

POPULAR MECHANICS

MAGAZINE

WRITTEN SO YOU CAN UNDERSTAND IT

NOVEMBER 1946
25 CENTS

BARGE-CARRYING SHIP
PAGE 143



Tough, BUT OH SO GENTLE



When your automobile engine starts pumping oil or smoking, it will pay you to install Hastings piston rings. They stop oil-

pumping, *check* cylinder wear, restore engine performance. Ask your motor specialist.

HASTINGS MANUFACTURING CO. • HASTINGS, MICH.
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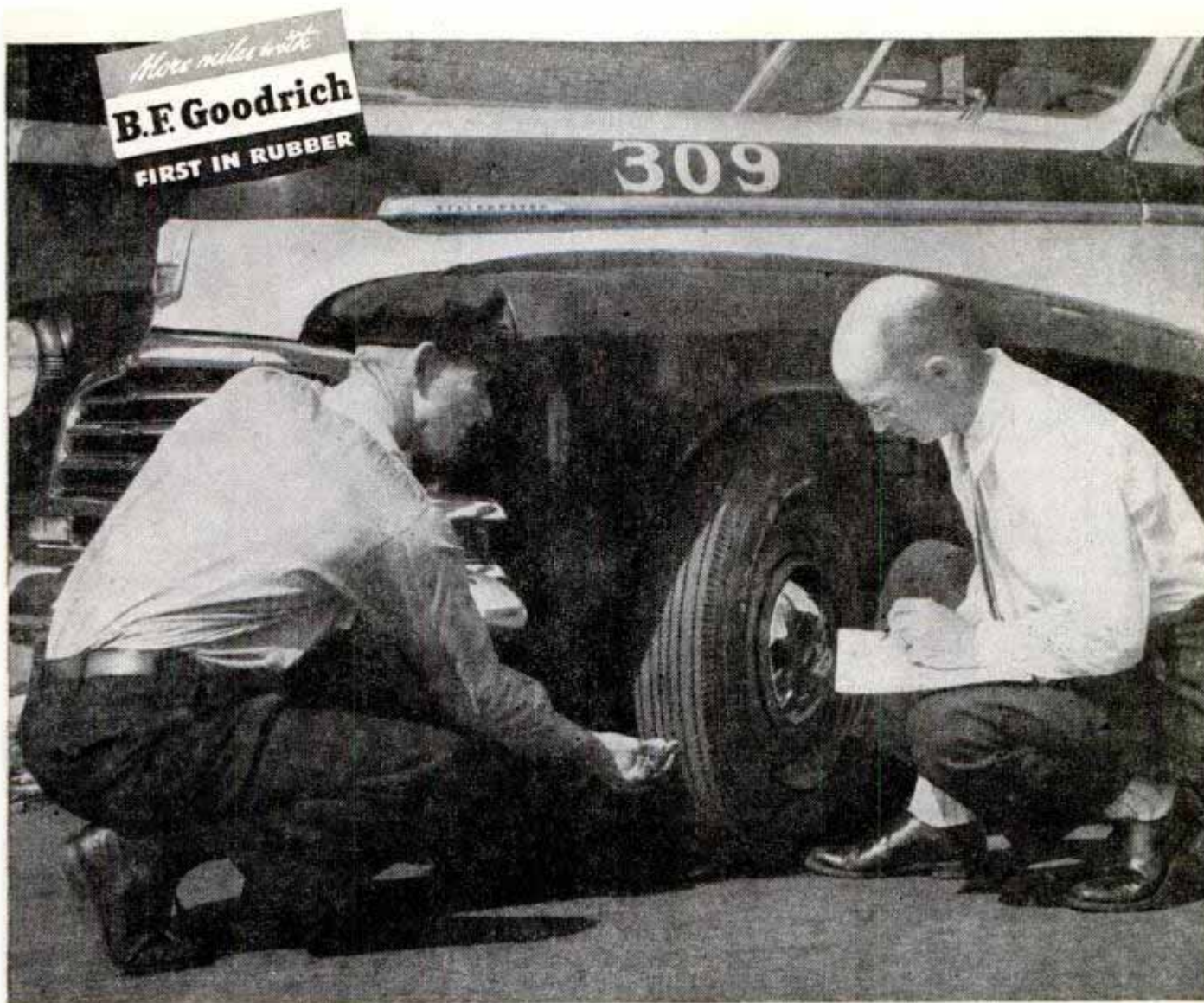
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HASTINGS STEEL-VENT
PISTON RINGS

TOUGH ON OIL-PUMPING GENTLE ON CYLINDER WALLS



TAXICAB FLEET TESTS PROVE NEW TIRE OUTWEARS PREWAR TIRES

"RAIN OR SHINE, winter or summer, our cabs must serve the public twenty-four hours a day," says Mr. T. A. Ballantine, President, Yellow Cab Co., Louisville, Ky. "The new B. F. Goodrich tires meet *all* our tire requirements for such operation! In actual mileage, tests on our own fleet have proved conclusively that the new B. F. Goodrich tires *outwear prewar tires.*"

From taxi fleets and commercial car owners—from police departments and passenger car drivers—reports like this are coming in every week. They all tell how much better the new B. F. Goodrich Silvertown tires with the wider tread stand

up than the tires of prewar days.

These tires were *built* to take the punishment of thousands of miles of driving—designed with a wider, flatter tread that hugs the road and spreads wear over a greater area. This better-type tread is backed up by a 35% stronger cord body made with *more* cords and *stronger* cords. The result is extra miles of trouble-free driving.

Of course, supplies of tires are

still limited. In spite of greedy increased production, demand is even greater. This is especially true of the B. F. Goodrich tire that outwears prewar tires. Please check your needs well in advance. Talk to your B. F. Goodrich dealer about the size and number of tires you'll need. He'll do his best to keep you rolling until he can get the new tires for you. *The B. F. Goodrich Co., Akron, Ohio.*

B.F. Goodrich

FIRST IN RUBBER

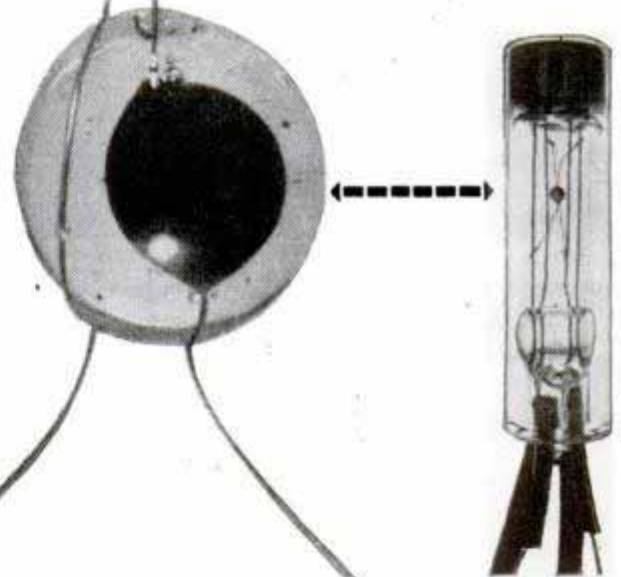
The Eye That Never Closes

You are looking at a thermistor—a speck of metallic oxide imbedded in a glass bead hardly larger than a pinhead and mounted in a vacuum. The thermistor was developed by Bell Telephone Laboratories to keep an eye on the amplification in long-distance telephone circuits.

When a thermistor is heated, its resistance to electric current changes rapidly. That is its secret. Connected in the output of repeater amplifiers, it heats up as power increases, cools as power decreases. This change in temperature alters the resistance, in turn alters the amplification, and so maintains the desired power level.

Wartime need brought a new use for this device which can detect temperature changes of one-millionth of a degree. Bell Laboratories scientists produced a thermistor which could “see” the warmth of a man’s body a quarter of a mile away.

Thermistors are made by Western Electric Company, manufacturing branch of the Bell System. Fundamental work on this tiny device still continues as part of the Laboratories program to keep giving America the finest telephone service in the world.



BELL TELEPHONE LABORATORIES

EXPLORING AND INVENTING, DEVISING AND PERFECTING FOR CONTINUED IMPROVEMENTS AND ECONOMIES IN TELEPHONE SERVICE

Popular Mechanics Magazine

Registered in U. S. Patent Office and Canada

H. H. WINDSOR, Founder

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

NEW CARS for next year was our standard leadoff article in the November issue in prewar years. Sorry we can't dazzle you with an array of 1947 models—but we believe we have the next best thing: an authoritative "Forecast From Detroit." This article gives the real low-down on what you can expect in the way of new cars during the next 12 months.

NEXT MONTH the lineup of features and story-telling pictures is so outstanding that every one is worth shouting about in this column. "Inside the 'Atom City'" takes you to Oak Ridge, Tenn., for the hitherto untold story of what goes on behind the walls of the most restricted area in the world. "Narrow Gauge Movies" opens new vistas for the 16-mm. camera fan and reveals the important role these films will play in future television programs. "Home Town Circus" is going to put a lot of ideas in the heads of community boosters. If they can do it in Gainesville, Texas, why not in Earlville, Ill., or Grand Island, Nebr.? Then there's "Special Delivery House," introducing a new type of prefab that can be erected by one man. "How Good a Driver Are You?" is packed with some alarming figures and a challenge to every auto owner.

HOME CRAFTSMEN planning to furnish a room for a younger member of the family get the first call next month in the Craftsman section. Complete details are given for the construction of two chests of subdued modern design and built of choice cabinet woods. There's also a practical feature on servicing your vacuum cleaner. Another story tells how to shape plastics by a simple heat-forming process. Photo fans will be clipping out the article telling how to shoot single-column pictures.

NEWCOMER "hams" will find a simple and efficient 50-watt 10-meter transmitter in the Radio and Electronics section next month.

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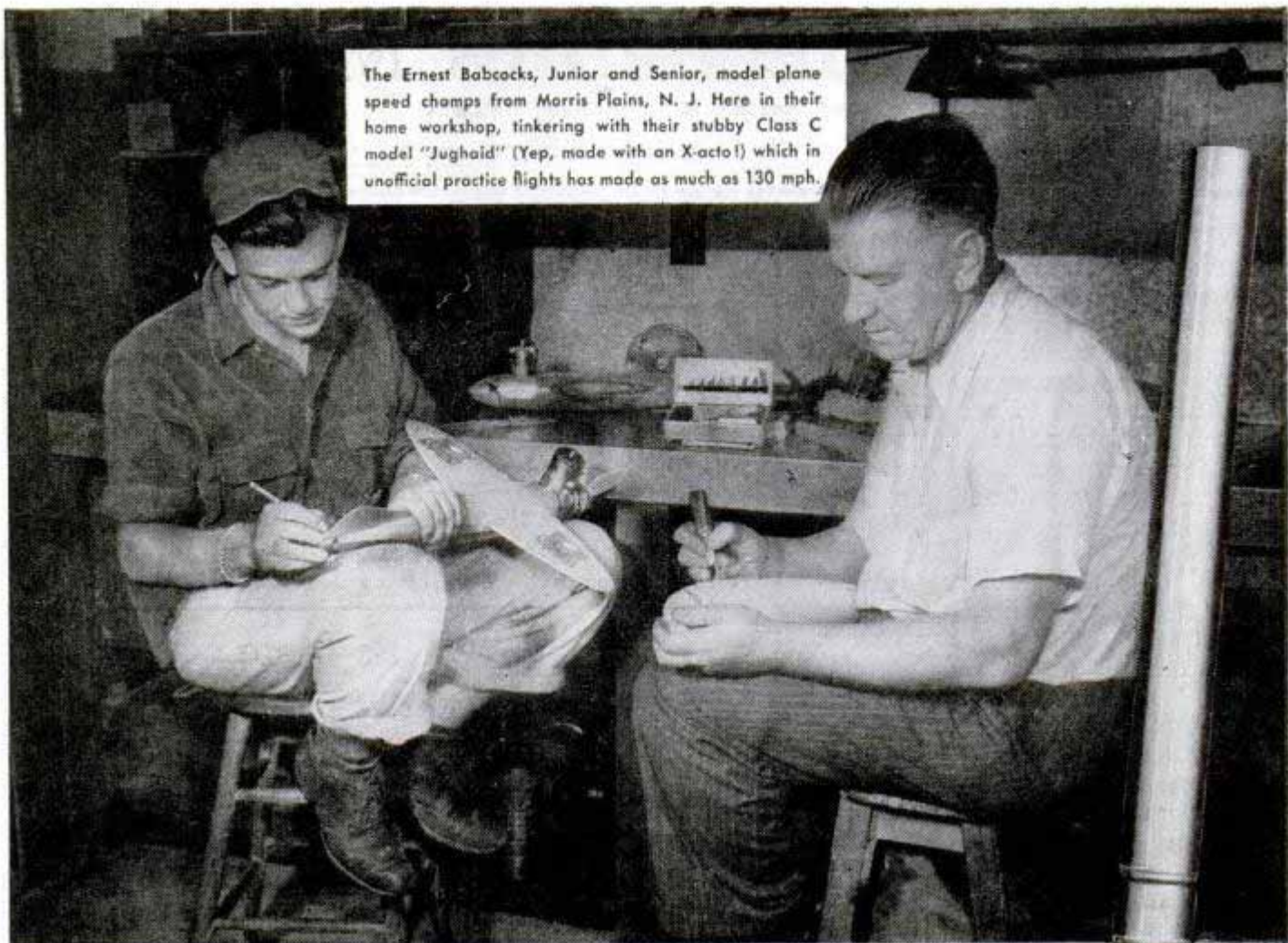
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The Ernest Babcocks, Junior and Senior, model plane speed champs from Morris Plains, N. J. Here in their home workshop, tinkering with their stubby Class C model "Jughaid" (Yep, made with an X-acto!) which in unofficial practice flights has made as much as 130 mph.



MEET THE CHAMPS...THE BABCOCK TEAM

...and read what *they* say about X-acto!

When thirteen-year-old Ernest Babcock asked his Dad for a model plane kit four Christmases ago, he got an X-acto Knife Chest, too. But, neither father nor son dreamed, then, that they'd become the nationally famous model plane team they are today.

Dad designs the planes, Junior flies them, but *both* work at building them with their trusty X-actos. Together, the amazing Babcocks have broken more records and run away with more top prizes than most ordinary mortals ever heard of.

Anyone who ever put a knife to wood knows a brilliant record like this takes more than expert skill in designing and handling the planes.

It takes the patience of a saint in building accurate models. And it takes good, dependable tools.

So when the Babcocks say, "We've used X-acto Knives since we first began building models, and find them *the handiest tools to have in a model shop*"... there's a tip for you, brother!

13 Blade Shapes Quickly Interchangeable!

X-acto is tops, as well, for whittlers, paper sculptors, or any other hobby crafter, be he amateur or expert. With 13 scalpel-sharp blades and 3 safety-grip handles (*all-metal, no more substitute plastics!*) you'll do a slicker job, and *quicker*, when you use super-sharp X-acto.

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X-acto No. 2 Solid Duraluminum Knife . . . **50c**
With 5 assorted blades, \$1. Other X-acto Knives, Tools, Chests, 50c to \$12.50.



Hobby crafter's Dream Gift. No. 85 X-acto Tool Chest—3 all-metal knives; full assortment of blades; saw; sander; stripper; planer; drills and holders; steel ruler; complete in wooden chests, \$12.50.

X-acto
KNIVES & TOOLS

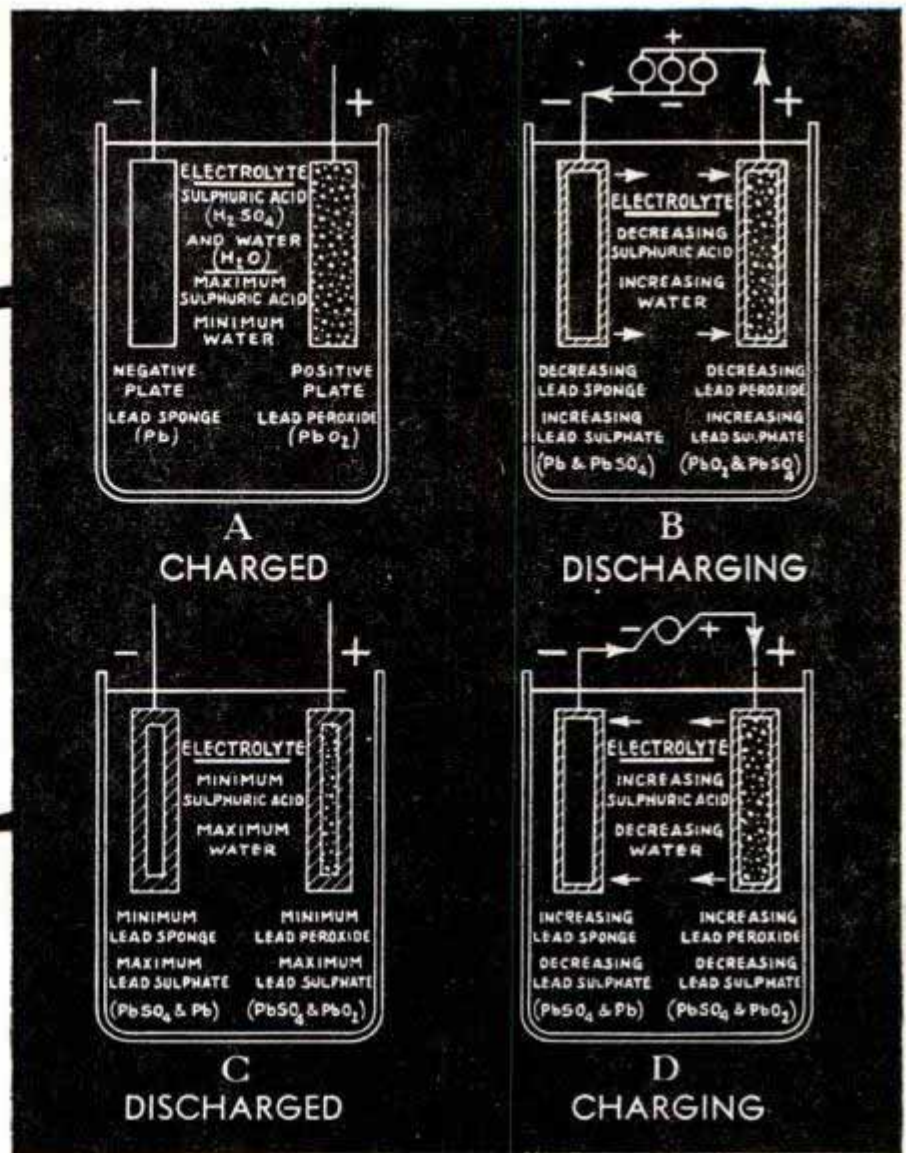


At hardware, hobby and gift shops

X-acto Crescent Products Co., Inc.,
440 Fourth Ave.,
New York 16, N. Y.
In Canada: Handicraft Tools, Ltd.,
Hermant Bldg., Toronto

*Reg. U. S. Pat. Off.

WHAT GOES ON INSIDE A BATTERY?



The pictures tell the story. When a cell (A) is fully charged, the negative plate is lead sponge (Pb), the positive plate is lead peroxide (PbO₂), and the specific gravity of the electrolyte (sulphuric acid, H₂SO₄, and water, H₂O) is at its maximum.

When discharging (B), the H₂SO₄ is divided into H₂ and SO₄.

The H₂ passes to the positive plate, liberates some of the Pb and combines with the plate's oxygen to form H₂O, thus increasing the water content of the electrolyte.

The SO₄ combines with the liberated Pb and forms lead sulphate, PbSO₄, on both plates, reducing acid content and specific gravity of the electrolyte. When sp. gr. reaches 1.150 the battery is discharged (C).

When recharging (D), the current flow and chemical changes are reversed and the plates and electrolyte returned to their original condition.

Because of lower capacities, some batteries discharge more rapidly than others. Exide Batteries are noted for their high capacity, long-life, low cost per mile of operation and strong starting power.

"WHEN IT'S AN EXIDE YOU START"

Would you like to know more about batteries? The complete story is told in a booklet, "THE STORAGE BATTERY, Its Fundamentals, Use and Maintenance." Mail a postal card today for a FREE copy.

Exide BATTERIES

THE ELECTRIC STORAGE BATTERY COMPANY, Philadelphia 32

Exide Batteries of Canada, Limited, Toronto

The Music of the Spheres



Are You In Tune With The Infinite?

HAS your whole being ever pulsated with a mysterious *exhilarating* rhythm? Have there been days when life suddenly and unexpectedly seemed especially enjoyable—when all of nature and yourself seemed to be swept up in a *silent symphony* of ecstasy? Have you longed to sustain such occasional experiences because of the self-confidence and peace of mind that they instilled within you?

High above the earth lies the cause of such strange phenomena. Within the canopy of space great worlds revolve at constant speed. With preciseness not conceivable by man, stupendous universes retain their relative distances—energies unwaveringly oscillate to and fro. Such is Cosmic motion—the orchestration of the *infinite*. If reducible to sound, it would be music Divine! Yet, silent as it is, this music of the spheres, this Cosmic *harmony*, prevails throughout all nature. The smallest living thing and the largest universe, alike, have their particular note in this scale of rhythm.

There are ways to attune yourself with these Cosmic and natural forces! There are ways in which your being may be continuously stimulated by this harmony of nature, resulting in an influx of greater *personal power*. The Rosicrucians (*not* a religion) are a world-wide philosophical fraternity. Let them show you in simple words how to attune yourself, mentally and physically, with the Infinite for the *fullness of living*.

Accept This Free Book

Write today for a *free* copy of the book, "The Mastery of Life." It has been instrumental in helping thousands to find themselves. It has revealed to many a heretofore *unsuspected* power. Use the coupon below for your copy.

Scribe E. E. H., Rosicrucian Order, AMORC
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I am interested in knowing how I may attune myself with the harmony of the universe. Please send me the *free* book, "The Mastery of Life," which explains how I may receive such knowledge.

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ADDRESS _____

The ROSICRUCIANS, (AMORC) • SAN JOSE • CALIFORNIA, U. S. A.



If YOU were Boss would YOU promote "YOU"?

valuable asset to any business organization. He never wants for a good job and above average earnings. He gets ahead.

Be honest now—

suppose that a better job had opened up in your company—carrying with it promotion and more money—could you qualify?

If you were boss, would you select "YOU" for that better job?

Consider before you answer.

First of all, could you *fill* the job? Has your experience fitted you for the step forward—have you been preparing for promotion apart from experience gained on the job?

Or have you just been filling a niche, doing daily tasks well but making no real and intelligent effort to learn and qualify for the job ahead so that if an opening should occur you would be ready to fill it?

The man who gets real promotion makes his own breaks—the man who slaves in the ordinary job at low pay just wishes and dreams of promotion and more money. Which are you?

Business is always willing to pay the man who knows—and pay him well. The man who is ready and willing to take responsibilities—and capable of directing the efforts of other men is a

We have helped thousands of men achieve promotion and more money—success sometimes beyond their dreams—a success that was started by a coupon similar to the one below.

Get out of that rut—don't be satisfied with a mediocre job at small pay—be a success in business—this coupon may be your first step.

So send it today—right now—tomorrow never comes for the man who consistently puts things off.

G. I. APPROVED

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If you can help me get the ability and knowledge for real promotion, I want to know it. Please send me your free 48 page booklet telling how I can succeed in the field I have checked below. I understand you will send this without obligation to me.

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Stenotypy (Machine Shorthand)

Name.....Age.....

Position..... **This One**

Address.....

City and State.....



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WEAR
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PYROIL ADDS LIFE TO YOUR CAR!

When your gas station attendant adds Pyroil to your gasoline and crankcase, he is adding life and mileage to your car. Pyroil provides a constant protective film which reduces wear of pistons and cylinder walls . . . it removes sludge and carbon formations. One pint of Pyroil in the crankcase and one ounce of Pyroil added with each five gallons of gasoline is an easy way to more trouble-free miles. Next time you drive into your gas station . . . simply say . . . "add Pyroil" . . . and you add life to your car.

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PYROIL COMPANY

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I want my car to last and run properly. Please tell me more about Pyroil and how it can accomplish this for me.

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



Jerry, the talking dog, is entertaining hospitalized veterans, by courtesy of the PYROIL Company. Picture of Jerry, sent on request.

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BIOGRAPHY QUIZ

DO YOU KNOW THE ONE CORRECT ANSWER COVERING ALL OF THESE QUERIES ABOUT ASSORTED FAMOUS FOLK?

WHO

- ...is England's foremost political cartoonist?
- ...founded and built up the second largest auto manufacturing concern in all the world?
- ...is the Negro sea captain celebrated as the first of his race to obtain a Master's license and command an American ship?
- ...tripled the firing power of U. S. infantrymen when he invented the semi-automatic rifle used in World War II?
- ...is famous both as an automotive engineer and as a co-designer of the Liberty Aircraft Engine of World War I?
- ...rose from janitor for a sorority house to the presidency of one of the nation's largest railroads?
- ...designed the first outboard motor?
- ...won the Gordon Bennett cup as a racing-car driver and went on to head a great corporation manufacturing aircraft engines?

Answer: *James Watson* A former student of the International Correspondence Schools.

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Working Hours _____ A.M. to _____ P.M. Length of Service in World War II _____

Special tuition rates to members of the Armed Forces. Enrollment under the G.I. Bill of Rights approved for War II Veterans. Canadian residents send coupon to International Correspondence Schools Canadian, Ltd., Montreal, Canada.

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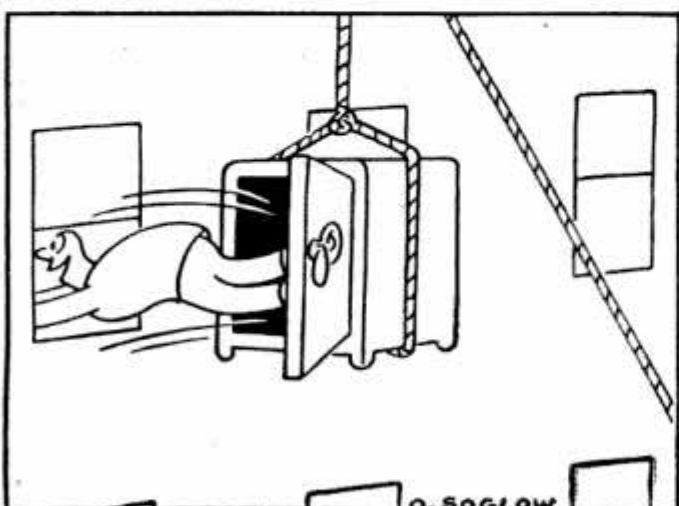
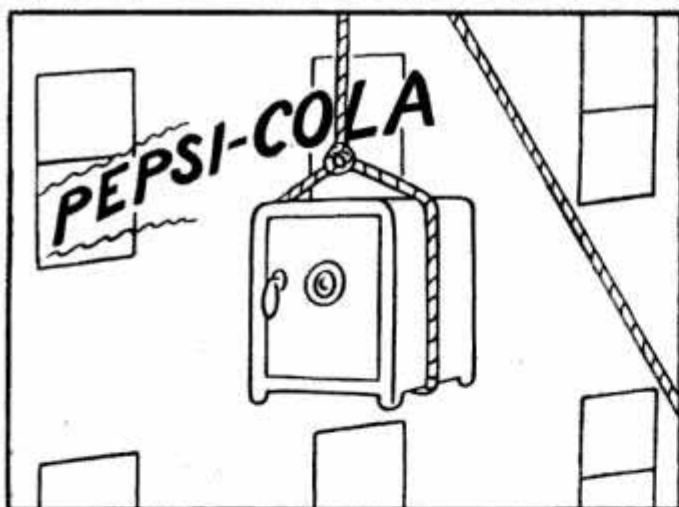
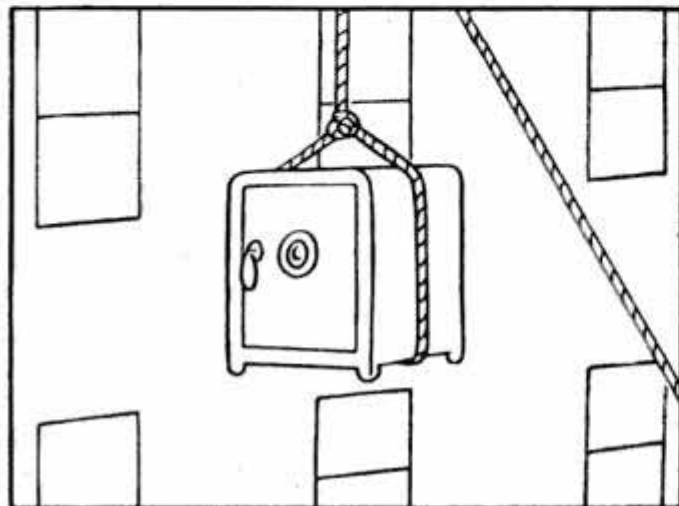
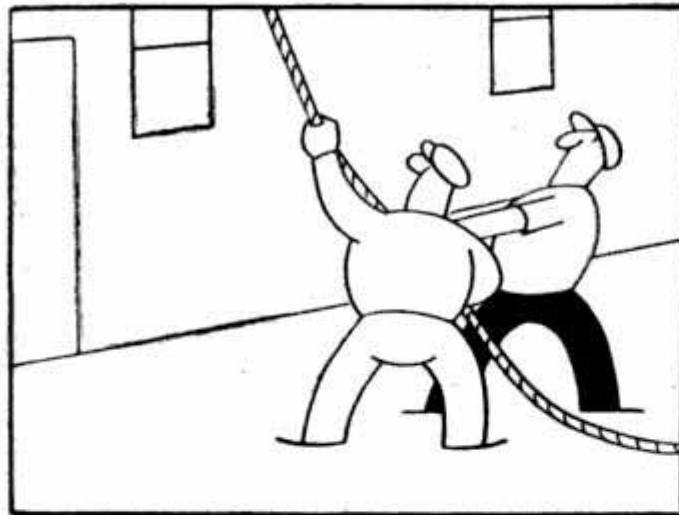
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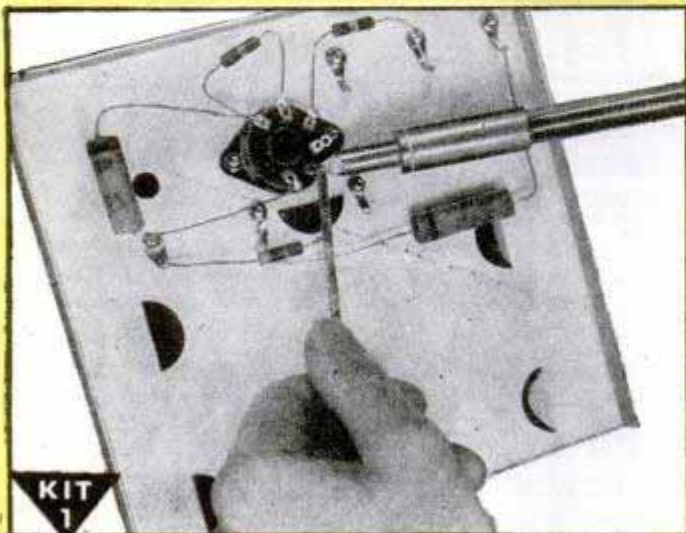
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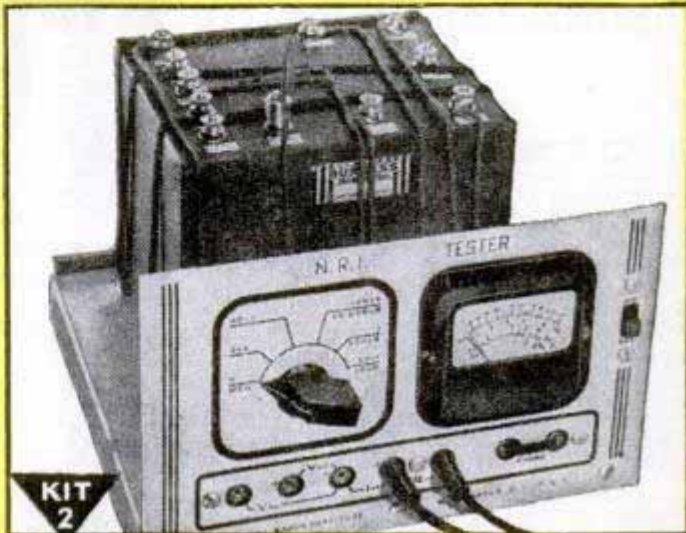
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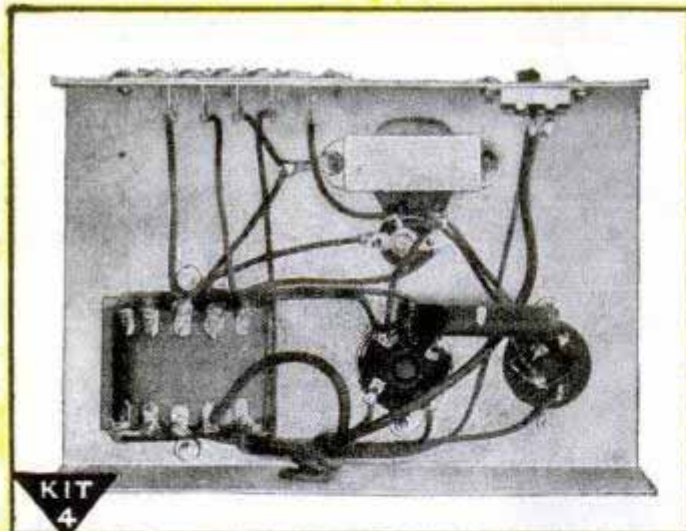
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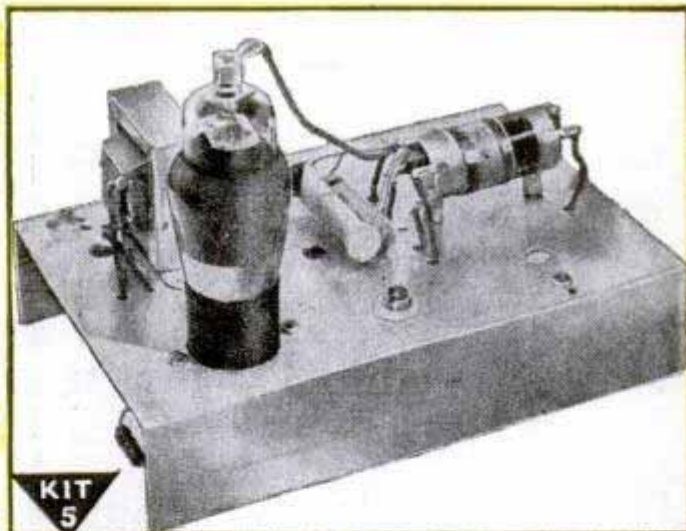
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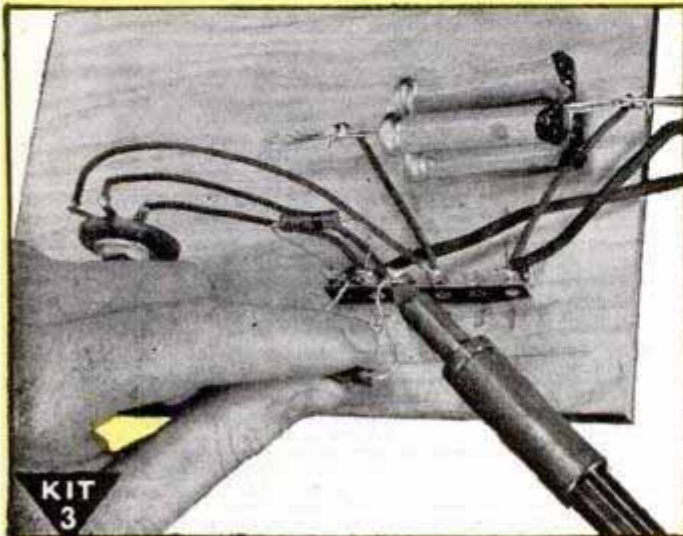
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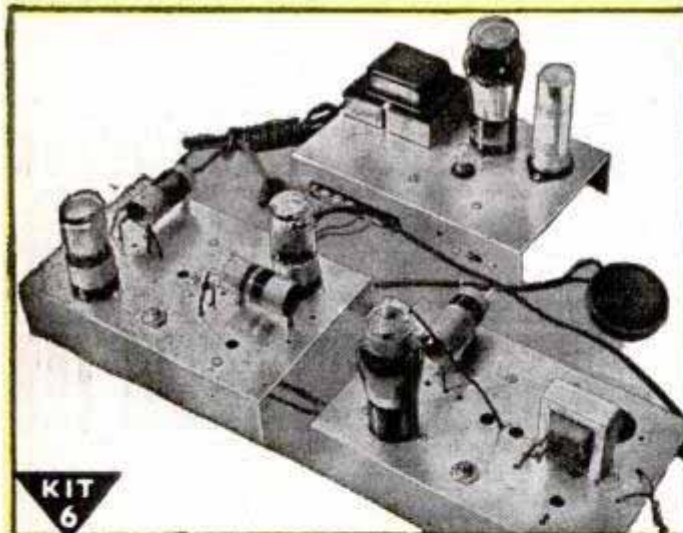
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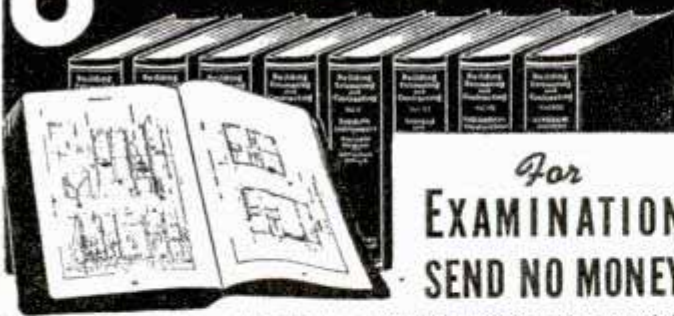
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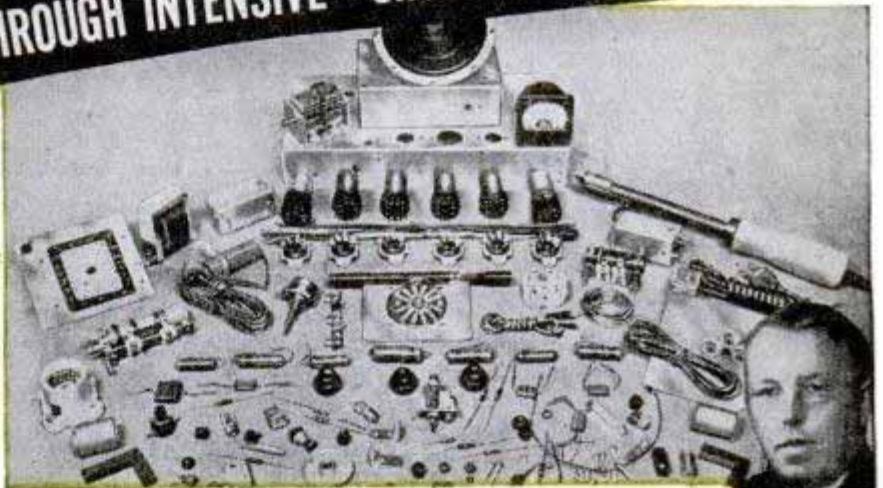


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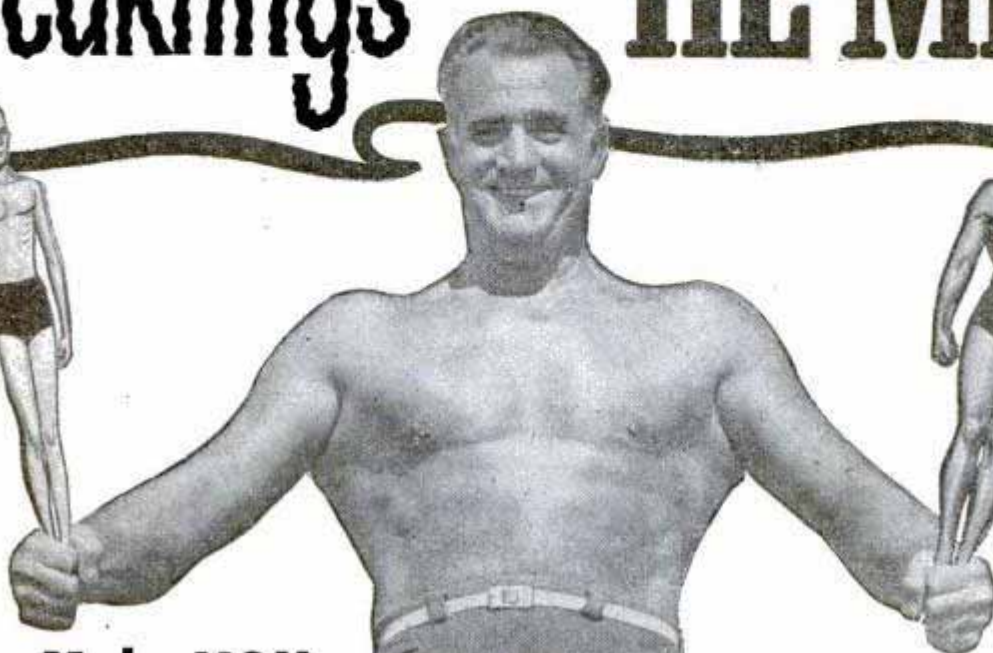
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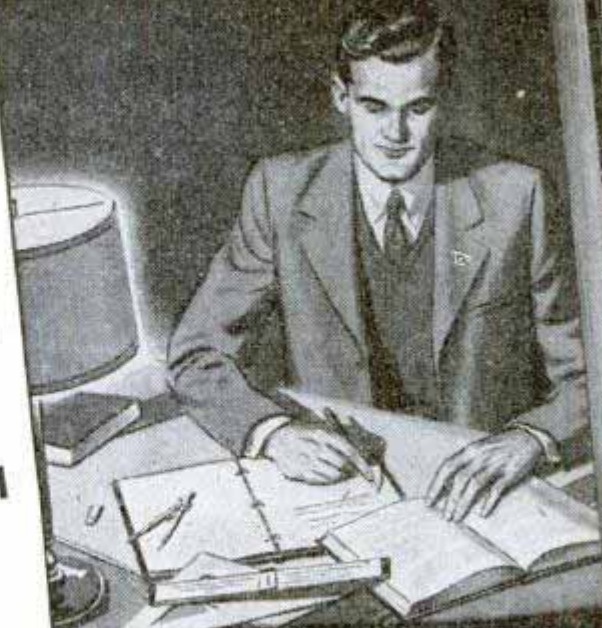
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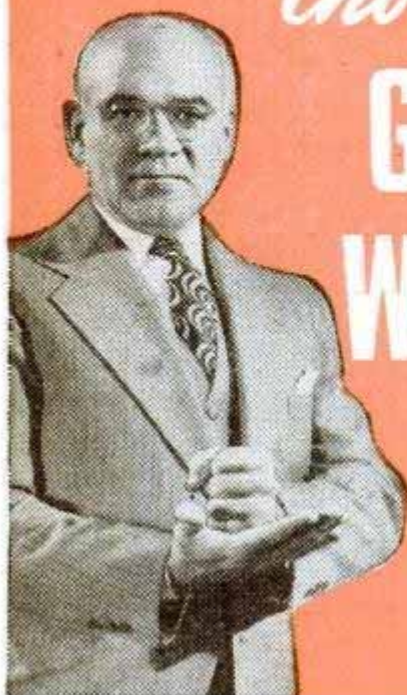
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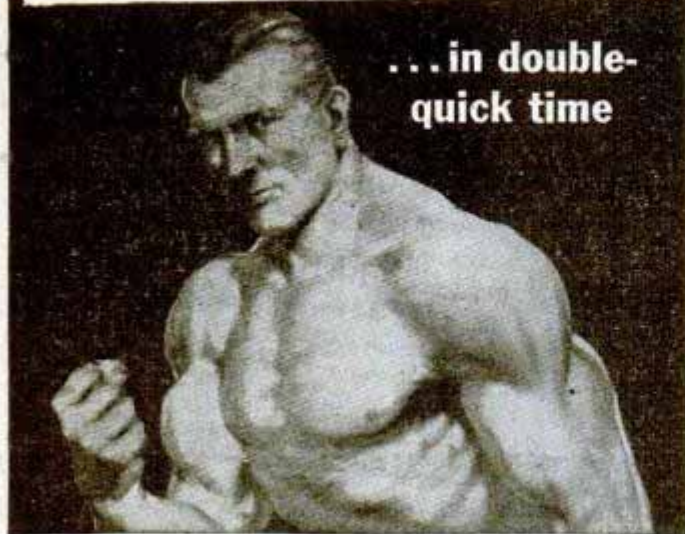
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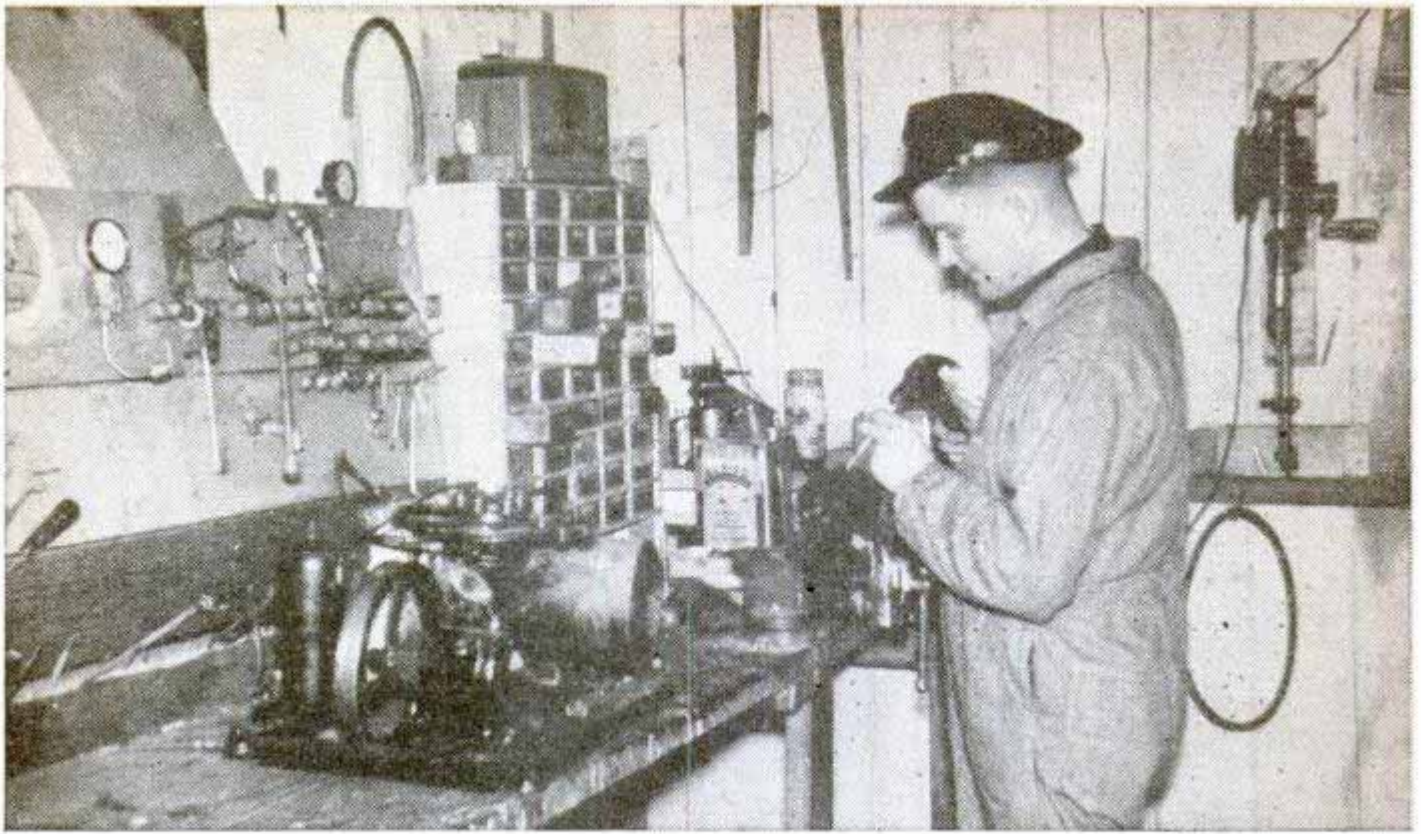
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By S. T. CHRISTENSEN
the "Fix-it Man"

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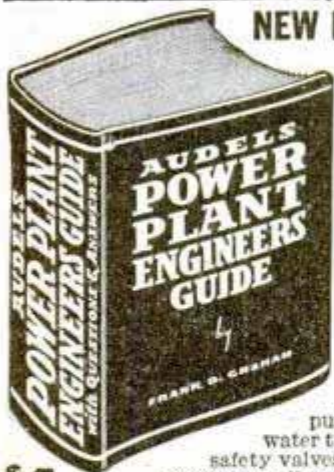
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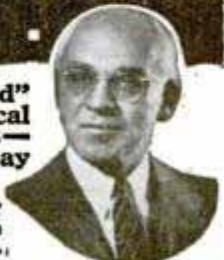
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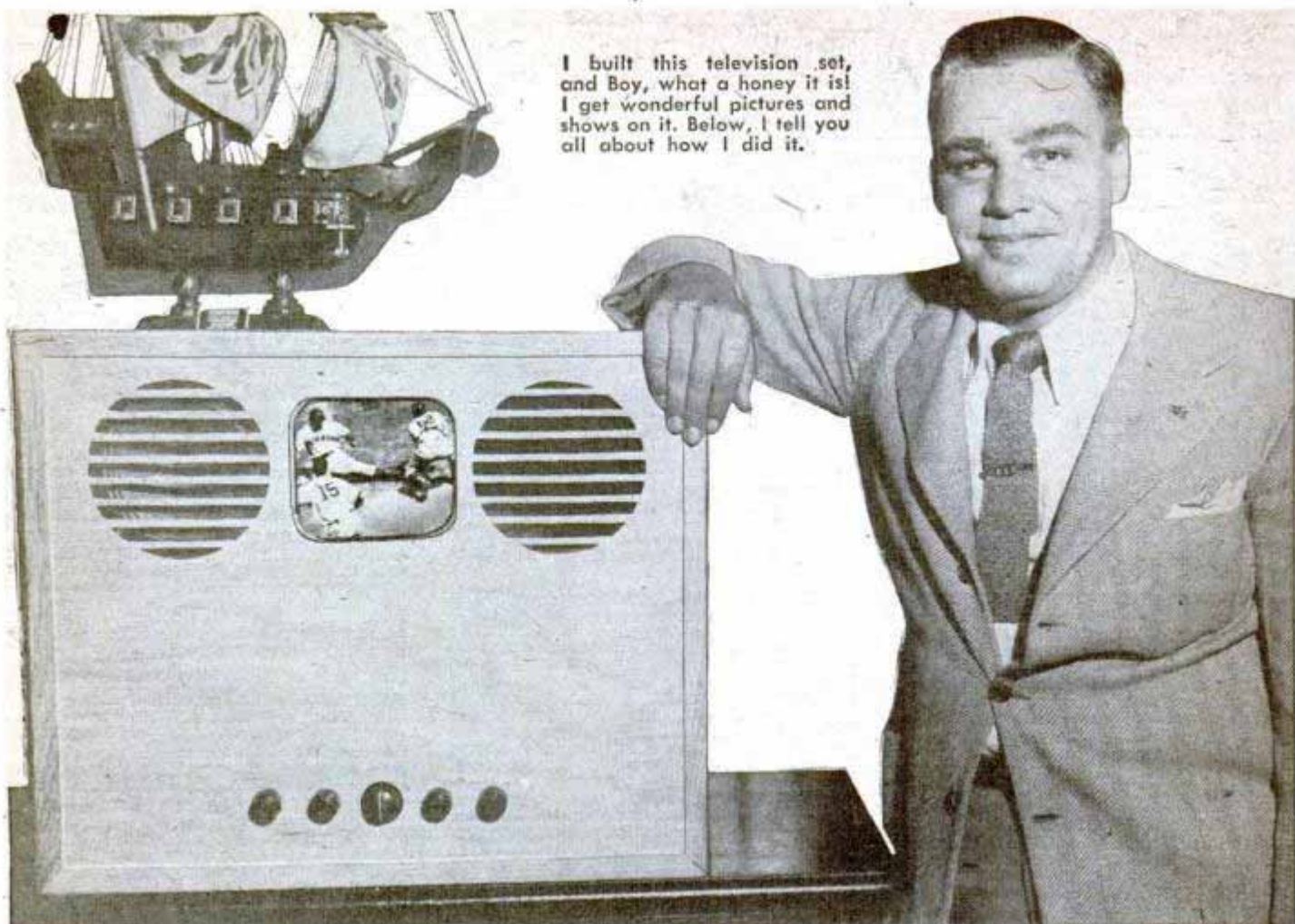
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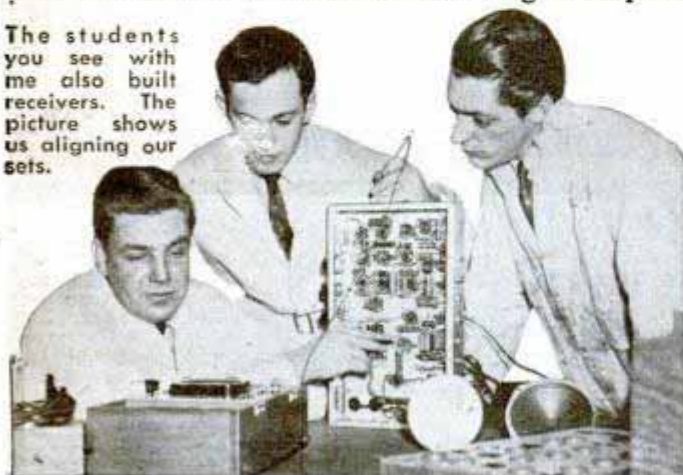


How I Built My Own Television Receiver

By Bill Nagel

NOT so very long ago, television was a complete mystery to me. But not only did I build a complete television receiver chassis, but I had a lot of fun doing it. And I've learned so much that I'm well on the road to becoming an expert.

