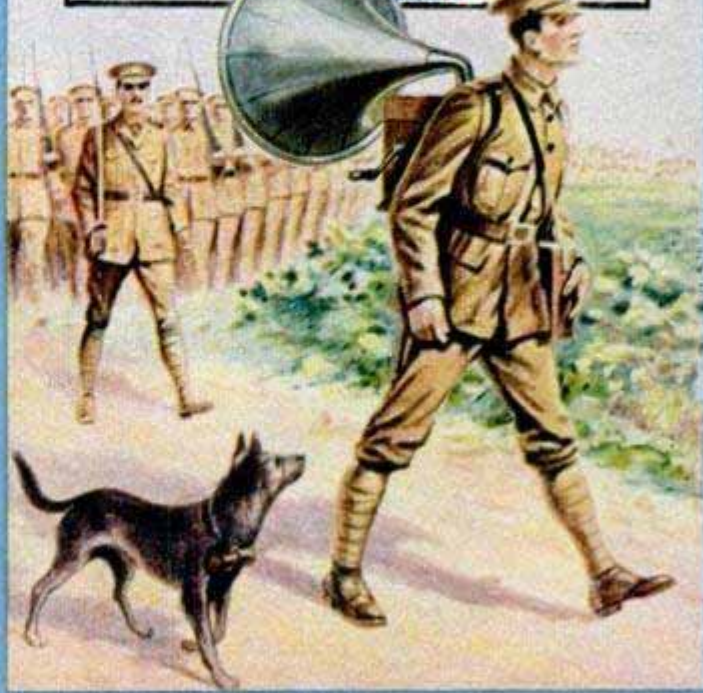
Back in 1916, a Cleveland dealer built this seven-wheel bike to accommodate a gay quintet. The master control is from steering wheel on bike at the right

The sporty motorist of 1915 crossed a bay on West Coast on this barge propelled by the car it carried. Driving wheel for auto ferry attached to car wheel

POPULAR MECHANICS

MAGAZINE

WRITTEN SO YOU CAN UNDERSTAND IT



The popular talking machine of 1917 was used by a British unit to replace a marching band in drills. During World War I the phonograph helped recruiting

A life raft for airplanes introduced in 1921 was such a novelty that it rated a PM cover painting. Rafts of this type have since saved scores of lives of aviators

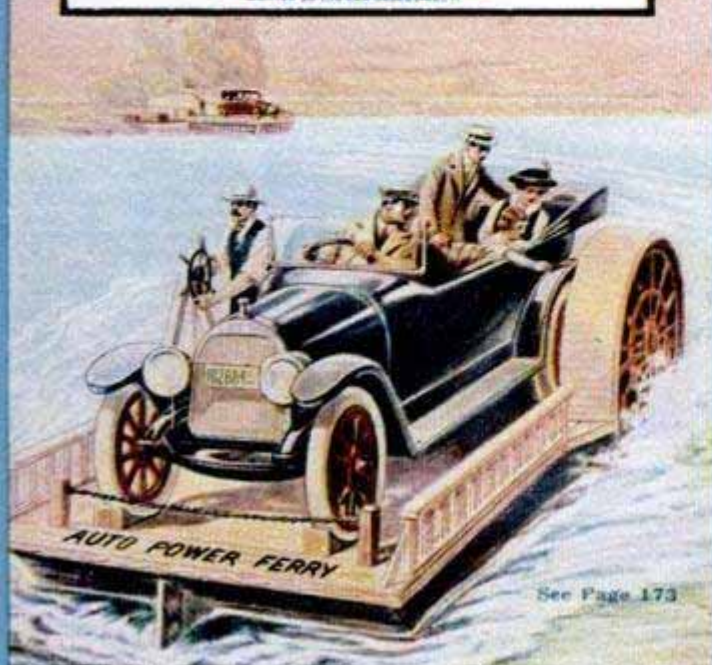
August

15 Cents

POPULAR MECHANICS

MAGAZINE

WRITTEN SO YOU CAN UNDERSTAND IT



See Page 173

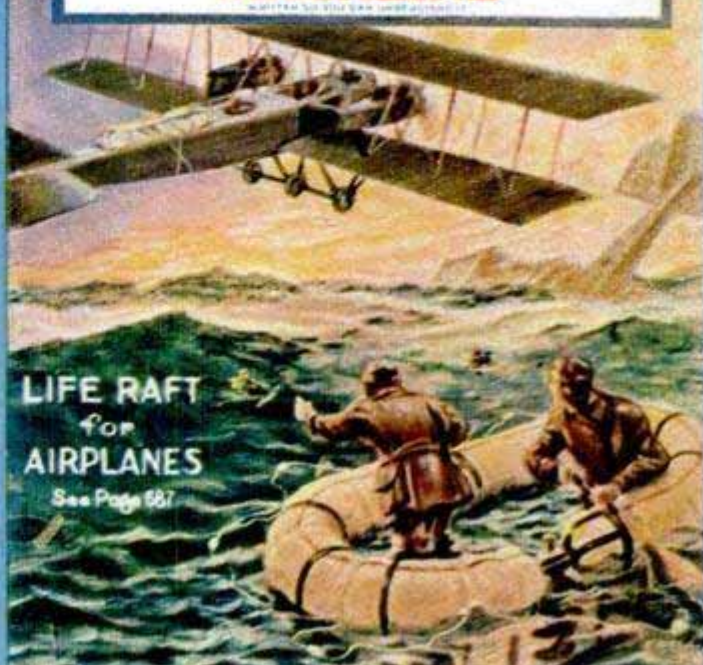
November

25 Cents

POPULAR MECHANICS

MAGAZINE

WRITTEN SO YOU CAN UNDERSTAND IT



LIFE RAFT
for
AIRPLANES

See Page 67

POPULAR MECHANICS

MAGAZINE

WRITTEN BY YOU CAN UNDERSTAND IT



ABRAHAM LINCOLN'S
FIRST INVENTION
PAGE 360

In March 1924 somebody in the Patent Office discovered that Abraham Lincoln was once an inventor and patented a device to lift vessels over shoals

In 1938, the flying wing was still a dream of Lockheed's chief engineer, H. L. Hibbard, who wrote an article about it. Northrop built the first one to fly

POPULAR MECHANICS

MAGAZINE

WRITTEN BY YOU CAN UNDERSTAND IT



MARCH
25 CENTS
\$3.00 IN CANADA



SEE PAGE 362

This 1935 cover was linked to an article on inventions and prophecy. The top line shows that DeForest was writing about television all of 17 years ago

When this Santa Fe diesel appeared on the cover in 1941, it was the most powerful locomotive in world and heralded a new era in transportation on rails

THE MAKING OF A RACE DRIVER

POPULAR MECHANICS

MAGAZINE

WRITTEN BY YOU CAN UNDERSTAND IT



SEE PAGE 232

JUNGLE EXPLORING BY TRAILER

By Commander Attilio Gatti

POPULAR MECHANICS

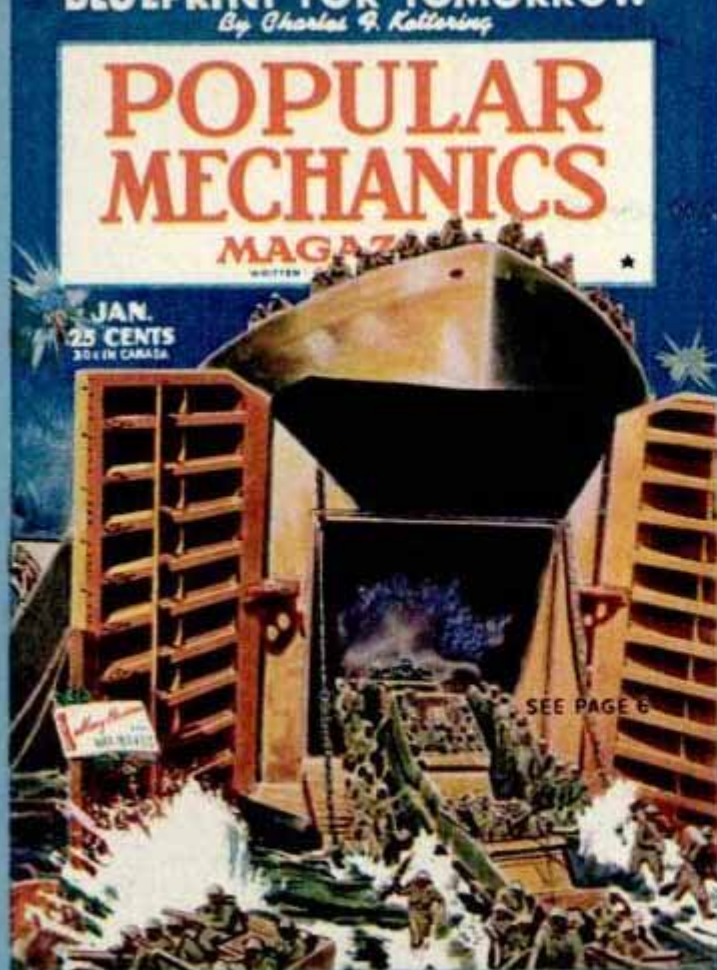
MAGAZINE

WRITTEN BY YOU CAN UNDERSTAND IT



JUNE
25 CENTS
\$3.00 IN CANADA

SEE PAGE 8



One of PM's best World War II covers was this fine painting of an LST (Landing Ship, Tanks) in 1944. The ship landed thousands of men on hostile beaches

Bell Aircraft's postwar rocket-powered XS-1 flashed across this cover in 1947, a new aviation milestone pointing the way to supersonic speeds of the future

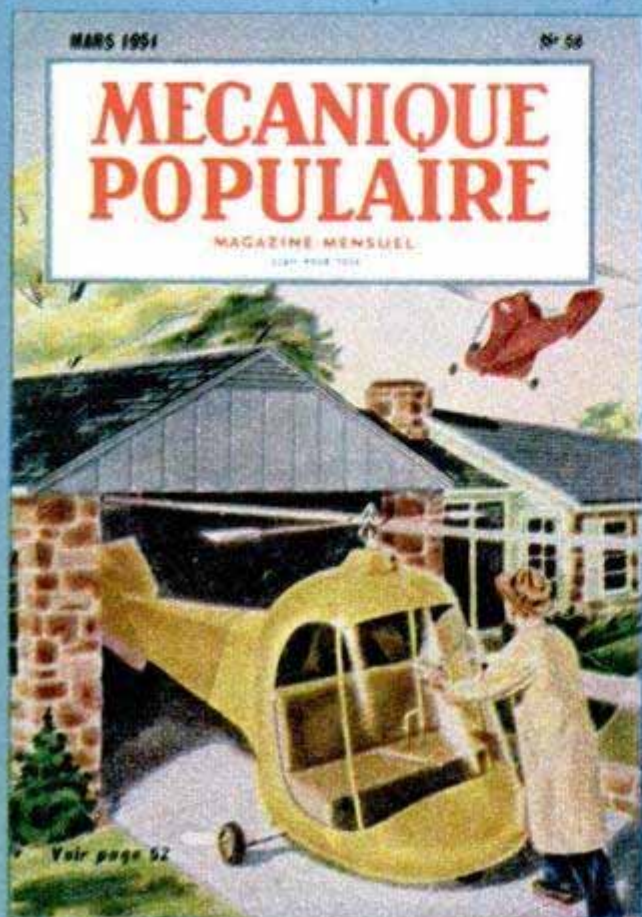


Another wartime cover (1945) was an oil painting of "Big Mo." The original was given to President Truman and hung in the White House until remodeling began

PM's ranch house was featured on the cover last May. It is one of several houses that have been designed and built by the magazine as a how-to-do-it feature

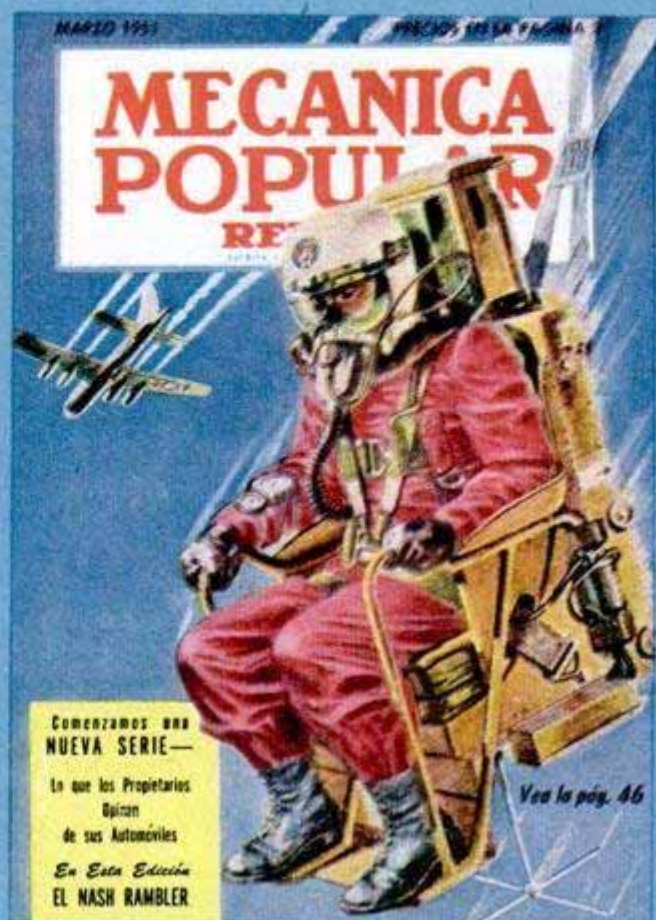


Printed in Five Languages on Its Golden Anniversary, Popular Mechanics Magazine Is Read 'Round the World



The French edition of Popular Mechanics—*Mecanique Populaire*—is familiar to thousands of our readers abroad. It was the magazine's first foreign edition

The Swedish edition of Popular Mechanics is translated and published at Copenhagen, Denmark, for readers in Sweden. It was first published in 1950



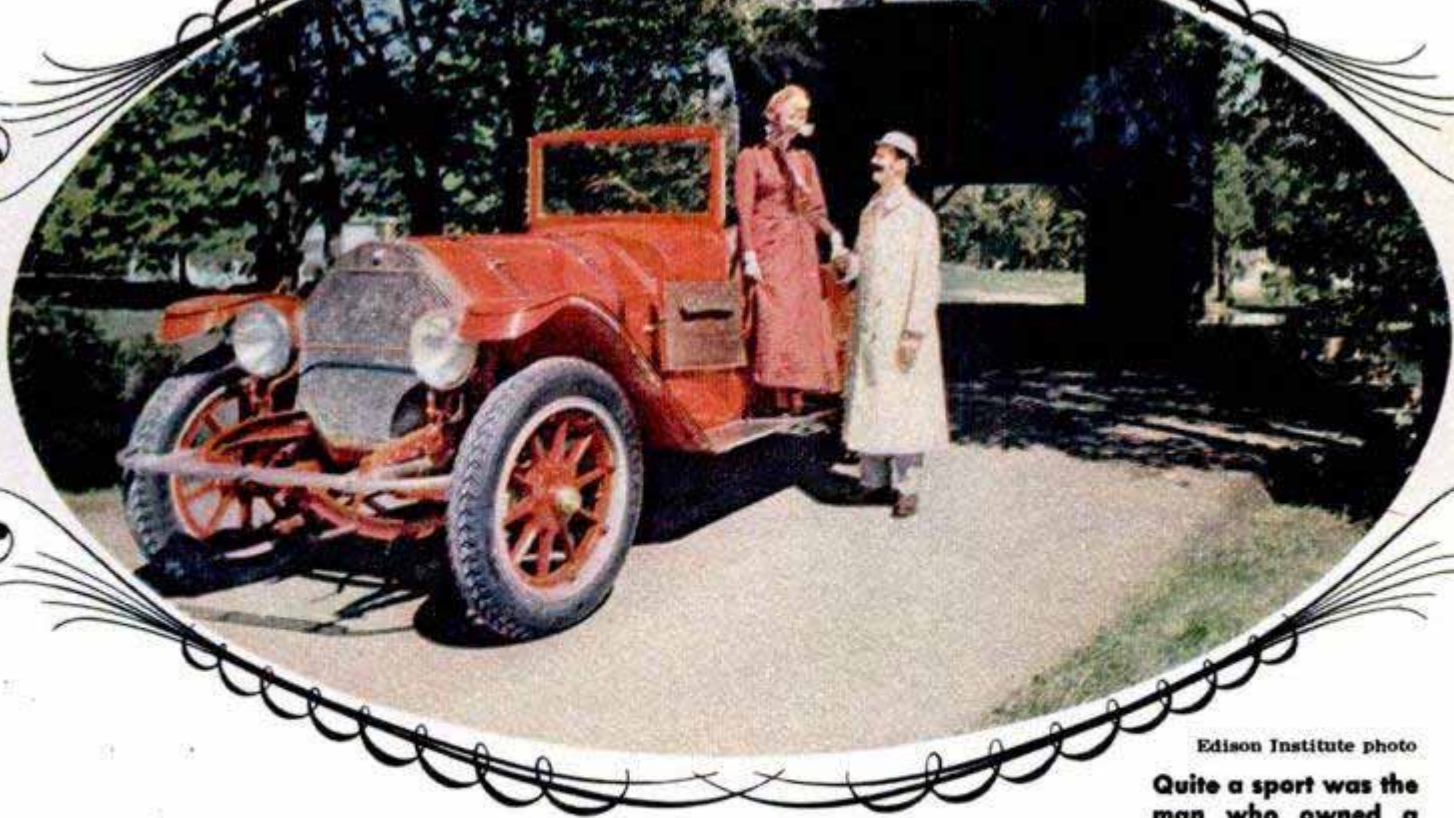
Comenzamos una NUEVA SERIE—
La que los Propietarios Opican de sus Automoviles
En Esta Edición EL NASH RAMBLER

Vea la pag. 46

South of the border, from Mexico to the tip of South America, goes *Mecanica Popular*, Spanish-language edition which was introduced in 1947

First of the Scandinavian editions was the Danish, which is also published at Copenhagen. This magazine is distributed in both Norway and Denmark





Edison Institute photo

Quite a sport was the man who owned a 1914 Thomas Flyer

...And Then Came the Horseless Carriage....:

By Charles F. Kettering

WHEN HENRY WINDSOR decided to bring out a new magazine, *Popular Mechanics*, early in 1902, some other things were happening around the country which were destined to have an impact on the future of the new venture.

In another midwestern city, Detroit, Ransom Olds had just finished building more than 400 curved-dash horseless carriages, or runabouts, which he sold for \$650 each. Up to that time there had never been so many automobiles built at such a low price. Mr. Windsor seemed keenly aware of this innovation in transportation because he persuaded F. L. Faurote, the Olds advertising manager, to address the annual convention of rural-mail carriers. As a result, Faurote introduced into the United States post-office service the first Oldsmobile



Kettering and 1912 Cadillac, first with self-starter



Early Ford, which entered the controversy over superiority of gas, steam or electric power, was this 1903 model which cost \$900

Ford photo



Ford photo

First Ford, built in 1893, had a two-cylinder engine mounted between rear wheels. Below, hold your hat! 1918 Chevrolet zipped along with its V-8 engine

Edison Institute photo



Edison Institute photo

Packard runabout, 1903 vintage, cost \$2500, averaged 50 miles per day in cross-country tour. Below, 1903 Cadillac had one-cylinder engine, chain drive

Edison Institute photo





Edison Institute photo

runabouts, which became the first gasoline cars to be used in mail service.

But Ransom Olds' venture into the automobile business had much wider implications. First, his auto's low price gave a new slant on the low-cost, individual-transportation problem. Second, his utilization of the progressive-assembly technique marked the beginning of mass production in the automobile industry. Third, his new factory in Detroit was the first in this country erected for the sole purpose of manufacturing automobiles. But beyond these contributions, Olds was greatly instrumental in helping change the old order of things.

To appreciate this last statement fully let us go back to Columbus, Ohio, where I was a student in that year of 1902. As I remember it, Columbus in those days was a pretty good-sized city—around 150,000 people. It had about 100 miles of improved streets and about 90 miles of electric street railway. And it had a reputation as a manufacturing center—building buggies and carriages “sold in every state and every country on the face of the earth.” Fourteen hundred people turned out over 28,000 vehicles every year. Columbus had a horse and mule population of 6000 to pull some of these vehicles. But, in addition, in those days, I recall seeing a lot of bicycles—in fact I found out there were some 12,000 of them on the streets. Buggies, carriages, wagons, horses, mules and bicycles plus street railways—that was city transportation in 1902! In the country you were lim-

If you were the owner of a sporty 1906 Franklin runabout, you no doubt were a man-about-town with the ladies. This cream-colored job had a four-cylinder, air-cooled engine, two speeds forward and one reverse

ited to buggies and wagons, horses and mules—the pavement stopped at the city limits.

But Columbus was not asleep. The editor of the *Board of Trade Bulletin* editorialized regarding new developments in science and invention: “Perhaps the most important of the ‘newfangled’ things is the automobile. Although its appearance, in an experimental way, has been very recent, it is in practical use in many parts of the country and its general adoption is retarded only by the ability of the maker to supply the demand.”

So it was at the turn of the century—“the good old days.” But the *Trade Bulletin* editor, when he used the phrase “in an experimental way,” should have received a prize for understatement. Unless you have driven one of those early “newfangled” things it is hard to appreciate just what “in an experimental way” meant.

It meant you stood beside a vehicle that resembled a topless buggy without a horse, patiently twisted a crank until, eventually, the one-cylinder engine under the seat started to cough and shake the entire vehicle. Then before it gave up the ghost, you leaped into the seat, grabbed the tiller bar, put it in gear and rolled coughing and jerking down the street at perhaps 10 or 15





Sleek and luxurious 1952 Packard makes its debut. Its styling is a far cry from the 1903 model on page 138

miles an hour. From then on you were at the mercy of the road, the tires, the weather and the whims of a temperamental power plant. And when you did break down, you called on the local blacksmith who had a wealth of experience—mostly with horses and buggies.

Volumes have been written on the evolution of the automobile since those days, so I won't attempt to repeat that story. However, I have been associated with several of these automotive developments so perhaps it would be better if I gave you a few high lights of three or four of the things with which I am personally familiar—things which fit into a much larger story of American science and invention.

In the first decade of the century, the horseless carriage became the automobile—engines grew in size and power and performance improved, the passengers were made more comfortable, and the new vehicle became easier to handle.

There was an exception to this, though, that deterred some men and most women—engines still had to be cranked by hand. Even husky men found this rugged and often suffered broken arms. Mr. Henry Leland, head of Cadillac, told me in 1910 five of his men had suffered broken arms and that one of his best friends, Mr. Carter, died as a result of a broken jaw caused by a kicking hand crank.

I told Mr. Leland I thought something could be done about an electric self-starter, and we began the uphill battle that was to last for a long time. I say "battle" because we had to fight prejudice, misinformation and bad breaks—all things every inventor must face when he tries to do a new thing.

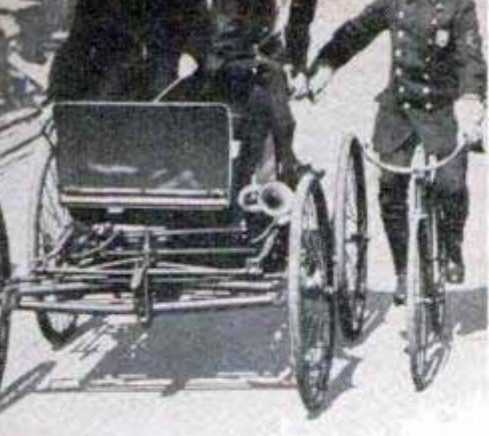
The experts said it would take an electric motor of two to five horsepower to spin the engine, and there existed no electric battery with enough capacity to do this particular job. And, of course, carrying these batteries around in a car was ridiculous.

There was just one thing they overlooked—an ordinary man cranked a car and he didn't put out several horsepower continuously! What was needed was a small motor that would give a big spurt of power for a short time and a generator to charge the battery between spurts.

It sounded simple, but like every inventor I didn't fully appreciate the things we were going to run into—ridicule from the motor and battery people, misfortunes such as the fire that destroyed our only demonstrator, a broken leg and the skepticism of nearly everybody. But Mr. Leland was most patient and in August 1911 the self-starter was approved as equipment on the new-model Cadillac. *Popular Mechanics* came out with a timely article on the device and, as a result, the derision of many people was transferred from me to the editor. A number of his readers called him to task for including pipe dreams in his articles!

I have been accused of a lot of things in my day, but I believe Christy Borth is stretching things a little when he said the self-starter was responsible for women taking their places behind the steering wheel and as a consequence, mark you, adopted more suitable attire such as short skirts and discarded things such as "bustles, layers of petticoats and towering coiffures." However, since today nearly all women drive, maybe I should take the blame for some of that.

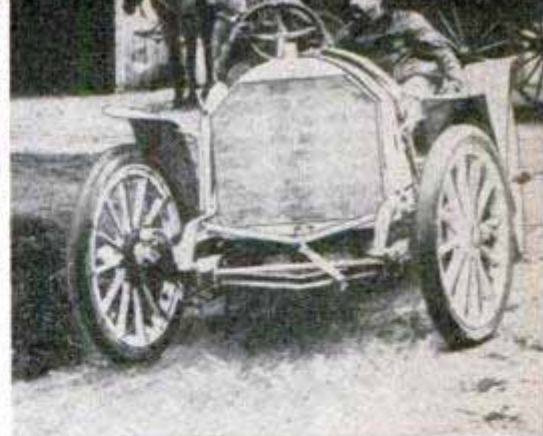




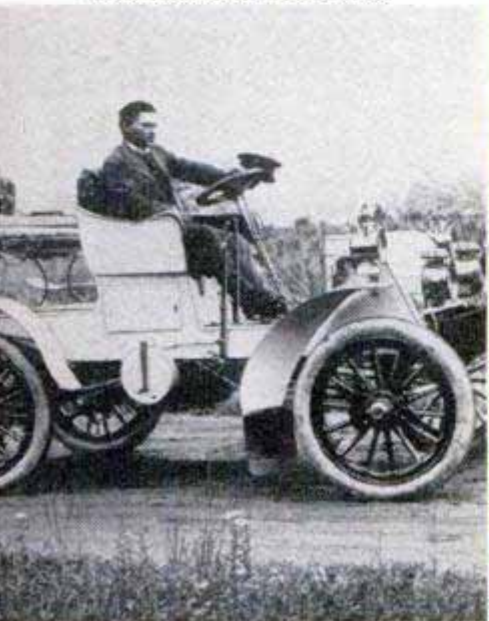
Automobile Mfrs. Assoc. photo



General Motors photo



Automobile Mfrs. Assoc. photo



PIONEERS

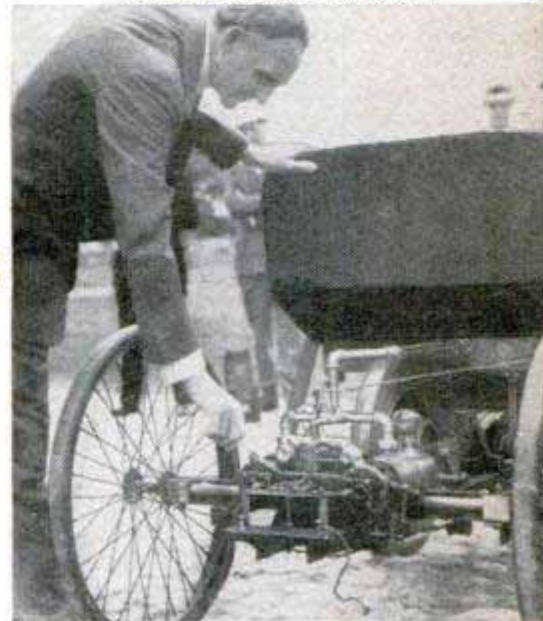
ELWOOD HAYNES, above left, built one of first autos. Here, driving his own car, he's overtaken by bicycling cop

RANSOM E. OLDS, above, sparked the "Merry Oldsmobile" and the Reo car. Famous curved-dash Olds sold for \$650

LOUIS CHEVROLET, above right, at the wheel, leans around corner in 1905 race

JAMES WARD PACKARD, left, was dissatisfied with first car he bought so he built his own. This is his 1902 model

HENRY FORD, right, pioneer in assembly lines, here inspects first car he built



Ford photo

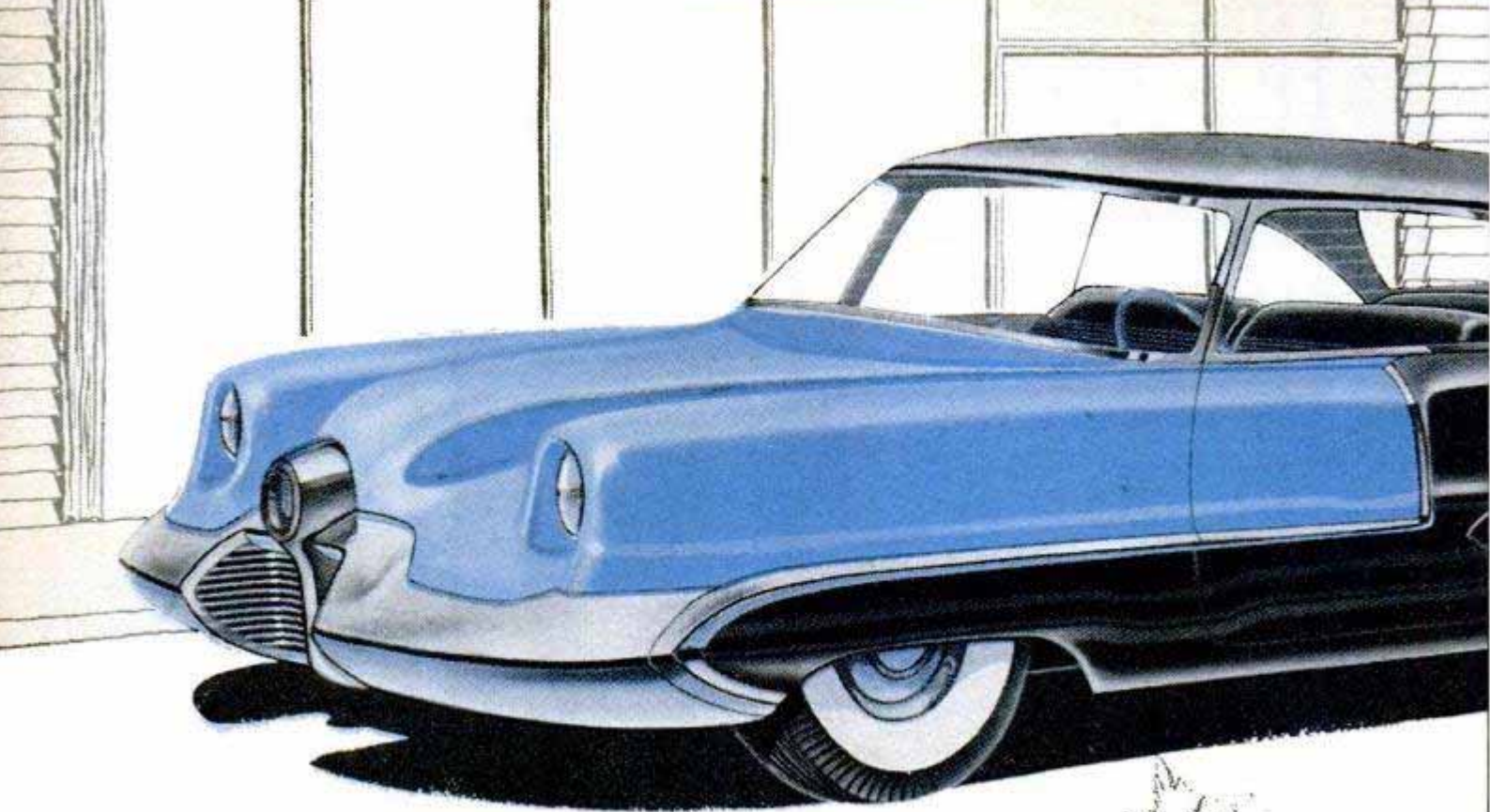
As we entered the second decade, the automobile began to change the landscape and the habits of the people. Everyone wanted a car and with this demand manufacturers multiplied, and new ways and means were sought to build more and still more. Car registrations rose from a half million in 1910 to over nine million in 1920. New techniques for mass production were added yearly: improved continuous-assembly processes, division of labor, standardization of parts and new materials all helped to supply the ever increasing demand for more cars.

But in their careful analysis of methods of increasing this flow of cars, the manufacturers always came face to face with a serious bottleneck. Chassis were assembled with precision and came off the line with clocklike regularity. Bodies were put together with gratifying speed and sent to the finishing department. But there the rhythm of production stopped. Highly skilled finishers would prepare the metal and skilled painters would spend hours brushing on the varnish. The body then went to the

drying room and then to the rubbers who laboriously produced a glasslike finish. This process went on for days and weeks as coat after coat was applied. It was not unusual for a plant visitor to see hundreds of bodies in the drying warehouse just waiting for the finish to harden between coats. It was the needle eye through which all production must pass.

Something had to be done about it, so a committee was formed to investigate new finishes. The one that looked most promising was an ancient one—lacquer. Since 1905 a synthetic lacquer, a sort of "liquid cotton," had been marketed but it had limitations. It could be quickly sprayed on with an air-pressure gun, but it was pretty thin stuff and lots of coats had to be sprayed on to get the right color and thickness. If you thickened up the solution it would come out of the gun like bullets. The old-time varnish dried too slowly and the lacquer too fast. That is where the chemists came in and, after years of research, finally found a new low-viscosity cellulose that held lots of pigment, could be easily sprayed





Car of the near future? General Motors' stylists sketched this car for PM's Anniversary issue. It features bumpers running length of pontoon fenders, one-piece bumper-grille, polarized windows

and gave a greater film thickness with a few coats.

As a consequence, a car body could be covered in a more durable, colored finish in about five hours, instead of weeks, and the bottleneck was broken. The spray gun replaced the hand brush in many other industries, and lacquers invaded the home bringing color to furniture, household appliances and hundreds of other things all around us.

As we see the gleaming, many hued cars rolling by us today, it seems to me we should regard them not as just so many automobiles but rather as symbols of the research man's ability to find quicker and better ways of doing many things handed down to us by our forefathers.

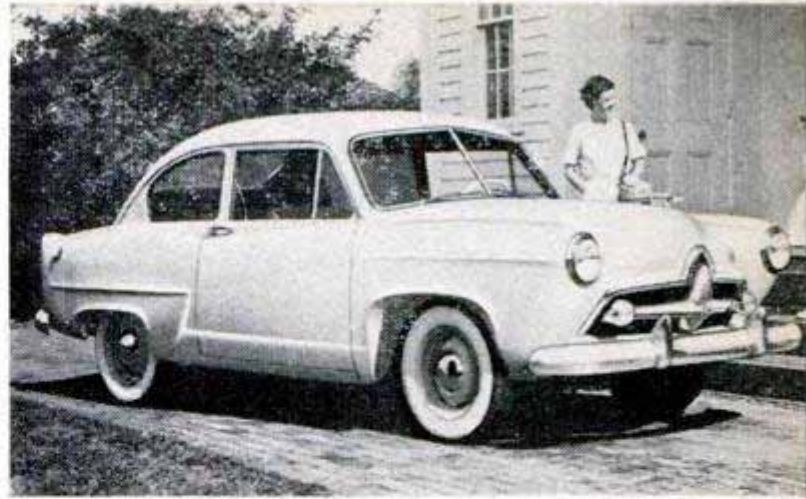
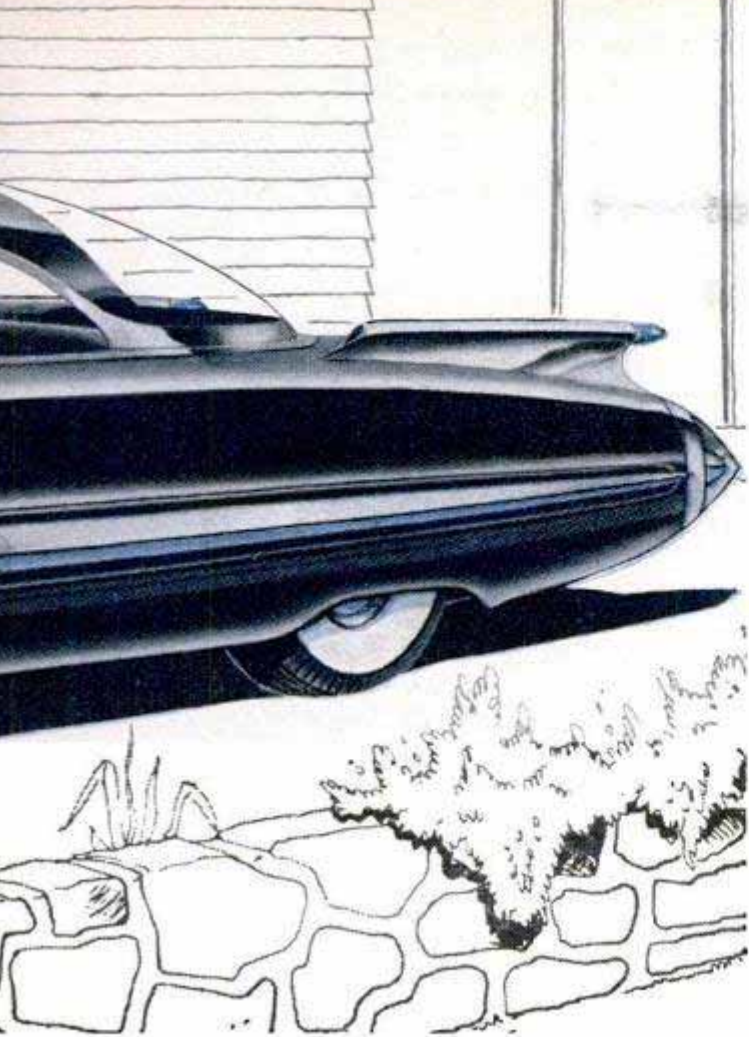
As the public became more automobile conscious, it asked for more refinements, reliability and performance. Soon there was a variety of closed bodies in many colors and practically all cars were equipped with self-starters, electric lights and more dependable engines.

But increased engine performance was usually achieved by adding more cylinders and increasing their size until it was not an

unusual sight to see an engine five feet long producing 60 horsepower. Engineers knew even before World War I that by increasing the compression ratio—squeezing the fuel in the combustion chamber more—you could get more power from the same size engine. But they also knew that if you did this the engine would knock unbearably.

So Tom Midgeley and I started into the long battle against knock—to find out what caused it and, if we could, a cure. By developing a lot of our own instruments and putting a quartz window in the side of the engine, we found that the fuel was the chief offender so we began the long search for something we could add to the fuel that would reduce the power-robbing knock. Thousands of chemicals were patiently tried—some good, some bad—until we began to get a picture of the type of chemical compound that would do the job. And with the assistance of some able chemists we obtained a sample of the ideal antiknock—tetraethyl lead. It did the job all right and the knock disappeared! Now we had some control over the knock that stole power, if we could only produce the new fuel on a commercial basis.





Late example of the horseless carriage is the Henry J, light car built on trim lines. It has a very high horsepower-to-weight ratio and yields excellent mileage

ance. But in the case of ethyl gasoline the results were well worth the battle because by its use, together with better fuels and mechanical improvements, smaller and more powerful automobile engines resulted and the motoring public's fuel bill was reduced by a third.

When Hitler threw down the gauntlet and challenged the world, he underestimated this country's ability to mass produce mechanical horsepower and the things that went with it. He banked on a rapid-fire mechanized war—blitzkrieg. In World War I an infantry division required about 3500 mechanical horsepower to keep moving. A World War II armored division required over 400,000 horsepower. And Hitler thought he was all set because he had been stock-piling mechanical horsepower for years and we were still turning out so-called "luxury" items such as automobiles, refrigerators and radios. There wasn't a chance that the U.S. could convert her factories to producing war goods in time to stop him.

That is where he made his big mistake. He overlooked our not-so-secret "secret weapon"—our ability and "know how" to change models quickly. For years we had been doing this once a year. True, it would take some time to get machine guns off a line that produced refrigerators, but if the blueprints and the sample model of the gun were okay, no people in the world could get into production faster than we could.

And that is the way it turned out. Taking the example of the machine guns: An entirely new plant was built, 2000 machines were installed, employees were trained and *six months later* the guns were delivered!

(Continued to page 340)

The problem of developing a commercial process was almost as great as that of the initial discovery. It meant trips to Egypt and the Dead sea on a floating-laboratory ship; all to find a cheap source of bromine, one of the basic ingredients. At last a method of extracting it from sea water was developed, a plant was built and in February 1923 ethyl gasoline first went on sale at a station in Dayton, Ohio.

The next year saw a wider and wider use of ethyl, and the engine designers were beginning to take advantage of the new frontier opened to them. But several newspapers uncovered what they thought was a good story, and late in 1924 one of them carried the following statement: "20,000,000 automobiles on American highways are belching exhaust gases impregnated with poisonous dope." So a different kind of battle started, and it was not settled until January 1926 when a committee appointed by the U. S. Surgeon General gave lead-treated gasoline a clean bill of health.

This will give you a sketchy idea of the difficulty of doing any new thing—you must first make your idea work, then make it commercial and, last, win public accept-



Twenty years ago Winston Churchill, then a young British statesman yet to attain the stature of Prime Minister during World War II and most eminent Briton of our times, wrote for *Popular Mechanics* this brilliant article prophetic of the atomic age . . .

FIFTY YEARS HENCE

THE great mass of human beings absorbed in the toils, cares and activities of life are only dimly conscious of the pace at which mankind has begun to travel. We look back one hundred years and see that great changes have taken place. We look back fifty years and see that the speed is constantly quickening. This century has witnessed an enormous revolution in material things, in scientific appliances, in political institutions, in manners and customs.

The greatest change of all is the far greater numbers which in every civilized country participate in the fuller life. In the United States, scores of millions have lifted themselves above primary necessities and comforts, and aspire to culture—at least for their children. Europe, though stunned and lacerated by Armageddon, presents a similar, if less general, advance. We all take the modern conveniences and facilities as they are offered, without being grateful or consciously happier. But we simply could not live if they were taken away. We assume that progress will be constant . . . if it were stopped, or reversed, there would be a catastrophe of unimaginable horror.

Mankind has sometimes traveled forward and sometimes backward, or has stood still for hundreds of years. It remained stationary in India and China for thousands of years. Now it is moving very fast.

What is it that has produced this new prodigious speed of man? Science is the cause. This power called science has laid hold of us, set us to work upon its highways and in its arsenals; rewarded us for our services, healed us when we were wounded, trained us

when we were young, pensioned us when we were worn out. The changes have been so gigantic that no period in history can be compared with the last century.

By observing all that science has achieved in modern times, and the knowledge and power now in her possession, we can predict with some assurance the inventions and discoveries which will govern our future. We can but guess, peering through a glass darkly, what reactions these discoveries and their applications will produce upon the habits, the outlook and the spirit of men.

The most wonderful of all modern prophecies is found in Tennyson's "Locksley Hall":

For I dipt into the future, far as
human eye could see,
Saw the Vision of the World, and all
the wonder that would be;

Saw the heavens fill with commerce,
argosies of magic sails,
Pilots of the purple twilight, dropping
down with costly bales;

Heard the heavens fill with shouting,
and there rain'd a ghastly dew
From the nations' airy navies grappling
in the central blue;

Far along the world-wide whisper
of the south wind rushing warm,
With the standards of the peoples
plunging through the thunderstorm;

Till the war-drum throb'd no longer
and the battle-flags were furl'd
In the Parliament of man, the
federation of the world.

Slowly comes a hungry people, as a lion,
creeping nigher,
Glares at one that nods and winks
behind a slowly-dying fire.

Reprinted in condensed form
from the March 1932 issue
of *Popular Mechanics*

by
**WINSTON
CHURCHILL**



These six stanzas of prediction, written eighty years ago, have already been fulfilled. The conquest of the air for commerce and war, the world struggle of Armageddon, the League of Nations, the Bolshevik revolution—all divined in their true sequence by the great Victorian, all now already in the history books and stirring the world around us today.

Whereas formerly the utmost power that men could guide and control was a team of horses, or a galley full of slaves, or a gang of laborers like the Israelites in Egypt, it is today already possible to control accurately from the bridge of a battle cruiser all the power of hundreds of thousands of men. Or, to set off with one finger a mine capable in an instant of destroying the work of thousands of man-years. These changes are due to the substitution of molecular energy for muscular energy, and its direction and control by an elaborate, beautifully perfected apparatus. These immense new sources of power, and the fact that they can be wielded by a single individual, have made possible novel methods of mining and metallurgy, new modes of transport and undreamed-of machinery. They substitute the 100,000-kilowatt turbo-generators at Niagara Falls for the mill wheel of our forefathers. Each invention acted and re-

acted on other inventions, and with ever-growing rapidity that vast structure of technical achievement was raised which separated the civilization of today from what the past has known.

There is no doubt that this evolution will continue at an increasing rate. We know enough to be sure that the scientific achievements of the next fifty years will be far greater, more rapid, and more surprising than those we have already experienced. The slide lathe enabled machines of precision to be made, and the power of steam rushed out upon the world. And through the steam clouds flashed the dazzling lightnings of electricity. But this is only a beginning. High authorities tell us that new sources of power, vastly more important than any we yet know, will surely be discovered. Nuclear energy is incomparably greater than the molecular energy we use today. The coal a man can get in a day can easily do five hundred times as much work as the man himself. Nuclear energy is at least one million times more powerful still. If the hydrogen atoms in a pound of water could be prevailed upon to combine

(Continued to page 326)



Bettman Archive photo

Man's first powered flight, by Orville Wright in 1903, above, was 120 feet long and 10 feet high. Now a Lockheed Neptune can fly 11,236 miles nonstop



"Captain Eddie," the author, now a top airline executive

From *KITTY HAWK*

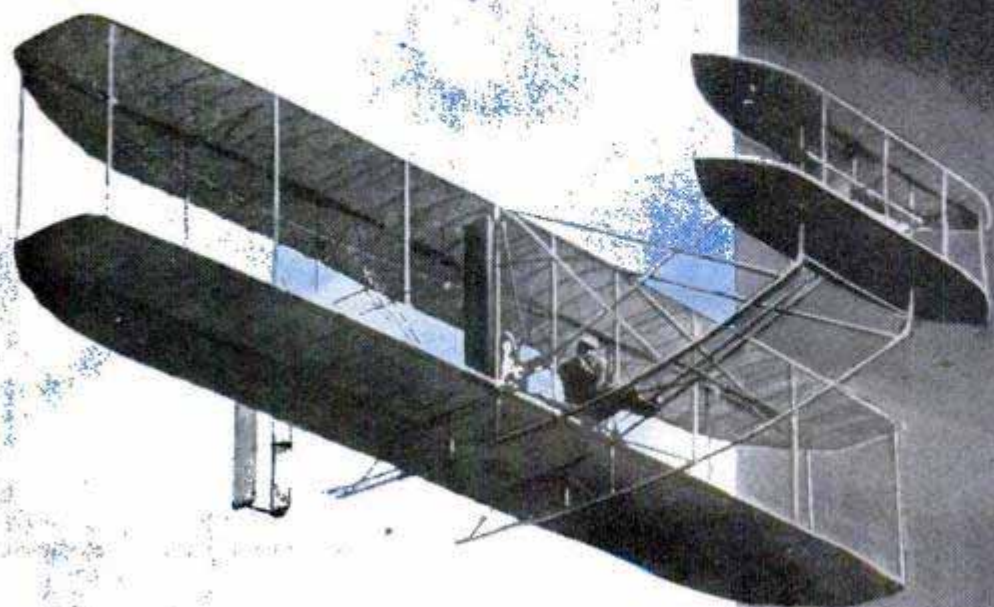
IT SEEMS ONLY yesterday that I walked into the hangar of the 94th (Hat-in-the-Ring) Squadron at Villeneuve, France, and stepped aboard the little French single-seater Nieuport biplane that was to take me through scores of aerial dogfights. The Nieuport was a fairly "hot" airplane in March 1918. It had a rotary-type engine, a ceiling that varied from 16,000 to 20,000 feet depending on how the plane felt that day, a hair-raising speed of 120 miles an hour with a following breeze and it could outdive the enemy's famous Fokker—provided the fabric didn't peel off the wings in the process.

The fabric hazard was no joke. It brought a number of our group fluttering down in crashes. The first time it happened to me, I

Four jet and six piston engines, each of the latter generating 3800 horsepower, keep giant B-36 aloft

In 1909 the Wrights had to rely on a 30-hp. engine to keep their "Flyer" airborne an hour in Army test

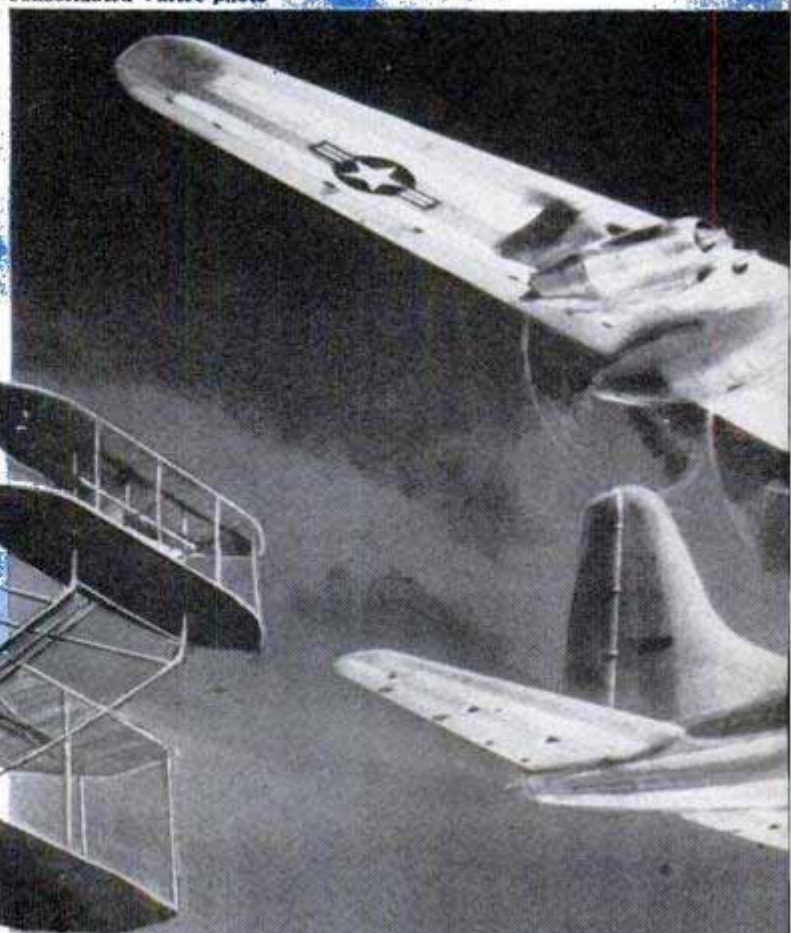
Bettman Archive photo



was roaring in on a flight of three armed German Albatros photographic planes headed for Allied lines north of St. Mihiel, and closed in on the trailing plane until, at 50 yards, the pilot saw me and went into a dive. I was on his tail in an instant and, as he came into line with my sights, my tracers ripped along the fuselage until they disappeared into the back of his seat. His plane careened earthward out of control.

Then I eased back on the stick to pull out of my dive—too late. With a ripping crack, my lower-right wing collapsed and the entire spread of taut canvas on the top

Consolidated Vultee photo



In less than four hours a six-jet B-47 spanned U. S., averaging 607 miles an hour
Boeing Aircraft Co. photo



to *JETS*

By Capt. Eddie Rickenbacker
President and General Manager,
Eastern Air Lines, Inc.

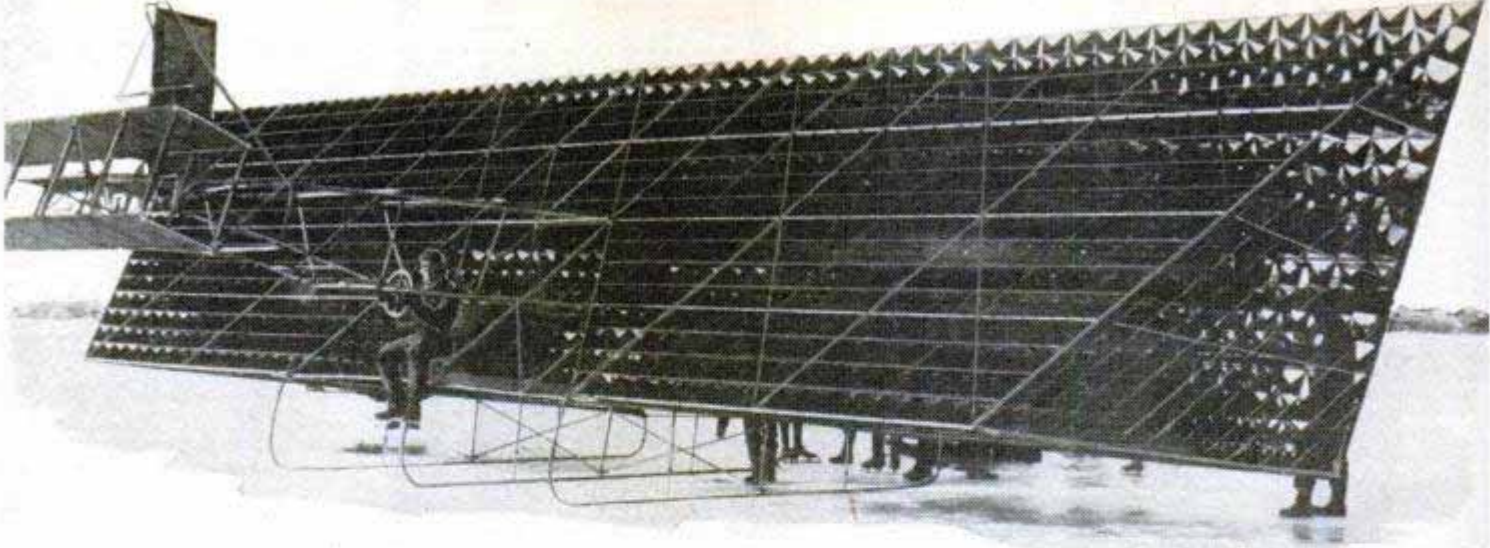
wing tore loose and went flapping away in shreds. I fell into a spin and spiraled downward for 10,000 feet. In desperation, at 3000 feet, I gunned the throttle. Amazingly enough, it brought the crippled ship into horizontal position and kept it there until I skimmed over the hangars of our airdrome and onto the dirt runway amid a cloud of dust, noise and debris. How I walked away from that mess without a scratch is a thing no mere man can explain.

Thinking back on those action-filled months when my squadron mates and I flew the 94th's collection of nuts, bolts,

struts and wires to many victories and our share of defeats against the finest that Von Richthofen's Flying Circus could put in the air, brings a man up with a jolt. When we stepped into those rickety crates back in 1918, it was a 50-50 chance that if a sharp German pilot didn't knock us from the sky, the plane would fall apart under us. Yet we thought they were as nearly perfect as planes could be.

Now, 34 years later, we talk in terms of gleaming, dart-shaped aircraft that pierce the ether at speeds faster than sound, pull out of power dives intact under pressures





Sherman Fairchild Collection photo

In exploring flight theories, Alexander Graham Bell evolved this tetrahedral kite, with its many wind pockets

that can crumple steel, and climb more than four miles high. The "big" three-seaters of World War I have grown into airborne mammoths that will carry two hundred men. It's safe to say that along with electronics and nuclear physics, aviation has advanced more rapidly than any of the other sciences benefiting mankind today.

Since 1903, when man first found wings through the successful experimenting of

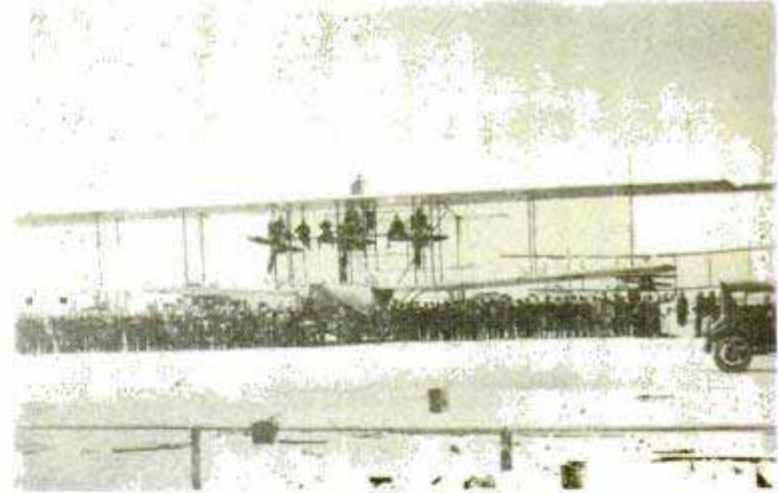
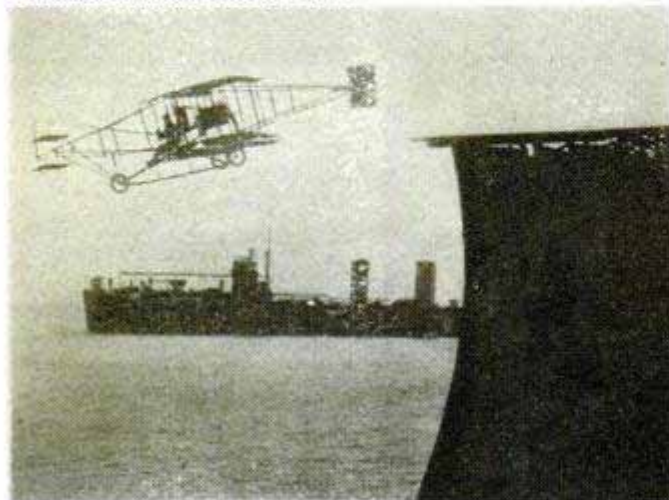
the Wright brothers, an estimated 3000 different models and styles of heavier-than-air craft have flown the skies. If you took all the issues of *Popular Mechanics* since it began publication (incidentally, about the time man started to fly) and attempted to read through them in one afternoon, the best you could possibly do would be to catch a few glimpses of events, facts and personalities as the pages flipped past.



Bettman Archive photo

One of the first of a long line of famous seaplanes built by Glenn Curtiss skims over the water. Below, test pilot Eugene Ely flying off deck of the U.S.S. Birmingham, November 1910, in a Curtiss biplane

Sherman Fairchild Collection photo



Trans-Atlantic flying was pioneered in 1919 by the NC-4, the first aircraft of any type to cross the ocean. Below, virtually every U. S. World War I pilot got his first taste of flying in a "Jenny" (JN-4D)

Curtiss-Wright photos



That is the kaleidoscopic view you get when you glance back over the short 50 years of aviation. An even greater rate of progress lies ahead in the next half century. Transportation through the air in the year 2000 is bound to be miraculous and spectacular.

Although we date man's ability to propel himself through the air in controlled flight back to the Wright brothers, Americans were interested in, and contributed to, aeronautics for 120 years before that historic event took place at Kill Devil Hills, near Kitty Hawk, N. C. Benjamin Franklin was probably one of our first aviation enthusiasts. His correspondence in 1783 and 1784 indicates not only a keen interest in the mechanics of the gas-filled balloon, but a prophetic understanding of its future application in warfare. Before the United States Constitution was drawn up, Americans were flying.

A 13-year-old boy, Edward Warren, is believed to be the first American to soar above the earth. One June 24, 1784, he volunteered to make a flight in a captive balloon and took off from a site near Baltimore, Md. The balloon was built by a man named Peter Carnes. In November of the

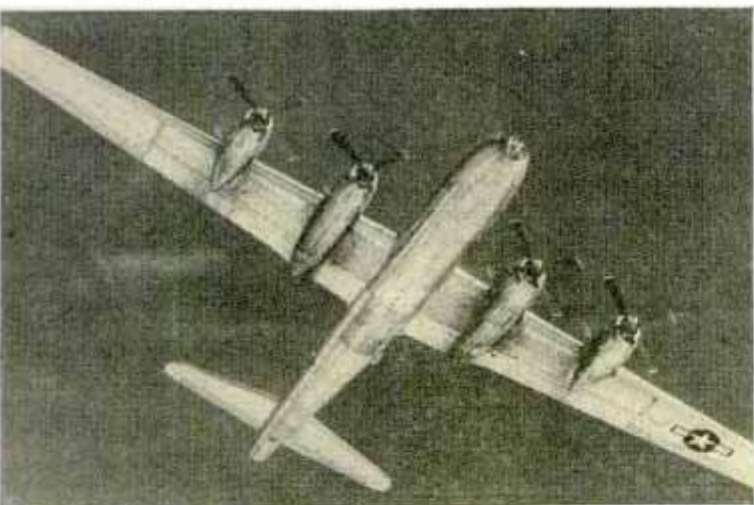


Cargo compartment of a Fairchild Packet, above, has space nearly equal that of standard railroad boxcar



North American Aviation photo

Fastest of U. S. fighters in World War II was the F-51 Mustang, with a speed over 450 miles an hour



Boeing Aircraft photos

A study in rapid growth: By the time World War II ended, the largest U. S. bomber was the 120,000-pound B-29, above, double the size of the 1941 B-17, below

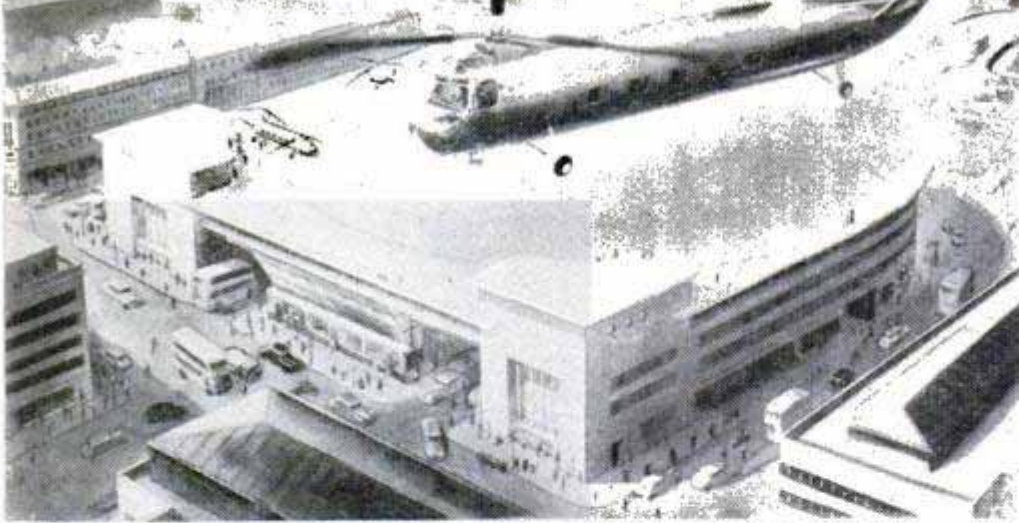


Republic Aircraft photo

Sturdy and heavily armed, F-47 Thunderbolts carried the brunt of much of the air fighting against the Nazis. Below, Marine-piloted Corsairs loaded 2000 pounds of bombs on long missions against Japanese

Chance Vought Aircraft photo





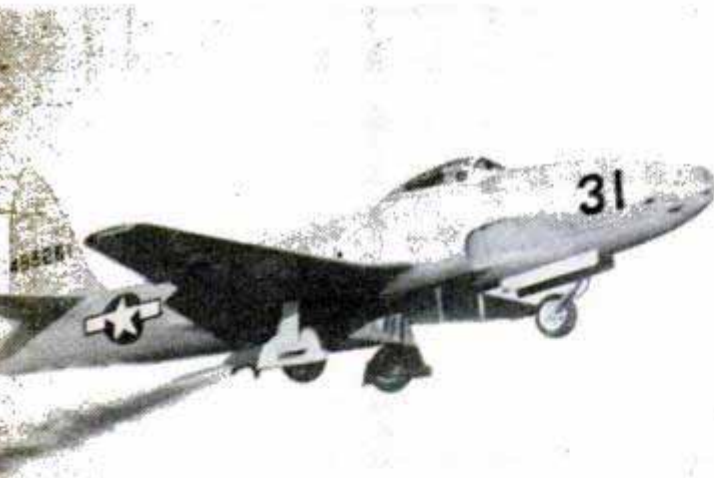
Along with their growing military usefulness, the author underscores the great potential role of helicopters in carrying passengers between airports and the business districts. This is the Air Force's concept of the helicopter's future use

same year, Dr. John Jeffries of Boston sailed across the English Channel in a balloon with Pierre Blanchard, a Frenchman.

During the 35 years leading up to the 20th century, there were increasing numbers of persons who conceived and patented different types of flying machines, ranging from flying steamships to aircraft with flapping wings. During the 1880s and 1890s, experiments with gliders were carried on by Octave Chanute in Michigan and John J. Montgomery in California. These two probably paved the way for the final invention of the airplane. Montgomery is reputed to have soared aloft as early

as 1883. It is an established fact that he made numerous successful flights at Otay Mesa, Calif., in subsequent years. Chanute's book, *Progress of the Flying Machine*, stirred the imaginations of a number of practical men.

Among these were Prof. Samuel P. Langley, assistant secretary of the Smithsonian Institution, and two brothers, Wilbur and Orville Wright, who operated a bicycle-repair shop in Dayton, Ohio. Langley succeeded in building a 13-foot model which flew successfully with a miniature steam engine, but his man-carrying machine of similar design crashed into the Potomac on



First operational U. S. jet was the Lockheed F-80, in the 600-mile-an-hour class. It was the workhorse of early fighting in Korea. Below, holder of the world's speed record, 670 m.p.h., is the swept-wing F-86 Sabre
North American Aviation photo



Two of the Navy's most powerful shipboard aircraft. The jet unit of the Grumman Panther, above, delivers 6250 pounds of thrust. The McDonnell Phantom, below, in 1946 became the first twin-jet carrier fighter



two futile endeavors to launch it in 1903. Orville and Wilbur Wright experimented with controllable box kites and gliders until they felt certain they could handle similar craft in powered flight. Not until then did they go about designing and building an engine for their airplane.

It is history that Orville Wright made the first test flight December 17, 1903. He traveled approximately 120 feet and damaged his machine upon landing. The original flight didn't equal the wingspan of a modern four-engine airliner. But don't forget that both Orville and Wilbur had to learn how to fly after they were airborne.

America and the world did not take to the air overnight after the Wright brothers made their flight. As a matter of fact, during the entire year of 1904 the total flying time of the brothers combined was only 45 minutes, although they built a second airplane. The next year they made 50 flights, but during the year 1906 they did no flying whatsoever, devoting all 12 months to perfecting a new engine having vertical, rather than horizontal, cylinders. At the end of 1907 only seven men in the U. S. had flown. In addition to the Wright brothers, they were A. M. Herring, F. W. Baldwin, Lt. Thomas Selfridge, Glenn H. Curtiss, and J. A. D. McCurdy.

(Continued to page 350)



Douglas Aircraft photo

For more than a decade earlier versions of the DC-3, above, were the backbone of U. S. air transportation



Latest models of the graceful Lockheed Constellation, above, have a cruising speed of more than 330 m.p.h.



Northrop Aircraft photo

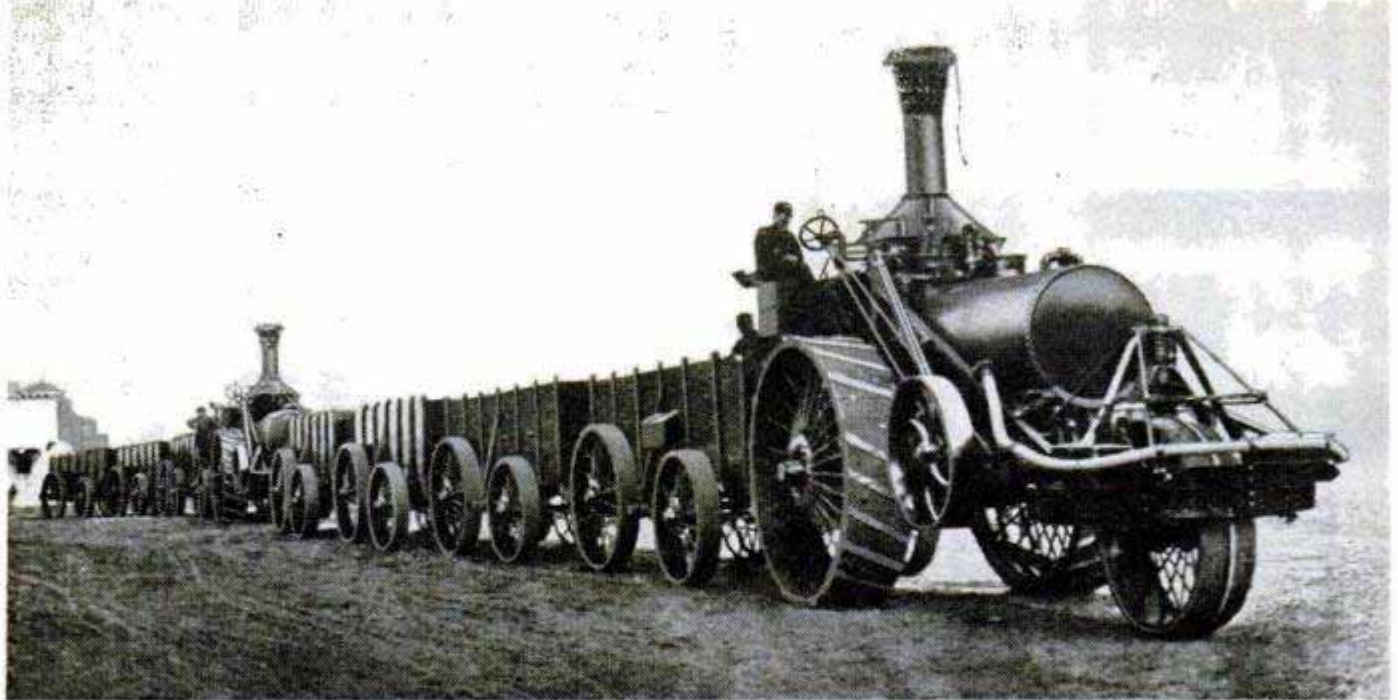
One of the most unusual planes ever to fly was the pusher-type B-35, with a 172-foot wingspan and a length of 53 feet. Years of popularity won Piper Cub, below, description of "Ford of private flying"



On a flight from Honolulu to California, a 72½-ton Martin Mars, above, carried a record 144 passengers. Below, developed from the wartime B-29, double-decked Stratocruisers are pressurized for high altitudes

Boeing Aircraft photo





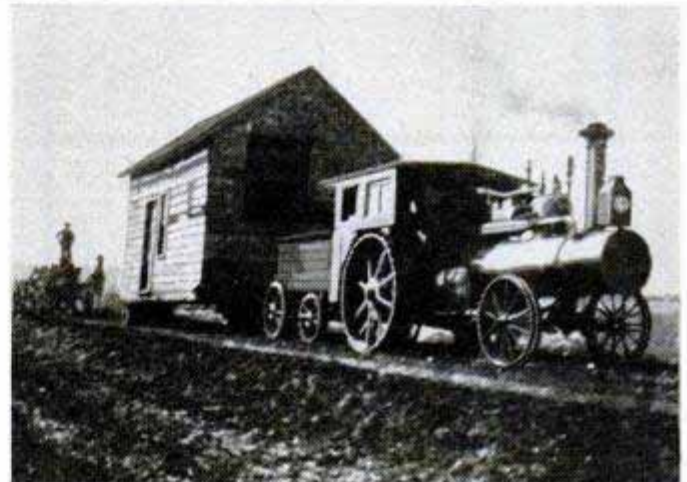
THE BEGINNING OF THE HORSELESS AGE



We have already crossed the threshold of the horseless age. Not that the time will ever come when the inborn love which man possesses for the horse will cease, nor horses entirely disappear from the boulevard, and town and farm; but henceforth machinery will perform the heavy work now done by animal power, just as the harvesting machine has taken the place of the sickle. The largest displacement of horses thus far was when street railways adopted electricity to operate their cars. To do the work performed by the trolley cars of the United States today, would require not less than 300,000 horses or mules, and these would have to be replaced every four years.

Automobiles propelled by steam, gasoline and electricity are already in use by thousands, and that village is far remote where at least one of these flying roadsters has not been seen. This week we illustrate several types of machines built for practical work.

California is a state of magnificent distances. Its railroads are few and far between as yet. To reach the nearest shipping point, hundreds of farmers must team the



grain and other products of thousand-acre farms many miles. This has resulted in the construction of thousands of miles of the finest highways in the country. Many of these roads are kept sprinkled at public expense for seven months in the year. The common method of hauling is in wagon trains of six or more big wagons, fastened one behind the other, and drawn by 16 to 20 horses. Two men constitute the crew. Travel is mostly by night when the air is cool. One of these trains carries upwards of 25 tons, and makes three to four miles an hour.

Keyless Clocks Available for Telephone Subscribers

1907—The good old-fashioned clock operated with weights or springs is being crowded out of existence in these electrical days, and is rapidly becoming a curiosity. Telephone companies are now furnishing their subscribers, at a small annual rental, self-winding electric clocks that give absolutely accurate time. The clock, or clocks, can be placed anywhere in the house and

are connected to the telephone wires by means of concealed wires. The telephone clock never stops, for it never runs down. Should it vary a second or two in the course of 24 hours, it will be correct again within a few hours, for once each day all the telephone clocks in the city are synchronized. This setting is done from the central office at an hour when the phone is least used.

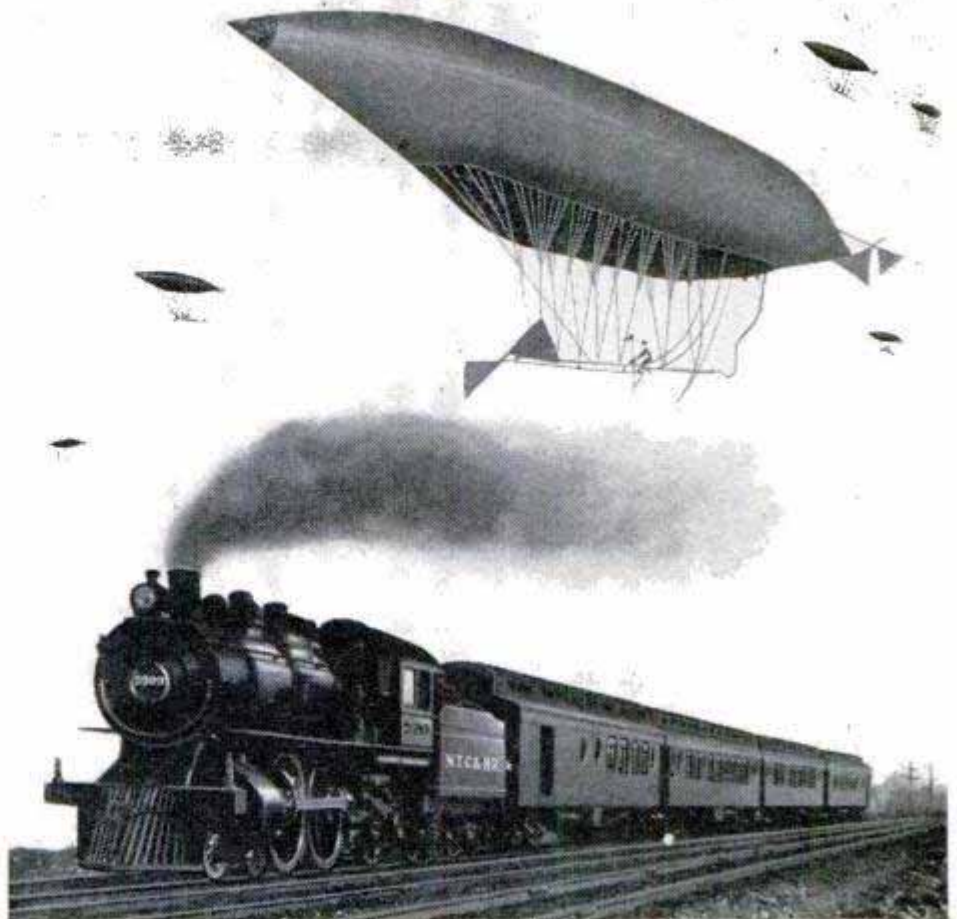
Airship Versus Passenger Engine



An airship race from New York to St. Louis during the coming World's Fair has been proposed by a New York aeronaut. This, it is claimed, would give the entire country lying on the route between the two cities an opportunity of witnessing the ships in flight and would prove the most sensational race in history. Of course, there is no airship at present that would undertake the long journey, but Santos Dumont claims that he will have a craft in readiness by the time of the World's Fair that can safely fly across the American continent.

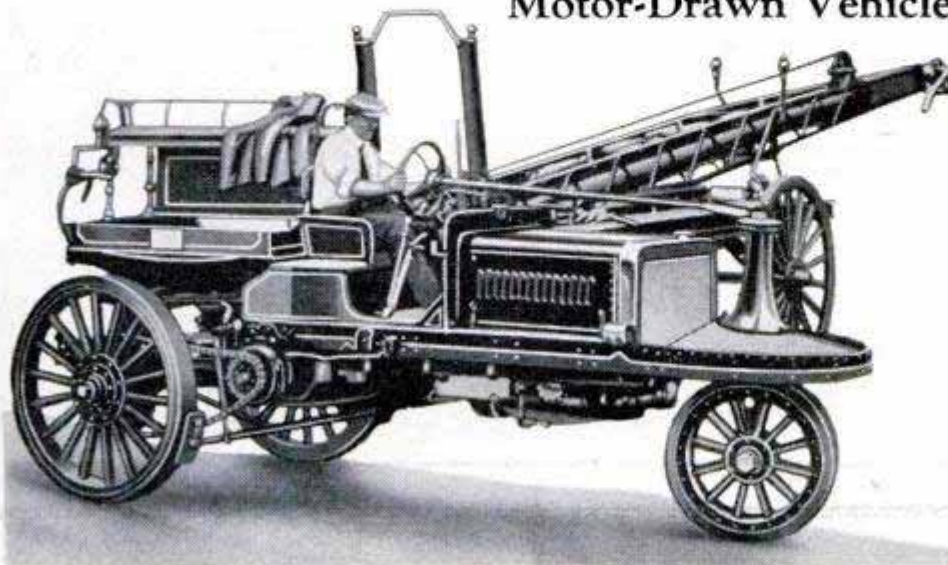
The same claim is made by Professor Stanley, who is building the monster aluminum airship in San Francisco, and by a Chicago aeronaut.

While some of the inventors say that their ships will be able to double the speed of a passenger train in the race, the New York Central officials say they have no fears of anything that flies, walks or rolls, making better time than the 20th Century Limited, the fastest long-distance train in the world. The suggestion has been made to enter the Limited in the race, should it materialize. The accompanying illustration shows the relative position of the racers as they would appear at the end of the fifth



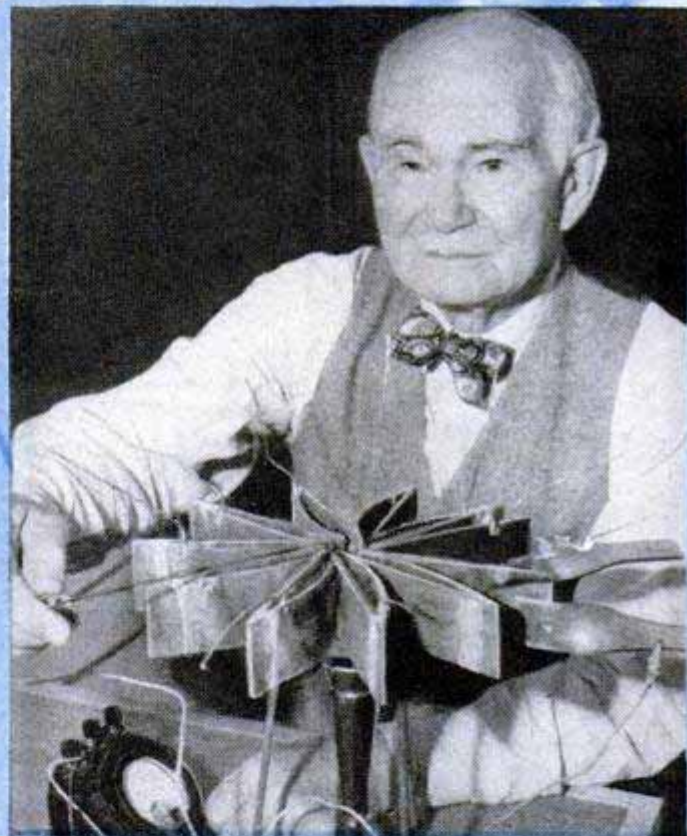
mile, according to the calculations of railway engineers, who claim they have made due allowance for the increased speed capacity that may be attained by the new airships yet to be built. The train leading the racers is the famous 20th Century Limited; pressing close behind is Santos Dumont's airship being propelled by the renowned aeronaut. Next in order is Spencer's aerial craft; next Stanley's and others are "also rans." Of course, this all comes from the fanciful dreams of railways officials; but things that looked stranger than this vagary have come true, and it may be that scenes like the one above will become familiar sights to persons even now living.

Motor-Drawn Vehicle Replaces Fire Horses



1912—A horse-drawn water-tower of the Springfield, Mass., fire department has been converted into a motor-drawn vehicle. A single front wheel, mounted on the apparatus in place of the front truck, makes it possible for a complete turn to be made with the vehicle on a pavement that is only 30 feet wide. The over-all length of this tower and motor car is 57 feet.

Dawn of the



Lee deForest writes of the electronic age, which began in 1906 when he invented the three-electrode tube

With the giant antenna, at left, Army Signal Corps engineers made the first radar contact with the moon in 1946, only 40 years after the electron tube was invented by the "Father of Radio"

Electronic Age



DeForest's patent of a "device for amplifying feeble electrical currents" is one of most valuable ever issued

By Lee deForest
("Father of Radio")

WHEN VOCAL SOUND first became articulate the ancestor of man leaped suddenly from the dumb shackles of the brute. The first crude sign writing, whereby thoughts might be recorded, helped to bring scattered men and tribes into social units and establish contact with future generations through the permanency of the written word. For ages, ecclesiastics maintained a monopoly of reading and writing. Then came movable type and the printing press of Gutenberg. Reading and writing became common heritage. The postal service followed, fostering a moderate exchange of thought between people. Ancient Greeks developed a crude method of heliograph for military signaling. Then flags by day and fires by night conveyed information over wide distances. Later, the system of signaling by semaphore devised by Claude Choppe during the French Revolution blazed the path leading to the electric telegraph of Morse. Scarcely more than a cen-

tury ago came the first telegraph, an instantaneous means for communicating over great land distances, followed by the submarine cable for spanning the oceans. Bell, experimenting with a new form of telegraphy, came upon the telephone, and as a result business and social life were immeasurably increased in tempo.

Late in the 19th century, wireless telegraphy entered the communications field,

Right, from the crude sets of early radio (three are seen here with the Audion tubes mounted on their front panels) to the magic of radar and television, the electron tube has been the heart of each instrument





U. S. Army photos

Above, halfway up a Korean mountain, this Army radio operator uses a complex VHF receiver-transmitter. Left, his 1904 counterpart takes down a radio message on an early receiver at Fort Mason



first as a means of spinning threads between ships and shores, and robbing the sea of its sinister silence; later as a practical means of transoceanic communication. Inspired by the classical formulas of Maxwell in England, Hertz in Germany in the 1880s discovered electromagnetic waves, proving them akin

to light waves but of vastly longer wavelengths and lower frequencies.

Although signaling by means of these hertzian waves, generated first by a condenser discharge across the crude spark gaps of Hertz, Marconi, Lodge and others, and controlled by the telegrapher's key into dots and dashes of the Morse code, preceded by 10 years the advent of the radio tube, those historic crudities could scarcely be considered as properly belonging to the electronic age.

By common consent today, that era was born with the discovery that electrons traveling across an evacuated space could readily be controlled by a simple grid electrode interposed between the electron emitter, a heated cathode, and a cold plate connected to the positive terminal of a battery, preferably of low voltage, its negative electrode being connected to one



Below, Dr. Vladimir Zworykin and a reflected-image television set he made in 1929. Left, today's TV cameras are literally jammed with electronic tubes and parts



In 1916, DeForest went aloft in this plane, making what is said to have been the first time radiotelephone was used in a plane. It was so successful the Army ordered two sets



end of the filamentary cathode. In that so-called "B," or secondary, circuit was inserted a signal-indicating device, usually some form of telephone receiver; later a loudspeaker was used.

The date of my discovery of this small acorn from which has sprung the gigantic oak that is today world-embracing, was the latter months of 1906. But it was not until 1912 in Palo Alto, Calif., that the Audion was used as an amplifier, first of radio signals, then for long-distance telephone communication. This rediscovery was made just in time to render possible the fulfillment of A. T. & T.'s contract with the Panama Pacific World's Exposition to establish transcontinental telephone service between New York and San Francisco before January 1915. Later that year the Western Electric Company, now further licensed under the Audion-amplifier patents, succeeded in transmitting by radiotelephone the human voice from Arlington, Va., to

the Paris Eiffel Tower, and also to Honolulu, more than 6000 miles distant.

This gigantic step in radio speech was made possible by the discovery, also in Palo Alto in 1912, that the Audion amplifier, when properly connected in a "feed back" circuit, became an oscillator or generator of alternating currents of practically any frequency, numerically dependent upon the dimensions of the circuit elements that were involved.

That invention of the oscillating tube and circuits began forthwith to force into disuse the spark-gap, open, rotary, or quench types, and also high-frequency alternators. Today the use of the tube oscillator is universal, found in every radio and television station for the generation of long, short, or "ultra short" waves around the world.

No greater influence has been at work in molding our civilization than the telephone. Today we have some 50,000,000 telephones installed throughout the world, connected

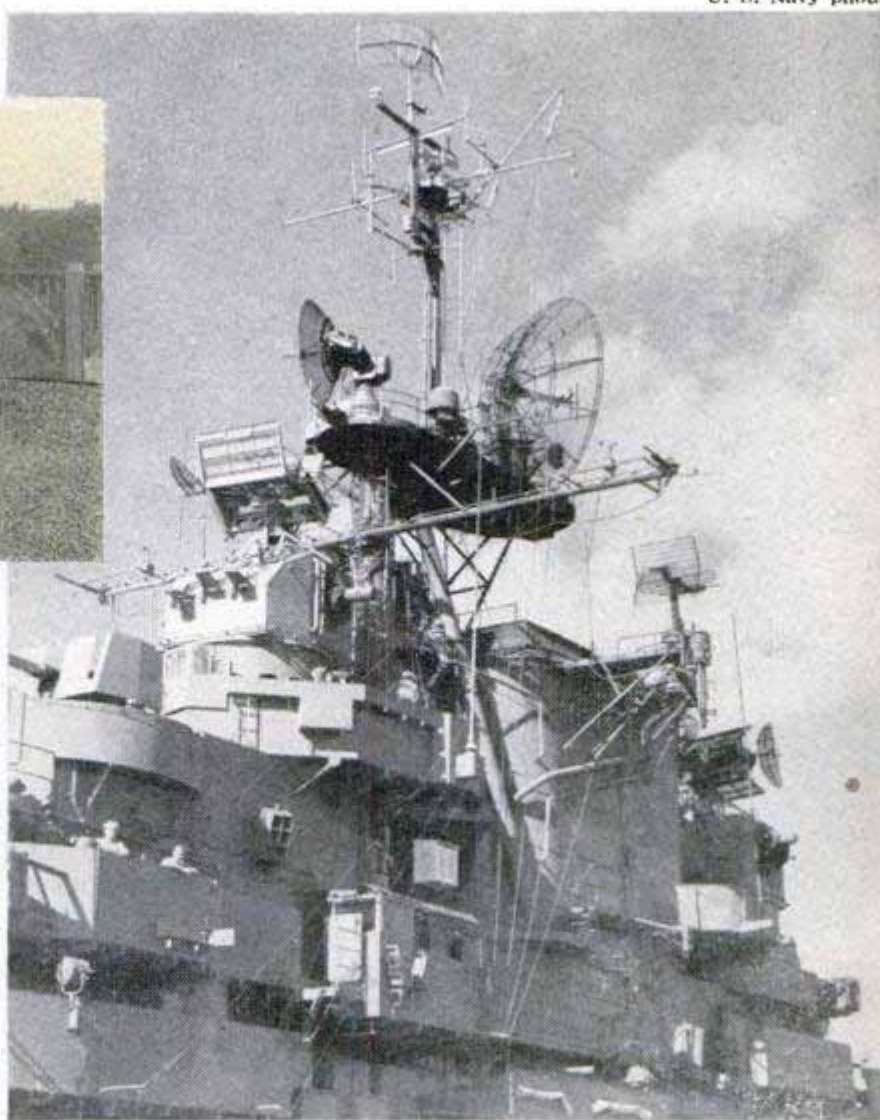
U. S. Navy photo



Westinghouse photo

Above, two early experimenters in the beaming of radio waves use a highly polished reflector behind an antenna. Experiments such as these led to the subsequent development of the radar

Crude as its beginnings were, radar is today complex beyond the understanding of the layman. Some radar antennas on the island of the U.S.S. Hornet give a clue as to its value



by some 100,000,000 miles of wire and unnumbered miles of "etheric" linkage. And in all telephone lines today longer than 50 or 75 miles you will find electron "booster" tubes so that one can speak from Los Angeles to Paris with the same voice volume as used in local calls.

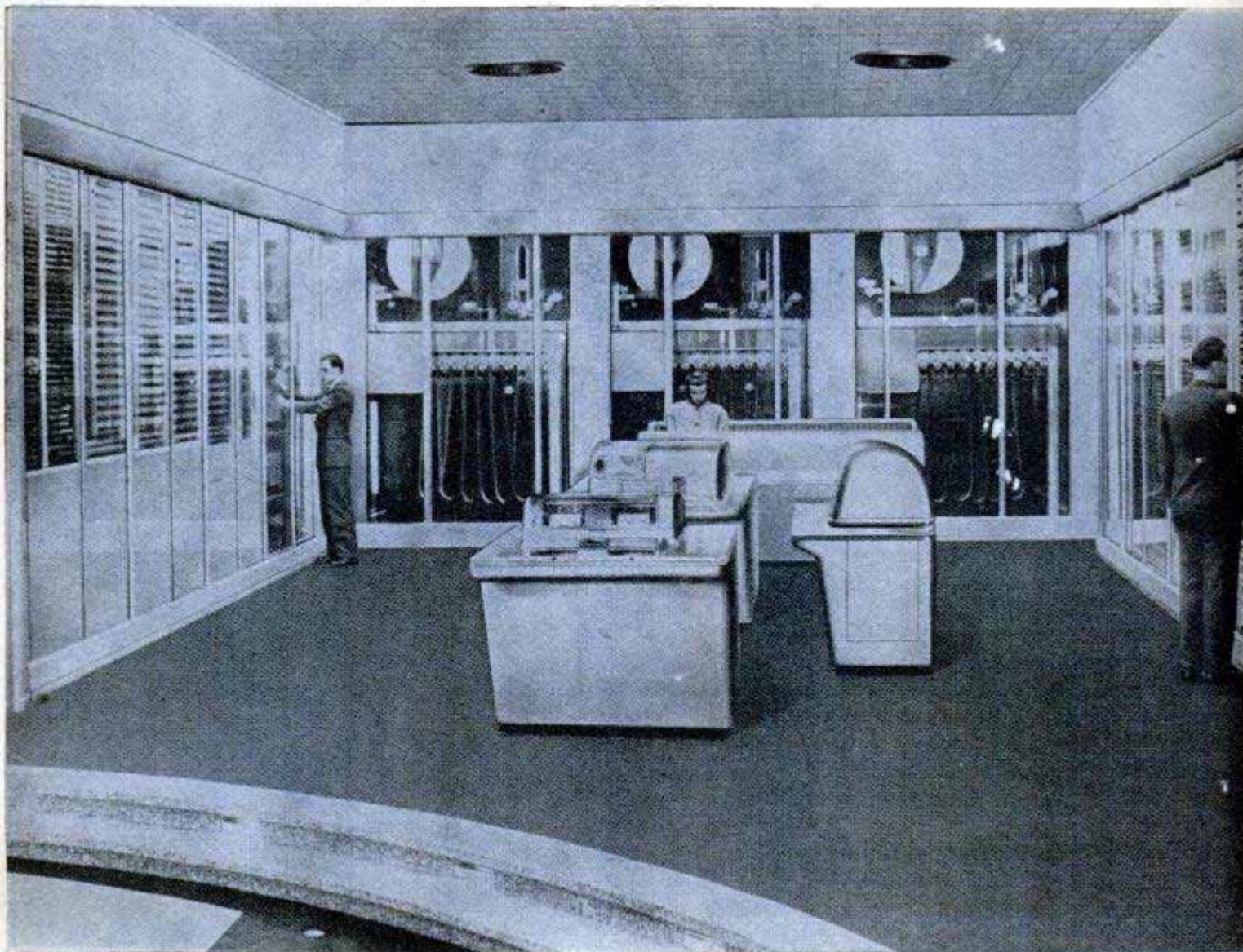
The actual poetry of this engineering triumph was first brought stunningly upon me in 1915 when I sat in an audience in San Francisco and heard the breaking of the surf upon the far Atlantic shore. There our modern sophisticated generation was able to appreciate for the first time the deep significance of that historic phrase, first signaled over Morse's wire: "What hath God wrought?"

During its early years there was every indication that radio would be employed mainly for military purposes. The Navy and then the Signal Corps were for years its chief proponents. Then the widespread clan of radio hams, or amateurs, tiring of dot-dash conversation reached eagerly for the new implement, the Audion, and soon global conversations began. It was such hosts of young pioneers in the short-wave ocean of space, after the long waves were officially denied them, that demonstrated

the unexpected ability of such high frequencies to span the globe and to reach out into empty space. Thus instructed, every effort was hastened by the radio engineer to speed up transoceanic service. Soon we had fast facsimile, followed by unbelievably accurate transfer of photographs.

Today photographs, drawings, fingerprints, printed matter, handwritten and typed messages, business and legal documents are flashed across the sea in facsimile form and accepted at their face value. Thus a new business day opens when a person in New York can sign his name to a document in Japan or Berlin within the hour.

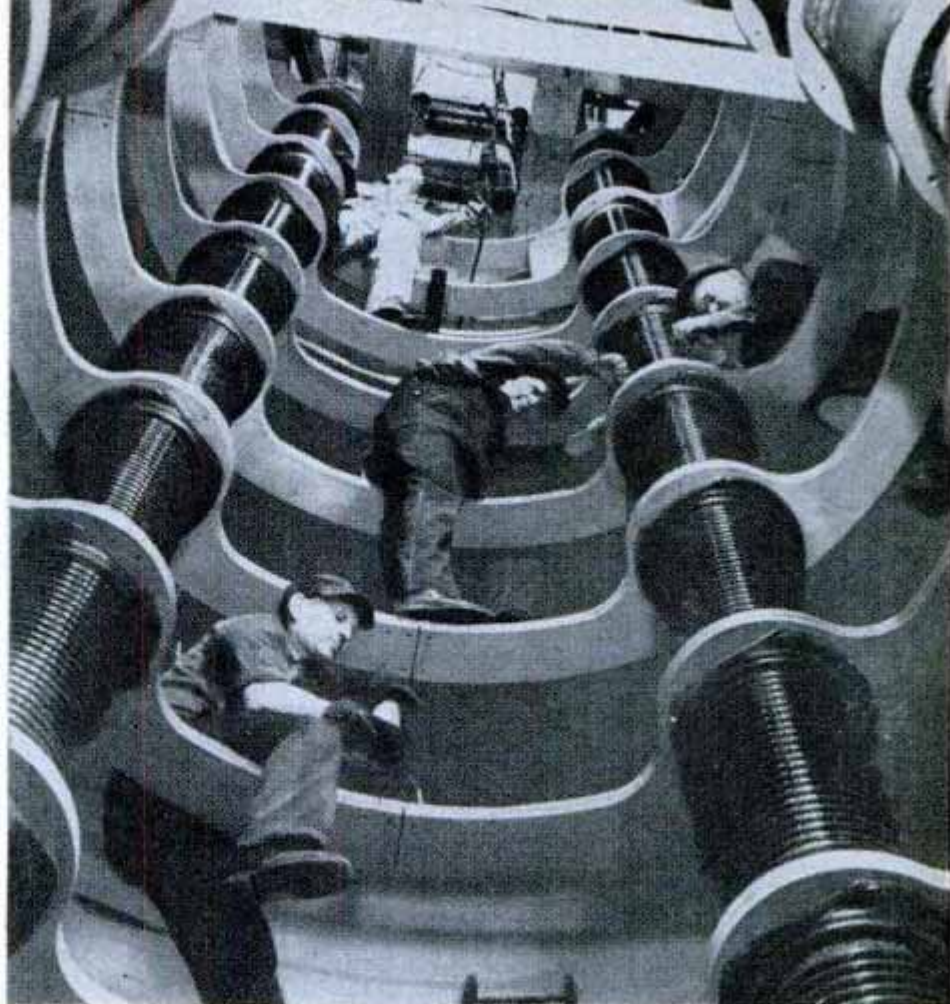
The microphone-amplifier-loudspeaker combination is having an enormous effect on our civilization. Not all of it is good! Consider to what heights of impudence and tyranny, and to what depths of moral depravity, has radio broadcasting and the loudspeaker attained in that recent monstrosity, Transit Radio, Inc. Almost incredible is the loathsome fact that already in 21 cities bus riders must listen to never-ending, blatant advertising and unwelcome jitterbug and bop music, "viciously repugnant to the spiritual and intellectual assumptions of American life," as Prof. Charles



Black of Columbia University wrote. This outrage is unquestionably the all-time low to which radio broadcasting can sink.

Such crimes notwithstanding, it is questionable whether science has contributed in one single instance more to present and future civilization than it has in the gift of broadcasting. In 1907 I began to build radiotelephone transmitters for the United States Navy. In testing these devices I placed their output "on the air" and played phonograph records by the hour. The tests attracted widespread attention and gave me the idea of mass communication or "broadcasting." Three years later Caruso's voice was broadcast from the

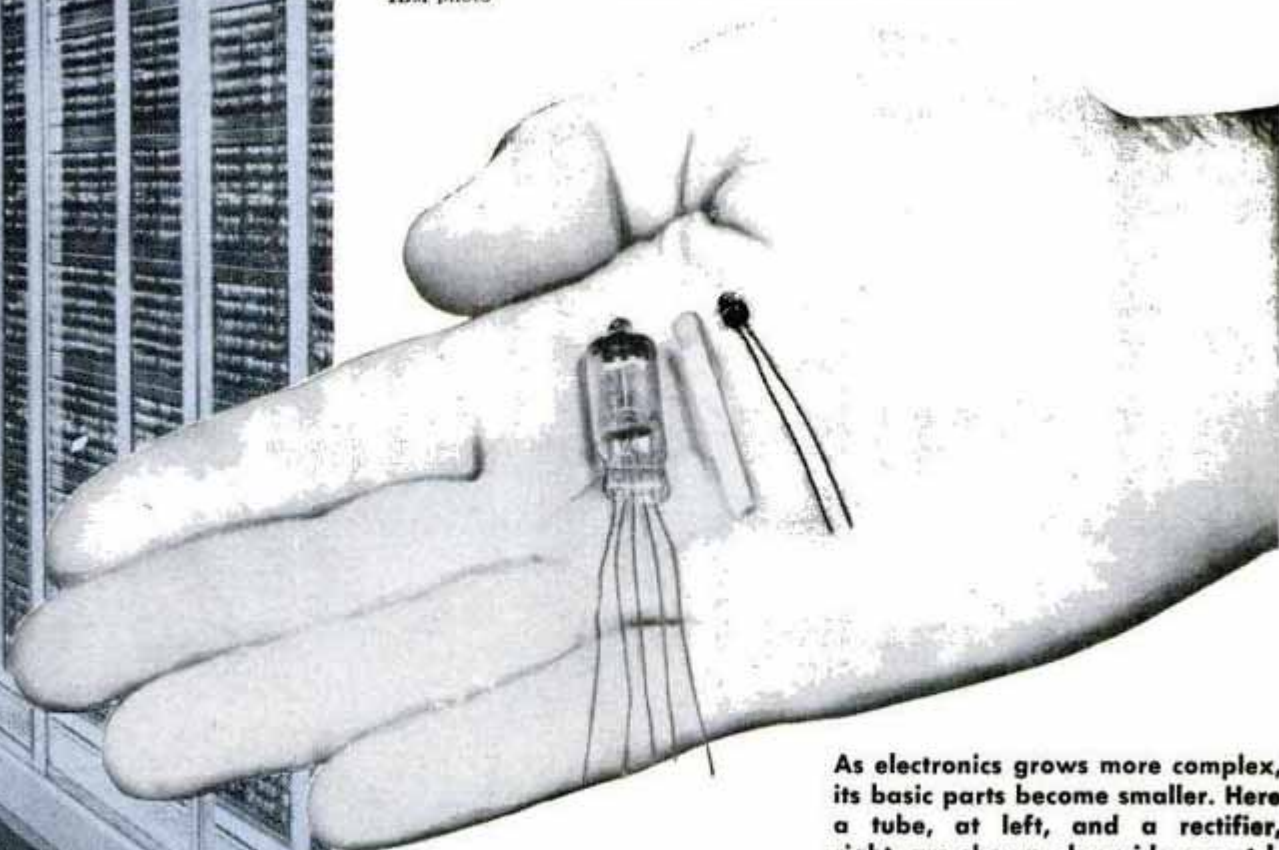
(Continued to page 358)



Westinghouse photo

Electron tubes are vital to much research. Without them, atom smashers like this wouldn't exist

From the first three-electrode vacuum tube, which DeForest made in 1906, have come such electronic marvels as the big selective-sequence calculator
IBM photo



As electronics grows more complex, its basic parts become smaller. Here a tube, at left, and a rectifier, right, are shown alongside a match

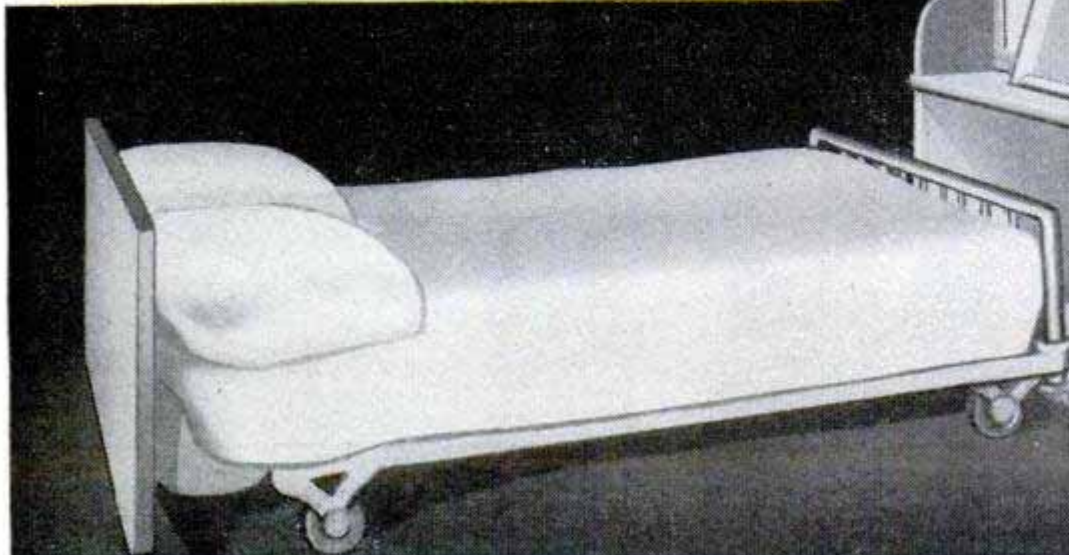
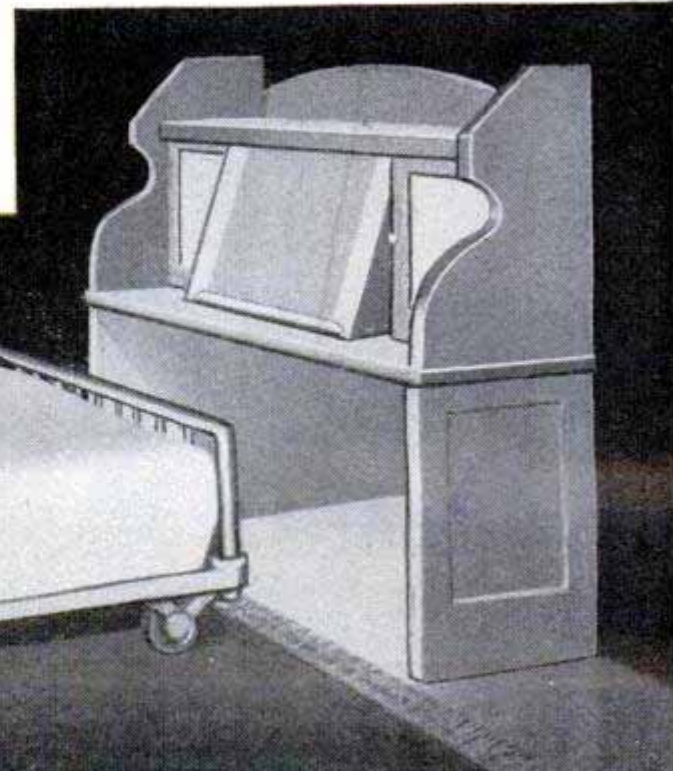
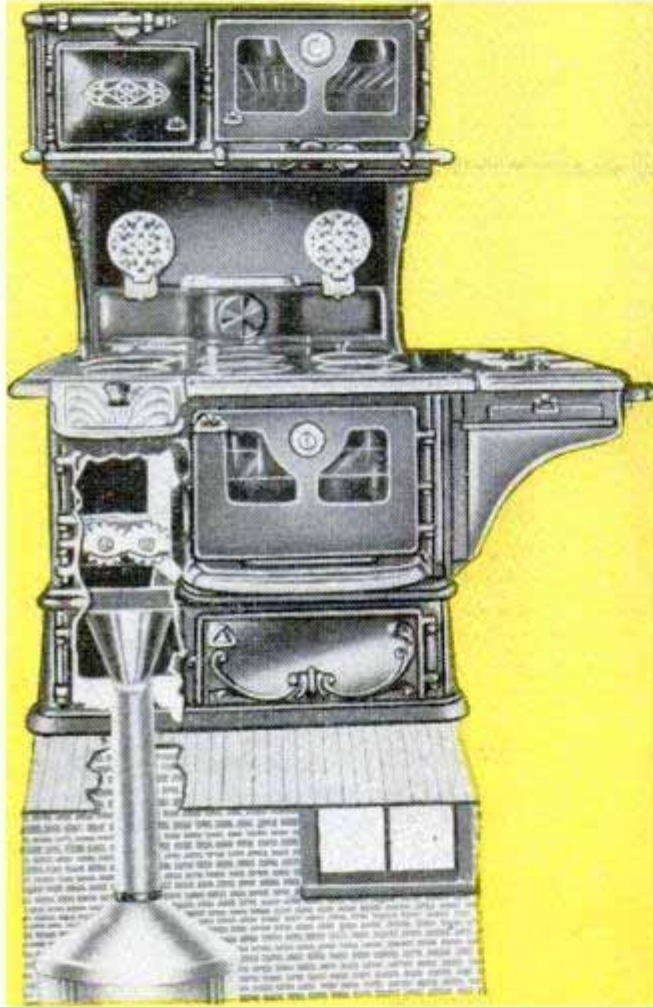
**What WAS New
for Your HOME
when Popular Mechanics
was young**



Back in 1920, PM's pages reported that the lady above brushed dust from her garments with a new rotating electric brush regulated by a handy toe switch

The de luxe coal-burning range with an attachment for gas was quite a sensation in gala pre-World War I days. A chute to the cellar handled the ashes

Roll-away beds were the rage in 1916, and beds popped out of 'most anything. This desk-bed pushed back out of sight under elevated floor in adjoining room



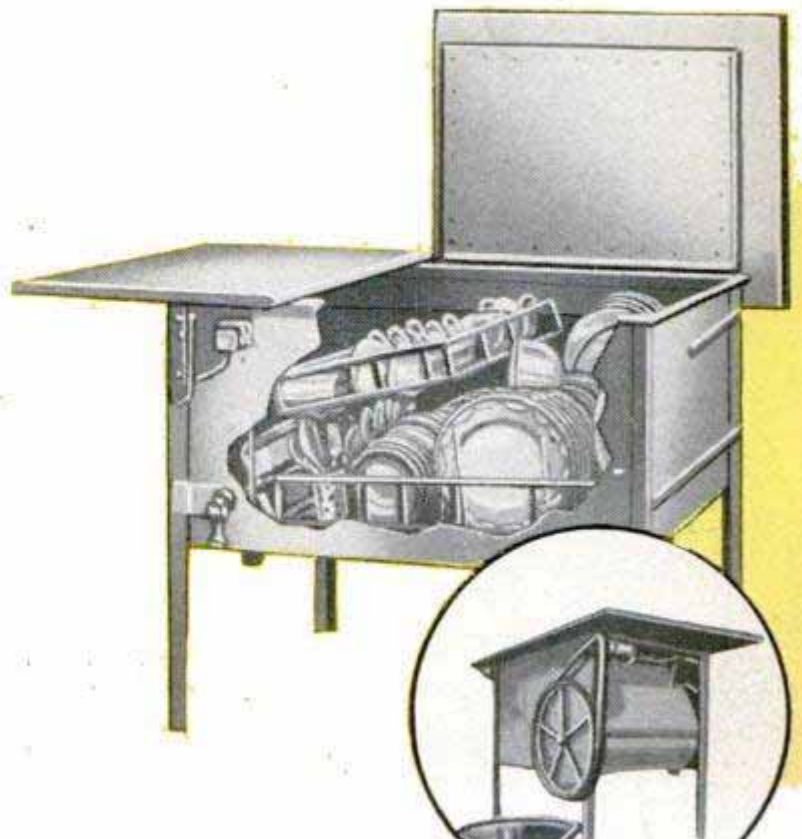
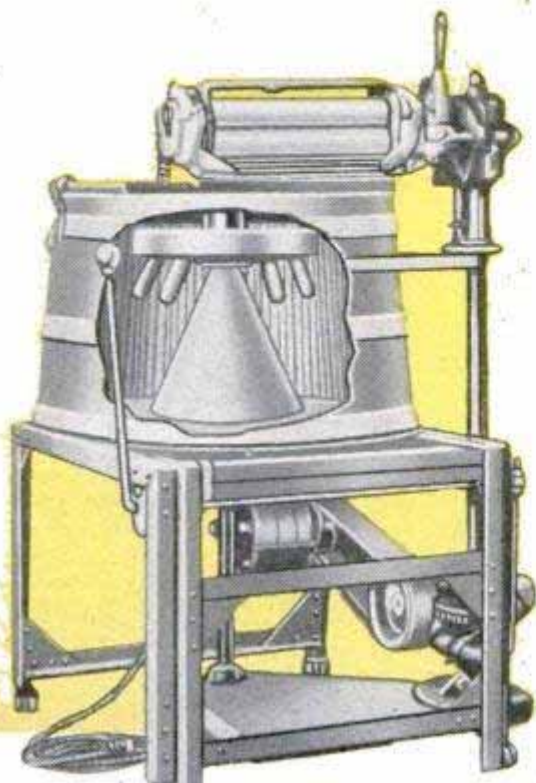


No home was complete in 1915 without a hammock and the one above rated an article in PM with its new-fangled stand-up feature. The reason? Feet could be rested on the ground without twisting body to side

There's muscle under the left sleeve of the lady at the right with the 1911-model vacuum cleaner. She had to pump the bellows with one hand while guiding the suction nozzle with the other. Notice harness

Below right, an early type electric dishwasher was introduced in 1920. It had a paddle wheel to throw hot water on the dirty dishes, and when the unit was closed up (inset) it served as a handy work table

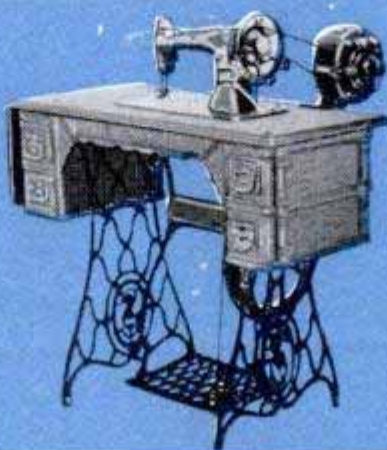
Below, the latest thing in washing machines in the early '20s was this model with a reciprocating cone in the center to keep the clothes from massing together, and assuring a good sousing in the hot suds



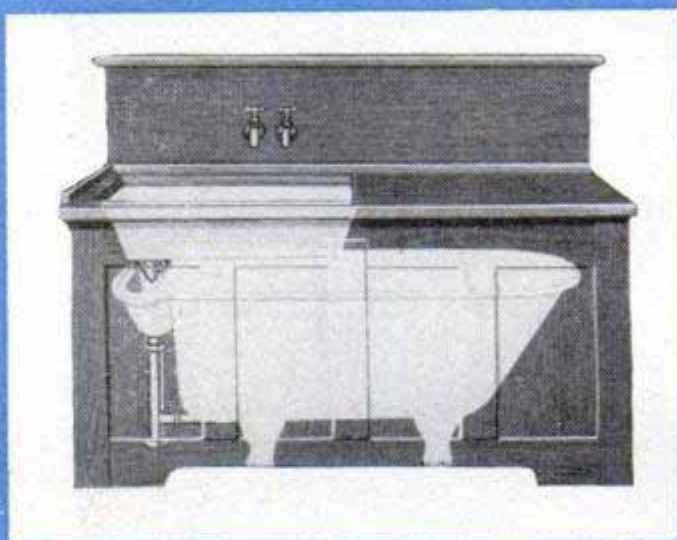
What WAS New for Your HOME when Popular Mechanics was young



A 1914 article introduced a new toaster to turn bread automatically by merely turning a knob on patented frame



The floor polisher and sweeper, at left, and the sewing machine with an electric motor, above, were 1908 examples of how electricity was heralding the day "when the weary duties of daily housekeeping should be relieved of their terrors." The porch lamp, above, has a bug screen below the shade. Below, the bobbed-haired 1925 "flapper" is demonstrating her completely modernized kitchen with a roller cabinet that tucks under the sink, and the shelves just above. And that was only 26 years ago!



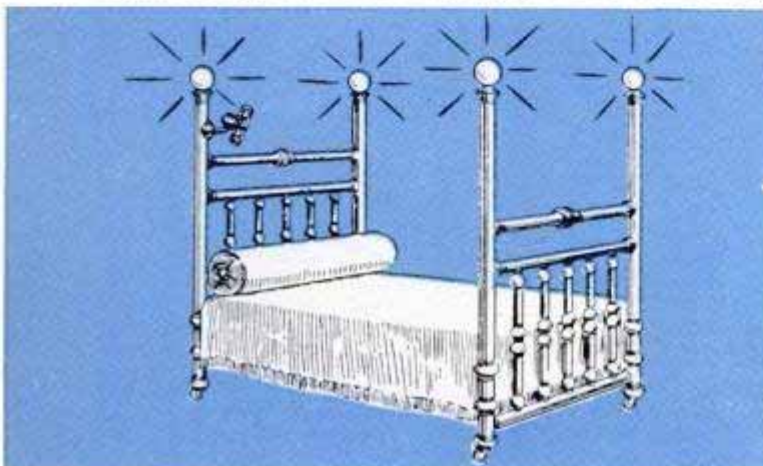
Just the thing for the Saturday-night bath in 1916 was this tub concealed under the kitchen sink. The cabinet had to be moved, however, to get into tub



Sliding drawers on this refrigerator featured in a 1925 article eliminated stooping and were easy to clean. A neat item was the water bottle on the top



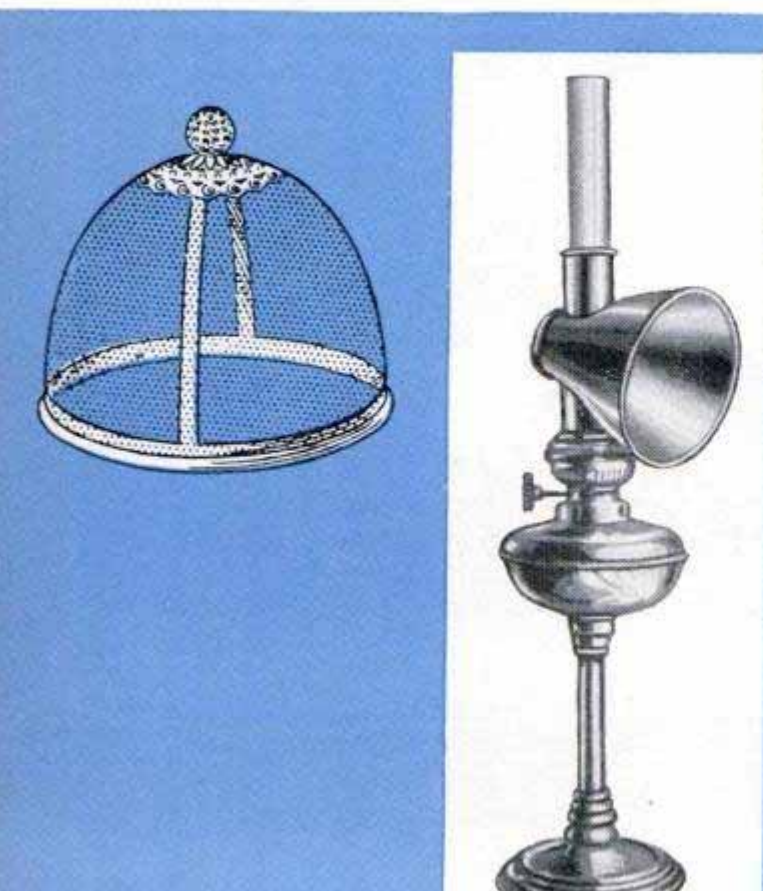
This small electric range which plugged into a wall socket made its bow in PM's pages in 1920. A double element in oven permitted four cooking operations

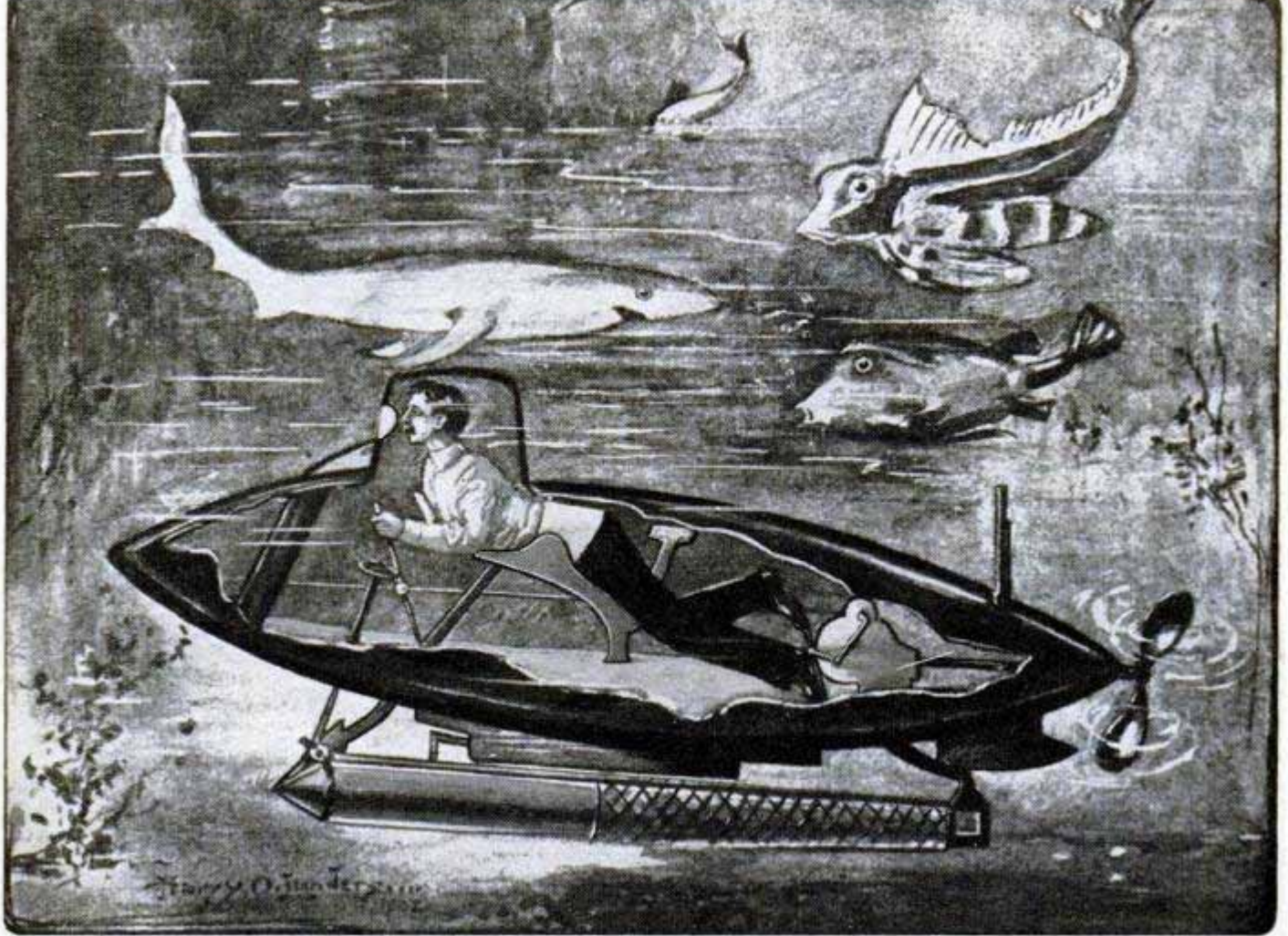


Electricity ran wild back in 1912 and a Cleveland company turned out the brass bed, above, with light bulbs on all four posts, electric fan and heat pad

An elegant import from France in pre-World War I days was the silvered fly screen, below, to be set over dishes of food. The lamp has a side reflector

The happy housewife below has just discovered the new 1920 model "drier." The hook shown in detail was clamped to the edge of the tub while milady twisted





ONE-MAN SUBMARINE TORPEDO BOAT



A new terror of the deep has made its appearance in the form of a torpedo boat, only 11 feet long, built for one man only, the inven-

tion of Thomas J. Moriarty, of the Newport Manufacturing Company, Newport, R. I. It can dart about on top of the water, under the water, and defy the most tempestuous seas.

The greatest war vessels of the earth's power would be at its mercy in the event of war. With no danger of detection, the tiny boat can slip down, plant a torpedo on the bottom of the largest man of war, make its escape and rise to the surface again in time to see the iron-clad monster be blown into fragments.

Looking like a fish as it glides about on the surface, it can drop down into the ocean's depths and change its course at the operator's will. It will open up anew to man the mysteries of the deep and make him at home in the realm of the fishes. To the water it is what the perfected flying machine will be to the air.

Almost as long as man has been trying to invent a flying machine he has been trying to invent a one-man submarine boat, but this is the first time he has succeeded in

devising such a boat—one that will delve into the mysterious deep, rise and sink at the will of the operator. "The boat is guided, submerged and controlled by one person only," says the American Ship-builder, "and is provided with a conning tower about the size of a bucket. The operator rests in an inclined position on a padded frame. This position gives free play to his legs in operating the pedals connected with the propeller shaft. The man keeps his head in the conning tower, which is provided with a glass front through which he can observe his course and objects about him. Two handles, connected with the propeller shaft, are in easy reach of his hands."

In addition to the foot and hand power, there is a little engine, also connected with the propeller shaft, which is utilized for moving the boat. A submersion tank permits the boat to be submerged until the base of the conning tower is level with the surface of the water. Four movable fins enable the boat to rise or plunge beneath the surface when in motion.

A torpedo, suspended in a casing beneath, serves as a keel. When this has been discharged, a collapsible keel is let down from a recess in the bottom of the boat.

POPULAR MECHANICS
FIFTIETH ANNIVERSARY

HALL OF FAME

1902-1952

FROM THE VANTAGE POINT of a half century during which *Popular Mechanics Magazine* has observed and reported the noteworthy accomplishments in the fields of mechanics, the sciences and discovery, its editors pay tribute in this Golden Anniversary Hall of Fame to 50 Americans, native or naturalized. These are the men whose achievements in these fields have contributed in such high degree to the welfare of mankind as to deserve signal honor of their fellow men. There are other men of eminence whose lives reached into the 20th century but whose significant work occurred before 1902; these have been omitted from this roll of honor. Throughout the years, the pages of *Popular Mechanics* have reflected the accomplishments of every man on this distinguished roster.



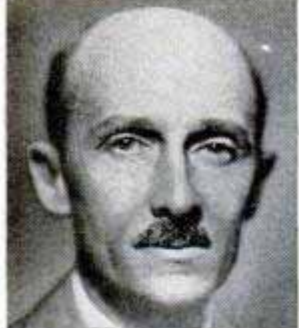
Carl D. Anderson

For his discovery in 1932 of the positron, a part of the atom, which was a vital contribution to new research on the structure of matter. Faculty member, California Institute of Technology, Pasadena



Edwin H. Armstrong

For his inventions as an electrical engineer in the field of radio; FM static-free radio, 1939; super-regenerative circuit, 1920; superheterodyne, 1918, and others. Faculty member, Columbia University



William Beebe

For his explorations in which he has given man a glimpse into new frontiers; for his descent into hitherto-unknown ocean depths in the first bathysphere; and many other contributions in zoology



Ewing Galloway

Richard E. Byrd

For explorations in the Arctic and Antarctic; for flights over the North Pole (1926) and the South Pole (1929); for the discovery of great land areas in the Antarctic and his solitary 5-month vigil



Hugh H. Bennett

For his work in soil conservation, which for generations to come will be a boon to agricultural nations; for founding the Soil Conservation Service, Department of Agriculture, of which he is chief



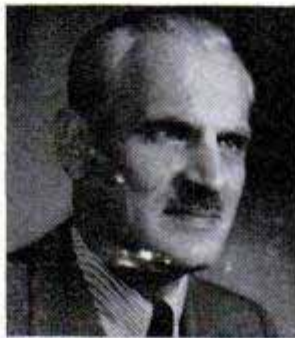
George W. Carver

For his work as an agricultural chemist in helping revolutionize agriculture in the South; for the creation of new products from peanuts, soybeans, sweet potatoes and cotton stalks. Died in 1943



Hans A. Bethe

For basic research in theoretical physics; for his theory of atomic nuclei; for his discoveries on the energy production of stars; for his shock-wave theory. Faculty member, Cornell University, Ithaca



Arthur H. Compton

For directing the work at the University of Chicago which resulted in the first atomic chain reaction; for important discoveries on X rays and also on cosmic rays. Chancellor, Washington Univ., St. Louis, Mo.



Percy W. Bridgman

For discoveries on the physical effects of high pressures; for research on the electrical conduction of metals and the properties of crystals. A member of the faculty, Harvard Univ., Cambridge



Karl T. Compton

For his discoveries in the field of electrical discharges; for research on the harnessing of atomic energy; for leadership of development board, Nat'l Military Establishment. Chairman of Corp., M.I.T.



Luther Burbank

For the creation of new fruits, grains, grasses, vegetables, flowers and trees; for his work on the crossing and selection of plants which he conducted until shortly before his death in 1926



Glenn H. Curtiss

For pioneer work in the development of aircraft; for his Navy-Curtiss flying boat which made the first flight across the Atlantic Ocean in 1919; for building World War I planes. He died in 1930



Vannevar Bush

For his work as director of the Office of Scientific Research and Development in coordinating war research for an electrical superpower system and many inventions. President, Carnegie Institution



Lee deForest

For the invention of the radio tube and 300 other inventions in wireless, telegraphy, radiotelephone, wire telephone, sound-on-film talking pictures, facsimile and the television. Los Angeles

**Albert Einstein**

For his theories of relativity, on which all atomic research is based; for revolutionizing mankind's ideas of time and space; for his law of photoelectric effect. Faculty member, Princeton University

**George E. Hale**

For research in astronomy on solar and stellar spectroscopy, depths of the universe and the stellar evolution, for his work as organizer and director of Mt. Wilson Observatory, Pasadena. Died in 1938

**Lincoln Ellsworth**

For polar exploration; for Amundsen - Ellsworth Nobile transpolar flight in 1926; Antarctic flight, 1935, when he claimed 300,000 square miles of new land for the United States. He died in 1951

**Edwin P. Hubble**

For his theory of the expanding universe and for other research on outer space; for work on the design of 200-inch Hale telescope at the Palomar Observatory. Cosmologist, Palomar, Mt. Wilson

**Enrico Fermi**

For discoveries in atomic research as pertaining to the magnetic moments of nuclei, beta-ray emission, artificial radioactivity as well as for devising the first atomic pile. Faculty, the University of Chicago

**Edward C. Kendall**

For research and discoveries in biochemistry; for isolation of thyroxine from thyroid gland and hormones of the adrenal cortex, also synthesis of the latter. The Mayo Clinic at Rochester, Minnesota

**Henry Ford**

For his pioneer activity in the automotive field; for his original assembly-line methods and mass production which made it possible for the average American to own an automobile. He died in 1947

**Charles F. Kettering**

For his pioneer work as automotive engineer and inventor; for the self-starter, lighting and ignition systems; for improved auto fuels; for nearly 50 years of vital research. Dayton, Ohio

**James Franck**

For research on energy exchange between electrons leading to discoveries in photochemical processes and in photosynthesis. A member of the faculty, chemistry, at the University of Chicago

**Morris S. Kharasch**

For work in organic chemistry, seed disinfectants and fungus diseases; for isolation of ergot; for his discoveries in antiseptics and hormones as well as in synthetic rubber. The University of Chicago

**George W. Goethals**

For his work as chief engineer and chairman of the commission which completed one of the greatest of engineering feats of all time — the Panama Canal. Colonel Goethals died in 1928

**Irving Langmuir**

For chemical research and molecular physics; for the development of the gas-filled tungsten lamp, electron-discharge apparatus, a high-vacuum pump, surface chemistry. General Electric Company



Ernest O. Lawrence

For his invention of the cyclotron and other vital machines for nuclear physics; for important research into the nature of the atomic nucleus. Director of Radiation Laboratory, University of Calif.



Robert E. Peary

For the discovery of the North Pole in 1909 after years of Arctic exploration; for his courage in proceeding on foot with a small group when most of his party had turned back. Peary died in 1920



Charles A. Lindbergh

For planning and executing the first solo flight across the Atlantic Ocean on May 20-21, 1927, in The Spirit of St. Louis; he flew 3600 miles in 33½ hours; for his inspiration to aviation development



I. I. Rabi

For discoveries in physics pertaining to magnetism in regard to molecules resulting in much new information in the atomic and molecular structures; also for radar research. Faculty, Columbia Univ.



Thomas Midgley, Jr.

For his discovery of the antiknock properties of tetraethyl lead, principal ingredient of the ethyl and the high-test aviation gasolines and vital to powerful modern engines. He died in 1944



John L. Savage

For outstanding work in civil engineering; for directing design and the building of Grand Coulee, Hoover and other dams and irrigation projects throughout the world. The Bureau of Reclamation



Robert A. Millikan

For his work in physics, including determination of fundamental electrical charge on the electron; for his research on the properties of cosmic rays. Prof. emeritus and v.p., California Institute Tech.



Glenn T. Seaborg

For discoveries and continuing research in nuclear physics pertaining to the elements heavier than uranium; codiscoverer of plutonium and others. Member of faculty, University of California



J. Robert Oppenheimer

For extensive research in nuclear physics; for his direction of the Los Alamos laboratory in New Mexico during the perfection of the atomic bomb; for work on Atomic Energy Comm. Princeton, N.J.



Alexander P. deSeversky

For the invention of the fully automatic bomb-sight, for airplane design, including a single-seat fighter plane, air-cooled engine with a turbo-supercharger for high altitude flight. New York City



Linus C. Pauling

For his resonance theory of chemical bonds; for his discoveries in the fields of physics, biology, chemistry and medicine; for atomic structures of protein molecules. California Institute of Technology



George H. Shull

For the development of hybrid corn, which has increased the annual corn crop by millions of bushels — believed to be one of greatest food boons of modern times. Faculty member, Princeton Univ.



Igor I. Sikorsky

For the development of first successful helicopter built in the United States; for building and flying the first multiengine planes; for work in developing many long-range planes. Sikorsky Aircraft



Nicola Tesla

For early research on electric current; for the substitution of alternating current for direct current; for a system of arc lighting; for a high-frequency generator; for the Tesla coil. Died in 1943



Elmer A. Sperry

For his contribution to aviation with early instruments for blind flying, the Sperry gyrocompass, airplane and ship stabilizers and scores of other important inventions. He died in 1930



Harold C. Urey

For the discovery of the hydrogen atom of atomic weight two and for the production of heavy water and uranium-235; for extensive research on the construction of atoms. University of Chicago



Charles P. Steinmetz

For his electrical inventions, including magnetite-arc lamps, induction regulators, transformers and measuring instruments; for protection against lightning. General Electric. He died in 1923



Frank Lloyd Wright

For the major role he played in the development of modern architecture; for his originality in arranging interior spaces and for his exteriors of functional design. Wisconsin and Arizona



Louis H. Sullivan

For his work in architecture; for applying many new principles to skeleton-steel buildings; for introducing "functionalism" as the basis of modern architecture. Chicago. Sullivan died in 1924



Orville Wright

For the invention, with his brother, Wilbur, of the first successful airplane; for being the first man to fly in the historic power-driven airplane at Kitty Hawk, N. C., Dec. 17, 1903. He died in 1948



Leo Szilard

For his work with Enrico Fermi in devising the first atomic-pile chain-reaction system composed of uranium and graphite used in the earliest atomic experiments at the University of Chicago



Wilbur Wright

For the invention, with his brother, of the first airplane; for the successful promotion of the plane to the United States government; for early glider research with Orville Wright. He died in 1912



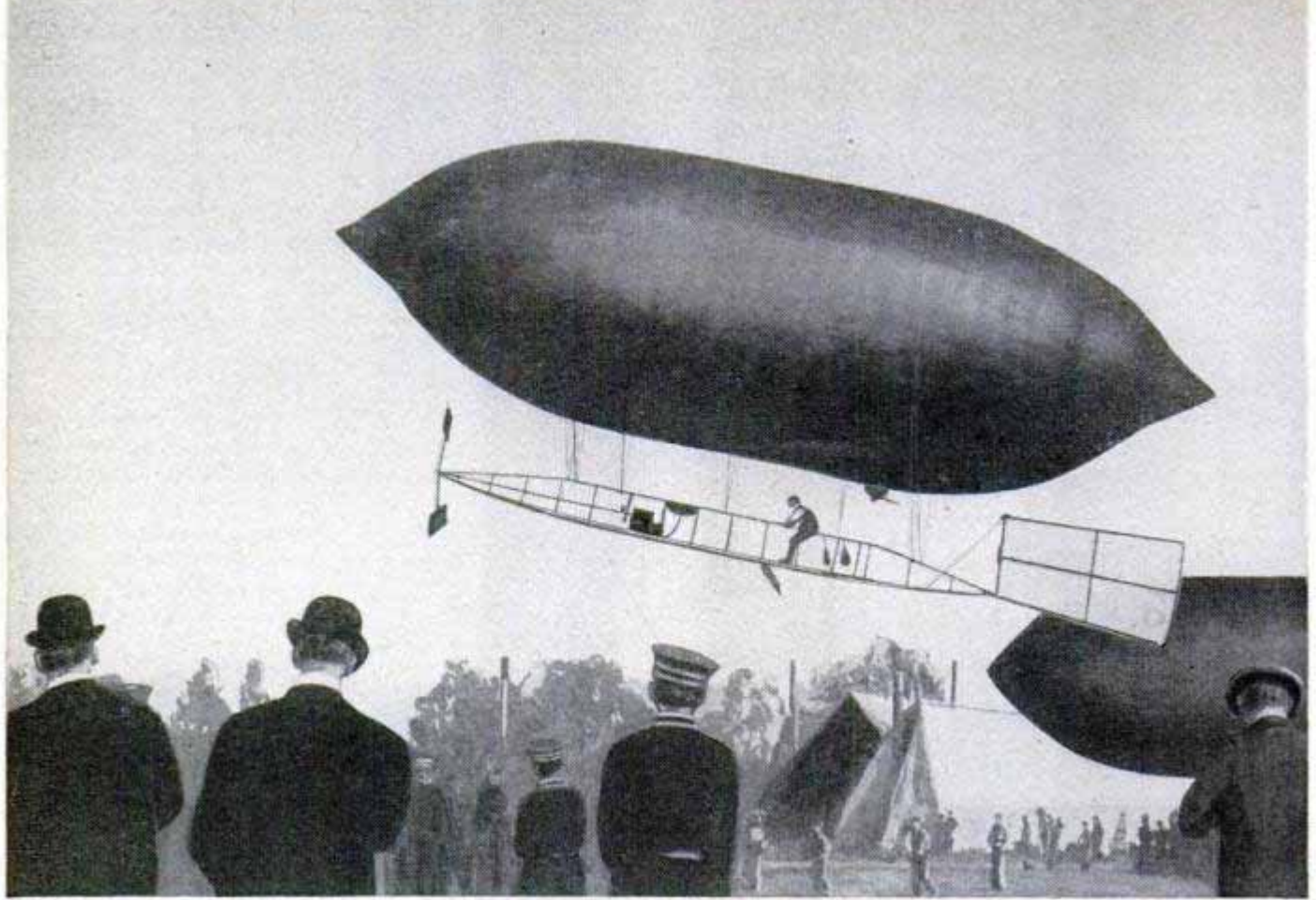
A. Hoyt Taylor

For pioneer research in the development of radar during the years 1922-1945 at the U. S. Naval Research Laboratory; for research in radio; for his electrical measurements. Taylor retired in 1945



Vladimir Zworykin

For the development of the iconoscope, an electronic tube which made modern television possible; for the development of the electron microscope. R. C. A. Laboratories, Princeton, N. J.



In exhibition of dirigibles (controlled airships) Lincoln Beachy demonstrates proper position for ascent

INTERNATIONAL BALLOON RACE OF 1907

By H. H. WINDSOR—*Founder of Popular Mechanics Magazine*



"One, two, three, four, five, six, seven, eight, nine, ten, go."

It was the official starter counting off the remaining seconds of the five-minute interval allowed each balloon to start on the International Race which occurred in St. Louis, October 21, 1907.

As the moment approached for the contest, 150,000 excited spectators surged around the inclosure where the nine great gas bags were swaying at their moorings. The Pommern, German prize-winning balloon, was the first to start. As it rose majestically, bands played and the gathered thousands shouted. From away up in the air floated back a farewell. Meanwhile, a score of men were moving the next balloon to its place. So perfect were the arrangements, there was no delay in any of the ascensions. The first occurred at four p.m.,

and 45 minutes later the last one was sailing away in the hope of winning the Bennett cup and a cash prize of \$2500.

The International Balloon Race of 1907 was altogether the greatest event in aeronautics ever seen in this country. Not only did each balloon start with several thousand pounds of sand ballast, but provisions for seven days were taken. Even though the balloon came down after 24 or 36 hours, it might land in a wilderness several days' journey on foot to the nearest dwelling.

It may be well to state here that the balloons were of the old-fashioned round gas-bag type of enormous size, but without any means for steering or propulsion. They could, of course, rise to a higher level at any time by unloading ballast, and likewise come down by letting out gas and, in this way, seek a more favorable current of air. For instance, when the Pommern started, it rose almost vertically to about 8000 feet,



Cromwell Dixon, 14 years old, starts on flight in foot-powered dirigible that weighs only 75 pounds

and remained there directly over the grandstand for nearly two hours. It had passed through the air currents near the surface and rested at the chosen altitude where there was not, at that time, any air moving. That this policy proved best is seen in the ultimate result, for the Pommern won the prize.

The U. S. balloon United States, in charge of Major Hersey, U.S.A., rose only to a height of 80 or 100 feet and, being immediately caught in a surface breeze, bounded away at a stiff pace and was soon lost to sight. Five minutes before the start, a messenger arrived all out of breath and handed Major Hersey some weather reports. The Major, being in charge of the weather bureau of Milwaukee, refused to take advantage of his office, but had a copy delivered to each balloon. It was a special report fresh from the wires, giving the prevailing winds in all parts of the country. Just before ascending, the Major traced his expected course on a map; and the course he took was almost identical with the prediction he made.

For the distance flown, the balloon United States made the best speed, covering 624 miles in 26 hours. The United States' average speed was 24 miles an hour and the Pommern's speed 22 miles an hour.

An exhibition of dirigibles was given on the second day, in which three ships made ascensions. The standard dirigible has a

horizontal, cigar-shaped gas bag, sharp-pointed at both ends. Near the middle is placed the gas engine, geared to a hollow propeller shaft which extends to the bow and terminates in the propeller blades. The ease and certainty with which the dirigible turns corners, or plows into the teeth of the wind, appeared fully equal to the control of a horse-drawn buggy on a good street or a motor launch of equal length.

In the exhibition of dirigibles, the first prize was won by the youngest aeronaut in the world, Cromwell Dixon, of Columbus, Ohio, 14 years of age. He constructed his own framework and machinery, his mother assisting in sewing the gas bag. This bag is 25 feet long and 10 feet in diameter. The complete outfit before inflation weighs 75 pounds. His propeller is driven by foot power, secured by using a bicycle frame and pedals. The ascension of this bright boy, who has not yet outgrown his knickerbockers, was made with the deliberation and coolness of an old-timer. On leaving the grounds, he narrowly escaped being wrecked in a tall tree, but by emptying ballast, putting the rudder hard about, and a diligent use of the pedals all in a few seconds, he cleared the obstruction. His strength was insufficient to hold out long against the wind, so climbing to an elevation of 1200 feet, he sailed east over the city, crossed the Mississippi and landed safely in Illinois eight miles away.

American Way of Life

PHOTO CONTEST

FOR A HALF CENTURY—a vivid, swift-moving, often turbulent half century—*Popular Mechanics* has mirrored to Americans and interpreted to the people of the world our American Way of Life.

On our pages have been inscribed the diary of a growing nation. Through these pages have moved the great people and the small, the Edisons and DeForests and Bells, the Ketterings and Lindberghs and the thousands of lesser men and women who have contributed their ideas and achievements to the enrichment of this nation and the world.

Enrichment not alone in the material things, but in the nourishing of the American tradition of freedom to think and learn, to worship, to work and to play; to pay allegiance not to emperor, usurper or dictator, but to leaders chosen for their devotion to trust; and to develop and share with others the bounty with which a provident Nature surrounded the pioneers who founded this nation.

This is the theme of this Golden Anniversary Issue of *Popular Mechanics*. In keeping with this theme, we present on the following pages the first 14 of the prize-winning photographs submitted by our readers in a \$5000 contest. The pictures portray the individual photographer's interpretation of the American Way of Life. Additional prize-winning photographs will be presented in the February issue.

The Winners

BLACK-AND-WHITE DIVISION

1st PRIZE: \$1000

C. E. Westveer,
63 Amherst Rd.,
Pleasant Ridge, Mich.

2nd PRIZE: \$500

Grant M. Haist,
1200 Lake Ave.,
Rochester 13, N. Y.

3rd PRIZE: \$300

Joseph G. Principato,
72 Aberdeen St.,
Lowell, Mass.

4th PRIZE: \$100

Earle W. Brown,
19355 Greenlawn,
Detroit 21, Mich.

5th PRIZE: \$100

Leonard Nadel,
132 North Clarence St.,
Los Angeles 33, Calif.

6th PRIZE: \$100

Nicholas Cannistraro,
26 Clark Lane,
Waltham 54, Mass.

7th PRIZE: \$100

Bill Peery,
1223 Leyden St.,
Denver, Colo.

8th PRIZE: \$100

K. F. Kunkel,
326 East 30th St.,
New York 16, N. Y.

Prize-winning pictures not shown in this issue will be printed in February.

(Continued to page 348)

The Judges



David W. Lockwood, vice-president and art director, Foote, Cone and Belding advertising agency, Chicago



Valentino Sarra, one of the world's greatest photographic illustrators with studios in New York and Chicago and
The Editors of *Popular Mechanics*



1st Prize: "Penny Arcade"
Norman A. Wilkes, New Hyde Park, N.Y.

COLOR DIVISION

1st PRIZE: \$1000
 Norman A. Wilkes,
 80-36 Langdale St.,
 New Hyde Park, N. Y.

2nd PRIZE: \$500
 Henry S. Brinkerhoff,
 622 E. Mt. Airy Ave.,
 Philadelphia 19, Pa.

3rd PRIZE: \$300
 Walter Singer,
 6239 Broadway,
 New York 71, N. Y.

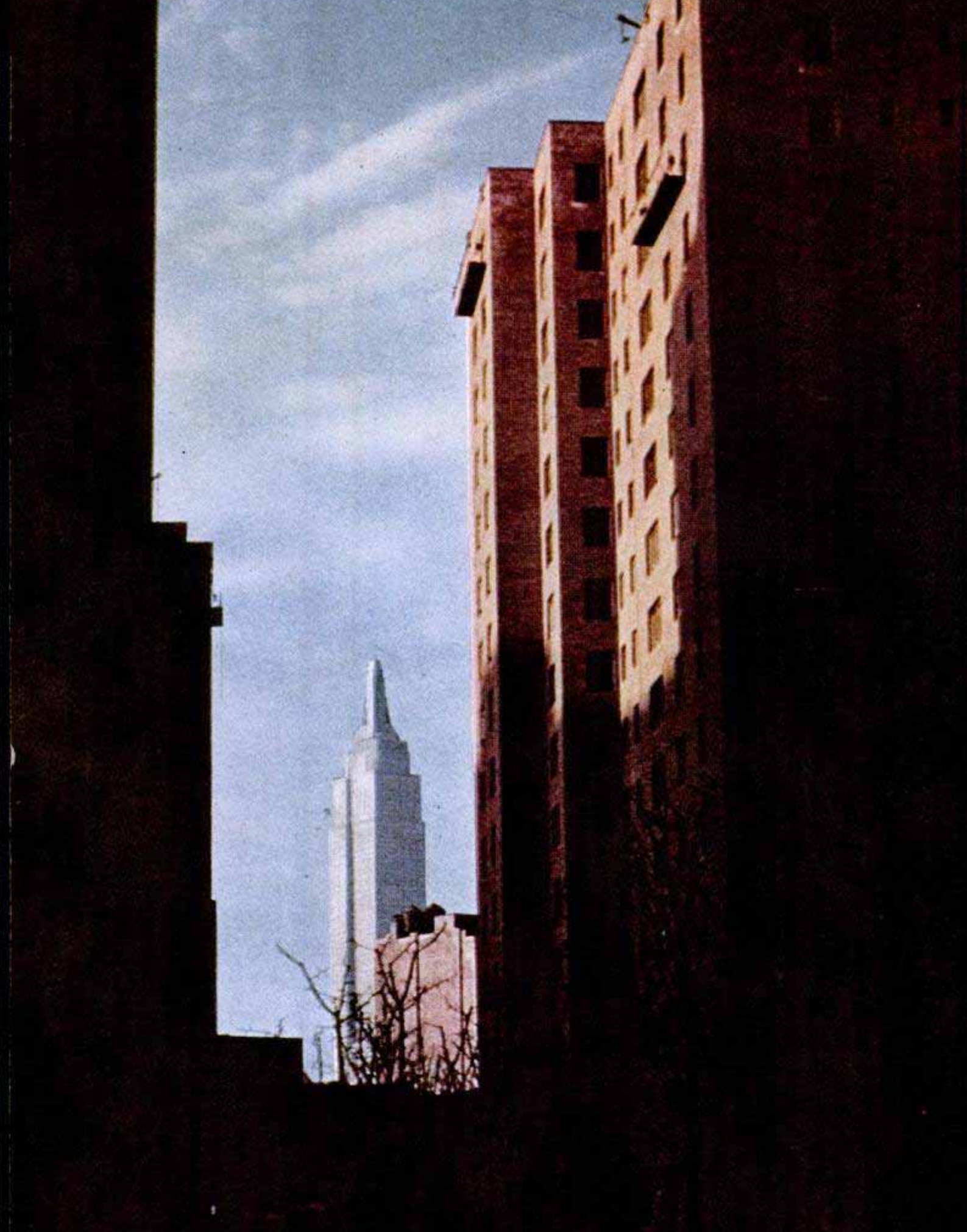
4th PRIZE: \$100
 Gottlieb Hampfler,
 Longwood,
 Kennett Square, Pa.

5th PRIZE: \$100
 Robert E. Wiles,
 14 Coleridge St.,
 Springfield, Mass.

6th PRIZE: \$100
 Jack Zehrt,
 4211 Flora Place,
 St. Louis 10, Mo.

7th PRIZE: \$100
 Robert A. Buchanan,
 217 Harvard Rd.,
 Linden, N. J.

8th PRIZE: \$100
 Carl Mansfield,
 151 North Fourth St.,
 Steubenville, Ohio



2nd Prize: "Reaching Upward"
Henry S. Brinkerhoff, Philadelphia, Pa.



3rd Prize: "Vanilla, Please"

Walter Singer, New York, N. Y.

4th Prize: "Gloucester Fisherman"
Gottlieb Hampfler, Kennett Square, Pa.

5th Prize: "Tying a Bucktail"
Robert E. Wiles, Springfield, Mass.





6th Prize: "Choosing Sides"
Jack Zehrt, St. Louis, Mo.

**BLACK AND WHITE
DIVISION**

1st Prize:
"Street Scene, U.S.A."
C. E. Westveer,
Pleasant Ridge, Mich.



7th Prize: "Washing the Family Car"
Robert A. Buchanan, Linden, N. J.

8th Prize: "Threshing" Carl Mansfield, Steubenville, Ohio







2nd Prize: "Picking Up the Mail"
Grant M. Haist, Rochester, N.Y.



3rd Prize: "Playing Hooky"

Joseph G. Principato, Lowell, Mass.

4th Prize: "Home From School"

Earle W. Brown, Detroit, Mich.





5th Prize:
"Friendship"
Leonard Nadel,
Los Angeles, Calif.

6th Prize:
"New England Church"
Nicholas Cannistraro,
Waltham, Mass.



Wireless Telegraphy Practicable as Cabling

By *Guglielmo Marconi*



Wireless telegraphy across the ocean is now as practicable as cabling. We have sent more than 2000 words in all from Glace Bay to

Poldhu and have reached a speed of 15 words a minute which, considering our clumsy sending apparatus—a mere wooden lever to connect and disconnect the current—indicates what we can do when we substitute a sending key designed for speed. With proper sending key we can get off 30 words a minute, and I shall be surprised if we do not soon send at a higher rate.

The Atlantic cables average about 21 words a minute in their regular work, I believe. And there is this vital difference in the two systems of transoceanic telegraphy: As the cable grows longer, the rate of speed in sending messages decreases, while distance makes no difference in the rate at which we can send by the wireless system.

With properly tuned instruments we can make the reading of our trans-Atlantic messages very difficult. To read a wireless message, an outside station would have to be in exact tune or vibratory unison with our stations at the same moment. It would cost a rival not less than \$50,000 to try the experiment on the smallest scale.

Besides, we can arrange our apparatus so that the tune, or rate of vibration, can be automatically changing every moment at the same rate in the sending and receiving stations on each side of the ocean.

In England I offered to pay a large sum of money to anyone who could pick up one of our wireless ocean messages after notifying me that it was to be attempted, and I even offered to lend apparatus to anyone



who desired to try the experiment. No one took up my offer. But even if it were possible to read our signals—and I do not admit it is a contingency to be feared—it would be the simplest matter in the world to use a constantly changing secret code between our stations.