The students you see with me also built receivers. The picture shows us aligning our sets.

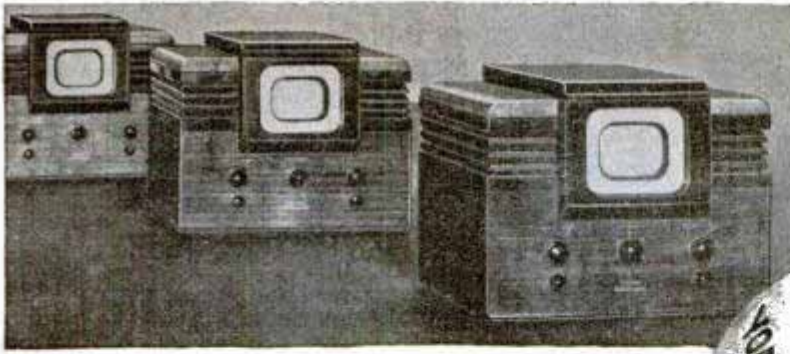


In a few years I'll be able to "write my own ticket."

I always had a yen to get into television, even while I was in the service. But I didn't know just how to go about it—until I heard about N.Y.T.I. of N.J. I went there with my discharge papers, and they did the rest. They showed me how the Veterans Administration would pay up to \$500 a year against my total educational expenses, under the G. I. Bill of Rights. This meant that I had to pay very little out of my own pocket. It's a big break for veterans like myself—especially when you get subsistence allowances in addition. And part-time jobs are easy to get so you can earn extra money. Of course, all of the students here aren't veterans.

What bothered me at first, was that my mathematics was kind of rusty. I soon found that the school had brush-up courses in math and even had facilities for teaching radio math from the beginning to students who had never had a high school education. I convinced them that I was sincere

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Here is a line of RCA television receivers that I and my fellow students use for comparative test purposes at N.Y.T.I. of N.J. The very latest equipment in television is ours to inspect and study at the school.

and enthusiastic and that I was technically inclined, and so I became a student. You know, you just can't build a television set right off. I built seven radio sets and had to go through a total of 75 electronic experiments, before they would even let me start on a television receiver.

Then I began work in earnest. The instructors around here have plenty on the ball, and it was amazing how fast I progressed. Boy, school was never like this. You should see the magnificent equipment. There's a swell gang here. They come from all over, because practical television schools are hard to find, and N.Y.T.I. of N.J. has a wonderful rep when it comes to television. I don't believe that you can find better training anywhere.

Another thing I like about N.Y.T.I. of N.J. (New York Technical Institute of New Jersey) is the convenient location. It's right in the heart of America's electronic industry, (Newark, N. J.), only 19 minutes from New York City. Big radio, television and electronics manufacturers are nearby—like RCA, General Electric and Edison. So are the big network stations like WJZ, WEAJ and WOR. This means that the school is always right in touch with the latest developments.

The conditions here are ideal. They have thousands and thousands of dollars worth of the latest



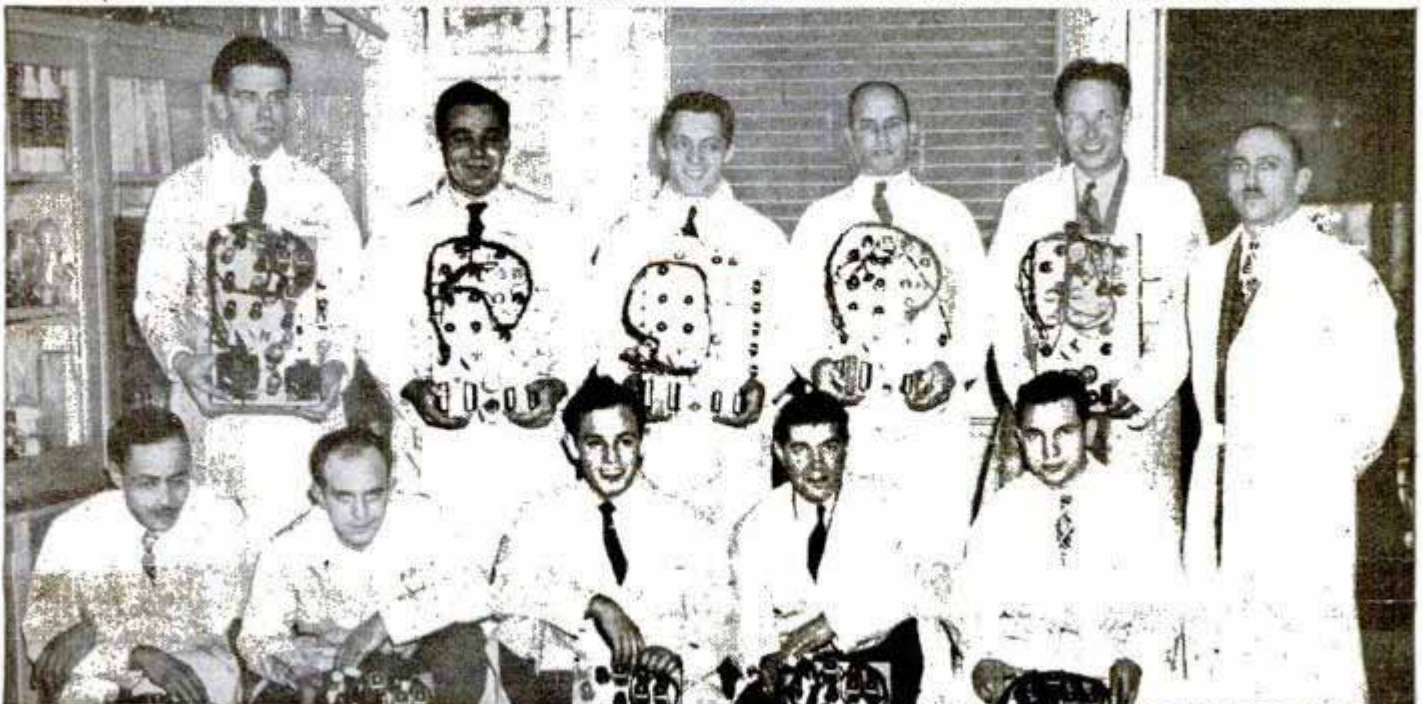
I want to learn about television transmitters also. Here you see one we have under construction. I hope to enroll for a special evening class on television transmitters.

types of equipment. There is a great deal of individual instruction and the instructors know their business.

I am sure there are a lot of fellows, particularly veterans, who want to get into this field. I understand there are about 120 openings now for new day students in the classes beginning this November and December. If you want the complete dope about the school, you can have a free bulletin, which illustrates and describes its facilities and equipment. It also tells the classes that may be attended, housing conditions, costs, hours, etc. There is no charge for this bulletin. Just ask for Bulletin 211. Send your postcard or letter to the New York Technical Institute of New Jersey, 158 Market Street, Newark, N. J.

These are my class-mates (note that I am second from the left, standing) with the television receiver chassis they built at the same time I built mine. I built the cabi-

net at home later on. Most classes are small, so you are sure of a lot of individual instruction, which is very important in learning the technical side of television.



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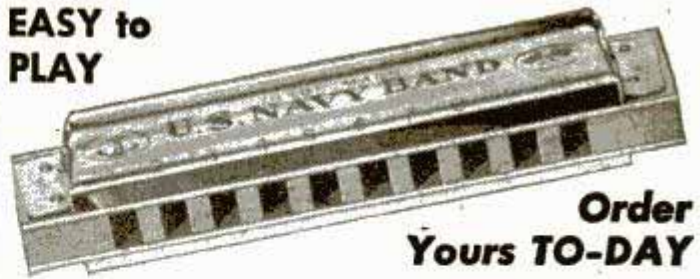
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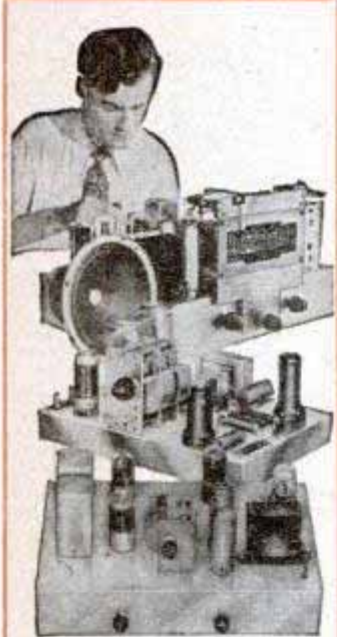


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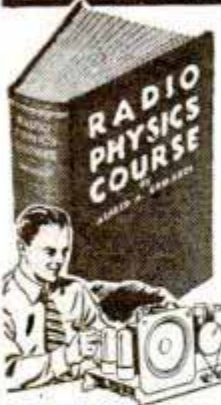
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Before me, a Notary Public in and for the State and county aforesaid, personally appeared H. H. Windsor, Jr., who, having been duly sworn according to law, deposes and says that he is the Editor of the Popular Mechanics Magazine, and that the following is, to the best of his knowledge and belief, a true statement of the ownership, management (and if a daily paper, the circulation), etc., of the aforesaid publication for the date shown in the above caption, required by the Act of August 24, 1912, as amended by the Act of March 3, 1933, embodied in section 537 Postal Laws and Regulations, printed on the reverse of this form, to wit: First, That the names and addresses of the publisher, editor, managing editor, and business managers are: Publisher, Popular Mechanics Company, 200 E. Ontario St., Chicago, Ill.; Editor, H. H. Windsor, Jr., 200 E. Ontario St., Chicago, Ill.; Managing Editor, R. M. Grant, 200 E. Ontario St., Chicago, Ill.; Business Manager, P. H. Dunakin, 200 E. Ontario St., Chicago, Ill. Second, That the owner is: (if owned by a corporation, its name and address must be stated and also immediately thereunder the names and addresses of stockholders owning or holding one per cent or more of total amount of stock. If not owned by a corporation, the names and addresses of the individual owners must be given. If owned by a firm, company, or other unincorporated concern, its name and address, as well as those of each individual member, must be given.) Popular Mechanics Company, 200 E. Ontario St., Chicago, Ill.; H. H. Windsor, Jr., 200 E. Ontario St., Chicago, Ill.; H. H. Windsor, Jr., Trustee for H. H. Windsor III and Wm. T. Windsor, 200 E. Ontario St., Chicago, Ill. Third, That the known bondholders, mortgagees, and other security holders owning or holding 1 per cent or more of total amount of bonds, mortgages, or other securities are: (if there are none, so state.) The Equitable Life Assurance Society of the United States, 29 S. LaSalle St., Chicago, Ill. Fourth, That the two paragraphs next above, giving the names of the owners, stockholders, and security holders, if any, contain not only the list of stockholders and security holders as they appear upon the books of the company but also, in cases where the stockholder or security holder appears upon the books of the company as trustee or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting, is given; also that the said two paragraphs contain statements embracing affiant's full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustees, hold stock and securities in a capacity other than that of a bona fide owner; and this affiant has no reason to believe that any other person, association, or corporation has any interest direct or indirect in the said stock, bonds, or other securities than as so stated by him. Fifth, That the average number of copies of each issue of this publication sold or distributed, through the mails or otherwise, to paid subscribers during the twelve months preceding the date shown above is (not daily publication). (This information is required from daily publications only.) H. H. Windsor, Jr., Editor. Sworn to and subscribed before me this 20th day of September, 1946. Vera L. Frechill, Notary Public. (My commission expires July 17, 1949.)

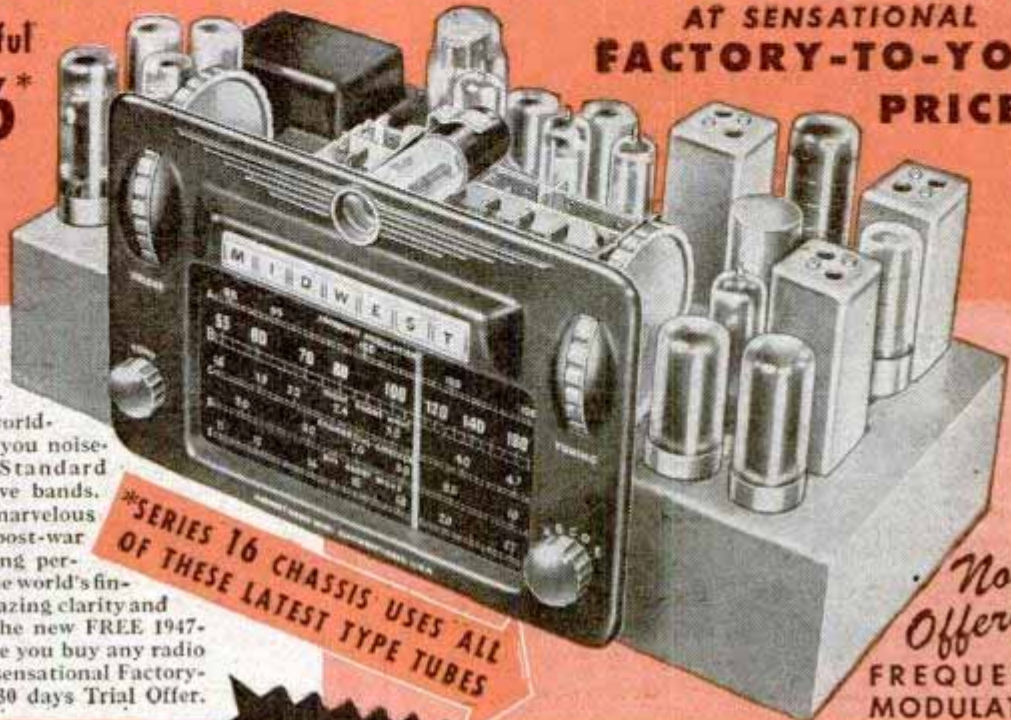
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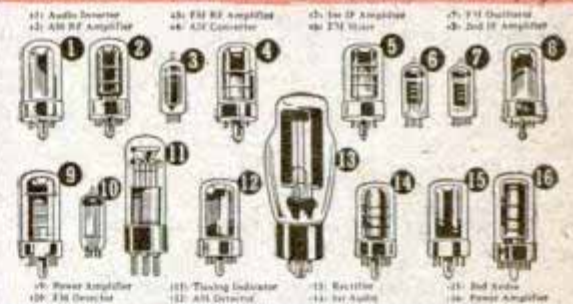


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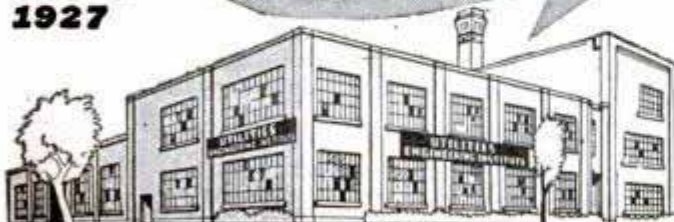
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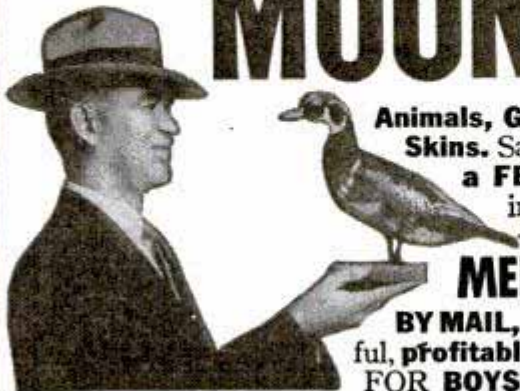
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BARGAIN! Caymans set, Nepal, Montserrat, Gilberts, St. Helena, 11 other countries. 10c with approvals. Marathon, 1246 W. Marshall, Ferndale 20, Michigan.

60 CORONATION Souvenir stamps 3c to approval applicants. Morrell, 203 Fenimore St., Brooklyn 25, N. Y.

PACKETS—List of 200 different countries free on request. Subway Stamp, 87 Nassau, New York.

FREE Mint Korea Flag with \$5 foreign packet or 125 different U. S. for dollar bill. Beattie, 2309 Huidekoper, Washington 7, D. C.

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FINE Approvals, freshly mounted. Fast, personal service. Tell me what countries you prefer and I'll send them stamps. Skinner, 438 Locust, Long Beach 2, Calif.

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118 DIFFERENT Stamps including commemoratives, charities, airmail sets, etc., only 3c to approval buyers. We buy collections. Badger Stamp Co., Milwaukee 3, Wis.

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BEAUTIFUL Polished Mexican Opals. Sample packet \$1.00 prepaid. Westland Sales Co., P.O. Box 1931, El Paso, Texas.

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PHOTO Finishers. \$20 per thousand cash paid for empty #127 spools. Cash will be sent promptly or you may ship c.o.d. if you prefer. No other sizes desired at present. Howard West, 3 W. 42nd St., New York 18, N. Y.

300 WATT 2x2 Slide projector. Build with hand tools. Material cost approximately \$4.00 including lamp. Instructions, blueprints—\$1.00. Jackson Engineering, Box 776-HN, Chicago 90.

FILMS. 5 Rolls 127, \$1.20; 120 or 620, \$1.45; 116, 616, \$1.70. Best quality guarantee. New cameras. Roll finished, 16 pictures, 35c. Reprints 2c. Dodge Studios, Albany, Wisconsin.

PHOTO Printer kit \$1.00. L. Spada, 10 Lexington, Wethersfield 9, Conn.

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CASH! Spot cash for cameras, lenses, binoculars, movie and still equipment. Send full description for prompt cash offer. Over 36 years of dependability. Bass Camera Company, Dept. AG, 179 W. Madison St., Chicago 2.

BASS Says: Trade cameras? For 36 years Bass has satisfied thousands everywhere! Finest equipment available. Always satisfaction guaranteed or your money back! Bass buys 'em, sells 'em, trades 'em. Bass Camera Company, Dept. AG, 179 W. Madison St., Chicago 2.

USED Camera Directory, Box 1031-M, Canton, Ohio—lists hundreds of war-bargain used cameras—35mm., Speed Graphics, Kodaks, Rolleiflex—many others. Send 25c for latest issue.

HAVE You a camera? Improve your hobby of photography and learn how to make better pictures. Write today for our latest book catalog and sample copy of American Photography, containing articles and pictures by the world's foremost writers and photographers. Camera House, 601, 353 Newbury St., Boston 15, Mass.

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CHRISTMAS Greeting cards from your own snapshots, send negative and \$1.00 for 18, (including envelopes). Rolls developed, 8 prints 25c, over 8 exposures 40c. Reprints 3c. Fred D. Eastman, Bode, Iowa.

CHRISTMAS Cards, with your picture. Send 5c and negative for sample card, list of styles and prices. Smith Studios, 8 Saint John Street, Plains, Pennsylvania.

25 BILLFOLD Size black and white copies from your favorite portrait. \$2.00. J. G. Jacob, 125 N. 4th Ave., Morton, Ill.

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2 BEAUTIFUL Hi-Gloss prints each good negative and enlarging coupon with each 6 or 8 exposure roll developed 28c. Owlphoto Co., Weatherford, Oklahoma.

AT Last we have films: 116 and 616, 38c ea.; 120 and 620, 33c ea.; 127, 27c ea. Roll developed, all your snapshots hand-colored as beautiful as most actual colored photography 35c. Hand colored reprints 4c each, 12 for 45c. Midwest Photo, Janesville 26, Wisconsin.

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VICTOR 16MM. sound projectors, Model 41A, 15 watt amplifier. Completely overhauled, good used condition, 90 day guarantee. \$237.50 f.o.b. Davenport, Eastin Pictures, Davenport, Iowa.

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MAKE Money at home. Paint and decorate wall plaques, brackets and book ends at home, no skill required, sell to stores, friends, bazaars, etc. Big demand, good profits. We furnish you with the plaques at very small cost. Write today. Marbleite Art Company, Ames Station, Box 53-P, Omaha, Nebraska.

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QUICK Profits mailing postcards. Ideal for mail order beginners. Plan complete only 25c. Name listed, "National Opportunity Seekers Directory"—free with plan. Miller, 408 E. 83rd St., Los Angeles 3, Cal.

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1001 MONEY-MAKING Ideas! Free details. Neuway Institute, Box 5463-M, Chicago 80.

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10,000 FORMULAS And trade secrets. Free literature. Stillman, 555 Kingston Ave., Brooklyn 3, N. Y.

MAKE 25 Pounds soap for 25c in about 25 minutes. Three ingredients. No lye or grease. (Original). Also bubble liquid. Carpet cleaner. Soap substitute. Garment cleaning soap. All 25c coin. Smart circular free. Teycer, Chemist, Box 1287¼, Chicago 90.

MECHANIC'S Soap powder and 109 other money making formulas for 50 cents. K. Reeves, 3226 Tularosa Street, El Paso, Texas.

NEW Formulas, analysis, research. Write Dr. J. C. Hertstein, 330 Charles Ave., Grand Rapids 6, Michigan.

PUNCTURE Proof your tires. Prepare Sealtight mixture yourself, easily, economically. Formula, instructions, \$1.00. Cealtite Ltd., 656 Linden Ave., East Kildonan, Manitoba.

ANY Formula \$1 or money back. F. Armstrong, 212 Baldwin Ave., Charlotte, N. C.

GUARANTEED Formulas for any manufacturing chemical product or process. Free catalog. Starr Technics, 868 Eddy Rd., Cleveland, Ohio.

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

FORMULAS — Latest, best. Analysis. Giant formula catalog and chemical instruction sheet 10c. Refunded first order. Belfort, Engineering Building, Chicago 6.

NEED Chemists? Formulas. Analyses. Ideas. Consulting Scientific Company, Swarthmore, Pennsylvania.

MANUFACTURE Cleaners, flavors, cosmetics. Formula catalog free. Kemico, Park Ridge 16, Illinois.

PLASTICS

SPECIAL—Square foot Plexiglas, ¼" thick, \$2.00, postpaid. Price list for stamp. Yonkers Plastic Supply, 137 Riverdale Avenue, Yonkers 2, New York.

MAKE Plastic novelties with Hollywood kit containing 2 lbs. of Lucite and Plexiglas; 3 colors of dye, bottle of cement and complete instructions. Postpaid \$3.25. Hollywood Items Co., Box 1151, Hollywood 28, Calif.

NEW Liquid plastic. Clear, colors. Cast without heat. Embed flowers, insects, coins. Saw, drill, carve. Manual tells how. Send \$2.95 plus 20c postage for complete kit including one pound liquid Castolite. Castolite, 211, Kenilworth, Ill.

PRE-FABRICATED Plastic kits! Complete, ready for assembly. Ideal Xmas gifts! Assemble, sell. New designs. Illustrated catalog 10c. Plastic Products Co., 211 - 7th St. S.E., Canton, Ohio.

WRITE For free information, home fabrication, plastics. Learn, earn. Son-Wray Plastics Co., Topeka, Kansas.

PLASTICS; Sheets, rods, tubes. Free list. Plastic Supply Co., 2618 St. Louis Ave., St. Louis 6, Mo.

GUARANTEED! We are America's lowest priced plastic supply house. Write for free price lists. Allcraft Products, Box 212, Hempstead, N. Y.

MAKE Money assembling our pre-fabricated plastic kits. Sample kit 50c. Fabros, Box 156, Station F-1, Buffalo 12, N. Y.

WRITE Today for generous free samples "Lucy-Plex" and "Coty-Bak" fast action; dustless, greaseless, non-burning, optical polish plastic buffing compounds. 5000 plastic hobbyists now use them. Enclose 12c postage. Plastic Masterpieces, 529 West Manchester Ave., Los Angeles 44, Calif.

PLEXIGLAS And Lucite liquid cementing dye kit. Full color range. Excellent for cementing or dipping. \$2.00 postpaid in United States. Money orders only. Handicraft Supply, 409 N. Akard, Dallas, Texas.

\$100 CASH, Plus up to \$1000 "royalties." Enter "Allcraft Products Contest." Write immediately. Allcraft Products, Box 212, Hempstead, N. Y.

PLEXIGLAS, Lucite, Cellulose Acetate for hobbies, money-making opportunities. Sheets, rods, tubes, clear or colored. Full range of sizes. Cements, dyes, polishing compounds, buffs. Free price list. Plastic Parts & Sales, 1157 S. Kingshighway, Dept. H-2, St. Louis 10, Mo.

PLEXIGLAS—Prime sheets 12" x 12" 1/16"—1.20, 3/8"—1.37, 3/16"—1.94, ¼"—2.28. Include 10% for postage. Dyes, rods, cements, buffing compounds, jewelry findings, tools. Free listings. Craft Plastics, Box 129-M, Somerville, N. J.

SENSATIONAL plastic injection molding machine. Low price plexiglas; dyes, cements, shellcraft kits, molding sets, etc. Free literature. G. Baker Company, River Edge, New Jersey.

DECORATIVE Plastic, etc. Ad under Machinery. Metplias Supply Co., 1420 So. 16th, Maywood, Ill.

PLASTICOR Injection molding press produces 100 ¼ oz. Tenite moldings per hour! Mechanical pressure, electric heat, sixteen colors, 2½" x 2" x 1" molds. Commercial results! Magazine featured! Money-back guarantee! \$34.95 complete! Limited supply! Technicraft, 1156 Commonwealth, Boston 34, Mass.

PLEXIGLAS Pr. sq. ft. 3/16" \$1.80; ¼" \$2.00. First grade in following colors: pastel blue, rose, yellow, green and white opaque. Small scrap—35c per lb. Add 10% on orders under \$10.00. Rainbow Plastic Co., Box 163, Arlington, Texas.

FORMALIN Quicksetting liquid plastic sample kit \$2.50. Dealers wanted. Formalin Works, 5 W. Larned St., Detroit 26, Mich.

LUCITE—Price list. Special offer. Midwest Plastic Supply, 1717 No. 66, Omaha 4, Nebr.

PLASTICS And supplies—New Plexiglas, Lucite, Catalin sheet, rods, tubes, etc. Attractive prices. Exceptional kits \$2.00, \$5.00, \$8.00. Internal floral carving drill. We pay postage. Free list. Plas-met Sales & Engineering, 4648 Shirley Place, St. Louis 15, Mo.

MONEY In plastics! Lucite plastic hobby kit. Two pounds Lucite materials, coloring dye, cement. Instructions. Send \$2.50 to Plastic Specialty Co., (Dept. M), 192 Lexington Ave., New York 16. Also Swiss music movements, \$3.50 each.

PLEXIGLAS, Sheets and supplies, first quality, lowest prices. Plastics information folio free with first order. Details free. Art Plastics of California, 8127 East 14th St., Oakland 3, Calif.

LUCITE—Complete illustrated fabricating instructions, used in craft classes throughout the world, price list on lucite, dyes, complete supplies. Booklet 10c, with sample, 35c. "Gem-O-Lite" P.O. Box 686-B North Hollywood, California.

LEARN At home "Working With Plastics." Full information on sheets, blocks, rods, tubes. Trade names, sizes, colors for fabrication. Designing, tooling, bending, cementing, polishing. Also for homework-shop. Only \$1.25 postpaid. Money back guarantee. Modern Technical Book Co., Dept. MMC, 55 West 42nd St., New York 18.

PLEXIGLAS Prime sheets 12" x 12" 1/16" \$1.20, 3/8" \$1.37, 3/16" \$1.94, ¼" \$2.28. Include 10% for postage. Dyes, rods, cements, buffing compounds, jewelry findings, tools. Free listings. Craft Plastics, Box 129-P, Somerville, N. J.

PLASTICS. Make yours at home. Formula and moulding instructions \$1.00. Forester, Zone 84, Station K, Toronto, Canada.

"FORMALIN" Quicksetting liquid plastic "kit" with complete instructions \$2.50. National Plastic Products Co., 5 W. Larned St., Detroit 26, Mich.

BIGGEST \$1.00 Plastic value transparent plexiglas and lucite sheets and strips in irregular shapes and thicknesses. Useful for many projects and experimental work—big package by return mail, no waiting. Double size package with dye and cement included \$2.00. Send money order to HomeCraftsman Plastics, 1945 W. Harrison Street, Chicago 12, Illinois.

CHEMISTRY

HYDROGEN! 10 Charges \$1.00. Inflate balloons, etc. Miles Specialties, Kokomo, Indiana.

HANDBOOK For chemical experimenters, illustrated, hundreds of experiments, 50c. Experiment booklet 15c. Supply catalog 5c. Reading Scientific Company, Reading, Penna.

THE House of Winn, home of supplies for amateur chemists. See Winn's New Idea chemical kits and apparatus outfits for home experimenting. Send 10c for retail catalog. Established 1931. John H. Winn, Dept. 511, 124 West 23rd St., New York 11, N. Y.

STUDENTS' Laboratory supplies. Send 5c for catalog. Mel-Glo Chemical Co., 258 Fourth Ave., Brooklyn, N. Y.

APPARATUS, Chemicals, ounce quantities, catalog 5c. Fleischer's Laboratories, Everett 49, Mass.

LABORATORY Supplies, Chemicals and apparatus all descriptions. 36 page book 10c. Standard Science Supply Co., 1232 N. Paulina St., Chicago 22, Illinois.

CHEMICALS And apparatus for industrial, analytical, and private laboratories. Complete supply service for correspondence school students. Send 3c for catalog. Dept. M-43, Biological Supply Co., 1176 Mt. Hope Ave., Rochester 7, New York.

FREE Catalog. Chemistry, mineralogy, biology, optics. Tracey Laboratories, Evanston, Illinois.

HELP WANTED

OPPORTUNITY Of lifetime supplying DDT and other profitable products to farmers. No experience or capital required. Must have auto and good references. Permanent. Write or wire McNess Company, Dept. 712, Freeport, Ill.

LECTURER, Tutor. Full—part-time. Commission. Professor Martin, 406 Panama Bldg., Portland 4, Oregon.

KNITTING Machinist and operator, one well qualified through experience and interest, desirous of locating permanently in California. Position is with one of America's better knitting mills. State fully experience, salary, marital status, age, etc. Brisacher, Van Norden & Staff, 310 Crocker Building, San Francisco 4, Attention Dorothy Gibson.

PUBLICITY Firm is expanding and needs representatives in city and country. Part time work in public surveys, etc. Good pay. No selling. National Public Relations Service, Inc., Box 412, Thomasville, Ga.

50,000 EXCELLENT Job opportunities in Latin America. Send \$1.00 for details, how-when-where to apply for specified firms in mining-aviation-oil. Pan Americana, Box 424J, Hollywood 28, Calif.

AGENTS WANTED

SELL Full, part time individualized belts, buckles, cap badges, tie holders. 2,000 emblems to choose. Fast profits. Repeats. Write today special outfit offer. Hookfast Specialties, Box 1425, Providence, Rhode Island.

\$1 STARTS You in business. Sell de luxe ties, 100% wool interlining. Costs you only \$7 per dozen, you make \$5.00 dozen. Send \$1.00 for special introductory offer two de luxe ties. Catalog complete line free. Philip's Neckwear, 20 West 22nd St., Dept. K-5, New York 10.

AGENTS—Big money for men, women, boys, girls—selling gorgeous night-glowing orchids, gardenias; perfect imitation real flowers; last for years; all the rage for wear on hair or clothes. Write for wholesale prices. Marney's, Dept. M-4, P.O. Box 581, Ogden, Utah.

SELL Rad, the new "Antu" rat bait to dealers. Bellefeld, New Knoxville, Ohio.

AGENTS—Highly profitable local business, requiring no selling whatever on your part. Write today for amazing free particulars. Glass Products, Ellwood City 1, Penna.

SILVER Plating Liquid: (Nu-Silver). Apply with a cloth. Or by immersion of article in liquid. Whichever is easiest. In 1 minute deposits a light durable coating of genuine pure silverplating 1000 Fine. Unconditional money-back guarantee. Occasional applications and rub-ups will keep articles silvered brilliantly like new. No equipment, tanks, batteries, or brushes needed. This is a scientific method of chemically-applying silverplating to a list of certain affinitive metal surfaces, like silverware both Sterling and silverplated ware, and also brass, copper, bronze, zinc, and some other metals. Sells by every known method using personal demonstrations. If you want to sell it you must demonstrate it. Selling representatives are wanted to go out and introduce themselves, then show, explain, demonstrate and sell it. Good profits (4 for 1). Also a companion product for de-tarnishing silverware. Atomic Metal De-Tarnishing Plates. Likewise sells on a sensational thrilling demonstration. Allows a 5 for 1 profit margin. Two good sellers for salespersons who can and will demonstrate and sell. Full details by letter mail free. NuProcess Products Laboratories, Dept. 254, Aurora, Illinois.

ODOR "Mufflers," finest refrigerator deodorizer for ice boxes, closets, kitchens. Retail \$2.00. Sell consumer and retailer. Big profits, exclusive territory. Write L. A. Muffler, Continental Bldg., Los Angeles.

SELL Superb line personal printed stationery. High quality items, year 'round sales. Attractive sample book, supplies free. Writewell Stationery, Dept. 113, 108 Massachusetts Avenue, Boston.

SELL Christmas cards. Easy money showing exquisite Christmas, everyday, wrapping assortments, stationery. Over 100 quick sellers. Request \$1.00 Christmas box on approval. Free samples of 50 for \$1.00 Christmas cards. Special offers. Hedenkamp, 343 Broadway, Dept. N-22, New York 13.

LOOK: Agents. Golden rays kit. New, different. Past seller, big profits. Sample kit \$1.00. Clinton Sales Co., 237 So. 4th St., Hamburg, Penna.

STRANGE "Dry" window cleaner. Sells like wild. Replaces messy rags, liquids. Simply glide over glass. Samples sent on trial. Kristee 128, Akron, Ohio.

WAR Honor scroll. All branches of service, 12 by 16. Space provided for name and photograph. Agents make big money. Sample 25c. E. Condon, Upper Darby, Penna.

CHRISTMAS Card money-makers. Fifty magnificent dollar box assortments \$25.00. Postpaid. Catalog free. Greenport Art Company, 252P - 12th Street, Brooklyn 15, New York.

CHRISTMAS Gift orders pay big! Easy sales. Repeat orders. Build your own business with our help. Rush request for details, confidential commissions, all magazines. McGregor Magazine Agency, Dept. 23, Mount Morris, Ill.

POPULAR Fast-selling, stainless-steel bracelets. Easy 100% profit! Details and price list free. Special sample \$2.00 prepaid. Write today. Ar-Clo Guild, 2055 W. Summerdale, Chicago 25, Ill.

COSTUME Jewelry for Christmas, \$21.50 for sample dozen latest designs, retail to \$50.00. Wicks, 3528 99th Street, Corona, Queens, New York.

OPERATE Profitable mail order business. Splendid opportunity. For details write. Ladouceur Service Bureau, 10105 Beechdale, Detroit 4, Mich.

ADDITIONAL Line for greeting card salesmen. Sell household novelties, nursery pictures. Hillside Studios, West Bend, Wisconsin.

AGENTS—House to house men "night numbers" sweeping the country. "No competition." Earn \$200 to \$250 weekly. "Free particulars." Ross Industries, Box 5460, Philadelphia 43, Penna.

A GOLD Mine for house to house agents, write Easy, 712 Case Bldg., Rochester 4, N. Y.

BALLOONS, Balloons. Wholesale price list free. Collins Co., Forsyth, Ga.

COSTS 20c. Sells \$1.00. Millions prospects. \$20 daily. Samples free. Burns Company, Johnstown, Penna.

EASY To sell beautiful rock necktie slides. Sample 50c. V. Fish, 437 W. 56th St., Los Angeles 37, Calif.

MAKE Amazing profits! Easy, inexpensive process beautifully gold embossed names on greeting cards, stationery, etc. Write for seven big profit ideas, sample, and full details. Valvick Specialties, Warba, Minn.

OPERATE Profitable business selling, packaging products under your own name. Lyle Products, 5 E. Spaulding, Willoughby, Ohio.

NEW Specialty! 200% profit. Free advertising. Lorrac Products, Albany 1, N. Y.

NEW Cheap oil burner sweeping the country! South Dakota manufacturer discovers how to cook, bake and heat the easy economical modern way by inventing a new low cost oil burner for coal or wood ranges, cook stoves, circulating heaters, heating stoves and laundry stoves. Larger size for furnaces. With its sensational Fuelizer Starter vaporizing system it turns cheap 130 flash furnace oil, distillate, diesel, range, kerosene and like oils into oil gas heat without clogging up the vaporizing system. No more shoveling coal or ashes—better heating, cooking and baking. Every burner has a lifetime guarantee against defects. New sales plan is one of today's most exceptional money makers and you can get your new Quik Heat for introducing in your territory. The manufacturers are so much sold on their new oil burner that they will offer you \$1.00 bonus for testing and will let you try it in your own stove, range or furnace for one month. Be first to cash in on the tremendous demand for this new oil burner by sending in your name today to Northwest Mfg. Co., 416 A. Mitchell, S. Dakota.

FAST Sellers offer big profits. Potholders of colorful assorted slip cover fabrics, insulated, average size 7" square. Retail 20c. Your cost postpaid only \$1.25 for one dozen, \$6.60 for six dozen, \$10.20 for one gross. Send cash with order today. Domestic Specialties Company, 2157 Division, Chicago, Ill.

SELL Photo rings, enlargements. Big profits. Details free. J. H. Daniels Company, Route 3, Box 70-C, Meridian, Miss.

RUBERLYKE Plastic foneholder. New, novel, fast selling. Retail, 60c. Fair-traded. Everybody a prospect. You also sell retail outlets. Fits all phones. Telephone rests on shoulder. Leaves hands free. Sample 50c. Reyam Plastic Co., 1525-A-East 53rd St., Chicago 15.

ZIPPER Billfolds, English morocco. Sample postpaid \$1.95. Arrow Leather Goods, P.O. Box 807, Elmira, N. Y.

PLASTONE: Amazing new polishes for floor, furniture, autos. Beautifully packaged. Low priced. Whirlwind seller to stores, gas stations, homes. Fast repeater. Big profits. Unconditional moneyback guarantee. Write for "free sample offer" now. Plastone Company, 2207-PM11 West Chicago Ave., Chicago 22, Ill.

FREE Wholesale list multicolored Biblical wall mottoes, etc. C. C. Heflin, 380 So. Main, Memphis 3, Tenn.

CHRISTMAS Cards—Earn big money selling personals and boxed assortments. Samples. Lincoln Press, P220 Hartwell, Fall River, Mass.

MEXICAN Feather pictures. Christmas novelty. 50c (stamps) bring \$2.00 worth samples, details. Refunded if unsatisfied. Aztec Art, Apartado 762, Mexico City.

MEN! Make more money and build up a profitable business on fast selling popular priced items that are in big demand. This is a wonderful opportunity to go-getters. Hausman Sales Co., Dept. P, 1243 No. Harding, Chicago 51, Ill.

HERE Is a wonderful opportunity to make a lot of money selling new low priced fire extinguisher, needed in every home, office, store and auto. Big profit and steady all year 'round business. Fire-Out Equipment Co., 1243 No. Harding, Dept. P, Chicago 51, Ill.

LOW Prices, six cent cigars, and electric shavers. S. Kelley, 2302 Ontario St., Ft. Wayne 6, Ind.

SELL Mexican pottery, glassware, chairs etc., feathered bird pictures. Sample 25c. Large framed picture \$1.50. Wholesale catalog free. Foley's, 217 Grafton St., Brockton 6, Mass.

ONE Tool does twelve jobs! See Bishop Tools ad under Machinery, Tools, Supplies.

NO Money or experience required. Spare or full time writing orders for guaranteed men's hosiery. We deliver and collect. Advance profit and 33% cash bonus. Huge demand everywhere. Steady repeat business. Write for free sales outfit including everything needed to make money. Kentcraft, 44 Court St., Dept. KM, Brooklyn 2, N. Y.

UNBELIEVABLE! New discovery "fire doom" fireproofs (anything) absorbent! Demonstration sells anyone! \$5.00 (refundable) gallon prepaid! Agents. (PM) Laboratories, Box 742, Passaic, N. J.

MAKE Extra money selling "How to Succeed." 50-page book. Sells on sight. Increases income, health and happiness for anyone. Prepaid for \$1.00. Cook, Box 667, Hollywood, Calif.

INCREASE Your income by selling "Hot-spark" non-pulverizing flint, considerably decreasing cigarette lighter trouble. Sample package 25c postpaid, including lighter parts list. Cigarette Lighter Parts Manufacturing Company, 126 Lexington Avenue, New York 16.

SELLING To housewives? Double your sales with inexpensive premiums. Postal brings interesting details. A. Kinford, Wayne, Penna.

EXCELLENT Sideline for printing and advertising salesmen. Decalomania name plates in small quantities. Great demand. Also make money applying initials on automobiles. Free samples. "Ralco" XL-Roxbury, Boston 19, Mass.

HOUSE Numbers that glow in the dark. Luminous pictures, etc. Large mfr. wants factory representative. Wonderful new product. Fast seller. Free samples. Madison Mills, 303 4th Ave., New York City.

TAKE Orders for attractive plastic nameplates. Good commissions. Write for details. William Lacey, 8 Lewis, Medford 55, Mass.

\$1.00 STARTS: Sell 9" x 12" baby; religious, scenic, "mirror shadow box." Cost \$7.00 dozen, profit \$11.00, refunds. Test sales sample \$1.00. Hayner House, Ballston Spa, N. Y.

WHOLESALE — Toilettries, flavorings, concentrates, barber supplies. LaPura Laboratories, Toledo 4, Ohio.

REPRESENT Safeguard moth-proofing compound in your territory. Opportunity for state distributorship. Cannon's Compounding Co., Box 246-P, Doylestown, Penna.

WAR Action picture sets by divisions. Agents, distributors wanted. Official War Pictures Co., Dept. PL, 64-40 98th St., Forest Hills, L. I., N. Y.

AGENTS: Do you want \$50 per week? Selling a profitable line of fibre brooms, mops and floor dusters. Write, Burtz Fibre Broom Co., Columbia, Pa., Dept. A.

AGENTS—Big line including food products. Fast selling premium and bargain deals. Low prices. Send card for big profit offer with gift. Ho-Ro-Co, 2796 Dodier, St. Louis 7, Mo.

MEXICAN Bird pictures handmade with real feathers. Free particulars. Sample 15c. Importer C. O. Staff, 14960 Evanston, Detroit 24, Mich.

SELL Books by mail. Mammoth sales and huge profits. Everything furnished. Send 10c for complete details. Business Plans Foundation, Box 56-R, New York 10.

CALENDAR 1753 To 2152. Sample and quantity prices 35 cents. Tracy Newton, Decatur, Georgia.

WONDER Cleaner, new type bubble bath. Glasgow, sell fast. Tremendous profits. Supplies, circulars, furnished. Courier, 3829-I Delmore, Cleveland Heights 21, O.

CHRISTMAS Cards. Sell 50 for \$1.00, names imprinted. Samples free. Complete line boxed assortments. Dunbar Cards, New Brunswick 20, N. J.

300% PROFIT Possibilities! New post war item, "Artistic Honor Scroll" in six beautiful colors! Tremendous demand! Details free. Schoen Sales, 4860 No. 37th Street, Milwaukee 9, Wisconsin.

AMAZING Seller: "Soilless Garden Chemical." Grow plants, vegetables, fruits, flowers all year round without soil. In or outdoors. Tremendous demand. Excellent profits. Literature free. Nega & Co., 1824 W. Dickens, Chicago 14.

NEW Revolutionary PerfeCrease trouser and skirt hangers that millions of men and women will buy on sight. Designed by General Motors engineer. All metal. Beautifully plated. Lasts years. Simple demonstration averages three or more sales every home. Call back in week and they will buy more. Red hot Christmas seller. Exclusive territory. Sales kit including sample hangers, \$2.00 postpaid. Details free. Metal Products Company, Troy 1, Ohio.

SCHOOL Seniors—Sell classmates America's most beautiful, distinctive graduation name cards. 40% commission. Largest selection. Lowest prices. Free cards and sample kit. Printcraft, 1425 E. Elm Street, Scranton 5, Penna.

EASY Money now to Christmas. Up to 100% profit selling friends, others, marvelous new 1946 Christmas and year 'round box assortments—30 boxes 35c up. Odd cards 2½c up. Extra bonus. Request special feature \$1.00 Christmas assortment on approval. Send today for free samples of our fast selling 50 for \$1.00, 25 for \$1.00 personal Christmas cards and personal stationery lines. Special offers. New England Art Publishers, North Abington, Mass.

JUST Out! History of World War II. Huge volume. Popular price. Authentic text. Official photographs. Big profits. Riverside Book Company, Iowa Falls, Iowa.

SELL New-used clothing from home, auto, store. Men's suits \$1.09, Leather jackets 49c. Overcoats \$1.00. Dresses 22c. Ladies' coats 38c. Other bargains. Catalog free. S&N, 565A Roosevelt, Chicago.

BIG Profits selling used clothing, etc. Operate from home, auto, or store. Sensational low prices. Catalog free. Kadetsky & Son, 702 Barber Street, Dept. 14, Chicago 7, Illinois.

SCHOOL Seniors! Your postal will bring our wonder, Kwick-Sell Cardalog of popular graduation name cards. Biggest profits! Only firm giving free souvenir chest and card case. Don't miss out! Hurry that postal! Craftcards, Box 235(L), Pittsburgh 30, Pennsylvania.

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

BIG Bargains for big profits. Over 100 sensational values. Men's used suits \$2.00, pants 35c, topcoats \$1.25, overcoats \$2.00, shoes 20c. Experience unnecessary. Free wholesale catalog. Superior, 1250-FB Jefferson, Chicago 7.

200 MONEY Making deals. Plans, rare formulas. Schemes. Folio free. Formico Service, Box 572, Dayton, Ohio.

137 COMPLETE Plans for starting own business: local—mail order. Particulars free. Elite Co., 220-A Grand St., New York 13.

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

MAGIC Cleaner and laundry soap deal. Hotter than a firecracker. Big profits. Sample free. Bestco, 5007 Irving Park, Chicago.

\$3 FIRE Extinguisher; quick sales, wholesale or direct; liberal profits. "Fire-Killer," 109 N. Franklin, Syracuse 1, N. Y.

PLATING Outfits for autoparts, reflectors. Connect to a battery. No tanks necessary. Free booklet and particulars. Gunmetal Co., Ave. N. Decatur, Ill.

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

"OUR Flag"—famous picture. Four colors. 500,000 sold. Sample print—free. Our Flag Sales Corp., Dept. C1076, Excelsior Springs, Mo.

GOLD Lacquered window sign letters. Large sizes penny each. New foils. Absolutely beautiful. Free samples. Atlas, 544 W. 79th, Chicago 20.

HIGH-GRADE SALESMEN

SELL Record of Service certificates. All data from discharge paper may be copied on certificate for framing. Sales made easily. Sample \$1. Wilbur Sales Company, Box 451, Plymouth, Mass.

SALESMAN Wanted. To sell foot adjusters that fit in any shoe. Easily adjusted to raise arches proper height for individual foot comfort. Excellent opportunity for big earnings. Write for proposition now. C. H. Stemmons Mfg. Co., 300 E. 51st Street, Kansas City 2, Mo.

SALESMEN To sell simplified bookkeeping and tax record system small stores and public accountants. Sells \$13.50, your commission \$8.00. Exclusive franchise. Write, Hawthorne Sales Co., Decatur, Ala.

SALESMAN—Sell hard-to-get items on open account to drug, dept., variety, hardware and general stores for national organization. Liberal commission paid weekly. Full commission on repeats. Complete sales kit free. Write today! Lee Industries, 217B North Dearborn, Chicago 1.

VAST Shortage creates big market to sell new patented glass mail boxes and crystal wall vase. Amazing earnings. Skokie Industries, Skokie, Ill.

ORANGES, Most delicious, bursting full with health giving juice and vitamins, from our famous Indian River groves direct to consumers. Employers are placing now Christmas gift orders for employees and customers. Salesmen earn over \$100.00 commission weekly. Sunset Valley, Oak Hill 7, Florida.

LOOK Here! Wanted—Men and women to start in business on our capital. Sell some 200 farm-home products. Thousands our dealers now make quick sales, big profits. For particulars write Rawleigh Co., Dept. K-192-PPM, Freeport, Ill.

QUICK Profits with individualized belts, buckles, cap badges, tie holders, uniforms. Choice of thousand emblems. Sure repeat orders. Easy-selling outfit offer. Write Hook-Fast Company, Dept. 12, Roanoke, Virginia.

AMAZING New zipper shoe sells on sight. Big profits for salesmen. Leads line 200 splendid styles. Territories open. Get free sample outfit. Write Consolidated Shoe, Dept. S-203, Chippewa Falls, Wis.

EXCELLENT Sideline for printing salesmen. 300% profit. Samples 25c. "Acme," Oblong, Illinois.

TAX Law forces merchants keep records, sell Green's; every merchant your prospect; big commissions; yearly repeat business. Mill-Green Publishing Company, 370 Seventh Avenue, New York.

WAGON Salesman—Fast moving carded goods and 10c line. Long profit. Free facts. Peerless, 2717 Dodier, St. Louis 7, Mo.

SELL Christmas cards, everyday cards, pictures, books, novelties. Big profits. Bulletin free. Elfco, 432 North Wells, Chicago 10.

BIG Commissions—selling to stores celluloid pricing tickets, metal shelf moulding. To restaurants, menu covers, signs. P. Pricing Press, 124 White St., New York 13, N. Y.

FREE! Latest issue Opportunity Magazine. Salesman's Guide. Inspiring, constructive. Shows how to earn money selling for others or in your own business. Hundreds postwar opportunities. Send name and describe what you have sold or are selling. Illustrated copy sent free. Opportunity Magazine, 620 N. Michigan, Dept. 17, Chicago 11, Ill.

EDUCATIONAL AND INSTRUCTION

TUNE Pianos. Vibration principle. New course. New low price. \$1 lesson, chart, information. Oscar Fylling, 841 Robinson, Oroville, Calif.

NON-RESIDENT, High school, college, professional degrees. Bulletin free. Capital City College, Washington-5, D. C.

GOOD Jobs and a sound, substantial future await you in hotel and institutional field. Men and women—all ages—needed for well-paid positions that offer color, excitement, ever-new and fascinating duties. Record-breaking travel means even greater opportunities for trained men and women in hotels, clubs and institutions. Lewis School receiving calls for managers, assistant managers, stewards, hostesses, purchasing agents and 55 other types of important positions! From coast to coast there are important positions that offer splendid opportunities for advancement in a business where you are not dropped because you are over 40. Previous experience proved unnecessary! No need to leave your job to qualify. A good grade school education, plus Lewis Training qualifies you at home, in spare time. Our National Placement Bureau helps to place you—and our amazing Certified Job Plan—actually certifies you will "make good" when placed. Write today for free book! Veterans: This course approved for veterans' training. Lewis Hotel Training School, Room HW-368, Washington 7, D. C. (First and only school of its kind—now in its 30th year.)

GET A U. S. government job! Men-women. \$145-\$250 month. Paid vacations. Yearly raise. Veterans get preference. Try next examinations. Prepare now. Sample coaching with full particulars—list positions free. Write today. Franklin Institute, Dept. B24, Rochester, N. Y.

"INDUSTRIAL Engineering" the sure road to success. Learn this profitable profession now under personal supervision of internationally known professional engineer. H. G. Hecketsweller, 3355 N. Olcott Avenue, Chicago 34, Illinois.

STUDY Real estate at home. Free bulletin. DeVoto Realty Schools, 35 Vicente, San Francisco 16, Calif.

RESORT Hotel positions. Travel south and north. Beginners trained. Lee's Hotel Institute, 714 Winthrop Building, Boston 9.

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ATTENTION: Have you a practical and saleable invention—patented or unpatented? Contact us immediately. John D. & Son, 140 Spruce St., PM-11, Box 3213, Bridgeport 5, Conn.

WANTED: Practical inventions for mar- keting through chain, drug, and cigar stores. Particularly desire lighters, smok- er's articles, etc., in plastic, wood or metal. Write Matt, 1412-DN Great Northern Bldg., Chicago 4.

CASH For inventions, patented, unpat- ented. Mr. Ball, A-9441 Pleasant, Chi- cago.

EARN Up to \$2,000 year, inventing sim- ple items for special cash markets. Ideas only. No patents. Hendrickson, Argyle (7-B), Wisconsin.

INVENTORS: Hundreds of manufac- turers have requested our assistance in locating marketable new products. Com- plete information, free. Institute of Amer- ican Inventors, Dept. 40-D, 1926-Eye St. N.W., Washington 6, D. C.

WANTED—Patented, unpatented inven- tions having profit possibilities, all kinds. If will sell, reply immediately. Descrip- tive booklet, references, free. Invention Reporter, 5B-11106 So. Longwood Drive, Chicago 43.

PATENTS FOR SALE

PENDING, New type electric hand saw, run power or battery, used anywhere, boards, "planks." John Cvetnic, Box 1, Pewamo, Mich.

NEW Design aluminum ladder. Pat. pending. Nationwide possibilities. Manu- facturers only. Box 207, Southampton, New York.

NEW Adjustable crutch. Patent pend- ing, features more freedom of movement. No under arm chafing. Light weight, stur- dy, inconspicuous construction. Suitably manufactured out of wood, metal or plas- tic. Sales possibilities unlimited. Royalty. George Eisenberg, 1437 Hooker, Denver 4, Colo.

MANUFACTURERS: Simple attachment for wood plane. Accurately produces be- veled edges. Gauges width, angles. Patent- able. John B. Kline, Lititz, Penna.

INVENTIONS For sale. Manufacturing only. All kinds. Tom Beaton, 928 South Hope, Los Angeles 15, California.

"VOL-K-NO" Automatic smoke ring ejecting incense burner. Makes perfect smoke rings. Useful. Has "eye appeal." Millions sale prospects. Patent pending. Write Dale Propst, Willamina, Ore.

DOUBLE Arm tractor loader with at- tachments. Number 2,341,776, cash or lease. W. L. Peters, 305 State Bank Build- ing, Fort Dodge, Iowa.

CAPTURED German and Jap patents, 18,000 enemy alien formulas, patents, ideas, plans, drawings. Use immediately; royalty free. Bishop Tools, 111 W. Wash- ington, Chicago 2.

JUST Patented, card game for chain store business. Royalty basis, information to manufacturers only. Oh-Kay Games, Box 127, Wilkes-Barre, Penna.

REALLY New: patented oil filter for cars, trucks, has simple metal filtering unit that cleans its self while engine is running. Great sales possibilities. E. Sei- fert, 124 E. Chestnut Ave., San Gabriel, Calif.

SIGNAL That indicates on dash when tires need air. Cheap to manufacture, in- stall on trucks, busses, automobiles. Pat- ent applied for. Robt. P. Eagles, R.F.D. #8, Richmond, Virginia.

18,000 ENEMY Inventions. Manufacture royalty-free. Instructions, subjects, \$1.00. Patent Service Company, Saint Cloud 4, Minnesota.

FOR Sale: Game. Patent number, 2,131,332. Covers both toy and larger models. Cash or royalty. Write Elmer N. Rose, P.O. Box 176, Escondido, Calif.

INVENTORS—Your patented, unpatented invention, if practical, may have spe- cific cash, royalty value in correct mar- kets. Find out now. Explanatory booklet free. Invention Reporter, 5D-11106 So. Longwood Drive, Chicago 43.

INVENTORS: Test the commercial value of your patented or unpatented inventions, quickly and inexpensively. Write for free information. Institute of American In- ventors, Dept. 40-B, 1926-Eye St. N.W., Washington 6, D. C.

MANUFACTURING

NAME Plates for manufactured prod- ucts. Any quantity. Ad-Craft, LaCrosse, Wis.

INVENTORS — Market study; develop- ing; manufacturing models. J-M, Burling- ton, Kentucky.

SEND Sketch for estimates. Manufac- turing Machinists, 114-111-PM 229th, St. Albans 11, N. Y.

CANVAS Items manufactured. What do you need? Cohanzick Canvas Goods Mfg. Co., Bridgeton, New Jersey.

MODELS—Small lot manufacturing. Metals, plastics, etc. Milburn, Burlington, Kentucky.

MODELS AND MODEL SUPPLIES

BUILD Modernistic plastic kit! Sixteen kits, stamp for price-list. Johnson, 366 Freeman, Long Beach 4, Calif.

PATTERNMAKERS, Modelmakers. Use metal. Workable with fingers. Hardens like steel. Sample included. \$1.00. Wm. Koppel, 167 Carter, Pawtucket, R. I.

MIDGET Steam engines \$2.98, boilers \$2.65. Stamp for literature. R. Looker, Box 105, Michigan City, Indiana.

REMEMBER. When selecting model equipment at GMCO, you will find a com- plete stock of model airplanes, gas engines, ship models, railroads, race cars, supplies and tools. Chances are we have just what you want in stock. Send 25c for your copy of our new catalogue to GMCO Modelcraft Hobbies, 91-17 (M11) 173rd St., Jamaica 3, New York.

ONE Tool does twelve jobs! See Bishop Tools ad under Machinery, Tools, Supplies.

TWO Cycle model engines traded. Bear- ings, rods, crankshafts, pistons made, fitted, alterations—Circular, New Pace- maker, Delong, Bantam, Arden, Rocket, Merlin engines—accessories. N. Hurst Smith, Cedar Glen, Athens, Tennessee.

$\frac{3}{4}$ " **SCALE** Steam locomotive, cheap. Simmonson, 3054 N. Greenview, Chicago, Illinois.

MAGNESIUM Dowmetal for light weight construction now available in miniature extrusion structural shapes and 1/16" flat stock. Write for size and prices. Sims & Associates, Grosse Pointe, Michigan.

150 MPH Model airplane. See Interna- tional Research advertisement page 266.

BRASS Gears and model supplies for the inventors. Send 10c for catalog. Pierce Model Works, Tinley Park, Ill.

WIZZ Electric motor 35c. Further de- tails under Engines, Motors heading.

STEAM Engines, boilers, castings. Cir- culars 10c. Anton Bohaboy, 2297 Price, Rahway, New Jersey.

FREE Catalog of model trains, airplanes, ships, accessories and tools. Ben's Hobby Company, 72 West Washington, Chicago 2, Illinois.

BUILD Complete miniature circus, $\frac{1}{8}$ " scale. Cage wagons, pole wagons, bag- gage, property, ticket, band wagons, cal- liope, 75c to \$1.25. Cast metal horses, drivers, lions, camels, giraffes, elephants, people, acts, 15c to 25c. Main tents, side- show tents, circus railroad cars. Send 35c for booklet-catalog "Building Miniature Circus." Bathgate, 30 Main, E. Orange, New Jersey.

BUILD Model ships, airplanes, railroads. Catalog 10c. Ideal, 21 West 18th Street, New York 11, N. Y.

SHIP Models and yacht supplies complete. Large 64 page catalogue 30c. Bill Wild's, 510 East 11 St., New York City 9.

LANDLOCKED Sailors! Here's a beautiful, richly illustrated, fully descriptive catalogue of famous model ships-whalers, slavers, corvettes, etc., authentic in every detail. Send for it today. Only 10c. Marine Model Company, Inc., Dept. C-17, Halesite, Huntington, N. Y.

ENGINE Castings, Supplies. Catalogue 10c. Howard A3, 2417 N. Ashland, Chicago, Ill.

RAILWAY Models, complete line, 123 page catalog, HO and O gauge 25c. Walthers, 247 Erie, Milwaukee 2, Wis.

SHIP And yacht model fittings and blueprints. Hundreds of items to choose from. Send 25c for new illustrated catalog. A. J. Fisher, 1002 Etowah Ave., Dept. M, Royal Oak, Mich.

MODEL Engine catalog, railroad supplies, 25c refunded. Simonsen, A-3054 Greenview, Chicago 13.

BIG Illustrated model engine catalog 10c. Active Products & Supply Co., 53 W. Jackson, Chicago 4.

SHIP Model kits and fittings. Complete line Fisher model yacht equipment. All Boucher, Fisher, Marine Model and Ideal kits, fittings and blueprints at standard prices. Most complete stock in New England. Send 10c for price list. James Bliss & Co., Inc., 220 State St., Boston, Mass.

MINIATURE Steam locomotives, 1/4", 1/2", 3/4" scales. Castings, parts, rail! Thorough drawings with instructions. Catalog 25c. Little Engines, Wilmington, Cal.

CATALOGS (Illustrated) for modellers! Airplanes, 60 page book on solids. Features construction data, specifications, camouflage, 15c; railroads: 128 page "HO" guide. Equipment, accessories, fittings. 25c (includes refund coupon). Send coin or stamps for each profusely illustrated catalog desired. Polk's, "Nation's Leading Hobby House," 314-PM Fifth Ave., New York City 1.

HOME CRAFTSMEN

SPECIAL—30 Silverplated earscrews—\$1.00. Refundable. Frances Jones, Box 2581, Sarasota, Fla.

DOLLAR Brings shell material for butterfly brooch, bracelet, floral spray. Shell catalog free. Dixie Shell Service, Lakeland, Fla.

WOODWORKING Outfit—Includes lumber, designs, tools, equipment, instructions. Make many fine toys, novelties, gifts for fun and profit! Only \$2.00 postpaid. Handicraft Creators, 1734 President Street, Brooklyn 13, N. Y.

PLYWOOD Cabinet kitchen plans 25c. Playne Cabinets, 4617 Johnson Avenue, Western Springs, Illinois.

ANYONE Can learn carving figures with penknife. Write Carv-It Projects, 343 Division, East Lansing, Michigan.

LEATHER Craftsmen—Hand engraved plastic transfers imprint design instantly for tooling. Sample 10c. Introductory set \$1.00. Lampkin Artcrafts, Box 641-M, Culver City, Calif.

\$46 FROM Square foot plywood; jigsaw necessary. Write. Woodarts, X-34, Bridgewater, Mass.

MAGNIFICENT New bronze genuine World War 2 army assault boat propellers. 3 blade. 12" dia., approx. 5 lbs. Makes marvelous souvenir base for numerous articles that can be made in your own shop. Only \$5.65 each postpaid. Remit with order. Baker Bros., Box 301F, Palatine, Ill.

TRUCRAFT Practical models make world's most unique, exquisite gifts. Use them yourself or sell them. Folder free. Quaker City Products, 1613 North Carlisle Street, Philadelphia 21, Penna.

HOBBYISTS! Join "Allcraft Club." Free, no obligations. Fun, profits galore! Write immediately: Allcraft Products, Box 212, Hempstead, N. Y.

CERAMIC Jewelry supplies, bar pins, ear screws, for ceramic and woodworkers; also glass and seashell assemblers. Free catalog. Philadelphia Badge Co., 1007 Filbert St., Philadelphia, Penna.

C-THRU-MIRRORS Allow you to see others without being seen yourself. Write Beeler Enterprises, North Hollywood 21, Calif.

MAKE Beautiful sea shell jewelry, easily. Biggest complete kit \$3.50 postpaid. Instruction booklet 35c. Wholesale price list. Shelart Studios, 2100 Tangerine Ave., St. Petersburg, Fla.

ONE Tool does twelve jobs! See Bishop Tools ad under Machinery, Tools, Supplies.

U. S. Leathercraft kits: coin purse, 50c; billfold, 90c; cigarette case, 50c; key case 60c; complete set of 4, \$2.25. No tools needed. Instructions included. U. S. Handicraft Service, 92 Lee Ave., Brooklyn, N. Y.

FINISHES For any type material. Electroplating chemicals and supplies; wood and metal finishes; shop chemicals; industrial and novelty finishes. Write for price list now being prepared. Craft-Finishes, Box 467 M, Arlington, Virginia.

KILNS, Electric, with Pyrometers three sizes. Factory guaranteed. Also pouring and press pottery molds. M. Fred Keglmyer, North Wales, Penna., Distributor.

JEWELRY Supplies, earbacks, pinbacks, metalcraft supplies. Write for pricelists. Milton Orkin-Crafts, 333 Washington St., Boston, Mass.

WHEELS! 5" Ball bearing steel wheels for 5/16" shaft. Molded rubber tire. 65c each, 4 for \$2.40 postpaid. Write for quantity prices. Westgate Electronics Company, 226 Green Briar Lane, Havertown, Penna.

SHELLCRAFT Supplies, wholesale; (buy direct) (complete line) plastic animal shapes; discs; pin backs; "instructions"; etc. Packages or gallon; dozen or gross quantities. (Free catalog.) Pace's, 2117-14 St., Bradenton, Florida.

TOY Plans, Free descriptive circular. Production Engineering, 403-C City Hall Building, Rockford, Illinois.

BLUE Prints and instructions to make new type lathe collet system, range 1/4" to 3/4" any steps desired. Not complicated. Ideal for home shops. Blue prints \$3.00. Prints and material \$15.00. Harry Smith, P.O. Box 623, South Gate, Calif.

NEW Super bandsaw blades cut wood, plastics, metals. Most sizes \$1.00 C.O.D. plus postage. Box 723, Cedar Rapids, Iowa.

JIGSAW Patterns, 26 assorted, \$1.00. Northwoods Specialties, 432 Detroit, Royal Oak, Michigan.

SHELL Workers, you now can buy all your supplies of seashells, plastic and jewelry findings at strictly wholesale prices. Catalog free. Beachcomber Novelty Co., Box 551, Fort Myers, Florida.

WOODWORKERS: Reconditioned rotary files 3 shapes \$2.00, 1/4 shank. Carving, shaping made easy. (New value \$8.00.) Muller Equipment Company, 1235 Main, Hartford, Conn.

LEATHER Scraps for hobbyist. Six pounds \$2.00. Hobby books "Applied Leathercraft" \$3.00. "Art of Whittling" \$2.00. "Wooden Toymaking" \$2.25. Hobby books catalog free. Northern Supply Co., Dept. A, Sheboygan, Wis.

CRAFTSMEN, Make children's playthings. Full size patterns rocking horse, swan rocker, stroller, cradle and wheelbarrow \$1.00 postpaid. Lincoln's Craft Shop, Farmington, Conn.

LEATHERCRAFTERS! Send for free catalog listing leather, kits, supplies. Kit Craft, 1607 S. Western, Los Angeles 6, Calif.

CRAFTSMEN—Lawn furniture plans, beautiful jigsaw designs—large selection—free folders. Summercraft Studio, 42 Vernon St., Newton 58, Mass.

30 FULL Size toy patterns 50c. 40 novelty and lawn ornament patterns 50c. Other patterns; craft supplies; lists 10c. Lynds, Medway, Mass.

PATTERNS 70 Lawn ornaments and novelties \$1.00. Five new hanging shelf \$1.00. Doll stroller, colonial cradle, circus group, table and chairs \$1.00. Milne's Hardware, 1501 Wadsworth, Saginaw, Mich.

FELTCRAFT Projects for Christmas sales. Beanie kit 59c, suspender kit 59c, de luxe suspender kit 98c, pennant kit 75c, needle holder or pen wiper kit 25c. Send 10c for felt color chart and book list. The Felt Crafters, Felcraft Dept., Plaistow 10, N. H.

BEAUTIFUL Mirrors from ordinary glass. Complete instructions, \$1.00. Tesco, PM-2, P.O. Box 189, Wilkes Barre, Penna.

MASONITE Mill ends 10 lbs. \$1.00 plus postage. Carl Sign Co., Wooster, Ohio.

INTERESTED In radio, electrical, mechanical devices from war surplus? List free. E. Siefke, Box 18, Station E, Buffalo 11, N. Y.

BALSA Wood. Ideal for modelers, craftsmen. Sample carving block 25c. List free. Sanlader, Manitowoc, Wis.

WHITTLER'S Supplies, readicut blanks, special woods, knives. Old Whittler, 1402 Charles, LaCrosse, Wis.

MAKE Shell jewelry—for gifts, as a hobby or start a business. Free catalogue and price list. Complete illustrated book of instructions 75c. Florida Shellcraft Company, Box 1840, Sarasota, Florida.

SOLDER Aluminum with ordinary soft solder and soldering iron! Send \$1.00 for generous supply of our new flux. Warhaven Industries, R.D. No. 3, East Aurora, N. Y.

SHELLCRAFT Kits for beginners—shells and complete supplies for making pins, earrings, combs and novelties. Instructions free. Kits \$2.00 and \$5.00. Herbert Diamond & Co., 1121 North East First Avenue, Miami 36, Florida.

35 PATTERNS Of action pull toys, trucks, carts, toy furniture, etc., \$1.00. Continental Homecrafter, 907 Birch, Eau Claire, Wisconsin.

SHELL Jewelry supplies. Wholesale only. McFarland Plastic Co., Sarasota, Fla.

CATALOG: Patterns plywood novelty furniture, letters, numerals, plaques, frames, weathervanes, silhouettes, lawn ornaments, 100 books and booklets on crafts and hobbies, picture frame mouldings, tools, large line decal transfers. Other lines. Hundreds articles finely illustrated. Write Wo-Met Shop, Ashburn, Ga.

KNOCKDOWN Cedar chest lumber veneers. Free price list. Giles-Kendall, Huntsville, Ala.

MAKE IT YOURSELF

BUILD A backyard railroad of wood and tin. Fun for all. Plans for engine, car and 3 inch track, \$3.00. Write for list of other plans. G. P. Padrick, 1535 S. W. 9th St., Miami 35, Fla.

BUILD Concrete block machine. Vibration and hand operated types. 100 blocks per hour. Easy, inexpensive. Sell blocks, build home, garage, barn at low cost. Details free. Horne, 206 West Wilder, Tampa 3, Florida.

BUILD Kitchen cabinet, 25 inches high. Sells for \$10.00. Made from fruit boxes. Plans \$1.00. Tapp, Box 2593, Little Rock, Ark.

BUILD Concrete mixer. Power driven, simple, inexpensive. Details free. Horne, 206 West Wilder, Tampa 3, Florida.

SPEEDY 1" Motor, runs on top of flashlight cell Parts, instructions, 35c. Arthur Fonskov, 655-L Amboy Ave., Perth Amboy, N. J.

ACTION Xmas toys. Steam shovel, loader, dump, tanker trucks. 4 big projects \$1.00. Alpha Co., 241 Orange, Suite 8, New Haven, Conn.

AIRPLANE Jettison gasoline tanks, streamlined, ten foot six inches by two foot four inches, 165 gallon, twenty gauge terne coated steel. Ideal for making boats, bob sleds, midget auto, etc. Price \$10.00 per tank, \$7.50 per tank quantities of five or more. General Truck Sales, Inc., 205 Market S.W., Grand Rapids, Michigan.

CONCRETE Block homes, 24 page booklet: drawings and instructions, how to build, \$1.00. H. C. Lightfoot, Civil Engineer, Richboro 1, Penna.

BUILD Concrete block machine, mixer, portable sawmill, woodworking, metalworking, farm machines. Free catalog. Nichols Equipment Co., Dept. PM, Purvis, Miss.

BUILD Your home as a hobby. No rent. No mortgage, save 50%. Use spare time. No special skill required. Amazing facts sent free. H. C. Lightfoot, Civil Engineer, Richboro 1, Penna.

GRANDFATHER Clock building system, simple, shop-tested, thousands built, with weight movements pictured in production \$1. Kuempl Chime Clocks, Minneapolis 16, Minn.

BUILD A famous Norwood direct positive camera. Plans \$1.50. (E.) Poch, 2858 So. Lawndale, Chicago 23, Ill.

BUILD Concrete mixer from oil drum. Inexpensive. Power or hand. No cogs. No gears. Complete, easy plans \$2.50 postpaid or write. Clyde Lee, Dept. A, Mountain View, Oklahoma.

BUILD Concrete block machine. New principle. Inexpensive. Motor vibrator or hand tamp. Make standard block per minute. Complete, easy plans \$3.50 postpaid or write. Clyde Lee, Mountain View, Dept. A, Okla.

HOW To build cabins, lodges and bungalows. Features costs, estimates, instructions: \$1.98. J. K. Lasser's famous book: "Your Income Tax." Helpful guide in filing 1946 returns: \$1. Add 10c postage per book. Canada 25c. Order C.O.D. or money order. Eastern Book Service, 520 Washington St., Hoboken, N. J.

HOT Water free—from sunlight. System efficient any locality year 'round. Standard materials—easily built—low cost. Facts free. Solar Water Co., Box 175, Dept. Q, Coral Gables, Florida.

HONEST Profits! \$3.00 up! Make Colored xylophones. Hand tuned steel notes, mallets, 12 songs, numbers, decorations, specifications. Guaranteed. At factory or postpaid. One octave \$1.00, two octaves \$2.00. Egerton, 195-29 Jamaica Ave., Hollis, N. Y.

PRINTS And instructions for building live centers, regular or pipe. State type and taper \$1.00. Planco, Box 7132, Houston 8, Texas.

BUILD Your own food freezer, save \$200.00. 33 drawings, material list and instructions, \$2.00. H. Gordon Anderson, Lakeshore Drive, Rome, Georgia.

BUILD 250 Amp. a.c. welder yourself. Simple, low cost. Complete instructions, \$3.50. Used successfully in industrial plants past seven years. Wesco Mfg. Co., Marshall, Texas.

BUILD Your own oil furnace. Inexpensive. Simple to operate. A clean method of heating. Plans \$1.00. Roland Kadletz, Box K-103, Salmon, Idaho.

WATCHES, OLD GOLD, JEWELRY, ETC.

LEARN The jewelry manufacturing trade at home. Excellent profits, pleasant work. Easy illustrated course teaches custom and production jewelry making, goldsmithing, gem setting, repairing, etc. Catalogue. The Gemcrafters, Dept. B, Kalispell, Montana.

GENUINE Diamonds, out-of-pawn low prices, wonderful values. Unredeemed loans and big buying power enable us to offer beautiful gems at prices far less than original cost. Shipped free for inspection, appraisal. Send for big free list showing fine diamonds at startling low prices. Lloyd J. Butler, President, Prudential Loan Association, 133-VM North Clark St., Chicago 2.

WOOLLY Lapel Santa Claus. Handmade. 50c. Cado Products, 4842C Hutchinson, Chicago 41, Illinois.

WANTED—Old, broken jewelry. Cash paid immediately. Mail gold teeth, watches, rings, silverware, diamonds, spectacles. Satisfaction guaranteed. Information free. Rose Smelting Co., 29-A East Madison, Chicago.

FREE Catalog: Watch repairing, chemistry, aeronautics, engineering, optics, etc. Engineers' Book Service, 19 West 44th St., New York City 18.

WATCH Repairing. Guaranteed. Complete overhauling and cleaning \$8.00. Price includes mailing, material and repairing. Postpaid—C.O.D. Apt Watch Repair, 1237 West Ohio Street, Chicago 22, Ill.

TROPICAL Charm for your wife or sweetheart, with jewelry from Miami. Beautiful Caribbean pearl (pat.) seashell necklace, \$2.39; bracelet, \$1.39 in her favorite color, tax paid, postpaid, satisfaction guaranteed or refund. Linda's Tropical Jewels, Riverside Box 1895, Miami, Fla.

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SEND Your discarded jewelry, watches, crowns, bridges, spectacles, silver, etc., for cash offer. Goods returned promptly if offer unsatisfactory. Old State Metal Co., 812 Erie, San Antonio, Texas.

"JEWELRY, Gem Cutting, Metalcraft." Fascinating designs for hobbies and money-making opportunities. New, complete illustrated book covers cutting, polishing, mounting gems, metal, jewelry work, etc. 287 pages, \$3.25 postpaid. Money back guarantee. We supply tools, materials at lowest cost. Modern Technical Book Co., Dept. MMC, 55 West 42nd St., New York 18.

GOLD \$35.00 Ounce—Mail old gold teeth, diamonds, jewelry, watches—receive cash by return mail. Satisfaction guaranteed. Free information. Dr. Weisberg's Gold Refining Company, 1500-Q Hennepin, Minneapolis, Minn.

GEMS, Precious and semi-precious, all genuine, from world wide sources. Deal direct, no overhead, save money. Catalog 10c. Hill Co., Route 7, Salem, Oregon.

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CIGARS, 100 choicest quality, hand-made. \$5.95 postpaid. Money order, check or cash. S. & E. Co., Dept. PM, Red Lion, Penna.

CIGARETTES—Popular brands, \$1.40 per carton postpaid. Minimum order 3 cartons. Cigars: Natural Bloom Dandies; bx. of 50, \$6.00. Ingersoll, Havana blend; bx. of 50, \$4.49. Pipes: Medico—\$1.00. Also Yello Bole, Kaywoodie, Weber, Milano, etc. Our policy—everything postpaid; satisfaction or full refund; amazingly fast delivery service. Ask for complete price literature or send your check or money order today to: Ace Mail Order Company, East Orange 86, N. J.

FREE To pipe smokers—For new pipe smoking thrills, write us your brand of tobacco and get free package mild, tasty "Green River." Pete Moberly, Box 997, Owensboro, Kentucky.

PIPE Smokers! Monthly pipe magazine! Pictures, articles, gadgets, ideas. Sample 10c. Cushman, 532P Pine, Long Beach 2, Calif.

TOBACCO And cigar bargains. Regular Coronas \$2.95 box 50. Others \$3.60 up. Pipe tobacco 8 oz. \$1.60. Briar pipes \$1.50. Free catalog. Zibar Co., Roselle 12, N. J.

\$3.00 CIGARETTE Lighter—case combination \$19.50 doz. Zipper leather tobacco pouches \$7.00 doz. Sample of both \$3.00. George Pierce, 18 Pryor St., Atlanta 3, Ga.

MAKE Your own pipes. Detailed, illustrated, pipe makers manual \$1.00. Harold Mangus, Rt. 3, Alliance, Ohio.

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INGERSOLL \$1.00. Strapping outfit \$7.00 doz. George Pierce, 18 Pryor St. SW, Atlanta 3, Ga.

BLADES Last a lifetime same as old razors did if you use Razorlife as instructed. Send \$2.00. L. G. Eggers, Box 2406, Sarasota, Florida.

RAZOR Blades. 125 Champion double-edge \$1.25. 1000, \$8.90. Stephen Erdos, 129 East 61st, New York 21.

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MECHANICAL Drawing instruments—Veeco, 4 piece, compact, precision set, brand new in lined case, value \$12.50, special, \$7.25; \$10.00 Charvos 9 piece set, \$8.50. Army surplus slide rules, slightly used, 75c each. Hull automobile compass, for accurate road direction, brand new, \$2.50. Brand new folding valise knapsacks made of heavy olive green duck, heavily bound and reinforced, repellent to fire or water. Inside 3 large snap fastened pockets, heavy webbed straps, hand and shoulder handles, size opened 22"x54" closed 22" rolled. Useful to hunters, Boy Scouts, hikers and for all traveling use. A \$7.50 value, special \$2.25 postpaid. Prisms for 6X30 or 8X30 binoculars, brand new, \$1.50 each. Offset prisms to be attached to 7X50 B. & L. binoculars gives double the field of the ordinary 7X50 binocular. Cost \$98.00, special \$25.00. Green sunshades for binoculars, size 6X30 and 7X50, snap on type, value \$7.50, special \$1.25 per pair. Forward money order. No c.o.d. shipments. Public Sport Shops, 13 S. 16th, Philadelphia, Penna.

A FEW Beautiful ram heads whittled from choicest white pine. Horns measure eight inches, \$25. Picture sent on request. Eddy Radtke, Dover, N. J.

HOUSE Screw jacks, 500 used, like new, government surplus, 12 ton capacity, 14" overall height, 10" lift, 1 1/4" screw. With handle \$6.49. Special price, lots of 10. Midwest Surplus Sales, 1515 Locust, Kansas City, Mo.

CUTTERS, Dental burs, reclaimed, assorted 125 \$1.90; 400—\$4.90. Am. Standard, 1208 N. 13th, Philadelphia 22, Penna.

ARMY Clothes trunks (2,000 used). Made of durable plywood, size 32" long, 16" wide, 13" deep, with removable divided tray, for small articles. Reinforced corners, metal hardware fittings. Real value at \$4.98 with shipping charges paid. Midwest Surplus Sales, 1515 Locust, Kansas City, Mo.

STAINLESS Steel; strips, 3" squares, and odds, sixteen gauge. Send \$3.00 for 5 pounds postpaid. U. S. Good Measure. Buehrens Co., Dorchester, Wis.

TOASTERS; Clocks; mixers; irons; other appliances. Immediate delivery. Price list. Mail order. Electric, 713 South Dearborn, Chicago.

CLOTHESPINS, Clothespins. Guaranteed 100% hardwood. 10 gross only \$9.30; 50 gross \$43.49 (prepaid). Rush check, immediate delivery. Scheall, Box 263, Duluth, Minnesota.

WANTED MISCELLANEOUS

SUCCESSFUL Distributor planning enter manufacturing field. Interested in new products, preferably mass production items. Vermilye Corporation, 155 E. 44th St., New York 17, N. Y.

SUPPLY Source—Two-color process cards. Swayne, Box 4694, Jacksonville, Florida.

WANTED: Old watches for parts, discarded watches too old-fashioned to warrant costly repair; Key-wind watch movements; small clocks, any condition, traveling, repeater, alarm, automobile, ornamental, French carriage. Please pack carefully and insure when mailing. L. Rankin, Ocean City 11, Md.

WANT To swap-buy-sell anything? Send 25c for National Swapper's Guide. It's full eager swappers-buyers-sellers coast to coast and opportunities to swap-buy-sell almost anything under sun. National Swapper's Guide, P. O. Box 415, Evansville, Indiana.

MERCURY—Highest prices. Free containers. Write. Wholesale Terminal, Norwood, Mass.

MERCURY (Quicksilver). Write for quotation stating quantity. Metallurgical Products Co., 35th and Moore Sts., Philadelphia, Penna.

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REPLACEMENTS. Stoves, furnaces. Grates, firepots, linings. Craxmend. Majprudax, Royal Oak, Mich.

PRESERVE Lustre. Silver, brass, all bright metals. Easy to apply as nail polish. Protects indefinitely. \$1.00 postpaid. Madison Laboratories, Box 41, Madison, New Jersey.

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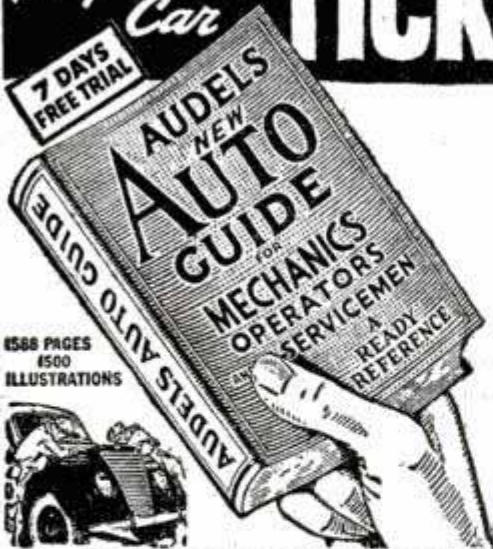
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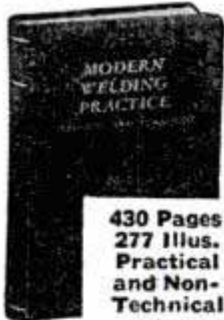
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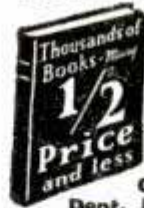
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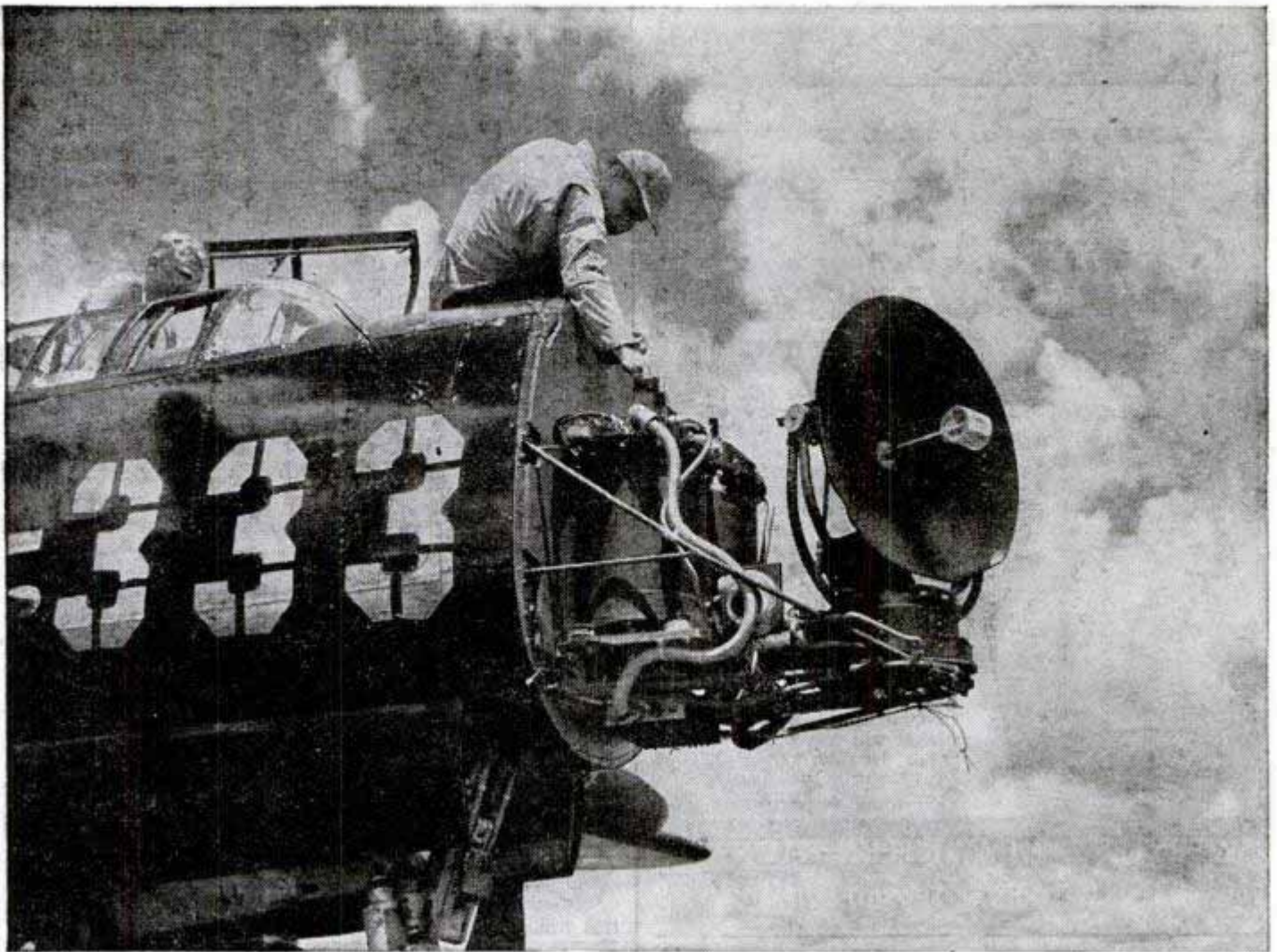
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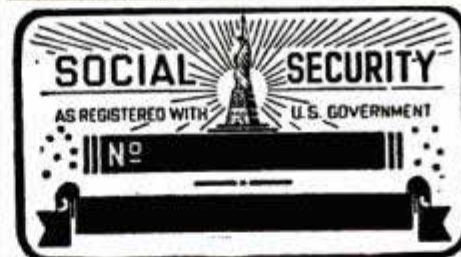
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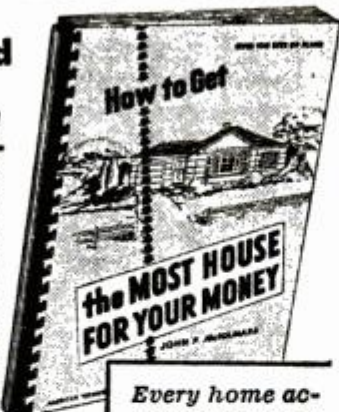
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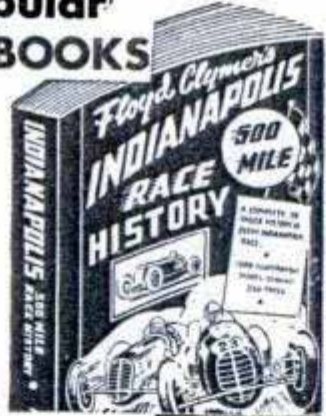
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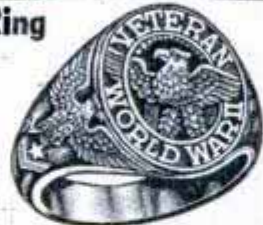
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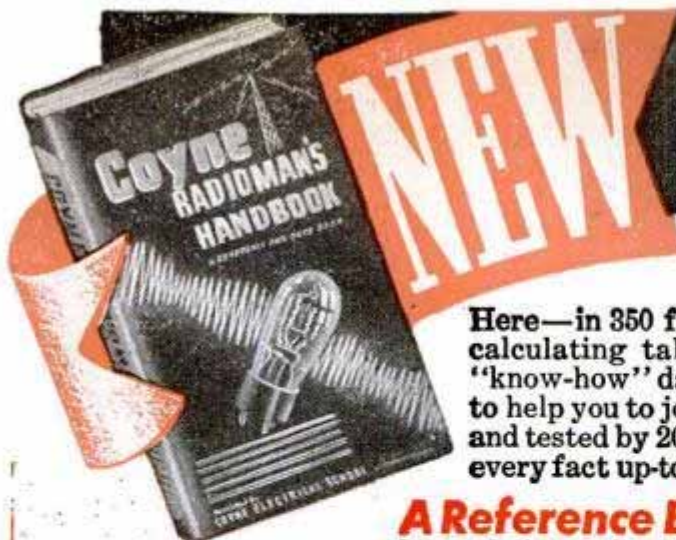
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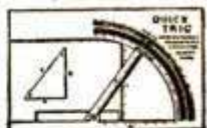


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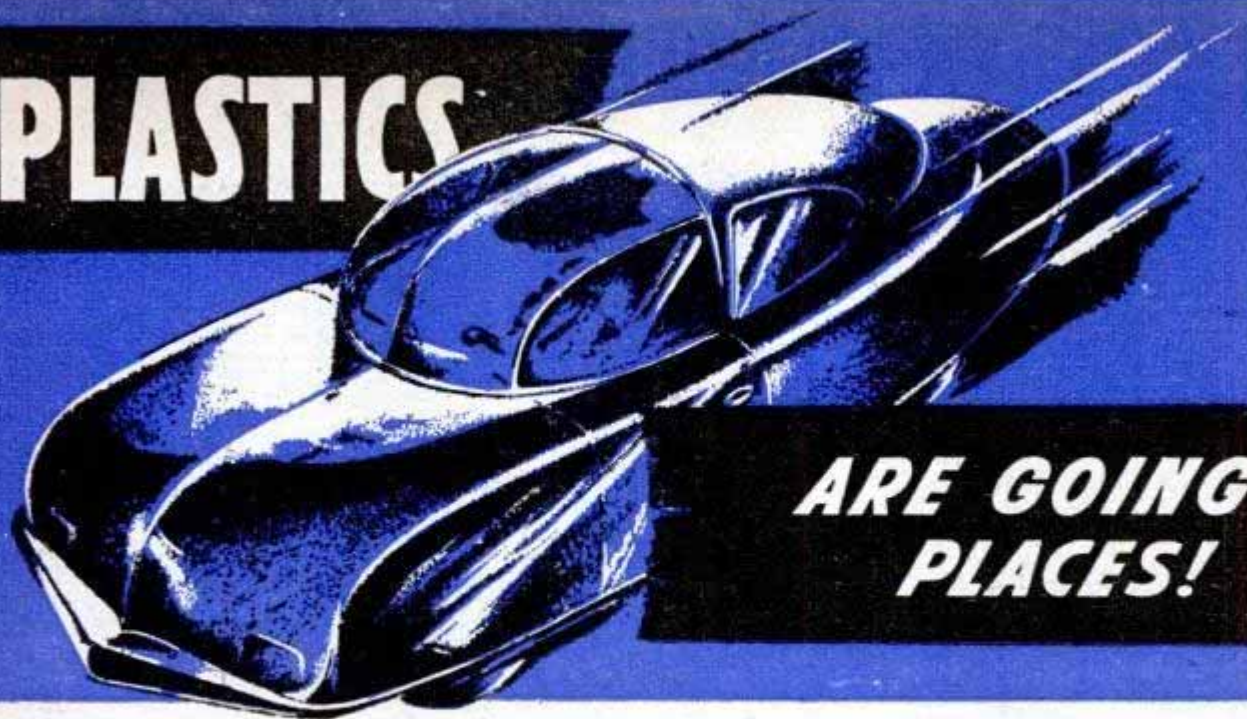
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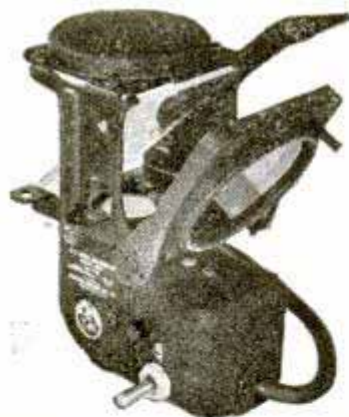
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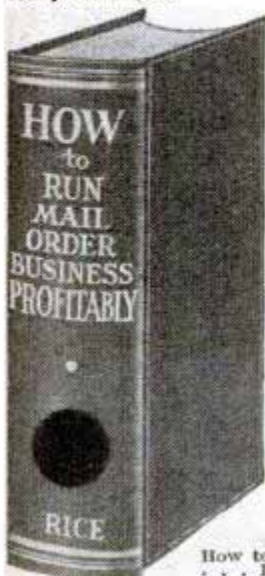
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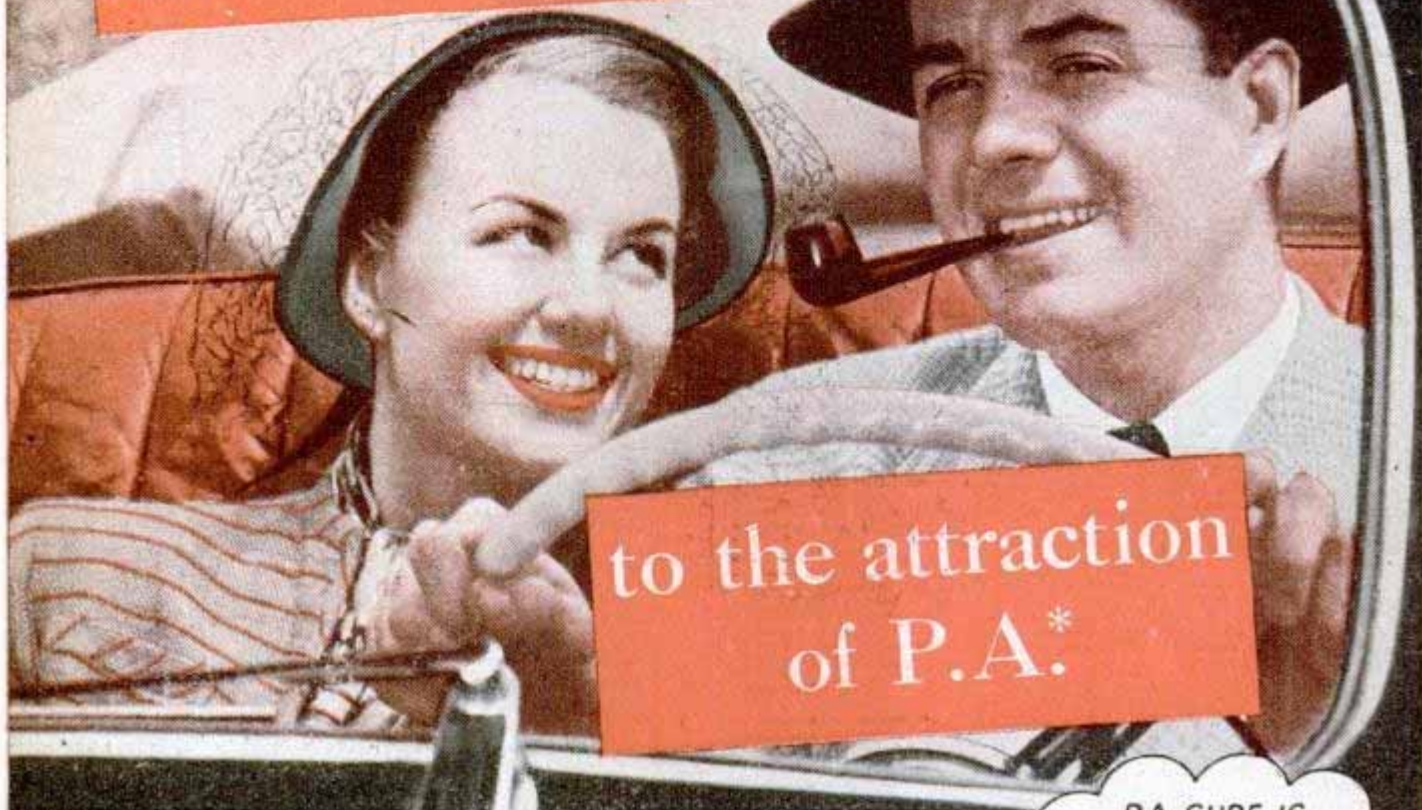
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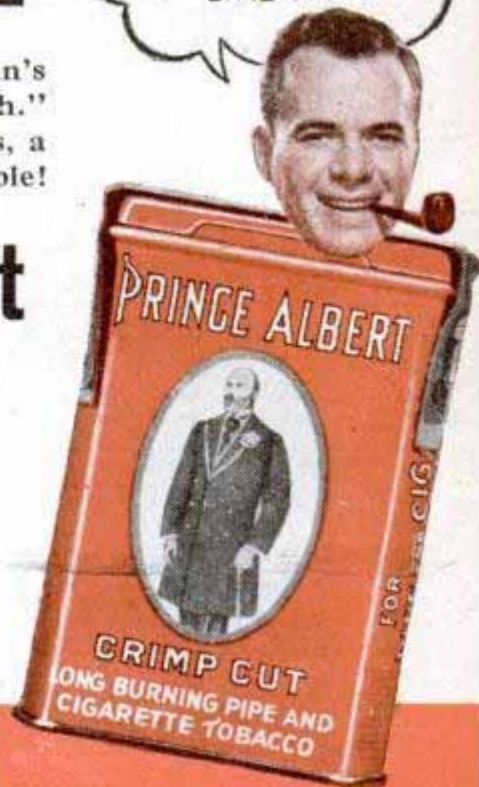
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THE NATIONAL JOY SMOKE



Low and wide are the lines of quarter-size model being roughed in by Ford designer. It could be a '48 car

FORECAST from DETROIT

IF YOU HAVE been postponing your purchase of a new car until the first of the postwar "dream" cars is available, you'll have to wait at least another year.

Not that the automobile manufacturers haven't got some very attractive new cars designed, and some of them in test-model stages—but the circumstances thought propitious for introducing them haven't been brought into alignment.

The tip-off on another year's delay in bringing out the really new cars was the recent and almost simultaneous announcement by General Motors and Ford that their proposed lightweight cars had been indefinitely postponed.

Timed for release some time between Thanksgiving and New Year's, most of the 1947 models will be face-lifted cars with

By Leo Donovan

not-too-easily-discernible evolutionary changes. There will be new front-end designs featuring grillework attractions, decorative trim changes, new hub caps and additional mechanical improvements, but there won't be much that auto designers consider radical in 1947 cars.

The Big Three—General Motors, Ford and Chrysler—are competitors, even in a seller's market. In all probability each of them will introduce a model that will serve to indicate the trend in appearance changes you can expect in most cars in 1948. The balance of their models won't look much different from current vehicles.

Reasons for the gradual, rather than a sudden, change in the appearance of next year's models are many and practical. In the first place, production has been so light



Photo from Macy's

The first 1947 Crosley is launched in nautical style—and why not? Its 59-pound engine was developed in wartime for the Navy



Nine-foot span of glass across rear of Studebaker five-passenger Champion coupe affords excellent vision. Total window area in car (shown below) is 2430 square inches—a postwar pacesetter



in face of original anticipations and assembling capacity—and particularly in view of a terrific backlog of orders—that manufacturers insist upon full production first.

Public irritation over failure of the industry to produce cars by the millions despite strikes, material shortages and government pricing policies has the public relations experts worried. And reports of avaricious dealers making fortunes out of the shortage are further aggravating the situation.

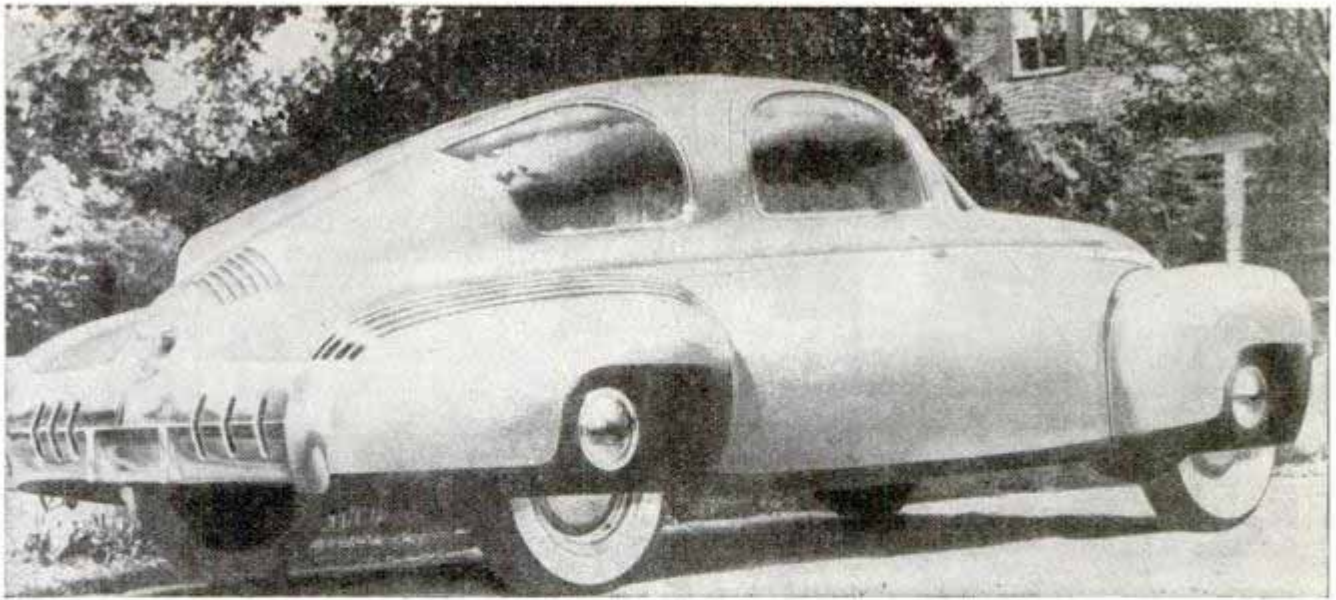
Worries over the sheet steel supply for bodies are lessening in view of the steel mills' promise of a peak capacity of an additional 2,500,000 tons by next spring. Other basic shortages can be relieved only through changes in administration policy.