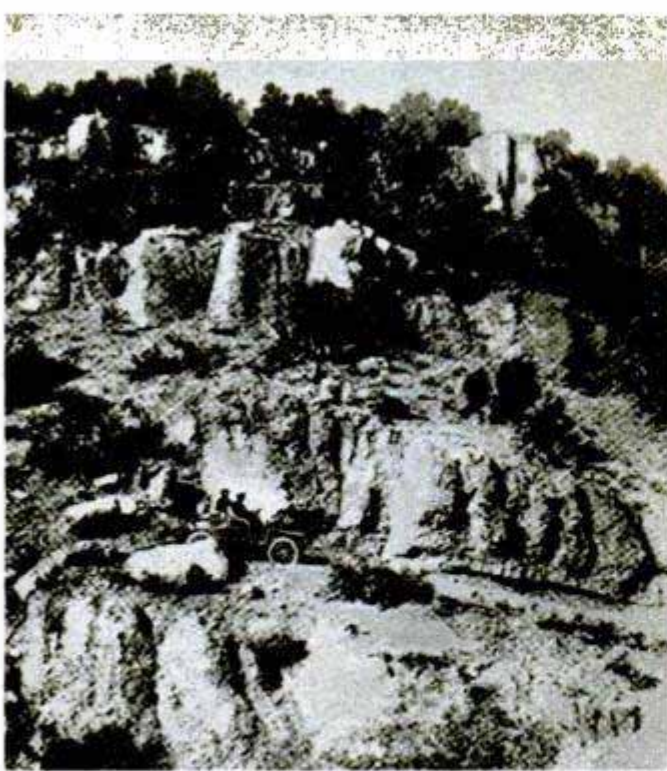
Even if secrecy were actually impossible, there are thousands of messages to be sent by a cheap system of telegraphy which are not necessarily secret in their nature. If it were not so, postal cards would not be used so extensively. If a man in New York wants to send a sailing date or a birthday message or any other such communication to a man in London, what does he care whether his message is read by an outside operator or not?

Locomotive Will Haul Train of Cars Two Miles Long

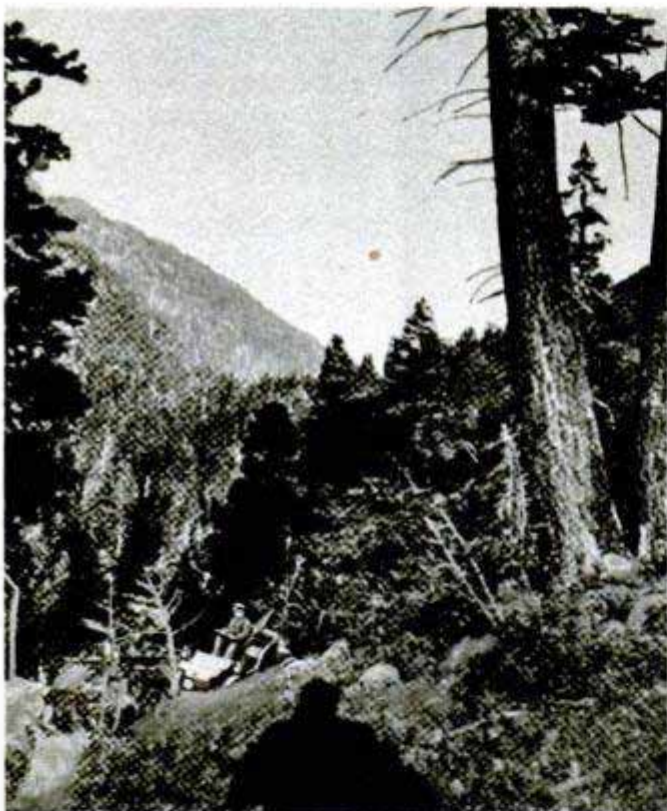
1907—The interest of the locomotive world is at present centered in the three articulated compound locomotives now building at the Schenectady works of the American Locomotive Co., for the Erie Railroad. These engines will be the heaviest and most powerful locomotives ever built and will break all records in locomotive construction. They are of the type known as the Mallet compound and will have 16 drive wheels, arranged in two independent groups of eight each. The high-pressure cylinders, which are 25 inches in diameter by 28-inch stroke, drive on the rear group of driving wheels and the low-pressure cylinders, which are 39 inches in diameter by

the same stroke, drive on the forward group of wheels. The four rear pairs of wheels are arranged in frames which are rigidly attached to the boiler. The forward four pairs of drivers are, however, carried in frames which are not rigidly connected to the barrel of the boiler, but which are in fact a truck; this truck swivels radially from a center pin located just in advance of the high-pressure cylinders.

The locomotive, without tender, will weigh 205 tons, and will haul on the level 320 loaded freight cars, or a train about two miles long. The boiler is over 43 feet long and the inside diameter of the largest ring is eight feet.



Left, pulling out of the swamp at Spanish Fork, Utah. Right, Soldiers' Canon, Utah, seemed almost impassable



Perilous spot in Utah was one of the worst obstacles

Crossing the Continent In Automobiles



Crossing the continent in automobiles is ceasing to be regarded as a remarkable feat. Since the first trip from San Francisco a short time ago others have been made and several more have been planned. A Packard automobile and a Winton have already made the journey and an Oldsmobile is now on the way from Pasadena, Calif., to New York. The trip in the Packard was made by E. T. Fetch and M. C. Krarup in their car, named the "Pacific." Some remarkable conditions were experienced on this trip that will be of aid to future expeditions of the kind. In Carson Valley a most treacherous and obstructive sand bed was encountered. The road here is twisted around the mountain side so as to measure six miles in length in a distance which, in a horizontal plane, would measure less than two miles. The road, in many places, pitched as

Left, the meeting with old "Pacific" outside Denver, Colo. Right, treacherous sands near Thompson, Utah



steep as 17 percent. The road was so deep in sand that rubber tires were often completely submerged and steering was exceedingly insecure.

Then there was a terrible swamp at Spanish Point, Utah, and a "flume" that made the tourists often fear that their vehicle would be swallowed up by the deceptive earth on which they journeyed. At Soldiers' Canon, Utah, Fetch and Krarup halted and debated a long time as to whether it was possible to continue their peregrinations. This spot seemed absolutely impassable for a time. Huge walls of rock stood in defiance on every side and there were bogs and streams and thickets that made the autoists think they had certainly strolled beyond the domains of human aggression. An indefatigable perseverance and determination, however, successfully steered them from out this unearthly region and they proceeded on their trip.

The *Automobile Review*, discussing transcontinental automobile trips, says: "The great feat of crossing the continent in



Fording a dangerous flume at Spanish Fork, Utah

an automobile, will in a short time be a thing of the past and the trip is destined to become a summer outing for the enthusiastic automobilists."

It is likely, however, that a person will not be over-anxious for more than one trip in an ordinary lifetime.

Milking Stool Prevents Spilling of Milk



1916—By preventing the spilling of milk, a combination milking stool and pail holder makes possible a considerable saving. It consists of a metal frame, aluminum painted, with four spreading legs which can be folded under the frame when not in use. On the frame is a seat resting on ball bearings which permit it to be moved forward or backward a distance of four inches. At the opposite end of the stool from the seat is a circular holder that can be adjusted to hold a pail of any size. It is so hinged that the pail can be quickly swung to one side in case the cow begins to move about.

Bubbling Cup Can Be Lifted To User's Lips



1912—The one disadvantage of the ordinary bubbling-cup sanitary fountain lies in the fact that the drinkers must place their lips to the cup instead of placing the cup to the lips. To remedy this, one fountain manufacturer has designed a bubbler which may be raised to the lips while the user is in a standing position.

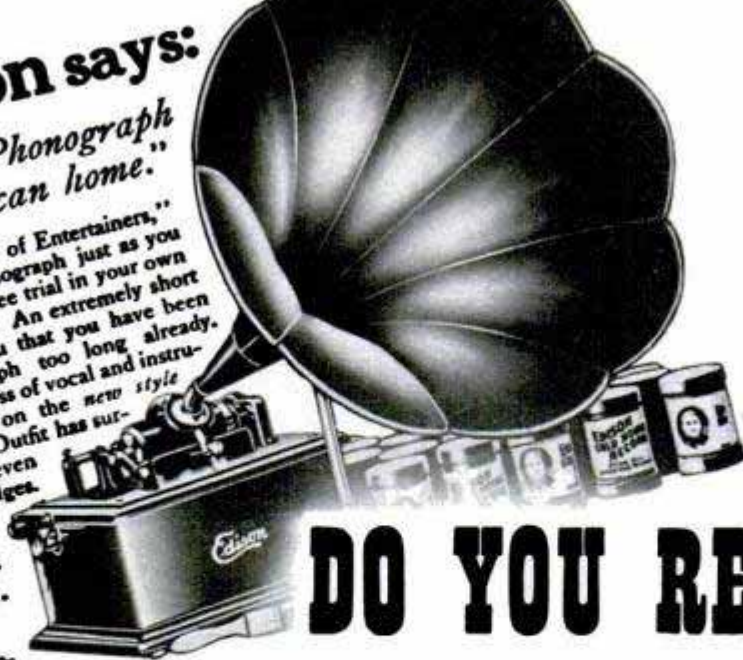
Mr. Edison says:

"I want to see a Phonograph in every American home."

HERE is the "King of Entertainers," the Edison Phonograph just as you receive it for a free trial in your own home—records and all. An extremely short trial will convince you that you have been without a phonograph too long already. The perfect naturalness of vocal and instrumental reproduction on the new style 1907 model Edison Outfit has surprised and pleased even the most critical judges.

An Offer open to every responsible person.

Thomas A. Edison



1910



DO YOU REMEMBER?

New Invention!

FOR THE HOME

Air Now Does All the Work

Cleans Carpets, Rugs, Mattings, etc., on the floor, by the Vacuum Process

The Home Vacuum Cleaner

WEIGHS FOUR POUND 1910

Operated by child or weakly woman. Air is drawn through body and fibre of carpet at terrific speed. Carries all dust, dirt, grit, germs, etc., into the Cleaner. No dust in room, it all goes into Cleaner. Supercedes broom, brush, sweeper, dust pan and dust cloth. Cleans, Sweeps and Dusts in one operation. Keeps house clean, does away with house-cleaning. Portable, dustless, always ready. Adapted to every home—rich or poor—city, village or country. Does same work as expensive machines. Costs nothing to operate—costs nothing for repairs.



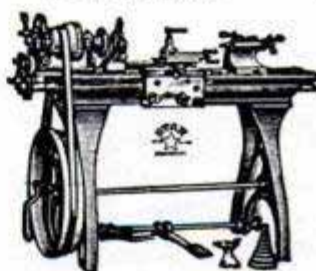
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"Star" Lathes

Foot or Power

9-in. to 16-in. swing



High-grade screw-cutting engine lathes, with or without compound rest, taper, draw-in chuck, milling and gear-cutting attachments, friction countershaft, metric lead screw, etc.

(m-1)

Send for catalog "B"

1907

The Seneca Falls Mfg. Co.

102 Water St., Seneca Falls, N. Y., U. S. A.

1908

Speed! I Guess Yes!

\$375 to \$450

—And economy, too, in the



Black MOTOR RUNABOUT

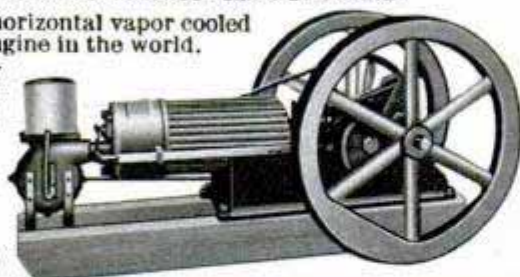
Write Today

Travels any road —up hills, through mud. 2 to 25 miles per hour. 30 miles on one gallon of gasoline. Engine 10-h-p., 2 cylinders, air-cooled. Chain drive gear—Double brake. No tire troubles. Safe, reliable, handsome. Also Top Motor Buggies and Surries. Write for free book No. A. 204 BLACK MFG. CO., 124 E. Ohio St., Chicago

WATERLOO VAPOR COOLED GASOLINE ENGINES

The only horizontal vapor cooled gasoline engine in the world.

Absolutely frost proof and cannot freeze.



Patented May 15, 1906

1907

1907

5-Acre FRUIT, TRUCK AND CHICKEN Farms, \$60 Only \$2.00 a Month



In Lake and Muskegon Counties, near Muskegon, Mich., a city with 30,000, with five million dollars in factories. Finest crops of peaches, pears, plums, apples, cherries, grapes, and all kinds of vegetables and small fruits; pure water, perfect climate, fine fishing and hunting. Grapes and cherries yield \$500 per acre profit. Daily boats and transportation, only \$3.50 round trip from Chicago. Do not delay. Send \$2 today. Money returned promptly if received too late. [This house and 20 acre farm only \$450 at \$5 monthly.]

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We have deposited a bond for \$10,000 with
 Chicago Loan & Trust Co. operating in the
 city of Chicago for the purpose of
 insuring them or to pay back in Chicago

\$10 dresses you complete in latest style

We are the originators of the plan of dressing a lady or gentleman complete from head to foot for less than half the price ordinarily charged by others. We operate one of the largest tailoring departments in the country, and in order to gain new friends and customers, make this remarkable offer.

- Note Carefully, then send for Free Samples, measurement blanks, etc.**
- For \$10 we send a complete lady's outfit as follows:**
- 1 genuine pure wool or wool mixed latest style tailor-made Eton suit (strictly to measure).
 - 1 very neat satin-finish petticoat.
 - 1 entirely new pattern shirt waist.
 - 1 beautiful latest style hat.
 - 1 pair of long, serviceable shoes.
 - 1 pair genuine silk-thread stockings.
 - 1 latest style seal-grain leather belt.
 - 1 beautiful 2000 pattern silk tie.
 - 1 genuine Irish linen lace handkerchief.
- Every article good honest value.**
- For \$10 we send a complete man's outfit as follows:**
- 1 latest style, pure wool or cheviot, tailor-made suit (strictly to measure).
 - 1 Derby, Fielow or Panama style hat.
 - 1 pair latest style satin calf shoes.
 - 1 pair Late-English hose.
 - 1 rub underwear, heavy or light weight.
 - 1 latest style percale shirt.
 - 1 collars. 1 cuffs to match.
 - 1 silk bow, neck or four-in-hand tie.
 - 1 gold-plated scarf pin.
 - 1 pocket handkerchief.
 - 1 pr. fancy suspenders.

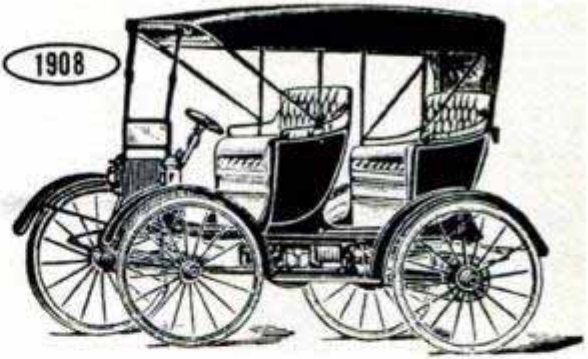
You need not pay till you receive the goods and find them exactly as represented.

SENT G. O. D. with privilege of examination

We are a co-operative association and divide our dividends with our members. Anyone may belong—want you nothing. Send for our "Proposition," also send for catalogues of Ladies' Wear and Men's Wear. We issue ten different catalogues. Address Tailoring Department

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1903



KIBLINGER MOTOR VEHICLES

P.M. ads from the good old days

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Telephones
 is
Satisfactorily Answered

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\$19.90 BIG PARLOR ORGAN

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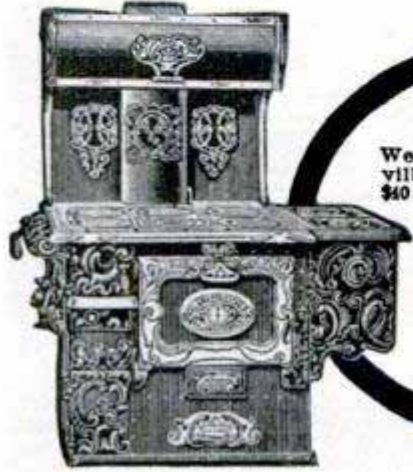
AT \$25.95 to \$51.95 we sell other beautiful ORGANS, all made in our own organ factory and sold direct to you at only a little above actual manufacturing cost, at much LOWER PRICES THAN ANY DEALER CAN BUY.

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We have more than 100,000 satisfied customers in more than 17,000 cities, villages and towns in the United States who have each saved from \$5 to \$40 by buying a Kalamazoo stove or range on

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direct from our factory at actual factory prices. No stove or range has a higher reputation or gives better satisfaction. You run no risk. You save all dealers' profits. We pay the freight.

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Kalamazoo Stove Company, Mfrs., Kalamazoo, Mich.

Our patent oven thermometer makes baking and roasting easy.





“Yield” Sign Reduces Accidents

Warning motorists to give the right of way to cars on the intersecting road, a new “Yield” sign is already reducing accidents in Tulsa, Okla., where it was developed. Designed for use in areas where traffic generally is not heavy enough to warrant full-stop requirements, the sign definitely places responsibility without requiring a complete stop. Motorists approaching the sign must slow down to at least 10 miles an hour and yield the right of way to any car approaching along the intersecting roadway. Any driver becoming involved in a collision at an intersection after passing a yield sign is automatically deemed to have violated the law.



On-the-Spot Puncture Repairs

Punctures can be repaired as soon as they occur and without removing the inner tube from the tire with a new tool not much larger than a pencil. When a puncture

occurs, the offending nail is pulled out and the tire partially inflated. Then the tip of the tool simply is held against the hole and a handle turned, forcing a compound through the hole and against the tube. The compound seals the puncture at once.

Arabogalactan—You Can't Say It But You May Soon Be Eating It

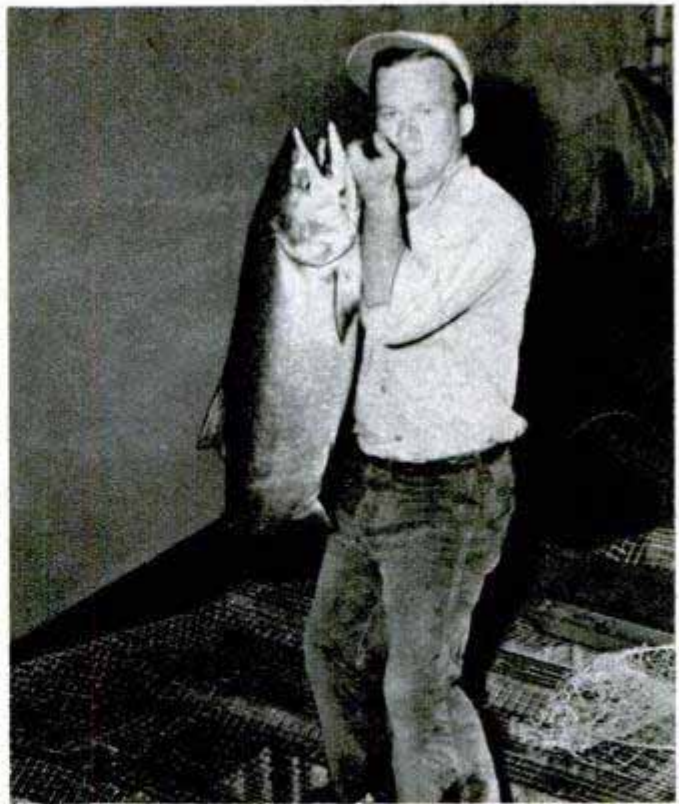
If you like jelly beans or take aspirin tablets, you may soon be getting your share of arabogalactan (pronounced arabo-glack-tan). This strangely named chemical is a palatable, adhesivelike material found in all woods in small quantities. Recently, however, it has been found to be abundant in larch—enough to make recovery commercially practical. Manufacturers of aspirin tablets, jelly beans, marshmallows

and other confections are looking to the promised supply of arabogalactan to free them of their present dependency upon imported gum arabic as a binder material for their products.

☐ One cubic inch of powdered carbon (used in gas masks and water filters) has an internal and external surface exposure area of about 20,000 square yards.

"Pretty Kettle of Fish"

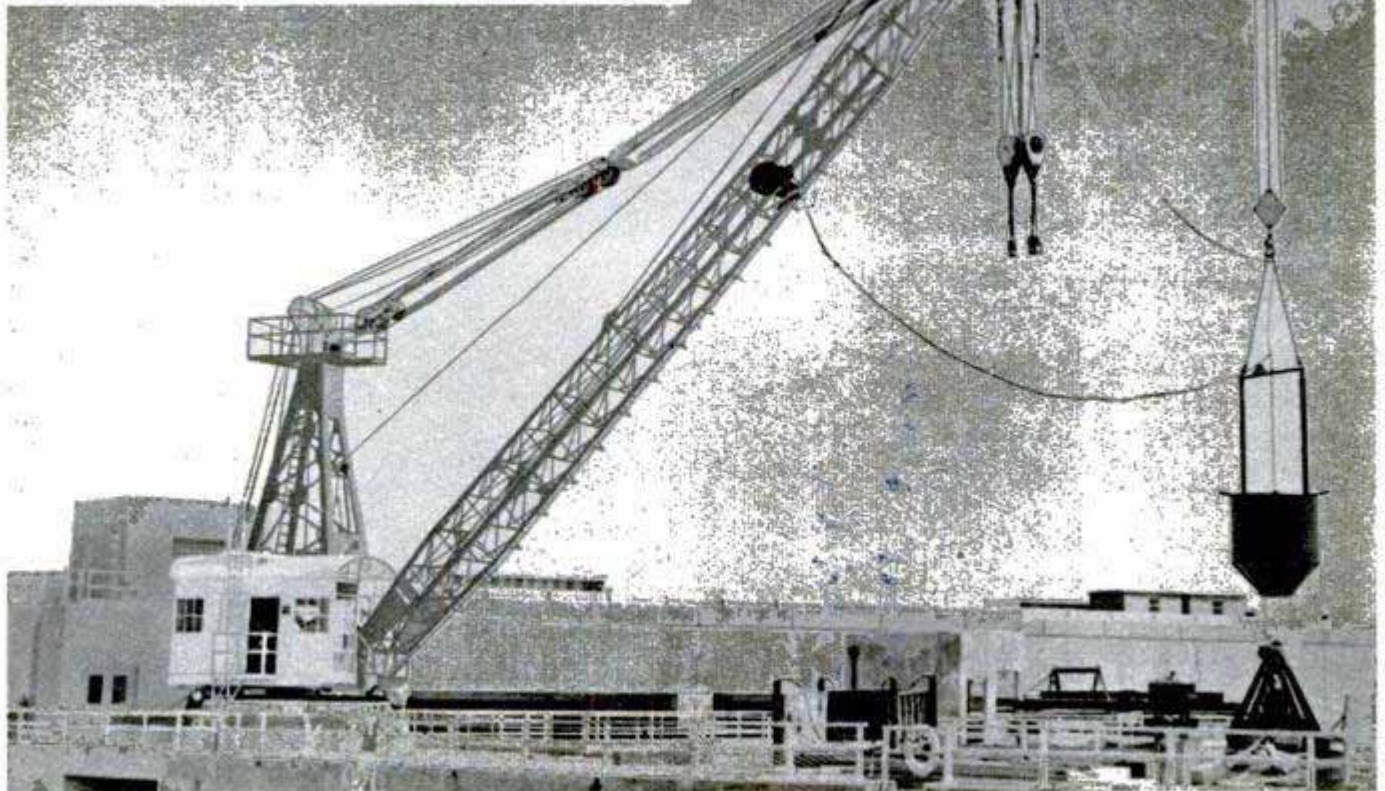
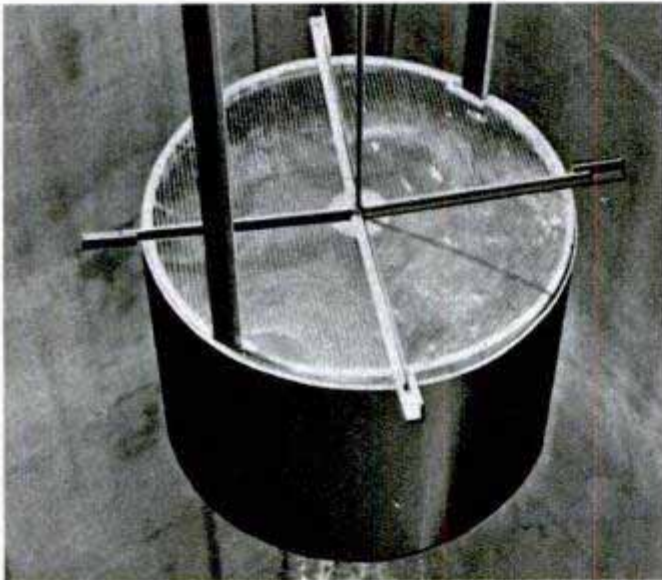
Because the huge McNary Dam, now under construction on the Columbia River, has blocked the annual salmon run, U. S. Army engineers are lifting the fish above the dam with a huge bucket. The scoop, about six feet in diameter and eight feet high, dangles from a crane atop the dam. It is lowered into a shaft which eventually will contain a fish elevator. At the bottom of the shaft is a fish trap. As the bucket slips into the trap, the operator closes a door. Then he raises the bucket—now holding 1000 gallons of water and countless salmon weighing up to 60 pounds—to the water level above the dam. Here the door is opened and the fish swim away to their spawning grounds. The bucket lifts about 10,000 fish every 24 hours and is in operation night and day during the salmon run. Other salmon manage to make their way through the locks.

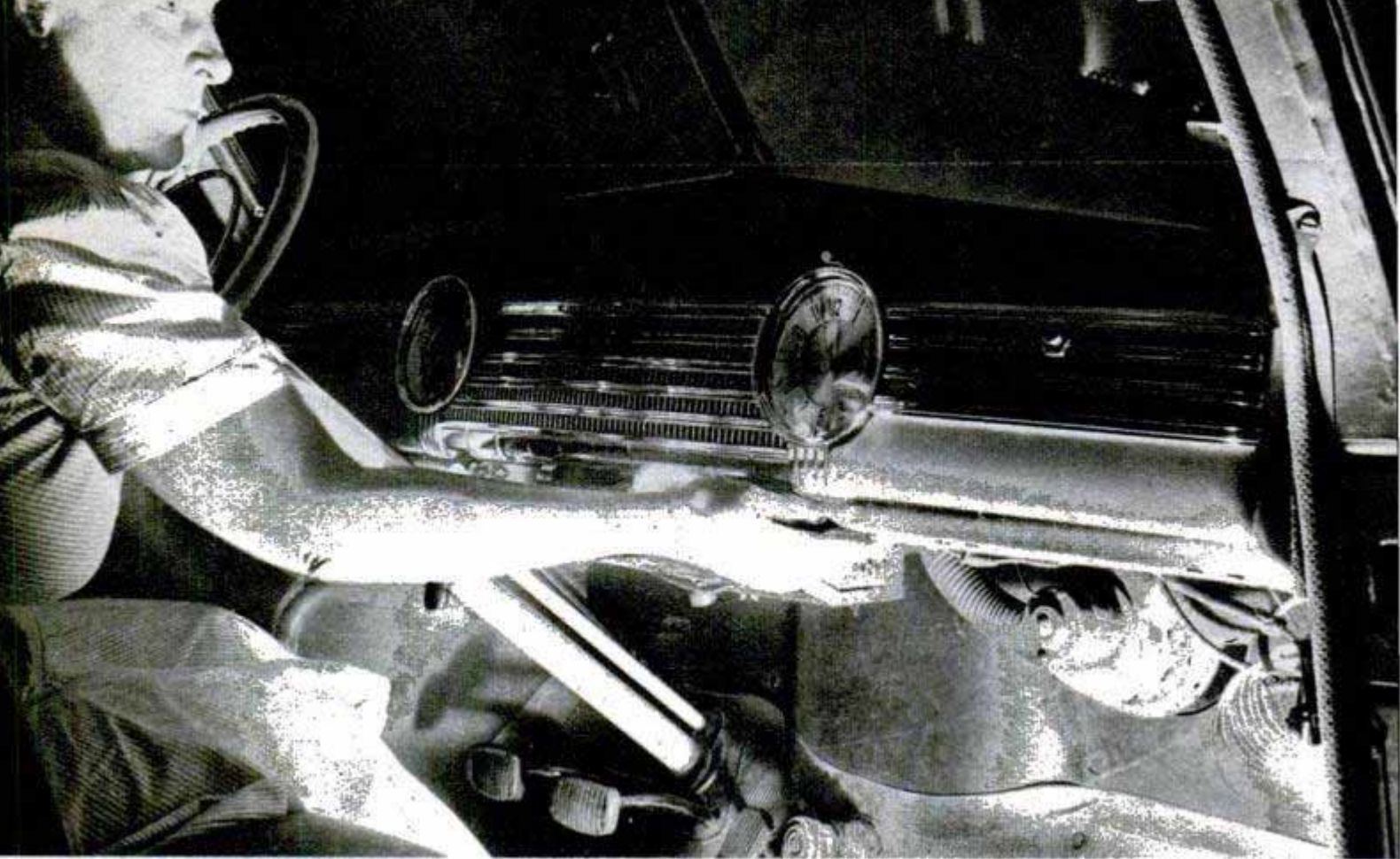


Big Chinook salmon comes up in the fish bucket with his smaller brothers. This one weighs about 40 pounds

Left, up the elevator well comes a "kettle" of fish. After it is swung over locks, fish will be released

Below, permanent crane installed atop dam operates the fish lift, dipping bucket into elevator well





With a tiny transmitter in their car, Mrs. Kearsley signals her husband that

The TINKER with

By Don Romero

WHEN General Electric invited William K. Kearsley to join its famous research laboratory, the young inventor replied modestly, "I'm just a tinker who is more interested in helping people with their everyday problems than in making profits. If I join your staff, you'll just have to let me putter around with whatever I

For U. S. Air Force, Kearsley developed an electrically heated flying suit, shown at left, and nonfrosting goggles, below



*Mount Dora,
Florida*





she has arrived at GE parking area. Kearsley, in research lab, hears wife's signal on his crude receiving set

MILLION-DOLLAR IDEAS

think I can do." GE agreed to his terms.

In 45 years of puttering Kearsley has produced machines which have saved industry millions of dollars every year, has provided our armed forces with some of their critical devices and has contributed much to the health, comfort and safety of everyday living.

GE has never regretted hiring its mighty tinker. Take the case of the surgeon friend who complained to Kearsley that his spectacles often "misted up" right in the middle of an operation. Kearsley promptly solved the problem by running a small battery-powered heating wire around the edges of the lenses, thus keeping them too warm for moisture to condense. Years later when Army Air Force officials came to Kearsley in a frantic search for aviation goggles that wouldn't fog up at high altitudes, he handed them the model he'd developed for his friend. On that one patent alone—and General Electric has received a total of 40 from Kearsley—GE made two million dollars.

Kearsley has always believed there is no profession more rewarding than inventing. "Help one person solve a problem," he says, "and the chances are you'll help mil-

lions." When a neighbor complained of the "fuzziness" of television, Kearsley devised an accessory which sharpens the image. When Mrs. Kearsley mentioned that some clothes she'd stored had been ravaged by moths, he created the electric moth killer now in wide use. When some camping friends complained of the weight and bulkiness of the food supplies they had to carry, he developed the electronic process used subsequently by manufacturers of dehydrated foods. And when Kearsley grew tired of lying under a heavy load of blankets to stay warm in bed, he created GE's now-famous electrically heated blanket.

Kearsley was born in St. Louis, Mo., the son of a railroad auditor. He knew what he wanted to do by the time he was 15. Against strong parental opposition, he left high school in his freshman year, built himself a workshop and started tinkering. His first invention was a treadle which swung open the cellar door when he rode up to it on his bicycle. When his family moved to Washington, D.C., he rushed to the Library of Congress to read about the newly developed "wireless." A month later, getting some of his parts from an old ice-cream freezer and grounding his circuit on a fire



Untiring efforts of the master tinker were largely responsible for perfection of the Inductotherm, a device which makes high-frequency heat treatments possible

hydrant, he built one of this country's earliest amateur transmitters.

At 19 Kearsley became an apprentice electrician at GE's Edison Lamp Works in Newark, N. J. For the next 15 years, after

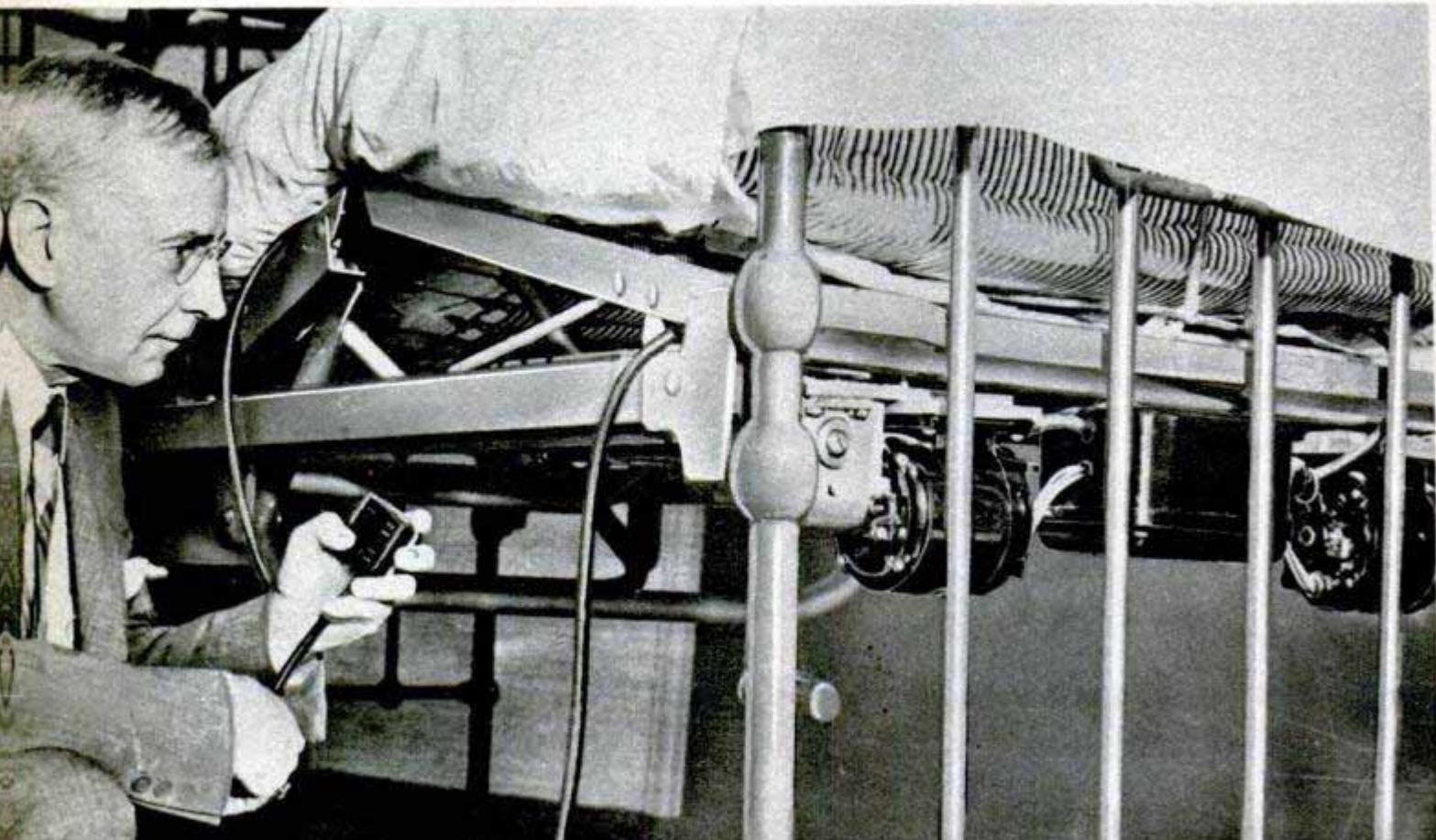
leaving his job each day, he would study and putter far into the night building ingenious little devices for himself, his family and his friends.

Then one day Kearsley was sent to GE's huge research laboratory in Schenectady to do a routine repair job on X-ray tubes. After finishing his task, Kearsley hesitantly began to tell the laboratory director how the tubes could be improved. The director, eyeing the presumptuous young electrician, began to question him. Kearsley shyly told of his workshop, of the devices he'd built. The director seemed impressed. "How much formal education have you had?" "None," replied Kearsley. The director thought hard, then said, "No matter. You've got something a lot more important—curiosity. If you like, you can start developing your new ideas here in the lab." The next day the astounded young gadgeteer found himself a colleague of such world-famous GE research scientists as Whitney, Langmuir, Coolidge and the electrical wizard, Steinmetz.

Shortly after joining the lab, Kearsley married a young girl from New Jersey. Mary MacHattie, a genial, unaffected woman who has always accepted her husband's accomplishments with modest pride, for 34 years has given Kearsley calming sympathy in his struggles with seemingly insoluble problems.

Kearsley is often amused by the strange problems that sometimes beset people. A restaurateur wrote asking if there was a quicker way of opening oysters than with a

Constantly solving other people's problems, Kearsley invented a hospital bed operated by push buttons



knife. Kearsley produced a traveling belt on which the oysters moved between electrodes which caused the bivalves to pop open. For an animal trainer who couldn't make his ferocious gorilla behave, he devised an electric stick with which the animal could be harmlessly shocked into docility. And for a fellow inventor in quest of a realistic method for testing razor blades, he produced a mechanical face that "grows" its own whiskers.

Literally nothing is too small for Kearsley's omnivorous ingenuity. Mrs. Kearsley is probably the only woman in America who is reluctant to ask her husband to perform even the simplest chore. "Whenever I do," she sighs, "he invents something." Her husband found her attempting to wash the ceiling one day. So he produced a machine to do the job for her. When she accidentally scorched a shirtwaist by leaving a hot iron on it while rushing to answer the phone, he contrived the thermostatically controlled iron now found in most households. When she suffered a broken leg and had to be taken to the hospital, he developed an electrical push-button affair—now used in many hospitals—by which she could raise or lower the head or foot of her bed without having to call the nurse. When she was ready to come home, he presented to her astounded doctor a simple device for removing the cast easily and painlessly. And when she finally arrived home and found the front porch miraculously free of mosquitoes, it developed that, as a homecoming gift, he had invented an electric insect repellent—now found in many

(Continued to page 392)

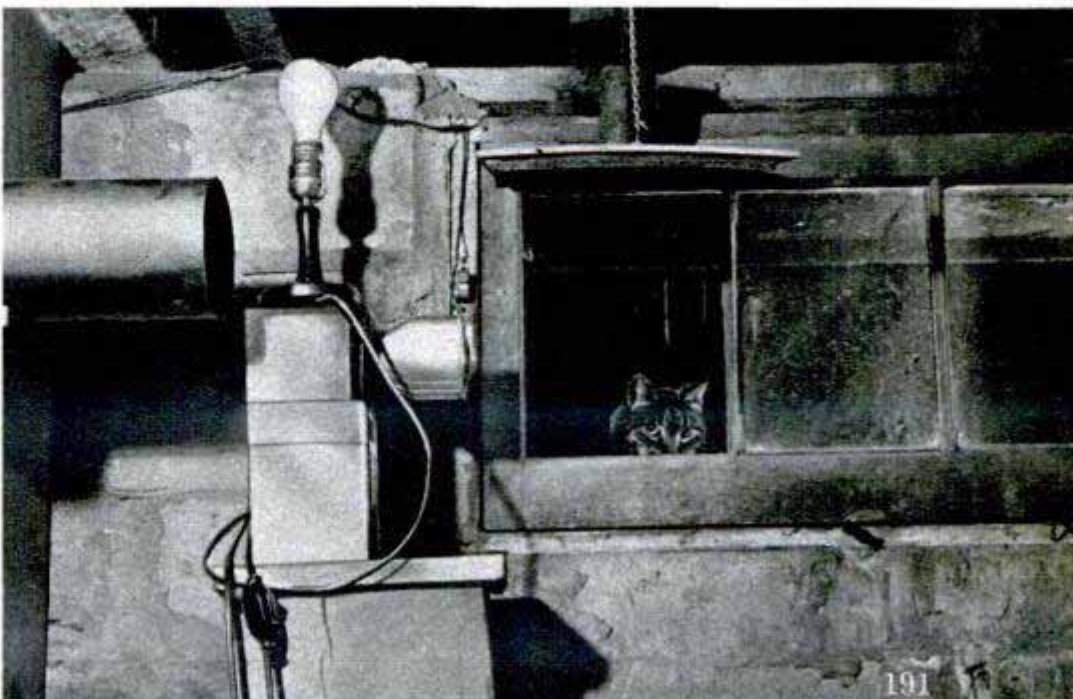


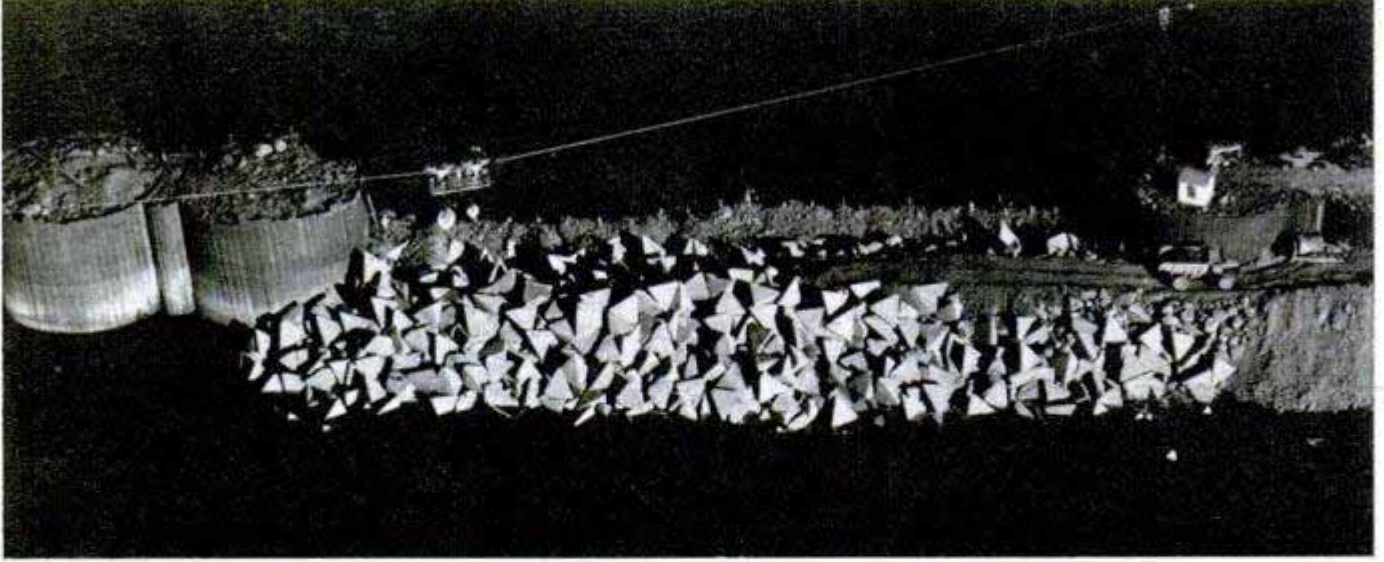
Tired of lying under a heavy load of blankets to keep warm, GE's master tinker came up with the now-famous electric blanket, being tested above



To cut down dishwashing when preparing greasy foods, Mrs. Kearsley lines frying pans with aluminum foil, as suggested by her ingenious husband

Operated by a photoelectric-cell device, a trap door was installed in the Kearsley basement to let their black cat come and go as she pleased





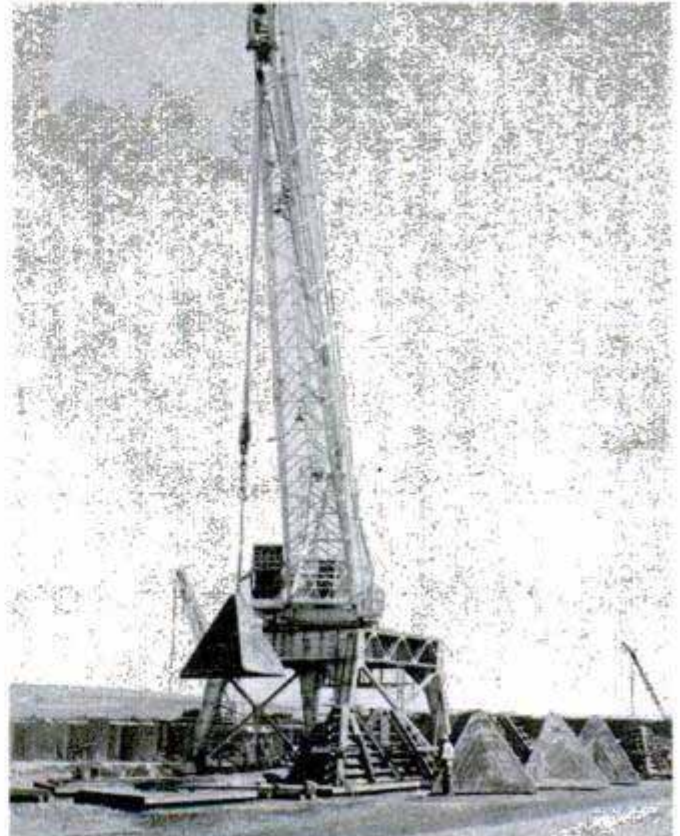
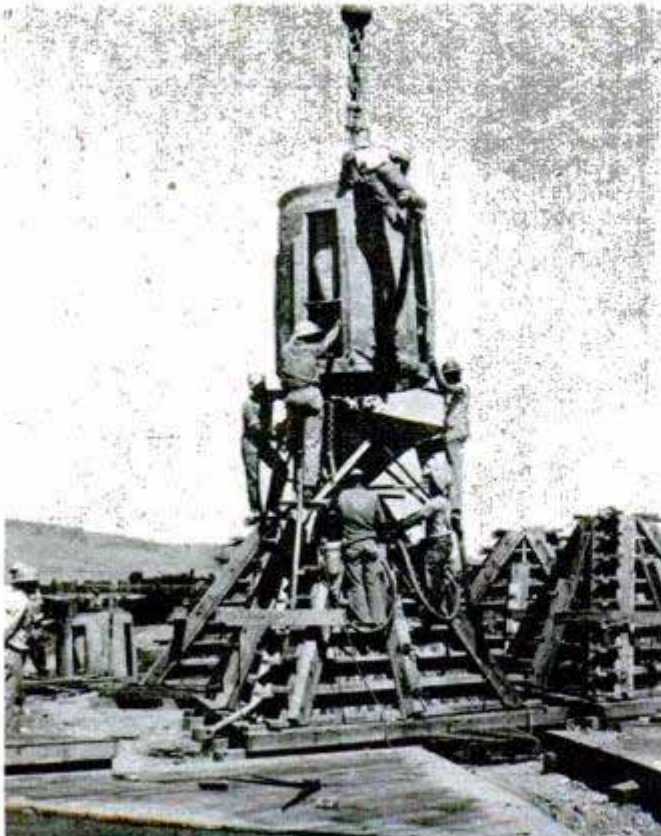
Above, dropped into the gap from a cable, the heavy tetrahedrons effectively plugged the gap in the dam

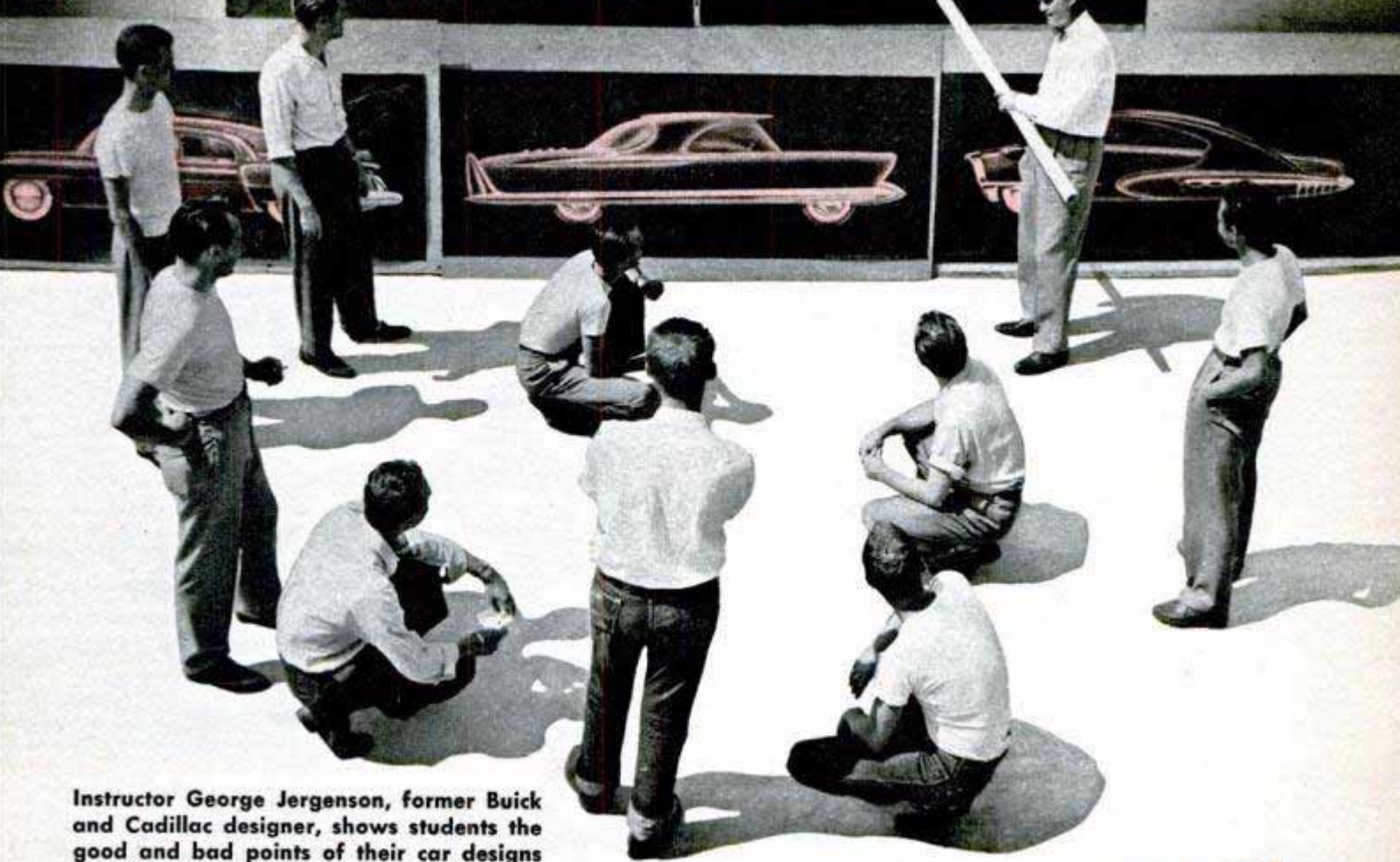
Concrete "Tets" Plug Gap In Columbia River Dam

Closing the final 240 feet of the cofferdam for the McNary Dam across the Columbia River was like trying to stop the stream from a fire hose with your hand. The powerful river, 60 feet deep at that point, swept everything downstream as fast as it was dumped into the channel. Army engineers, after laboratory tests, completed the closure by using 3280 concrete tetrahedrons, each weighing 12 tons. Hauled over the opening in the cofferdam by a cableway and dropped into the water, the "tets," in effect, "bombed" the gap shut. Five weeks were required to complete the job. The sharp angles of the four-faced castings plus their tremendous weight kept them jammed together despite the swift current, diverting it so construction could continue.



Above, close-up of the four-faced concrete castings in position across the gap. Below, the tetrahedrons were cast at the dam site in forms like this one. Below right, one of the "tets" on its way to the dam





Instructor George Jergenson, former Buick and Cadillac designer, shows students the good and bad points of their car designs

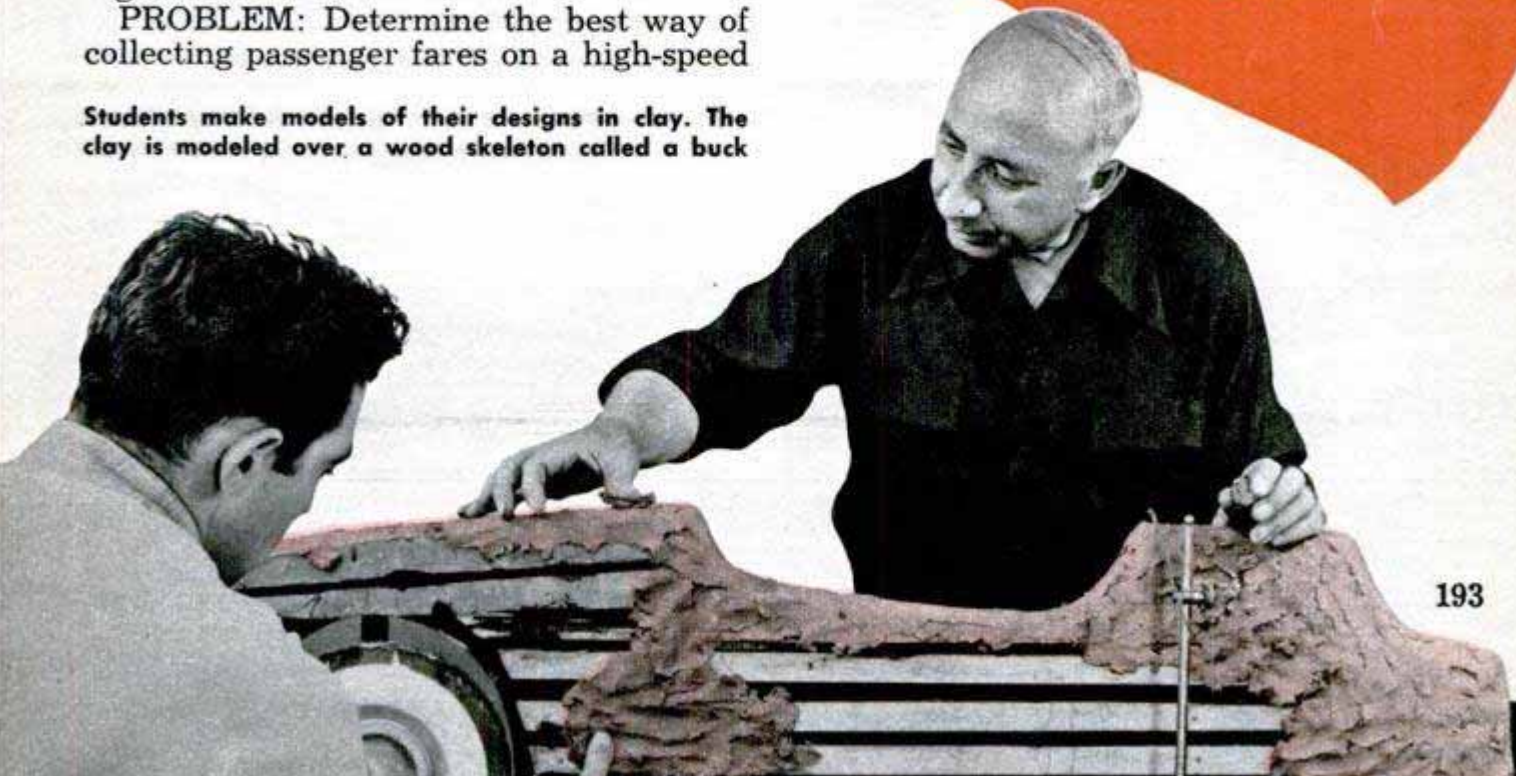
Here is a school without a textbook, without a clock, and without a full-time professor. Out of its classrooms come . . .

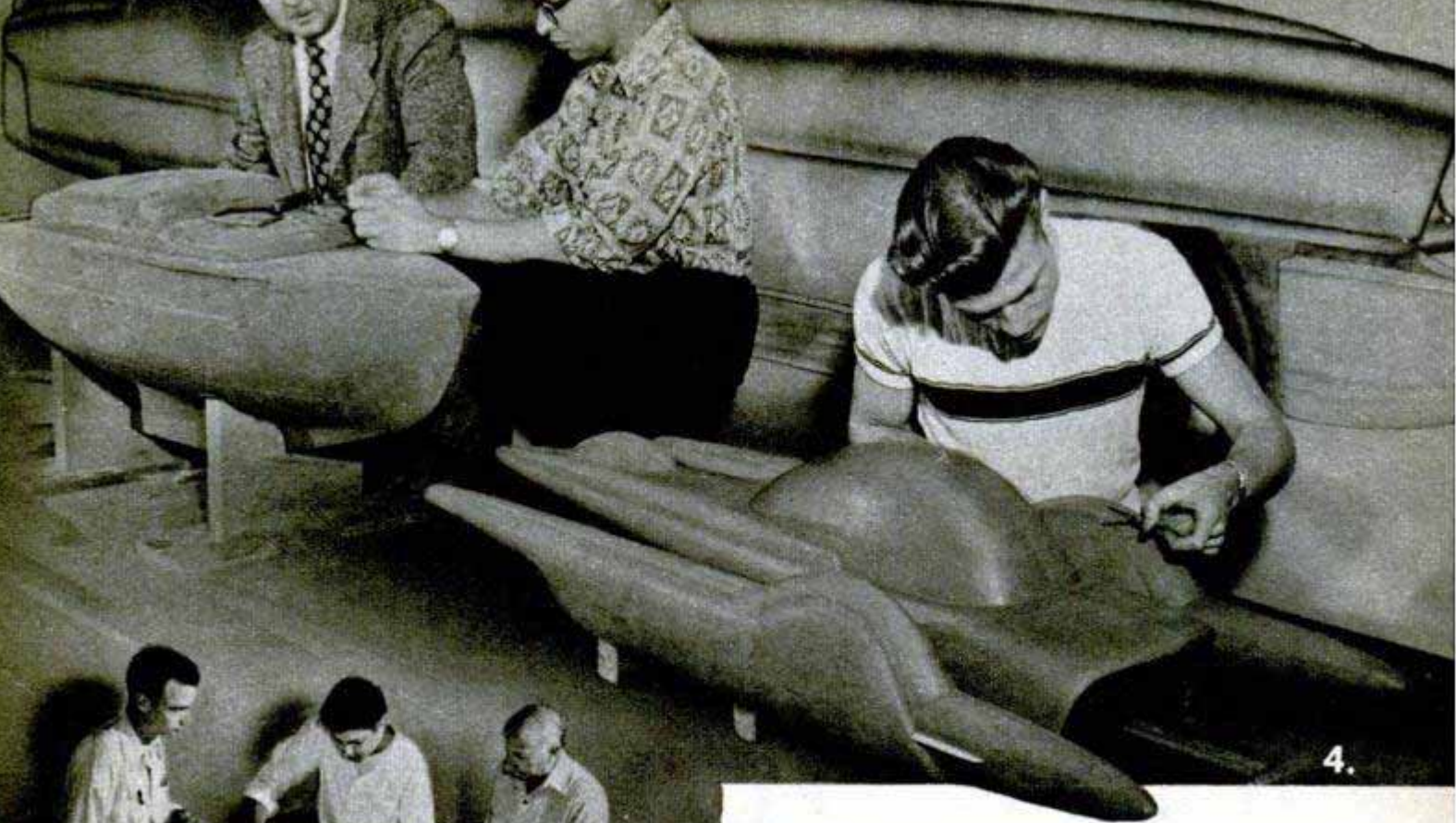
By Thomas E. Stimson, Jr.

- PROBLEM:** Invent an electric waffle iron that won't scorch the finish of a table.
- PROBLEM:** Design a light, inexpensive camping trailer arranged so that its outdoor kitchen can be used from inside during wet weather.
- PROBLEM:** Determine the best way of collecting passenger fares on a high-speed

Students make models of their designs in clay. The clay is modeled over a wood skeleton called a buck

Designs for Tomorrow

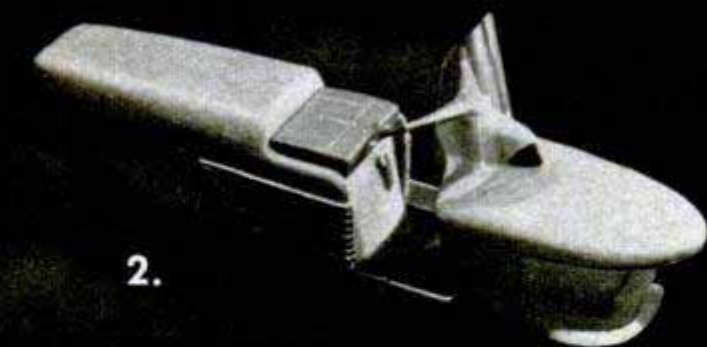




4.



3.



2.



1.

On these pages are shown some of the students' work: 1. Design for a railroad club car; 2. Sleek are the lines of a motor scooter; 3. Plaster model of range has sloping front to direct heat away from control knobs; 4. Modeling a racing car and boat with clay; 5. Composite design resulted when each student was assigned one part of the car; 6. Back-yard swimming pool and dressing rooms; 7. Motor scooter for hauling luggage at airports; 8. Bandsaw design; 9. Two cars designed for a monorail-transportation system

monorail-transportation system such as has been proposed for Los Angeles.

PROBLEM: In view of the metal shortage, design for mass production a wooden pull toy that has sound and animation.

These sound like major projects for trained engineers; actually, they are typical assignments that are handed out to students of industrial design at the Art Center School in Los Angeles. This nonprofit institution produces graduates skilled as artists, engineers and inventors.

"Basically, an industrial-design student learns to combine art and mechanics," explains George Jergenson, who heads the school's industrial-design section. "He becomes a creative artist for mass production."

This concept works so well that aircraft and automobile manufacturers, among others, depend on the school for supplying numbers of their young industrial specialists. About half the students have been hired over long-distance telephone by the time they graduate. They go direct to jobs that quite frequently pay as high as \$5000 a year to start.

Art Center uses no textbooks because

5.



the latest books are out of date for its needs by the time they are published. There are no clocks on the classroom walls because classes last all day. And the school has no full-time faculty members. Instead, industrial-design specialists who are tops in their profession are brought in to teach and lecture on a part-time basis.

Jergenson, for instance, is an old graduate of the school who since has spent 11 years with the styling section of General Motors and was the principal designer of the "Train of Tomorrow." Another part-time instructor is Strother MacMinn, whose experience includes work with General Motors, John Deere tractors and the industrial-design firm of Henry Dreyfuss. A third, John Coleman, is another early graduate of the school who has had considerable automotive experience, as well as having done design in the airline and appliance fields. All these men are operating their own concerns in industrial design. In charge of the school's modeling laboratory is Joseph D. Thompson, whose experience

6.



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8.



9



goes all the way back to the prototype of the Model-A Ford.

Mere restyling of an object isn't enough. There must be a reason for changing a shape. And a change that adds complications to manufacture or operation is poor practice; the best improvements are simple ones. These tenets govern the class studies.

In the case of the electric waffle iron mentioned above, for instance, the best solution that the students found was to elevate the iron on short legs to prevent direct heat transfer to the table. The modification is simple and effective.

Likewise the camping-trailer project was based on simplicity of design. The average small, camp trailer is too simple; it is merely a covered bed on wheels with a lid at the rear that opens out to expose a gasoline stove and some shelves. After discussion the students made two changes. They altered the bed arrangement so that you can sit down inside to change muddy shoes without soiling the bed, and they made the kitchen accessible from inside the trailer

as well as from its exterior. Around these ideas they designed a 10-foot trailer of laminated Fiberglas and plastic aimed at the \$1000 market.

Sometimes it's possible to make basic improvements in a product simply by changing its shape. One student learned this after he was handed an ordinary hand-held hair drier and was told to work it over. It was an awkward thing to hold and it didn't do an efficient job.

After study, the student changed the angle of the motor inside the case. This one operation permitted a more comfortable shape and also left room inside for a second air impeller and a larger heating element. The improved drier would cost a little more to manufacture, but would be much more efficient without using excessive power.

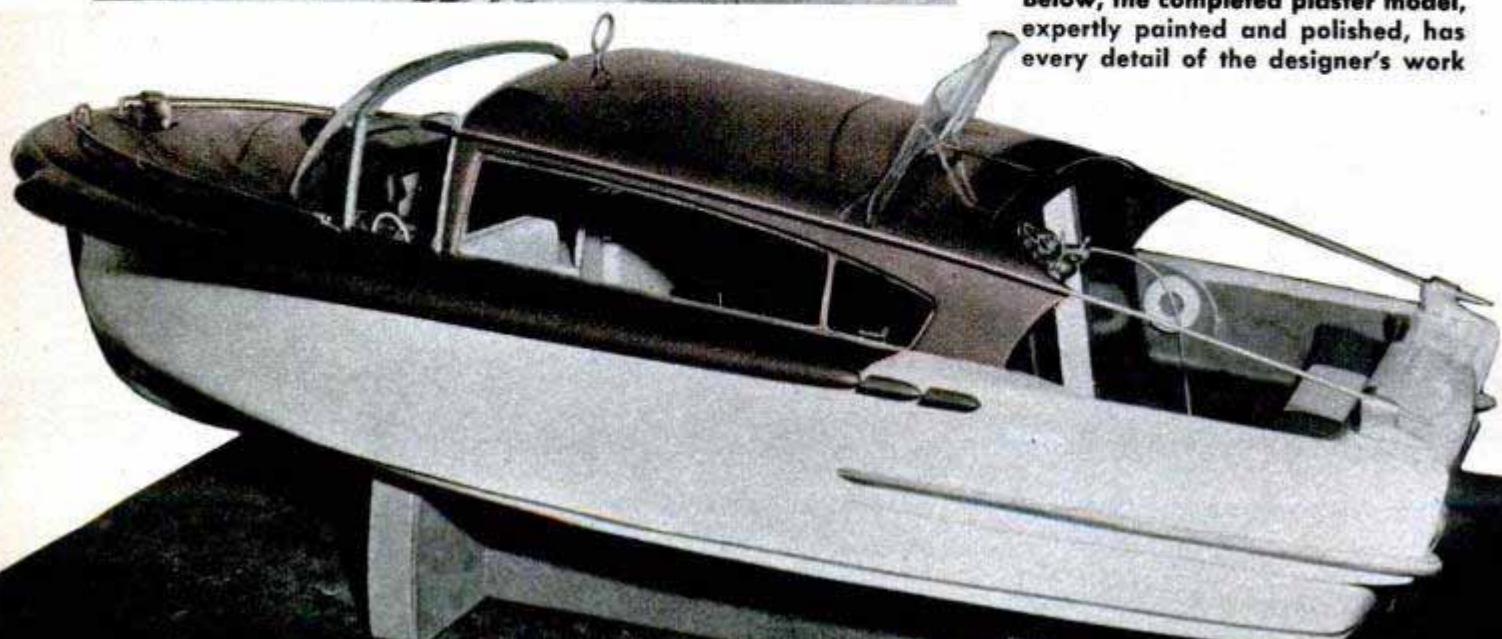
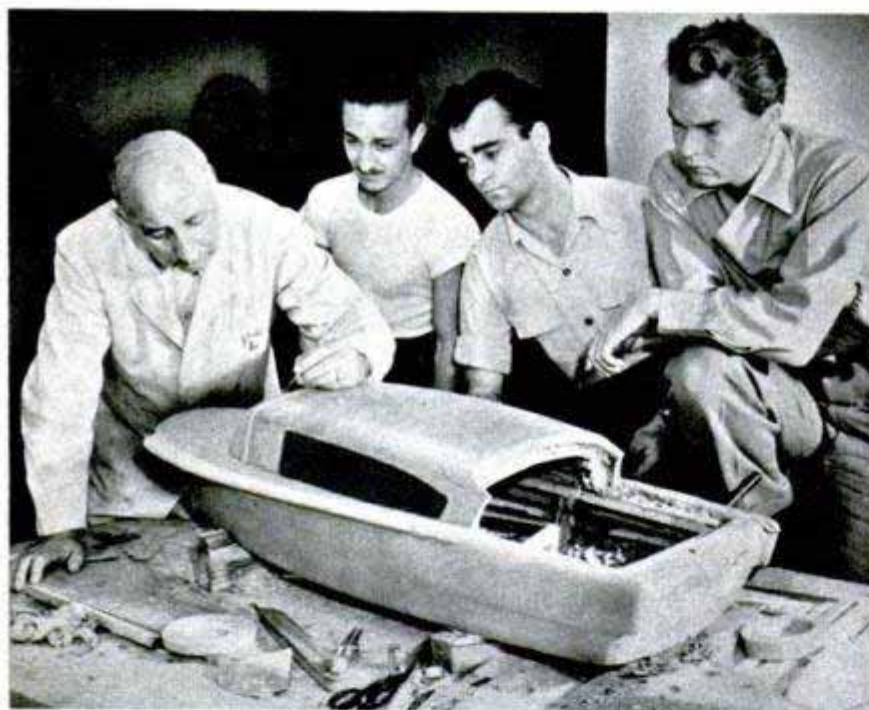
"What can you do to improve a small table radio?" instructor Coleman asked another of his students. All small radios are pretty much the same and this suggests that manufacturers think there's little room for improvement. But the student

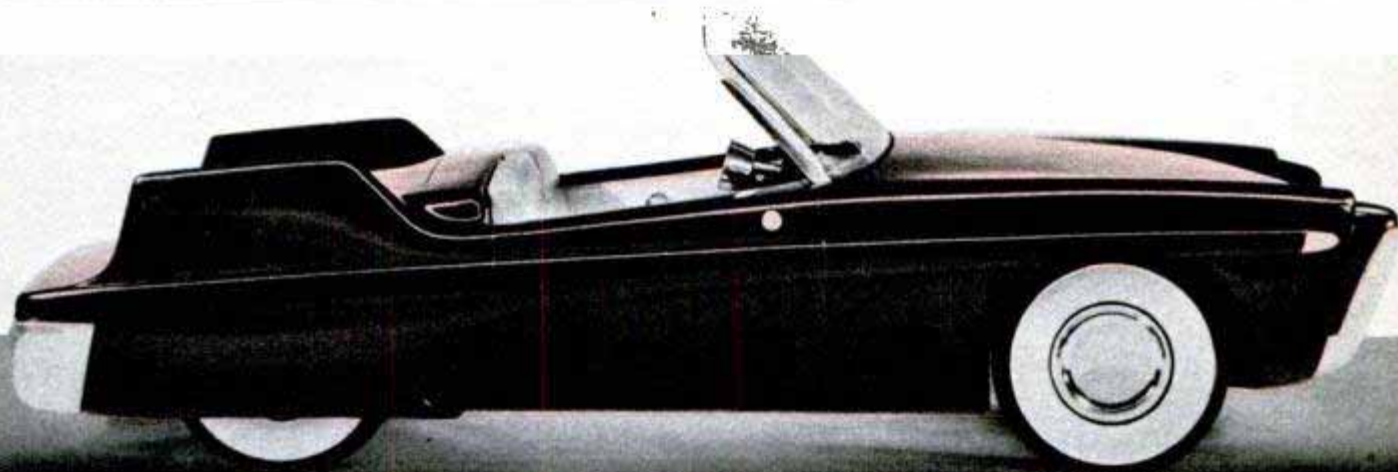
was able to make a simple change that opened up a brand-new market for small radios. Using all the original parts, he redesigned the chassis into a thin, flat package. His radio can be used on a table as usual, and now it can also be hung on the kitchen wall like an electric clock, saving valuable working space.

When several groups of students tried their hands at designing a better lavatory their research led them to conclude that present shapes and sizes are just about ideal.

Once the design has been modeled in clay, a plaster cast is made of it, like this one of the cruiser model

Below, the completed plaster model, expertly painted and polished, has every detail of the designer's work





Above, design and modeling of sport cars are two favorite occupations at the Art Center School in Los Angeles

Then they originated one good idea. To hide the unsightly display of water and drain pipes under the bowl of a wall lavatory they added a removable fairing that conceals the plumbing. It fits up under the bowl and streamlines it into the wall.

Not only is the new lavatory more attractive, the chances are that it could be produced at only a slight increase in price. Pipes and fixtures would need no finishing or plating when they are concealed and this saving would just about balance the cost of the fairing.

Engineers who are asked to visit the industrial-design classes to criticize student projects sometimes leave with their heads filled with new ideas for their own products. Take the case of a gas cookstove that was a recent group project. It has several new features that eventually may be placed on the market.

One of the troubles with modern tabletop stoves, the students found in their re-

search, is that heat from the oven rises upward and makes the burner control knobs almost too hot to handle, in spite of the usual insulation. In their own design they sloped the front of the stove so that the heat is directed away instead of being allowed to rise. The control knobs remain cool.

They designed and tested their own cast-iron grills for the top of the stove and they perfected their own design of aeration bowl or collar that fits around the burner. These collars can be removed for cleaning. In addition to these improvements the stove was engineered to pass the 57 different tests to which the American Gas Association subjects new stoves before they are approved for marketing.

New students are encouraged to execute radical ideas regardless of how impractical or expensive their designs might prove to be. This helps to "free their thinking." Then they are brought down to earth by

(Continued to page 398)

Roving Machine Shop

Any small garage in the vicinity of Covington, Ky., can call in a roving machine shop to do special repair work on autos. The shop, built in a truck, rolls right up to the door. It has all the power equipment needed to do pin fitting, valve reseating, cylinder re-boring, crankshaft grinding and motor rebuilding for garages that do not have this equipment. Furthermore, no service charge is made for local calls, as the shop is operated by an auto-parts company which charges only for the parts and the labor. Standard auto parts required for the work are kept in storage cabinets, and those used each day are replaced when the roving shop returns to its home base in Covington.

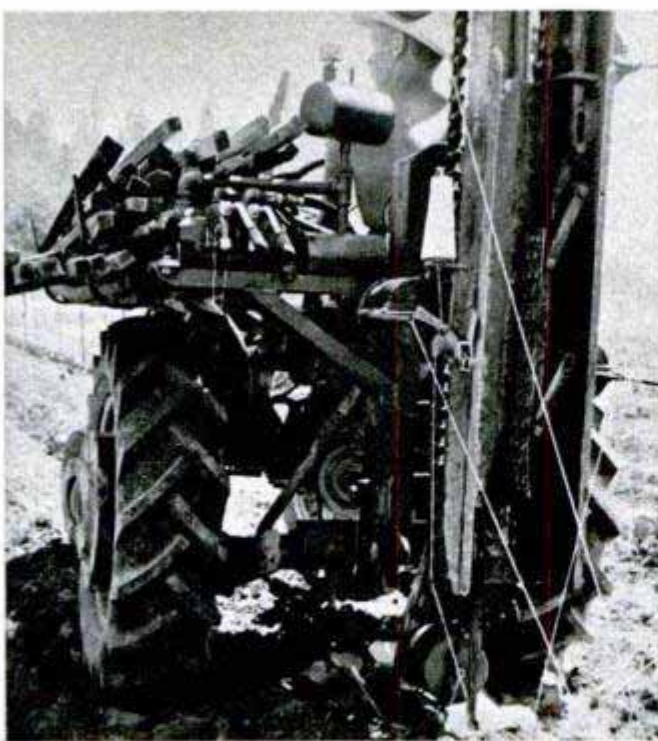


Skilled mechanic in the traveling shop is using a piston-pin honing machine. The shop draws its power from the garage being serviced by means of its long extension cable

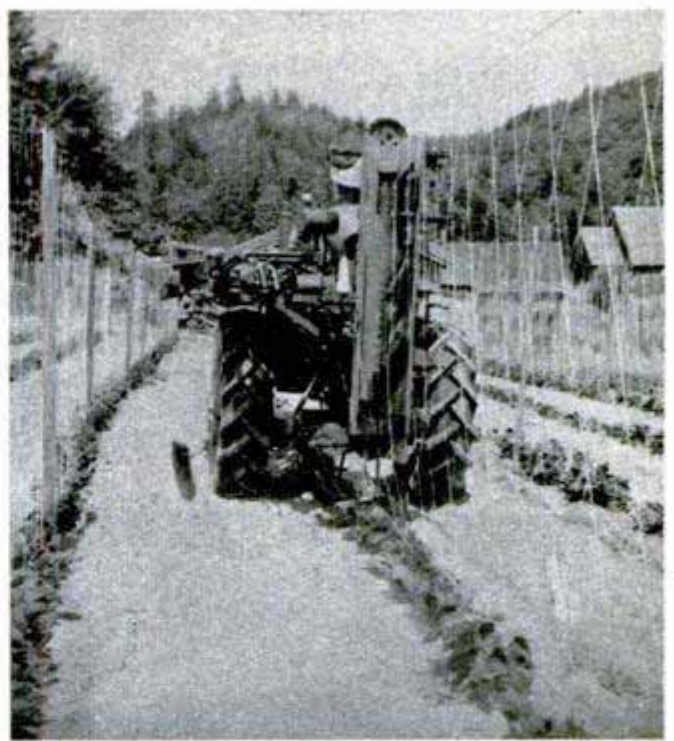
Right, overload springs are about the only extra used in the truck chassis. It is a standard $\frac{3}{4}$ -ton van-body truck. Total weight with all its equipment is 7600 pounds

Below, drawing of the interior of the mobile workshop shows how equipment is arranged to give the mechanic satisfactory work space. Inset, lower right, the floor plan





Upright assembly on right holds poles while they are driven. Spools on chain move in circle to form web



Wire unreels along top of the poles and cord unreels along bottom to form framework for crisscross strings

Mechanical "Spider" Weaves String Into Trellises for Beans

Making trellises for pole beans involved too much handwork for Fred Maloney, near Tacoma, Wash., so he developed a mechanical "spider" which automatically weaves a web for the beans to climb. Pole-and-string trellises are erected for the beans on thousands of acres each year. Maloney's trellis-maker is attached to a tractor. Seven-foot poles are placed by hand in a vise at the rear of the tractor. The

vise then thrusts the pole 14 inches into the ground. At the same time a wire unreels along the top of the poles and a string unreels along the bottom. To weave the web of strings, Maloney attached an endless chain to the tractor's power take-off. To this he welded five steel fingers, each containing a ball of string. Now when the tractor crawls down a row of beans, the fingers circle to wind the string into a web.



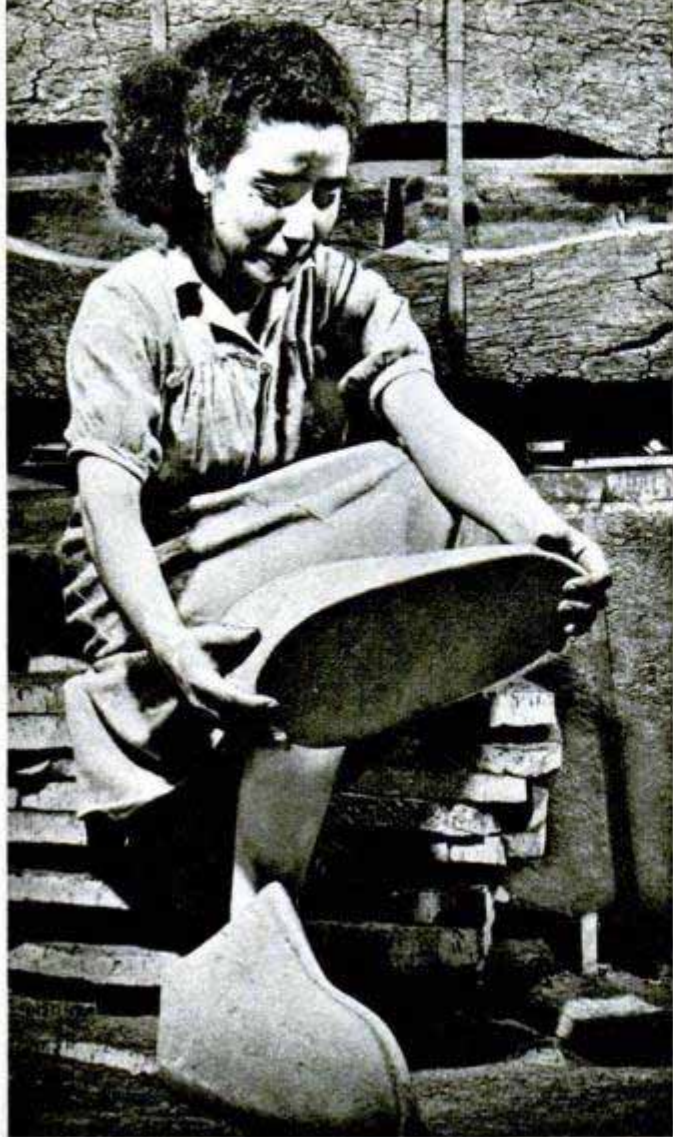
Mother Can Convert Baby Buggy Into One-Wheel Sidecar for Bicycle

In a few seconds a new baby buggy, developed in England, can be converted into a bicycle sidecar. The mother pulls two steel arms from under the buggy and positions them against a steel plate on the bicycle. She presses a locking lever and the

buggy is securely attached to the cycle. Then she folds back the hinged handle of the buggy, the action lifting three of the wheels off the ground, reducing the drag on the bicycle. A curtain fitted with a window keeps the baby dry in wet weather.

Sombreros and shoes, doormats and dinner pails — Portugal finds them all in its unique . . .

HOUSE of CORK



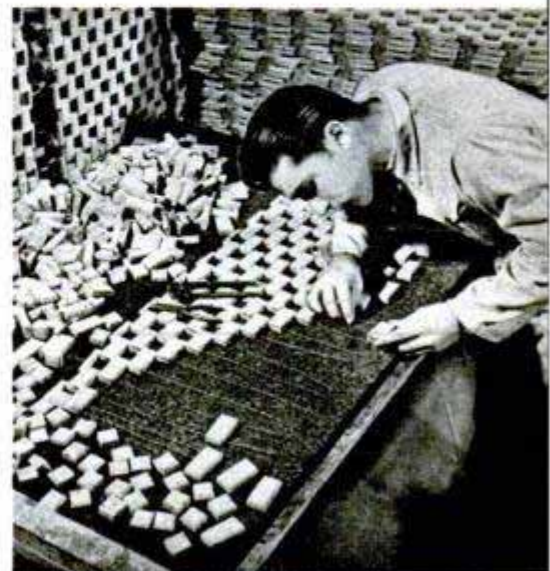
Above, real "gunboats," cork shoes keep the feet dry and warm in cold, wet weather and weigh very little

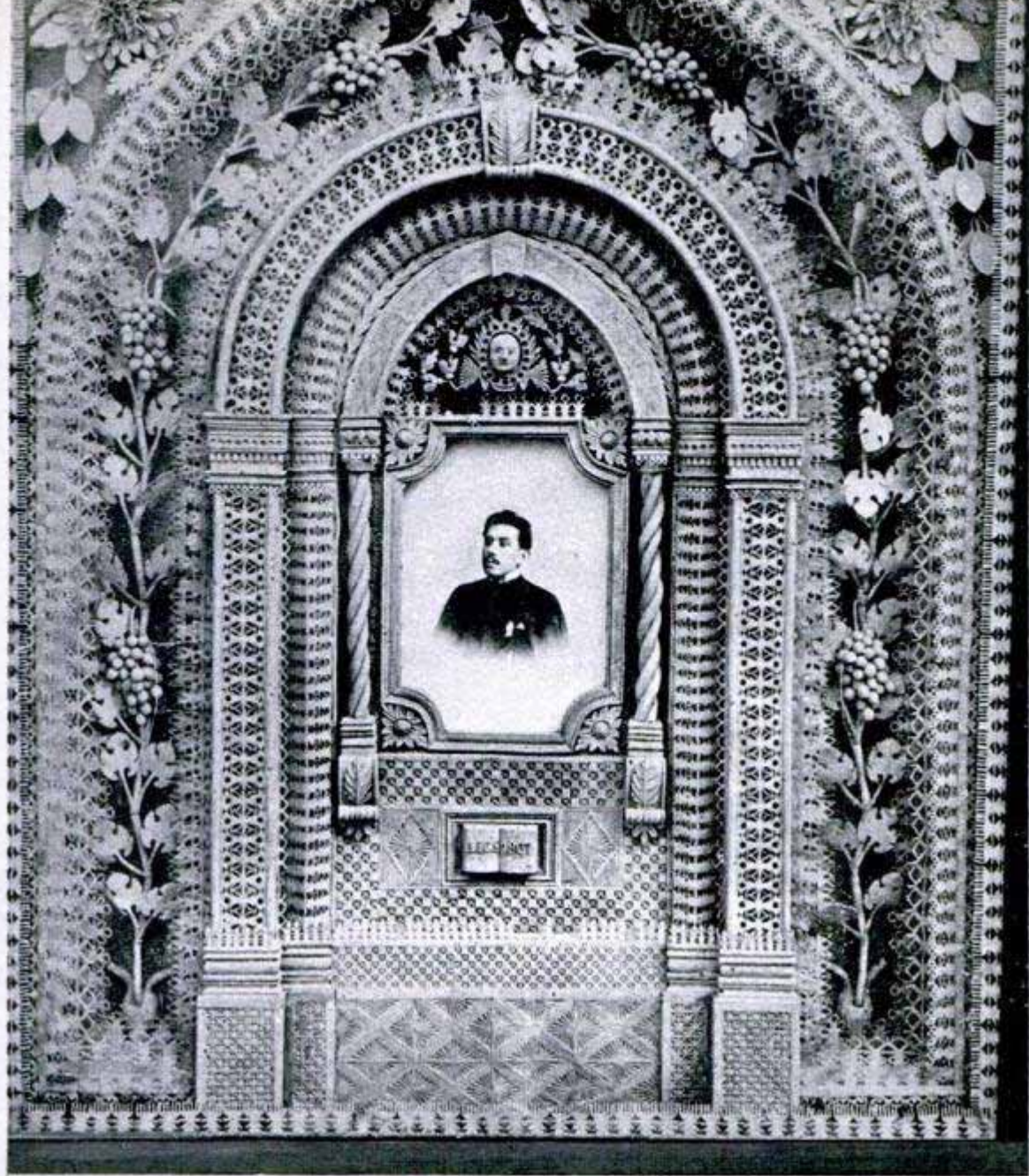
Right, broad-brimmed cork sombreros are light as a feather and act as insulation to keep the head cool

Below left, first step in production of cork dinner pail is to bend a sheet and cement it in that shape

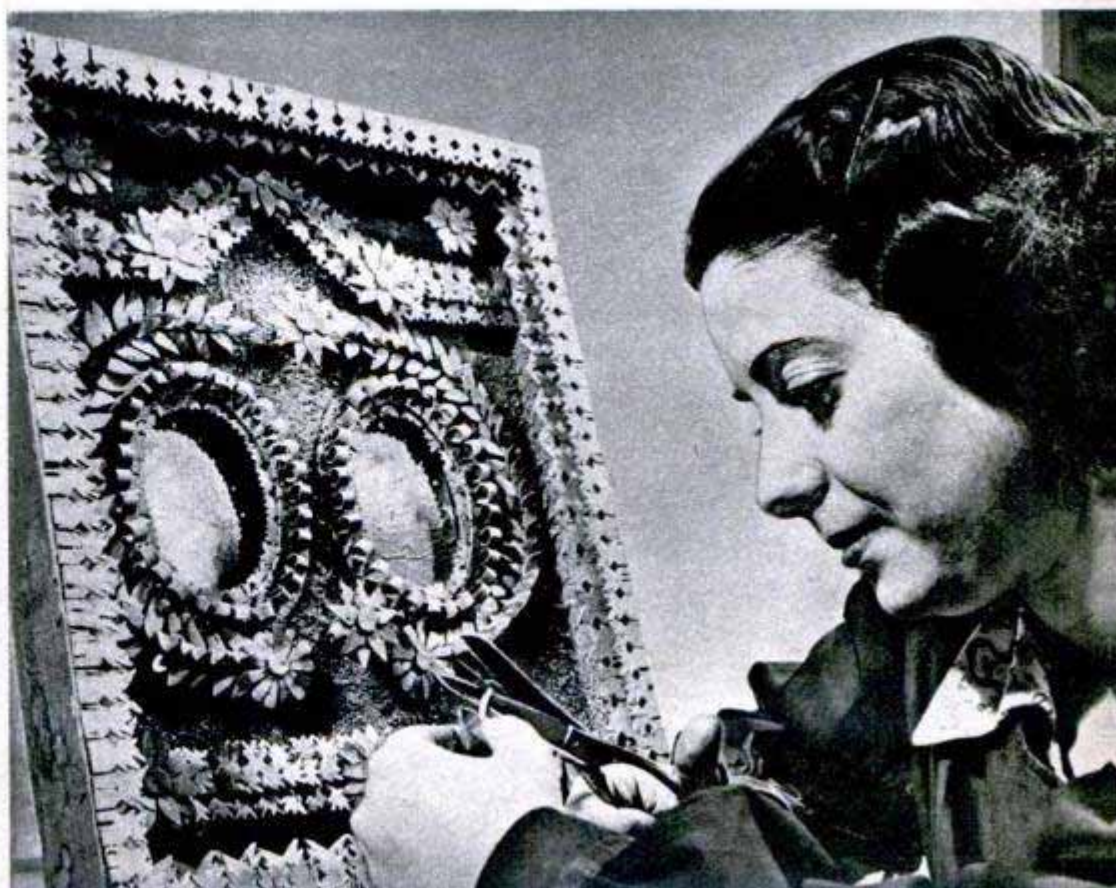
Below, cork pail is not quite round so lid fits only one way and correct position is indicated by a notch

Below right, slipproof and dry are these bath and kitchen mats made by stringing cork pieces on wire





ONE OF Portugal's most profitable exports is cork, so it's no wonder that the light, resilient bark has many uses there. In Lisbon, at the Casa das Corticas, which means the House of Cork Things, you'll find picture frames so delicately carved in cork that they look like huge, old-fashioned lace valentines. There are cork hats that flap in the wind, dinner pails of cork that are self-insulating and, of course, the usual items such as cork shoes and mats. Only the finest cork can be used for the intricate designs.



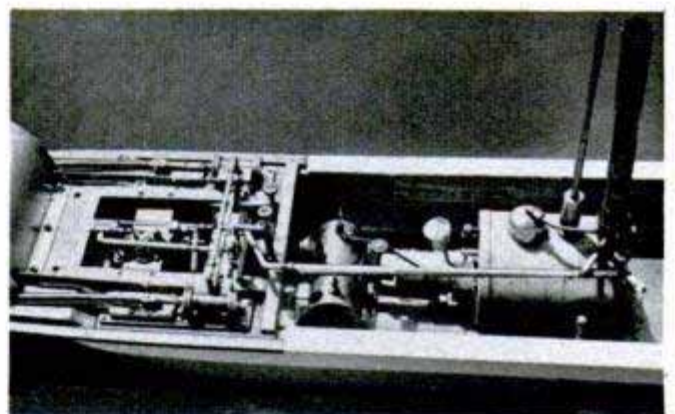
Model Steamboats Piloted by Radio

Under its own power, the Consulator II steams into position in front of its pilot who steers it by the radio he is holding. Why does he wear waders? Well, just in case something goes wrong out in "midocean"



As real looking as the riverboat after which it is modeled, the Delta King is powered by a steam engine

Radio waves control the movements of a pair of model steamers that operate on steam just like the full-size originals. Members of the San Francisco Model Yacht Club, famous for its trophy-winning sailboats, are finding radio-controlled steamers even more exciting than sailers. An ocean-going tug, the Consulator II is 74 inches long and weighs 125 pounds. Its engines develop one third horsepower. Another



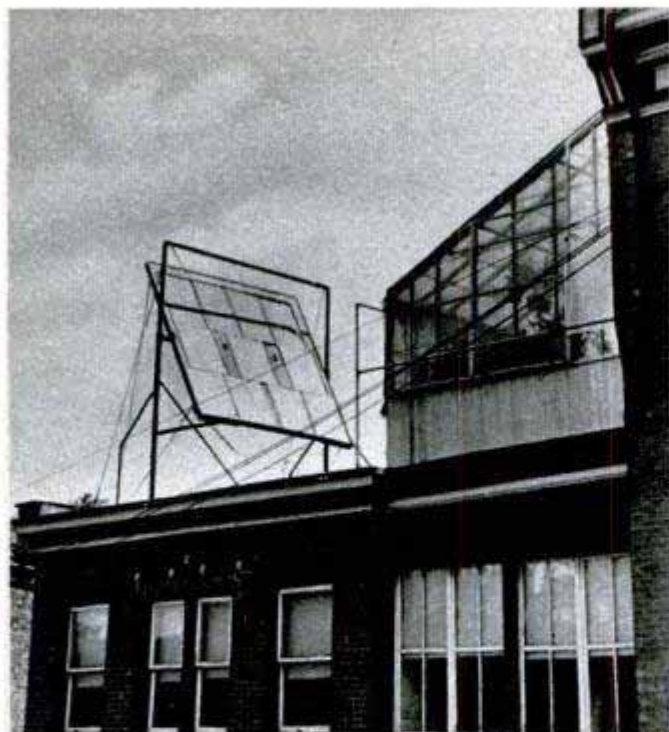
Engine room of the Delta King with superstructure removed. Each part operates as the boat puffs along

model is the Delta King, a scale model of a riverboat that once plied the upper San Francisco Bay. Radio signals give five elements of control; forward and backward, to port and starboard, and the whistle, which can be blown at any time. The operator simply presses a button and the boats respond. An antenna about two feet long and highly directional beams the signals from the control transmitter to the boats.

Tiny Carbon Spheres Are Hard Enough to Scratch Glass

Tiny spheres of pure carbon, so hard they will scratch glass, have been developed by the Bell Telephone Laboratories. The shiny little globes are an intermediate carbon stage between graphite and diamonds, the hardest substance known. They are so abrasive they will probably be used in grinding operations, and may replace diamond dust in some cases. Because the

spheres are so pure and uniform, they also can be used in making carbon rods which are used to "moderate," or control, atomic piles. Diameter of the spheres varies from one millionth to one sixteenth of an inch. Formed by heating a chemical, polydivinyl benzene, to 1050 degrees Centigrade, the spheres can be worked into sheets, filaments, films or other desired shapes.



Reflector-Lighted Greenhouse

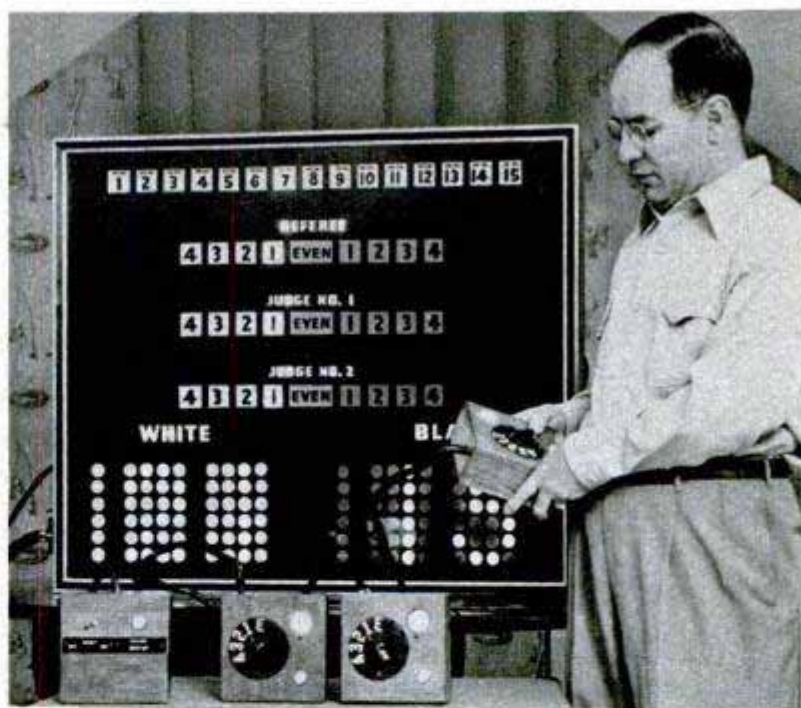
Blocked from the sun by a brick wall, a small greenhouse in downtown Philadelphia gets its sunlight with the help of a large reflector. Developed by Maurice Mandelkern, a Philadelphian whose hobby is raising orchids, the novel system involves



the use of an 8 by 10-foot reflector made with 11 large mirrors. In the summer months, the greenhouse is shaded with plastic to reduce some of the reflected light, but in winter, when the sun is low in the sky, the shades are removed and the reflector bounces the sunlight on the plants, causing fall blooms to flower in spring.

Boxing Scoreboard

Round by round, the balloting of the referee and two judges is flashed to fight fans by an electrical scoreboard invented by Michael J. Mesi of Portland, Ore. The board, which also keeps a cumulative total of points scored throughout the fight, can be hung at any vantage point in the arena. A light behind any number from 1 to 15, across the top of the panel, indicates the round in progress. None of the scoring lights flashes on until all three officials have registered their votes on separate control boxes at the ringside. Their scoring panels remain lighted until the 10-second warning whistle for the beginning of the next round. Totals accumulate at the bottom under the headings "black" and "white"—depending on which corners the fighters occupy. Mesi's board, which has 546 lights,



32,000 feet of wire and 12 relays, was made from parts of old pinball machines with the aid of one mechanic.

Waterproof Rope

Possessed of remarkable resistance to moisture absorption, specially treated Manila rope now available is designed for the protection of linemen, maintenance men and workers who face electrical hazards.

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OVERBURDEN

CABLE WHEELS

COAL SEAM

DRIVING
GEAR

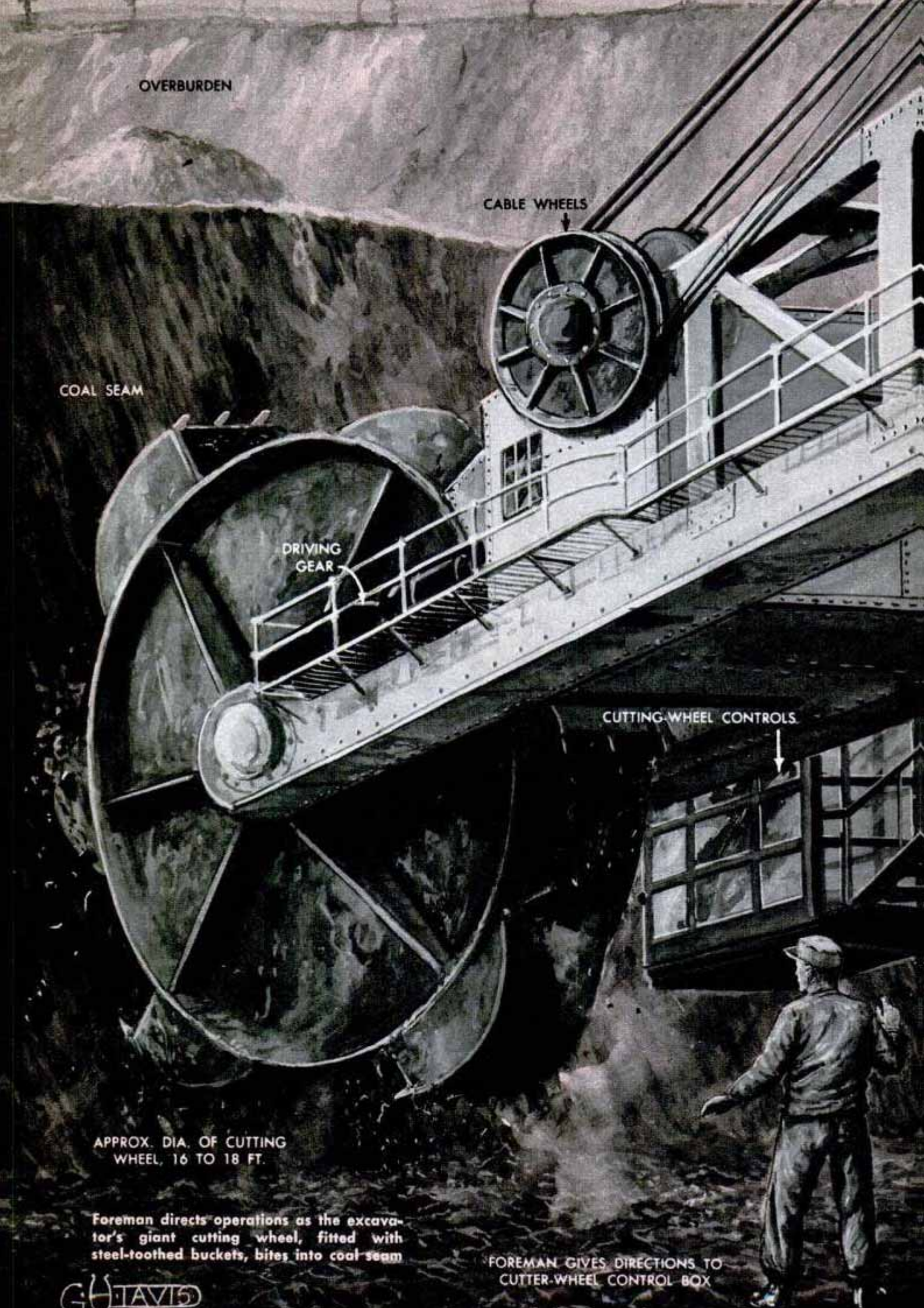
CUTTING-WHEEL CONTROLS

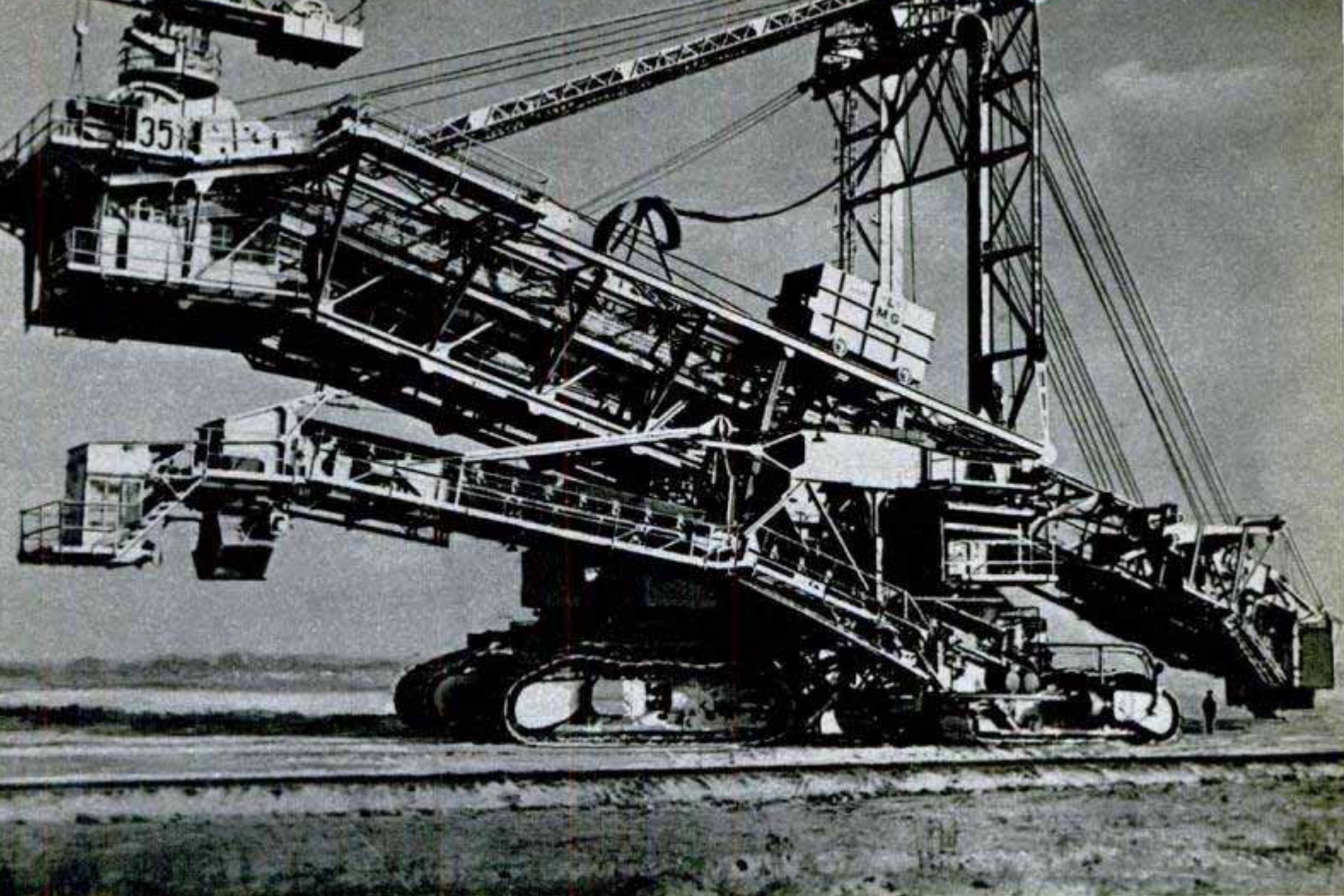
APPROX. DIA. OF CUTTING
WHEEL, 16 TO 18 FT.

Foreman directs operations as the excavator's giant cutting wheel, fitted with steel-toothed buckets, bites into coal seam

FOREMAN GIVES DIRECTIONS TO
CUTTER-WHEEL CONTROL BOX

G. H. TAVI'S





"Walking" down road near Helmstedt, Germany, 1000-ton coal-digging monster displays its maze of girders

SIX-LEGGED BEHEMOTH MINES GERMAN COAL

By G. H. Davis

IN A MIGHTY PIT at Helmstedt, Germany, stands a gigantic machine created by a Leipzig engineering firm to increase the output of coal in that area.

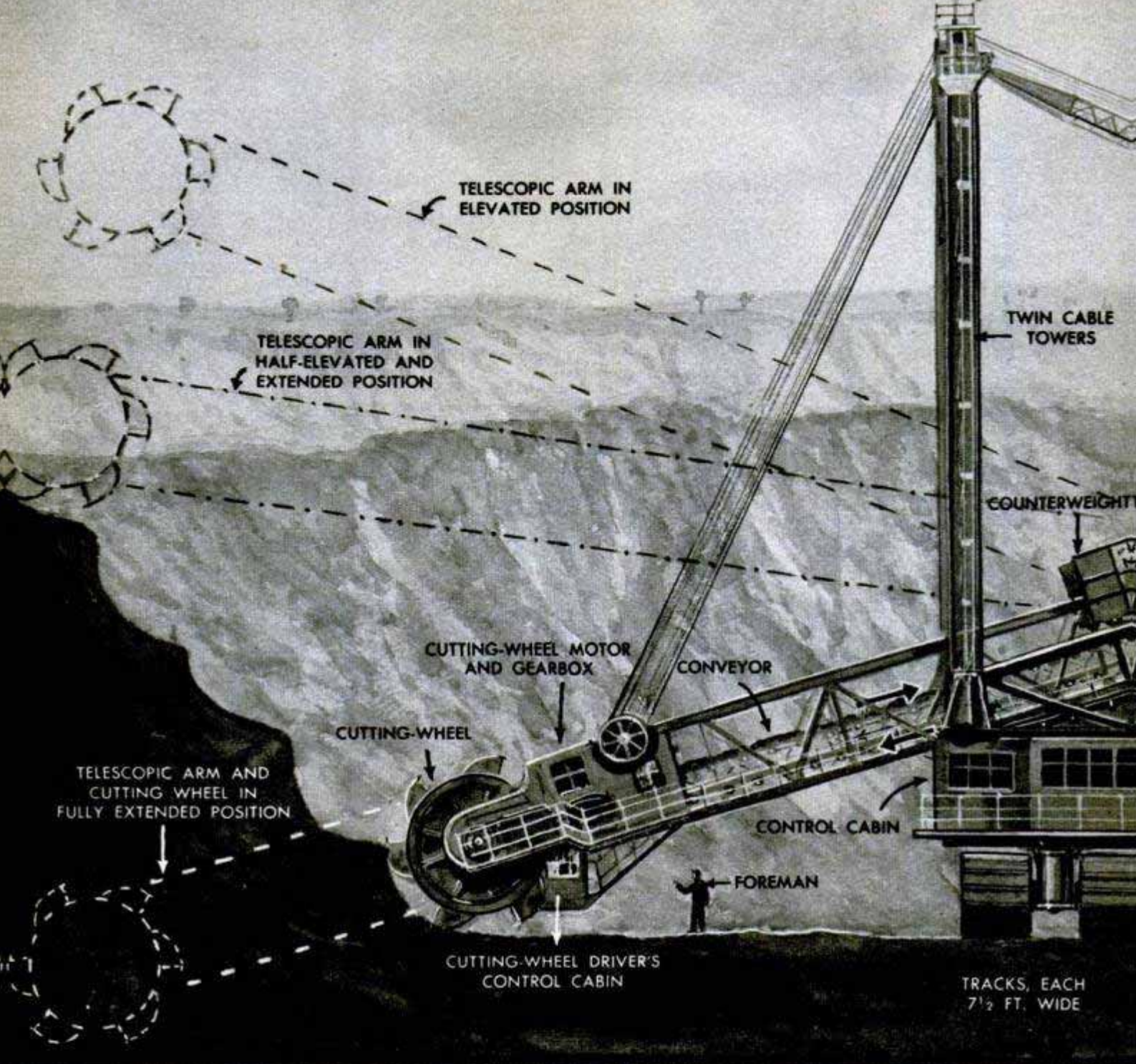
As the 1000-ton monster slowly moves on its six enormous Caterpillar feet (each track is over seven feet wide and ten feet high), the whirl of its numerous electric motors fills the air. The giant cutting wheel at the end of a central arm of the machine eats into the coal seam, filling its steel-toothed buckets and dumping them on conveyor belts that carry the coal through the machine and deposit it from the rear-end hopper into waiting coal wagons.

Located throughout the machine to drive all of its various working parts are 40 electric motors fed by a heavy electric cable that snakes along the coal floor of the pit from a commercial power supply.

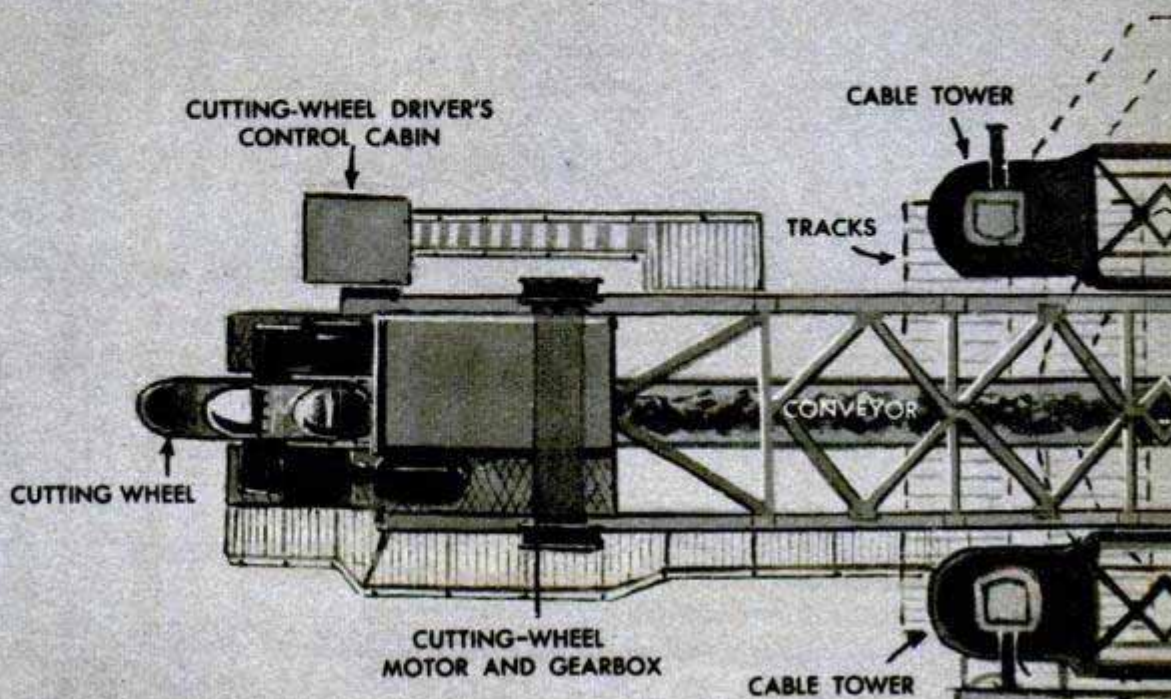
Only three workmen are visible around

the giant digger when it is in operation: One sits in a forward cabin and controls the digging wheel; another, in a similar enclosure near the coal chute, controls the supply of coal to waiting cars, and a foreman watches the cutting and gives hand signals to the cutting-wheel controller.

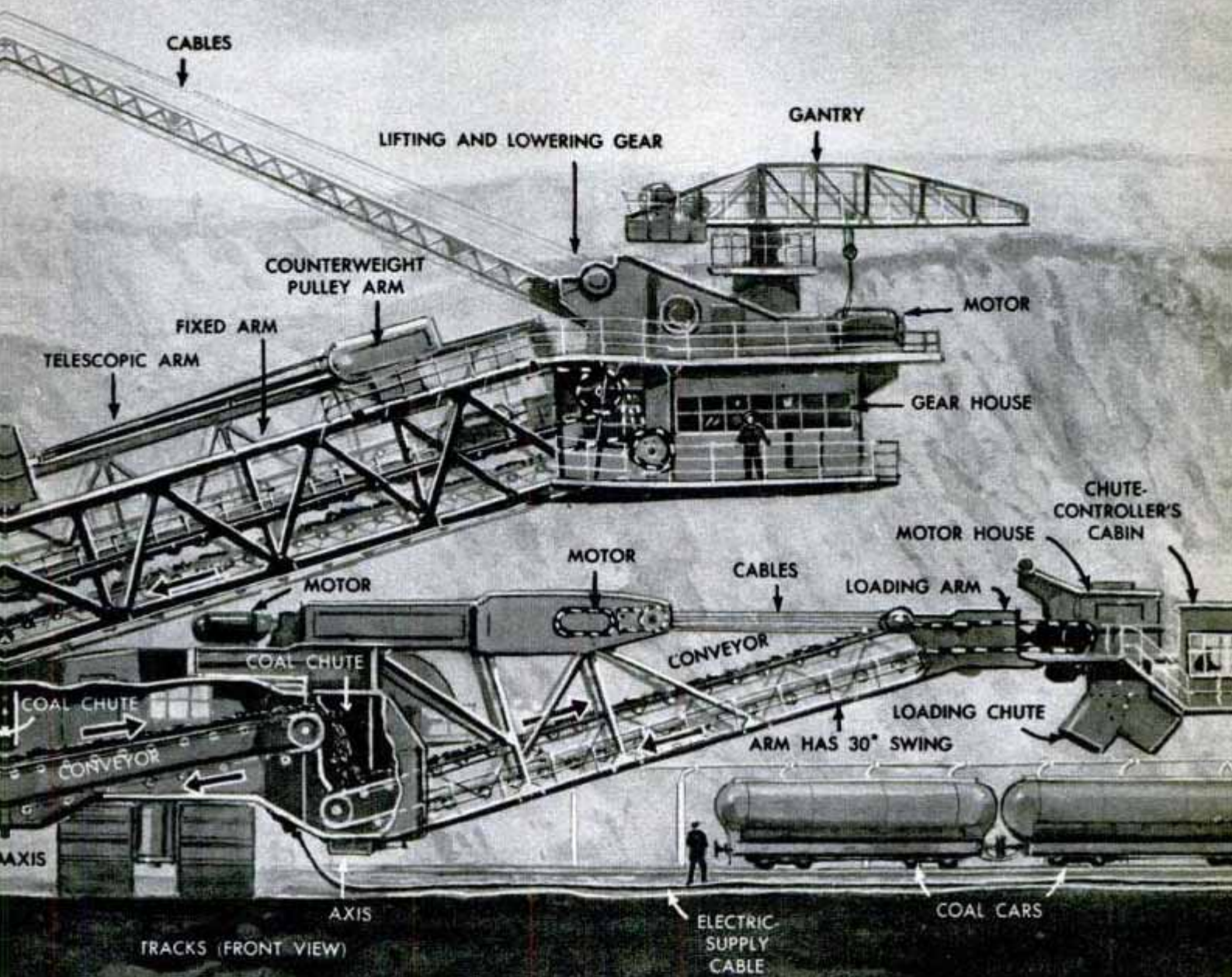
As the excavator works along the coal face digging upward and sideways, the staggering weight of the machine exerts a pressure of seven pounds per square inch on the ground. It is only possible to realize the enormous size of the "walking" monster by standing near it and looking up at the towering, intricate latticework of girders that extends 86 feet into the air. From one end of the machine to the other, the over-all length is approximately 241 feet, with the telescopic arm in its retracted position, as illustrated in detail on the following pages.



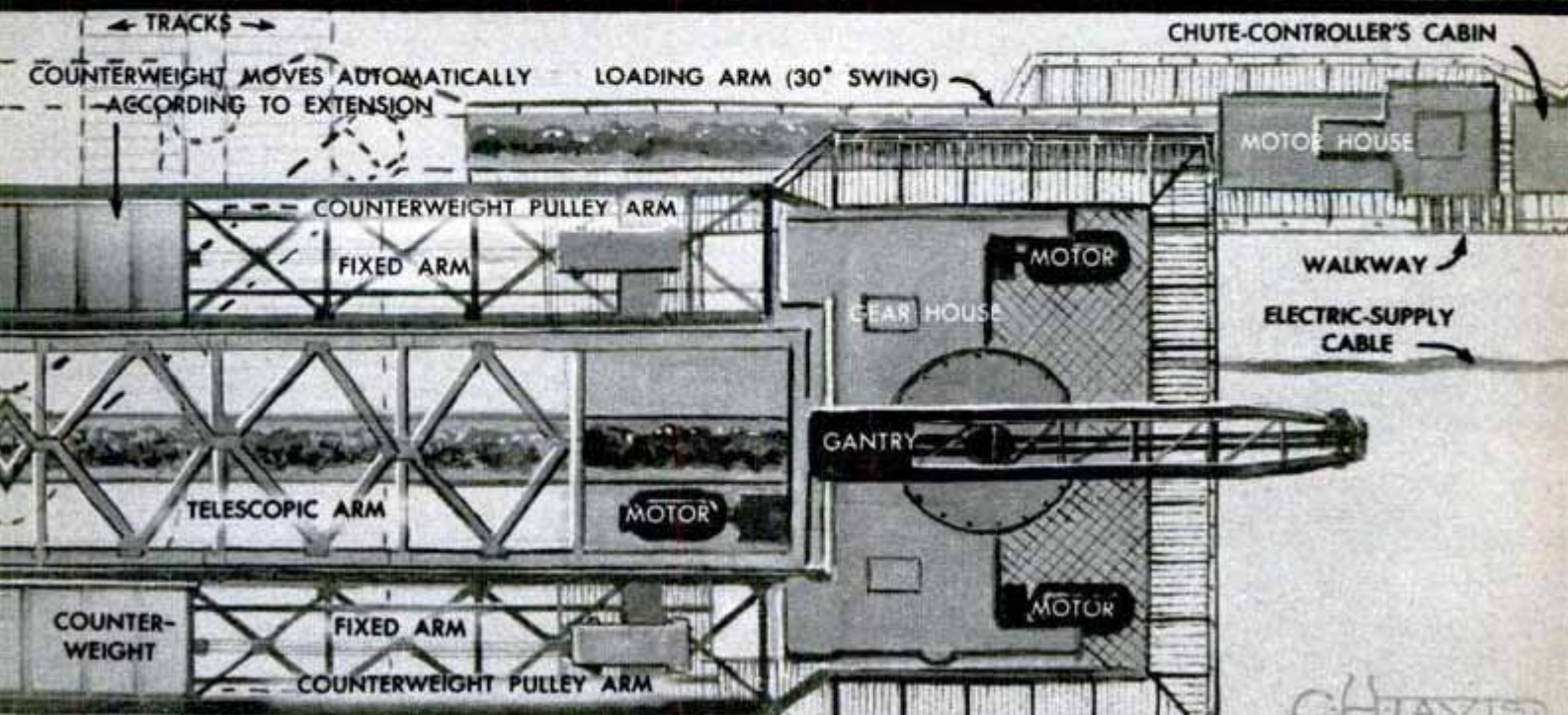
**PLAN VIEW
SHOWING
FIXED AND
TELESCOPIC
ARMS**



SIDE ELEVATION OF GIANT COAL EXCAVATOR AT HELMSTEDT, GERMANY



LENGTH OVER-ALL 241 FT. WITH ARM NOT EXTENDED



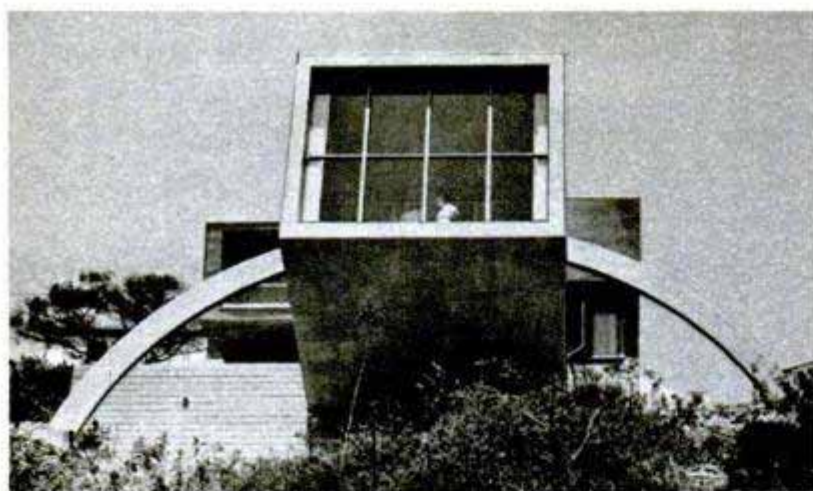


Self-Service Upholstery Shop

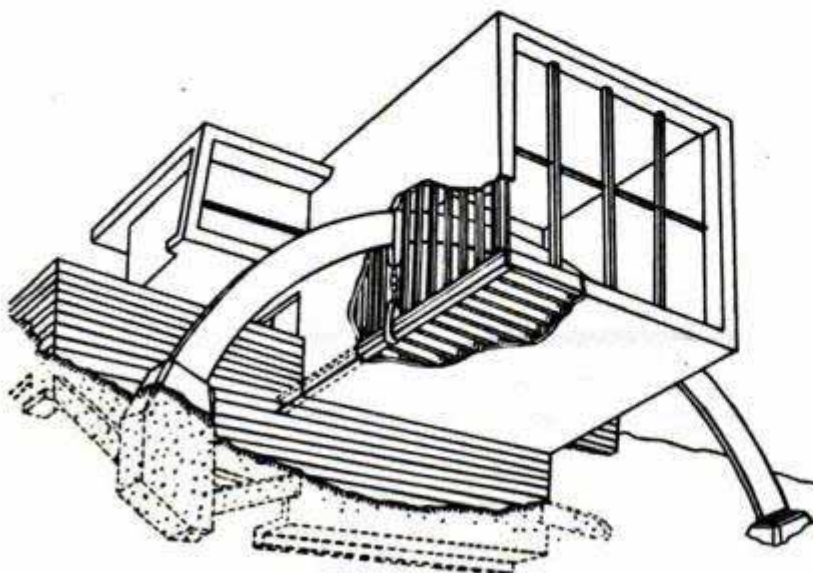
Novices can upholster their own furniture under professional guidance in a self-service workshop at Wichita, Kans. A local furniture store has installed a complete upholstery shop divided into six stalls, which customers may rent on an hourly or daily basis. All the tools needed in uphol-

stery work are available, including extra-heavy-duty sewing machines. Experienced upholsterers are on hand to guide each customer in his project. The novice can buy anything he needs in the way of fabrics, foam rubber, decorative nails and other supplies in the shop. It is estimated that the self-service arrangement saves the customer about 50 percent on each job.

California Living Room Hangs in Air From Huge Plywood Arch



In a new hillside home in Hollywood, the living room projects out into space to provide an airplane-like view of the surrounding area. Instead of resting on a conventional concrete foundation, the room is supported high above the hillside by a 60-foot arch made of laminated plywood. The arch, with its ends anchored in concrete footings, passes through the walls of the room. The portion of the house supported by the arch consists of a two-story living room, one end of which is all windows, and a balcony. The weight of this section is 20,000 pounds. Installed, the arch cost \$1400 and required a 70-foot crane to set it into position on its footings. Inside the room, the balcony is built over the top of the arch, providing extra living space for the homeowner.



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Plastic Bugs

Insects molded of plastic—to serve as fishing lures—are so lifelike they're difficult to distinguish from their real counterparts. The plastic bugs include crawfish, crickets, roaches, water crickets, grubs, grasshoppers, stone flies and weed worms. The natural coloration of these insects is closely followed in the lures. Each bug hides a fishhook. The lures can be used for still or fly fishing, and are resistant to sun, water and aging.



Laundry-Vending Machine

Now, in Cleveland, there's a vending machine to handle your laundry and dry cleaning. It receives money, gives the correct change, returns incorrect deposits and opens its doors, all without manual aid. Each unit consists of a series of lockers and a control panel equipped with a telephone. The customer simply lifts the phone and advises the operator in a central office of the laundry or cleaning to be done. The operator assigns and unlocks a locker by remote control. Trucks arrive at the lockers at frequent intervals to pick up and deliver the clothing left by customers.

Underwater Camera

Shaped like the tail structure of an airplane, a French movie camera is designed for underwater photography. The lens is said to be corrected for the refraction of light under water. Completely self-contained, the large camera even has an oxygen bottle mounted on it for the use of the operator.

Sick Plants Run a Fever, Too

Like sick human beings, sick plants can run a fever, according to Prof. C. E. Yarwood, plant pathologist at the University of California. In studying plants infested with virus and fungus diseases, Yarwood found temperatures of diseased plant leaves from 0.1 to 2 degrees Centigrade above healthy plants. He also found that fungus diseases produced higher temperatures in plants than virus diseases.



on the BUICK



Popular Mechanics was observing its first birthday when Buick made this two-cylinder job back in 1903

Foot-operated parking brake on Buick, right, is released by pulling a hand knob located on the dash



The true test of an automobile begins when the owner takes the wheel. This is another report from owners of 1951 cars who answered questionnaires sent by Popular Mechanics to 1000 Buick owners from coast to coast

By Floyd Clymer

BEST BUY on the market for the money." That phrase was repeated time and again in answer to our survey question, "Why did you buy a Buick?"

It soon became apparent as the results of the questionnaires were tabulated that those who drive Buicks, by and large, are among the happiest of car owners today. Thousands of owners buy Buicks time and again and many reported they would buy no other make of car. As always, there were suggestions for improvements.

A Denver mechanic said, "I work on all cars, day in and day out. I prefer Buick as my own car. Dynaflo, which slips some in starting, is the best and smoothest drive of

all. Buick can take abuse in the rough mountain roads."

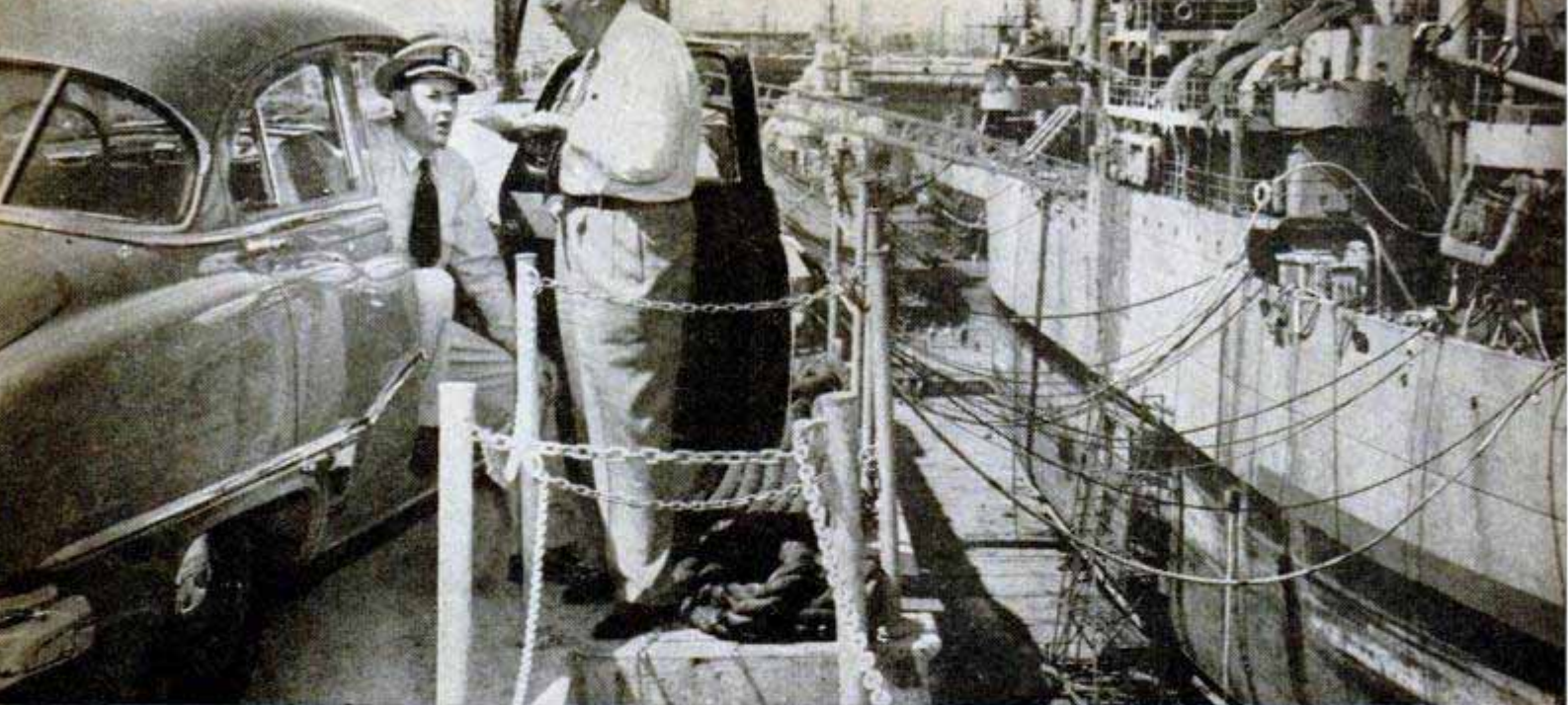
A Los Angeles contractor said, "I've owned 50 cars in 50 years—19 of them Buicks. Despite some criticism, it's the best buy of all cars made today."

"I have been driving Buicks for 15 years," wrote a Dundalk, Md., machinist, "and as a former Roadmaster owner, I believe the new Special is far better than any car in its field for comfort, roadability, design and trim. The horsepower is more than adequate. As for economy, considering the size of the car, it is sufficient."

On the other hand, an Indianapolis chemist was asked what he disliked about his



"Buick took the rough stuff with little effort," says Floyd Clymer after driving the car 1590 miles



In polling Buick owners, Clymer interviews Lt. Cmdr. W. E. Jones at the Long Beach, Calif., Naval Shipyard

Special, and he replied, "It's just that it isn't a Roadmaster."

A Macon, Ga., traveling salesman pointed out one advantage: "I use only the Buick Special. In small towns it can very easily be serviced or parts can be replaced in almost any Chevrolet place if no Buick agency is available."

It is noteworthy that many buyers of new cars still are war-conscious. Several Buick owners said they bought '51 models "to last through any war in the near future."

A few random replies to our question, "What do you like about the Buick?" were:

"It has all the comforts of a rich-man's automobile and still is within the price range of a working man." — Minneapolis pharmacist.

"Increased visibility and the ventilation system." — Milwaukee tool engineer.

"Starter under the gas pedal and 'step on' parking brake." — Glen Burne, Md., truck driver.

"G. M.'s research backing." — Washington, D. C., diplomat.

Samplings of criticism of the 1951-Buick models included these comments, mostly from otherwise satisfied owners:

"I can't understand why, of all G. M. cars, Buick seems to have the poorest upholstery and body workmanship." — Springfield, Mo., truck driver.

"I have owned nine Buicks, and the doors and windows on the last four never have been completely satisfactory. The inspection of new cars these days must be made by a one-eyed man. The rubber molding on the car is faulty. The gasoline gauge on my new Super has been worked on three times and still does not work. . . . The radios in my last three cars have required about three overhauls before giving satisfaction." — Liberty, Mo., attorney.

"The 1951 Buick with Dynaflo needs a small light for night driving under the 'P-N-D-L-R' on the shift indicator." — Buyer for El Paso, Tex., department store.

"The rear-view mirror is not good. . . . Either a lower mirror or a higher glass in the rear is needed." — Richmond, Va., apartment manager.

"The body assembly is terrible and for this reason alone I never would buy another Buick." — St. Louis, Mo., executive.

Among the owners' survey, 88 percent approved of Buick's Dynaflo drive and said they want it on their next car. (Of all 1951 Buicks, 86 percent were Dynaflo-equipped.) A Springfield, Minn., woman

ACCELERATION TEST

Buick Special with Dynaflo

¼ mile from zero	23.90 sec. — Drive range only
	21.50 sec. — Low and Drive
½ mile from zero	34.80 sec. — Drive range only
	33.60 sec. — Low and Drive
0 to 30 m.p.h.	9.25 sec. — Drive range only
	6.40 sec. — Low range only
0 to 60 m.p.h.	21.90 sec. — Drive range only
	20.10 sec. — Low and Drive

(In tests using both Low and Drive, shift from Low to Drive was made at 30 m.p.h.)

Top speed by speedometer.....98-100 m.p.h.
Actual top speed, about nine percent less (speedometer variation)

Percentages From P. M. Poll

Owners of Special models	49%
Owners of Super models	36%
Owners of Roadmaster models	15%
Owners of Dynaflo	77%
Owners of standard transmission.....	23%
Average gasoline mileage in country—	
Special and Super	16.9 m.p.g.
Roadmaster	14.7 m.p.g.
Average gasoline mileage in city—	
Special and Super.....	13.9 m.p.g.
Roadmaster	12.2 m.p.g.
Use premium gasoline	82%
Use regular gasoline	18%
Owners who change oil	98%
Average mileage for change of oil	1474
Owners who add oil (also change periodically)....	18%
Average mileage for adding oil	1170
Maneuverability excellent	80%
average	19%
unsatisfactory	1%
Acceleration outstanding	37%
very good	50%
average	13%

Best-Liked Features

Increased visibility	98%
Coil springing.....	97%
Sweepspear styling	95%
Step-on parking brake	95%
8-cylinder OHV engine	94%
Interior finish	87%

(These percentages are based on the answers to direct questions on the questionnaires.)

Owners' Rating of Car

Excellent	66%	Average	5%
Good	28%	Poor	1%

General Information

Prefer in-line engine	66%
Prefer V-type engine	34%
Prefer eight cylinders.....	98%
Prefer six cylinders	2%
Prefer overhead valves	92%
Prefer side valves	8%
Prefer automatic transmission	82%
Prefer standard and overdrive	9%
Prefer standard only	9%
Prefer Dynaflo drive	88%*
*(The above figure means 88% of the 82% preferring automatic transmissions.)	
Prefer makes other than Dynaflo	12%
Like low-pressure tires	87%
Average pounds carried above recommended pressure (by 45% of owners reporting).....	3.9 lbs.
Previous Buick owners	68%
Have owned five or more Buicks	14%
Will buy another Buick	71%
Might buy another Buick	27%
Will not buy another Buick	2%
Dealer service good	62%
average	28%
poor	10%

Most frequent objections:

1. Body fitting and assembly; 2. general interior finish; 3. location of rear-view mirror

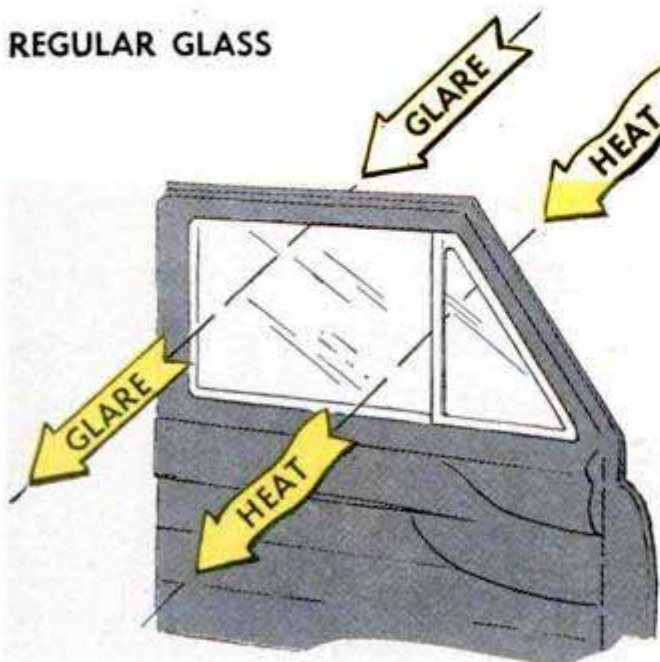
bookkeeper said that Dynaflo gives "a smoother start, and ease in winter driving." A Winston-Salem, N. C., safety supervisor thought Dynaflo "overrated," but a Huntington, Ind., trucking manager, who has owned 19 Buicks, said Dynaflo provides "easy getaway and comfortable driving." Reports on gasoline mileage always are

interesting in our surveys. Buick owners of all models averaged from 12.2 to 16.9 miles per gallon in both city and highway driving.

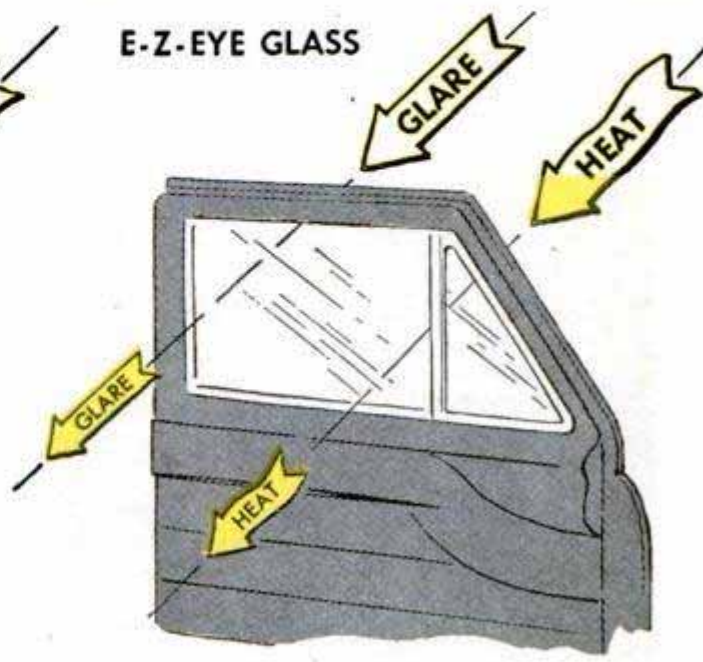
Much discussion has surrounded the curb and road clearance of 1951 cars, including Buick. In the present survey 95 percent of Buick owners said clearance is satisfactory,

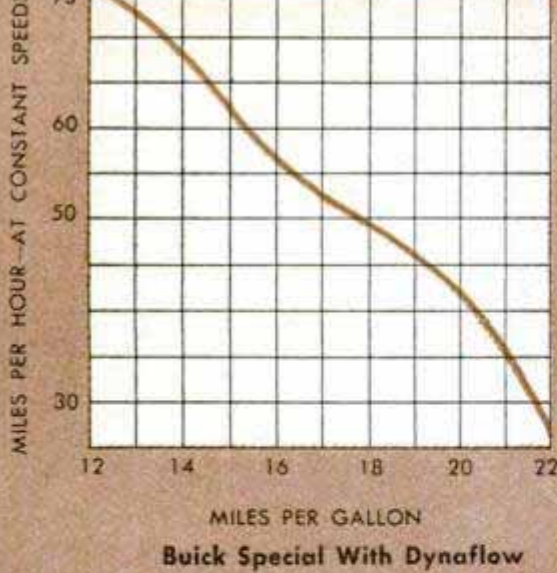
Optional E-Z-Eye glass in Buick screens out some heat rays and glare that would pass through ordinary glass

REGULAR GLASS



E-Z-EYE GLASS





Buick Special With Dynaflow

Speed (m.p.h.)	Miles Per Gallon
At constant 30 m.p.h.	21.70 m.p.g.
At constant 50 m.p.h.	17.90 m.p.g.
At constant 60 m.p.h.	15.20 m.p.g.
At constant 75 m.p.h.	12.20 m.p.g.

CROSS-COUNTRY MILEAGE

(Speedometer showed only 49 miles at start of test)

Flint, Mich., to Springfield, Ill.	15.80 m.p.g.
(Car new, quite heavy traffic)	
Springfield, Ill., to Kansas City, Mo.	17.10 m.p.g.
Kansas City, Mo., to Denver, Colo.	18.70 m.p.g.
(Premium gasoline of various brands was used on test)	

while only five percent said that it is too low.

Regular gasoline was used by 18 percent of the owners replying; 82 percent used premium. In this respect, a Wichita, Kans., man wrote: "I know the gasoline mileage indicated in my report seems pretty good. However, this was my experience: For the first 2000 miles, my Special averaged 15.4 miles per gallon on over-all driving, two thirds in the city with regular gasoline. I switched to premium gas because of carbon ping. For the next 1476 miles I averaged 17.46 miles per gallon."

A suggestion from an Indianapolis meat packer read as follows: "The 1951 Special can be improved by using the Super-Roadmaster dash panel. The Special dash panel is not as distinctive as the 1950 Special, which has the speedometer dial located in the center: The entire Buick line can be substantially improved with heavier moldings and bumpers and conversion to the V-type engine. Heavier chrome moldings such as Cadillac uses would be worth the extra cost."

One satisfied Dynaflow customer was a Ft. Lauderdale, Fla., retail-store owner. He said: "My Super holds the road well. . . . I can drive all day with minimum fatigue. . . . Dynaflow is the smoothest in taking off or slowing down."

A Kansas City broker said: "If you are careful with Dynaflow you can get more gas mileage than other cars of similar size with automatic transmissions. Even if I don't get as good mileage, I'd still buy Buick because of satisfaction I get in driving one, high-trade-in value and good dealer service. Yes sir, I'm a dyed-in-the-wool Buick fan—no other make for me."

An Illinois farmer says: "There may be better cars than Buick, but I've never found one. Don't like the rear coil springs—my only kick."

Amateur car designers are uncovered in

every survey. This time a Minneapolis architect could find nothing wrong with his Super model, but drew a diagram to explain the "rubber bumpers on rear of frame strike metal seat when car is loaded. As rubber strikes slanting surface a squeak is produced. This design could stand some improvement."

A Racine, Wis., retail merchant said he would not trade his Roadmaster for a Cadillac. "Why are Buick engines noisy?" is the only complaint I ever hear," he wrote. (Actually, the new hydraulic valve lifters greatly reduce OHV engine noise.)

A Topeka, Kans., dentist bought a Buick this time because of its performance in mountain driving. "Buicks seemed to pass us easily when we drove other makes," he noted on his questionnaire.

Several owners complained of Buick's body workmanship. One of these, a Norfolk, Va., marine engineer, writes: "Because of my observance of various makes of cars in the lower-class field, I have found the workmanship of the bodies and interiors such as door fit and moldings around windows as good or better than in the two Buicks I have owned."

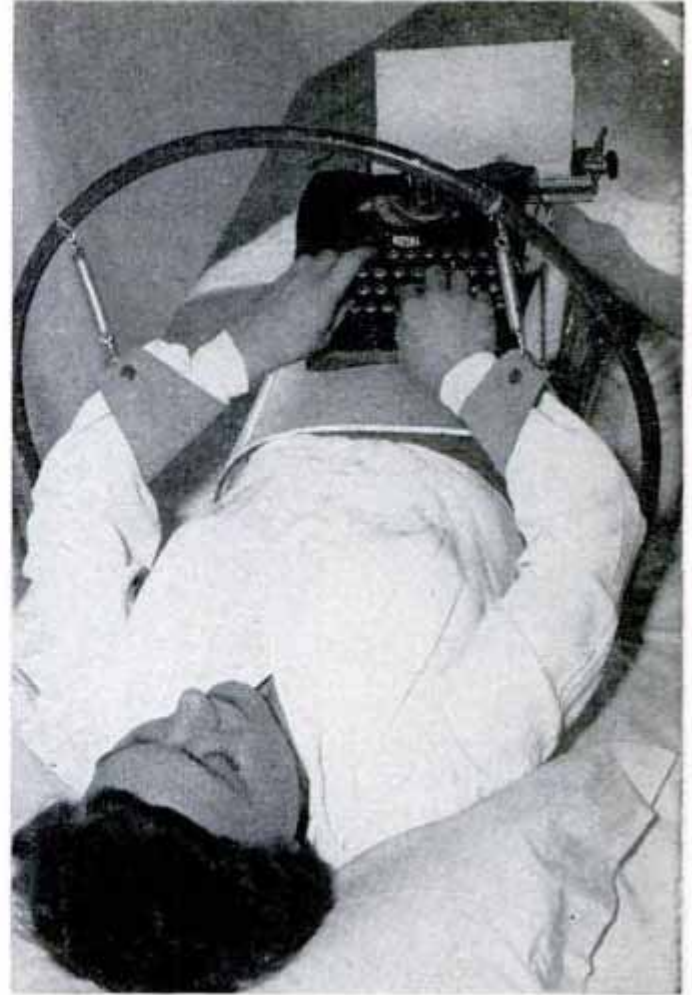
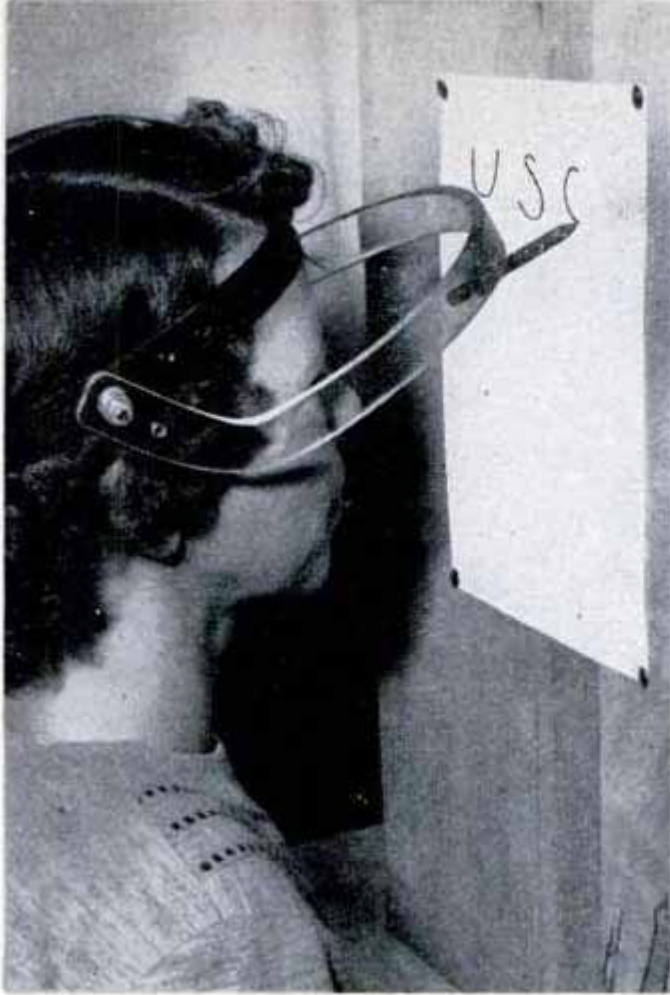
A Milwaukee fireman driving a Special Dynaflow model dislikes "the sound of being in second gear in city driving." He also would "like to see an over-all increase in gas mileage." (Who wouldn't?) "Combining overdrive and Dynaflow might give it to you," he observed.

An Arlington, Va., physician who owns a Special reported that he had that rarity of rarities, an automobile clock which keeps good time.

Finally, Buick received this mash note from a Danville, Ill., trucking owner: "I cannot describe the pride my wife and I have in our Buick Roadmaster."

My own test: The test car was driven

(Continued to page 314)



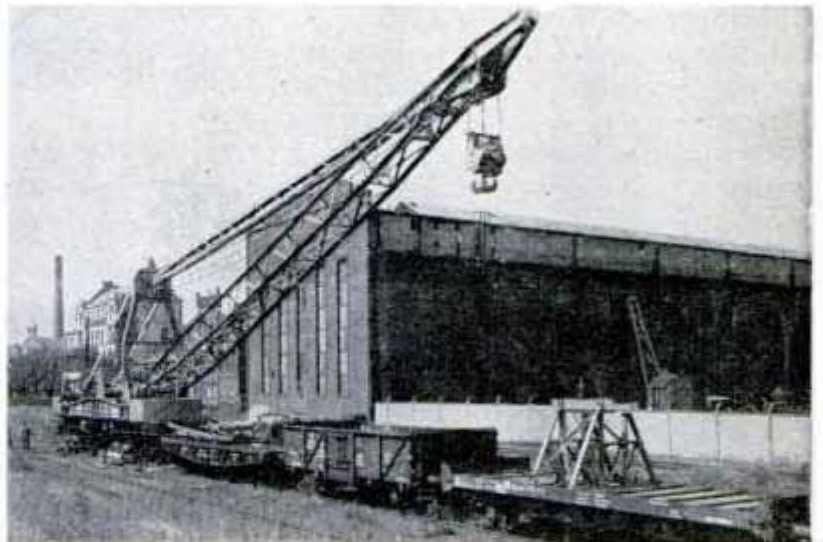
Inventions Help Handicapped to Help Themselves

Invented at the occupational-therapy department of the University of Southern California, two ingenious devices help handicapped persons perform various acts. One device fits inside an iron lung and holds

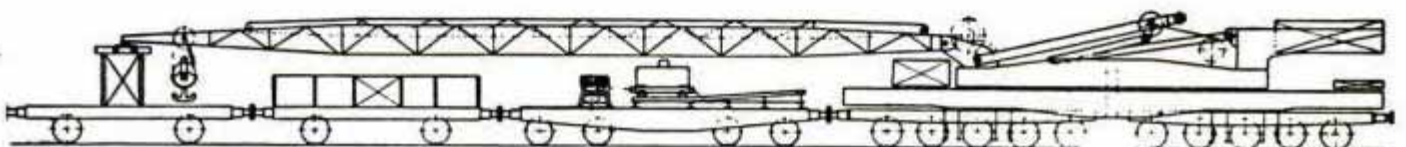
the patient's wrists above a typewriter keyboard so she can pound out words although she cannot raise her arms. Another device fits on a patient's head and holds a pencil so she can write on the wall.

Giant German Crane "Kneels" in Transit

With a capacity of 30 tons, a German railway crane used to rebuild bombed bridges "kneels" almost flat to comply with clearance requirements of the right-of-way. Four cars carry the crane and accessories. Over all, the train is about 150 feet long. The crane weighs 175 tons. Power comes from an electric generator driven by a diesel engine. An electromagnetic brake holds the load in any position. Cast-iron counterweights are used to prevent the crane from tipping and these weights have to be distributed throughout the train when the crane is in transit.



With its boom up and ready to lift anything from a bridge to a locomotive, the giant German railway crane looks like this. But when it's time to get rolling over the rails, the whole machine collapses, drawing below, to extend over three cars

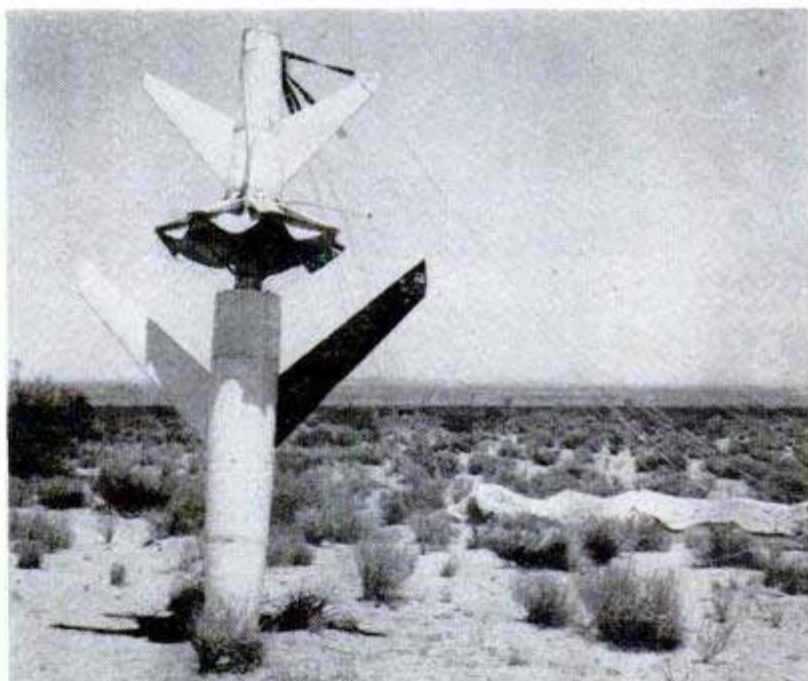




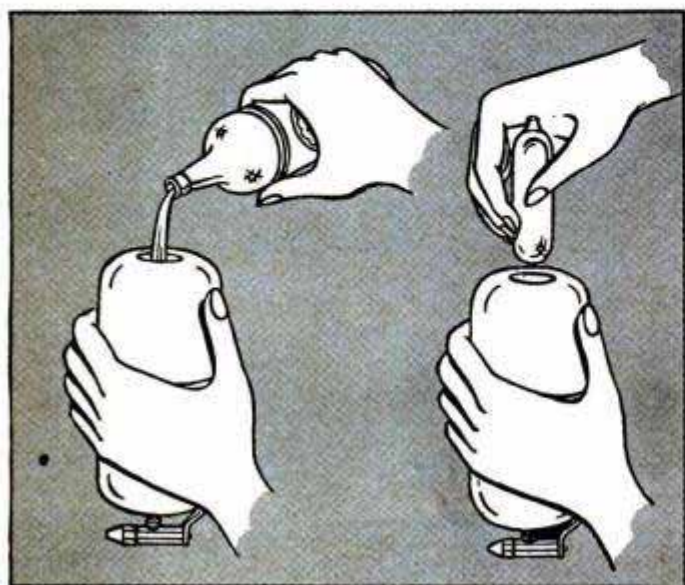
Test "bodies" dropped from plane, above, are slowed down by automatic "dive brakes" before they land, below

"Dive Brakes"

In testing wings, tails and control surfaces considered suitable for flight faster than sound, research engineers at the Ames Laboratory, Moffett Field, Calif., mount them on streamlined "bodies" to be dropped from planes at altitudes of 35,000 to 40,000 feet. As the free-falling bodies are loaded with valuable instruments to measure such factors as drag and lift, the engineers have devised a system of "dive brakes" and a self-contained parachute to increase the possibility of instruments being recovered. Located toward the rear of the body, the brakes open at a set point, and a hydraulic-fluid metering system limits the brake force to a predetermined value, thus avoiding the terrific impact of a suddenly opened parachute. When the body has been slowed



to a point where the chute can be used safely, it is released automatically from a compartment in the tail.