Retooling for new models takes a long time under the most favorable circumstances. And tool and die makers are reported to be far behind in their orders.

Chevrolet's postponement of its new lightweight car, for instance, could be due to many factors, including the possibility that its two huge plants in Cleveland, designed solely for that job, can't be finished for another 8 to 12 months because of lack of construction materials.

The automobile industry guards its secrets well, and it doesn't announce its plans until they're ready. It also has learned expensive lessons from sudden presentation of radical models. It makes thorough checks beforehand on what the public wants in the way of transportation before it approves its designers' sketches and invests millions in new tools.

But you can't keep too many secrets when they're shared by hundreds of designers, engineers and component parts suppliers. The Motor City, of course, is the center of such secrets, and rumors about what's on the drawing boards, the blueprints and the boss' mind cir-



Tucker Torpedo has six-cylinder engine in rear; curved back window extends into the top for full vision. This revolutionary car carries six passengers and will be in the "medium price class"—\$1500 to \$1800

culate like hot air at a political convention.

Some of the new developments you can expect in 1947 models, however, include the probability that the new Cadillac Series 60 will lead the way in General Motors' parade showing the trend in design and engineering. A great many engineers not on the General Motors pay roll confide that Cadillac is, mechanically, the best car made. Its appearance in 1947 is likely to change more sharply than any other GM car. They say it will be roomier inside, with even wider front seat; that the windshield will be moved forward more than a foot; that automatic transmission will be standard; that its lines will be even more flowing than the Darrin-designed Kaiser Special and Frazer models.

Plans for the new Chevrolet are rumored to be moderate—the idea being that Chevrolet must regain its position as leader in the low-price field. Ford so far has outdistanced Chevrolet, principally because of General Motors' agonizing strike, but Chevrolet has the greater output capacity.

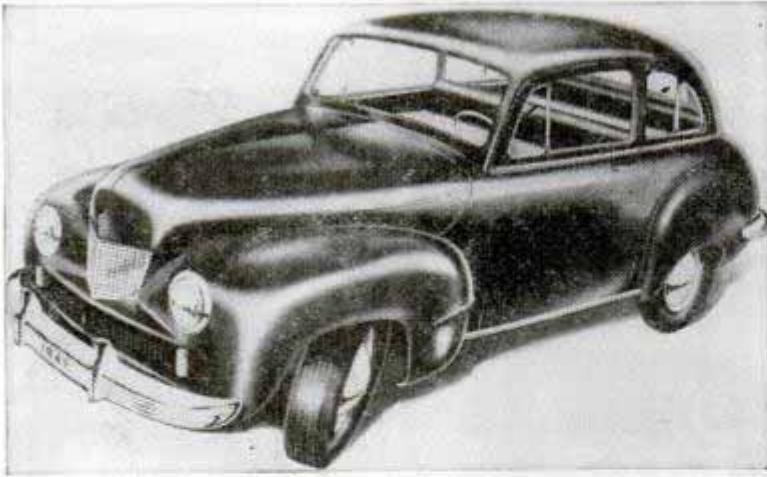
Buick, with an expansion program increasing its capacity 50 percent, is expected to startle the buying public with a chassisless, single-construction body having individual front-wheel suspension. However, under GM's production schedule, you might not see it until 1948.

Oldsmobile and Pontiac, according to the gossip, are due for face-lifting and mechanical improvements but little change in basic styling.

Chrysler Corporation is maintaining a discreet silence and in its advertising has referred only to its new cars without mentioning yearly models. Chrysler cars incorporated so many changes with their first postwar production, however, that it isn't likely they will produce anything startling, except in the New Yorker line. Body lines there may be lower and wider and automatic transmissions may become standard in more than one series. You can look forward to increased power in Chrysler engines. Plymouth, Dodge and De Soto are likely to present new models—after 1947

Peep preview—a new Ford glimpsed at Dearborn test track is wider and lower. You may see it late next year





New six-cylinder Willys-Overland has independent suspension of all four wheels—a 1947 contender in low price market



Busy Buick assembly line is a treat for car-hungry eyes. Below, pride of Willow Run is the long-awaited '47 Frazer sedan

production begins to catch up with demand.

Henry Ford II has reorganized top personnel in a determined drive to match the range of prices of all General Motors cars with a long line of models for any purse.

Look for a radically designed new 1947 Mercury line, with fenders practically disappearing into the body. Look for the Lincoln Continental to surpass anything in appearance in the luxury line.

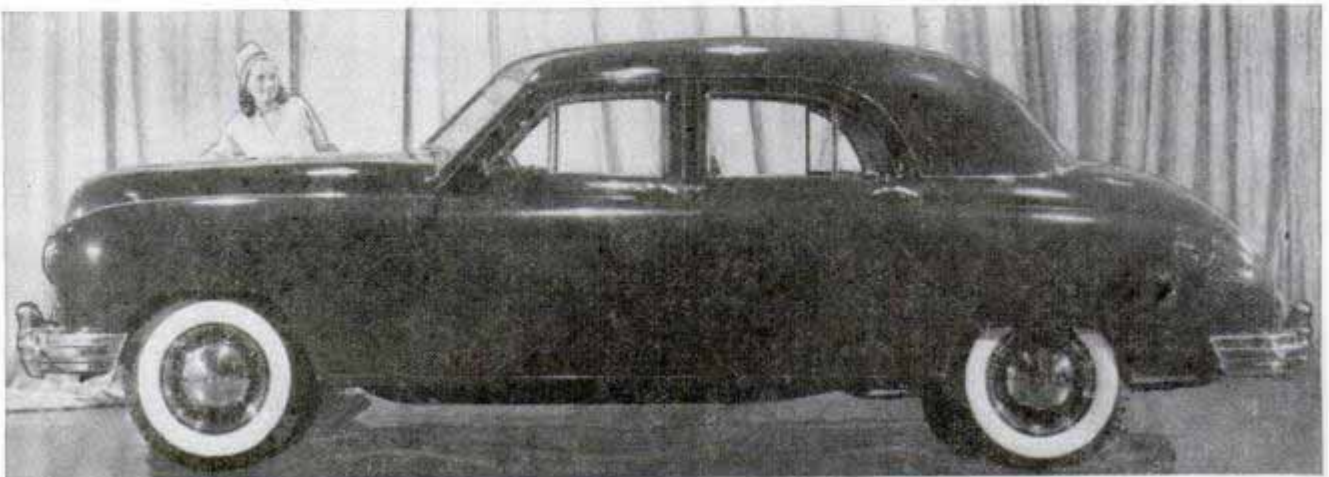
The new Ford won't be seen until 1948, but it meets its tests on the Dearborn track to the satisfaction of the engineers. However, they are convinced that the public wants transportation, not necessarily new models.

Output capacity at the River Rouge plant is estimated at 6500 cars a day, and Ford is running at about two thirds of capacity. Ford's production at other plants is being expanded. However, with a backlog of more than 1,000,000 orders it is estimated that it will take a year and a half of full production before Ford can catch up with the demand.

It would be considered highly impractical to shut down for 60 days for a new model change and lose production of 160,000 units in the process. And if Ford, Chevrolet and Plymouth all shut down for model changes the loss would be more than 500,000 cars, production engineers estimate.

Engineers in the know say Ford has a terrific six-cylinder engine in the testing laboratories. It is reported to have the best torque curve in the business. With less displacement it develops the same horsepower, but that doesn't mean that they'll forsake the V-8 engine.

(Continued to page 280)



Midget "Cable Car" Launches Jets in 100 Yards

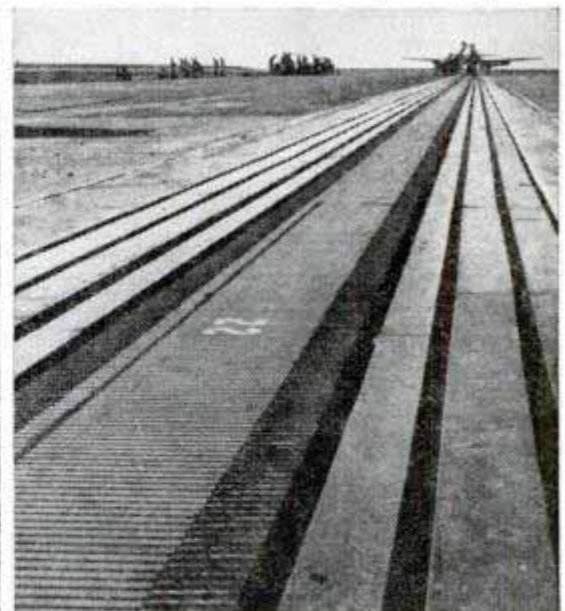


Jet fighter releasing steel cable "bridle" and taking to the air at 116 miles an hour after 340-foot run

Planes take off in a little more than 100 yards with an electric catapult built to launch aircraft from ship decks and small fields. The electropult, resembling a miniature cable-car line, is essentially a huge electric motor laid out in a straight line. It develops 15,000 horsepower, as much as three of the mightiest locomotives, and provides a quarter-mile track for a small shuttle car. A steel cable, with the two looped ends hooked over projections beneath the

plane's wings, is hitched to a lug at the front end of the car. The aircraft in tow rides along the tracks on its own wheels and when flying speed is reached the car stops abruptly, the bridle falls off and the plane takes to the air. Jet fighters normally requiring about 2000 feet can fly after a 340-foot run. It can be adapted to pull four-engine transports, which now need a 4000-foot run, into the air in 500 feet, according to Westinghouse engineers.

Hitching the "bridle" to shuttle car for takeoff and a view of the 1382-foot track on which plane is pulled



Plutonium in Atomic Bombs Weighs Between 22 and 66 Pounds

Two more facts about atomic energy have been made public: (1) the amount of plutonium used in an atom bomb is somewhere between 22 and 66 pounds. Until recently the War Department had revealed only that the amount was between 4.4 and

220 pounds. (2) Another chain-reacting substance, other than plutonium, can be manufactured. It can be made through use of uranium and thorium, but uranium, from which plutonium is made, is necessary to start with.



Oxygen Tank Cart Aids Football Team

Georgetown University's football team uses portable oxygen tanks to restore normal breathing in 30 seconds to players who have had their wind knocked out or have lost most of their wind through hard play. The two tanks mounted on a two-wheel cart are equipped with 11 outlets to refresh an entire team during a timeout. This method of administering to winded players is expected to become widely used.

Cranberry Sprayer 'Floats' Over Beds

Because cranberries are planted in beds instead of rows, heavy power spray machinery would damage the plants. One Wisconsin grower controls insects and fungus with a 40-foot spraying boom, light enough to be carried by two men. Pressure comes from a power spray drawn by a tractor along the dike surrounding the beds. A third worker carries the hose to prevent damaging the plants. Recoil from the 34 nozzles helps "float" the boom.



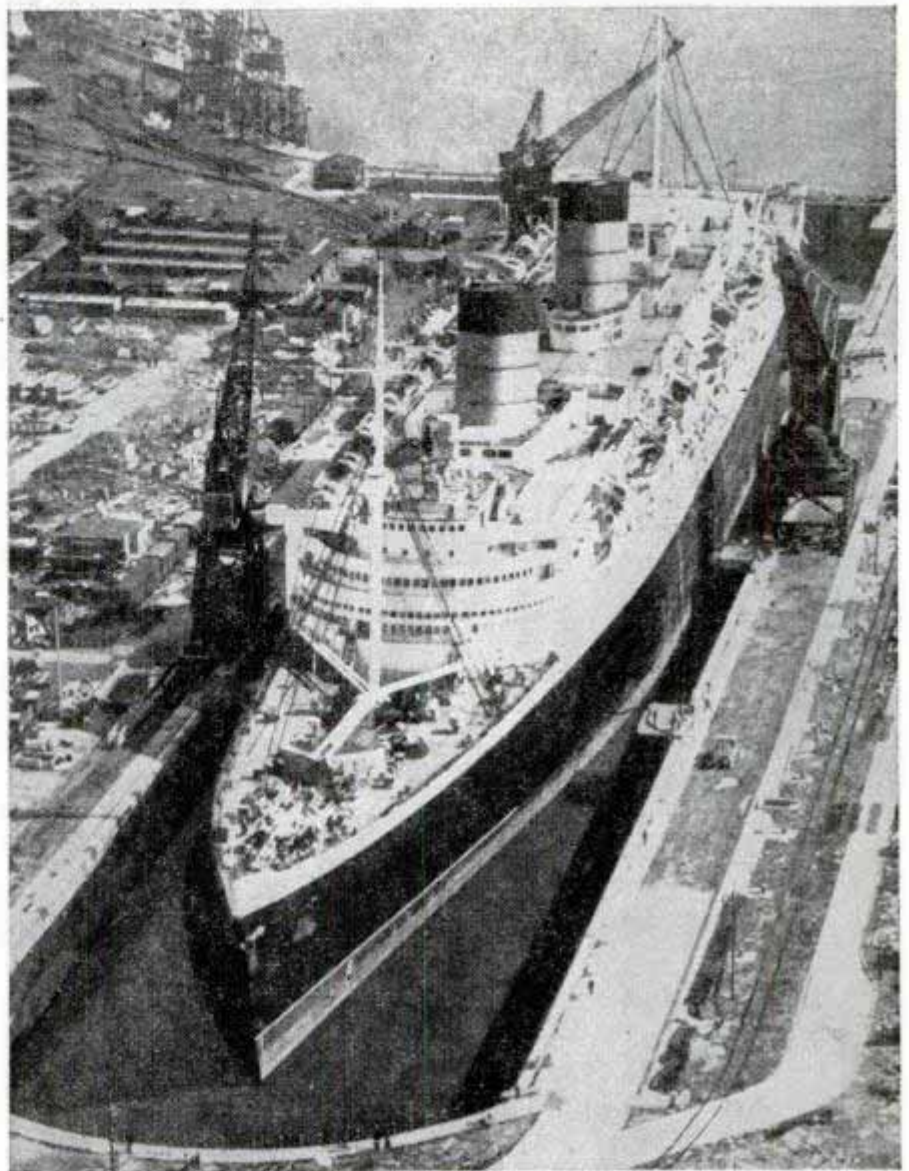
China Filter for Coffee Maker Saves Both of Paper Disks

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You may wish to obtain additional information about the new products described each month in Popular Mechanics. If you want to know the name and address of the manufacturer or distributor, just write to Bureau of Information, Popular Mechanics, 200 East Ontario Street, Chicago 11, Ill.

World's Largest Ship Sheds War Togs for Passenger Runs

The 83,673-ton liner Queen Elizabeth, world's largest vessel, has been reconverted to peacetime use and is again ready for passenger runs. Used as a troopship during the war, the ship was refitted in the King George V graving dock at Southampton. After the dock was drained of its 58 million gallons of water, the propellers, rudder and other underwater parts of the ship were cleaned and repaired in preparation for her maiden passenger run to New York.

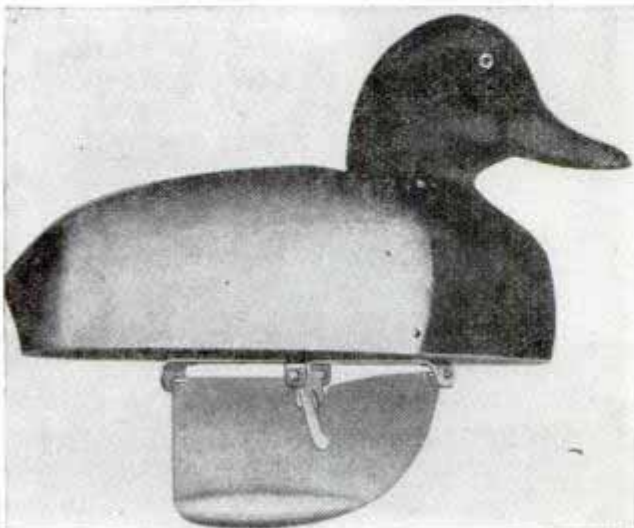


"Linguist" Radios Aid Conferences

Pocket-size radio receivers used at international conferences permit simultaneous translations of a speaker's words into seven different languages while he is talking. Developed by the International Business Machines Company, the receiver is equipped with earphones and an aerial embedded in a shoulder strap. The speaker's words are transmitted by radio to interpreters who make running translations of the speech into their own languages. These translations are re-broadcast to the listeners, who turn a knob on the receivers to select the language they understand. Listeners can move anywhere

within the loop of the antenna wire that encircles the auditorium. The power of the radio wave is so low that the broadcast cannot be received outside the building. Once the system is set up and functioning it requires no switching.

"Trigger" Keel Rights Duck Decoy If Overturned by Rough Water



Duck decoys equipped with a "trigger" keel automatically right themselves if overturned by rough water. If the decoy is upset, a trigger drops, allowing the metal keel to fall on one side of the duck's base. This concentration of weight unbalances the overturned decoy and causes it to return to a right-side-up position. The trigger then automatically locks the keel in vertical position again.

Army Signal Corps meteorologists have developed reflectors which, when carried aloft by balloons and traced from the ground by radar, supply data on the speed and direction of winds as high as 100,000 feet above the earth.



Scientists believe the X-1 will reach the twilight limit where first magnitude stars are visible directly overhead as the sun sets or rises

MAN is about to open the door to a new world—the world of supersonic speed. Today projectiles are the only objects able to cross the strange barrier that occurs when the speed of sound is reached. However, soon an Army Air Forces test plane may cross the threshold and enter a new realm.

Sound travels approximately 725 miles per hour at sea level, varying widely with the temperature of the air and its pressure. When planes reach this speed, strange things happen to them. The air, instead of flowing smoothly around the wings and fuselage, seems to break up and pummel the plane with hammerlike blows. Control surfaces refuse to respond, the plane dives at increasing speed until it crashes. Pilots who have survived the experience of sonic speed say that fearful noises are heard and the plane shudders violently. Drag is increased manyfold—as much as 10 times normal—and stick motion which is normally a *pull* at subsonic speeds becomes a *push* at sonic speeds.

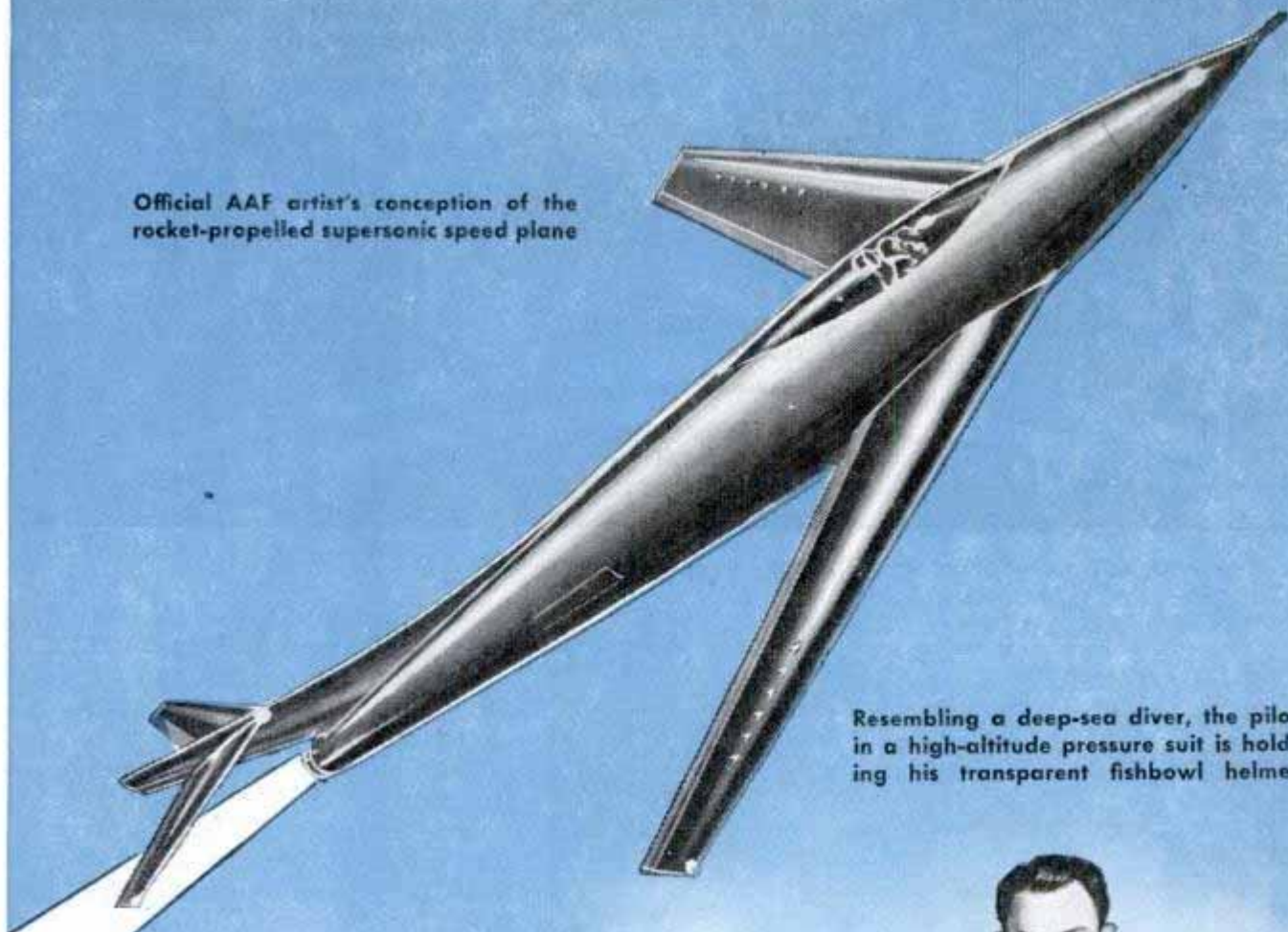
Speeds vary widely through what is called the transsonic region—from 600 to 900 miles per hour, depending on altitude, temperature and pressure. The shock waves generated at these speeds act like a barrier, and once the plane succeeds in

SPEED UNLIMITED

By E. M. ROGERS

In its race against the speed of sound, the Army Air Forces aims at "double or nothing" from its rocket-propelled X-1

Official AAF artist's conception of the rocket-propelled supersonic speed plane



Resembling a deep-sea diver, the pilot in a high-altitude pressure suit is holding his transparent fishbowl helmet

passing through this hellish region it begins to act more normally.

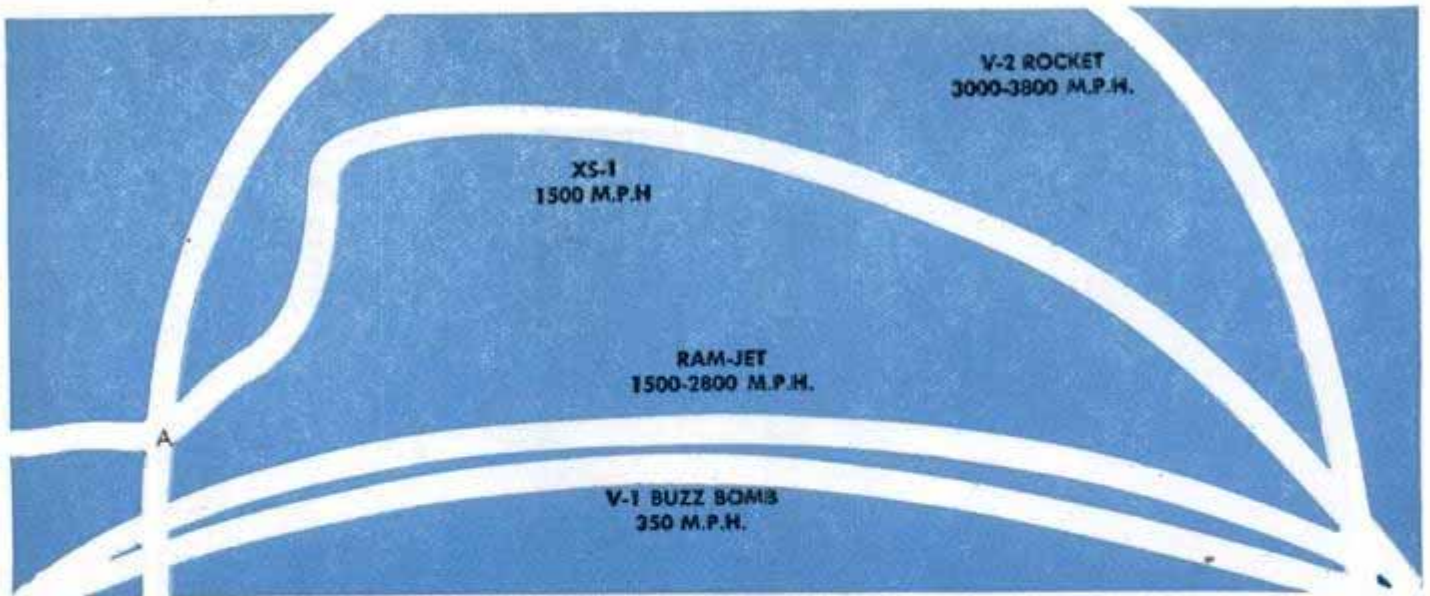
Most of us do not think of sound as being a force. Yet it is. Notes from a pipe organ cause a building to vibrate. The shuddering effect of airplane engines that pass at low altitudes is another example of the force of sound.

When an object moves through air, the noise it generates, in the form of sound waves, precedes it. As the object's speed increases, it overtakes these waves, and at the speed of sound these waves or vibrations are compressed, since they cannot get out of the way, into a shock wave. This shock wave has a very definite force composed of all the smaller forces of sound.

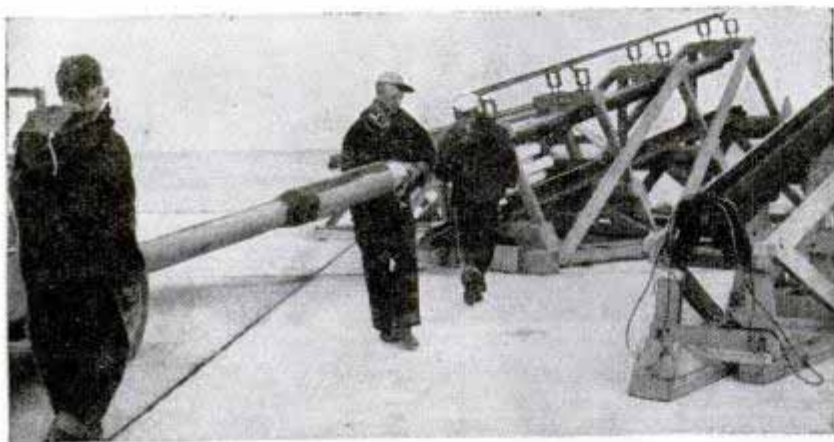
At transsonic speed, or the region through which these shock waves are formed, air takes on peculiar characteristics. The shock waves bunch the air into almost solid blocks of matter. It resembles water flowing around the hull of a boat moving swiftly through it, only to become a seething mass in the turbulence of the wake as the water is broken up by the swiftly moving propeller.

At Aberdeen Proving Ground, the Army Ordnance Department has a supersonic wind tunnel with a miniature model sus-





XS-1 will be released from a B-29 at point A, near 30,000 feet, then climb to about 80,000 and glide to earth

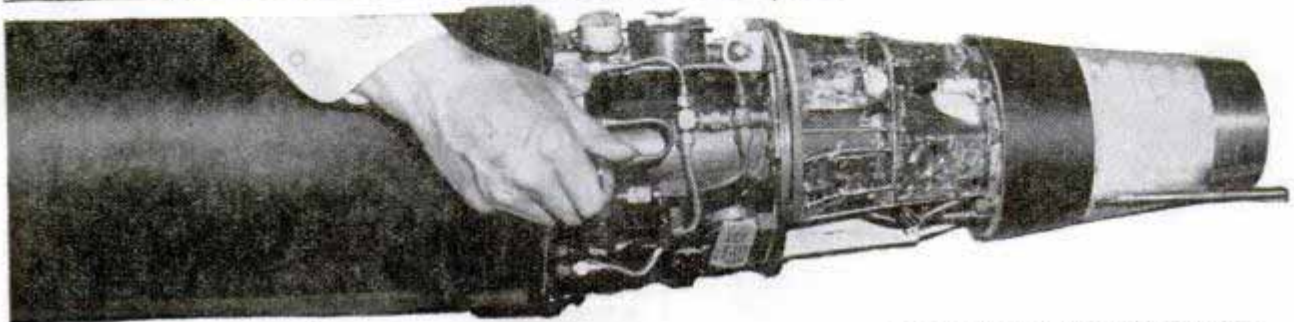
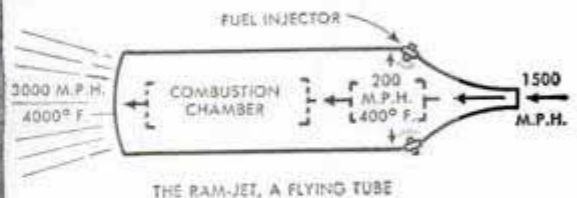


Above and below, launching 70-pound ramjet engine capable of speeds over 1500 miles an hour. Bottom, close-up view of the propulsion unit



pendent in the air stream. As air velocity increases to sonic speed, the turbulence can be seen with the eye. At sonic speed, suddenly a curved line is seen that flows back along the model. This is the shock wave. As speed is increased the shock waves bend more closely to the model and the turbulence ceases. Air speeds over four times that of sound have been reached in this tunnel. Even at supersonic speeds the shock wave clings to the nose of the object like a leech.

Calculations and tests have shown that a plane must have wing sections that are almost knifelike to fly at supersonic speeds. This poses the difficulty that an extremely thin wing section has very little lifting power at relatively low speeds. To overcome this, special flaps are built in the wings



to allow the plane to take off and land at speeds that are not too hazardous.

In their attempts to use wind tunnels to test model planes, engineers found that no matter how much power they poured into the huge fans, the speed of the air would not increase above sonic speed. The tunnel was filled with turbulence, blocks of air choked the tunnel and destructive vibrations were encountered.

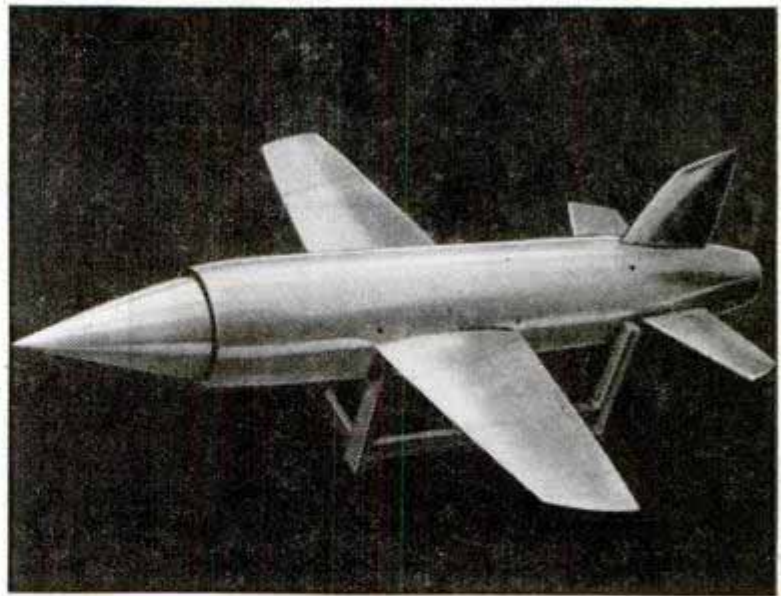
From this discovery, it is known that supersonic planes would have to use other means of propulsion than a propeller. Jet or rocket engines are the apparent solution.

The latest type of jet engine is the ramjet. It is somewhat like a stove pipe with a fire in it. Air enters the front, is mixed with a fuel, burned, and exhausted from the rear. It is difficult to imagine anything simpler.

The ramjet utilizes the basic processes common to any automobile engine. An automobile engine operates on a four-stroke cycle: (1) intake, (2) compression, (3) power, (4) exhaust. In the ramjet there is, first, intake and compression of air; second, combustion or heat release; third, expansion of air or power stroke. The complete cycle is applied to air moving continuously through the ramjet with no interruption.

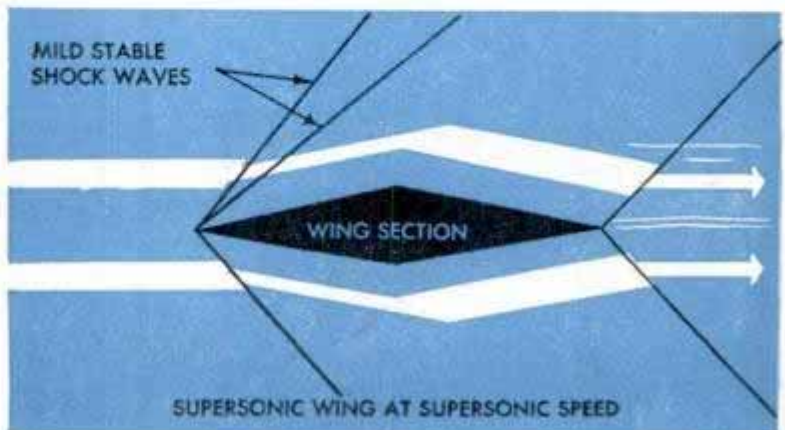
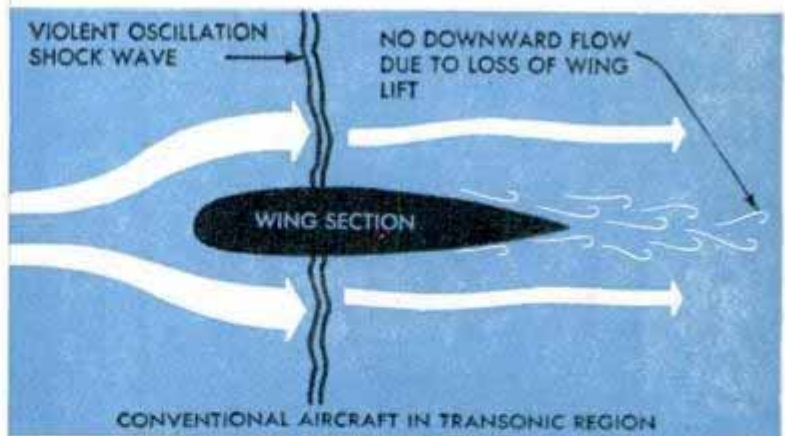
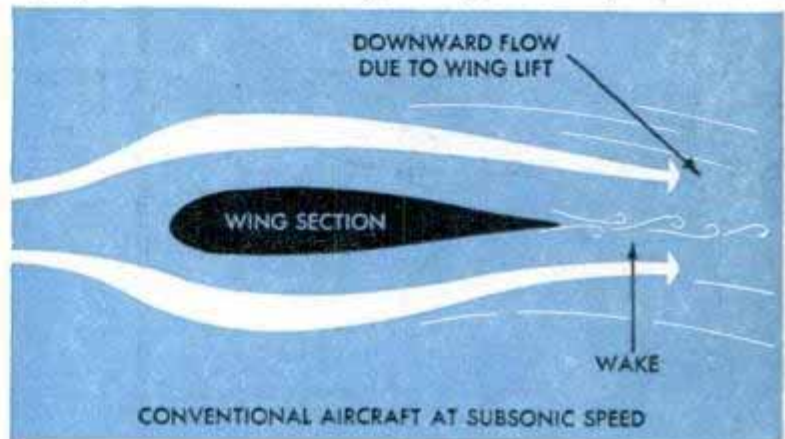
As it hurtles through the air at sonic speeds, the compression, or increase in pressure which is furnished by a piston in an automobile engine, is obtained in the ramjet with an inlet diffuser which converts the kinetic or velocity energy of the fast moving air to pressure energy. In other words, the air moves into the engine with a high velocity. Once it is inside, the air is slowed down and compressed, creating a high pressure.

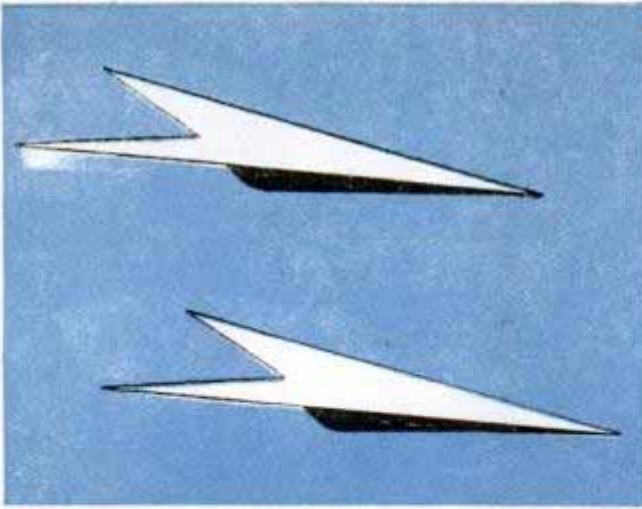
One unique feature of the ramjet engine is its utilization of the shock wave to compress air. As the air enters the diffuser it is moving at high speed. Since the diffuser is of much larger volume than the intake nozzle, the air slows down to fill it. As it slows down it passes through sonic speed and a shock wave is formed, which rams the air forward into the combustion chamber and builds up pressure. That pressure can be used to discharge the air through



Mockup of 1000-m.p.h. jet plane proposed by British designers

Sketches show how conventional wing reacts to airflow at increasing speeds and how knife-edged design meets supersonic needs





Some of the military designs now on the boards bear a startling resemblance to schoolboy's paper planes



Swept-forward wings are another possible answer to problems of supersonic speed. The British Swallow, below, races sound with wings angled back

the outlet at approximately the same speed it entered the engine.

If the air is heated while moving slowly and under high pressure and discharged through a small opening or nozzle, the outlet velocity can be made to exceed the inlet velocity by a wide margin. That increase in velocity at the outlet produces thrust or forward motion. The shock wave also prevents the combustion gases from exhausting through the forward inlet. It acts as a barrier. Its reaction force is similar to that caused by the water that rotates a lawn sprinkler. Rockets operate on the same principle.

Ramjet engines are not effective at low speeds and require another type of power plant or launching device to establish an operating speed.

At high speeds the chief competitor of the ramjet is the rocket. The ramjet requires about one sixth as much fuel as the rocket at 2300 miles per hour because it uses oxygen from the atmosphere while the rocket carries its own. At high altitudes the lack of oxygen makes the ramjet ineffective.

Thrust alone, however, is not the most striking feature of the ramjet; it is its low ratio of weight to horsepower developed. Standard internal combustion engines weigh roughly one pound per horsepower. The ramjet engine has a ratio of one half ounce per horsepower.

Since the ramjet works best at supersonic speeds, it cannot be tested in wind tunnels for the reasons mentioned before. Therefore, methods of testing them in free flight have been developed by the Applied Physics Laboratory of the Johns Hopkins

At the XS-1's pace, Chicago will be only about an hour from San Francisco and three hours from Paris



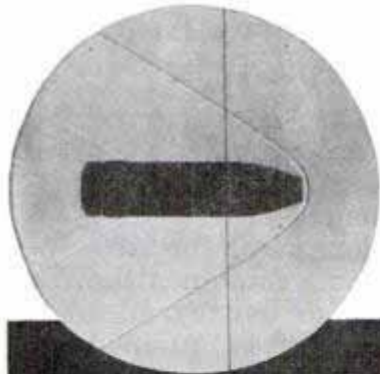
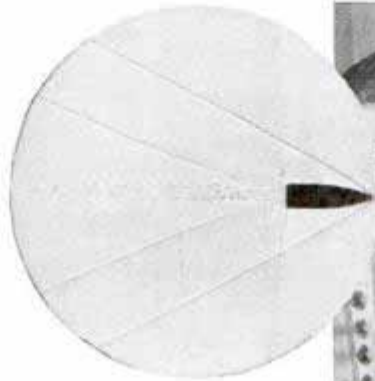
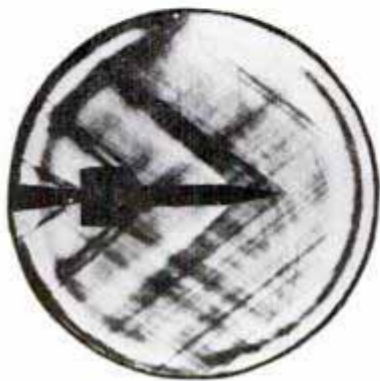
University, which developed the ramjet engine for the Navy. Pressures, accelerations, temperatures, fuel flows and other factors have been converted into radio signals which are broadcast from an antenna integral with the ramjet and then picked up and analyzed by field equipment at the test site. It was necessary to develop equipment so small and compact that a four-channel radio system, complete with power supplies, measuring instruments and broadcasting equipment, could be contained in a space only slightly larger than a man's two hands. Components of the proximity fuse were used for the set. This use of telemetering equipment greatly augmented the analysis of flight tests and speeded up the development program.

There are three possible fields for the

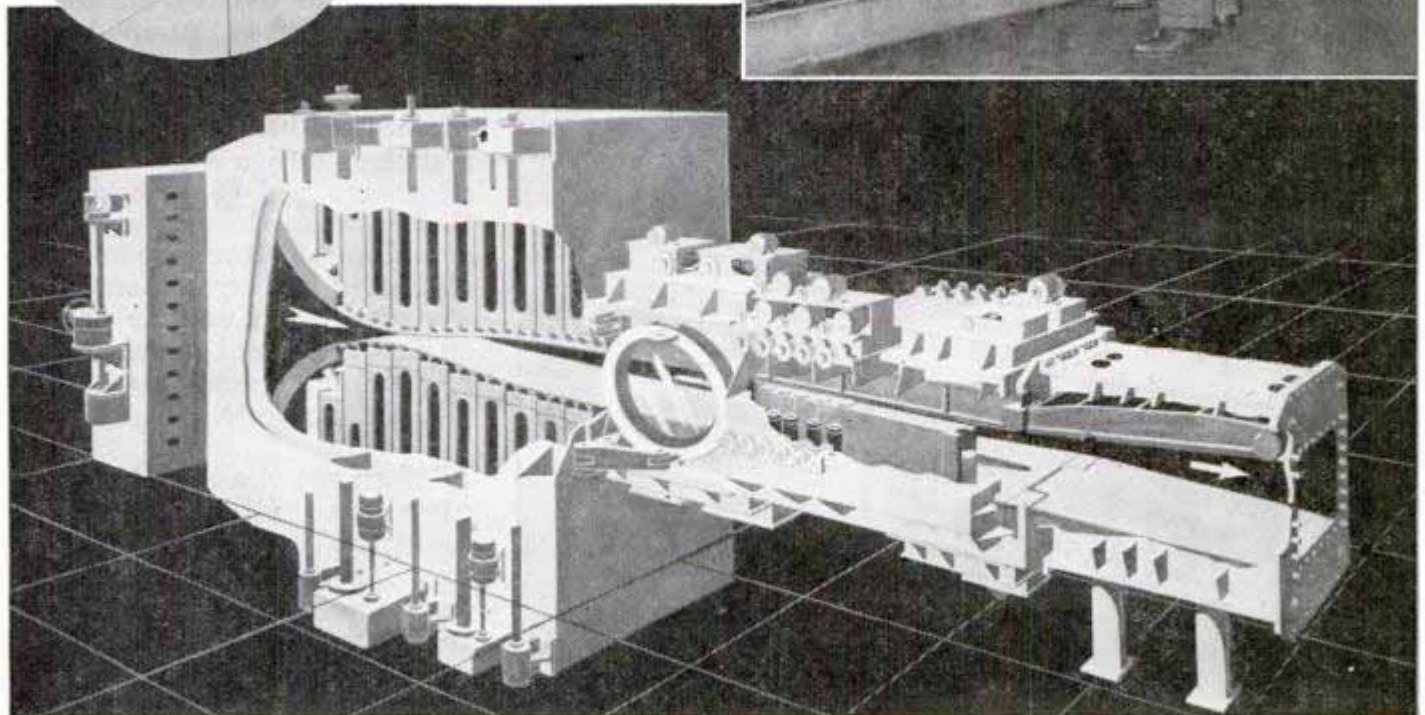
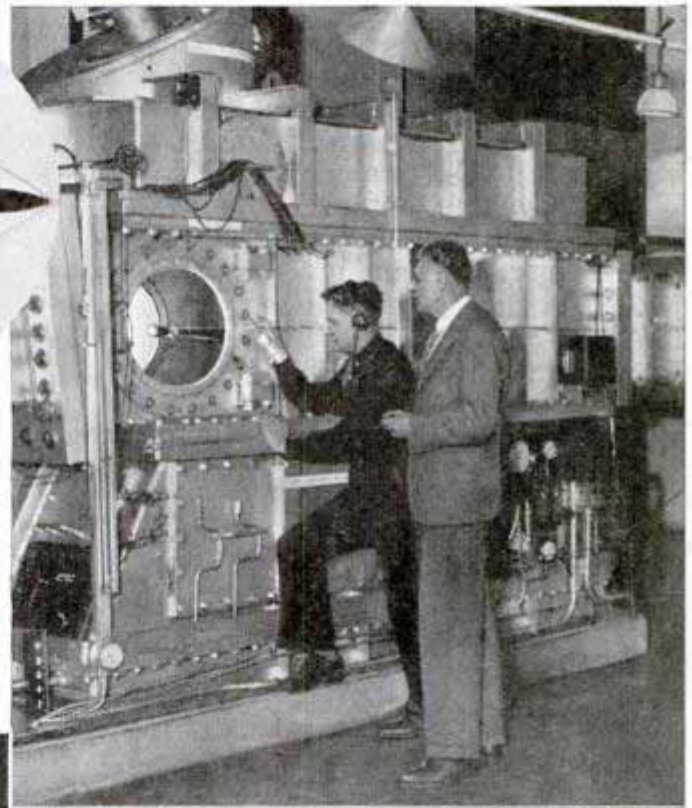
ramjet. Its greatest suitability is for supersonic planes or missiles. Because of its light weight and ease of manufacture, it can be used for subsonic expendable missiles. Again its light weight makes it suitable for rotary wing aircraft where rotor wing tips may approach the speed desired for ramjet operation and where the economy of weight and freedom from power transmission problems compensate for a higher fuel expenditure.

The Army Air Forces has a brand new type of plane for supersonic speeds, the XS-1, thus far only test flown in powerless glides. It was built by the Bell Aircraft Corporation. Powered by a rocket motor developing several thousand pounds of thrust, it is hoped that the plane will reach

(Continued to page 268)



Photographs made at a millionth of a second show shock waves from supersonic missiles. In wind tunnel below and at right a series of hydraulic jacks constricts the tunnel throat, thus increasing air velocity



Navy Sharpens Air "Eyes" With Two New Scout Planes



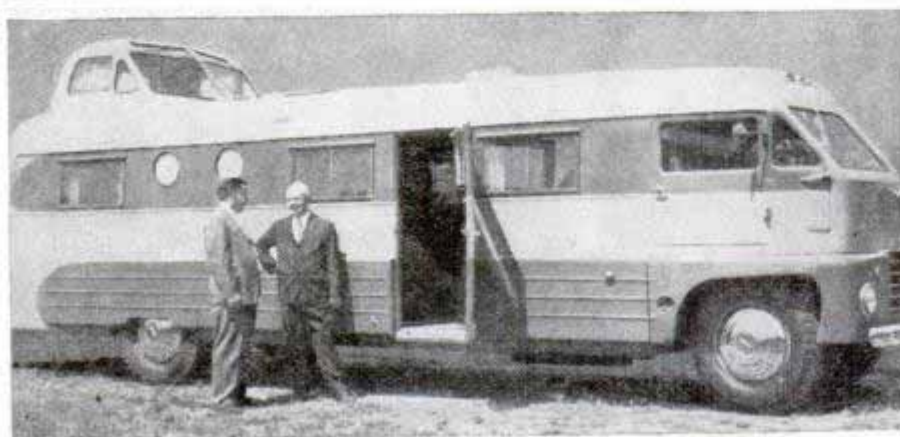
Two new air "eyes" have been added to the U. S. Fleet. The lightweight Edo XOSE-1, catapult launched, is specifically designed for rough water operations. With a Ranger 550-horsepower engine, it travels well over 200 miles an hour and has a range of 1000 miles. The Curtiss SC-2 Seahawk, with a Wright Cyclone engine, exceeds 250 miles an hour and has a 650-mile range. Normally operated with Edo floats, it has a seat behind the cockpit for rescue work. Both planes have folding wings.

Flaps that retract automatically when hit by water are a new feature of the XOSE-1, while the Curtiss SC-2, below, has a cabin hood that can be thrown open by compressed air in emergencies



"Penthouse" Auto Sleeps Eight

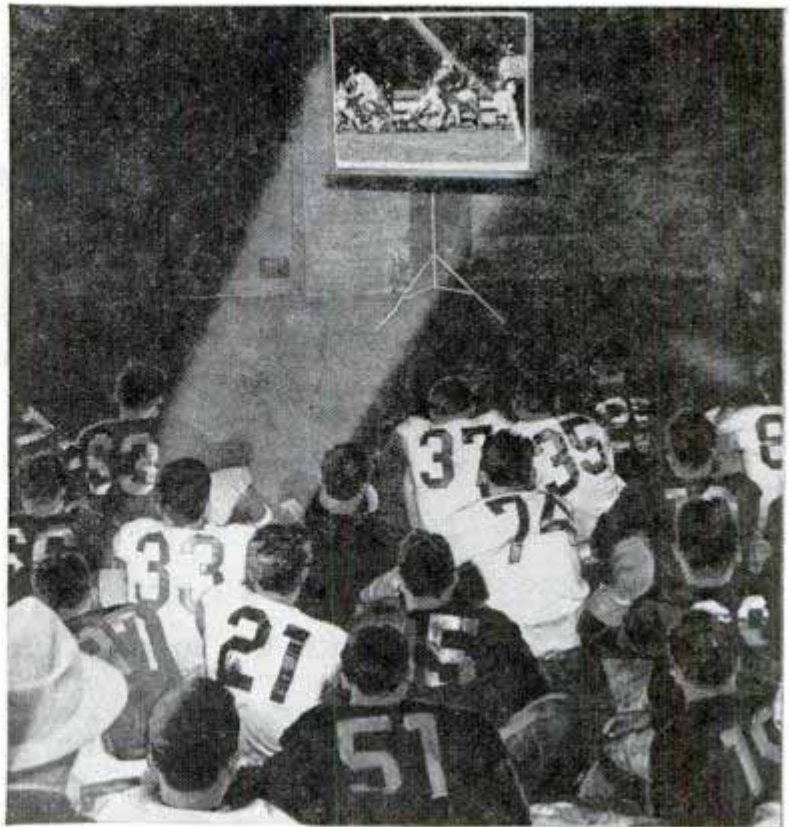
Four air-conditioned rooms are provided in a luxurious "land cruiser" built for Dr. H. J. Sealey of Dumont, N. J. The \$20,000 vehicle combines the features of a house trailer and a truck. It is equipped to sleep eight persons and has a main salon, living room, tiled bathroom and a galley with a sink, refrigerator and gas range. Radios, telephones and complete furniture are included in the equipment. The seven-ton vehicle is 30 feet long and capable of attaining speeds up to 75 miles an hour.



Ⓛ When snowflakes hit an airplane in flight they break up into 30 to 500 tiny fragments and produce enough static electricity to black out radio voice communications between plane and ground.

Gridders See Misplays At Post-Drill Movie

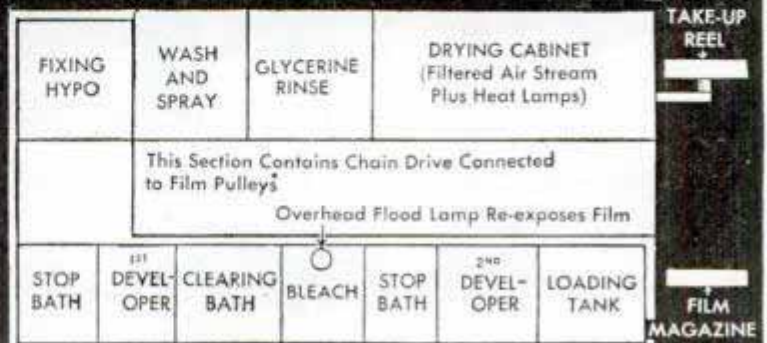
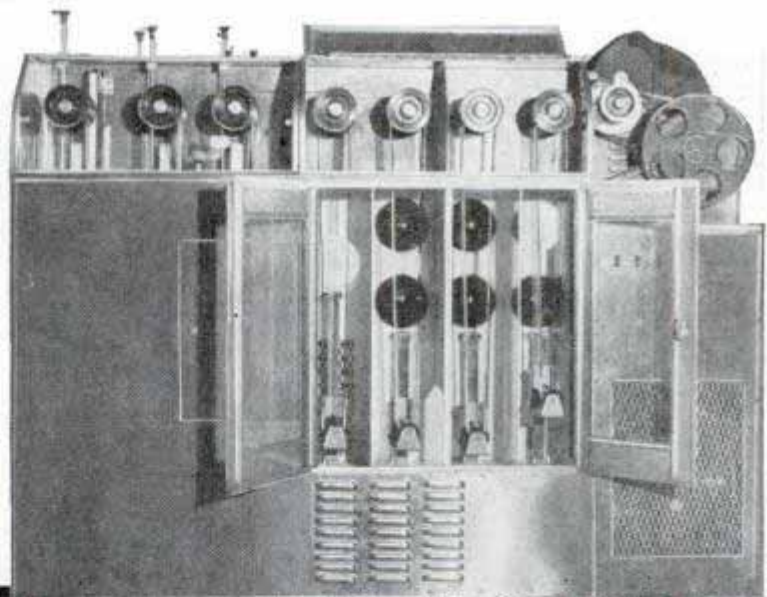
Movies of plays just rehearsed are shown to the University of Southern California football squad immediately after practice, permitting players to watch themselves in action and check their own mistakes while the plays are still fresh in mind. Similar motion pictures are made during important games, processed at once, and shown in the dressing room between halves so that the opponent's successful plays can be analyzed and defenses evolved. Speed-processing of the 16-mm. film is done in a portable machine similar to those used by race tracks when film of a race must be developed for immediate inspection by judges and stewards. The processing takes less than 10



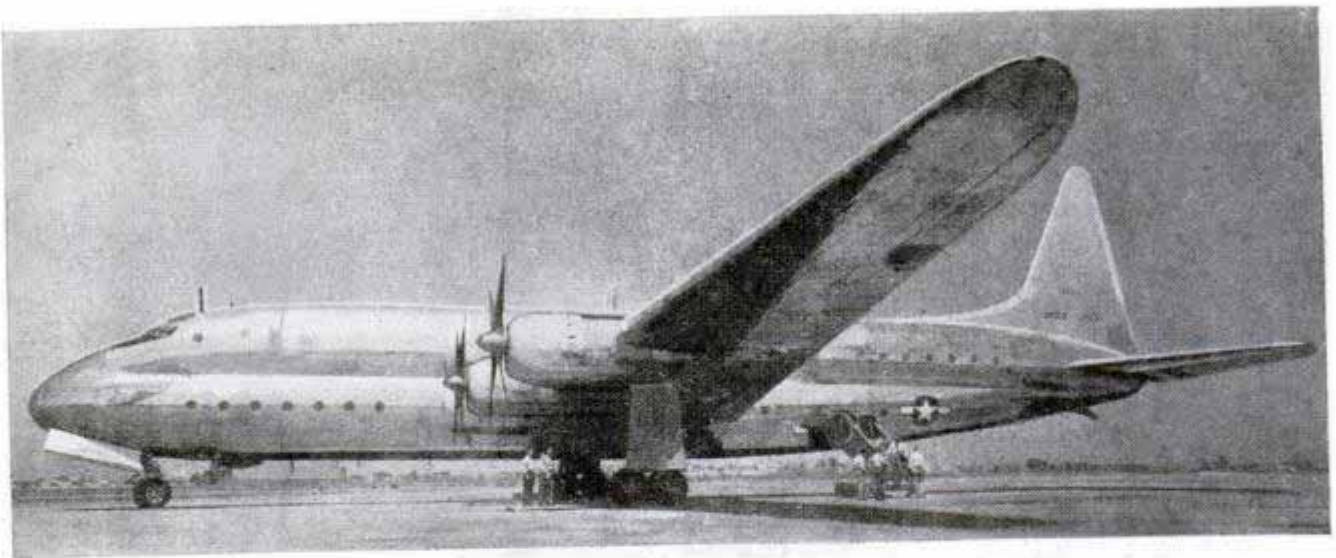
Above: Players studying movie of action filmed 20 minutes before by cameraman at left and a helper shooting close-ups from the sidelines. Every detail in the execution of plays can be quickly noted. Below: View of the drying compartment with doors open and a vertical drawing of the entire unit



minutes, including development, reversal, washing and drying. Heating and refrigeration units in a water jacket that surrounds the tanks keep the solutions at the proper temperature. The drying cabinet has infrared lamps, white lights and a constant stream of filtered air blowing on the film.



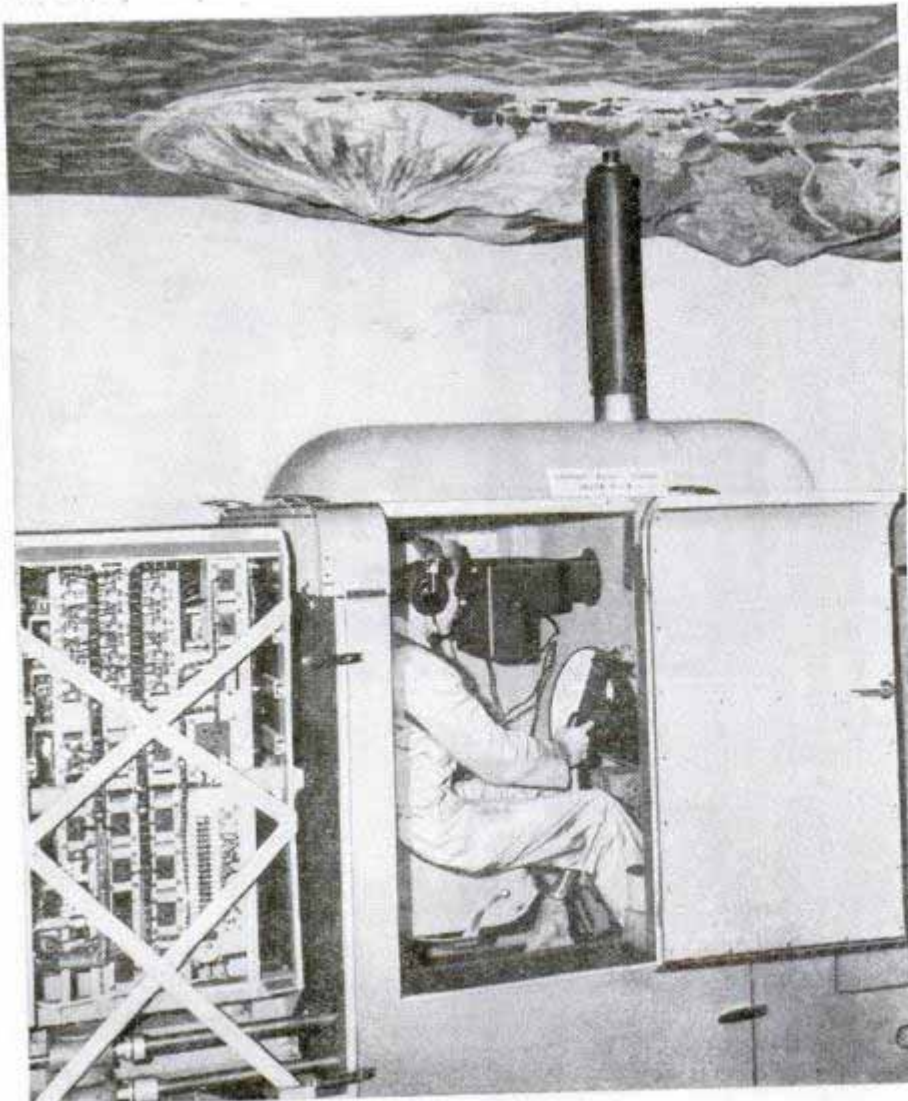
Double Walls Hold Water Jacket With Built-in Calrod Strip Heater and Freon Refrigeration Coils for Automatic Temperature Control



Largest airplane ever built for the U. S. Navy, the Lockheed Constitution is the first American transport with a wing specifically built for the installation of gas-turbine engines when they become available. The first model has four Pratt and Whitney Wasp Major engines totaling 12,000 horsepower. It has a wing span of 189 feet, length of 156 feet and carries over 34 tons of cargo and passengers. There are 92 seats on the upper deck and 76 on the lower, which is divided amidships by the

Navy's Largest Airplane

wing. Maximum ferrying range is 6000 miles and its top speed is 300 miles an hour. As an added safety factor for operating on rough island air strips or on steel mesh runways each of the main landing gears has four wheels. Man-size tunnels within the wings permit "in-flight" inspection and adjustment of all four engines and most mechanical, electrical and hydraulic fittings. Extra wide cargo doors, 106 by 74 inches, are large enough to permit loading of jeeps or other bulky items.



Pilots 'Fly' Contact In Indoor Trainer

Contact flight training can now be given in the classroom as well as the sky with equipment devised by the U. S. Navy. To the airman looking through a periscope mounted atop the trainer, the terrain reproduced upside down on the ceiling appears exactly as it would in flight. Purpose of the training is to speed recognition of landmarks and terrain. The device, exhibited at the Naval Research Center on Long Island, saves many weeks in the schooling of a flyer.

☞ Harnessing of the sun's rays to provide a source of industrial power by heating a boiler so that it develops a pressure of 150 pounds to the square inch has been disclosed by a Russian inventor who has put the helioboiler's energy to use in a cannery.



ON THE AIR...

there've been some changes made

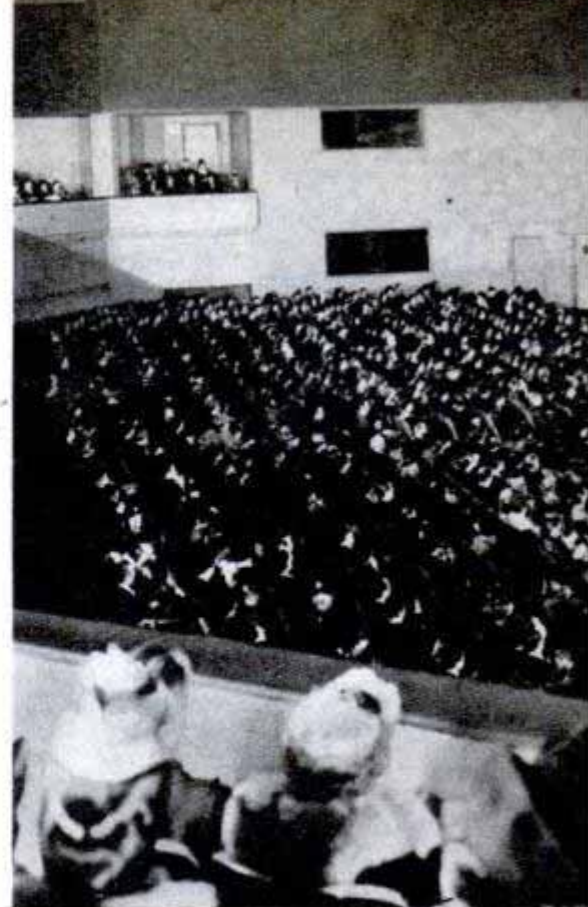
First mass-produced radio (above) was built by Westinghouse in 1921. Below, RCA television camera "watches" football fans

By Bill Reiche

RADIO, airborne colossus of American amusement, has been described as an art and as a science. Primarily it is neither. It is a business—BIG business—which artists and scientists have served as faithful handmaidens.

Regularly scheduled broadcasting began in 1920 because a smart corporation executive realized that when people discovered that entertainment was to be had free in their own homes they would create a tremendous market for the machines which would enable them to receive it. Network broadcasts became a fact when sponsors were ready to pay for an expensive radio show and bear the additional cost of wire charges and





NBC photo

Back in 1924 Olga Petrova thrilled radio listeners; modern studio theater (right) was unknown in those days

of buying time on a number of stations.

Radio is a billion dollar business today because it sells a lot of soap, toothpaste and coffee—which is to say that you listen to it and buy these items by the ton.

There was only a handful of radio sets in the nation capable of receiving the first regularly scheduled broadcast by KDKA in Pittsburgh—the Harding-Cox election returns. In 1926 when the National Broadcasting Company formed the first permanent network there were an estimated seven million receivers and that number has swelled to 60 million today.

In 22 years, radio listeners increased from the handful who heard the Harding-Cox returns to a throng of more than a hundred million who heard FDR report to the warring nation in February 1942.

Granting that radio has grown into an industrial giant—what have the engineers and scientists done to make it more enjoyable to the public?

“There is no single development which can be cited as the great factor that has brought radio from its early technical imperfections to its present advanced state,” said O. B. Hanson, vice-president and chief engineer of the National Broadcasting Company. “Radio transmission and reception are essentially the same operations they were in the early 1920s; the vast betterment can be attributed to literally thousands of improvements and modifications in all types of components.”

But three types of equipment were cited

by Mr. Hanson and Robert G. Thompson, manager of technical operations for the Columbia Broadcasting System, as having raised the level of 1946 listening far above that enjoyed by the 1921 fans with the shockproof ears: microphones, tubes and speakers.

In a radio broadcast the microphone is the first piece of equipment to go to work and it is of prime importance since no transmitter can produce a signal of any better quality than it gets from the studio.

The first mikes were single diaphragm carbon types, similar in construction and performance to a telephone transmitter. How this cut down the range of sound may be appreciated when we consider that it had a range of only 100 to 2000 cycles per second, whereas music extends from 100 to 5000 c.p.s., speech from 250 to 2500 c.p.s.

This was succeeded by the infinitely superior condenser type, which operated on a change in voltage and had an amplifier incorporated in it. This type was finally displaced by the current dynamic microphone—as far removed from the carbon type as a Stradivarius from a squeaky door.

Of possibly even greater importance to the ultimate consumer was the evolution of the home loud-speaker—the final link in the long electronic chain which links coffee, McCarthy and citizen.

The first speaker possessed the same limited virtues as telephone receivers of the early 1920s, which was natural when we consider that it was an almost identical



Control rooms—old and new. The one above is NBC's original master control room as it looked in 1926

device with the addition of a horn. The horn vibrated excessively and reproduced practically no low notes at all.

But the radio fan automatically compared his crude set's output with that other audible living room entertainer—the phonograph. The “talking machine” used a horn which was no better—and frequently worse—and used acoustical recordings, which were made by mechanical means and betrayed their mechanical background when Caruso was heard in a recorded aria. Compared to this latter disturbance, the radio, bad as it was, sounded pretty good—and the user didn't have to buy and change records all the time!

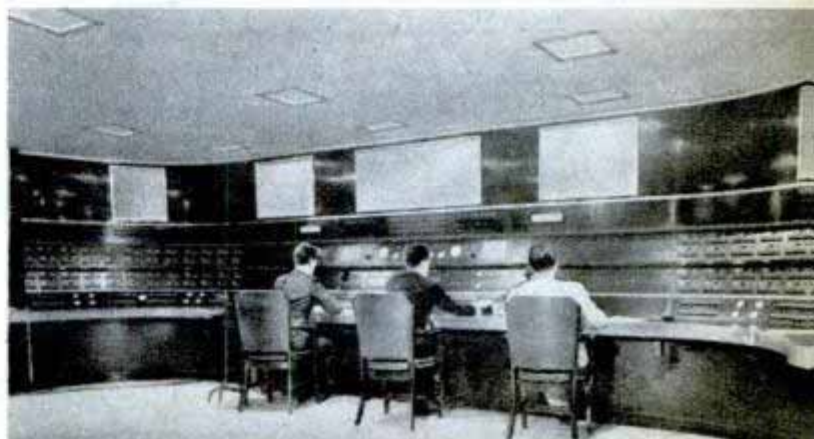
Thus by the gradual improvement in the mechanical devices that changed sound into electric impulses and back into sound was the audible quality of radio enhanced.

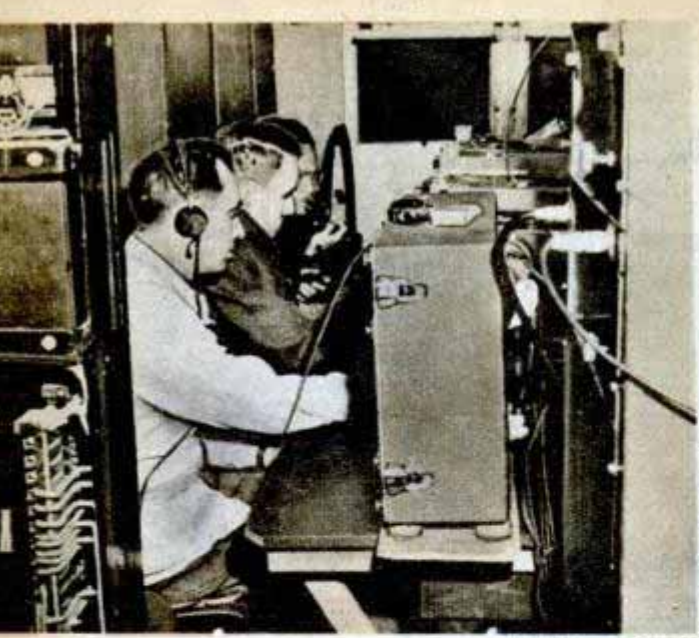
Radio soon freed itself from the whimsicalities of the crystal detector as the vacuum tube, invented by Lee De Forest in 1906, took over as detector and amplifier. But it was still shackled to batteries—generally dry cells, but occasionally storage batteries—which nestled in the vicinity of every home receiver.

Electricity, which lighted the American home, toasted its bread and curled its hair, was as useless as uncontrolled lightning to power its radio sets. This impasse was eliminated in 1922 when Westinghouse engineers developed the thermionic vacuum tube with indirectly heated cathode, which permitted home radios to be operated on house current. The troublesome and ex-

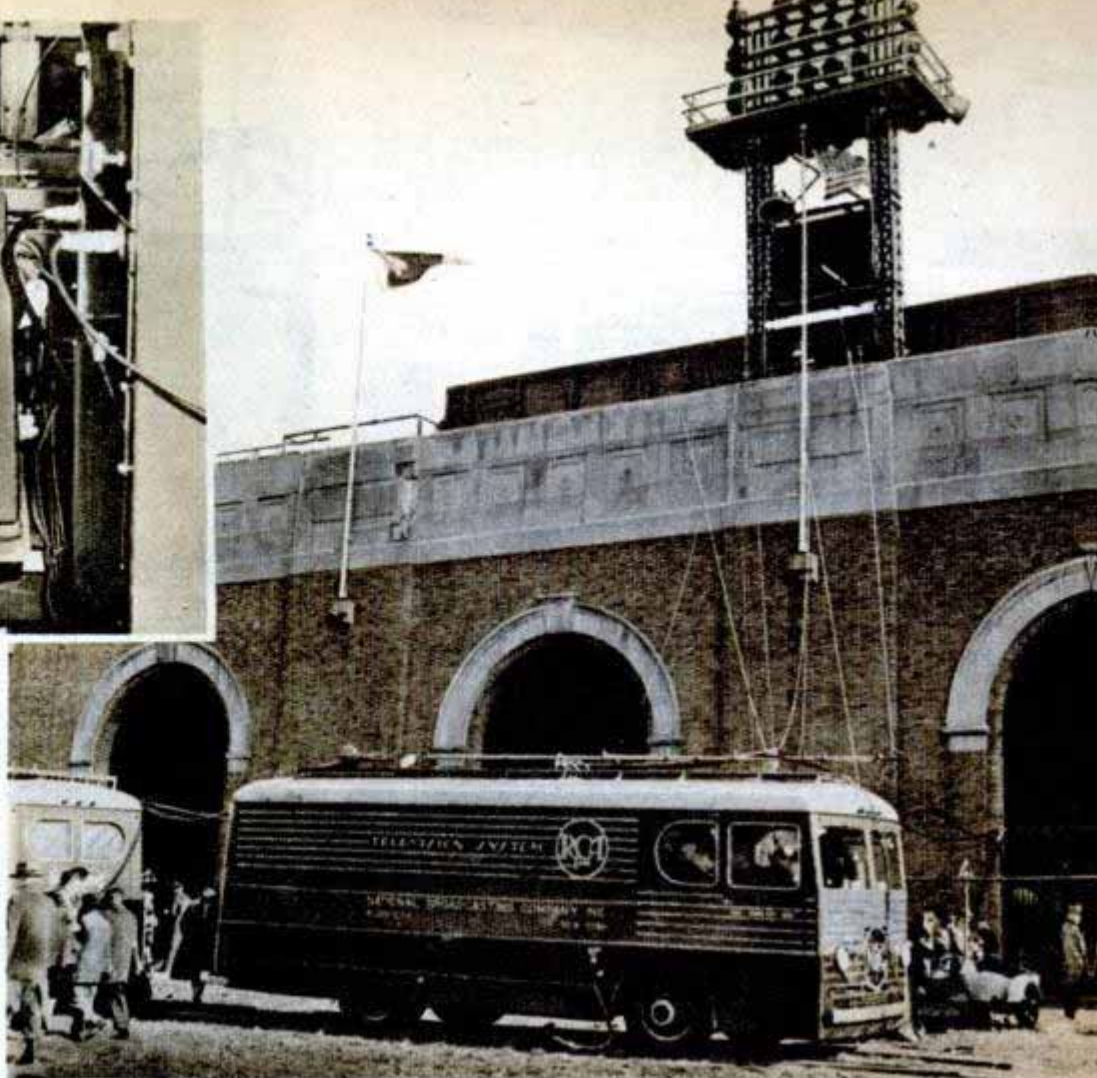


Control room operators (foreground) keep eyes on newscaster and announcer in modern newsroom. Trio below takes NBC “pulse” in new master control room





Telecasting football game with mobile unit parked outside stadium. Many big games have been broadcast with this outfit. Interior view (above) shows the operators working inside the unit



pensive batteries—which always seemed to go dead during the listener's favorite program—went the way of all second-best devices and receiver production swept on to new heights.

Radio broadcasting as we know it today can trace its origin directly to a \$5 bet on the accuracy of a \$12 watch in 1915, but the cornerstone of the art was laid by James Clerk Maxwell, a Scottish physicist, in 1865. He developed the theory that alternating current flowing in a wire causes some energy to be radiated off into space—holding that it was possible to transmit power through space without benefit of wires or other conducting agents.

A German and an Italian scientist, Hein-
1928—Amos and Andy at old-fashioned twin mike

rich Hertz and Guglielmo Marconi, took the theory and experimented it into the realm of fact. With this Hertz was satisfied and went on to other things, leaving Marconi to make wireless history which is too well known to stand repetition.

With the invention of the three-element vacuum tube in 1906 by De Forest the groundwork was sketchily laid for what was to become a great industry bringing information and amusement into the homes of the civilized world.

Nine years later Dr. Frank Conrad, assistant chief engineer of Westinghouse, had an argument with a friend as to whether his watch was the fine timepiece its \$12 cost seemed to justify. Dr. Conrad built a small

1946—John Vandercook, commentator, with new mike





receiver to pick up the time signals from the Naval Observatory at Arlington, Va., and soon became an ardent wireless fan.

The following year his new transmitter was licensed as station 8XK and Conrad began code and later voice transmission to every amateur radio operator he could contact. The latter medium he soon found taxing to his voice and he substituted phonograph records for ad libbing in 1919 to save his vocal cords. The response to this free entertainment was enthusiastic and by the summer of 1920 his twice-a-week "broadcasts" had sufficient following for the Joseph Horne department store in Pittsburgh to advertise "amateur wireless sets, \$10 up."

H. P. Davis, Westinghouse vice-president, read the ad and saw an industry in the making. Provide regular programs, he reasoned, and millions of people will want to buy sets. A more powerful transmitter was built, licensed as KDKA, and on November 2, 1920, it broadcast the first regularly scheduled program in radio history.

There followed one of the greatest scrambles since the Oklahoma land rush and the forty-niners. By the end of 1922, two years



NBC photos

In the early days of radio (top) everybody joined in to produce some weird sound effects. Today one man (above) handles recorded sounds as well as gear panel (his hand is on crank) simulating sound of machines, carton (just behind him) which is hit with a stick for pistol shot, and standard door for slamming at his right. The tank holds air for hissing sounds

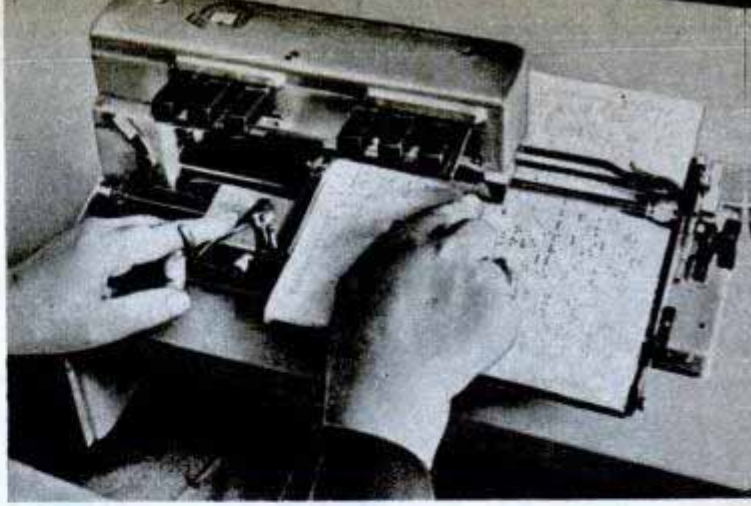
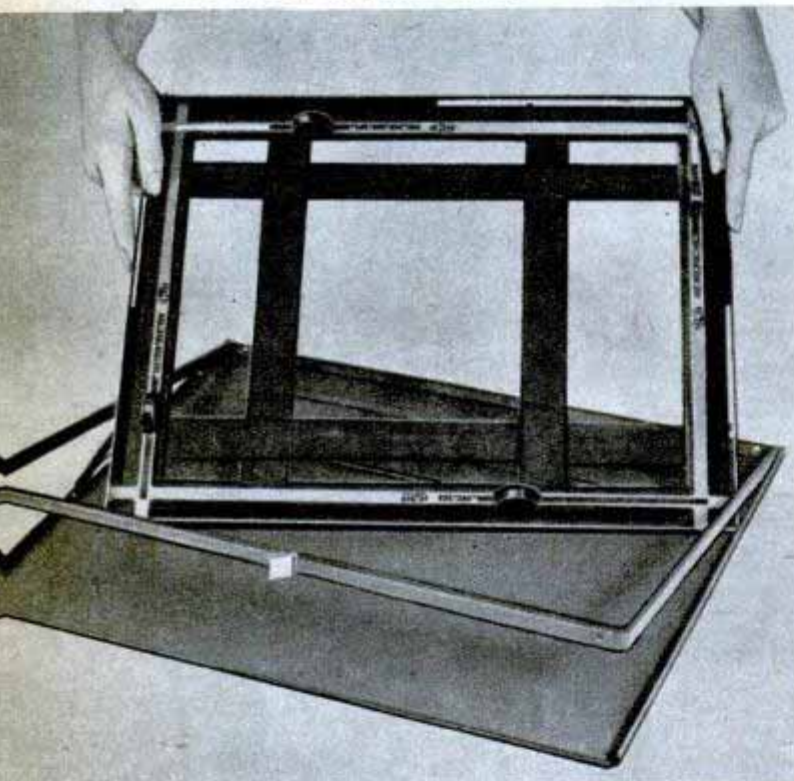
after KDKA had broken the ice and the ether's silence, there were 600 broadcasting stations in the country; in 1924 there were 1400 and the air was bedlam. Harried listeners picked up a half dozen signals at once from the overcrowded and underpoliced air waves; stations changed wave

(Continued to page 264)



ALL-METAL WINGS replacing fabric-covered type boost speed of Luscombe Silvaire five to eight miles an hour. They're also more durable and easier to inspect

TWO-IN-ONE metal easels make it possible to enlarge photographs of all sizes. The masking assembly snaps out of place to permit enlargement up to salon size



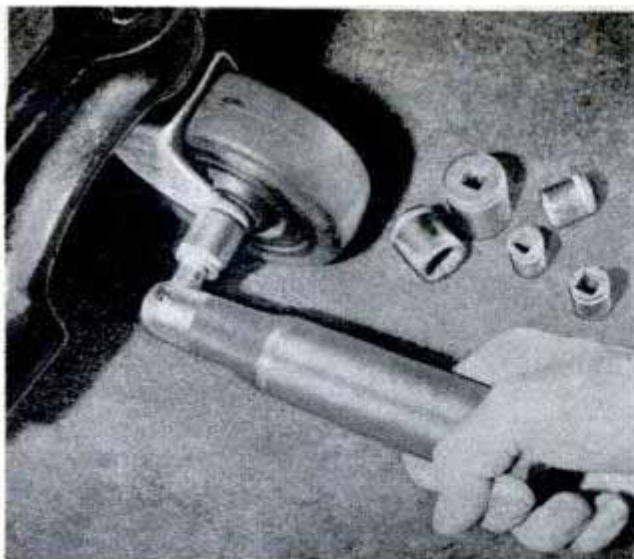
BRaille TYPEWRITER for the blind is an 11-pound portable machine with only six keys. Any of Braille's 63 raised characters can be typed at a single stroke

CHINESE TYPEWRITER, the first practical machine built for the language, prints 5400 characters. To make each one a typist must press four separate keys



FLYING WING BOMBER, the first of 15 that Northrop Aircraft is building for the Army Air Forces, rises into the air on its initial test flight. The high-speed camera momentarily "stops" the pusher-type eight-blade coaxial propellers. Performance figures are still secret but it has been revealed that the plane has a 10,000-mile range



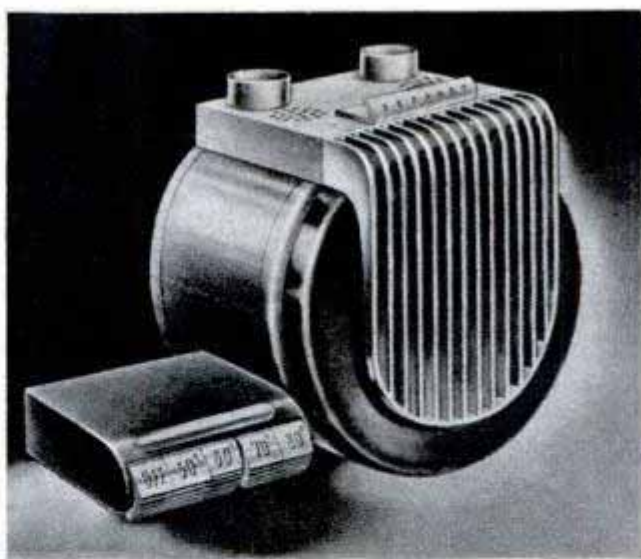
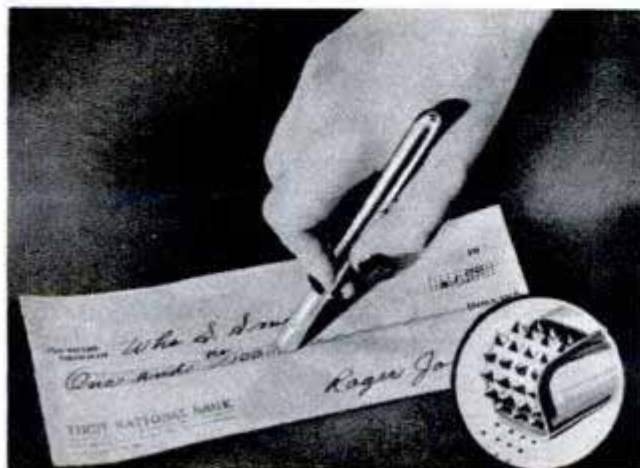


Hollow Tool Handle Stores Extra Bits

From five to nine interchangeable bits are stored in the hollow plastic handle of a handy tool that can perform many jobs in factory, garage or home. A swivel chuck is attached to the handle and bits can be changed in a jiffy. This tool—or “tool kit”—is available in several models including two socket screw kits, two socket wrench kits and one home kit. The chuck has a positive lock for straight line positions and also snaps into five different positions within a 180-degree radius to enable mechanics to reach hard-to-get-at places.

Vest-Pocket Check Perforator Punches Holes With Roller

Checks are protected from alteration by a new perforator that can be carried in the pocket like a pencil. The perforator is rolled across the writing on a check that has been placed on a blotter or other soft surface. A case-hardened steel roller punches small holes through the paper, making it impossible to erase the amount written on the check without tearing the paper. The perforations also prevent fill-ins and protect the check from other alterations. The pencil-shaped perforator is made of highly-polished aluminum.

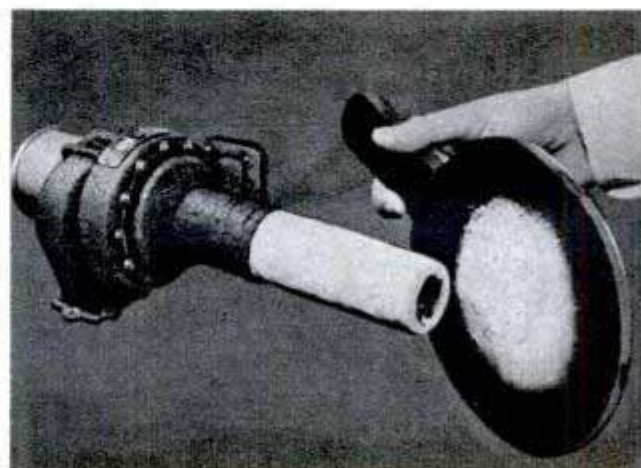


Push Button Automobile Heater Has Thermostat Control

Push-button control for temperature selection and a thermostat to maintain a desired temperature regardless of weather changes are features of a new gasoline car heater. Developed during the war to pre-heat airplane and tank engines and to heat Quonset huts and trailers, the heater produces in one minute 18,000 B.T.U. Push buttons enable the motorist to have a steady supply of heat at 50, 60, 70 or 80 degrees. The heater is expected to find use in heating trucks carrying fruit and other perishables,

Midget Cooler for Airplanes

One hundred thousand revolutions a minute are made by a three-pound air expansion turbine unit used to air condition planes. It weighs one fiftieth as much as a conventional refrigerating system of similar capacity. The compressed air enters the turbine at approximately 150 degrees Fahrenheit and leaves it at about 15 degrees Fahrenheit, cold enough to freeze the exit pipe and to blow snow on anything held in front of it. The turbine uses only air as a refrigerating medium and requires no additional source of power. It is self-lubricated and has only one moving part.



SCIENTIFI

If you're a welder and should be trombonist in a band, aptitude tests will set you right

BEFORE civilization got quite so complicated it was a simple thing to find your vocation. If grandpa was a plumber, father also was a plumber and so were you, in time. The village smithy was the father of a long line of village smithies, and if your ancestors were farmers or watchmakers or lawyers the odds against breaking the chain and becoming an artist or banker were high.

But now there are some 21,000 different ways to earn a living, ranging from accounting to zoology. To screen out the 20,999 less suitable jobs and pick the field most suited to the worker's talents and therefore most productive of success and happiness, industry and schools and individuals are turning increasingly to scientific aptitude tests.

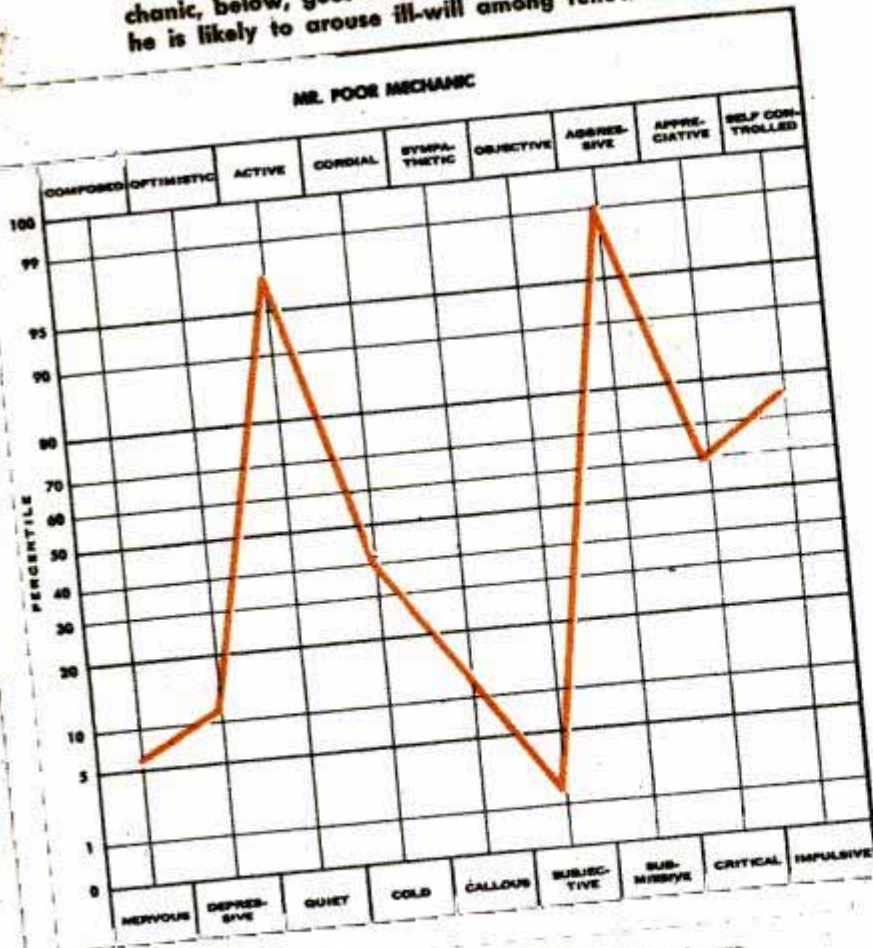
Aptitude for a particular job doesn't guarantee success but it is one key to achievement.

Literally hundreds of thousands are getting the right steer toward a career by submitting to evaluation by trained engineers and psychologists. After filtering you through systems of questions, analyzing your personality and dexterity and creative capacity, watching you match colored blocks and fit together jigsaw puzzles, the experts who have formulated these talent measurement examinations through 40 years of research can pretty well tell where you belong.

Probably the biggest talent-sorting endeavor in history was accomplished by the military services, which did their best to keep from wasting a good radar man in public relations work or a good cook



Analysis of the temperament structure of a good and a poor mechanic: good worker, above, is stable and self-controlled. He works best by himself. Poor mechanic, below, goes to extremes. Overly aggressive, he is likely to arouse ill-will among fellow workers



Copyright 1945 by Dalley, Brenner and Schreiber, Management Engineers

FORTUNE TELLERS

By Maston M. Jacks

in gunnery. Industry finds the aptitude tests invaluable in placing personnel. One railroad company reported a 90 percent decrease in operating mistakes by workers placed through tests. Many management engineering firms offer this service to industry, and many counselors help the individual chart his course from grade school age on. The usual fee for the individual runs from \$15 to \$30.

The Veterans Administration maintains its own staff of job-guidance counselors. Or VA may send the ex-service man to one of 200 approved testing centers established by universities or professional psychologists. After test scores are received, a job consultant will advise the most suitable



↑ Form board test is first cousin to jigsaw puzzle; time required to fit blocks into proper slots indicates subject's aptitude for three-dimensional problems

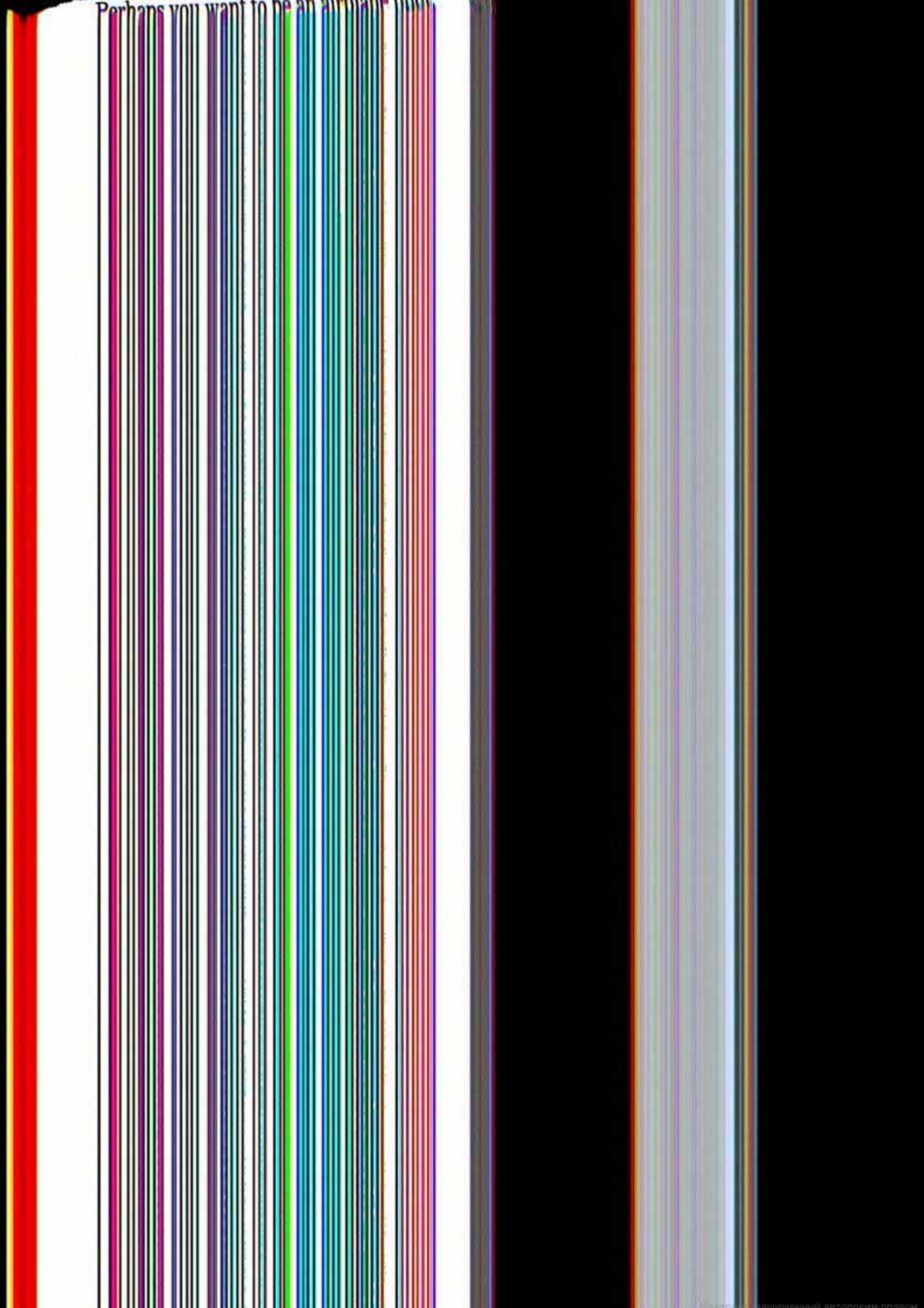




Human Engineering. It has laboratories in 10 cities where its researchers probe into the mental equipment and earning patterns of its clients. Human Engineering tests are used only in the organization's own laboratories. They are not published.

The Human Engineers label your mental characteristics as: personality, accounting aptitude, creative imagination, structural visualization, inductive reasoning, analytical reasoning, finger dexterity, tweezer dexterity, observation, memory for design, tonal memory, sense of rhythm and number memory.

An employer wants to know your "working" personality. To appraise personality makeup, the Robert N. McMurry Company in Chicago devised a "patterned" interview. Your answers to the administrator's questions indicate your stability, industry, perseverance, maturity, motivation and your ability to get along with other people. The interview is based on the premise that the administrator must carefully what he personality patterns



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Perhaps you want to be an airplane pilot, a musician, a mathematician. Each may require different aptitudes. Most tests used to measure those aptitudes are developed in university psychology laboratories or on the job. They are then published for mass application in schools or industry.

Psychologists define aptitude as an ability to learn in a specialized field. They search for the talent pattern by testing general intelligence, specific aptitudes, interest, emotional adjustment and skill. One of the most widely known interest tests is the Kuder Preference Record. Among industrial companies who use it are Ford, Western Electric and the Frigidaire, Delco and A. C. Spark Plug divisions of General Motors. In taking it, you decide which of three alternatives you like most and which you like least. For example, "Would you rather: (1) write articles on hobbies; (2) construct tables of figures on cost of living; (3) repair and refinish old furniture."

By checking your answers to such questions, the test administrator learns whether your interests are mechanical, computational, scientific, persuasive, artistic, literary, musical, social service or clerical.

For example, a mechanical engineer would need mechanical and scientific interests. After these were found, further skill tests would reveal his present ability to solve mechanical and scientific problems.

One testing laboratory believes it has isolated 13 mental elements which combine in more than 8000 different patterns covering 8000 jobs. This particular analysis was made by an organization called

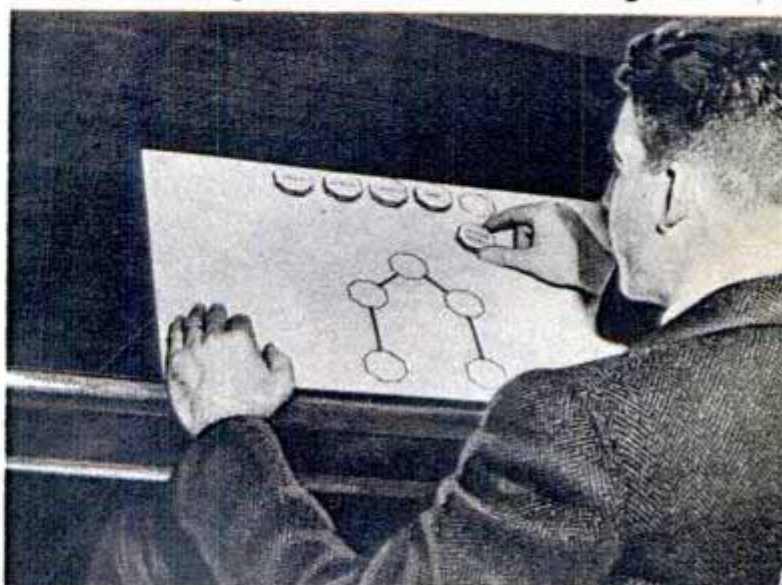


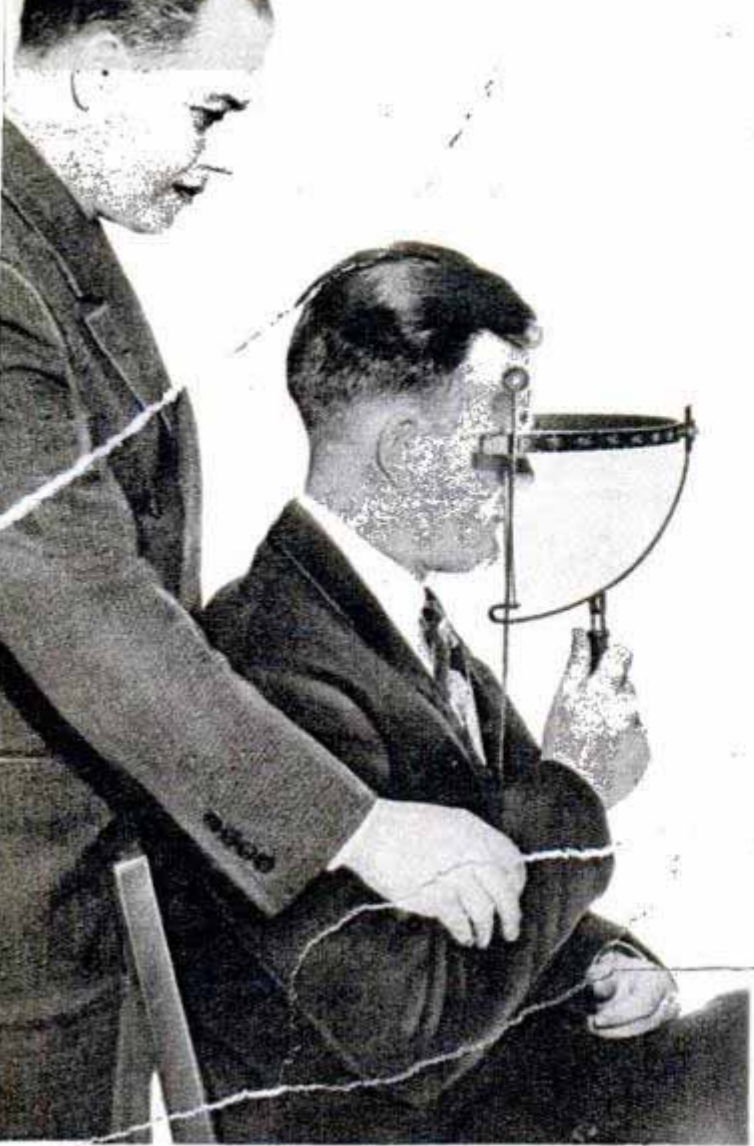
↑ Form board test is first cousin to jigsaw puzzle; time required to fit blocks into proper slots indicates subject's aptitude for three-dimensional problems



↑ An ear for music? In tone test at Illinois Tech, subject must decide whether tones are same or different

↓ At Human Engineering laboratory, subject must arrange tiles in logical order in inductive reasoning test





Many jobs require workers with wide vision. Applicant's sight is checked, above. Wiggly blocks, below, test ability to think in three dimensions. Time required to put them together is noted. Written tests are scored electrically in grading machine, right



the mental equipment and earning patterns of its clients. Human Engineering tests are used only in the organization's own laboratories. They are not published.

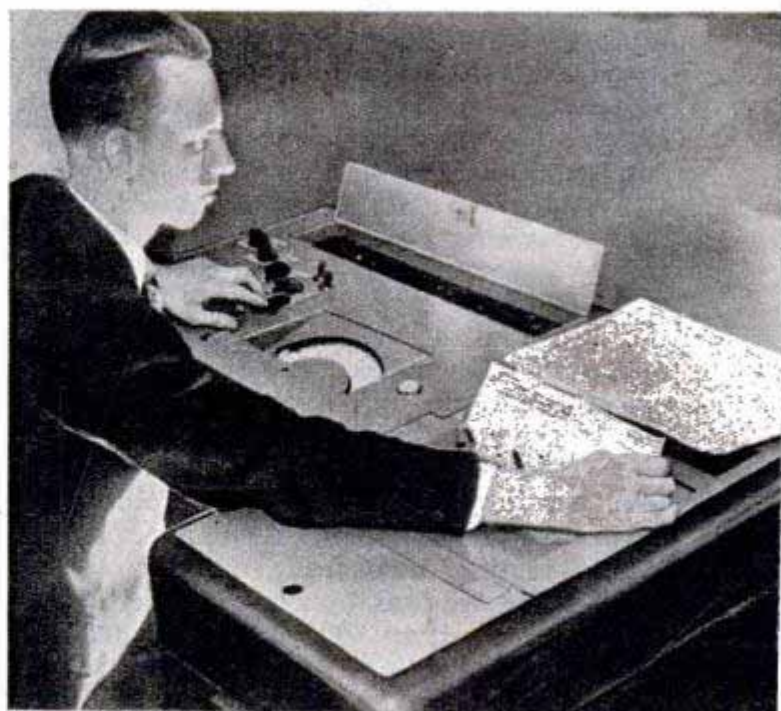
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Of all workers selected by this method at one war plant nearly 80 percent were successful in their jobs.

Other companies may use one of many written personality tests. Caterpillar Tractor, International Harvester and Bell and Howell, among others, check personality traits with the Adams Personal Audit. In answering, you indicate your degree of liking for certain activities such as acting as a master of ceremonies at a night club, interviewing applicants for a job or learning to fly an airplane.