Rechargeable Sprayer Uses CO₂ Cartridges

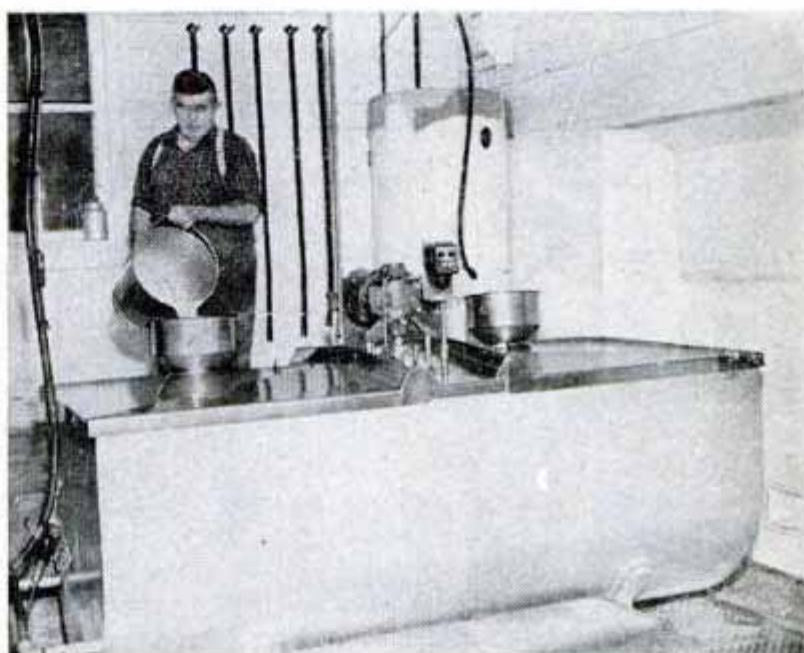
You can spray any liquid you want from a refillable and rechargeable spray "bomb" that is powered by a CO₂ gas cartridge. Insecticides, deodorants, cleaners, weed killers or any noncoagulating, nonviscous liquid can be loaded into the bomb. One of the cartridges is inserted and the cover screwed on tightly. The compressed gas in the cartridge then sprays the liquid in a fine mist.

☐ A new insulated rubber boot for combat Marines operates on the principle of sealed insulation, similar to a vacuum bottle.



Milk Tanker Replaces Cans

Bacteria don't have a chance in a pickup system for bulk milk in use in Connecticut that eliminates the familiar milk cans. The milk is poured into a holding tank in the sterile milkhouse immediately after milking. A refrigerating system cools the milk down to 38 degrees and holds it there until the pickup truck arrives. This pickup truck is an insulated semitrailer tanker that carries the milk to the dairy, maintaining its temperature at below 40 degrees to retard bacteria breeding. The milk is weighed and sampled for butterfat on the farm.



Amphibious Hunter

Austrian hunters can walk on water now in their quest for ducks. Inflated boots enable them to paddle and glide noiselessly across the water. Straps inside hold the hunter's legs steady while firing. Afterward he can coast through the reed beds on his pontoons to pick up the fallen game.

Spray Seals Mine Shaft

Coal mines improve ventilation by sealing unused shafts with a spray-on plastic that blocks gas and moisture. A vinylite plastic, the liquid is sprayed on cloth-covered frames or walls to form a film durable like that used to protect stored military equipment.



Step right up and speak to His Majesty, The King. One of the most popular displays is England's royal family

Meet the King and Danny Kaye. They live side by side in London, peaceably, with Joe Stalin, Abe Lincoln, Napoleon and Mae West at a Baker Street address made famous by Madame Tussaud's . . .

GREATEST SHOW IN WAX

By James F. Scheer

WHEN YOU WALK through the door of a plain, three-story brick building on Baker Street in London's West End you're in for the jolt of your life. In the tiled lobby, a pretty girl smiles at you. She holds booklets listing exhibits. You try to buy one, but the gal won't talk or sell. She's wax. When you see another smiling girl with booklets, you start to turn away. But she moves. She's not wax.

You climb a flight of stairs, and at the door of Madame Tussaud's world-famous Wax Museum you see a guard in a blue uniform. You accidentally bump him and apologize, but rudeness doesn't matter to him. He's wax. Farther on, another guard is standing stiff as a statue. To experiment, you dig a sharp elbow into his ribs. He explodes with a bellow of pain in the most

outraged cockney you have ever heard!

By the time you reach the displays in the Grand Hall, you've lost all ability to judge the wax from the real. Just about the only false note in the entire museum is one you can't see—most of the 500 figures, the royalty, presidents, statesmen, great military men, religious leaders, film stars and assorted criminals wear long underwear—the real, old-fashioned gray "long johns"! From Mae West and President Truman to Napoleon and Danny Kaye, the figures are woolly warm.

The reason? These unglamorous bristly underthings protect the plaster-of-paris bodies from wear when suits, gowns, and capes are brushed and cleaned. Further, they make outer clothing drape better and add just one more realistic note to wax

figures that almost move about and speak. Lifelike realism in the smallest of details has been the exhibition's policy since the museum was established in Paris during the French Revolution and, later, moved to London by Madame Tussaud. In fact, this policy—added to natural curiosity of patrons about the great, the near great, the famous and notorious of today and yesterday—accounts for the fact that Tussaud's is still one of the world's greatest shows, even in the atomic age.

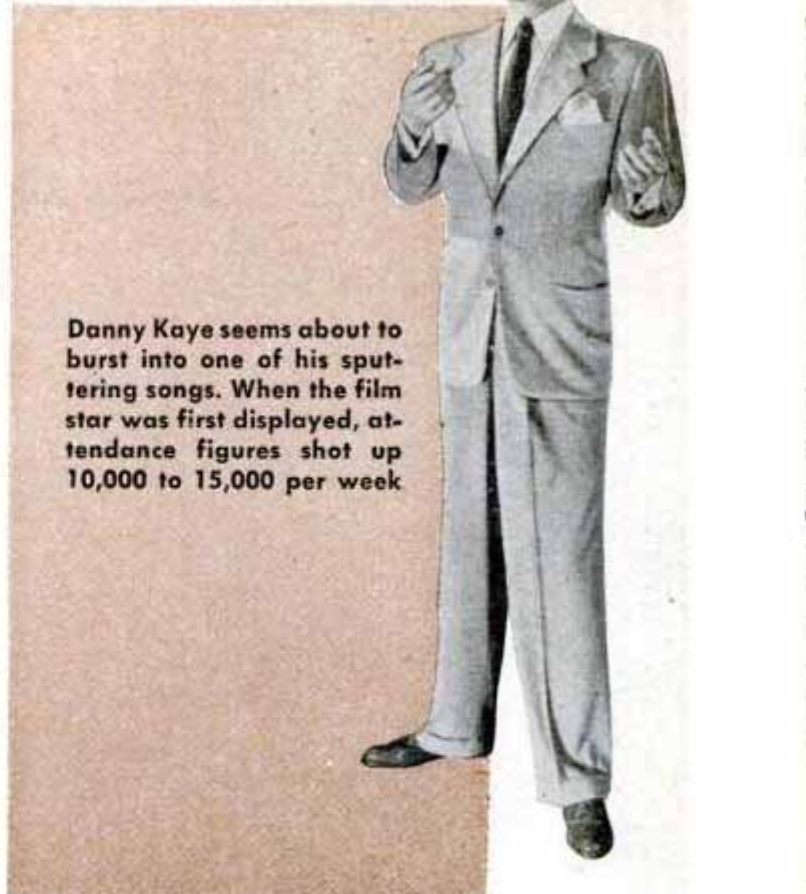
Already as much of a tradition for tourists and native Britishers as Westminster Abbey, this exhibition of wax artistry draws about 3000 cash customers daily at an annual profit nearing \$400,000. And, of course, the Tussaud clan is represented, mainly in the person of scholarly looking Bernard Tussaud, great-great grandson of the museum's founder. He's an unassuming artist who likes bright tweed jackets and enjoys transforming mere beeswax into celebrated personages.

Madame Tussaud's—which has survived a devastating fire in 1925, the depression of the '30s and the Luftwaffe's aerial blasts in the last war—spares no expense or effort to make every figure so lifelike it seems ready to speak.

Turning out one wax bust, for instance, is a drawn-out and exacting job that would exhaust the patience and fray the nerves of an average man. A finished replica for the exhibition costs more than \$500 for labor and materials. A few have run as high as \$5000 by the time they have been fitted with elaborate robes and jewelry, many of which are genuine.

Before Bernard Tussaud even raises a finger to interpret his subjects in wax, a great deal of work must be done. What happened to screen star Danny Kaye is typical of the experience most celebrities endure to gain near immortality at Madame

Bernard Tussaud heats a glass eye for Prime Minister Attlee, then painfully positions it with bare fingers



Danny Kaye seems about to burst into one of his sputtering songs. When the film star was first displayed, attendance figures shot up 10,000 to 15,000 per week

Tussaud's Wax Museum on Baker Street.

Danny had to sit and stand for 12 stereoscopic photographs as well as for 20 to 24 more or less candid shots. Then he had a thorough going over with a pair of calipers for finding eight head measurements—between eyes, from tip of nose to point of chin, from point of chin to back of head, between lobes of ears, between base of nose and lower ear-tip, lower lip to point of chin, upper lip to base of nose and bridge of nose to hairline.

Before Kaye knew what had happened he felt tape measures around ankles, wrists and neck. Then came measurements for vital statistics such as tailors keep on file for their most exacting customers. Next

Working from a set of enlarged photos, Tussaud carefully sculpts a clay bust of a cabinet minister





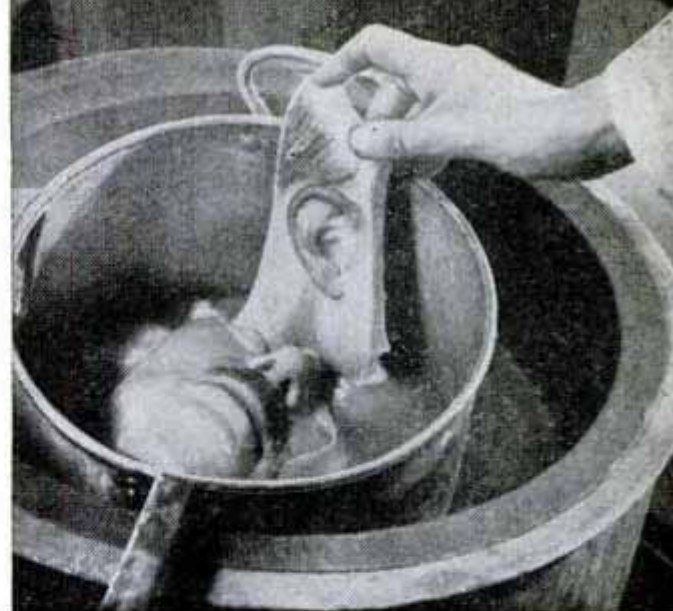
a barber shaved on the most minute hair of his hands, up to the wrists. With plaster of paris applied as a cast from wrist to finger tips, Kaye was forced, for an hour and a half, to refrain from talking by hand.

After the ordeal, he had left behind all impressions necessary for Bernard Tussaud to begin work. Here is how the job customarily is done. A dozen of the best photos are enlarged and arranged on a table before the artist. One of these is the master photo, the main source of data. Then Tussaud molds moist clay into a likeness. This takes anywhere from two to six weeks. The completed bust has to be true to the eight caliper measurements.

It has always been distressing to the management of Tussaud's that so many men and women achieve fame late in life, at an age when they have white hair—an item that's hard to get and costly—and many wrinkles. The plaster-of-paris head mold

◆ Thoughtful Ben Franklin was made almost 170 years ago, taken from life while Franklin was in Paris. Other figures, clockwise, are Andrew Johnson and William Penn, who look on as wardrobe mistress rearranges Abe Lincoln's tie. Just below are France's King Louis XVI, Marie Antoinette and their family. George Bernard Shaw's beard gave hair-planter long weeks of hard work. Movie-goers should recognize Greer Garson, and at center left, Bernard Tussaud tidies up figure of his great-great grandmother, Madame Tussaud, who made this replica of herself

Rough edges of a plaster-of-paris body are rasped off by an employee. It'll soon be ready for a head



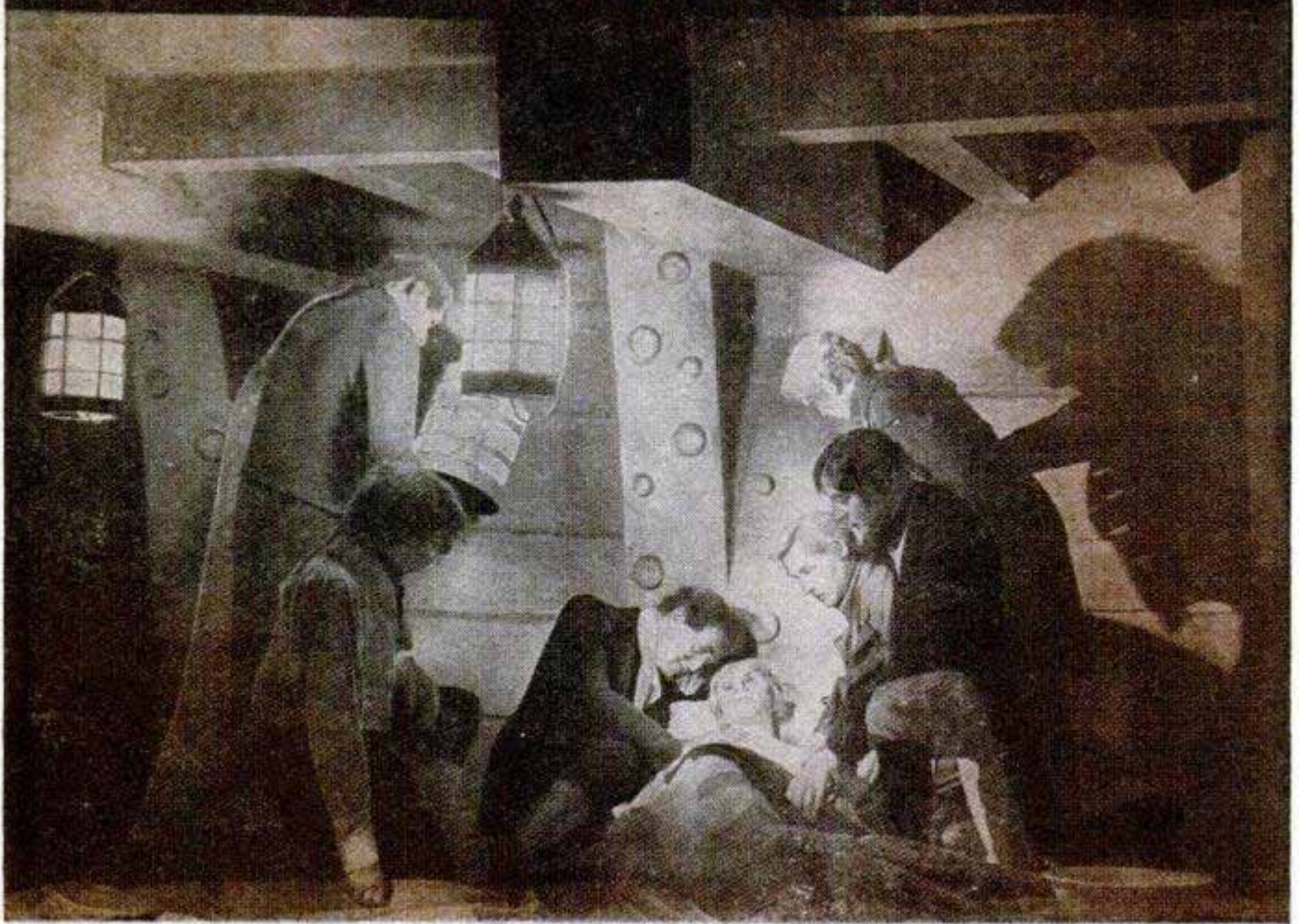
Into the melting pot goes the head of a man no longer considered famous enough to rate a figure in Tussaud's



Eerie scene is this room where wax heads are broken apart. Smiling Lord Beaverbrook is getting the mallet

Stars, crowns and jewelry must be kept bright and sparkling. One of Madame Tussaud's descendants cleans a medal worn by wax figure of an English king





In an elaborate tableau at Tussaud's, England's immortal Admiral Nelson dies in the arms of his comrades



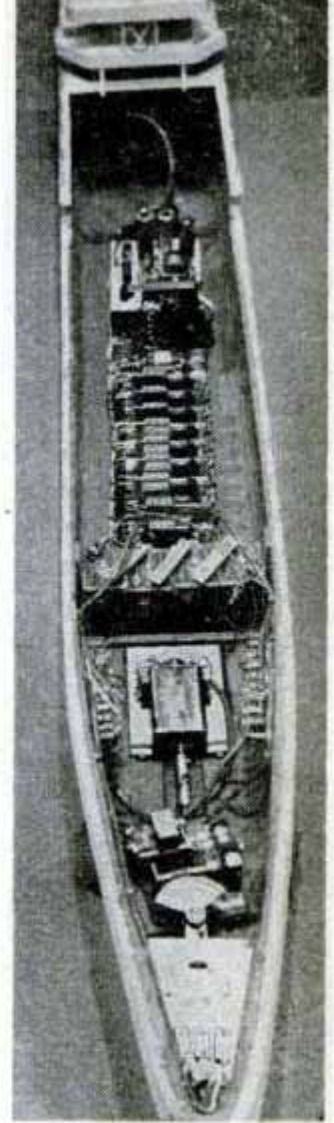
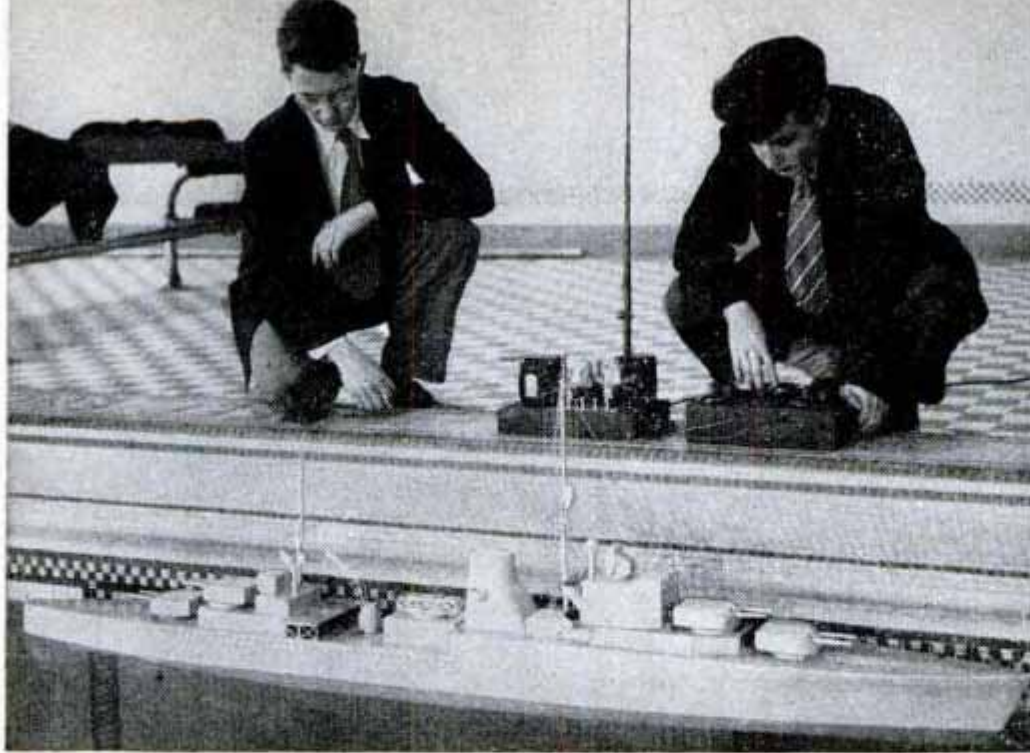
is usually cast in about 12 pieces, but many wrinkles make much undercutting necessary. This means extra work and more pieces—as many as 18. Before plaster of paris is applied, two long, thin, Vaseline cords are crossed at a 90-degree angle over the clay head. When the plaster cast has become firm, the cords, one at a time, are pulled up through the plaster of paris. By means of these openings, it is possible to lever off the head segments with a blunt tool.

Once the piece mold is fitted together and tied with tough string, the head is literally stood on its head. Molten beeswax, with a small quantity of vegetable wax—for added hardness of the finished product—is poured in. The wax cools against the mold first. When a crust about an inch thick has formed, wax that is still liquid in the center is poured off. Within three hours the mold is cool, resulting in a hollow wax casting.

One of the tasks that gives the maker of wax men a great deal of pain, physically, is the fitting of eyes into figures. From the prewar supply of 5000 pairs of German-made glass eyes, valued at almost \$30 a pair, Bernard Tussaud considers the many

(Continued to page 328)

Man in the Iron Cage looks weirdly down on Chamber of Horrors, most famous section of the museum



Dial-Operated Ship Model

Two teen-agers at Upper Canada College in Toronto can maneuver their big, radio-controlled ship model merely by turning a telephone dial. The ship, which displaces 75 pounds, is a scale model of the British cruiser H.M.S. Ajax. It is powered

by two batteries, one of which operates the propeller and the other the rudder. The "captain" dials the appropriate number on the telephone dial. A radio transmitter sends a signal to the ship, where the signal actuates the proper relay.

Child's Car Is Mongrel — Part Plane, Auto and Motorcycle

There's a little bit of everything in a custom-made car that six-year-old Pat Cantrell drives. The chassis was once part of a 1934 Chevrolet; the front end is from a Cushman package car; the engine and rear wheel are from a motor scooter and the steering mechanisms from a Crosley. The wheels, seats, windshield and steering wheel are from airplanes. Pat's father, Dennis Cantrell, an Arkansas airport operator, built the small vehicle. A centrifugal clutch eliminates the clutch pedal. Pat drives the small car skillfully and safely at speeds up to 25 miles an hour.



Man's Hottest Flame

Anything known on earth can be burned by a hydrogen-fluorine torch developed at Temple University's Research Institute. The flame from the torch burns at 8000 degrees F., the highest temperature man has ever created. The temperature of the flame can be increased by boosting the atmospheric pressure in which it burns and scientists expect to reach the sun's temperature (9000 degrees) by raising the pressure beyond that used in their recent experiments.





Detroit Listening Post

By Siler Freeman

IF GOVERNMENT controls persist in plaguing the automotive industry—such as the recent one reserving all new machine tools for military and defense purposes after February 1—the few really new 1952 cars may be the last ones the public will see for some time.

One of these is the new passenger car introduced by Willys-Overland. This car is no midget and is right up in the front line of competition with the Ford-Chevrolet-Plymouth group in size, horsepower and price.

The Willys is on a 108-inch wheelbase, has an F-head Hurricane engine especially designed for it with 90 horsepower and a top speed of about 90 miles an hour. During tests at sustained speeds of 30 miles per hour, the car got up to 35 miles per gallon of gasoline and 25 miles per gallon at 60 miles per hour. Although the engine has a compression of 7.6 to 1, it is said to operate efficiently on regular gas. This is an important factor in the face of a dwindling supply of high-test fuels.

All of the 1952 Chrysler line—Chrysler, DeSoto, Dodge and Plymouth—are appearing on schedule. A new V-8 engine of 160 horsepower has been announced for the DeSoto. Chrysler is dazzling the public with a so-called "car of the future" with a 310-horsepower experimental engine and

radical design. The sports sedan, designated as the K-310, was built in Turin, Italy, at a cost of \$400,000.

Many of the new '52 cars will not vary much outwardly from their predecessors. Packard is featuring its new power brake at the head of a list of 76 improvements. The company's "bread and butter" 200 model has the cuplike chrome decorations on the rear fender which distinguished the 300 and 400 series last year.

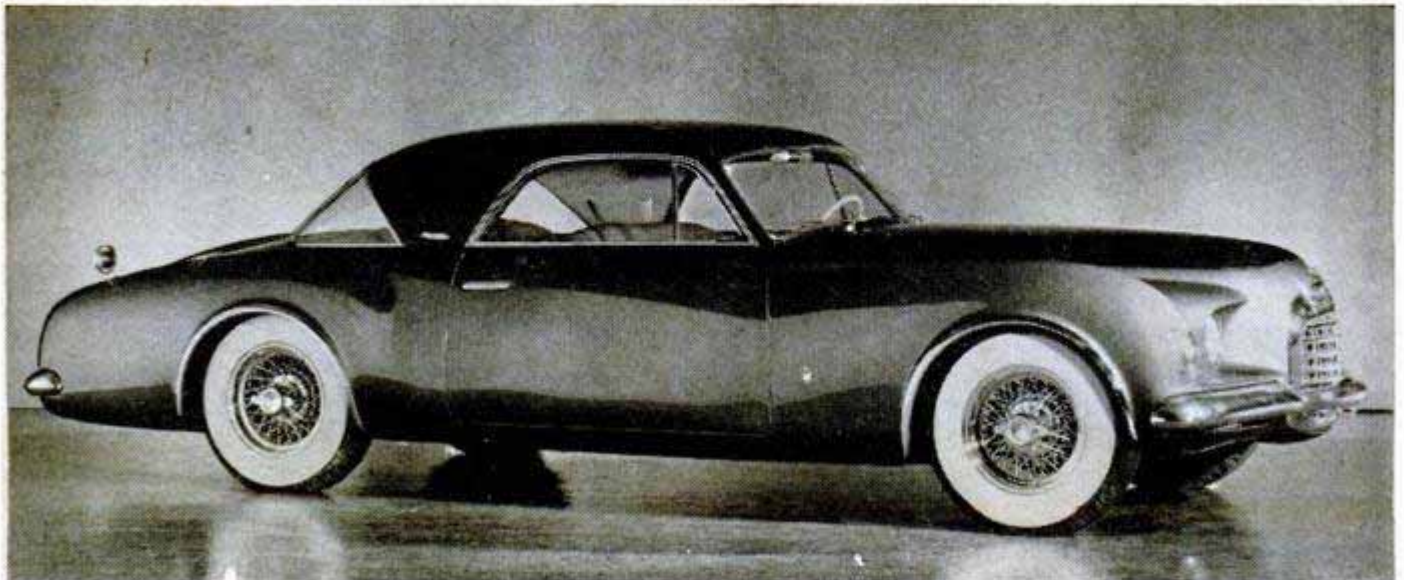
The power brake is Packard's big bid for public favor. The Bendix-made device is called Easmatic. It reduces pedal pressure 40 percent and cuts down the time required to swing the foot from accelerator to brake pedal by 29 percent. Mechanically, it appears to be a simple device. Power is supplied by vacuum from the engine through a cylinder mounted under the toeboard and directly connected to the brake treadle.

Another feature is a large cooling fan to save copper. It enables a reduction in the size of the core. Another saver of scarce material used in the new models is a nylon speedometer gear, which saves on brass. It needs no machining, according to William Graves, engineering chief for Packard, and has longer life.

While other automotive officials expect a shortage of new cars around the first of

(Continued to page 410)

Experimental Chrysler sports sedan, K-310, has low sweeping lines and is powered by 310-horsepower engine





Custom-Made Roadster

By lowering the floor so much that the driveshaft "tunnel" serves as an armrest, Bob Trammel converted his 1941 Ford coupe into a ground-hugging roadster. Most of the original body was discarded and new sections handmade to form the new contours. Road clearance is only two inches less than originally, but the floor was dropped nine inches. A reworked Mercury engine that develops 206 brake horsepower replaced the original engine.



"Seamless" Sports Car

You have to look long and hard to spot a seam or projection on a sleek sports car built from a Ford V-8 convertible. Owner and builder, C. C. Alexander of Miami, Fla., says it will do 125 miles an hour. The engine is a souped-up Mercury. Hood and front fenders are one piece which lifts to permit access to the engine. An airplane-type steering wheel and dashboard padding are features of the interior. Alexander has invested over \$4000 in the car.



By Richard F. Dempewolff

BLACKBOARDS and dull lectures are something the Army's new recruits won't gripe about. Today on our vast training reservations the recruit is learning first hand what he'll be up against at the front. Machine guns chatter across infiltration courses, and live ammunition snaps over the head of the crawling GI. He goes out on night problems to "get" an objective which is not just a vague hilltop, but an actual fieldpiece, truck or tank—life-sized, but made of inflatable rubber. As he creeps through the woods, live TNT charges explode a few feet from him.

At Fort Benning, Ga., the modern infantryman may sit in front of huge terrain models—complete with hill-sides, houses, gun emplacements, pill-boxes, tank traps—and show the instructor how he would move a platoon across the rolling papier-mache hills to the objective. Tomorrow's forward observer sits before "puff

Rangers learn 14 ways of knifing an enemy sentry so he'll drop without a sound. Here a ranger practices his work in mockup village



With shells popping overhead and a tank rumbling past, these recruits get a realistic taste of simulated combat



board" trainers, table-top models of a country landscape molded from screening. Scanning the board with field glasses, he calls a position for artillery fire, and a puff of smoke rises from the "ground" on the spot—activated by a man with a pneumatic bulb at the other end of the table.

Realism is the byword in today's training center. In World War II, recruits sat in bleachers while artillery was fired over their heads to accustom them to the noise. No more. Reports of the "Taylor Mountain Problem" at Fort Dix, N. J., basic-training camp, where 20,000 raw recruits at a time are now being processed into hardened soldiers, sound like battle accounts out of Korea. Men wake to the sound of heavy fire, stiff and sore in slit trenches, and surrounded by guards and camouflaged tanks. Up ahead a tank platoon, guns chattering with live ammunition, grinds toward an objective behind a crashing artillery barrage. Real shells whistle overhead.

Today's recruit has a much better deal than his World War II predecessor. His base pay is \$75 a month. He gets a \$152.09 clothing allowance, plus \$4.50 a month for replacements. Last July, the basic-training period was extended from 14 to 16 weeks in order, says Gen. Mark Clark, "to give



Ranger equipped for combat travels light for fast and stealthy movement, but he packs a miniature arsenal

Ranger trainees cross a swift stream by rubber boat. They may carry rope across, then use boat as a ferry





On confidence course, rangers face hazards they may meet on regular mission. These four men tightrope across a pair of cables, simulating a chasm crossing

Up and down a giant ladder with rungs three feet apart moves a group of ranger trainees. Confidence course teaches man his capabilities and limitations

Future ranger must shinny up to second story of a "house," then lower himself from the window by rope

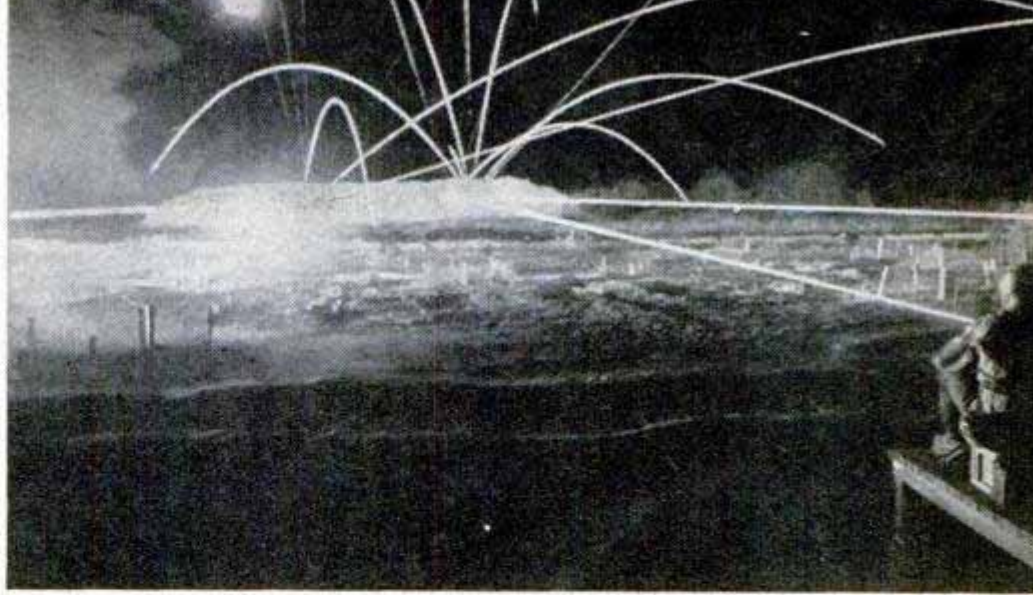


every man extra time devoted to combat skills and physical conditioning."

Today, instead of one aptitude test, there are 11: Radio code ability, radio information, automobile information, electrical information, arithmetical reasoning, clerical speed, shop mechanics, mechanical aptitude, pattern analysis, reading and vocabulary. It's part of the Army's determination to put square pegs in square holes. Records show that civilian truck drivers are actually becoming Army truck drivers, and auto mechanics actually are assigned to the motor pool.

At the end of his 16 weeks, the recruit may be sent to one of the Army's 17 schools for special training. Or he may volunteer for special duty with one of a dozen rugged outfits, where hundreds of devices from jump towers 250 feet high to small pillbox models are used to teach him the ropes. To see how it works, *Popular Mechanics* sent me to Fort Benning, Ga., to watch the making of rangers as they kicked up the yellow dust of that reservation's 360 square miles under the Army's new plan of training ranger specialists to serve in every fighting unit.

To become a ranger a man must volunteer, then be selected. He may choose airborne training or ground-infantry training. Rangers are professional combat patrolmen — experts in explosives, communications, hand weapons, concealment and rough, tough commando-type operations. Every infantry company will have about 12 of these men. They may be sent out to destroy bridges, cut supply lines, sabotage railroads, ambush enemy



Tracer bullets curve just above the heads of recruits crawling through an infiltration course — just one part of infantrymen's realistic training



Five well-trained rangers demonstrate five different types of camouflage suits and makeshift camouflage. Ranger, when he finishes the course, can virtually vanish in the countryside. Below, trainee learns to handle a flamethrower by actually using it to assault an "enemy" pillbox objective





Rifles crack and smoke rolls through the air as rangers race in to capture a realistic town. Rangers learn village fighting to the tune of live TNT explosions

New-type rifle grenade, propelled by special cartridge, has a shaped charge that will pierce armor

Below left, ranger leaps from plane mockup. He'll get jolt of chute opening, then go for a cable ride



troops, take prisoners, kill with stealth and cunning. The ranger knows how to operate entirely behind enemy lines, day or night, where he may be dropped by parachute—or go himself, scaling snow-capped peaks if necessary.

Under the new program at Fort Benning, the selected volunteers get an eight-week workout that leaves them panting, and winnows out all but the iron men. It's no disgrace to be washed out. The men are on the go 57 hours a week, plunging through swamps (it takes eight hours to go through 2000 yards of the worst one), working over courses while demolitions explode within yards of them, leaping from planes and drop towers day and night. In a life-sized mock-up town they learn village fighting. The last three weeks they're out until three a.m. on night problems, but must be on deck at six for another strenuous day—haggard and hollow-eyed.

The ranger gets a thorough shakedown in everything from intelligence to unarmed defense. When he's through, he knows how to stick an enemy sentry with a bayonet or knife 14 different ways so the man will drop without making a sound. He is equally versed in the quiet method of throttling a man with a garrote.

The rugged ranger atmosphere drops like

(Continued to page 384)





Left, the control device for the test speedometer is mounted on the dashboard. Right, the speedometer dial

Drivers Check Their Speedometers With Giant Meter on Police Car

Motorists won't be able to plead, "My speedometer must be wrong," when picked up for speeding in Seattle now that the police provide a mobile test service. Mounted on the rear of a patrol car is a huge semi-circular meter marked in miles an hour from 15 to 40. As the police car rolls along the street, the speed in miles an hour is

automatically flashed on the dial by lights behind the markings. Motorists driving behind the car can check their own speedometers instantly. A new model of the mobile speedometer will also announce the speed limit for the stretch of road over which the car is operating. Two such cars are used by the Seattle police department.

Austin Seven

In answer to a worldwide demand for cheaper motoring, the new Austin Seven has all the "feel," comfort and safety of modern big-car travel, according to its London manufacturers. Integral construction has been used to reduce weight, but front fenders are detachable to minimize repair costs. Additional design features include a tool kit, simplified by the introduction of a combined crank, jack handle and wheel brace, and seats of molded foam rubber. The car has a fuel capacity of $5\frac{3}{4}$ gallons, four speeds forward and an over-all length of $136\frac{5}{8}$ inches. With a compression ratio of

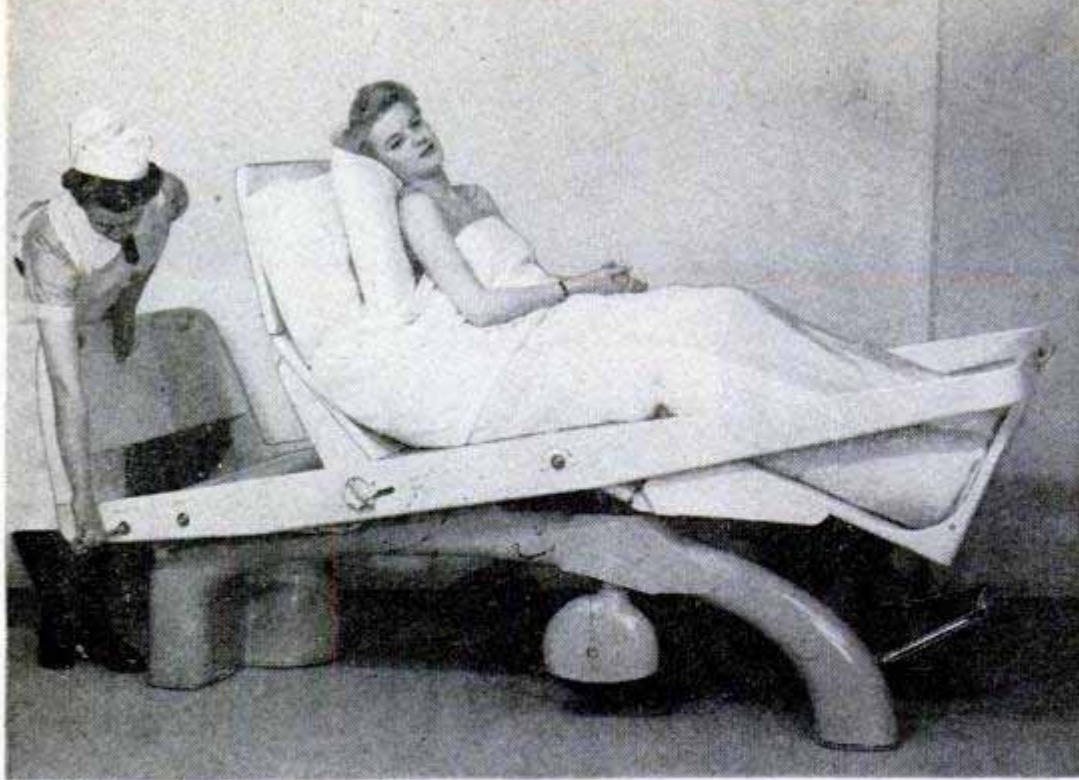


7.2 to 1, the four-cylinder, overhead-valve engine delivers 30 horsepower at 4800 revolutions per minute.

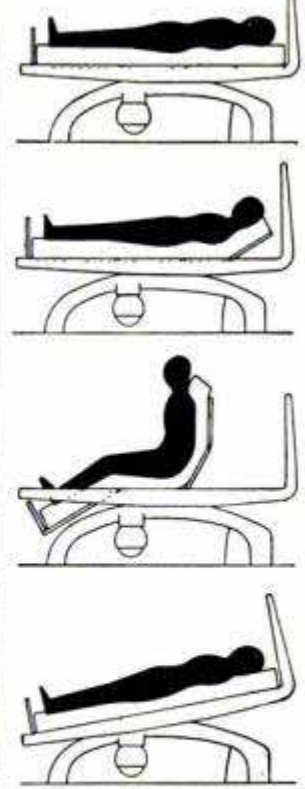


Wooden Track Provides Traction

Designed like a corduroy road, a wooden track provides traction for the rear wheels on ice or snow. There's no bother of attaching the device to the wheel. You simply toss it on the ice directly in front of the wheel and drive up on it. It is made of a number of thick wooden strips connected by two lengths of rope and is said to replace the bucket of sand that you usually carry in the trunk of your car during the winter months.



Copyright Essex Aero Ltd.



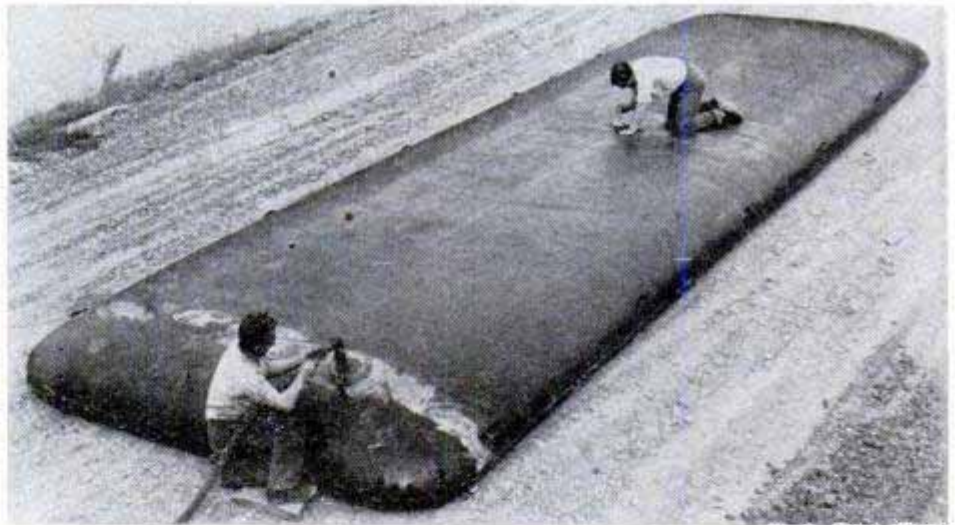
British Hospital Bed Provides Variety of Postures

Equipped with a retractable three-wheel undercarriage, a British hospital bed can be wheeled around easily by one nurse. A hydraulic lift, actuated by a foot pedal, raises and lowers the undercarriage. Four

panels, three of which are hinged, replace the spring and adjust to various positions for the patient. Made of magnesium alloy, the bed is about half as heavy as a conventional hospital bed.

Collapsible Fuel Tank

Army engineers have developed a collapsible storage tank for use near the front lines. The tank holds about 10,000 gallons of gasoline or oil. Easily transported, it can be rushed to a combat area and placed in operation as a fuel point for tanks, trucks and bulldozers until more permanent facilities can be built. It can be folded when empty.



U. S. Army photo



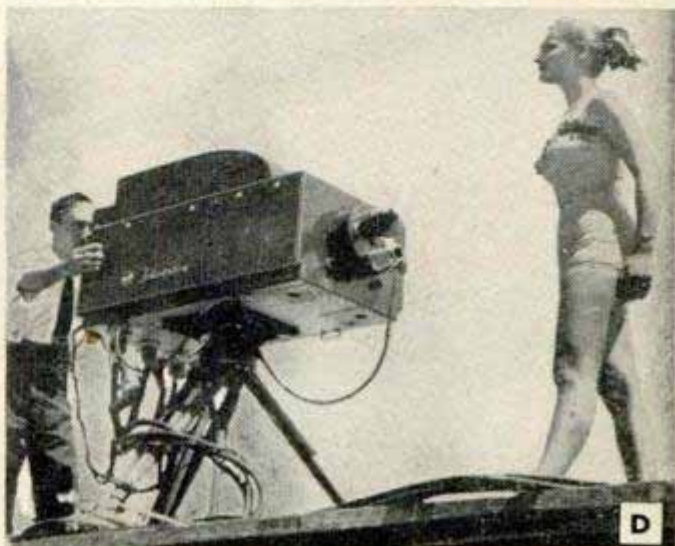
Bantam Calculator

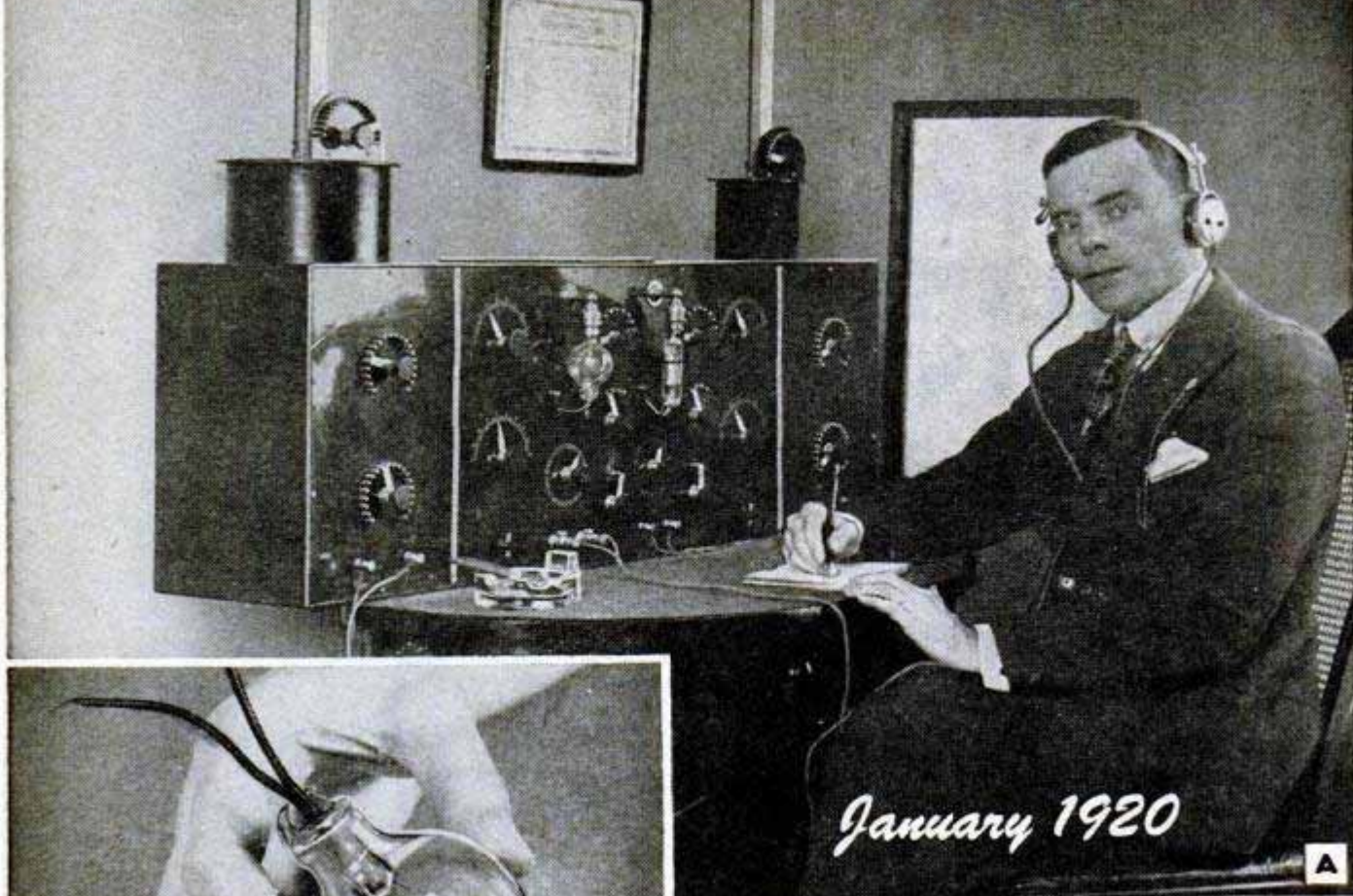
Built like a fine watch, a bantam calculating machine can be carried in the pocket to provide salesmen, estimators and engineers with a device that computes quickly and accurately. It has a capacity of 11 numbers in the results mechanism. Other characteristics of the tiny machine, which is produced in Germany, include a visible register for the feeding numbers, a shift lever for dividing and continuous gearing between counting mechanisms. Virtually noiseless in operation, the tiny calculator weighs slightly more than eight ounces.

COLOR TELEVISION Today

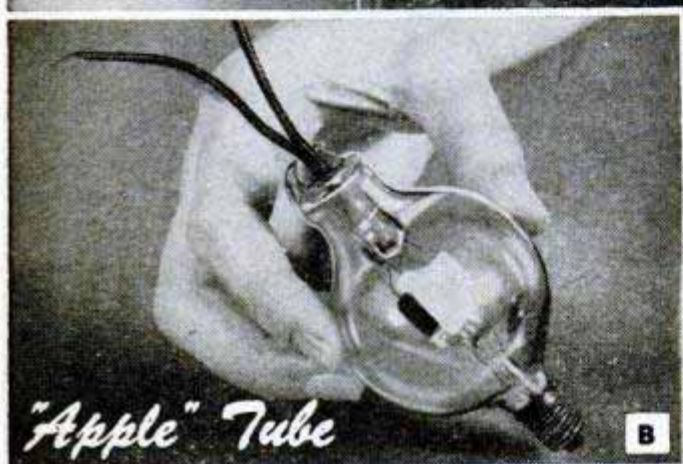
ALL-ELECTRONIC color television, fully compatible with the present standard black-and-white system, has made rapid strides in the past two years as demonstrated in recent field tests. Owners of TV sets in the New York area responded favorably to reception of the RCA color programs in black-and-white. A new RCA experimental color-TV receiver appears in photo A. NBC studio shots, and outdoor scenes, photo D, were picked up by the color cameras during the tests. In the RCA color-TV system the equipment is all-electronic—at the studio, transmitter and receiver as illustrated in sketch B.

Late in September a new contender made a thrilling entry in the color-television field with a handmade experimental model of a compatible all-purpose TV picture tube. Basically it employs the same idea as the RCA color tube—but simplified. The inventor, shown with the new tube in photo C, is Prof. Ernest O. Lawrence, atomic physicist at the University of California and the inventor of the cyclotron. The tube employs a wire grid for color switching, and automatically switches from one system to another. Experts say that, if it proves successful, the tube can be mass-produced at comparatively low cost.





January 1920



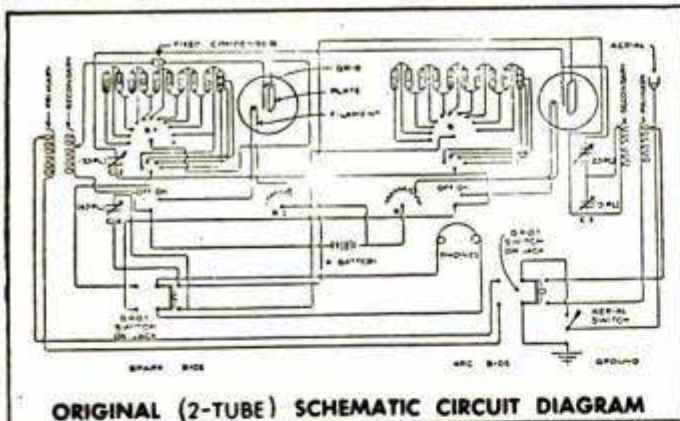
"Apple" Tube

Popular Mechanics

FIRST RADIO and TELEVISION RECEIVERS

FOR EXPERIMENTERS

By Frank L. Brittin W9DCX



ORIGINAL (2-TUBE) SCHEMATIC CIRCUIT DIAGRAM



Five Years Later

PERHAPS there is no better way to make us realize and appreciate the convenience, entertainment and educational value of today's radio, television and electronic devices than to take a quick look at some early models. *Popular Mechanics Magazine*, now celebrating its 50th Anniversary, was a pioneer in keeping readers informed about these comparatively new modern arts that have developed so rapidly.

Today we can put radio receivers in our pockets—but the first vacuum-tube receiver ever described in *Popular Mechanics Magazine* for construction by experimenters was 9 in. deep, 14½ in. high, 41½ in. long and employed only two tubes. It appeared in the January 1920 issue. For photo A above, the caption read, believe it or not, as follows: Taking up Only a Small

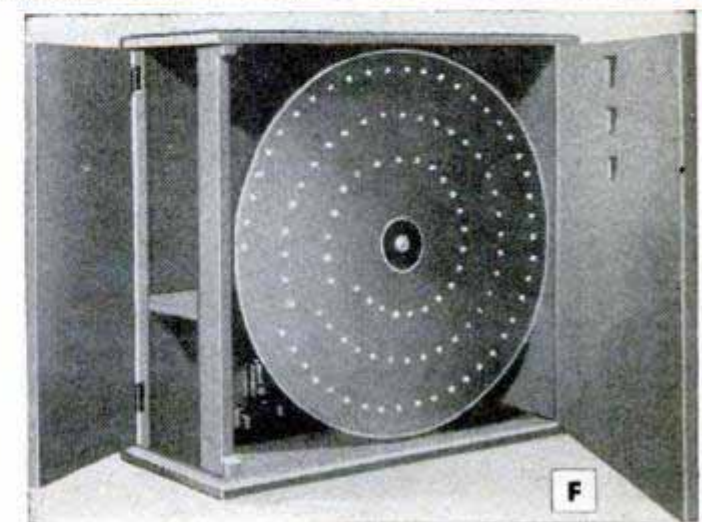
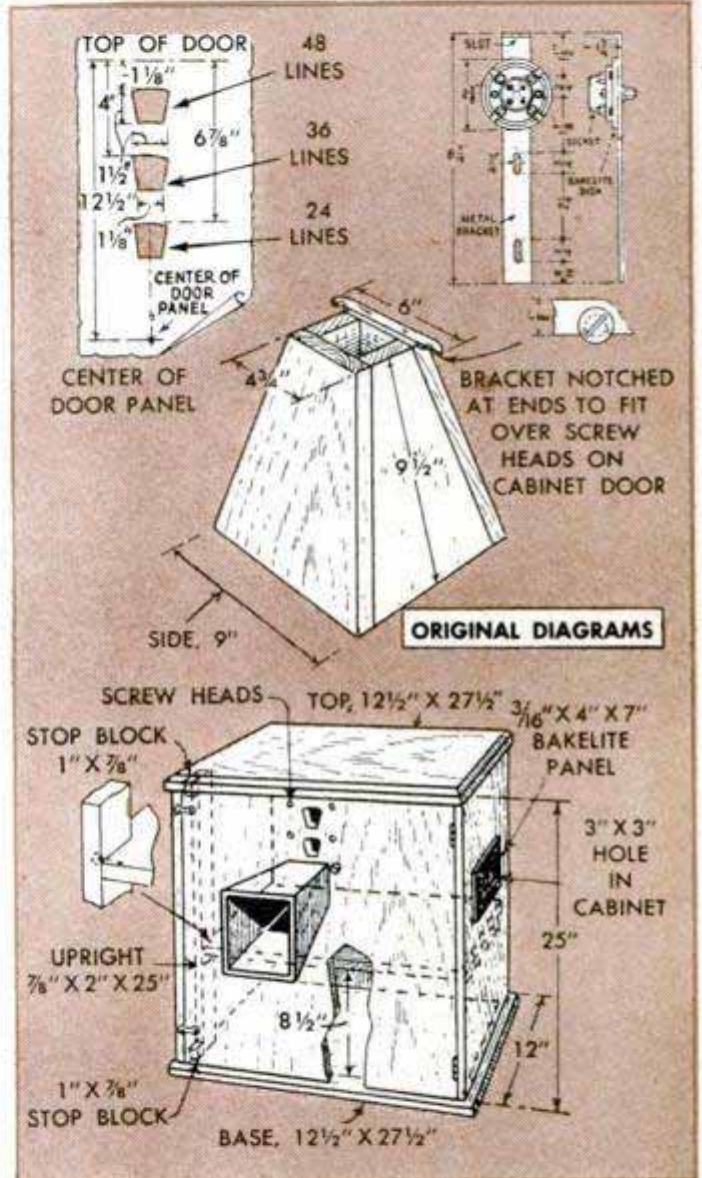


Amount of Space in the Corner of the Room, the Cabinet is an Inconspicuous Article of Furniture, and if Properly Finished, may be a Real Ornament. However, in those days it was considered to be a keen performer, bringing in long-wave signals from IDO (Rome, Italy), POZ (Nauen, Germany) and YN (Lyons, France), as well as from the American stations such as Sayville, Arlington and others. It also tuned in the short-wave ham band. This was, of course, all "wireless telegraphy" as voice broadcasts did not come until later.

A 6-volt storage battery provided the A-supply; the B-battery consisted of two banks of 10 flat-type three-cell flashlight batteries. The two-tube circuit employed a \$7.50 DeForest Audion tube, photo B, (known to the "wireless fraternity" as an "apple" tube), and one \$5.00 Audio-Tron tube. Both the primaries and secondaries of the large couplers (tuning coils) were multitapped. The elevator devices for raising and lowering the secondaries were lead counterweights operating on pulleys; the antenna used was a single wire, 160 ft. long.

The builder of all of the receivers shown was a Radio Operator, Commercial First Grade, license No. 14540, and also a radio "ham." *Popular Mechanics'* radio section continued to keep its readers informed of every improvement in this rapidly advancing art. Soon, voice and musical programs were available and five years later, in the February and March 1925 issues, an "eight tube superheterodyne receiver" was described for construction. This popular student receiver, photo C, was housed in an attractive homemade cabinet and used a loop antenna. Radio quickly became an ideal cooperative hobby for father and son. A surprising number of the outstanding radio and electronic engineers of today will tell you that they began by building and repairing radio sets and electronic devices at home for fun. From these early days to the present time *Popular Mechanics* has been one of the chief feeders of new students to the large radio and television training schools.

Television started to show promising

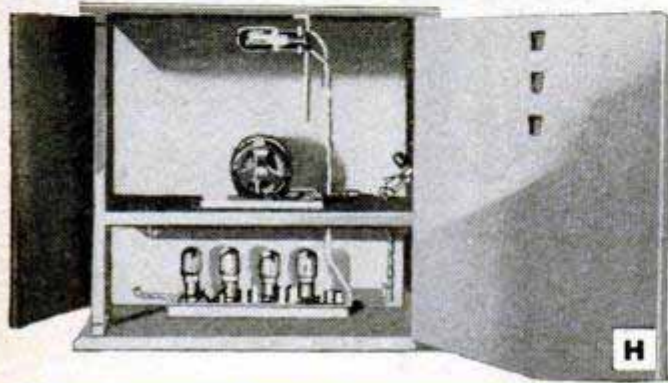




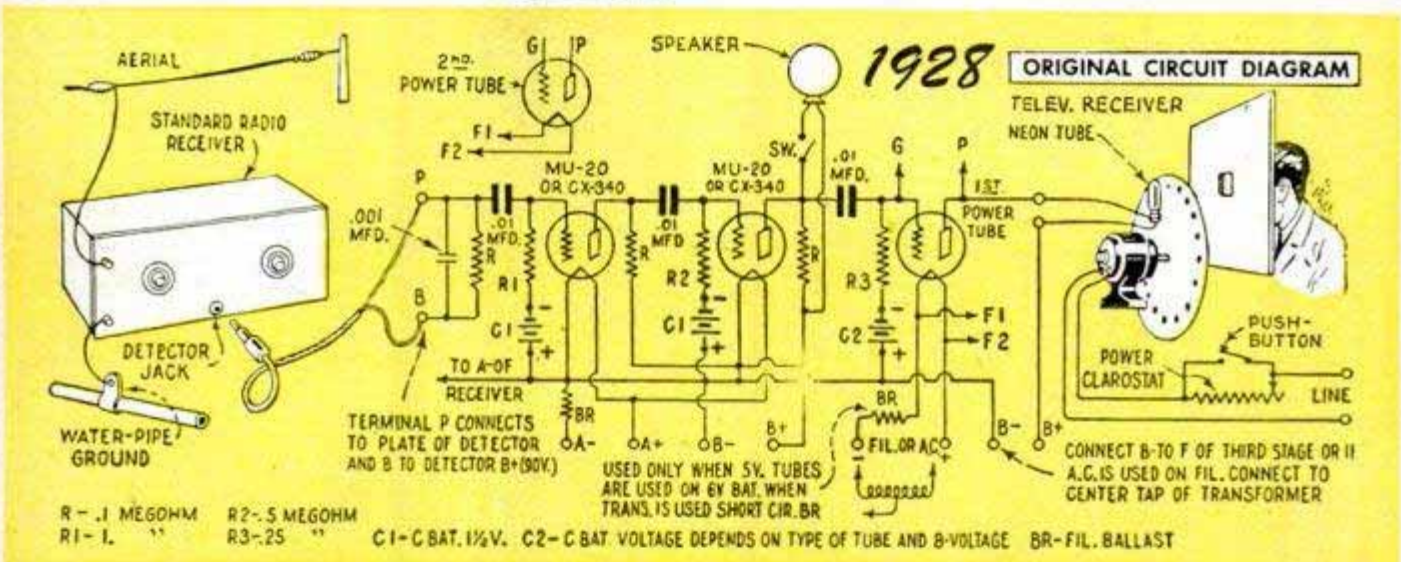
G

Experimental television programs were on the air in New York, Chicago and Los Angeles in 1928 and 1929. These were rather crude efforts as measured by today's standards. TV engineers of the 1920s used Paul Nipkow's idea of the 1880s for scanning pictures with a perforated spinning disk. These scanning disks, and a neon lamp, or "tube," used with them, photos E and G, were made available in 1928. They were used in *Popular Mechanics'* experimental television receiver construction article that appeared in the December 1928 and January 1929 issues. Photos D, F and H show various views of this receiver, which, with the aid of a condenser lens, gave a pinkish picture about 3 in. square. The original cabinet and circuit diagrams are reproduced. Three perforated spirals in the scanning disk, and corresponding openings in the cabinet, permitted the operator to tune in either 24, 36 or 48-line pictures.

Today we look forward to peacetime all-electronic, three-dimensional color television, and radio astronomy.



H



A CORNER OF POPULAR MECHANICS' RADIO-TV AND ELECTRONICS LABORATORY TODAY

I

TOMORROW'S ELECTRONIC BARBERSHOP QUARTET

By L. A. Meacham

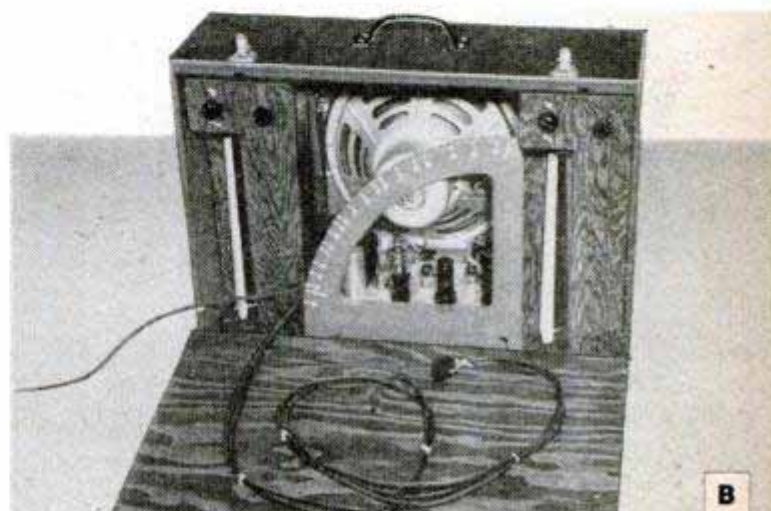
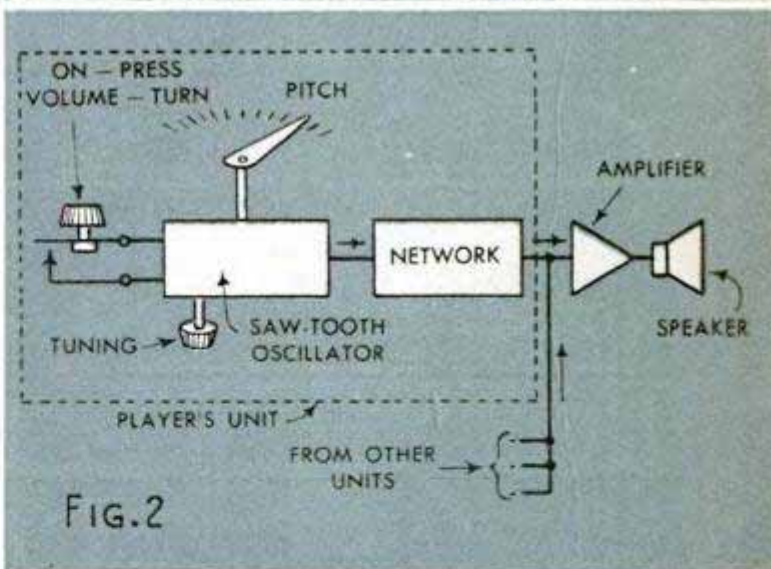
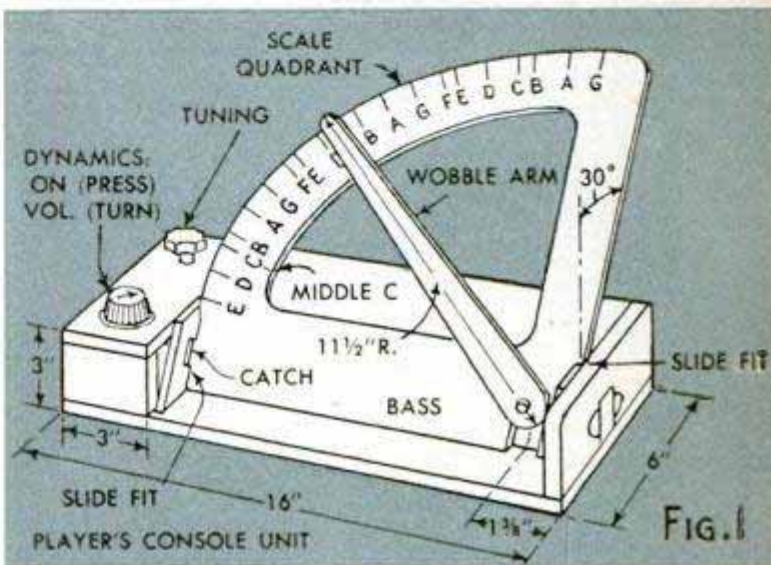
MUSICALLY inclined communications engineers have all, at one time or another, connected a laboratory oscillator to a speaker and twiddled the frequency dial to play themselves a tune. But did anyone ever bother to provide four people with four oscillators, so that they might play electronic barbershop quartets?

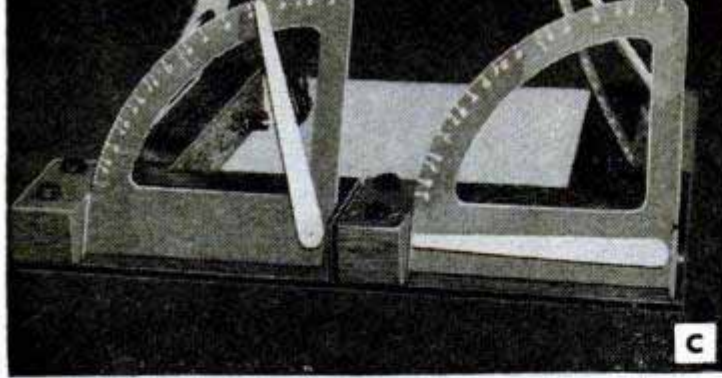
Here is a promising facet of electronics which, up to now, so far as the author has been able to discover, has been left singularly unexplored. The question came up while searching for a novelty to entertain members of a Bell Laboratories glee club at their annual party. The result of preliminary research (conducted in the author's cellar, since it was not an official company project) was a complete electronic "wobble organ" which was received so enthusiastically at the party that improved models were designed in the basement workshop. Playing techniques were improved, and concert experience was obtained before several surprised and delighted audiences.

The present state of the art is represented by the units described in this article. The units employ standard inexpensive radio parts which are available from radio-parts houses, and the project offers interesting possibilities for home recreation of the "participation" kind, as well as for the various entertainment fields involving large groups. However, speculation on uses may more properly follow an inspection of the various photos and diagrams.

The four players sit around three sides of a card table, as shown in photos A and D. The fourth side is turned toward the audience, and may conveniently be faced by a music rack if desired. In front of each player is a small "playing console." On the floor near the table is a cabinet containing a power supply, an amplifier, and a speaker. Pairs of playing consoles that are adjacent to one another are plugged solidly together mechanically and electrically as shown in photo C and diagram Fig. 3, the whole set of four being connected to the amplifier in the speaker cabinet by a six-conductor cable. Note the positions of the bass, tenor, alto and soprano consoles.

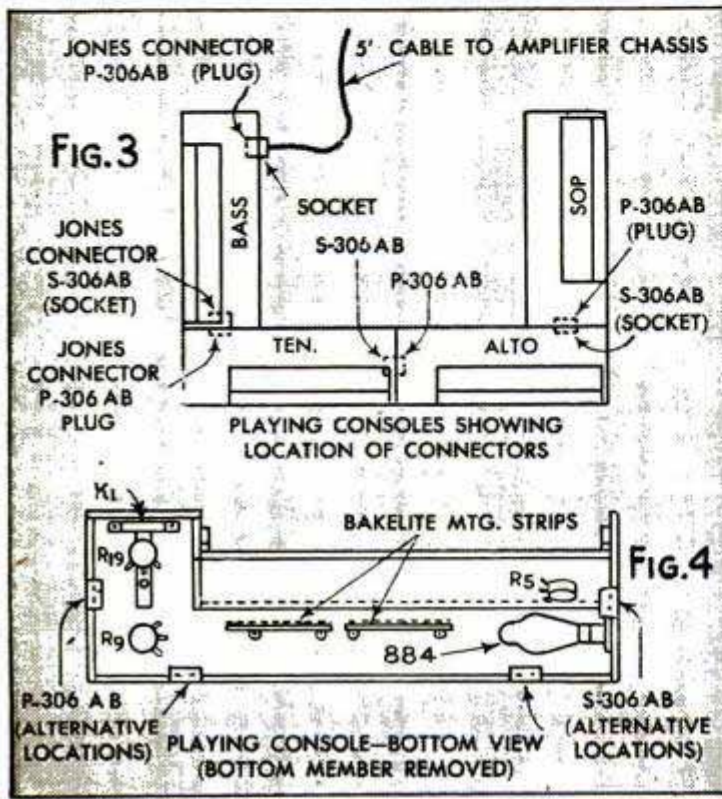
Each playing console, Fig. 1, contains a thyatron saw-tooth oscillator, with suitable control circuits, and a simple waveform-shaping network which emphasizes or suppresses various harmonics in the



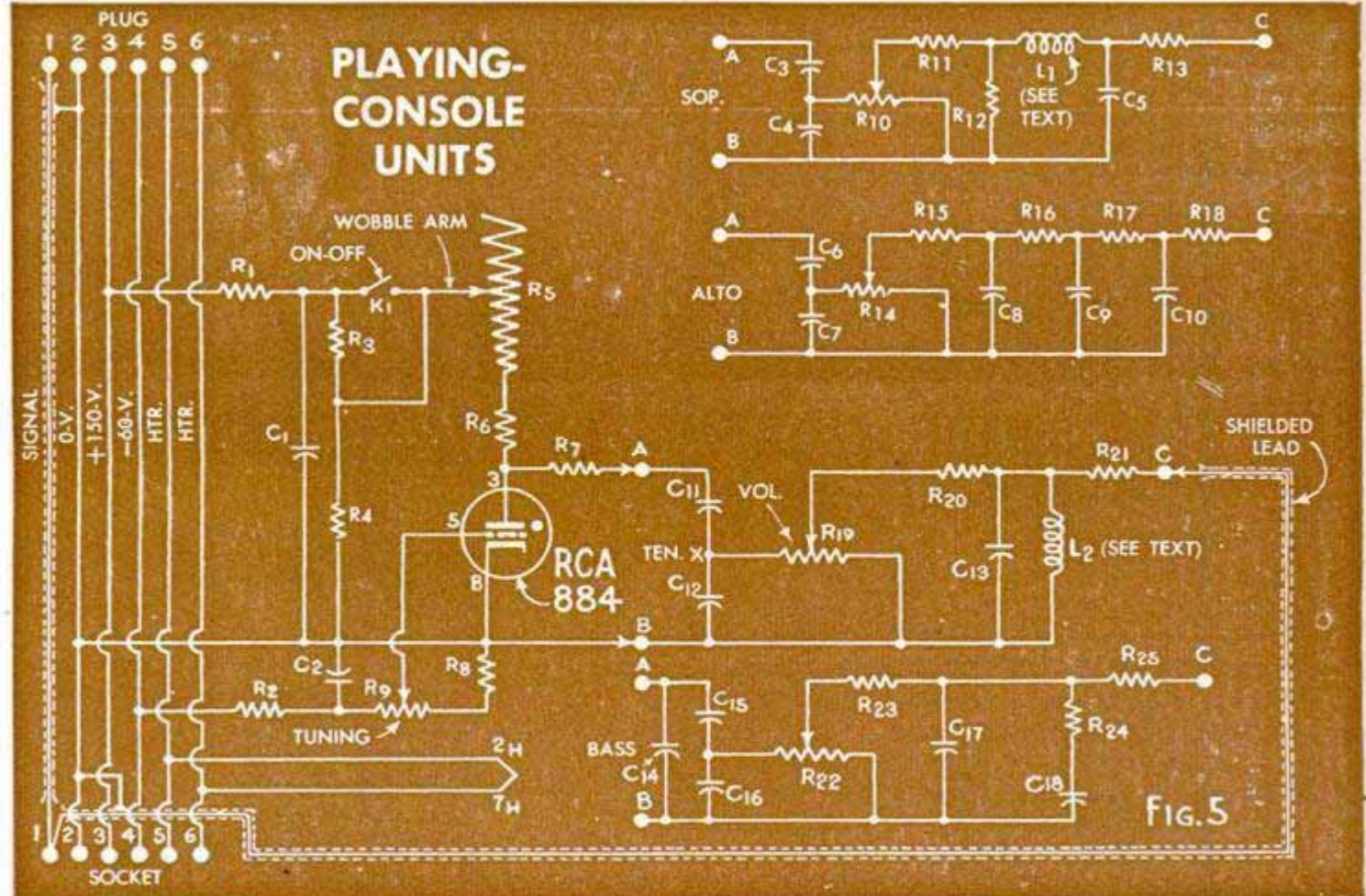


C

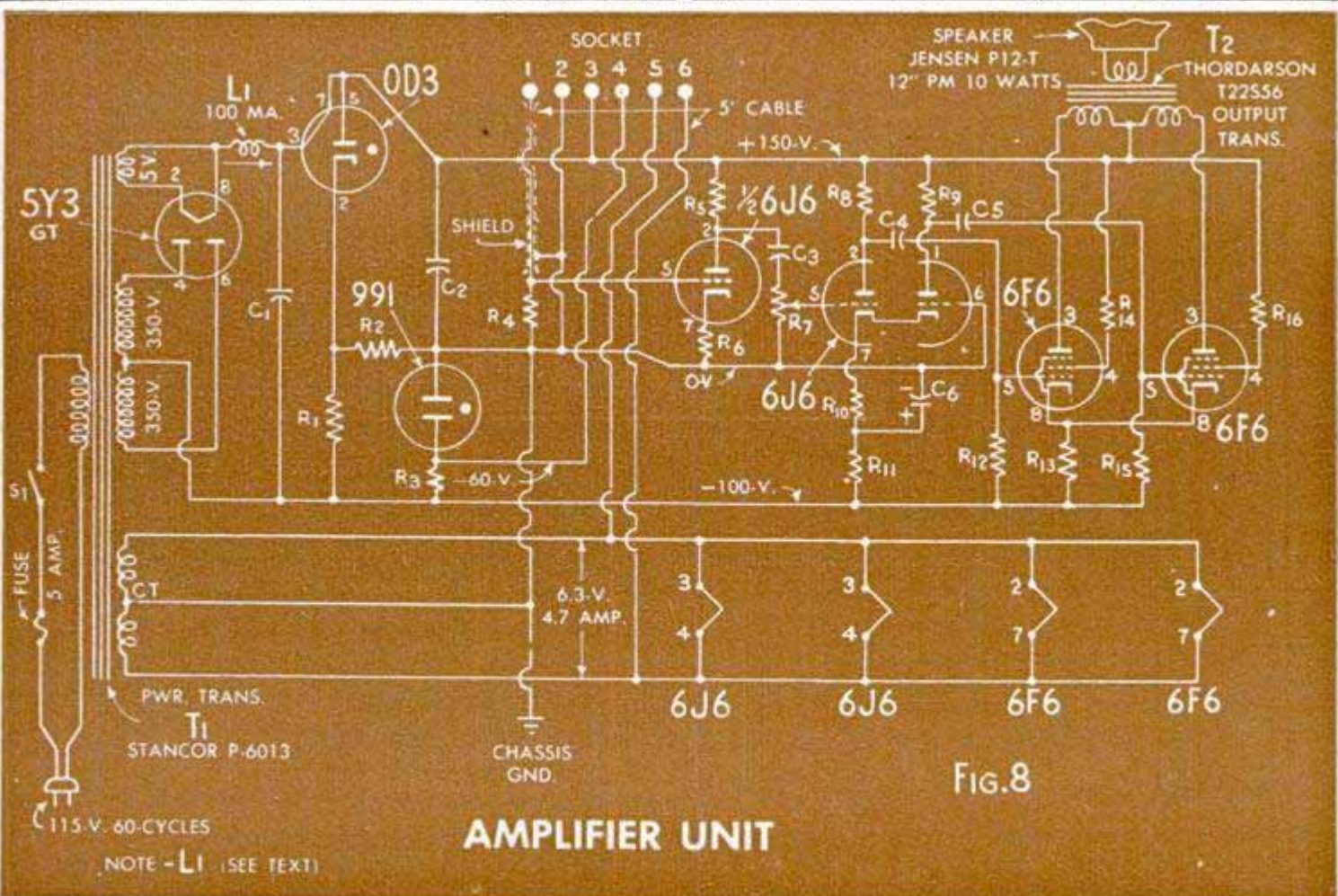
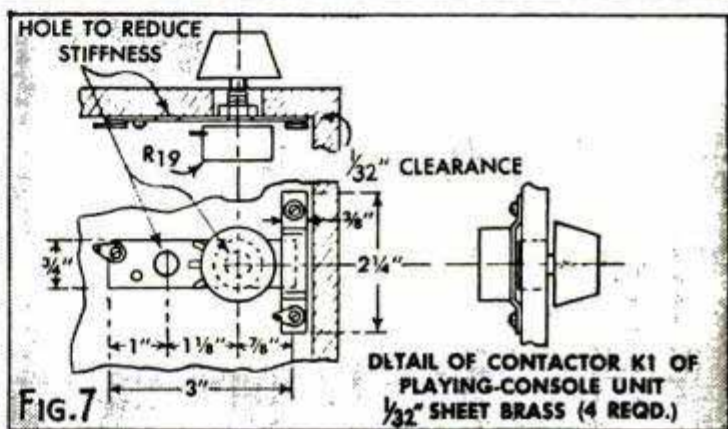
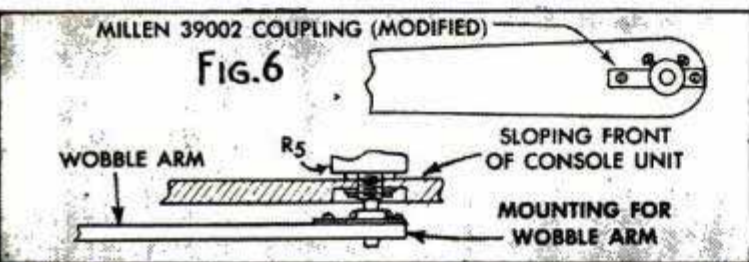
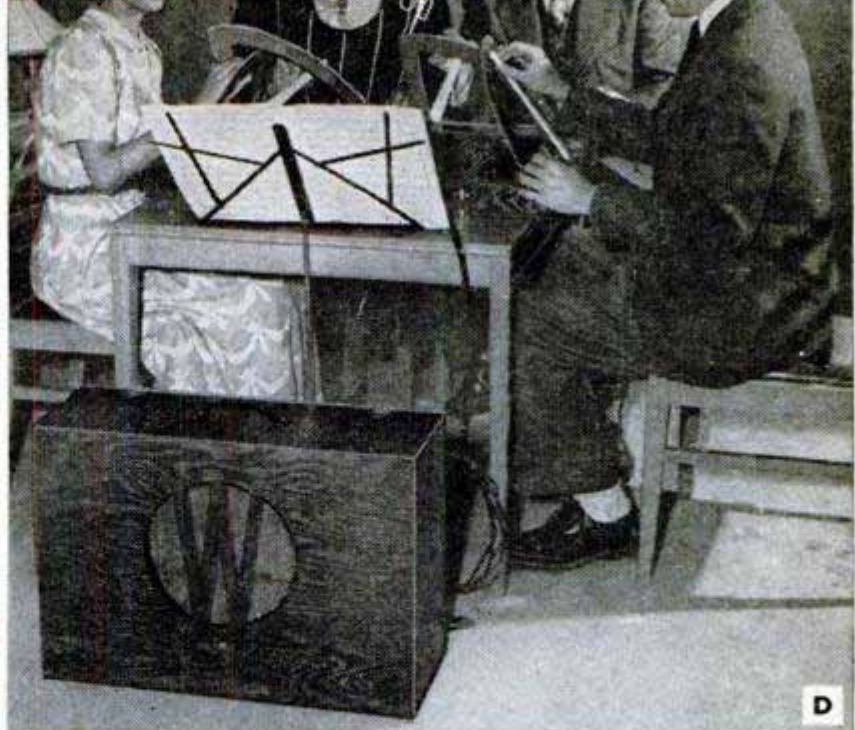
complex saw-tooth wave providing a distinctive tone quality, different for each player. The wobble arm controls the pitch by varying potentiometer R5. Two other potentiometers control volume and tuning, Fig. 2. The main control, of course, is the wobble arm, which is fastened to the potentiometer shaft that extends through the sloping front of the console. This control is designed to vary the pitch over a range of more than $2\frac{1}{2}$ octaves (about six to one in frequency). This range is at least that of the human voice, and in the present model is located differently on the frequency spectrum for each console, covering the vocal ranges of soprano, alto, tenor and bass, respectively. (A "male quartet" model could be obtained merely by changing capacitance values.) Figs. 4, 6 and 7 show construction details for the playing-console units. The schematic circuit diagram for these playing units appears in Fig. 5. The front end of each unit is the same up to connections A and B. The networks for the other tonal ranges connect to the oscillator stage in the same manner, as indicated.



The consoles are made of $\frac{3}{8}$ -in. plywood, with scale quadrants of $\frac{1}{8}$ -in. pressed hardboard. Each scale quadrant is made removable to facilitate storage, being mounted in slides at its edges. A simple catch is provided to support the free end of the wobble arm when not in



sole is removable for access and the principal dimensions are given in Fig. 1. The design of the speaker cabinet is conventional, the only novel feature being the provision for storage space for the playing consoles, two at each side of the speaker as shown in photo B. Thus the entire wobble organ is made portable in a single suitcase-sized unit. This cabinet is made of $\frac{3}{8}$ -in. plywood except the top and bottom which are $\frac{3}{4}$ -in. plywood. The inside dimensions are $7\frac{1}{2} \times 17 \times 24\frac{1}{2}$ in. The chassis base for the audio amplifier, Fig. 8, is centered in the bottom of the cabinet. This sheet-metal base is $2 \times 7 \times 11$ in. This amplifier is conventional except for special voltage regulation. It includes the power supply and the socket for the 5-ft. cable to the playing consoles. The layout is not critical. However, keep the low-level



4 SETS REQUIRED

- K1—Special contactor (see sketch Fig. 7)
 C1=8 mfd. 150-V. Wkg. electrolytic condenser (Cornell-Dubilier BR815)
 C2=.1 mfd. 400-V. tubular-type paper cond.
 R1=560-ohm, ½-watt carbon resistor
 R2=150,000-ohm, ½-watt carbon resistor
 R3=1,300,000-ohm, ½-watt carbon resistor
 R4=510,000-ohm, ½-watt carbon resistor
 R5=1-megohm, potentiometer (Ohmite "AB" pot. type CB-1052 log. taper)
 R6=10,000-ohm, ½-watt carbon resistor
 R7=300-ohm, ½-watt carbon resistor
 R8=15,000-ohm, ½-watt carbon resistor
 R9=25,000-ohm, potentiometer (Ohmite "AB" type CU-2531, linear taper), TUBE=RCA 884
 1=Millen No. 39002 coupling (modified) for wobble-arm mounting

- NOTE—All carbon resistors $\pm 10\%$
 L1=.45 H Graybar Electric No. D-170718 retard coil
 L2=Same as above
 C3=.02 mfd. 400-V. tubular-type paper cond.
 C4=.22 mfd. 400-V. tubular-type paper cond.
 C5=.003 mfd. 600-V. tubular-type paper cond.
 C6=.025 mfd. 400-V. tubular-type paper cond.
 C7=.15 mfd. 200-V. tubular-type paper cond.
 C8=.002 mfd. 600-V. tubular-type paper cond.
 Note—C9 and C10 are same as above
 C11=.05 mfd. 200-V. tubular-type paper cond.
 Note—C13, C15, and C17 are same as above
 C12=.5 mfd. 200-V. tubular-type paper cond.
 C14=.03 mfd. 400-V. tubular-type paper cond.
 C16=.5 mfd. 200-V. tubular-type paper cond.
 C18=.25 mfd. 400-V. tubular-type paper cond.
 R10=250,000-ohm potentiometer (Ohmite "AB" type CU-2541 linear taper) NOTE—R19 and R22 are same as above
 R11=24,000-ohm, ½-watt carbon resistor
 NOTE—R13, R21, R23 and R25 same as above
 R12=51,000-ohm, ½-watt carbon resistor
 NOTE—R15, R16, R17 and R18 same as above
 R14=1-megohm potentiometer (Ohmite "AB" type CU-1052 linear taper)
 R20=10,000-ohm, ½-watt carbon resistor
 R24=5100-ohm, ½-watt carbon resistor
 NOTE—All carbon resistors $\pm 10\%$
 All tubular-type paper cond. Aerovox P88

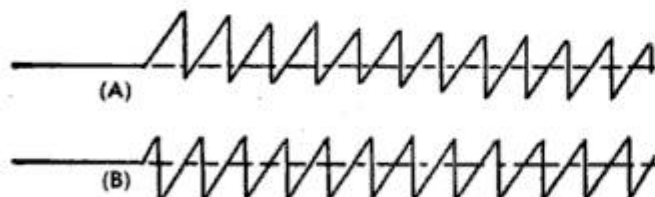
1 SET REQUIRED

RESISTORS AND CONDENSERS FOR AMPLIFIER UNIT

- R1=5000 ohms, 5-watts (Ohmite Brown Devil)
 R2=100 ohms, ½-watt carbon
 R3=11,000 ohms, ½-watt carbon
 R4=20,000 ohms, ½-watt carbon
 R5=100,000 ohms, ½-watt carbon
 R6=3300 ohms, ½-watt carbon
 R7=1-megohm pot. Ohmite "AB" type CA-1052 (LOG)
 R8=100,000 ohms, ½-watt carbon
 R9=100,000 ohms, ½-watt carbon
 R10=39,000 ohms, ½-watt carbon
 R11=27,000 ohms, ½-watt carbon
 R12=510,000 ohms, ½-watt carbon
 R13=360 ohms, 2-watt carbon
 R14=100 ohms, ½-watt carbon
 R15=510,000 ohms, ½-watt carbon
 R16=100 ohms, ½-watt carbon

- NOTE—All carbon resistors $\pm 10\%$
 C1=80 mfd., 300-volt, Cornell-Dubilier UP-8030
 C2=20 mfd., 250-volt, Cornell-Dubilier UP-2025
 Note—Above are electrolytic types
 C3=.1 mfd., 400-volt tubular paper type
 C4=.1 mfd., 400-volt tubular paper type
 C5=.1 mfd., 400-volt tubular paper type
 C6=1 mfd., 200-volt tubular paper type

NOTE—SEE TEXT FOR ALL OTHER PARTS



WAVE FORM AT POINT X (FIG. 5) AT START OF OSCILLATION. (A) WITHOUT BIASING RESISTORS R3 AND R4. (B) WITH BIASING RESISTORS R3 AND R4

FIG. 9

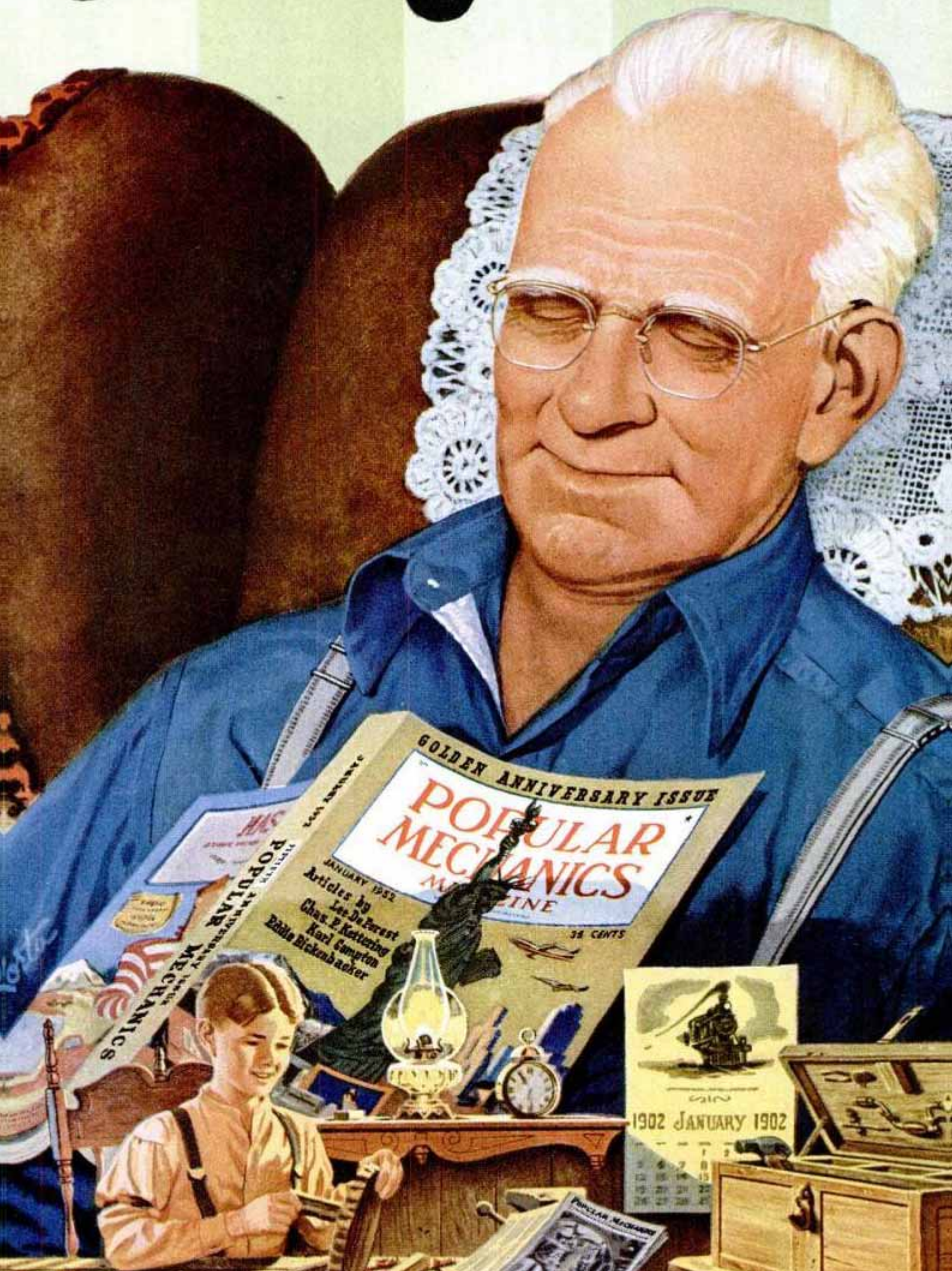
separated and arrange the taller elements where they will not interfere with the speaker in the cabinet. Voltage-regulating tubes OD3 and 991 provide the necessary regulation to avoid fluctuations of pitch with line voltage, and to insure stable plate and bias potentials. Choke L1 in the amplifier is a Chicago Transformer Corp. RC-8105, 8 hy., 103 ohms, approximately 100 ma. The 5Y3-GT and OD3 tubes require octal sockets; the 991 tube uses a bayonet candelabra double-contact socket; the 6J6 tubes use seven-pin miniature sockets and the 6F6s require octal sockets. The shielded single-conductor wire in all units is Belden type 8411 (about 15 ft. required).

In the playing consoles, Fig. 5, the 884 oscillator tube is a type used in oscilloscope sweep circuits, with the variable timing resistance used for the main pitch control, and the grid bias for tuning. The use of a 1-meg. logarithmic potentiometer (R5) in series with the 10,000-ohm fixed resistor (R6) for each frequency control provides a relationship between shaft angle and musical pitch which is linear over a resistance range of 16,000 to 450,000 ohms, with a slope of about 30 degrees per octave. Accordingly, each half tone occupies $2\frac{1}{2}$ degrees and each whole tone 5 degrees. The wobble arm swings over more than 75 degrees, giving the desired $2\frac{1}{2}$ octaves, and is set on its shaft so that the minimum total resistance actually used is 75,000 ohms. The potentiometer should have a molded carbon element so that mechanical wear will not affect the scale calibration. A voltage divider across the 150-volt supply (resistors R3 and R4 in Fig. 5) holds the plate of the thyatron at about 40 volts above cathode potential while the "on" contact is open. The tube does not conduct in this condition because its firing point for normal tuning is designed to be near 80 volts. The effect of this bias is illustrated in Fig. 9. If

(Continued to page 322)

Full-color reproductions of the painting by Robert Korta on the opposite page are available to Popular Mechanics readers. The print measures $10\frac{1}{4}$ by $13\frac{3}{8}$ inches and is suitable for framing. Send 10 cents to cover the cost of mailing to: Department C, Popular Mechanics Magazine, 200 East Ontario St., Chicago 11

MECHANICS CRAFTSMAN



1902

By
Wayne
C.
Leckey

(Asst. Crafts Editor)

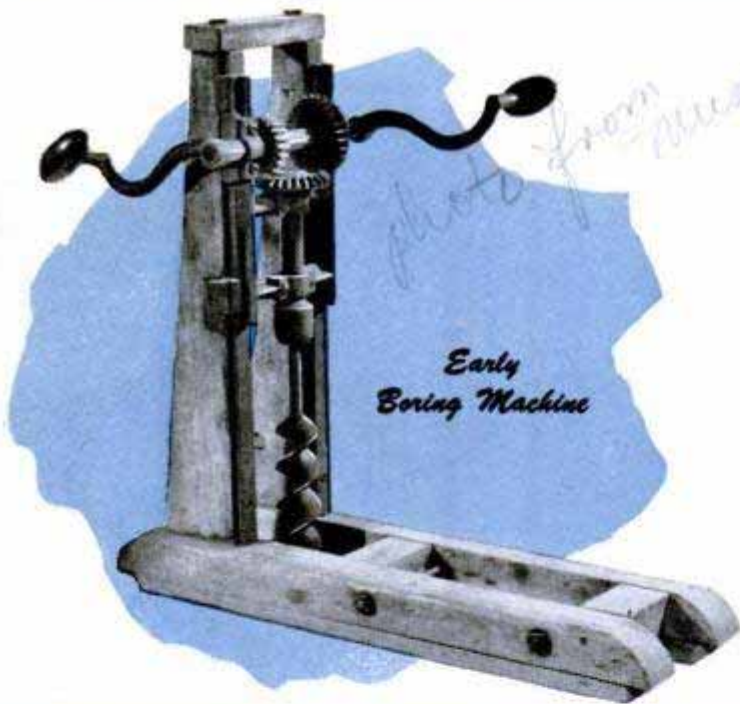
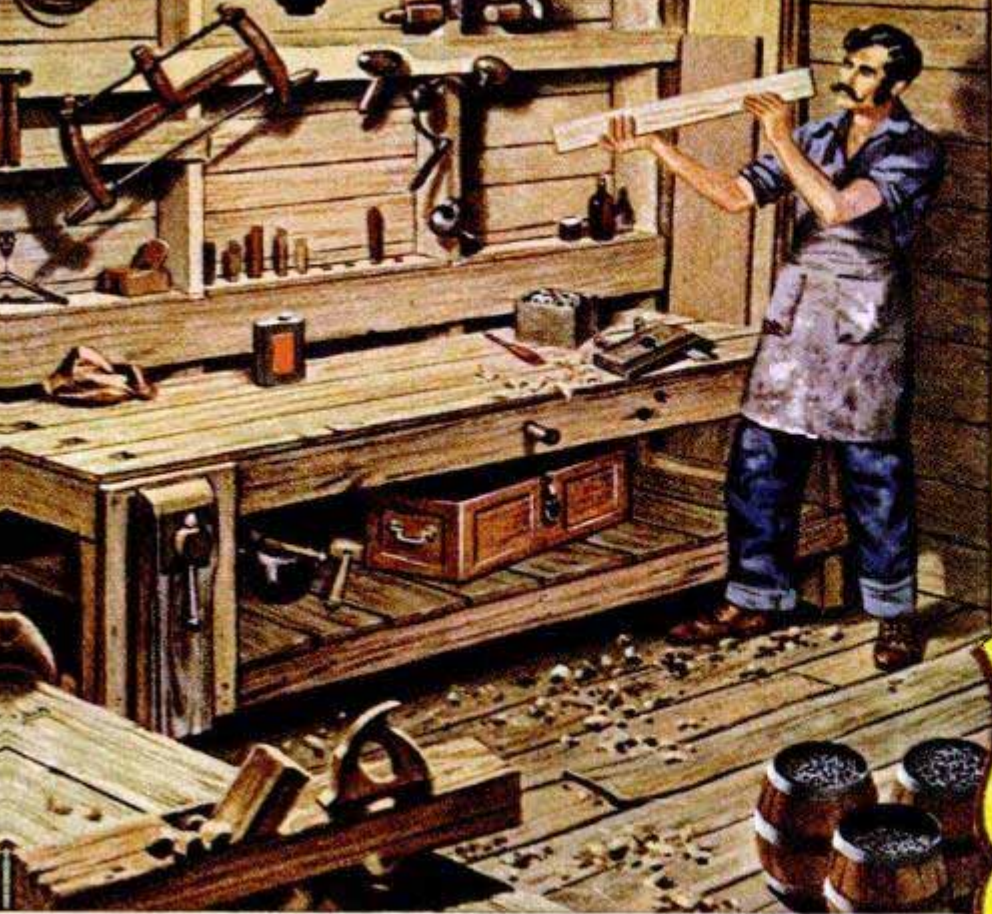
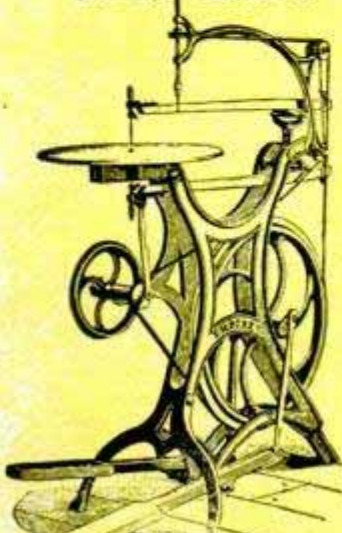


photo from Museum

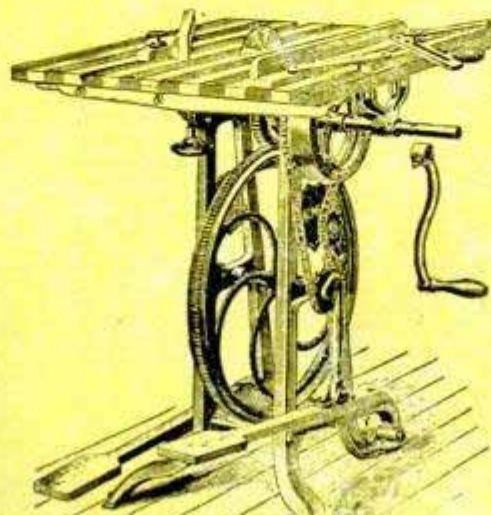
*Early
Boring Machine*

BACK IN 1902 when the first weekly issues of *Popular Mechanics* were being read by a mere handful of mechanically minded men, anything remotely resembling what is now known as a home workshop was limited to the primitive shops of the skilled cabinetmakers. To envision the day when the average man could have his own workshop of motorized tools right in the basement of his home was beyond the wildest dreams of the most far-thinking craftsman. His was an era of producing by hand with crude and simple implements. The turn of the century found treadle

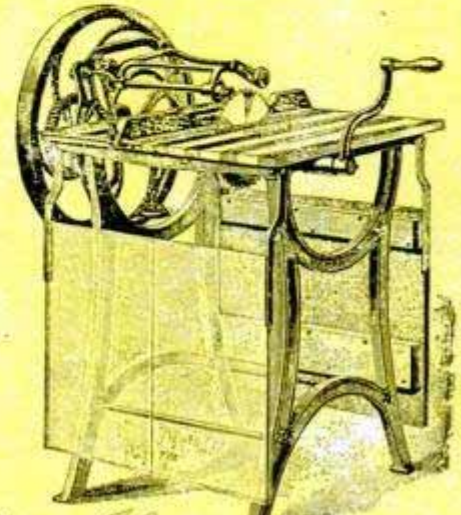
*Treadle
Scrollsaw*

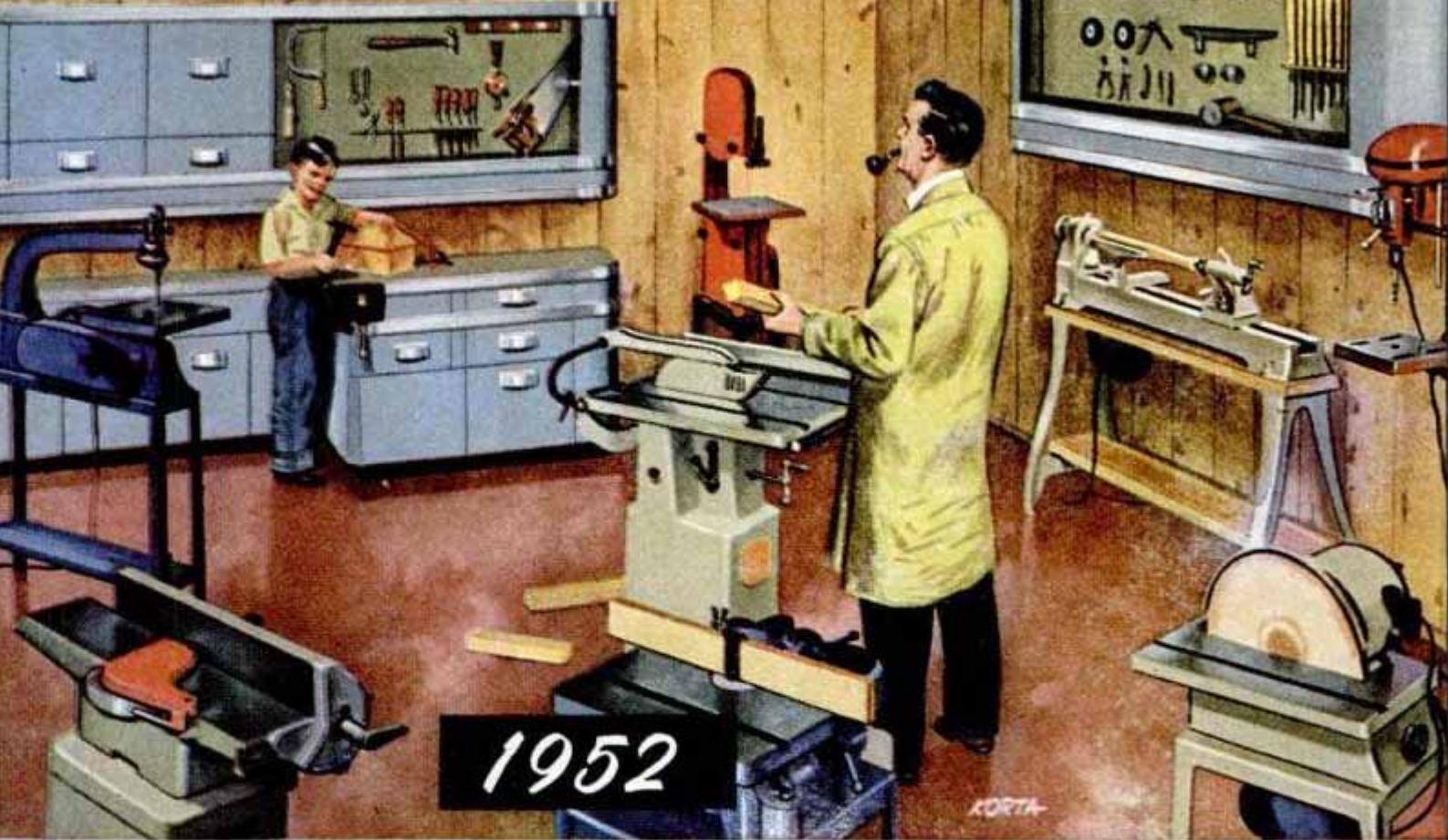


Foot and Hand-Driven Saw



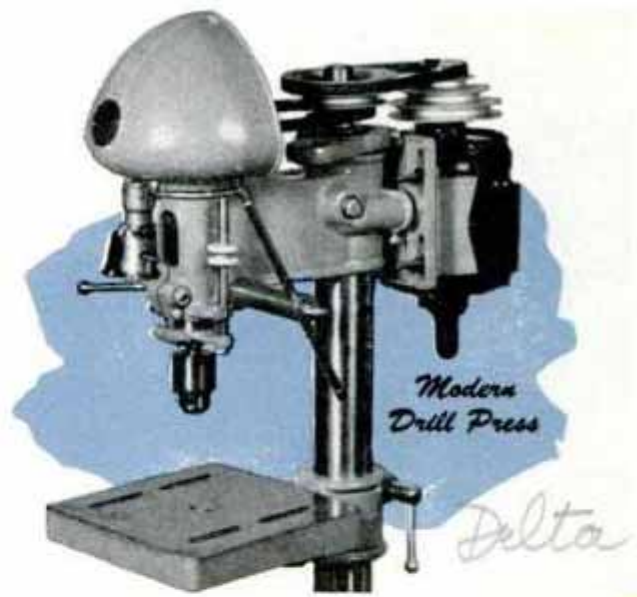
Self-Feed Ripsaw





OF CRAFTSMANSHIP

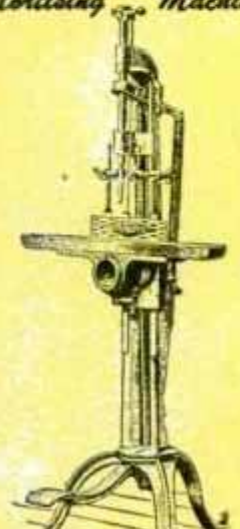
and hand-operated machines beginning to take their place in the woodshops. No doubt, many *Popular Mechanics* readers remember such machines, and, perhaps, even may have operated them. Included among these machines were those reproduced below from an old catalogue of Seneca Falls Machine Co. Considered a great step in man's constant desire to better his lot and lessen his labors, these treadle-driven machines, still far from high speed, permitted far greater accuracy and saved considerably more time than was heretofore known. In a sense, these early machines provided the first opportunity to "mass produce" duplicate work to any degree of accuracy. But while these machines were a mere beginning in the march of progress to come, they were costly in the days when butter was only a



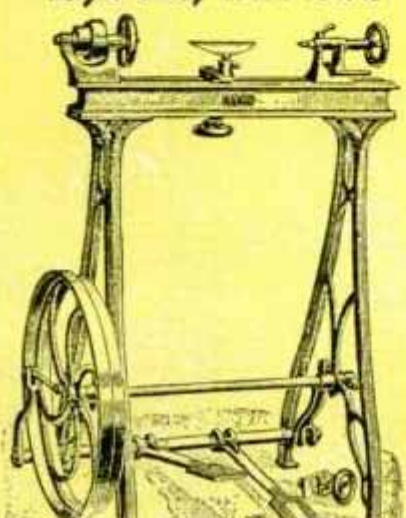
Modern Drill Press

Delta

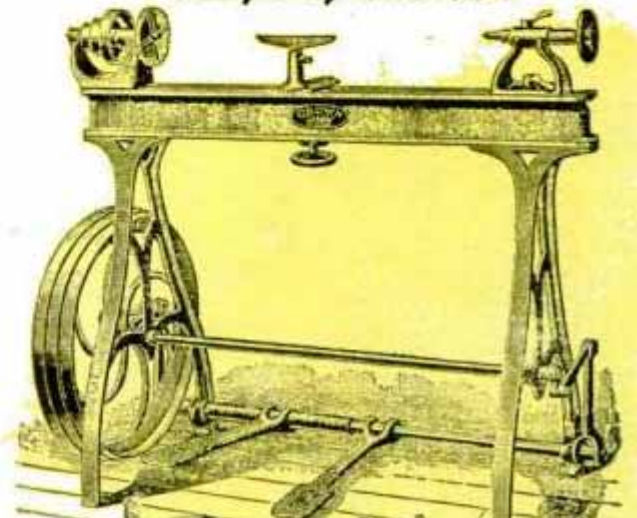
Mortising Machine



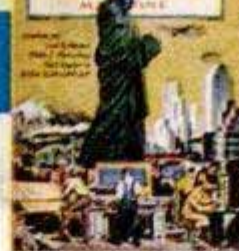
Light-Duty Wood Lathe



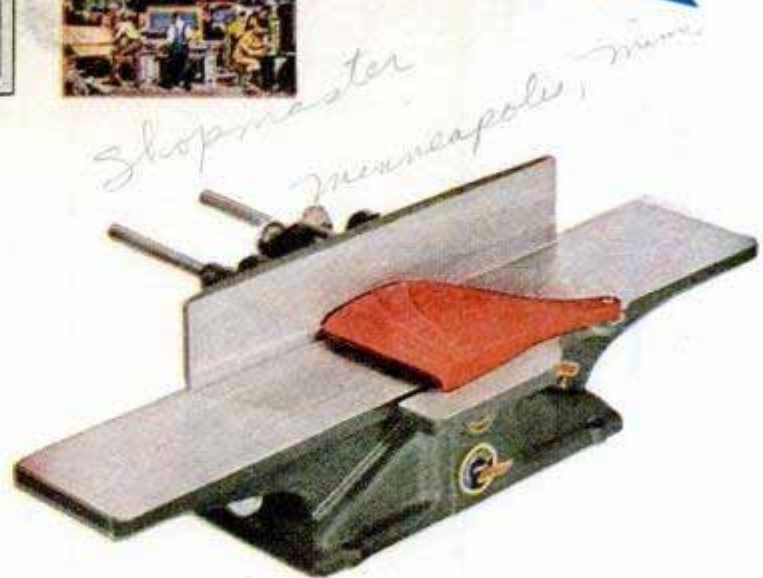
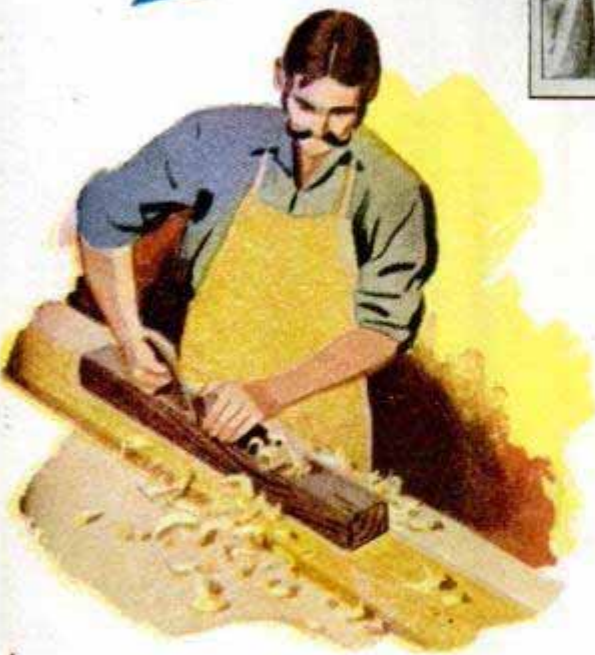
Heavy-Duty Wood Lathe



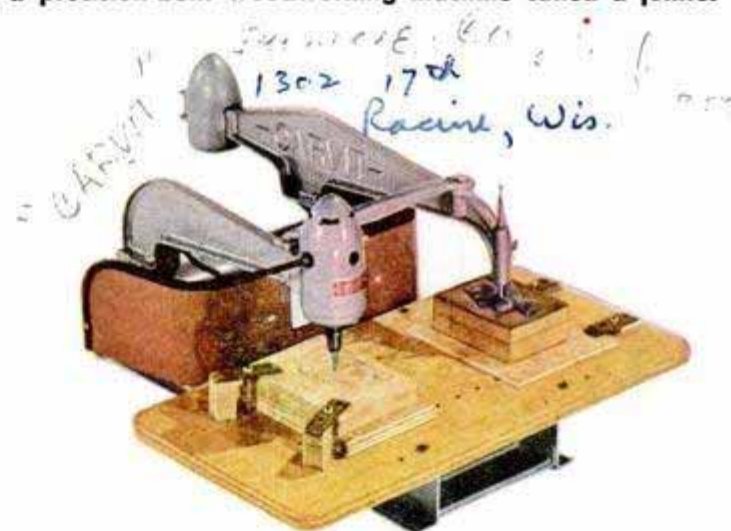
1902



1952



Hand jointing and surfacing were laborious jobs for the 1902 craftsman, and considerable skill was required to plane a true edge. Now, to joint and dress his lumber accurately and quickly, the 1952 craftsman needs little more than the ability to hold the work in position on a precision-built woodworking machine called a jointer



Compared to the old woodcarver who had to be endowed with extraordinary skill in handling a chisel, the man who takes up the hobby of woodcarving in 1952 has merely to guide the high-speed carving bit of a duplicating machine. Likewise comparing modern bandsaw to crude turning saw of 1902 illustrates how contour sawing has been simplified to point of merely following a line in producing accurate cut in stock up to 6 in. thick

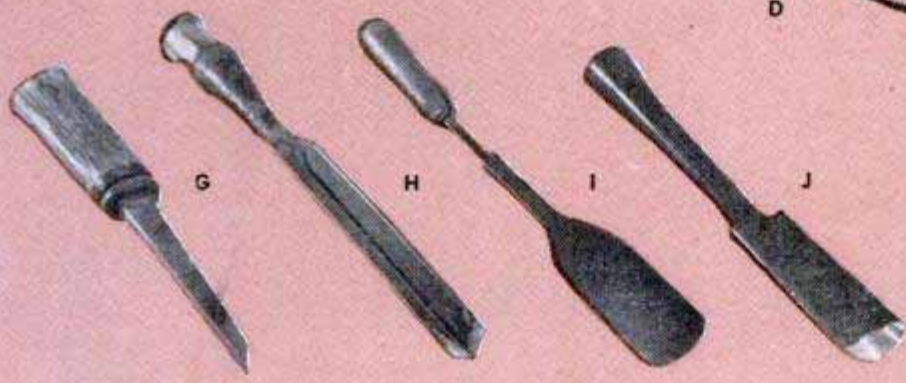
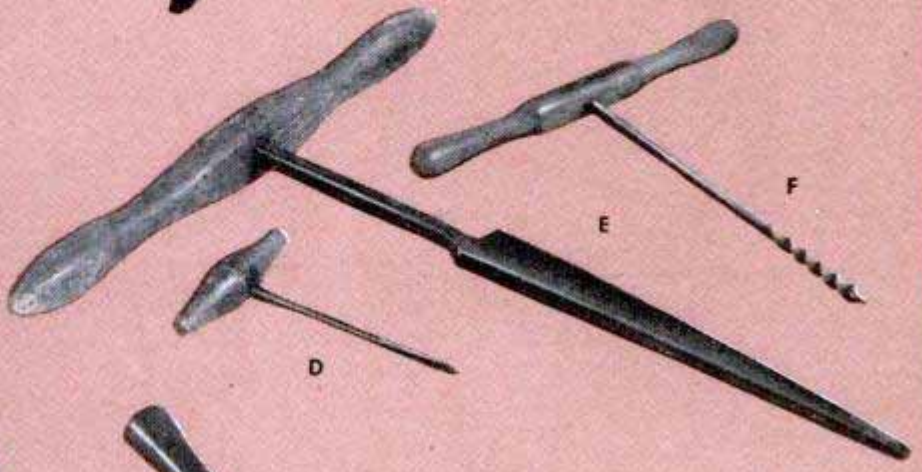


Hand Tools That Granddad Used



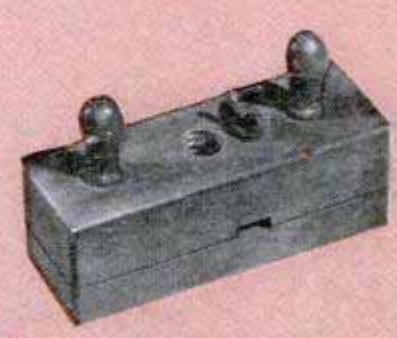
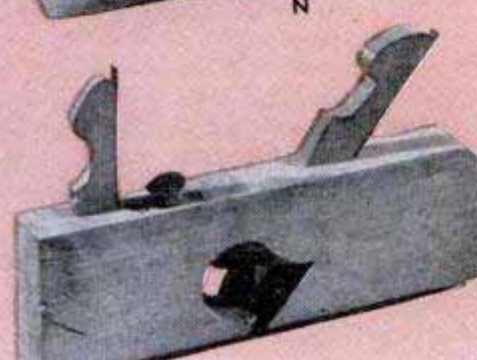
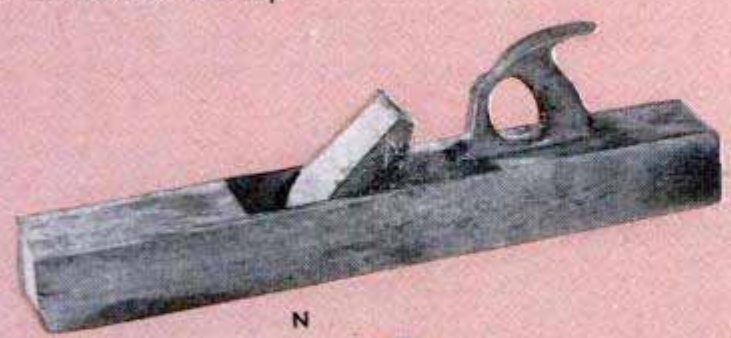
A—Wooden brace with metal jaw
 B—All wood bit brace
 C—Screwdriver brace

D—Gimlet
 E—Taper reamer
 F—Auger bit



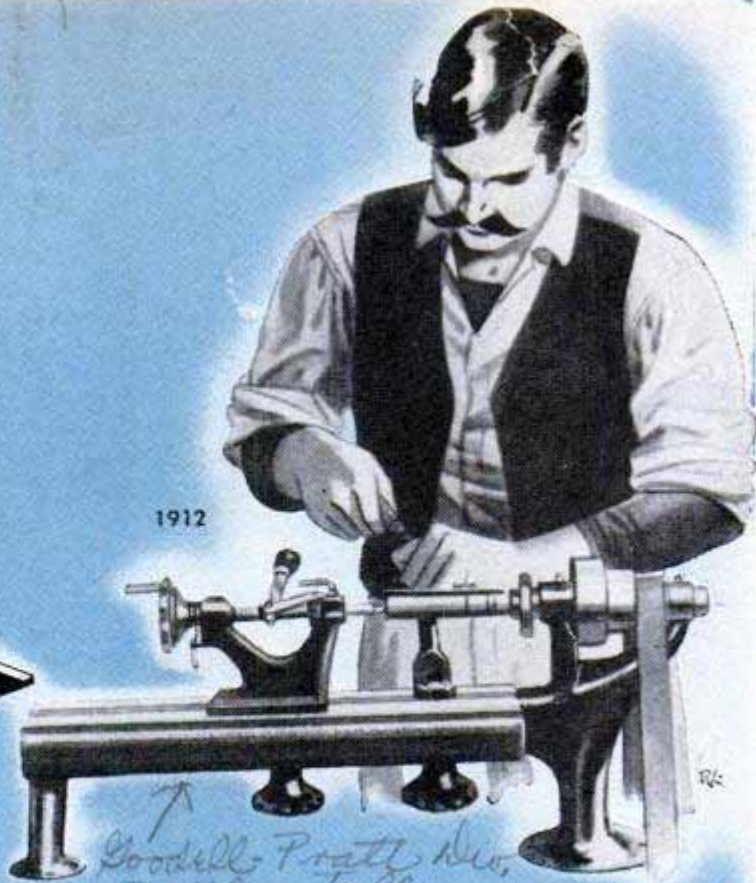
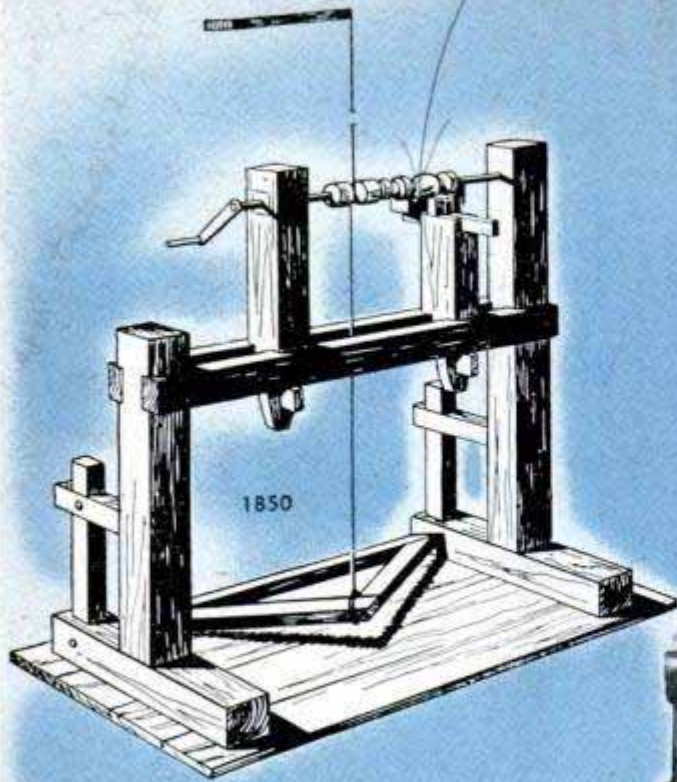
G—Mortise chisel
 H—V-gouge
 I—Spoon gouge
 J—Wide gouge

K—Finishing adz
 L—Forming adz
 M—Flat-blade adz
 N—Wooden block plane
 O—Molding plane
 P—Screw box and tap



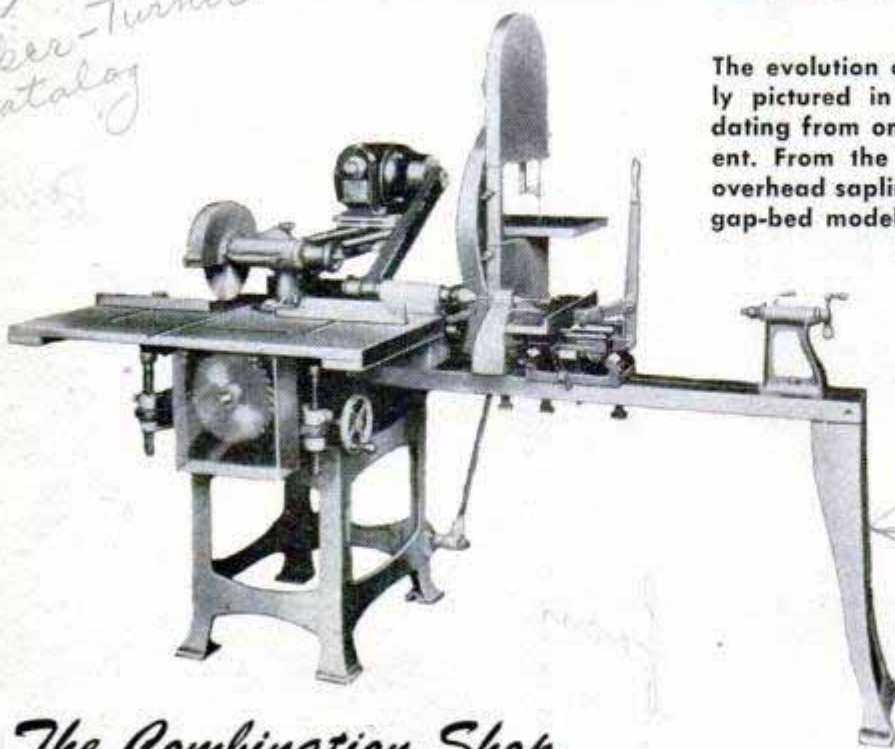
*photos from
 ...*

The Wood Lathe



Walker-Turner
catalog

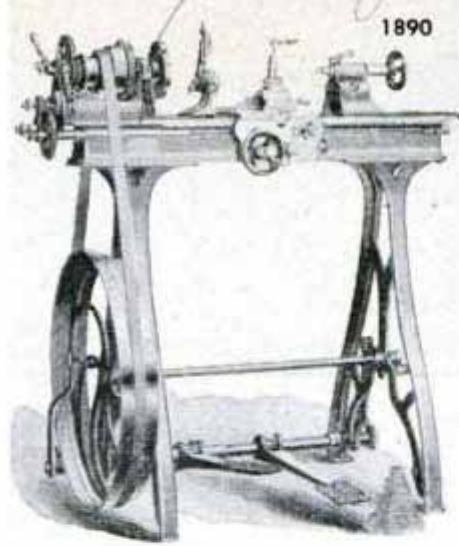
The evolution of the wood-turning lathe is graphically pictured in this representative group of models dating from one of the earliest forms up to the present. From the early treadle type that relied on an overhead sapling to provide momentum up to modern gap-bed model, basic design has remained the same



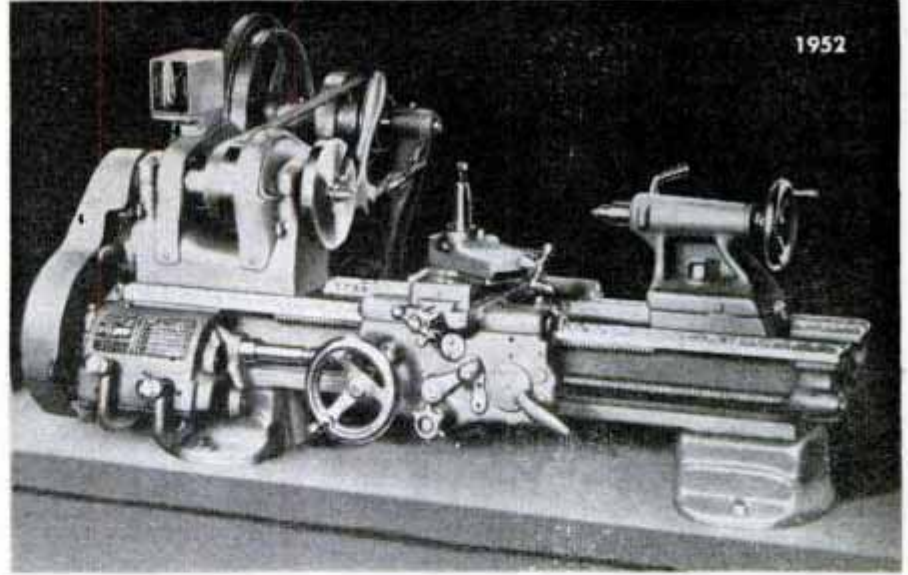
Representing one of several combination shops to hit the market, this Ever-Ready Woodworker was offered by Porter-Cable Co. in 1930. Featuring individual tools driven by one motor, this husky outfit included all the basic tools to make it a favorite among patternmakers and craftsmen alike

The Combination Shop

not available any more



1890



1952

The Screw-Cutting Lathe

Typical screw-cutting lathe found in use around 1900 compared to modern motorized bench model. Large flywheel provided three-step pulley ratio and lent momentum to new-type "walking" treadle drive

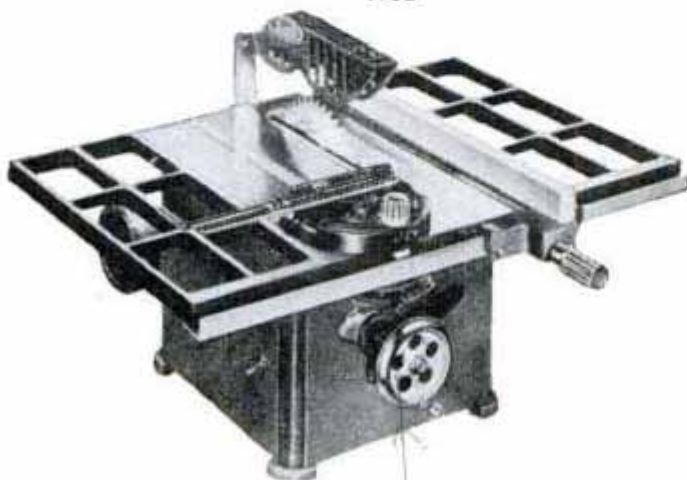
dime a pound and, for the most part, the machines were limited to professional use.

Today, fifty years later, it's a far different story. In 1902, it was necessary for the craftsman to rely entirely on his skill and dexterity in the use of hand tools to produce a fine piece of furniture. He had to possess the ability to cut a board squarely, to plane an edge true or to bore a hole accurately. It was up to him to guide the tool with a skill acquired only from years of apprenticeship and practice. Until the advent of the treadle-driven machine, he had no means other than hand. The 1952 craftsman knows well what little effort it takes to saw a board, plane a block or drill a hole. The machine has taken over!

This ease of doing things is responsible for the existence of the thousands of home workshops and their ever-increasing popularity. The man or woman with a desire for a hobby, whether it be woodworking,

Tilting-Arbor Saw

1952



1914

A forerunner of the first commercially successful tilting-arbor saw, this pilot model is a far cry from the modern one below, left



The Line-Shaft Shop 1929



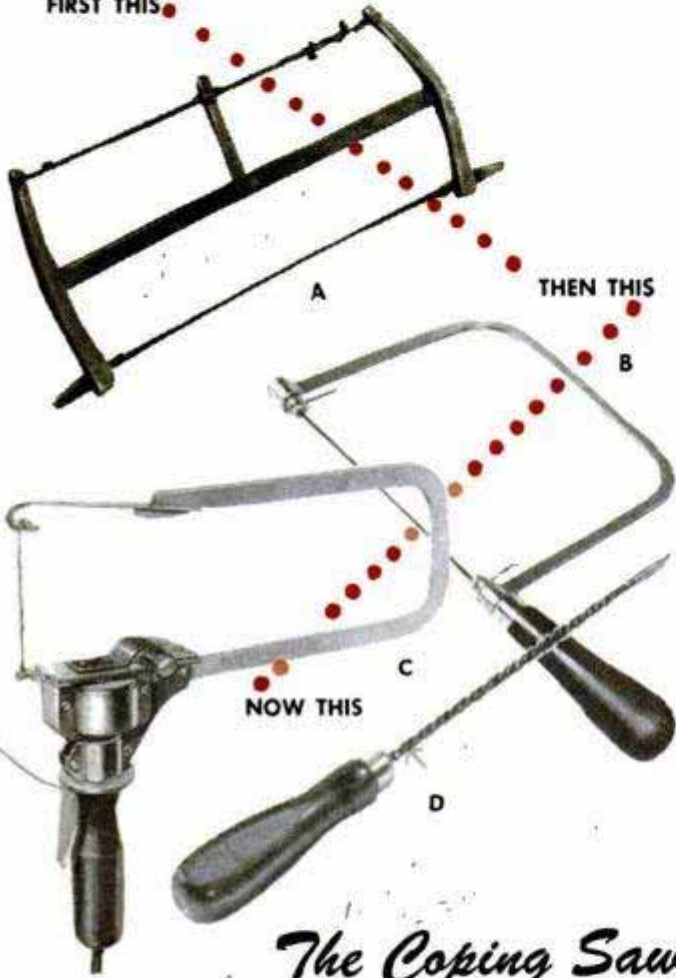
Playing an important part in the early development of the home workshop, this famous "Driver" shop will be remembered by craftsmen of the early thirties

metalworking, leathercrafting or one of the many other crafts, and who possesses but a minimum of mechanical aptitude, can produce a creditable job from the very beginning. Development of the modern power tool and its attachments has all but eliminated the need for exacting skill on the part of the "crafter." Whereas in 1902 it was up to the individual to guide the tool, the primary concern of the 1952 craftsman is the simple procedure of guiding the work. Jigs, guides and fixtures have made it easy to become an expert.

In an endeavor to better early labor-saving machines, treadle-driven models gave way to such improvements as two tools in one. Scrollsaws were made to include a small "drill press." Circular saws were designed with built-in jigsaw, molding and boring features. Self-feed attachments were added to rip-saws so that one man could crank the blade and feed the work at the same time. An improved double treadle, featuring a new "walking motion" principle, gave the operator greater foot leverage and a more positive, continuous

A marked contrast between the old and the new is shown in the photos below of the three-wheel bandsaw. Early Wallace model, left, found greatest popularity during the jigsaw-puzzle craze some years ago

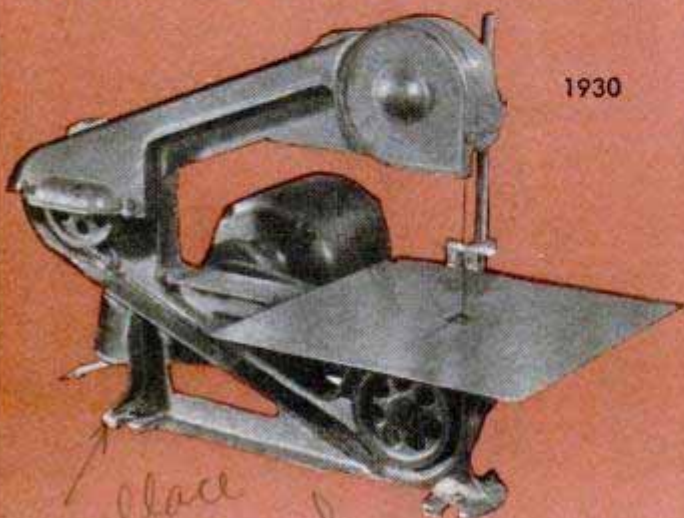
FIRST THIS



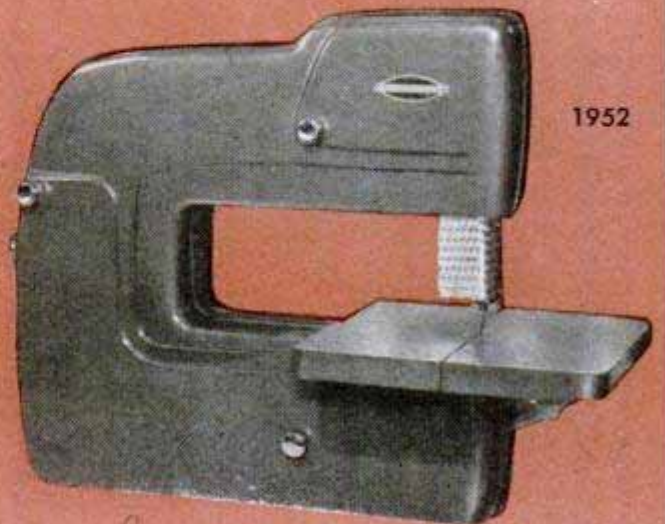
The Coping Saw

Picture history of the coping saw includes crude turning saw, A; familiar metal-frame model, B; and magnetic saw, C. Latest addition is a file-shaped tool, D, that drills own entrance hole and saws in any direction

Three-Wheel Bandsaw



1930



1952

*Maya Engineering
110 Binaldfield Dr.
Menlo Park, Calif.*



GROOVING SAW



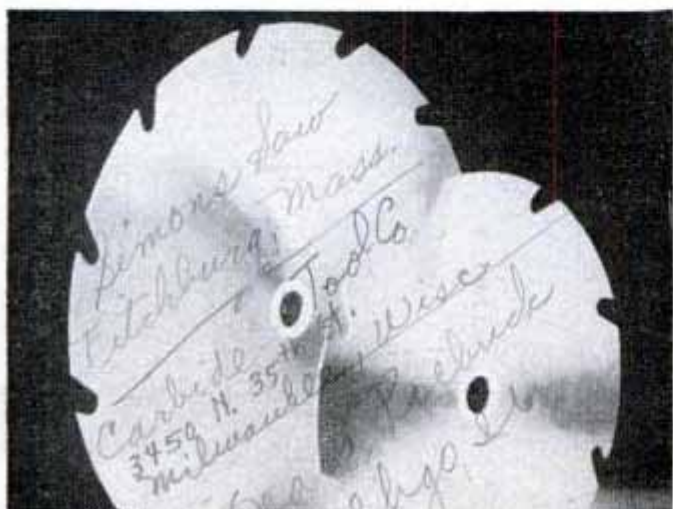
Where the craftsmen of 1902 used a series of thick individual blades, today he "wobble" saws dados of various widths with a single blade. New geared type is adjusted for width of cut with socket-head wrench

drive. Soon the pedals gave way to steam-engine drive and water power and, finally, to electricity with the invention of the electric motor and the dynamo.

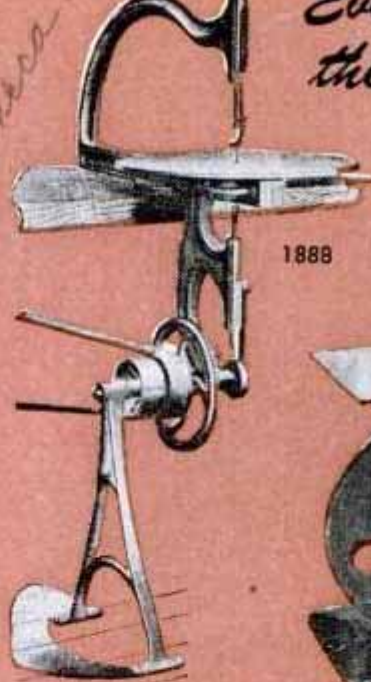
In 1914, the J. D. Wallace Co. developed and produced the first commercially successful tilting-arbor saw. Crude compared to the streamlined, precision models of today, this early design was a forerunner of the present popular-type saw. Boring machines advanced from the early types in which the operator sat on the tool and cranked the bit with both hands, to the modern multispeed drill press. A highly versatile machine, special attachments have made the drill press virtually a workshop in itself. Saw blades of the day were the common rip and crosscut type. The combination and the hollow-ground planer blade were unheard of, and little did the craftsman of the horseless-carriage era dream of the day when there would be a carbide-tipped blade with which he could saw right through a nail with the greatest of ease without fear of dulling the blade.

Emerging from World War I, the country set a dizzy pace and enterprise was on the

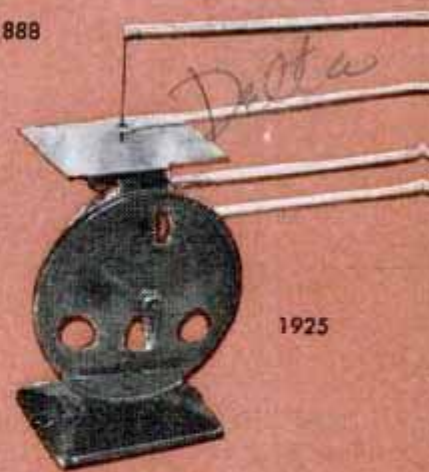
A marvel to the craftsman of '52 is the revolutionary carbide-tipped blade. The new design prevents kick-back, and extreme hardness of teeth permits sawing through nails or concrete without dulling the blade



*Evolution of
the Jigsaw*



1888



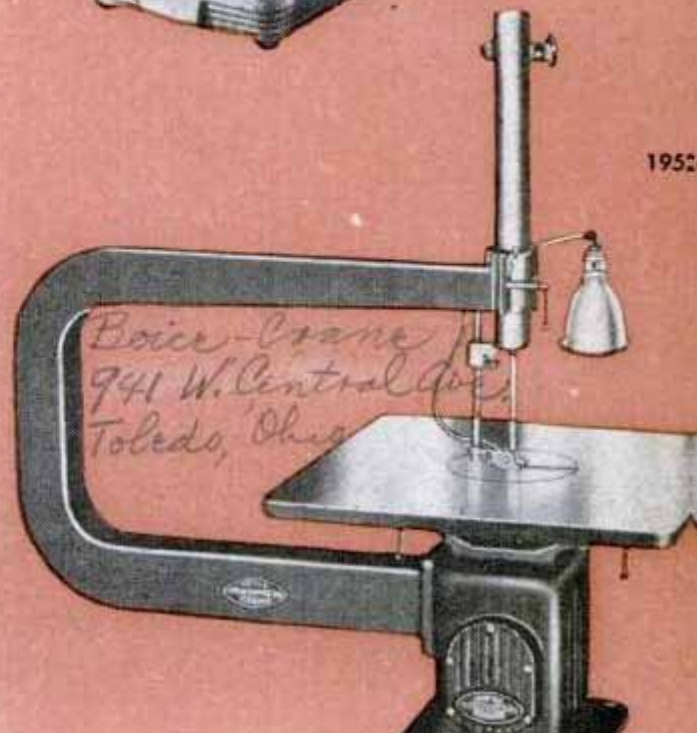
1925



1929

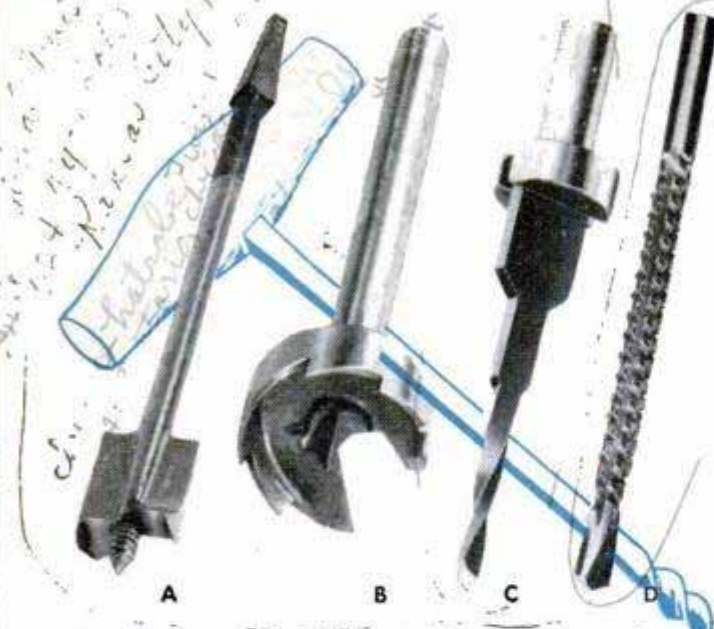


1950



1952

*Boice-Crane
941 W. Central Ave.
Toledo, Ohio*

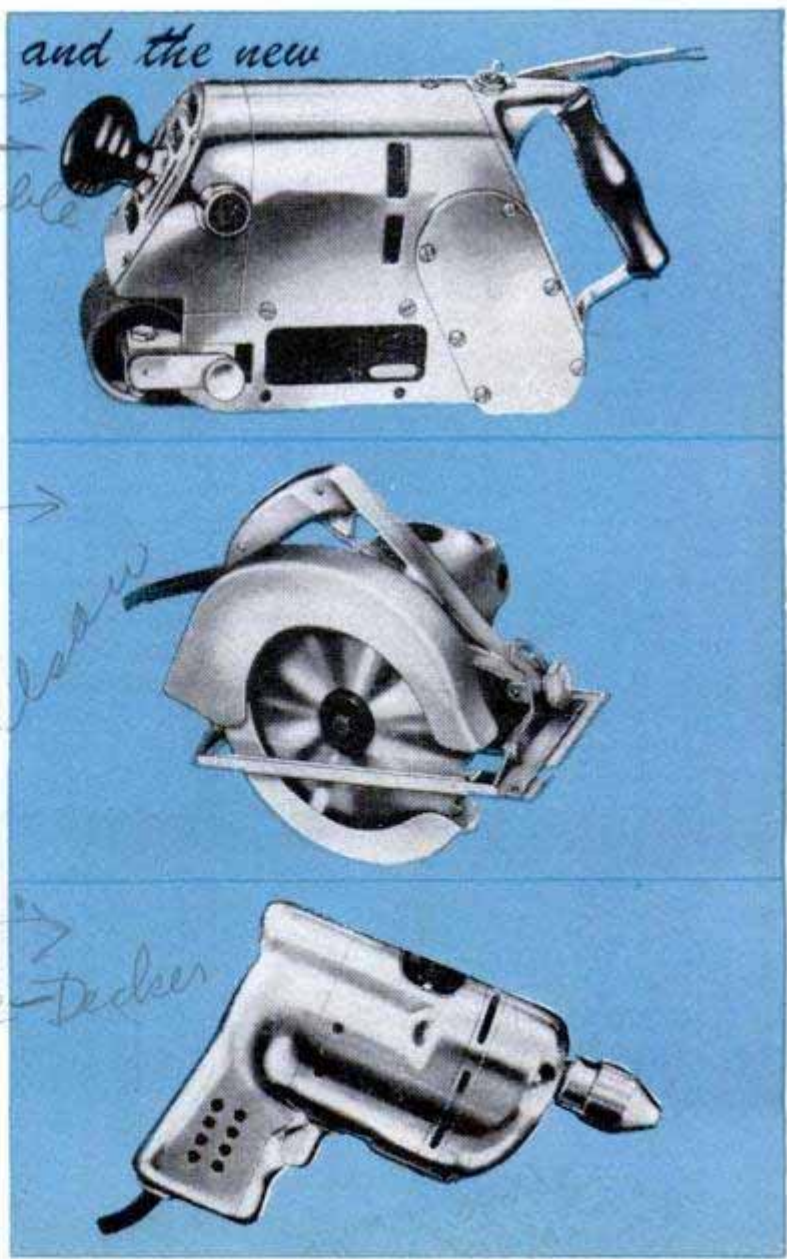
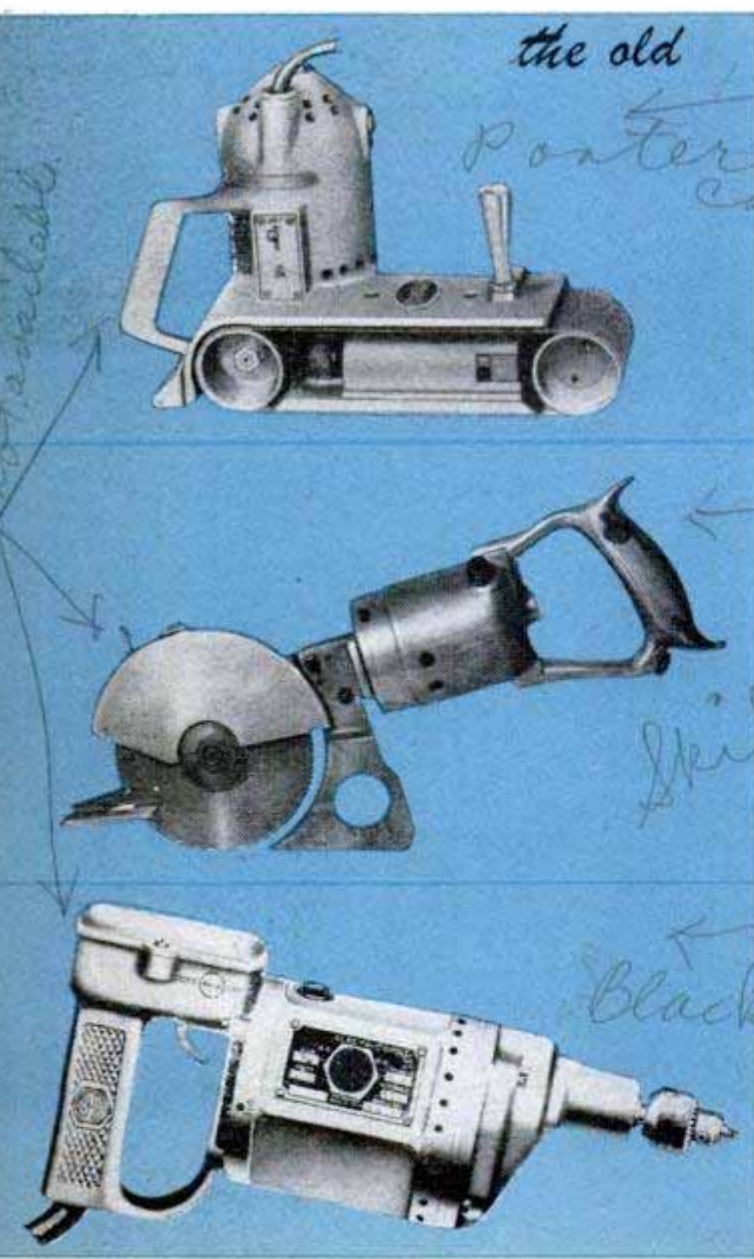


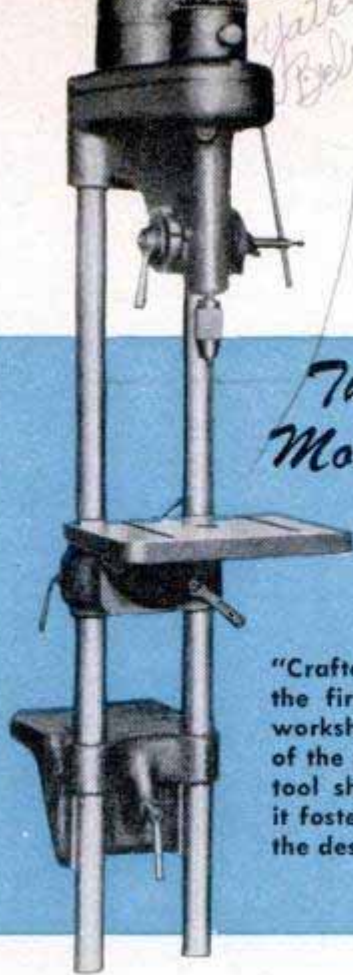
Among the many new boring bits familiar to the modern craftsman are the radically designed auger bit, A; the saw-edge Fostner bit, B; the three-in-one screw-hole bit, C; and the rotary cope-saw drill bit, D

Typical of the advancement of the portable power tool are the examples of the old and new sander, saw and drill. Basically the same, the modern and improved designs have added the 1952 streamlined touch

upswing. In 1925 a young firm, remembered best as the old Delta Specialty Co., began making a small bench-model scrollsaw. Little more than a hand-cranked toy at first, it was later converted to a belt drive. At a time when the jigsaw-puzzle craze hit the country, this little saw marked the beginning of a power-tool era. However, it was not until the depression years of the thirties that the hobby spirit really took hold. It was then that unemployment gave birth to the home workshop. With thousands of people thrown out of work, their livelihood cut off, they turned to the home shop as a source of income. Small businesses of many descriptions sprouted overnight. Manufacturing widely sought puzzles helped many victims weather the depression. Others with more leisure from their jobs sought a hobby to occupy idle hours of unemployment. The hobby business grew by leaps and bounds.