Two of the most interesting Human Engineering tests are designed to measure



creative imagination and structural visualization. The test administrator might ask you, "How does it feel to be a fish?" and then give you 10 minutes to write as much as you can about what you think it would be like to be an angler's lure. Quality of the writing, misspelled words or faulty punctuation don't count. By counting the number of words you write, the administrator gauges your creative imagination. Writers, artists, advertising people, composers, schoolteachers and designers have a lot of it. So do many salesmen, architects, cabinetmakers and cooks.

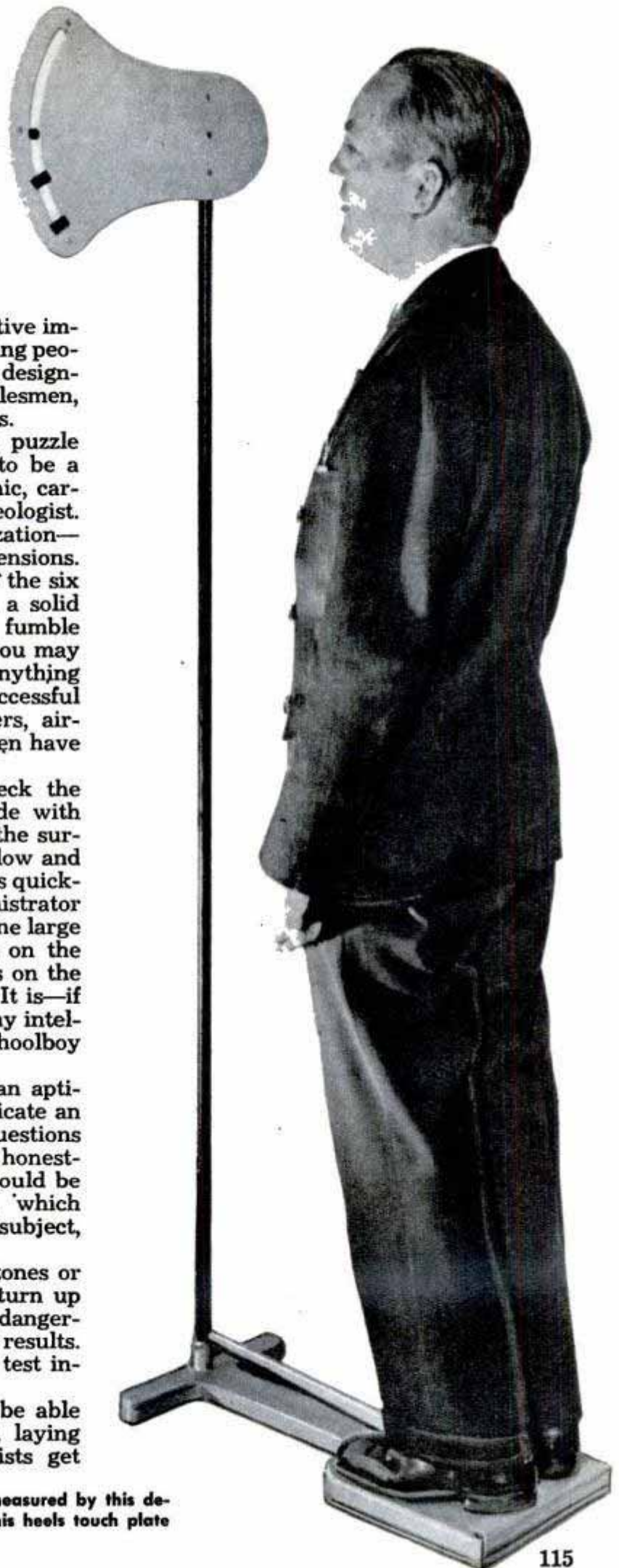
Wiggly blocks, cut in jigsaw puzzle shapes, can forecast your ability to be a builder, engineer, surgeon, mechanic, carpenter, window decorator or geologist. They measure structural visualization—your ability to think in three dimensions. Either you'll be able to fit together the six to nine wavy pieces of wood into a solid block in thirty seconds or you'll fumble around so long, as many do, that you may become angry and refuse to have anything more to do with them. Highly successful scientists, contractors, city planners, airplane mechanics and production men have put the blocks together quickly.

The Human Engineers also check the three-dimensional thinking aptitude with a tray of wooden cubes. Some of the surfaces of the blocks are painted yellow and some black. The object is to build as quickly as possible, while the test administrator marks the time with a stop watch, one large block with all the black surfaces on the outside and all the yellow surfaces on the inside. Sounds simple, doesn't it? It is—if that is the way you think—but many intelligent adults score far below schoolboy levels on this test.

It is almost impossible to trick an aptitude test. Some persons try to indicate an absent aptitude by answering questions not as they would if they answered honestly but as they think a question should be answered. Innocuous questions, which seem to have little to do with the subject, invariably trip up such fakers.

Tests with peg boards, musical tones or simple mechanical problems may turn up other aptitudes and interests. It is dangerous to exaggerate the value of test results. Even to trained interpreters, each test indicates only a trend.

Supervisors, for example, must be able to exercise practical judgment in laying out jobs for workers. Psychologists get



Worker's resistance to physical fatigue is measured by this device. Subject stands on toes, bell rings if his heels touch plate

INTERESTS

By studying the subject's answers to questions like these, a psychologist can determine the individual's special fields of interest. The person being evaluated circles "M" for the alternative liked most and "L" for the one liked least.

- M L Tinker with a broken sewing machine.
- M L Play a piano.
- M L Sketch an interesting scene.
- M L Weigh packages and look up amount of postage needed.
- M L Read manuscripts submitted for publication.
- M L Try out new automobiles to find out how they can be improved.
- M L Edit the financial news for a newspaper.
- M L Work on the development of a lighter and stronger metal.
- M L Manage a model village for factory workers.
- M L Be an expert on cutting jewels.
- M L Conduct research on developing a substitute for rubber.
- M L Be a radio commentator.
- M L Prepare the advertising copy for a new dishwasher.
- M L Determine the cost of producing the dishwasher.
- M L Sell dishwashers.

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PRACTICAL JUDGMENT

From the answers given to a series of questions like these, the practical judgment of an individual can be diagnosed. The subject is asked to circle "1" for what he considers the best of four alternative answers, "2" for second best and "3" for third best.

What would you do if you wished to ask a favor of an acquaintance?

- 1 2 3 Impress upon him that he will benefit by it.
- 1 2 3 Discuss the benefits you will receive.
- 1 2 3 Offer to do something for him in return.
- 1 2 3 Ask him briefly, stating your reasons.

Why are traffic lights used at busy intersections?

- 1 2 3 To speed up traffic.
- 1 2 3 To give pedestrians a chance to cross.
- 1 2 3 To eliminate traffic officers.
- 1 2 3 To cut down accidents.

Why is electric refrigeration considered better than ice?

- 1 2 3 It provides more even refrigeration.
- 1 2 3 It improves the appearance of the kitchen.
- 1 2 3 It provides more space for food.
- 1 2 3 It eliminates the iceman.

What is the first thing you would do if the driver of the car in which you were riding fell asleep?

- 1 2 3 Wake him up.
- 1 2 3 Pull up the brake.
- 1 2 3 Turn off the ignition.
- 1 2 3 Take the wheel.

What should you do when you are criticized by your superiors?

- 1 2 3 Explain the situation.
- 1 2 3 Pay close attention to what he says.
- 1 2 3 Try to shift the responsibility.
- 1 2 3 Try to remedy the falling.

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some indication of potential supervisory ability from answers to the Cardall Test for Practical Judgment. Among the companies who use it are Ford, Trans World Airlines, Campbell's Soup and the Illinois Central Railroad. The person tested is asked to select the first, second and third best alternatives to problems. For example, "What would you do if the auto horn was stuck in your car? Would you: (1) pull out the wires under the dashboard; (2) call an auto repair shop; (3) call the nearest policeman; (4) look for the connection."

Your answers are linked closely with your general intelligence.

Careful analysis of thousands of jobs has isolated the aptitudes needed for successful performance. By comparing the results of your tests with standards established by others, the talent consultant can direct you to the proper occupational area. At one plant, workers were tested when they were hired. Some time later, supervisory workers rated their degree of success on the job. Checking test scores disclosed that most of those successful on the job had high marks on the tests.

Many school "intelligence" tests are really tests of acquired ability to do schoolwork. Tests of a group of chil-

PERSONALITY

Your likes and dislikes reveal your personality to trained aptitude appraisers. These are typical of the questions asked. The subject is told to circle "M" if he likes the following activities a great deal, "S" if he has some liking, "L" if little liking and "N" if he has practically no liking.

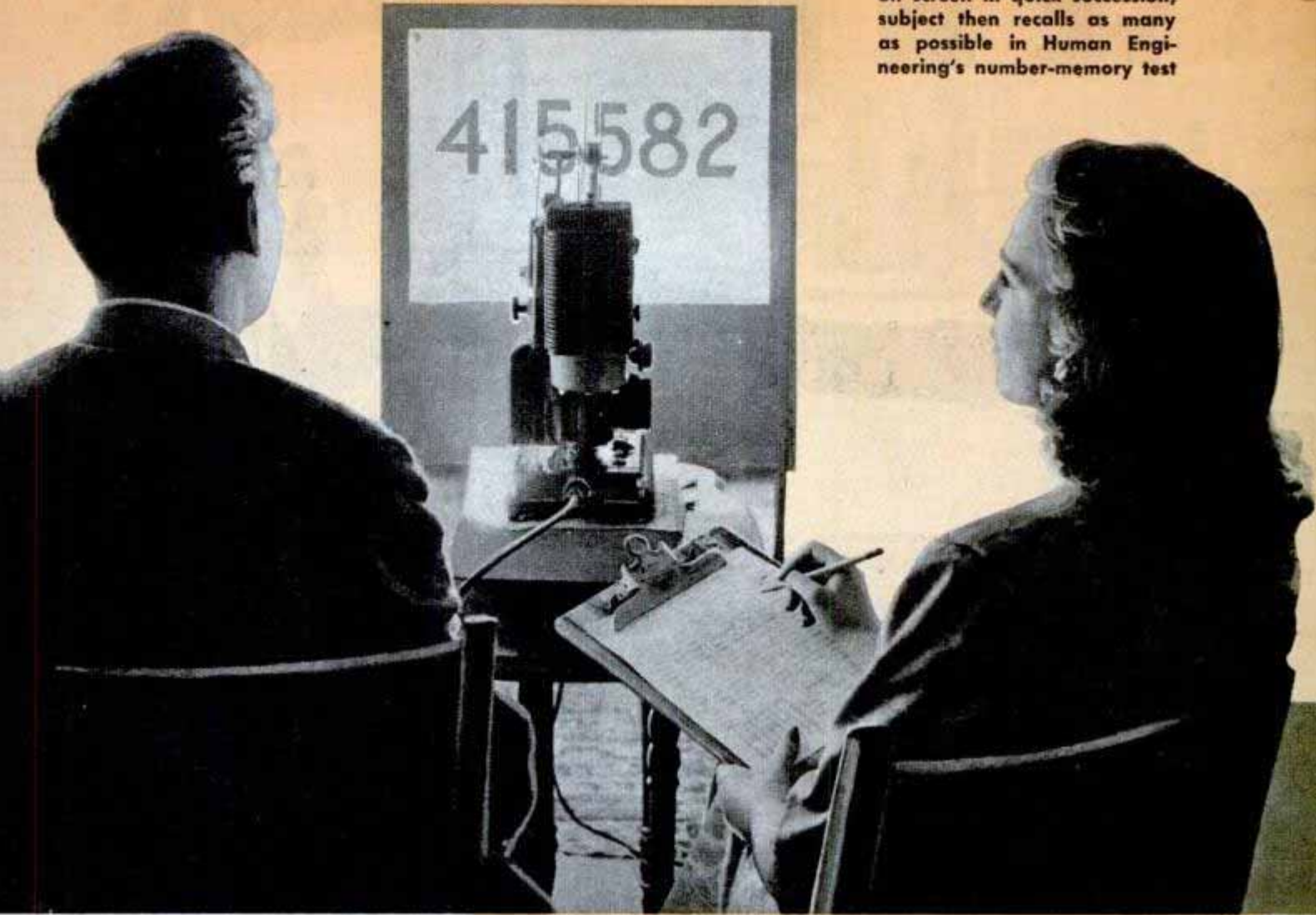
- M S L N Introducing strangers at a party.
- M S L N Being a delegate to a convention.
- M S L N Making application in person for a job.
- M S L N Looking at a musical comedy or vaudeville.
- M S L N Working for a commission rather than for regular salary.

Following are several common annoyances. The person being tested is asked to indicate his degree of annoyance by circling the "M" if a great deal, "S" if some, "L" if a little and "N" if none.

- M S L N To wait in a long line to see a show.
- M S L N To be detained when you are in a hurry.
- M S L N To run out of gasoline several miles from a filling station.
- M S L N To have someone break an engagement at the last minute.
- M S L N To have to talk when you don't feel like it.

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Six 6-digit numbers are flashed on screen in quick succession; subject then recalls as many as possible in Human Engineering's number-memory test

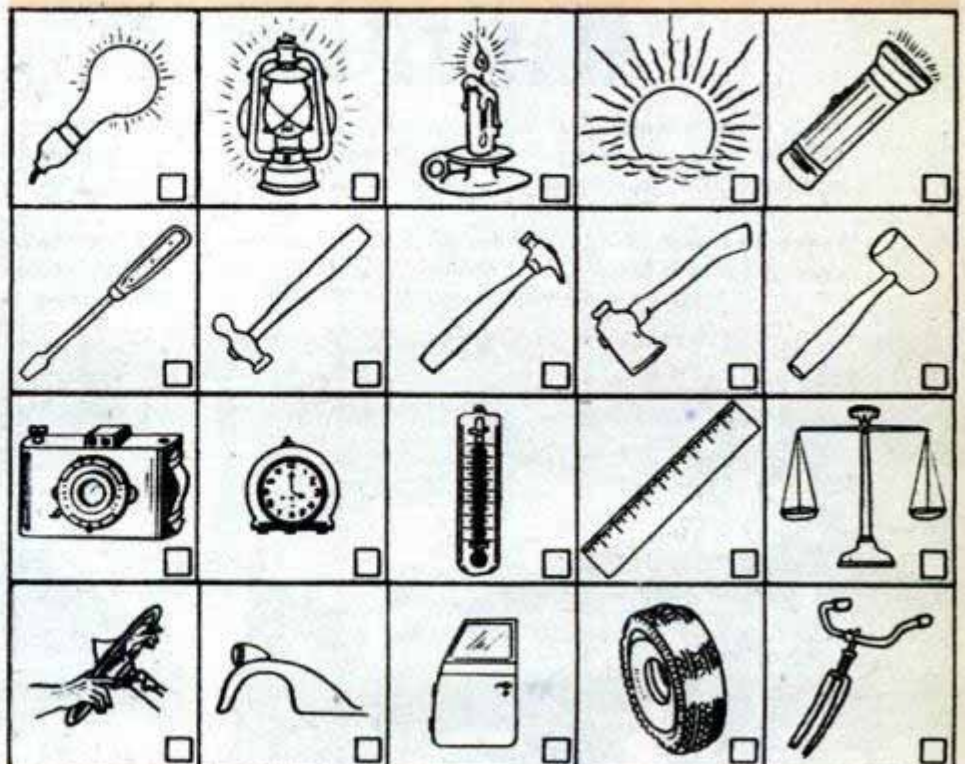


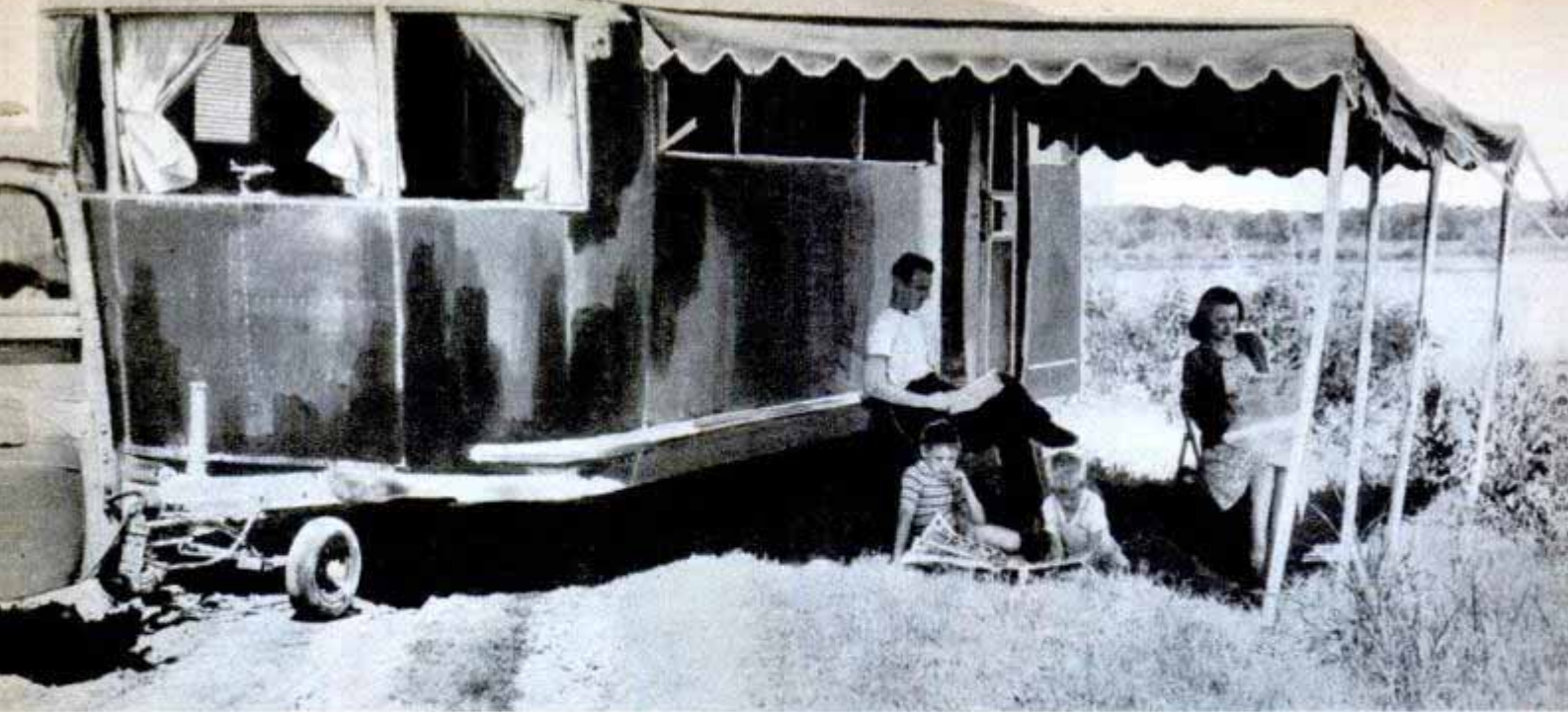
dren disclosed that of those failing in their lessons many had more strong aptitudes than those passing. Faulty instruction is to blame for such a condition. A follow-up survey by Human Engineering of one group tested divulged that most persons with high income are those using their strongest aptitudes and that those with low incomes are not.

On the Human Engineering scale of 13 aptitudes, four are enough if used properly. Only one person in 8000 has none, 13 in 8000 have one; 78 have two and 7500 are above average in four to nine.

Very probably you are six times as talented as you think you are, and you have five or six aptitudes which can be used profitably. Dig them out and use them. The talents are there waiting to be put to work.

Nonverbal picture test measures reasoning ability of persons unable to read or write. Subject eliminates the most different picture in each row
Copyright 1946, Robert N. McMurry & Co. Published by Science Research Associates





Three-room efficiency apartment on wheels, all-aluminum trailercoach has two-sink galley, bedroom with double bed and observation lounge outfitted with studio couch. It is 25½ feet long and weighs only 3500 pounds



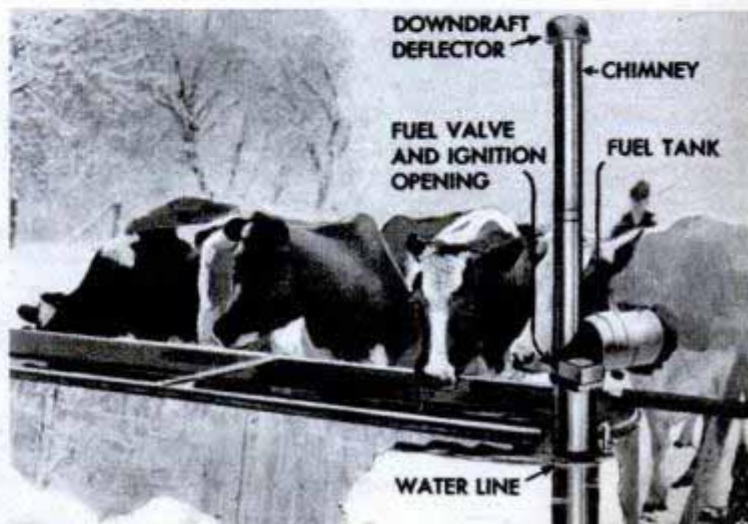
Movie reenactment of first tandem-wing glider flight in 1905 by John Montgomery. Balloon lifted frail craft to 4000 feet to launch six-mile glide for cameramen

Runabout designed in London for disabled persons has interchangeable hand or foot controls. It gets 65 miles per gallon from 2½-hp. motor at speeds up to 40 m.p.h.



Chain arrangement on fluorescent light fixture permits lowering lamp enclosure and supports it while it is being cleaned. Chains unlock for complete removal

Hot water needed on farm can be heated on the spot with utility heater which can be submerged in an open vat or stock tank. It burns gasoline, kerosene or oil



Thumb-Size Scissors Sharpener Holds Stone at Proper Angle

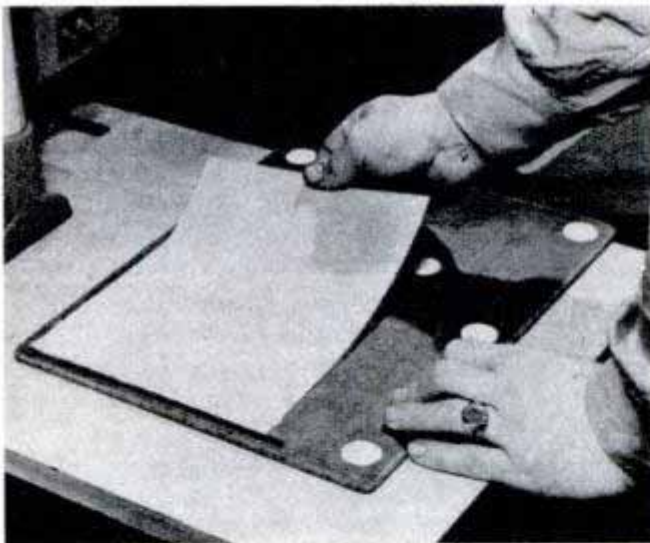
Dull scissors are given a sharp cutting edge by a thumb-size sharpener that is simple to operate. Made in a single stamped and nickel plated unit, the sharpener grips a carborundum stone at the exact angle to produce a keen edge.



One scissors blade is held in the left hand with the flat angle guide of the sharpener placed against the blade. This brings the cutting stone down on top of the blade and in precise position for sharpening. A few two-way strokes produce a sharp edge.

Adhesive on Enlarging Easel Holds Print Paper in Place

Borderless photographic enlargements that require no wasteful trimming can be made on a new easel that uses a thermo-plastic adhesive instead of moving parts to



hold the sensitized paper in place. Retaining its tackiness permanently, the thermo-plastic holds the print flat during projection. Only slight pressure is necessary to fasten the paper to the easel, and no trace of the adhesive will adhere to the back of the prints. Conveniently placed holes provide an easy means of removing the exposed paper. The paper can be placed accurately on the easel even in complete darkness through use of a corner guide.

Like the drinking fountain that spurts as you bend over it, a liquid soap dispenser for surgeons squirts soap when a photo-electric beam is interrupted by the hand.

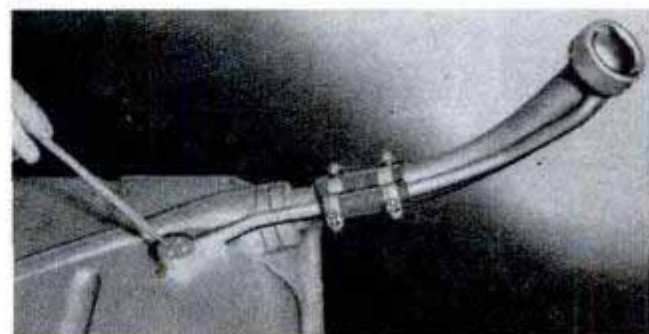


Coin Changer Returns Change From Dimes and Quarters

Customers who do not have a nickel handy can change their dimes or quarters into nickels with a fully automatic coin changer now installed on vending machines. The coin changer, produced by the Bell Aircraft Corporation, collects five cents for the merchandise and returns the correct amount from dimes or quarters to the customer. It is equipped with a slug-rejecting device. If merchandise in the machine is exhausted, the machine returns deposited coins.

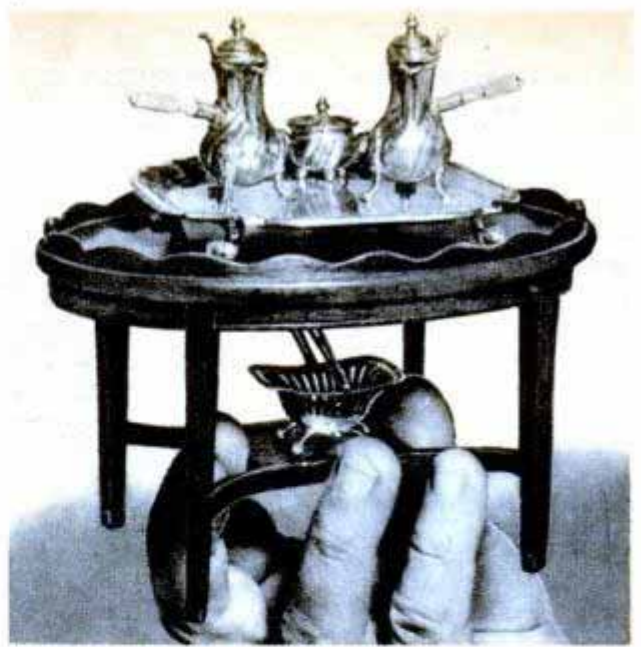
Gas-Tank Whistle Prevents Spilling

Some automobile gas tanks are equipped with a fill tube that whistles when gasoline is pouring through it but stops whistling when the gas reaches one gallon from the top of the tank. When the whistle stops, the oil-station attendant shuts off the lever and no gasoline wastefully bubbles out of the tank. It is estimated that the whistle tube might save motorists an average of one half of one percent of the gasoline they purchase.

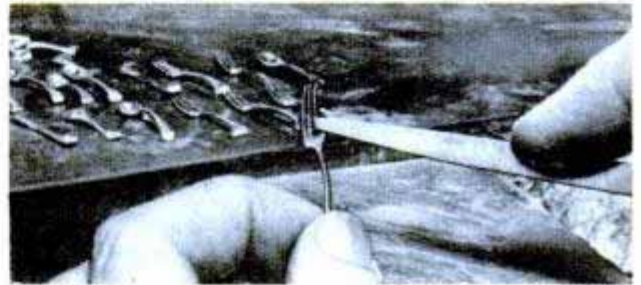




Midget Masterpieces in Silver



↑ Coffee service in French 1770 style weighs only three ounces, miniature pots stand 1¼ inches tall
↓ Finishing a fork with a special file is close work



← Beating hardens silver, so half-finished pieces must be annealed on bed of pumice to make them soft again

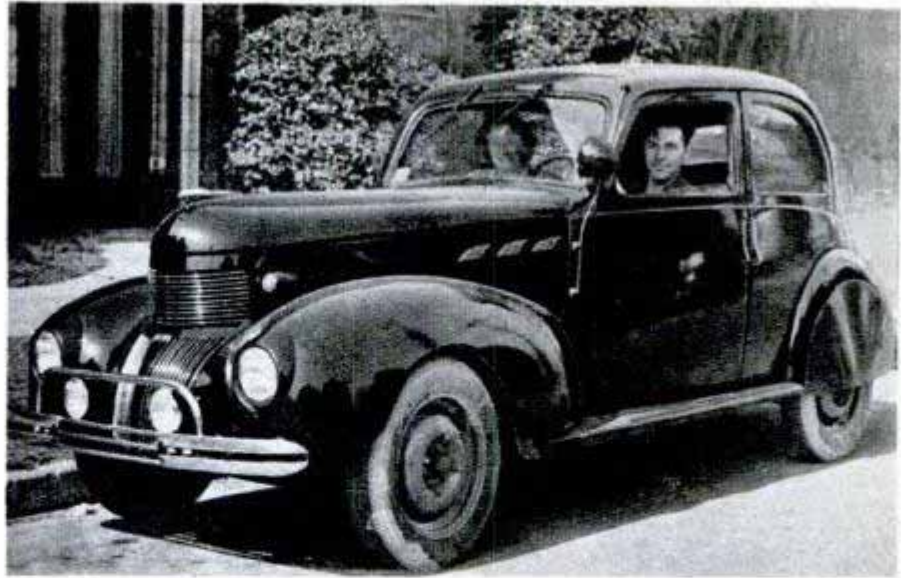
WHEN silversmith William Meyers of Newark, New Jersey, chose a hobby he merely reduced the size of his regular work. Now collectors of miniatures are buying all the midget silver service that he can produce and Meyers has turned to his hobby as a livelihood. A jeweler's glass must be used to see the fine detail of his exquisite pieces. All covers are hinged, all spouts pour, and his lamps burn real fuel, fed by a needle!



Tiny reproduction of 18th century Sheraton table is set for six with authentic miniature silver service

"Mongrel" Automobile Assembled From Parts of 17 Different Cars

Harry Delaloye, 32-year-old Seattle, Wash., auto repairman, got tired of waiting for a 1946 automobile and built his own. He used parts from 17 dismantled cars, two trucks and one motorcycle. A 1934 Willys frame was lengthened by splicing into the middle a section from a 1939 Fiat frame. The Willys also supplied a double universal drive line and front and rear axles, while the Fiat's choke and throttle controls were utilized. Other parts included: 60-horsepower engine, transmission and radiator, Ford V-8; overdrive unit, 1942 Nash 600; shock absorbers, International truck; wheel bearings, hubs and brake drums, 1941 Studebaker Champion; hydraulic brake assembly and wheels, 1941 Nash 600; 5.00x16 tires from a motorcycle; hood narrowed down from 1937 De Soto; hood lock, 1941 Chevrolet; owner's name plate, 1941



Hudson; front fenders, 1940 Mercury; motor generator, 1940 Lincoln; instrument panel, 1935 Oldsmobile; wiring harness and light switches, 1940 Dodge; taillights, 1941 Plymouth; rear license light, 1940 Pontiac; back-up lights and hood louvers, 1937 Graham-Paige; windshield wipers, Dodge truck; parking lights, 1940 Chevrolet. Delaloye says the car has ample power and speed.

Letter Files Open Sidewise to Save Space and Avoid Toppling

Letter files opening sidewise instead of vertically save space and are easy to manipulate. Called Rock-a-File because the entire inner compartment rocks a quarter

turn sidewise in opening, the new file saves an estimated 10 to 50 percent floor space. Other features are reduced accident hazard because it won't topple when fully loaded and opened, and the use of different compartments at the same time.



Sound Waves Chase Pigeons Off Courthouse Perch

Sound waves that can't be heard are driving unwanted pigeons from their perches on the courthouse at Minneapolis. To combat the pigeon nuisance, a pigeon annoyer was developed that drives off the birds with high-frequency sound waves. The device emits waves at 17,000 cycles per second, so high-pitched that they bother the birds. It was developed as a result of war research that proved there is a sound that annoys the ear of any living creature. The human ear is bothered by 2500-cycle waves, can still hear waves at 13,500 cycles per second, and can "feel" waves at 14,000 cycles. But the 17,000-cycle waves that are driving away the pigeons can't be heard or felt by the Minneapolis residents.

Leaks in fuel pipe lines under the English Channel are now spotted by using the same chemical with which downed airmen colored the water around their rafts.

How to play THREE-CUSHION BILLIARDS

By Willie Hoppe

THREE-CUSHION-BILLIARD addicts live longer than other people. Like chess players, they concentrate so hard on their game that they forget about business, OPA, shortages and other worries. They learn to relax and enjoy themselves.

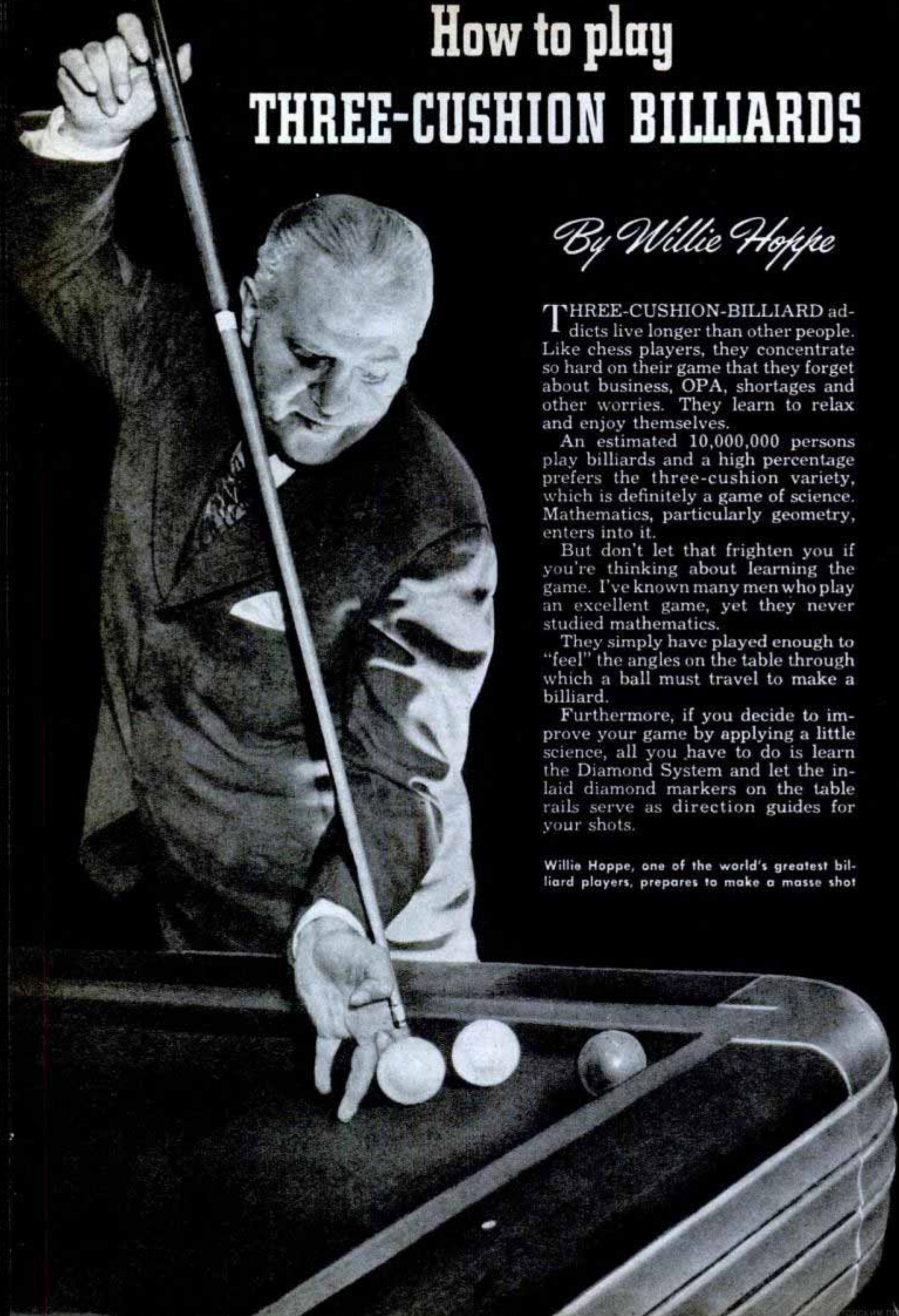
An estimated 10,000,000 persons play billiards and a high percentage prefers the three-cushion variety, which is definitely a game of science. Mathematics, particularly geometry, enters into it.

But don't let that frighten you if you're thinking about learning the game. I've known many men who play an excellent game, yet they never studied mathematics.

They simply have played enough to "feel" the angles on the table through which a ball must travel to make a billiard.

Furthermore, if you decide to improve your game by applying a little science, all you have to do is learn the Diamond System and let the in-laid diamond markers on the table rails serve as direction guides for your shots.

Willie Hoppe, one of the world's greatest billiard players, prepares to make a masse shot



Follow the arrows drawn on this multiple-flash photograph and you can see how Hoppe makes a break (opening) shot. Millionth-of-a-second light flashes from a stroboscope "slowed" the speeding balls for photographing

I played billiards for at least 10 years before I learned and began using the Diamond System. Of course, I started playing at an earlier age than most fellows. In fact, I was only five years old when I played my first game of pocket billiards.

My father, himself an excellent player, operated a little hotel at Cornwall-on-the-Hudson, N. Y. We had a combination billiard and pocket billiard table and when things were slack Dad would teach me the fundamentals.

By the time I was nine I played a pretty good game. I never will forget one experience I had when I was still a boy in short

pants. A traveling salesman (we called them drummers then) stopped at the hotel and saw me practicing.

"I've got some spare time, sonny," he said, "so I'll be glad to play you a game and give you some pointers."

He suggested that we play 15 points of pocket billiards and I said that suited me. The salesman took the first shot, scattering the balls but failing to make the one he called. I got up and knocked in every one of the 15 balls without a miss. The stranger walked away, muttering:

"What kind of a town is this? I'm a fair player, but here even children beat me."

THE UNPARALLELED HOPPE RECORD

(WORLD TITLES AND MARKS)

THREE-CUSHION

World Champion:
1936, 1940, 1941, 1942, 1943, 1944
High Run.....25 (Exhibition)
High Run.....20 (League)
High Run.....15 (Challenge Match)
High Run, Choice of Balls.....20
High Grand Average.....1.161 (World Tournament)
Consecutive Tournament Victories.....35 (1940-41)
Tournament Victory Streak
38 out of 39 (1936, 1940, 1941)

18.1 BALKLINE

World Champion: 1906-07, 1908-11, 1914-46
High Grand Average.....36 4/11

18.2 BALKLINE

World Champion: 1907, 1910-20, 1923-24
High Run.....622 (Exhibition)

14.1 BALKLINE

World Champion: 1914-46
High Run.....303
High Single Average.....40
High Grand Average.....25.75

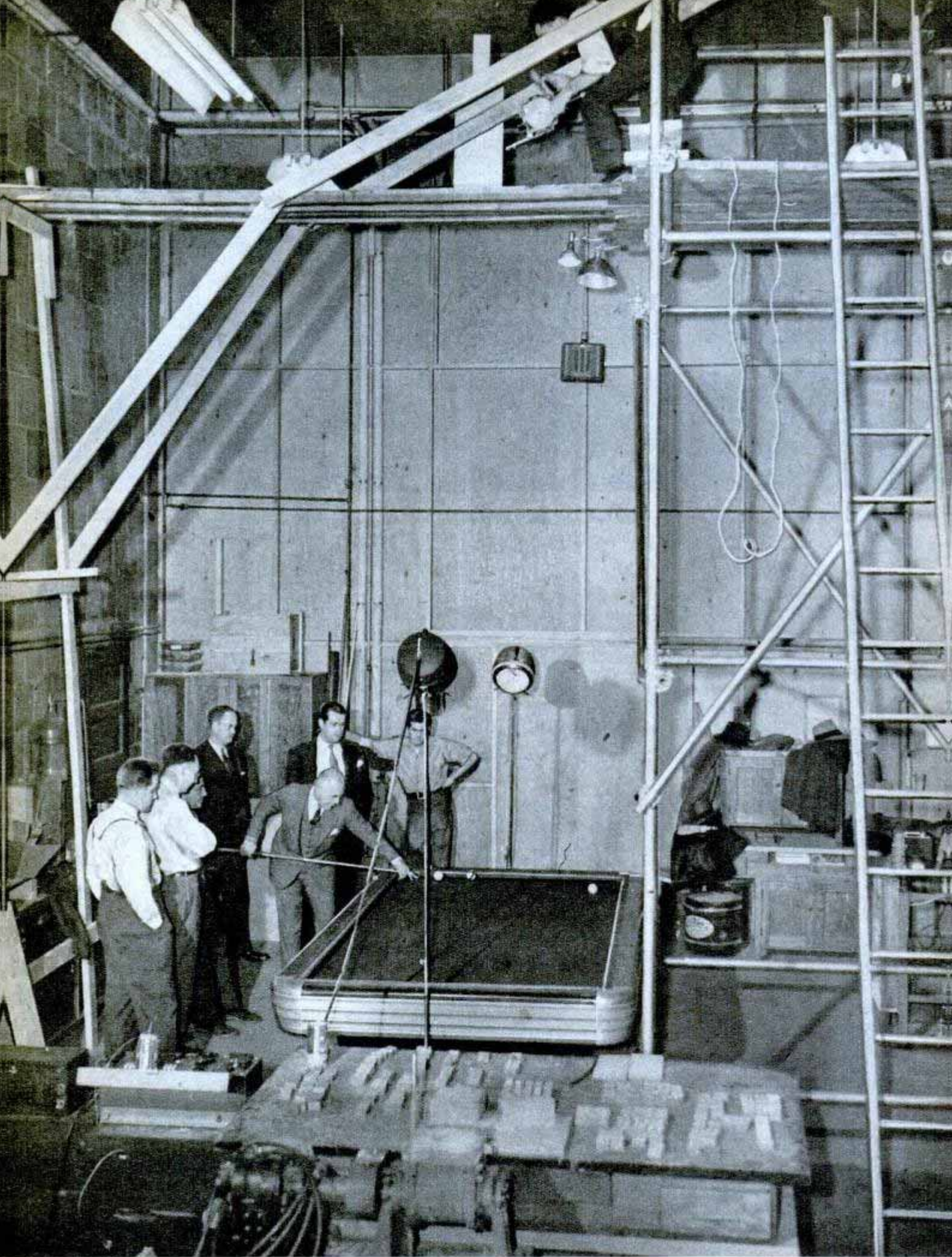
71.2 BALKLINE

World Champion: 1938-46
High Run.....248
High Single Average.....83
High Grand Average.....42

CUSHION CAROMS

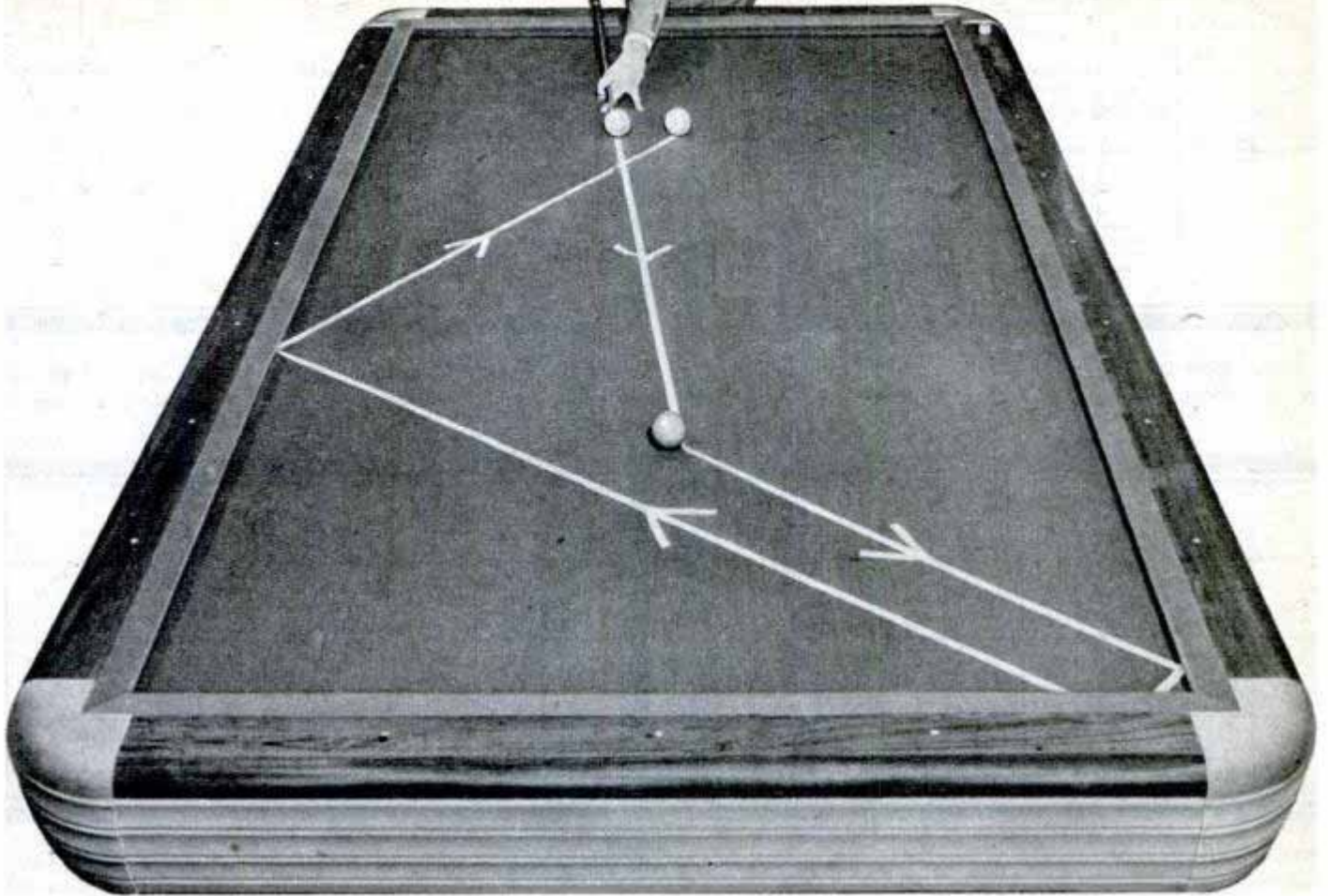
World Champion: 1933-46
High Run.....53 (Challenge Match)
High Single Average.....11.36
High Grand Average.....6.43
Best Game.....22 Innings (250 Points)

Copyright 1941, Reilly & Lee Co.



This is how the high-speed billiard photos were made for Popular Mechanics at Armour Research Foundation. As Hoppe shot, stroboscopic lamps at each end of the table blinked on and off every two-millionths of a second. The shot was photographed by a cameraman on a scaffold, who used a Speed Graphic with shutters open

Tape and arrows trace the path of the cue ball in making three-cushion break



Some years later I decided to make billiards my profession and went to work for the Brunswick-Balke-Collender Company. By constant study and practice during my 57 years I've been able to win most of the world's billiard championships: three-cushion, 18.1 balkline, 18.2 balkline, 14.1 balkline, 71.2 balkline and cushion caroms.

Before describing the mechanics of three-cushion billiards and how to apply them to improve your game, perhaps I'd better explain the rules of the game.

Three balls are used, one red and two white ones. One white ball is marked with a small black spot on two sides to distinguish it from the other white ball. Each of two players selects a white ball as his cue ball. In order to score a point, the cue ball must strike three or more cushions before completing a billiard. By "completing a billiard," I mean that the cue ball strikes the other two balls.

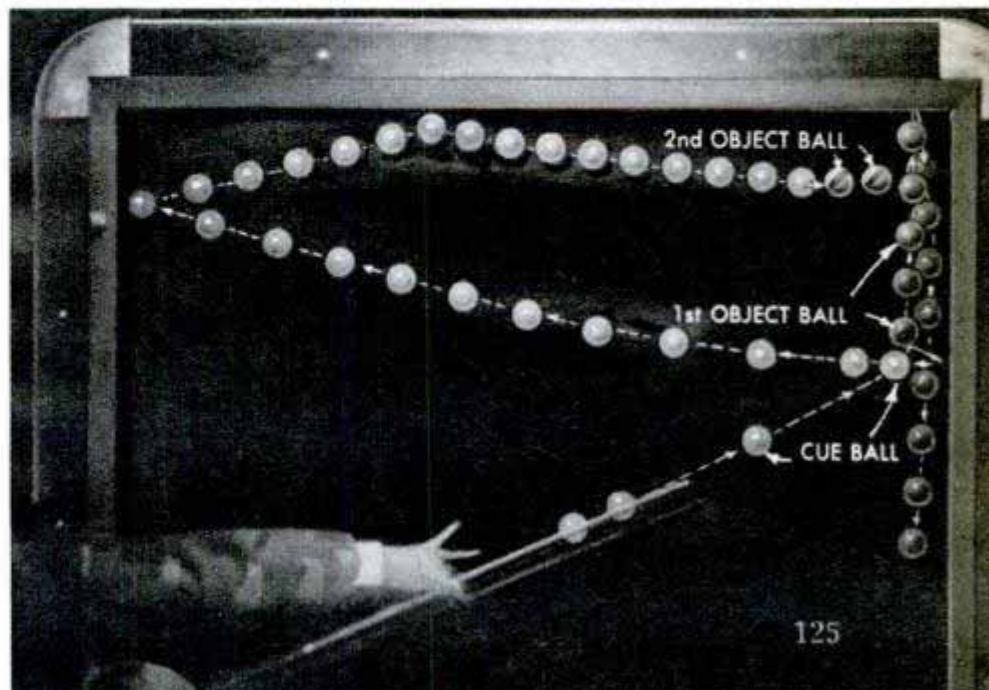
If you've played straight billiards in which you score simply by hitting the cue ball against the other two balls, or pocket billiards (pool), it won't take long for you to

become a pretty good three-cushion player, IF—

You study and apply the seven essential fundamentals I shall describe in this article. Those seven points are:

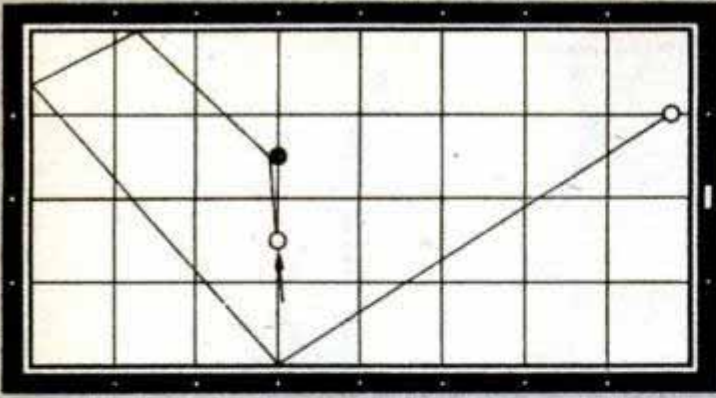
- (1) Position at the table (stance)
- (2) Grip on the cue
- (3) The bridge (way you hold the cue near the tip)
- (4) Cuing the ball
- (5) The stroke (follow-through)

High-speed photo shows "up-and-down" three-cushion billiard shot

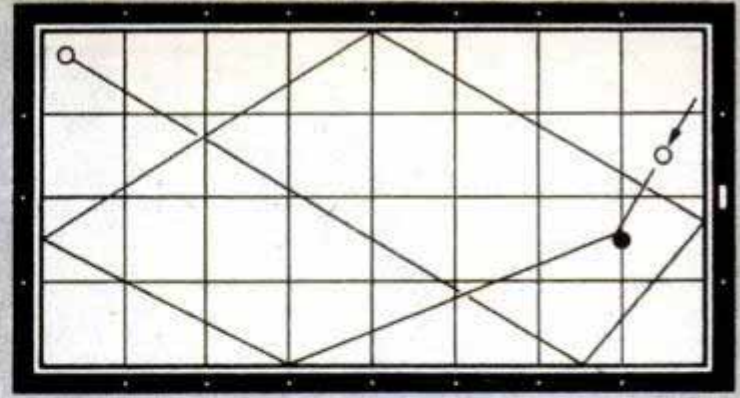


KEY SHOTS IN THREE-CUSHION BILLIARDS

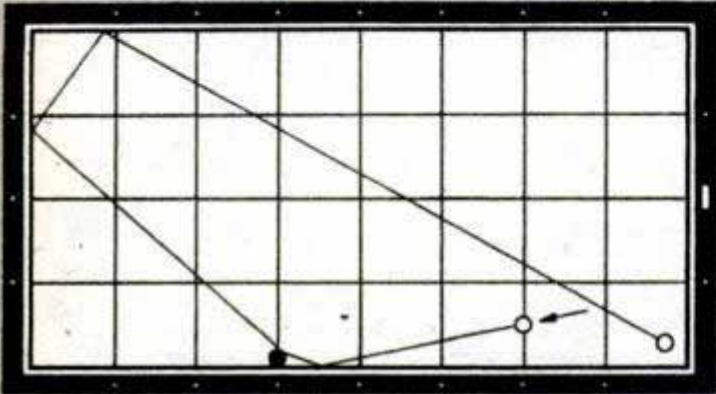
Diagrams by Reilly & Lee Co., Publishers, Chicago, Ill.



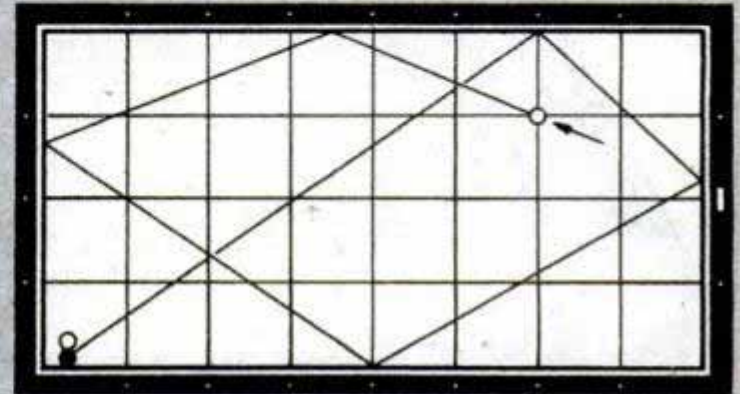
Hit object ball on the left, about a third of the way in from the edge. Strike cue ball a little to left of center



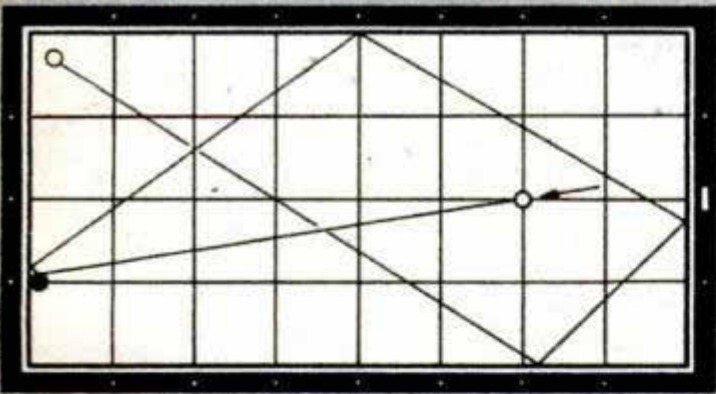
To make this five-cushion shot, hit the object ball fairly thin on the right while putting right english on cue ball



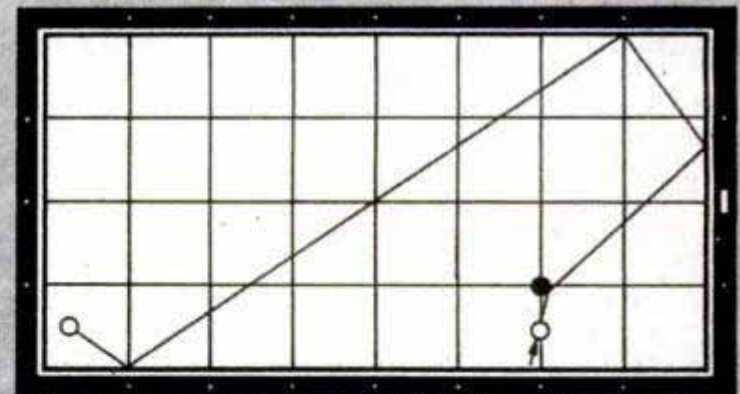
In this rail-first shot, hit the cushion as illustrated in the diagram. Strike cue ball in center and use no english



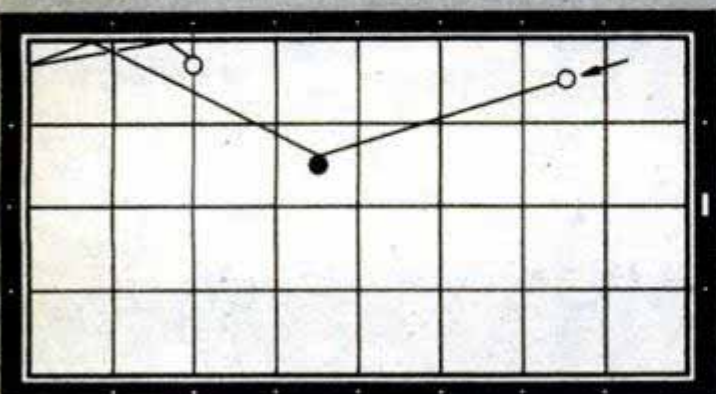
This makes a spectacular five-cushion bank shot. You use a moderately hard stroke with a little left-hand english



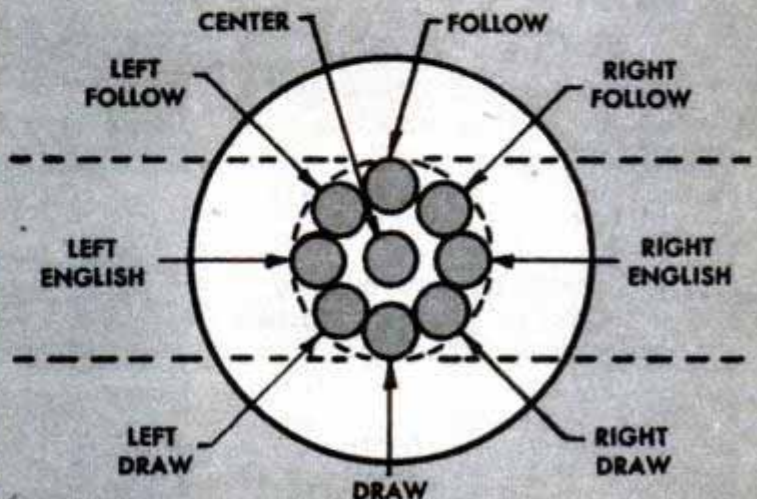
You have to have a "good eye" to make this shot because its success depends on your ability to hit the object ball thin

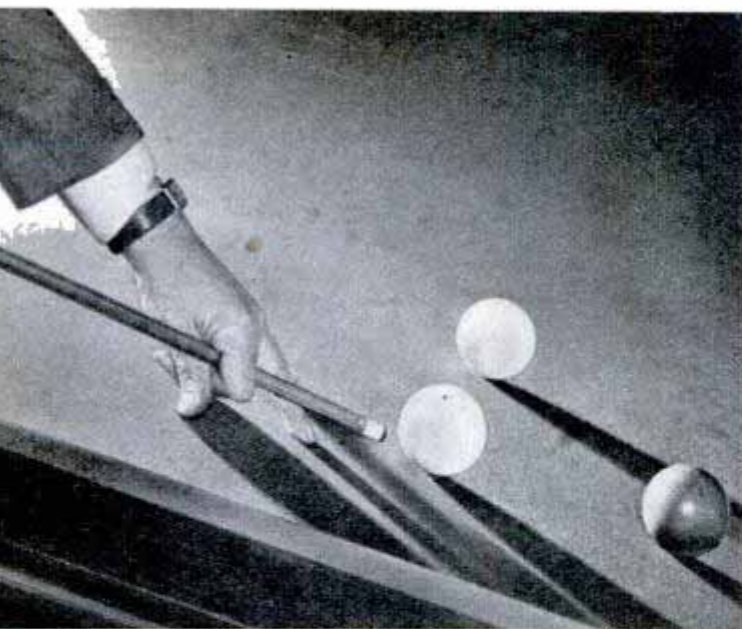


In executing this shot you hit the object ball on the right side while putting a little left-hand english on the cue ball



This is a tough shot but you can make it by putting plenty of right-hand english on the cue ball. For all shots, cue the ball within the dotted area (right) to avoid miscues





Steadiness and accurate aim are provided by holding the cue in what Willie Hoppe calls a "tripod" bridge

(6) Application of english (spin on the ball)

(7) Speed and force

Your position, or stance, at the table should be natural yet solid. You should be comfortable, relaxed in posture and in position to execute the shot facing you.

Face the shot squarely, your feet a slight distance apart, with the left foot forward to give you firmness. I stand with my feet about 19 inches apart. For clarity, all instructions in this article apply to right-handed players.

When you bend over to make a shot, keep your head directly over and on a line with the cue so that you can sight as a hunter sights a gun. The right arm swings freely with no interference from your body and the left arm is extended and kept straight with the hand resting on the table to form a bridge to hold the cue at the tip end.

In gripping the cue, only the thumb and the first finger are in contact with it. The contact is light but tight enough to be firm. The middle finger sometimes touches the cue in the grip of the average player, but very lightly. Hold the cue at or near the balance point. Don't grasp it in a rigid, viselike "death" grip.

There are variations in the bridge used by professional players, usually due to the difference in finger lengths, but the orthodox "tripod" bridge always is the basis.

Here is the four-step method I recommend for making your bridge:

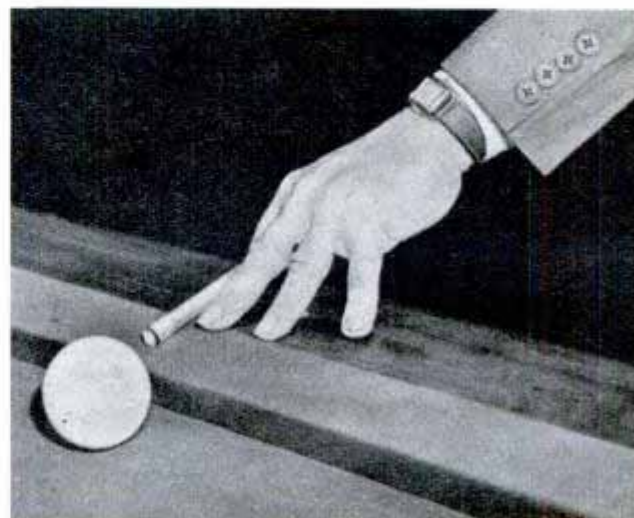
- (1) Place your left hand flat on the table with the heel of the hand firmly on the cloth
- (2) Bend or double the forefinger until the tip rests against the thumb, forming a loop

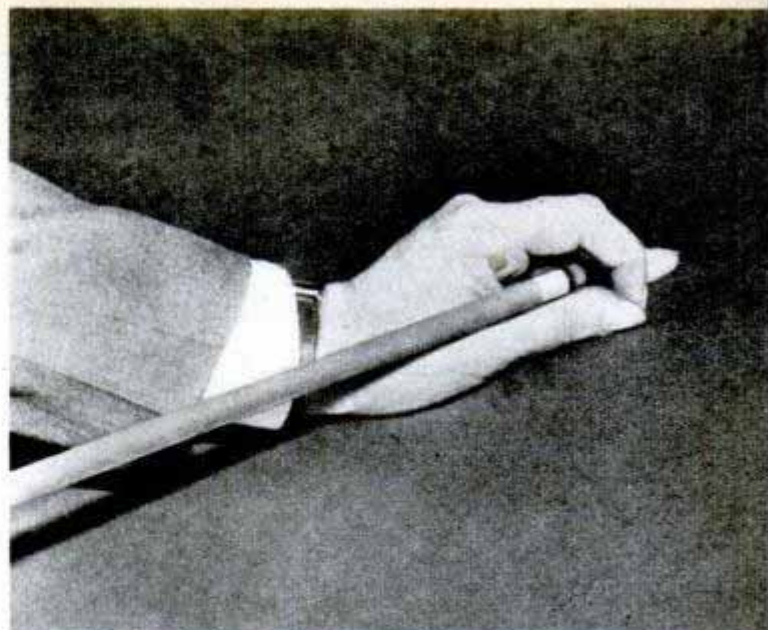
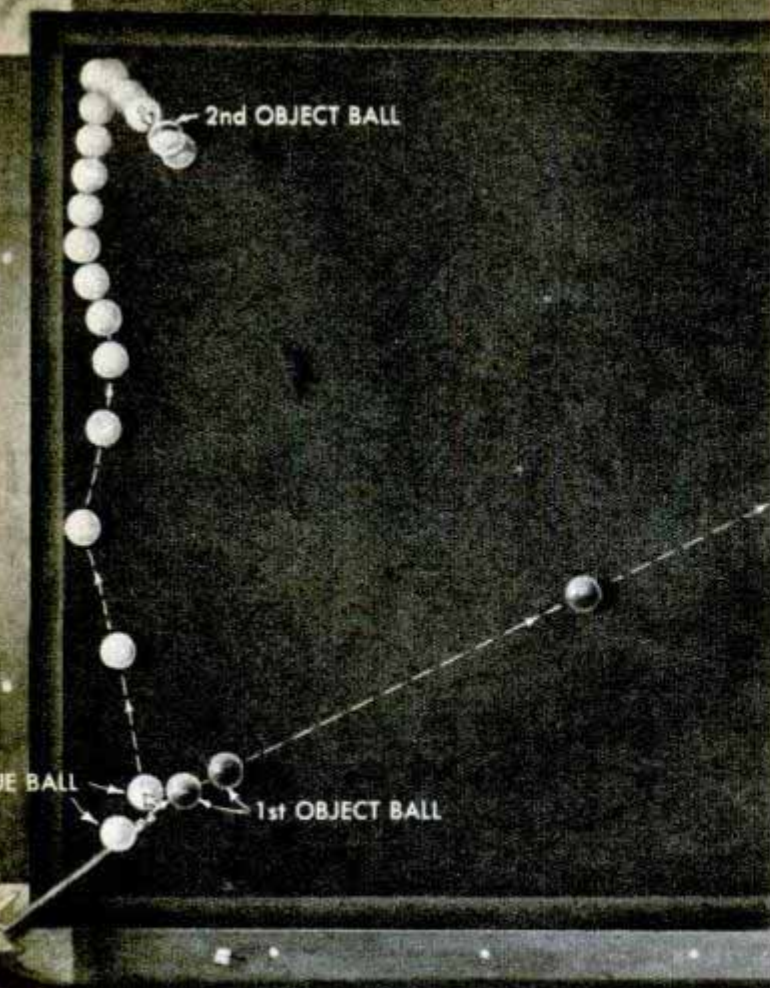


Hoppe shows John R. Kinsey, associate editor, where to place the left hand for a shot off the cushion



The butt of a cue is grasped near the balance point and held with a light grip but tight enough to be firm. Below, guide cue in this manner for rail shots





↑ How fingers form a "bridge" to hold billiard cue
 ← Cue ball hugs left cushion in this difficult shot

- (3) Place the cue in the groove between thumb and forefinger
- (4) Put the cue through the loop made by your forefinger and thumb, and pull your forefinger back firmly against the cue

Now, to form the orthodox tripod bridge, which I use and advocate for three-cushion

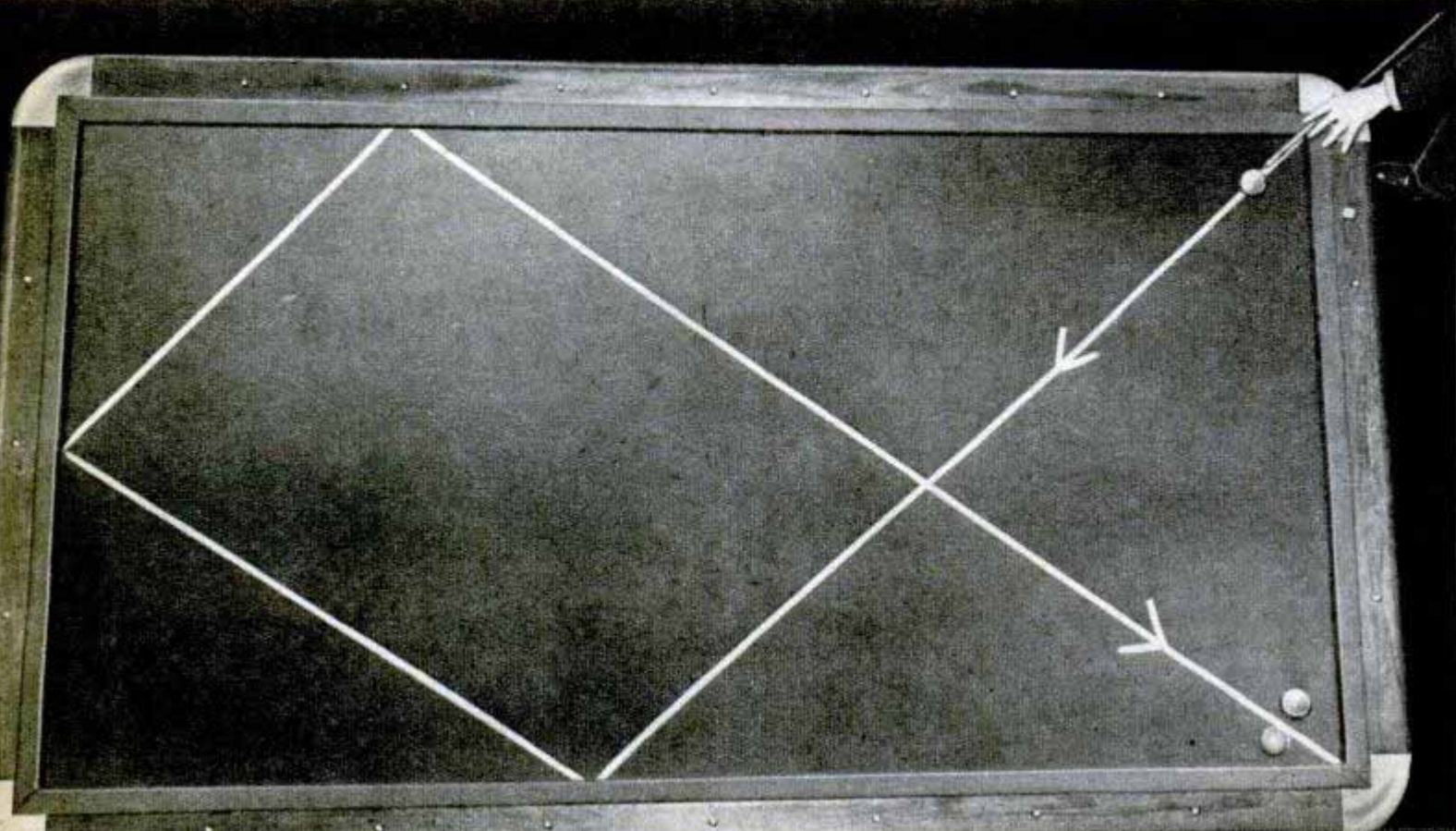
play, raise the heel of the hand off the table, putting all the pressure of the hand on your thumb, curled-back middle finger and third and little finger. You can automatically sense the firmness of this bridge.

The next lesson is on "cuing the ball." The manner in which you strike the cue ball with your cue determines whether or not you will make a billiard, assuming that you have figured out the correct angle.

The most important thing to remember is: Don't put too much english (spin) on the cue ball. Anyone who has watched

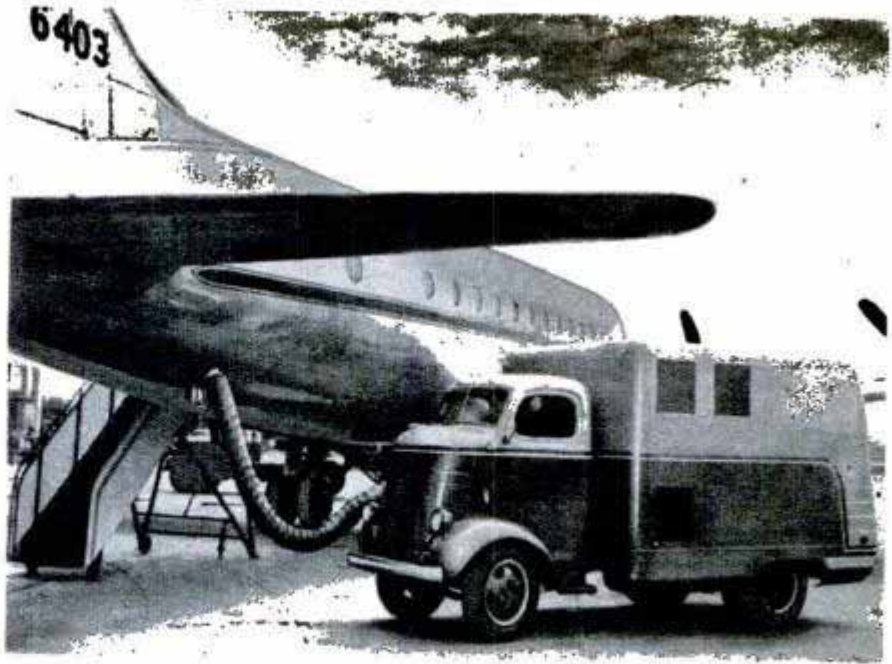
(Continued to page 248)

This bank shot, often called a "natural," is easy for the three-cushion player who knows the Diamond System



Mobile Air Conditioner for Big Planes Could Service Five Homes

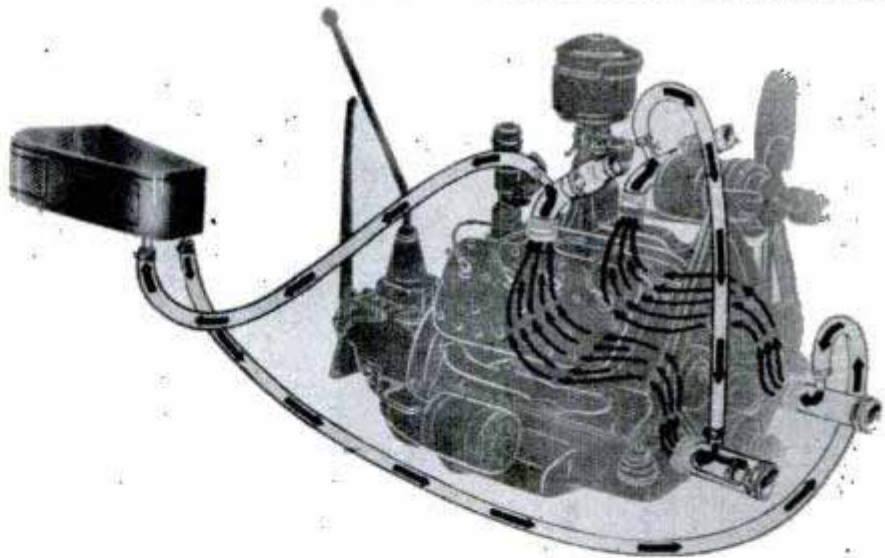
Enough heat for five small homes or a cooling capacity equal to the melting of 10 tons of ice is provided by a mobile air conditioner for air liners. The truck-contained unit operates while the plane is grounded for loading or unloading. It is attached by a 20-foot flexible hose. In 120-degree heat the plane interior can be cooled to 80 in a few minutes, or at 30 degrees below zero the temperature can be boosted to 70 within an equally short period. Conditioned air is distributed through the plane's existing duct system and thermostatic temperature control is automatic. While designed for the largest planes, it is readily adaptable to the smallest types.



The unit can be used to preheat airplane engines or for other emergency heating or cooling problems.

Booster System for Ford V-8 Heater Gets Water From Each Block

Both blocks of Ford V-type engines can be made to supply warmth for the car heater through a system which employs both water pumps in series. A thermostat setting maintains a balanced temperature in both blocks and prevents overheating of one block or too quick cooling of the other. Water flows from the right bank of the engine through the heater to a T-fitting installed between the radiator and water pump on the left cylinder pump. This water is forced through the left engine block by the left engine pump to a check valve between the radiator and the right water pump of the right cylinder bank. If



it should be too hot the thermostat control allows it to flow into the radiator for more cooling before it is pumped into the right engine block and to the heater again.

Sanitary Aluminum Capper for Infant's Bottles Keeps Hands Off Nipple



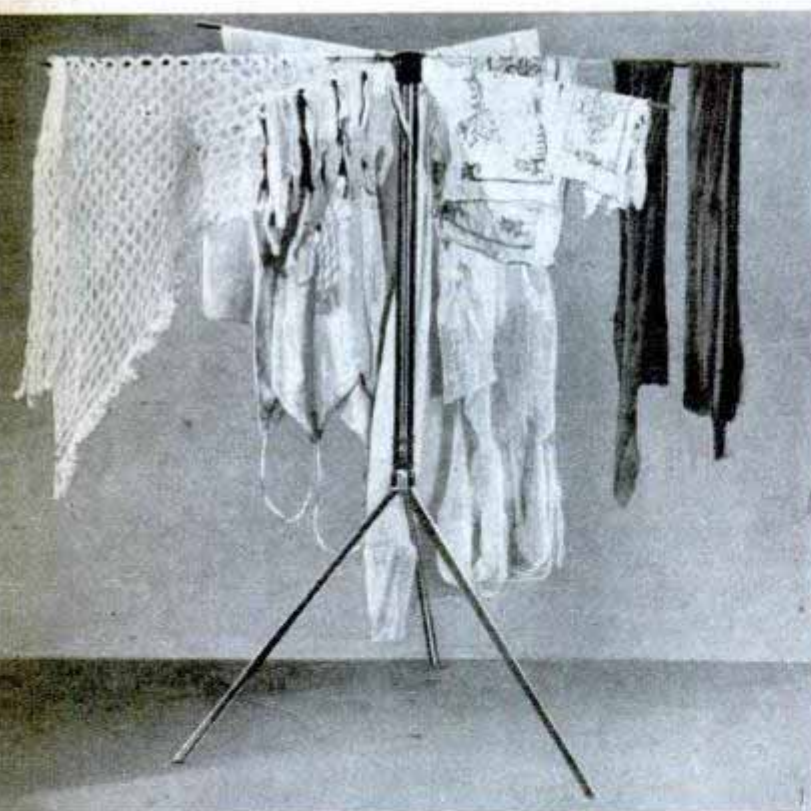
There's no danger of hands contaminating a baby's bottle with a capping device consisting of a pair of tongs and an aluminum frame which slips over the bottle. The nipple is placed on the frame with the tongs. The frame then is placed over the bottle and pushed down. The prongs of the frame spread and stretch the nipple over the mouth of the bottle.



Sturdy nursery chair also serves as a play table. The double seat is hinged and it and the back of the chair swing to the floor to become half the table.



False front over top two drawers of child's five-drawer chest drops to make a desk. The play table shown at left is chair again.

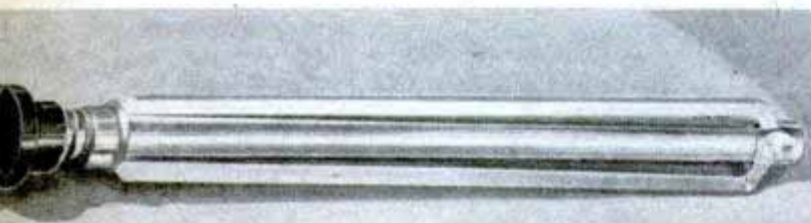


Clothes drier opens like an umbrella and requires little storage space when shut. Six drying arms and tripod legs are locked in position by sliding rings.

"Inside Stubb"

for Your Home

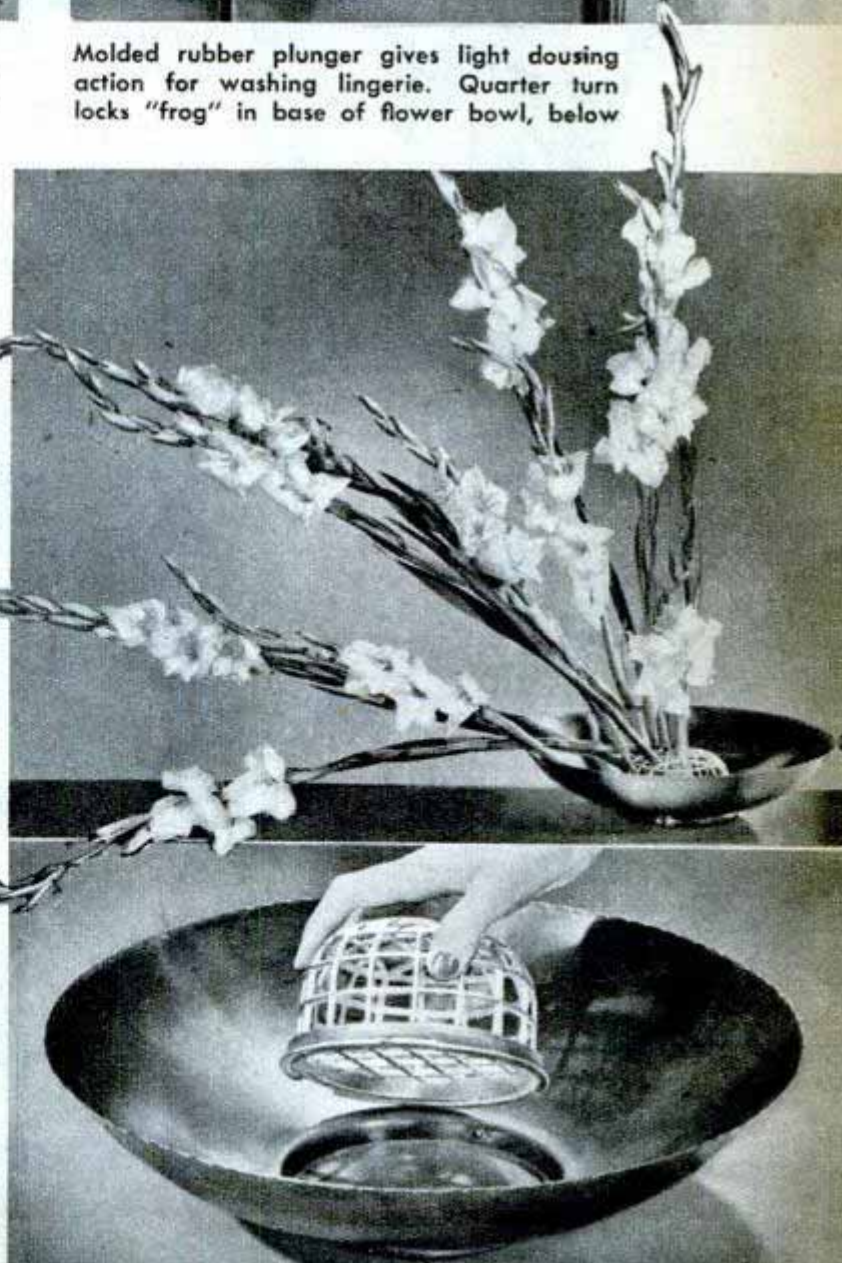
Clothesline tightener keeps line taut after downward pull tightens it. The tension can be released quickly by pulling on locking end of the tightener.

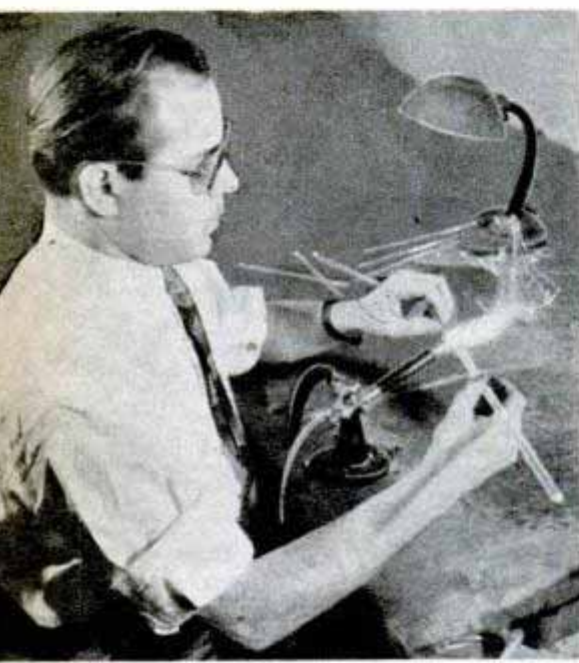
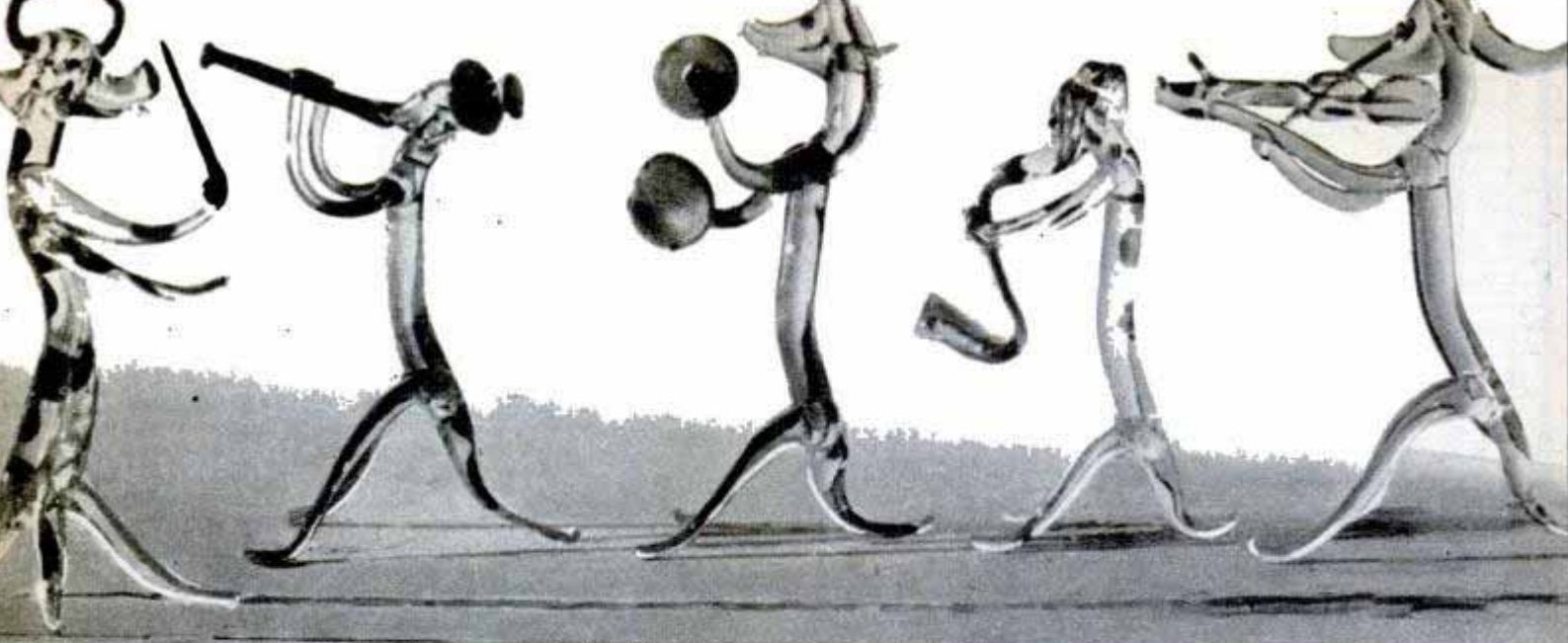




Slotted slats in Venetian blinds, above, can be removed for cleaning. Hauling a heavy basket of wet clothes to lines is easy job with laundry buggy below

Molded rubber plunger gives light dousing action for washing lingerie. Quarter turn locks "frog" in base of flower bowl, below





“GLASS MENAGERIE”

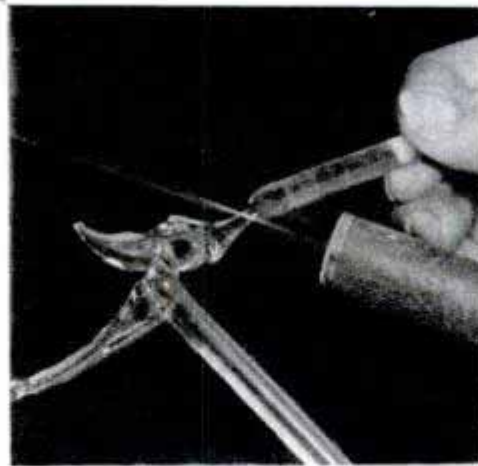
POSSIBLY because of the success of the hit play, “The Glass Menagerie,” collection of miniature glass animals has become a fad again after a lapse of many years.

Violin-playing cows, graceful deer and flamingos, and weird-looking creatures that defy identification now grace fireplace mantels and what-not shelves.

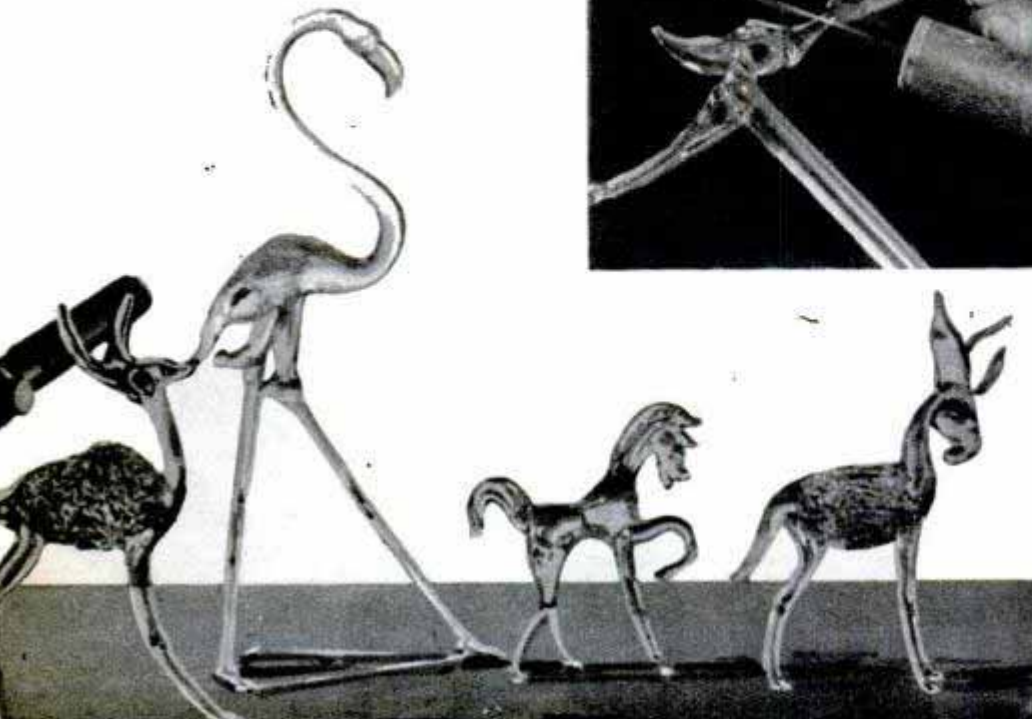
Most of these little figures are made in New York by Bohemian-born craftsmen who jealously guard the secrets of their art even though production line methods are becoming more and more commonplace.

Roughly speaking, the technique of sculpturing glass consists of holding a glass rod, usually about half an inch in diameter, in an oxygen and gas flame and then manipulating the molten mass into various fanciful shapes.

Besides the craftsmen's hands, the only tools used are a pair of flat-nosed pliers for bending purposes and a flat sheet of steel to press the soft glass edges into flat surfaces.



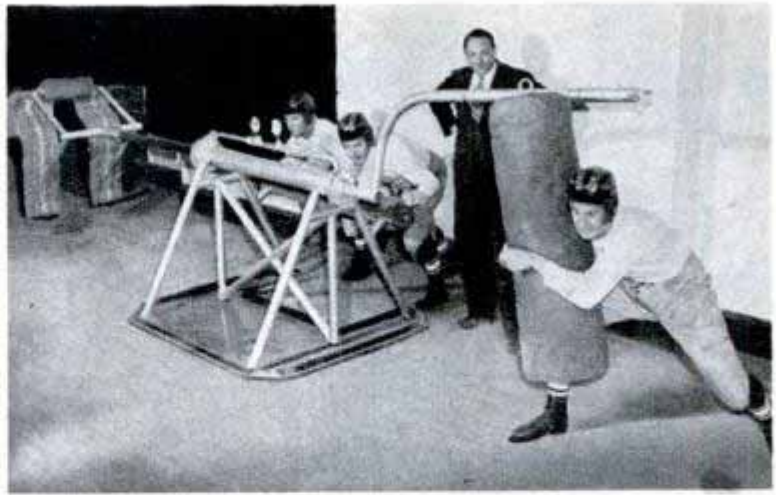
It takes a master craftsman to create the glass animal musicians shown at the top of this page. Note the implied action. Robert Miller (upper left) manipulates a glass rod in a flame to fashion a figure. Pliers and a piece of steel (below) are the only tools used





Football coaches now can check with scientific accuracy the force exerted by players in blocking and tackling. Mal Stevens, coach of the Brooklyn Dodgers profes-

Pneumatic 'Coach' Checks Tackle Power



sional team, invented a pneumatic machine equipped with gauges to measure such force. The main purpose of the machine is to condition and train players indoors.

Tires of Future Made With "Carbon White" to Rival Rainbow in Color

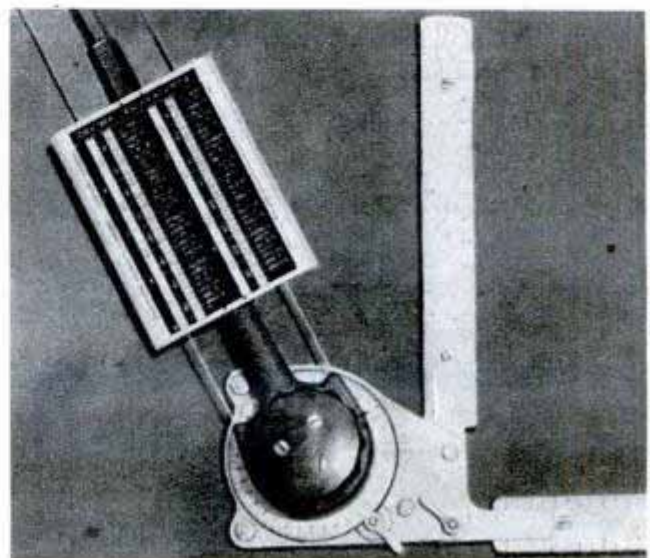


Tires of baby blue, orchid, bright red or almost any other color of the rainbow will be practical and durable as a result of the discovery of "carbon white." The substance, actually not carbon at all, is a powder produced from sand through a complicated chemical process. In demonstrating the "white soot," chemists burn a liquid, formed in the final stage, in a cigarette lighter and collect the carbon white on a dark plate. It performs exactly as carbon black does in rubber compounds, giving extra tear resistance, abrasion resistance and tensile strength. Carbon black has prevented the use of colors in many rubber products because even tiny amounts of the substance discolors rubber. Carbon white

was discovered after 10 years of research by chemists of the B. F. Goodrich Company. In addition to its possible use in tires, it will be used in the production of rubber footwear, floor coverings and many other products. Overshoes, for example, no longer need be black but can be made in fancy colors. Commercial use of the compound will be delayed until mass production reduces the cost.

Drafting Board "Mathematician" Figures Decimal Equivalents

Decimal conversions are accomplished quickly and with no chance of error by referring to an aluminum decimal equivalent chart attached to drafting machines. The chart is three by five inches in size and has large legible lettering. When mounted on a drafting machine, next to the dividing head, it eliminates much unnecessary figuring for the draftsman.





Assembly Line

By John R. Kinsey

THIRTY-EIGHT MILLION TURKEYS—one for almost every family in the U. S.—were raised this year. After a careful turkey census, the Department of Agriculture reports production is nearly double that of 10 years ago.

How was this possible with the manpower situation still a big headache for producers? The answer: electrical and mechanical "helpers."

From the egg to roast turkey, automatic devices assume much of the work formerly performed by man. And the tasks are done with scientific exactness.

From tiny poults to full grown strutters, 12,000 turkeys are raised almost entirely mechanically each year at the Oakhurst Terrace Farm, Genoa City, Wis.

Allen-Century photo



Gobblers

There are mechanical aids for cleaning and weighing eggs, mammoth incubators, thermostatically controlled brooders, pressure-fed watering troughs equipped with float valves, gravity-fill feeders of 2000-pound capacity, labor-saving elevators and conveyors, skid-mounted feeders and shelters which are moved easily by tractor to fresh ranges, and mechanical turkey pickers.

All this adds up to better quality poultry, decreased death loss from disease and increased production despite limited farm help.

To get an idea of how these mechanical contrivances are put to work, come along on a visit to the Oakhurst Terrace Turkey Farm, two miles northwest of Genoa City, Wis.

Bob Fox, owner and manager, is a great believer in using all the "practical" scientific equipment available to raise turkeys. He is busy right now marketing about 12,000 Broadbreasted Bronze turkeys which he and one other fellow raised during the past six months, with the assistance of a third man during the first eight weeks. A crew of 25 dressed the turkeys, 800 a day.

It is evident that Fox has to have a lot of automatic equipment to accomplish this. He has. Starting at the beginning, he has 51 brooder houses that shelter the turkeys from the time they're day-old poults until they are eight weeks old and ready for the range.

Each hexagon-shaped brooder house accommodates from 250 to 300 poults. Thermostatically controlled gas heats the houses, starting at 95 degrees when the turkeys are only a day old and dropping down five degrees per week until 70 degrees is reached. By this time the poults can get along fine in 70-degree temperature.

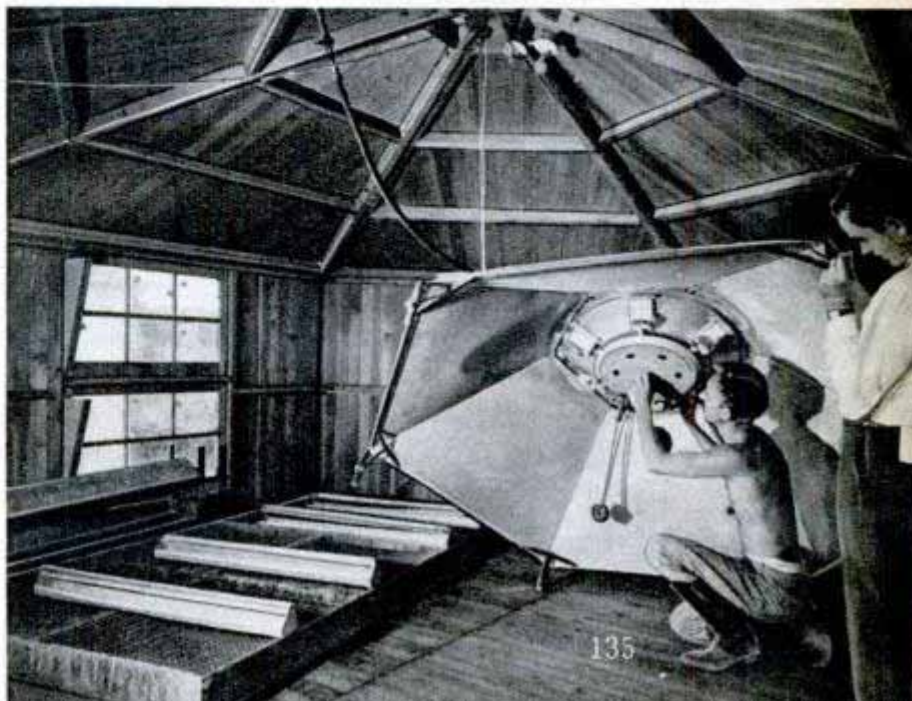
There are two lights in each brooder house. One seven-watt bulb burns every night to supply

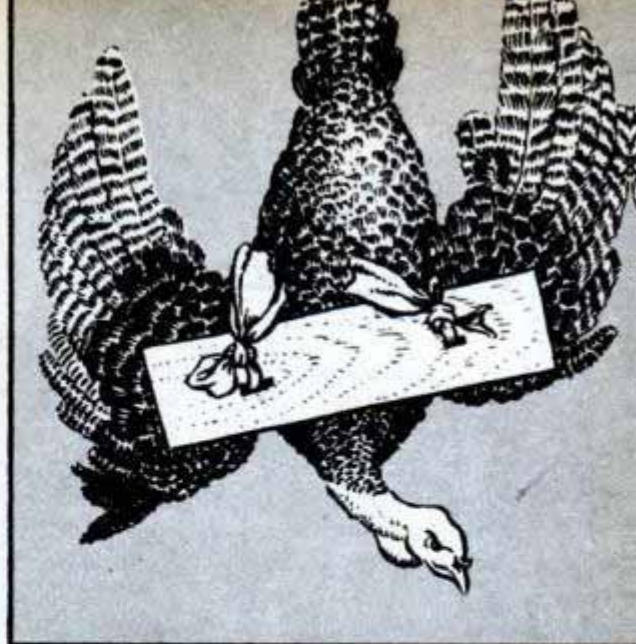


During the first eight weeks young turkeys (poults) spend all their time in brooder houses where heat is carefully controlled



Fox has 51 brooders equipped with automatic water troughs, special lighting and wire platforms to insure sanitary conditions. Below, dismantling thermostatically controlled gas line





Once a week tractors pull skid-mounted shelters, feeders and watering troughs to fresh pastures in a matter of minutes. Right, a wooden guard is attached to the wings to prevent a turkey from flying over a fence

a little light and keep the turkeys calm and quiet. Sixty-watt bulbs can be turned on in the entire string of brooders by flipping a single switch. The stronger light is used to calm poults when a heavy storm comes up. Without light to reassure them, the young turkeys would run to a corner, pile on top of one another, and many would smother.

The poults stand on peat moss which is spread over the wooden flooring to absorb moisture and manure and make the houses warm and dry. Feeders and water troughs are set on 5 by 10-foot wire platforms to provide sanitary conditions.

Water under pressure is piped to the brooders, with float valves controlling the flow. When a day or two old, 12,000 poults drink about 72 gallons of water in 24 hours; six weeks later their daily capacity is over

1200 gallons. At maturity, the same turkeys drink 3000 gallons per day.

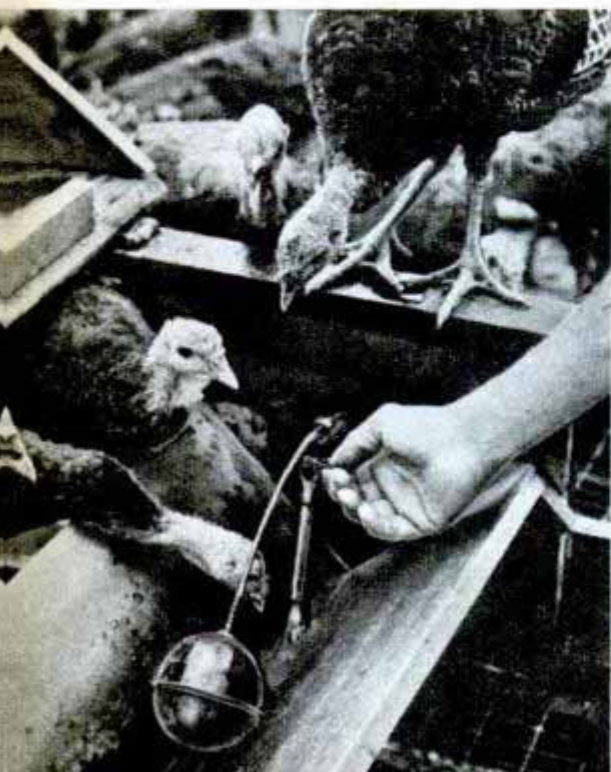
During the first eight weeks the poults are fed a starting mash which contains an abundance of vitamins and minerals. About 150 pounds of feed satisfies 12,000 poults the first day, but in 10 weeks it takes 5000 pounds daily to fill that number of birds. At fattening time, 12,000 pounds of feed disappear daily.

It's during the first six or eight weeks that Fox and his helpers really "mother" the little turkeys. Despite the safeguards of scientific equipment, the turkey raisers keep a constant watch over the brooder houses to see that nothing goes wrong.