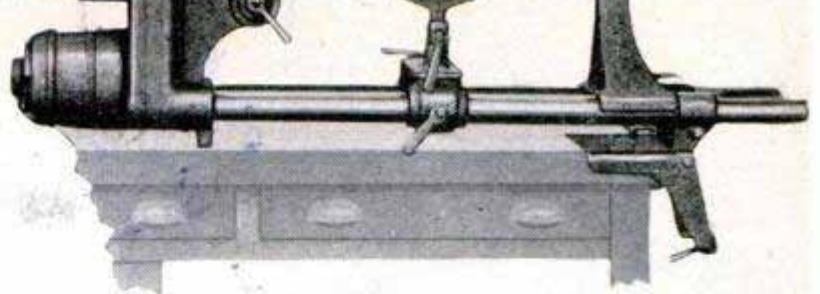
Pioneer and new manufacturers were quick to see the potential market, and many of the older readers of *Popular Mechanics* will recall such famous old trademarks as Driver, Workace, Handi-Shop,



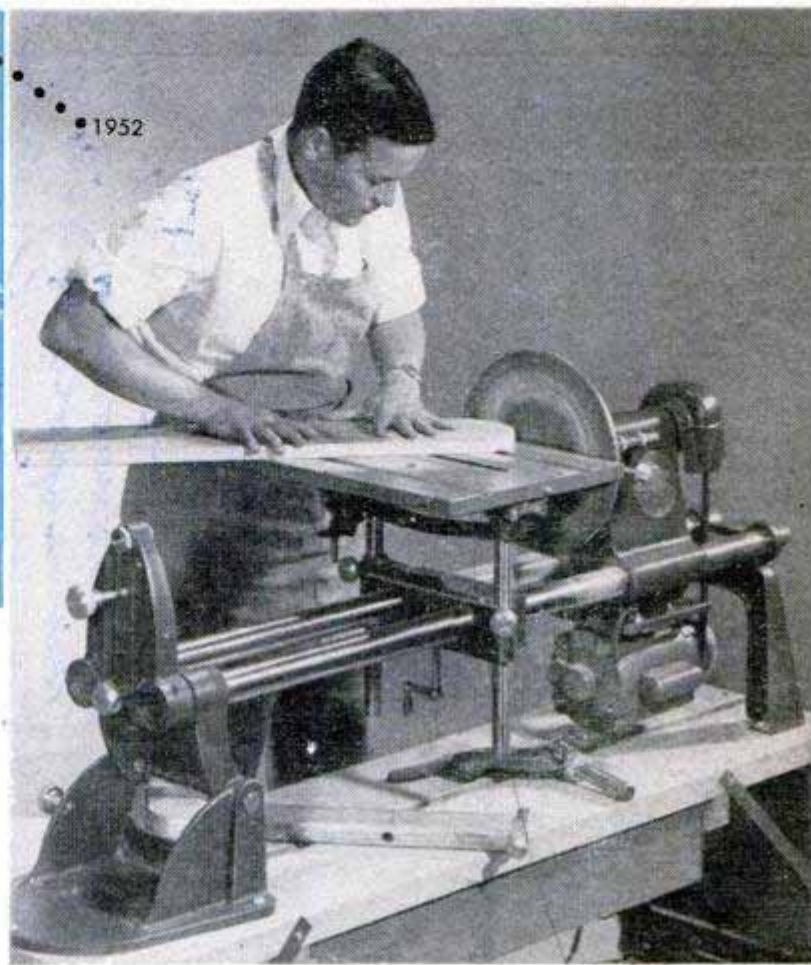


The One-Motor Shop

"Crafters" of 1934 saw the first conversion-type workshop. A forerunner of the present five-in-one tool shown at the right, it fostered a new idea in the design of power tools



1934



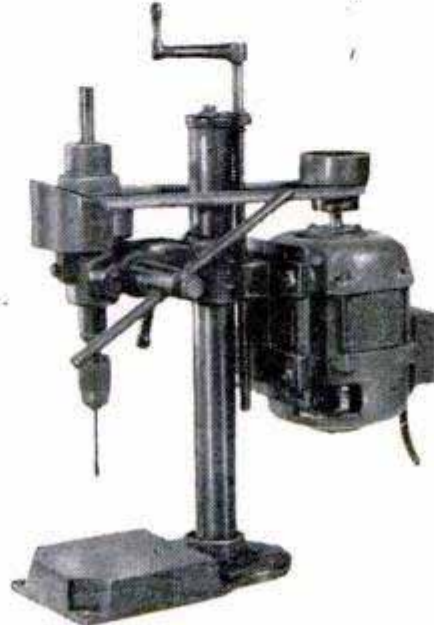
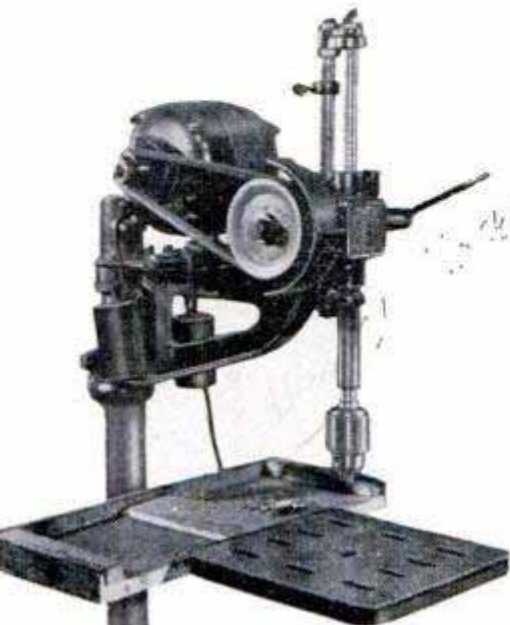
1952

Red Jacket, Ever-Ready, Shop-King and others. Chain stores and mail-order houses began to offer low-price power tools. One could buy a little 6-in. lathe for as low as \$4.00, a jigsaw for \$6.40 and a bench saw for \$9.75. While they were still Tom Thumb versions of their big industrial brothers, these little machines and others like them found a tremendous market. It brought a boom to a prostrate tool industry.

The hobby impact was felt also by *Popular Mechanics* and other craft publications. Now that he owned the tools, the hobbyist was eager for ideas of what to make, to be

Craftsmen with more than a few years of experience will quickly recognize the three old-timers shown below. Picturing three different types of drives featured through the passing years, these early-model drill presses were considered excellent tools in their day

Drill Presses When Popular Mechanics Was Young





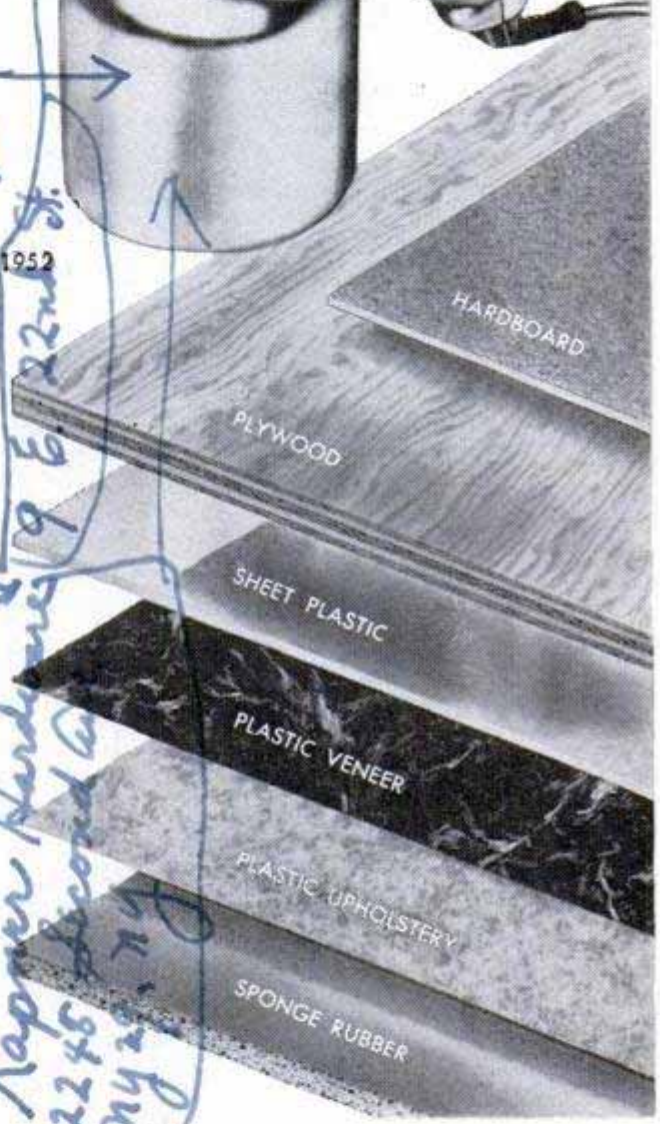
1902

*Raywell Corp.
801 Andrews Bldg.
Minneapolis, Minn.*

*Telco Corp.
815 Central Bldg.
Minneapolis, Minn.*

1952

*Kapner Hardware & E. 22nd St.
2245 Second Ave.
New York, N.Y.*



New Finishes and Craft Materials

told how to use the tools and, most of all, how to put them to work making money during those lean years. As competition became keen, better tools were designed and developed. Line-shaft shops became popular, and several firms featured combination shops powered by one motor. In 1934 the Yates-American Machine Co., an old established builder of industrial machines, built a new conversion-type workshop that incorporated several tools in one. Made for a few years and then discontinued, this tool marked the beginning of the combination versus the individual power

tool, and bore a strong likeness to its present-day counterpart, a five-in-one space-saving tool that combines all basic wood-working operations in a single machine. As with tools, craft materials, as well as finishing materials and methods, have changed considerably since 1902. Such materials as plywood, hardboard, sheet plastic, sponge rubber and plastic veneer and upholstery were something out of this world. Whereas it was customary to see the old gluepot on the stoves of 1902 shops, the 1952 craftsman has many strong, fast-setting adhesives from which to select, includ-

ing the latest hide, fish and resin glues which require no heating. Lacquer applied with modern spray equipment has antiquated slow, brushing methods of early days when finishes were built up by dozens of coats and rubbed by hand. In this power age, finishing now is done in a very short time, motorized rubbing machines supplant hand methods, while flat and rubbed-effect lacquers and varnishes simulate the real thing beyond detection. Spray equipment has advanced to the point of including the compressor right in the gun, and the development of the pressurized container has made it possible to spray paints, enamels and other finishing materials directly from the can.

Looking to the future, indications point to an even greater growth of the home workshop. Hobby clubs and vocational teaching in the schools and among handicraft groups of various civic organizations will continue to promote the value of a hobby in fostering both health and happiness. In years to come, the home workshop is apt to move out of the basement. The present popularity of the basementless home is a strong indication and the tendency will be more and more to include hobby space in an attached garage. In the coming years, the cutting edges of hand and power tools no doubt will be carbide tipped to make them far outlast present tools. Like the craftsman of 1902, the 1952 craftsman will be amazed with things to come fifty years hence, and it is sincerely hoped that many 1952 readers will be on hand to compare the present with the new in the 2002 centennial issue of *Popular Mechanics Magazine*.

Veneer Strips "Ironed" on Work

Veneering edges of plywood need not be a troublesome job involving the use of bar clamps, blocks, etc. Here is a method which one craftsman uses to do the job quickly and effectively. It requires only a household iron. The veneers should not be thicker than $\frac{1}{16}$ in. and the glue used should be of a nonstaining, plastic-resin or urea-resin type, which is available in powdered form and mixed with water as needed. After brushing glue on both the work and the veneer, place the latter in position and apply the hot iron firmly to one area, rocking it slightly to assure a positive contact. When the heat of the iron causes the glue to bubble out at the edge in the form of little beads, move the iron to the next area. Although scorching can be removed from the veneer when the work is sanded, deep burns should be avoided by controlling the temperature of the iron.

Sid Christofferson, Phoenix, Ariz.



Draft Through Furnace Utilized To Control Dust From Ashes

Instead of wetting down the ashes in a furnace when removing them in order to check flying dust, one homeowner suggests the following method of doing the job. Shovel the ashes into a shallow container placed directly in front of the ashpit opening as shown in the photograph. Remove ashes only when the draft damper is completely open, and most of the dust will be pulled into the ashpit by the draft.

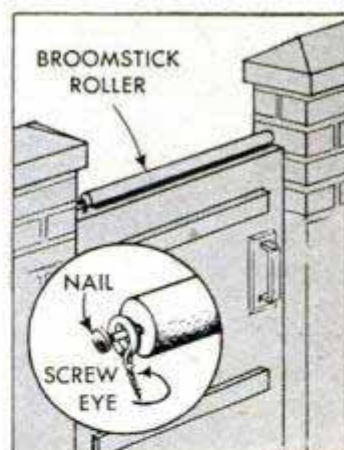
Ivan Grosvenor, Richmond, Ind.

Gate Fitted With Roller Keeps Dog in Yard

If your dog leaves the yard by jumping over the gate, the habit usually can be broken by attaching a wooden roller across the top. As the dog undoubtedly uses the edge as a "springboard" to clear the gate, the roller will prevent getting a foothold at this point.

A roller from a window shade may be used, or even a suitable length cut from a broom handle. A couple of long screw eyes will support the roller if nails or screws are driven into the ends to serve as small axles.

Hi Sibley, Nuevo, Calif.



☞ Should you hear cracking and creaking noises in the house during winter nights, it doesn't necessarily mean that the house is haunted. Chances are that the house is groaning from a lack of humidity.

CLOSET-DOOR BUFFET

WHY NOT MAKE a closet door serve double duty?" thought Edward R. Lucas of Poulsbo, Wash., and here's how he replaced a standard door with an attractive swinging buffet. Fitted with shelves for china, a drawer for silverware and a cabinet for linens, this "built in" unit truly is the answer to the problem of space in small living quarters. A rubber-tired caster relieves strain on the hinges, and a strong friction catch takes the place of the regular door lock. Fitting the top of the door casing with a scrolled header adds to the deception and makes the door look even more like a built-in cabinet.

While over-all dimensions will have to be

taken from the actual opening in each particular case, the drawings show how the cabinet is assembled. As weight is a factor to consider, a lightweight wood, such as pine, is best. This can be common lumberyard stock, the back being covered with either hardboard or plywood. The entire cabinet is made of 1-in. stock, which actually measures $\frac{3}{4}$ in. thick. To provide the necessary clearance for the buffet to swing properly, you'll note that the swinging side of the cabinet is built up of two pieces and joined at an angle. The degree of angle required is determined in the manner shown in the drawing. To obtain a close fit in the door opening, hang the cabinet be-





House-Trailer Sewer Hose Stored In Downspout Hung Under Chassis

A length of downspout attached to the underside of a house trailer provides ideal storage space for a sewer hose while the trailer is in transit. The spout should be plugged at one end and then suspended from the chassis with pipe straps or heavy wire. A second plug is used to cap the open end of the spout when the hose is stored.

Cliff Segerblom, Boulder City, Nev.

Shelf Protected From Acid Burns By Rubber Stair-Tread Covering

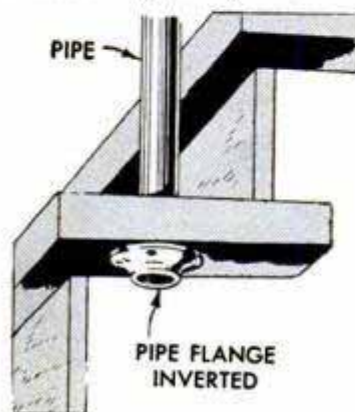


The shelf on which strong acids are stored can be protected from burns by covering the shelf with a stair tread, section of inner tube or a similar piece of sheet rubber. The covering simply is

tacked in place with the front edge overlapping the shelf as indicated.

George Kapitan, Bronx, N. Y.

Flanges Mounted Beneath Steps Add Rigidity to Handrail



When anchoring a pipe railing to the steps of a wooden porch, the usual practice is to screw the floor flanges to the top surface of the step treads. However, one homeowner found that a far more rigid job

could be had by drilling holes through the steps and mounting the flanges on the underside as shown. With the vertical rail supports passing through the step, extra rigidity was gained to provide a more sturdy railing.

Emergency Pouring Spout For Screw-Cap Cans

Difficulty in pouring liquids from cans that have screw caps, such as those containing solvent, can be overcome by using the rubber pouring spout from a battery water dispenser. Just hold the spout over the neck of the can as shown.

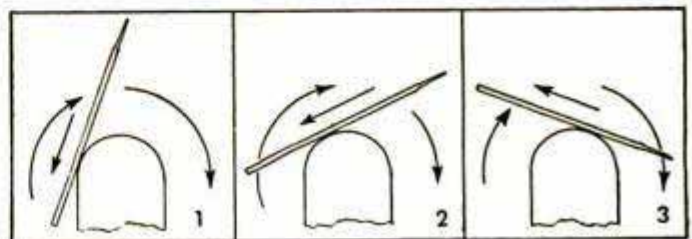
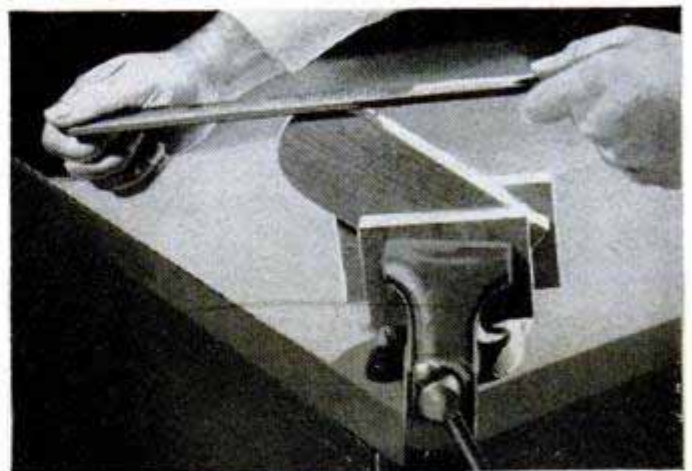


In fact, the spout can be used as a funnel if one is needed in an emergency.

R. F. Donovan, Guttenberg, N. J.

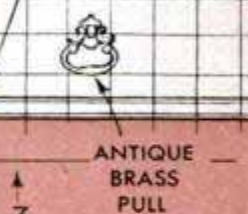
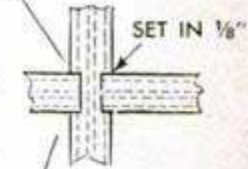
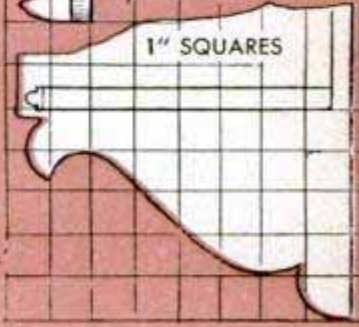
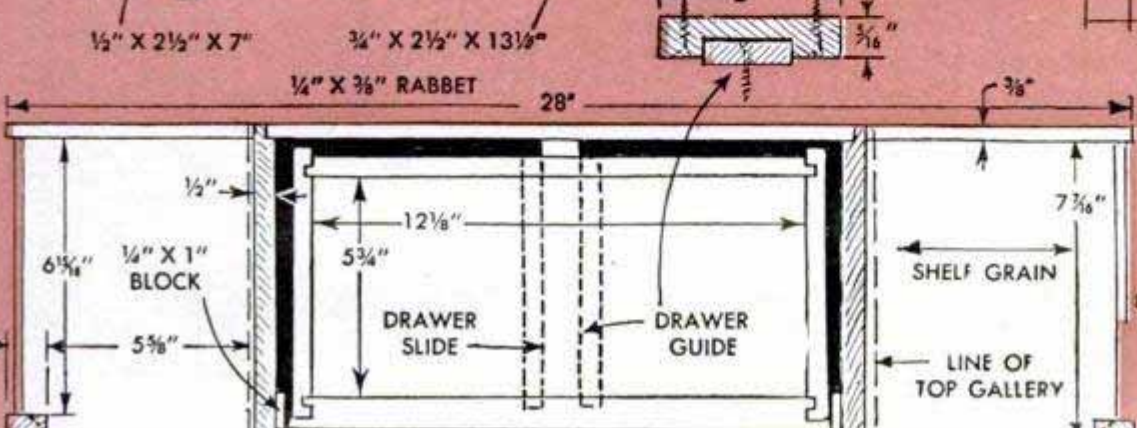
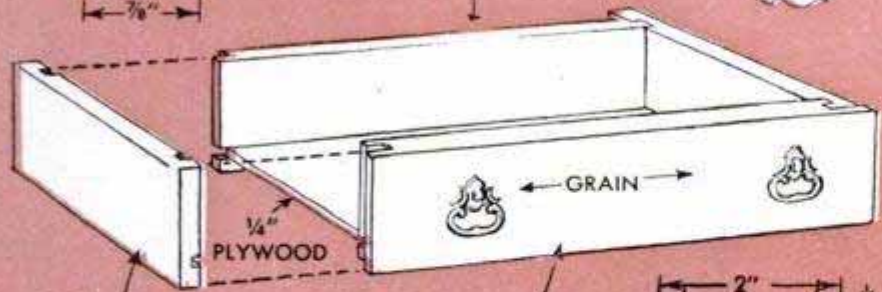
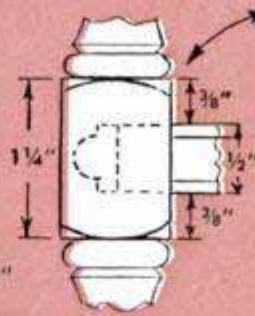
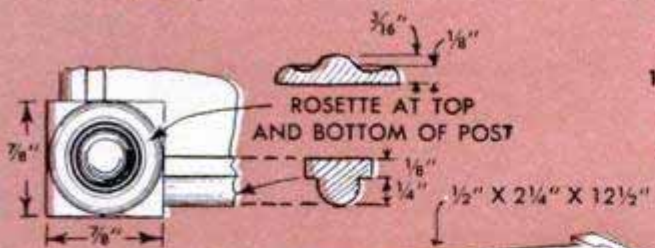
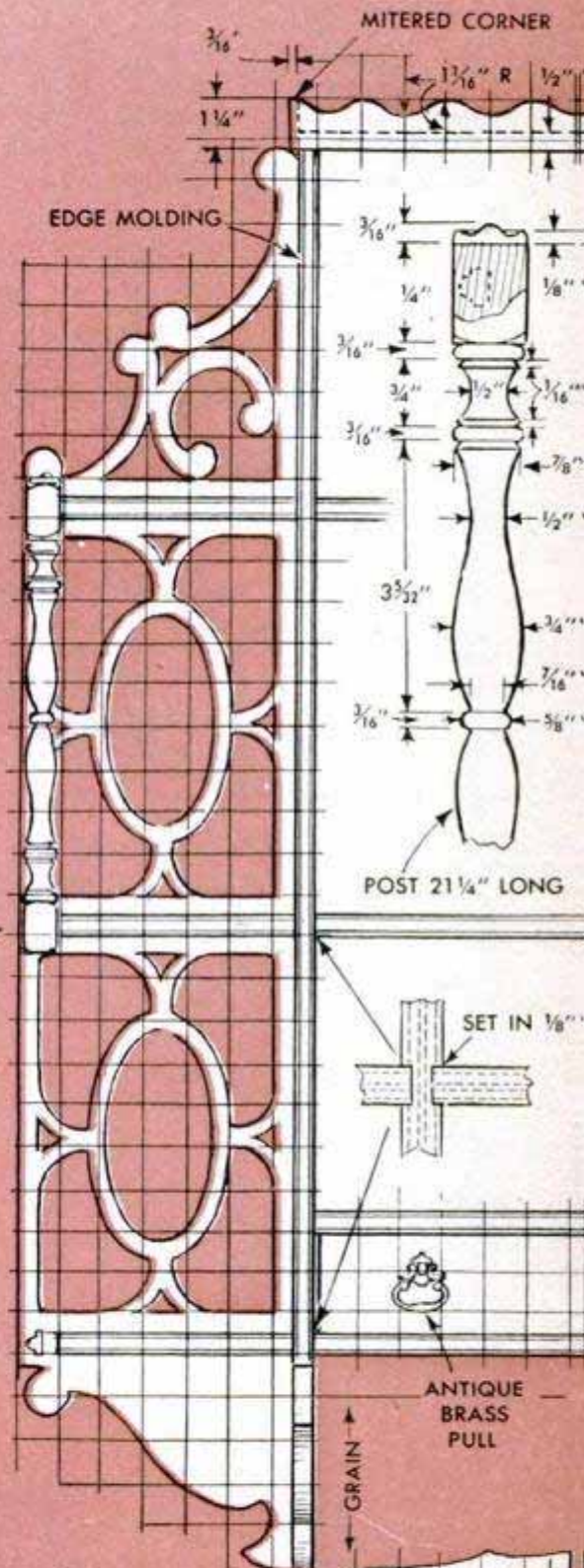
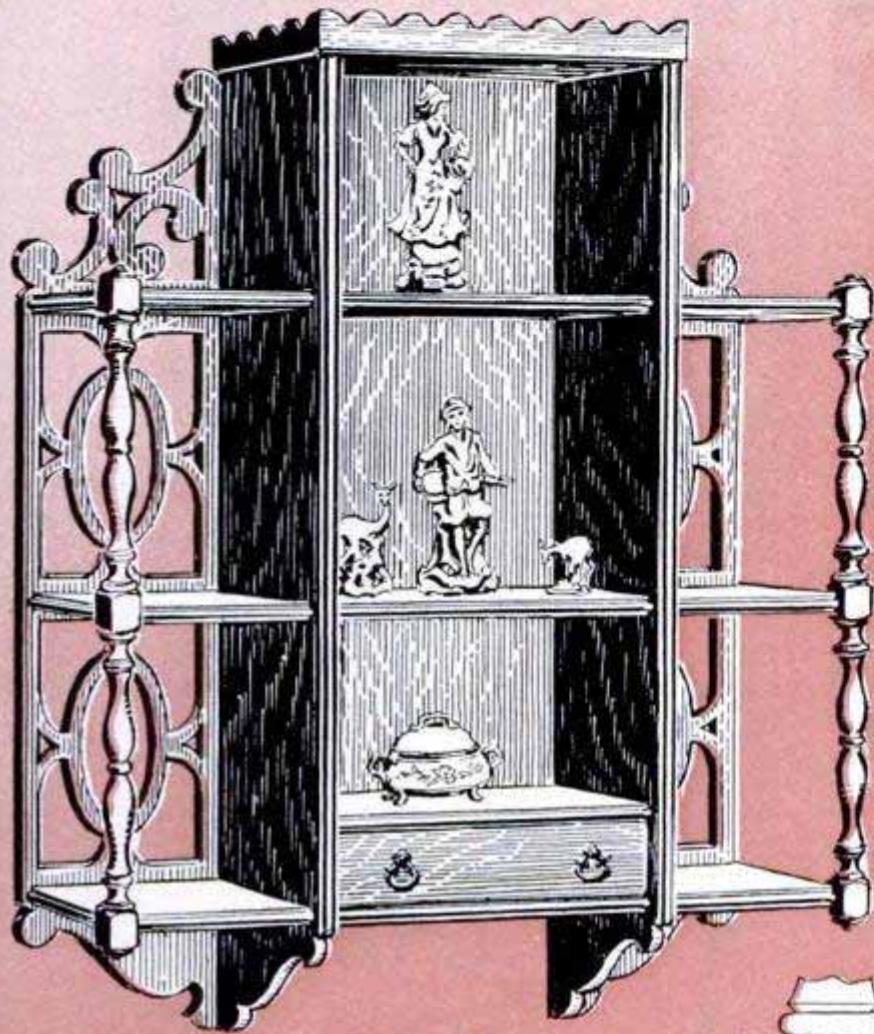
Technique of Filing a Radius

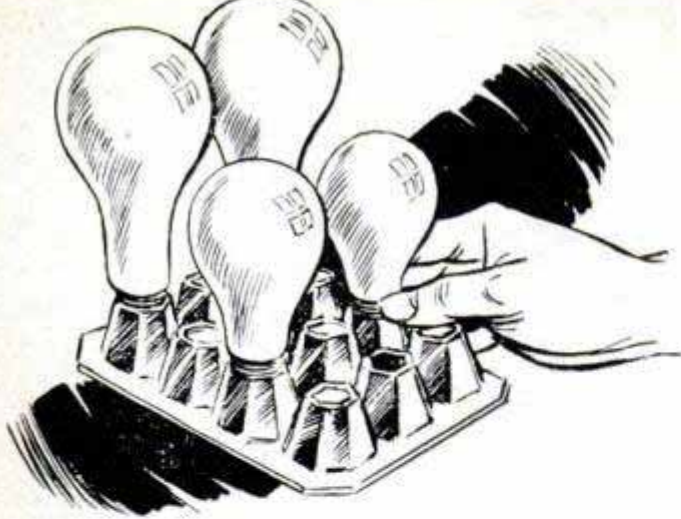
Rounding the corners of either wood or steel stock can be a simple job once you learn this technique. The secret lies in moving the file with a rocking motion, starting at the end of the cut farthest from you and working backward, as pictured in the three steps below. Note that the angle of the file constantly changes for each stroke, resulting in a uniform removal of stock from the curved surface. Keep in mind that the two movements of the file (forward and downward toward the work) are made at the same time.



Mahogany Knickknack Shelf

Challenging your hand at fine craftsmanship, this distinctive scrolled knickknack shelf provides opportunity to test your skill at both the lathe and jigsaw. Solid cabinet stock, either mahogany or walnut, is the wood to use for this elegant piece from the scrapbook of John Bergen, noted furniture designer

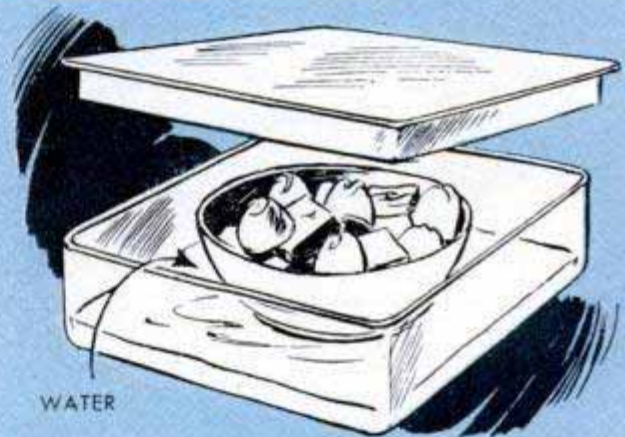
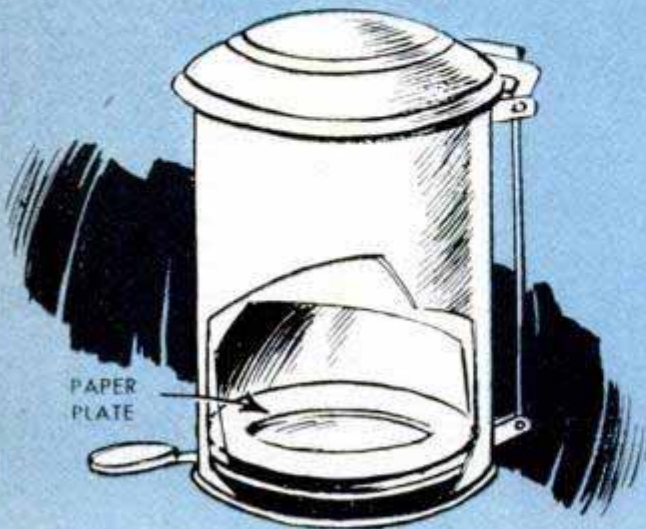




Inverted egg carton, above left, provides novel storage rack for light bulbs. Egg compartments are cut out to take bases of bulbs. Above, stains can be removed from copper-bottom pans with salt and vinegar. Wipe stained surface with vinegar and sprinkle with salt. After few minutes, wipe again

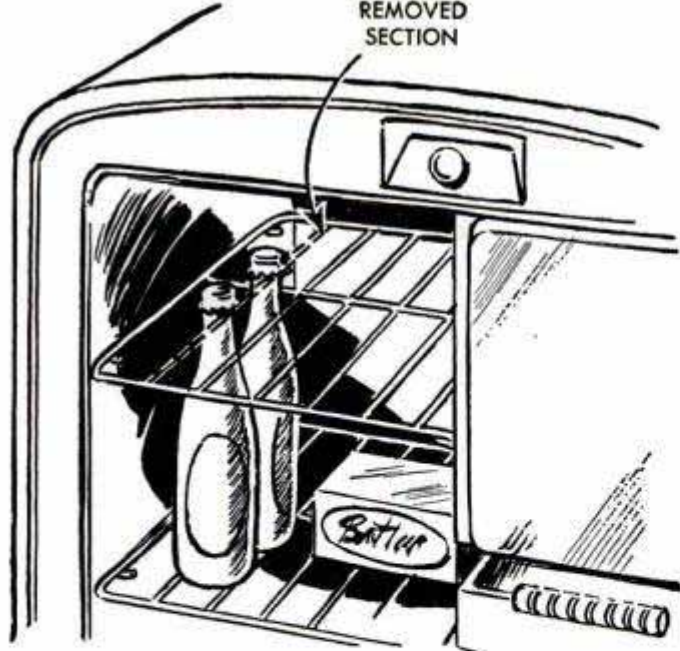
Solving HOME PROBLEMS

Rusting of a step-on garbage pail can be retarded by lining the bottom of the pail with a paper plate. The latter absorbs any leakage from the bag of garbage and can be easily replaced when necessary



To restore tastiness to fudge, bonbons and similar candies, place candy dish in covered "bowl" which contains a little water, as above, and leave for a few days. Below, skirt pleats can be given a sharp crease by first ironing with dampened cloth. Then, before pleats dry, press with wrapping paper over fabric





If your refrigerator does not allow enough storage space for tall beverage bottles, provide extra "head-room," as above, by removing section from shelf. Right, coating painted window sills with paste wax speeds dusting and wiping up finger marks. Remember to remove the wax with turpentine before repainting



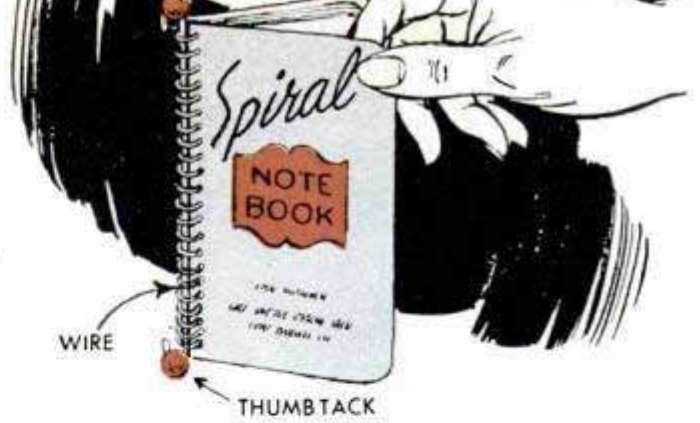
Above, leftovers of woolen yarn are stored without fear of moth damage if wrapped around mothballs. Below, metal shelf brackets form neat hangers for clothespoles that are not installed between closet walls. Screws driven in ends of pole hold it between the brackets which are screwed to shelf or ceiling

When lids of kitchen utensils fit too tightly, "wax" them by laying several sheets of wax paper over the rim, as above, before replacing the lid. Below, if rubber-heel marks are marring the appearance of your hardwood floors, erase the marks by rubbing them lightly with fine steel wool

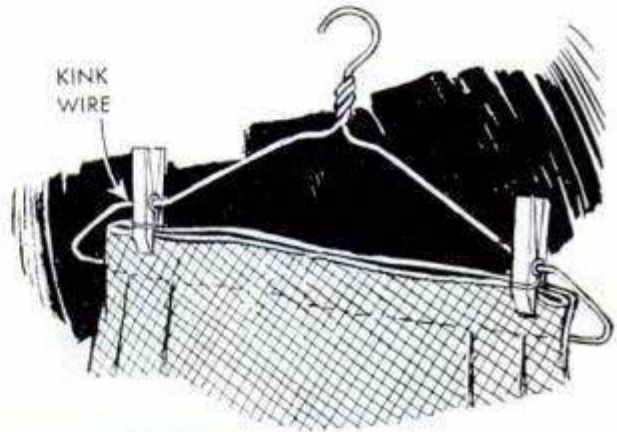




Tacking a strip of elastic to the front of a vanity drawer forms a convenient holder for bottles of fingernail polish and vials of perfume. The polish can be applied without removing bottle from holder

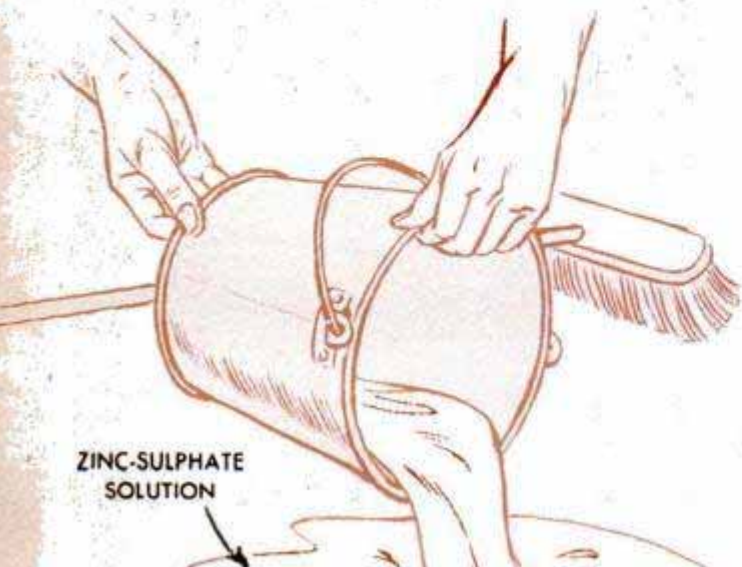


Spiral notebook fastened to wall with thumbtacks, as above, becomes handy telephone pad. Book is held by wire slipped through binding. Below, threading clothespins on coat hanger and kinking wire at points indicated spaces pins to prevent bunching of skirt

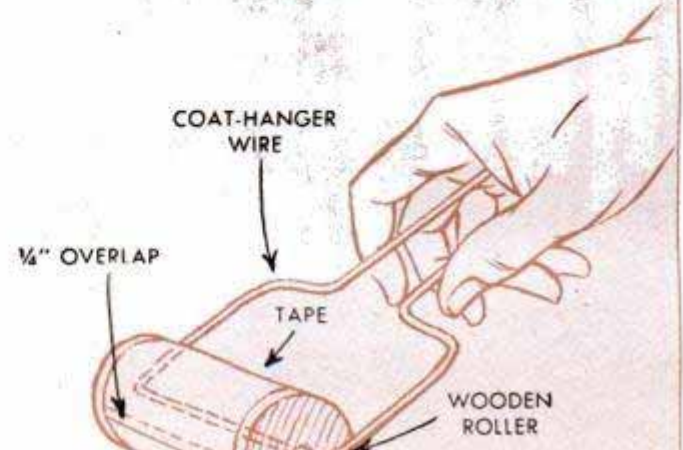


Solving HOME PROBLEMS CONTINUED

Pouring zinc-sulphate solution onto a "dusty" concrete floor results in hard, dust-free surface. Use 3 lbs. of chemical to 1 gal. of water, brush solution into pores of concrete and, when dry, sweep clean

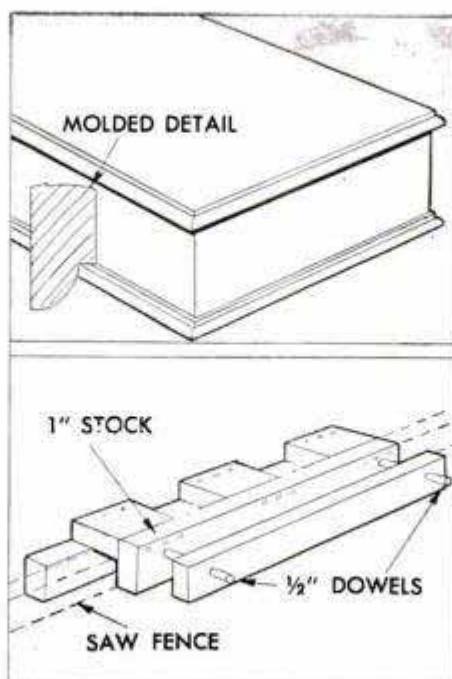


Above, "rings" on varnished furniture caused by hot dishes and spilled beverages usually can be removed by polishing with toothpaste. Below, tape-covered roller removes lint quickly from garments and upholstery. Dowel fitted with wire handle is wrapped with surgical tape, adhesive side out

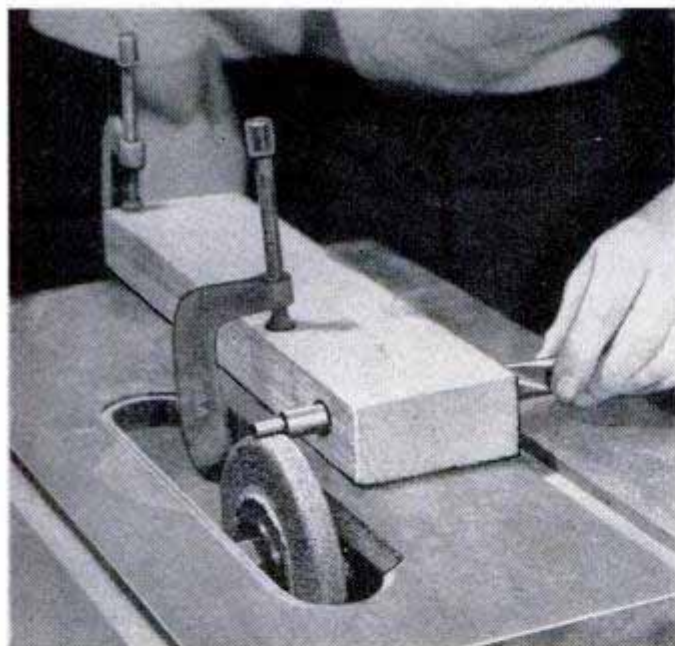


Fixture Rides Rip Fence to Simplify Shaping Edge of Thin Work

The difficult job of shaping the edge of thin work with a molding head is simplified greatly with this jig, which is used to support the work securely as it passes over the cutters. The jig straddles the ripping fence with a sliding fit, and the work is held vertically in the jig with C-clamps. Note that the adjustable strip of the jig is drilled at each end to slide on two horizontal guide pins. In use, the work is clamped between the "jaws" of the jig and, after the saw fence is adjusted to bring the work into position, the jig is merely pushed along the fence.



Grinding Jig Used on Circular Saw Permits Shouldering Round Stock

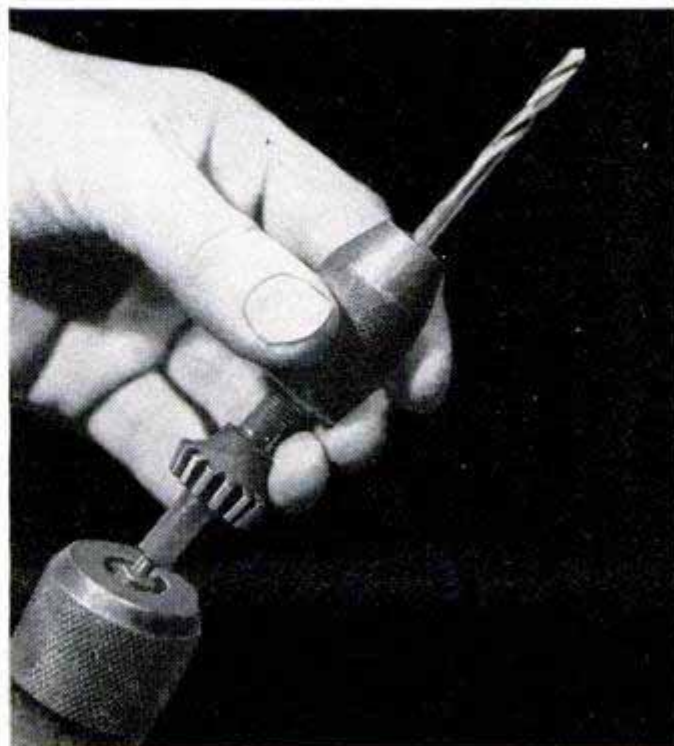


When it is necessary to make a shoulder cut on round stock or reduce the diameter of a large drill shank, the job can be done on a circular saw fitted with a grinding wheel. First, a simple jig is made by drilling a hole crosswise through a length of 2 x 4 to take the work. This is clamped to the saw table parallel with the grinding wheel as illustrated. Then, the work is inserted in the hole and is ground by turning it slowly into the wheel. The jig may be drilled in several places to take various size rods and also is useful, with the saw blade attached, for cutting tenons on dowels.

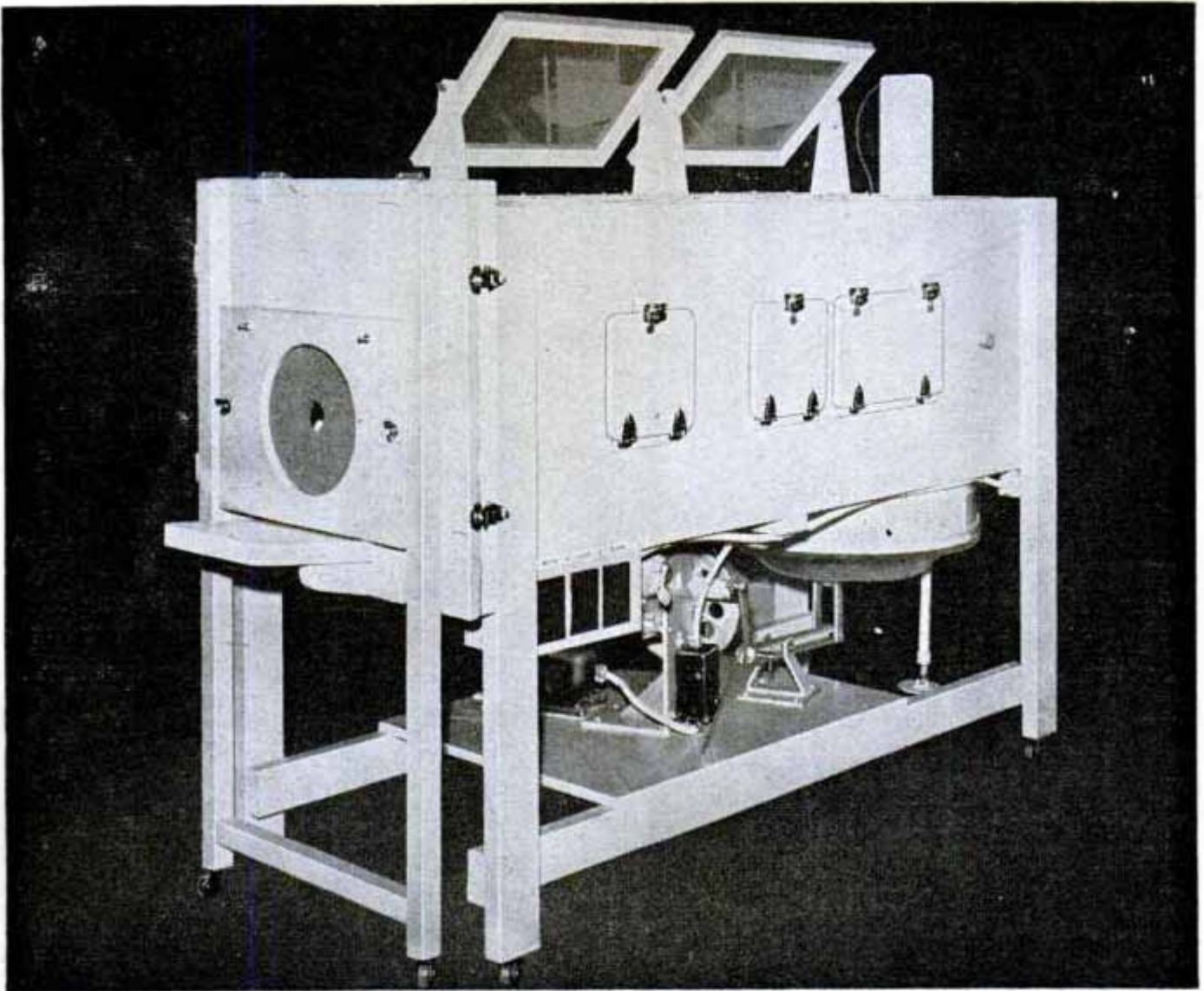
D. J. Murphy, Springfield, Mass.

Hand-Drill Chucked in Bit Brace Holds Small Twist Drills

Drilling through metal by hand normally requires the extra pressure that can be applied with a bit brace over that of a small hand drill. But where a small drill of less than 1/8-in. dia. is being used, it is impossible to chuck it in the split-type chuck of a brace. However, in an emergency, you can use both tools to do the job by chucking the hand drill in the bit brace. This is done, of course, by first pulling off the tight-fitting wooden handle of the drill and removing the large handwheel drive.



Emergency WOODEN



Could a life have been saved in your community if a mechanical respirator had been at hand for immediate use? Often just a matter of minutes means the difference between life or death for a little child stricken with polio, or a victim of drowning or a paralyzing accident. Here's a chance for every community to be ready at little expense for such emergencies. Members of clubs and civic organizations can do a great service by making one of these respirators and placing it in competent hands. Save a life — maybe your own

IN TENDED only for emergency use until a commercial respirator could be obtained, this "wooden lung" was designed by engineers and built by a volunteer group under the supervision of Dr. Gerald M. Cline, Dr. Homer O. Dolley, and Sister Celine of the medical staff of St. Joseph's Hospital, Bloomington, Illinois. On completion, the unit was put into immediate use in emergency treatment of eight-year-old Rudy Landheer, a victim of polio in the epidemic of 1949. The original unit did emergency service for 12 hours until a conventional iron lung could be obtained.

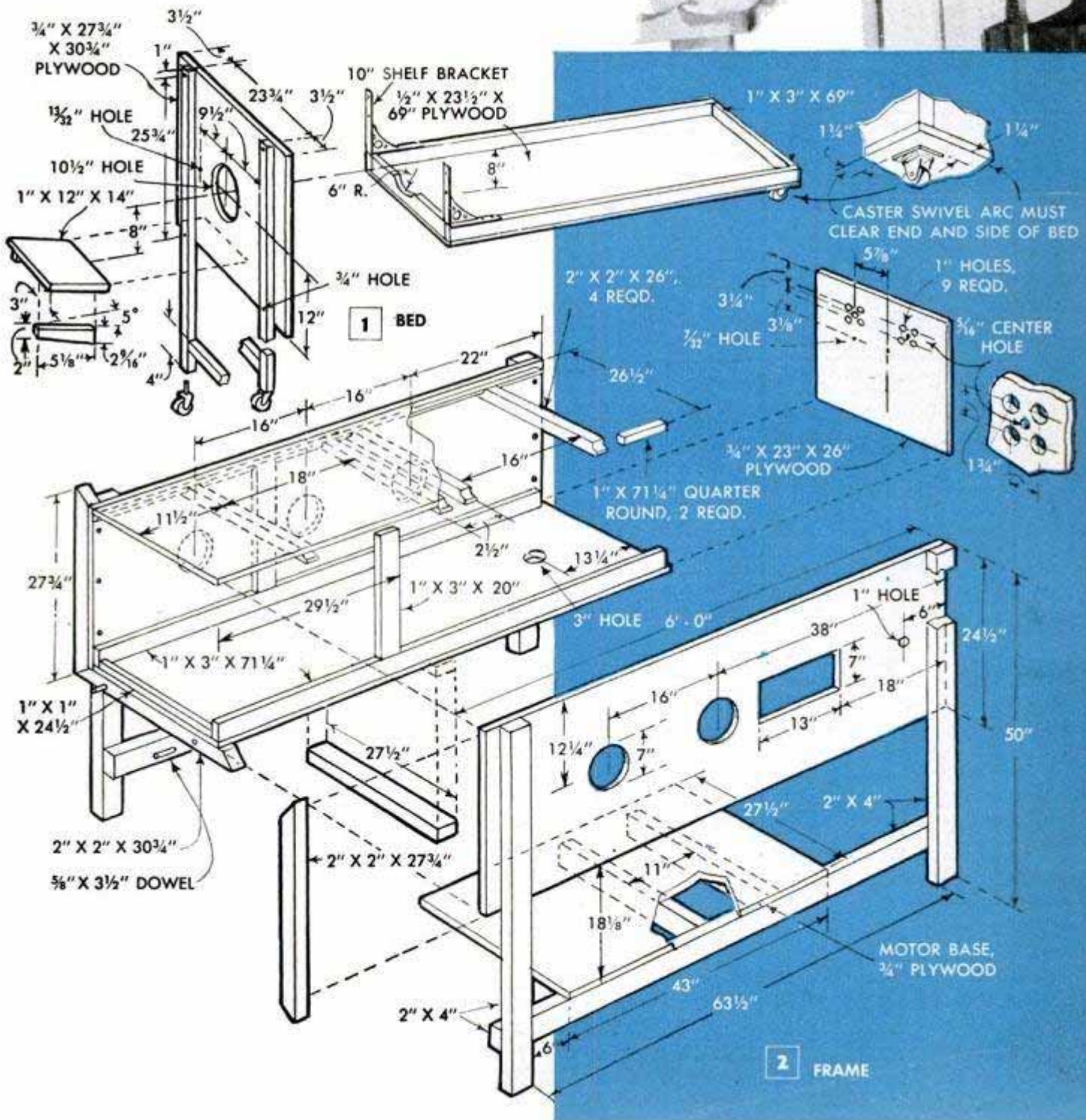
The unit, detailed on the following pages, has been approved only for emergency use under the direct supervision of a doctor or registered nurse. The motor-driven mecha-

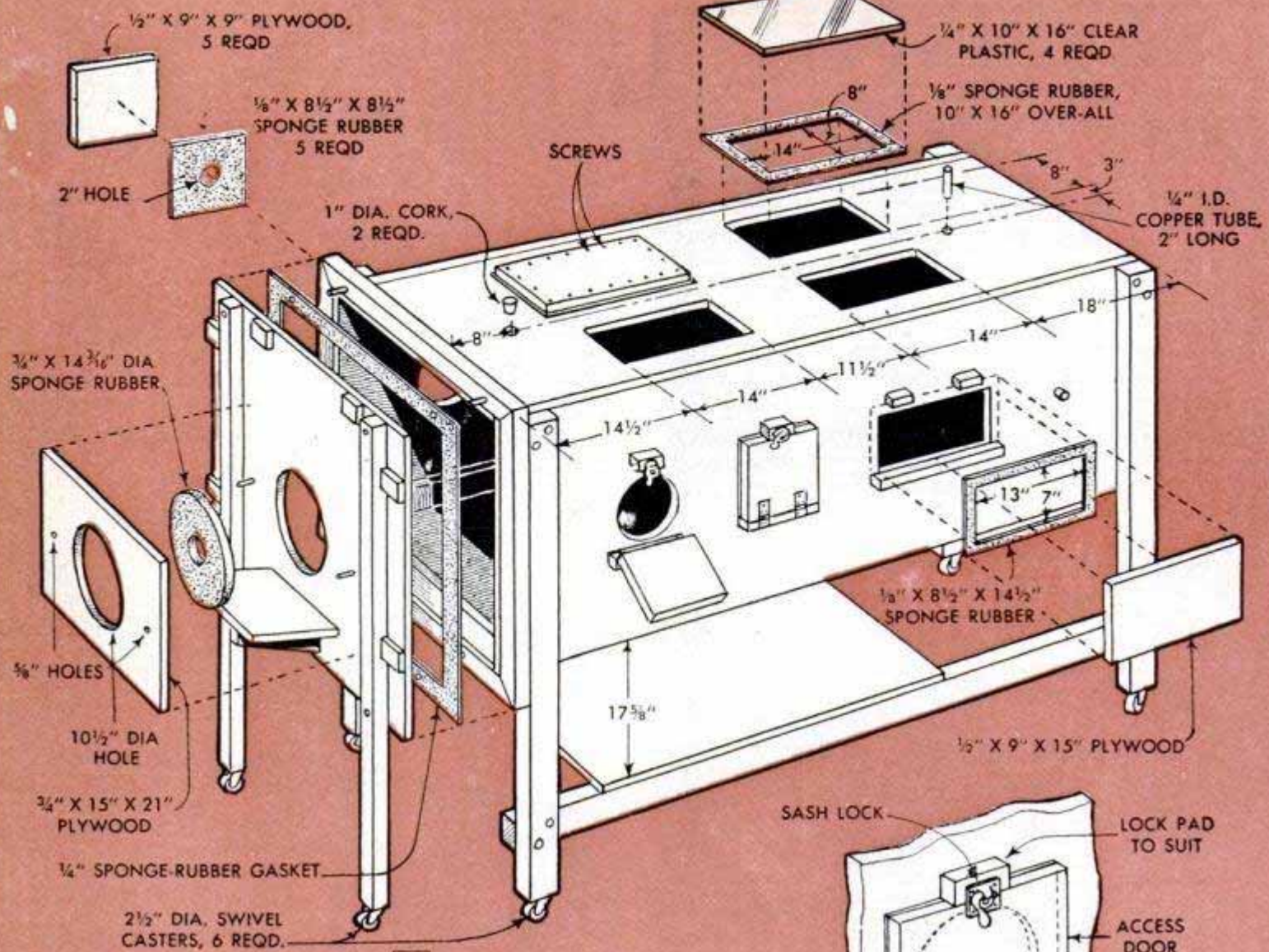
nism can be changed to hand operation in a few seconds, if necessary. As detailed, drive ratios have been arranged to give the proper diaphragm action, and a variable-speed pulley on the motor can be adjusted to give a respiratory frequency within the required range of 12 to 20 cycles per minute. The large sprocket on the final drive shaft has 26 teeth.

The cabinet and frame, Fig. 2, are of the simplest construction, all joints in the cabinet assembly being glued and screw-fastened. Note that the bed, Fig. 1, and the end panel and headrest are joined to form one unit which rolls on swivel casters. When the bed is in position in the cabinet, luggage clamps placed at the four corners hold the head panel, Fig. 4, and draw it

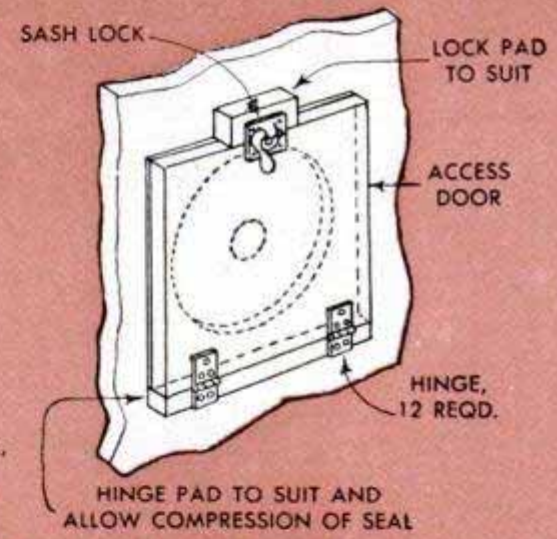
RESPIRATOR

tightly against the gasket. Note that all openings into the cabinet, Fig. 3, are fitted with gaskets and that the access doors are fitted with ordinary sash locks, which exert sufficient pressure on the gaskets to assure an airtight seal when the doors are closed and locked. The top openings into the cabinet are closed with clear-plastic panels screwed over sponge-rubber gaskets. Note that the clamp which holds the sponge-rubber head gasket in place is drilled to slip over two bolts in the head panel and is locked with wing nuts. Although the photo on page 262 shows two hanger bolts located above the wing nuts, two additional

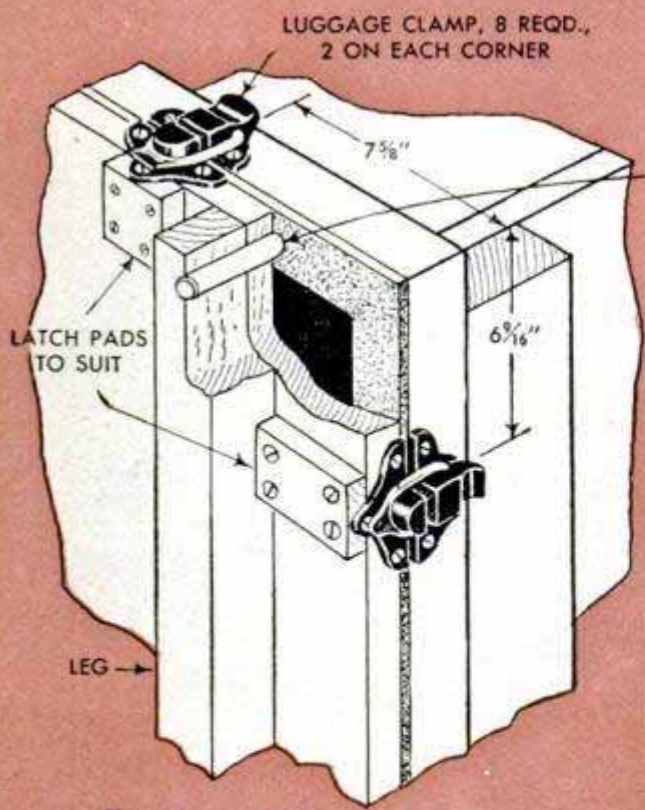




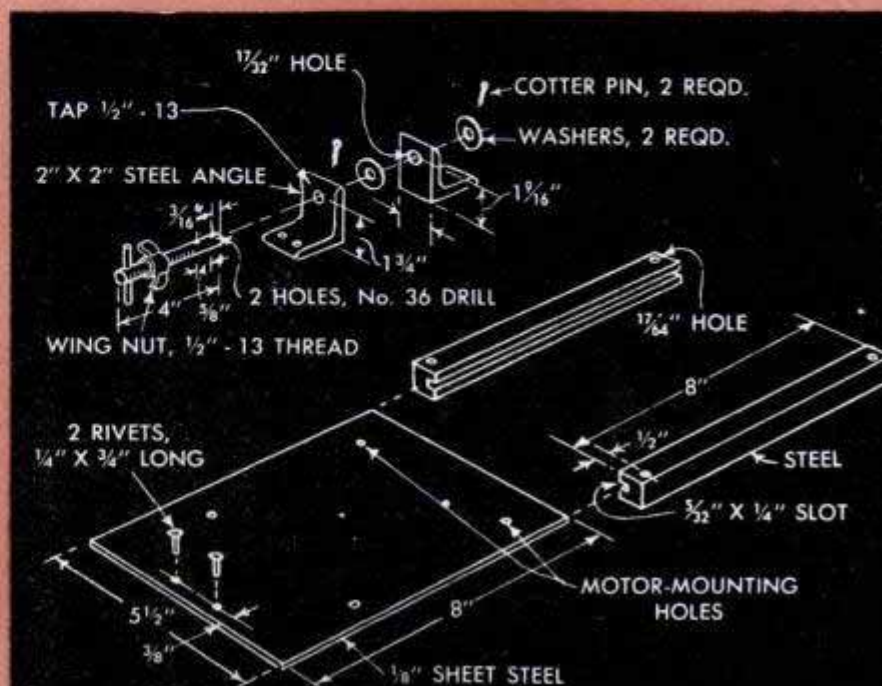
3 CABINET ASSEMBLY

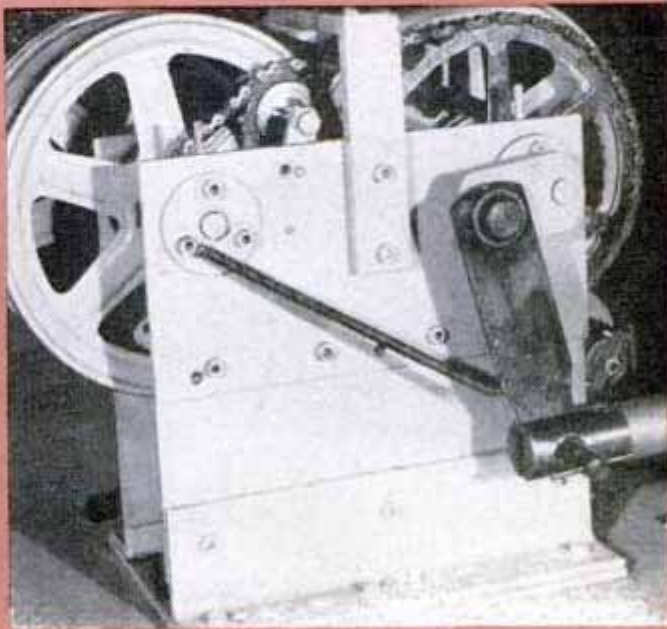
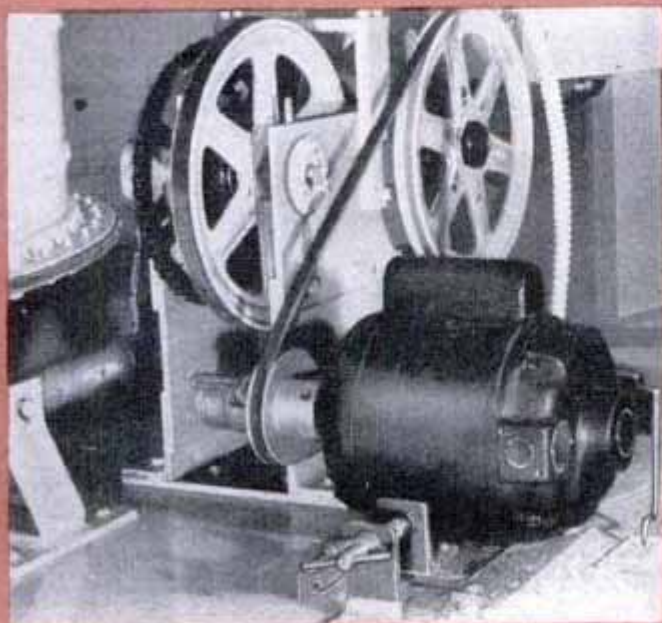
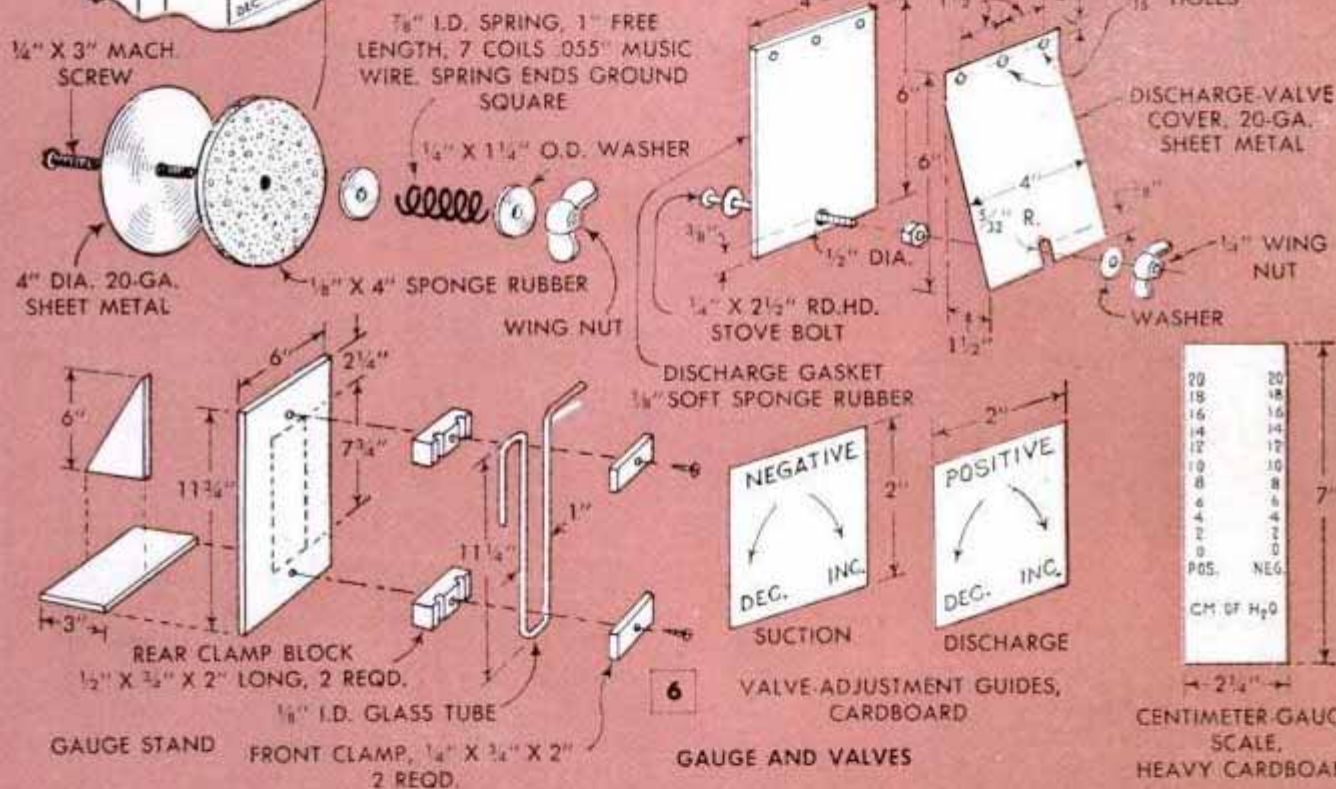
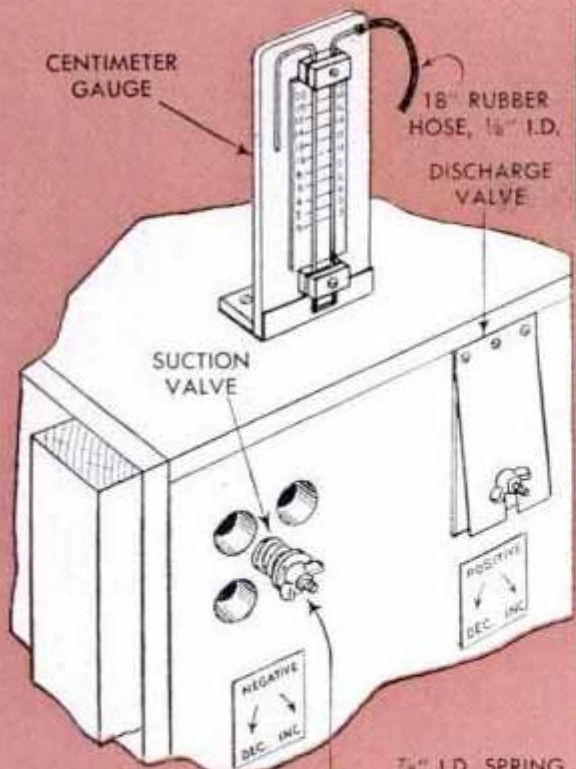


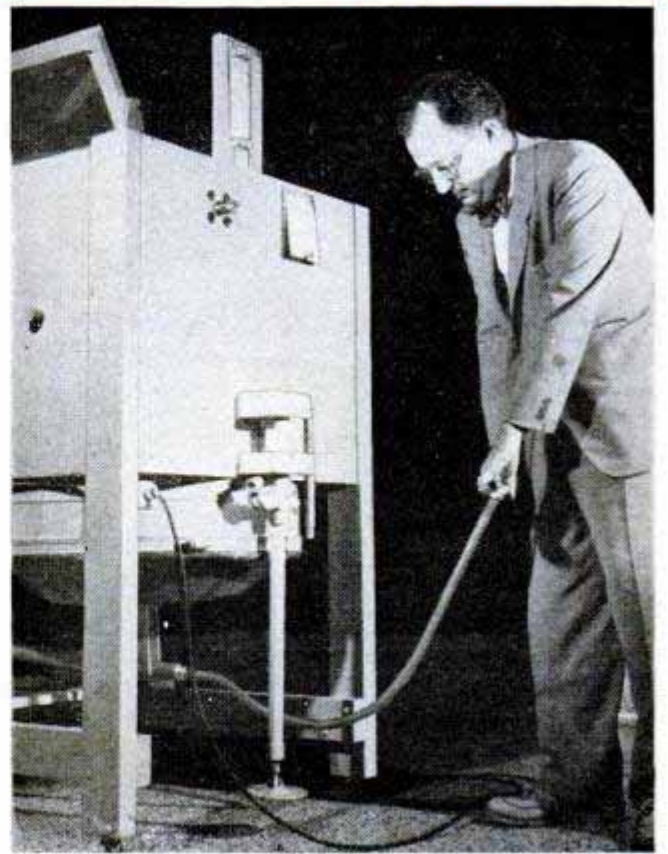
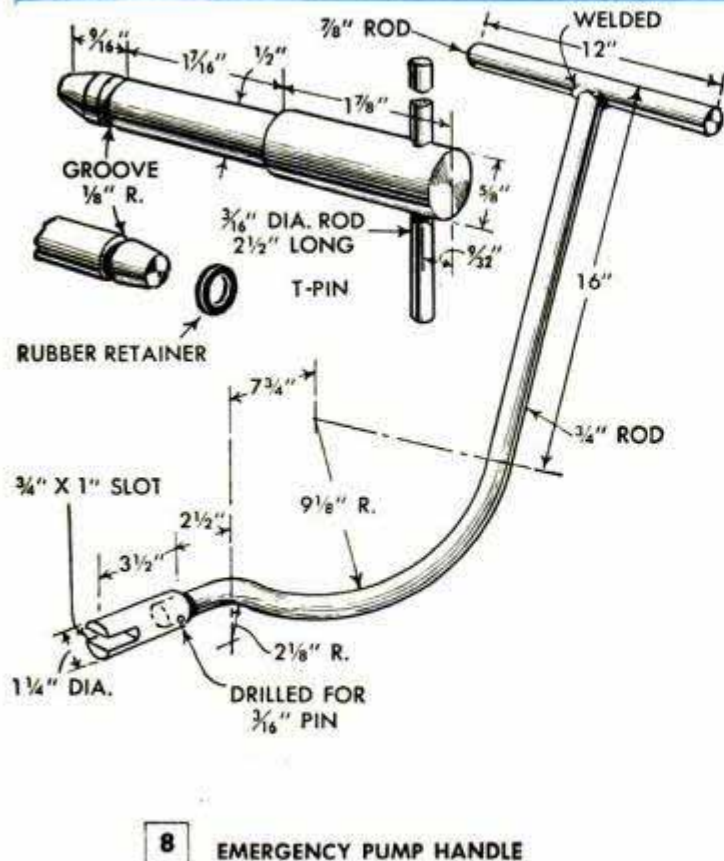
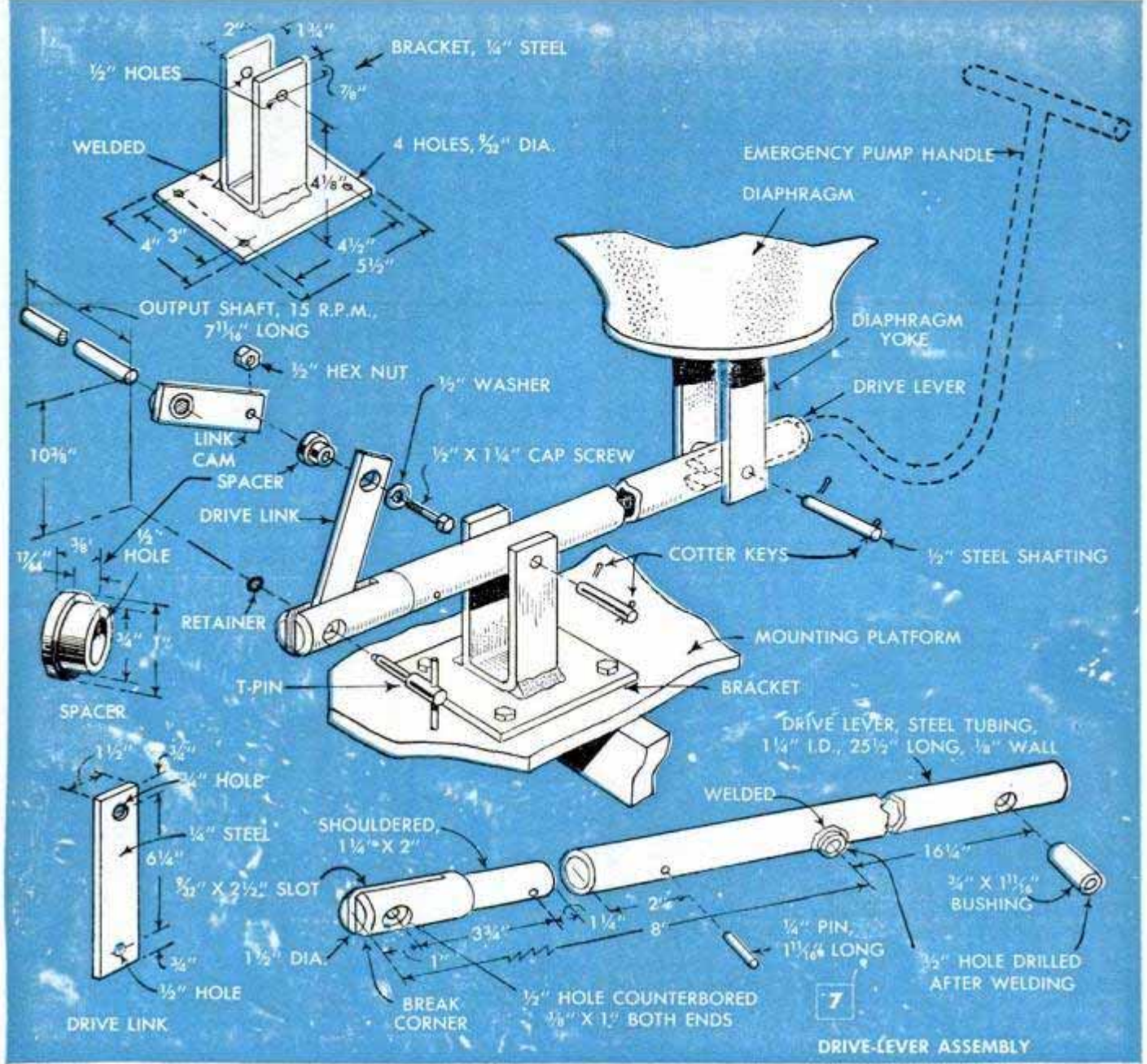
ACCESS DOORS AND SEALS CENTERED OVER ACCESS HOLES



4 BED AND CABINET-LOCK DETAIL







Patches Around Car-Door Handles Improve Appearance of Interior



You can "tone up" the appearance of your car interior and at the same time reinforce the upholstery around the handles of the doors by applying neat patches of artificial leather or plastic material. To do the job, remove the handles and cut holes for the handle shafts

in the patches. Then apply each patch with quick-drying cement, placing the upper edge under the window molding.

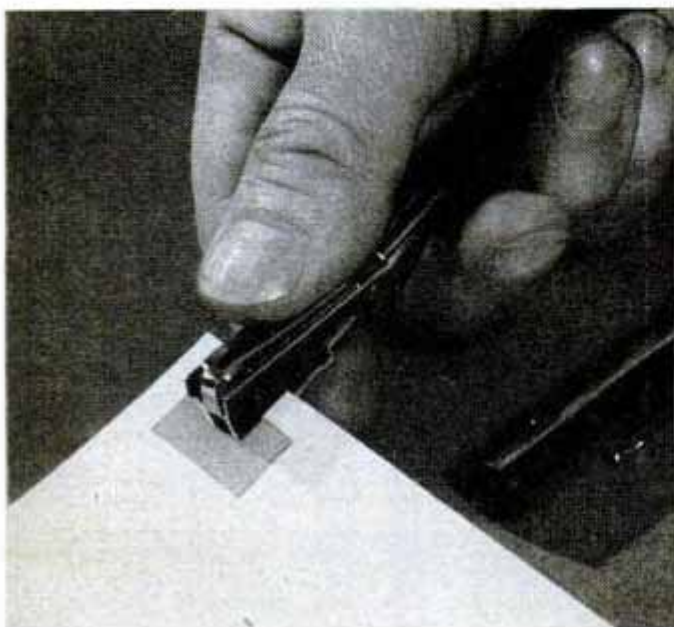
Waterproofing Leather Footwear

To keep your feet dry in rainy or snowy weather, and also to preserve the leather of your boots or shoes, rub them periodically with a solution consisting of pine tar, 2 oz. and cod-liver oil, 3 oz. Heat the two ingredients together over a low flame, and while the mixture is still hot, thoroughly rub it into the tops of the leather footwear.

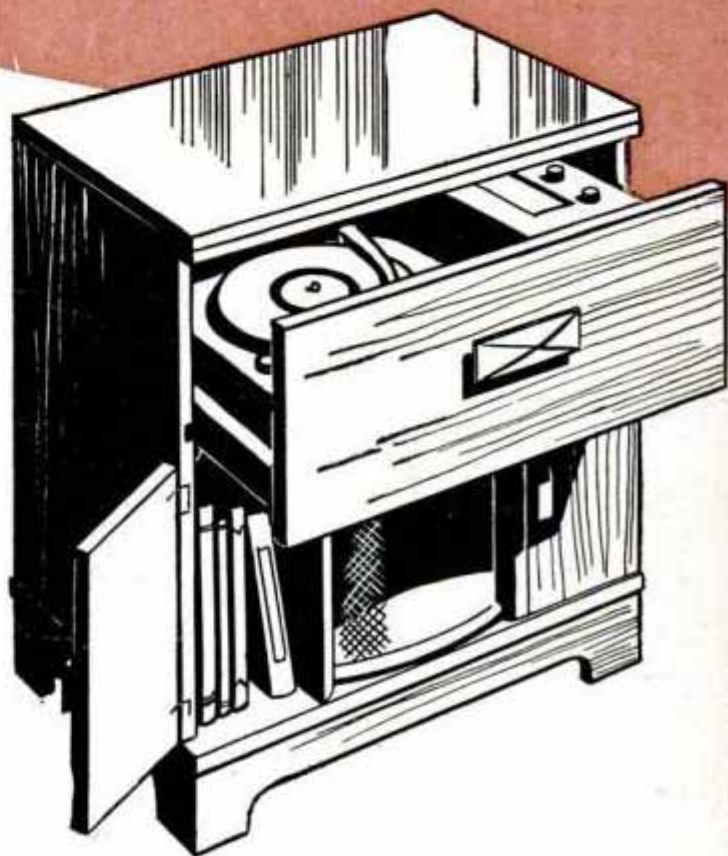
R. A. Jenkins, St. Louis, Mo.

Stapled Areas on Papers Reinforced With Tape

When stapling together two or more papers that will be handled often, the area of paper around each staple can be reinforced with cellulose tape. Just stick a small piece of tape on the front and back of the group of papers and drive the staple through both pieces of tape.

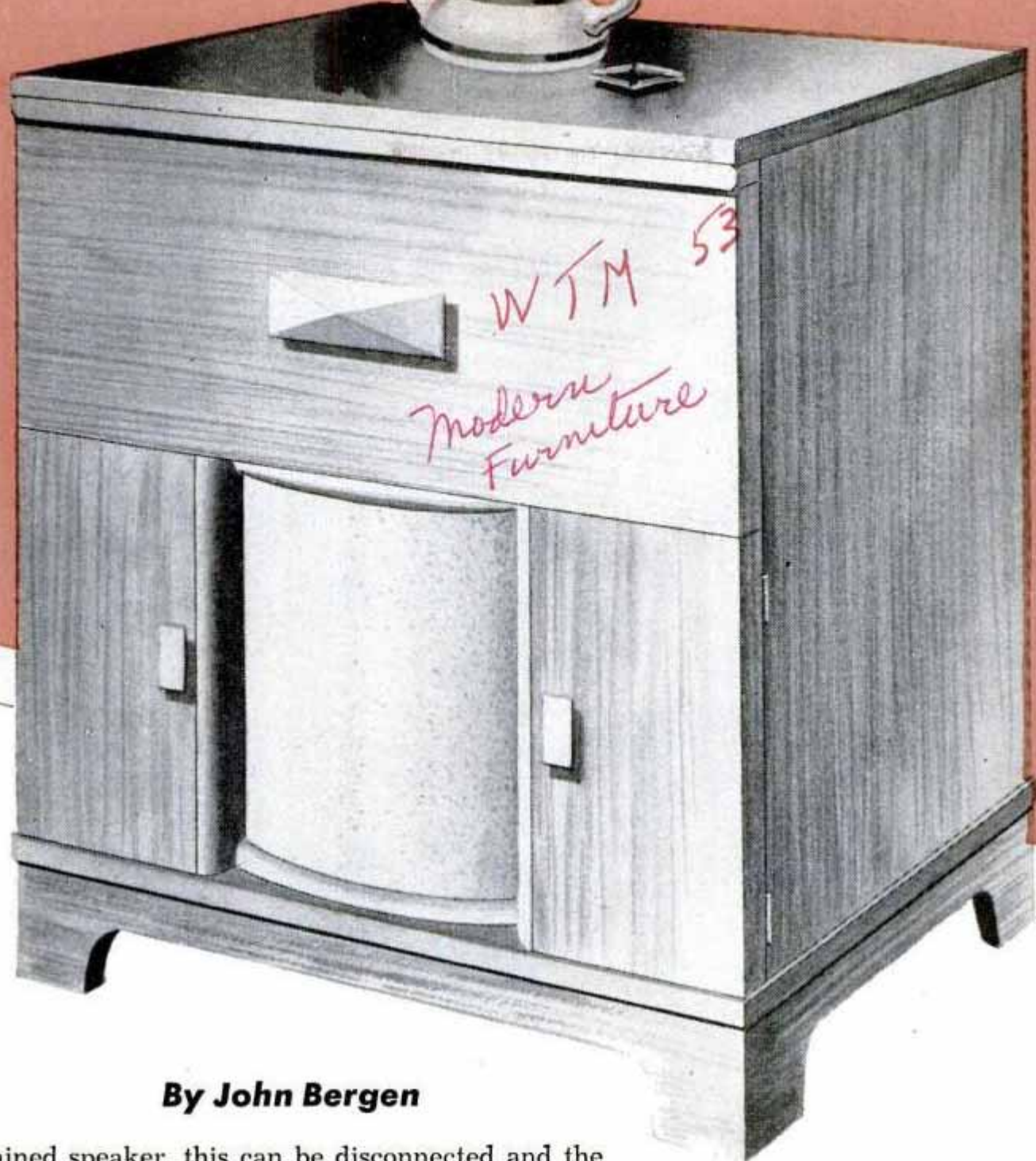


RADIO-PHONO COMBINATION



Group your present table-model TV set, radio and record player in this striking cabinet and you will have a combination unit equivalent to one costing several hundred dollars. Has swivel top for best TV viewing and storage for record albums

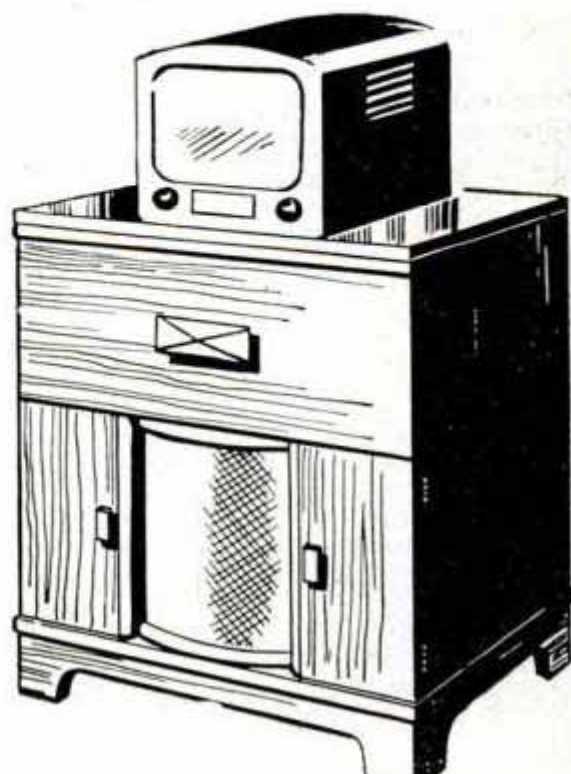
DESIGNED to serve as a base for a table-model television set, this cabinet has a top that pivots on a ball-bearing swivel so the TV set can be swung to the best viewing position with the touch of a finger tip. It includes a smoothly operating drawer, which houses your small radio or its chassis and a record player, a baffle for a large speaker, and two record-album compartments. The radio speaker may be mounted on the baffle board of the cabinet for better reproduction and used for both the radio and record player. Should your record player be of the type having a self-con-

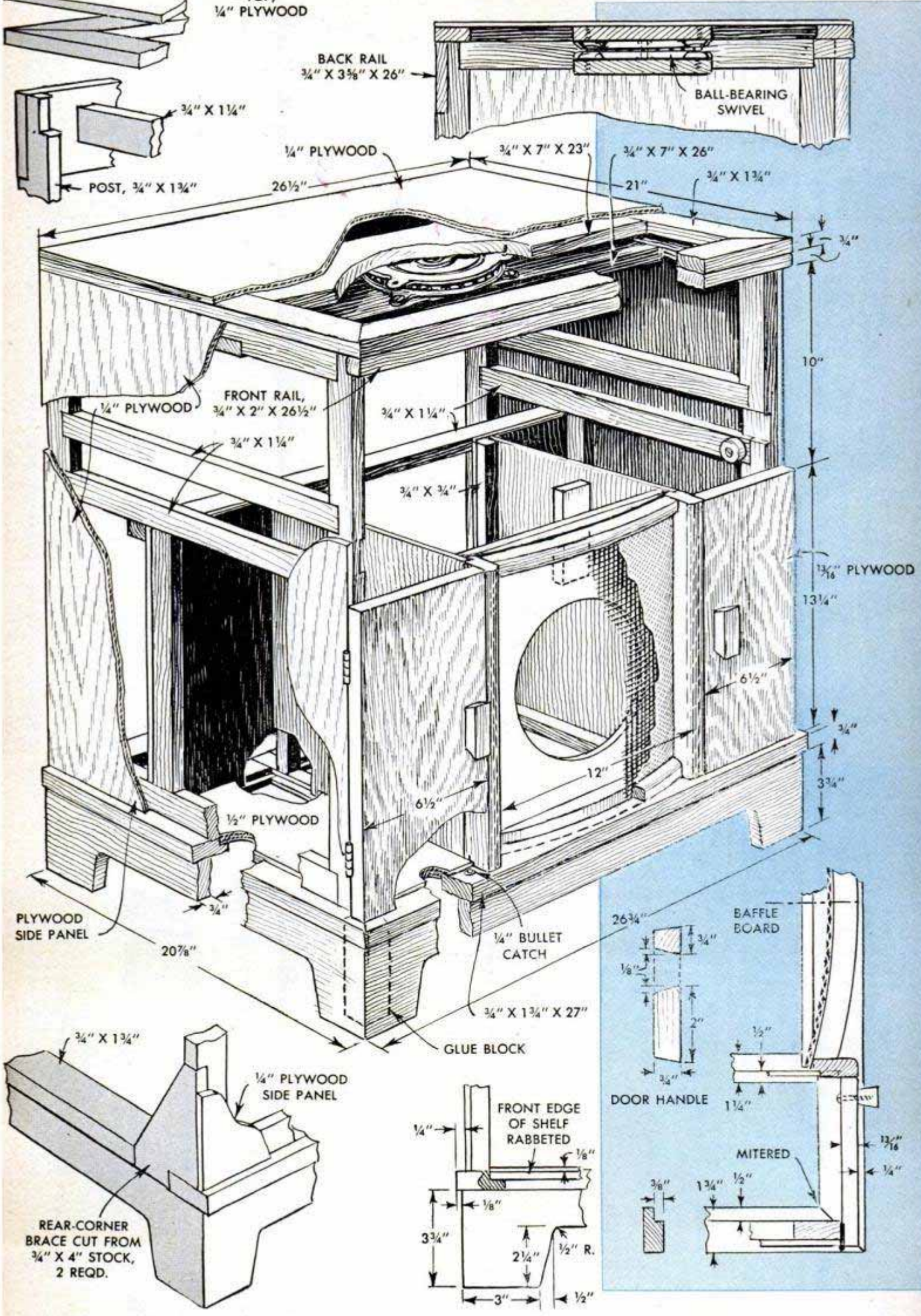


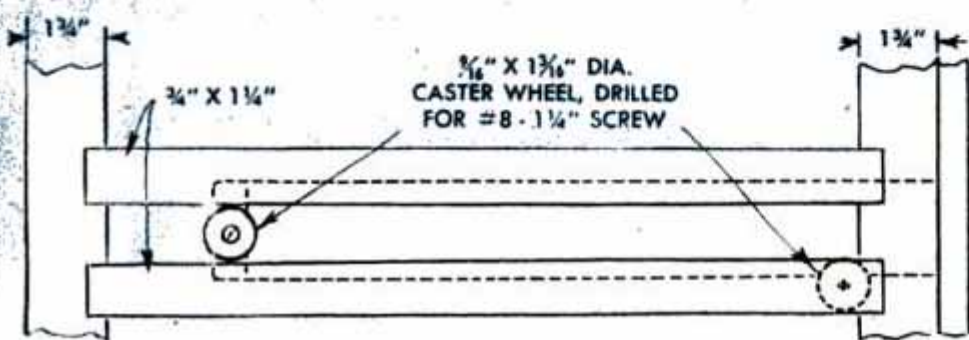
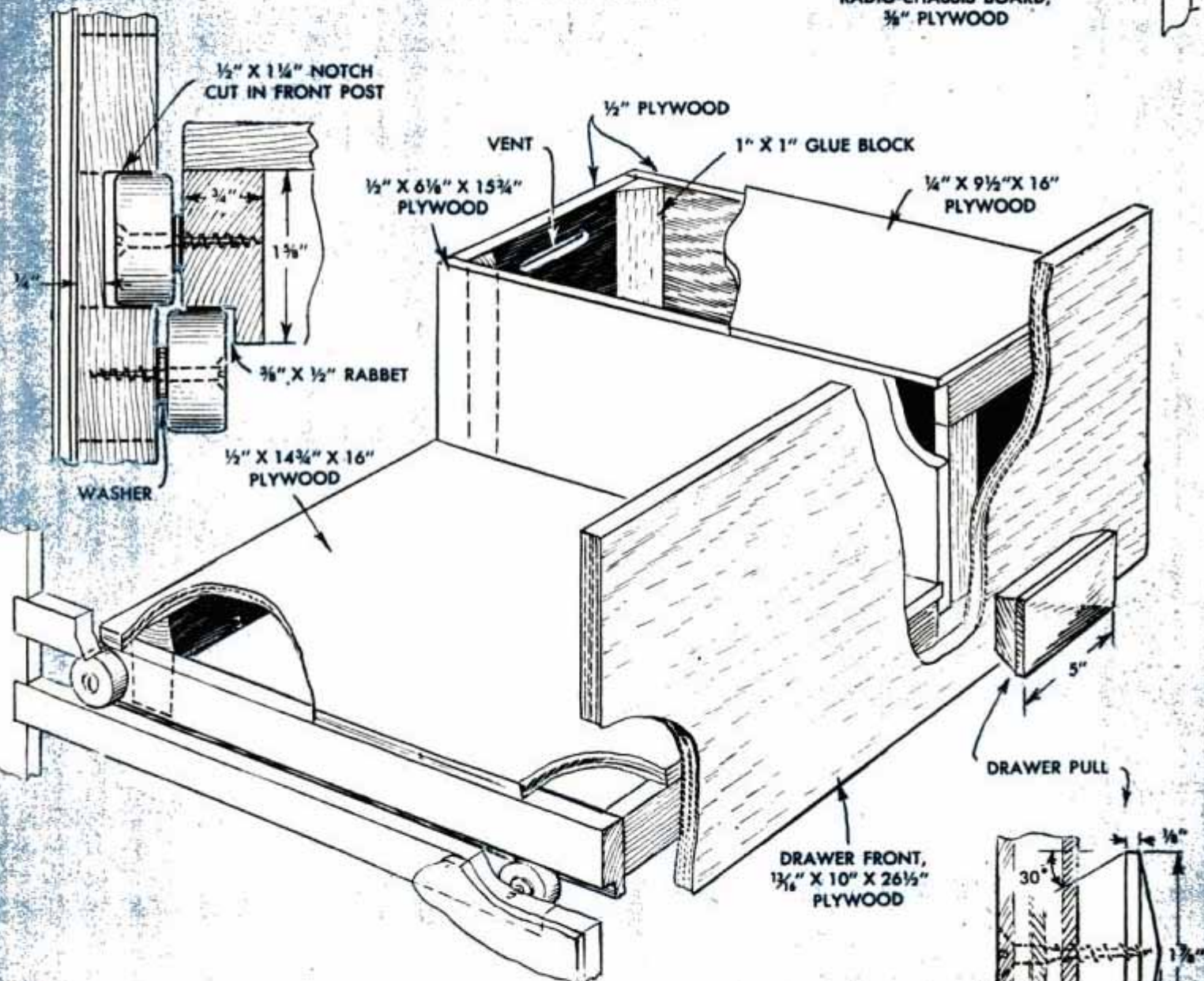
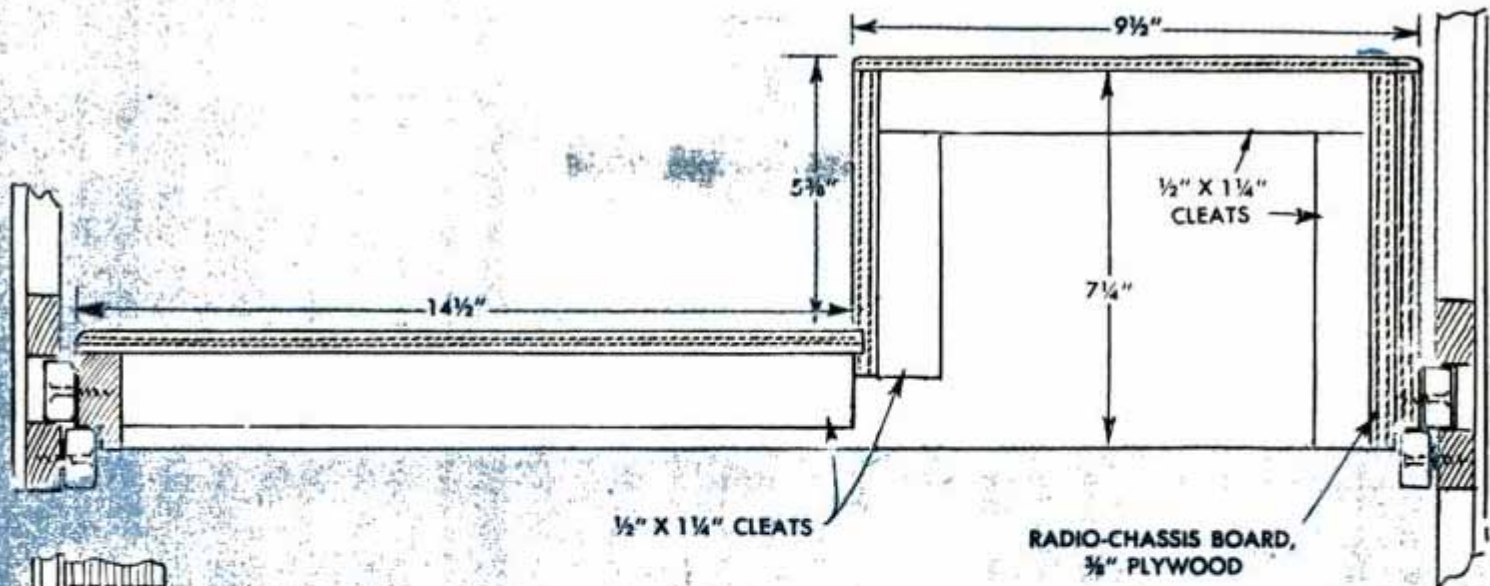
By John Bergen

tained speaker, this can be disconnected and the lead wires run to the radio speaker. However, a switch must be installed in the lead wires from the record player. If desired, you can purchase a single larger speaker and use it for the entire combination. Your TV-radio serviceman will install it for a few dollars.

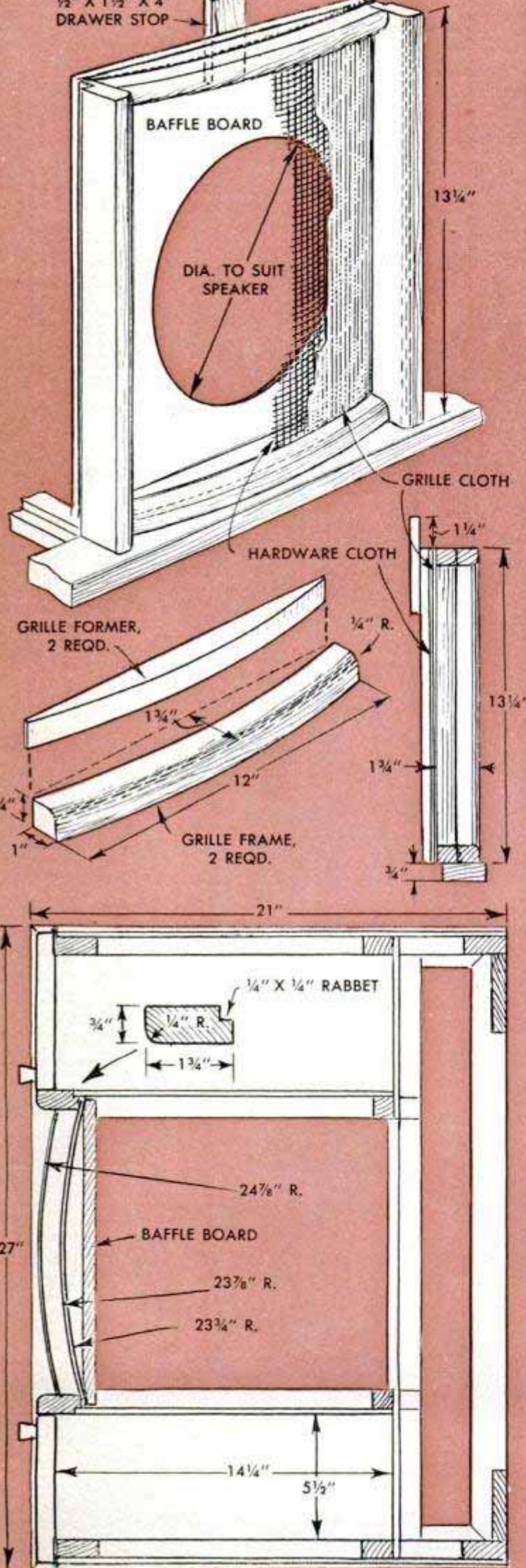
As the cabinet is likely to be the outstanding piece of furniture in your living room, its finish is very important. If oak, walnut or other cabinet woods are used for the exposed rails, and plywood faced with the same veneer for the doors, panels and drawer front, your choice of the many popular finishes can be applied. However, if you wish to hold the material cost to a minimum, the cabinet can be built of less-expensive birch, poplar or gum in both solid stock and plywood, covering all the visible surfaces with wood-grain plastic veneer. When finishing in this way, additional savings may be had by utilizing $\frac{1}{4}$ -in. hardboard for the swivel top and side panels. Application of plastic veneer was fully described in the January







1/2" x 1 1/2" x 4"



1951 issue of *Popular Mechanics Magazine*.
 Should you wish to build the radio-phonograph combination and use it for a time without a TV set, be sure to weight the back of the cabinet, as otherwise pulling out the radio-phono drawer is likely to cause the entire cabinet to tip forward. Of course, this does not have to be done when the TV set is in place on the swivel top, as the cabinet was designed so that the weight of the set would counterbalance the weight of the open drawer. But, keep this in mind if the TV should be sent out for repairs.

Construction of the cabinet and the phono-radio drawer and installation of the swivel top and caster guides is apparent from the details. Note that the upper guide rails hold the drawer in a level position when extended, and that a vertical stop is screwed to the baffle board after the drawer is installed. The plywood record-changer base is drilled to suit the particular changer and the top panel of the radio compartment is drilled and cut out to take the radio dial and knobs. The radio chassis is mounted on a plywood chassis board, which is bolted to the side panel of the drawer. Flat-headed stove bolts are set permanently in the side panel, and the chassis board is drilled so it can be slipped over the bolts.

MATERIAL YOU WILL NEED

Plywood

- 1 pc. 1/4" x 21" x 26 1/2" — top
- 2 pcs. 1/4" x 20" x 24" — sides
- 1 pc. 1/4" x 9 1/2" x 16" — dial panel
- 2 pcs. 1/4" x 13 1/4" x 13 3/4" — album-comp. sides
- 2 pcs. 1/4" x 7 1/4" x 13 3/4" — album-comp. backs
- 2 pcs. 1/2" x 5 1/2" x 14 1/4" — album-comp. bottoms
- 1 pc. 1/2" x 6 7/8" x 16" — drawer side
- 1 pc. 1/2" x 7 1/4" x 22 3/4" — drawer back
- 1 pc. 1/2" x 6 1/8" x 15 3/4" — drawer partition
- 2 pcs. 1 3/16" x 6 1/2" x 13 1/4" — doors
- 1 pc. 1 3/16" x 10" x 26 1/2" — drawer front
- 1 pc. 1/2" x 14 3/4" x 16" — phonograph board
- *1 pc. 3/8" x 7 1/4" x 14" — radio-chassis board
- *1 pc. 1/2" x 12 3/4" x 13 1/4" — baffle board

* Fir Plywood Suitable

Lumber

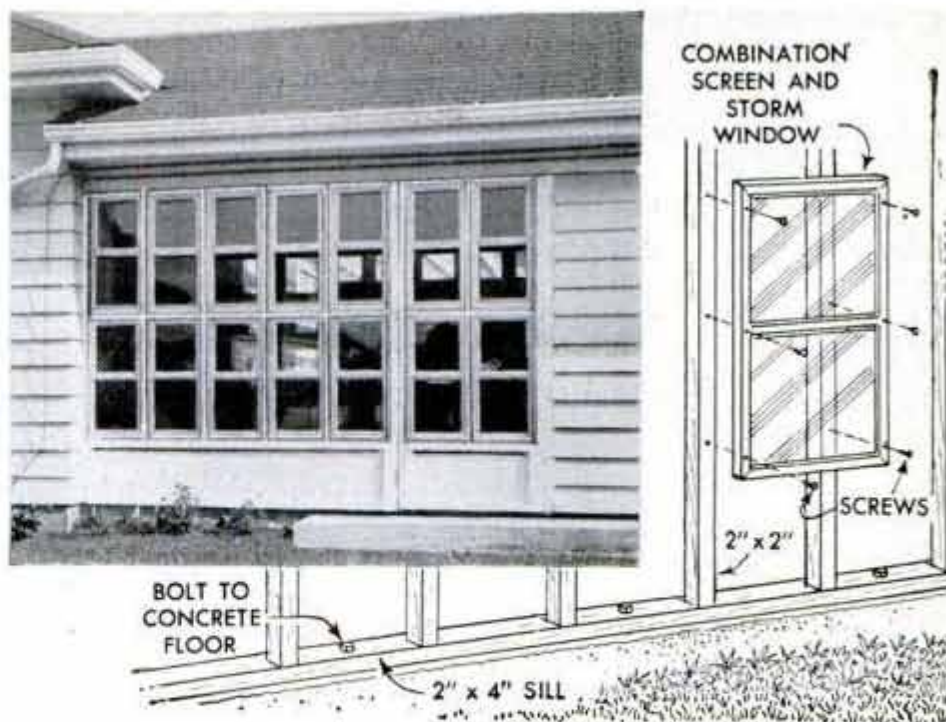
- 2 pcs. 3/4" x 3 3/4" x 26 3/4" — front and back base
- 2 pcs. 3/4" x 3 3/4" x 20 7/8" — side base
- 2 pcs. 3/4" x 1 3/4" x 27" — base rails
- 2 pcs. 3/4" x 1 3/4" x 21 1/8" — side base rails
- 1 pc. 3/4" x 1 3/4" x 26 1/2" — front rail
- 2 pcs. 3/4" x 1 3/4" x 26 1/2" — top frame
- 2 pcs. 3/4" x 1 3/4" x 21" — top side frame
- 4 pcs. 3/4" x 1 3/4" x 24" — posts
- 8 pcs. 3/4" x 1 1/4" x 18" — side rails
- 1 pc. 3/4" x 3 5/8" x 26" — back rail
- 2 pcs. 3/4" x 1 1/4" x 26" — album-comp. back rails
- 2 pcs. 3/4" x 1 1/4" x 11 1/2" — album side rails
- 2 pcs. 3/4" x 3/4" x 13 1/4" — album corner braces
- 2 pcs. 3/4" x 1 3/4" x 13 1/4" — grille side posts
- 2 pcs. 3/4" x 1 3/4" x 12" — grille frame
- 1 pc. 3/4" x 7" x 23" — swivel-top brace
- 1 pc. 3/4" x 7" x 26" — swivel-top mount
- 1 pc. 3/4" x 1 7/8" x 5" — drawer pull
- 2 pcs. 3/4" x 3/4" x 2" — door handles
- 1 pc. 1/2" x 1 1/2" x 4" — drawer stop

Miscellaneous

- 4 1 1/2" x 1 1/2" butt hinges
- 2 1/4" bullet catches
- 4 casters
- 1 pc. grille cloth
- 1 pc. hardware cloth, 1/4" mesh
- 1 ball-bearing swivel

Purchased from a secondhand shop at exceptionally low cost, sample combination sash were used to enclose this year-round breezeway. The sample sash, designed for counter displays and salesmen's presentations, function exactly like full-sized combination screen and storm sash. This provides a well-ventilated breezeway for the summer and a tightly sealed room for winter living. Note in the detail that the sash are screwed directly to 2 x 2-in. studs spaced to suit the width of the sash. Plywood is used to cover the face of the studs at the bottom of the enclosure, after which the plywood is framed with 1 x 2-in. material. A door made by glazing a frame of 2 x 2-in. stock with four of the sample sash completes the enclosure. If desired, a

Sample Combination Sash Enclose Breezeway To Form Comfortable Room the Year 'Round

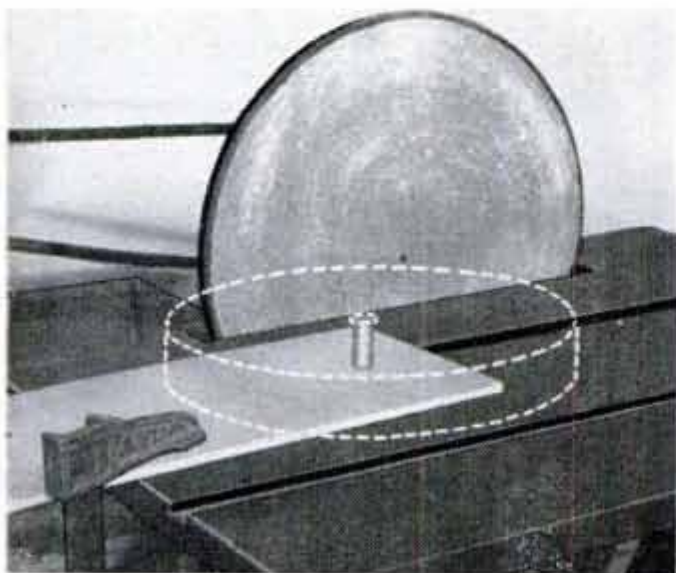


stock combination storm door can be used, and the interior of the breezeway finished in panel board or knotty pine.

Wheels Made on Disk Sander

Needing a couple of thick, wooden wheels for a piece of lawn furniture, but not having a bandsaw in his shop to cut them, one home craftsman made this jig and "turned" the wheels on his disk sander. The jig is simply a 1/4-in.-plywood base drilled near one end to take a short dowel. Each wheel is roughed out and drilled at the center to fit over the dowel. Then the jig is clamped loosely to the sander table, and the wheel held against the sander until it has been cut to the desired diameter at one spot. The jig is clamped in this position and the work is rotated on the pin.

Harry Truchelut, Atlanta, Ga.



House Cut in Half for Moving Provides Two Separate Homes

One homeowner, who found it necessary to move his two-story house from its original location, decided to separate the first from the second floor and move the two floors individually. This allowed plenty of clearance for overhead utility lines, and each floor was then utilized as a separate dwelling. To do this, the entire house was first placed on moving dollies. Then the upper floor was separated from the lower one and jacked up with timbers which were supported by cribs built at each side of the house. After the lower floor was pulled from under the upper one, the second floor was gradually lowered onto dollies and moved in the same way as the first floor.

Evans W. Buskett, Joplin, Mo.



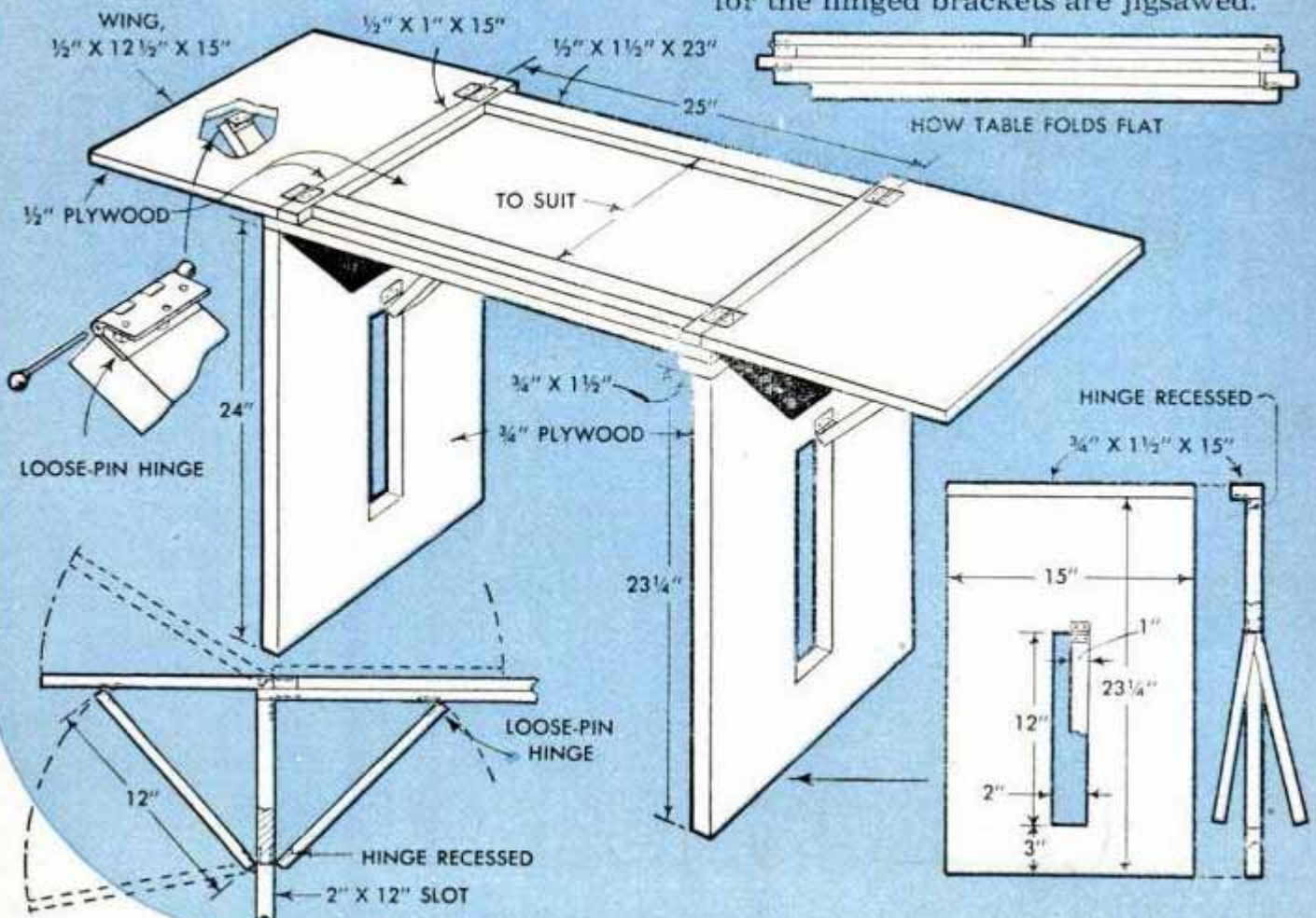
FOLDING STAND FOR PORTABLE

By Elma Waltner

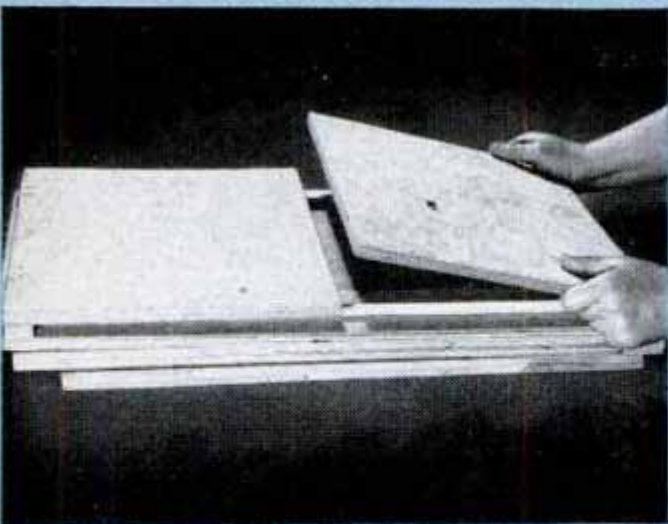


MOST OWNERS of portable electric ironers find that the average kitchen table is too high to permit operating the machine from a comfortable sitting position. But, for lack of space to store a separate table of the right height, the housewife generally puts up with this inconvenience. However, the problem of comfort and storage is solved nicely with this rigid little plywood stand. Its height of approximately 24 in. is just right for the average machine and, being collapsible, the stand folds flat for storing in a minimum of space. Compactness when folded is made possible by the manner in which the support brackets fold flush within the thickness of the plywood legs. This is accomplished by recessing the hinges at the points indicated and by using loose-pin hinges to lock the legs and table wings in position.

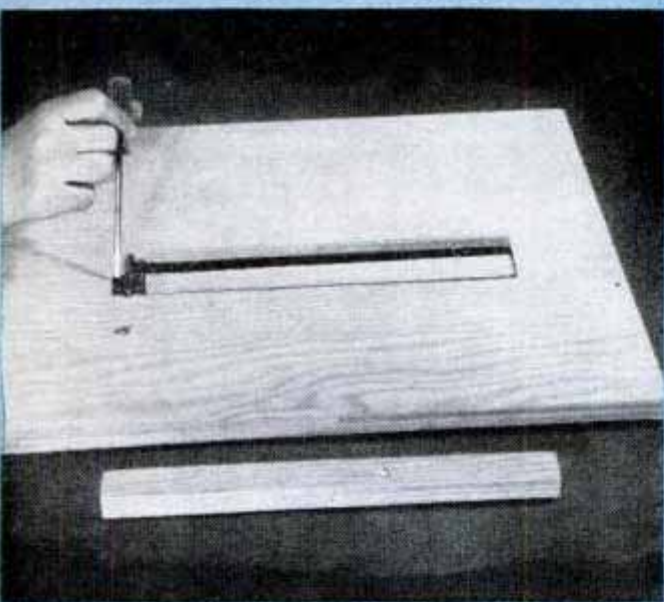
Assembly of the stand is apparent from the details given below. Placement of the strips which form a recess for the ironer is determined by the particular model at hand. Openings for the hinged brackets are jigsawed.



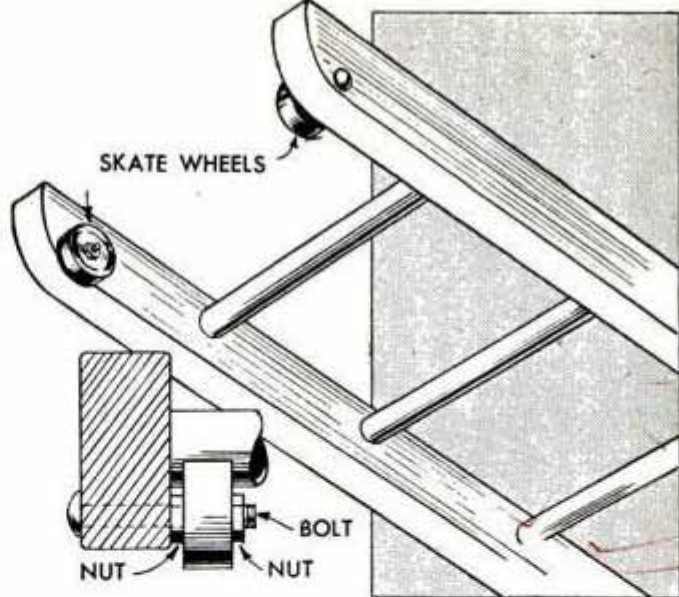
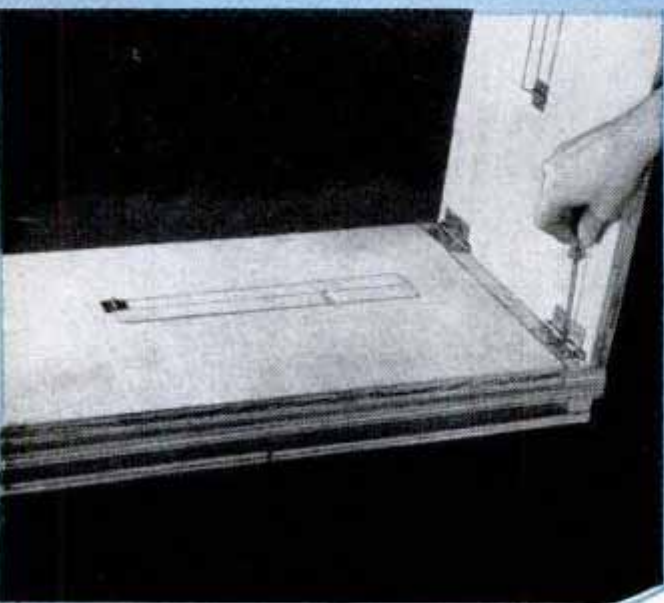
IRONER



The wings fold down over the top, while the legs fold up against underside of the stand. Folded unit takes only 4 x 15 x 20-in. space

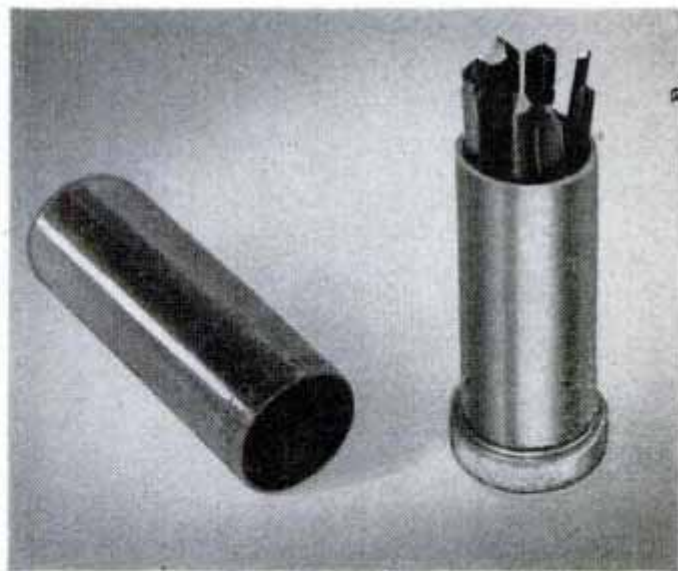


Above, the pair of brackets in each opening is hinged to swing in opposite directions. Below, the hinges which pivot the legs to the top are recessed flush for folding legs flat



Skate Wheels on Extension Ladder Make It Easier to Raise

Difficulty often experienced in raising long extension ladders singlehanded against a house was overcome by one painter who fitted skate wheels to the upper ends of the ladder rails. The wheels reduced friction between the ladder and the side of the house and also minimized marring of the siding. The under corners of the ladder rails were rounded and the wheels, which are attached with bolts, are located to project beyond the edge of the ladder rail.

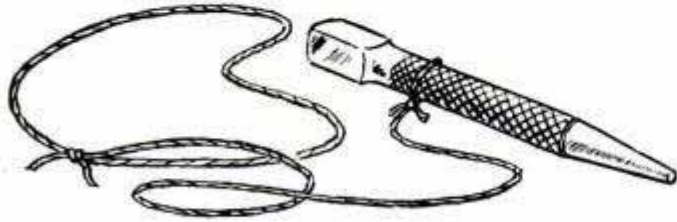


Small Drills Stored In Lipstick Tube

You will find a large lipstick container ideal for storing small drill points such as those used with push drills. A wad of cotton, dampened with light oil and pressed into the bottom of the container, will help keep the drills from rusting.

☞ The metal "saw edge" from an empty wax-paper box, when broken to the desired length, makes a fine cutter for cheese.

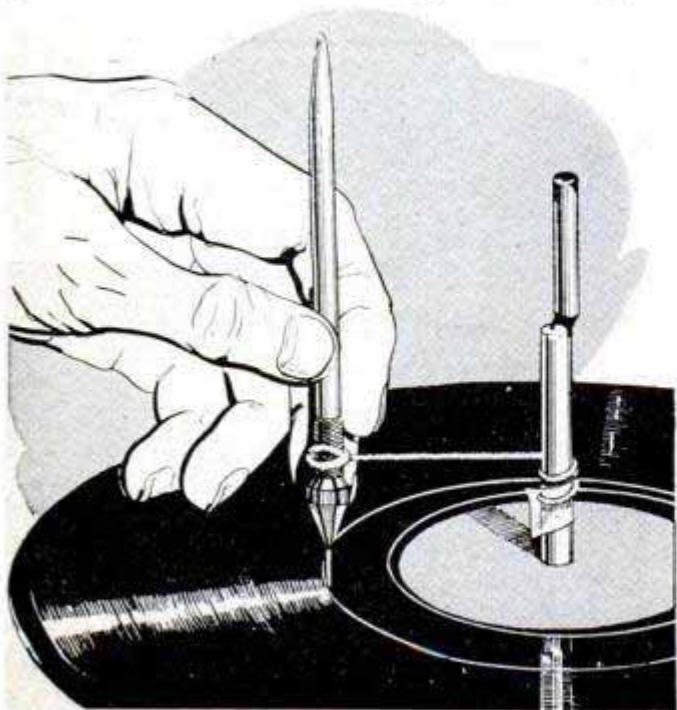
Nailset Tied to Wrist Is Always at Hand



On jobs requiring frequent use of a nailset, considerable time can be saved by tying the set to your wrist. This eliminates the possibility of misplacing the set and the necessity of fumbling through your pocket or going to the tool kit each time the tool is needed.

Trip Grooves Hand-Cut in Records Permit Playing on Changer

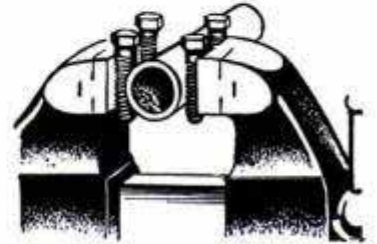
To permit home recordings and many old-time records to be played on an automatic record changer, here's a method for hand-cutting the eccentric and run-in grooves required to trip the changer mechanism. Using a pair of dividers, or a compass fitted with a phonograph needle, the eccentric groove is cut first. The legs are set $1\frac{5}{8}$ in.



apart. Then one leg is set at the edge of the center hole in the record and the eccentric groove cut by scribing a circle, going over it several times to make the groove deep enough. The spiral or lead-in groove is cut with a scriber and a length of string, the latter being taped to the center post of the player and tied to the scriber. Starting at the end of the last playing groove and keeping the string taut, the spiral is cut by wrapping the string around the post. In this way, the spiral groove is drawn inward gradually until it runs into the eccentric groove.—Ken Murray, Colon, Mich.

Stud Bolts Provide "Pipe Jaws" For Bench Vise

When a pipe vise is not available, a bench vise and four equal-diameter bolts often can be used as a substitute. Just clamp the bolts in the vise with the work, as illustrated, so that the threads of the bolts will serve as "teeth." However, if tubing is held and must be clamped very tightly, the portion gripped should be plugged to prevent crushing it.



Hugh Lineback, Stillwater, Okla.

Picket-Fence Safety Rail Prevents Animal Injury

The danger of a dog getting its neck caught between the pickets of a fence can be eliminated by installing a safety rail on the fence. This is simply an extra cross member nailed near the top as pictured.—Hi Sibley, Nuevo, Calif.



Fertilizer Spreader "Sands" Ice-Coated Walks

Sand can be spread uniformly and economically on ice-coated walks and driveways with a spreader of the type used to seed and fertilize lawns. Fill the hopper about half full of screened sand and set the controller to spread the sand in a thin, uniform coating. Crushed or granulated rock salt may be spread in the same way. However, on walks and driveways adjacent to lawns, it is best to use sand only, as salt will damage the grass.

Mrs. Michael Fey, New York City.

NO REST FOR YOUR FAN

By Charles P. Fitz Patrick

ARE PRESENT-DAY COSTS forcing you to put up with an inadequately heated house or apartment due to an improperly installed or outmoded heating system? If, on bitter-cold days, the rooms become uncomfortably chilly near the floors or in corners opposite the source of heat, usually it means that the heating system does not provide adequate air circulation. Whether you have a warm-air system of the gravity type, a hot-water system or simply a space heater, you will find that the small electric fans used to keep the rooms comfortable in summer will help keep them warm in winter. The photos picture four different ways of using the fans to improve air circulation when the house is heated with a hot-water or warm-air system, but there are many other ways in which the fans can be employed to even the room temperature. The right positioning of the fans to correct your particular heating problem may be found by a little experimenting. With a space heater, an oscillating fan mounted on a shelf above the heater will help circulate the warm air. If the heater must warm two or more rooms, its efficiency can be increased by installing fans over the doorways to blow warm air from the ceiling of the heated room into the adjoining rooms.

Cold-air pockets in gravity-type heating system can be eliminated by installing grille in the floor to "drop" cold air into basement. Fan at floor grille or at grille in furnace jacket helps circulate air



Fan set on warm-air register gives occupants full benefit of heated air by directing it across room at "living level." Fan pictured below speeds gravity circulation by blowing air into cold-air register



Placed on radiator, the fan in photo below serves much the same purpose as fan on warm-air register. Even though directed upward, fan keeps room temperature even by forcing warm air down from ceiling



X72



ADRIENNE JEAN All-Purpose Dinghy

Lightweight, plywood construction and easy portability make this trim, seaworthy boat ideal for the hunter or fisherman who desires a boat that can be carried on top of his car

ANYONE—even the most inexperienced craftsman—can build this lightweight dinghy at small cost. It takes relatively little storage space and can be loaded on a car singlehanded. If you are not interested in a boat for hunting or fishing, but like to take your family on week-end trips to a lake or river, this boat will add to your pleas-

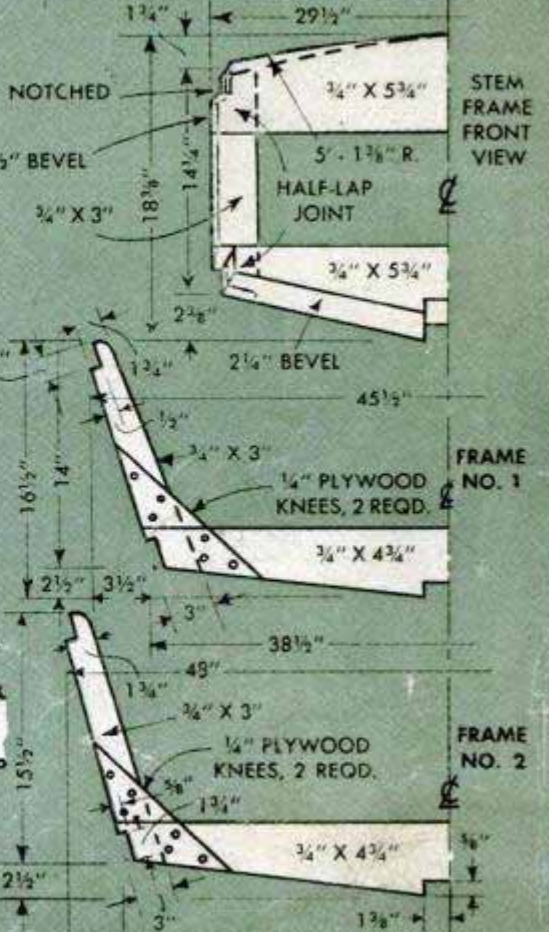
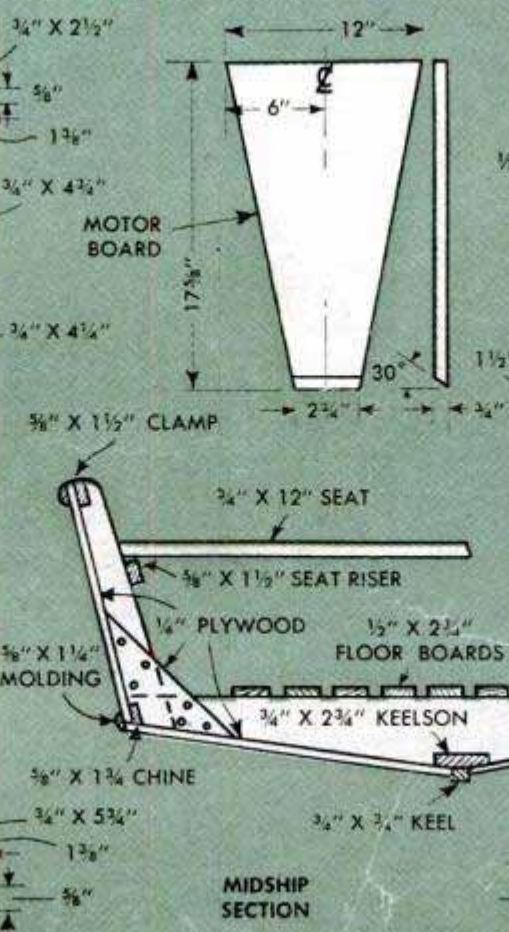
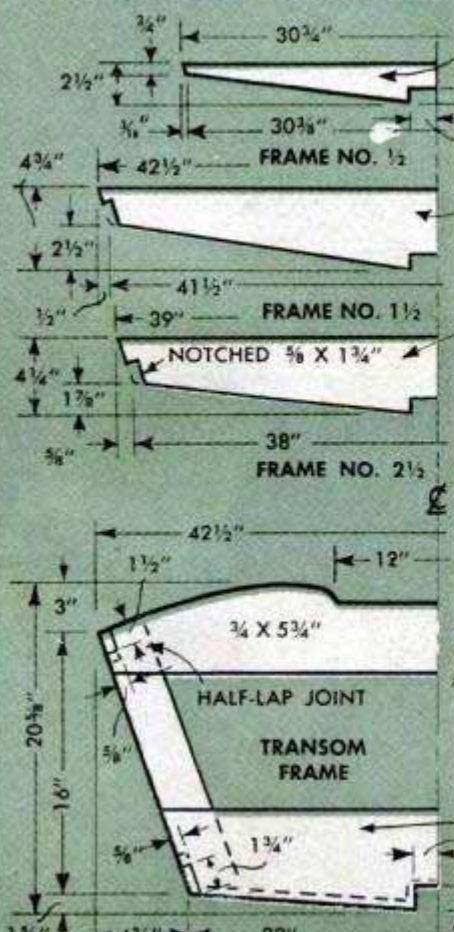
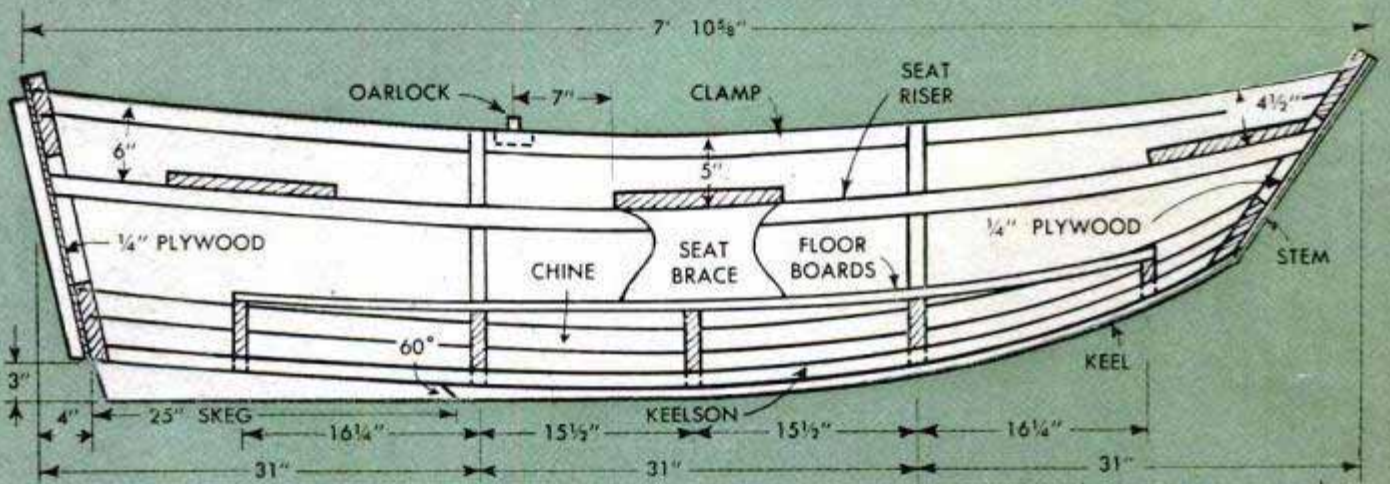
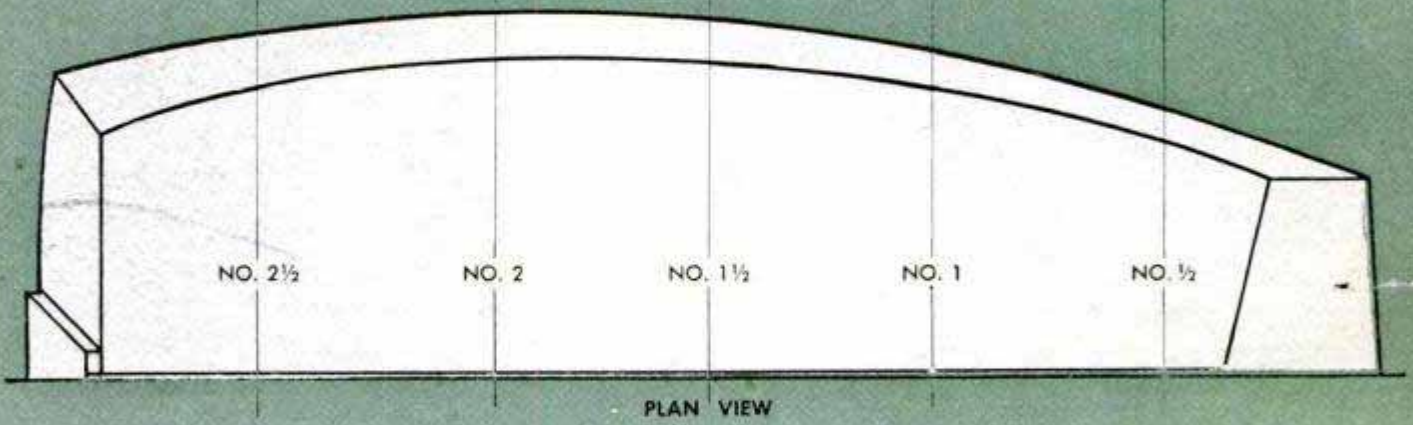
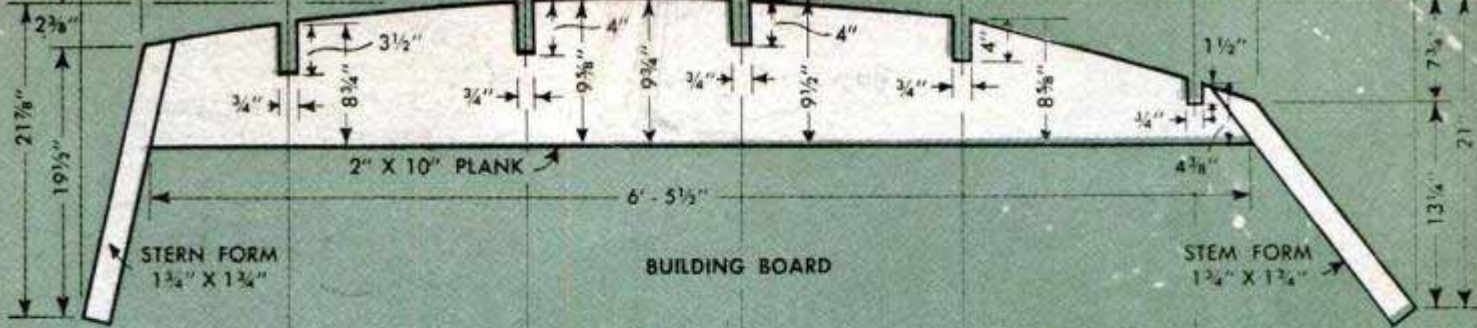
ure. Just load the family in the car, put the boat on top and take off.

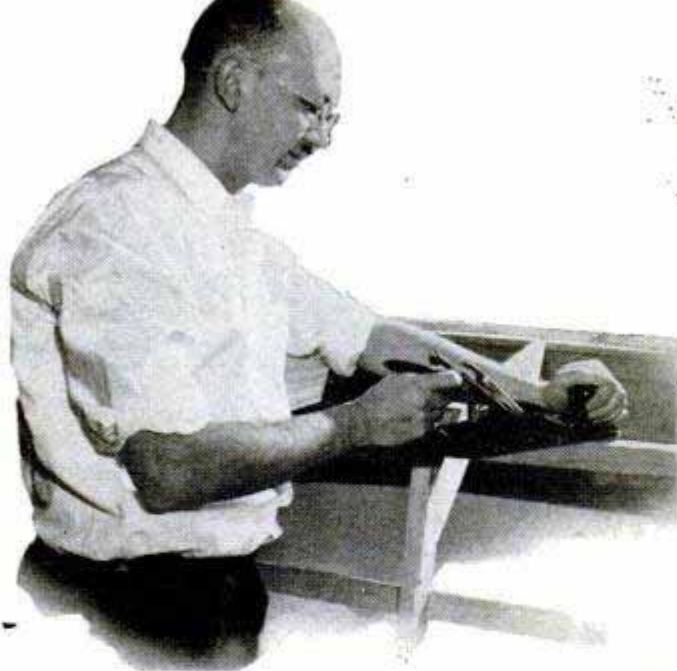
It rides high and level in the water, making it safe for the children to handle, and easy to row or scull in shallow backwaters for fishing or wildfowl hunting. A 25-in. skeg holds the craft steady if you wish to power it with an outboard motor.

The boat is assembled almost completely on a building board. Two full frames, two side frames, and the stem are joined by iron join chines and clamps, and by rubber battens, to provide a strong support for the 1/4-in. plywood bottom and sides.

To start construction, lay out the building board on a flat surface, such as the garage floor, and cut the five notches for the frames. Then make all the frames and attach them to the building board in the order indicated in the detail on the opposite page. Note that the full frames are reinforced with plywood knees, or gussets, attached with screws and waterproof glue. After the frames are in place on the building board, brace them to







the floor in the level position with small strips. Now, cut and fit the keelson, making sure that the bottom of each notch is properly beveled so that the keelson is a snug fit in each lapped joint. Join the keelson to the frames, including the stem and transom, with screws and marine glue. Install the chines and clamps with the same method of fastening, but be sure to make an accurate fit of the chines in the notches, especially at frames Nos. $\frac{1}{2}$, 1 and $2\frac{1}{2}$ and also at the stem and transom. In this case, it probably will be necessary to bevel the bottom of each notch to receive the chine and clamp with a full bearing across the width of the frame stock.

Next, the frame members and chines must be faired in—hand planed as in the photo at the left—to take the sides and bottom with a full-width bearing. This means that the outer edge of each chine and one edge of each frame member must be beveled slightly so that the plywood bottom pieces and the sides will lie flat on the chines and frame members. This is an important operation as the structural strength and seaworthiness of the boat depend on the fit of these joints. Be sure that the keelson is beveled in two directions before fitting the keel and skeg. Join the latter two parts to the keelson with screws and marine glue, wiping off the excess glue after the joint has been made. For added strength, drill a $\frac{5}{16}$ -in. hole through the skeg and keelson at a point just aft of frame No. $2\frac{1}{2}$ and fit a $\frac{5}{16}$ -in. galv. or bronze bolt. Due to the absence of a stopwater at this point, it is advisable to set the bolt in marine glue. It's regular practice on a boat of this type to use cotton tape in all joints where the plywood joins the frame. Spread a coating of marine glue, lay the tape over the glue, then apply a second coat of glue before joining the parts. Use this procedure when joining the plywood to the frame. Now, cover the stem and transom frames with $\frac{1}{4}$ -in. marine plywood, joining with screws, marine glue and tape in the manner described.

MATERIAL LIST Marine Fir Plywood

1 pc.	Bottom	$\frac{1}{4}$ " x 4' - 0" x 8' - 0"
1 pc.	Sides	$\frac{1}{4}$ " x 4' - 0" x 8' - 0"
1 pc.	Transom and stem	$\frac{1}{4}$ " x 2' - 0" x 6' - 0"

Oak

2 pc.	Chines	$\frac{3}{4}$ " x $1\frac{3}{4}$ " x 8' - 0"
2 pc.	Clamps	$\frac{1}{2}$ " x $1\frac{1}{2}$ " x 8' - 0"
2 pc.	Moldings	$\frac{5}{8}$ " x $1\frac{1}{4}$ " x 8' - 0"
2 pc.	Seat risers	$\frac{3}{4}$ " x $1\frac{1}{2}$ " x 8' - 0"
1 pc.	Keelson	$\frac{3}{4}$ " x $2\frac{3}{4}$ " x 8' - 0"
1 pc.	Keel	$\frac{3}{4}$ " x $\frac{3}{4}$ " x 8' - 0"
1 pc.	Top and bottom of transom and stem frame	$\frac{3}{4}$ " x $5\frac{3}{4}$ " x 12' - 0"
1 pc.	Transom and stem sides and frame side ribs	$\frac{3}{4}$ " x 3" x 12' - 0"
2 pc.	Bottom ribs	$\frac{3}{4}$ " x $4\frac{3}{4}$ " x 9' - 0"
2 pc.	Seats	$\frac{3}{4}$ " x 12" x 14" - 0"
1 pc.	Seat brace	$\frac{3}{4}$ " x 12" x 8"
4 pc.	Knees	$1\frac{1}{4}$ " x 7" x 10"
1 pc.	Motor board	$\frac{3}{4}$ " x 12" x 21"
9 pc.	Floor boards	$\frac{1}{2}$ " x $2\frac{3}{4}$ " x 4' - 6"

Building Board

1 pc.	2" x 10" x 7' Common lumber
1 pc.	$1\frac{3}{4}$ " x $1\frac{3}{4}$ " x 4' Lumber

Fastenings

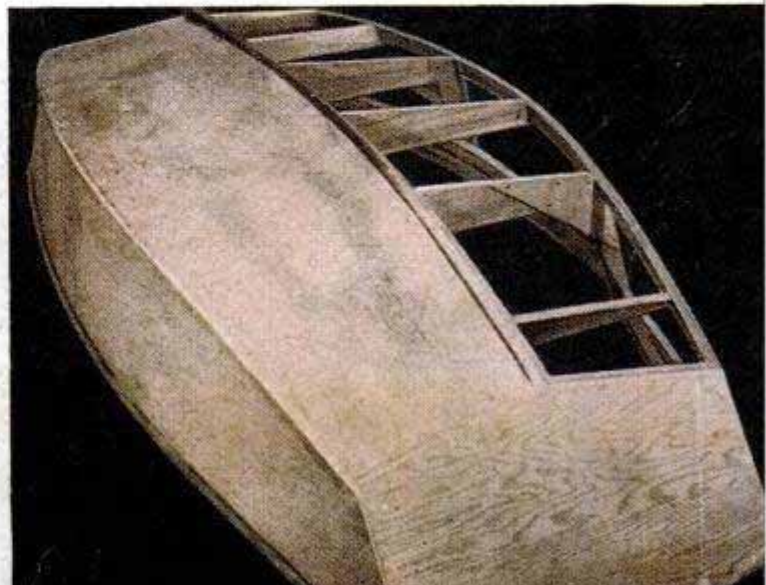
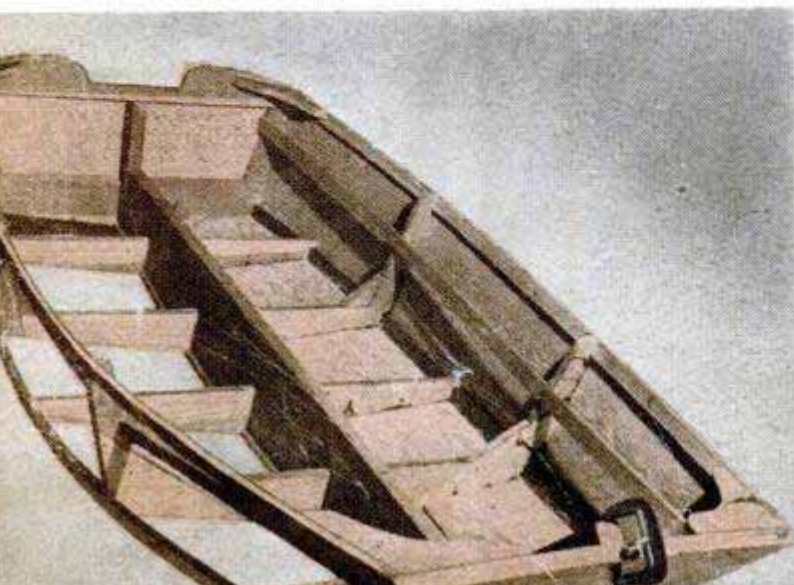
1 qt.	Marine glue
20 yds.	Cotton tape
5 gr.	1" - #8 brass flat-head screws
2 doz.	$1\frac{1}{2}$ " - #8 brass flat-head screws
2 doz.	$1\frac{3}{4}$ " - #8 brass flat-head screws

Paint

$\frac{1}{2}$ gal.	Sealer (clear)	$\frac{1}{2}$ gal.	Paint
1 qt.	Spar varnish		

Fittings

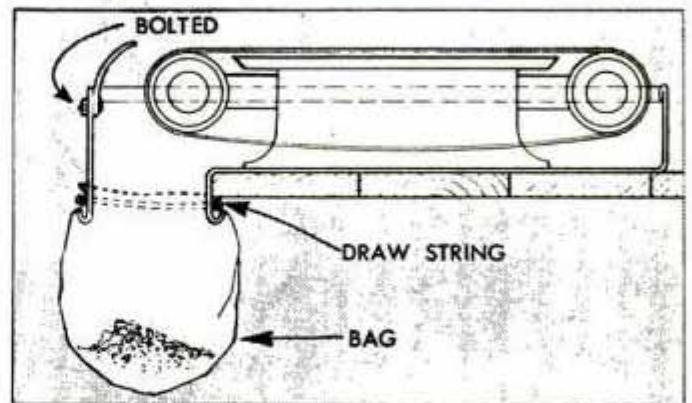
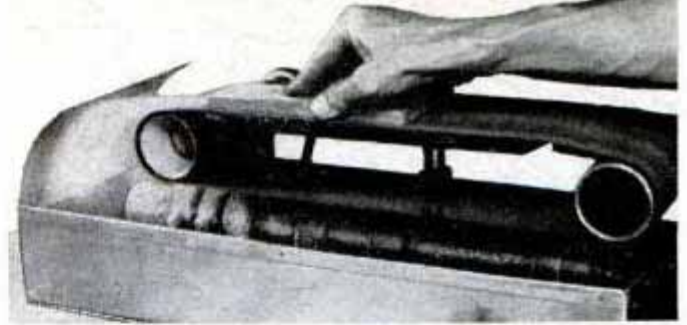
1 pr.	Oarlocks	1	Eyebolt
2	Lifting handles		



the curve of the bottom and sides. Cut, fit and join the side planking, using the same material and method of fastening. Fair the edges of the plywood to the angle of the frames. At this point the boat can be removed from the building board.

Cut the plywood bottom pieces to the rough size and bevel plane to a perfect fit at the keel and skeg. Then join with screws, marine glue and tape, applying the glue liberally where the bottom pieces join the keelson and butt against the keel and skeg. Drive the screws flush and in straight rows. Space all planking screws approximately 1½ in. apart. Plane the edges of the bottom pieces flush with the sides and finish the upper edges of the side planks flush with the clamps. Sand all joints and exposed edges smooth. Fit oak corner knees fore and aft as in the lower left-hand photo on the opposite page, and join to the end frames and clamps with long screws driven through from the outside. Use a water-resistant resin glue in these joints. Before fitting the half-round molding at the chines and gunwales, apply a coat of fir-plywood sealer to all inner and outer plywood surfaces. Fill the exposed edges of the plywood with marine putty and sand lightly after the putty is dry. Then sand all surfaces lightly and round corners to prevent splintering of the wood. Use fine sandpaper for this job. Coat the frames and interior plywood surfaces with marine enamel or spar varnish as desired.

Install the floor boards and join to the frames with screws only. Do not use any glue in these joints. Then add the seat risers and seats and install the motor board. All these parts should be of selected oak and finished with a natural wood filler and two coats of spar varnish. Install the half-round molding at the chines and gunwales, spacing the screws about 3 in. apart. Apply a copper-base paint to the bottom, and finish the sides, stem and transom with two coats of marine enamel. Finally, install the fittings given in the material list.



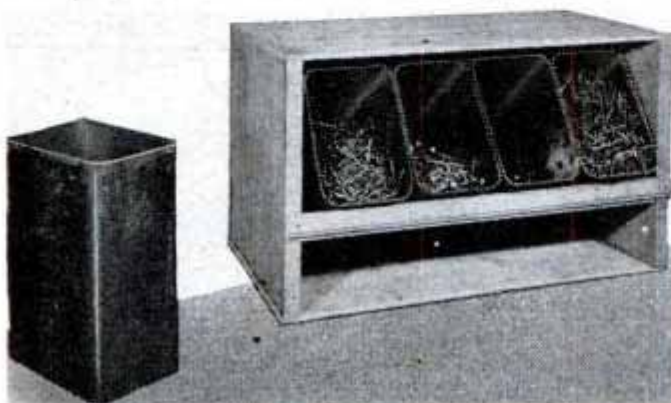
Metal Tray Under Belt Sander Reduces Dust in the Shop

By mounting your bench sander in a shallow, sheet-metal tray, such as the one shown, dust in the shop will be reduced considerably. Note that a shield is bolted to one end of the tray, and that a bag is tied over an opening directly under the shield. This catches the dust at the point where most of it is thrown off the belt. Dust that gathers in other parts of the tray is pushed into the bag when necessary.

Child Prevented From Locking Door

To prevent a small child from locking herself in a room, fill the lower slot in the strike plate of the lock with putty or modeling clay. Then cover the slot with a strip of adhesive tape and paint over it with quick-drying enamel or clear fingernail polish. When the child grows older, the tape can be taken off and the putty removed.—Bess Ritter, New York City.

Empty Varnish Cans and Wooden Box Provide Bins for Small Parts



Rectangular gallon cans, such as those commonly used for varnish, provide ideal storage bins for nails, screws, etc. They will fit compactly into a rack, which can be made, as shown in the photograph, by nailing a divider across the open end of a wooden box to hold the bins at a convenient angle. Remove the tops of the cans with a can opener, clean them and, if desired, give them a coat of paint to prevent rusting. If the edges of the openings are rough, tape them to prevent injuring your hands.

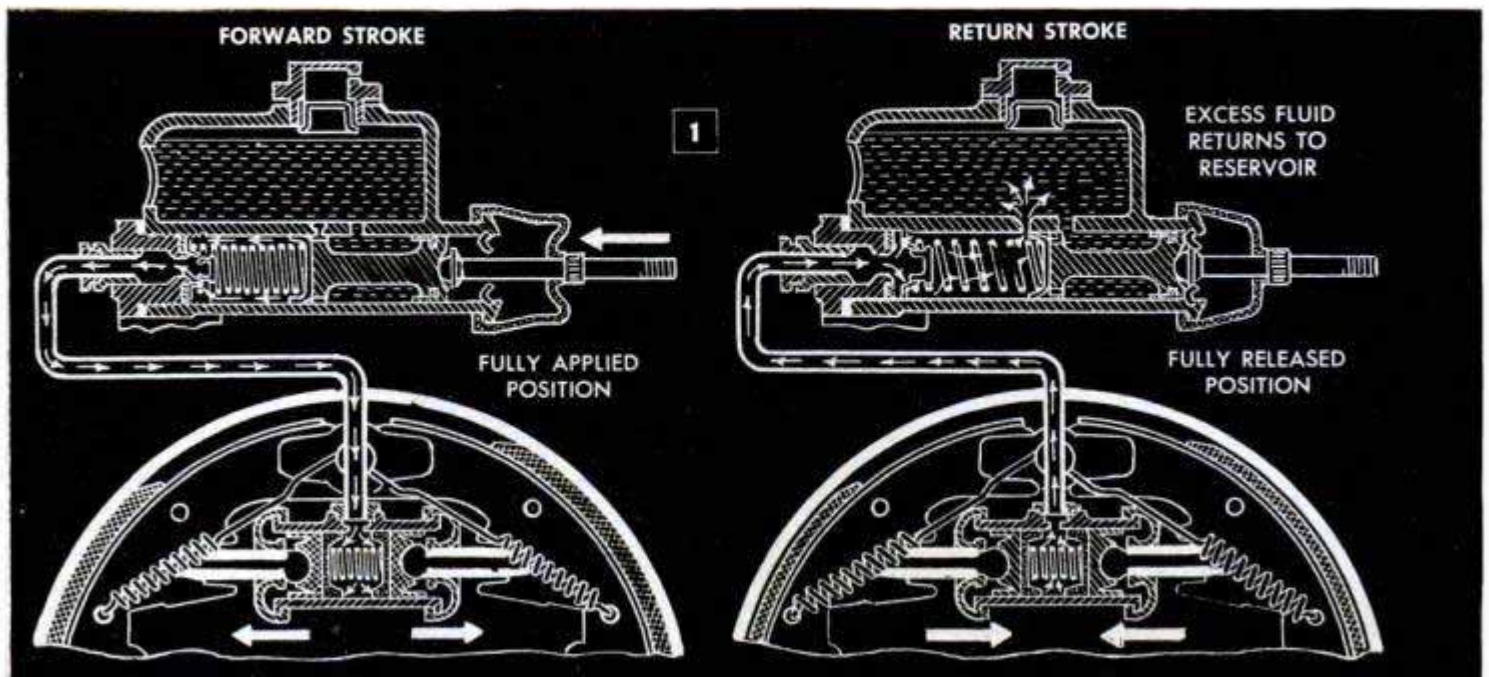


KNOW YOUR BRAKES

By Ed Packer

KNOWING the condition of your brakes and how much you can expect from them in an emergency often means the difference between just a sudden stop and a collision. Although brakes on modern cars are built to "take it" over long periods of severe service, a lot of unnecessary wear on linings and mechanical parts can be saved if you treat the brakes right. To get the maximum in long and reliable service, the brakes on a new car will require more careful breaking in than the engine. It takes a little time for brake linings to wear in to a perfect fit against the drums, which makes this period the critical one that determines brake life. During this period, the linings do not contact the drums over

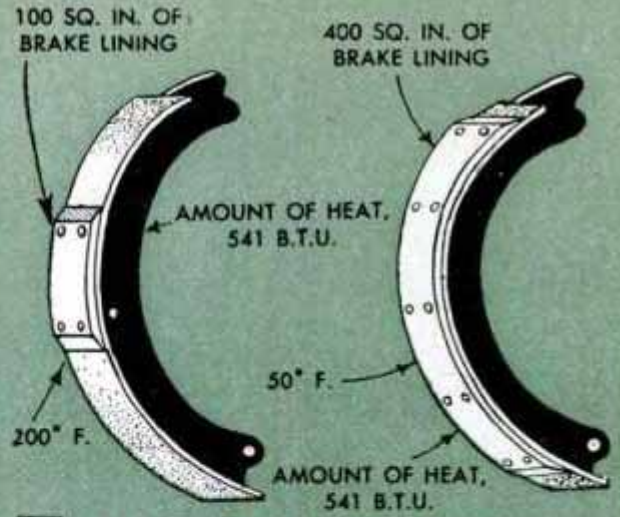
the whole of the effective area when the brakes are applied. Sudden, hard application concentrates braking effort in a comparatively small area of the individual linings. This results in hot spots that localize expansion of the drums which may result in distortion of the drums and burning of those surfaces of the linings that are forced to do the work. The details in Fig. 2 will serve to emphasize this point. Because of this danger, it's a good idea to "wear in" the brakes during the first 500 miles or so by repeated soft applications while you're driving on the open road at comparatively slow speeds. During the break-in period, try to avoid traffic congestion where sudden, full stops may be necessary. Also, it's



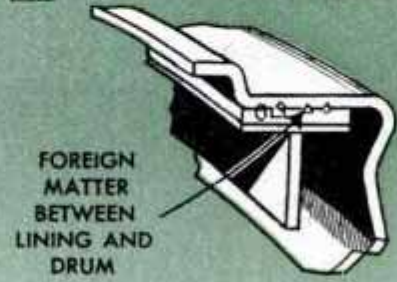
a good idea to keep in mind that while the brakes slow down and stop the wheels, it's the friction between the tire treads and the road surface that stops the car. This brings up another point in good brake usage. Sudden, hard stops not only generate excessive heat in the brake mechanism, but also set in motion forces which are dissipated through the springs and frame of the car, thus placing heavy, twisting strains on various parts of the chassis. Fig. 6 shows how these forces are transmitted through the brake backing plate to the rear axle, springs, shackles and the frame of the car. Locking the wheels by brake action on a car traveling at moderately high speed on a dry hard-surfaced road may break a rear spring, twist the spring shackles or distort the car frame.

"Standing" on the brake pedal when the car is new may seriously damage the drums and may break the weld where the rib of the brake shoe is joined to the rim. Excessive heating of the parts due to prolonged abnormal use can cause distortions of both the drum and the shoes which make it impossible to obtain reliable braking action by adjustment alone. One of the most common results of brake abuse is the tendency of the drum to take a bell-mouth shape as in Fig. 5. This is especially true on cars having all-steel brake drums. On those equipped with cast drum rims, the shoe is more apt to be distorted. Shoes damaged by excessive heat tend to take a permanent set and usually they are inclined inward, causing the linings to contact the drums at their edges. This results in rapid wear of the linings and unsatisfactory brake operation. When brakes have been damaged in this manner, the only safe and permanent repair is renewal of all the affected parts.

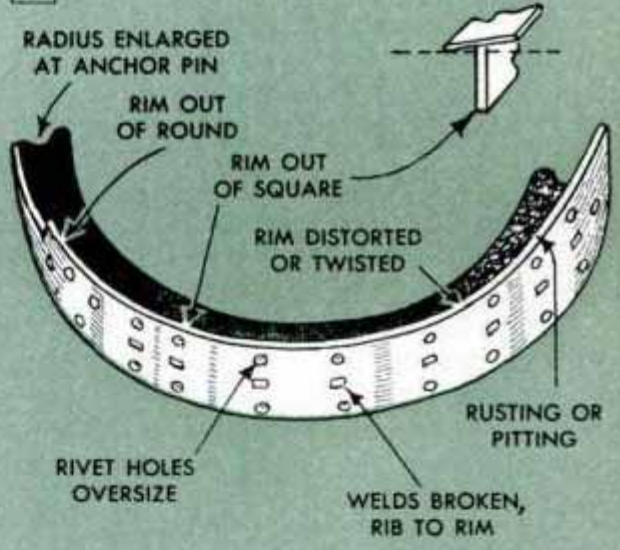
The details in Fig. 1 show the operation of the hydraulic-brake system with the



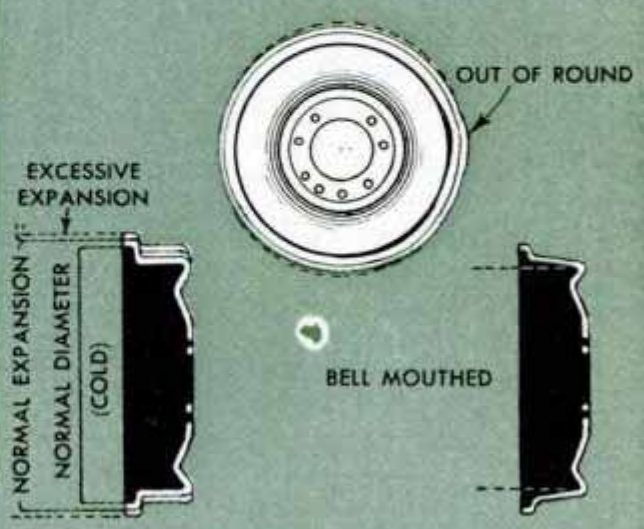
2 BRAKE-LINING TEMPERATURE



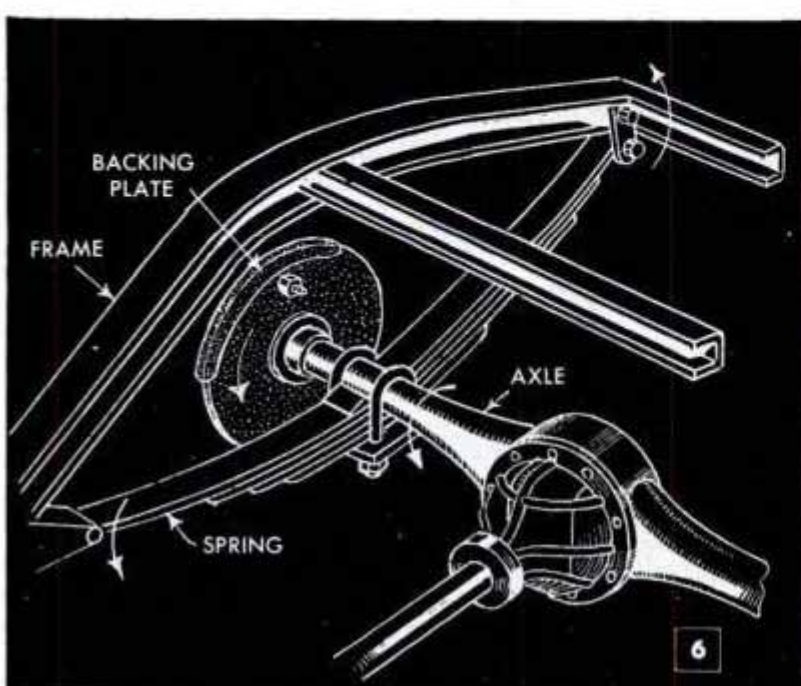
3 SCORED BRAKE DRUM



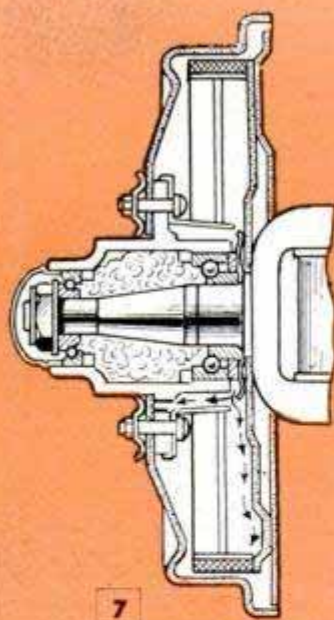
4 BRAKE-SHOE DEFECTS



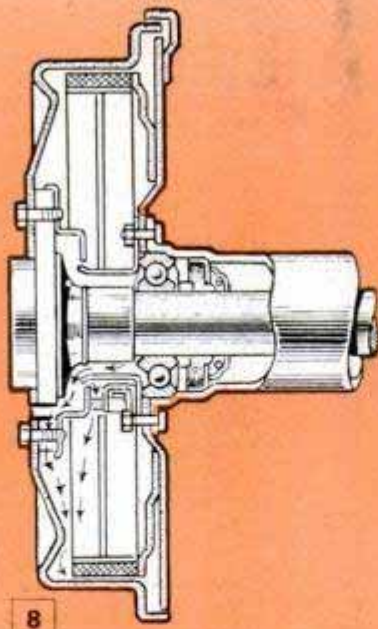
5 DISTORTED BRAKE DRUM



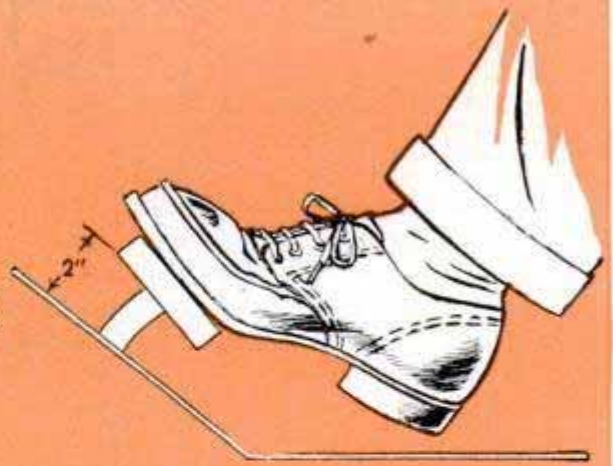
6



7
**LINING SOAKED
 BY EXCESSIVE
 LUBRICATION**



8
**LEAKING OIL SEALS
 CAUSE SOAKED
 BRAKE LININGS**



9
**BRAKES NEED ADJUSTMENT
 WHEN PEDAL RESERVE
 IS 2" OR LESS**

piston in the master cylinder in the "fully applied" and "fully released" positions. Arrows indicate the direction of fluid flow when the brakes are applied and released.

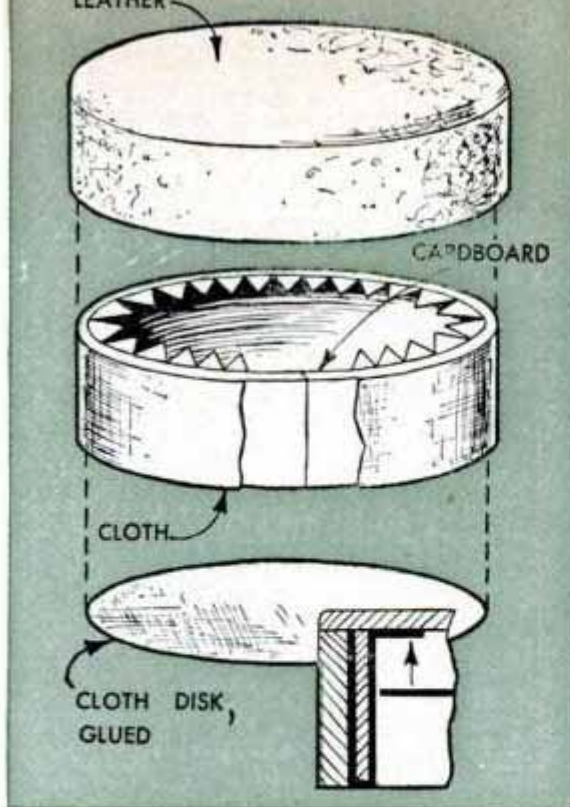
Owners of cars fitted with brake shoes having bonded linings never experience the troubles due to faulty riveting of the linings, or to linings so badly worn that the rivet heads touch the brake-drum rim. Other brake-shoe defects also can cause scoring of the drums as shown in Fig. 4. If the scores are not too deep, scored drums can be salvaged by turning the braking surface down in a brake-drum lathe. After turning in the lathe, the new braking surface should be ground smooth. Well-equipped service shops can handle this job at a nominal cost. The faulty shoes should be relined with oversize linings and the brakes broken in in the same manner as new brakes. Bonded brake linings seldom cause damage to the drum but scoring can result from a small particle of abrasive matter that may find its way into the brake and become embedded in the lining, Fig. 3.

If your brakes grab or chatter at any time, it is quite possible that the faulty performance is due to a leaking oil seal in either a front or rear-wheel bearing. Over-lubrication of the front-wheel hubs and excessive lubricant in the rear axle are indirect causes. The excess may be forced past the oil seal and into the brake drum where it collects on the linings. A coating of oil on the linings will cause the brake to slip and grab alternately. The manner in which oil leaking from either the front or rear-axle bearings can find its way to the brake linings is shown in Figs. 7 and 8. Oil-soaked brake linings always should be

replaced. Another thing to watch in an older car is the pedal reserve. Many owners of these cars form the habit of checking this each time the car is driven. Simply depress the brake pedal through its full travel and note the clearance between the bottom of the pedal and the floor board. As shown in Fig. 9, this should be about 2 in. although, of course, manufacturer's recommendations may vary somewhat. If the clearance is less than 2 in., or if the pedal feels "soft" throughout its travel, then examine the brake system before driving the car. Greatly lessened pedal reserve, or a soft pedal, may mean a slow leak in the hydraulic system, presence of air in the system, or badly worn brake linings. Often, merely bleeding the system and replenishing the fluid in the master cylinder will remedy the fault in a newer car, but in an older one it also is well to keep a close check on the condition of the brake linings.

Engine Shield for Cold Weather

To operate your car on minimum fuel consumption it is necessary that the engine be operated at the recommended temperature at all times. To help the engine quickly reach this temperature during cold weather, one motorist wires a single thickness of burlap to the radiator core. This admits sufficient air to avoid overheating of the engine, but shields it against cold. It also will keep out drifting snow. If you live in a region where cold weather is sporadic and frequently followed by warm periods, it will be convenient to stretch the burlap over a heavy wire frame, which will be easy to install and remove as needed.

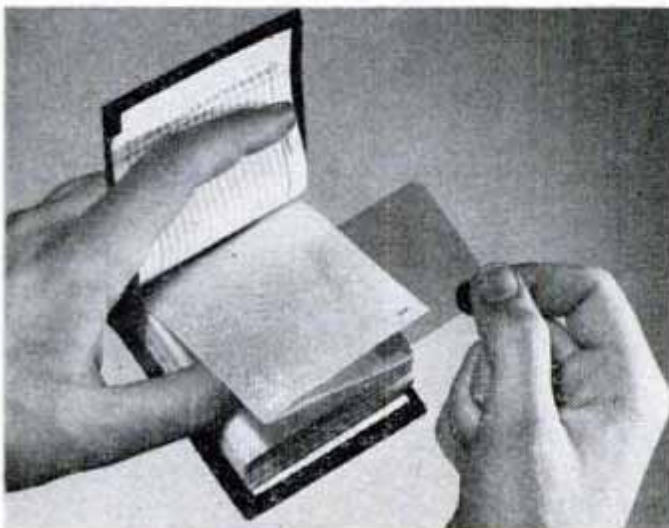


LEATHER CAP PROTECTS CAMERA LENS

By **Walter E. Burton**

Full protection against dust, finger smudges and abrasive particles is afforded by a tight-fitting leather lens cap and making one to fit any ordinary camera lens is so simple that you can finish the whole job in one evening. For larger lenses, use a grade of leather known as carving cowhide, which is about $\frac{3}{32}$ in. thick. For smaller lenses, use tooling calfskin. Measure the depth and diameter of the lens barrel, then cut a strip of leather of a width equal to the depth of the barrel, and of a length 1 in. greater than the circumference of the barrel plus an allowance for the cloth lining, which is fitted inside the leather ring. Skive $\frac{1}{2}$ in. of each end of the leather strip to a feather edge and join the skived

ends with a leather cement. Now cut a strip of blue velvet about three times as wide as the leather strip and wrap it around a strip of thin cardboard with the pile side out and with about $\frac{1}{4}$ in. of one edge overhanging. Cement the fabric to the cardboard, then notch or pink the overhanging edge as in the center detail above. Cut a disk from the same fabric to a close fit inside the ring formed by the fabric and cardboard. Cement the fabric disk to the serrated edge. Now, cut a disk from leather and cement it to the top of the leather ring and to the fabric. Trim the edges of the leather disk flush and polish and finish the leather with shoe-sole dressing, which is similar to lacquer. When applying this finish, follow directions on the container. The completed cap should fit the barrel snugly.



Gelatin Color-Correction Filters Stored in Negative File

Negative files, the type consisting of numerous glassine folios bound in a little book, can be used for storing gelatin color-correction filters. Such files usually have indexes in the front where the numbers of the filters can be entered, making it possible to find the desired filter quickly.

Paul T. Hutchinson, Wheaton, Ill.

☐ A few dabs of luminous paint at strategic points in a darkroom will enable you to keep yourself oriented when working in total darkness.

as Darkroom Ventilator

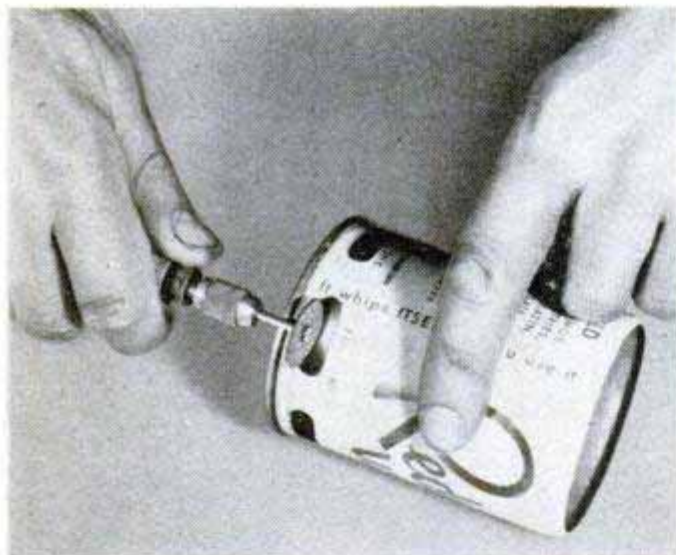
By M. G. Winterton

MANY HOMEOWNERS who have converted from coal to gas or oil heat have transformed newly acquired coalbin space to a basement darkroom. Whether the existing walls of the coalbin are used or new ones are built for the darkroom, there's always the difficulty of ventilating such a confined, light-tight room. This posed a problem for me until I thought of my wife's electric hair drier and began to plan how it could be used to draw fresh air in through the window formerly used to fill the bin. By providing a wire bracket to cradle the drier in front of a light-trap ventilator, the drier would be instantly available when needed for its original purpose, and also readily accessible when needed to speed the drying of films and

prints. Replacing the center pane in the window with a panel of plywood solved the problem of installing the ventilator, and painting the glass black made the window light-tight. When completed, the arrangement proved even more ideal for a general airing of the darkroom when desired, as the bracket in no way interfered with opening the window.

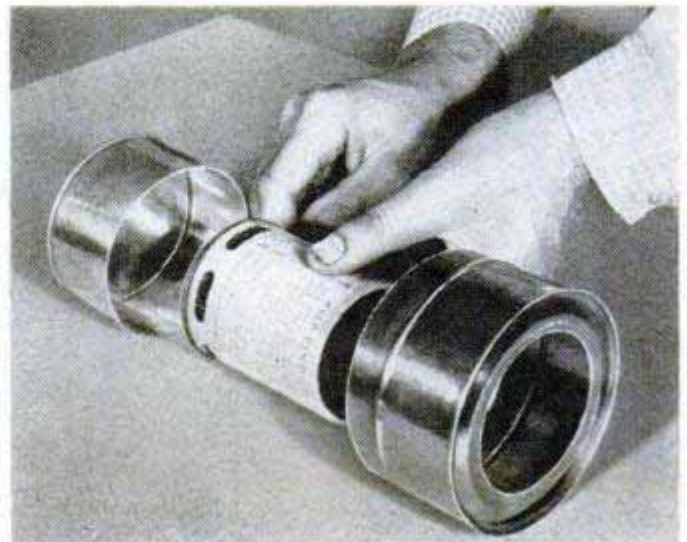
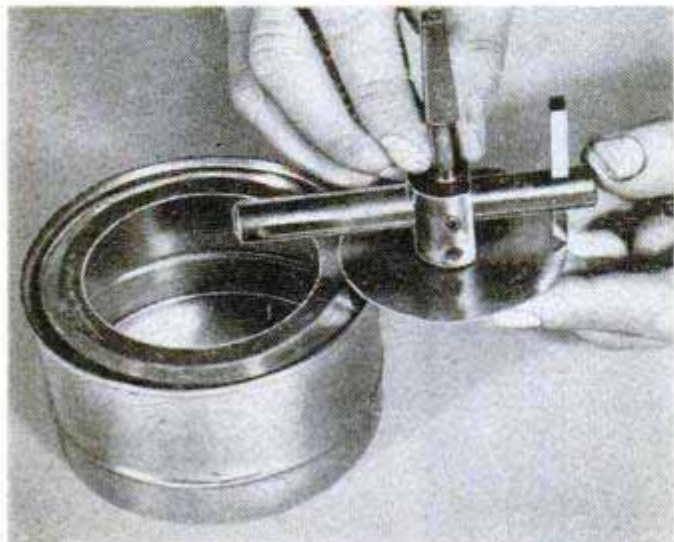
I set to work making the light-trap ventilator first, Fig. 1. I found that a can of the type in which pressurized liquids are packaged was perfect for part B. To cut the five elongated slots around the base of the can, $\frac{1}{4}$ in. up from the edge, I used a hand grinder, first drilling holes at each end and removing the waste with a small grinding wheel. If you do not own a hand grinder, tin snips can be used to remove the waste between the holes. To form parts A and D, I selected a can of the type in which lubricating grease is sold and cut a hole in both the bottom and the lid, the one in the bottom being the same diameter as part B. Except for the bottom of part B, I painted all other parts with flat black lacquer, inside and out.

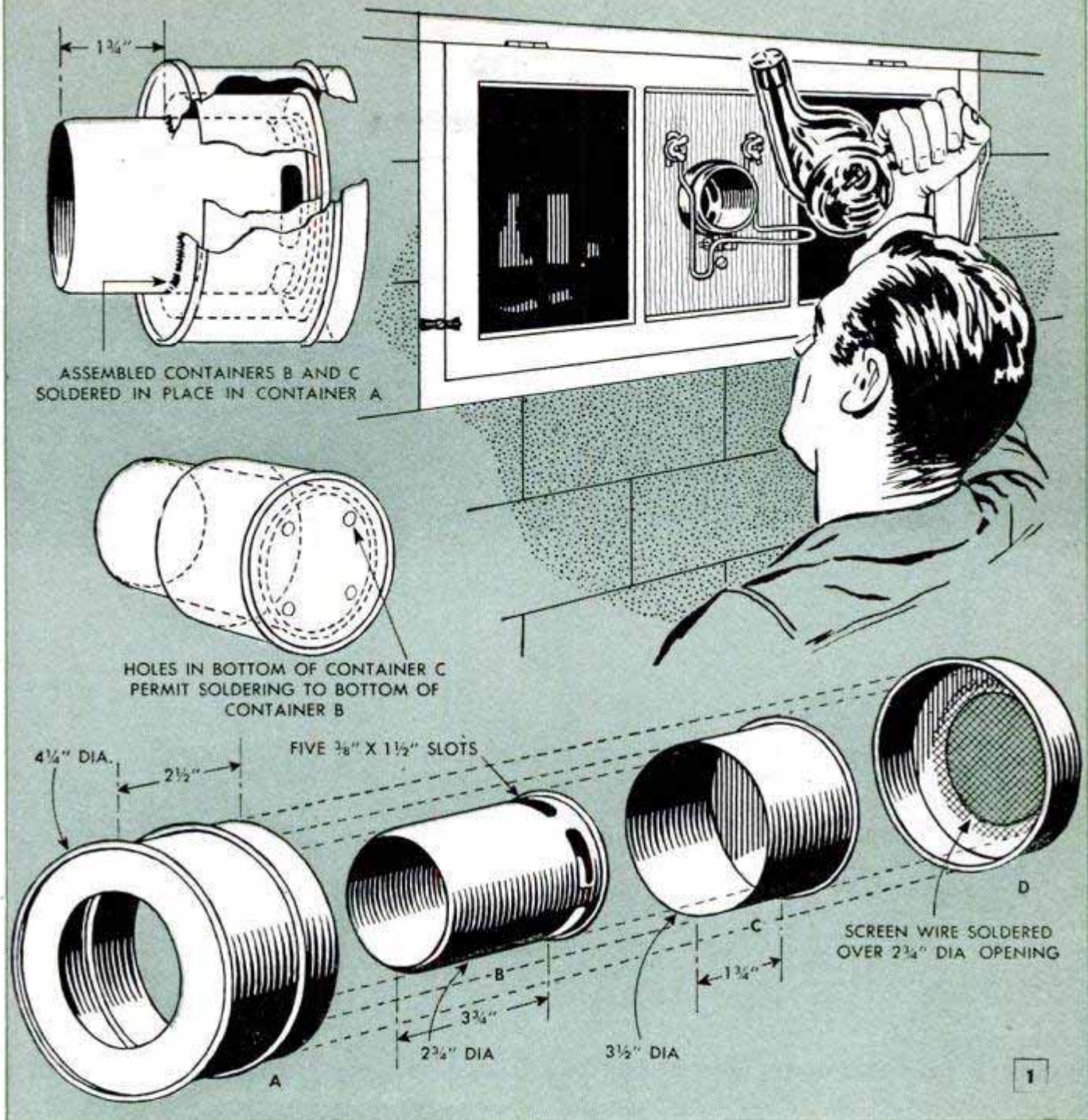
The cutaway detail at the top of Fig. 1 shows how the four parts are assembled, part B being centered in part C and spot-soldered to the bottom through four small holes. Part C is cut down from a common can measuring about $3\frac{1}{2}$ in. in diameter. Finally, part B is placed in the hole in the bottom of part A and soldered to it at a point $1\frac{3}{4}$ in. from the end. To prevent insects from entering the ventilator, I soldered a piece of screen wire over the hole



Above, a hand grinder was used to cut the slots in the inner can of the original ventilator. Below, a neat hole for part B is made with a metal hole cutter

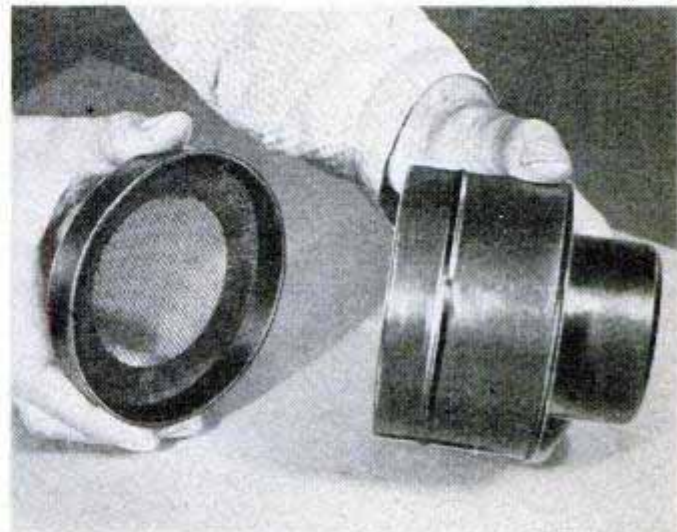
Here are three of the four parts that make up the ventilator and the order in which they fit together. Slots in inner can permit entrance of air but not light

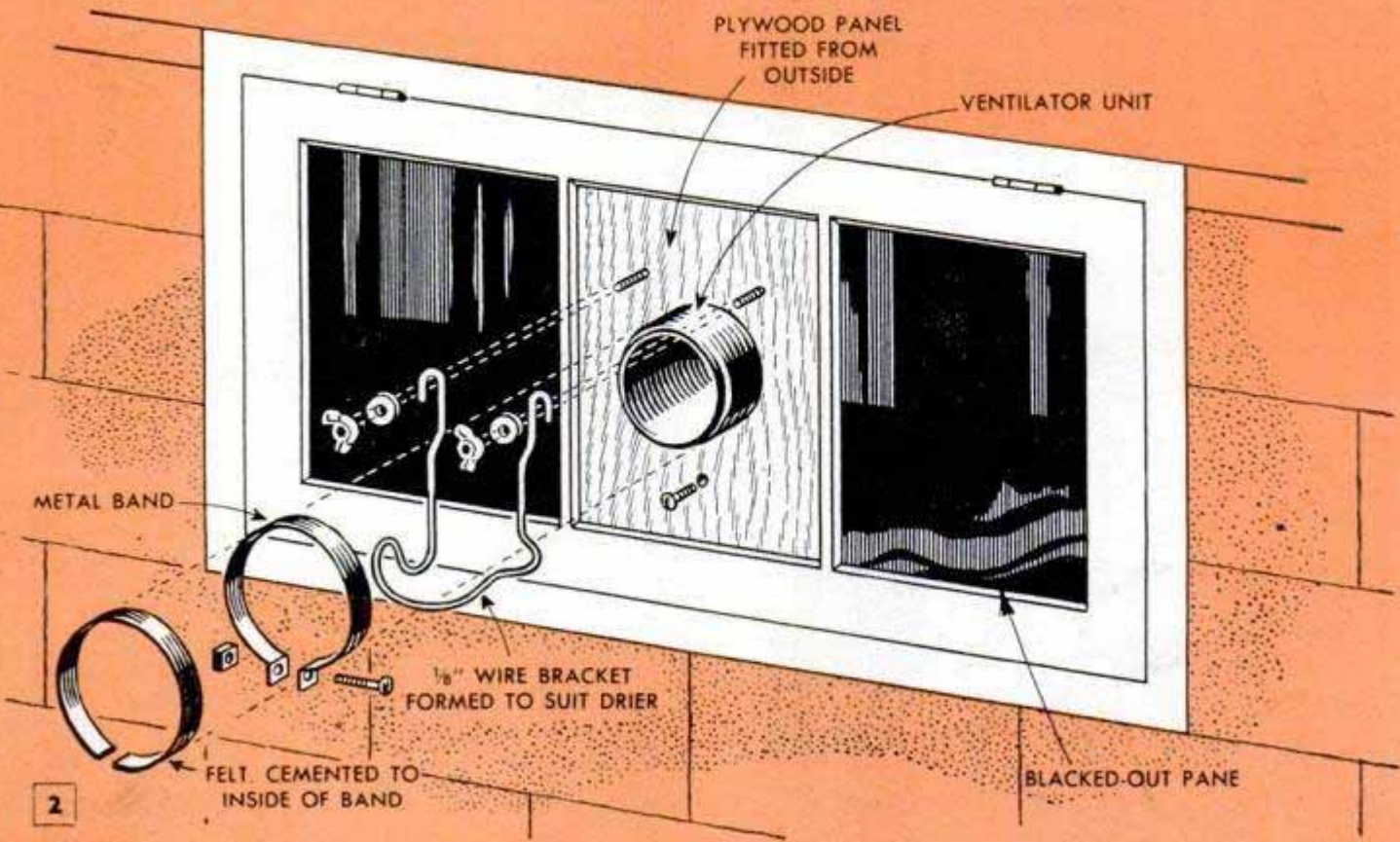




Except for the bottom of part B, all surfaces of the ventilator are painted black before the parts are soldered together. Flat drying lacquer is recommended

A hole is cut in the lid of the can which forms part A, and a disk of screen wire is soldered to the inside of the lid to keep insects from entering the ventilator



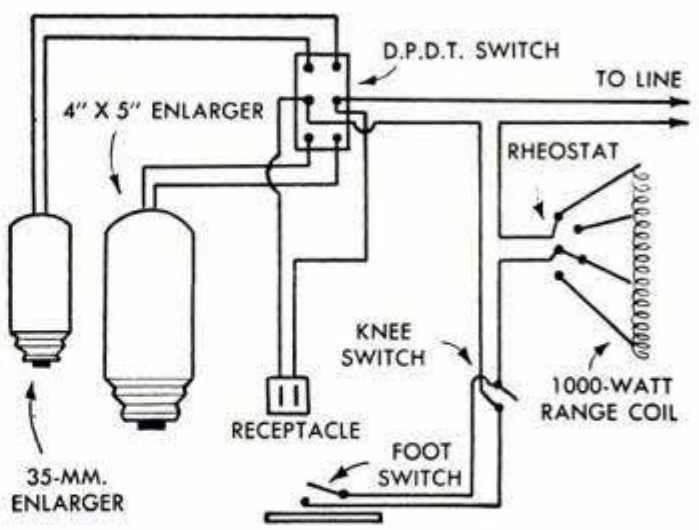


in the lid, part D, placing it on the inside. Fig. 2 shows how I formed the wire bracket to fit my particular drier, although the exact shape of this will vary according to the drier used. The ventilator passes through a hole jigsawed in the plywood window panel and is held in place with a felt-lined band, similar to a hose clamp, that

slips around the protruding end of the ventilator. Wing nuts and washers are used to attach the wire bracket to two stove bolts in the plywood. With the bracket positioned to hold the drier directly in line with the open end of the ventilator, I found it most convenient to install or remove the drier whenever desired.

Horn Switches and Rheostat Afford Positive Control of Enlarger

Two switches and a rheostat wired to his enlargers permit one photographer to control the equipment with his foot or knee, thus allowing more accurate timing of exposures than when a hand-operated toggle switch is used. In addition, this arrangement leaves both hands free for dodging and burning-in the prints. The knee and foot switches are wired in series so that either one can be used to operate the equipment. Both are improvised from auto-horn buttons, distributor points being soldered to the horn-button contacts. The foot switch is mounted on an 8-in. plywood disk, and the knee switch is fastened to the leg of the enlarger table at a convenient height. The variable rheostat (4 contacts) consists of a 1000-watt electric-range coil suspended on insulators inside a section of 3-in. tubing. Use of the rheostat permits selection of four graduated light intensities, thus increasing the life of the enlarger



bulbs. Note in the diagram that two enlargers are wired to a D.P.D.T. (double-pole double-throw) switch and that a receptacle is provided for connecting the contact printer. However, the control switches may be wired to a single enlarger.

Dental Mirror Reflects Settings When Camera Is Elevated

If a camera is used on a tripod above eye level, a dentist's mirror will enable you to easily read the scales on the camera. The mirror can be attached to a length of tubing, metal rod or wood dowel to provide a handle. The mirror also can be used to advantage when doing photomicrography, where the lights and subject matter must be placed so close to the camera lens that the settings are blocked from view.

Louis Hochman, Sherman Oaks, Calif.

Removing Excess Rubber Cement From Mounted Photographs

A pencil eraser of the type shown is ideal for removing excess rubber cement from the edges of mounted prints. Being pointed, the eraser permits getting near the very



edge of the print. Larger areas can be cleaned by rubbing them with a ball made by peeling and kneading the dried cement found remaining in a used container.—
John J. Rea, Urbana, Ill.



Tape on Developing Tank Prevents Exposing Film

When film is placed in a developing tank, but is not immediately developed, stretch a strip of cellulose tape across the top of the tank. This will remind you and others that the film in the tank is undeveloped, and that the tank should not be opened.—Virginia Hanson, Los Angeles, Calif.



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Since the first issue in 1902 all the important developments and advances in the fields of mechanics and the sciences have been pictured and described in *POPULAR MECHANICS*. Many of these stories have again been brought to life in our new book, *50 YEARS OF POPULAR MECHANICS*, which has just been published by Simon and Schuster, outstanding New York publishers, and commemorates our 50th Anniversary.

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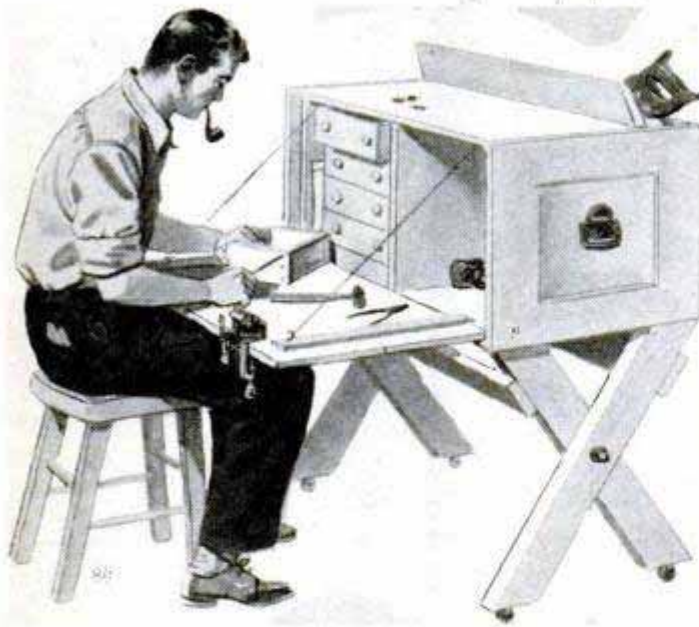
Shortly after the birth of *Popular Mechanics Magazine*, readers requested that we reprint in

one book the most interesting how-to-do-it articles so they could have them in their libraries for use as reference books. Our annual book, *SHOP NOTES*, was the first book of this type and was to be the forerunner of such famous and familiar titles as *WHAT TO MAKE*, *THE BOY MECHANIC*, *THE BOAT BOOK* and scores of others. *SHOP NOTES* has been published every year since 1905 and we believe the current 1952 issue to be the best we have ever published. In addition to many interesting how-to-do-it articles, it contains a 31-page article entitled "Table Top Workshops" in which our craftsman editor tells how you can start a miniature workshop that can be stored in a drawer when not used. It also contains a four-color article on plastic veneer which, as indicated by letters from our readers, is one of the most famous how-to-do-it articles ever published in *Popular Mechanics Magazine*. This story tells how to cover old pieces of furniture or make new ones of cheap woods and cover them with plastic veneer, which comes in simulated wood grains as well as marble grains. As an introductory offer, you can get the issues of *SHOP NOTES* for 1948, 1949, 1950, 1951 and 1952 for \$3.98, postpaid. The regular price of these five issues would ordinarily total \$5.00.

Many of you remember *THE BOY MECHANIC*, the set of books which was first published in 1913 and became the outstanding volumes in encouraging youngsters to build things and in developing their latent skills. For many years, these four volumes set the standard for manual accomplishment. Total sales of this title are well over 200,000 copies. In 1945 *THE BOY MECHANIC* was published in an inclusive single-volume edition at \$2.00. Get a copy today for that boy who is the apple of your eye.

Apartment WORKSHOP

By Joseph Whitehill



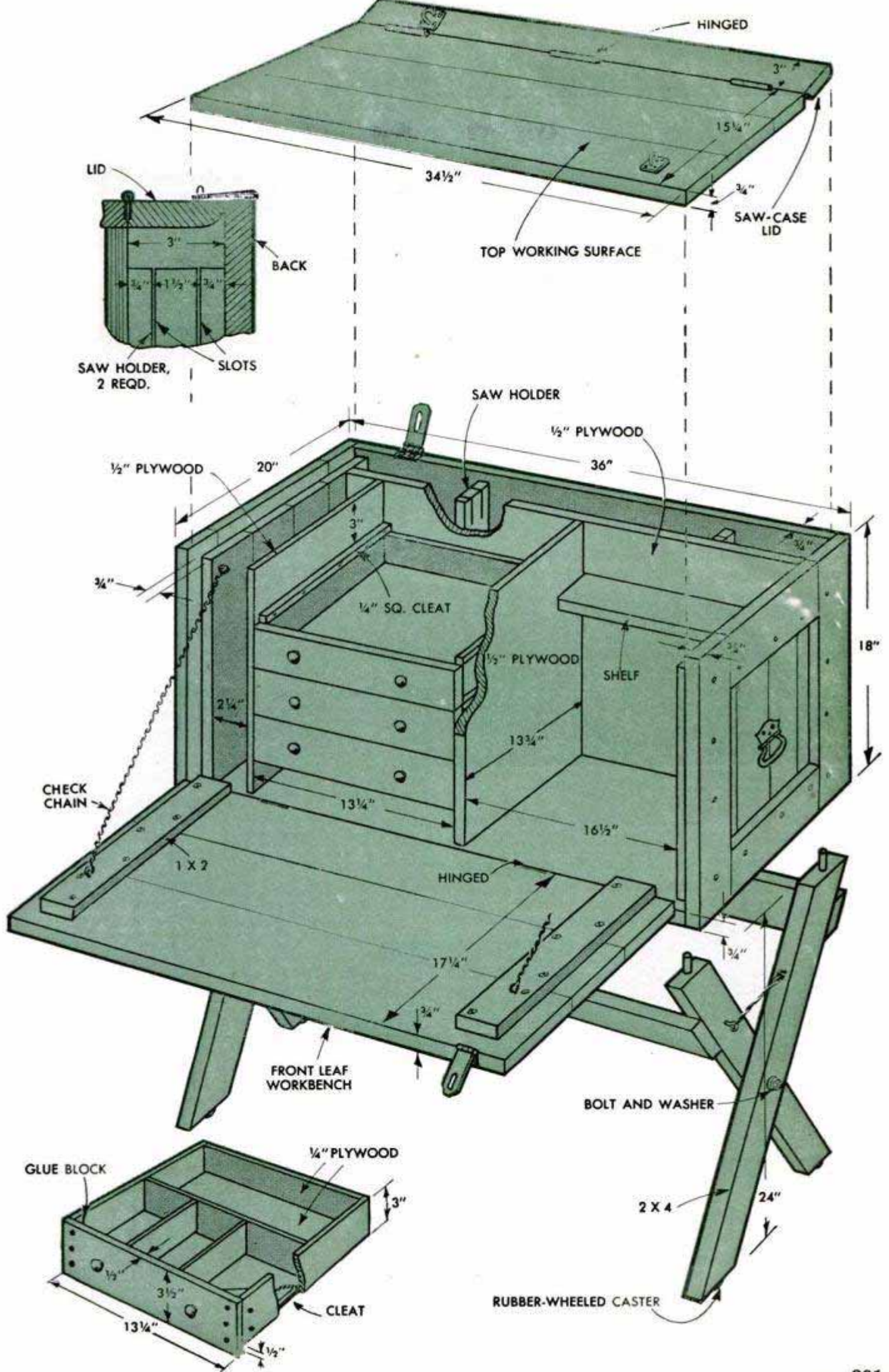
DOES THE kitchen table serve as your workbench, much to the annoyance of your wife? If so, this article is especially for you. It shows how you can have a workbench and tool chest all in one within the confines of a compact trunklike box. Supported by a folding detachable sawbuck stand, both parts of this workshop can be stored in a minimum of space. It's the perfect setup for the man who resides in an apartment, or the owner of a basementless house who likes to tinker, build models or keep the household appliances in repair. Everything is at hand when you want to "set up shop" and, when you're through, tools can be quickly packed away for another day. It's as simple as that.

You literally "set up shop" when you roll out this compact little workshop. Combining a chest and bench in one, it's the answer to the apartment "crafter's" prayer for a convenient place to work and store tools

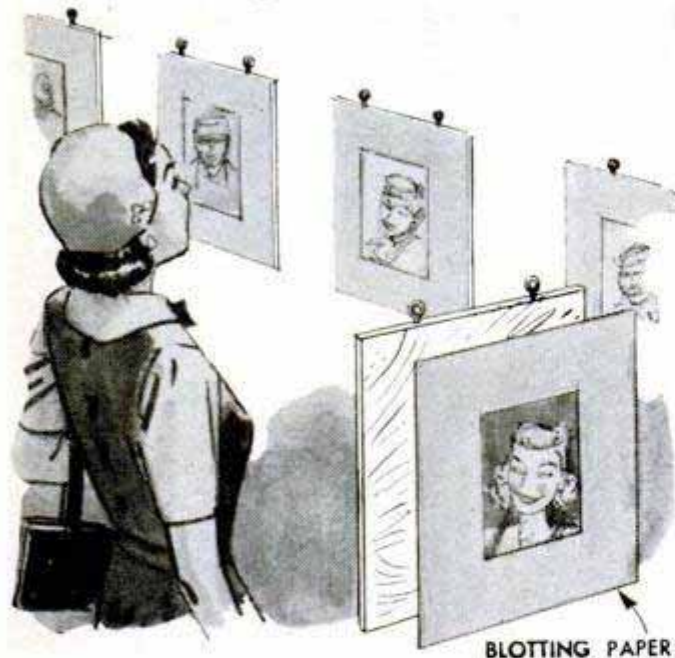
Chain-supported drop lid lowers to form a handy lap-type bench top when chest is open. Compartment at rear affords storage for handsaws, square, level, etc. Drawers care for countless small tools

The photo below shows how the box is divided into compartments and fitted with four drawers for regimenting small tools, parts and materials. Features of the box are a separate compartment at the back for storing two handsaws, and a lid that drops down to provide a bench top. The drawing on the opposite page details construction. Crate lumber will do for the box, although pieces of plywood are best for forming the compartments and drawers.





Colorful Frames for Wall Pictures Cut From Large Desk Blotters



Attractive frames for photos or other pictures can be cut from large desk blotters. These may be obtained at most dime stores and are available in a wide variety of colors and interesting textures. The framed pictures should be tacked directly to the wall or backed with $\frac{1}{4}$ -in. plywood having screw eyes driven into the upper edges to permit hanging. Or, if desired, omit the screw eyes and attach easels to the plywood backs.

Glare From Plated Car Accessories Killed With Electrician's Tape

Driver discomfort caused by reflection from plated spotlight handles and other accessories can be avoided by killing the glare with plastic tape of the type used



for making electrical splices. Such tape adheres tightly to clean metal surfaces and is peeled off easily at any time. Areas of an instrument panel that reflect in the windshield may be similarly covered.

Walter E. Burton, Akron, Ohio.

Sheet-Metal Paintbrush Holder Retains Shape of Bristles

To prevent the bristles of a paintbrush from bending when left in a can, place the brush in a holder submerged in the can as shown. The holder is merely a strip of tin which is bent to the shape of the letter M.

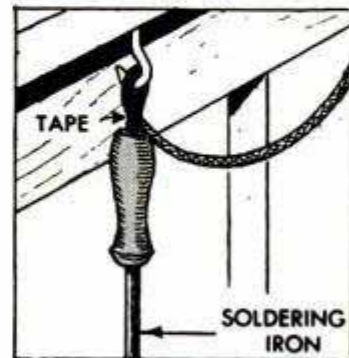


Damageproof Food Box For Camping Trips

A beverage case of the type having hinged lids that close together at the center is ideal for carrying food on a camping trip. Coat the case with orange shellac to make it water resistant, and also to discourage mice, pack rats and other pests from gaining entrance by gnawing holes through the sides. For storing flour, meal, sugar, etc., inside the box, use salt containers of the type having metal pouring spouts, and shellac the outside surfaces. These containers are filled through the spouts with a funnel and, in use, will not require the removal of lids or covers that may be lost or misplaced. Bacon and salt pork should be kept in plastic bags to prevent them from soiling other foods. Lard and butter will remain clean and will be easy to get at if stored in tin cans having press-fit lids.

Soldering Iron Hung on Bench By Loop Formed in Cord

One shop worker avoids the possibility of burns from his hot soldering iron by hanging it on a hook at the end of the bench when not in use. A loop was formed in the cord of the iron near the handle



and wrapped with friction tape to hold it in shape. Being able to hang the iron out of the way is especially good when it is set aside to cool.



SHOP NOTES

THICKNESS PLANER

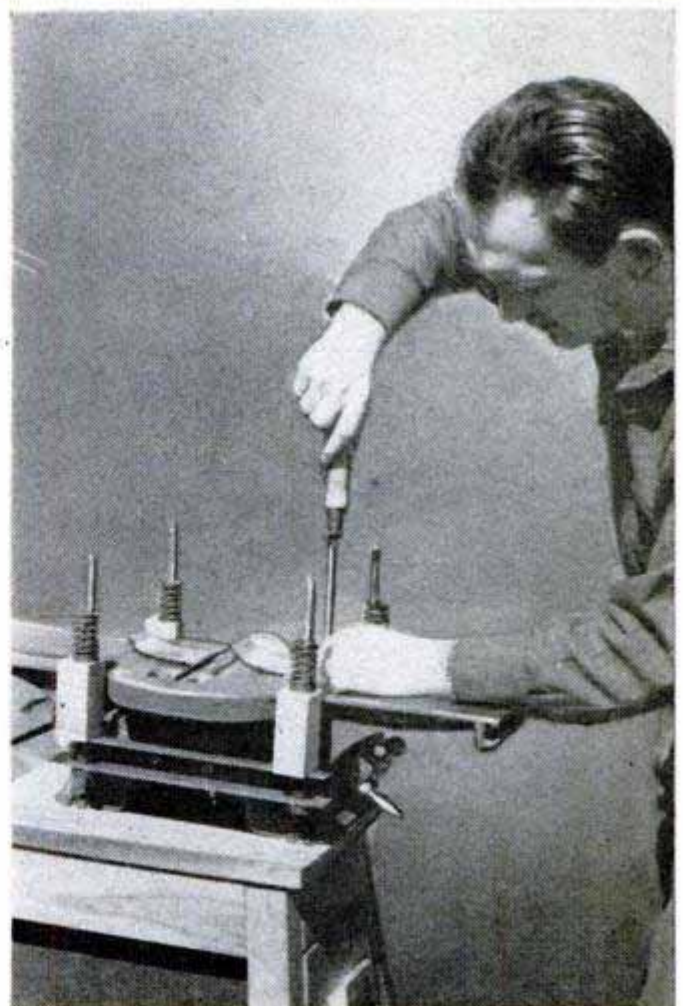
from your jointer

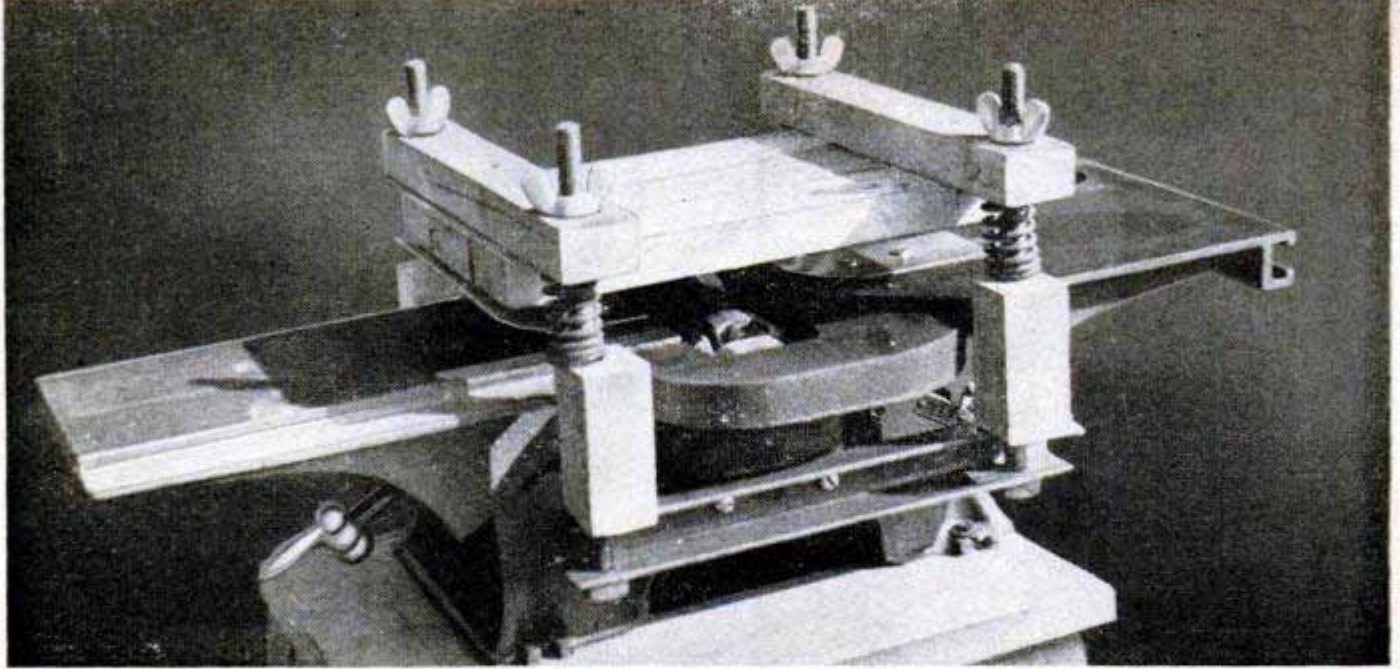


By Norman E. Schultz

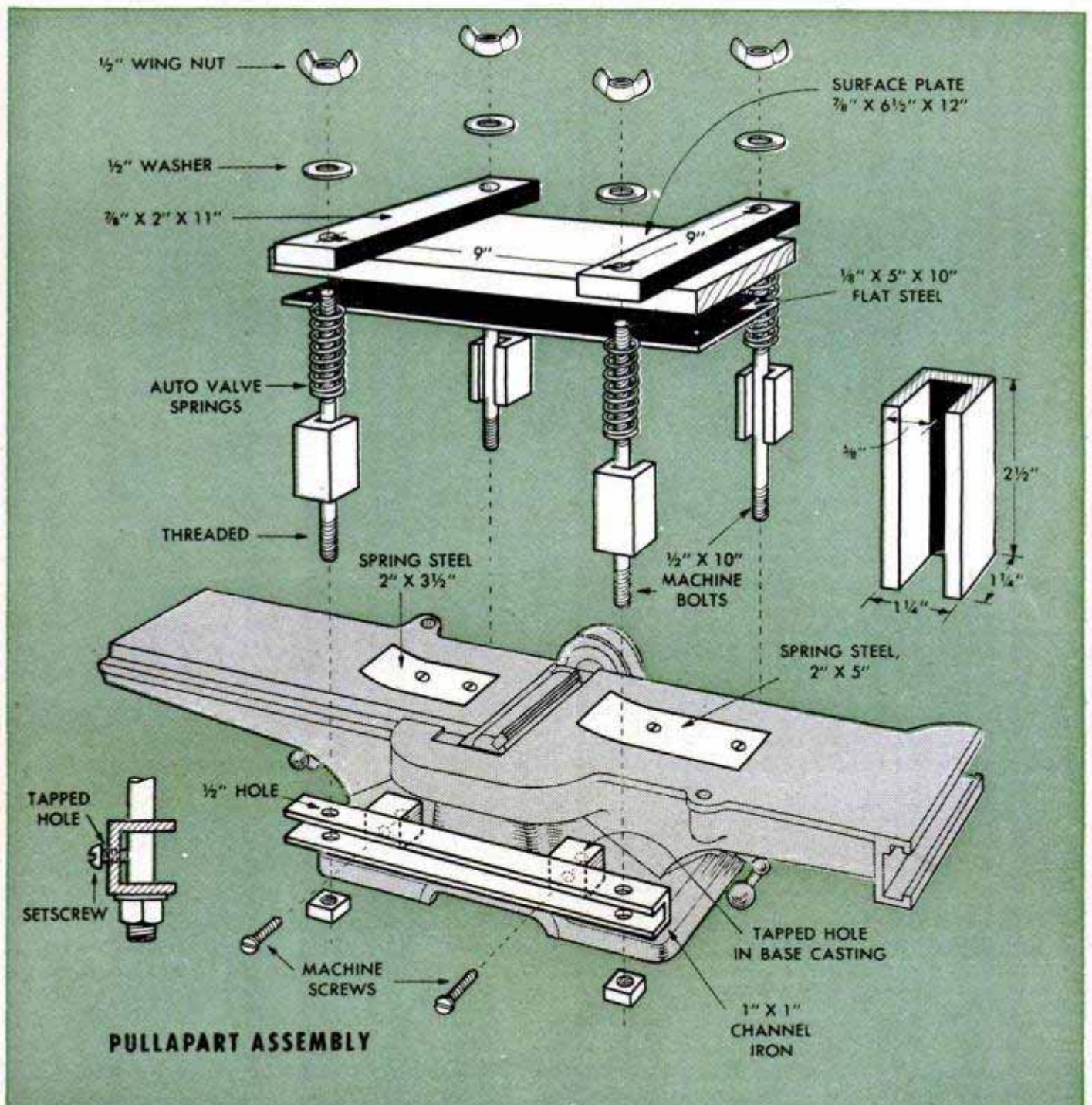
YOUR JOINTER will do double duty as a thickness planer when fitted with this unusual "pickaback" attachment. It works equally well on either a 4 or 6-in. jointer, and enables you to dress rough-sawn boards to finish dimensions, or plane re-sawed stock from $\frac{1}{8}$ to 2 in. in thickness. Simplicity of construction will be apparent from the detail and photo on the following page, but the dimensions given may have to be altered somewhat when fitting the unit to different makes of jointers. First, the front and rear jointer tables are drilled and tapped for machine screws which hold two flat springs with upturned ends. These springs serve a twofold purpose, as anti-kickbacks and also as pressure springs to support the stock tightly against the overhead surface plate, which substitutes for the regular table in the conventional thickness planer, or surfacer. On nearly all types of small jointers it is possible to attach a length of channel iron to each side of the machine frame by means of cap screws and

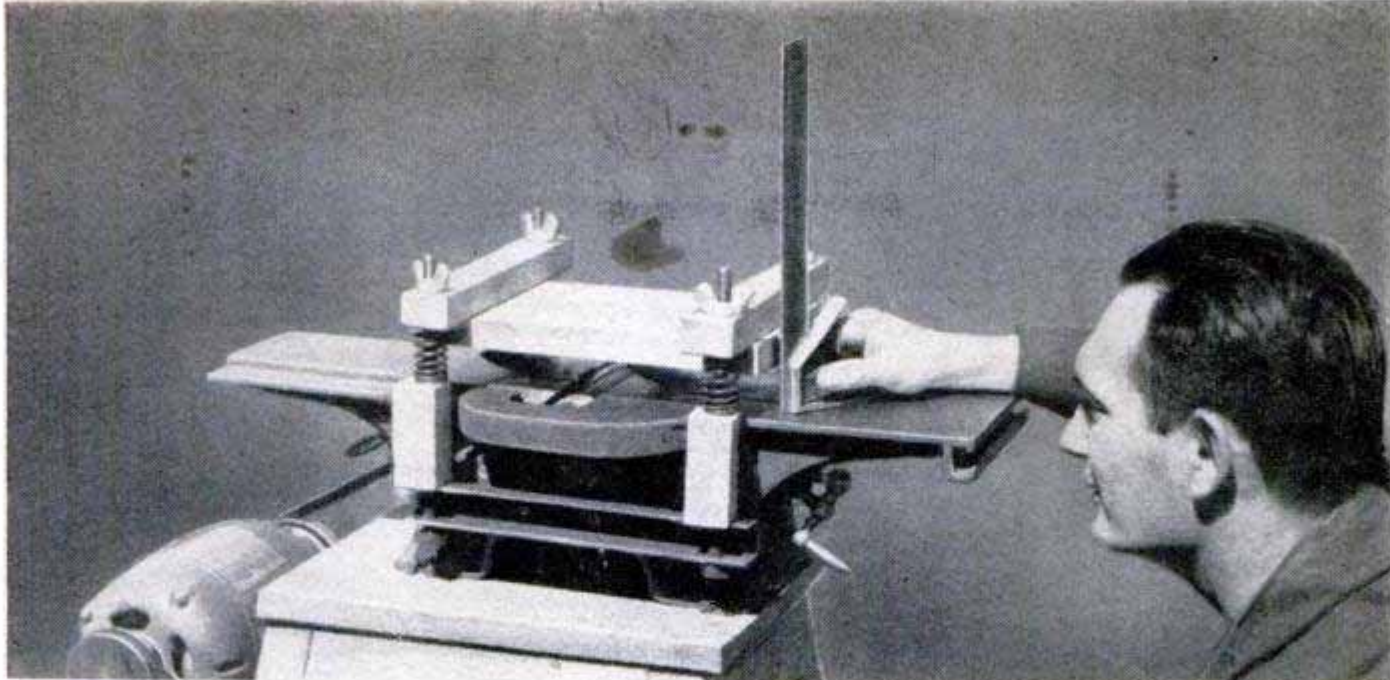
Photo at right shows flat pressure springs being fastened to jointer tables which have been tapped for machine screws. Note upturned ends of springs





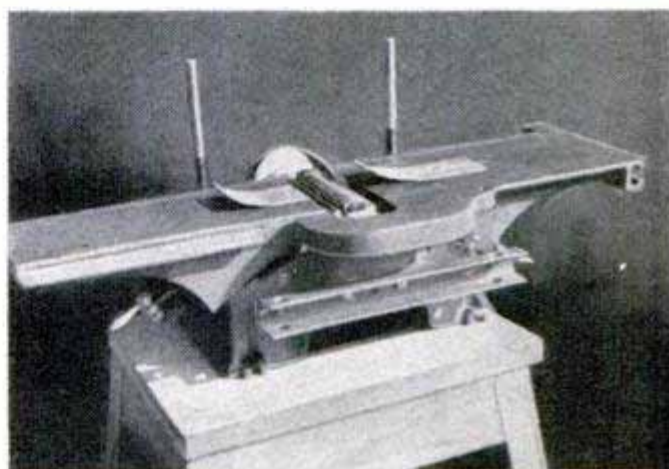
Close-up pictures thickness-planer adapter mounted on jointer. Springs force surface plate against wing nuts





Above, square is used to be sure surface plate is parallel with jointer table and to check distance above head. Right, jointer ready for planer unit

spacers as shown in the detail. Note that the legs of the channels are drilled near each end to take $\frac{1}{2}$ -in. studs. You can make the studs from $\frac{1}{2}$ x 10-in. machine bolts by cutting off the heads and threading the ends to accommodate wing nuts. Note also that the webs of the channels are drilled and tapped to take setscrews which are tightened on the studs to hold them in a fixed position. The surface plate is made from hardwood, cleated as shown for additional strength, and the bottom is faced with flat steel ground and polished smooth on the lower face. The steel plate is attached with flat-headed wood screws, the heads being countersunk slightly below the surface. The unit is assembled on the jointer as in the photos above and on the opposite page. The surface plate is supported on coil springs such as auto-valve springs, the lower end of each spring bearing against a hardwood spacer block grooved lengthwise to fit over the studs. This arrangement permits easy removal of the entire attachment and, at the same time,



provides a fine adjustment of the surface plate when planing stock to a given thickness. To adjust for depth, set the jointer tables at the same height with the cutting circle of the knives projecting above the tables sufficiently to take a light shaving cut, allowance being made for the thickness of the flat springs. Then place a square on the jointer tables as shown in the photo above and adjust the surface plate to give the thickness desired. Run a trial piece to check the accuracy of the setting. In ordinary work, the surface plate must always be set parallel with the jointer tables.

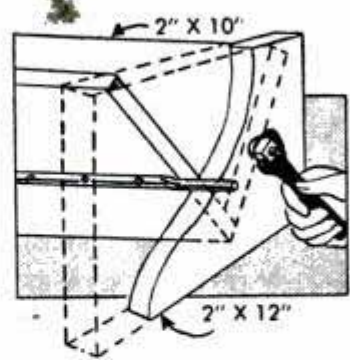
Characteristics of Lubricating Oils Determined From Simple Tests

Here are three tests that anyone can make to determine the relative characteristics of lubricating oils used in journals, etc. To check for tenacity, or "staying" ability, place two drops of different oils, which are labeled as having the same viscosity, on a sheet of plate glass. Tip the glass to a near-vertical position and note the oil that is slowest to run down the glass. That one has the greater tenacity. To determine shock-resistance capacity of the same two oils, place a drop of each on a steel plate,

and then strike each with a hammer. The lubricant that splatters least under the impact is the one most likely to prevent metal to metal contact when in use. You can tell if an oil has sufficient lubricity by dipping a piece of cardboard about 4 in. wide into it, and then lifting the board out to watch the way the oil drains off. If it falls in a film from the entire edge of the board, it passes the test. With your finger, rub a few drops of this oil on the palm of your hand and notice the absence of frictional heat.

Ends On V-Type Feeding Troughs Held With Wagon-Box Bolts

Hog raisers who find that V-type wooden feeding troughs serve their purpose best often have trouble with the ends of the troughs working loose and causing feed waste.



One good way to prevent this is to attach the ends to the trough with wagon-box strap bolts. The straps are riveted to the sides of the trough with the threaded ends projecting far enough to permit bolting

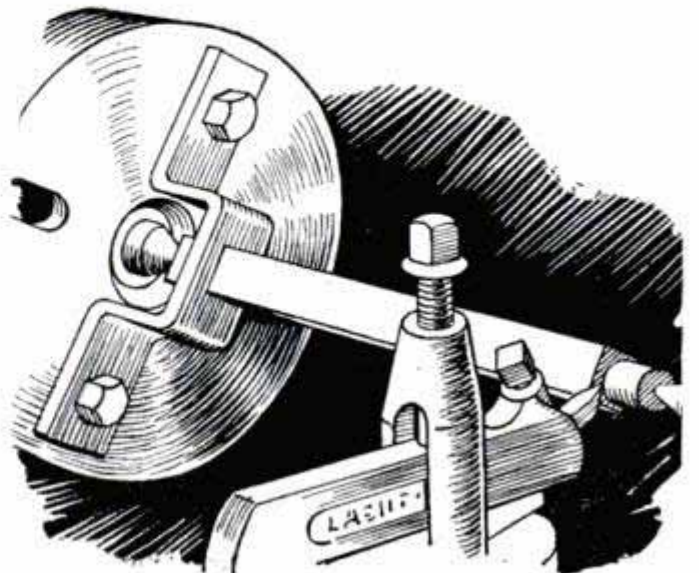
on the ends. Use wagon-box rivets with washers at both ends; also use washers under the bolt nuts to prevent them from cutting into the wood as they are tightened. When making troughs of this kind, be sure that the ends of the boards used for the sides are perfectly square. This will assure tight joints and will help prevent leaks as well as add rigidity to the troughs.

A. M. Wettach, Mt. Pleasant, Iowa.

Special Dog Screwed to Faceplate Saves Time in Mass-Machining

When mass-machining bar stock of duplicate sizes, holding the work between centers and turning it with this special dog will save considerable setup time. Having a square hole centered over the headstock spindle, the work is automatically chucked in the dog by merely inserting it in the hole. The dog is made by filing a square hole in the center of a strip of flat steel and forming it into a U-shaped bracket. A hole is drilled at each end for mounting the dog to the faceplate with cap screws.

C. W. Woodson, Miami, Fla.



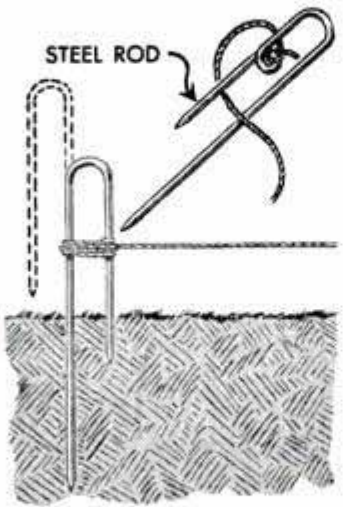
Safe Way to Inflate Truck Tires Mounted on Three-Part Rims

To avoid injury when inflating a truck tire mounted on a three-piece rim, which has a removable side that sometimes "blows off," one service-station owner offers this advice. After mounting the tire and assembling the rim, put a few pounds of air in the tire and tap the locking ring in several places with a hammer to be sure it is seated properly. Then, before inflating the tire fully, place it on the floor with the removable side of the rim down. In this way, the floor and the weight of the tire will absorb the impact of the removable rim should it be forced off.

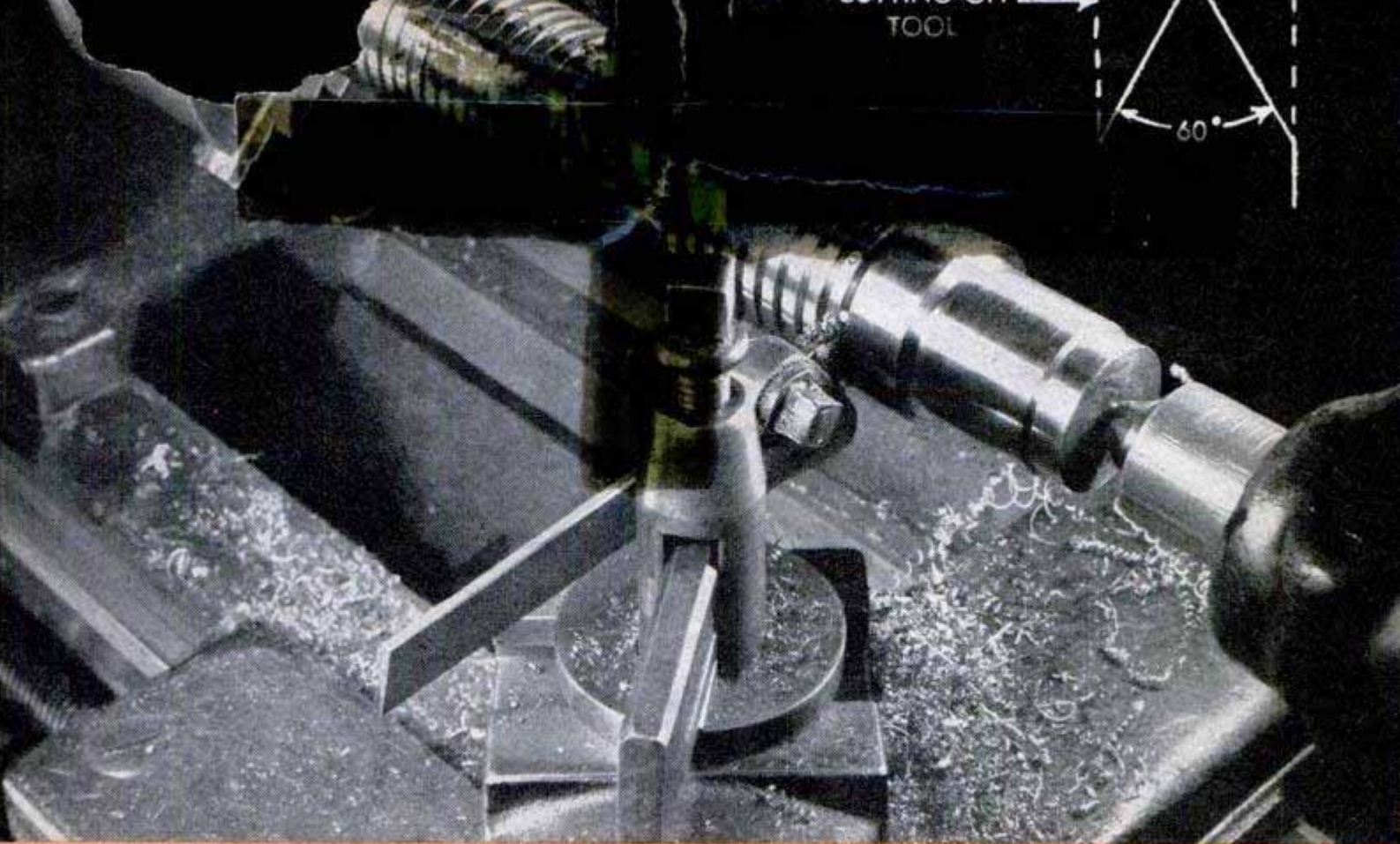
L. W. Crosby, West Medway, Mass.

Stake Doubles as Tightener For Mason's Chalk Line

Not only will this wire stake serve as a reel for a mason's chalk line but its hairpin shape permits it also to function as a tightener. Pivoted on one leg, which is longer than the other, the stake is rotated to tighten the line by merely pulling it up sufficiently for the short leg to clear the ground.



With the slack taken up, the stake is pushed back into the ground where the extra leg will prevent the stake from rotating.



IMPROVISED THREAD-CUTTING TOOL

When no suitable threading tool is available, machinists sometimes improvise one by grinding the thin blade of a cutting-off tool to a 60-deg. point with a 3-deg. clearance. The top of the tool is then ground flat. On brass and other metals which produce short chips, the top of the tool is ground with a slightly negative rake, which results in somewhat smoother work. Such an improvised tool is especially suitable when cutting fine-pitch threads on large-diameter work and also is useful for making V-shaped scores on ornamental turnings

Converted Branding-Iron Heater Used for Controlling Grass Fires

Desiring some means of rapidly starting backfires for the control of weed fires, one ranch foreman converted a branding-iron heater into a flame thrower. Fueled on butane from tanks mounted in a pickup truck, the firing equipment can be transported quickly to wherever needed, and backfires can be started by an operator riding in the bed of the truck. The flame thrower also is useful for burning weeds on right-of-way land alongside railroad tracks and highways and for other similar firing jobs, which ordinarily require the use of heavy, hand equipment. To convert the heater, it was necessary only to replace the fuel hose with a longer one and to attach a steel pipe to the heater jet.

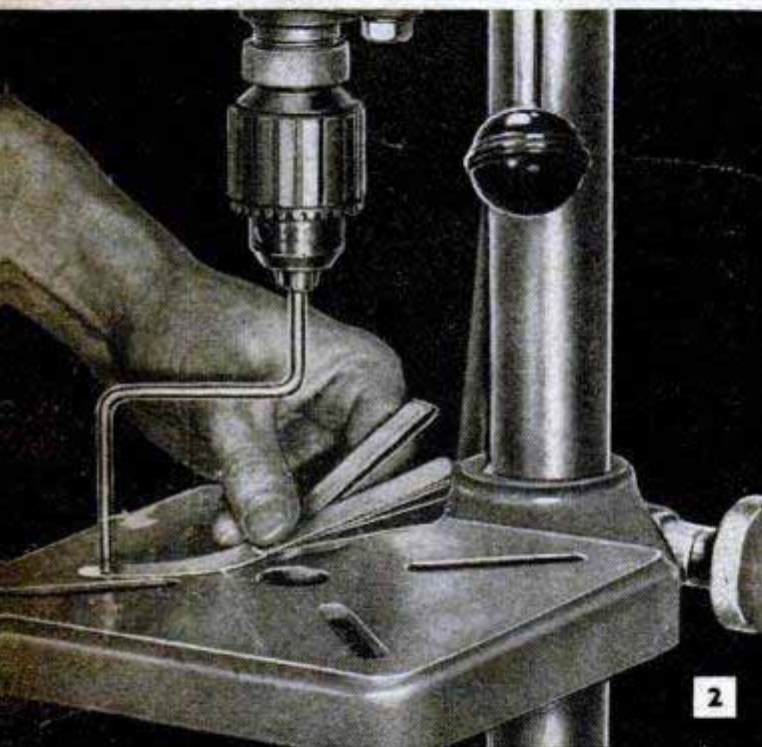
J. Garland Smith, Aurora, Colo.

☐ If you experience difficulty in engaging the splines of a transmission shaft with those in a new clutch-plate hub, bevel slightly the ends of the splines on the transmission side of the plate.

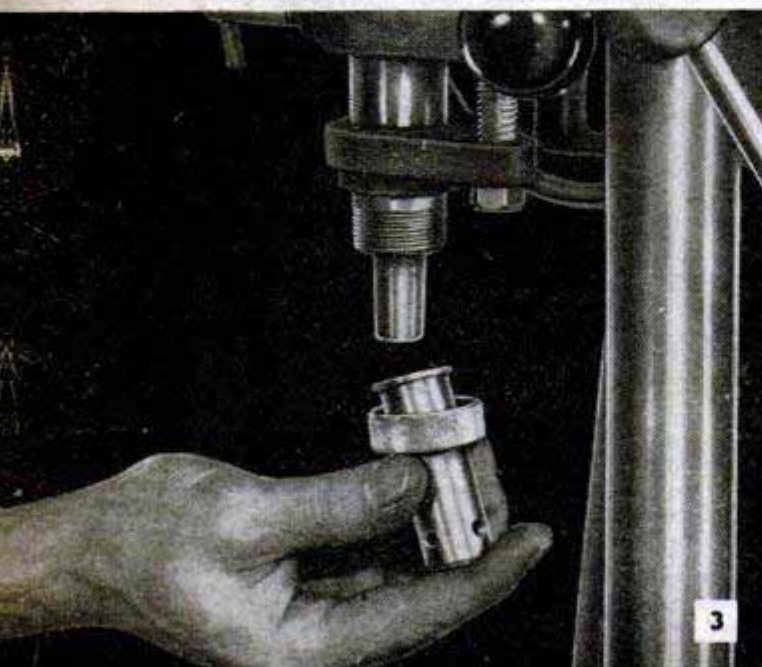




CHECK SPINDLE RUNOUT



TEST TABLE ALIGNMENT



USE A SPINDLE ADAPTER

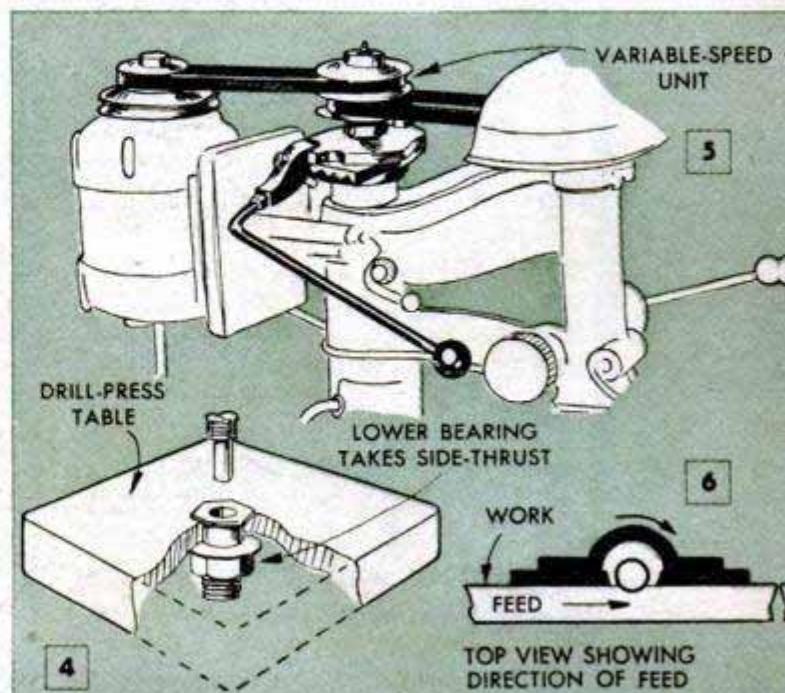
extra 30 for your DRILL PRESS

By E. R. Haan

Part I — Woodworking

OFTEN considered just a hole-puncher by the average inexperienced person, a drill press is one of the most versatile power tools for use in both wood and metal. It can double as a high-speed boring machine, router, hollow-chisel mortising machine, surface planer, shaper, dovetailer and so on through a long list of special applications. However, when used for these jobs, the drill press must be in good mechanical condition, and should be checked thoroughly.

Excessive play between the spindle and its bearing requires replacement of these parts. Although spindle run-out sometimes can be corrected, it generally is best to replace a bent spindle. To check for spindle run-out, remove the chuck and use a dial indicator as in Fig. 1. Then turn the spindle

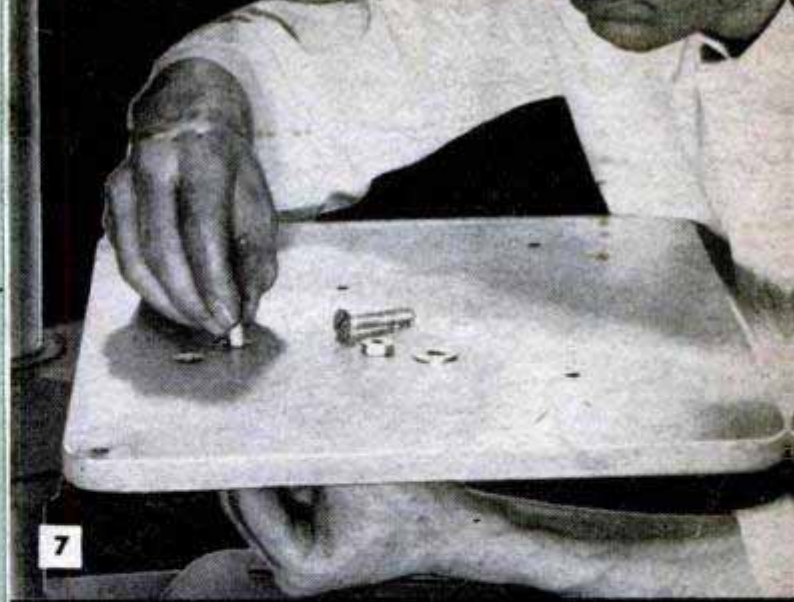


WOODWORKING

You can carve, shape, rabbet, rout; cut mortises, flutes, disks, large holes, beads, dovetails and plugs; sand with drums or belts, or, even jigsaw, and taper dowels

METALWORKING

In metal you can do milling, grinding, tapping, filing, buffing and polishing, as well as scratch brushing, spot finishing, countersinking and other machining jobs



AUXILIARY TABLE

by hand. Any considerable variation of the needle indicates run-out.

Next, with the table in the horizontal position, check it to see if it is at right angles to the spindle axis. Use a light rod bent to the shape shown in Fig. 2. Chuck this and lower the spindle until the rod just clears the table. Lock the quill in this position and use a feeler gauge to see if the clearance is the same at various points. Most tilting tables can be shimmed between the table boss and column clamp to correct misalignment.

Chucks on tapered spindles may be used to hold tools when the cutting thrust is upward, but may loosen if the thrust is sideways. Therefore, when using high-speed tools, such as shaper cutters and large router bits involving side thrust, a special spindle adapter, Fig. 3, should be used.

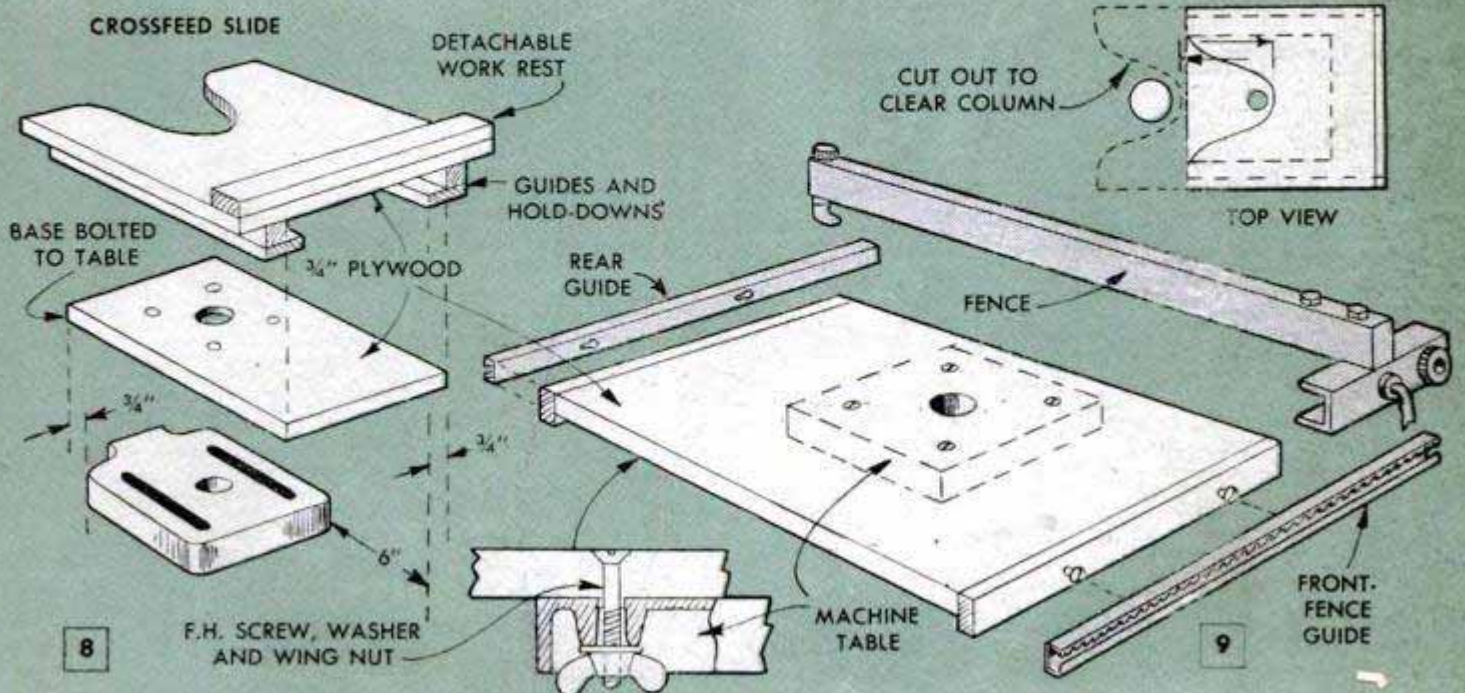
In some operations, the tool overhang makes it advisable to provide a bronze bearing in the table for the end of the tool

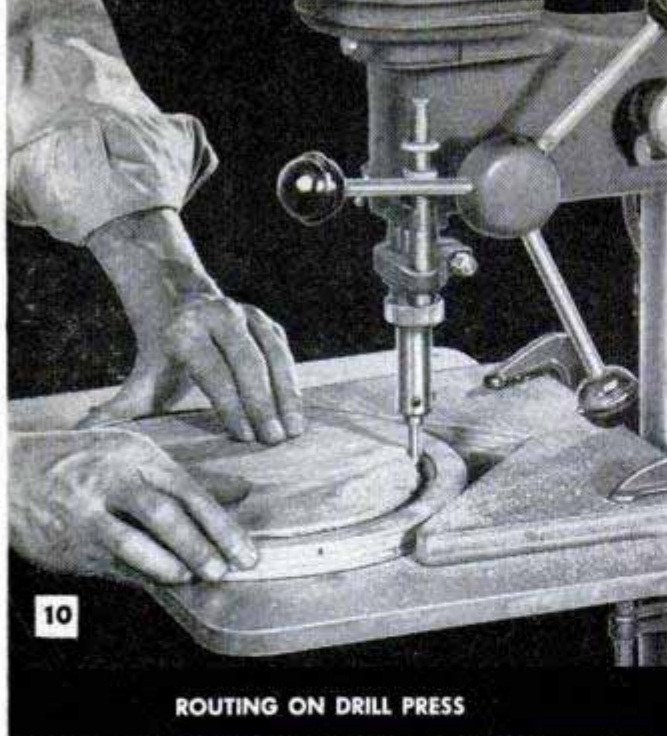
as pictured in Fig. 4. Also, unusually high-speed operations make it necessary to use a variable-speed drive similar to the one shown in Fig. 5.

Feeding the work: Work that contacts the side of a rotating cutter or abrasive tool should be fed against the direction of rotation as in Fig. 6. For example, when shaping with the drill-press head above the work, feed from left to right but, when the head is mounted below the work on a floor-type drill press, the feed and direction of rotation are in the opposite direction.

If a larger work area is required than that provided by the regular table, you can purchase an auxiliary table, Fig. 7, or make one from $\frac{3}{4}$ -in. plywood, Fig. 9. For cross-feeding, you can improvise a slide as shown in Fig. 8.

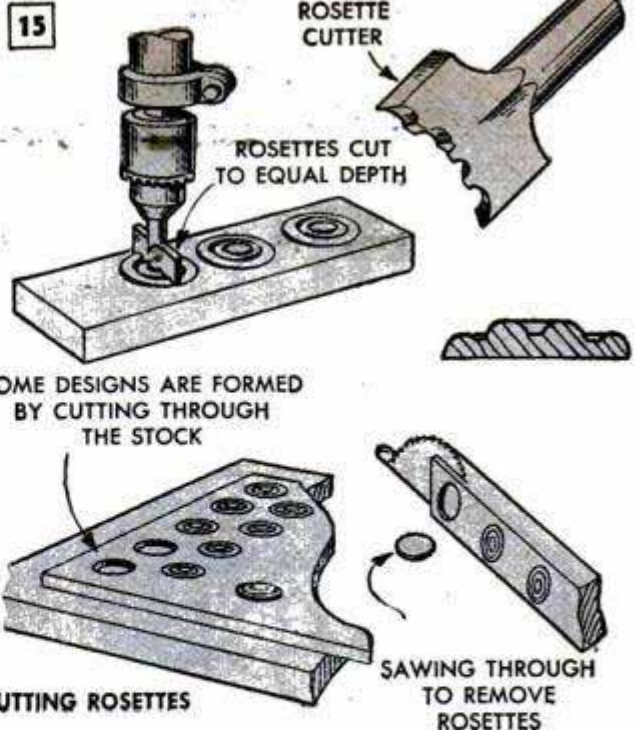
Routing: A drill press can be used for routing in a range from small inlay grooves to large recessed areas. Spindle speed





10

ROUTING ON DRILL PRESS

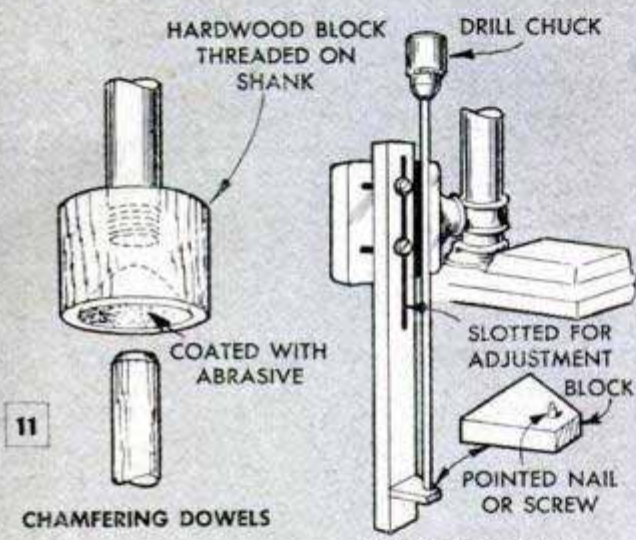


SOME DESIGNS ARE FORMED BY CUTTING THROUGH THE STOCK

CUTTING ROSETTES

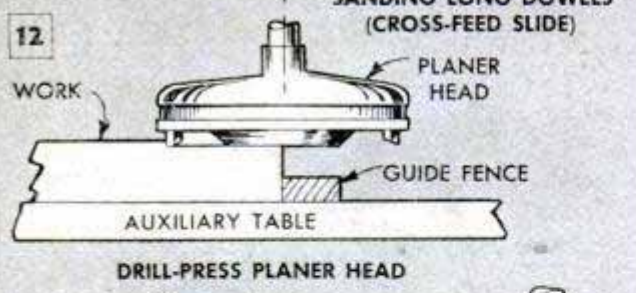
should be about 5000 r.p.m. For straight cutting, always use a fence. For circular cuts, you can use the guiding method shown in Fig. 10. A guide is clamped to the table and guide pins are set in the table securely. Sometimes a guide cut out to the same radius as the work is better than the angular cut pictured. When routing a groove wider than the diameter of the bit, the fence or guide is set over for an overlapping cut.

For routing irregular-shaped recesses, use a plywood template bradded to the underside of the work as in Fig. 13. A guide pin of the same diameter as the router bit is set in the plywood auxiliary table directly under the bit. To start the cut, place the cut-out section of the template over the guide pin, lower the bit to the desired cutting depth, lock the spindle and then move the work until an edge of the template contacts the guide pin. Outline the recess with a continuous cut, and clear out the waste. With a larger router bit chucked in the drill press, you can cut round-end mortises by placing



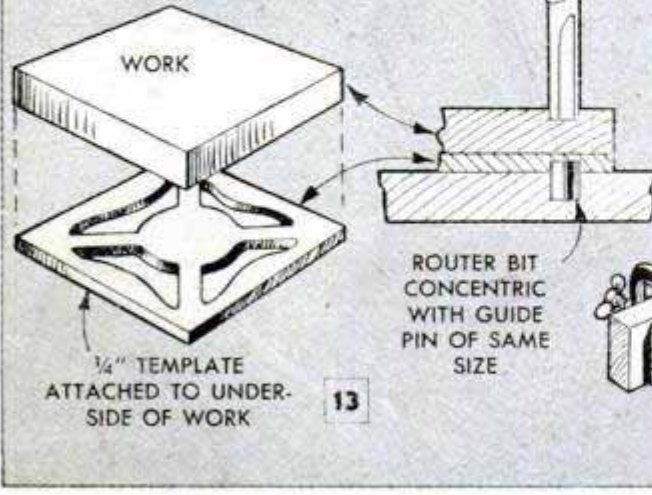
11

CHAMFERING DOWELS

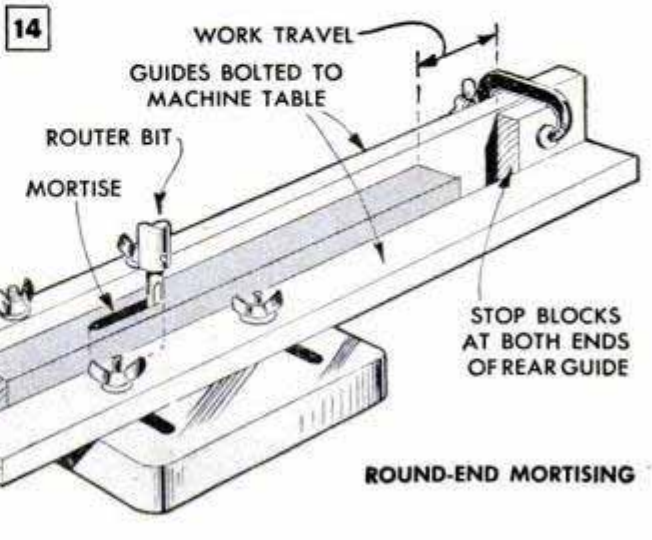


12

DRILL-PRESS PLANER HEAD

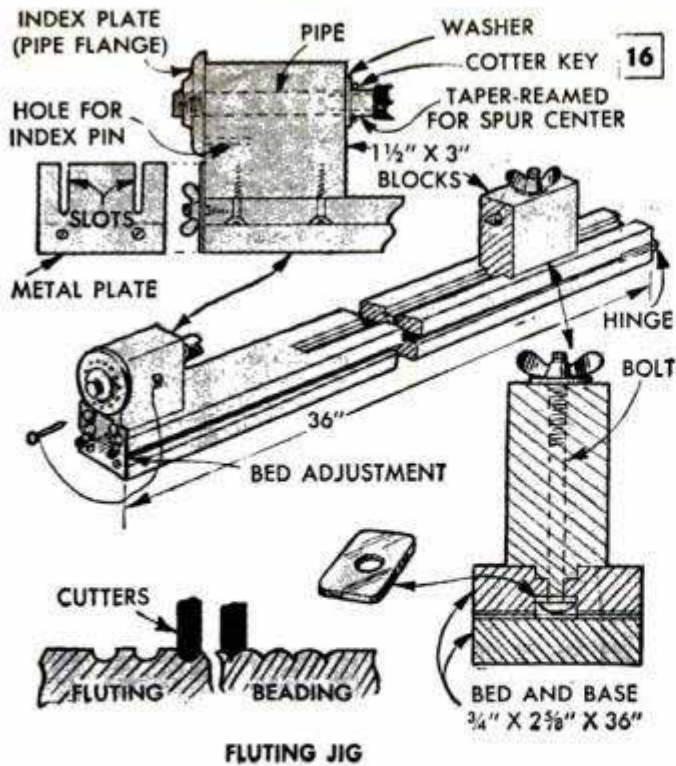


13

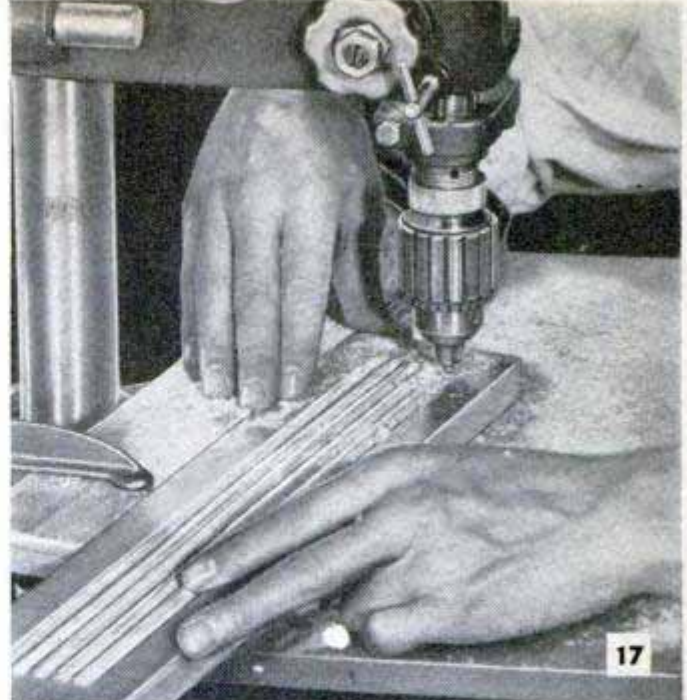


14

ROUND-END MORTISING



FLUTING JIG



FLUTING AND BEADING

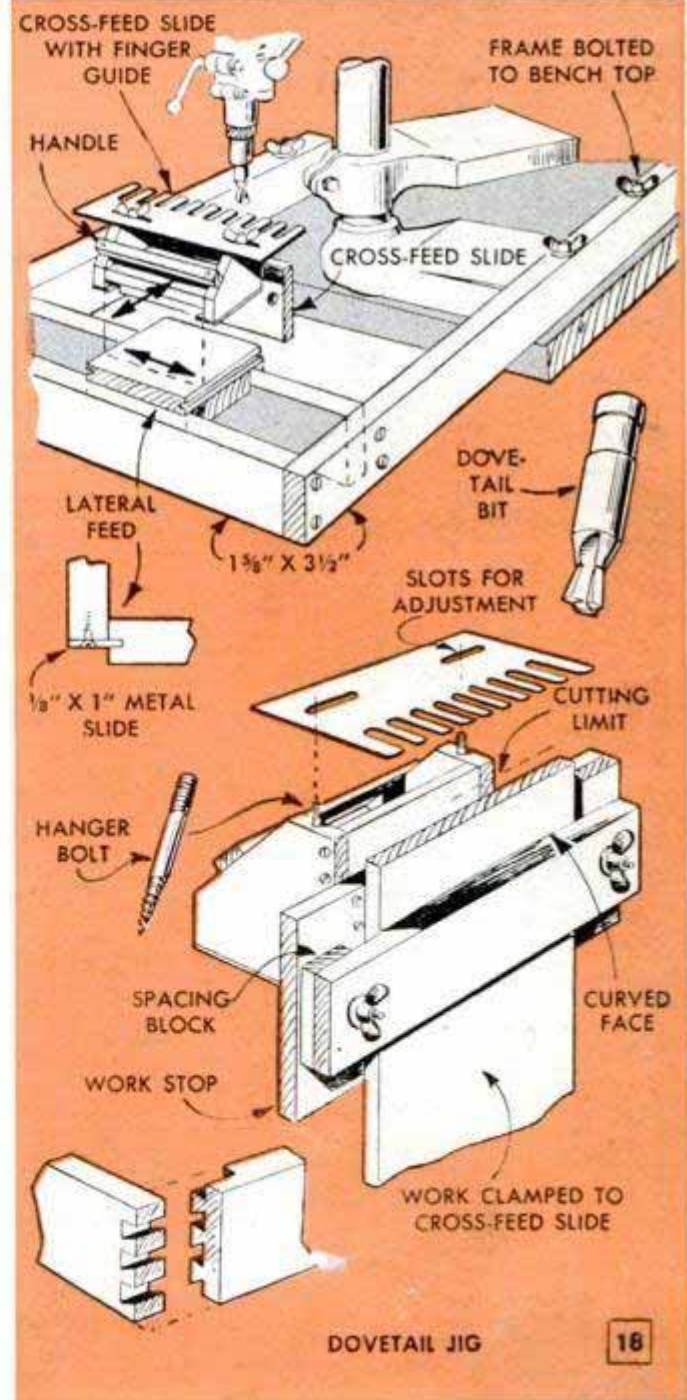
the work in a box-type fixture, Fig. 14.

Fluting and beading: In fluting, parallel grooves are cut with a special fluting bit instead of a straight router bit. Beading is formed by cutting parallel V-shaped grooves with rounded corners as in Figs. 16 and 17. When doing such work on round or polygon-shaped table legs, you need the special jig in Fig. 16. This is fitted with an indexing disk, and one end can be raised so cuts on tapered legs are made in a horizontal plane. The jig slides along a fence clamped to the table.

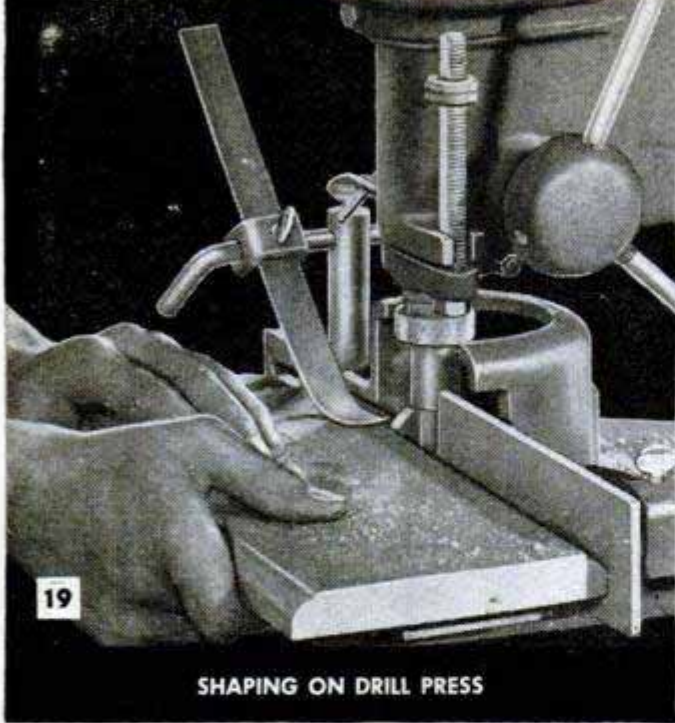
Dovetail joints: With a dovetail cutter and a jig to advance the work into the cutter, you can cut blind dovetail joints in a professional manner. The jig detailed in Fig. 18 holds the work vertically and permits it to be moved in two directions. The dovetail pins are spaced by means of a slotted metal bit guide. The dovetail sockets are cut in the second piece by clamping the metal guide to the inside face of the work and feeding freehand. For cutting buttons and rosettes from wood or plastics, use specially ground rosette cutters, Fig. 15.

Using shaper cutters: For shaping on the drill press, Fig. 19, use cutters of the solid-shank, three-lip type, or a special shaper head into which the individual cutters are clamped as in Fig. 25. A set of depth collars of different sizes is required to control cutting depth when shaping curved work where a fence cannot be used. On straight work an adjustable shaper fence, Fig. 20, is used. Use a ring guard, Fig. 22, when shaping curved work.

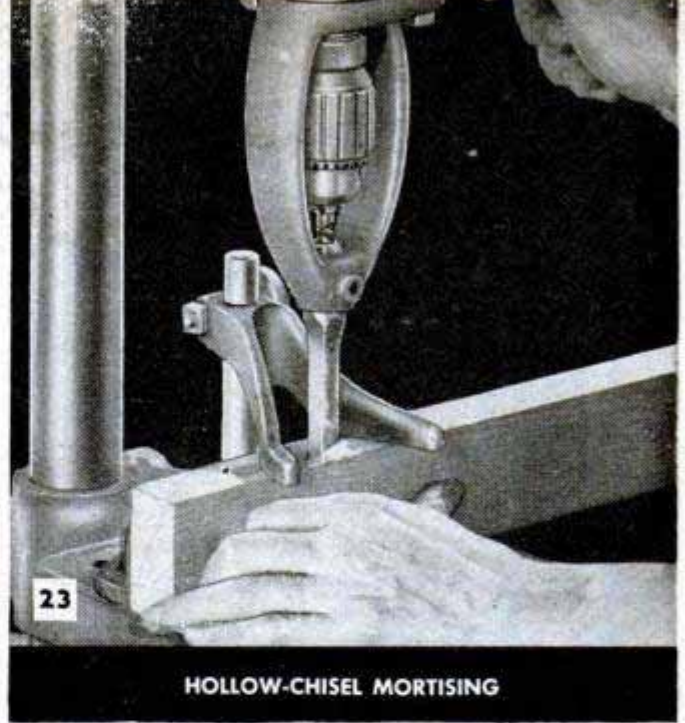
Narrow pieces of irregular shape are best held on a base as in Fig. 21, permitting you to grip the holder instead of the work. Such a base can be used as a template to guide



DOVETAIL JIG



SHAPING ON DRILL PRESS



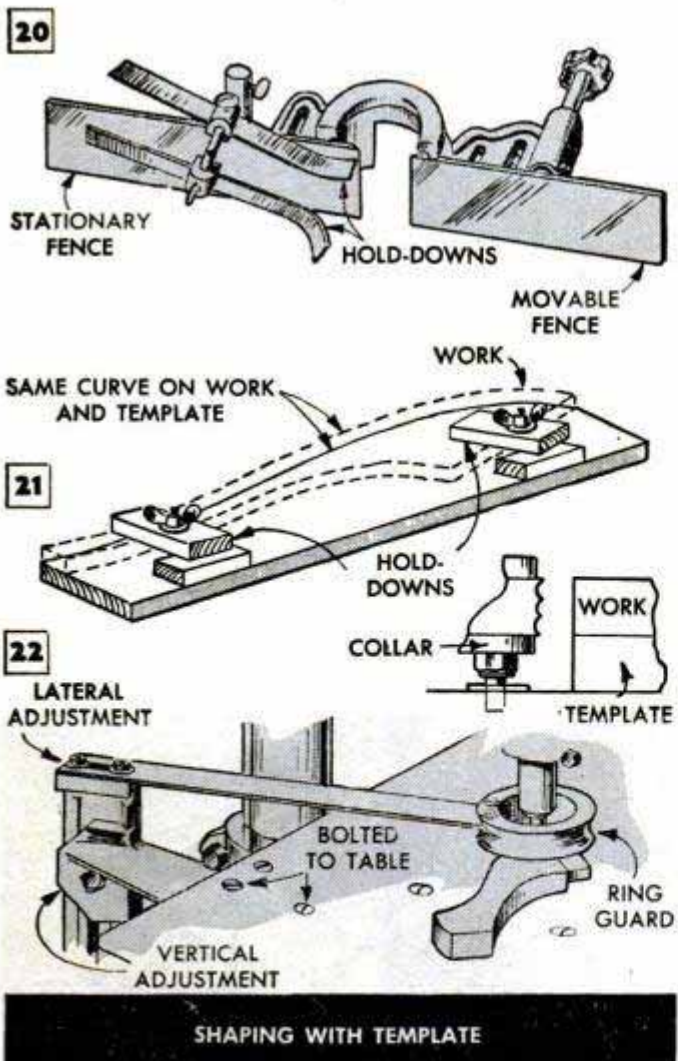
HOLLOW-CHISEL MORTISING

work against a collar, in which case the template edge must be identical to that of the work. Spindle speed for shaping operations should be at least 5000 r.p.m.

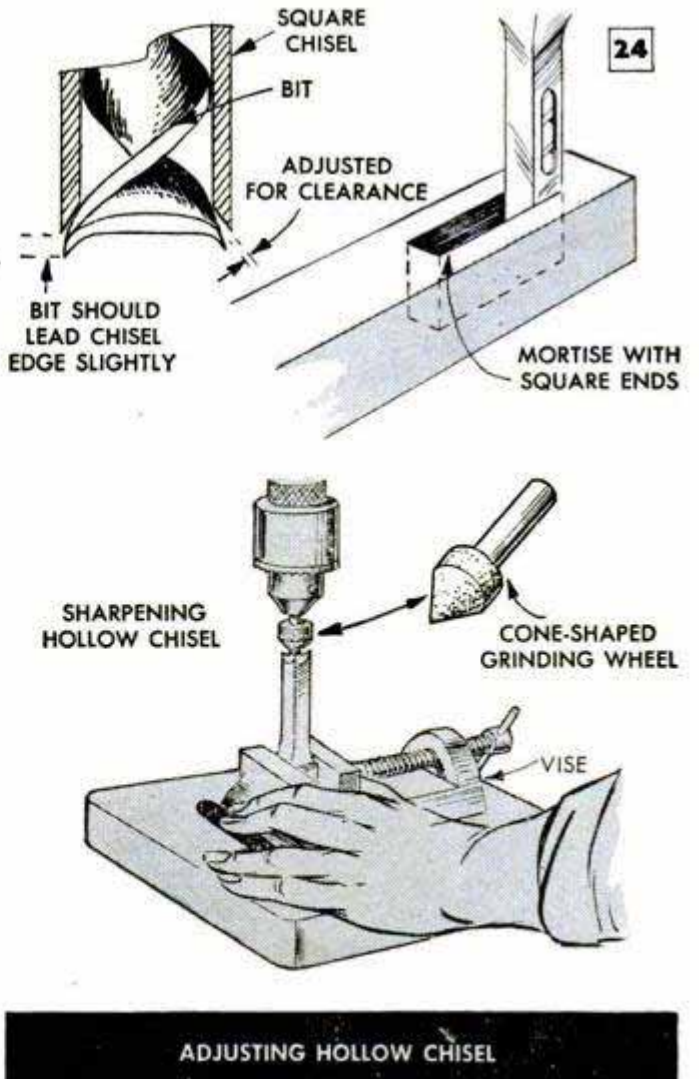
Hollow-chisel mortising: Special attachments are supplied for hollow-chisel mortising, Figs. 23 and 24. Spindle speed for mortising should not exceed 900 r.p.m. when driving small chisels. After the first

cut has been made, about three quarters of the chisel width is used for overlapping successive bites. Chisels are sharpened on a drill press with a pointed abrasive stone.

Planing: With a rotary planer head of the type shown in Fig. 29, a drill press can be used for surfacing. It also is useful for rabbeting, cutting tenons, etc. For straight cuts, use a fence or cross-feed slide; for circular



SHAPING WITH TEMPLATE



ADJUSTING HOLLOW CHISEL

work, use a guide as in Fig. 12. Spindle speed is about 5000 r.p.m.

Sanding: Small drum sanders up to 3 in. in diameter, Fig. 30, are handy for edge sanding. To get a uniformly smooth surface, use a fence, Fig. 31, for straight work and a depth collar of the same diameter as the drum for curved work. Flat table legs can be fitted accurately to a turned column if the ends are sanded concave, Fig. 32. Speeds for drum sanders vary; about 1800 r.p.m. for a 3-in. drum, 2700 for a 2-in. drum and 4100 r.p.m. for a 1-in. drum.

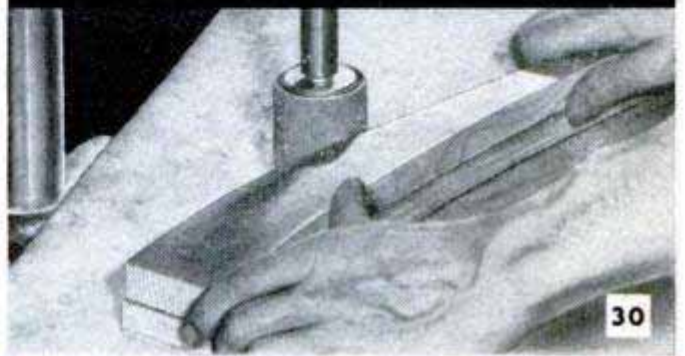
Four other types of sanders are also convenient. A small belt sander, Fig. 33, presents a vertical, flat, sanding surface and is run at a spindle speed of 1500 to 1800 r.p.m. Disk sanders, Fig. 26, for use in a drill press, should not exceed 4 in. in diameter and are run at 1800 to 2400 r.p.m. Irregular-shaped work is sanded with a contour sander, Fig. 27. In the absence of a shaper, you can make moldings with a form sander, Fig. 28.

The ends of plugs and dowels may be chamfered by touching them to a cone-shaped form sander, Fig. 11. To taper long dowels for use as model-boat masts, etc., chuck them in the drill press and support the lower end with a jig clamped to the table set vertically as in Fig. 11.

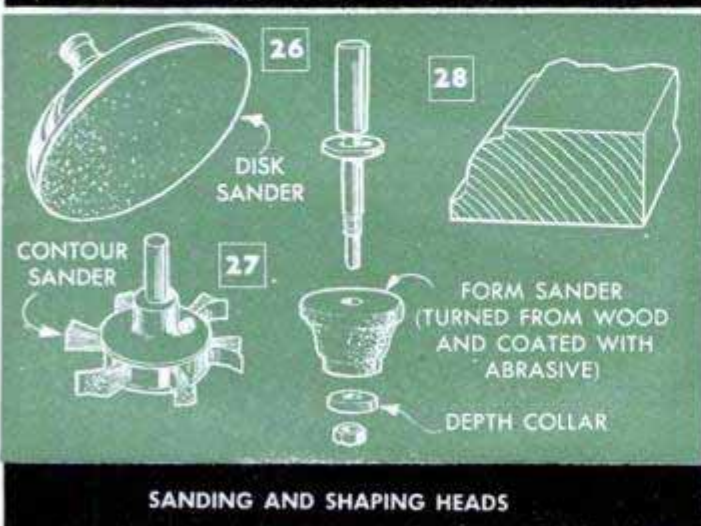
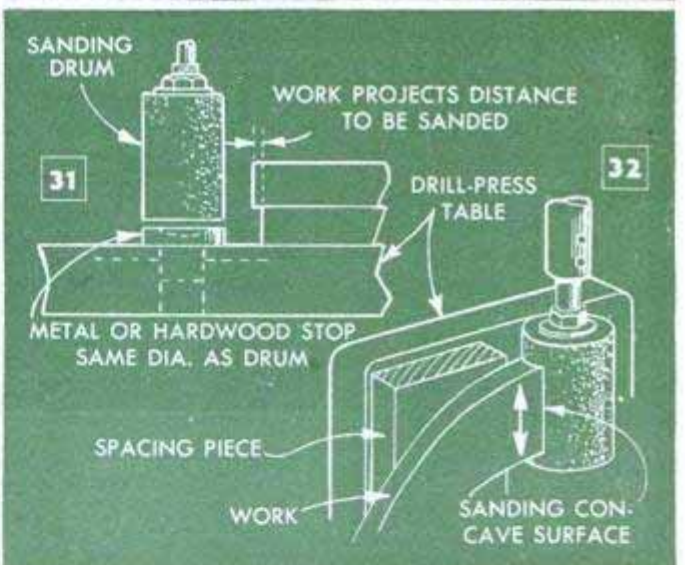
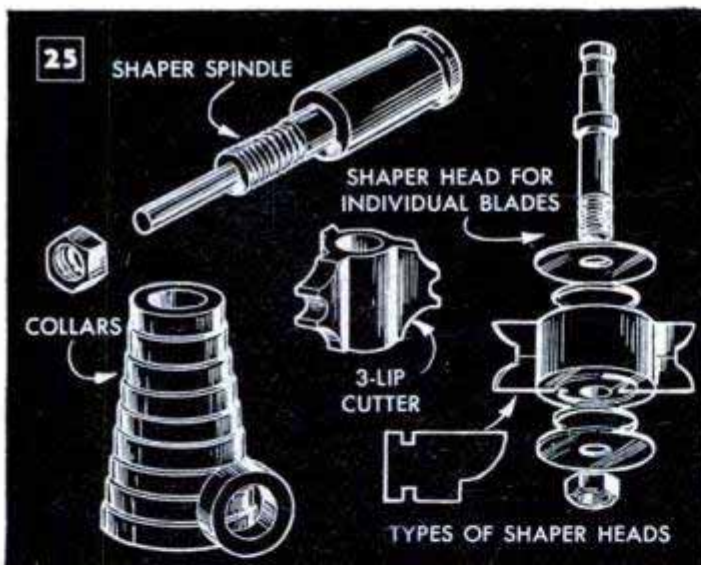
(Continued next month)



PLANING ATTACHMENT



30



SANDING AND SHAPING HEADS



BELT-SANDING ATTACHMENT

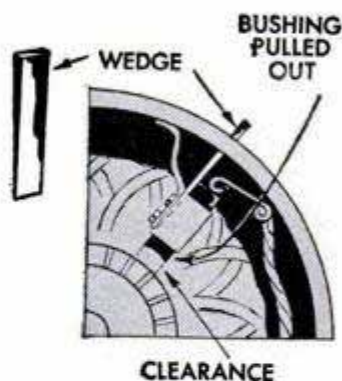
with a lid, a piece of masking tape, stretched over the top, will cap the end.

C. W. Philpot, Laurens, S. C.

Wedges Hold Generator Brushes While Inserting Armature

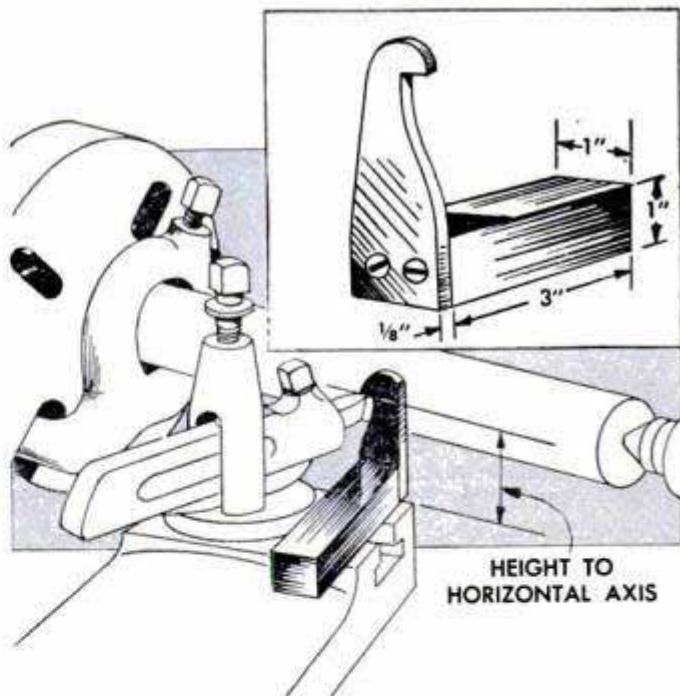
When reassembling a generator or starter, the difficulty of inserting the commutator past the extended brushes can be overcome by wedging the latter back out of the way with small pieces of sheet metal. These are filed or hammered thin enough on one end to permit forcing them between the brushes and their holders.

Herbert E. Fey, New Braunfels, Tex.

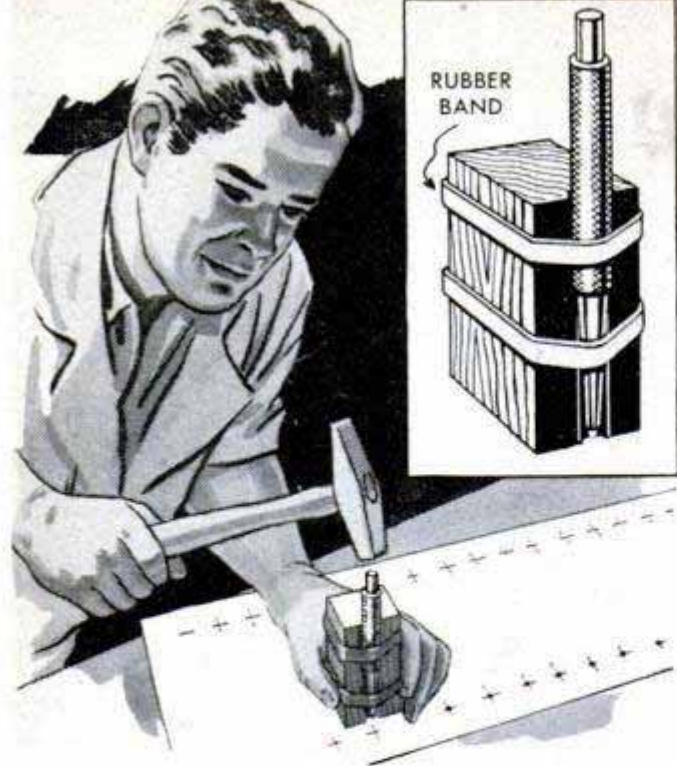


Time Saved in Setting Lathe Tool By Using Simple Height Gauge

Considerable time will be saved in setting a lathe cutting tool exactly at the horizontal axis of the work by using this simple gauge. It consists of a short length of 1-in. bar steel to which a small flat-steel arm is screwed



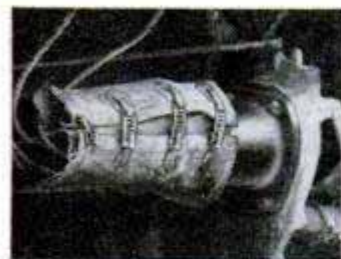
vertically, the arm having been ground to the shape shown to provide an overhanging lip at the proper height. In use, the gauge is placed on the compound rest and the tool adjusted to the height of the underside of the lip. If desired, the gauge may be used to set tools at other heights by grinding steps in the underside of the lip, each step representing a required height.



Prick Punch Held on Wooden Block Speeds Making Repeat Marks

Frequently having a number of punch marks to make in large sheets of metal, one tinsmith finds he can do a faster and more accurate job by using a block of wood and two rubber bands to hold the punch. The block was squared and a slight groove cut in one side to hold the punch at a right angle to the work. In use, the punch is set under the bands with the point suspended just above the work so that the block can be slid over the work without scratching it.

Snap-On Boot Cut From Overshoe Protects Tractor Distributor



If it is necessary to leave a tractor outdoors, the distributor can be protected from rain or snow with a cover made from the top of a four-buckle overshoe.

The boot is simply cut off just below the lower buckle and then buckled around the distributor body.

Transparent Small-Parts Holder

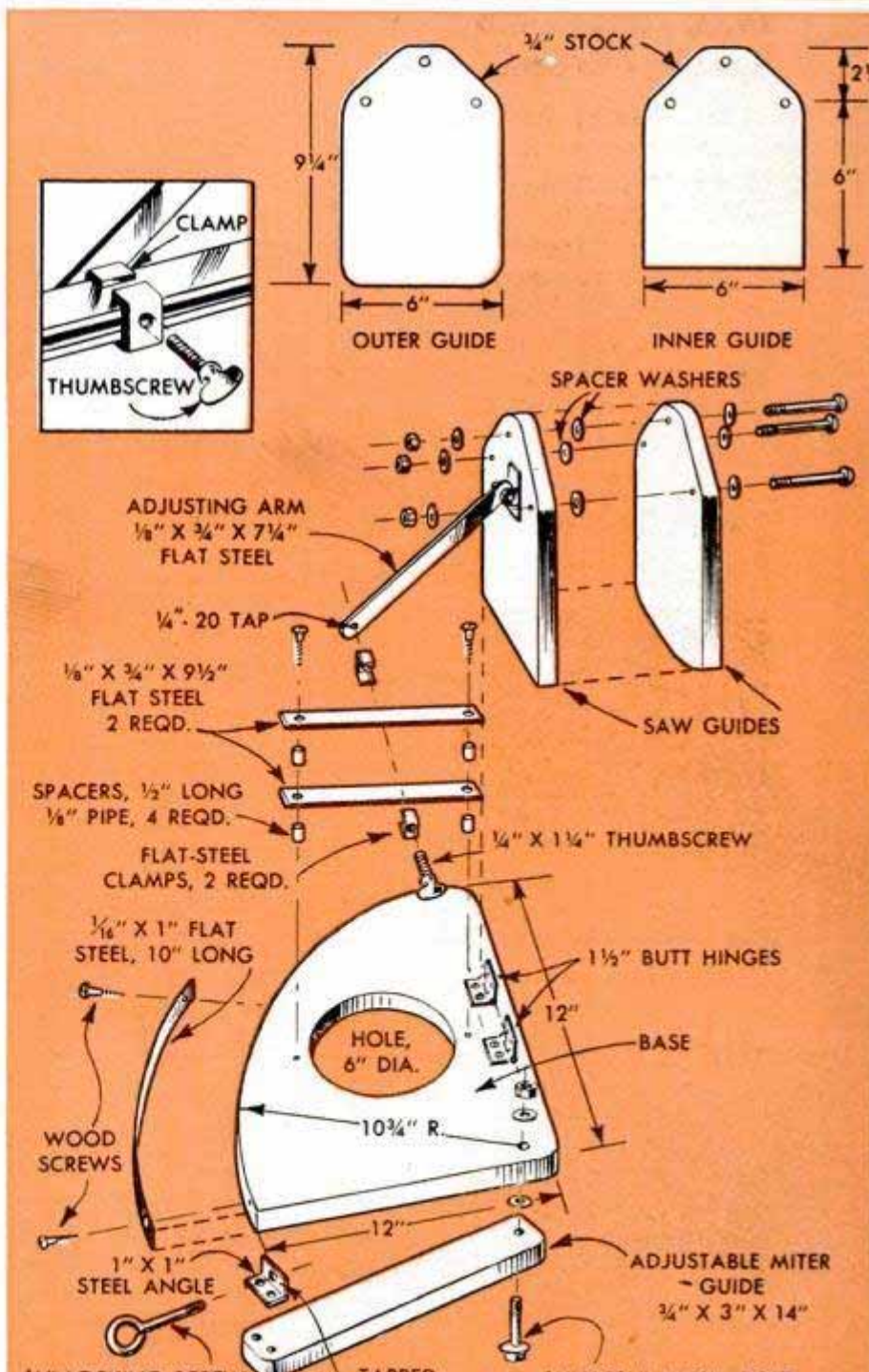
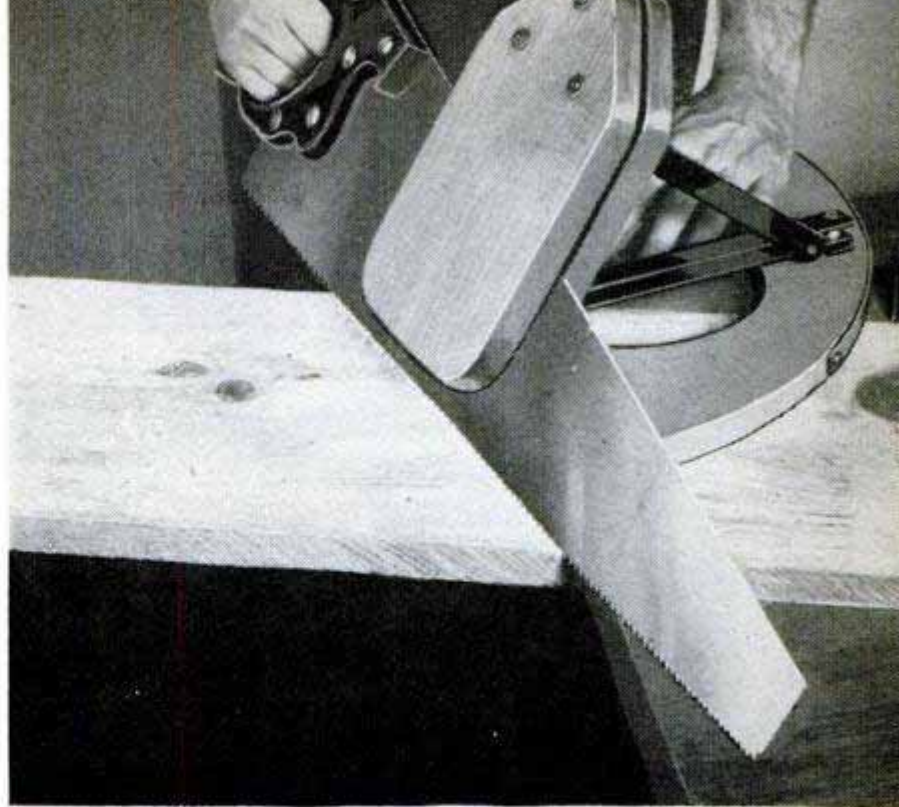
A plastic toothbrush container provides a convenient holder for small nuts, bolts, brads, etc. As the container is transparent, it is not necessary to pour the contents from the holder to see if the part needed is on hand. Being small, the container is easily

COMPOUND MITER BOX

By Marvin Hartley

DESIGNED for those special jobs that require angle cuts in boards too wide to be handled in a regular miter box, this novel unit rides the work and features a tilting saw guide which permits compound cuts to be made at angles up to 45 degs. In use, the cut to be made is marked on the work and the saw guide adjusted accordingly. Although the box can be held in place when sawing, it is better to clamp it to the work with C-clamps.

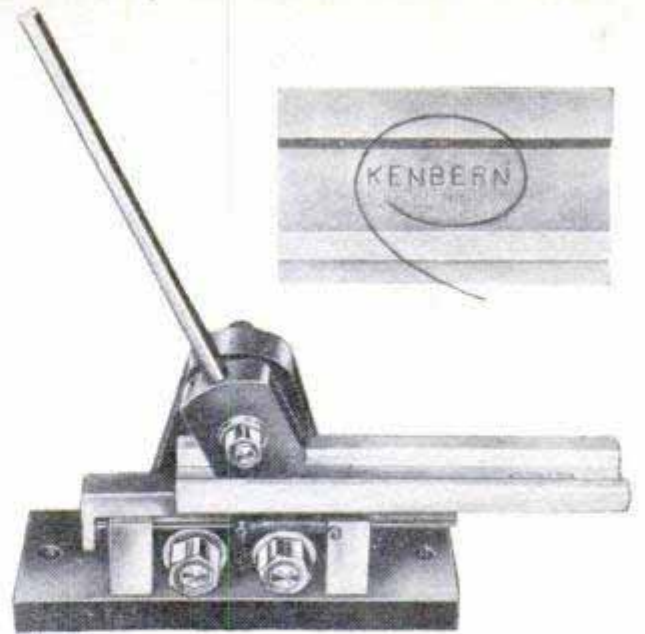
The pull-apart drawing below shows the various parts and how they go together. Plywood, $\frac{3}{4}$ in. thick, is best for the wooden parts, although solid stock will do. A circular opening is cut in the base piece to provide a handhold for holding the miter box in position against the edge of the work. The curved edge of the base piece is faced with a strip of metal to provide a clamping surface for the adjusting thumbscrew on the miter guide. Note that the outer saw guide is 1 in. longer than the inner guide so that it supports the blade when tilted to make a compound-angle cut. An adjusting arm, attached to the guide unit and to a sliding clamp, provides a means of adjusting the saw guide to any angle vertically from the 90 to the 45-deg. positions. By adjusting both the miter and saw guides it is possible to cut any compound angle within this degree range. Only slight play should be allowed between the saw guides.



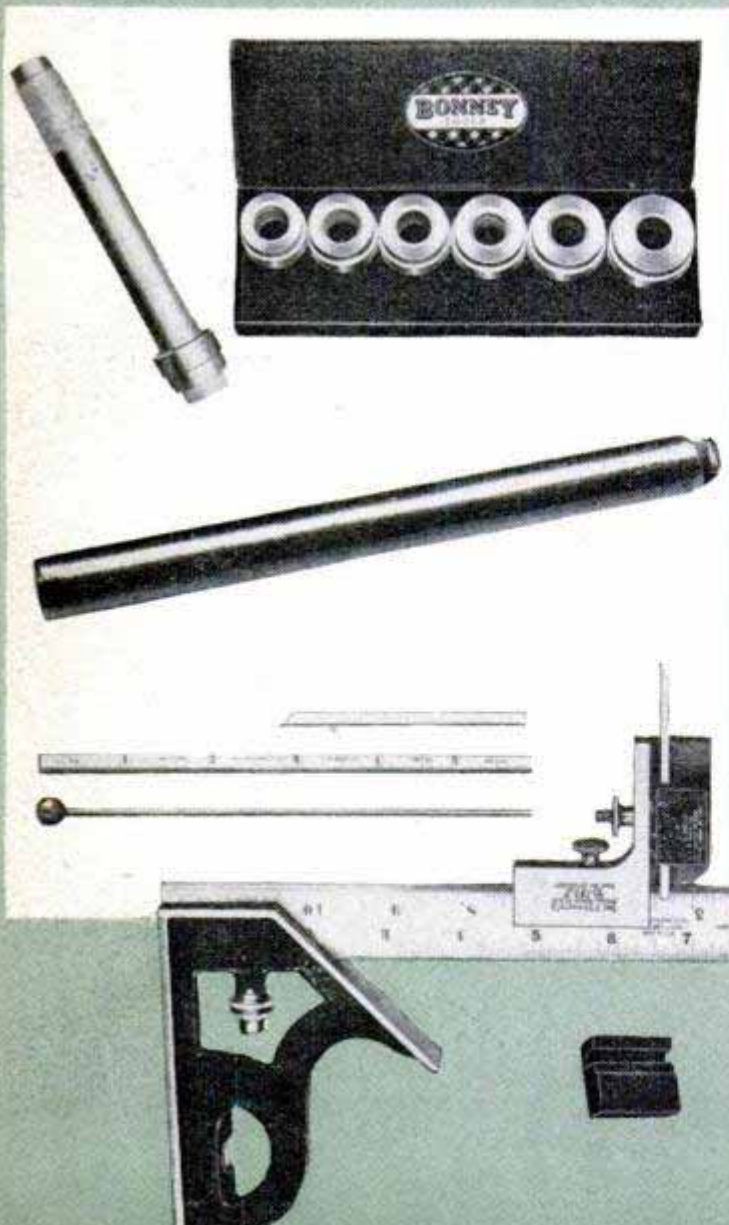
SHOPPING



AIR-OPERATED FENDER IRON for smoothing out dents, dimples and rough spots on auto or truck fenders, turret tops and other sheet-metal parts, handles most of the rough-out work and does the finish ironing in 50 percent less time. Separate die prevents stretch



STAMPING MACHINE for embossing trade names, addresses or code marks on aluminum channels and other metal parts, rolls a deep, clear-cut mark without distorting the metal. The channel is marked simply by swinging the lever from left to right in one easy motion



BUSHING-DRIVER SET has been assembled especially to meet the requirements of mechanics working on trucks, busses, tractors and road machinery. Drivers range in size from 1-5/16 to 1 7/8 in. and are made from selected alloy steels heat-treated to withstand hard use

CARBIDE-TIPPED DRESSER for grinding wheels of the softer grades trues the wheel more accurately than either a carbide stick or a conventional disk-type dresser. Consists of aluminum handle fitted with carbide insert for freehand dressing of wheels up to 10 in. dia.

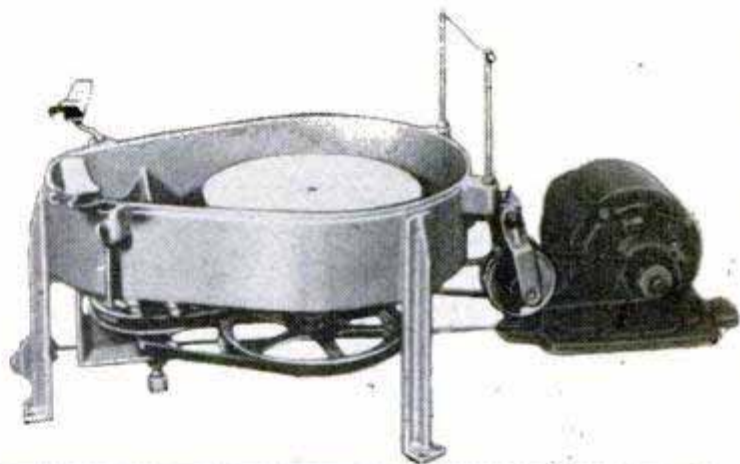
DEPTH-GAUGE ATTACHMENT converts a combination square into a height or depth gauge. Attachment is supplied with a scribe, 6-in. rule and a rod for measuring depths in stepped holes and narrow slots. Clamp block, shown separately below, provides a ready means of mounting the scribe, rod or rule. When fitted with the scribe, the square is converted into a practical height gauge for measuring or marking vertical distances from a plane surface or scribing layout lines

FOR TOOLS



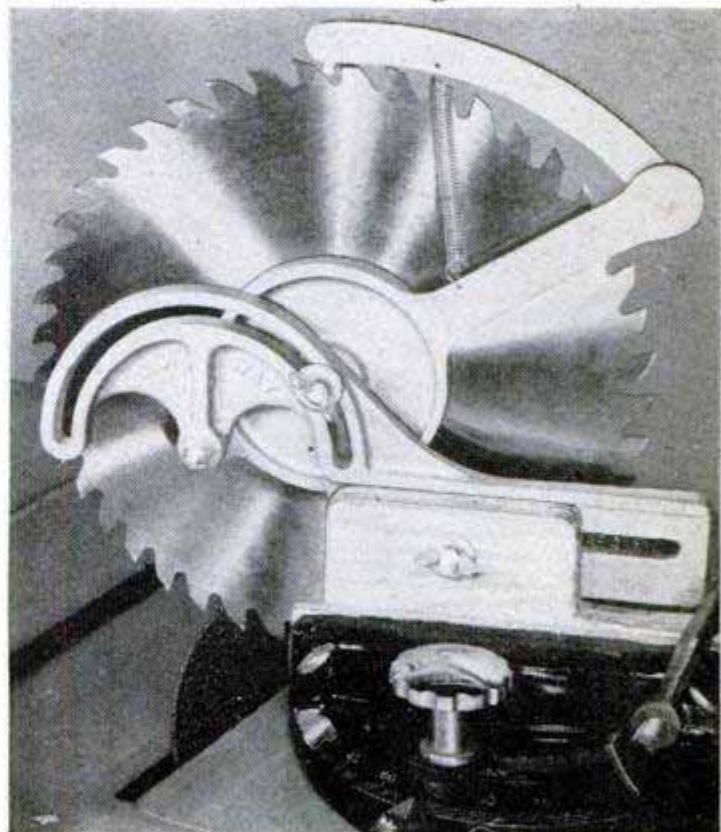
PAINT ROLLER of a new type has been designed for easy cleaning by simply sliding the wool jacket onto a holder as pictured. Then the jacket can be dipped in a solvent and cleaned and dried by spinning as shown

POTTER'S WHEEL is equipped with a foot control and a variable-speed reducer which gives a range of speeds varying from 38 to 130 r.p.m. Other special features are reversible throwing head, built-in water container, adjustable armrests and attached wedging wire. The reversible throwing head permits molding plaster bats on one side while reverse side has concentric circles for ease in centering. Available with or without motor



ELECTRIC HEAT GUN softens paint, melts adhesives, thaws frozen pipes and does any other similar job where heat must be applied without open flame. Reduces fire hazard to minimum in shop and home. Operates on either 110-v. a.c. or d.c.

SAW SHARPENER attaches to miter gauge on your circular-saw table and supports blade over a grinding wheel mounted on saw arbor. By tilting the saw table, or arbor, it is possible to grind correct tooth shape on any circular blade. Use 3/16-in. saw-gumming wheel



Fence Posts Pulled With Truck If Simple Fulcrum Is Used

Fence posts can be pulled quickly by using the simple device shown in the detail. A chain is attached to the frame of the truck and grab-hooked to the post just above the ground. Then a 4-ft. length of 4 x 4 is placed under the chain at approximately the angle shown to serve as a fulcrum. When the truck is driven forward, the post is pulled from the ground without damage. This method also may be used to pull shrubs and tree roots.

Hugh Lineback, Stillwater, Okla.



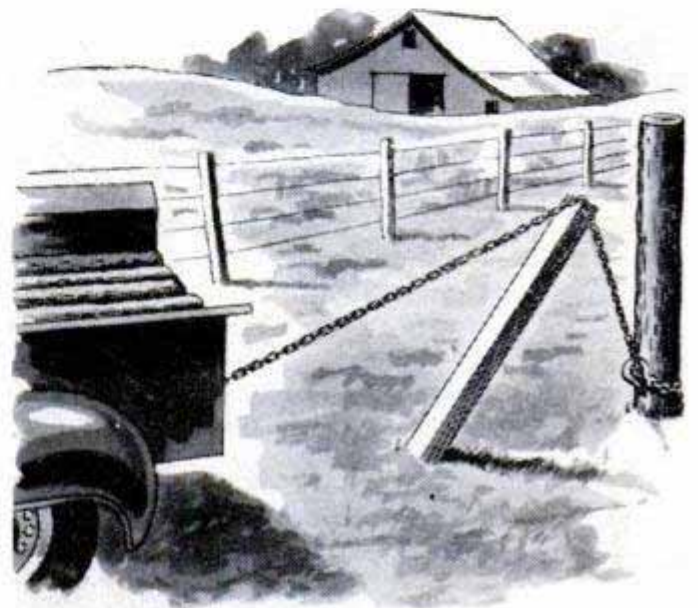
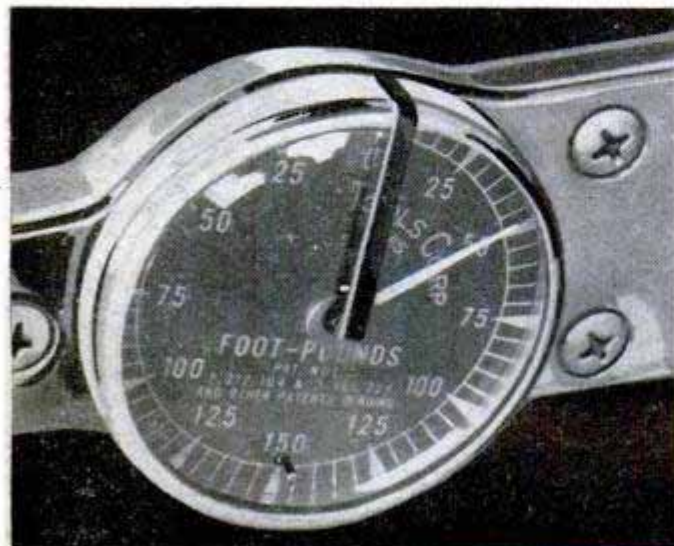
Marker for Measuring Tape Provided by Key Ring

Surveyors, real-estate men or farmers who have occasion to lay out equal divisions of a plot of land, such as when marking the positions of posts for a fence line, can save time and be assured of accuracy by using a measuring tape marked with a key ring. The latter should be the type illustrated and is simply slipped onto the tape over the number representing the distance between points. Thus, the number can be found quickly and the chance of error is eliminated.

Making Torque-Wrench Dial Easy to Read in Dim Light

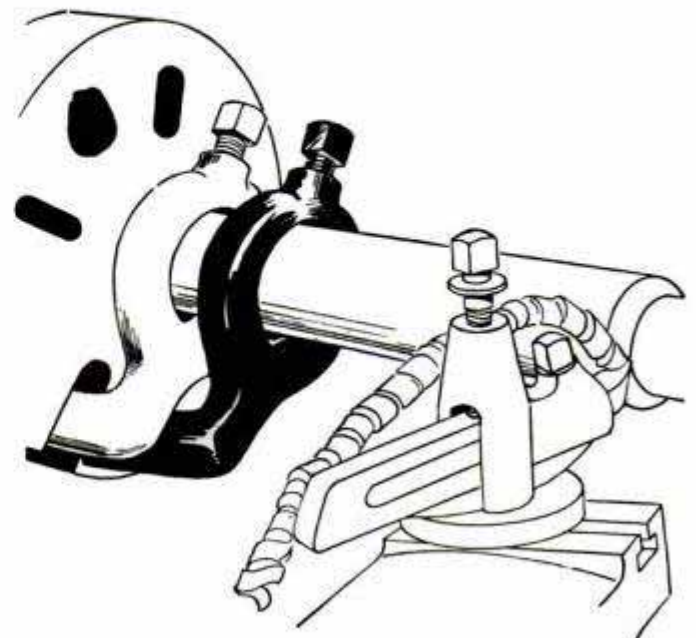
To make a torque wrench easier to read in dim illumination, stick a narrow strip of tape on the lens of the dial directly in line with the zero mark. Then set the dial so that the needle points to the desired torque. In use, the correct torque will be applied when the needle reaches the tape.

Ed Packer, Chicago.



Extra Lathe Dog Checks Slippage When Taking Heavy Cuts

Slipping of work held by a single lathe dog when taking heavy cuts can be prevented by adding a second dog. Just mount it on the work in front of the original dog as indicated.





PRIDE IN PERFECTION

It is an inborn trait. The real mechanic thinks precisely. His materials and equipment must be flawless. He makes no compromise with quality in tools. He applauds perfection in the work of other artisans.

Pride in perfection. That is the reason Bonney wrenches are America's finest —unmatched for lightness, strength, balance, and precision.

Bonney wrenches are the pride of the men who make them . . . the pride of the men who use them.

BONNEY FORGE & TOOL WORKS
Allentown, Pennsylvania



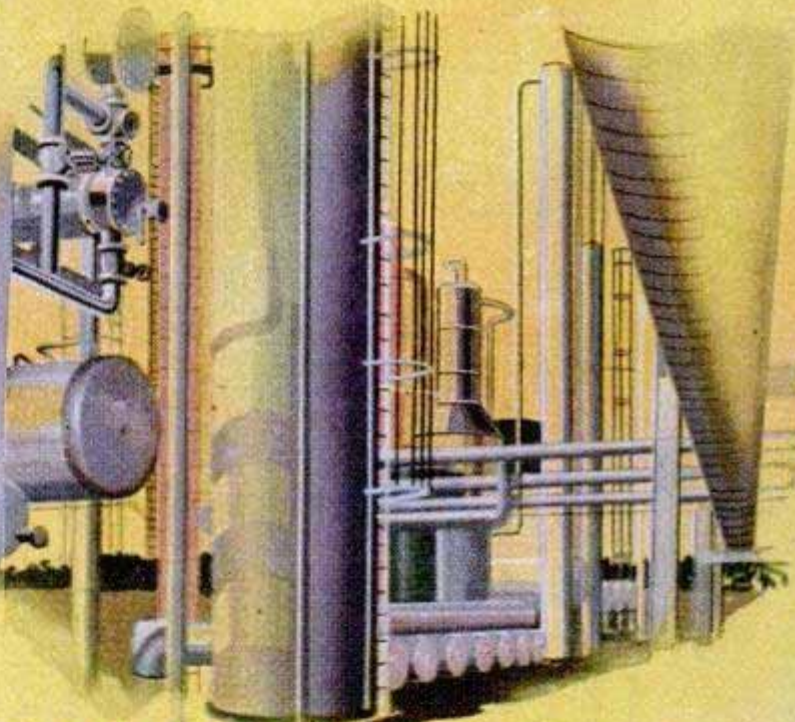
Pride in perfection is exemplified in the precision ball and roller bearings produced by leading bearings manufacturers such as SKF, Timken, Fafnir, BCA, and Norma-Hoffmann.

Contributing to Industrial Progress since 1855

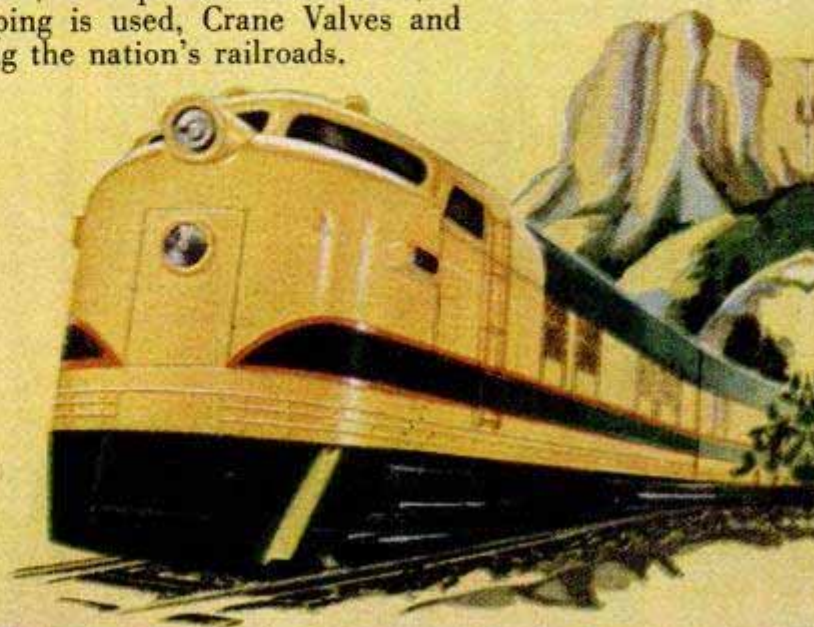
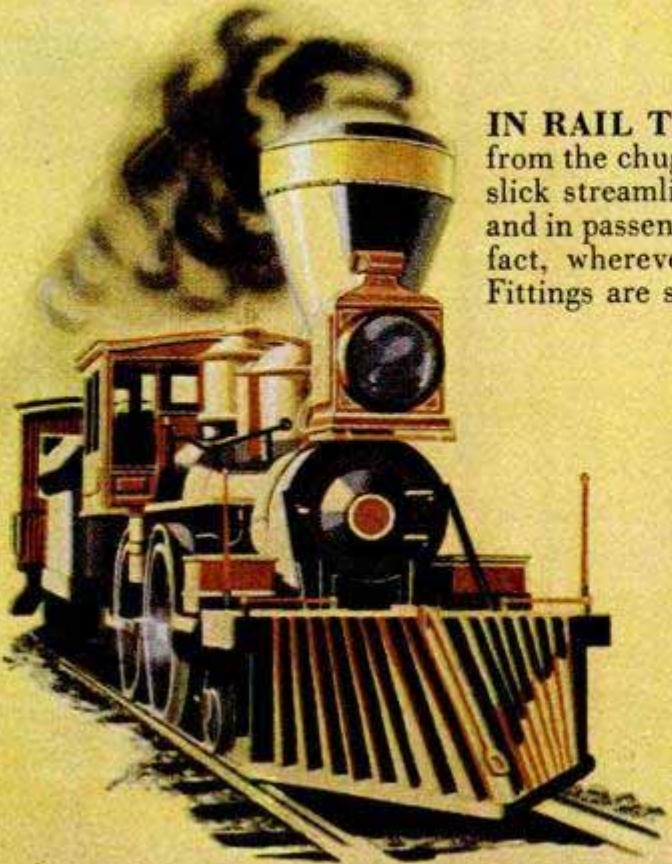
On July Fourth, 1855, a new industry was born. In his foundry in Chicago, R. T. Crane poured the molten metal to make the first Crane casting. America was on the threshold of a mighty era of progress—an era that would show dramatic advance in the development of power—in transportation—in industrial production. The valves and fittings manufactured by Crane Co. have played a vital part in the building of industrial America. Below are a few of the many fields that Crane has served for nearly a century.



IN OIL PRODUCTION—Coal oil for lamps—this was the petroleum industry in 1855. Crane piping has served in the mighty advances made in the production, as well as the refining, of oil and in the processing of the many petroleum by-products.



IN RAIL TRANSPORTATION—It's a far cry from the chugging little wood burner of 1855 to the slick streamlined diesel of today. On locomotives and in passenger cars, in shops and roundhouses, in fact, wherever piping is used, Crane Valves and Fittings are serving the nation's railroads.

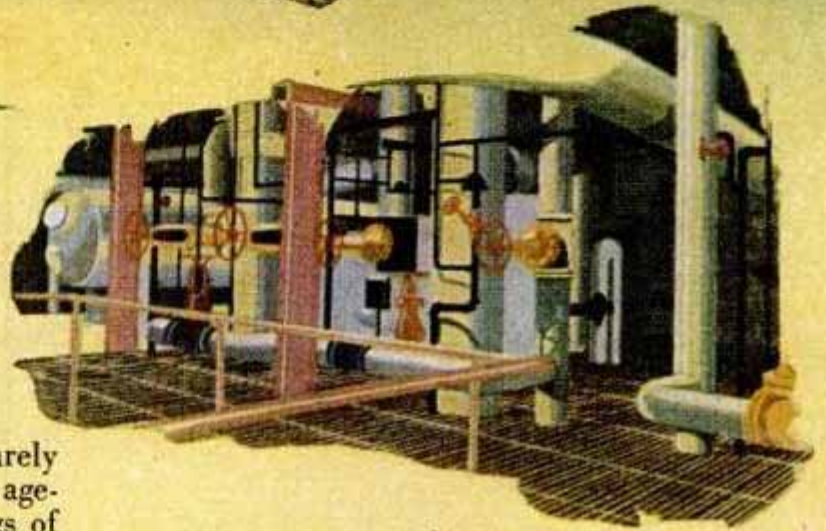


foundry, this company has grown to the world's largest supplier of pipe, valves and fittings. Crane products today are designed to handle and control the flow of air, gas, steam, and liquids in all industrial applications.

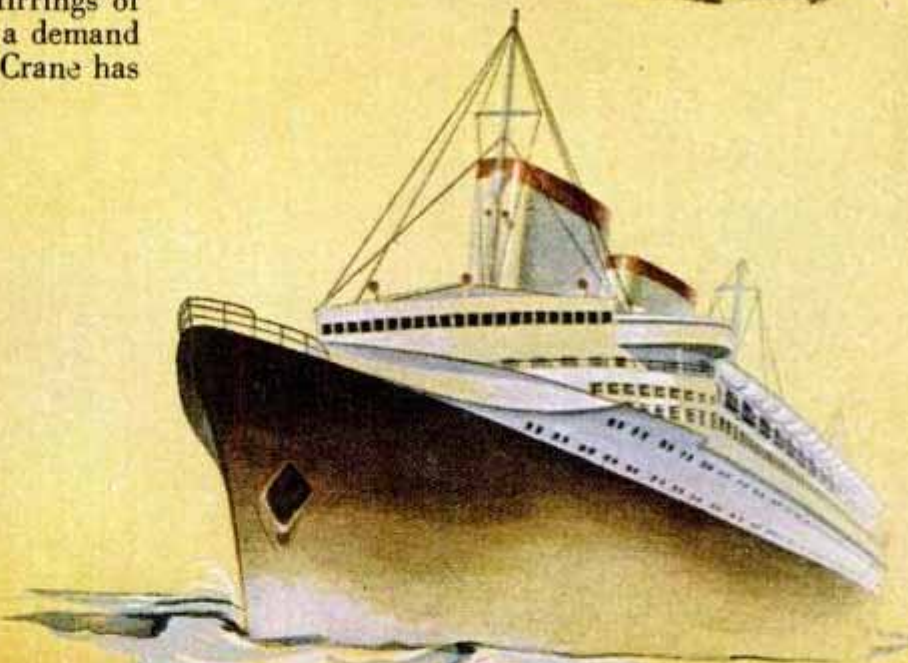


Crane Foundry 1855

Crane Chicago Works 1952



IN POWER—Manufacturing moved at a leisurely pace in 1855 when power was provided by the age-old water wheel. But already the first stirrings of the Industrial Revolution were creating a demand for more and more piping. This demand Crane has filled for almost a century.



IN THE MARINE FIELD—The swift clipper was queen of the seven seas in 1855. Then the steam auxiliary brought the doom to sailing vessels. On tankers and freighters, stately luxury liners and Uncle Sam's fleet, Crane Valves and Fittings are helping carry American goods and American men to the four corners of the earth.

CRANE CO.

General Offices: 836 S. Michigan Ave., Chicago 5, Ill.

Announcing

Ultramodern

... with the versatile new Kodak Ektalux battery-condenser system

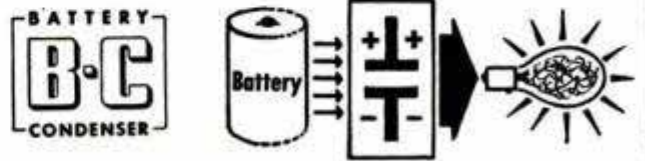
You'll find features galore in this sensational new lighting system for flash photography. Kodak Ektalux Flashholder, the basic unit, can be used alone, or with as many as six Ektalux Extension Units in perfect synchronization—B-C power from the Flashholder supplies all the energy.

Addition of the new Kodak Ektalux Solenoid permits you to use the accessory Remote Release for exposure control at a good distance from the camera.

And for cameras that have non-flash shutters, you get a complete external synchronizer by adding the Solenoid and Synchro-Switch to the basic Flashholder. Choice of brackets permits quick, rigid attachment of the Flashholder to practically any type of camera.

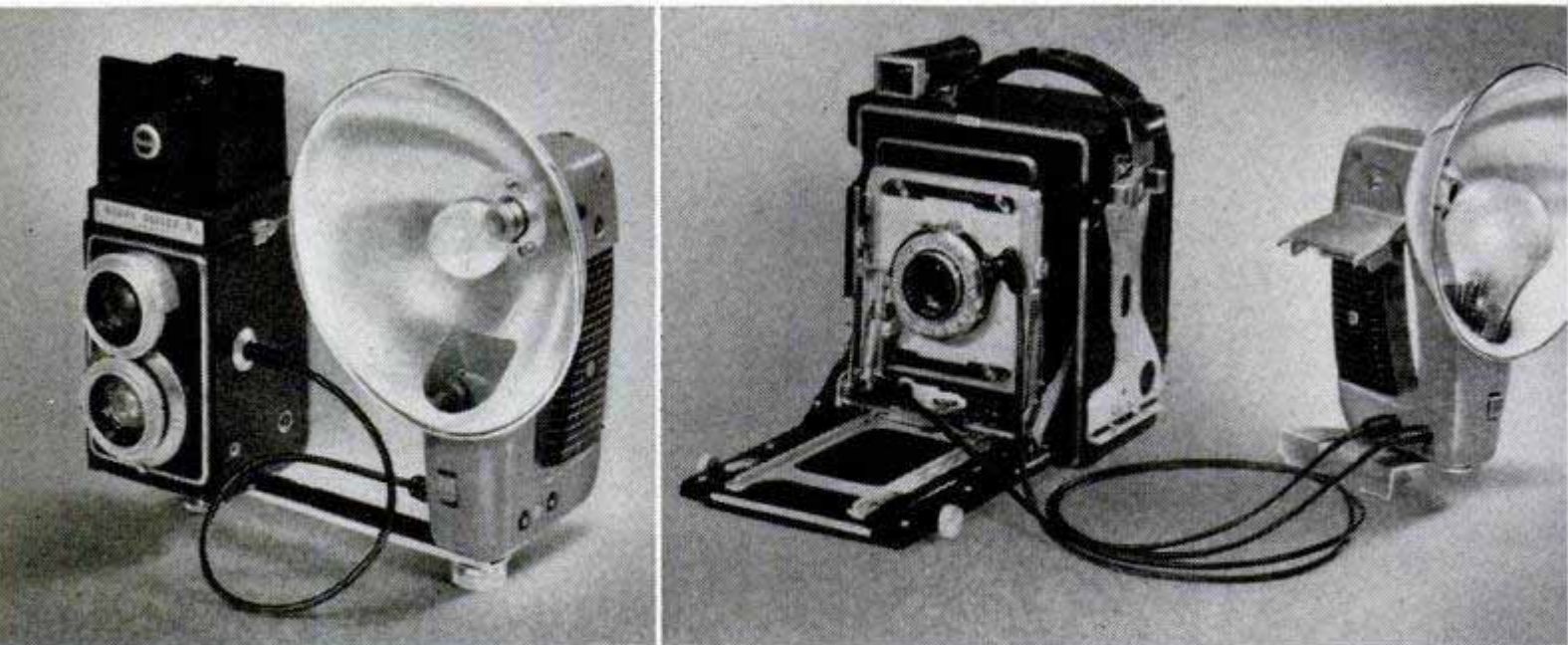
In all cases you benefit by the new pistol-

grip handle...the durable, light magnesium construction. Be sure to ask your Kodak dealer to put this versatile Flashholder system through its paces. You'll be amazed.



How battery-condenser power works

The B-C system brings to the Kodak Ektalux Flashholder a revolutionary new power supply. A small 22.5-volt photoflash battery feeds power to a condenser which stores the power until needed. The condenser then fires the lamp in a single surge *15 times as strong* as the force of the usual 1.5-volt flashlight battery. This uniformly high power surge insures flash performance of far greater dependability and scope than is possible with conventional battery operation.



"Ektalux" quickly adapts to amateur or professional cameras

Use with practically any roll-film camera—Standard Bracket fits Ektalux Flashholder to most reflex, folding, or miniature cameras. For cameras that have built-in flash synchronization, no further attachments are required for this new high in dependable "flash" picture taking.

Ideal teammate for press-type cameras—By means of the Press Bracket, the Ektalux Flashholder can be fitted to most press-type cameras. Camera and Flashholder firmly lock together or detach quickly. A special bracket is also offered for the Polaroid Land Camera.

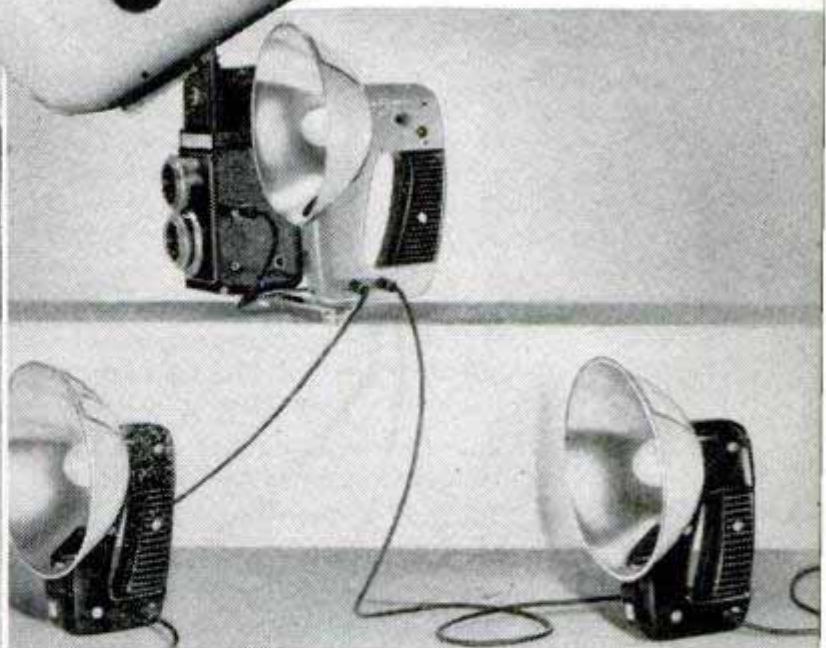
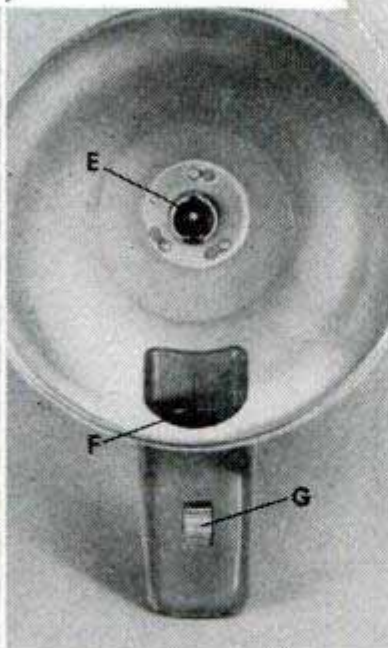
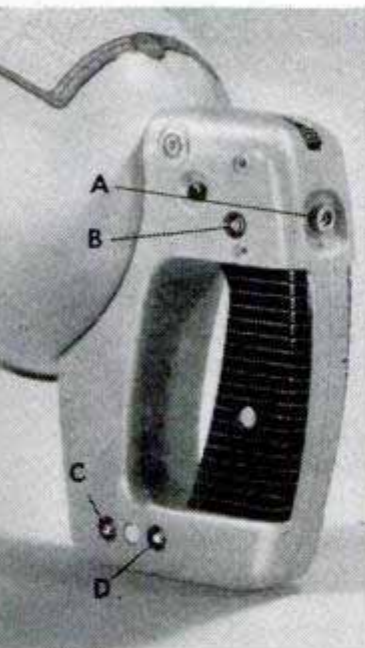
Flash

Kodak Ektalox Flashholder

- With Standard Bracket.....\$34.75
- With Press Bracket..... 39.50
- With Bracket for Polaroid Land Camera..... 35.75

ACCESSORIES EXTRA

Prices are subject to change without notice and include Federal Tax applicable when this advertisement was released for publication.



Accessory outlets are handy—Button **A** is Solenoid release that permits tripping shutter from Flashholder. Outlet **B** accepts the Remote Release. Outlets **C** and **D** take Extension Units. The entire system is series-wired.

Lamp system is flexible—For midget lamps, note socket **E**; provides for two-way focus. Ejector is in back. **F** is socket for medium-base lamp, with its ejector **G**. A handy exposure table is on back of reflector.

Outstanding choice for multiple flash—Extension Unit cords may extend to either side of the camera. Each unit can then be hooked to another unit. Units stand steady on flat surface. Socket in base fits tripod or Clamp. Removable reflectors nest; handles stack for storage.

Kodak

South Bend's

SENSATIONAL NEW

SMOOTHCAST REEL



Fast

Smooth



NYLON GEARS



Here's a sparkling new reel unlike any other you've ever cast. Its action is fast—smooth, quiet, free-running. Nylon gears and direct drive give this new SmoothCast Reel thrilling, sensational performance. Dual spool adjustments free it from backlashes. Corrosion resistant chrome steel frame with maroon plastic head ring. Weight 7.7 oz. No. 900 — \$22.50

2 OTHER MODELS!

No. 780 SmoothCast Reel — \$12. Another beautiful performer! Lightweight — only 5½ oz. Maroon finish. Aluminum alloy frame and spool.

No. 790 SmoothCast Reel — \$12. A sturdy reel for long, rugged service. Chrome plated brass frame and spool. Weight 8½ ounces.

Write for literature

**SOUTH BEND
BAIT COMPANY**
891 High St.
South Bend 23,
Indiana

SOUTH BEND
A Name Famous in Fishing

The Owners Report on the Buick

(Continued from page 214)

from the factory in Flint, Mich., to Kansas City, then over the Santa Fe Trail to Pueblo, Colo., and on to Denver, a distance of 1590 miles, which included some side-road testing. The model used was the Special four-door sedan with 128-horsepower engine, 121½-inch wheel base and Dynaflow-equipped.

The smallest car in the Buick line and the most popular in sales was better than any other Buick I've ever used in my previous tests. The car handled well, cruised nicely at 80 to 85 miles per hour, with a top speed of 98 to 100 miles per hour by speedometer — which, like most speedometers, was fast by about nine percent.

Steering is excellent with about the proper ratio, by American standards. A good "feel" of the wheel at all speeds is evident, and spring steering-wheel spokes reduce wheel vibration to a minimum. There was some steering-column vibration at about 75 miles per hour. Springing was a little soft on the front end. The rear end, with torque tube and coil springs, had a tendency to hop around a little and break away in high-speed cornering. I attribute this to heavy unsprung weight of torque-tube construction and coil springing. Heavily loaded, the car sometimes hit bottom on hard bumps. (I prefer leaf rear springs.) The ride is soft and comfortable and the driving position, as well as the vision, is good.

The Dynaflow (torque converter) is undoubtedly the smoothest in operation of all automatic transmissions, and has been improved since the first units were built. There is no evidence of abrupt gear change — no jerking, and the flow of power is even and smooth; the torque multiplies rapidly as the speed increases. You've heard of slippage in torque converters, and it's true about Dynaflow. Definitely, there is a noticeable slippage or "mushiness" when accelerating from zero to perhaps 40 miles per hour. This slippage is magnified by a rather loud accelerating "hum." While you do not get the sensation of a quick take-off, actually you are gaining speed faster than you think. Faster acceleration from zero can be had by starting in Low and shifting quickly to Drive at about 30 miles per hour without releasing the throttle. Dynaflow drivers can waste gas by improper handling of the throttle. The mileage a Dynaflow driver gets depends much on the lightness of his throttle foot. In accelerating from zero to 40 miles per hour, a wide-open throttle really is unnecessary and wastes

(Continued to page 316)

SLASH ENGINE REPAIR COSTS with

Nurlizing

Perfect Circle's
exclusive method of restoring worn pistons



Yes, Nurlizing reduces engine overhaul costs by making worn pistons re-usable—with *absolute safety*. And, that's only the *first* saving because Nurlizing permits closer piston fit, better lubrication and longer life.

Here's how: Nurlizing accurately and permanently increases piston diameter by displacing metal in the piston skirt in a regular pattern. Not only can the overall increase be precisely controlled but the increase in diameter can be varied to compensate for piston collapse or excessive wear. The resulting interrupted surface also provides small "reservoirs" for oil, assuring adequate lubrication at all times . . . closer fit is possible without danger of scuffing or scoring and piston slap is eliminated.

For better, more economical performance—for thousands of extra trouble-free miles—insist upon Nurlized pistons for your engine overhaul. See your Doctor of Motors or write Perfect Circle Corporation, Hagerstown, Ind.



Perfect Circle Nurlizing

Proved on the highways...



Why Permaglas

AUTOMATIC WATER HEATERS

outlast all others

Glass-surfaced Steel Tank. That's the secret of Permaglas water heater longevity!

It took years of research and experimentation before A. O. Smith engineers and

technicians perfected the glass surfacing that provides the ultimate in sanitation and protection for water heaters.

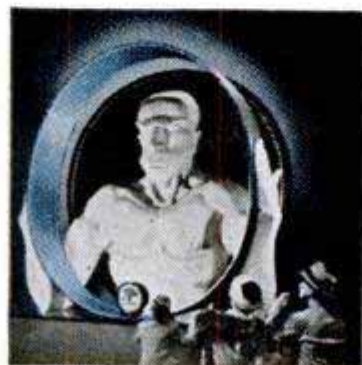
Glass surfacing withstands impact and thermal shocks... has the same expansion coefficient as the steel to which it is permanently fused!

Glass surfacing pays off in benefits for home owners all over America by giving them water heaters that *can't rust* because *glass can't rust*... eliminating stained bath-water, spotted laundry and ruined fixtures!

In **Permaglas** water heaters you get this positive protection from tank corrosion... the cause of frequent replacement... and at no extra cost, for *Permaglas*...



Heavy mallet blows cannot chip or crack the diamond-tough glass-surfaced steel.



More than 2,000,000 bends by this mechanical giant, yet the glass-surfaced steel "ring" is good as new!



Sudden shock of ice cold or scalding water does not affect the glass surface of *Permaglas* water heaters.



Permaglas Automatic Water Heaters, 20 to 80 gallon sizes, are available in Electric, Gas and LP-Gas types.



COSTS NO MORE

THAN ORDINARY WATER HEATERS!

Contact the merchant plumber, appliance or utility company displaying this emblem and get the whole, interesting *Permaglas* story... or use the handy coupon, today.

A.O. Smith

AUTOMATIC WATER HEATERS



A. O. SMITH CORPORATION
Water Heater Division, Dept. PM-152
Kankakee, Illinois

Send me complete information on your *Permaglas* Gas Electric LP-Gas Automatic Water Heaters, including your illustrated booklet on "Ceromitron" Construction.

Name _____

Address _____

City _____ Zone _____ State _____

3 Ways to Handsome Hair! Right Now!



*Fights
Dandruff!*

*Relieves
Dryness
and Itching!*



*Grooms
Hair
Perfectly!*



Lucky Tiger grooms your hair perfectly. But it does a lot more besides. Lucky Tiger kills on contact the dandruff germ, *Pityrosporum ovale*, removes loose dandruff and gives your scalp a clean, wide-awake tingle. Treat your hair to all this, plus natural, greaseless grooming. Ask your barber, he knows.

LUCKY TIGER 3-PURPOSE Hair Tonic



Sold at all toilet goods counters.

gear unexpectedly as in some automatic units.

Six quarts of oil are carried in the converter (7½ quarts in 70 models) and Dyna-flow cooling is controlled by 1½ additional quarts of water capacity over regular-transmission models.

The eight-cylinder, in-line, high-compression (7.2:1), 128-horsepower Fireball engine is smooth and flexible and causes little vibration. The engine is, of course, OHV design, which Buick has used for 47 years. Even the first two-cylinder Buicks had OHV and Buick never has offered for sale any car without an OHV engine (they call it valve-in-head) under Buick name, but the firm did once offer a Buick-built Marquette with a side-valve engine.

The gear ratio of 3.6:1 (3.9:1 on Roadmaster) gives the car a nice cruising ratio, comparable to an overdrive on other makes. The engine is extremely quiet for OHV design, partly because of the hydraulic valve lifters. Pistons are aluminum alloy—Buick calls them “hump” and “depression” design—to shorten flame-wave travel, prevent ping and gain better combustion. They are good. Even with regular gasoline there was little pinging.

A unique flexible oil ring now used by Buick apparently helps in keeping oil consumption low, as my test showed that little oil was used.

The brakes are good, operate easily, but could have a little more pedal “cushion.” With no clutch pedal, I would prefer a wider brake pedal. The emergency-brake-lever operation is unusual in that it is controlled by the left foot, and the release is easy, by a knob operated by the left hand. Women especially will like this novel brake arrangement. Not a bad idea, either, as actually a Buick driver has two foot brakes in event of emergency.

The Fisher body is tight and solid. Very little body noise or rumble is heard at high speeds. Doors open and close nicely, but with a little harder pressure than seems necessary. The windows have a quick wind-up and that's good! I found no dust leaks and no water came in while driving 300 miles in the rain. No squeaks or rattles developed.

Whether or not you approve of the gaudy “sweepspear” outside-body design with lots of metal and chrome, it does offer good parking-lot protection when the driver of another car alongside swings his door recklessly, as some do.

The names “three holer” and “four holer,” as Buicks were referred to a while back, has given way to the more dignified term “fender ports.” The number of holes

(Continued to page 412)

"GOOD OLD DAYS"
were terrible

**J&L
STEEL**



IRON ROLLING MILL more than half a century ago from a painting by Adolph Menzel, loaned by Professor W. Trinks of Ohio, Pa.

FIFTY YEARS ago iron and steel workers had a 12-hour day, 7 days per week. They worked largely with their hands—and their backs—and earned a base pay of 14¢ per hour.

Today steel workers have an 8-hour day, 5 days per week. They operate huge modern machines that give them finger-tip control of thousands of horsepower—and earn an average base pay of \$1.36* per hour.

The quality of steel has greatly improved, too. Fifty years ago there were only two steels—"mild" and "hard." Today steels are "tailor-made" with a different grade for almost every application.

The same pattern of progress applies to other workers and products in other industries. Powerful machines make it possible for Americans to produce more goods per hour worked than any other workers anywhere.

*December, 1951

The secret of America's success is America's ability to produce. And the secret of America's ability to produce is the genius of Americans to invent machines and the willingness of industry to invest huge sums in their purchase, so that *men can produce more in less time with less effort.*

Money to pay for these modern machines comes from one source and one source only—*profits.*

If any group of players on the shareholder-worker-management team demands too much of these profits for its share—or if the referee, Uncle Sam, takes too much in taxes, the ability to buy new machines vanishes and we stop progressing.

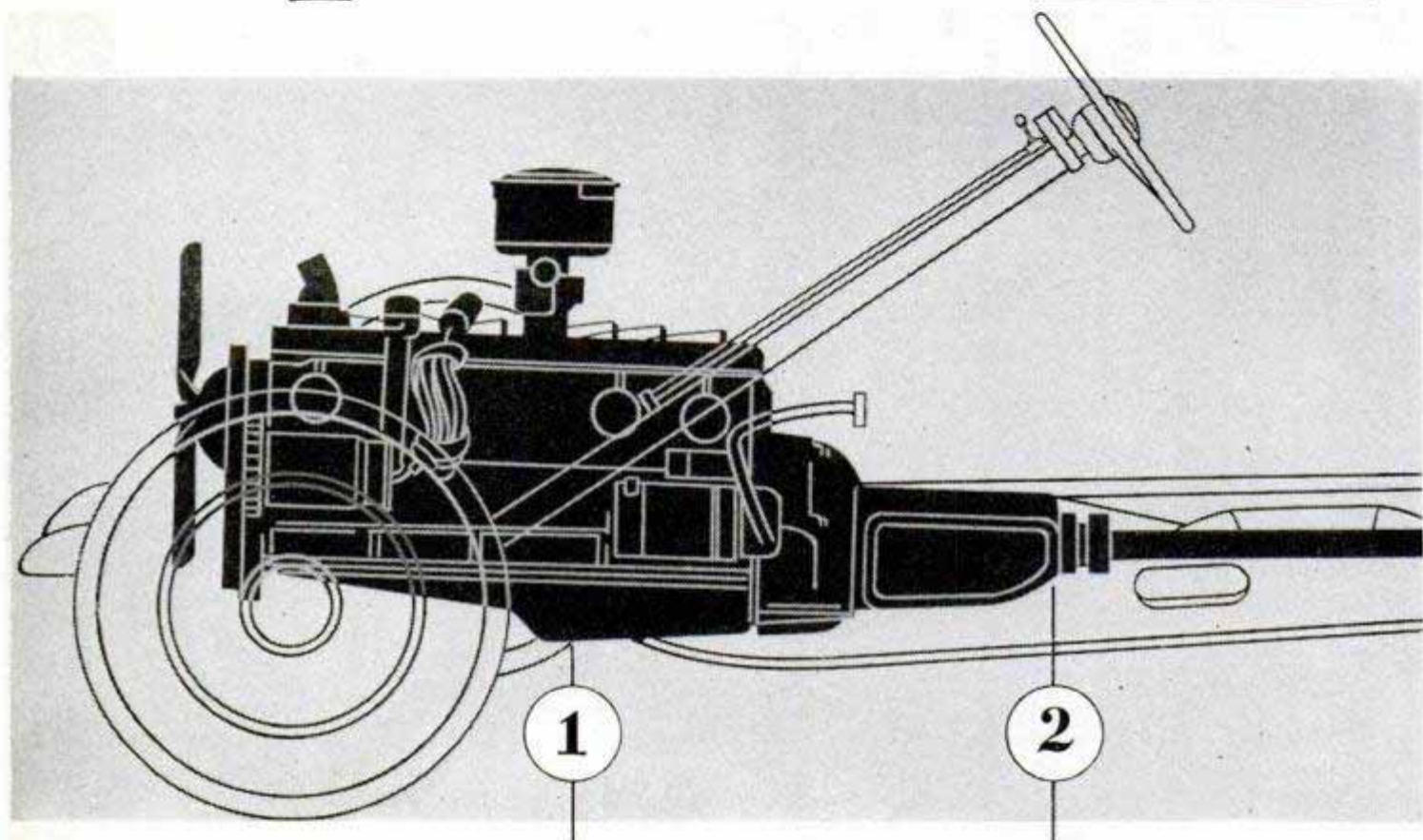
The next 50 years can be the greatest in our history—if we all work together.

If anybody tells you we should return to the good old days—tell them the good old days were terrible.

JONES & LAUGHLIN STEEL CORPORATION

Announcing the Great New '52

With Spectacular Dual-



THE POWER YOU WANT • WHEN YOU

You'll be hearing a lot about the great new '52 Pontiac with Dual-Range Performance. It's an exclusive engineering advancement that combines Pontiac's powerful, high-compression engine with new Dual-Range Hydra-Matic* and a new economy axle. The results are nothing short of *spectacular!*

With this new "power train" Pontiac offers finger-tip control of two different driving "ranges." One brings amazing

new acceleration and flexibility in congested traffic *and* increased engine braking ability for steep grades. The other offers improved gasoline economy for highway cruising, quieter operation and a feeling that approaches "coasting."

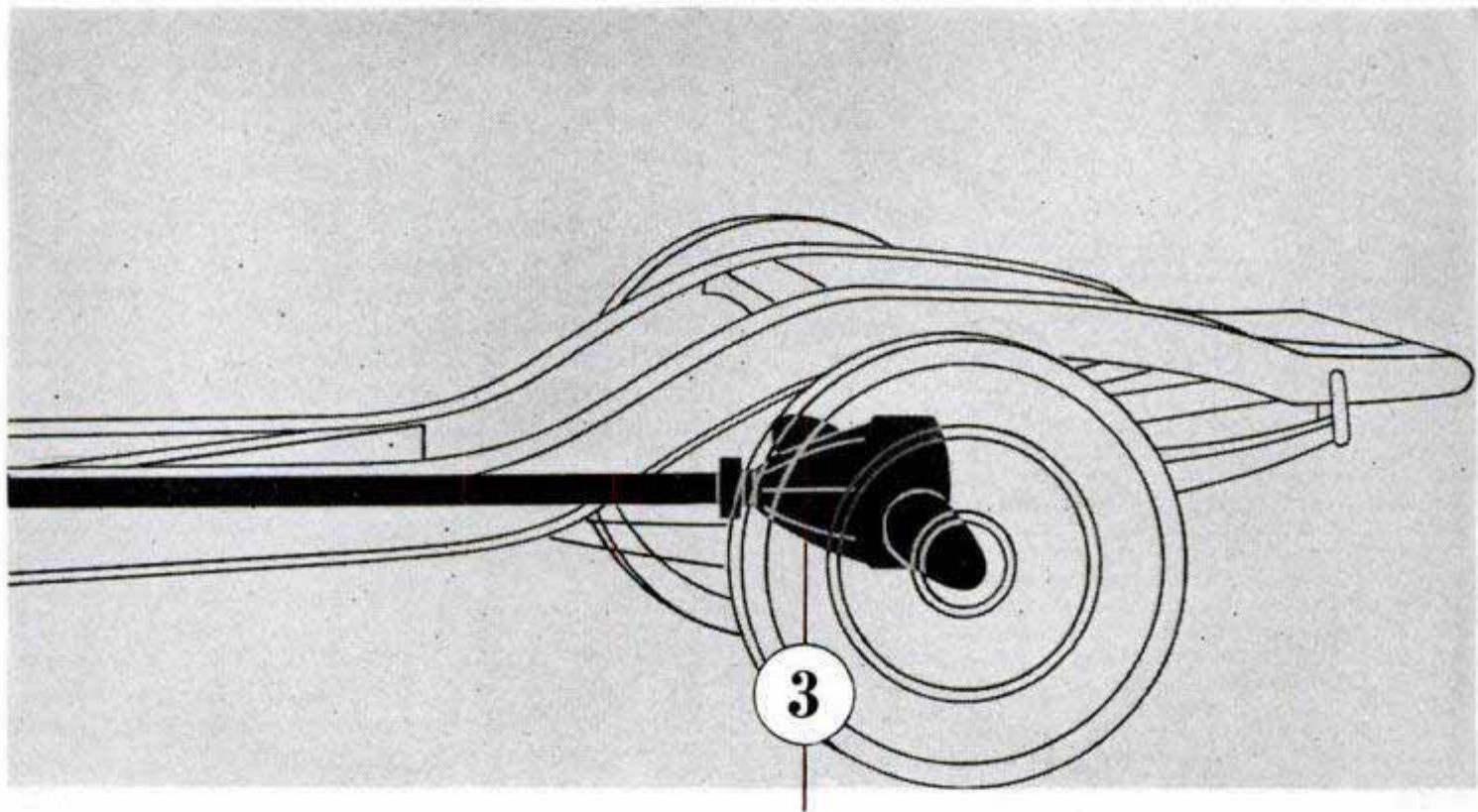
Pontiac is not only the *first* car to bring you this amazing development—it is the *lowest-priced* car to offer it for 1952! Better see it and drive it yourself!

*Optional at extra cost.

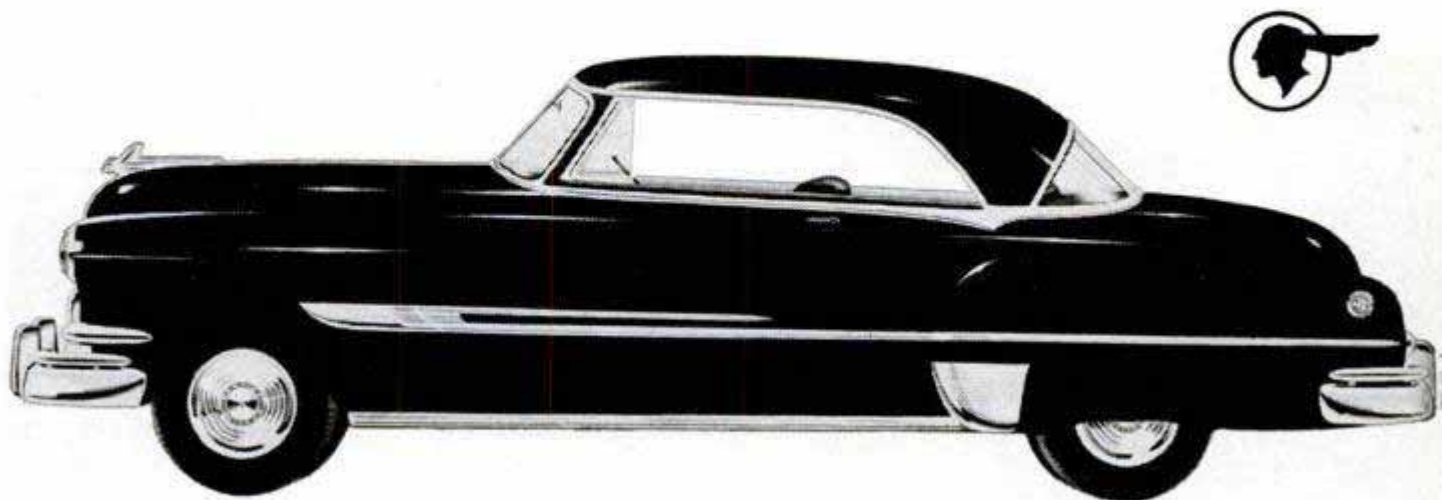
SEE YOUR NEAREST PONTIAC DEALER

Pontiac

Range Performance!



WANT IT • WHERE YOU WANT IT



DOLLAR FOR DOLLAR YOU CAN'T BEAT A '52 PONTIAC!

INSTALL IT YOURSELF

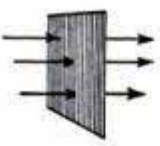
RA-TOX FOLDING DOOR



GIVE YOUR HOME MORE ROOM and NEW BEAUTY THIS *Low Cost-Easy Way!*

With Ra-Tox Folding Doors alone, you can work near-miracles in your home. For greater useful room area, save the space now wasted by swing-type doors; Ra-Tox Doors hang from overhead track and fold to side. If you want to give rooms a definite glamour and really new look . . . there's nothing equal to Ra-Tox Doors. Harmonize with any room design. Made of woven wood slats. Supplied complete with all hanging hardware and finish painted. Your choice of ten colors or Natural wood finish. Easily installed in few minutes time. Simply screw track overhead, and hang door from track.

UNIQUE FEATURE . . . slat construction lets air pass through door. Perfect for wardrobe and clothes closet ventilation. Ends moisture condensation and musty air . . . permits air flow for proper heating and air conditioning.



CUTS NEW CONSTRUCTION COSTS
Here's typical clothes closet construction. Ra-Tox Doors eliminate costly door wall. Hang Ra-Tox Door from wall to wall and ceiling to floor. Makes closet interior easy to build no cramped area for wall finishing.

Ra-Tox Folding Doors are supplied in any door or room divider size. Now used everywhere by builders and architects. Easy installation. Low cost . . . meets any budget. For home remodeling . . . and savings in new construction, use Ra-Tox Folding Doors. For sale at Building Material Dealers or Lumber Yards . . . or send 10c for Ra-Tox Door Bulletin.

THE HOUGH SHADE CORPORATION
Ra-Tox Division • Janesville • Wisconsin

FOR WARDROBE • CLOTHES CLOSET • BETWEEN-ROOM DOORS



AND ROOM DIVIDERS

Tomorrow's Electronic Barbershop Quartet

(Continued from page 240)

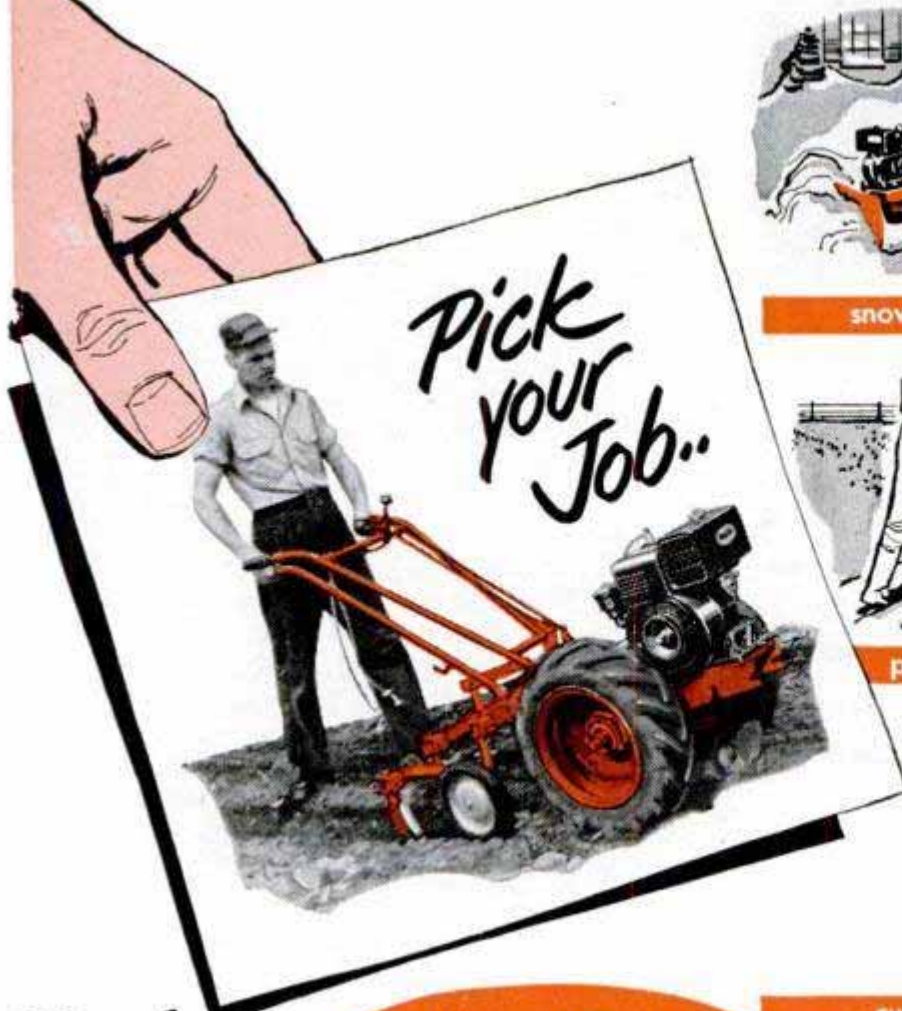
not used, there would be a noticeable "thump" at the beginning of each note.

The RCA 884 tube in the console units requires an octal socket. Three Jones connectors, type S-306AB (sockets), and four Jones connector P-306AB (plugs) are required for the playing consoles. Eight six-terminal mounting strips are also needed. One Jones S-306CCT socket is required for the amplifier cable. All other parts are listed above Fig. 9.

Several interesting facts have developed from playing and experimenting on this instrument. First, although steady tones without vibrato are desirable in some kinds of music, a much more "live" effect can be obtained by wobbling the pitch control smoothly through a small range above and below the position of true intonation. This corresponds to the vibrato used in playing a violin or trombone, or occurring naturally in the human voice. This motion, as may be guessed, accounts for the name "wobble organ."

The pitch control, or wobble arm, is operated by the right hand of the player in relation to the musical-scale designations on the sloping "scale quadrant." These designations need be used only as a rough guide, but they are of great value even to an experienced player in making rapid and accurate changes over large musical intervals. Accurate intonation and blending of the four "voices" depend upon the players' musical ear and judgment. Operation of the tone source or oscillator is not continuous; each one can be turned on and off at will by the performer; the instrument is normally silent. Oscillation is started by a slight downward pressure of the player's left hand on the "dynamics" knob shown at the left front of the console, Fig. 1. This pressure closes a contactor (the simple sheet-brass cantilever spring switch, K1) detailed in Fig. 7 thus applying plate voltage to the oscillator. This permits the player to use a "portamento" between notes (leaving the tone on) or "detache" (momentarily interrupting it), as desired. The volume of the sound delivered by the individual console to the common speaker is also under the control of this knob, which can be turned as well as pressed by the player's left hand. The rotation can be calibrated in musical symbols, *pp*, *p*, *mp*, *f* and *ff*, indicating different degrees of loudness; these are not indicated in Fig. 1. The switch action (K1) is obtained by simply mounting the potentiometer near the free end of

(Continued to page 324)



snow removal



auxiliary power



plowing



disc harrowing



ride while you work

Do it WITH **Simplicity**
3 H.P. 520 2 H.P. 415

Owners *everywhere* know that EVERY MONTH is a LABOR-**SAVING MONTH** for a Simplicity with implements. Versatile and reliable, Simplicity makes light work of a multitude of hard jobs (and patented "Quick-Hitch" allows implement changes in less than a minute, *without tools!*) Does so much—it quickly pays for itself in savings of time and work.

THE RIGHT TRACTOR FOR EVERY JOB

3 H.P. Model M-1—5 speeds forward. Fully enclosed gears.

2 H.P. Model L-1—Same features as the M-1 . . . designed for lighter work.

52-week Utility • 28-way Versatility



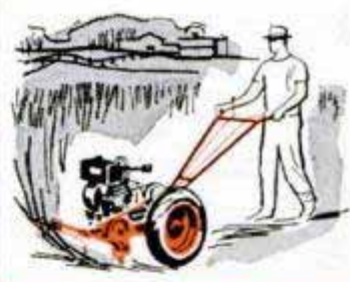
Discover these benefits for yourself—write for **FREE ILLUSTRATED FOLDER** and for the name of the Simplicity dealer nearest you or see the classified section of your telephone book.

Simplicity America's **NO. 1** Garden Tractor

Simplicity Manufacturing Company
 5201 Spring St., Port Washington, Wis.



lawn mowing



weed cutting



hauling



grading



felling trees



sawing cordwood

In the Home, as in Industry, the choice is **WISS METAL SNIPS**

The superior quality of famous **WISS** Metal Cutting Snips has made them the first choice in the home and in industry. Every pair is rigidly tested and guaranteed to cut easily and efficiently for an unusually long time. Carefully adjusted blades are set precisely to reduce wear and permit maximum cutting power with a minimum of effort.

WISS METAL MASTER COMPOUND ACTION SNIPS



Compound leverage produces amazing cutting power with minimum effort. Will cut holes, circles and complicated patterns in metals to 18 gauge. Rubber grips recommended. M-1 (Cuts Left) 10" long; M-2 (Cuts Right) 10" long; M-3 (Cuts Straight) 10" long; M-5 (Bulldog Combination) 9 $\frac{1}{8}$ " long.

WISS SOLID STEEL STRAIGHT CUTTING SNIPS



Economical in price, these snips meet government specifications. Made of a specially selected grade of solid tool steel. For general metal-cutting. Four sizes, 8" to 12 $\frac{1}{4}$ " long.

WISS SOLID STEEL COMBINATION SNIPS



Will cut straight, curves or irregular shapes with ease. Two sizes, 7" and 13" long.

J. WISS & SONS CO.
NEWARK 7, N. J.



the flat cantilever spring, the fixed end of which is screwed to the underside of the console top as indicated in Fig. 7. A downward motion of about $\frac{1}{32}$ in. brings the free end into electrical contact with a fixed metal detail that also limits the travel. The tuning adjustment compensates for temperature variations. This tuning knob is readily adjustable by the player's left hand while the corresponding wrist presses down the "dynamics" knob and his right hand aligns the wobble arm with the scale mark (such as "middle C") corresponding to the pitch of the reference source to which he wishes to tune.

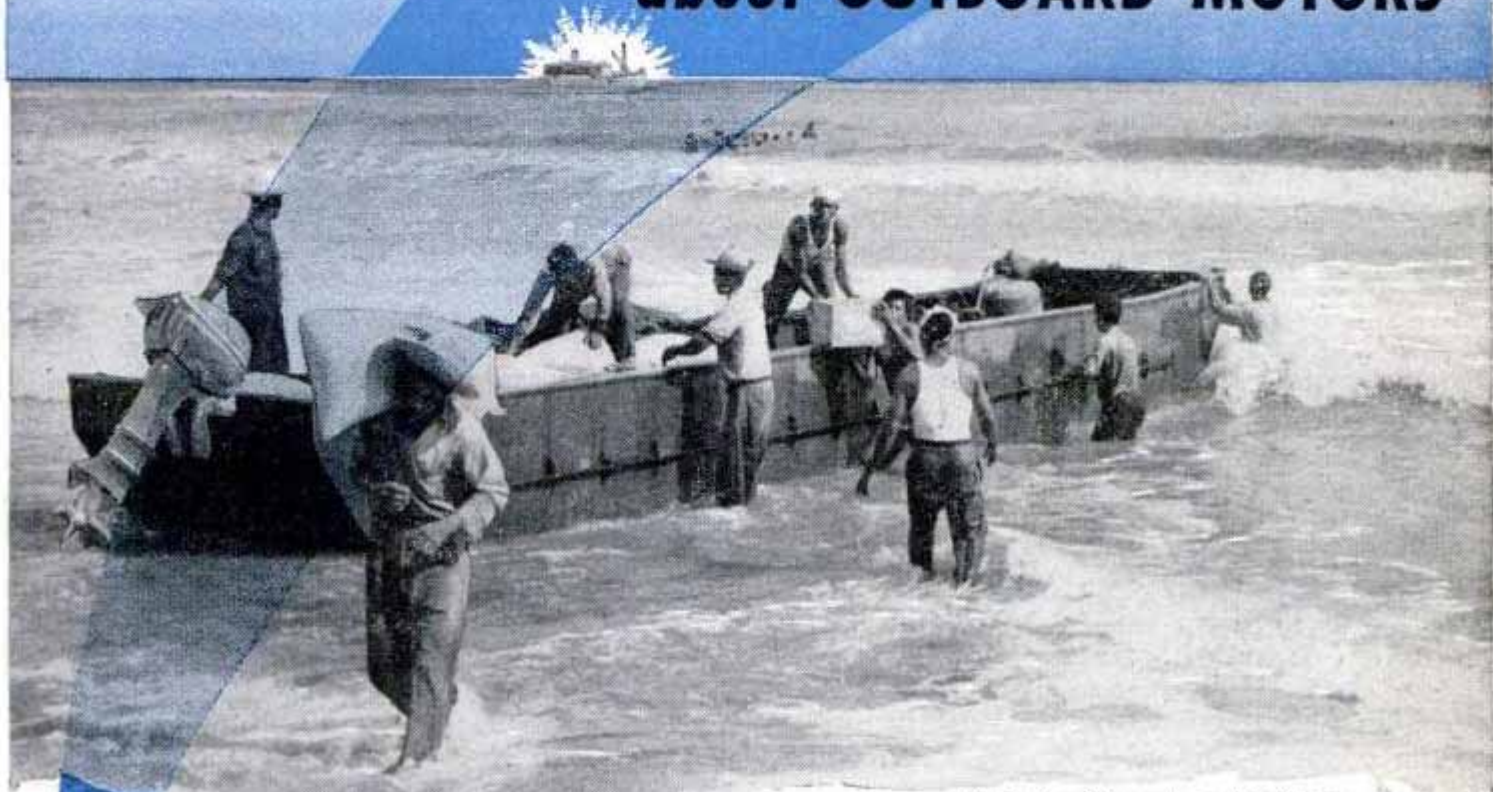
It may be noticed in Fig. 1 that the scale quadrant is calibrated with high notes toward the left and low notes toward the right. This comes about because logarithmic potentiometers having a left-handed taper are not commonly stocked in suitable sizes. Although players quickly become accustomed to this arrangement, it has been found that most of them would prefer to have the scale changed to match the convention of the piano keyboard, and of course this can be done by ordering special left-handed units.

Experience has been obtained both with family groups playing for their own entertainment, and with quartets well rehearsed for public performance. Some solo work has also been done using a single console with piano accompaniment. In every case enjoyment and recreation value have been strikingly evident. Even two professional symphony players who took part in one of the quartets were highly entertained, and incidentally behaved like amateurs in that they played awkwardly at first but improved very rapidly. The music used has varied from simple "rounds" and folk songs to Bach chorales. Although no suggestion is intended that the wobble organ may ever join the ranks of the serious musical instruments, nevertheless it can do things with Bach that are actually rather satisfying. It has a voicelike quality, and yet overcomes certain vocal restrictions. The soprano never has to strain for the high passages, the alto cannot possibly run short of breath, the tenor never cracks and the bass has power at his command for his very lowest note in this electronic barbershop quartet. Volume control R7 in the audio amplifier permits adjusting the instrument for any size room up to a fairly large auditorium.

This Wobble Organ is covered by Meacham patent No. 2544466 but may be built by (or for) you for your own use. Permission to build this electronic device or copy these plans for resale purposes is NOT granted.

something you didn't know

about OUTBOARD MOTORS



Lightering Cargo from Freighter
on an Unprotected Coast

SURE... they're used "for fun" ... the outboard motors millions see in familiar everyday service. They power the boats of fishermen and vacationers. They drive sleek runabouts ... tow water skiers ... take families picnicking ... perform any number of similarly pleasant tasks.

But such service is only *part* of the picture. Actually, hundreds of thousands of outboards *work for a living*. Outboard motors were "born into hard labor." Not sportsmen, but hard-bitten toilers of the sea were first to sense the real importance of the "outboard idea." 42 years ago it was their orders, scrawled in many languages, that made Ole Evinrude's struggling enterprise a solid success ... and established a new American industry!

Today 23% of all outboards, (Department of Commerce estimate) are in *commercial service*. *Essential serv-*

ice, for, wherever shallow water may be encountered, *there is no satisfactory, economical substitute for outboard motors!*

Small cargo lighters, freighters, ferries are widely powered with outboards. And commercial fishing boats in vast numbers. And rescue boats, police boats, construction tenders. Thousands are in round-the-clock service in many of the country's most productive oil fields.

Even "pleasure" outboards render vital service. In every major flood catastrophe the call is broadcast, "Outboards ... send more outboards." And outboards play their part in national defense ... in World War II they served in all branches of our armed services ... the historic crossings of the Moselle, Roer, and Rhine were made in swift storm boats driven by powerful Evinrude Motors.

Our experience in the use of outboard power for work-boat duty is available to all commercial boat operators. Write

EVINRUDE MOTORS
4730 N. 27th St., Milwaukee 16, Wis.
In Canada: Evinrude Motors, Peterborough, Ontario

EVINRUDE
OUTBOARD MOTORS



Fifty Years Hence

(Continued from page 145)

and form helium, it would suffice to drive a 1000-horsepower engine for a whole year. If the electrons—those tiny planets of the atomic systems—were induced to combine with the nuclei in the hydrogen, the horsepower liberated would be one hundred and twenty times greater still. What is lacking is the match to set the bonfire alight, or it may be the detonator to cause the dynamite to explode. The scientists are looking for this.

The discovery and control of such sources of power would cause changes in human affairs incomparably greater than those produced by the steam engine. Schemes of cosmic magnitude would become feasible. Geography and climate would obey our orders. Fifty thousand tons of water would, if exploited as described, suffice to shift Ireland into the middle of the Atlantic. The amount of rain falling yearly on the Epsom race course would be enough to thaw all the ice at the arctic and antarctic poles. The changing of one element into another would transform all our standards of values. Materials thirty times stronger than the best steel would create engines fit to bridle the new forms of power. Communications and transport by land, water and air would take unimaginable forms if, as is in principle possible, we could make an engine of six hundred horsepower weighing twenty pounds and carrying fuel for a thousand hours in a tank the size of a fountain pen.

Wireless and television would enable their owner to connect up to any room similarly equipped and hear and take part in the conversation as well as if he put his head in through the window. The congregation of men in cities would become superfluous. There would be no more object in living in the same city with one's neighbor than there is today in living with him in the same house.

Up till recent times, the production of food has been the prime struggle of man. That war is won. There is no doubt that the civilized races can produce or procure all the food they require. But food is at present obtained almost entirely from the energy of sunlight. Radiation from the sun produces from the carbonic acid in the air carbon compounds which serve people in plants and vegetables. We use the latent chemical energy of these to keep our bodies warm, we convert it into muscular effort. We employ it to replace the wasted cells of our bodies. Many prefer food in what the vegetarians call "the secondhand form," i.e., after it has been digested and convert-

ed into meat by domestic animals. In all these processes, however, ninety-nine parts of the solar energy are wasted for every part used.

Great improvements are probable here. Microbes, which at present convert the nitrogen of the air into the proteins by which animals live, will be fostered and made to work under controlled conditions. New strains of microbes will be developed and made to do a great deal of our chemistry for us. With a greater knowledge of hormones, the chemical messengers in our blood, it will be possible to control growth. We shall escape the absurdity of growing a whole chicken in order to eat the breast or the wing, by growing these parts separately. Synthetic food will, of course, also be used. Nor need the pleasure of the table be banished. That gloomy Utopia of tabloid meals need never be invaded. The new foods will be practically indistinguishable from the natural products from the outset, and any changes will be so gradual as to escape observation.

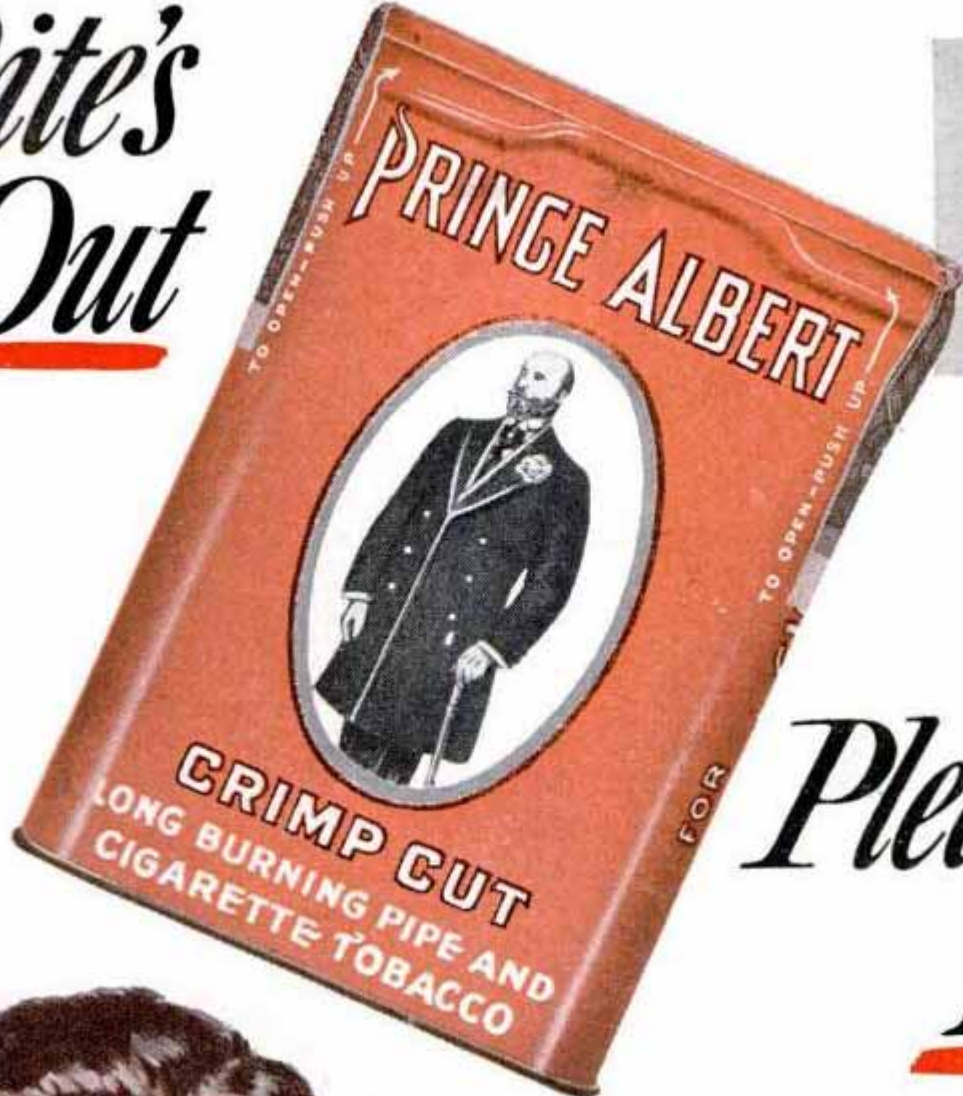
If the gigantic sources of power become available, food would be produced without sunlight. Vast cellars, in which artificial radiation is generated, may replace the cornfields and potato patches. Parks and gardens will cover our plowed fields. When the time comes, there will be plenty of room for the cities to spread themselves.

But equally startling developments lie just beyond our fingertips in the breeding of human beings and the shaping of human nature. It used to be said of scientific progress: "You have taught the dog more tricks, but you cannot alter the breed of the dog." This is no longer true. A few years ago London was surprised by a play called *Rossum's Universal Robots*. The production of such beings may well be possible within fifty years. They will not be made, but grown under glass. There seems little doubt that it will be possible to carry out the entire cycle which now leads to the birth of a child, in artificial surroundings. Interference with the mental development of such beings, expert suggestion and treatment in the earlier years, would produce beings specialized to thought or toil.

Silver-Plating With a Cloth

Copper, brass and bronze surfaces can be silver-plated by rubbing them with a cloth dampened by a special liquid. The liquid deposits a coating of genuine silver in a few seconds. Worn areas on old silver-plated objects can be covered with the coating, and new objects completely silver-plated. An eight-ounce bottle of the liquid plates about 4800 square inches.

Bite's Out



*the
National
Joy Smoke*

Pleasure's In



**— AND THERE'S MORE TOBACCO IN EVERY TIN!
Prince Albert's patented* "no-bite"
process means real smoking comfort**

... Prince Albert is made to give you more smoking enjoyment than any other tobacco! P.A. is specially treated to insure against tongue bite. Rich-tasting and mild... No wonder it's the big favorite with roll-your-own smokers and pipe smokers alike!

*Process patented July 30, 1907

MORE MEN SMOKE

Prince Albert

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**NATIONAL AIR SANDER, INC.
2820 AUBURN ST., ROCKFORD, ILL.**

Greatest Show in Wax

(Continued from page 222)

sizes, shapes and colorings carefully. Placing the eyes is precision work that requires accuracy to .001 inch. The eyes are heated and, through the hollow neck and head, are brought up into position. Cotton and wool wedge sticks are the only usable tools outside of the human hands. When the wedge tools, held like chopsticks, fail, the artist must manipulate the burning-hot eyes into the wax. Tussaud's finger tips are frequently glassy from burns.

Another unpleasant job is planting hair in the bald wax heads of subjects. Tussaud is glad he can sit this one out. Vera Bland, another skilled artist, has handled the tonsorial department since 1930. Working from photos, Miss Bland, using a blunt, thin-bladed knife, inserts each hair individually, working within three inches of an electric bulb that heats the wax. Once the wax cools, the human hair set in by Miss Bland is as hard to pull out as the variety that really grows.

It usually takes her about a week or 10 days to insert hair, eyelashes, brows and mustaches. General Eisenhower, with his sparse growth, took less than a week, as did England's Field Marshal Montgomery. Joseph Stalin, a problem to the entire world, was no small one to Miss Bland, who had difficulty finding the right color and texture of hair, and then spent three weeks planting the Russian's hair and thick wiry mustache. Tussaud's never tries to fake. Under beret, hat or shawl, each figure has a complete head of hair—that is, assuming he or she has one in real life.

An equal amount of attention is paid to getting the subject's teeth to seem natural. Wax impressions similar to those made by dentists are taken of the person's teeth and his mouth formation. Teeth, like eyes, are inserted from within, through the neck.

Before the head is ready to join its plaster-of-paris body equipped with wax limbs and hands, it must have the proper skin coloring. Complexions are made by means of special pigmentary water colors known only to insiders at the museum. How far Tussaud's goes to re-create subjects accurately is shown in Miss Bland's method for duplicating a shadow beard. With a knitting needle, she pricks small pores into skin in the beard area and artfully rubs in blue paint. Flesh color is put over this, and the result is just short of five o'clock shadow.

Ever since Madame Tussaud herself operated the museum, it has been a custom for subjects to offer suits or dresses from their own wardrobe to clothe the wax

(Continued to page 330)



New portable radiotelephone, of less weight but longer range, designed and built by RCA engineers.

*Longer range, but lighter weight
for the "Take-along Radiophone"*

You've read how useful our Armed Forces found their portable "walkie-talkie" radiotelephones. But now this almost indispensable military instrument has become even more efficient.

At the Signal Corps' request, RCA engineers undertook to streamline the older, heavier model—which many a soldier of World War II called "the backie-breakie." Following principles of sub-miniaturization—pioneered at RCA Laboratories—every one of its hundreds of parts was redesigned. Models were built, tested, rebuilt, and finally

RCA came up with an instrument weighing only 29 pounds. Its range is double that of the World War II model.

Even more important, under present conditions, RCA was able to beat the most optimistic estimate of the time needed to design such an instrument by nearly three months. Signal Corps engineers have called this "A major engineering and production achievement."

* * *

See the latest wonders of radio, television, and electronics at RCA Exhibition Hall, 36 West 49th Street, New York. Admission is free. Radio Corporation of America, RCA Building, Radio City, New York 20, New York.



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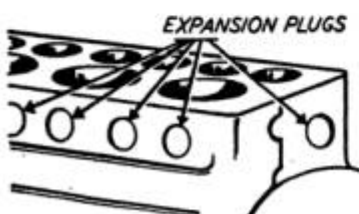


Care and Feeding of Engines

BY S. P. CORP

PLUG YOUR LOSSES

When a cylinder block is cast, large holes are provided in the side of the casting for cleaning. These holes are stopped up with plugs known as expansion plugs or Welch plugs. They are about two inches in diameter,



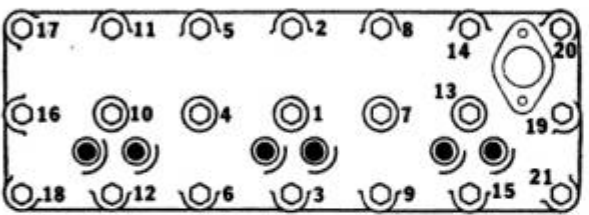
and are forced into position to keep water from leaking out. At times they do leak, and you lose expensive anti-freeze.

To remove one of these plugs, drive a small punch into its center, which will dish the plug so it falls

out. Clean the hole of all rust and dirt. Make sure new plug is free of sharp edges. Fit new plug into its seat in the engine block, curved side out, and expand it by flattening it with a blunt drift and hammer. A good sealing compound may be placed around plug before installing. Check engine for water-tightness.

MUSTN'T BE TOO TIGHT

Don't draw a cylinder head down too tight, or it may cause engine to pump oil. When checking engine head for winter operation, use a Torque wrench to make sure all cap screws and nuts are tightened evenly. Center cap screw or nut should be tightened first, then next row on each side, as in diagram.



This method will iron out the head gasket, preventing leaks and distortion. Apply 65-70 foot-pounds of pull for cap screws and 50-60 for cylinder head nuts.

IF YOUR CAR DRINKS TOO MUCH

An engine that uses too much oil needs new Sealed Power piston rings. The Sealed Power MD-50 Steel Oil Ring does the world's best job of oil control, even in badly tapered and out-of-round bores. Your dealer has Sealed Power Rings or can get them for you. They save gas, save oil, restore original power to your engine and lengthen its life. A postal to "Sealed Power, Dept. G-1, Muskegon, Mich." will bring you free a helpful book, "7 Ways to Save Oil."



models of themselves. Shortly after World War II, President Truman sent over a double-breasted suit, a light-blue poplin shirt, and a dark-blue tie with narrow stripes by means of a high-salaried delivery man who was in the U. S. at the time—England's Prime Minister Attlee. The famous and the infamous in recent world history were only too glad to ship Tussaud's a military uniform to keep their wax facsimiles decent—Adolf Hitler, Hermann Goering, Joseph Stalin and even Marshal Tito. Tussaud's makes such arrangements through foreign embassies.

Often a celebrity contributes a new suit that he has never worn. Either he is asked to break it in for greater realism, or the museum has one of its employees of comparable size wear the suit until the new, stiff look is gone.

Even though shortages have eased up somewhat in Britain, Tussaud's is still operating along austerity lines—not wasting any of the precious materials of which the noted and notorious persons are made.

Once the plaster-of-paris head molds have been made, used and stored, the original clay from which their impressions were taken is sliced up and beaten down for future use. Wax hands that become broken or damaged beyond repair are saved to be melted for reuse. Old heads are broken up to be melted down for new. And, of course, the glass eyes are removed, cleaned, graded for size and color, matched for pairs and sorted into their proper boxes.

Tussaud's, with a reputation for salvaging everything but the souls of wax figures, cannot reclaim hair. This is strained from molten wax and discarded. During the war and immediately after, the museum had quite a time staying with its custom of using only real hair, rather than wigs. The main source was women and men in rural areas on the continent.

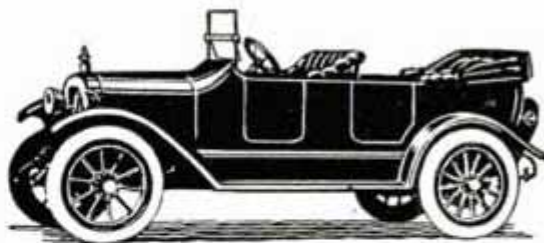
Museum executives will never forget the time and money it cost to present the wax model of a U. S. war hero, Admiral Stark, with his proper growth of thick hair. All of London was scoured for the needed fine, white variety, the hardest kind to get, that was planted in his scalp at 333 hairs per square inch. At \$20 an ounce, Admiral Stark's hair alone cost more than \$100.

Although Madame Tussaud's opens at 10 a.m. daily, men and women behind the scenes start at six. The first order of the day is brushing specks of dust off clothing of figures. Everyone from Henry Landru, the French Bluebeard, and Kemmler, the first man to be electrocuted in the States—displayed in the Chamber of Horrors—to Princess Elizabeth and her husband in the

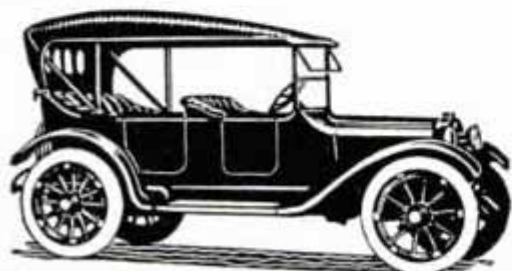
Famous Cars of Early Years Used Sealed Power Piston Rings



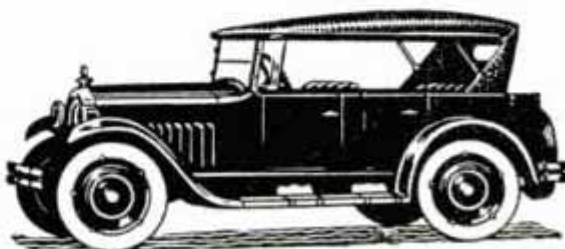
CADILLAC "Thirty" with four cylinders and 30 horsepower was priced at \$1600 and offered as "Touring Car, Demi-Tonneau, or Gentleman's Roadster." Cadillac was one of the earliest users of Sealed Power Piston Rings.



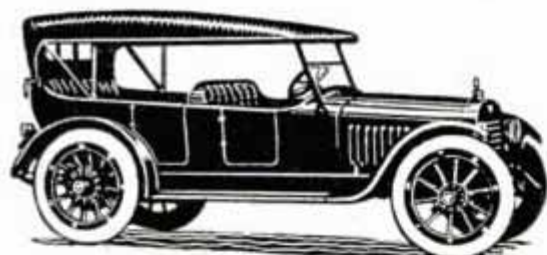
MAXWELL assured prospects that this 1915 model would "hold the road at 50 miles an hour." It was offered as touring car, roadster, or cabriolet, at prices ranging from \$595 to \$840. Sealed Power Piston Rings were right in there, pitching.



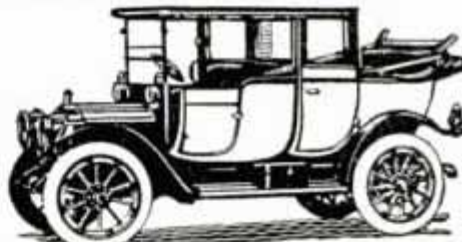
DODGE BROTHERS created a considerable sensation with this first model, featuring an all-steel body, in 1914, when Horace and John Dodge had America on its toes to see what they would produce. Sealed Power Piston Rings contributed to its performance.



OLDSMOBILE featured this "SIX Sport Touring" at \$915 in 1924, or the roadster in the same model could be had for only \$785. Of course, the sport job included windshield cleaner, which was \$1.25 extra if you bought the roadster. Sealed Power Rings were standard on all five models, however.



HUDSON, in 1918, urged "Farmers, Listen! Buy a Hudson Super-Six and Be Free From the Annoyances of a Car That Won't Run Unless It Is Under Constant Attention." You could choose from any of ten different body types. Sealed Power Rings, of course.



PACKARD in 1912 was offering a "30" with 40 horsepower at \$4100, an "18" with 26 horsepower at \$3200, and a "Six" with 48 horsepower—wow!—at \$5000! This is the Packard "18" Landaulet. Packard has used millions of Sealed Power Piston Rings since those early days.



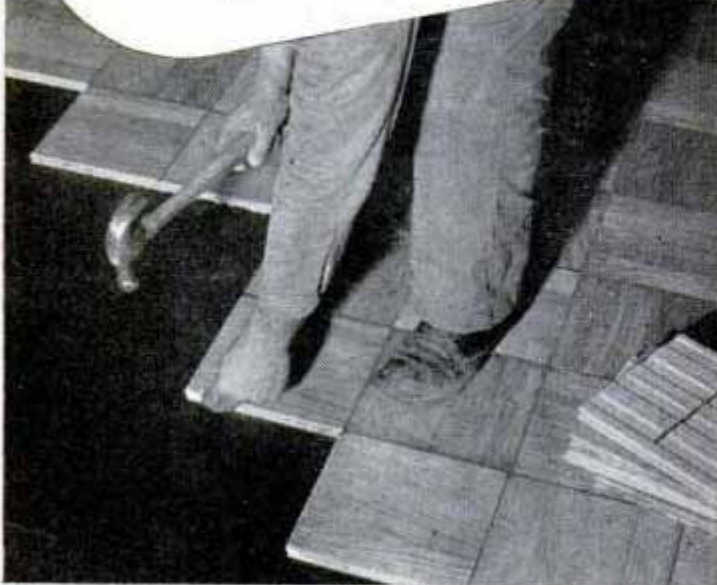
LINCOLN produced this first model in 1922, soon after Ford bought the Lincoln Motor Company and began the production of higher priced cars. Sealed Power Rings were used as original equipment.



STUDEBAKER manufactured this "Big-Six" in April, 1918. It made a world's record of 490,000 miles in 5½ years. Studebaker was one of the earliest manufacturers to adopt Sealed Power Piston Rings as original equipment.

Descendants of these cars are still using Sealed Power Piston Rings. In fact, Sealed Power products are used as original equipment by manufacturers of more than 80% of all passenger cars. If your car smokes too much, drinks too much, spends too much, or loafs too much, it's a sure sign you need new Sealed Power Piston Rings to save gas, save oil, save engine wear. Best in new cars! Best in old cars! Write for free booklet: "7 Ways to Save Oil." Sealed Power Corporation, Muskegon 60, Michigan.

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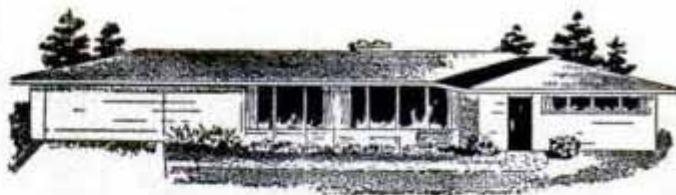
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Circular Saw Heats

Q—I have a small circular saw in my home shop with an 8-in. blade and whenever I cut pine or other soft woods, pine especially, the blade binds and heats unduly. I've checked the alignment of the ripping fence with the blade as directed by the manufacturer and it seems to be correct. Still the blade binds. What's my trouble?—B.U., Calif.

A—If you will take the blade off the arbor and examine it closely, you probably will find a small hard deposit of resinous pitch under the cutting point of each tooth on the leading edge. This changes the clearance angle of the tooth and is a cause of the trouble you describe. In other words, the pitch deposit prevents the blade from cutting freely. This is a common trouble when cutting material having a high moisture content and, especially, certain grades of pine containing pitch, as it is commonly called. In production work the trouble usually is corrected by filing the saw teeth with a greater clearance angle, but in the home shop this procedure is not practical, as a blade filed in this way will be unsuitable for other work. You generally can cure the trouble by keeping the teeth filed sharp and cleaning the blade at frequent intervals with spirits of turpentine, or a special solvent which is supplied for this specific purpose. Usually you can obtain this solvent from your hardware dealer.



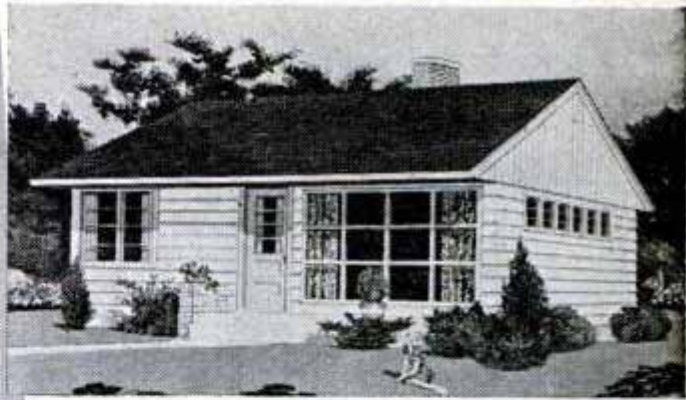
Chiming Mantel Clock

Q—Recently I purchased an old chiming mantel clock and although it seems to run satisfactorily, the chiming mechanism does not operate properly. The chime is too rapid, the notes being struck so fast that they sound almost like one—because of the sustained tones, I suppose. What is the cause of this trouble, and how can I correct it?—W.F., Mass.

A—We are assuming that you are referring to a clock of American make striking a full chime on rods mounted below the movement. If this is one

(Continued to page 334)

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For over 45 years Aladdin has manufactured its own houses and sold them direct to home builders. The finest quality DRY lumber is used. This lumber is cut to exact size on fast, precision machines in Aladdin's own mills. Because Aladdin's Read-Cut System eliminates expensive hand measuring and cutting you save as much as 30% on labor. You save 18% on waste also. And you can choose the size and style house you want from Aladdin's



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THIS IS THE WAY TO BEAT THE HIGH COST OF BUILDING!



Every hour you put in on the construction of your Aladdin house means a saving to you of from \$2 to \$3 per hour—\$14 to \$21 a day! Total carpenter work runs from 300 to 1200 hours, depending on the house you choose. **WITH MOST OF THE SKILLED LABOR ALREADY PERFORMED AT THE ALADDIN MILLS** think how

easy it should be for you to bring the cost of your new home down to practically a pre-war level. Our drawings and instructions are simple to follow and cover everything from the foundation up so you can save any or ALL labor costs.

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BURGESS BATTERIES

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FREEPORT, ILLINOIS • Niagara Falls, Can.

(Continued from page 332)

of the older spring-driven chiming movements, then it is possible that the speed of the chiming mechanism is controlled by what is known as a "fly" fan, which is located on one of the high-speed shafts. If this fan is bent or otherwise damaged, or is missing entirely, this could be a cause of the trouble you describe. Replacing the fan will, of course, correct the defect, provided the missing fan is the cause, but it is not possible to determine the proper size without having the original part. Usually the fly fan is simply a rectangular piece of sheet metal (brass) and is either fitted with a hub drilled to a press fit over the shaft, or is center-slotted to form an opening through which the shaft passes. If the original fan is not at hand, then it will be necessary to determine the size of the new one by experiment. Rather than try to make this repair yourself, we would suggest that you either write to the manufacturer of the clock and get his recommendations, or take the clock to your local jeweler.

Warped Siding

Q—I have an older house sided with narrow, beveled siding having a molded lower edge. The siding boards have warped in several places on the walls and have opened, leaving spaces between the boards ranging from 1/8 to 1/4 in. Should I draw the boards down with nails or fill the openings with a calking compound? — T. N., Wis.



A—You did not say whether you recently have insulated the walls with a blow-in type of insulating material, or whether the condition of the siding is of recent origin. The reason we are raising this question is that we are inclined to suspect that the presence of moisture behind the board is the cause of the trouble. This could result from condensation of moisture within the walls, or could be caused by a leak in the roof over the plate, which is permitting water to get behind the siding in some manner. If this is so, then it will not be advisable to nail the boards until the cause of the trouble is corrected. Otherwise, it probably is permissible to nail the warped boards at the lower edges, spacing the nails whatever distance apart is necessary to draw each board down tightly. It is suggested that you use aluminum nails, if they are available, as the heads will not rust and cause streaks on the paint. In most cases it will be necessary to drill holes before driving the nails as otherwise, the siding may be split. Generally it is best to begin nailing at the center of each board, rather than nailing from one end to the other.

Plastered Walls Crumbling

Q—The plastered walls in my new home, in one room especially, are beginning to crumble. The surface seems unusually soft and it dusts—breaks away in fine particles—when rubbed lightly with a finger. What has caused this? Will paint sealer bind the surface or is there some other preparation available?—O.R., Del.

A—Any condition which unduly delays the setting action of the materials used in ordinary plaster is likely to produce a soft wall. While your description of the condition of the walls makes it rather difficult to judge with any certainty, we are inclined to believe that the present condition of the walls is due to what plasterers call "dry out." This results from a too-rapid evaporation of the water contained in the plastering materials when they were applied. The surface affected in this manner usually is soft and crumbly, as you describe, and has a chalky appearance. Plasterers generally try to correct this condition by successive applications of water to the surface in a fine, light spray which is continued for several hours until the plaster sets hard and firm. As a rule this treatment will prove successful where the plaster is comparatively new.



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A M E R I C A N
F L O O R M A C H I N E S

Grand Hall gets the treatment. Hands and faces are dusted with down-soft cloths. Hair, beards, and mustaches are combed. It is indeed an experience to watch Marie Antoinette—one of the originals made by Madame Tussaud herself—having a shampoo. (This happens at least every few months with all figures.) The French Queen's upper portions are removed from the rest of her body. First her blond hair is combed to remove the powder. Then come the washing and elaborate combing and setting.

By a few minutes before ten, Bernard Tussaud makes a complete tour of inspection, as rigid as any carried on at officers' training schools. Every necktie must be straight. All shoes must be shined and laces neatly tied. Belts and military insignia must be up to parade-ground standards.

But despite the best-laid plans, sometimes things go amiss anyhow. The staff of Tussaud's remembers clearly what happened to the Sleeping Beauty of Versailles, the figure of a lovely court lady which is near the wax model that Madame Tussaud made of herself at an advanced age. This beauty is different from all other persons displayed. Reclining on a couch, she seems to be alive, actually breathing. Her breast rises and falls, through efforts of a noiseless, mechanically operated cam.

One afternoon a throng of spectators gathered around the Sleeping Beauty, and unrestrained laughter echoed through the otherwise quiet halls. Reginald Edds, Tussaud's historian, says that a guard and a museum executive hurried over to learn the reason. They found that the Beauty was having difficulties—so many that it must have been hard for her to remain sleeping. The cam rod had become dislodged and was walking around under her dress, causing her to inhale and exhale in the most peculiar places.

Such events make the management and, especially, the guards, even more watchful. And yet unforeseen things happen. There is some stealing and occasional vandalism. During the war, blubbery Hermann Goering, the man in danger of falling face down for weight of medals, could never keep his latest military decorations very long. Museum property men had to replace so many that the battle was a losing one. They gave up. Hermann looked almost nude without a medal. Hitler's iron crosses usually vanished shortly after being pinned on.

Almost \$28,000 worth of jewelry, equipment and clothing is stolen annually. Queen Victoria recently lost a miniature gold dress crown, complete with jewels and red velvet. A substantial piece of Henry

(Continued to page 340)

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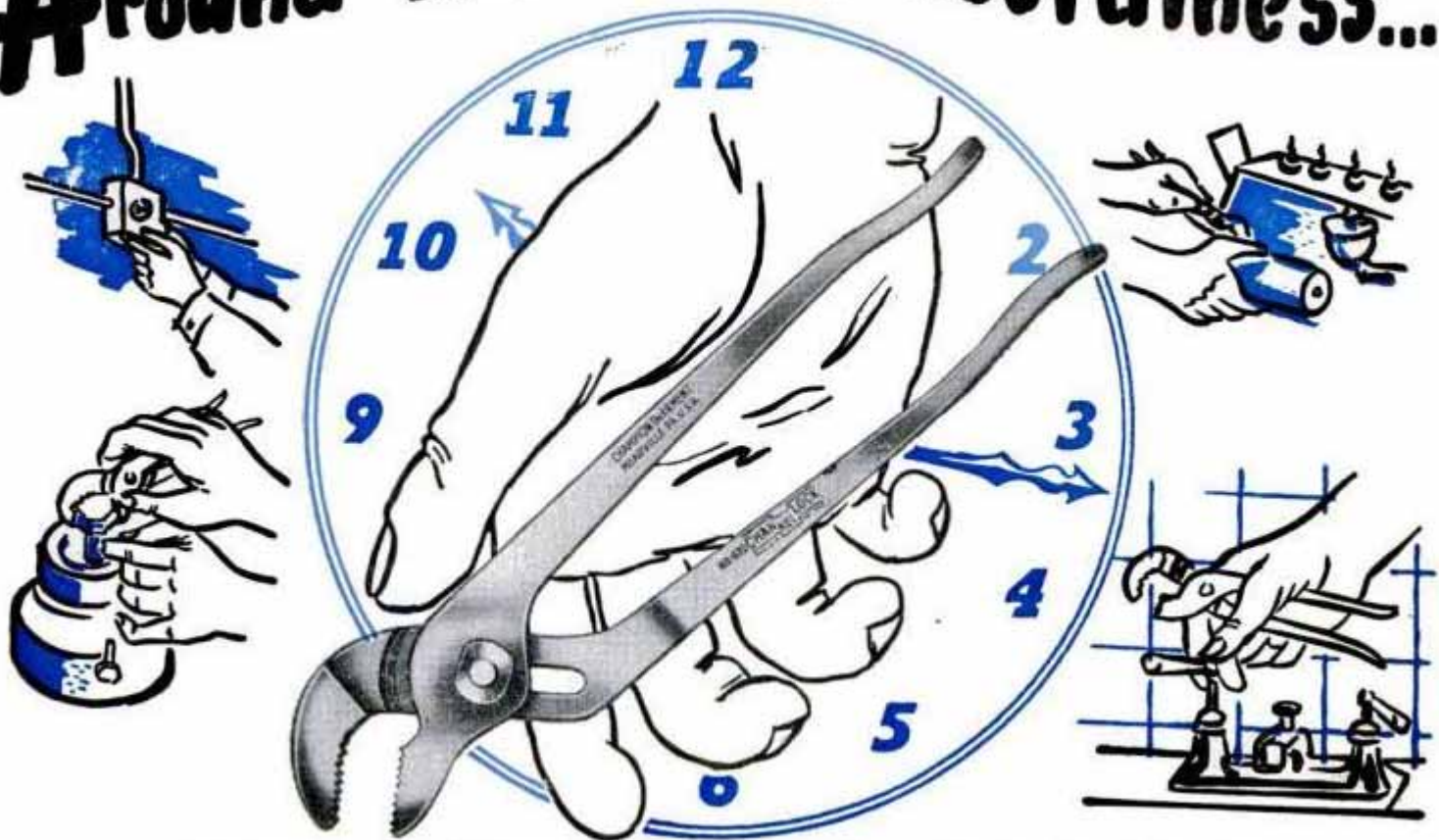
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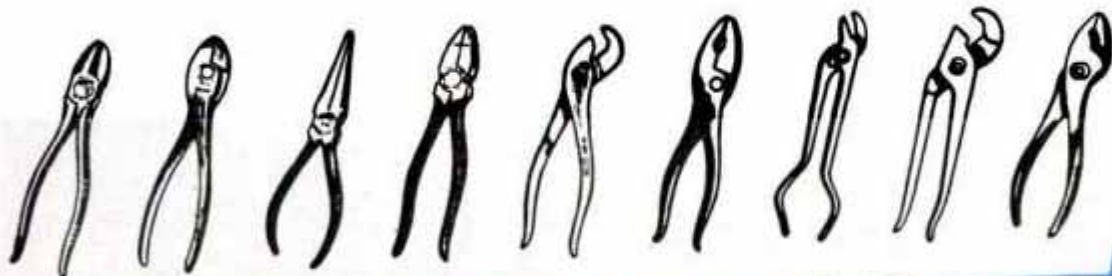
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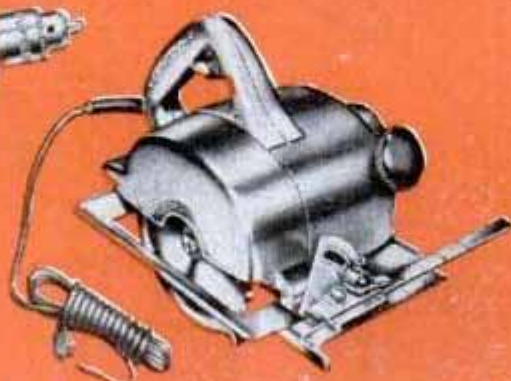
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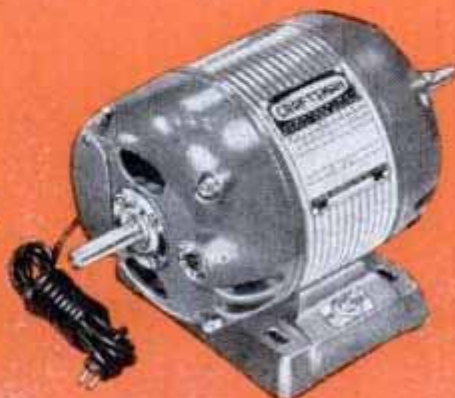
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\$15.95* \$2.00
Cash Down
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CRAFTSMAN and **DUNLAP** Tools by **SEARS, ROEBUCK and CO.**
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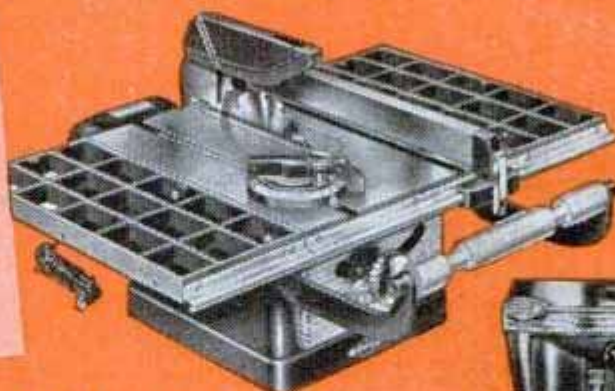
of fine quality Power Tools!

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Just a small down payment on Sears Easy Terms puts one or more in your shop!



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1952 CRAFTSMAN Power Tool Catalog! Get yours NOW from the Hardware Department of your nearest Sears Retail Store!



CRAFTSMAN 8-inch Tilting-Arbor Bench Saw

\$60.00* \$6.00
Cash Down
Less guard, motor, extensions



CRAFTSMAN Ball Bearing Drill Press

\$82.50* \$8.50
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Without motor

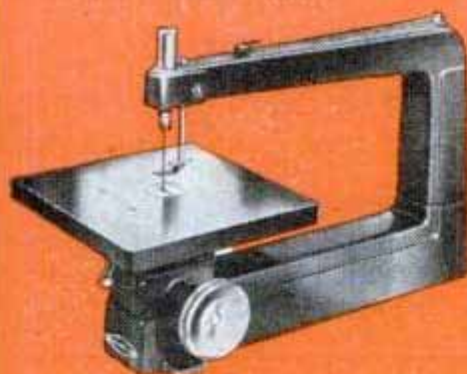
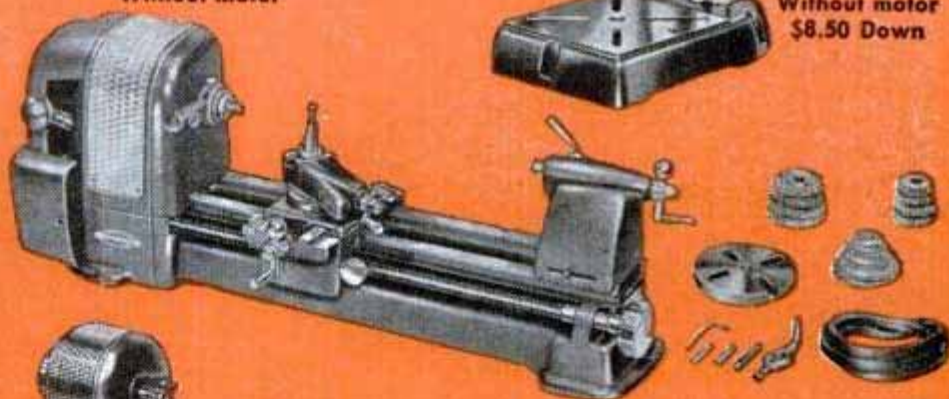


CRAFTSMAN 3-Drum Belt Sander

\$58.95* \$6.00
Cash Down
Without case

CRAFTSMAN Metal Turning Lathe

\$47.50* \$5.00
Cash Down
Without motor



CRAFTSMAN 18-inch Jig Saw

\$32.50* \$3.50
Cash Down
Without motor



CRAFTSMAN Ball Bearing Wood Lathe

\$43.95* \$4.50
Cash Down
Without motor



CRAFTSMAN 3-wheel Band Saw

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Cash Down
Without motor



CRAFTSMAN 4 1/2-inch Jointer-Planer

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* Prices slightly higher south of the Ohio and west of the Mississippi rivers.

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No. 230
"Satin Chrome" Micrometer. 1" capacity, tapered frame, Sycamore case.

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Improved Combination Square. With 12" hardened blade, reversible lock bolt.



No. 327
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VIII's real-ermine robe was snipped off. King Edward VII lost his jeweled Order of the Garter. A string of pearls was removed from Queen Elizabeth's neck. The regent of Mary Queen of Scots found himself without the gem-studded hilt of his sword. Greece's General Metaxas lost his hat. At Madame Tussaud's, Anne Boleyn fared much better than she did in actual life with Henry VIII. She lost only a golden necklace instead of her head.

So far as vandalism goes, it seems that in all periods of history, there are prominent persons considered villains and whose wax images are molested by museum visitors.

During World War I, Kaiser Wilhelm took a number of manhandlings. An Australian soldier on leave seized the German emperor's sword and bisected the royal fellow's head. A number of others tried to maul the Kaiser on various occasions, and he was put in storage until things cooled down.

Adolph Hitler was attacked by a pair of Communists in 1936 and splashed with red paint. This bit of sport cost the Reds \$160. Then during World War II, shortly after raiders of Dieppe were put in chains by the Germans, inebriated Canadian soldiers jumped der Fuehrer. One of the pair tried to pull him over but failed because Hitler, like all figures, was secured to the floor. The other, waving his revolver in ever-widening circles, was stopped just in time.

As yet Joe Stalin hasn't been molested unduly. True, his mustache has been tweaked and his hair mussed, but he's just as good as ever today. And the operators of Tussaud's hope he stays that way—at least in his wax form.

... And Then Came the Horseless Carriage

(Continued from page 143)

ered! By the end of the war 350,000 machine guns were made by this plant. So it went throughout industry. Automobile-assembly lines became tank and airplane lines and the same know how was applied to producing 200,000 tanks, 300,000 airplanes and thousands of other war items.

We all know the result and from it we should recognize the value of this most powerful weapon.

Our system of mechanically duplicating things—as developed by the automobile makers—is one of the most valuable assets our nation possesses. It can give us more and better things in time of peace and is the backbone of our defense in times of war.

(Continued to page 344)

AMERICA'S FINEST WORKSHOP TOOLS — AT BUDGET PRICES

Precision built Shopmaster tools are known for their durability. They're especially designed for the home workshop. Shopmaster tools have features found only in higher priced tools. With available accessories, each tool will adjust to handle many tasks. Convenient operating mechanisms, sealed-for-life ball bearings and large working surfaces. A Shopmaster tool will do any job better and easier.

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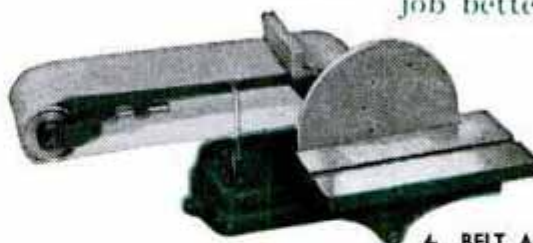
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12" TILTING TABLE BAND SAW. Table work surface 12" x 18". Cutting depth, 6 1/8". Table tilts to 45°. Ball bearings. **\$87.50**

Also available in 10" size. \$46.45



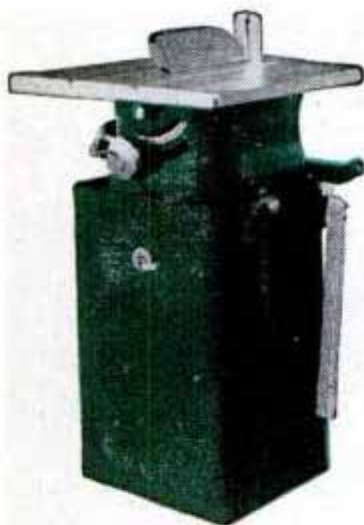
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15" TILTING TABLE JIG SAW. Table size 10" x 10". Cutting depth, 2 3/4". Table tilts 45° **\$27.95**



7" TILTING TABLE BENCH SAW. Table size 14" x 18". Depth of cut, 2 1/4". Sealed-for-life ball bearings. **\$33.95**



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7" TILTING ARBOR BENCH SAW. Ball bearing arbor. Heavy cast construction. Depth of cut, 2 1/8". Blade tilts to 45°. Ideal for the small shop. **\$47.95**

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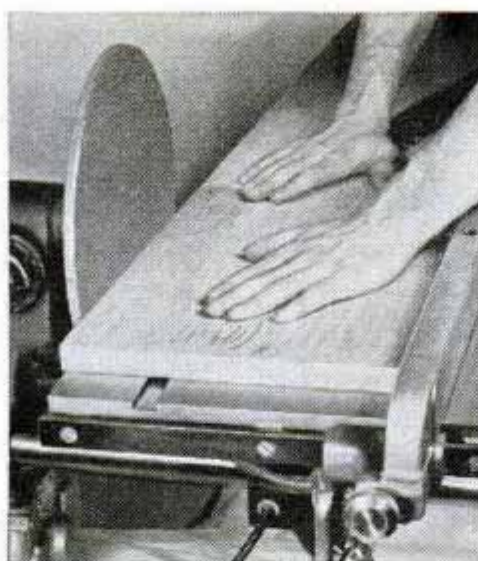
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1 "Big-job capacity. I don't know of any other 8-inch saw that matches the capacity of SHOPS MITH. The table extension gives you a working area 17" x 54". Sawing long boards and 4' x 8' plywood panels is a one-man job."



2 "Smoothing edges with the disc sander is a SHOPS MITH exclusive. It's done by setting the rip fence at a slight angle to the disc. Work fed between fence and disc is jointed to precise widths. The big, tilting table gives plenty of support."



3 "Perfect doweling is possible with SHOPS MITH in the horizontal drill press position. Work is laid flat on the table and backed up by the rip fence. Drill is fed in from the side. Ball and crank table-raiser accurately adjusts table height."

See SHOPS MITH demonstrated at leading hardware and department stores or any Montgomery Ward store. FREE! 16-page information-packed catalog. Gives details and specifications on SHOPS MITH and accessories. Write for it.

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8" circular saw • 15" drill press
12" disc sander • Horizontal drill
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5-tool unit complete except for motor* **\$189.50**

*Special 1/2-hp., capacitor-type motor, \$34.50

ON SHOPSMITH!



"A built-in wardrobe cabinet was my first real SHOPSMITH project. And what an eye-opener it was! I never realized that SHOPSMITH could do so much in so many different ways in such limited space.

"I like the way SHOPSMITH converts quickly and easily from saw to disc sander to wood lathe to horizontal and vertical drill press. I like the way it's made—four ball bearings, heavy castings, precision-fitted parts. Best of all, I like its

flexibility and the fact that, in each of its five positions, it has features you won't find in any other power tools. Simplified micro-adjustments and convenient, ready-to-use jigs, for example.

"In making the cabinet, I found that no job was too big, too difficult, or too unusual for my SHOPSMITH. Being able to use the right tool the right way saved me hours of time. And the accuracy I got was mighty satisfying. It was a big job, but SHOPSMITH made it easy!"



4 "Face to face. SHOPSMITH is the only lathe that lets you face your work while turning knobs, bowls or other flat or hollow objects. The full-swivel tool rest makes it easy to get into and behind faceplate turnings. Lathe has 15" swing, 33" capacity."



5 "Tall trimming. I needed to trim 3" off the side of the doors for the wardrobe. So I set SHOPSMITH in the vertical saw position and used the floor as a fence guide. It was a lot faster than hand sawing—and far more accurate."



6 "Built-in jig. When it came to drilling dowels for the drawer pulls, SHOPSMITH again showed its flexibility. The fence and tilting table formed a V-block for holding the dowel accurately. SHOPSMITH as a drill press is second to none!"



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THE ANDERSON COMPANY
Gary, Indiana, U. S. A.

Last spring I drove through Ohio and, in passing through the countryside, I couldn't help but compare it with my youthful impressions. The old dirt highway was gone, horses were seldom seen, a school bus loaded with children passed me, a tractor was busy harrowing a near-by field and I had to stop to let a truck loaded with crates of chickens pull out in front of me. Everywhere the gasoline engine had left its imprint, relieving the farmer's burden and making his family's life fuller.

On my way down I stopped in Columbus and talked to one of the boys in the Chamber of Commerce. We went over some figures he had handy, and I'll just give you a few of them for the sake of 50 years' comparison. In a half century the city's population has more than doubled, and it covers 40 square miles as compared to a little over 17 in 1900. The people who own automobiles and trucks have insisted on paved streets; there are 540 miles of them, over five times as many as in 1900. The electric

Milestones of Speed

1903	C. S. Rolls	63.1 m.p.h.
1904	Henry Ford	91.3 m.p.h.
1910	Barney Oldfield	131.7 m.p.h.
1924	Malcolm Campbell	146.1 m.p.h.
1927	H.O.D. Segrave	203.7 m.p.h.
1935	Malcolm Campbell	301.1 m.p.h.
1938	John R. Cobb	350.2 m.p.h.
1947	John R. Cobb	394.1 m.p.h.

(On one run at Bonneville, Utah, in 1947, Cobb was timed at 403.135 miles per hour, the fastest ever traveled by man on land.)

railways are disappearing, but last year 98 million bus riders traveled over 236 miles of bus routes. You may recall I mentioned Columbus as being a manufacturing center for buggies and carriages in 1902 and the industry employed 1400. This industry has gone but, just for the record, one of our plants there that makes only automobile hardware employs over 4000 people!

Columbus, Ohio, is just one of thousands of communities that have been transformed in that period by the automobile. No one thing in our history has so changed the habits of our people, has created employment, either directly or indirectly, for every one out of seven of us and brought us all closer together.

If events permit us to continue our steady engineering developments, the automobile of tomorrow will not resemble today's any more than today's resembles the horseless carriage. Engines will take advantage of higher compression ratios, new mechanical designs, new fuels and new materials. They

(Continued to page 348)

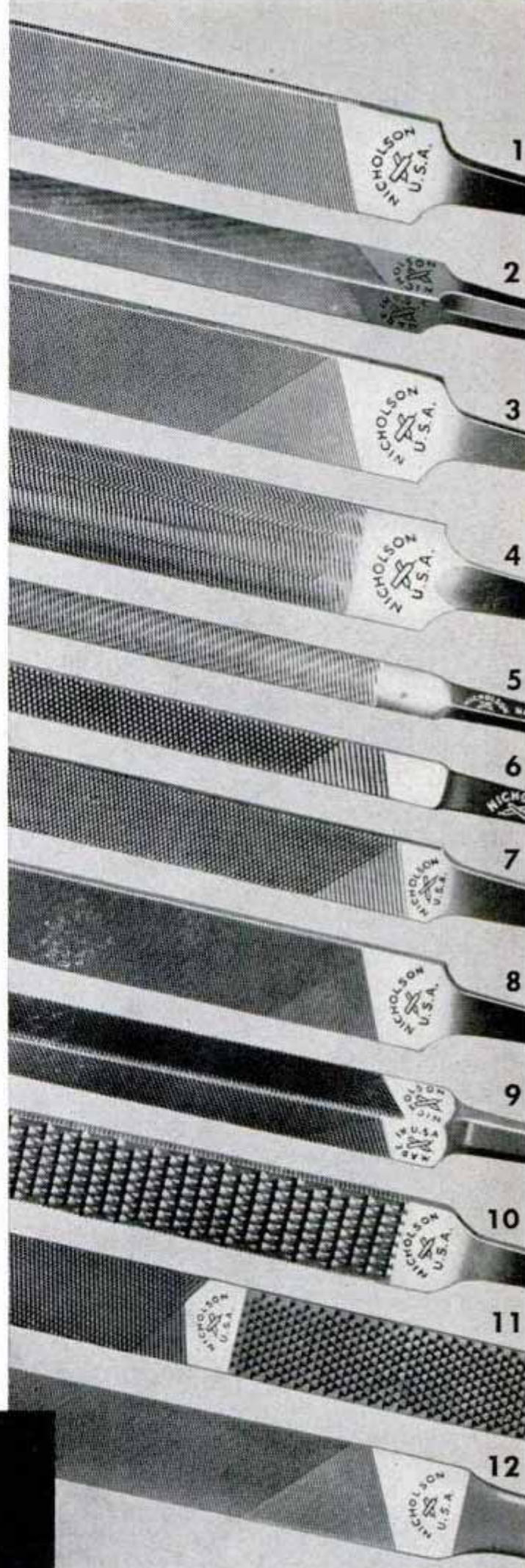
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Any reasonable poll or survey will show Nicholson and Black Diamond files the first choice among top mechanics. You'll find these world-famous files in pattern, toolmakers and fine-instrument shops—where precision filing is highly essential. . . . In industrial plants where fast filing is a production "must." . . . In home workshops where fine tools as well as fine accomplishments are owners' pride.

Whatever the requirement, the superiority of Nicholson and Black Diamond files shows up in results—through correct design, accurate cut, proper hardening, uniformity, and maximum wear. Shown here are some of the types most widely carried by hardware and industrial supply houses in popular lengths and range of coarseness. They represent a practical home workshop assortment toward having on hand The right file for the job, saving time and materials, and improving work.



- (1) **MILL** — for smoothing, edge-sharpening, large-tooth-saw filing.
- (2) **TAPER** — Regular, Slim, Extra Slim, Double Extra Slim — for small-tooth-saw and other delicate filing.
- (3) **FLAT** (4) **HALF ROUND** (5) **ROUND** (6) **SQUARE** (7) **PILLAR** (8) **KNIFE** (9) **THREE SQUARE**. Mostly double-cut — for fast stock removal.
- (10) **WOOD RASP** — flat and half round types, for woodworking.
- (11) **SHOE RASP** — with many uses, on wood, metal, plastics, etc., as well as leather. Half round; half of each side rasp cut, other half file cut.
- (12) **HANDY FILE** — with forged-on handle; two types of cut — single on one side, double on other.



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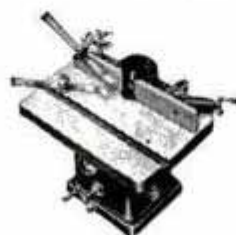
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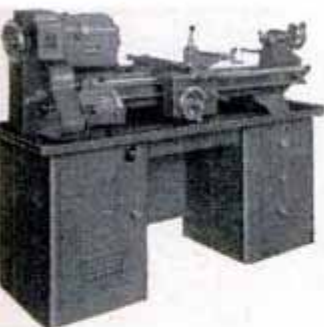
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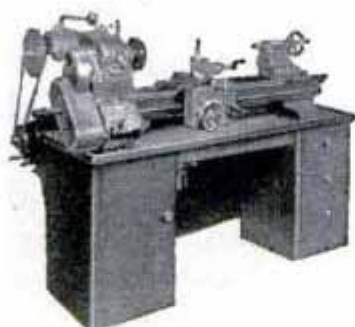
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on ground table, and ball bearing construction. The range in capacities and price lets you select the tools best fitted for your particular needs. Ask your Atlas-Power King dealer for all details.

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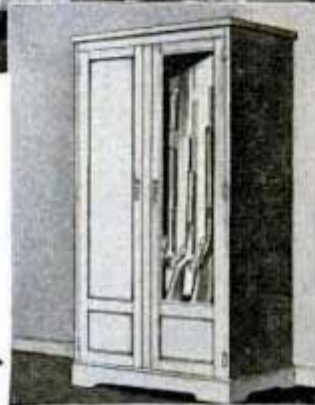
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These are the Western Pines

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will be smaller but more powerful and what is most important, they will use less of our precious fuel reserves. In fact, in the next decade or so you will probably be traveling a third more miles on the same gallon of fuel.

It is difficult to predict the appearance of tomorrow's car but this we know—it will be even more comfortable and easier to operate than today's. New materials—metals, plastics, fabrics and rubber—will change entirely today's conception of the automobile. Probably some of you visited the Futurama at the New York World's Fair about ten years ago. At the time you probably said to yourself, "Fascinating, but fantastic." Yet, if we look around us ten years later does it appear quite so fantastic? Aren't we actually planning transcontinental highways, multiple-level streets for cities and some of the other things predicted in that exhibit?

The automobile is a typical example of the American way of doing things. The first crude examples opened our eyes to new possibilities in transportation. Men, many men, worked and experimented year after year until today, 50 years later, we see the results of their work transform the country and the habits of its people. But today Americans still are not satisfied with everything around them. I hope I never see the day that happens. So we keep on working, experimenting with many things, and some fine morning we shall wake up and find these dreams have become accomplished facts. That's what happens again and again in this land of ours.

American Way of Life Photo Contest

(Continued from page 172)

Black-and-White Division

Honorable Mention (\$25 each):

- Roger Baele, 1626 S. Taylor St.,
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Lil and Al Bloom, 5412 Ridgewood Ct.,
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Percy J. Hussakof, 380 Knickerbocker Ave.,
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Mrs. Janet Konkle, 819 North Ottilia St., S.E.,
Grand Rapids, Mich.
Vivienne Lapham, 13923 Fairford Ave.,
Norwalk, Calif.
Vincent J. Mandese, 1130 Punta Gorda,
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Carl Robert Mesterton, 66 Milton Rd., Rye, N. Y.
G. L. Osmanson, 715 Liberty St., Morris, Ill.
George H. Padginton, 641 Northumberland Ave.,
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Alvin M. Radin, 406 Winter St.,
Yellow Springs, Ohio
Charles S. Rice, 19 New St., New Holland, Pa.
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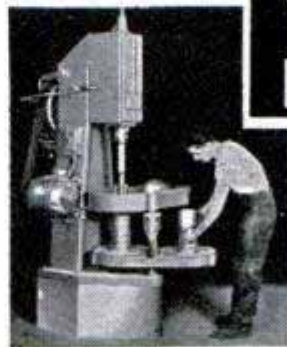
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Farm drainage, home building, reclamation projects, highway construction. From these and other sources come the biggest demand for drain tile in history. More local plants are urgently needed.

Millions of dollars' worth of drain tile are used annually. Much of it, ordinarily, is shipped from far distant points. Local manufacturing is economical, logical, profitable. The Champion Drain Tile Machine makes manufacturing easy. Pares production costs. Requires no skilled labor. Makes all sizes from 3" to 12". Yet requires only a moderate investment.

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Write for descriptive book "Blueprints for Profit."

DUNBRIK-DUNSTONE

(Continued from page 151)

Despite this period of apparent inactivity, things were happening behind the scenes. New companies were being formed, new patents were being issued and the military had taken an interest in flying. Our present-day Air Force had its beginning in July 1907, when the Aeronautical Division of the Army was established in the Office of the Chief Signal Officer. In December the Signal Corps advertised for bids on an airplane.

A glance at a few of the aircraft designs tried out by 1915 would lead you to believe that "everybody was trying to get into the act." There were monoplanes, biplanes and triplanes—and even airplanes with four or five wings. Some people seemed to think that the more wings the plane had the better it would fly. There were others who didn't believe in wings at all. They built flying machines with circular air scoops. From the back yards and small shops of America emerged an endless procession of contraptions ranging from a pedal-powered "Cycleplane" to Dr. Alexander Graham Bell's tetrahedral kite, "Cygnet II."

World War I not only demonstrated the potentialities of the airplane as an implement of war, but it forced the United States and its allies into a competition with the enemy to produce better airframes and engines. The "flying machine" grew up into an airplane.

By the middle of the war, the German Fokker appeared on the scene. It was a real plane in every sense, with a cruising speed respectable even today, plus rugged climbing and diving ability. It ruled the skies through 1916 and 1917. In the race to outdo it, the French built the little Nieuport, which could outmaneuver it. Then came the Spad to outspeed, outdive and outclimb the German menace. The British developed the S.E. 5, which could outmaneuver and outdive the enemy, but couldn't outrun him. The British also had the Camel and the Snipe, barely off the drawing boards, which bettered all the planes in many respects. The latter was rumored to have the unheard-of ceiling of 33,000 feet and a speed of upward of 250 miles per hour.

In the 94th, we used to sit around our Nieuport at the airdrome—a tiny sod area no more than ½ mile square, accommodating about 80 craft—and eat out our hearts for these new "hot" biplanes. We finally got some Spads, but for the first few months we fought in the old Nieuports. Though we grumbled about them, there were some

(Continued to page 352)

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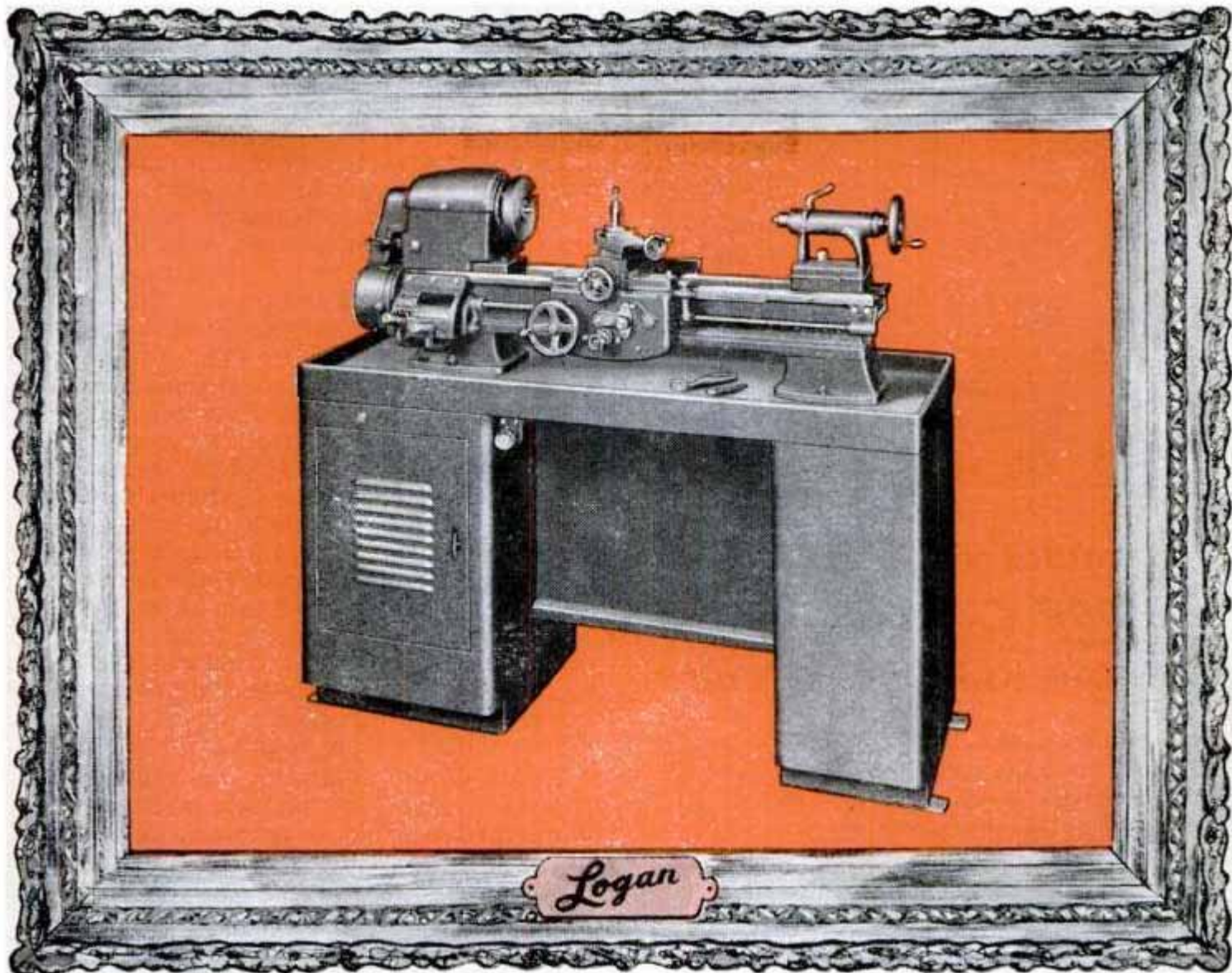
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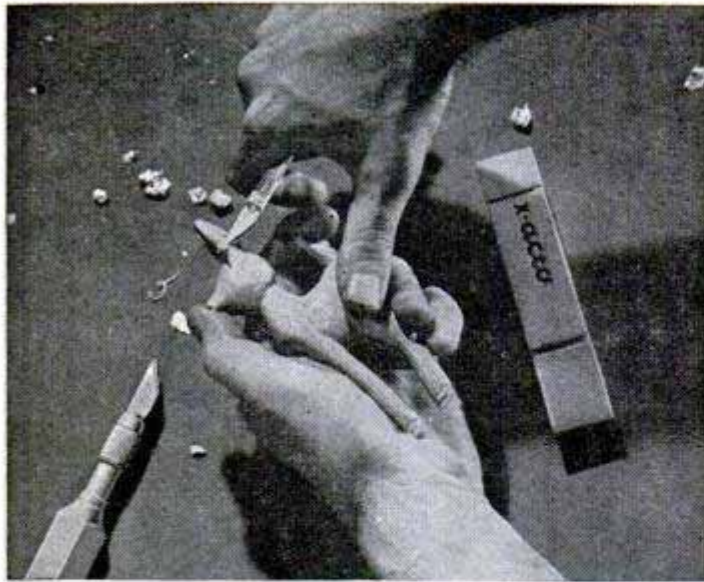
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real advantages to those kites. You could roar earthward with the plane in almost any condition of disintegration short of afire and stand a good chance of walking away from it.

However, one of our boys, Sumner Sewall, even lived to tell about being shot down in flames. In trying to escape an attacker who had set his whole tail assembly and rear fuselage afire, he whipped into a dive, doused the flame in the process, landed in a shell hole, somersaulted into another, and crawled away dazed but whole.

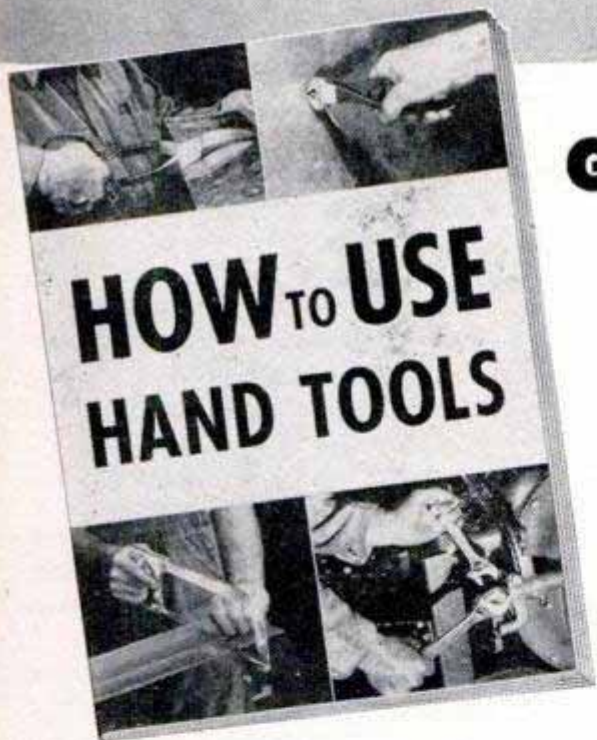
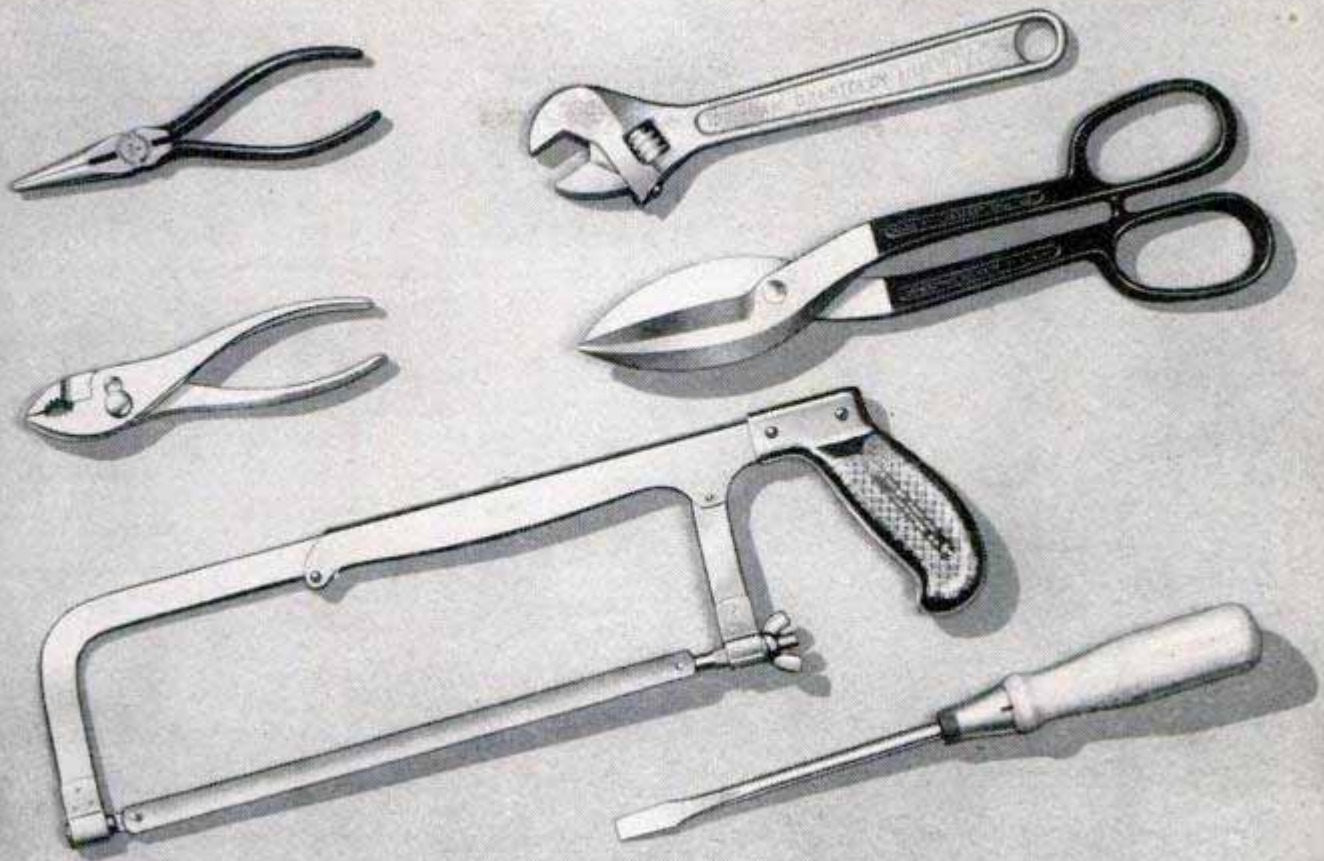
The planes would stay airborne under incredible circumstances. On one of my first sorties with Maj. Raoul Lufberry, one of our great aces and C.O. of the 94th when I joined it, my heart sank when I saw his prop go dead and his plane dip into a long dive. I dove after him, circling as he flattened out and plummeted into a muddy field, where he whipped over in a shattering somersault. A second later "Luf" crawled from under the wreckage, grinned up at me, waved and started hiking for the airdrome. The plane had blown a cylinder head. Luf sustained only a tiny scratch.

Twice, Jimmy Meissner, our rugged ace from Brooklyn, stripped the skin off his wings in his gritty determination to out-dive enemy craft in running combat. The first time, he completely peeled the top wing, leaving only a frightening view of ribs. But he nursed the crazy plane back across the lines, crash landed and crawled from the pile of debris unscathed. The second time, all the fabric was ripped from his right wings and Jimmy pulled the same stunt. He was the only man I knew who could consistently fly a Nieuport to a satisfactory landing with or without wings.

In one running fight with an Albatros I wouldn't have given much for my life. Right in the middle of the dogfight, with my sights lined up on the enemy pilot, my guns jammed. I jarred them free with my "jam hammer" and tried again. They jammed again at the crucial moment. Then to top it all, my oil ran out and the engine froze solid. I slid off in a dive, got away from the Albatros, hedgehopped over some barbed wire and was able to set the dead plane down in a perfect landing on a narrow field. I brought her in again with half the prop shot away, and she sat down like a feather.

One of our boys even landed in the treetops with a dead engine. The Nieuport crashed through the branches, rolled over and over, bounced to the ground in several sections, and the pilot walked home without a scratch. Another actually fell asleep as he was coming over the field to land his

(Continued to page 354)



GOOD TOOLS

... save time ... reduce costs

Users of Crescent and Crestoloy Tools have long since learned the economy of paying just a little more (than "cheap" tools cost) to get a whole lot more in hand tool quality. Superior tool design not only reduces worker fatigue but produces more and better output. The longer life of Crescent and Crestoloy Tools definitely reduces maintenance and replacement costs.

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The engine bearings

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**YES, OVER 50 YEARS OF KNOW-HOW
GO INTO FEDERAL-MOGUL OIL-CONTROL
ENGINE BEARINGS FOR YOUR CAR!**

... that's why mechanics everywhere use Federal-Mogul engine bearings for replacement when owners complain of oil-pumping. Your mechanic will tell you that new rings are not enough to correct the sluggish operation, poor pick-up and performance that result from motor-fouling oil waste. When the trouble is caused by worn connecting rod and main bearings, correction must start there, too. Replace with Federal-Mogul Oil-Control Bearings—they are engineered for the job! Ask your mechanic!

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Division of Federal-Mogul Corporation
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CONTROL OIL-PUMPING

WHERE IT STARTS—REPLACE WITH

FEDERAL-MOGUL

OIL CONTROL

BEARINGS



Spad. He overshot, woke up to find his wheels skimming treetops, circled back, whammed into some scrub brush and completely demolished the plane. Yet he came trudging up to the hangar with nothing more serious than a sheepish grin to show for the episode.

In spite of this hair-raising era of "growing up," the airplane was here to stay. When we entered the war on April 6, 1917, the air arm was still the Aviation Section of the Signal Corps and consisted of 35 pilots, 1987 enlisted men and 55 training planes. The Navy had 35 officer-pilots, 163 men and 54 airplanes. By the time the armistice was signed, the Army Air Force consisted of 20,568 officers, 174,456 men and 8403 planes. The Navy had built its air strength of 2853 officers, 32,873 men and 2127 planes. In addition, there were 282 officers and 2180 men in Marine Corps Aviation.

In the 1920s, aviation's second generation, the youngsters who entered the field after the war took over and the air age streaked ahead like a comet. Many of the men we regard as pioneers were hardly old enough to shave daily when they made their marks in history—Charles Lindbergh, James H. Doolittle, Clarence Chamberlin, Adml. Richard E. Byrd and a long list of others. Still others blazed trails for succeeding generations to follow. To the engineers and technicians of 20 years ago goes much of the credit for enabling planes to conquer the air over the oceans, around the globe and at each of the poles.

As one of the results of this pioneering, aviation operations, as well as aircraft manufacture, became an industry. Beginning with a few open-cockpit mail planes flying through the night, private operators built a transportation industry of staggering proportions, which now carries passengers, mail and air cargo to all corners of the earth. The average number of passengers carried by the domestic scheduled lines alone during 1950 was nearly 1,500,000 per month.

We are actually conducting our business today with aircraft built for the future. The next logical advancement in commercial air transports will be jet propulsion. Airliners being integrated into our fleets today are designed so that their reciprocating engines can be removed and replaced by jet power plants driving propellers. These days engines become obsolete faster than airframes. To protect our enormous investment in new planes, we are making sure that basic aircraft are adaptable to several stages of more powerful engines.

The time is not far distant now when

(Continued to page 356)

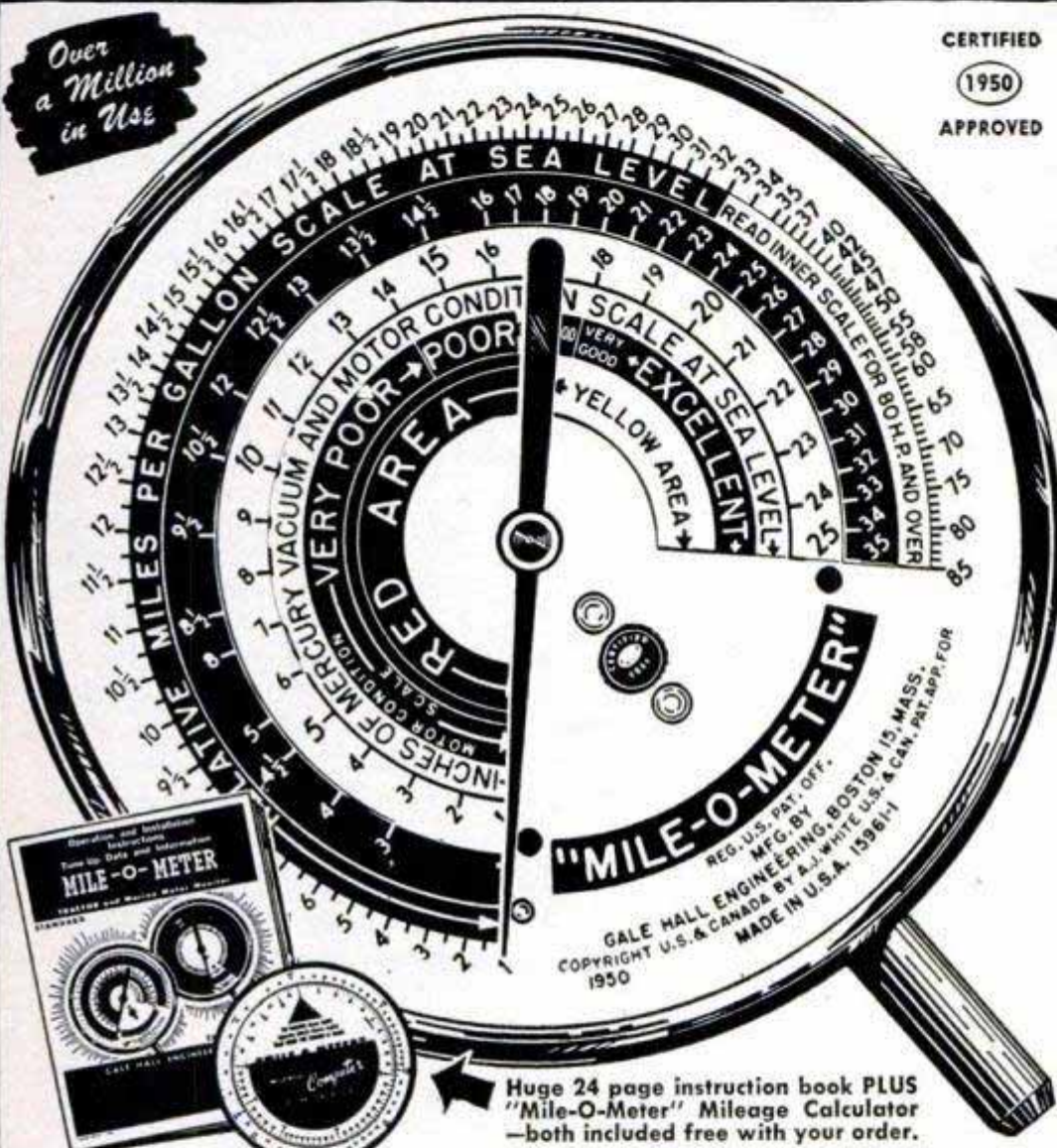
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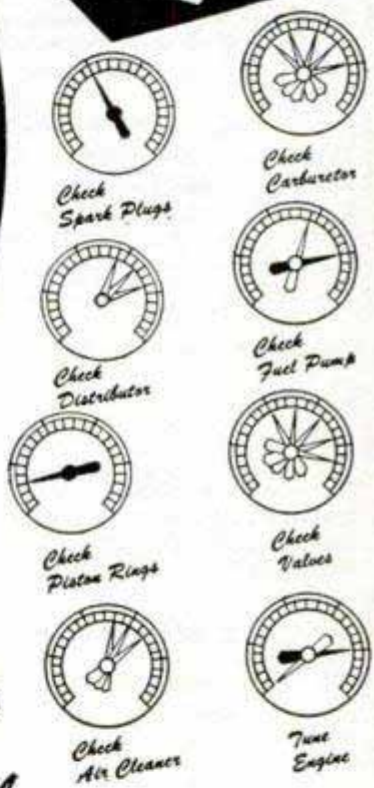
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*FOR CAREFUL CAR OWNERS AND "POPULAR MECHANICS"

Select important replacement parts for your engine carefully. Burd offers these helpful hints on piston rings for assuring the maximum in care-free motoring.

- 1 When excessive oil consumption demands new piston rings be sure to replace with the proper Combination Set for your *particular engine, its specific condition, and class of operation*—since no *one* combination of piston rings can be expected to correct *all* engine conditions.
- 2 Piston ring installation is no job for a dub, so choose a reputable mechanic. No good mechanic will guarantee an *incomplete* job. Too often a perfectly installed set of piston rings is blamed for poor performance and oil waste caused by other engine ailments.
- 3 If your engine is already "down" for a piston ring replacement, you should have valves ground; install *Burd* valve packing to prevent costly leaks, remove carbon; replace worn bearings, pins, etc., to save labor cost.
- 4 Give newly installed *Burd* piston rings a chance to deliver maximum efficiency. Change oil regularly. Keep it *clean* with a good oil filter and replace cartridge frequently. This is especially important in winter to prevent formation of sludge and carbon that hurts piston ring performance.
- 5 Last but not least, consider the *brand* of piston ring you buy. BURD—a famous name in the automotive industry—has for 40 years enjoyed a rightfully earned reputation for tops in performance on passenger cars, trucks, tractors, and hundreds of industrial piston ring applications.



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passenger planes will be driven by pure jet engines at 500 to 600 miles per hour cruising speeds. Specifically, this means that you will fly from New York to Miami in some two hours. In four or five hours you will span an ocean that Columbus struggled against for three long months.

From the passenger's standpoint, these planes will be the last word in luxury. Cabin interiors with supersoft reclining seats and roomy club-car motif will surpass anything ever attempted before. Pressurization and air conditioning will afford a superb "climate," even though you are cruising six to seven miles above sea level. Your plane of the future will be practically noiseless. It will have little or no vibration. You will read, write, work, play games, visit with fellow passengers or just relax while you travel from continent to continent as casually as you once went downtown to shop.

Other aspects of air travel will undergo drastic changes. The larger air terminals will become small cities within themselves. Baltimore's new Friendship International Airport is an indication of what the most modern will be like. There will be stores, shops, hotels, banks and other facilities where you can buy any article or service you require.

Despite these improvements, the odds are in favor of air travel becoming still cheaper rather than more expensive. Increased speeds will reduce almost all of the direct flying costs now paid by commercial operators. They will be able to pass these savings on to passengers. Ultimately, aviation will provide our cheapest means of transportation.

Experiences in Korea have high-lighted the use of the helicopter for short-haul trips between cities close together and from business districts to airports. Such service is already in operation in Los Angeles and similar service is planned for New York. Eastern Air Lines pioneered in this type of operation in 1939 when it operated autogyro mail service from the Camden, N. J., airport to the roof top of the Philadelphia post office. The project was discontinued after a year because of the impending war emergency. During the period it flew, the autogyro carried 83,766 pounds of mail and completed 85.8 percent of its schedules.

What's coming in the distant future? Frankly, I'm reluctant to hazard a guess. Atomic energy may fly airplanes in the next generation. Somebody alive today may take a voyage in a spaceship. Anyone who has watched aviation closely for the past half century is justifiably hesitant to even predict what the shape of the future

(Continued to page 358)

Fine tools at their best - for 84 Years

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World's most advanced line of metalcutting hand and power saws, including amazing "Jet-Edge", "Blu-Mol" and "Blu-Flex".

Heavy Duty Bench Grinders. Powerful, smooth-running, precision - balanced motors.



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SAVE \$50 OR MORE

GIL-BILT 10-INCH TILT/ARBOR SAW



- 27x28 in. table, 13½ in. capacity in front of blade
- 10 in. blade cuts 3¼ in. deep, tilts full 45 degrees
- Floor model 34" high, table always stays level
- New Departure ball bearing arbor, ¾" precision shaft turned down for 5/8" bore blades, alum. housing, shipped ready to run
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GIL-BILT Metal Parts Kit includes Plans, ball bearing arbor, miter gauge and bar, rip fence guide, dado insert, lock knobs, jack screw mechanism and handwheel, and all other metal parts (less blade) \$20.95
Same Kit with 10" Combination Blade \$24.90
Same Kit with 8" Combination Blade \$23.90

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- 84 sq. in. sanding surface. Over 4 times the effective area of a 10 in. disc sander.
- Belt operates in either vertical or horizontal position, does all sanding operations.
- Driver drum and pulley turn on sealed New Departure ball bearings; tension drum turns on Chrysler Oilite bronze bearings.
- Spindle and tension mechanisms of cast aluminum, completely machined and assembled.
- Belt travels 1800 ft. per min. Over a MILE of straight sanding action every three minutes. Saves more "elbow grease" than any other tool.

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GIL-BILT 12" BANDSAW

- Cuts to center of 24 inch circle
- Handles stock up to 6 inch thick
- 18x18 inch table tilts 45 degrees
- Lower wheel and drive pulley runs on sealed New Departure Ball Bearings; Upper wheel runs on two 5/8" bore Oilite Bronze bearings.
- Upper wheel tension and tilt mechanism of cast aluminum, completely assembled.
- Upper and lower blade guides. Each has ball thrust bearing, self-lub bronze jaws.
- Rigid cast aluminum wheels fully machined ready-to-install. Heavy rubber tires.
- Uses standard 78 inch blades up to 3/8 in. wide.
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GIL-BILT Metal Parts Kit includes Plans, rubber tires, aluminum wheels, ¼ in. blade, ball bearing spindle, tilt mechanism, blade guides, table tilt segments, and all other metal parts \$21.95

NEW FOR '52—18" BANDSAW

- Cuts to center of 36 inch circle
- Maximum height under top guide 12 inches
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- Floor model. Motor and all moving parts fully enclosed
- Heavy ¾" drive shaft. Oilite bronze bearings never need oiling
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Also available — Plans and Parts kit for 8" Tilt/table saw. Order Plans at \$1.00 each — Sent postpaid anywhere in the World or write for FREE descriptive catalog.

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for several years. Experiments with guided missiles may result in drastic changes in our aircraft. An airframe not even on the drawing boards today may be the conventional design at the close of this century.

The engineers tell me that tomorrow's multijet airliner at 150,000-foot altitude could travel from New York to Miami in 15 minutes. If you're talking about airplanes, it's wise not to scoff at anything. Picking up an old album the other day, I saw a picture of the Gee-Bee Super-Sportster. I don't expect to ever see a stranger-looking airplane. Yet Jimmy Doolittle won the 1932 Thompson Trophy Race with it at an average speed of 252.68 miles per hour.

In this business, the impossible may only take a little longer, but its accomplishment is certainly probable.

Dawn of the Electronic Age

(Continued from page 159)

stage of the Metropolitan Opera House. Other stars followed. I continued my broadcasts until 1917, then resumed after the war, first in New York, later in San Francisco. Then broadcasting struck the public fancy. It spread swiftly. First came the programs on the air, then the public urgently seeking equipment to listen in. There began the growth of the multi-billion-dollar radio industry as we know it today, with some 2000 transmitters and 50,000,000 receivers in day-and-night operation. Business soon saw here a wonderful medium for the commercial "good will" message (too frequently, crass commercial advertising breeding anything but good will) and so generously sponsored the programs that today sales of AM-station franchises are frequently reported in the millions of dollars.

A melancholy view of our national mental level is obtained from a survey of the moronic quality of the majority of today's radio programs. So few of the owners of radio stations or the sponsors of their programs realize their unequalled opportunities for uplifting the cultural level of our public. Neither the church nor the public school has so powerful an influence over the mass mind of America. There are many outstanding exceptions to the average mediocrity, like the programs of the "music stations," and educational programs. The same may be said regarding the television stations now operating. The engineers and scientists have done a most outstanding, almost miraculous, job in giving us the marvelous electronic-television system of which all Americans may well be proud.

(Continued to page 360)

BEFORE YOUR ENGINE GETS BALKY...

MAKE THIS ROAD TEST

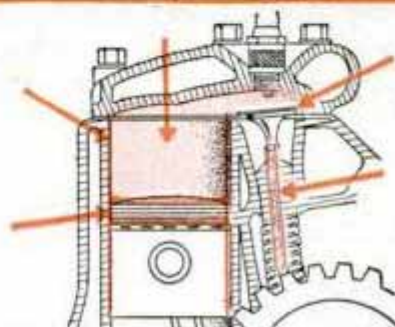
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SMOOTHER! Marvel goes to work where regular oils stop. It combats top-cylinder dry-firing . . . reduces wear . . . keeps your engine free of gum, sludge and varnish. That means a dream of a ride, even under the most extreme conditions of pressure and heat.



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Tame that wild grain with FIRZITE. Virtually prevents grain raise or checking... readies the surface satin-smooth for paint, stain or enamel. (For blond, pickled, or tinted effects on soft or hard woods, use White Firzite).

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For "natural wood" finishes on furniture, panelling or woodwork, there's nothing like Satinlac. Brings out natural grain and color beauty of any plywood or solid wood. Avoids that "built-up" look; will not turn yellow or darken with age. "Water-clear," easy to brush or spray, dries ready for next coat in 2 or 3 hours.

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Send me free leaflets on Weldwood Glue, Firzite
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But many who are given to use this splendid instrument are so clumsy, so stupid, so shamefully dull-witted.

As though the present refinements of black-and-white TV were not sufficiently marvelous, television engineers have now in readiness for public approval two systems of color. One by CBS has had the too-hurried approval of the F.C.C., an approval upheld recently by the Supreme Court. It is mechanical, uses a whirling tri-color disk, is limited in size to a 10 or 12-inch picture, is incompatible, so that even in black and white not one of the existing 15,000,000 receivers can reproduce the picture without an adapter gadget. By contrast RCA has an all-electric system, not limited in picture size and wholly compatible. Every existing receiver can reproduce that picture in black and white. It is clear which of these two systems will be more patronized by the advertising sponsors! The choice made here by F.C.C. is therefore one of today's outstanding marvels of bureaucratic bungling. National welfare demanded no such haste!

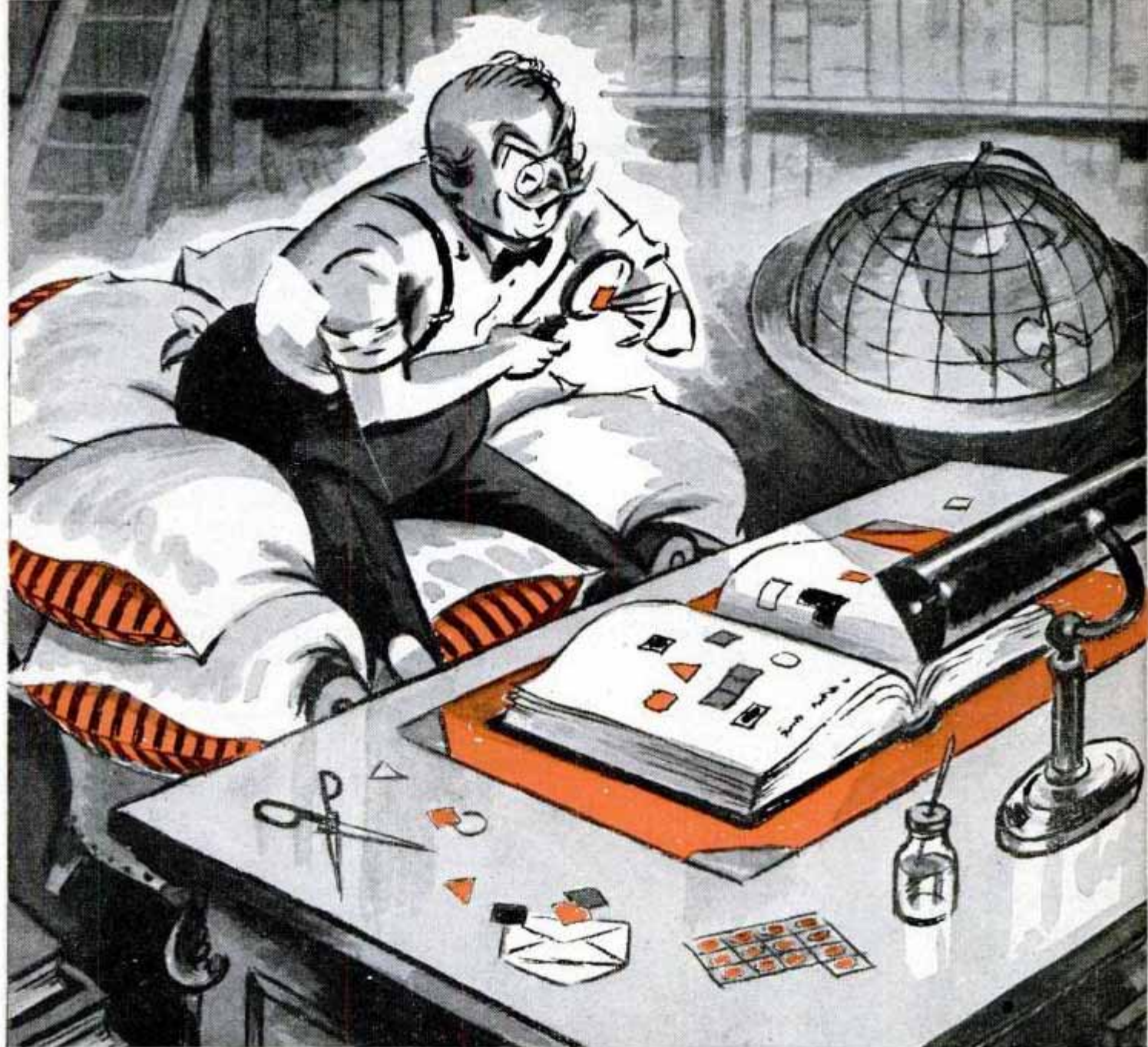
In four years World War II gave to electronics a stimulant and boost which 15 years of peaceful development might not have produced. The foremost development was radar; then came sonar, loran, the proximity fuse, the guided missile, the blind-landing systems for aviation, ground altimeters, ground-speed indicators, automatic pilots, as well as a hundred less-spectacular electronic devices within the inner working of today's airplane. Today's surging preparation of more complicated weapons for defense and offense is finding hourly new uses for, and new forms of, that Promethean device, the grid tube—evacuated or hydrogen filled.

At one time in 1906 I held in my coat pocket the entire world's supply of three-electrode tubes, two in number. Last March the month's output of small receiving and amplifying tubes reached the astronomical figure of 42,400,000. All in one man's lifetime! Such is the progress of science and technology in free America in this mid-20th century.

The old, long-waged, unsuccessful battle of wireless telegraphers for static suppression led Edwin Armstrong to his frequency-modulation system, an old idea long discarded as impractical. Since that accomplishment we have had a new growth in broadcasting transmitters in friendly competition with the old AM stations. Both systems have their special merits.

In the vacuum-tube amplifier, in whose operation the grid (by controlling the B current) is itself the key, reside most of

(Continued to page 362)



MARFAK MADE HIS CAR RIDE SO CUSHIONY HE'S SPOILED

This winter, get longer lasting lubrication protection for your car's chassis. Get *Marfak* lubrication. It lasts for 1,000 miles or more! *Marfak* guards against winter's slush and snow—it resists wash-out. Specially made to resist jar-out and squeeze-out, too. Get "cushiony" riding that *lasts*. For *Marfak* lubrication see your Texaco Dealer, *the best friend your car ever had*.



Faithfully yours
50
 for Fifty Years

THE TEXAS COMPANY
TEXACO DEALERS IN ALL 48 STATES

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TUNE IN . . . TEXACO STAR THEATER starring MILTON BERLE on television every Tuesday night. METROPOLITAN OPERA radio broadcasts every Saturday afternoon. See newspaper for time and station.

First for fine work!

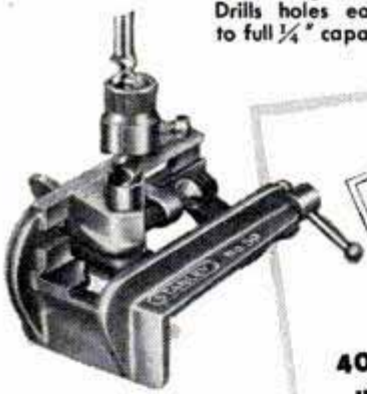
There's one point on which all mechanics agree—Stanley Tools are first for fine work. That's why you'll see these Stanley Tools in the tool chests of skilled woodworkers everywhere. Accuracy and easy action make these tools perfect partners for fine workmanship. Look for this famous **STANLEY** at your hardware dealer's. It's the sign of top quality tools.



No. 106 "Zig-Zag" Rule
Green ends. Large, easy-to-read numerals. New protective plastic finish. 6' and 8' sizes.



No. 610 Hand Drill, New!
Enclosed gears for safety. Drills holes easier, faster to full 1/4" capacity.



No. 59 Doweling Jig
For boring holes accurately and easily in the edge, end or surface of boards. Furnished with depth gauge and six guides — 3/8, 1/2, 5/8, 3/4, 7/8, 1"



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the present and future possibilities of electronics. Space permits only the briefest mention of some tubes and their uses. A compact maze of diode elements may constitute an electron-multiplier tube having an amplification factor of several thousand, in a tube the size of your finger. Such tubes are indispensable in the image-orthicon TV camera that "photographs" electronically your favorite television program.

I can merely mention today's employment of "counter" tubes, the basis of all computing machines, solving in seconds complex equations which would require months of tedious mathematical analysis, but basically employing the old Eccles-Jordan "tick tack" circuit, useful in the instantaneous advance computation of the course of projectiles.

The oscillating tube has a hundred uses beside those of radio transmission, as in diathermy (physical therapy), plastic molding, metal fusing, welding, tin plating and plywood manufacture. The cyclotron, synchrotron and bevatron, atom-smashers, generating up to a billion volts, depend on high frequencies generated by the oscillating vacuum tube. Thus has this tube ushered in the atomic age. Now we have the protective radar barrage triggered with megawatts of pulse energy generated by a grid-controlled hydrogen-filled tube to protect us from a future Pearl Harbor! What more important achievements can one ask for the grid to perform?

With grids working half-time only we have the thyrotron, ignitron, using mercury vapor and argon, hydrogen or helium gas, carrying thousands of amperes in some sizes. Electronic devices control high-speed wrapping of packages, fill bottles to the proper level, remove slate from coal at the mines, level elevators, open doors, detect smoke and fumes, measure vibrations and thickness, cement, select and count, saving man from limitless hours of tedious toil. The traveling wave amplifier of ultrashort waves and the transistor will more and more supplement, but never supplant, the Audion.

As a growing competitor to the tube amplifier comes now the Bell Laboratories' thermistor, a three-electrode germanium crystal of amazing amplification power, of wheat-grain size and low cost. Yet its frequency limitations, a few hundred kilocycles, and its strict power limitations will never permit its general replacement of the Audion amplifier.

In optical engineering the combination of a phototube and the electron amplifier tube is omnipresent, indispensable. It makes possible the talking motion picture

(Continued to page 364)



... this 1952 ALLIED catalog mirrors the Electronic Age!

**SEND FOR YOUR
FREE COPY!**



**212 PAGES OF ELECTRONIC PRODUCTS—HIGHEST
ACHIEVEMENT OF AMERICAN INGENUITY AND PROGRESS**

American achievements in the field of electronics rank at the top of the momentous accomplishments of the past fifty years. In Radio, in Television, in the application of Electronics to industry, defense and everyday living—American ingenuity and inventiveness have set the pace.

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Today, as always, the 1952 ALLIED Catalog is the one authoritative, complete, up-to-date buying guide to Radio, TV and Industrial Electronics. Its pages mirror the Electronic Age. Here you will find the world's largest stocks of quality equipment at

lowest money-saving prices. You will see the latest in electronic apparatus: new TV, FM and AM receivers; High-Fidelity Audio components, P.A. systems and accessories; recorders; Amateur receivers and station gear; specialized industrial electronic equipment; test instruments; builders' kits; huge listings of parts, tubes, tools, books—*everything* in Electronics. And ALLIED gives you every buying advantage: speedy delivery, expert personal help, lowest prices, assured satisfaction. Get the 1952 ALLIED Catalog—and stay ahead in Electronics!

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that fit!



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BILLINGS® LIFE-TIME® WRENCHES

Available at your favorite hardware store, singly or in practical service kits. Engineers' — Combination — 45° & 15° Box patterns.



NEW PRACTICAL TIE CLASP!

Genuine BILLINGS Wrench made into handsome TIE CLASP suitable for work or play! Brilliant plated finish over Billings quality steel. Engineers' pattern Wrench (3/16" & 1/4" opening).
ONLY 50¢

Write today! Only one per person.
THE BILLINGS & SPENCER CO. HARTFORD CONNECTICUT
Specialists in Drop Forgings of all kinds since 1869

as well as television, measures the energy of stars infinitely distant from our telescopes. The electron microscope, with magnification of 25,000 diameters, makes visible the infinitesimal universe.

As to the future of the electronic age we can foresee a multiplication and extension of every discovery and development which these first 45 years have revealed. In detail: I foresee great refinements in the field of short-pulse microwave signaling, whereby several simultaneous programs may occupy the same channel, in sequence, with incredibly swift electronic communication; vastly important developments in microwave technique, whereby present clumsy connecting leads between wall or floor sockets and electric devices like toasters and vacuum sweepers may become unnecessary; gigantic magnetrons and klystrons, or their successors, will generate megawatts in microwaves; living rooms and their occupants will be heated by high-frequency waves from walls or ceilings; short waves will be generally used in the kitchen for roasting and baking, almost instantaneously, with far better results than in the past; insect pests will be eliminated by like means; bacteriological and biological research will be enormously advanced by short and microwaves of selective frequencies; plant growth amazingly hastened and improved by similar means.

Automobile collisions will be rendered impossible, or unlikely, by radar-controlled brakes and warning signals. By means of the radio space-analyzer, or "telescope," astronomers' knowledge of our universe will be vastly widened. (I do not foresee "spaceships" to the moon or Mars. Mortals must live and die on Earth or within its atmosphere!)

In yet more remote decades electron physiologists will solve the mysteries of biologic "wave emanations," akin to but very different from hertzian waves of any form or frequency, so that radiated "thought or brain waves" may be picked up at some distance, transformed into electrical phenomena, analyzed, measured in units, eventually to make a definite science of the transference of brain and body radiations and emotional disturbances; so that joy and grief can be measured in definite, quantitative units! Eventually, a professor may be able to implant knowledge into the reluctant brains of his 22nd-century pupils. What terrifying political possibilities may be lurking there! Let us be thankful that such things are only for posterity, not for us.

As is eloquently engraved in stone on the National Archives Building in Washington: "What's Past Is Prologue."

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"inside-out"

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save gas!



The Hygrade System mechanic locates the trouble faster and does a more thorough job. He replaces all worn parts and parts that wear with brand new parts.



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New! Easy! Quick!



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Waterproofs, Rustproofs, Protects 1001 Things!

- Auto chrome
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City _____ Zone _____ State _____

The Story of Popular Mechanics

(Continued from page 132)

The early years of financial struggle were not reflected in the lively pages of the magazine. The Panama Canal was presented in maps, diagrams and text. Another 1902 item told of Emperor Wilhelm Hohenzollern's new yacht, "with splendid furnishings including a silver service weighing two tons and valued at \$1,250,000." A British steamship was first to cross the Atlantic fueled only by oil. Chicago was busy turning a river around and creating the Chicago Sanitary and Ship Canal. There was a picture story, "Drilling the Great Subway Under New York."

Progress was noted in the development of the automobile in an article that appeared in November 1902. The title was "The Ferocious Automobile Is Tamed." An excerpt: "Like a wild bronco of the Texas plains it would buck and lunge and pitch until few had the nerve to tempt its ferocity. Sometimes it would charge backward when the chauffeur tried to make it go forward, or switch around sideways, jump upward and endways. It was a hard matter to tell which way the 'mechanical beast' would go. But now all these troubles of the automobilists are over."

The advertising columns told their story, too. International Correspondence Schools urged readers to double their salaries with a simple arithmetic problem showing that \$15 plus \$15 equals \$30! The Century Manufacturing Company of East St. Louis advertised a buggy at \$33.50, also "elegant parlor organs, \$25 and up, elegant upright pianos, \$125, elegant sewing machines, \$13." Another ad featured a fountain pen as "a miracle of ingenuity."

Other high lights of that first year included the introduction of the Shop Notes department in the Craftsman section, a bow to the steam locomotive, which was observing its 100th anniversary, and a boost in circulation from the original few hundred to 17,000!

In 1903 the magazine achieved a mark of distinction with an article by Guglielmo Marconi, inventor of the new wireless telegraphy. Marconi's was the first of the many truly distinguished by-lines that have appeared in *Popular Mechanics*. Thomas A. Edison, Theodore Roosevelt, Adm. George Dewey and Pierre Curie also contributed to early issues. Curie wrote: "It is difficult to predict the future of radium, but I believe its field will be in the domain of medicine rather than of warfare and commerce."

During the first decade of *PM's* existence, the magazine's pages reflected a nation

(Continued to page 368)

Now a Kentile Floor for Only \$17⁷⁵* for a 7' 6" x 9' room

IT'S SO EASY TO INSTALL
GUARANTEED KENTILE
YOURSELF...AND
SAVE MONEY



Here's the floor anyone can lay — and thousands are doing it! Kentile is precision-cut to go down tile by tile, quickly and simply over any smooth, firm underfloor.



Low-Priced Kentile Floors are Guaranteed...and only your Kentile Dealer can make this Offer!

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*Price quoted is for a 7' 6" x 9' Kentile Floor installed by you. Your Kentile Floor may cost you less or slightly more depending on size of room, colors selected and freight rates.

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struggling to learn to drive an automobile and, what's more important, to keep it going; a nation intensely interested in man's frantic efforts to fly; a nation that marveled at the wonders of wireless, the telephone, the phonograph and at the multitude of uses for electricity. From research laboratories throughout the land came mechanical aids to help alleviate the drudgery of everyday life and make the world a better place in which to live. One of the latter, a boon to the farmer, was the small gasoline engine.

In the summer of 1903, an automobile performed the "daring feat" of climbing Pikes Peak. This was duly recorded in an early issue of *Popular Mechanics*.

On December 17, 1903, two young men from Dayton, Ohio, Wilbur and Orville Wright, made history by flying their crude plane at Kitty Hawk, N. C. *Popular Mechanics* promptly published "The Truth About the Flying Machine," which concluded, "So long as flying machines have gotten off the ground their conquest of the air is only a matter of time, of money, of patience and of brains."

The year of 1904 also saw the beginning of *Popular Mechanics'* book department. *Shop Notes* was the first book brought out and was the forerunner of such familiar titles as *What to Make*, *The Boy Mechanic*, *The Amateur Craftsman* and scores of others. Millions of books and pamphlets bear the imprint of the Popular Mechanics Press and in more recent years the Windsor Press. Norman Guess, well-known in the book world, is the present director of PM's flourishing book department.

First-decade readers of the magazine followed the exploits of Commander Robert E. Peary (later Captain, finally Admiral) in his efforts to reach the North Pole. Climaxed by the Pole's discovery in 1909, a subsequent article by the admiral was entitled, "What the World Gains by the Discovery of the Poles." That year—1909—the magazine also reported a new record for the flying Wright brothers, who stayed aloft for one hour, 53 minutes and 59 seconds; the development of a European "gyropter" that had two umbrellalike whirling propellers—granddaddy of the helicopter; the soaring of a Frenchman to a new altitude record of 1800 feet; the first flight across the English Channel by Louis Bleriot, and the introduction of anti-aircraft guns in Germany. Craftsmen were building mission-style furniture, and the magazine featured a seven-room, four-bedroom house that could be built for \$5500. That was also the year of a cover announcement that read: "Largest Circulation of Any

(Continued to page 370)

A NEW THRILL for Home Builders . . .

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PROFESSIONAL QUALITY
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Heathkit 5" OSCILLOSCOPE KIT

A laboratory quality oscilloscope 5" cathode-ray tube—every part supplied including instructions for operation and assembly. Includes ten tubes—all controls—high gain .03 Volt RMS per inch vertical sensitivity useful to 5 Mc. An outstanding buy. Shipping weight, 29 lbs. — Model O-7

\$43.50



Heathkit VACUUM TUBE VOLTMETER KIT

A complete electronic voltmeter in kit form. All parts supplied: cabinet, 200 microampere 4½" meter, tubes, test leads and instructions. Has 11 megohm DC input resistance. Measures full scale voltages AC and DC of 0 - 3 - 10 - 30 - 100 - 300 - 1000 Volts and resistance between ½ ohm and one billion ohms. The outstanding VTVM available today. Shipping weight, 7 lbs. — Model V-5.

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Heathkit SUPERHETERODYNE RECEIVER KIT

A high quality AC operated superheterodyne receiver in kit form. Complete with five tubes—six inch slide rule dial—all coils—transformers and ready punched chassis and instructions. Learn about radio by building this outstanding receiver.



Model BR-1
Shipping Wt. 11 lbs.

\$19.50

Heathkit 6 WATT ECONOMY AMPLIFIER KIT

A powerful 6 watt amplifier kit. Complete with tubes—transformers and all parts. Use it for music reproduction—public address system—factory call—school dances, etc. Easily assembled. Rent it in your community and it will quickly pay for itself.



Model A-4
Shipping Wt. 8 lbs.

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HAVE
A COMPLETE
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FOR A FEW
HUNDRED DOLLARS

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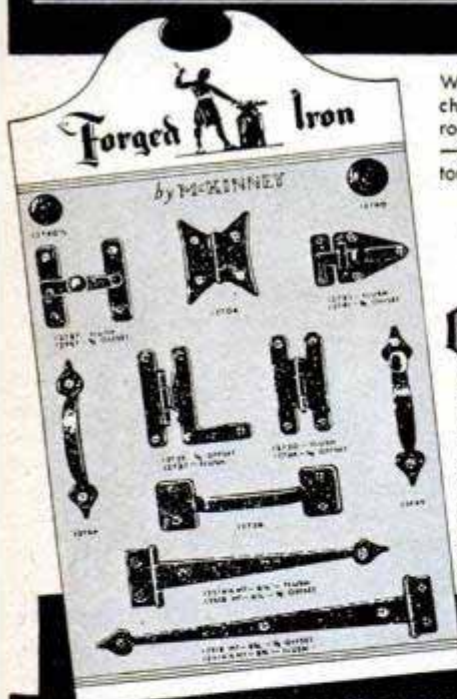


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L hinges, latches, drawer
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Please send free folder on McKinney Forged Iron Hardware to:

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Mechanical Publication in the World"—a proud statement that has been sustained through the years. After seven years of struggle the magazine was successfully established.

One of the turning points in the magazine's success was founded on the faith of two members of the advertising department—Clyde Blair and Charles Minor. They came to work for Mr. Windsor in 1907 and today—45 years later—are still actively selling advertising space. When the going was roughest they shared Mr. Windsor's belief in the future of *Popular Mechanics*. Their youthful vision has made them two of the most successful and famous advertising salesmen in the country.

Early in 1912 *Popular Mechanics* polled 1000 of the world's leading scientists to name the seven wonders of the modern world.

This proved to be one of the outstanding features that year in any American magazine. The results from the poll of 1000 scientists were reported in the August issue. The seven wonders selected were: Wireless, telephone, airplane, radium, antiseptics and antitoxins, spectrum analysis and X ray. Close runners-up were the Panama Canal, anesthesia and synthetic chemistry. Alexander Graham Bell contributed an article on the telephone to that issue.

During those pre-World War I years *PM* readers studied "Lessons From the Titanic Disaster"; they learned about flying boats from Glenn H. Curtiss; they followed the step-by-step completion of the Panama Canal; they hunted "The Biggest Game of All" with Roy Chapman Andrews; they read with unbelieving eyes that a man named Charles F. Kettering had invented a self-starter for automobiles, and promptly wrote to Editor Windsor complaining about such an impossibility being recorded in *Popular Mechanics*; they read about a mantle lamp that "beats all electric or gasoline-lighting facilities" and a toaster that "turns bread automatically"; they saw pictures and a story of the completion of the transcontinental telephone line (final link was from Denver to San Francisco).

World War I, from its beginning in 1914 to the armistice in 1918, was extensively covered by *PM*. One issue alone (December 1914) carried 50 war pictures out of 300 appearing in the magazine. One article, "Size and Power of German Howitzers Surprising Development of the War," pointed out that "never before have such terrible engines of annihilation been carried by an invading army." These guns fired a 16.5-inch projectile and a single shot

(Continued to page 372)



SINCLAIR RESEARCH LABORATORIES—nine buildings containing the most modern testing equipment known—have contributed many of today's most important developments in petroleum products, production and

refining. Under the Sinclair Plan, the available capacity of these great laboratories is being turned over to work on the promising ideas of independent inventors who have no such facilities within their reach.

An Offer of Research Facilities To Inventive Americans Who Need Them

The Sinclair Plan is opening up the Company's great laboratories to every American who has an idea for a better petroleum product

INVENTIVE Americans are often at a loss today. Not because of any lack of ideas, but because of a need for large and expensive facilities to find out if and how their ideas work.

This was no obstacle in our earlier days. The Wright Brothers designed their first airplane with the help of a foot-square homemade "wind box"—and the plane flew.

In contrast, the man with a new idea in airplane design today often needs a supersonic wind tunnel costing millions.

In short, science and invention have become so complex that a man with an idea for a better product often needs the assistance of an army of specialists and millions worth of equipment to prove his idea has value.

Within the petroleum field, the Sinclair Plan now offers to provide that assistance.

Under this Plan, Sinclair is opening up its great research laboratories at Harvey, Illinois, to independent inventors who have sufficiently good ideas for better petroleum products or for new applications of petroleum products.

If you have an idea of this kind, you are invited to submit it to the Sinclair Research Laboratories, with the provision that each idea must first be protected, in your own interest, by a patent application, or a patent.

The inventor's idea remains his own property

If the directors of the laboratories select your idea for development, they will make, in most cases, a very simple arrangement with you: In return for the laboratories'

investment of time, facilities, money and personnel, Sinclair will receive the privilege of using the idea for its own companies, free from royalties. This in no way hinders the inventor from selling his idea to any of the hundreds of other oil companies for whatever he can get. Under the Plan, Sinclair has *no control* over the inventor's sale of his idea to others, and has *no participation* in any of the inventor's profits through such dealings. Moreover, it is a competitive characteristic of the oil business that the new products adopted by one company are almost invariably adopted by the whole industry. This means that the very fact of his agreement with Sinclair should open up to the inventor commercial opportunities which might otherwise be hard to find.

How to proceed: Instructions on how to submit ideas under the Sinclair Plan are contained in an Inventor's Booklet available on request. Write to: W. M. Flowers, Executive Vice-President, Sinclair Research Laboratories, Inc., 600 Fifth Avenue, New York 20, N. Y. for your copy.

IMPORTANT: *Please do not send in any ideas until you have sent for and received the instructions.*

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EXPAND YOUR HOME!

**USE
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**Install the
PRECISION
Folding Stairway
at a cost of
\$60 to \$75**



Makes your home more livable by providing extra rooms and storage space in the most economical way. Fits all ceilings—Just saw a 26x54 inch hole in your ceiling, frame the hole with 2x6's, nail the stairway in place and cut off at the calibrated ceiling height.

SIMPLE AND EASY TO OPERATE—A slight pull of the cord and the counter weights silently ease the stairway into down position. The same counter weights return the stairway to its up position with equal ease. **RUGGED AND STRONG**—Construction of No. 1 kiln dried poplar. Brackets, rocker arms and hinges of heavy cast aluminum alloy. All parts numbered and interchangeable. Panel insulated and protected with tough chip board. Steps covered with safety treads. **FITS ANY CEILING**—from 7 feet to 10 feet 3 inches high. Runners graduated to facilitate cutting off for different ceiling heights. **REQUIRES NO ATTIC SPACE**—Full height above attic floor only 36". Folds completely into opening in ceiling. **SHIPPED IN ONE PACKAGE**—Each stairway thoroughly inspected, assembled and ready to install. Shipping weight 130 pounds. Sold by more than 12,000 dealers in U.S.A. and Canada. **APPROVED BY F.H.A. EVERYWHERE.** Mail coupon TODAY for descriptive folder and complete information concerning delivery, prices and installation.

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Dealers
Everywhere

Gripper Recedes
into Handle

Upson Bros., Inc. Rochester 14, N. Y.

had destroyed the principal defense of Liege.

German U-boats. Spies. Camouflage. Torpedoes. Dogfights in the sky over France. The Lusitania. The Battle of Jutland. 1917—President Wilson. General Pershing. The draft. Slackers. Hoarding. Liberty Loan. Chateau Thierry. Gas masks. "Over There." Every phase of the war, from saving walnut shucks to the sensational British tank, was reflected on the pages of *Popular Mechanics*.

Then, late in 1918, H. H. Windsor wrote: "With a silence like that which follows the mighty crash of a great organ, the Great War came suddenly to an end."

By this time the magazine had moved its offices to 6 N. Michigan Ave. Meanwhile, *PM's* circulation boomed and advertising poured in from every corner of the country. Thousands of businesses got their start with a few lines of advertising in *Popular Mechanics*. The files of the magazine are filled with letters paying tribute to the part the magazine has played in many a flourishing enterprise.

After the war, *PM's* pages reflected the intense interest in aviation that swept the country. Everybody was airminded and America's future in aviation was a prime topic. Who would be first to fly the Atlantic? Would it be a seaplane or a landplane? Army or Navy? U. S. or foreign? Prizes galore awaited the first pilot or crew to accomplish this milestone in aviation.

A number of flyers soared out across the ocean never to be heard from again. Then on June 14-15, 1919, two British Army flyers, Capt. John Alcock and his navigator, Lt. Arthur W. Brown, flew a Vickers-Vimy biplane from Newfoundland to Ireland. They covered 1950 miles in 16 hours and 12 minutes and won \$75,000 in cash and world renown for the first nonstop crossing. That same year, the British dirigible R-34 made a round-trip flight across the Atlantic. U. S. Army flyers made a trip around the world and covered 24,000 miles—and this in only 5½ months! This outstanding feat led Brig. Gen. William "Billy" Mitchell to predict "16-hour service between New York and San Francisco and round-the-world passenger service."

Another postwar interest, closer to home for most *PM* readers, was radio. The magazine introduced its popular radio department in 1920, and Frank L. Brittin began immediately telling readers how to build crystal sets, a two-tube set (this unit was a whopping 4½ feet long and used headphones), and in rapid succession followed plans for making sets up to nine tubes. In the early '20s everybody was getting into

(Continued to page 374)



1 SEEDBED PREPARATION—Without Change of Attachment!
No more changing from plow to disc to harrow as with ordinary "garden tractors"! Much easier — much quicker — much less expensive!



2 CULTIVATING — With Far Less Damage to Plant Roots!
Think what this means for raspberries, grapes, corn and all your other crops which have lots of tender surface roots!



3 POWER COMPOSTING — For Miracles of Soil Improvement!
No more hauling, turning, watering of messy compost piles! No more need to buy expensive, hard-to-get manures!



4 WHAT A LAWN MOWER!
Cuts velvet-smooth 25" swath! Has no casters or over-hanging wheels — leaves no untrimmed edges! Follows contour of ground perfectly!



5 AS POWER SCYTHE IT'S A DOWNRIGHT JOY!
Tall weeds, hay, brush, heavy grass melt away in front of your ROTO-ETTE —without clogging! Cuts 30" wide!

New Low-Cost Wonder Does Your Toughest Yard & Garden Jobs

... Spend More Time Relaxing While Others "Break Their Backs" Trying to Match Your Beautiful Garden and Grounds



Really 8
Yard and
Garden
Machines
in 1



THIS FREE BOOK

Brings You the Whole Wonderful Story

THIS big FREE 68-page book, "A Little Power — A Lot of Living," was written for you by Ed Robinson, author of the famous "Have-More" Plan. Ed is an enthusiastic ROTO-ETTE owner.

Packing his 68-page book full of scores of interesting photographs, Ed shows just how his ROTO-ETTE improves the soil, eliminates weeds, composts by machine, cultivates garden, berries, fruit—and does dozens of other outside jobs. Also included are the actual, low-cost delivered prices, and the name of your nearest ROTO-ETTE Dealer, in case you'd like a demonstration. No obligation whatsoever. Simply mail coupon at right.

THE NEW 1952

Lightning ⚡ Change

ROTO-ETTE
Reg. U. S. Pat. Off.

DOES A WHOLE DAY'S CHORES IN AN HOUR!

CAN you imagine employing a skilled gardener who would work for less than a dollar a day? And can you further imagine that this gardener could do the work of eight men, *all at the same time?*

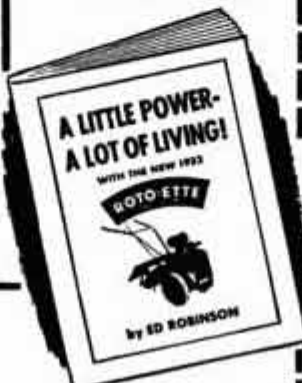
That's the kind of "gardener" you get when you own this amazing New Lightning-Change 1952 ROTO-ETTE! Here is an easy-to-operate, low-cost, yard-and-garden machine that makes it fun for anyone to maintain beautiful lawns and gardens without outside help. Here, in but ONE machine, with simple, lightning-change attachments, is your answer to leisure country living!

Grow All the Fresh Vegetables, Berries, Fruits You Want Without Outside Help!

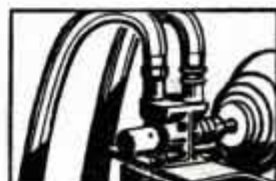
Now you can have acres of crisp, fresh vegetables, berries, fruits—lovely broad lawns — all kinds of flowers — without having to hire a single gardener! Now you can really ENJOY country living—for the New 1952 Lightning-Change ROTO-ETTE can do a day's back-breaking chores in a single hour!

And what more versatile mechanical gardener can you find anywhere? Just see (pictured here) the 8 different jobs it does so quickly, so perfectly—everything from cultivating to wood-sawing. Even if you've never before thought about getting a "garden tractor," you owe it to yourself to find out about this amazing, new LOW-COST Wonder!

MAIL COUPON FOR FREE BOOK



6 SNOW PLOWING — GRADING, LIGHT BULLDOZING!
Wonderful for cleaning walks and roads of snow. Perfect for grading new lawns.



7 EASILY PORTABLE POWER — For Dozens of Other Jobs!
A year-around power source for water pumps, electric generators, insecticide and paint sprayers, trailers, grain grinders, etc.



8 CUTS FIREPLACE AND STOVE WOOD LIKE BUTTER!
In a couple of hours you can cut enough wood for a month. Pays for itself over and over again if you have a wood lot.

Rototiller, Inc.
Dept. 201, Troy, New York

Please send me FREE, by return mail, a copy of your Big 68-page Illustrated BOOK, "A LITTLE POWER—A LOT OF LIVING," by Ed Robinson, author of the famous "Have-More" Plan.

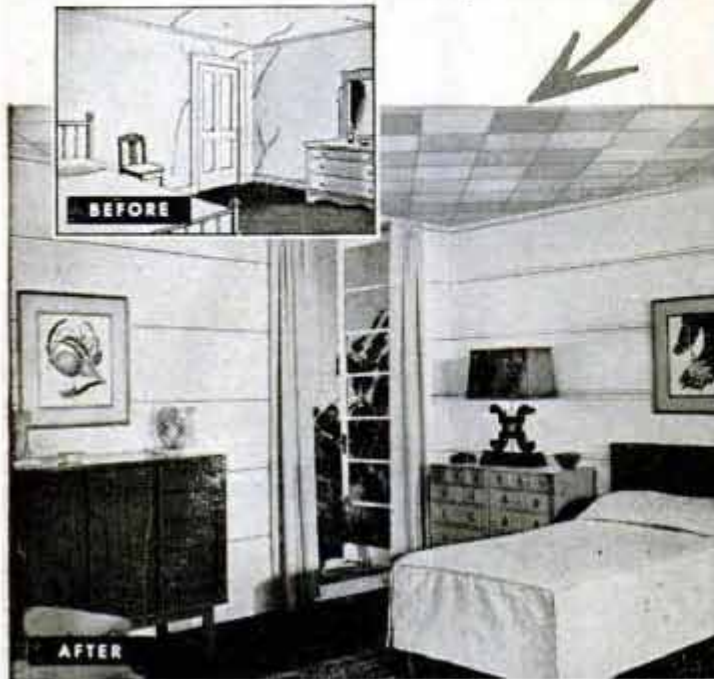
Name _____

Address _____

City _____ County _____ State _____

Look What's Happened

to the bedroom nobody wanted



The walls of this beautiful room are Celotex White Finish Plank applied horizontally... the ceiling, Celotex Ripple Blend Tile Board.

Do it with Celotex for only \$49⁵⁰*

*Approximate cost of Celotex Interior Finish materials for walls and ceiling of average 10' x 12' room.

Make old-looking rooms cheery and comfortable again, or build new rooms in your attic or other unused space. It's easy, thrifty with Celotex Insulating Interior Finishes! These strong, handsome panels build, insulate, decorate—all at one low cost. Just staple or nail in place.

No painting or papering! Celotex Insulating Interior Finishes are *pre-decorated*. Smart, exclusive blended colors in Tile Board, Building Board, Finish Plank. See them at your Celotex Dealer's. Mail coupon for booklet now!

Insist on genuine **CELOTEX** Insulating Interior Finishes

The Celotex Corporation, 120 S. LaSalle St., Chicago 3, Illinois

MAIL TODAY!

The Celotex Corporation, Dept. PM-12
120 S. La Salle St., Chicago 3, Ill.

I enclose 10c in coin. Send me the new Celotex Interior Finish booklet giving ideas on how to remodel present rooms or build new rooms at low cost. Plus "how-to-do-it" instructions!

Name _____

Address _____

City _____ Zone _____ State _____

the act. There were pictures of dancers leaping over loudspeakers, of radios on boats, automobiles, on straw hats, on the beach, in player pianos, in kitchens and schoolrooms. There were pictures of Mary Pickford and Douglas Fairbanks making their radio debut and of a snake charmer with her pet reptile wound around a loudspeaker. Brittin is still radio editor of the magazine, but his title has kept pace with the times and is now "radio, television and electronics editor."

Influenced by the Jazz Era, *Popular Mechanics* published one of the few musical articles in its history: "Where Jazz Comes From." Notice was also taken of prohibition with a report on the Coast Guard's activities in "The Battle of Rum Row." There was an article on Babe Ruth's home-run secrets.

During all this postwar hullabaloo, H. H. Windsor planned, built and moved into the structure at 200 E. Ontario St. in Chicago that is the home of *Popular Mechanics* today. The June 1923 issue showed a color picture of the seven-story brick building. At last the boy from Marshalltown had achieved his dream with giant presses that printed his magazine by the hundreds of thousands. Through the years these early giants have been replaced by newer, bigger and faster presses, including the recent additions of a five-color unit and a two-color rotary press that can print 1,190,000 pages an hour and use 30 tons of paper a day. Incidentally, a single edition of the present magazine requires about 20 carloads of paper, according to Lyle R. Howard, printing-department superintendent.

Henry Haven Windsor's dream came true just in time, for less than a year after moving into the new building he died. The date was May 11, 1924. His last words written for the magazine concerned radio and its infinite possibilities for communications and education: "One cannot cross our great Western plains by railroad or motorcar and fail to note the number of radio aerials... surely radio is the fairy godmother with something for every need."

Mr. Windsor's responsibilities were taken over by his only son, H. H. Windsor, Jr. The son soon demonstrated that printer's ink was part of his inheritance. During the more than a quarter century of his stewardship—despite years of depression and war—*Popular Mechanics* has won respect and attention from every corner of the world. Under his leadership, circulation has more than doubled, advertising sales have been spectacular and every phase of the company has grown substantially. In 1949, on his 25th anniversary as president of the

(Continued to page 376)

HANDEE - Everybody's Hobby

How about You?

Today all over the land, men and boys . . . and the ladies, too . . . turn to HANDEE - the complete, one-package tool kit - for genuine fun and relaxation. Why? Well, HANDEE's a hobby that everyone, young and old, can quickly enjoy. It's so easy to operate . . . you don't need any special skill.

And what a world of hobby projects awaits your attention - model building, wood carving, costume jewelry making, plastics engraving, gift initialing, etc. Just about everything you can think of . . . you can do with your HANDEE . . . today . . . right now.



HANDEE

Besides hobbycraft, you need a HANDEE for household repairs and auto maintenance. HANDEE gives you sure, smooth running controlled power for countless small jobs . . . grinds, drills, engraves, cuts, polishes, saws, routs, sands. There's no other tool in the world as versatile nor so precisely engineered. HANDEE is virtually a workshop you can hold in your hand. Pays for itself quickly.

ULTRA DELUXE HANDEE with 51 matched accessories in fitted carrying case. Tool weighs 12 oz.; speed 25,000 r. p. m.; 110-volt AC-DC; 25-60 cycles.

\$27⁵⁰



Easy to Use
Tool of 100! Uses!

HANDEE with 7 accessories
\$19.95



HI-POWER

Heavy duty model for production jobs. Full dynamic and static balance for vibrationless performance. Detachable motor; forced ventilation. 20,000 r.p.m.

110 volt AC-DC, 25-60 cycles. Jacobs Chuck. Weight 5 lbs. 10 oz. **\$49⁵⁰**



HANDEE '85'

Complete workshop with 41 accessories. Suitable for shop or home use . . . does precision routing, molding cuts. Tornado ventilation; cool running. 27,000 r.p.m.

110 volt AC-DC, 25-60 cycles. Interchangeable spring collet chuck. **\$29⁹⁵** Wt. 2 lbs.



CHICAGO WHEELS

Mounted Wheels - for every kind of grinding and polishing. Faster cutting . . . longer wearing. Abrasive Saw Blades - cut almost everything: glass, plastics, tubing, steels, etc. Fit any circular saw, bench grinder, motor or lathe. Easy to use!

Send for Free Literature on Handee Tools

All Chicago Wheel products are sold by leading dealers from coast to coast. See these tools at your nearest dealer - or write direct. Ask for giant illustrated 64-page Catalog.

CHICAGO WHEEL & Mfg. Co.
1101 West Monroe St., Dept. PM, Chicago 7, Ill.
Offices in Principal Industrial Centers

best
white tape
made

ONLY
98¢*



The new "Evans White-Tape" has everything you'll find in tapes costing over \$1.50—plus.

- snow-white blade with bold, legible, jet-black numerals and graduations. Graduated in 32nds for first 6 inches.
- sturdy die-cast case heavily chrome-plated, calibrated for quick reading inside and outside measurements.
- blade 1/2" wide made of finest high carbon steel—tempered—Bonderized—enamelled—baked.
- blade replaceable in seconds—without tools—without even opening case. And Evans replacement blades cost far less.
- every "Evans White-Tape" is unconditionally guaranteed.
- exclusive Evans automatic brake gives smoother push-pull action with absolutely no "creeping" of tape into case.
- underside is white, too. Mark with ordinary pencil, remove mark with flick of thumb.
- unheard-of low price*: 10-ft. \$1.49; 8-ft. \$1.19; 6-ft. 98¢. Prices higher in far west and Canada.

Evans & CO. • Elizabeth, N.J. • Montreal, Que. © 742.
Makers of Evans 6-ft. Folding Rule and "Folding Yardstick"

Sold only through retailers.

"MOTO-MOWER" WEED TOPPER *with*

first
fundamental improvement
in Power Lawn Mowing
now available on
MOTO-BOY and SCOUT
as optional equipment at the factory



The most outstanding accessory and improvement for a lawn mower developed in fifty years.

MOTO-BOY and SCOUT (illustrated) models so equipped, perform double duty. Topping the weeds ahead of the reel enabling the reel to cut the obnoxious weeds off short.

... at same time that it cuts grass to normal height. . . . Other MOTO-MOWER models sizes 17 1/2" to 71". Send for complete information and the name of the nearest dealer.

*This is strictly a WEED TOPPER—not a hay mower.

The best known name in power lawn mowers for thirty-three years
MOTO-MOWER
4615 Woodward Ave. Detroit 1, Michigan Company

Popular Mechanics Company, Mr. H. H. Windsor, Jr., was presented with a memorial plaque by the employees. In 1949, H. H. Windsor III became the third active generation in the business. Another son, W. T. Windsor, joined the staff in 1951.

Popular Mechanics' report on the roaring '20s was climaxed by the Lindbergh story. "My name is Charles Lindbergh," he had said to Ambassador Myron T. Herrick after he landed the Spirit of St. Louis at Le Bourget Field near Paris. How was he to know during those dark hours over the Atlantic that the name of Lindbergh was in every headline? An article reporting his flight appeared in the August 1927 issue and an interview, "Lindbergh Tells Future of Aviation," appeared in the November issue. It still makes good reading today.

An article in 1928 entitled "Television for the Home" explained the workings of a whirling-disk set that never got very far. However, the article held some historic predictions for TV.

The home workshop boomed in the depression '30s when everybody wanted to save money or make a little extra. More readers than ever before started building their own furniture, repairing their houses, tinkering with their automobiles, painting and papering their homes, developing and printing photographs, even making their own jigsaw puzzles. The advent of diesel locomotives and big passenger planes helped take the public's minds from their pinched pocketbooks.

In 1939 the pages of *Popular Mechanics* had a foreboding resemblance to those of 1913. There was approaching war between the lines about new guns and bombers, paratroopers and cargo planes. Soon after Adolf Hitler lighted the fuse for World War II, the editors of *PM* were startled to learn that copies of the magazine were being sent out of the country in diplomatic pouches to reach Axis governments. With Pearl Harbor came censorship. With almost every article devoted to war and war machines, the magazine worked closely with the Army, Navy and Air Force. On numerous occasions the magazine was gratified to learn that something a soldier had learned from past issues of *Popular Mechanics* had helped him do a better job of fighting the war.

Our staff men were often in possession of military secrets, but not once during the war did the magazine encounter censorship troubles by revealing anything that might have aided the enemy. *Popular Mechanics* was one of the first U. S. magazines invited to publish an overseas edition. When the war ended more than a million men a

(Continued to page 378)



Which lamp is ready to burn out?

ONE of the General Electric "All-Glass" headlamps on the test car above has just been lighted for the first time. It's at the beginning of its life. The other G-E lamp... the one on the left... has been burning day and night for many, many months. Yet when the photo was taken it was impossible to see any difference in the light output of these 2 lamps!

That's because General Electric "All-Glass" headlamps give an average of 99% as much light just before burning out as when new. Both the lens and reflector of the G-E head-

lamp are made of hard glass, fused together into one piece. Road and laboratory tests prove that this one-piece unit keeps out the dirt and moisture that might otherwise gradually rob the lamp of light output.

Because they **DO NOT GROW DIM**, G-E "All-Glass" headlamps mean easier, SAFER night driving. Use them to replace burnouts whenever you need a replacement.

**G-E "All-Glass" Headlamps
DO NOT GROW DIM!**

You can put your confidence in—

GENERAL  **ELECTRIC**

New Projects For your Workshop



**Fresh
New, Modern
Projects in
Every Issue!**

6 ISSUES OF A NEW KIND of Project Magazine

Prepared by a practical craftsman especially for the home workshop. Refreshingly new material—up to the minute—presented with photographs, plan drawings, step by step instructions, that even a beginner can follow easily. For the home craftsman who is looking for stimulating, different and modern ideas.

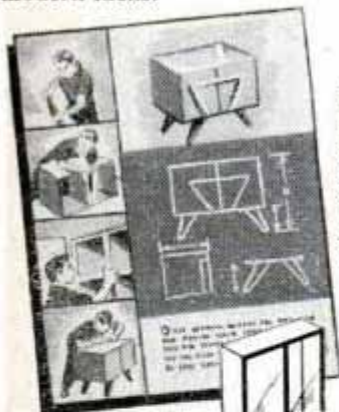
**Only
\$1.00**

A Goldmine of Project Ideas

A year's issues bring you complete how-to-make instructions for furniture, household equipment, toys, novelties, wood and plastic jewelry, home accessories, games, puzzles, garden furniture, shop equipment—all new, different and "off the beaten path," for only 25c an issue—or you can save 33½% and get 6 issues for only \$1.00.

Send Coupon Today

Send \$1 today for bargain value of 6 full issues. Any time you are not delighted—your subscription will be refunded.



DURO METAL PRODUCTS CO.,
2685 North Kildare Avenue, Chicago 39, Illinois

- I enclose \$1 for one year's subscription to the "DURO CRAFTER" (6 issues). I understand satisfaction is guaranteed or money refunded.
- I enclose 25c for single copy of "DURO CRAFTER."

Name.....

Address.....

City..... Zone..... State.....

month were reading this edition like a letter from home.

Corregidor. Guadalcanal. The B-17 Flying Fortress. PT boats. War bonds. Defense plants. The Norden bombsight. Mechanized warfare. Over the Hump. President Roosevelt. General Eisenhower. General Doolittle. Bombs for Tokyo. Iwo Jima. Submarine detectors. The U. S. S. Missouri. The invasion of France. The atom bomb. Month by month the story of the war unfolded across the pages of *PM*.

In the early days of the war, Mr. Windsor and all other publishers received word from Washington that no further mention was to be made of uranium-235. For years *PM* had followed closely the developments in nuclear research. One of the earliest articles which touched on this subject was written by Winston Churchill. (A condensation appears in this anniversary issue.)

A January 1941 article told "The Miracle of U-235," and another article in November the same year was the last to appear on the subject until after the bombing of Hiroshima and Nagasaki.

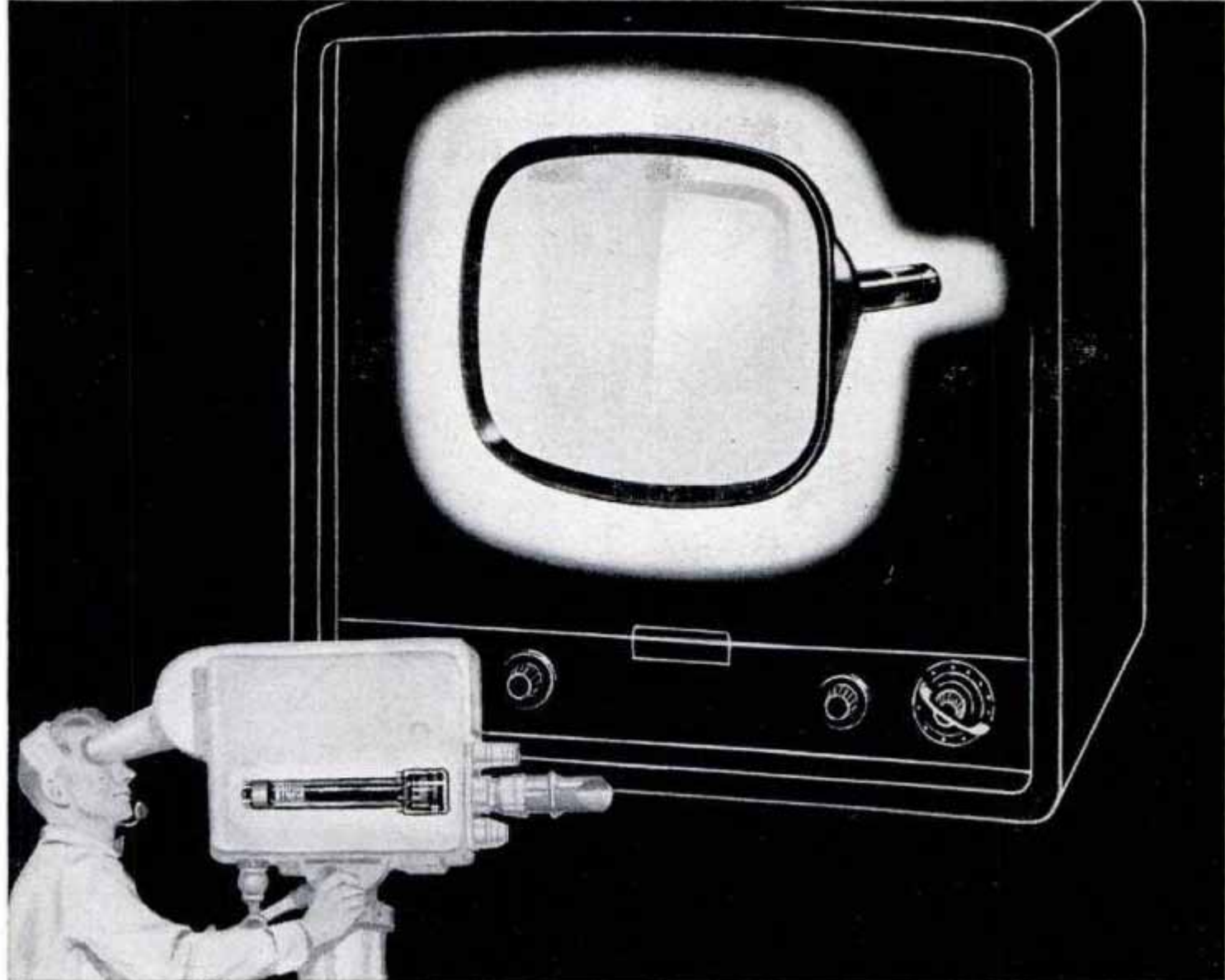
After World War II, the pages of *PM* mirrored America's return to peacetime pursuits with an energy that matched that of the war effort. New cars by the millions. Television. Bigger and faster airliners. Jet planes. New homes. New furniture. Washing machines. Refrigerators. Cameras. Air conditioning.

During the last decade there have been changes in the magazine, too. A new type face makes it easier to read. Modernized layout makes the magazine more attractive, and full-color illustrations have delighted readers. It is safe to say that new equipment of some kind is added every month to each mechanical department—pressroom, composing, engraving, bindery and subscription departments. Except for the rush holiday season, all subscriptions are handled in about three days.

A question many readers and old friends of the magazine ask is: "Where do all the articles come from?"

About half of the feature articles are written by the staff from material gathered all over the world. Roderick M. Grant, managing editor, sends *PM* writers to far-away places to get firsthand stories—Bikini, Alaska, Germany, Japan and South America. The short items come from approximately 5000 correspondents, from industry, from government sources, from any corner of the earth where something new is happening in the fields of mechanics and science. The magazine maintains its own photographic studio and staff, and in addition, every month the editors scan several

(Continued to page 380)



Two electronic hearts that beat as one

... to bring you better television pictures

The heart of every television camera is the image orthicon, or camera tube... the heart of every television receiver, the kinescope, or picture tube. Both were developed by RCA as integral parts of today's modern, all-electronic system of television. The camera tube and the picture tube work hand-in-hand to bring you the best pictures modern television has to offer.

Modern, all-electronic television is a glowing example of the American system of free enterprise at work. It has opened up new avenues of employ-

ment... established new entertainment vistas... and elevated the American standard of living.

RCA pioneered all-electronic television as it is known today... and through continued research and the development of mass production methods, has improved the product and lowered the cost.

RCA engineering leadership in the field of television is your assurance that the highest possible quality is built into every RCA picture tube. That is why RCA picture tubes have been in use in more sets, for a longer time, than any other brand... and why more are in use today.

To get the clearest, brightest pictures from your television set—ask your television serviceman for a genuine RCA picture tube.



RADIO CORPORATION of AMERICA
ELECTRON TUBES

HARRISON, N. J.

SWITCH TO

MILD

KENTUCKY CLUB

The Thoroughbred
of
Pipe Tobaccos



Get Fine Pipes at Worth-while Savings

— You bet it pays to switch to Kentucky Club. It's the thoroughbred of pipe tobaccos—choice white Burley specially blended to give you a mild, smooth smoke with grand taste and aroma. In addition, every package of Kentucky Club contains a valuable Dividend Coupon. Save these Coupons and get your choice of fine pipes at *big savings*. Beautiful pipes of imported briar made by expert craftsmen. 14 shapes. Do these two things today. Buy your first tin of Kentucky Club.

Mail coupon for free catalog.



FREE

Illustrated catalog showing Kentucky Club Dividend pipes and other premiums.

Mail Pouch Tobacco Co., Dept. 65
Wheeling, West Virginia
Please send—free—Kentucky Club Catalog.

Name.....

Street.....

City..... State.....

thousand photographs submitted by a variety of contributing sources.

One of the big illustrating jobs is for the Crafts section of the magazine. James R. Ward, able crafts editor, and Frank Beatty, art director, make sure that every detailed specification on all drawings is correct. In the news section of the magazine appears frequently the work of artists like G. H. Davis of England, famed for his diagrams and cutaways, and A. Leydenfrost. Covers are painted by such well-known artists as Dave Mink (who did the anniversary cover), Bruce Bomberger, Wendell Kling, John Howard, Roswell Brown, James Sessions and Robert Korta. (Korta's fine painting of the old-timer reading *PM* opens the Craftsman section in this issue.)

Since World War II, *Popular Mechanics* has not only increased its circulation to over a million copies every month, but has added four foreign editions. Alan M. Deyoe is circulation manager. Shortly after the war one of France's war heroes, Maj. Adrien Albarranc of Paris, made a trip to Chicago enthused over the idea of publishing a French edition of the magazine. During the war Albarranc was impressed with the way his American companions fought to get the overseas edition of *PM*. There was no magazine like it in France and he felt his country needed such a magazine. H. H. Windsor, Jr., and William Harrison Fetridge, vice-president, listened to Albarranc's story and the result, a few months later, was the introduction of *Mecanique Populaire*. The magazine is translated in Paris and printed in Strasbourg. It was an immediate success and is now widely read in France, Belgium, Switzerland, parts of Germany and North Africa. The French government showed its appreciation in 1949 by making Mr. Windsor an officer of the French Academy and decorating him with the Order of Palms for "Services rendus a l'influence francaise."

The Spanish edition of *PM*, under the direction of Senor Samuel Melo, formerly of Mexico, D. F., is printed in the main plant in Chicago. It is called *Mecanica Popular* and is distributed throughout Latin America and Spain. The Danish edition, *Populaer Mekanik*, and the Swedish, *Popular Mekanik*, are issued from Copenhagen under the joint supervision of Jorgen Grusgaard and Jorgen Norredam. The magazine also maintains offices on famed Baker Street in London, where Douglas W. Wedderspoon represents the company.

In the United States, the magazine has branch offices in New York, Cleveland, Detroit, Los Angeles, Portland and San Francisco. A Florida office will open soon.

(Continued to page 382)

"GUNNING

IS MY GAME"

says **TED ROBBINS**
famous guide, Transquaking Gun Club
Cambridge, Maryland

"And This
Marlin 90

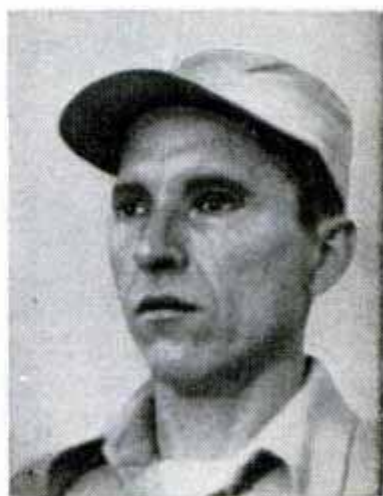
OVER-AND-UNDER

Is My Idea of a GREAT GUN!"



"Canvasback, teal, turkey . . . you name it and we've got it on the Eastern Shore," says this famous gunner. "And upland or in the blinds, I'll take my Marlin Over-and-Under every time. It gives you a fast first shot right where you want it. The recoil is lighter and straight back so you get faster recovery.

How the Marlin folks can put this precision-built baby out for the money is a mystery to me. But, if you want more birds, you'll pack a Marlin 90."



AMERICA'S BEST OVER-AND-UNDER!

Ideal for field, trap and skeet. In 12, 16 and 20 gauges. Hammerless, cocks on opening. Positive, automatic safety. Easy take down. Single sighting plane. Handles and leads like polished lightning and reaches

'way out with a fine, even pattern. A gun you'll prize for years to come. See your local dealer. If none available write us for name and address of nearest one. Try Marlin's new, sensational *Magnetized* double-edge razor blades. Marlin products are available in Canada.

THE NAME FOR GAME

Marlin

FINE GUNS SINCE 1870

---VALUABLE COUPON - MAIL TODAY---

THE MARLIN FIREARMS CO., Dept. PM-A, New Haven, Conn.

Send me catalogue with full information and photo-illustrations of Marlin Guns. I understand you will also send me pack of (please check) . . . single or . . . *Magnetized* double-edge Marlin Blades. I enclose 10¢ for postage.

NAME _____

STREET _____

CITY _____ ZONE _____

STATE _____

Clover L. Perkins is the advertising manager. F. W. Johnson, veteran *PM* executive, is classified advertising manager. The magazine publishes more pages of classified advertising than any general American magazine. Royal Lee is promotion manager. Including all departments, the magazine's employees today total 475. Many have been with the organization over 25 years.

We know that 28 percent of our readers are over 46 years old, only six percent are under 17, the other 66 percent falling between those two groups. Our typical reader owns his own home. He can be either

rich or poor, but one thing is certain: He has the type of mind that likes to know what is under the hood of an automobile; he is interested in mechanical things and why they perform as they do; he likes to do things with his hands; he enjoys reading an article "written so you can understand it" with graphic illustrations; he has an alert, forward-looking mind with only a casual interest in the past. In other words, he is typically American.

We like to think that *Popular Mechanics* is, too, because the story of the magazine is also the story of the American way of life during this last half century.

Build A MODERN READY-CUT HOME! Costs You Less!

Shipped
Direct
from Our
Mill



Liberty Homes

\$3184



31 Designs to Choose From

AS LOW
AS . . . \$2180

Recommended by Banks and
Building and Loan Associations

Save 30% to 40%
on Your New Home..

Don't pay several hundred dollars more than necessary when you build a home! Buy direct from our mill at our low factory price. We ship you the lumber cut-to-fit, ready to erect. Paint, glass, hardware, nails, etc., all included in the price—no extra charges. Plans furnished—also complete building instructions. No wonder our customers write us that we saved them 30% to 40%. Architecturally approved construction. (Not built in sections.)

Visit a Liberty Home!

Many thousands of Liberty Homes have been built in all parts of the country. There is one near you that you can visit and inspect. Write us and we will give you its location.

Handsome Big CATALOGUE

Pictures wonderful homes in colors at money-saving prices. Designs to suit everyone. Send 25c for catalogue today.

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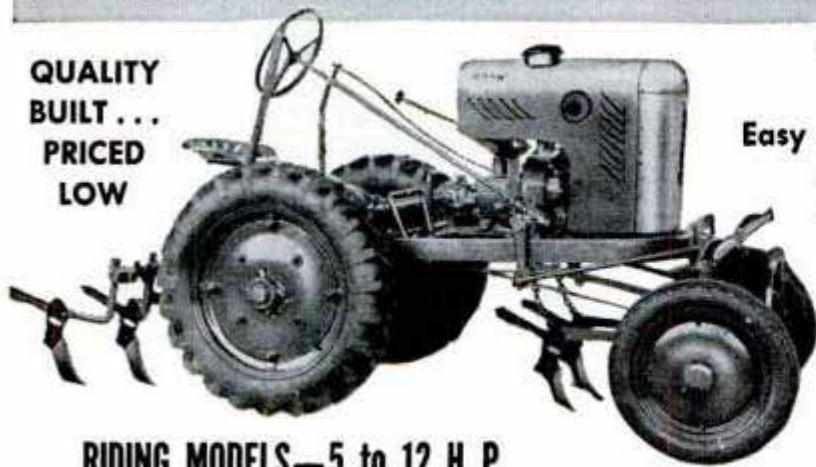
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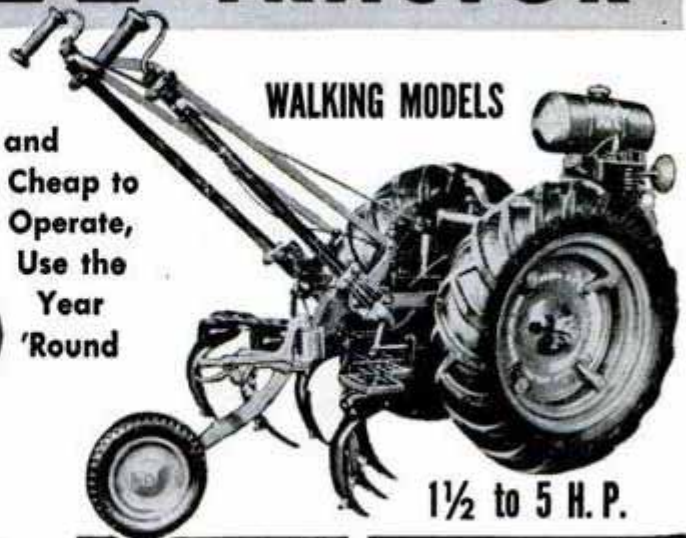
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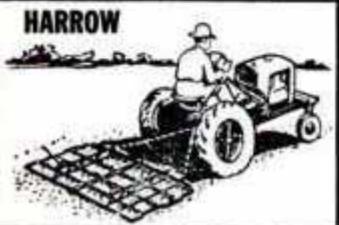
RIDING MODELS—5 to 12 H. P.

Easy and
Cheap to
Operate,
Use the
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'Round

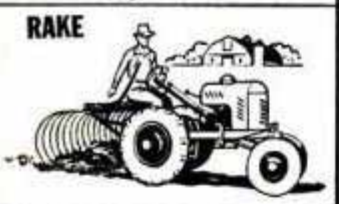
WALKING MODELS



1½ to 5 H. P.



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RAKE



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A Great Time and Money Saver on Small Farms, Gardens, Nurseries, Golf Courses, Poultry Farms, Cemeteries

The sooner you get a Shaw Garden Tractor the sooner you'll save money, time and lots of hard work around your place.

TRIED AND PROVEN! For nearly 50 years SHAW Tractors have proved dependable, low-cost helpers on scores of jobs... in gardens, truck farms, nurseries, orchards, cemeteries, golf courses, poultry farms and estates. Great for plowing, cultivating, discing, tree-felling and wood cutting, seeding, harvesting, spraying, mowing. Riding tractors with bulldozer also used in foundries and by building contractors. Also for running belt machinery. First cost is low; low operating cost.

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(Continued from page 230)

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a pall over the rookie on his first day. First Sgt. Herbert Brewer, who went through last spring, still remembers every detail. "We began with a two-mile run at eight a.m.," he says, "followed by 35 minutes of calisthenics. We ran through a class in concealment and hit the confidence course a few times—not counting miscellaneous push-ups for misunderstandings with the C.O., who was very free with push-ups."

The confidence course at Benning would batter a football guard. The ranger climbs a "ladder" with rungs three feet apart between two 100-foot pine trees. He writhes through the logs of a backbreaker called "the weaver," rolls across a row of loose logs suspended 15 feet in the air and practices second-story work through the windows of a tree hut 20 feet above the ground. He crosses a pair of cables strung over a chasm between two trees, climbs sheer log walls, wriggles, squirms and tightrope-walks his way through a maze of horrors.

During his first week, the volunteer airborne ranger is working on his first jump training. He starts by leaping 15 times through the door of a mockup plane into a sand pit. Then he moves to the 34-foot tower, a rugged pile of timber, crowned by a metal mockup of the center section of a flying boxcar. Inside the mockup, men line up as they would for a regular jump. Static lines are fastened to their dummy-chute harnesses and out they leap into space. But instead of being hooked to a canopy, the risers are attached by pulleys to cables outside. "One thousand . . . two thousand . . . three thousand . . . four . . ." yells the jumper, coming up with a jolt as the risers snap taut, and he goes for a bouncy 100-yard cable ride dangling like a fish on a line. "Most men would rather leave a plane than the 34-foot tower," says Sergeant Brewer. "You see those logs going by, and when the shock hits, you know you came a long way. The risers burn your neck. If one gets under your arm, you can dislocate a shoulder. Most of our washouts happen right there." Brewer, a 180-pound stalwart, tried four times before he made a qualifying leap. One man who wouldn't give up, hung up a record of 23.

By his second week, the airborne ranger has moved over to the four 250-foot free-drop steel towers, modeled after the carnival drop at the New York World's Fair. Here parachutes, with canopies hitched to conical cages on one end and a ranger on the other, are hauled by cable 250 feet in the air and released. Down float the rookies

(Continued to page 386)

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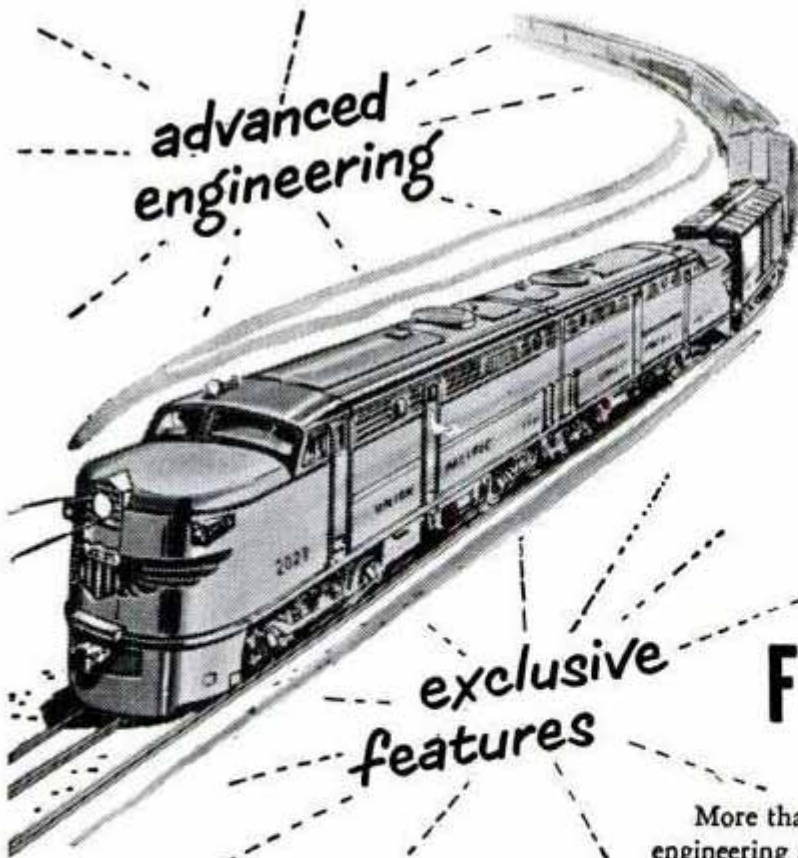


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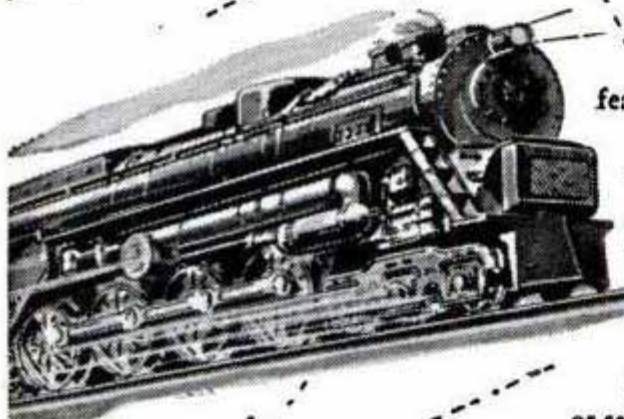
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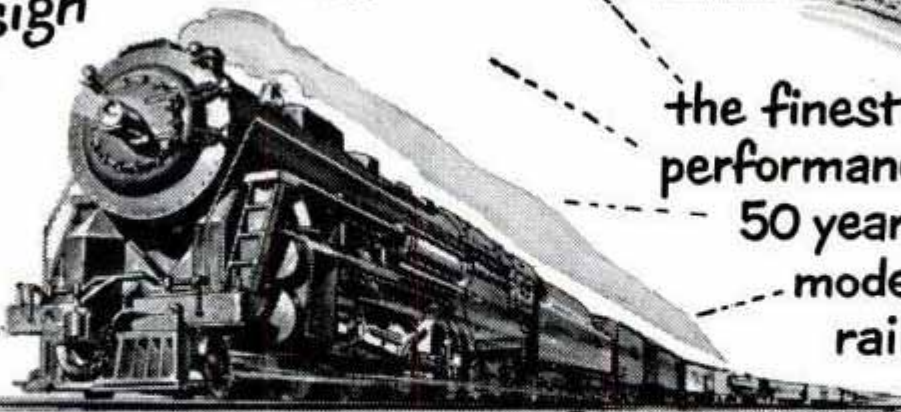


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whistles on this Rail-
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*Men in 10 cities nationwide compared New Schick Injector Razor and Blades with whatever they had been using. About 80% of the men had a preference. Of these, the votes were in the ratios shown above.

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SCHICK INJECTOR RAZOR & BLADES

instructions and insults over a loudspeaker as the men fall:

"Number one—left slip; number three—forward slip and straighten out. You look like a Buddha. . . ."

"If you follow instructions," says Brewer, "you'll never hit the cold steel." Several recruits, failing to take wind into account, have drifted into the towers, broken legs and arms and scared themselves out of the rangers. Luckily all have had the sense to hang on to the tower framework as their chutes collapsed around them, until men climbed up to rescue them. Those who were able wound up doing pushups for goofing the act.

In his third week, the airborne ranger is making live jumps. Here there's no time for nonsense. At 2000 feet above the drop area the men are ready and the jumpmaster sounds off:

"Stand up! Hook up! Check equipment! Sound off equipment check! Stand in the door! . . . GO!" A good jumpmaster will get 32 men out of a plane in five seconds flat. As chutes pop open, each man makes a sideslip to avoid fouling the chute of the man beneath him.

If he's still in the running, the ranger goes on to night drops.

If a qualified ranger goofs up, or stages a "refusal" at the plane door, he never gets to try again. He rides back to the field, rolls up 2000 static lines and shakes out a dozen chutes. Then he walks 15 miles back to the ranger area and, as a crowning blow, is relieved of his airborne status.

In the fourth and fifth weeks, the ranger is introduced to a group of life-sized cargo planes and mockups. In rows of tin-roofed replicas of flying boxcars, he loads big trucks and fieldpieces and learns to lash them down. To give him the concept of keeping cargo balanced, and illustrate lashings, instructors use models of trucks and jeeps, which they load into plywood plane models with cargo patterns marked out on their walls. The ranger is taught the principle of the chain and belt releases, which send trucks, tanks and 105 howitzers scooting out the back door for parachuting behind the lines. He learns that by lashing his droppable cargo to a platform, it will take a much harder jolt on landing. This is sometimes illustrated by dropping an egg on the floor—with and without cardboard under it. The egg with the cardboard platform won't break.

All through this training, and finally full time during his last three weeks at Benning, the ranger is out on squad, platoon and company missions. At supply depots

(Continued to page 390)

YOU GET MORE FOR YOUR MONEY WHEN YOU BUY A HARLEY-DAVIDSON

for a happier you in '52

**RIDE THE PLEASURE-AND-
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1952 HARLEY-DAVIDSON *HYDRA-GLIDE*®

The 1952 Harley-Davidson Hydra-Glide brings you more real enjoyment than you've ever had before...after hours, week ends, on vacations. It opens a whole new world of outdoor sports, travel, adventure. It introduces you to the greatest bunch of guys and gals you've ever known...at exciting race meets, gypsy tours, club runs and other thrilling events. Economical and handy, too, for riding to work or school. And this year, it's better than ever...with 4-speed foot shift-hand clutch, Parco-Lubricized valves, rich-toned, power-boosting muffler, flatter, wider tread tires for longer life, luxurious new color styling and other advanced features. Why not see your Harley-Davidson dealer now... and get set for a happier you in '52. Mail coupon.



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Ink-Bottle "Fountain Pen"

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☞ Slowly, buffalo are coming back, according to the Canadian Wildlife Service, which reports that there is a herd of bison in Wood Buffalo Park totaling between 12,000 and 15,000 animals.



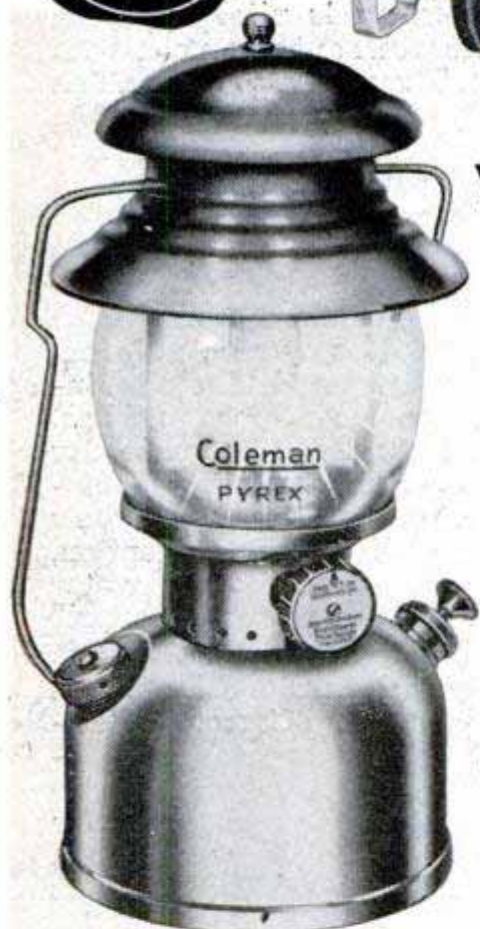
JOE GODFREY
founder of the
Sportsmen's Club
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Says:

"I take my Coleman Camp Stove and Lantern along on every outing for good eats, good light and more fun."



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Model 413D
2-Burner Camp
Stove. Also avail-
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You always have
Good Food and Good Light
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The Coleman Camp Stove means hot, tasty food wherever you go! Cooks like a city gas range. Lights instantly. Folds up and carries like a suitcase. Durably built for years of service. Safe; helps prevent forest fires. Means more fun for fishing, hunting, vacations, backyard picnics.

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New, powerful Coleman All-Purpose Lantern gives plenty of brilliant light along the trail or in camp at night. Compact, sturdier. 8 to 10 hours lighting service from one filling. Lights instantly. Floodlights 100-ft. area. Safe; can't spill fuel. Stormproof.

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The Coleman Company, Inc.
Wichita 1, Kansas

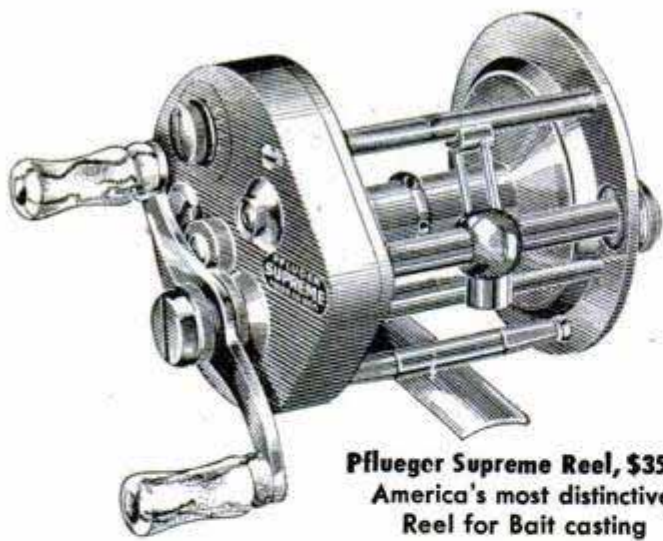
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America's most distinctive
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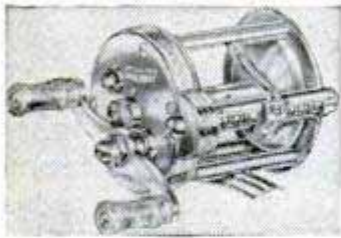


was 38 years old when
Popular Mechanics was
started 50 years ago

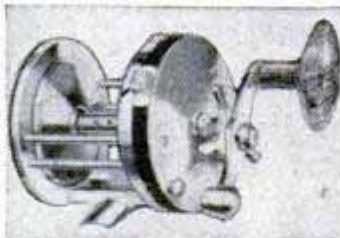
Both Pflueger and Popular Mechanics have grown in stature and prestige during the memorable 50 years that have passed. Today, as in time long ago, Pflueger is considered by everyone who knows fishing tackle to be the leader in the production of Reels, Baits and other Fishing Tackle Products. Millions of fishermen and women demand Pflueger Reels and Baits for their enjoyment of fishing at its best.

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Pflueger Pal-O-Mine Minnow Floats—Dives—Wiggles—Wobbles.



Pflueger Tandem Spinner
Luminous blades—it catches fish in the dark.

you can see rangers busy every morning inflating life-sized rubber trucks, guns, trailers and tanks. These are set out in the woods, and "enemy" forces placed to defend them. Everything is ultra-realistic. The "enemy" is even dressed in foreign uniform. On night missions, the "attackers" black their faces under the dim headlights of a jeep, study a sand table model of the area, don camouflage suits and plan their attack. Off they sneak through the woods, floating noiselessly from tree to tree. If they break through the enemy's perimeter defense, they plant a TNT satchel charge near the rubber objective and race for the woods. When it goes off, they've won. More often, the crack of rifle fire in the night indicates resistance. Some of the encounters are so realistic the boys get overenthusiastic. Recently, one successful platoon got so deep in the spirit of the game they planted their satchel charge in the breach of the rubber howitzer and blew it to a thousand pieces.

Since river crossing is vital in patrol work, the rangers work out on a river with a strong current. They learn to hook a line to a rubber raft, row upstream along the edge, then cross quickly, dragging the line behind them. One end is tied to a tree on the embarking shore, the other to a tree on the landing. The line is then used to pull the boat back and forth like a ferry for quick transferring of troops. Sometimes a line is shot across on a dummy rifle grenade. But rowing it across should take 15 minutes. Anything less calls for pushups. Classic in this line was one patrol leader whose men disgraced him by taking 40 minutes and fouling up everything. On their return to shore, he called them to attention, marched them chin deep into the water and barked: "Now, give me ten pushups!"

By the end of his eight weeks at Benning, the ranger is only partly trained. He moves out to Camp Hale or Camp Carson in Colorado and spends three more weeks clambering over crags, climbing chimneys, driving pitons, working ropes and knots. He hauls casualties down the slopes on litters, using ropes to ride the stretcher across chasms.

He learns survival in extreme weather. He gets to use all his weapons on mountain field problems, and practices aerial resupply in mountain valleys. Before he leaves he must run a conditioning course of two miles in 15 minutes—over crags, along ridges and rolling hills, and over a slide that slips out under his feet. The last 1000 yards is uphill.

When he's all through, the average ranger is a rough, tough soldier, slippery as an

(Continued to page 392)

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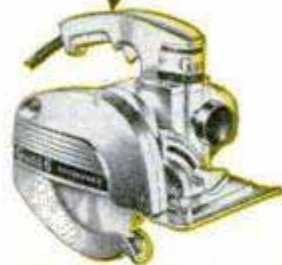
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Unmatched speed and power!

POWERFUL 6" SAW (Model A-6)

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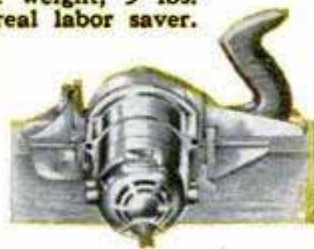


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Levels joints, removes paint, grinds, polishes any material. Rests solidly on the work—sands flat and true. Belt size 2" x 21". Speed, 600 SFPM. Net weight, 9 lbs. A real labor saver.

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Does weatherstrip grooving, levels stock and planes accurate edges in a fraction of the time required by hand methods. Width of cut, 1 1/8". Depth of cut, 0 to 1/8". Wt., 8 lbs.



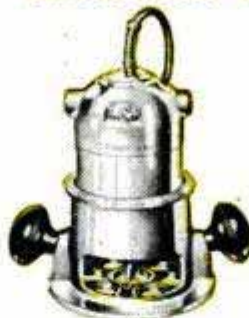
Sands all directions—without marring! FINISHING SANDER (Model 106)

Sands with, against, across the grain. Pad moves in 1/4-inch orbits at high speed—no scoring; no pattern. Powerful AC-DC motor—4000 rpm under load. Patented paper clamp holds abrasive flat and tight. Gearless—no lubrication.

Speeds up hundreds of jobs!

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Grinds flat or curved pieces!

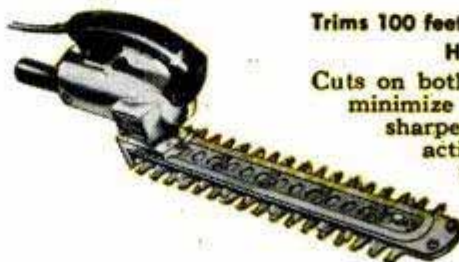
BELT GRINDER (Model CN2)

Uses flexible belt for irregular shaped pieces; a platen for flat surfacing; formed idler wheel for contours. Grinds metal, wood, glass, plastics, etc. Operates in vertical or horizontal position.



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eel and a threat to any enemy. The rangers report to their companies where they give the rest of the men a good dose of ranger training.

Recently one group of rangers, finished with a night problem in an active war area, noticed a U. S. artillery group bivouacked nearby. The sentries were half asleep. Just for practice, the rangers slipped through the artillery company lines, stuffed the muzzles of the guns with mud and put fake TNT charges in the breeches. Then they left notes saying: "Kilroy was here. So were the rangers."

"What if a guard had seen you and somebody'd been shot?" asked infuriated artillery officers next day.

"It would have been a good chance to practice tactics and first aid," replied the ranger officer. "And the guy who'd drawn fire would have gotten a black mark for goofing up."

The Tinker With Million-Dollar Ideas

(Continued from page 191)

suburban homes throughout the country.

To Kearsley, every inventive undertaking is an exciting adventure into the unknown. Once he sets out he never knows where he is going to land. To chart a course he uses his "magic wand." "I try to visualize what kind of a device I would have if I could create it with the mere wave of a wand. The moment I get a 'vision' I set out to make it a reality. Sometimes I can hit the vision right on the nose. Other times I'll miss—or hit something even better."

His famous electric blanket was a mile-wide miss. Actually, he set out one summer to find a bed-cooling device. His wand gave him an idyllic vision of lying in a cool breeze. This he produced by piping cold air in from his household refrigerator. Before he could get the device perfected, however, winter rolled around, and he turned his thoughts to a bed warmer. This time he envisioned a private "sun" in his room, which he produced by means of resistance wires and a reflector which he hung over his bed. "It worked fine," says Kearsley, "except that my electric bill jumped \$200 that month." He then recalled a foot-warming pad—made of resistance wires stitched between two muslin sheets—which he'd contrived in his home-workshop days. This he developed into a full-bed-sized blanket and then added a thermostat which regulated the current according to the temperature of the room.

When husbands and wives wrote complaining that the blanket was a "failure" because they couldn't agree on an ideal

(Continued to page 394)



IF THE FIXTURES
IN YOUR HOME
HAVE THAT
FALLING DOWN →
APPEARANCE,
USE **MOLLY**
SCREW ANCHORS

IT'S EASY TO INSTALL THESE FIXTURES WITH
MOLLY SCREW ANCHORS

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ING • FUSE BOXES OR ANY WALL MOUNTED APPLIANCE

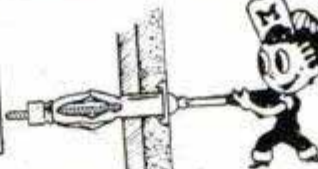
MOLLY SCREW ANCHORS ARE SOLD BY LEADING
HARDWARE DEALERS EVERYWHERE.



**MOLLY FASTENS FIXTURES SECURELY TO WALLS, FLOORS AND
CEILINGS. EASY TO INSTALL. NO SPECIAL TOOLS NEEDED.**

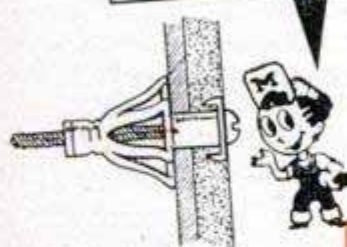


1. FIRST DRILL HOLE
SAME SIZE AS
MOLLY . . THEN
INSERT MOLLY

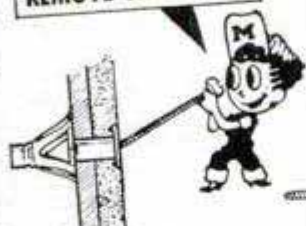


2. USE A
SCREW-
DRIVER TO
TURN SCREW

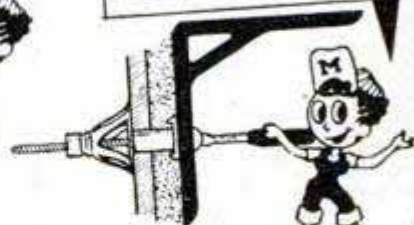
NOW MOLLY
3. IS FULLY
INSTALLED



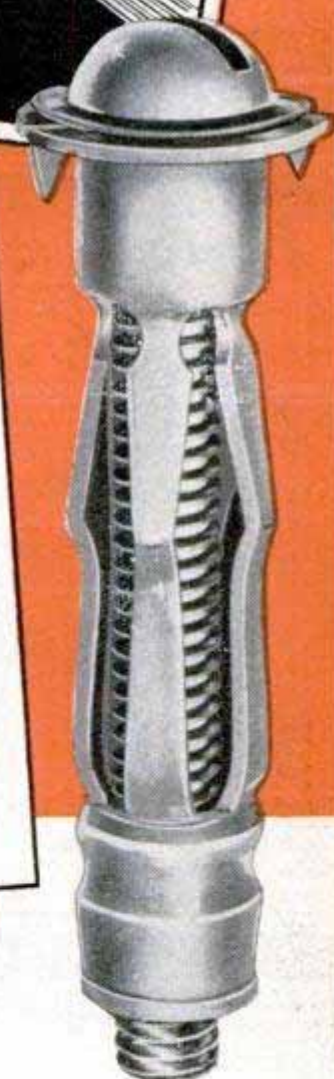
4. NEXT . .
REMOVE THE SCREW



5. NOW PLACE FIXTURE
IN POSITION . . RETURN
SCREW AND TIGHTEN



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MOLLY
SCREW ANCHORS



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temperature, he invented dual controls, by which one half of the blanket can now be set for one temperature, and the other half for another. GE has sold well over a million of his blankets, and has issued manufacturing licenses for the blanket to several other large companies.

Some of Kearsley's greatest inventive efforts have been to relieve the pain and suffering of the sick. As a result he's created four of the most valuable instruments now employed in medical science. His current stabilizer helped perfect X-ray photography. For victims of arthritis and similar painful ailments, he developed the portable Inductotherm with which patients can be treated in their own homes. His brain-wave recorder detects tumors and incipient epilepsy and aids in the diagnosis of brain diseases.

For 40 years Kearsley's inventions have been the "aspirin tablets" that have cured many of industry's headaches. Among his many time, money and life-saving devices now being used are a "doctor call" which can be installed on the lighting system of any hospital, a high-frequency leather drier for shoe manufacturers, a safety device which prevents explosions of the inflammable gases used in hospitals and dry-cleaning plants and an electrical dust remover which was first used by Walt Disney Studios in the filming of *Snow White*.

Kearsley pays dearly for his inventions. Once he finds a really challenging idea he attacks it with grim tenacity. All social life is shut out as he sinks into a lonely, silent world of intense concentration, during which he paces the floor endlessly and barely listens or speaks to anyone. Thus engaged, he will actually work 24 hours a day—"with my hands during the day, with my mind in the evening and with my subconscious when I'm asleep." Often he will wake in the middle of the night to find he has solved an important part of a problem. Because he does his best thinking lying in bed staring at the ceiling, however, he seldom gets enough sleep. As he often forgets to eat, he also loses weight. After a couple of torturous months of this, gaunt-faced Kearsley will appear to be on the verge of collapse. Yet should someone remind him of his approaching annual vacation, he will snort indignantly, "Don't be silly. I can't leave now. I'm having too much fun."

Although always ready to help solve the other fellow's problem, Kearsley invariably feels guilty of laziness when he solves his own. He explains it this way: Because he is too lazy to raise or lower the sliding door of his garage, he installed a short-wave

(Continued to page 396)

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Like thousands of other tool buyers, you'll be surprised to discover how much you save by choosing famous, professional-quality Westcraft Tools. They give you the precision engineering

and lasting accuracy you'd expect to find only in more expensive tools. See the complete line of guaranteed Westcraft Tools this week . . . yours on easy terms at Western Auto.

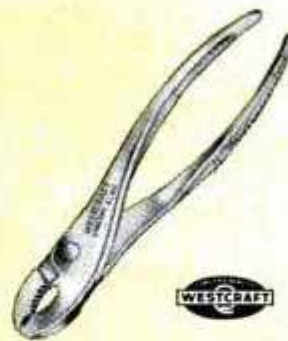
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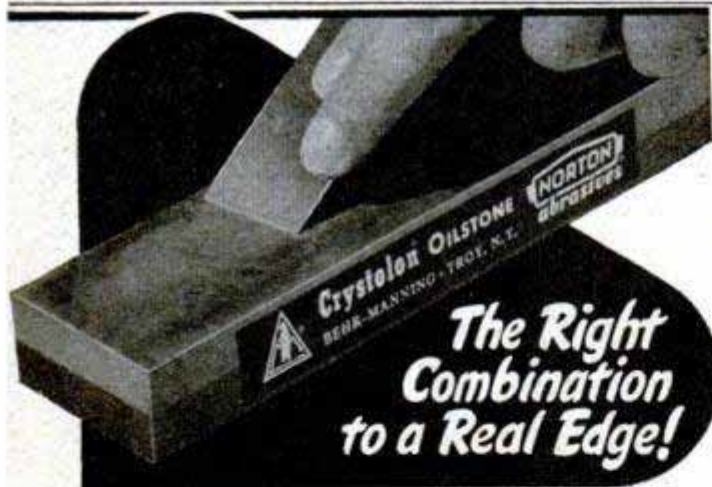
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transmitter in his car which puts the door up and down at the touch of a button; and because he couldn't be annoyed with letting in or putting out the cat, he contrived an elaborate photoelectric-cell device which would let his own jet-black pet come and go as she pleased through a trap door in the cellar, but would bar passage should a cat of another color try to enter.

Today at 68 Kearsley is a slim, gray-haired, soft-spoken man with the sober manner of a country minister. He is deeply religious, regularly attends the Episcopal church, and has recently been made a vestryman of his parish. He enjoys Canasta, archery and short motor trips with Mrs. Kearsley. His favorite hobby, however, is rifle shooting, at which he is expert. He tends to be absent minded. When his wife asks him to do an errand, he shifts his penknife from his right coat pocket to his left as a reminder. "His only invention that still needs to be perfected," says Mrs. Kearsley.

Kearsley was high on the list of scientists who were called upon during World War II to work out technical problems for our armed forces. For the Army he developed an "iron lung" to cure frostbitten feet, a hot-wire device for cutting irregularly shaped bandages, and a portable electronic sterilizing machine. For the Navy he created a long-range submarine detector. And for the Air Force he produced an electrically heated flying suit and an aluminum "umbrella" which, when launched from the rear of a bomber, scrambled the Nazis' radar-controlled anti-aircraft guns.

Three years ago, having reached GE's compulsory retirement age of 65, Kearsley moved to Florida. He went determined to do nothing but loaf. After a week of nerve-racking leisure he built a workshop in his basement where he has since been hard at work on electrified wallpaper as a more efficient means of household heating, a radio attachment which will automatically cut out commercials and a self-operating police camera which will photograph the license plates of speeding cars. And, as usual, in his spare time he is helping people with their everyday problems. For a northern friend who doesn't like to get out of bed in a cold room, Kearsley has produced a mechanical arm which closes his bedroom window on wintry mornings, lights the fire in the fireplace and turns on the radio. For Mrs. Kearsley he has created an ingenious cooking device on the dashboard of their car where she can brew herself a cup of tea as they drive along a Florida highway.

And for himself—because he is so lazy—he has developed an alarm clock which after waking him, lures him from bed with tempting odors of toast and coffee.

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Perfect answers to any sanding problem, both Models feature: Only 2 moving parts; 14,400 strokes per min., easy one-hand operation, dust-proof-foolproof; 10-second paper change; 110-120 V., 60 cycle A.C. PLUS—straight-line action for mirror-smooth finishes. Don't settle for less!

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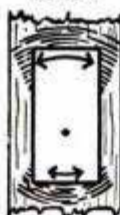
ROTARY Action



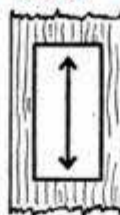
ORBITAL Action



ARC Action

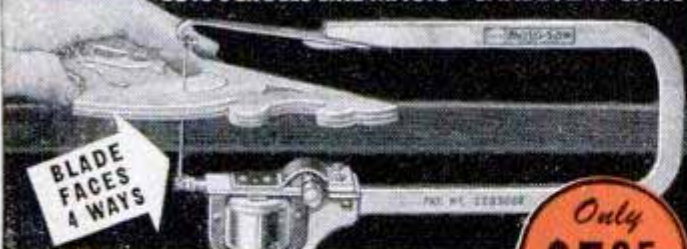


STRAIGHT-LINE Action



DREMEL Electric COPING SAW

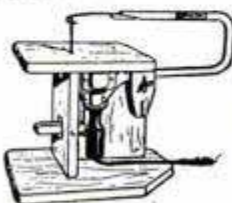
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Designs for Tomorrow

(Continued from page 197)

such prosaic studies as cost analysis, the necessity of working within a budget, the limitations of metals and other materials under different methods of fabrication and the necessity of designing each part so that it can be produced quickly and cheaply by available equipment.

It's easy for a student to design a beautiful lighting fixture, for example, but all his effort is wasted if the fixture throws spotty illumination or if it costs so much that it can't compete with other fixtures.

The student learns that when he adds one rivet to an assembly he really is adding two million rivets or whatever the annual production quota might happen to be.

He makes engineering drawings of the products he designs, prepares sketches that show the exterior appearance and then makes a three-dimensional model to check on his paper work. He goes as far as he can without building an actual operating prototype.

This procedure was followed by Kadry M. Ragheb, son of an Egyptian diplomat. Kadry is now employed by the industrial-design firm of Raymond Loewy Associates. His last assignment before he graduated from school was to design a car that would combine the high performance of a European sports car with the greater comfort of an American automobile. The chassis was to be encased in an attractive body that would suggest speed and power by its lines.

Under the guidance of instructor George Jergenson, Ragheb first made a thorough study of both kinds of cars. Partly by combining their measurements, he arrived at his own specifications.

He worked his figures up into full-scale, three-view drawings from which he took basic section lines. Next a wooden buck or skeleton of the car scaled to $\frac{3}{8}$ of the actual size and clay was molded over the buck to conform to the section lines. From the clay model a plaster mold was made and the mold was then used for making a plaster cast of the car body.

The cast was smoothed down and sprayed with several coats of enamel to simulate a rich finish. Wooden tires and wheels were painted and attached to the body. Metal hub caps were designed and added, wooden bumpers were shaped and metalized to give them a polished chrome surface and a metalized wooden steering wheel of unique design was installed. The car was completed by adding a curved Lucite windshield. The finished model is not only an

(Continued to page 400)

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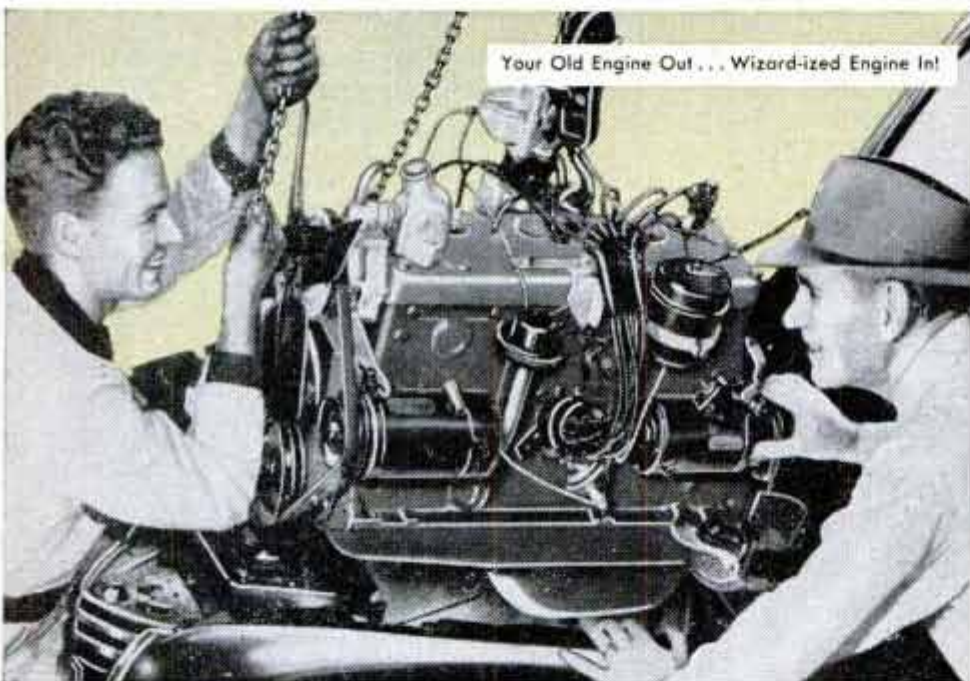


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STOP paying high gas, oil and maintenance bills on an unsafe, worn-out engine.

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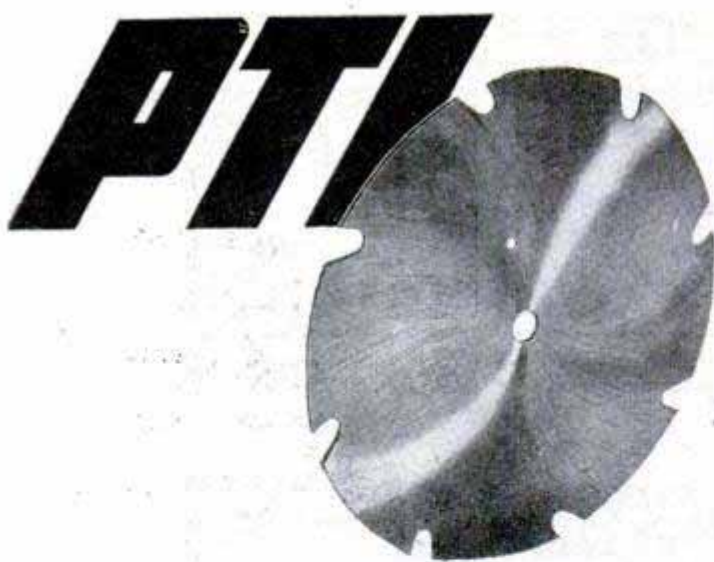
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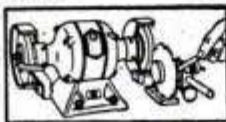
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This particular automobile may never be built, but instructors and students alike agree that it shows the trend toward the cars of tomorrow.

Art Center School offers four-year courses of college level, leading to degrees in industrial design, advertising design, photography, illustration and creative painting. Of the student body of 700, some 150 are enrolled in industrial design and represent most of the states and several foreign countries. Entering students must possess at least a high-school education and show evidence of ability in the subject they select. Even so, about 20 percent are flunked out before graduation. Full tuition costs about the same as a high-priced automobile, although for outstanding students this cost may be offset by scholarships that the school offers from funds made available by several corporations.

Industrial-design students major in transportation, in design of general products, in specialized structures which include laying out community developments, furniture design or in packaging and display. In all cases they get the same basic studies in perspective, technical drawing, industrial color and surface development. General academic subjects are included in the curriculum to round out the instruction.

Not all the students wait for graduation before beginning to practice their profession. Allan B. Johnson, for one, designed a novel combination of coffee table and magazine rack as a class project, laying out each part so that it could be shaped with the equipment in an average furniture factory. Then he took his design and a model to a local manufacturer. Today his glass-topped table with sloped magazine rack below the glass is being sold all over the country.

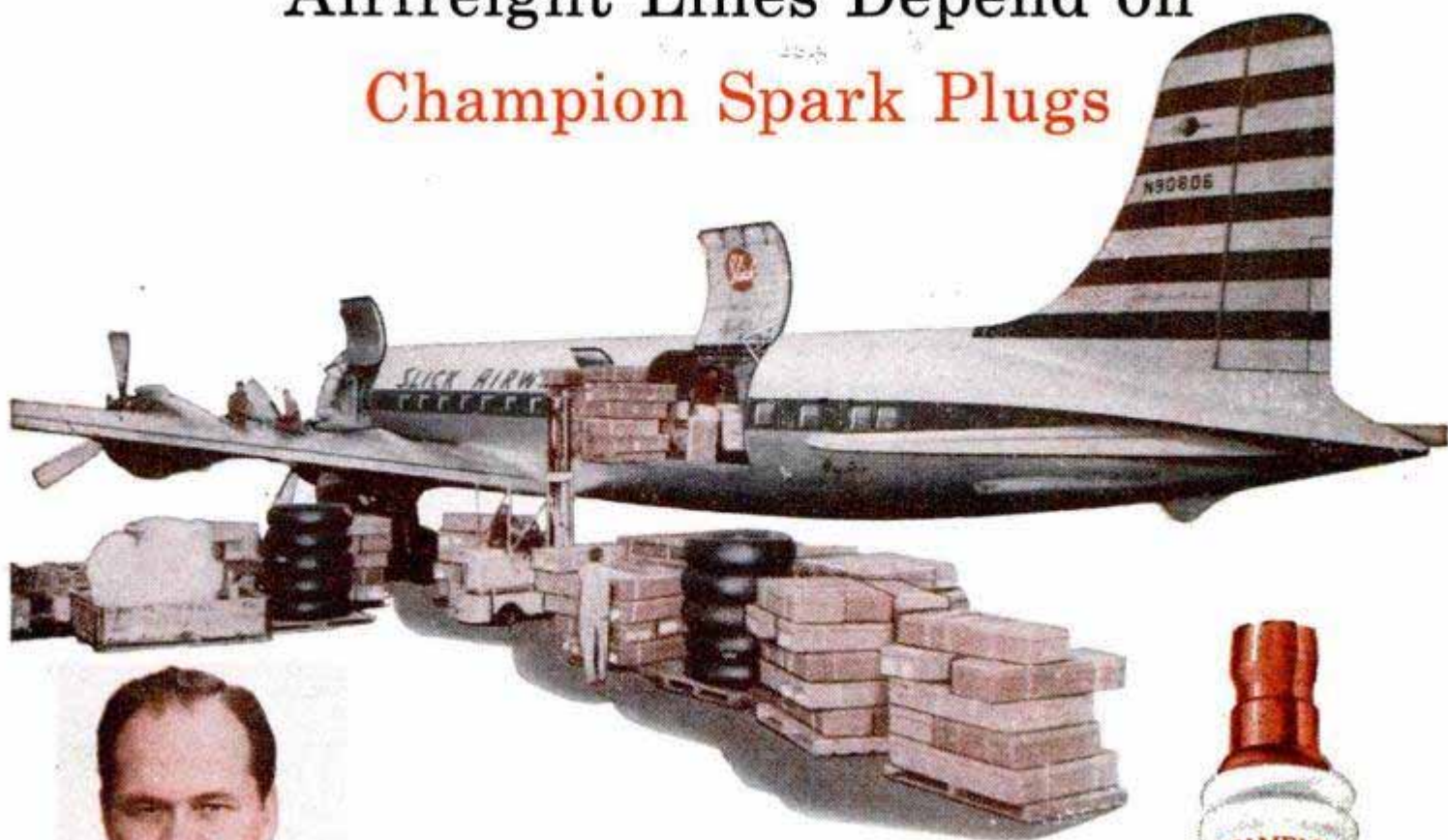
Science on the March

(Continued from page 125)

and the telephone. Whereas in 1912 we could send dot-dash messages by wireless, we can now send voice conversation and pictures. In other words, we now have radio and television. By further development of wireless we now have radar, by which we can locate otherwise-unseen objects, do blind navigation, measure the distance to the ionosphere or the moon and do many other things. Similarly, the telephone of today is a far more powerful and flexible instrument than was the telephone of 1912. These developments have come principally from the tremendous advances in the art

(Continued to page 402)

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and science of electronics. From electronics have come also a great variety of automatic-control devices, high-speed

mathematical computers and countless other devices. Today I should group all such things together in a modern wonder of the world—electronics.

Similar is the story of radium. For 50 years after the discovery of radioactivity, its interest was purely scientific, except for a few practical uses like cancer therapy and luminous watch dials. It was the phenomenon whose study threw the most light on the inner constitution of atoms, just as spectrum analysis and X rays gave us our knowledge of their outer structure. But studies of radioactive substances led scientists to try various methods of prodding into the innermost secrets of the nuclei of atoms, and for this purpose were devised the various types of atom-smashing machines—high-voltage generators, cyclotrons, linear accelerators, betatrons and synchrotrons. With these it was found possible at will to realize the old dream of the alchemists: To transform atoms into different types of atoms. This has been the most fundamental scientific discovery of our generation.

But, out of this work with radioactivity, and guided by Einstein's deduction from his famous theory of relativity that mass and energy were equivalent and interchangeable (if only means to effect the interchange could be found), came the atom

(Continued to page 404)

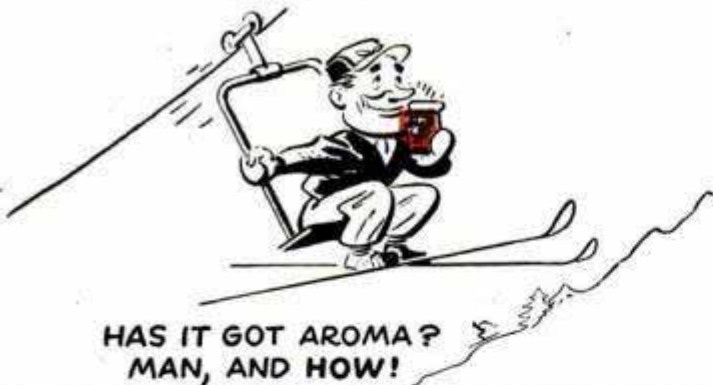


RCA photo

One of the wonders of the modern world of science is the electron microscope. This is a table model

UNCLE WALTER

IT SMELLS GRAND



HAS IT GOT AROMA?
MAN, AND HOW!

IT PACKS RIGHT



AND IT PACKS SO NEAT
IT RATES A BOW

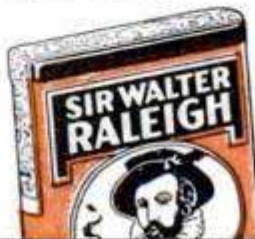
IT SMOKES SWEET



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YOU MUST ALLOW

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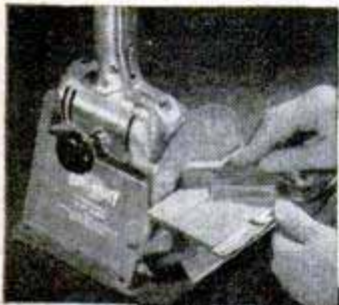
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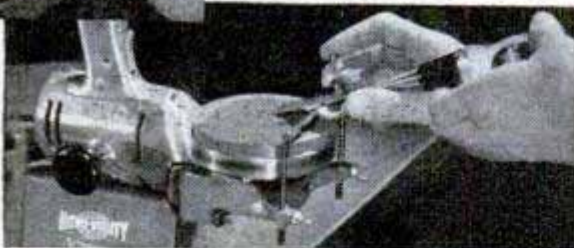
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bomb and the prospect of atomic power. Once the clue to the release of atomic energy through nuclear fission was given by the observations of Hahn and Strassman in 1939, the developments came with dazzling speed. Knowledge of this German discovery was brought to the United States promptly by the Danish scientist, Niels Bohr. Within a month after the original discovery, it had been verified and extended in several laboratories in this country and in at least three European countries. Within a year, more than a hundred scientific papers had been published on the subject, and there had been conferences on nuclear fission in Washington and, we are told, in Moscow. A few months later some possible military applications had been envisaged, secrecy was clamped down, thousands of Allied scientists were mobilized on the project, and on August 6, 1945, an atomic bomb was dropped to devastate Hiroshima and bring the war to a speedy end in the Pacific.

Now our Atomic Energy Commission supervises the greatest scientific and engineering project of all time, and the governments of all nations of any significance have similar agencies, in some proportion to their means. Undoubtedly, we have as yet only a glimmering of the potentialities of this new science of nucleonics. Certainly, as of this date, atomic energy must be accorded a high place among the modern wonders of the world.

Space permits only mention of several other significant wonders. I have chosen to enlarge on those above, in order to illustrate the way in which such things come about. Equally interesting stories could be told about modern scientific wonders in other fields. I think of plastics and synthetic textile fibers; of antibiotics like penicillin, streptomycin, aureomycin and the others of this fast-growing group; of the sulfa drugs and others which fool a germ or virus into feeding on them to its destruction; of the discoveries in genetics which have led to the breeding of agricultural products of greater yield, food value and resistance to disease; of the role of enzymes in life processes; of the regulation of the endocrine glands by chemical agents (hormones) like insulin and cortisone; of our knowledge of the internal constitution of the stars and of the atomic fuel which keeps them hot; of the identification of new fundamental constituents of matter such as neutrons, positrons, mesons and photons; of the widening use of radioactive isotopes to study and control a great variety of scientific and industrial and medical phenomena; of catalysts and chemical-engineering

(Continued to page 406)



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techniques which permit mass production of essential chemicals.

If one were to evaluate new developments in terms of their impact on our ways of living rather than on the elegance and fundamental character of scientific discovery, then other wonders should be added to the list. The modern automobile—about which the *Encyclopedia Britannica* says: "Until 1909-1912 the automotive industry was in general chiefly concerned with developing a product that at least would operate"—has revolutionized our pattern of living and doing business outside of the home. Within the home, probably any housewife would say that the modern ways of preserving, packaging and distributing food have similarly revolutionized the feeding of the family.

All of these things, and more, are products of scientific research within the span of the 50 years during which *Popular Mechanics* has played its useful role of spreading information and creating interest and ambition in those things which are so significant in this rapidly expanding technological age. Many of these things are only the early stages of still more significant developments in the future.

What will these future developments be? If we could reverse our sights from 50 years of past achievement to the next 50 years of scientific progress, what would we see in the year 2002?

Some answers to this question seem clear, and others seem very uncertain. It is safe to predict that the 2002 person will be clothed with synthetic textiles which will not fade, shrink or wrinkle and in which the desired creases will stay put. Atomic energy will be in use for special, but not for general, power purposes. Gasoline will be coming more from oil shale than from oil wells, and may be already produced commercially from coal. Cancer may then be as well under control as tuberculosis is now. Television may have proved to be an instrument to perpetuate dictatorship, or to make the democratic process more effective, depending on the trends of control and public concern. But let me close with mention of one great threat which hovers over the uncertain future.

Certain to be critical, sooner or later, is the problem of overpopulation in a world of limited and diminishing natural resources. The conquest of disease, the elimination of famine, the hoped-for abolition of war all result in increasing the population and the demands for production of food and goods. Can technological progress in production and in discovery of substitutes for exhaustible natural resources

(Continued to page 408)

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keep ahead of these increasing demands? On the answer to this question, or, alternatively, to some intelligently applied social control of population growth, depends the fate of civilization on this planet.

Thus far technology has done pretty well in the race. Improved agricultural production and distribution now support a vastly larger world population than could have been fed by the techniques of a century ago. But without rapidly continued progress both in food production and in the arts of living together in crowded communities, population increase may have forced on our citizen of 2002 the beginnings of some terrific social upheavals.

Let me describe just one of several directions in which science may help us to keep ahead of overpopulation disaster. I refer to cultivation of the sea for food; not by stocking it with little fish, but by far more fundamental chemical and biological methods. Why should ways not be found to "farm the sea" with the same scientific skill with which we farm the land?

The bases of all sea life are the algae, vegetable organisms which provide the food for the small fish. The fish population is limited by the amount of this algae food, which in turn appears to be limited by the amount of nitrate salts in sea water illuminated by the sun. Hence one project for increasing the supply of fish is by fertilizing the sea with nitrates. This may produce useful results in restricted sea areas, but the sea is very big, and perhaps this proposal is too gigantic to be practical.

Another approach, which can probably be made practical, is to grow algae in transparent pipes or channels through which sea water is slowly pumped. These channels may cover any area exposed to the sun, and nitrates or other enriching chemicals may be added to the circulating sea water. The algae would be of strains specially selected to produce fats or proteins which can be extracted and processed.

What the economics of this type of farming may prove to be remains to be discovered as the method is developed and tested. All that can be said now is that sooner or later something radically new must be developed in the food-production line to keep ahead of population growth, and this scheme seems worth working on. In any case it illustrates the sort of new and unexpected technological development which may be stimulated by the problems of living 50 or more years hence.

Whether we look backward or forward, or examine the present situation we see that it is the continual concern with things yet to come which is the inspiration and motive power of the scientist.

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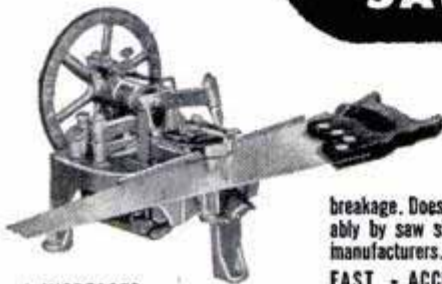


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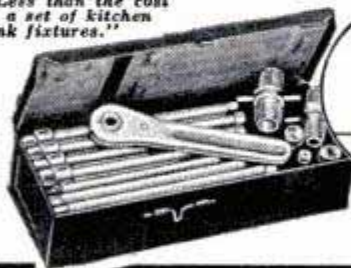
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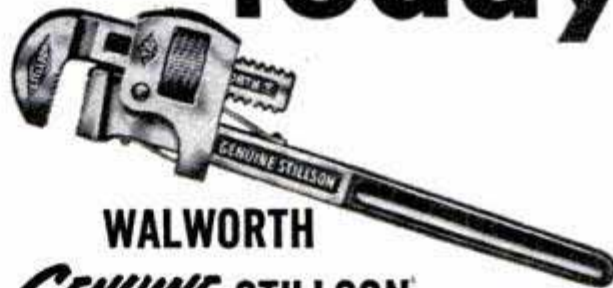
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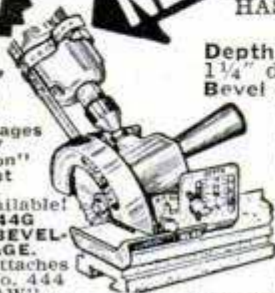
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Detroit Listening Post

(Continued from page 224)

the year, LeRoy Spencer, executive vice-president of Packard, sees only a good balance between supply and demand in the first quarter of 1952, because of higher prices and the tax burden. Around mid-1952, he sees a "mild seller's market." He expects Washington to maintain production at least at the 4,000,000-car level for next year to avert an economic crisis.

Ford is stepping up its pace to get out its Six the latter part of January.

The new Six will go up an inch in wheelbase to 115. But it will appear to be much longer, at least as large as the Oldsmobile Super 88 Deluxe. Like the Super 88, it will have a vertical chrome decoration just forward of the rear wheels.

The Ford Six will still have no sign of rear fenders but a one-piece windshield and a large wrap-around rear window will give it class. The grille will be a simple affair with only one spinner, instead of the present two. It will have only one bar in keeping with the trend toward simplicity among modern body designers.

The new engine for the Six will be of the overhead-valve type, have a compression ratio of 7 to 1 and will be rated at 97 horsepower at 3600 r.p.m., about the same as Plymouth's.

Mercury will use the same basic body, but a longer wheelbase will necessitate a different hood and front fenders. It will use the present engine at first.

Lincoln will have only the Cosmopolitan in 1952. Headlights will protrude from front fenders. Chrome strips along the rear fenders will also be used. It looks like a low and very wide car with an ultrastreamlined look. The new engine is rated at 160 horsepower. It has overhead valves and a 317-inch displacement.

George Walker will take the bows on the new Ford line. He is also working on two custom jobs to rival General Motors' LeSabre and the XP-300. He has been given *carte blanche* by Henry Ford II to outdo G.M., and his designs will be the center of the Ford's golden anniversary next year.

Oldsmobile is putting a bit of heat on its engineering to bring out its new models the latter part of January. The feature will be the new 98, with a completely new body and a bigger, more powerful engine. It must keep in step with DeSoto's new V-8.

Buick has put its XP-300 on display and is getting as much attention with it as Harley Earl did with his LeSabre. The car does not look quite so "Buck Rogerish" as the LeSabre, but it is eye-catching. These "dream cars" all are experimental jobs.

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(or ports) and the insignia in the openings indicate the model of the car.

Parking lights and the front turn-indicator lights are protected in a housing above the bumper.

The new, slightly blue-green-tinted glass not only gives eye comfort but reduces incoming sun glare to 18 percent and sunheat 45 percent over safety glass, according to Buick engineers.

The instrument panel is attractive and massive. Vision is good through the one-piece curved windshield. The hood is unconventional in that it lifts from either side, permitting easy accessibility to the engine. A knob on either side must be pulled to unlock the hood latch and this is good, as it offers some protection against theft of under-hood equipment.

The directional signals and dimmer indicator are easily seen by lights located directly in front of the steering wheel. The ventilating system and the heating is excellent. It has a two-stage blower with easy-to-operate controls. Twin map lights for night use are a nice feature. The switch key is operated by the left hand and can be removed while the engine still is running—a feature I do not like. The starter is operated by depressing the throttle. The radio has good reception. The bumpers are massive and offer good protection in case of accident. They also give more license-plate protection than bumpers on other cars.

The trunk space is ample, and the self-locking lid opens easily. I like the upright location of the spare tire. The same key is used for ignition, glove compartment and doors. Smokers will like the two ash trays in front on the instrument panel, as it eliminates long reaching by either driver or passenger.

After every conceivable kind of test and abuse given the test car, I have much praise for the new Buick—and little criticism. Buick offers real value in today's inflated-price market. Hundreds of thousands of Buick owners, past and present, attest to the high quality of Buick design, dependability and workmanship. The car has to be good to hold its high sales position (fourth in sales of all makes of 1951 cars).

I wouldn't say a Dynaflow Buick is the easiest car on gas I've ever driven, but I found that by proper and careful use of the throttle I secured reasonable mileage (see economy chart).

It is fitting that this Buick-owners' survey and test report should appear in the 50th-Anniversary issue of *Popular Mechanics*, because few names of any world product throughout the years have been held in higher regard than Buick.

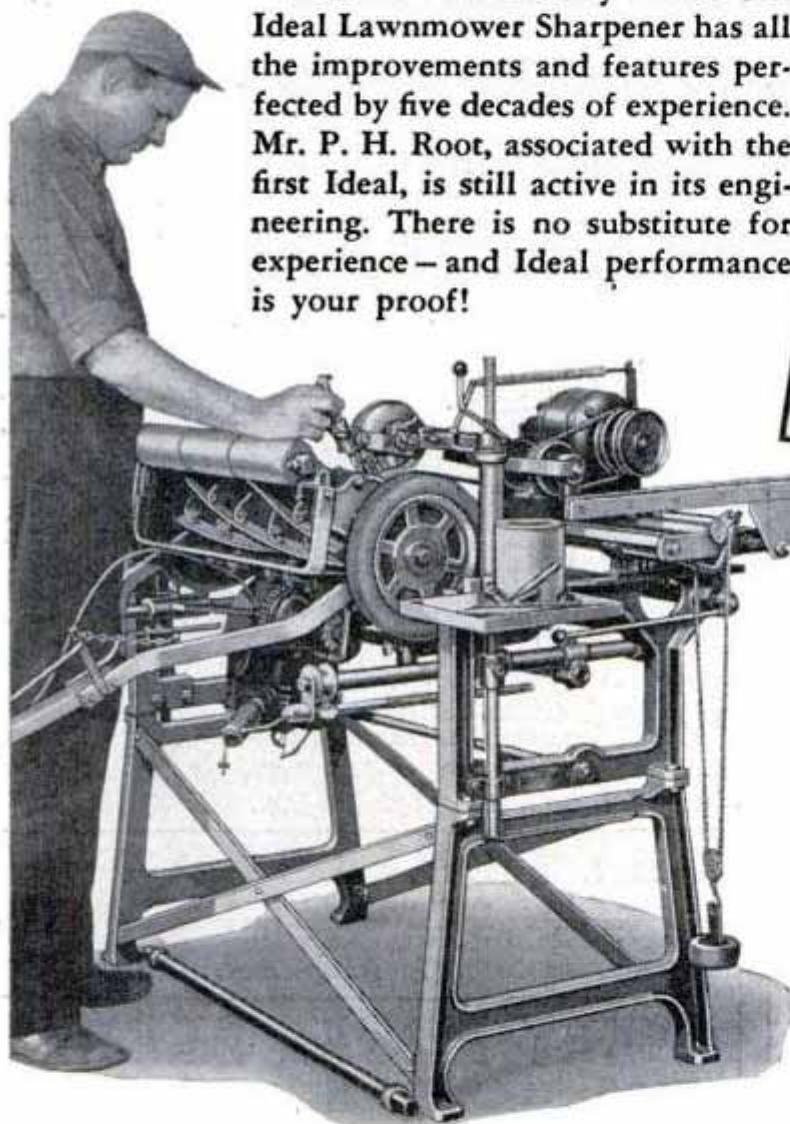
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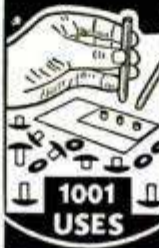
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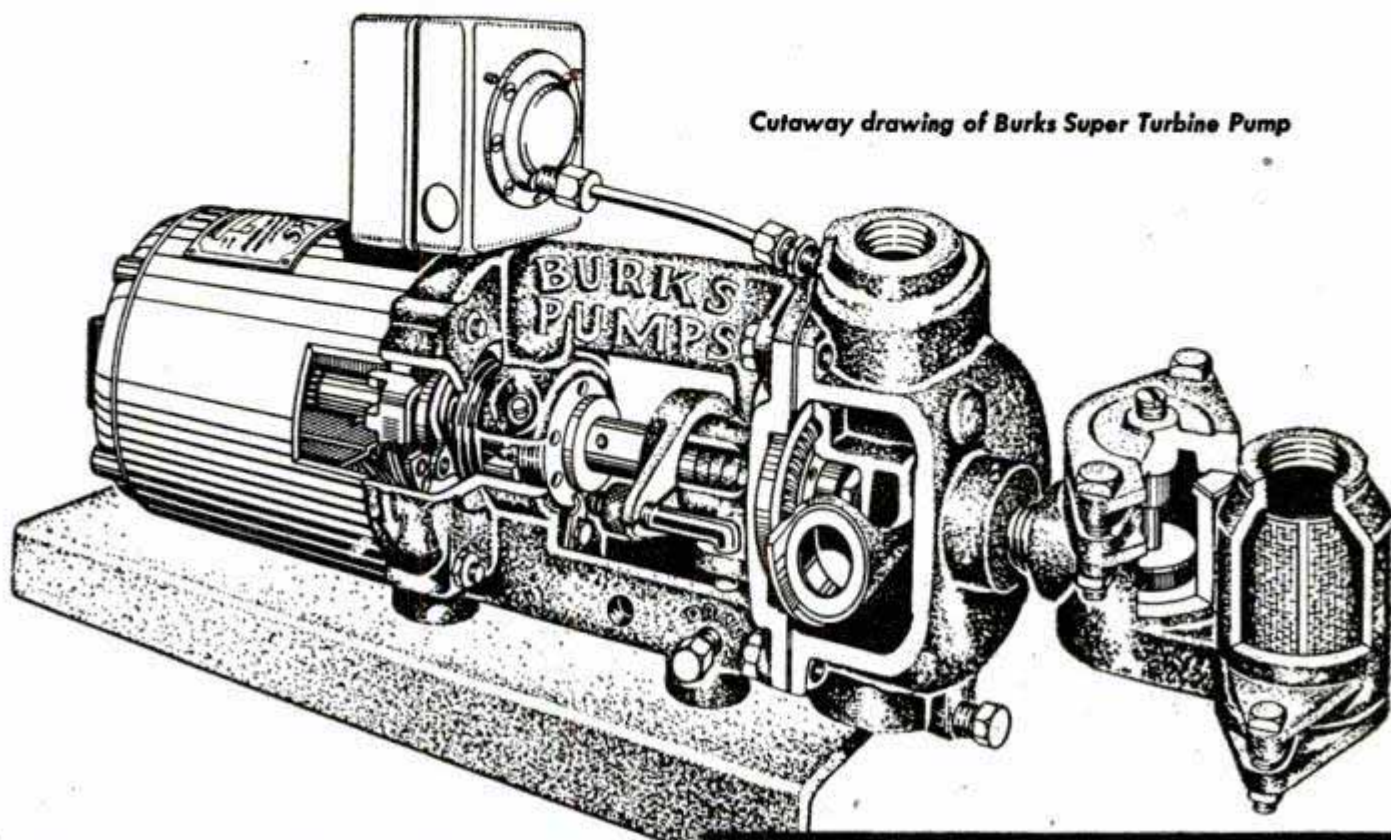
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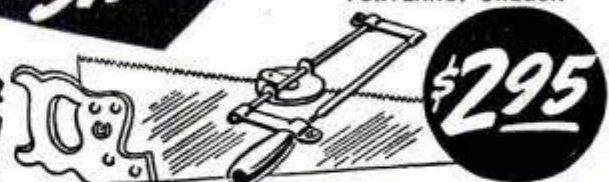
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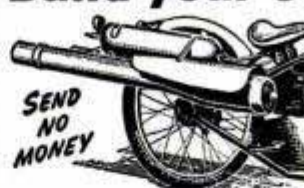
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Build A FIREPLACE



around this scientifically designed steel form which also provides circulating heat that assures perfect fireplace operation.

free folder tells how

TELLS HOW TO BUILD YOUR FIREPLACE—Step by Step

- Foundation
- Steel heat-circulating form
- Cold and warm air ducts
- Chimney and flue construction
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Foundation

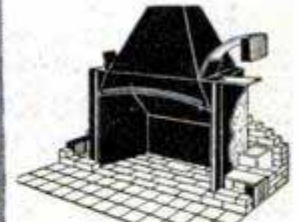
ASK FOR BOOK "100 FIREPLACE IDEAS"

Beautiful fireplace designs modern and conventional—shows artistic use of available material.

Enjoy circulating heat and the radiance of an open fire in your Home, Playroom, Cottage or Camp.



Fireplace form set on foundation includes firebox, damper, down draft shelf and smoke dome.



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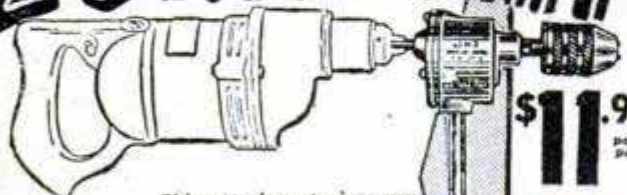
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\$11.95
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This attachment gives you two drills in one. It converts any 1/4 inch electric drill to 1/2 inch capacity. Reduction gears reduce the drill speed 5 to 1, the average speed of a 1/2 inch drill, and thereby increases the power. Absolutely indispensable for all shop work and home craftsmen.

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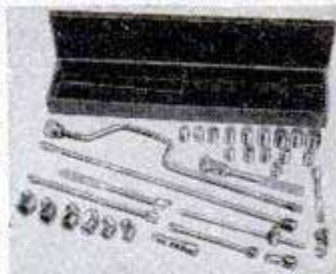
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Joins All Metals Permanently
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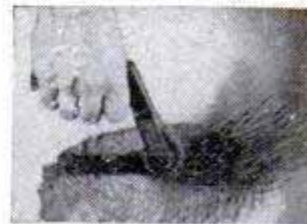
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• See editorial, page 216, Dec. 1951 Popular Mechanics

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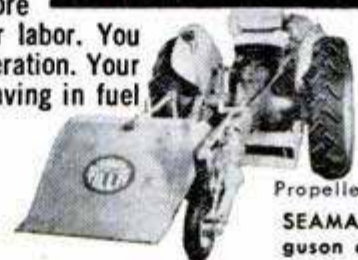
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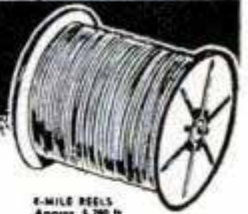
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500 ft. reels, \$4.95

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PORTO-WELD * 8 Handy Tools in 1



PORTO-WELD MODEL 2A
Recommended for repair, maintenance, and installation work. Comes as illustrated above with... welding shield and ground cable. Operates on 110 or 220 volt, 60 Cycle A.C., D.C. 7 welding ranges and welds up to 1/2" steel. Uses up to 1/8" rod. (150 Amps.) Shipping \$85.00 wt. approx. 80 lbs...

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- BRAZES ● BUFFS
- GRINDS ● QUICK
- SANDS BATTERY
- BRUSHES CHARGER

A self-contained motor generator, just like the larger industrial units — just plug it in and use.

Here is an Economy Combination Tool that is of vital importance in every shop — regardless of size — it pays for itself on the first job. Low cost, economical operation. Easy to take to the job. No special wiring required. No sticking — even an amateur welds like a pro. Versatile, too, use as grinder-buffer. Use portable power unit for saws, etc.

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Scouting's Birthday
February 6th—12th



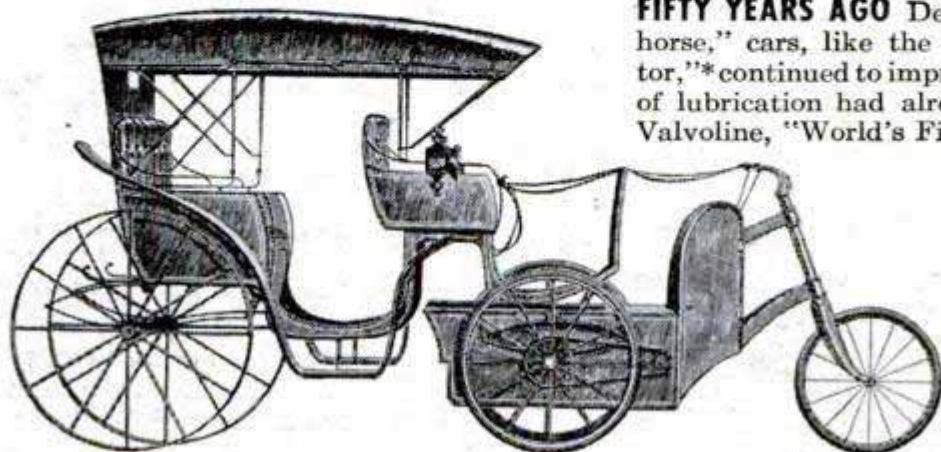
There's a Unit in your community that will welcome you into its ranks. Ask your Scout friends for the time and place of the next Scout meeting.

Cub Scouts	8-10 years
Boy Scouts	11-13 years
Explorers	14 years and over

FORWARD
On Liberty's
Team . . with the
BOY SCOUTS
OF AMERICA

FROM THE Valvoline Motor Album

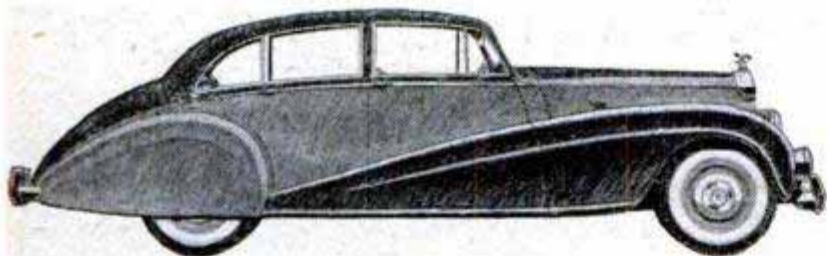
A SALUTE TO POPULAR MECHANICS
50th ANNIVERSARY



FIFTY YEARS AGO Despite cries of "get a horse," cars, like the 1901 "Phelps Tractor,"* continued to improve. The big problem of lubrication had already been solved by Valvoline, "World's First Motor Oil."



NEW Experimental cars often contain many new advanced features. Valvoline keeps pace with this engineering progress. For instance, a special mild detergent is added to clean your engine and minimize troublesome carbon, sludge, and varnish.



FOREIGN First choice of Kings and Mahara-jahs, the Rolls Royce has no equal. One famous feature is quietness. To maintain smooth quiet power, Valvoline keeps full lubricating quality mile after mile after mile.



YOUR CAR Valvoline saves you money and lengthens the life of your car by guarding the motor against Friction, Acid and Dirt. This is made possible by Valvoline's selective refining: the nation's finest crude oils, scientifically processed to keep all their natural oiliness and give lasting protection.

We Guarantee Valvoline Performance in Your Car!

VALVOLINE

MOTOR OIL

World's First Motor Oil

FREEDOM-VALVOLINE OIL COMPANY, FREEDOM, PENNSYLVANIA

An Affiliate of Ashland Oil & Refining Company

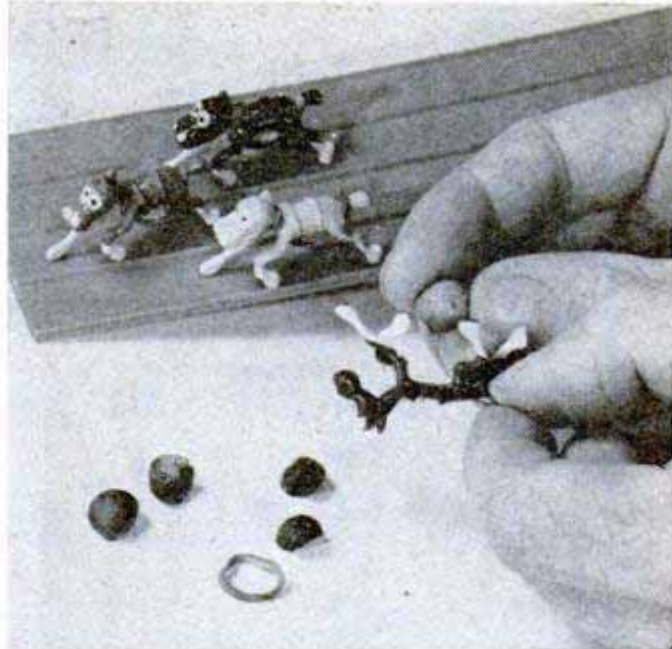
If your car manufacturer recommends heavy duty oil, use Valvoline HPO

*Courtesy Floyd Clymer's Historical Scrapbook

Minerals in Beef

In these days of high prices, a refreshing bit of news comes from the Armour Research Foundation; a pound of hamburger contains just as many health-giving minerals as a pound of the finest sirloin. Foundation scientists have identified and "weighed" the trace elements in beef. Many of the trace elements are known to be nutritionally important. For example, the body contains less than .14 ounce of iron, yet this minute amount prevents anemia. The research men cut as much fat as possible from the meat, which then is dried overnight, placed in a platinum cup and ashed for 24 hours at 1000 degrees F. The ash then is concentrated and analyzed with a spectrograph. The research indicates that the average American, who ate about 60 pounds of beef last year, also consumed 19 different minerals, ranging from 4.7 ounces of potassium to .000003 ounce of nickel. The trace-element contents of veal, pork and lamb will be studied in the future.

☐ There are an estimated 500 billion barrels of shale oil—17 times our known petroleum reserves—in a 1000-square-mile area of Colorado that is a mere fraction of the total deposit covering 16,500 square miles, according to the U. S. Bureau of Mines.



"Live" Ponies Race to Wire

Mexican jumping beans provide the "push" for a novel race-track game in which four plastic horses race each other down an inclined track. Each horse races in a separate groove so there is no interference. The beans are fastened to the underside of the horses and as they "jump" they cause the horse to slide down the ramp. Normal life of the bean is about five months, although heat will rejuvenate them briefly.

Only **TAC** has perfected the open-end ratchet wrench...

This TAC Open End Ratchet Wrench is doing spectacular jobs in the Armed Forces and Defense Industries. Made in Socket Type and Crowfoot type.

Sizes $\frac{3}{8}$ " to 4". Will operate with as little as 7° ratcheting arc on fittings, tubing, pipe, rod, cable, etc. Fully protected by patent

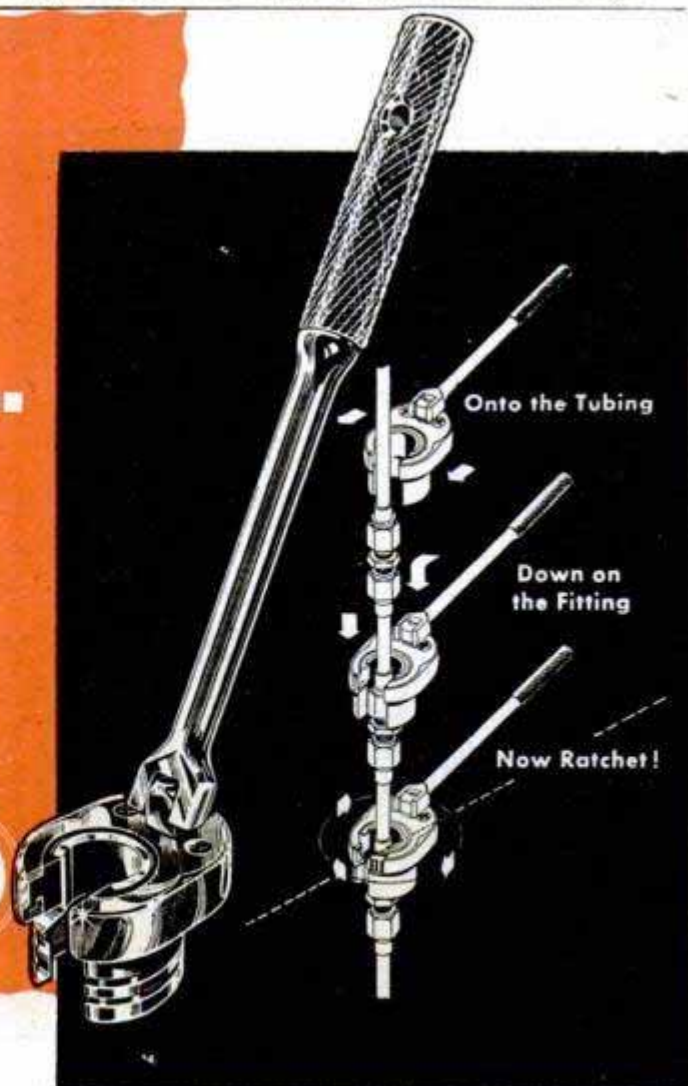
TAC does what no other tool can do.



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FIBER, PLASTIC FASTER, MORE
ACCURATELY AND AT LOWER COST!**

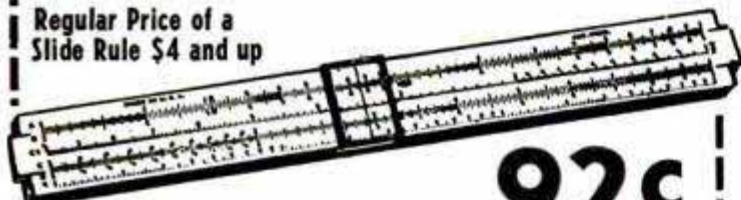


NOW every shop can have the advantages of band sawing. Wells new Model 49A is a rugged, horizontal cut-off saw that will do a man sized job. Welded steel frame and tubular base along with

many design features proved in Wells' widely used larger machines make it portable and easy and economical to operate. Automatic shut off at end of cut. Capacity—rectangular, 3½" x 6¾"; rounds, 3½" diameter. Shipped ready to operate complete with heavy-duty 1/6 H.P. Motor.

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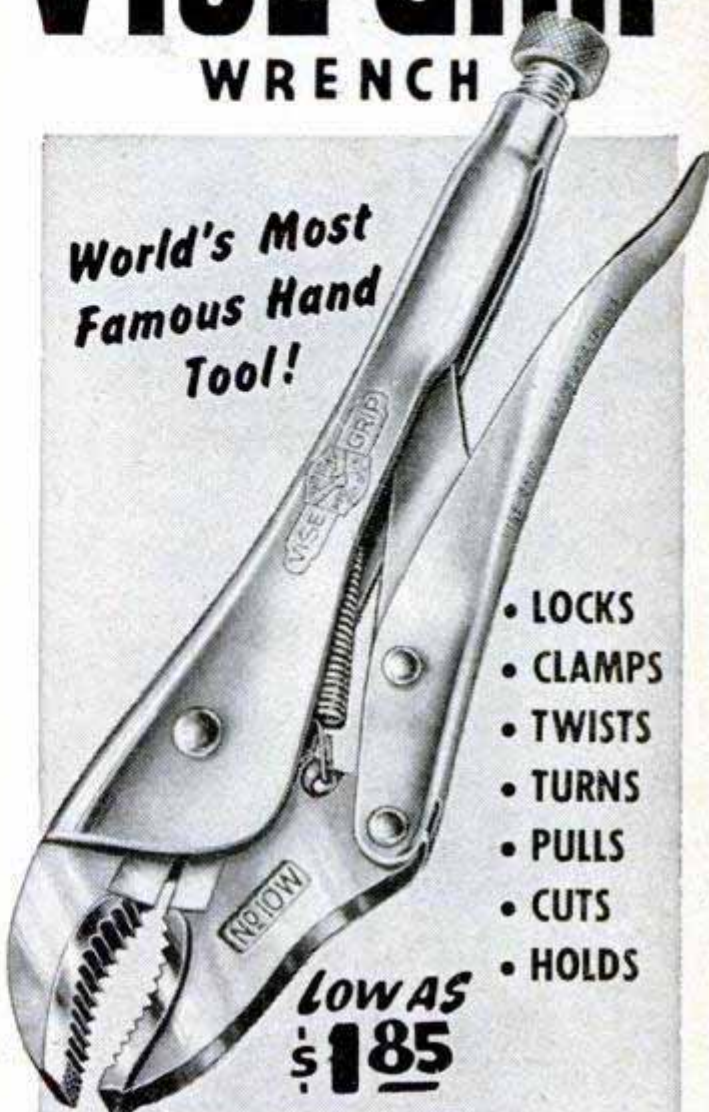
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BASEBOARD HEATING

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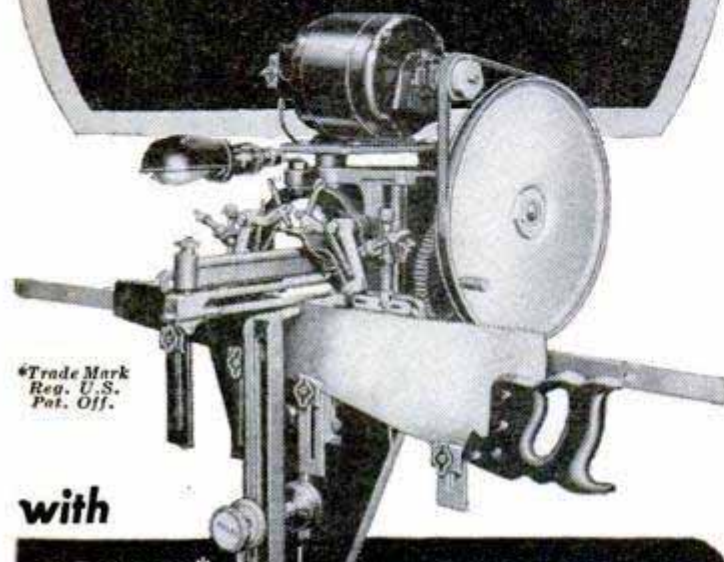
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"I did very well last year with my Foley equipment, sharpening about 950 saws in my spare time. About \$900 for me." Leo H. Mix

"I have done 4 or 5 thousand saws in my spare time in the 4½ years since I got the outfit, and they are all coming back." Len Crego

Make up to \$3 or \$4 an hour in Spare Time
With the high prices of food, clothing and everything else, just think what you could do with extra money every week! With a Foley Automatic Saw Filer you can file hand, band and circular saws better than the most expert hand filer. "The first saw I sharpened with my Foley Filer came out 100%" — writes Clarence E. Parsons. Cash business, no canvassing. No eyestrain, no experience needed.

(FOLEY congratulates POPULAR MECHANICS on its 50th ANNIVERSARY issue. The first Foley Saw Filer was built in 1900 — now in its 52nd year of progress.)

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Tells just what to do to start your own spare time business in your basement or garage. Just think—with a small investment, no overhead, no stock of goods to carry, you can get right into a cash business. Send coupon today—no salesman will call.

Also see *Foley Lawn Mower Sharpener*, page 432, and *Foley Saw Retooler*, page 452



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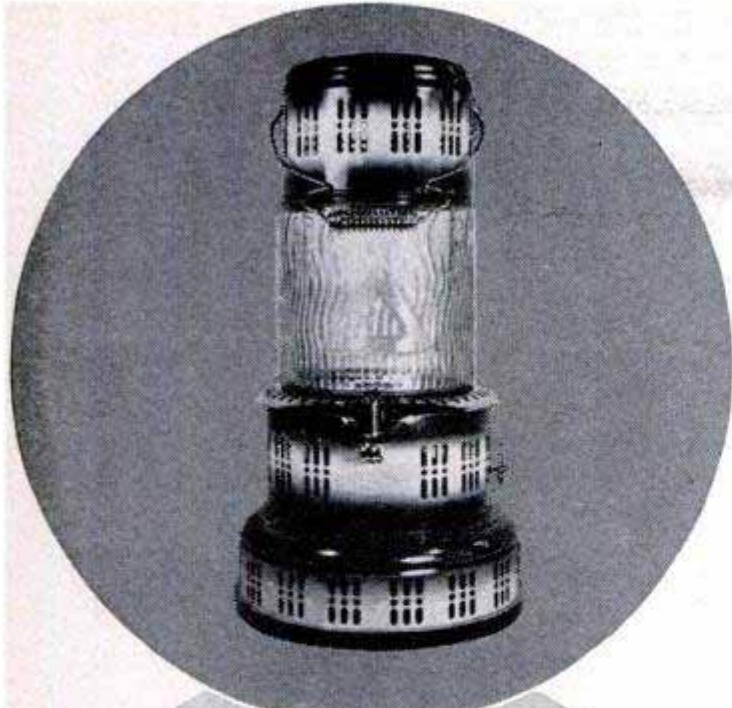


Reflector Disk Warns Motorist

Highly reflective, a small disk shines like a caution beacon, warning oncoming motorists of pedestrians or bicyclists on the highway. It clips to the lapel or belt and is 220 times brighter than white paint in the light of approaching vehicles. Because it is small and lightweight, it is easily carried in the purse or pocket during the day and is always ready for night use. Motorists can also use these disks to warn approaching traffic when parked for tire changing or engine trouble.

Clear-Glass "Dog Tag" Measures Atom Radiation

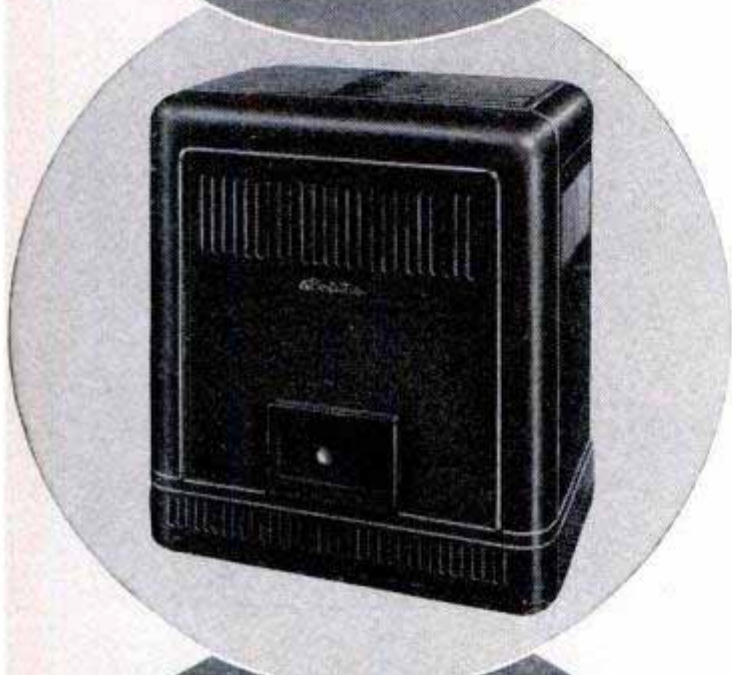
Measuring about an inch square, a clear, colorless-glass "dog tag" is a reliable detector of atomic radiation. Developed by Navy scientists and chemists at Bausch and Lomb Optical Company, the glass shows the amount of atomic radiation it has been subjected to when it is viewed under ultraviolet light. Under ordinary light, the dog tag is unchanged in appearance. Invisible in the glass are appreciable quantities of dissolved silver that produce an orange fluorescence under black light after radiation. The device is called a dosimeter and is extremely sensitive to small amounts of radiation—as little as 10 roentgens. It is economical to make by mass-production methods. The amount of fluorescence depends upon the extent of exposure, a characteristic that provides an accurate measure of the degree of radiation exposure.



The handiest portable heater made

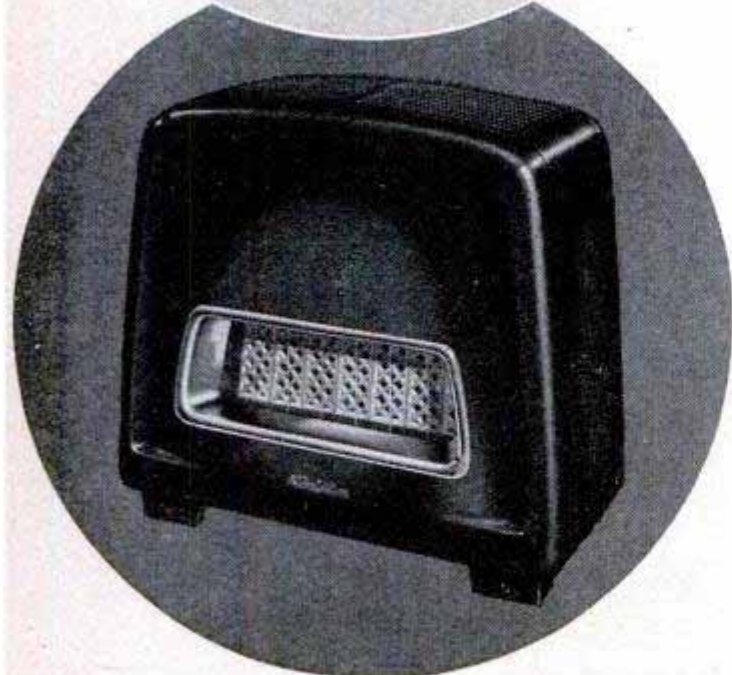
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Oil home heater based on new burner-pilot principle

Perfection's exclusive "Midget" Pilot . . . a tiny separate fire, not just a low fire . . . alternates with the high or low flame of the burner to give economical comfort at all times. No more roasting or shivering, no more wasted oil . . . and no more bothersome relighting.



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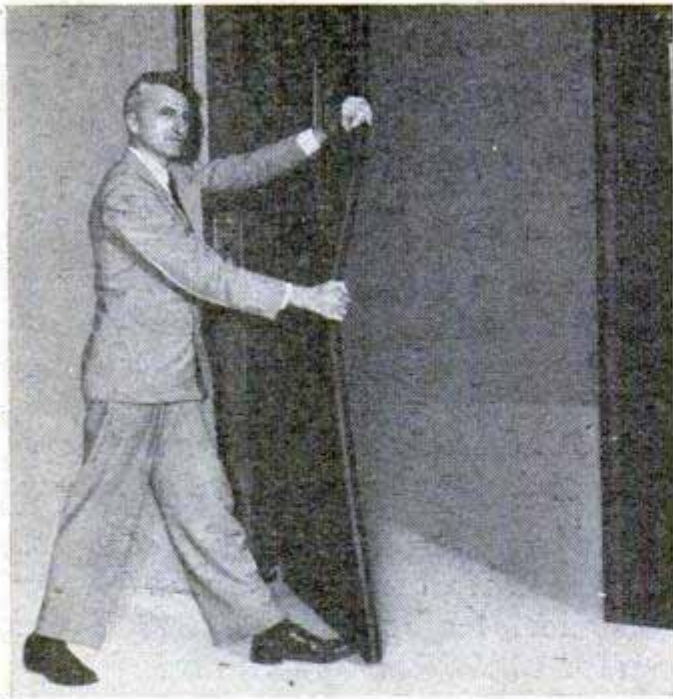
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- Oil Heaters
- Gas Heaters

Name

Street

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insulation value and can be bent to a 45-degree angle without damage. It consists of an outer layer of heavy cloth-inserted rubber covering a two-inch, rubber-tubing frame. Fifteen to 25 inflated rubber bladders run crosswise inside the facing, between rubber spacers, and are inflated by a hand pump through protruding valves. The complete assembly is suspended on hinges attached to steel strips running along one side. Though designed specifically for cold-storage warehouses, the door's design is believed applicable to hospitals and schools where ease of passage or absorption of shock is desired.

Rubber Swinging Door

Opening at the pressure of a finger, a new swinging rubber door for cold-storage warehouses is one third the weight of the conventional metal-protected wood type. It will eliminate the costly maintenance and damage of wood doors caused by power trucks banging into them. Though only 2½ inches thick, the new door has high

Fast Winker

With a range up to five miles, signaling searchlights for the U. S. Navy's newest-type minesweepers are equipped with a "Venetian blind" shutter capable of winking three times a second. Measuring 24 inches in diameter, the units use a carbon arc to produce a beam of over 50 million candlepower, according to Westinghouse engineers who are "tailor making" the searchlights. In tests, the units must be able to withstand drops ranging up to 40 feet and still continue to operate, in addition to passing the "shutter test," which requires a minimum of two million blinkings.



They're Such Fun and So Easy to Build!

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Fascinating nostalgic miniatures — so realistic they bring the early days of the automobile back to life! Get ALL 16 MODELS for your den, library, what-not corner or whoopee room! So authentic they are on display in famous museums. Length 6" to 10½" when completed. They come pre-fabricated with all ready-shaped die-cut parts, plastic cast-wheels, lamps, radiator, horn, etc. Authentic history with each car; also step-by-step instructions that a 10-year old can follow with ease! Parents and children love this educational and historical recreation. At toy, hobby and department stores. Nationally known; guaranteed money back if not satisfied. A grand hobby for all from 9 to 90; wonderful for shut-ins and convalescents. Start NOW — ORDER A COMPLETE SET!

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Selected for the Super-Powered

BUICK *XP-300*

...and for nearly as many new cars as all other makes combined

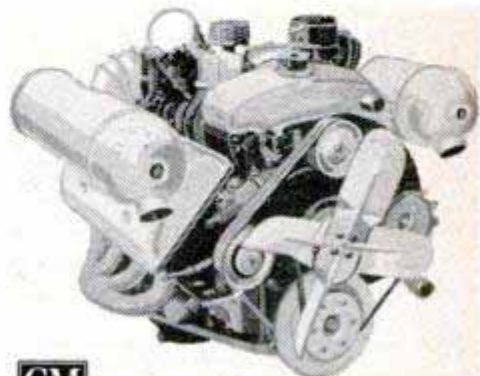
AC scores another triumph, with the selection of AC Spark Plugs to fire the 300 horsepower supercharged engine of Buick's "Dream Car," XP-300.

With its higher speed and extra high compression—using premium fuel up to 125 H.P. and methanol above 125 H.P.—the XP-300 develops terrific combustion chamber heat. No spark plug insulator before **CORALOX** could withstand it.

CORALOX, AC's patented Insulator, is the greatest contribution to spark plug efficiency in 40 years. It provides greater resistance to heat shock—better insulating qualities—greater resistance to fouling.

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BUICK'S XP-300 experimental masterpiece, with a host of ultramodern features, including a 300 horsepower high-compression V-type engine, sets the pattern for advanced performance, greater comfort and conveniences you may enjoy in the future.



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Rustproof Metal!

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Biologists in North Dakota catch ruffed grouse by "hypnotizing" them with the aid of a flashlight and a rocking tree! During the winter months, biologists of the state fish and game department tramp through the woods until they flush a bird. It flies into a tree. The biologist then aims a blinding beam of light from the flashlight at the grouse and, at the same time, rocks the tree back and forth until the bird becomes dizzy and falls to the ground. A net is tossed over the stunned bird, which is then transported to a distant part of the state where the grouse population is becoming depleted. Field biologist Wilford L. Miller, who developed the system, says the technique has been more successful than any other in capturing live grouse without injury.



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Sea-Net Mfg. Co.

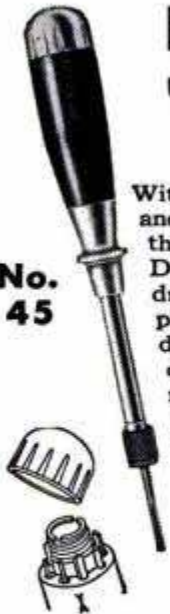
1428 Maple Avenue, Dept. PM-1, Los Angeles, 15, Calif.

1000-Year-Old Seeds Still Can Sprout

Shown to be over 1000 years old by the atomic calendar at the University of Chicago, ancient Manchurian lotus seeds are still able to sprout and grow. Dr. Willard F. Libby, professor of chemistry at the university's Institute of Nuclear Studies, measures minute amounts of naturally occurring, radioactive carbon 14 in archaeological findings. By computation he determines accurately their ages. The seeds, hard and pebblelike, had to be soaked in an acid solution to soften their tough skins before they could sprout. Other objects that Libby has dated include some Stone Age bones computed to be 12,000 years old, a Danish house built almost 10,000 years ago and the famed Biblical Dead Sea scrolls that were confirmed as being almost 2000 years old.

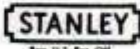
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Build a Small Atomic
Shelter for Your Family
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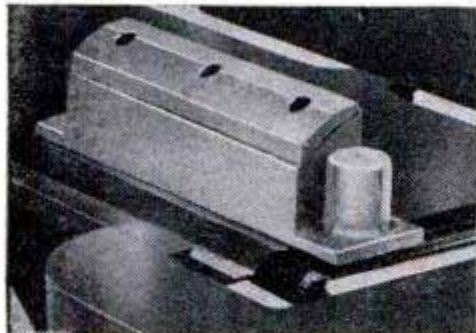
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Jig-gauge in place on back table

This combination sharpening jig and reinstallation gauge makes it easy for you to grind and reinstall your 4 and 6" jointer knives in fifteen minutes. All you need to do is install the grinding wheel in your drill press, put each knife in the jig, and pass it under the special cupped grinding wheel several times. Reinstallation is easy. The gauge—mounted on one end of the jig—tells you quickly and easily when the edge of the knife is exactly even with the top of the back jointer table.

Satisfaction GUARANTEED or your money back.

Sharpening jig with gauge, and grinding wheel complete with arbor

\$12.65

See your dealer or order direct. Postage paid on pre-paid orders.

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"Every man's a handyman with
PLASTIC WOOD"

Reset loose drawer pulls—

Replaces splintered wood . . .
makes loose screws firm!



Seal drafty cracks—

Fills openings easily . . . dries tight and hard!
Resists weather!

Repair loose tiles—

Holds tiles firm on wall!
Easy!



Also useful in filling cracks in floors, nail and screw holes, repairing broken toys.
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you're on the target with this
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AUTOMATIC
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THE AMERICAN WAY:**
To the hunter, this means con-
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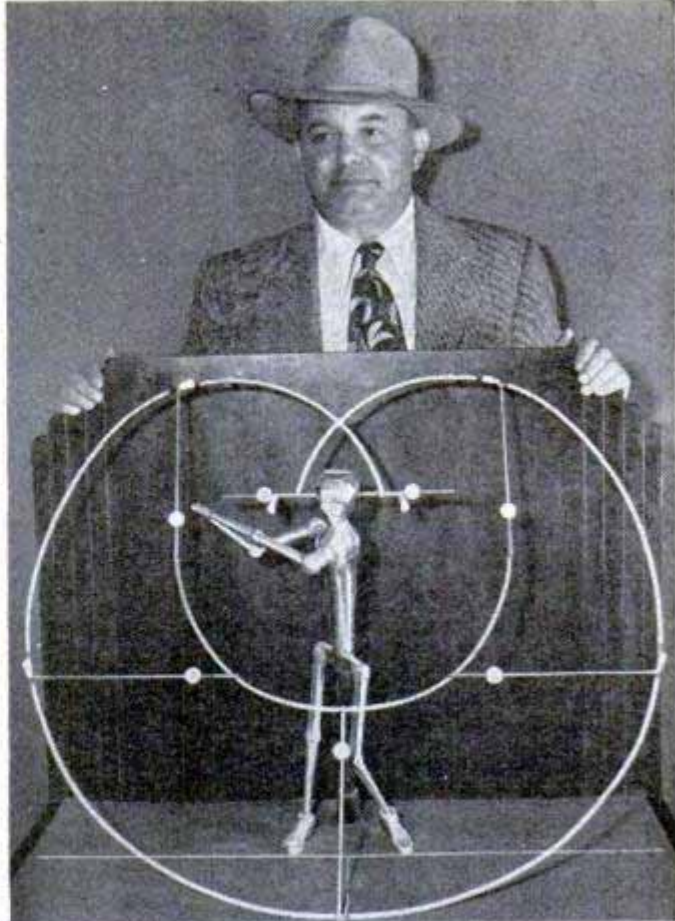
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Oscar Teaches Golf Swing

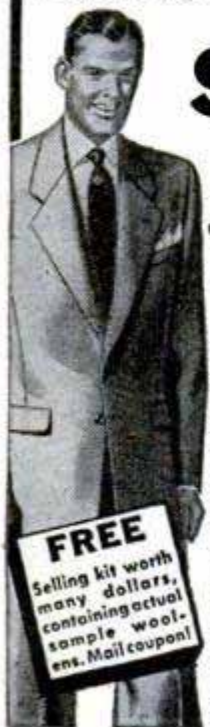
Oscar, a 19-inch-tall robot, helps instructors at Los Angeles' Sunset Fields Links demonstrate in slow motion the proper body positions throughout an entire golf swing. The aluminum-and-steel-golfer's hips, shoulders, arms and head are motor driven through coaxial tubular shafts. His precise motions and perfect timing are made possible by a series of compound gears and cams. Oscar's hands always move in the inclined plane of the swing, with the hips pivoting through 45 degrees and the shoulders through an arc of 90. His head remains in a fixed position—with eye on the ball—until the ball has left the club face, then it turns with the body.

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700-16 5.04	710-15 4.94	750-20 8.64	900-20 13.94		
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THIS GRADE MADE THE BLATT NAME "WORLD FAMOUS"

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700-16 7.94	700-15 6.54	700-20 11.94	1100-20 18.54
750-16 7.94	710-15 6.34	32x6(8) 10.54	1000-22 17.54
550-17 5.94	760-15 6.54	32x6(10) 13.92	1100-22 18.54
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ANY SIZE \$11

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Makes dull, tiresome jobs fun. With this professional, motor-driven, orbital-motion SpeedSander, you can quickly and easily re-surface and refinish furniture, woodwork, walls or metal . . . can sand-off old paint, stain, enamel, rust or corrosion; smooth rough plaster; or buff, burnish or rub to a "piano finish." Operates with wet or dry abrasives. Three 4 1/2" x 6 1/2" covers cut from 9"x11" sandpaper or abrasive sheet. Your local dealer will gladly demonstrate.

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Also see *Foley Saw Filer*, page 424, and *Foley Saw Retooler*, page 452

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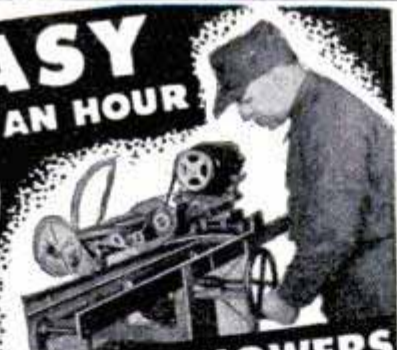


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AND
MORE
SHARPENING LAWN MOWERS**



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can the inside face and edge of the stationary blade, and all reel blades, be ground to proper clearance **ALL IN ONE SET-UP**

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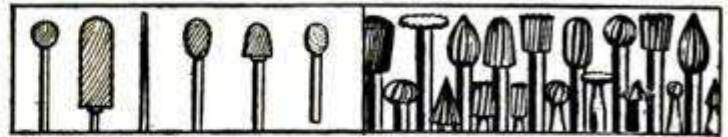
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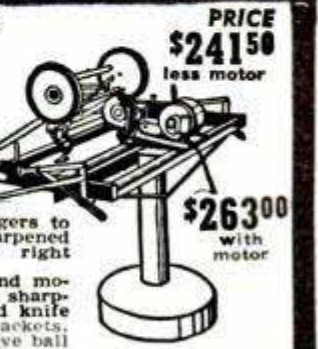
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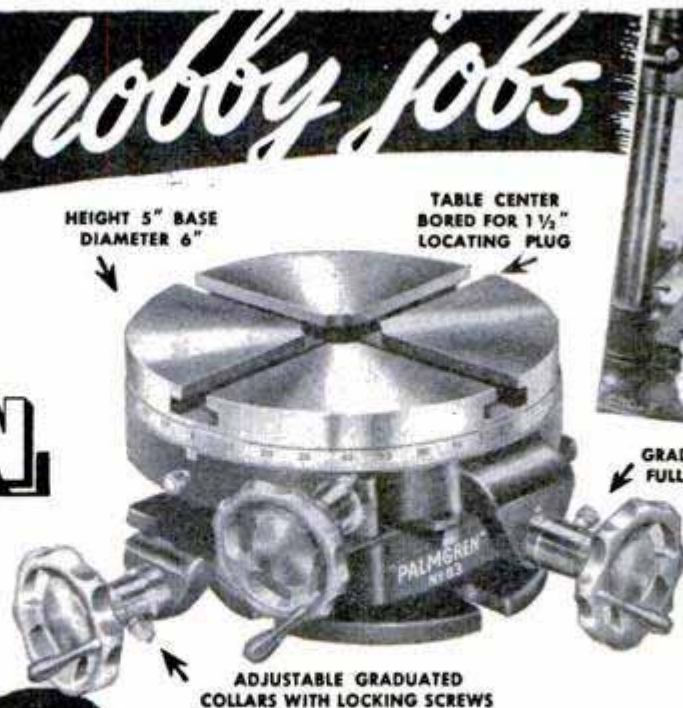
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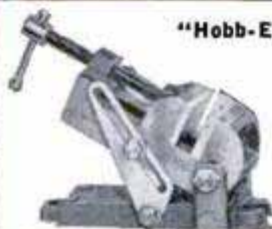
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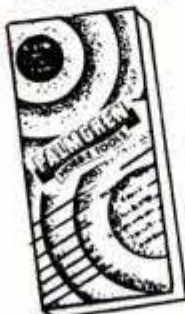


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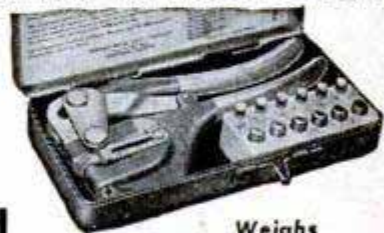
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37/64	20	4.00	17/64	9	4.00
39/64	6 1/4	1.05	1-7/8	8 1/2	4.00
47/64	3/4	1.57	1-5/32	6 1/2	3.75
49/64	4 1/4	1.64	1-11/64	7 1/4	3.95
13/16	4	1.82	1-7/32	8 1/2	4.14
13/16	22	8.00	1-15/64	7 1/2	4.51
55/64	5 1/2	2.02	1-21/64	5 1/2	5.38
7/8	4 1/4	2.02	1-11/32	9 1/2	5.38
57/64	5 1/4	2.12	1-15/32	8	6.13
15/16	9 3/4	2.20	1-17/32	7	7.16
15/16	5 1/4	4.00	1-11/16	12	9.13
61/64	4 1/7	2.42	1-3/4	5	6.00
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19/64	.48	7/16	.65
5/16	.48	29/64	.73
21/64	.50	15/32	.73
11/32	.50	31/64	.75
23/64	.55	37/64	.90
3/8	.55	17/32	.90

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17/32	.91	7/8	2.25
37/64	1.24	57/64	2.25
19/32	1.24	59/64	2.40
39/64	1.30	15/16	2.43
41/64	1.43	31/32	2.50
21/32	1.43	1-1/32	2.80
43/64	1.55	1-1/16	3.05
23/32	1.70	1-5/64	3.56
47/64	1.80	1-3/32	3.60
49/64	1.80	1-7/64	3.60
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1/4-NC or NF	.26	3/4-NF	.80
5/16-NC or NF	.29	1-NF	1.25
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7/16-NC or NF	.35	3/8 pipe	.50
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9/16-NC	.60	3/4 pipe	1.25

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3"x1/2"x1/4" arbor 60-grit wheels	30c ea.
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2 1/4"x1"x5/16" arbor 80-grit vitrified bond wheels	35c ea.
2 1/4"x1 1/2"x1/2" arbor 60-grit red wheel	25c ea.
2 3/4"x3/8"x1/2" arbor 40-grit red wheel	30c ea.
4"x1/2"x1/2" arbor Norton 130-grit wheel	65c ea.
8"x1 1/2"x1/2" arbor cut-off wheel	70c ea.
6"x1/4"x5/8" arbor A303-S-B7 wheel	50c ea.
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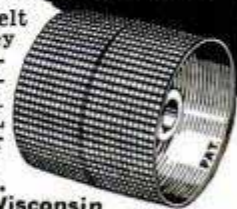
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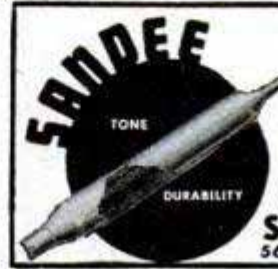
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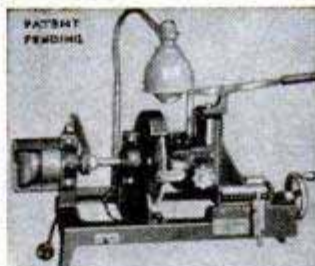
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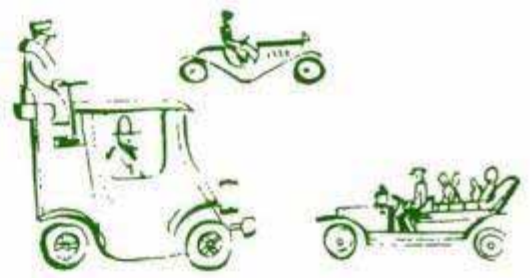
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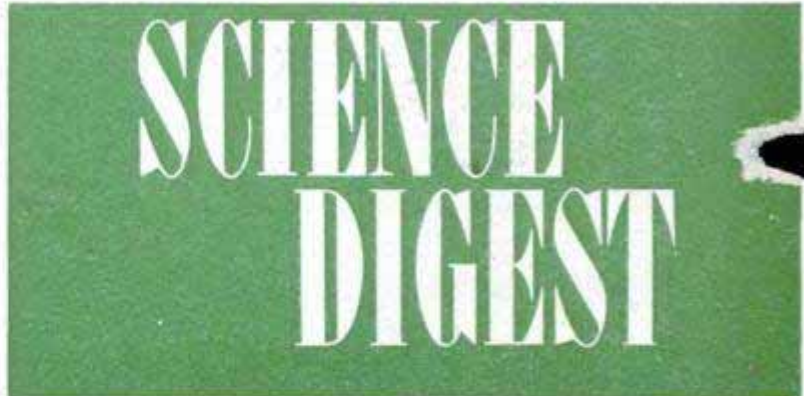
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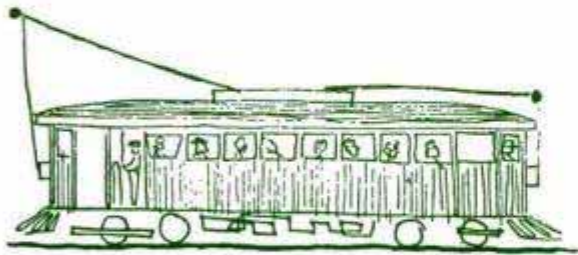
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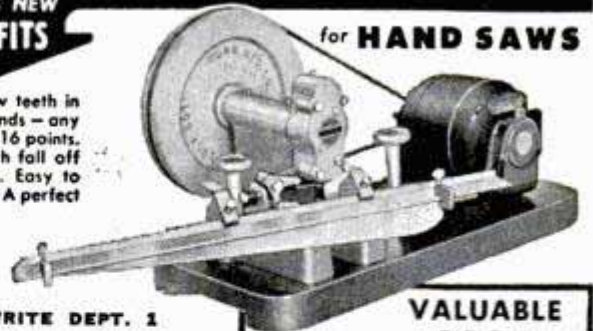


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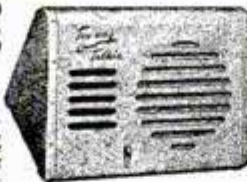
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DELTA
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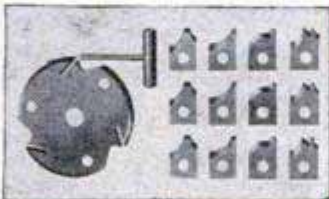
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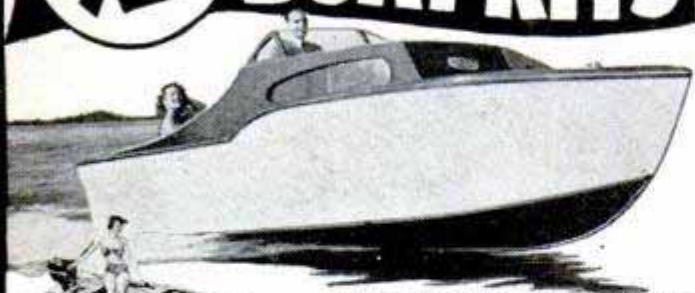
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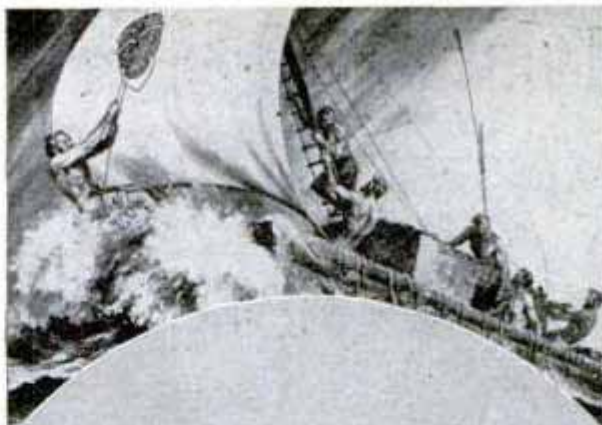
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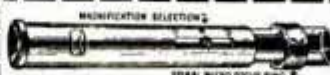


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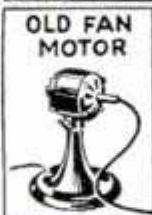
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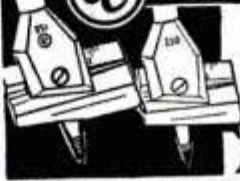
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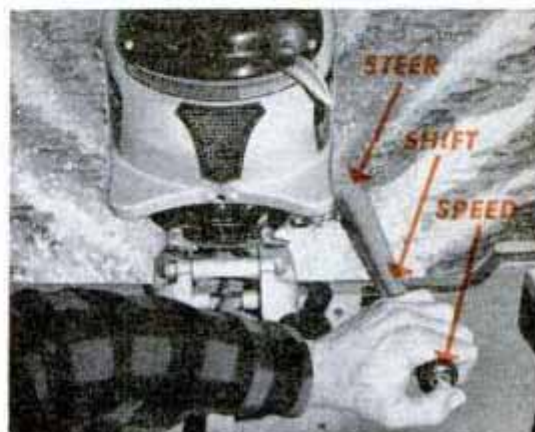
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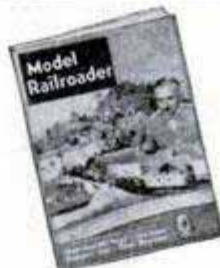


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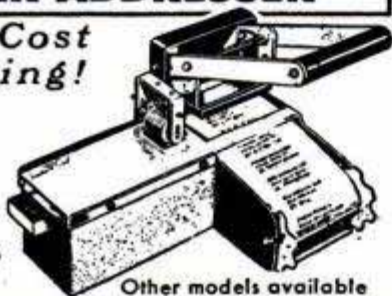
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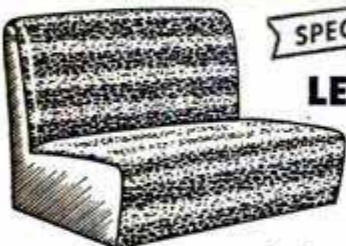
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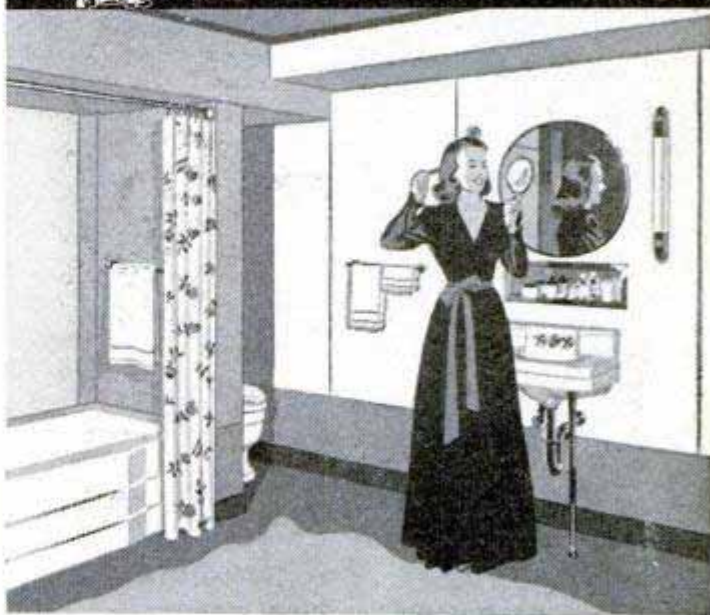
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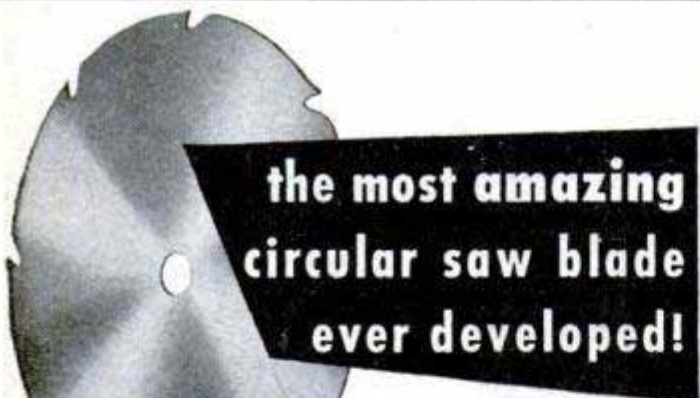


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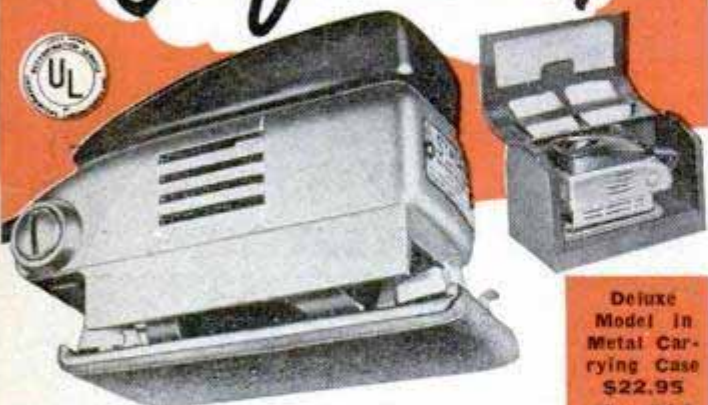
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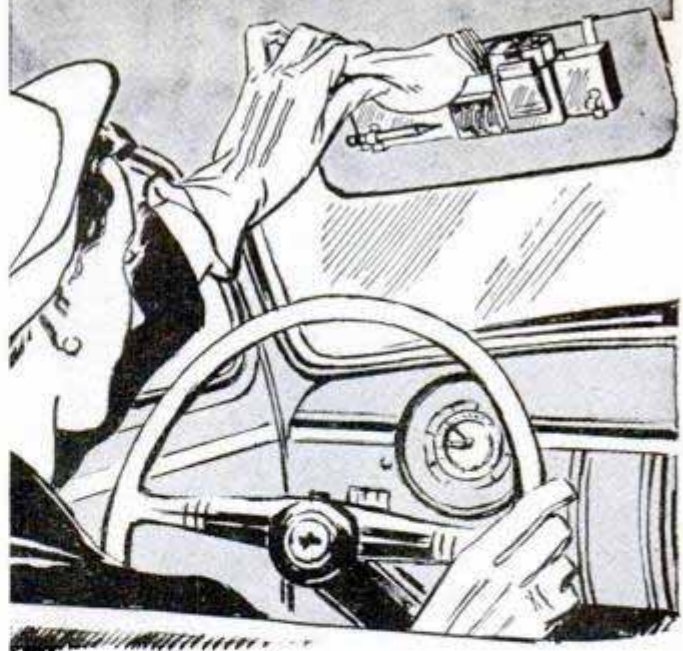
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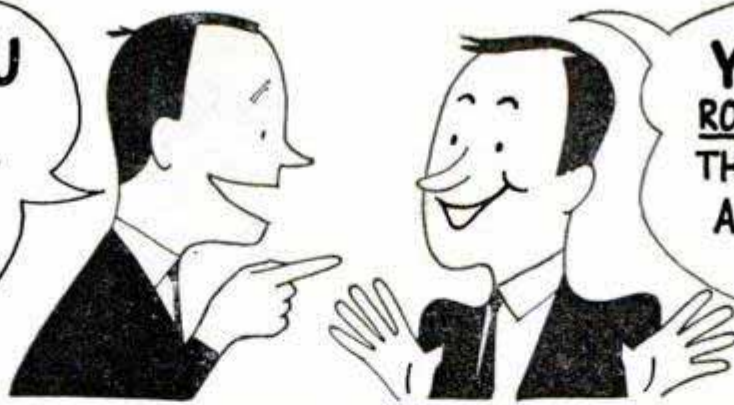
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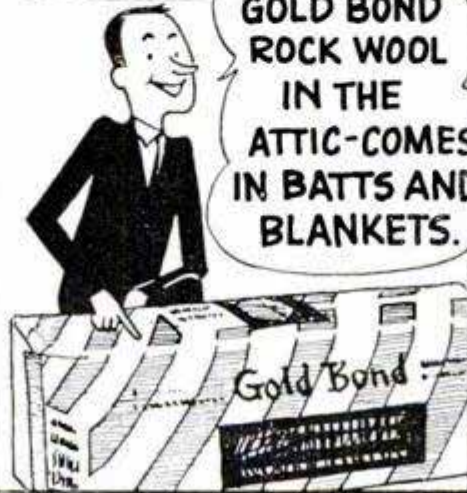


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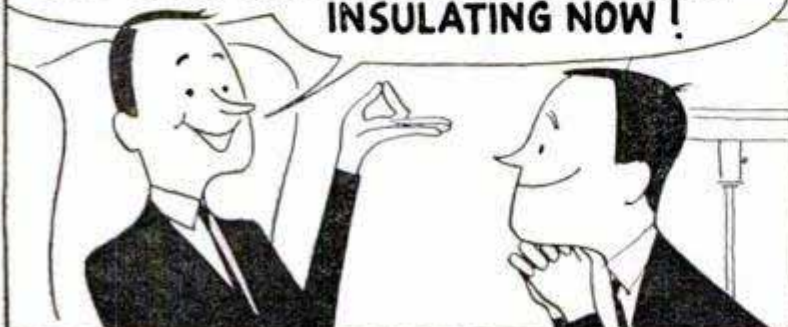
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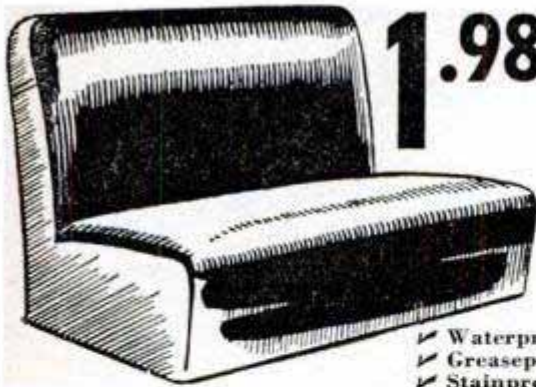
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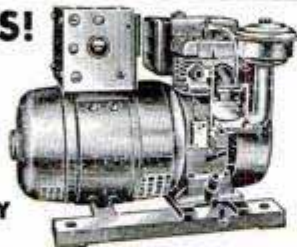
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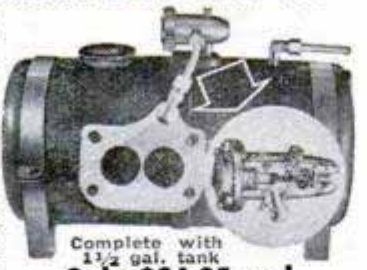
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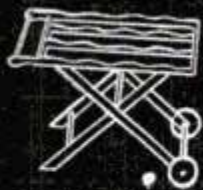
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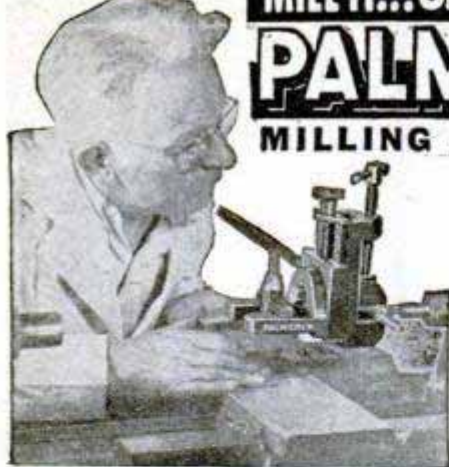
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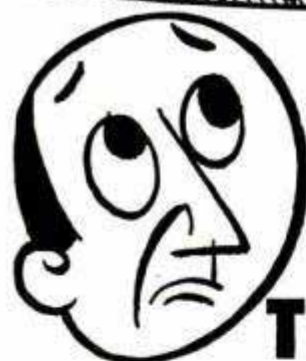
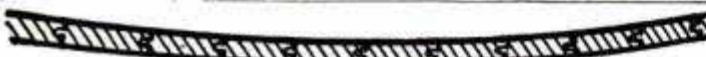
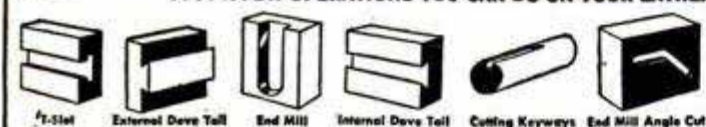
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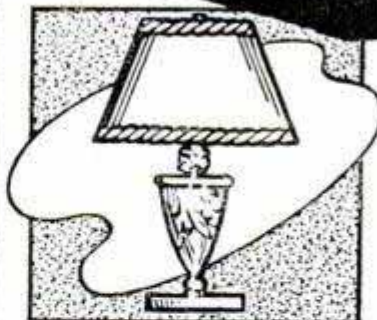
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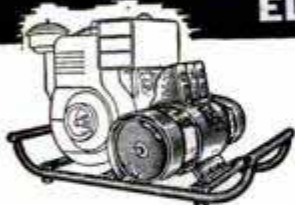
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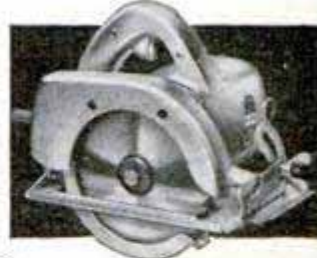
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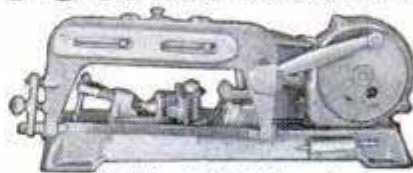


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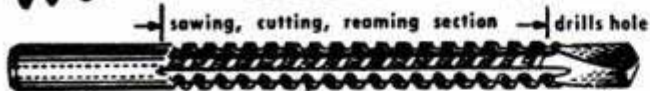
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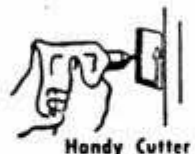
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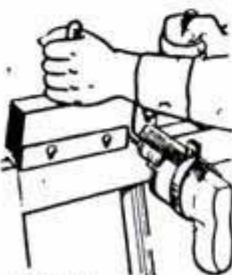
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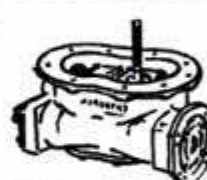
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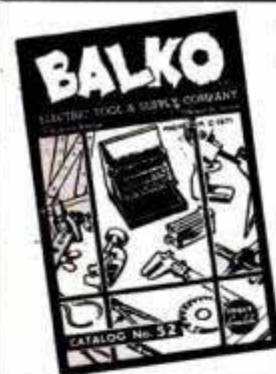
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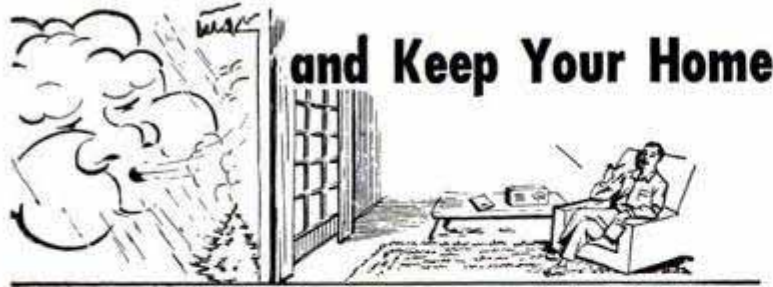
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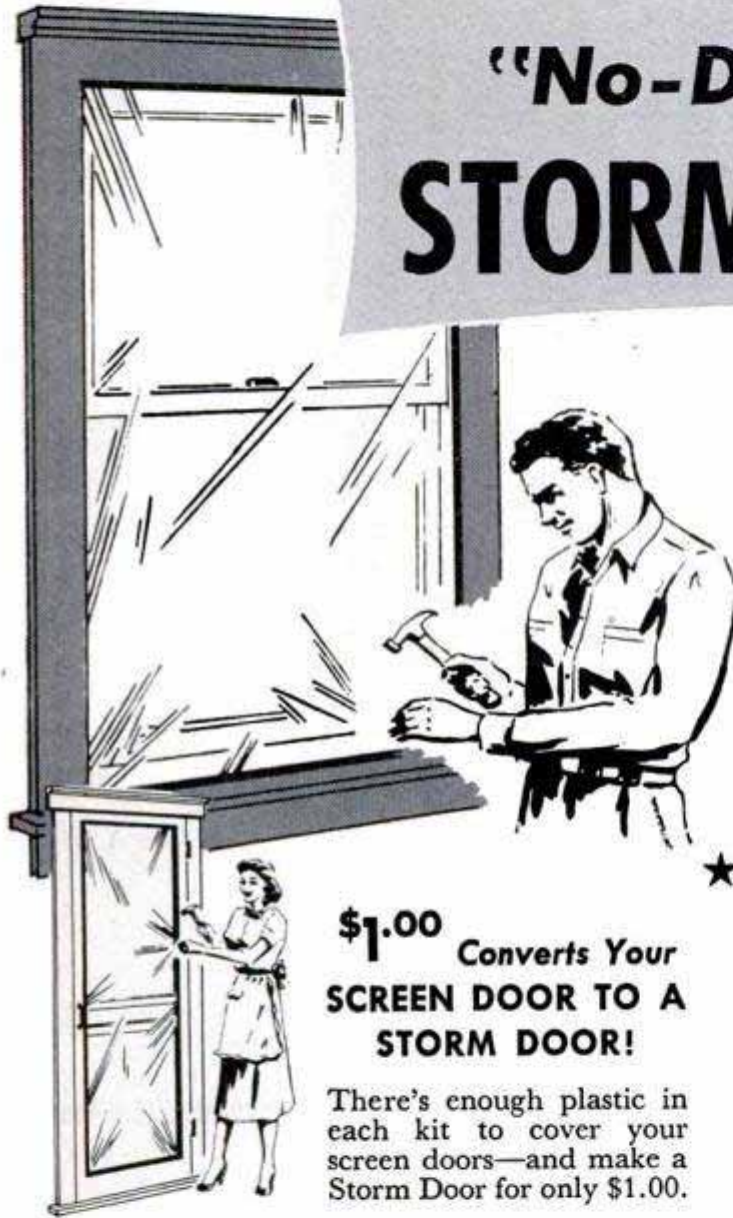


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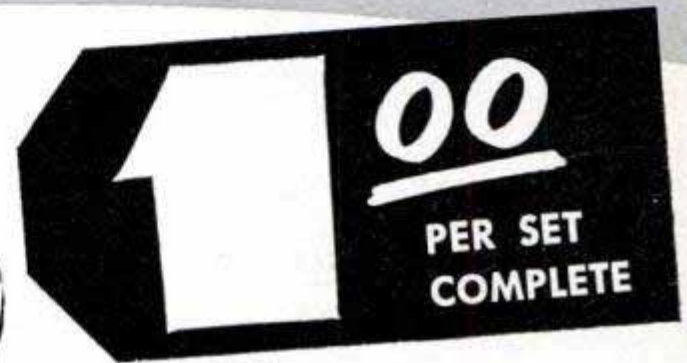
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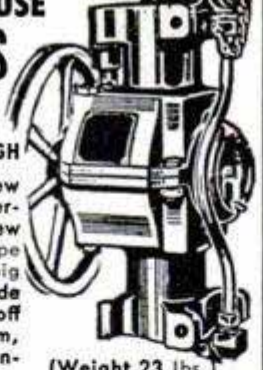
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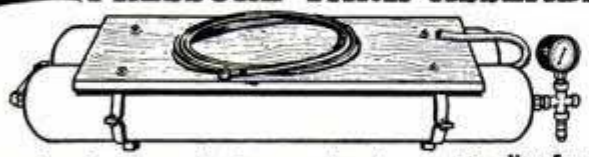
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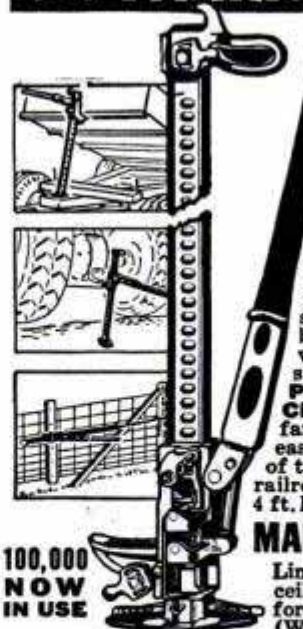
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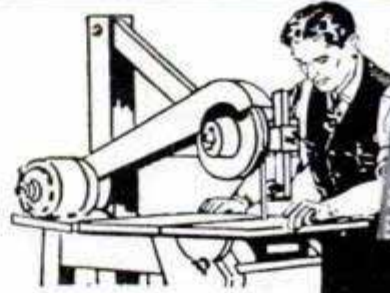
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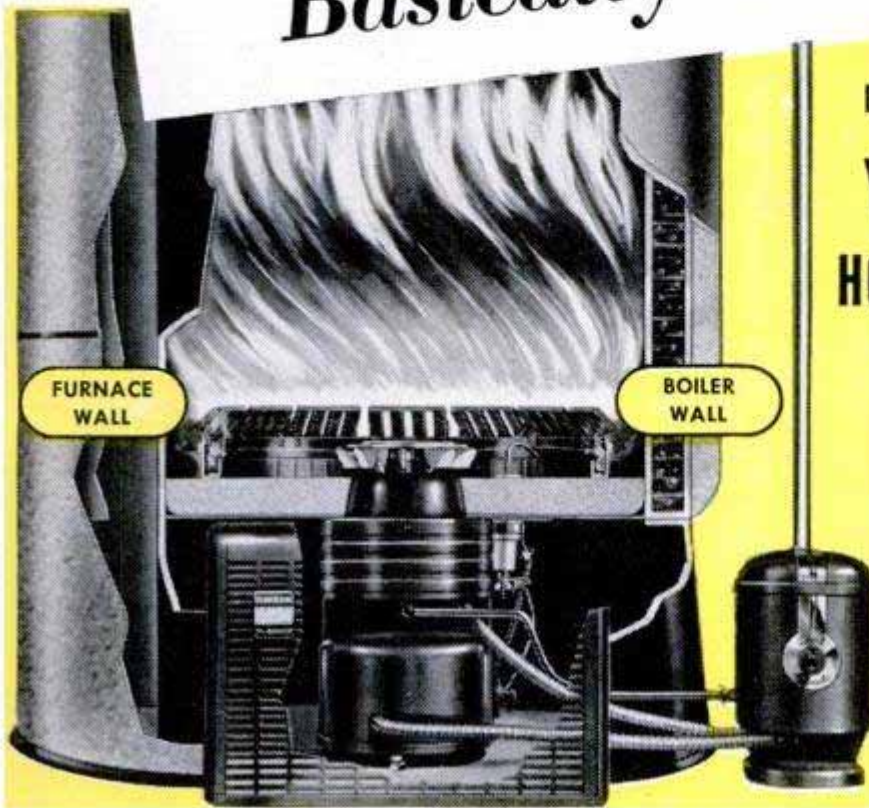
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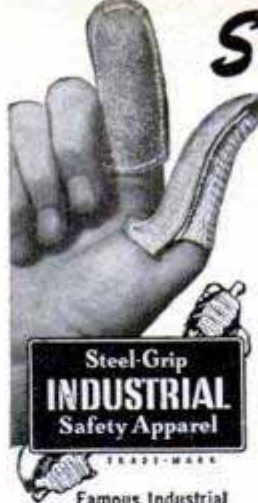
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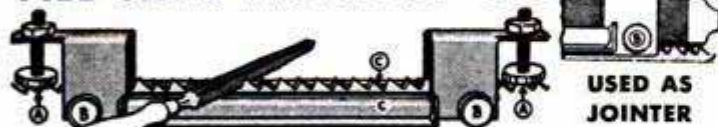
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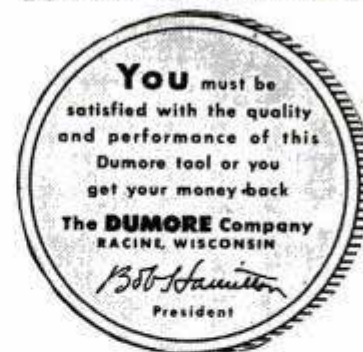
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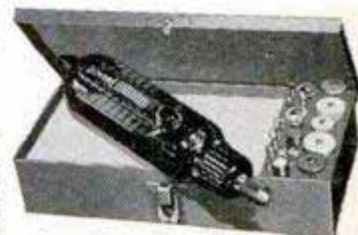
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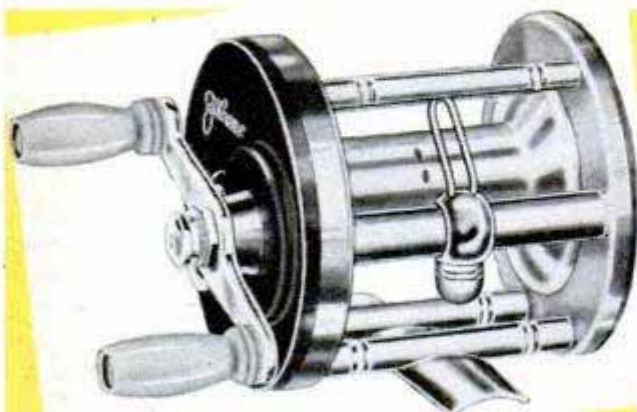
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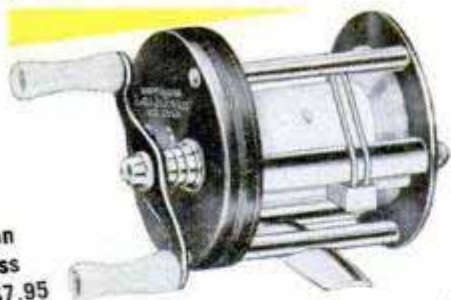
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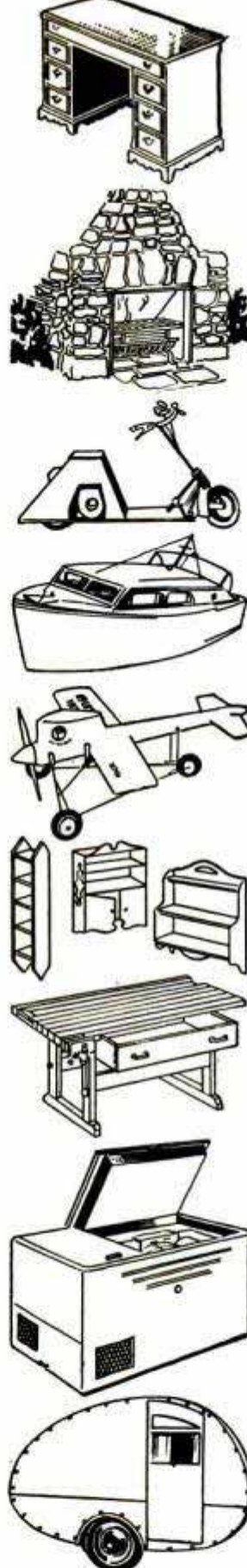
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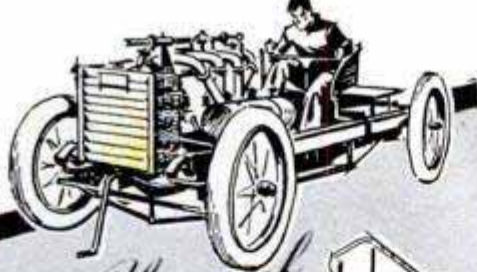
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1903 Barney Oldfield lowers track record at Indianapolis.

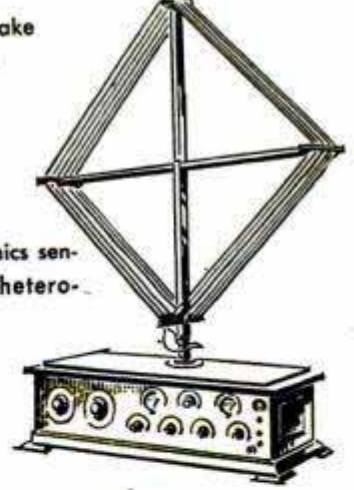


1909

Wright Brothers make new flight record.

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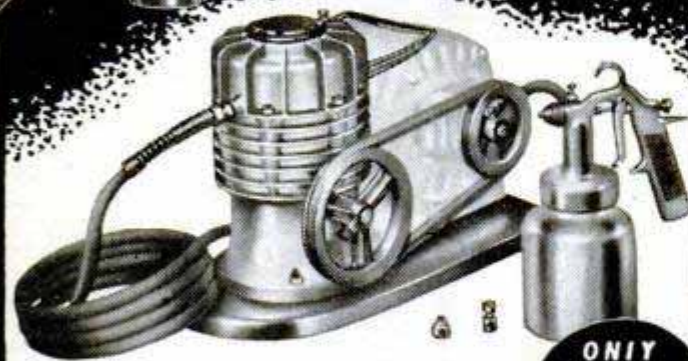
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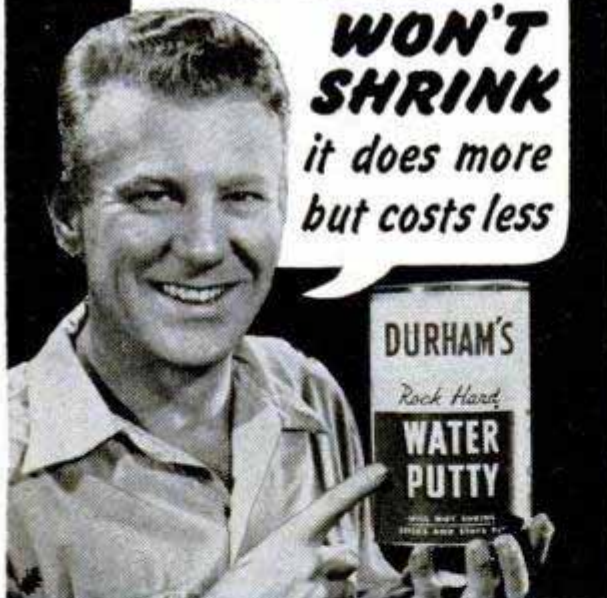
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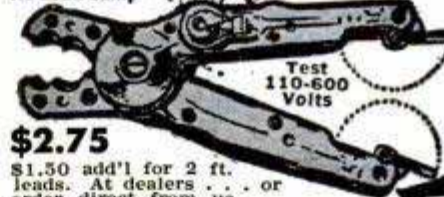
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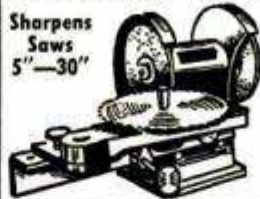
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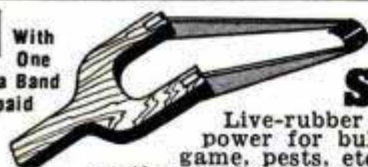
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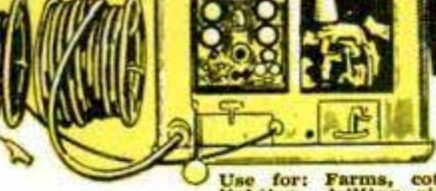
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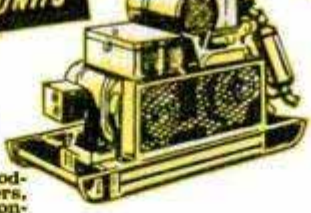


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FREE Book on Painting

Get this illustrated 24-page book absolutely free. Full of facts on how to get better results with aluminum paint—which type to use for different jobs. Absolutely no obligation—just write:

ALUMINUM COMPANY OF AMERICA 1718A GULF BLDG., PITTSBURGH 19, PA.

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One knife that CUTS EVERYTHING!

Craftsmen, Hobbyists, Home Mechanics hail this knife as the most valuable tool ever devised. Four interchangeable blades will cut everything from paper to 1/2" wallboard. Cuts all types of material. Yours... the Lockwood All-Purpose Knife with 2 blades of each style, (8 in all) for only **\$1.98** POSTPAID

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Groban's WAR SURPLUS ELECTRIC PLANTS

IMMEDIATE DELIVERY • LARGE STOCK • MANY SIZES
ALL UNITS BRAND NEW

PREPARE NOW FOR ANY EMERGENCY

Plenty of general utility and emergency stand-by power to operate your Oil Burner, Home Freezer, Lights, Milking Machines, Power Tools, Pumps, Water System, Construction Equipment, Tourist Cabins, Schools and Institutions, etc. NOW AVAILABLE at unsurpassed Bargain Prices!



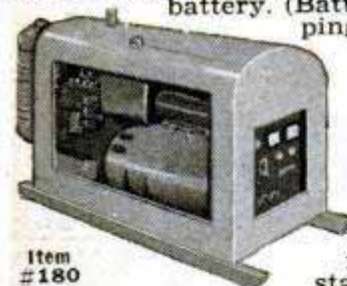
Item #183

Item #183 — Type M5-3KW-3.75 KVA-125 VOLT-60 Cycle AC, 130 Volt - 50 Cycle AC 3 phase, Hobart generator direct coupled to Hercules Model ZXB, 4 cylinder water cooled engine with push button start. Control panel equipped with full set of engine and generator instruments. Utility double receptacle mounted on side of generator. Two-wire single phase lines for supplying power to lights, oil burner, pump, etc., may be connected direct to terminal board. Use standard 6 volt car battery. (Battery not included.) Shipping wt. 600 lbs. F.O.B. **465.00 Chgo.**

Item #182—Type PE-95, 5 KW - 120/240 Volt - 52.5/26 Amp.-60 Cycle A.C.-single phase Onan generator direct coupled to Willys Jeep, 4 cylinder, water cooled engine, with push button start, battery ignition. Has provisions for remote starting and stopping. Use standard 6 volt battery. (Battery not included). Shipping Wt. 1200 lbs. **795.00 F.O.B. Chgo.**



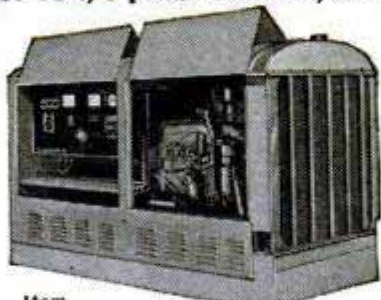
Item #182



Item #180

Item #180—15 KW-127/220 volt-60 cycle AC-3 phase 1800 RPM. Brance & Krachy Generator direct coupled to International Harvester 4 cylinder, water cooled engine with magneto ignition — push button start. Panel has voltmeter, ammeter, 4-wire electrical system, belt driven excitor generator, rheostat voltage control. Engine and generator mounted on steel skids. Shipping weight 2000 lbs. **1650.00 F.O.B. Chicago**

Item #128—25 KVA-250 volt, 3 phase-120 volt, single phase - 60 cycle. Totally enclosed - Hobart generator driven by a GMC 270, 6 cylinder gas engine, button start, liquid cooled. Has control panel with full set of instruments for both engine and generator. Shipping weight 2600 lbs. **2250.00 F.O.B. Chgo.**



Item #128

ASK FOR FREE INFORMATION on other size generating plants ranging from 350 watts to 25 KVA. Write, Wire or Phone WEBster 9-3793

GROBAN SUPPLY CO. Dept. PM-1
1139 S. WABASH AVE., CHICAGO 5, ILL.

CHECK BATTERY CONDITION

without leaving the driver's seat!
DETECTO-CELL



Amazing, instant visual check on battery strength, condition of cells, need for service!

Saves Money by Prolonging Battery Life...

Add as much as 70% to battery life! DETECTO-CELL shows instantly — in glowing lights — battery strength, condition of each cell, water levels, warns of battery weakness in time to prevent failure. No more unexpected dead batteries, no more needless, costly replacements!

Works with any 3 cell battery, on any car. Simple installation, takes just a few minutes and ordinary hand tools. No moving parts, fool-proof operation. Will last life of your car, or longer. Send check or money order today!

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SUMP PUMPS

2,400 GALLON CAPACITY

1 1/4" outlet — No screen to clog — fool proof

The time tested Lokomona sump pump is absolutely automatic — has a special fool-proof trap at the intake—oilless bearing at the bottom. Made of aluminum castings, it's 4 1/2" high and carries a 1/4 H.P. 110 V. A.C. heavy duty motor. The pump is designed for continuous service. Enclosed switch. All parts always available. Order yours today. C.O.D. If cash with order, we pay postage.

MONEY BACK GUARANTEE
LOKOMONA PUMP CO., P.O. BOX 86, ROYAL OAK 1, MICH.

\$44.50 COMPLETE
\$26.00 LESS MOTOR
\$22.50 PUMP ONLY

BIG LEATHER & CRAFT CATALOG!

1000's of items for Leathercraft, Textile Painting, Copper Tooling, Kits, Projects, Tools, Supplies, Etc. Send 25c (refunded with 1st order) to:

RUSSO HANDICRAFT SUPPLIES Dept. CD-7, 245 S. SPRING, LOS ANGELES 12, CALIF.

Only **\$27.50** other models to \$44.

Amazing NEW! SHAPE-AWL
FILE • SAW • SHAPE • ON YOUR DRILL PRESS!

PACIFIC MACHINE TOOL CO. 5447 SAN FERNANDO RD. WEST, LOS ANGELES, 39 CALIF.

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"BARGAIN BOOK"



SAVE ON WINTER NEEDS!

It's loaded with bargains in genuine Gov't Surplus for farm-home-industry. Save up to 85% on clothing, hardware, sporting goods, etc. The "Book of the Year". Send 10c for yours today.

MAIL TODAY Only **10c**

500 BARGAINS!
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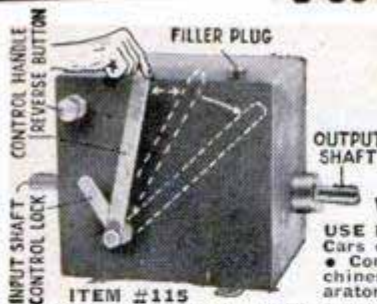
FISLER SALES CO.

723 WALNUT ST., DESK M-1, KANSAS CITY, MO.

SAVE ON THESE BRAND NEW

WAR SURPLUS SPECIALS

UNCONDITIONALLY GUARANTEED



HYDRAULIC SPEED REDUCER

with FINGERTIP CONTROL

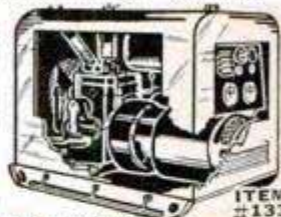
USE FOR: Reamer Drives • Midget Cars • Feed Mills • Canning Machines • Conveyors • Lathes • Milling Machines • Motor Boats • Cream Separators • Garden Tractors • Pumps

Variable output speeds ranging from 0 to input speed now available. Merely move control handle until desired speed is attained. Then turn locking handle to maintain the setting. Internal relief valves prevent overloading. Use input power of 1/4 to 1 1/2 H.P. This Westinghouse-Oil Gear Unit converted to commercial use from 40 MM anti-aircraft traversing mechanisms consists of a variable displacement hydraulic pump feeding a fixed displacement hydraulic motor. These components are contained in a crackle-finish steel oil reservoir (capacity 2 qts.). Adjustable relief valves set at factory for 100 inch pounds of torque may be reset up to 180 inch pounds. Independent reverse control allows full output power and speed selection in either direction of rotation. Both input and output shafts measure 5/8" diam., include keyway. Input rotation is counter-clockwise facing shaft. Recommended input speed not to exceed 750 R.P.M. Over-all dimensions 7 1/2"x7 1/2"x11 1/2". Gov't. acquisition cost, \$428.00. Shipping weight 31 lbs. Complete with 2 qts. of oil and full instructions. F.O.B. Chicago

54.50

IMMEDIATE DELIVERY - LARGE STOCK - MANY SIZES. GENERATING PLANTS

DESIGNED FOR CONTINUOUS OR INTERMITTENT SERVICE
PREPARE NOW FOR POWER FAILURE!
 PLENTY OF CURRENT TO OPERATE YOUR • OIL BURNER • REFRIGERATOR • HOME FREEZER • SUMP PUMP • POWER SAW • BROODER • CREAM SEPARATOR • INCUBATOR • VENTILATING FANS • MILKING MACHINES • BLOWERS • YARD LIGHTING • OTHER APPLIANCES



Item # 133 - 3 KW - 120 Volt

60 Cycle A.C. Single Phase HEAVY DUTY

Totally enclosed power unit with 2 cylinder water-cooled Hercules Model BXB engine direct coupled to generator. Magneto ignition, crank start, 4 gallon gas tank, 3 qt. oil capacity. Skid mounted with handrails for carrying. Instrument panel including killer button, oil pressure, water temp. gauges, voltmeter, ammeter.

Shipping wt. 560 lbs. F.O.B. **395.00**

Chicago
 ITEM #178—350 watt—110 volt—60 cycle A.C. direct coupled to 1 cylinder Midco engine. Shpg. wt. 116 lbs. F.O.B. Chicago **125.00**



AIRCRAFT QUALITY HYDRAULIC EQUIPMENT

HEAVY DUTY - Large supply of new labor-saving, economical hydraulic equipment in many types and sizes. Use these positive, highly efficient smooth pressure hydraulics on presses, arborers, lifts, loaders, power control, positioning, brakes, plastic dies, auto frame alignment, etc. etc.



ITEM #70—Purolator hydraulic oil filter. Permanent element type. 3/8" female pipe thread ports. Capacity 16 gallons per minute. A \$13.00

ITEM #127—Double acting hydraulic cylinder, 1" bore, 1" stroke, 1/2" diam. shaft, 1/4" tubing thread ports. Over-all length closed 6 1/2". Clevis mounting at both ends. Perfect for clamping and feeding. Postpaid **4.95**

ITEM #33C—Double action hydraulic cylinder, 1 1/2" bore, 4 1/2" stroke. Clevis mountings at both ends. Uses 1/4" pipe fittings. Postpaid **5.95**

ITEM #16C—Double acting hydraulic cylinder, 1 1/2" bore, 26" stroke. Will lift 1760 lbs. with 1000 PSI line pressure. Weight 8 lbs. A \$55.00 **8.95**

ITEM #126—Four-way, open center control valve with built-in adjustable relief valve. Factory set at 1000 P.S.I., spring loaded neutral position, for use with one double acting cylinder. Fully balanced plunger type, smooth, positive, easy operation, can be used as single unit or mounted in series of any combinations desired. Has 3/4" pipe thread inlet and outlet, 1/2" pipe thread cylinder ports. Newly manufactured to our specifications. Shipping weight 8 1/4 lbs. An outstanding buy! F.O.B. Chicago **16.95**

ITEM #103—Double acting hydraulic cylinder, 2 1/2" bore, 17" stroke. Clevis mounting. Will lift 4900 lbs. with 1000 PSI line pressure. 1 1/4" diam. shaft, 3/8" tubing thread ports. Overall length closed 28". Shpg. wt. 11 lbs. F.O.B. Chicago **21.50**

ITEM #6—Double action hydraulic cylinder, 3" bore, 24" stroke, will lift 7070 lbs. with 1000 PSI line pressure. Steel barrel, 1 1/4" stainless steel shaft. Gov't. acq. cost \$176.00. Ship. wt. 26 lbs. F.O.B. Chicago **28.00**

ITEM #42—Double action hydraulic cylinder, 4" bore, 18" stroke. Rated lift capacity with 1000 PSI line pressure is 12,500 lbs. Ship. wt. 30 lbs. F.O.B. Chicago. An Excellent Buy for **32.50**

ITEM #29KJ—Gear Type Hydraulic Pump. Ideal in industrial applications and for operating all hydraulically powered farm implements including loaders, stackers, swathers, plows, etc. Delivers 1000 PSI (may be set at lower PSI if desired), 12 GPM at 400 RPM. Maximum operating speed 800 RPM - rotation counter clockwise. Has built in relief valve, permanent or torque bar mounting, 1" diameter shaft, 3/4" pipe tap inlet, 1/2" pipe tap outlet. Shipping weight 22 lbs. F.O.B. Chicago **45.50**



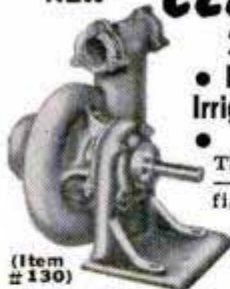
GENERAL MOTORS - ALLISON

BRAND NEW

CENTRIFUGAL PUMP

200 GALLONS PER MINUTE

- For Draining Basements • Fire-Fighting • Irrigation • Fuel Transfer • Swimming Pools
- Home Water Systems • Dewatering



This General Motors-Allison Centrifugal Pump—designed for use on U. S. Air Force Mustang fighters, now converted for commercial, home, and industrial high volume pumping applications. Inlet, 2 1/2" standard pipe thread, twin outlets with 1 1/4" pipe thread, ball bearing supported 3/4" shaft. Easy, fast simple priming. Rotation, counter-clockwise facing shaft. Shipping wt. 35 lbs. Gov't. acq. cost \$145.00. F.O.B. Chicago **39.50**

Suction Lift	Head Pressure	Gal. Per Min.	H.P.	R.P.M.
10'	75'	260	6.0	3500
10'	65'	200	5.2	3500
10'	80'	40	1.5	2500
10'	50'	140	5.0	3500
10'	30'	100	3.0	2500

D.C. GENERATORS

For welders, plating, truck and marine use, D. C. appliances, lights, etc. Aircraft quality—lifetime grease sealed ball bearings. Heavy duty.



ITEM #90—Type P-1, rated 200 Amps.—28 Volts, 2500 RPM. Mfd. by General Electric, Ford, Delco-Remy and Westinghouse. Gov't. Acq. Cost \$300.00. Shpg. wt., 53 lbs. F.O.B. Chicago. **22.50**
 ITEM #91—Type R-1, rated 300 Amps.—30 Volts. Mfd. by Jack & Heintz. Gov't Acq. Cost \$380.00. Shpg. wt. 59 lbs. F.O.B. Chicago. Each individually packed in wooden box. **35.00**

NEW MODEL 353 - DUAL RANGE

ARC WELDER

for Stationary or Portable Use
 HEAVY DUTY RANGE TO 250 AMPS.

NEW 'MAGIC TERMINAL'
 FOR LOW CURRENT
 30 TO 100 AMPS.

IDEAL FOR
 • FARM • GARAGE
 • FACTORY • WORKSHOP



These precision engineered D. C. Arc Welders contain the highest quality War Surplus aircraft components built to exacting government specifications. They are light in weight, have oversized lifetime grease-sealed ball bearings, air cooled commutator, dial type rheostat for easy pin-point control, a high-low rheostat switch, reactor coil for even arc and the new 'MAGIC TERMINAL' low current welding range for welding lighter materials. Designed for many years of trouble-free service. Run welder from drive pulley or power take off of a tractor or Jeep. 7 1/2 HP electric motor or 10 HP gas engine at 2500 R.P.M. Uses two V belts or flat belt. Continuous output rating 200 amps. Intermittent welding rating 250 amps, 30 volts. This sensational price includes double V or flat belt pulley and complete operating instructions. Shipping weight 107 lbs. \$350.00 Value, Item #65 Now Only **119.50** F.O.B. Chicago

VICKERS - PISTON TYPE HYDRAULIC PUMP

Ideal for use with hydraulic cylinders and valves described in this page ad. Vickers constant displacement piston type pump delivers .507 cubic inches per revolution, 8 gallons per minute at 3750 RPM, 1000 PSI. Has 1 1/2" diam. shaft, 3/4"-18 thread inlet and outlet ports. Rotation—clockwise. Postpaid. **19.90**

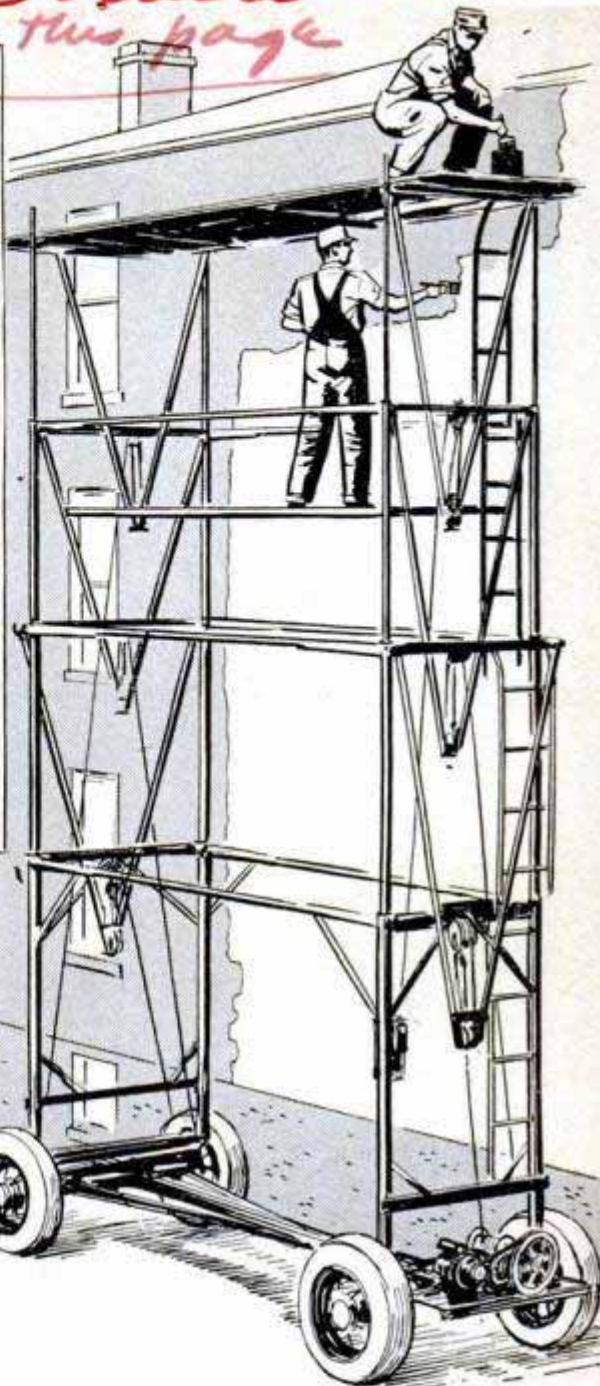
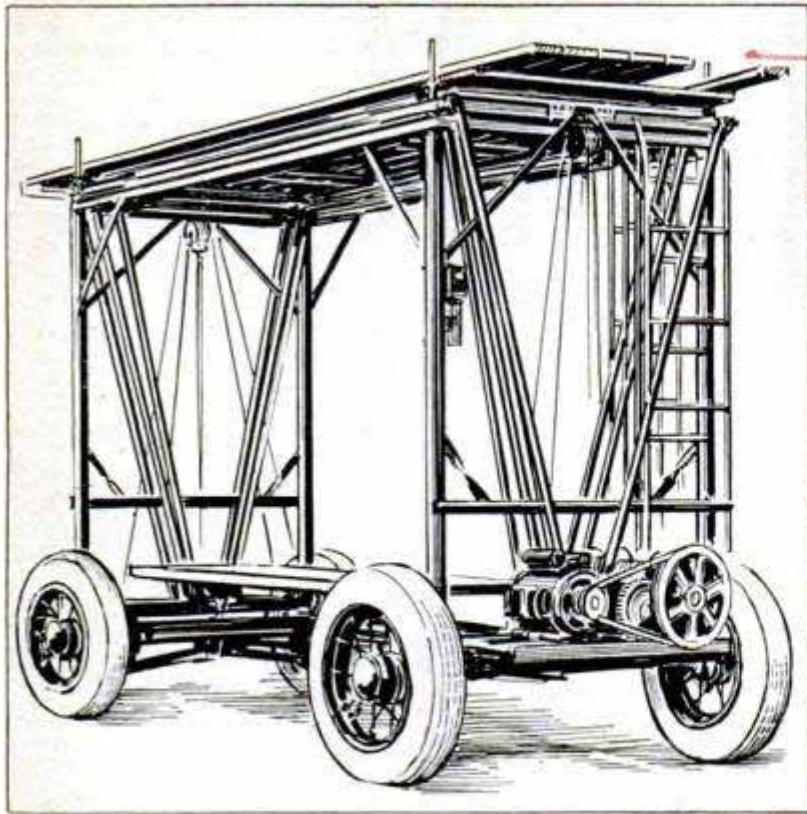


FREE: NEW 1952, 48-PAGE CATALOG jam-packed with Brand New War Surplus Bargains for the farm, home, factory and workshop. Write for yours today. WRITE, WIRE or PHONE Webster 9-3793

ORDER DIRECT FROM AD - SEND PAYMENT OR PURCHASE ORDER TODAY - SATISFACTION GUARANTEED

GROBAN SUPPLY CO. 1139 SO. WABASH AVE., CHICAGO 5, ILL. DEPT. PM-1

Carroll's illustration of this page



Telescoping Scaffold

Powered by an electric motor, a telescoping scaffolding raises itself at the flip of a switch. It can be made in various sizes to extend to almost unlimited heights. The scaffolding is "pushed" rather than pulled upward. A pulley arrangement pushes the second section into the air from within the legs of the first section. As the second section moves upward, it pushes the third and so on until the desired height is reached. A small model for painters and plasterers operates on the same principle, but by hand.

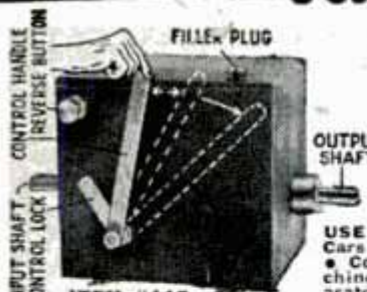
Inlaid Table Top Has Wood From Every Nation in World



Every remote corner of the world will be represented by a wood chip in a table top being built by Joe Schuld of Kingston, Pa. Schuld began collecting wood specimens 10 years ago and now has 1000 different types, with at least one piece from every country in the world. His table top will be inlaid with hundreds of small wood diamonds arranged in the shape of an eight-pointed star. It will show all the colors found in natural wood, from dark brown to red, from yellow to green and white. Schuld also has constructed a map of the United States, with a specimen of wood from each state, and a map of Pennsylvania with samples from each county.

HYDRAULIC SPEED REDUCER

with FINGERTIP CONTROL

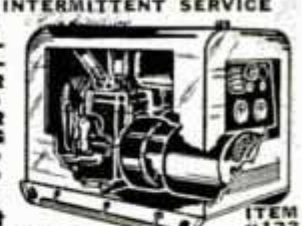


ITEM #115
 Variable output speeds ranging from 0 to input speed now available. Merely move control handle until desired speed is attained. Then turn locking handle to maintain the setting. Internal relief valves prevent overloading. Use input power of 1/4 to 1 1/2 H.P. This Westinghouse-Oil Gear Unit converted to commercial use from 40 MM anti-aircraft traversing mechanisms consists of a variable displacement hydraulic pump feeding a fixed displacement hydraulic motor. These components are contained in a crackle-finish steel oil reservoir (capacity 2 qts.). Adjustable relief valves set at factory for 100 inch pounds of torque may be reset up to 180 inch pounds. Independent reverse control allows full output power and speed selection in either direction of rotation. Both input and output shafts measure 5/8" diam., include keyway. Input rotation is counter-clockwise facing shaft. Recommended input speed not to exceed 750 R.P.M. Over-all dimensions: 7 1/2" x 7 1/2" x 11 1/2". Gov't. acquisition cost, \$428.00. Shipping weight 31 lbs. Complete with 2 qts. of oil and full instructions. F.O.B. Chicago

54.50

IMMEDIATE DELIVERY - LARGE STOCK - MANY SIZES GENERATING PLANTS

DESIGNED FOR CONTINUOUS OR INTERMITTENT SERVICE
 PREPARE NOW FOR POWER FAILURE!
 PLENTY OF CURRENT TO OPERATE YOUR • OIL BURNER • REFRIGERATOR • HOME FREEZER • SUMP PUMP • POWER SAW • BROODER • CREAM SEPARATOR • INCUBATOR • VENTILATING FANS • MILKING MACHINES • BLOWERS • YARD LIGHTING • OTHER APPLIANCES



Item #133 - 3 KW - 120 Volt
60 Cycle A.C. Single Phase HEAVY DUTY
 Totally enclosed power unit with 2 cylinder water-cooled Hercules Model BXB engine direct coupled to generator. Magneto ignition, crank start, 4 gallon gas tank, 3 qt. oil capacity. Skid mounted with handrails for carrying. Instrument panel including killer button, oil pressure, water temp. gauges, voltmeter, ammeter.
 Shipping wt. 560 lbs. F.O.B. **395.00**
 Chicago

Item #178 - 350 watt - 110 volt - 60 cycle A.C. direct coupled to 1 cylinder Midco engine. Shpg. wt. 116 lbs. F.O.B. Chicago **125.00**



AIRCRAFT QUALITY HYDRAULIC EQUIPMENT

HEAVY DUTY - Large supply of new labor-saving, economical hydraulic equipment in many types and sizes. Use these positive, highly efficient smooth pressure hydraulics on presses, arbors, lifts, loaders, power control, positioning, brakes, plastic dies, auto frame alignment, etc., etc.

ITEM #270 - Purolator hydraulic oil filter. Permanent element type. 3/4" female pipe thread ports. Capacity 16 gallons per minute. A \$13.00 value, now postpaid. **4.95**
ITEM #127 - Double acting hydraulic cylinder, 1" bore, 1" stroke, 1/2" diam. shaft, 1/4" tubing thread ports. Over-all length closed - 6 1/2". Clevis mounting at both ends. Perfect for clamping and feeding. Postpaid. **5.95**
ITEM #33C - Double action hydraulic cylinder, 1 1/2" bore, 4 1/2" stroke. Clevis mountings at both ends. Uses 1/4" pipe fittings. Postpaid. **8.95**
ITEM #16C - Double acting hydraulic cylinder, 1 1/2" bore, 26" stroke. Will lift 1760 lbs. with value. Now only, Postpaid. **16.95**
ITEM #126 - Four-way, open center control valve with built-in adjustable relief valve. Factory set at 1000 P.S.I., spring loaded neutral position, for use with one double acting cylinder. Fully balanced plunger type, smooth, positive, easy operation, can be used as single unit or mounted in series of any combinations desired. Has 3/4" pipe thread inlet and outlet. 1/2" pipe thread cylinder ports. Newly manufactured to our specifications. Shipping weight 8 1/4 lbs. An outstanding buy! F.O.B. Chicago. **21.50**



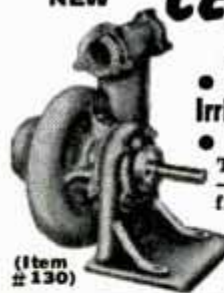
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ITEM #6 - Double action hydraulic cylinder, 3" bore, 24" stroke. Will lift 7070 lbs. with 1000 PSI line pressure. Steel barrel, 1 1/2" stainless steel shaft. Gov't. acq. cost \$176.00. Ship. wt. 26 lbs. F.O.B. Chicago **28.00**
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GENERAL MOTORS - ALLISON

CENTRIFUGAL PUMP

200 GALLONS PER MINUTE
 • For Draining Basements • Fire-Fighting • Irrigation • Fuel Transfer • Swimming Pools • Home Water Systems • Dewatering



This General Motors-Allison Centrifugal Pump - designed for use on U. S. Air Force Mustang fighters, now converted for commercial, home, and industrial high volume pumping applications. Inlet, 2 1/2" standard pipe thread, twin outlets with 1 1/4" pipe thread, ball bearing supported 3/4" shaft. Easy, fast simple priming. Rotation, counter-clockwise facing shaft. Shipping wt. 35 lbs. Gov't. acq. cost \$145.00. F.O.B. Chicago **39.50** Now Only

Suction Lift	Head Pressure	Gal. Per Min.	H.P.	R.P.M.
10'	75'	260	6.0	3500
10'	65'	200	5.2	3500
10'	80'	40	1.5	2500
10'	50'	140	5.0	3500
10'	30'	100	3.0	2500

NEW MODEL 353 - DUAL RANGE

ARC WELDER

for Stationary or Portable Use
HEAVY DUTY RANGE TO 250 AMPS.
NEW 'MAGIC TERMINAL' FOR LOW CURRENT 30 TO 100 AMPS.



IDEAL FOR FARM • GARAGE • FACTORY • WORKSHOP
 These precision engineered D. C. Arc Welders contain the highest quality War Surplus aircraft components built to exacting government specifications. They are light in weight, have oversized lifetime grease-sealed ball bearings, air cooled commutator, dial type rheostat for easy pin-point control, a high-low rheostat switch, reactor coil for even arc and the new 'MAGIC TERMINAL' low current welding range for welding lighter materials. Designed for many years of trouble-free service. Run welder from drive pulley or power take off of a tractor or Jeep. 7 1/2 HP electric motor or 10 HP gas engine at 2500 R.P.M. Uses two V belts or flat belt. Continuous output rating 200 amps. Intermittent welding rating 250 amps, 30 volts. This sensational price includes double V or flat belt pulley and complete operating instructions. Shipping weight 107 lbs. \$350.00 Value. Item #65 Now Only. **119.50** F.O.B. Chicago

D.C. GENERATORS



For welders, plating, truck and marine use, D.C. appliances, lights, etc. Aircraft quality - lifetime grease sealed ball bearings. Heavy duty.
ITEM #90 - Type P-1, rated 200 Amps. - 28 Volts, 2500 RPM. Mfd. by General Electric, Ford, Delco-Remy and Westinghouse. Gov't. Acq. Cost \$300.00. Shpg. wt. 53 lbs. F.O.B. Chicago. **22.50**
ITEM #91 - Type R-1, rated 300 Amps. - 30 Volts. Mfd. by Jack & Heintz. Gov't Acq. Cost \$380.00. Shpg. wt. 59 lbs. F.O.B. Chicago. Each individually packed in wooden box. **35.00**

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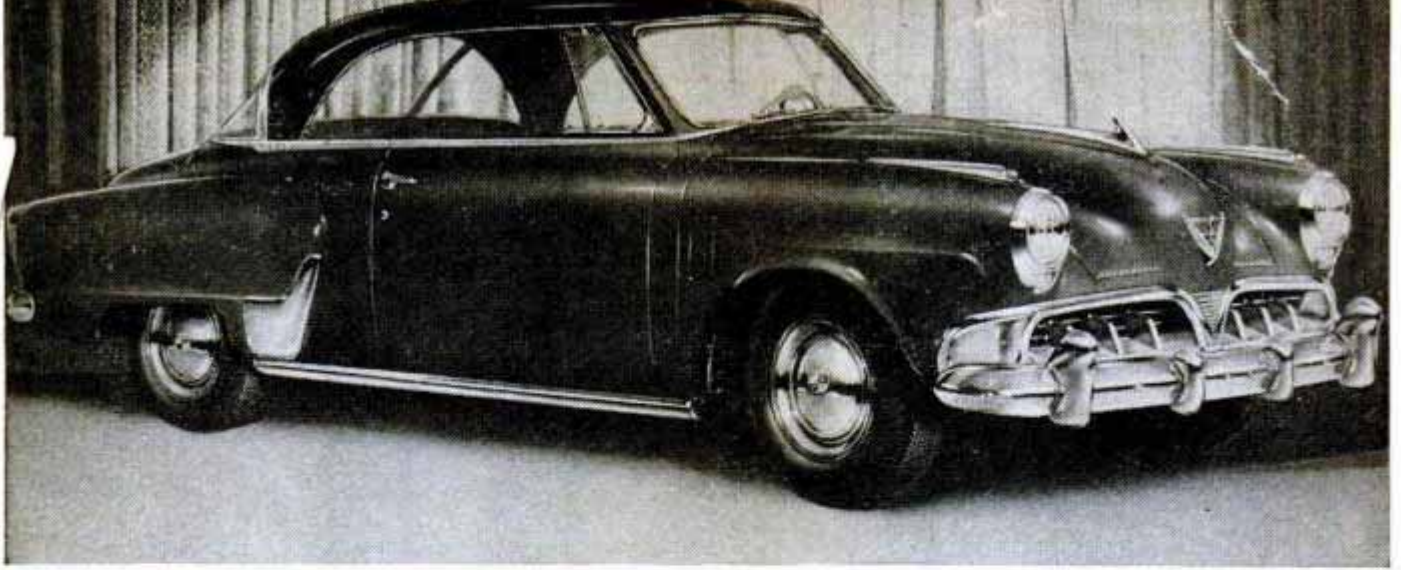


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GROBAN SUPPLY CO. 1139 SO. WABASH AVE., CHICAGO 5, ILL. DEPT. PM-1



Offered in both Champion and Commander lines, the Starliner is a pacesetter for Studebaker's 1952 models

'52 STUDEBAKER

STUDEBAKER this year joins the long list of passenger-car manufacturers who have gone to "hardtop" styling. This popular model is being made in both the Champion and Commander series, being displayed in dealers' showrooms.

Studebaker's offering also carries on the tradition of the industry of a colorful name for the hardtop, its contribution being the Starliner. It is a five-passenger coupe with large wrap-around windows, no pillars in the center and an underslung look that makes it distinctive.

Studebaker is offering 11 two-tone combinations in the Starliner. On the interior, it offers two styles of nylon upholstery. Leather upholstery is an extra-cost item for those who prefer it to nylon.

The 1952 Studebaker shows more changes than the average 1952 model of the rest of the passenger-car manufacturers. Hoods

are longer and lower in the new models.

Grilles have wrap-around styling. Bumpers look more massive than ever, and come equipped with four vertical guards. Headlamps are redesigned. Parking lights are larger.

In the rear, the 1952 Studebaker has taillights which appear to be integral parts of the rear fenders and seem to extend the sweep and make the bodies look longer. Trunk-lid handles are new.

Mechanically, Studebaker has improved brake action by changes in the pedal linkage, adoption of floating rear shoes and linings which have greater resistance to fading. The "floating" brake shoes make them self-adjusting.

Both the V-8 and the six-cylinder engines are unchanged.

For the convertible enthusiasts, Studebaker is pioneering Orlon fabric tops in light colors. It is highly resistant to shrinkage and weathering and cleans easily, it is claimed.

With entirely new front-end treatment, '52 Land Cruiser also has redesigned trunk-lid handles and taillights





Customers at Warner Hardware, Minneapolis, find:

"Production" Sandpaper lasts 10 times longer!

"We've learned plenty about sandpaper in the last 76 years," reports Lloyd Kelly, salesman at Warner Hardware, Minneapolis. "This new 3M Home Workshop Sandpaper surprises everybody. It's the longest-lasting sandpaper we've ever sold!"

What makes it last 10 times longer than flint, garnet or emery? It's "Production" Sandpaper, coated with aluminum-oxide . . . the world's toughest abrasive mineral. Woodworking plants have used it for years.

And now, for the first time, this super-tough sandpaper is pre-cut to fit most home power tools, plus the solid-rubber 3M Sanding Block. Packaged in fine, medium and coarse grits for easy selection, too.

Look for the bright yellow packs the next time you're in your hardware store. Stock up!



SANDING BLOCK of solid rubber holds pre-cut sandpaper firmly on six spikes. Fits the hand comfortably for wet or dry sanding.



DISC SANDERS take "Production" Paper Discs. Universal Centerhole* — 1/4" to 1" arbor, 5" and 6" diameter. Fine to very coarse grits.



BELT SANDERS take "Production" Cloth Belts. Six sizes fit most portable belt sanders. Fine, medium and coarse grits.



OSCILLATING SANDERS and the 3M Sanding Block take "Production" Paper Sheets. Two sizes for most machines. Fine to coarse grits.



*PATENT APPLIED FOR

Made in U.S.A. by Minnesota Mining & Mfg. Co., St. Paul 6, Minn.—also makers of "Scotch" Brand Pressure-sensitive Tapes, "Scotch" Sound Recording Tape, "Underseal" Rubberized Coating, "Scotchlite" Reflective Sheeting, "Safety-Walk" Non-slip Surfacing, "3M" Abrasives, "3M" Adhesives. General Export: Minn. Mining & Mfg. Co., International Division, 270 Park Avenue, New York 17, N. Y. In Canada: Minn. Mining & Mfg. of Canada, Ltd., London, Canada.



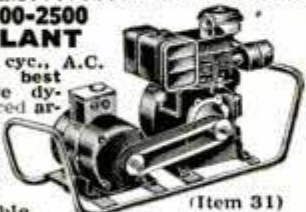
Portable LIGHT PLANT

PUSH BUTTON START
500-700 watts 110-120 v. - 60 cyc. A.C. Powered by a sturdy dependable, easy starting, air cooled 1 3/4 hp. gas engine. No wiring necessary. Just plug in and operate. Plenty of current for any oil burner, freezer, brooder, pump, emergency lights, etc. which require up to 700 watts. Ideal for Civil Defense, Fire Depts; trailers & camps. Complete with Voltmeter and built-in winding to charge 6 v. auto batteries. Wt. 85 lbs. Fully guaranteed. Be prepared if war or storm knocks out power lines.

(Item 24) etc. which require up to 700 watts. Ideal for Civil Defense, Fire Depts; trailers & camps. Complete with Voltmeter and built-in winding to charge 6 v. auto batteries. Wt. 85 lbs. Fully guaranteed. Be prepared if war or storm knocks out power lines. **\$143.50**
1000-1200 Watt Plant (Item 45) same as Item 24, but larger generator & engine. **\$199.50**

GIANT 2000-2500 WATT PLANT

110-120 V. 60 cyc., A.C. Absolutely the best made - exclusive dynamically balanced armature; heavy windings develop up to 5000 watt overload for motor starting. Skid mounted - portable. Powered by easy starting Briggs or 6 hp. Wisconsin engine - complete with all accessories; engine easily disconnected for other uses. Big outlet box, voltmeter, no wiring necessary. Ample current for all purposes. Factory warranty and instructions included. Wt. 220 lbs. Reg. \$585.00. Special at... **\$299.50**
With Electric Self Starter (Item 179) **\$359.50**
GENERATOR ONLY and control box. **\$169.50**
Drive it with your engine or tractor



(Item 31)

HI-LINE 6000 WATT PLANT (Item 162) Push Button Start, 115-230 v. 60 cycle A. C. A brute of a power plant with a rugged 13 hp. Wisconsin engine. Plenty of electricity for ranges, water heaters, freezers, pumps, machinery, etc. Affords both 110 and 220 volts. Ideal where heavy current is needed. Wt. 590 lbs. Easily worth \$995.00. (with self starter) **\$645.00**
Factory special. **\$585.00**
Same plant (with crank starter) (Item 168) Wt. 570 lbs. **\$585.00**
Generator and control box only, belt driven. Use your engine or tractor. **\$345.00**
Wt. 240 lbs.

We are World's Largest Mail Order Distributors of Light Plants

VARIABLE SPEED SELECTOR

Heavy duty, made by B. F. GOODRICH for industrial use. Provides instant speed changes for any drive. For machine tools, dryers, printing, conveyors, production lines, hoists - any operation requiring variable speed. Ideal for midgeut autos. Employs reliable "trouble free" planetary system. No hydraulic power losses or creeping. Infinite range, smooth operation, easy installation. 3 sizes: 1/2-1 hp. wt. 36 lbs.; 1-2 hp. wt. 55 lbs.; 2-3 hp. wt. list \$228, \$252 and \$352. Brand new, in Goodrich boxes and guaranteed. Complete installation data included. Unprecedented surplus sacrifice **\$79.50, \$89.50 and \$114.50.**



(Item 68)

HEATING & VENTILATING FAN

(Item 10) Easily installed in furnace pipes. Forces even heat to all rooms. Over range, removes kitchen smoke and odors. Powerful continuous duty motor, 110-120 V. A.C. Quiet, super efficient fan moves huge volume of air (400 to 600 c.f.m.) 8" Fan, wt. 5 lb. **\$6.35**; 9" Fan, wt. 6 lbs. **\$7.45**; 10" Fan, wt. 7 lb. **\$8.45**; 12" Fan, wt. 8 lbs. **\$9.45.**



HIGH PRESSURE HAND PUMP

(Item 53) Positive displacement type. Cap. 550 gph. Completely self priming. 3/4" pipe thread inlet and outlet. Use for fuel or water transfer on boats, trailers, air craft, etc. Ideal for insecticides, emerg. sump pump or as vacuum pump. Wt. 15 lbs. Govt. cost \$95. Our Special. **\$12.95**



GAUGE TESTER (Item 27) Precision made of solid bronze and steel by Ashcroft. (Cat. #1300-5). Calibrated weights (incl.) acting against hydraulic piston provides quick accurate testing of all pressure gauges up to 500 psi. Brand new. Wt. 90 lbs. Reg. \$318.00. Our Spec. **\$95.00**



IMMEDIATE DELIVERY—ALL ITEMS HEAVY DUTY ARC WELDER



(Item 38) Use as portable or shop welder. 250 amps, D.C., Senior model. Made for years of trouble-free, continuous service. Will handle light or heavy jobs. Weld up to 1/2" plate using 1/4" rods. Built-in air-cooling system. Arc is easy to strike and hold, because of specially designed arc stabilizer. Hi-lo switch and dial control gives wide range of welding heats. Run welder at 2600 rpm. with tractor, jeep or 15 hp. gas engine, or 7 hp. elec. motor. Complete with instructions, guar. and double V belt or flat pulley. Wt. 110 lbs. **\$99.75**

MAGIC TERMINAL model same as above but with built-in 3rd terminal for low heat soldering and brazing. Special. **\$119.50**
WELDING KIT. Two 10 ft. leads, welding helmet, electrode holder, ground clamp. Sold only with welder at... **\$10.50**

A-C ARC WELDER (Item 168) Master Hi-Line A-C Arc Welder. 20-190 amp. output. Welds or cuts iron, steel, brass, etc. from 24 gauge to 5/8" with single pass. Operates from 220/230 V. 50/60 Cycle A-C line. None better. Meets REA requirements. Handles 1/16" to 1/4" rods. Adjustable output for any job. In sturdy steel cabinet, on casters. Full instr. and 1 yr. guar. incl. Wt. 210 lbs. Reg. \$250 value. (Item 169) 20-100 amp. A-C Welder operates on 110 or 220 V. Wt. 65 lbs. Worth \$125. (Item 181) Welding Kit incl. helmet, 2 leads, electrode holder, ground clamp, power cord and rods (sold only with welder) **\$12.50**
Wt. 12 lbs.



\$159.50

\$64.95

\$12.50

CARRY-AIR



(Item 32) Stainless steel tank—capacity 500 cu. in. at 400 lbs. press. complete with inlet and shutoff valves, press. gauge, detachable air hose, tire chuck. Fill at any service station. Carry air for tire inflation, blowing out lines, spray painting, insecticides, etc. One emergency pays back cost. Wt. 10 lbs. Worth \$20.00. Our price... **\$8.95**
(Item 55) With big double tank (1000 cu. in.) **\$11.95**

POTTERS WHEEL



(Item 47) Complete, prof. equip. for making finest ceramics and pottery. Large dynamically balanced cast-aluminum reversible turntable with variable speed drive (38 to 140 rpm) controlled by foot-pedal. Built-in adjustable arm rests, water cup and wedging wire. 16x12" enclosed throwing table—ample area for largest pieces. Reg. 1/4 hp. motor (not incl.). Can be set up on 20x24" table and stored on edge. Complete with pulleys, belts and instructions. Wt. 26 lbs. **\$59.95**
\$145 value at...

ANGLE DRILL



(Item 23) Fits into chuck of any electric or pneumatic drill or flex. shaft. Operates at any angle in a full 360° arc. Makes possible drilling, grinding, carving, routing, etc. in close cramped quarters. Makes impossible jobs easy. Made by Kett Tool Co. Complete with built-in chuck (1 1/4" capacity) and adjusting key. Hardened alloy gears. Precision built for heavy duty. Lists at \$39.95—while they last... **\$9.95**

RUBBER HOSE



New genuine Neoprene Hose - outlasts ordinary rubber 3 to 4. Reinforced with super tough cotton cord plies. Flexible. Easy Flo brass couplings with standard pipe threads for quick connections. included. Pump water for irrigation, stock tanks, home, barn, fire fighting, etc. Pump Gas or Fuel Oil. Save more than 80%.

TERRIFIC VALUES!

	1"	1 1/4"	1 1/2"
Length	10 ft.	25 ft.	30 ft.
Price	5.95	9.25	14.75

If specified we will send special hose for gas or oil at same prices. Send 10c for a Big War Surplus Catalog. Included Free with Every Order.

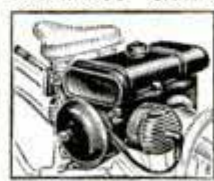
MAKES SNOW REMOVAL REAL FUN!



SNOW-BLO

The sensational device that makes snow removal real fun. Easy - a child can operate it. Safely guarded whirling impeller quickly scoops up the snow and blows it 25' either side. Big timesaver. Clears driveway and walks in a jiffy. Eliminates dangerous exhaust and overtaxed heart, which kills so many every winter. BOYS! Make big money clearing snow for neighbors. Easily converted to lawn mower when desired. New silent electric model powered by 1/2 hp. motor clears 16" swath. Complete with shockproof 100' cord (Item 72)... **\$139.50**
Gasoline Model with easy starting 2 hp. 4 cycle engine (Item 73)... **\$159.50**
For large areas (2 1/2 hp. engine) (Item 74)... **\$179.50**

We pay freight on Snow-Blos. FREE with purchase of any model, an extra 100' extension cord.



COMMANDO BIKE MOTOR

(Item 90) New, super-modern 1952 model. This job is the Cadillac of all bike motors. Sensational Auto-Clutch prevents killing motor at each stop. Also selects proper ratio on hills. Mounts behind and drives rear wheel with Dynarotor. Free Wheeling lever permits pedaling if desired. Rear Mounting eliminates fumes, heat, dirt, and hard steering. Easily installed in 15 minutes with home tools. Sturdy, trouble-free, easy starting, light weight. Airplane type engine: up to 150 miles per gallon. Fully guar. Ride for fun or profit. Ideal for deliveries, paper routes, messenger service, etc. Ride to work and save. The Commando Captain, 1 cylinder 1 1/2 hp. **\$99.75**
The Commando General, 2 cylinder 3 hp. (Item 91)... **\$125.00**
All Commandos shipped prepaid in U.S.

FIRE EXTINGUISHER

(Item 39) Fully charged at 1,000 lbs. P. S. I. or more) with CO2 (carbon dioxide), the proven miracle fire fighting chemical that smothers oil, gasoline and electrical fires. Play safe; keep one in your car, garage and home. Heavy ICC approved steel cylinder, valve and 3000 lb. gauge that shows available remaining pressure. REFILLABLE at nominal cost. Hose included for emergency tire inflator or air blast. Wt. 4 lbs. **\$19.50**
Special... **\$6.95**

LARGE FIRE EXTINGUISHER (Item 57) commercial size, 5 x 14 in. (275 cu. in.) heavy ICC approved steel cylinder charged at 1000 lbs. or more with CO2. Equipped with genuine Kidde Valve. Refillable. Hose incl. Suitable for fire depts., stores, garages, homes, etc. Wt. 18 lbs. **\$42.50** value. Spec. **\$15.85**

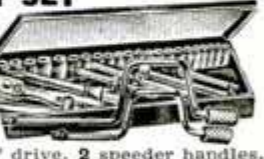


EXTENSION CORD

(Item 16) 40 ft. heavy duty, made of specially insulated No. 14 2-conductor wire. So tough that you can drive over it and yet amazingly flexible and easy to handle. Resists oil, grease or water. Extends electricity up to 400 ft. without voltage drop. Use indoors or out. Complete with heavy rubber plug and outlet. Wt. 2 1/2 lbs. Usually \$4.50—Special 40 ft. **\$1.99**
Comb. 2-40 ft. and 1-20 ft. (total 100 ft.) **\$4.95**
100 foot length (one piece)... **\$4.85**
WIRE ONLY (Item 50) No fittings, 100 ft. **\$4.00**
TRENCH-LAY WIRE. (Item 51) Anaconda #10-2 cond., for buried service to barns, outdoor lights, etc. Absolutely impervious to soil and moisture. Wt. 25 lbs. per 100 ft. Special surplus price. 100 ft. coils, 19c per ft.; 250 ft., 18c per ft.; 500 ft., 17c per ft.

34 pc. SOCKET SET

(Item 59) Highest quality guar. non-breakable sockets made by Plomb, Snap On, etc. Complete range of 22 sockets from 1/4" thru 3/4" in 3/4" drive and 7/16" thru 1-1/16" in 1 1/2" drive. 2 speeder handles, 2 extensions, 2 slide heads, double 3/8 x 1/2 in. "L" handle, reversible ratchet. Adapter bit, 2 end wrenches and metal tool box. For professional mechanics who want the best. Wt. 14 lbs. Easily worth \$34.50 while they last... **\$16.95**
TIRE CHAINS (Item 43) Extra heavy for dual truck tires. 7.50x20, triple side links, made by Intl. Chain. Reg. list \$57.50—our special... **\$19.50**



Broadcast Thru Any Radio

Talk! Sing!
Play!

with **NEW Micro-Vox Microphone and Portable Wireless Transmitter**



Imagine **YOUR VOICE** suddenly, dramatically coming over a radio in another room, another house or even over car radios! You'll thrill and surprise your friends by talking, playing or singing. Put on surprise programs, quiz shows, plays, musical productions, do imitations, broadcast games, news events, announce games, etc., etc.

Practise and improve your voice and playing. Save many dollars in lessons. Read the **HUNDREDS OF USES** and the fun you can have! How you can save time and money! How you can make money with it! Micro-Vox picks up and amplifies any sounds over any radio within 75 feet (or farther under favorable conditions). Produces high fidelity, professional performance with full bodied, clear tone, amplified as loud as your radio can make it! **NO WIRING! NO CONNECTIONS OF ANY KIND!**

HOW DO YOU SOUND?

Test & Improve Your Voice!
Play Better! Speak Better! Sing Better!

Easy to develop your ability to talk, sing or play yet save money on expensive lessons. It actually makes practising fun! Increase your popularity by developing your own personality and talent. Learn useful techniques worth many dollars! Did you know that most singers and announcers speak in a low voice, letting the microphone pick up, improve and amplify their voice, so that it comes out loud, strong and clear, with wider range! Let Micro-Vox improve your voice as it does for famous radio stars!

Fun! Jokes! Home Entertainment!

Fun in many ways. You can fool your friends by injecting "fake" announcements and news broadcasts. Mystify your neighbors with surprise announcements. Or, if you are having some friends over, it provides plenty of fun and home entertainment. Everyone wants to "try their voice" or to "broadcast". Imitate Bing Crosby, Bob Hope, etc. Every-time your friends drop in, they'll want to use it. Watch children "do their act." Even broadcast to car radios!

Public Address Amplifier

Call People - Announce Games & Events

Almost no limit to the many practical uses for Micro-Vox. Use it with 1, 2 or more radios for powerful public address system, music amplifier, etc. For games, parties, events it comes in very handy.

Broadcast your own games, news events, etc. Announce plays, scores, etc. Used by barkers at shows. Wonderful for any type of public, party or club events. Make money by renting it out or doing these services - and have fun, too! Because it is wire-less, you can **TALK AS YOU WALK** - no wires to bother with.

Intercommunication System

Many people and places use it to call out orders or make announcements to another room or another location. Talk from room to room, house to garage, office to shop, etc. Makes good private phone system. Used individually, you can make announcements one way. For two-way communication, two units are necessary. A cheap, practical, portable inter-communication set that needs no wiring, no hook ups.

Secret Detectaphone

Overhear Private Conversations

Imagine being able to conceal Micro-Vox in another room, then "listen in" on the conversation! It can be embarrassing and fun. It can be practical. Use as baby or burglar alarm. Fine for baby or sick room. Similar instruments used by detectives and spies to overhear plans, secrets, as well as suspicious noises. One fellow set up Mike downstairs in living room while his folks were having a party, then sat up in his room and listened over radiol! Overhear the girls and you're in for some real laughs! Stop and think! Isn't there someone you'd like to hear when they don't know you're listening?

Ready for Immediate Use! A Buy You'll Never Regret! Years of Use!

Use It Anywhere! Broadcast to Portable or Car Radios Too!

"CALLING ALL CARS! SPECIAL ANNOUNCEMENT!!" Yes, you can "Call All Cars" and make announcements to come over your radio. Even call from one car to another as you are driving along! Imagine the fun and the many practical uses. It will be the most exciting, the most useful instrument you've ever had. A time saver, money saver and money maker. Stores, clubs, schools, etc., will pay you to use it!

No Wiring! No Connections! No Adapters! Do Not Touch Radio! Radio Works Normally!

Wireless Micro-Vox Radio Microphone is self-contained, complete, portable transmitter. Nothing to do but turn on the switch, tune mike dial and **IT'S READY FOR IMMEDIATE USE.** No wiring; no experience. Operates indoors or outdoors. Marvel of electronic engineering. High fidelity, professional level performance. Full bodied, clear tone, fine modulation. Electronic 1-tube unit, complete with batteries. Tube lasts indefinitely; batteries easily replaced for few cents when their long life is through. Adjustable volume, beautiful streamline walnut plastic housing, 6-inches high. Amazingly low priced; limited quantity. **Order Now! Money Back Guarantee Protects You!** Get two if you wish to talk back & forth between two places, car to car, etc. (2 for \$16.95 Postpaid).

MICRO-VOX, Ready for Immediate Use \$8.98 (2 for \$16.95) Complete, Each Postpaid.

JOHNSON SMITH & CO., Dept. 475, Detroit 7, Michigan
Since 1914 America's Leading Novelty House—Mammoth Catalog 10c

Read What Users Say: "Made our party a riot of laughs—I use it in many other ways, too!" "Improved my voice and playing—saved me a lot of money on lessons!" "Most useful thing we've had around the home or shop. I get more use from it than with my camera, guns or field glasses!" "For schools, clubs & churches, it can't be beat!" "A bargain! Was pleasantly surprised how well it worked. Does the work of a unit costing over \$50.00."

Order Today! Money Back Guarantee

JOHNSON SMITH & CO., Dept. 475, Detroit 7, Michigan

Rush Micro-Vox Microphones \$8.98 Each \$16.95 for 2 Postpaid

Enclosed is \$

Name & Address

AMAZING TOOL BARGAINS!

ALL BRAND NEW MERCHANDISE

112 PIECE ASSORTMENT FOR ELECTRIC GRINDERS

Here's what you get! Mounted Stones on 1/8" mandrel, Drum Sander, Sanding Sleeves for sander, Rotary Cutters, Wire Scratch Brush, Bristle Brushes, Circular Saw, Buffing Wheel, Grinding Wheel, Rubber Polishing Wheel, Cut-off Wheels, Rubber Cylinder, Mandrels to fit above tool, asst'd. Sanding Discs, Sharpening Stone, etc. **\$10.00 VALUE ONLY \$3.95 P.P.**

18 ROTARY CUTTERS \$5.85

Post Paid Value \$13.50

Assorted sizes cutter on 1/8" or 3/32" shank. Will fit all hand grinders. Ideal for cutting wood, metal, or plastic. Brand new.

2 CIRCULAR SAWS ON 2 MANDRELS — ALL AT ONE LOW PRICE \$1.50

1" diameter saws on 1/8" Mandrels. For cutting wood, plastic, or soft metals. Order at once! Send Check or Money Order. U.S.A. Post Paid in U.S.A.

12 MOUNTED WHEELS \$2.95

and points on 1/8" Mandrel. For grinding on plastic, wood, soft and hard metals. Regular \$8.40 List Val. 12 wheels on 1/4" Mandrel \$3.60 18 MOUNTED POINTS ON 3/32" MANDREL \$2.50

2 DRUM SANDERS \$1.50

With 12 Bands in Assorted Grits. 1 1/2" dia. x 1" long on 1/4" arbor with 12 bands. ONE DRUM, 1" DIA. x 1" LONG ON 1/4" ARBOR WITH 6 EXTRA SLEEVES \$1.00 P.P. in U.S.A.

FLEXIBLE SHAFT — ONLY \$4.95

P.P. Fits all electric drills & hand power tools. 35 3/4" long. Oilite bearings. Core of specially wound, high carbon steel wire in flexible steel casing. Will accommodate tool shafts up to 1/8" dia. For lathes, electric drills, etc.

7 HIGH SPEED TWIST DRILLS \$1.00

15 DRILLS FOR ONLY \$2.00! Order Today! Postpaid 7 Popular Sizes — up to 1/4". Brand new, ideal for home or shop use. Fits all standard chucks.

ADAPTER CHUCK \$1.50

With 2 interchangeable collets, opening from 3/32" to 0, on 1/8" mandrel. Price each only. P.P.

SURPRISE VALUE 100 Pieces \$1.00

FOR ELECTRIC GRINDERS Post Paid in U.S.A. Grinding Wheels, Cut-off Wheels, Sanding Discs, Mounted Stones, Sharpening and Honing Stones, Rotary Cutting Burs, Abrasive Cartridges, Mandrels, and many other items.

18 GRINDING WHEELS \$1.00

and rubber polishing wheels up to 1" dia. P.P. For grinding & polishing metals, plastic, wood. With one 3/32" mandrel. 10 HIGH SPEED CUT-OFF WHEELS 1 1/2" DIA. WITH 1/8" MANDREL \$1.00

BUFFING WHEELS—5 for \$2.00

8 inch diameter muslin wheels — 1/2 inch thick. Ideal for coarse and fine polishing. Post Paid U.S.A.

SCHUPACK SUPPLY CO., 7331 Cottage Grove, Dept. M-26, Chicago 19, Ill. Illustrated Catalog 10c

12 MINIATURE CUTTERS



\$1.00

FOR CUTTING WOOD, PLASTIC, or METAL. Actual size. Ass't. shapes on 3/32" shank. For die makers, home workshop, etc. POST-PAID



20 ABRASIVE ROLLS, cloth, and 1/8" mandrel ONLY \$1.00

for grinding, sanding, deburring metal, plastic, wood or rubber. Post Paid

SCHUPACK SUPPLY CO. 7331 COTTAGE GROVE, DEPT. M-26 CHICAGO 19, ILL.

Illustrated Catalog 10c



BUILD NOW!

for BEAUTY and PLEASURE in YOUR YARD . . . Detailed plans or precision built knock-down kits make home and garden projects easy for you.

AUTHENTIC DUTCH WINDMILL (B-10 hexagon style, 40" high, plans 75c)



LAWN CHAIRS, illustrated above, styles B, C, A, plans 50c ea., all 3 only \$1.00. TRELLISES, 12 designs, all for 50c.

Send 10c for catalog illustrating many fine lawn figures, lawn animals, Dutch windmills, lighthouses, arbors, many other home and garden projects.

CRAFTSMAN'S MODEL CO. DEPT. P36 DELAFIELD, WISCONSIN

Opportunity OF A LIFETIME!

SELL AIR CUSHION SHOES



Build a permanent "repeat" business of your own without one penny of investment! Sell John Neil Air-Cushion Shoes Direct from famous New England factory. Firestone Foamex cushions — complete line of men's dress, work, safety shoes! DuPont Neoprene non-marking soles. Women's and children's shoes. Fast deliveries from our mammoth stock department.

Earn up to \$30.00 per day! JOHN NEIL SHOE CO. DEPT. 12 — Brockton 64, Mass.

MAGNETS 5 FOR \$1.00

IMAGINE five useful permanent magnets in assorted shapes and sizes at the factory-to-you price of only \$1.00 ppd. Magnets save time and money in home, shop or office. They are useful in school science classes. We guarantee satisfaction and send a large list of uses for magnets. This ad will appear this month ONLY. Clip it now; send your dollar.

RONALD EYRICH, 1219 W. Meinecke Ave., Milwaukee 6, Wis.

WELD \$1475 F.O.B. complete!

BRAZE, SOLDER, and CUT →



No experience needed. Follow simple instructions, weld on iron, steel, bronze, brass, aluminum, and other metals. Plugs into any properly wired 110 volt A.C. or D.C. line. Make or save time and money doing repair work for yourself and others. Repair men, farmers, tinsmiths, home and auto owners, hobbyists, etc., say FOUR-WAY pays for itself over and over. Order today or send for Free details.

Larger Equipment Available on Request FOUR-WAY WELDER COMPANY, Dept. F2-AC 2326 S. Michigan Ave. • Chicago 16, Illinois

ORDER NOW 10 DAY TRIAL

WELLWORTH BARGAINS - ALL NEW EQUIPMENT

Wellworth AIR COMPRESSOR

For Farm and Home Workshop



Compressor has 2" bore, 1 3/4" stroke, 2.8 cfm up to 150 lb. pressure. Motor required: 1/4 h.p. at 100 lbs.; 1/2 h.p. at 125 lbs.; 3/4 h.p. at 150 lbs. or equivalent gas engine. V-belt drive, intake muffler and cleaner, bronze bearings, splash lubrication. Wt. 16 lbs. Replacement parts always available.

\$20.50



6"x24" Steel Tank 200 lb. Pressure 2-1/4" openings

COMPLETE OUTFIT. Compressor, pressure tank, air gauge, air chuck, 20 ft. hose, pop valve, copper tubing with 4 brass flared fittings for connecting compressor to tank, 4-way cross and 3 nipples. **COMPLETE OUTFIT, wt. 30 lbs. \$32.45**
Equipment less compressor **\$12.45** Tank only. **\$6.25**

WELLWORTH COMPRESSOR BUY

1 Year Guarantee

FEATURES:

2 compression and one oil ring, aluminum alloy connecting rod. Stainless steel valves with brass seats and retainers. Cool-flo cylinder head, spray mist lubrication to every moving part. 10 1/4" V groove fly wheel for 5/8" B section belt.



MODEL W3

2 1/2"x2". 2.55 to 4.80 c.f.m. up to 150 lb. pressure. Operates with 1/2-1/2-3/4 HP motor.

\$27.95

Special Price. Shipping wt. 24 lbs.

MODEL W7

2 cylinder 2 1/2"x2". 5.10 to 8.50 c.f.m. up to 150 lb. pressure. Operates with 1/2-3/4-1-1/2 HP motor.

\$54.50

Special Price. Shipping wt. 45 lbs.

WELLWORTH V-BELT CLUTCH



Takes starting load off engines or motors. When speed is reached, a flip of handle shifts clutch from idling to driving position. Handles "A" belts, 2.35" pitch diameter, 5/8" bore. Ideal for use with lawn mowers, garden tractors, home workshop motors, etc. 3 1/4" long. Safe, easy to mount, sealed bronze bearings, positive action. Shpg. wt. 3 lbs. **\$7.50**
BUSHING FOR 1/2" SHAFT 15c

"Wellworth" BLOWER BARGAIN



Quiet operating. Double wheel inlet, double width blower. For heating, ventilating, cooling, air washing, exhausting and forced draft. DIMENSIONS: 10" wheel; outlet 13 1/4"x11 3/4"; inlet 8 3/4"; Height 19"; Width 18"; Depth 16 1/2". C.F.M., 1/4" S.P. 1600; outlet vel. 1575. Wt. 45 lbs. **\$27.50**

BLOWER LESS MOTOR AND DRIVE variable speed pulleys. \$2.50 extra. With belt and complete with 1/4 h.p. motor, \$47.50.

140 CFM "WELLWORTH" BLOWER

5 1/4"x4" mounting flange with 2 1/2" square discharge, 3 1/2" dia. blower wheel powered by direct-connected 1/15 H.P., 110 V. 60 C., A.C. motor with conduit box and 20" leads, 7 1/2" wide less flange by **\$16.20**
7 1/4" H. x 6 3/4" D. Shpg. wt. 6 lbs. **50 CFM BLOWER, 2 1/2" discharge. \$10.95**



OUR LUCKY BUY SAVES YOU \$18.00!

DRILL-O-MATIC ELECTRIC POLISHER and 1/4" DRILL

Polishes floors, furniture, automobiles; does sanding, drilling and buffing jobs. Handy family Work-Aid. Limited number available. Act fast. Drill and Polisher combination, 110 volt AC-DC. Disc Polishing Bonnet; 1/4" Jacobs chuck; horizontal bench stand; 12" polishing handle; wire wheel brush; 2-mounted wheels; 2-drill bits; spindle adaptor; buffing wheel; 6-amb right side discs; 1-grinding wheel; paint mixer; 12 ft. cord & plug; drill handle; steel hinged carrying case with handle and lock clamp. Wt. 9 lbs. 24 Pieces. 50,000 were sold at \$28.95. Our special price, only **\$10.95**



AIR REGULATOR and EXTRACTOR

1/4" Air Regulator, Gauge and filter. Wt. 5 lbs. New. **\$8.95**
Regulator and Gauge only. **\$5.95**

AIR CYLINDER & Moisture Trap

5" x 8" tank 400 lb. test with 1/4" air regulator, gauge, safety valve and shut-off cock. Complete as shown. **\$12.95**
Shipping weight 6 lbs.



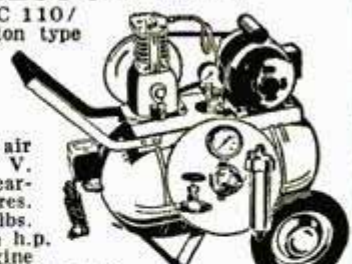
INSECT DUST SPRAYER

For dusting plants, shrubbery, etc. Easy-to-use, light weight gun. Also flock gun. Operates on Compressed Air, requires 2 c.f.m. at 40 lbs. pressure, 14" long. Weighs 2 lbs. **\$5.00 Value ONLY \$2.95**



AUTOMATIC COMPRESSOR UNIT

1/3 H.P. heavy duty capacitor motor, AC 110/220 volt, 60 cycle, 2x1 3/4 inch piston type compressor, splash feed lubrication. 12x24 inch tank, automatic pressure switch. CFM 2.8 at 100 lb. pressure, or 150 lbs. pressure for intermittent duty. Check valve, safety valve, air regulator with gauge and filter, 20 ft. air hose with air chuck for inflating tires. V. belt drive. Mounted on 2 wheels, ball bearing, with 2"x10" semi-pneumatic tires. Portable with handle. Shipping wt. 90 lbs. With 1/3 h.p. motor **Less With 1/2 h.p. \$160 Value Motor gas engine**

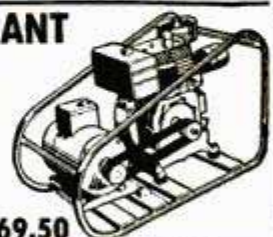


\$98.50 \$79.50 \$124.50

2000-2500 WATT LIGHT PLANT

Heavy duty windings

110 v. 60 cy., A.C., takes starting overload up to 5000 watts. Floating Base for Automatic Belt Adjusting, 2-Groove Engine Pulleys, V-Belts, Bolts, etc. 5 H.P. Wisconsin or Briggs & Stratton Model 14 Engine. Voltmeter, 2 plug-in receptacles. Portable Tubular Steel Skid Type Carrier. Dim.: L 34 3/4" x W 17" x H 20". Wt. 180 lbs. **\$299.50**



Generator only, with voltmeter, 2 plug-in receptacles. Shipp. Wt. 75 lbs. **\$169.50**

RED SEAL CONTINENTAL GAS ENGINE



BRAND NEW. 1 1/2 HP with 6 to 1 reduction gear. Operates at 450 R.P.M. For lawn mowers, scooters, garden tractors, pumps, compressors, generators, etc. List Price \$79.50 Shipping wt. 54 lbs. **\$47.50**
SPECIAL PRICE..



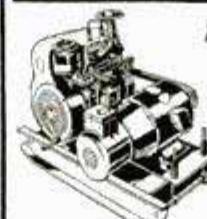
1/12 H.P. MOTOR

Delco 110V. 60-cy. A.C., 1 phase 1750 r.p.m. 2 amps., will take 50% overload. Shaft 3/8x1 1/4. Heavy duty, bronze sleeve bearing. Size 6" long, 5" high, net wt. 12 lbs. List **\$13.50**
Special. **\$21.00.** Special. **\$12.50**
LOTS OF 3, EA. **\$12.50**



LELAND GENERATORS

2500 to 3000 watts, 110 v. 60 cy. single phase 1800 r.p.m., self excited. Fungus treated for long life. 1951 model. Brand new, in original factory crate. Shipp. wt. 135 lbs. List \$375. **\$237.50**
SPECIAL PRICE..



5000 WATT LIGHT PLANT

1952 Model. 110/220 volts, 60 cy. AC, one phase, 50 amps. Takes starting overload up to 87 amps. Integrally mounted separate exciter giving exceptional overload and surge capacity for starting motors. Drip-proof constr. Ball bearing, lifetime lubrication. Voltmeter, 2 plug-in receptacles. Wise, air cooled, 2 cyl. 4 cy. 10 1/2 HP engine.

SPECIAL PRICE \$645
Wt. 575 lbs.
GENERATOR ONLY \$325
Wt. 225 lbs.



AIR TANK and ACCESSORIES

Brand New Steel 6"x24", 400 lb. test. Ideal wherever compressed air is needed. Equipped with 500 lb. combination air gauge and inflation valve with core for retaining pressure in tank; tire chuck. 3 ft. high test air hose. **\$7.95**
Ship. Wt. 12 lbs. Complete outfit.

PORTABLE SPRAY OUTFIT

1/4 H. P. HEAVY DUTY MOTOR EXTERNAL ATOMIZING GUN

Paint Sprayer mounted on 6x24 inch tank, 1/4 H.P. 110 V. 60 cy. Heavy duty motor with overload relay, 10 ft. cord and plug. V belt drive. Piston type Compressor with 2 Compression rings, 1 oil ring, 2 inch Bore, 1 3/4 inch stroke, displacement 2.86 C.F.M. at 60 lbs. pressure. Safety Valve. Gun external atomizing. Flat and round spray, quart cup; maintains 35 to 40 lbs. working pressure. Oil and water extractor, 1 air gauge, 20 ft. heavy duty two-braid air hose with leakproof fittings. Complete with carrying handle. Wt. 60 lbs.



OUTFIT LESS MOTOR . . . \$52.00 COMPLETE \$67.50
SPRAY GUN AND 20 FT. HOSE . . . \$12.95 OUTFIT

PRICES F.O.B. CHICAGO. MONEY BACK GUARANTEE. SEND CHECK OR MONEY ORDER TODAY. PROMPT SHIPMENT. WRITE FOR CATALOG. SEND 10c FOR POSTAGE.

WELLWORTH TRADING CO.

1832 S. WABASH AVE. Dept. D-152 CHICAGO 16, ILL.



U.S. NAVY PHONE SET

Used by the Navy for flight deck and gunnery control. An ideal emergency communication system because they require no power supply. Perfect for office-to-shop, house-to-garage or barn, or any point-to-point within a 1/2 mile radius. These sets are fully Sound Powered. Each set includes 2 phones on chestplate, 2 headsets, button switches & approx., 35 ft. of cable. **995**

USAF THROAT Microphone

Genuine USAF, Type T-30-O. Gives distinct voice reproduction for aircraft or amateur radio broadcasting. Consists of two microphones mounted on rubber neckpiece & elastic neck band. Operates between 100 & 300 ohms. **SPECIAL AT 139**

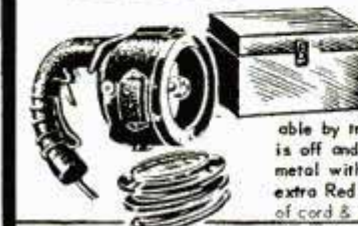
4" ALNICO SPEAKER

Model No. S10540-2 Permanent magnet type. Sturdy, die-stamped steel frame with four hole mounting. Requires only two wire hook-up. Makes an ideal speaker for small radios, multiple communication systems, inter-office, test equipment, etc. **249**



ARMY SIGNAL CORPS TEL. KEY

The new, model J5A with ball type, flame-proof metal key. Perfectly balanced to permit positive contact with minimum effort. An ideal instrument for "ham" or professional use. **A BUY AT 189**



SIGNAL LIGHT

New, Double Trigger Signal Light Kit. Has interchangeable colored filters and controlled, directional beam. The 4 inch Parabolic, Pyrex mirror reflector is movable by trigger in the handle. Other trigger is off and on switch. Lamp housing is all metal with crackle finish. Kit comes with extra Red & Violet filters, 2 bulbs, 25 ft., of cord & handy wooden carrying case. **595**



BELT KITS for TOOLS

For the Mechanic, Electrician, Machinist, Radio & TV technician, etc. Made of bark tanned, top grain cowhide and worn on the belt. Saves wear & tear on clothing. A convenient, handy place to carry all small tools. Re-inforced with rivets.

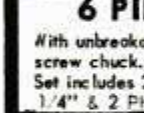
- A- ELECTRICIAN'S, 7 POCKET KIT - Holds Tape, pencil, tools, etc. **349**
- B- EXTRA CAPACITY KIT - Main pocket is 1 1/2" box type, 2 extra pockets. **319**
- C- METAL WORKERS KIT - Has 5 pockets & hammer holder. Roomy. **339**
- D- GENERAL UTILITY KIT - Has just 1 large pocket for all uses. **179**
- E- FLASHLIGHT HOLDER KIT - Handy holder for 2 cell lights. **109**
- F- RADIO & TV INSTRUMENT KIT - 1 large & 2 small pockets. **279**



PRECISION BOX JOINT PLIER SET

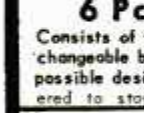
Top Quality, Imported, Precision, Box Joint Pliers. Set consists of 1 pair, Flat Nose for general work, 1 pair Needle Nose for fine work and work and 1 pair Round Nose for looping, etc. May be purchased separately for **175**

The complete set of three is ideal for the radio, TV repairman, hobbyist, inventor, electrician, silversmith, etc. All 3 with case. **495**



6 PIECE SCREWDRIVER SET

With unbreakable, shock-proof amber plastic handle and aluminum screw chuck. Blades are hardened, tempered and cross ground. Set includes 2 cabinet blades, 1/8" & 3/16", 1 mechanics blade 1/4" & 2 Phillips type blades No. 1 & 2 in wrap-around case. **ONLY 109**



6 Pc. WOOD CARVING SET

Consists of wood handle with screw type chuck and five interchangeable blades. These blades are designed to carve every possible design in wood & linoleum. Hammer forged and tempered to stay sharp longer. All 6 pieces in leather holder. **195**



AN-JC-48 HARNESS WIRE 20,16,12 GAUGE

Handy for emergency repairs on radios, aircraft, autos, boats, etc. Sold only in bundles of 6 pounds or more. These bundles are in mixed gauges & lengths, very clean & unraveled. This wire normally sells for 4¢ to 5¢ per foot. Here is your opportunity to have a stock of wire for approx., 1/4¢ per ft. - 6lbs. for **ONLY 295**



CLAMP-ON ANYWHERE LAMP

One of the handiest lights a photographer can own! Clamps on anywhere. Fully adjustable, swivel lets reflector move freely. Can be used with photoflood or photoflash lamps. Also used as reading lamp, work lamp, etc. Socket assembly, includes clamp, adjustable swivel, cord and plug. **LAMP ALONE 139**
Spot reflector (5" diameter) } **109 EA.**
Parabolic flood Reflector (9" diameter) }

SURPLUS WINCH



Originally used by the Navy to control gunnery targets when being towed by an airplane. Ideal for many uses. This winch will pay out, hold or reel in cable or rope. It has a capacity for 4500 feet of 3/32" cable or 2500 feet of 1/8" cable. The rotating drum is gear driven and is operated by a crank handle. Drum may be rotated at 1 to 1 or 8 to 3 ratio. A brake holds drum with with ratchet & pawl to set. Size 29" x 13 1/2" x 13" **ONLY 32.50**

NEW 1/2 TON CAPACITY HOIST WINCH PULLER

For LIFTING - STRETCHING - PULLING. Does the job Easier, Faster & Safer. Made of high tensile Manganese Bronze; Duraluminum; Aircraft Cable and Steel - weighs only 6 lbs. Has a 14 to 1 power ratio and guaranteed 1000 pound capacity. Tested to 100% overload. Fast, dependable operation. No chains to kink, no ropes to tangle. Does the job of bulky chain hoists **ONLY 17.95** costing many times as much. Saves time & labor.

Attention GADGETEERS

ELECTRIC GYRO

Turns up to 50,000 RPM. Electric drive motor is integral part of balance wheel. Has double end shaft to drive precision tools or machinery at precise, controlled speeds. Full ball bearing mounted. Operates high or low voltage. A highly precise instrument. Ideal for experimental work, science labs, hobbyists & technical engineers. **495**
A TREMENDOUS BUY!

2 Heat SOLDERING IRON

This is really TWO IRONS in ONE!!! A control button in handle selects 150 or 300 watt heat. Full size iron for light & heavy work. Removable, solid copper tip. Complete with cord and tip. **495**

PLASTIC PARALLEL STRAIGHT EDGE

A valuable asset to the navigator, engineer, draftsman or mechanic. Has adjustment knobs. Rubber pods prevent slipping. **ONLY 97c**



PRECISION GERMAN MICROMETER

One of the finest quality, imported, precision tools on the market. Reads from .001. It has a ratchet stop for absolute accuracy and a lock ring to hold setting secure. Head contains decimal chart. **9.75 NEW**



INSIDE-OUTSIDE VERNIER CALIPER

Measures Inside - Outside & Depth from .001 to 6 in. Reads both English & Metric scales. Specially hardened jaws. Sliding jaw has lock nut to hold setting. Made by one of the leading specialists in precision instruments. **9.75 NEW**

6 IN. SOLID STEEL STARRETT SQUARE

Has specially hardened beams and edges, accurately ground to insure parallelism and straightness. Made of finest quality materials and highly regarded for its use as a standard square. A PALLEY VALUE for ONLY. **13.50 VALUE 8.72**



MECHANICAL DRAWING SET

NEW 7 PIECE
A REAL PALLEY BARGAIN! Made in Germany. Has a 4 1/2" compass with pen and pencil part; a 4 1/2" divider; one 3 1/2" reverse bow compass for pencil and ink; 4 1/2" ruling pen; capsule with extra lead. Complete in velvet lined case, for only **3.25**



WESTINGHOUSE AIR COMPRESSOR

CONTINENTAL GAS ENGINE
THAT FAMOUS SINGLE CYLINDER, 4 CYCLE, ENGINE with a GENUINE RED SEAL, Air Cooled 'L' Head. Comes complete with all accessories such as: mesh type air cleaner, flywheel, magneto, float type carburetor, fuel tank, starter pulley, muffler, blower housing, etc. An ideal power plant for small farm machinery, lighting plants, air compressors, power tools, small boats, etc. Weighs only 43 lbs. **49.50**

1000's now in use for spraying, inflating, air tools, in garages, laboratories, shops & on trucks, tractors, jeeps, etc. Lightweight but powerful. Operates on 1/2 HP. gas or electric motor. Runs either direction. Delivers approx 3.27 CFM at 600 RPM or 6.54 RPM at 1200 Rpm. Has 2" bore, 1 1/2" stroke. We have motors, tanks and fittings to adapt this unit. **23.95**

SEE OPPOSITE PAGE FOR TERMS

SAVE TO 85% AT "GADGETEERS HEAVEN"

NOW! MAKE YOUR OWN ARC WELDER!



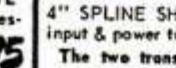
HERE'S A REAL BUY! Finest, Precision built, R-1 Generators, Originally used on B-29 airplanes. These generators cost the Government approx. \$400.00 each. Gives from 300 to 400 amps at 27 volts. Ideal for all welding, light and heavy, up to 5/8" thickness. Free instructions for converting to welding unit **2795**



3 SPEED TRANSMISSION
Converts a high RPM, low power input into low, RPM, high torque output. Has 2 take-off shafts at 4 to 1 & 16 to 1 ratio. Gear box has worm drive bronze gears & throw-out clutch. Will operate forward or reverse directions. Adaptable to many uses on power machinery. **1995**

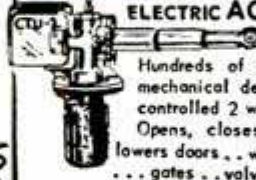


VICKERS HYDRAULIC TRANSMISSION
Self contained, 2 H.P., constant torque at all speeds with variable volume reversible, piston pump (controlled by outside lever) supplying piston hydraulic motor. Automatic pressure, dash pot for smooth control. Power output RPM -0 to 1/3 input RPM in both directions. Input RPM 1800 continuous, 4000 intermittent. Dash pot can be removed for greater RPM. Ideal for lathes, duplicator set-up of mills, conveyors, small cars, drives, gearings, etc. **3750**



4" SPLINE SHAFTS for input & power take-off . . . **250 PR.**
The two transmissions above can be combined to make an excellent "power booster" or speed controller for many types of power machinery.

OTHER AIRCRAFT GENERATORS
E-5A . . . 12 to 15 Volts 50 Amps \$12.95
P-1 . . . 27 VOLTS . . . 200 AMPS \$15.95
1273-1A. 27 VOLTS . . . 75 AMPS \$15.95
03 . . . 27 VOLTS . . . 100 AMPS \$25.00



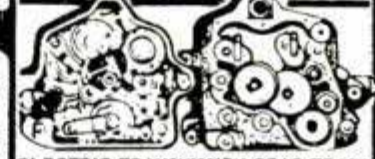
ELECTRIC ACTUATOR
Hundreds of uses for any mechanical device needing controlled 2 way action. Opens, closes, raises or lowers doors, windows, gates, valves.

CTU-2 Foote linear actuator. 24V. A.C. or D.C., 8500 R.P.M., 1/6 H.P. - Series wound motor. 4 1/2" stroke in 13 1/2 seconds. Compression and tension loads up to 750 pounds. Adjustable micro-switch for limits of travel. Overall length retracted: 11" **695**



GEAR HEAD MOTORS
Heavy duty G.E. Gear Head Motor. 1 1/2 H.P., 24 volt D.C., 125 Amp. reversible motor will drive reduction gear box unit 44.5 to 1, resulting in 168 R.P.M. at 5/8" diameter take-off shaft. Motor contains electro magnetic brake. **1095**

UNIT COMPLETE MOTOR 495
GEAR BOX ALONE 795



ELECTRIC TRANSMISSION GEAR TRAIN
GT-1 - approx. 50 Bronze Spur & Pinion Gears, 3/8" to 4" dia., 5 sets of 7 cluster gears, 2 complete worm and worm gear drive sets. 40 N.D. ball bearings 1 1/2" to 1 1/4" dia., watch springs bushings, posts, face plates, housings, micro-switches, 2 miniature controlled clutches, etc. Gears in multiple size and sequence, identical teeth ratio, giving 100's of gear reduction combinations. Weight: 19 pounds **849**

VALUABLE GEAR BARGAIN
Ideal for revolving radio antenna, television antenna, etc. **675**

GEAR BOX VTG-1 - 90° - Bevel gear
1 1/2 to 1 reduction. **395**
A lifetime value. Size: 7" x 6"
Has lever control for engaging and disengaging positive clutch. Dust-proof housing, pre-lubricated bearings . . . Can be adapted to Vickers Transmission.

ELECTRIC MOTORS

LEAR ELECTRIC MOTOR. 24 volt, 6 amps, series wound reversible motor . . . with overload clutch. Motor turns 11,000 RPM. Has 11 to 1 gear reduction box turning 1000 RPM at take-off. Adaptable to flex or rigid drive. Limit switch **795**
box. Size: 10" x 4"

SAMSELL MOTOR
27 volts, 16 amps, 1/5 H.P. reversible, series wound on motor. 3800 RPM, shaft 9/32" diameter. 12-spline. 4-1/8" x 2-3/8". ONLY **395**

SURPLUS MOTORS
No. 500 - New 1/2 H.P. 27 Volt, D.C. - A.C. This motor can be readily adapted to deliver up to 1/2 H.P. on 110 Volts, A.C. by the simple method of rearranging armature brush-leads. Free Diagram with each order. A SENSATIONAL VALUE. **595**
No. 500-A - Converted to 110 Volts, A.C. Equipped with plug and 3 1/2 ft. heavy duty cord . . . **849**

PIANO HINGE
Overall - Width - Length - Price ea.
1 1/2" (5/8" side) 72" alum. \$1.99
3 1/2" (1 1/4" - 54" st. steel 1.69
BRASS HINGE - 1 1/4" (5/8" side)
.040 thick) Any length at . . . per ft. .29

1952 CATALOG - 230 PAGES
COMPLETELY ILLUSTRATED, SHOWING 1000'S OF ITEMS IN NEW and WAR SURPLUS! Some at SAVINGS UP TO 85%! Clothing, Household Items, Hand & Power Tools, Camping & Outdoor Equipment, and a huge stock of Hydraulic Equipment, including Cylinders, Valves, Pumps, Motors, Fittings, etc. Send only 50¢ for your copy of this amazing, bargain catalog today.



PALLEY SUPPLY CO

6321 SAN FERNANDO RD. DEPT. PM.1 GLENDALE 1, CALIF.

PALLEY'S FAMOUS MIXES! Prepared especially for the HOME CRAFTSMAN, HOBBYIST, INVENTOR, GADGETEER, or SHOP MECHANIC.

GADGET MIX - Rivets, spacers, Bolts, Screws, Gears, Wheel bearings, Springs & Clamps. No. 106, 5 lbs. **119**

BEARING MIX - No. 170A. Approx. 20 needle, Ball & Roller Bearings. New & used. Sizes: 1/2" to 4". Some of these cost Gov't \$10 apiece . . . Never such a value . . . 5 lbs. for ONLY **159**

HINGE MIX - No. 170H. 12 pairs of strap & butt hinges, hasps, 1" x 1" to 7/8" x 10" in length and 8" strap. 2 lbs. **109**

ABRASIVE AND GRINDING WHEEL MIX - 50 pieces including honing stone, wheels, pencil rolls, etc. . . . A sharp value! No. 170AG . . . **99c**

SPRING MIX - No. 206. Torsion, Compression & Tension Springs. Ass't sizes. A treasure trove for emergencies. Scores of springs. 5 lbs. **169**

RIVET MIX - 3 POUNDS - Consisting of sizes from 1/4" to 3" long in many diameters and alloys . . . **119**

FILE MIX - Ten ass't files - 4" to 12". Includes Vixens, half rounds, mills, bastards, etc. in seconds & used but good condition. 1 Vixen alone is worth our price of entire mix . . . **99c**

PULLEY MIX - You'll want this one around. 10 micarta & metal pulleys, ranging from 1" to 5" with ball and one piece bearings. These are aircraft pulleys, the best made, with hundreds of uses **295**

SCREW MIX - 5 lbs. including assortment of wood and machine screws. Many sizes. Save dollars & always have plenty of screws on hand . . . **139**

NUT MIX - 3 lbs. approx. 500 Nuts, Anchor, Lock, Castle, Hex, Elastic Stop Nuts, etc. You'll always have plenty of nuts in the shop. NM-1 **139**

SUPER COMBO MIX - No. SC-2 - Here's a real bargain! ALL 10 ABOVE MIXES FOR ONLY **1295**

AIRCRAFT CABLE

Rust resistant, alloyed steel. Extra flexible. Pre-formed, 7 x 19 strand. On reels.
1/16" - 4 1/2 ft. 7/32" - 10 1/2 ft.
5/64" - 5 ft. 1/4" - 12 1/2 ft.
3/32" - 5 1/2 ft. 9/32" - 15 ft.
1/8" - 7 ft. 5/16" - 16 1/2 ft.
5/32" - 7 1/2 ft. 3/8" - 18 ft.
3/16" - 9 1/2 ft. 1/2" - 20 ft.

SPECIAL! 3/16" cable, 18 feet long, with tumbuckle ends. **99c**

Stainless Steel Cable - Pre-Formed
1/16" - 6 ft. 5/32" - 20 ft.
3/32" - 14 ft. 1/4" - 26 ft.

Bronze Cable - Not Pre-Formed
1/16" - 5 ft. 3/16" - 23 ft.
1/4" - 17 ft. 1/2" - 38 ft.

Plow Steel Cable - Hemp Center 6 x 19
7/8" 25¢ ft. - 1" 28¢ ft.

FIRE EXTINGUISHER

Kiddle Lux - CO² Type. Built to Gov't specifications. Heavy, shatter-proof case. Recent hydrostatic test. Reconditioned and fully charged. LIKE NEW! READY FOR INSTANT USE!!

2 lb. size with Swing Nozzle . . . 13.75
3 1/2 lb. size with Swing Nozzle . . . 17.95
7 1/2 lb. size with Horn 23.75
10 lb. size with New Squeeze Grip Handle & 3/4" flex hose with Horn. 29.75
15 lb. size with Squeeze Grip hd, 4ft. flex hose, plastic hom. . . 42.50
15 lb. size with Wheel Control . . . 37.95

ORDER FROM THIS AD. All sales final. Prices F.O.B. Glendale. Pay by M.O. or Check. P.O.'s accepted from D & B. Firms. 1/2 deposit with C.O.D.'s.

20,000 lb. thrust (push-pull) using 1500 PSI line pressure as obtained from our hyd. pumps. Or will produce 40,000 lb. thrust with 3,000 lb. line pressure. Can ALSO BE OPERATED ON LOW PRESSURE AIR SYSTEMS. 4" Bore, 1 1/2" dia. piston shaft, 18" stroke, length: 30 1/2". Equipped with ball bearing loaded clevis type mounting and swivel type high pressure steel pipe bracket for easy use. Ideal for road, farm, & shop machinery, presses, etc. Cost Gov't \$390.00. **295**

We carry the World's largest supply of Special Hydraulic Equipment featuring over 20,000 cylinders in 61 sizes and types. Can also supply all accessories such as Pumps, Valves, Tanks, Hose and Fittings. Write for information.

No. 3 HYDRAULIC CYLINDER
Double action. Bore is 1". Shaft is 1/2". Has a stroke of 2 1/2" to 4". Stroke can be adjusted with internal sleeve stops. Overall length is 8 1/2". Will take 1500 lbs. continuous duty. 3000 lbs. intermittent. Will lift or push up to 1100 lbs. **575**

No. 9-E HYDRAULIC CYLINDER
Double action cylinder. Has a bore of 1-3/8" and shaft of 1". Stroke is 9". Overall length 15 1/4". Built for 1500 lbs. continuous duty. 3000 lbs. intermittent. Will lift or push up to 2300 lbs. Can be adapted to hundreds of uses **975**

FOUR WAY VALVE
V-9A - LARGE VOLUME PRESSURE RELIEF VALVE
1/2" Standard pipe ports. Pressure setting - approx. 1200 PSI. Range - 1000 to 2100 PSI. **575**

STRATO-POWER PUMP
With built-in variable flow control valve in head. Positive displacement piston type. Displaces .450 cu. in. per revolution. 2 gal. per min. cap. at 1500 RPM at 1250 PSI. Pressure limit, 1250 PSI continuous, 1400 PSI for 15 sec. Operates at 3750 RPM, intermittent maximum 4500 RPM. Rotates either direction without adjustment **1950**

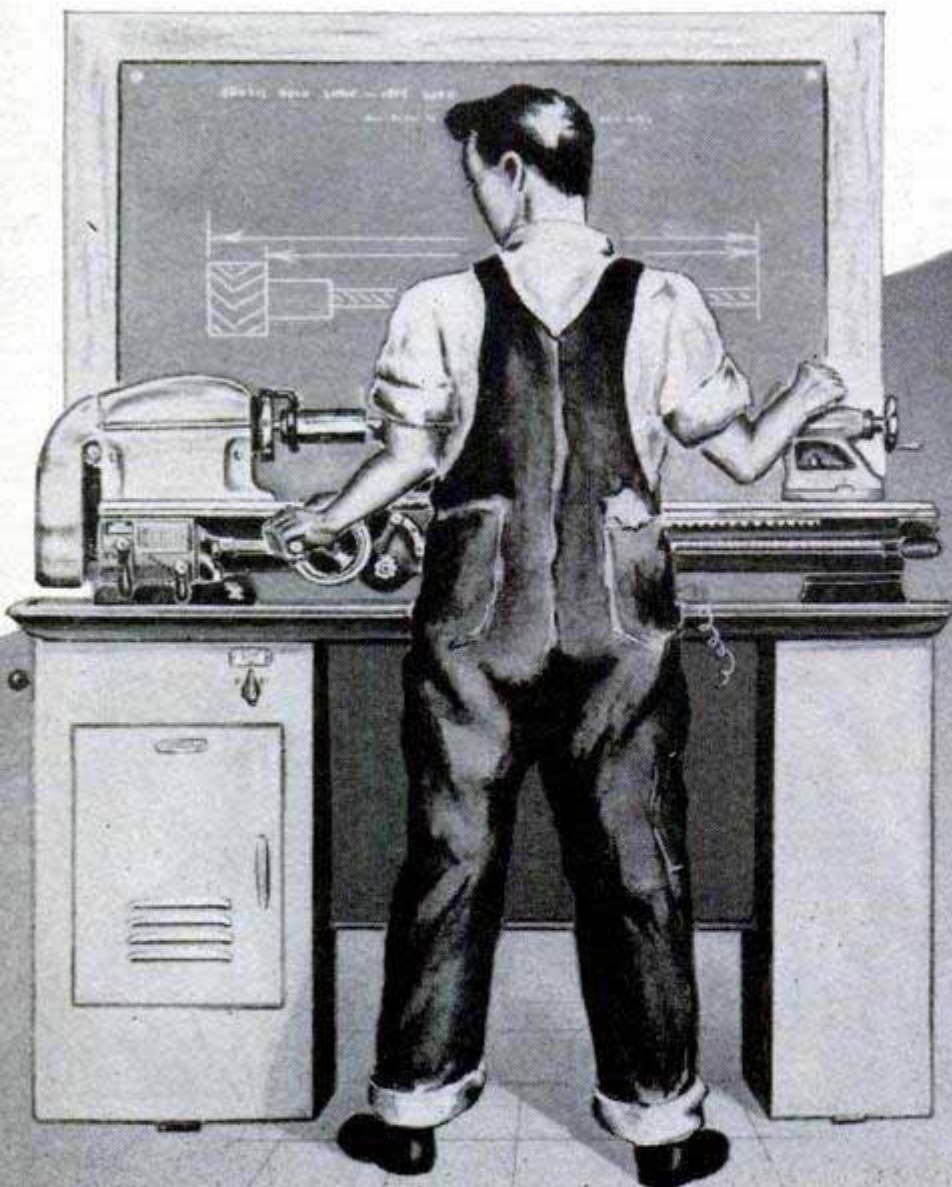
VICKERS HYD. VARIABLE DISPLACEMENT PUMP
Will deliver maximum volume at any pressure setting between 600 & 900 PSI. Desired pressure settings obtained with adjusting screw. Pump housing serves as reservoir for system. Has built-in compressed air supercharger which makes system independent of outside atmospheric pressure. Rotation is left hand only. Maximum speed for continuous duty is 3750 RPM. Displacement is .484 cu. in. per revolution or approx. 4 GPM at 1750 RPM. **3250**

ROPER HYDRAULIC PUMP UNIT
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1952

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LATHES

1906

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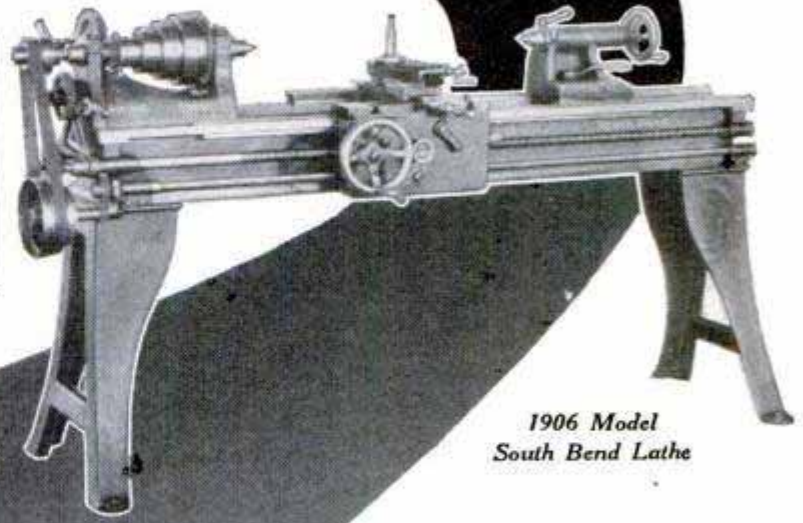


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This South Bend Lathe advertisement appeared in POPULAR MECHANICS, Feb. 1908



1906 Model
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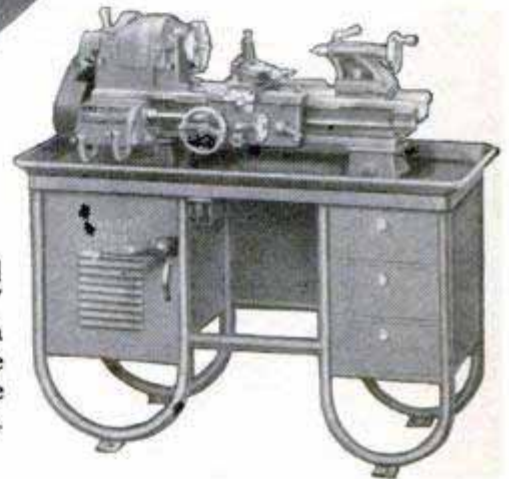
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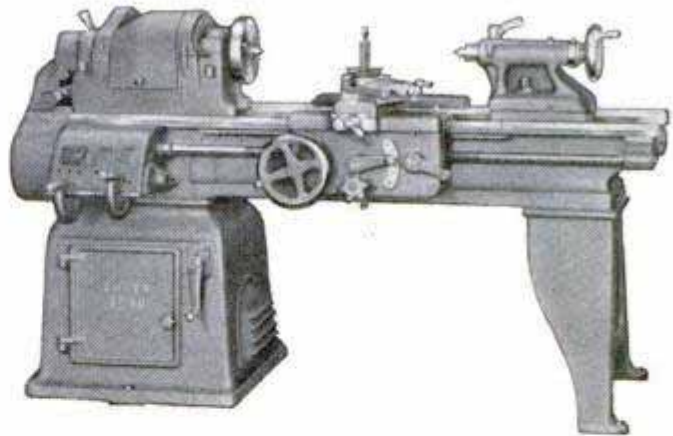
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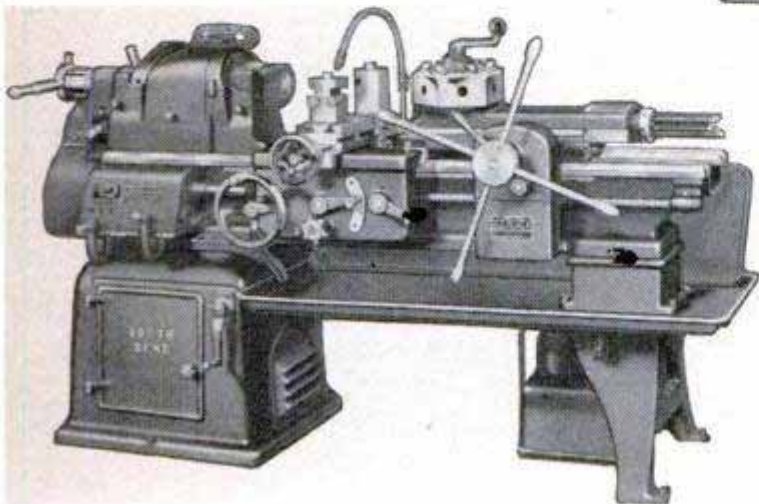
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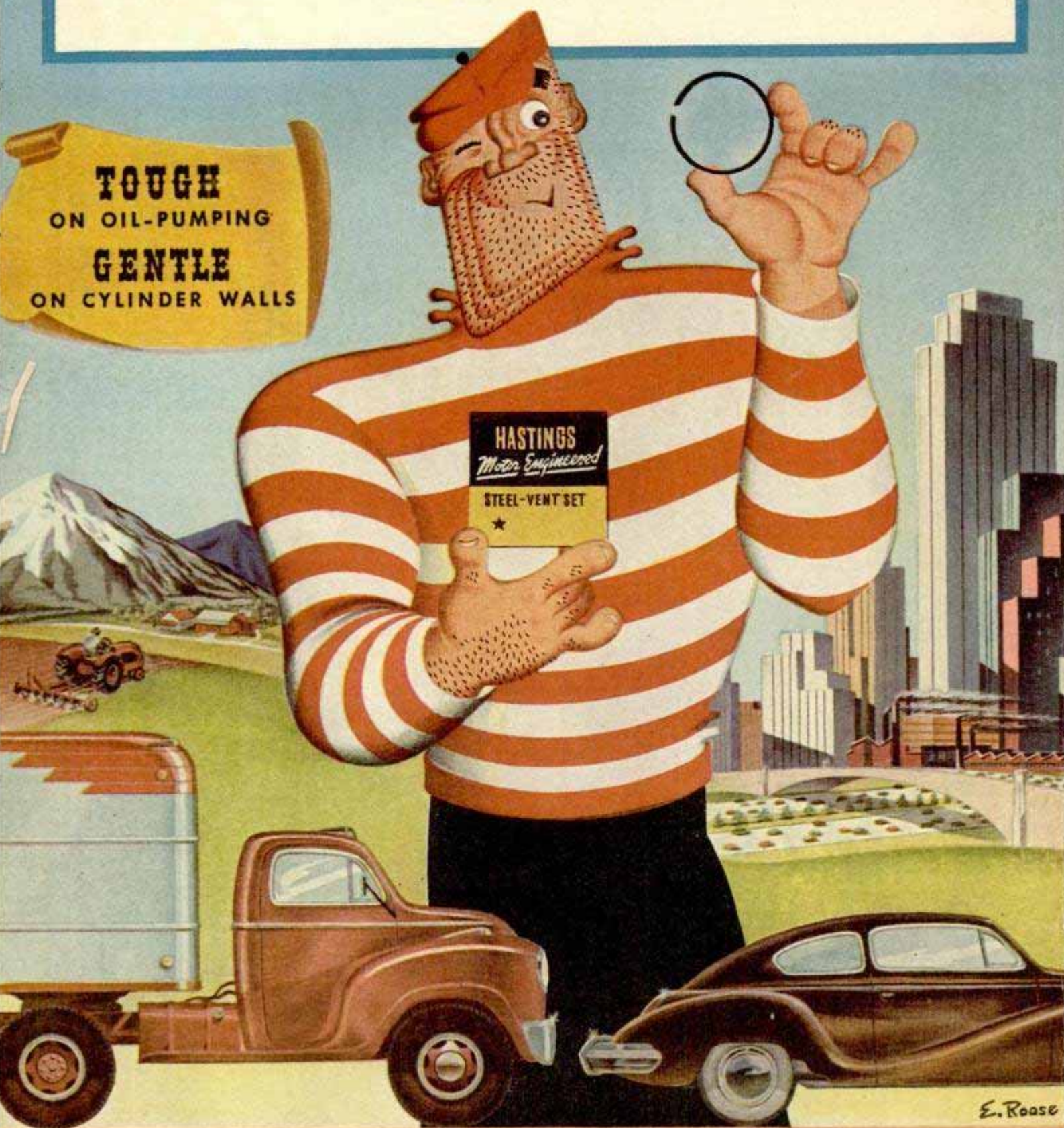
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