The poults cost Fox 75 cents each and when they're a day old they weigh 1½

(Continued to page 256)

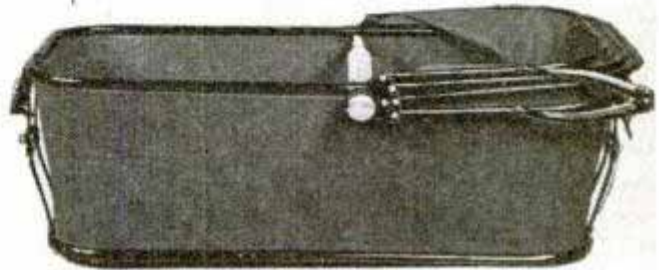
Float valves automatically regulate flow of water to troughs. Right, rubber-fingered mechanical feather picker





Bassinet Taken From Buggy Serves as Auto Bed

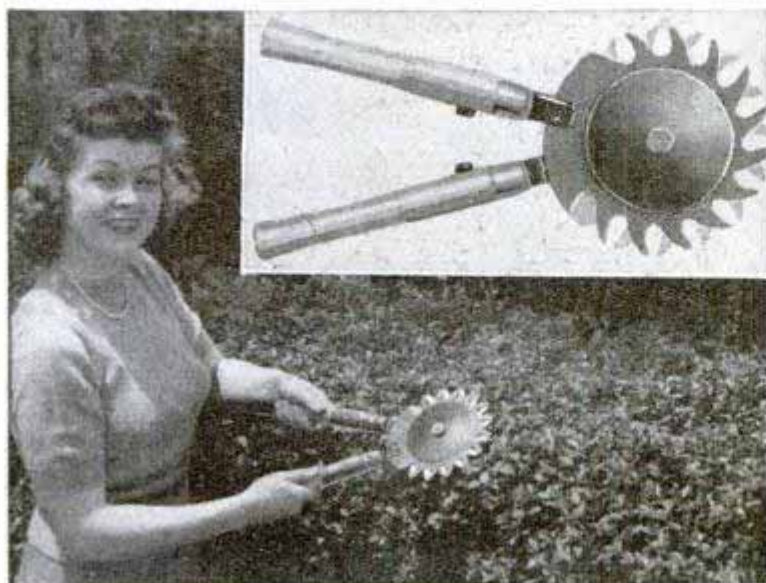
Baby can travel in comfort and safety in a double-duty bassinet which can be removed from the chassis of a baby carriage. It can be placed on a car seat to make a bed for the infant or it can be converted into a cradle or auto seat. It folds into a compact bundle small enough to store in the luggage compartment of a car.



Infrared Rays Made Visible by Adding Lead to Zinc Sulfide Phosphor

Infrared rays, normally invisible to the naked eye, now can be seen for short periods as the result of a discovery by Dr. Gorton R. Fonda of the General Electric laboratory. The discovery may lead to a simplification of the Army sniper scope and snooperscope, infrared weapons used by soldiers during the war to see without being seen. It also may simplify the receivers that are used on Navy vessels to read infrared signals from other ships. Dr. Fonda

found that when a minute quantity of lead is added to zinc sulfide and exposed to infrared rays, the rays can be detected by an increase in brightness. Zinc sulfide is a phosphor with qualities that make it glow after a light source has been removed. Dr. Fonda discovered that the minute quantity of lead makes the zinc sulfide phosphorescent when exposed to infrared rays as well as rays of other wave lengths. The rays can be seen in the afterglow of the phosphor.



Rotary Hedge Trimmer Has Teeth Like Saw

Rotary trimmers make fast work of keeping hedges cut back to the desired height and width. The cutters are sharpened easily by taking apart two blades and filing the teeth the same as saw teeth.

¶ Fastest between-stops schedule of any American passenger train is claimed for the Burlington's streamline Morning Zephyr, which travels the 54.6 miles between East Dubuque, Ill., and Prairie du Chien, Wis., in 39 minutes—an average of 84 miles an hour.



Fast action is vital in emergency. Phone number of sheriff's diving crew is posted in public booths



Alert radio dispatcher at WQMF relays the message and directs underwater crew to the scene of the accident

Law officers in Michigan are saving lives and foiling criminals by adopting deep-sea diving techniques

STATION WQMF calling diving crew . . . go to Huron River near Flat Rock . . . investigate a drowning."

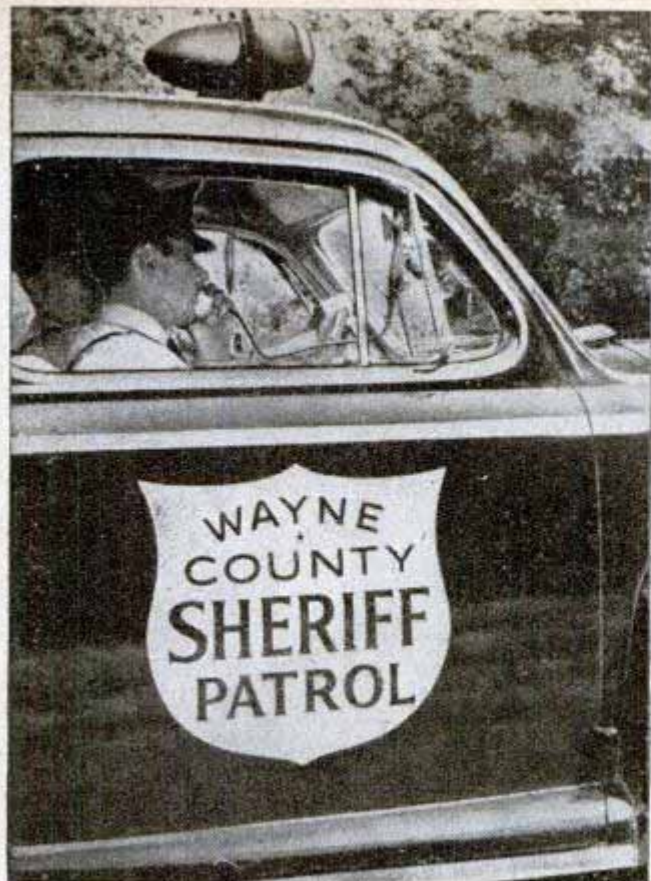
When such an order comes over the prowl car radio in Wayne County, Mich., deputy sheriffs race to the scene to begin rescue operations. They are organized in a diving and lifesaving team of "submersibles" unique among the nation's law enforcement agencies and ready for any underwater assignment.

The crew is particularly valuable during the summer when the number of drowning accidents increases. Sheriff Andrew C. Baird says that the ability of the divers to descend to the bottom of a lake or river to recover victims quickly is a great improvement over dragging and grappling methods used by most police departments. If a drowning person can be recovered soon enough there is always a chance that he can be revived. When a person's body becomes fastened or wedged beneath underwater obstacles it is impossible to locate it with grapples. Bad weather often interferes

with dragging operations but a diver ordinarily can work in inland streams during any kind of weather.

Because of the underwater division, Sheriff Baird points out, criminals are having a difficult time disposing of loot or weapons in Wayne County. Frequently, lawbreakers throw small weapons such as revolvers or knives into a stream, thinking that they cannot be found. The small size of such objects makes it particularly difficult to recover them by ordinary grappling methods. Divers using searchlights often locate them quickly in river bottoms.

Sheriff Baird believes the crew has an important duty to perform. Deputy Sheriff William Schwacha, a 25-year-old veteran who learned underwater work in the south Pacific, is in charge of the crew and is now training additional divers. Instruction covers all phases of diving from the proper method of underwater breathing to the correct way to handle air and communication lines when submerged. The officers also are taught how to avoid the bends and such



The call is received in prowler car by deputies trained in modern resuscitation methods



After last quick check on his equipment, officer is ready. Air compressor is portable so the diver can work anywhere

All water accident victims are given artificial respiration. If person is recovered in less than six minutes there is a fair chance to save a life





Trapped victims must be removed first. Then diver fastens salvage lines and wreckage is hauled to surface

hazards as nitrogen or oxygen poisoning.

The diving facilities have been made available to all law enforcement groups in Michigan. Display cards, telling how to call the diving service in an emergency, have been posted in prominent points in Detroit and other cities. Already word of the operation has spread. The crew recently flew to Cleveland to recover the bodies of persons killed in an airplane crash in Lake Erie.

The equipment consists of two Navy diving suits with telephone fittings. They are

suitable for use in almost any inland river and the Great Lakes. Each suit weighs 325 pounds. A compressor pumps seven cubic feet of oxygen per minute to the diver. A portable generator develops the power for the Pyrex sealed-beam reflector-type 300-watt lights used in underwater searches.

Plans are being made to emphasize the lifesaving function of the division. The deep diving equipment, with its rubberized suit, lead shoes and steel helmet, is too cumbersome for quick use in an emergency such as drowning. It takes several minutes

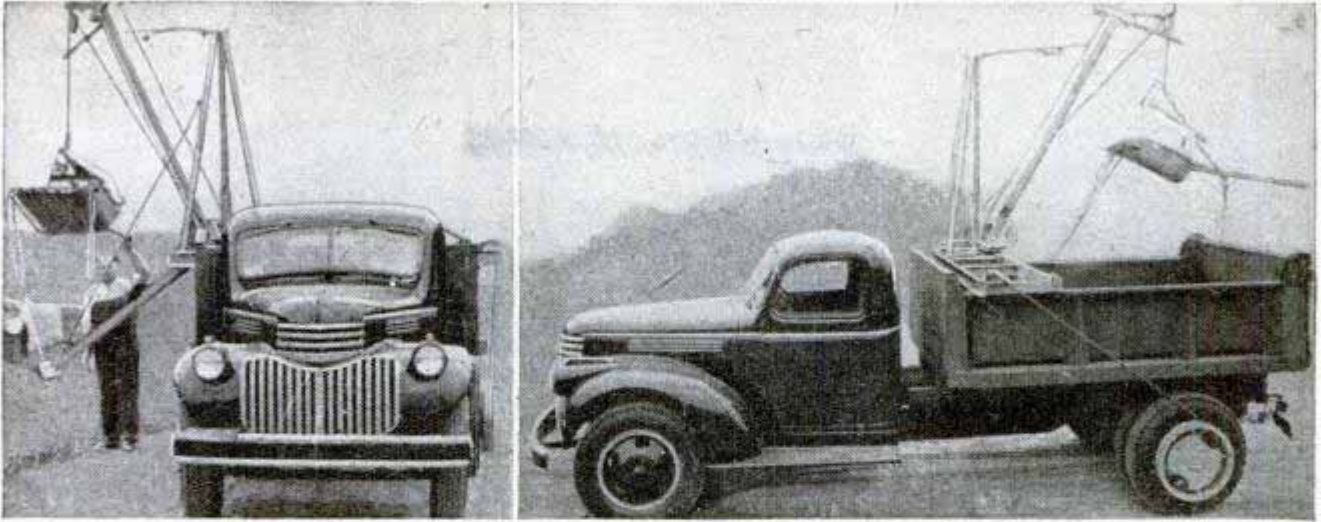
Sheriff's deputy William Schwacha starts mercy dive into Detroit River



to put it on and there is little chance of reviving a person who has been underwater as long as six minutes. Consequently the Wayne County officers have ordered a Lambersten amphibious respiratory unit designed for shallow water diving. It weighs only 25 pounds and can be adjusted quickly for use. While wearing it a diver can work for as long as 90 minutes at 60 feet or for 15 minutes at 100 feet below the surface.

When an emergency call comes in on a drowning, the diver in the sheriff's prowl car dons his suit. He can be ready for action in less than one minute. The other deputy in the car, also trained for just such a job, will be ready to apply artificial respiration.

Scraper-Loader for Dump Truck Hoisted by Backing Up



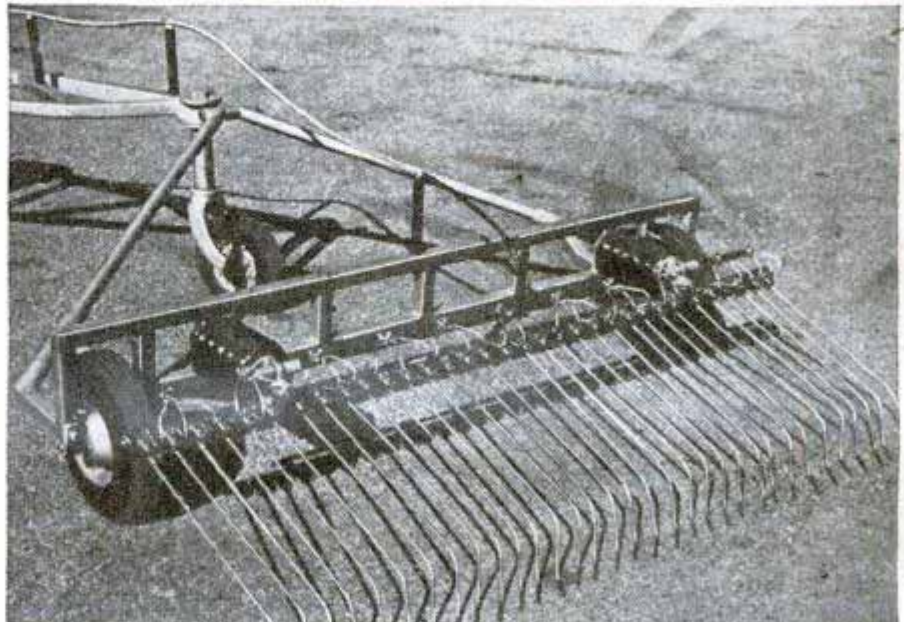
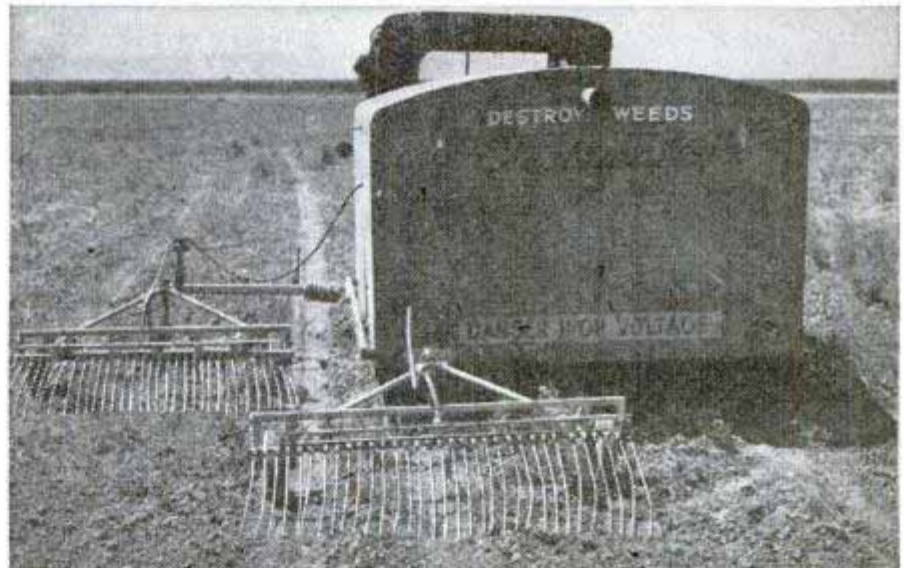
Two men operating a truck and scraper-loader which requires no power takeoff can pick up 25 loads of dirt per day — three times the average output of a driver and two men using hand shovels. The scraper-loader, adaptable to any standard dump truck, has a boom that swings out over

the ground from which soil is to be removed. When lowered into position, the scraper is pulled by means of a drawbar extending out from the truck. A cable attached to a winding drum on the left rear wheel hoists the load when the truck is backed and a trip line dumps it.

Electrocutor Rake Kills Weed Roots

Weed-choked farm lands are cleared for use by a machine that generates 12,000 volts to electrocute the weeds. The portable power unit is pulled by a tractor or a jeep, sweeping a 7½-foot path across weed-wasted lands. Attached to the power unit are rakes with copper electrode fingers. The fingers ride along the surface of the ground, striking the base of the foliage to sting the weeds to death. Even the root systems of deep-rooted perennials are affected by the electrical charge. Because electricity adds no ingredients to the soil, the treatment does not harm the dirt, neighboring crops or animals. From 10 to 15 acres of weed growth can be cleared in eight hours at a cost of \$10 per acre.

☛ The Soviet Steel Institute reports from Moscow the development of gold and rose-colored steel, applicable to decorative uses.



Infant Seat Ties to Chair Back And Is Handy for Travel



With an infant seat which ties to the back of a chair so that it rests at an angle, mother has no problem getting baby in position for feeding. It is also convenient in traveling, as it can be tied in place on an automobile or train seat. It is fixed at an angle restful for the baby because it allows him to lean back and relax. Easily carried, it weighs only three pounds.

Pocket-Size Ammeter for Batteries Requires No Wires



Batteries for photoflash synchronizers are tested by a small ammeter in less than a second. The battery is inserted in a slot which brings its positive and negative poles in contact with the ammeter's two contacts. The tester is sealed in glass and has an easy-to-read dial.

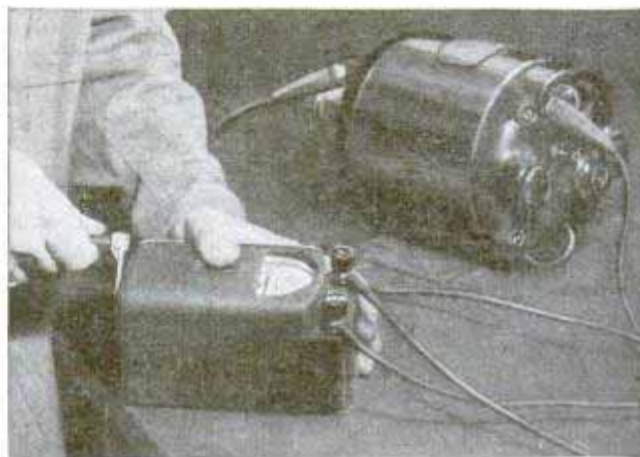
Midget Power Plants for Radios

Tiny batteries provide power for the radio transmitters in high-flying weather balloons. Developed by the Army Signal Corps, they are approximately four inches

long and 1½ inches wide. The "precharged" lead-acid batteries are vacuum packed in a dry state. They are activated by puncturing the container with a hollow steel rod which frees the acid. The container is opened by a key that winds up a strip below the top of the can. Excess acid is poured off and the battery is ready for use.

Tester Spots Electrical "Leak" In Wire Insulation

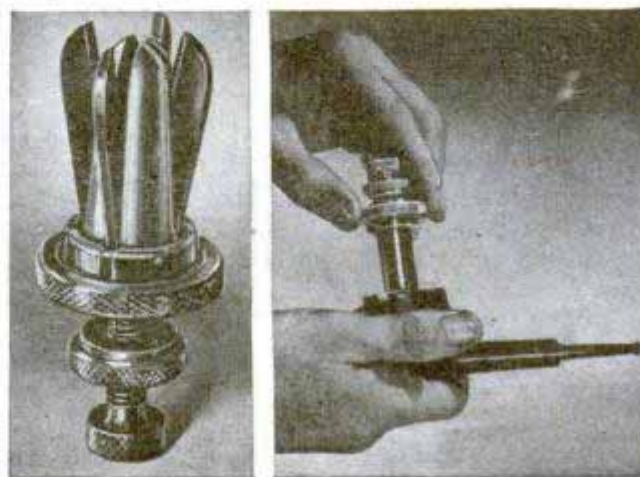
Impending breakdown of insulation that may force a costly shutdown of electrical equipment is spotted by an insulation resistance tester. The self-contained unit requires no batteries or outside source of power. It tests both alternating and direct current lines. The power is generated by turning a crank in either direction. If too much current is generated to obtain a

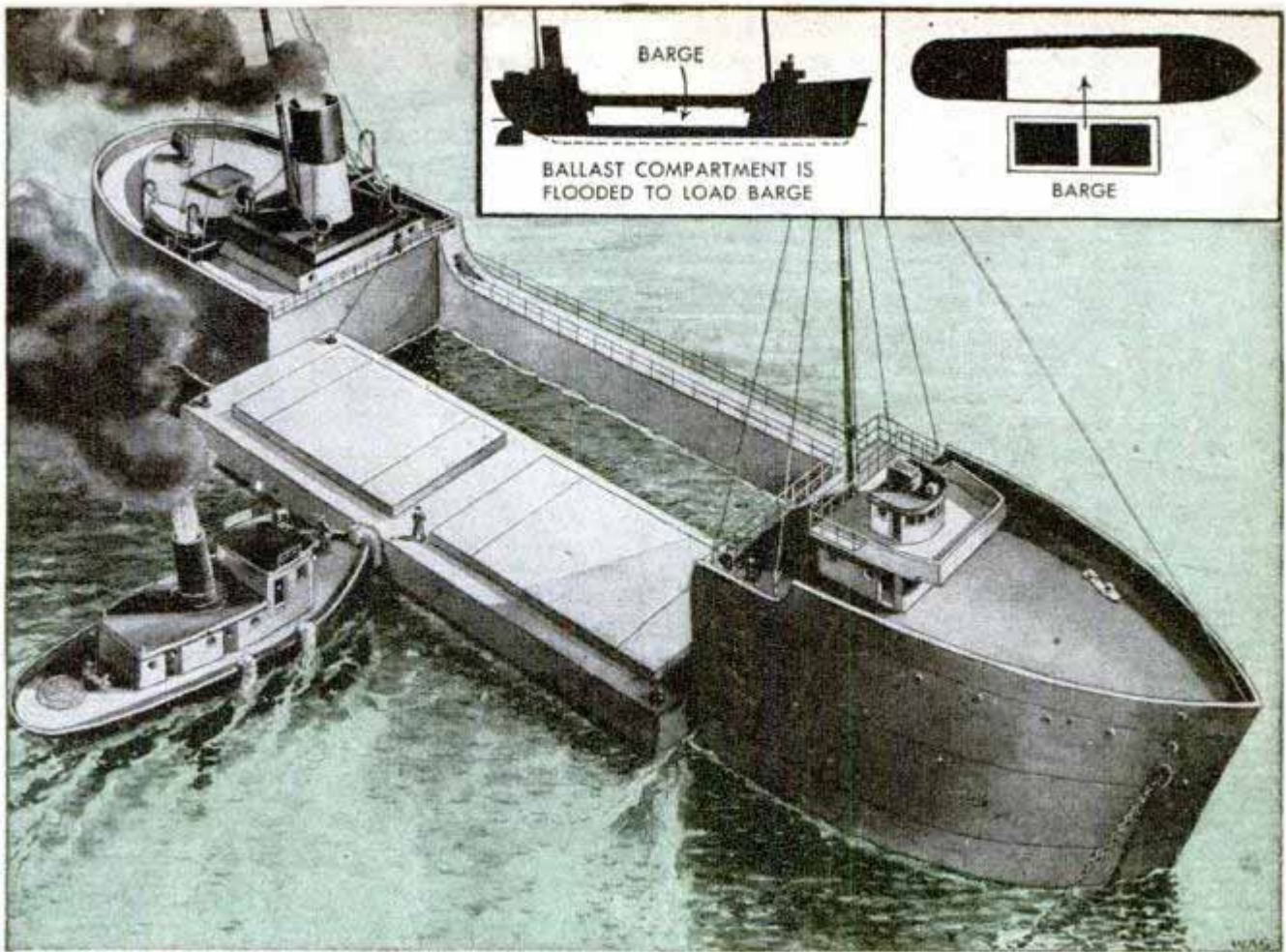


proper reading from the device, a regulator cuts down the voltage. Lights indicate the proper testing voltage.

Pipe Reamer Fits Any Size Bowl

Once an aluminum reamer is adjusted to fit the bowl of a pipe it can be locked to retain the proper size. The four reamer blades are expanded to fit any size pipe bowl by screwing down the adjusting bolt. A twist of the locking ring holds the adjusting bolt in place.





After a freighter makes port its immediate usefulness as an efficient ocean-

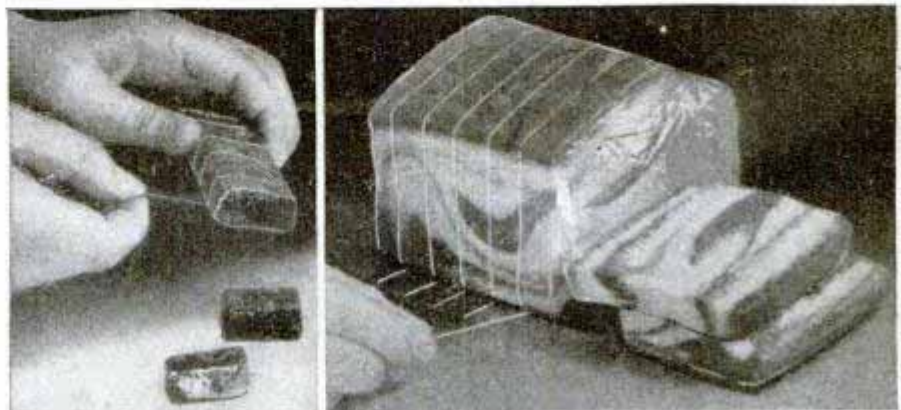
going carrier is done. Not until freight cranes and stevedores clear its holds and reload it with thousands of tons of cargo can it function again as a freight ship. Cargo is always carefully arranged for quick loading and unloading but if the number of idle days between voyages can be lessened, costs of water shipment probably can be slashed. One way in which this might be accomplished is through the use of sectional ships with removable cargo holds loaded or unloaded independently of the mother vessel. Patents have been granted for a

Removable Hold for Ships Floats Like a Barge

ship fitted with interchangeable barge midsections. In unloading, a ballast compartment in the double bottom of the ship is flooded. This lowers the ship in the water and the barge floats free. Then another barge, preloaded at the dock, is pushed into position by a tug. After the barge locking mechanisms are secured, the water ballast is pumped out and the ship floats normally with the barge as an independent but integral part. Such a ship, its designers say, is more seaworthy and capable of traveling at higher speeds than a tug and barge of equivalent tonnage. Engine rooms and crew quarters are located aft.

"Rip Cord" Wrapping Divides Food Products Into Equal Helpings

Strong thread embedded in transparent wrapping paper at regular, parallel intervals serves as an easy means of slicing the encased food product. To divide cheese, candy, cake or butter, a housewife pulls the "rip cord" near one end of the package. The thread knifes through the food and dislodges a serving.



NATURE FAKERS



Plaster-of-paris fish supported by metal rods, and reefs built up from real coral, serve as props for realistic underwater exhibit at Chicago Natural History Museum. Watery effect is produced by indirect lighting

LIKE Hollywood, natural history museums have learned the fine art of faking natural scenery. By the trial and error method they have gradually been able to make realistic facsimiles of rock, grassland, desert, water and sky.

Museum taxidermists have been making snow out of sugar (instead of cornflakes as Hollywood does) for many years. When sugar became scarce they tried salt, but it didn't work. The salt gathered moisture and eventually turned brown.

The earth you see in habitat cases isn't really dirt but plaster of paris colored to resemble dirt. Leaves, twigs and the bark

By M. J. Bauer of trees are made from wax, though solid wood and tree trunks may be original specimens. Grass is made by painting strips of celluloid green.

Stones and rocks are made from mesh wire, covered with a coating of plaster of paris and painted. When they are properly made they are based on molds of original rock made in the field. Sometimes asbestos is used to cover the stones, giving them a rough texture.

The background scenery is painted in. When the sun or the moon is desired in the scene, a dimmed light is placed behind oiled paper. Fire is imitated by using red tissue paper over a light bulb.

Artist (left) uses a sharp tool to mark veins on a giant lily pad for an Amazon River display (right). The hyacinth plants likewise are formed from wax, but celluloid strips painted green represent the grass

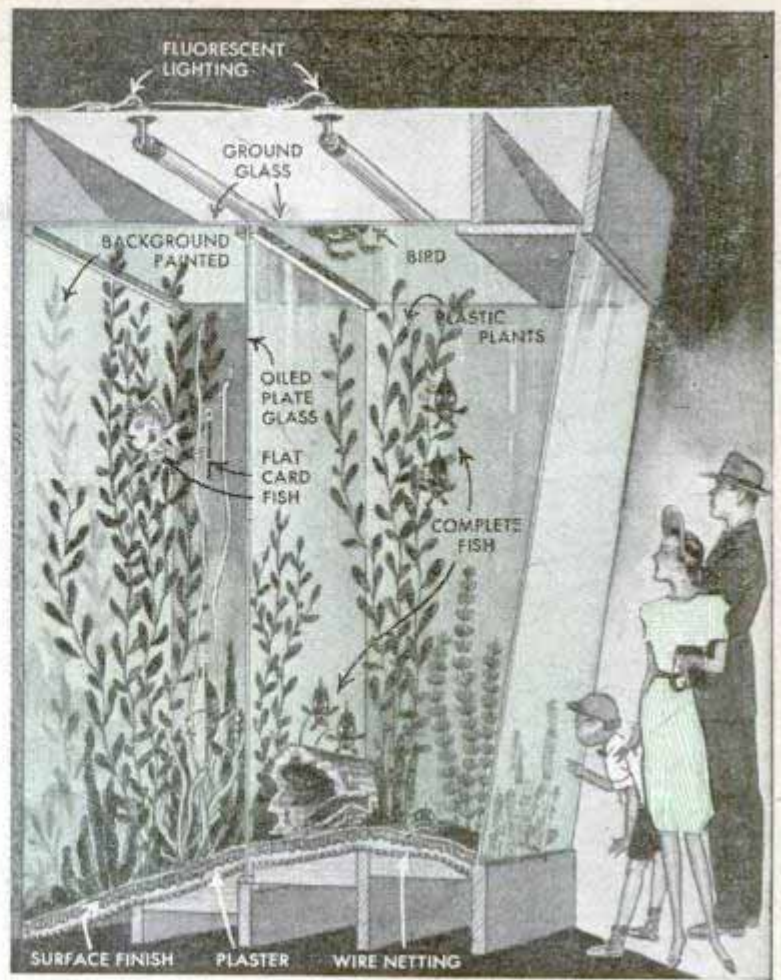


The most difficult element to fake is water. For a smooth pond or lake a sheet of glass is used with its undersurface painted to look like water. If the water is to look disturbed, the taxidermist first models in clay the ripples and waves he desires. A plaster mold is made of this. Hot gelatine colored to resemble water is poured into this mold. After the gelatine has set it is removed and is ready to be put in the exhibit.

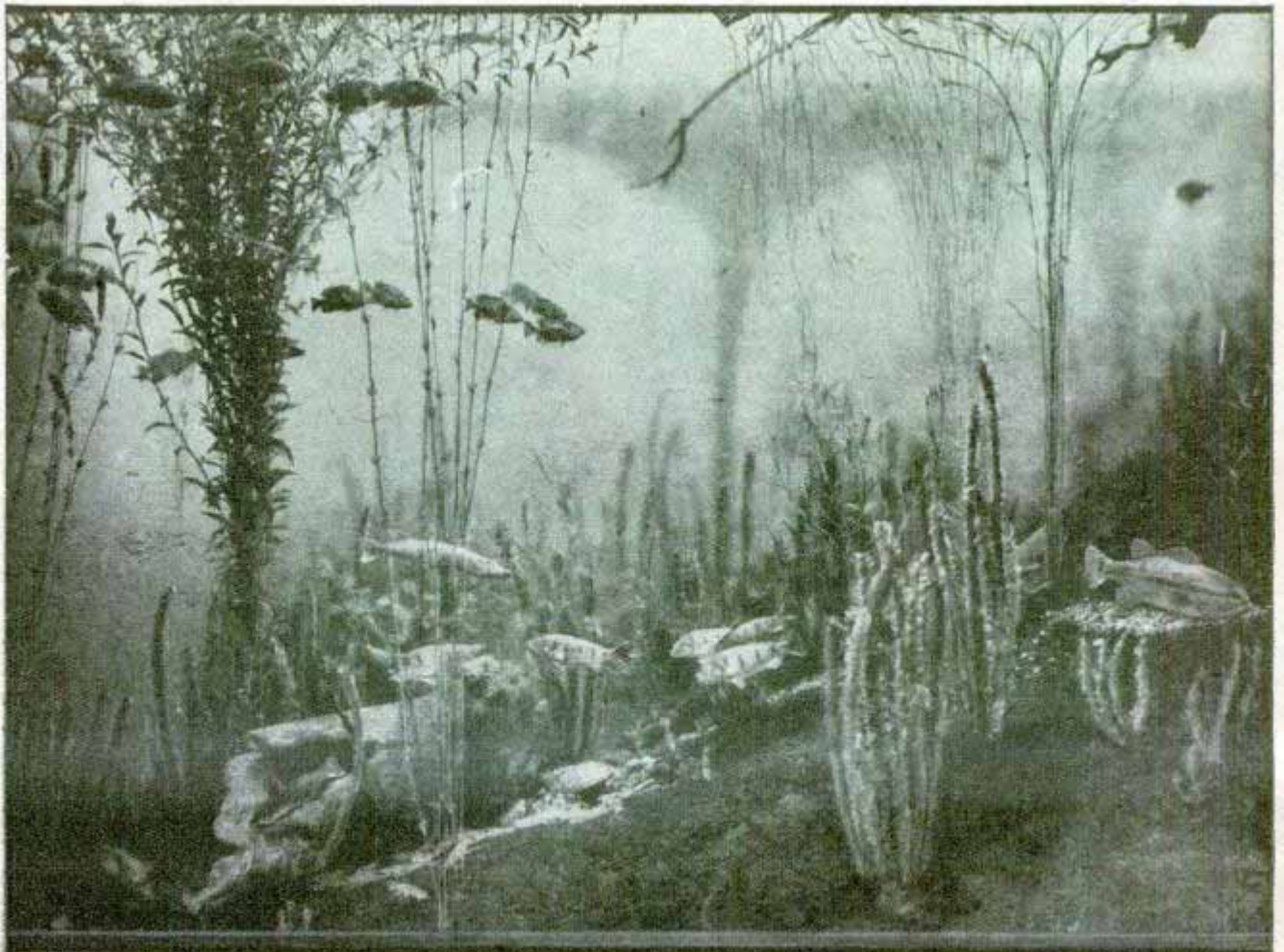
Most of the more striking underwater scenes, like those of tropical coral reefs, are of clear or deep water. This effect is achieved with nothing more than an intricate lighting arrangement. Black velvet is sometimes laid on the bottom of a case to give the appearance of depth.

The most difficult underwater scene to duplicate is that of water that is slightly muddy and where visibility is clear for only a couple of yards. Recently, the Chicago Natural History Museum wanted to represent a fresh-water lake bottom, typical of the midwest region. As lake bottoms are composed of soft mud and the water

(Continued to page 236)



Drawing shows how partition of oiled plate glass gives illusion of depth to exhibit below. Fish are of painted balsa wood





"Spark Plug" Power Spray Operates From Car

Pumping valves replace the first two spark plugs in an automobile engine and convert it into an air compressor to operate spraying equipment. The engine is reported unharmed by use of the valves which are designed so that gasoline or oil in the engine cylinders cannot enter the sprayer. The valves can be installed on any car of four or more cylinders. As a compressor they supply power for all kinds of spraying jobs.

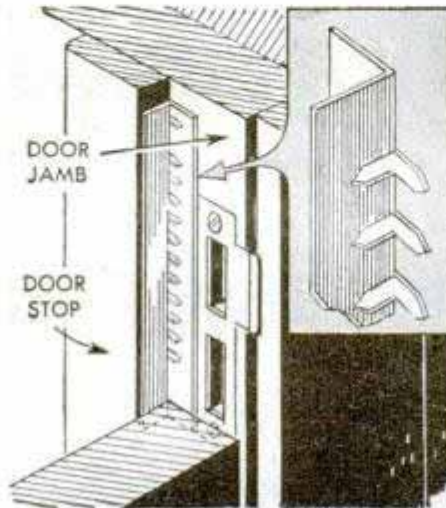
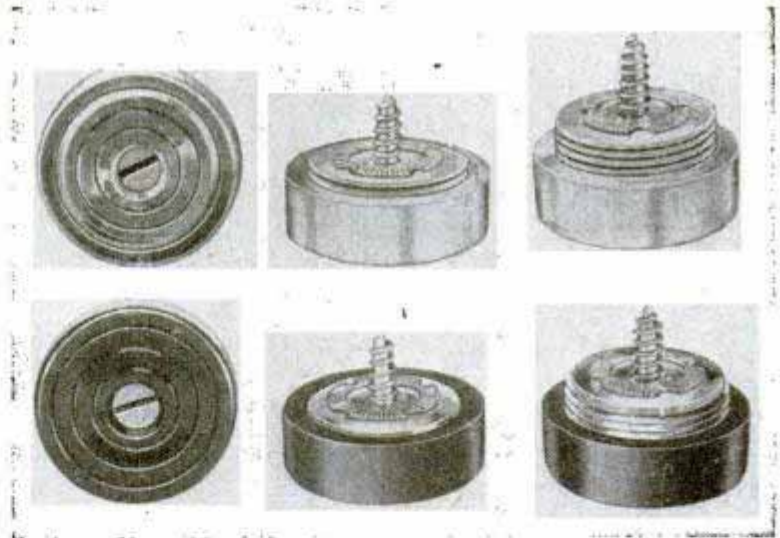


Guns Primed Electrically

Aerial guns fire faster with an electric primer developed by the Army and the Remington Arms Company. Serving as spark plugs for the cartridges, the primers are struck by the firing pin to set off the powder in normal shells. War-time primers consisted of a special mixture of powder in a small cup in the cartridge head.

Adjustable Plastic Gliders Stop Furniture Wobble

Adjustable plastic gliders will cure furniture wobble caused by uneven floors. They can be easily attached with a screwdriver and stay on permanently. They are self-locking but a slight downward pull unlocks them for readjustment to new positions. To blend with most furniture they are available in clear or mahogany colors. The gliders permit wide adjustments for furniture pieces that stand partly on a rug and partly on the bare floor.



Steel Latch Bolt Guard Protects Spring Lock

Prying back the catch on a spring door lock is virtually impossible when a thin steel guard is installed in the door jamb. Made of hardened metal, the guard is thin enough to be mounted in any door stop.

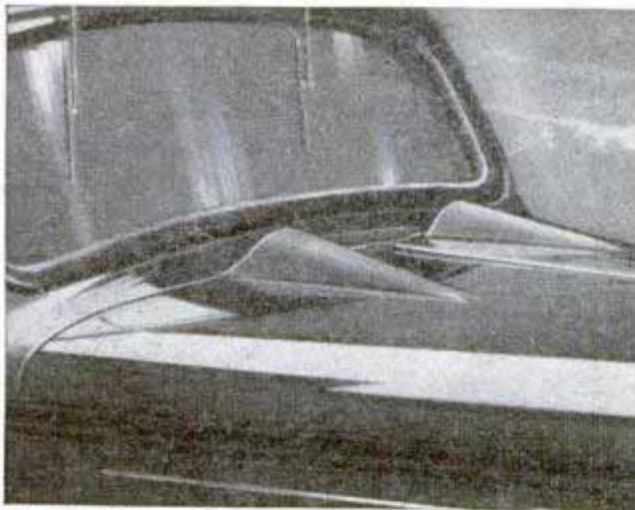
☐ An instrument which measures generator power was designed by Westinghouse engineers to shave 59½ ounces off the total weight of a 65-ton B-29 Superfortress.

Flashing Dot on Traffic Signal Tells Time Left Until Change

Pedestrians who hesitate to cross a busy intersection because they don't know how much time remains before the green light will change are given a break by a new traffic signal. The signal is a large disk with the customary red "stop" and green "go" illuminated at intervals in the center. A dot of light travels around the edge of the circle in the same way a second hand passes around the face of a watch. When the dot reaches the top of the disk the signal changes. By watching the dot the pedestrian or driver is able to judge the time remaining before the change. The signal was invented by John Kluesing of Niles, Ill.

De-Icing Vents in Car Hood Keep Windshield Clear

De-icing vents attached to automobile hoods keep windshields clear by making use of heat from the engine and radiator. The heat is blown by the engine fan into two streamlined vents. The openings just



below the windshield distribute the heat evenly to prevent moisture from freezing. As an added advantage, the vents aid in dissipating the heat of the motor. They can be attached easily to any car.

Air Pumped Into Polluted River Hastens Purification

By pumping air into polluted rivers the flow distance a stream requires for the oxidation of waste materials is shortened considerably. Successful tests of the method have been made on the Flambeau River at Park Falls, Wis. A ton and a half of oxygen was pumped into the stream daily.

☐ Carbon dioxide, the soda-water gas, is now used as an anesthetic for insects while they are subjected to microscopic surgery in certain types of research.

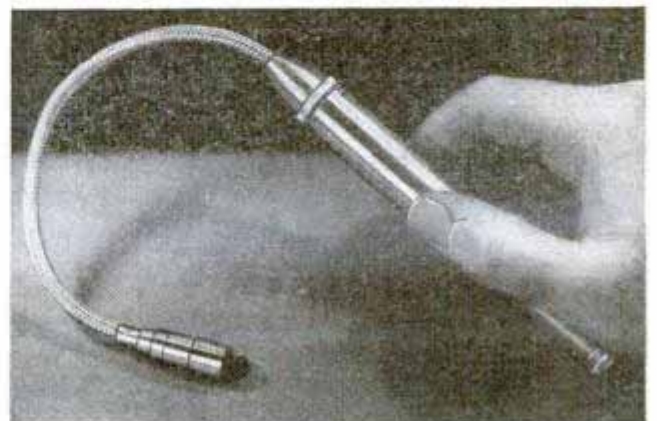


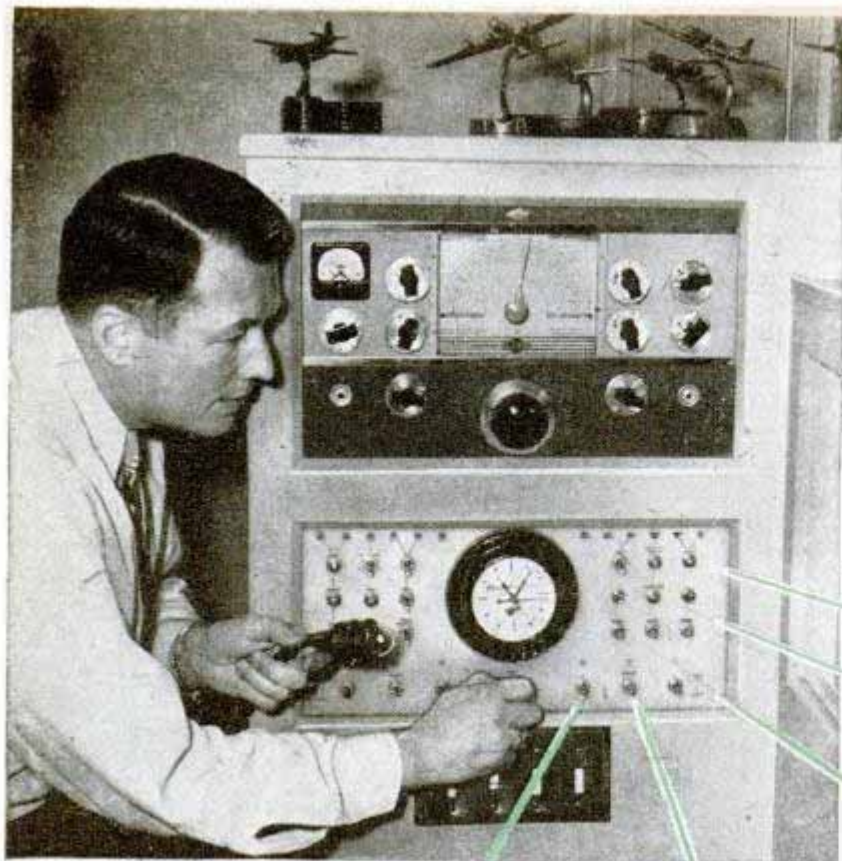
Radio "Net" Uses Miles of Wire

Radio—the so-called wireless medium—actually requires 95,000 miles of telephone wires for coast-to-coast broadcasts. This network of wire is used to carry the programs to the stations in the various key cities. On reaching the city, more wires are needed to convey the program to an outlying transmitter. From the transmitter the radio program goes on the air for the first time and is picked up from there by your home set.

Flashlight on Semiflexible Cable Lights Hard-to-Reach Spots

Mounted on the end of a semiflexible cable which will retain the shape into which it is bent, a small flashlight provides sharp illumination in confined quarters. It was designed as an aid to auto mechanics and radio repairmen. The aluminum case is six inches long and holds two standard penlite batteries. The cable and socket extend nine inches beyond the end of the case.





With his magic control board this Houdini of the hookups brews remote control coffee from his bed and warms his shoes with an electric current

Here's the switchboard that performs odd jobs around the Ellinwood home. At top of opposite page, the inventor works in front of vanishing alcove in his den. At bottom is pneumatic diving board

OPENS WINDOW

TURNS ON
ELECTRIC
GRILL

STARTS
FURNACE

The House That's Run by

GHQ at the residence of Ray Ellinwood, Los Angeles manufacturer, is a bedside pushbutton board. He can open or close the bedroom windows, draw the bedroom curtains and turn on the electric grill in the kitchen to make coffee without leaving his bed.

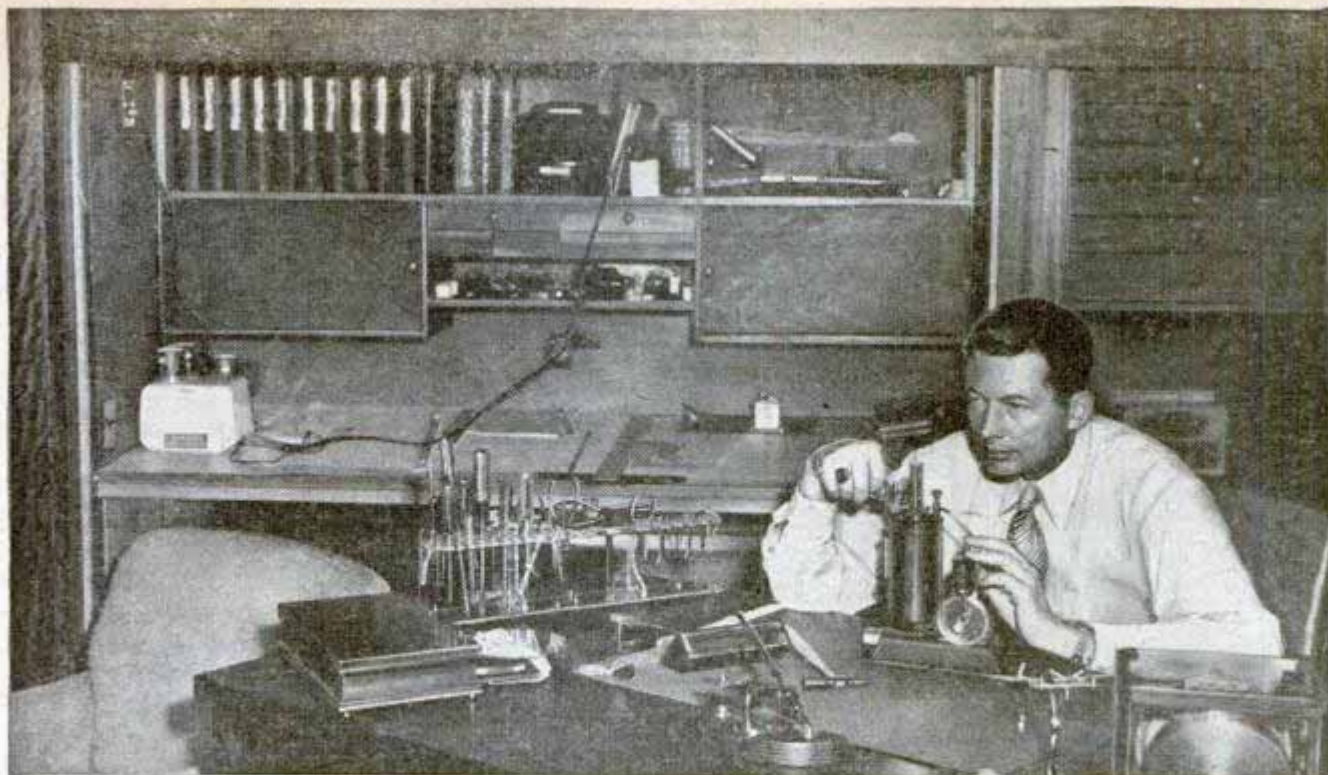
From the control board, too, he operates his garage doors and switches on the residence furnace or an electric heater in the bathroom. Still another switch turns on an electric shoe warmer before he arises.

The board controls standard-wave and short-wave broadcast receivers, an automatic phonograph and a microphone for cutting records. All switches may be operated manually or be preset through an electric clock to turn any circuit on or off at a predetermined time.

Recessed behind his bed are a telephone, house interphone, fluorescent lamp and "Steno-corder" dictating machine. Powered by house current or batteries, the "Steno-corder" preserves speech on small nonbreakable acetate records for future transcription by a secretary.

An inventor and manufacturer of aircraft control mechanisms during the war, Ellinwood has put a number of automatic control circuits to work around his house.

Water shoots automatically from his lawn sprinklers late in the afternoon and stops a half hour later. His garage doors open automatically when his car passes over a magnetic coil buried in the driveway. Any other automobile can operate the garage doors, however, if it is started while standing over the coil. Ellinwood is curing that

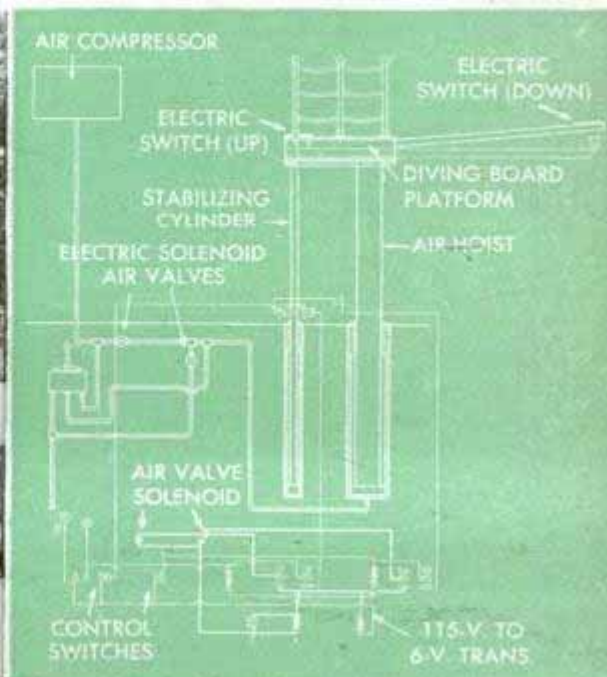
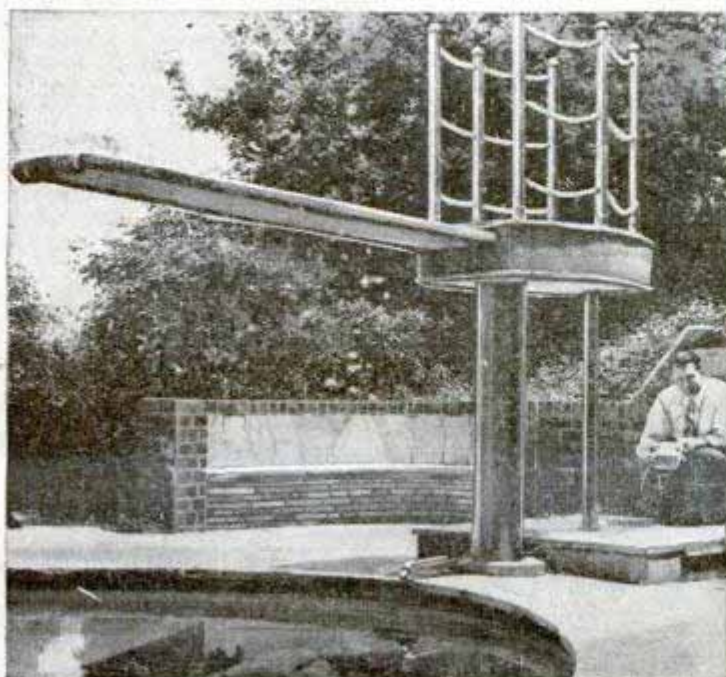


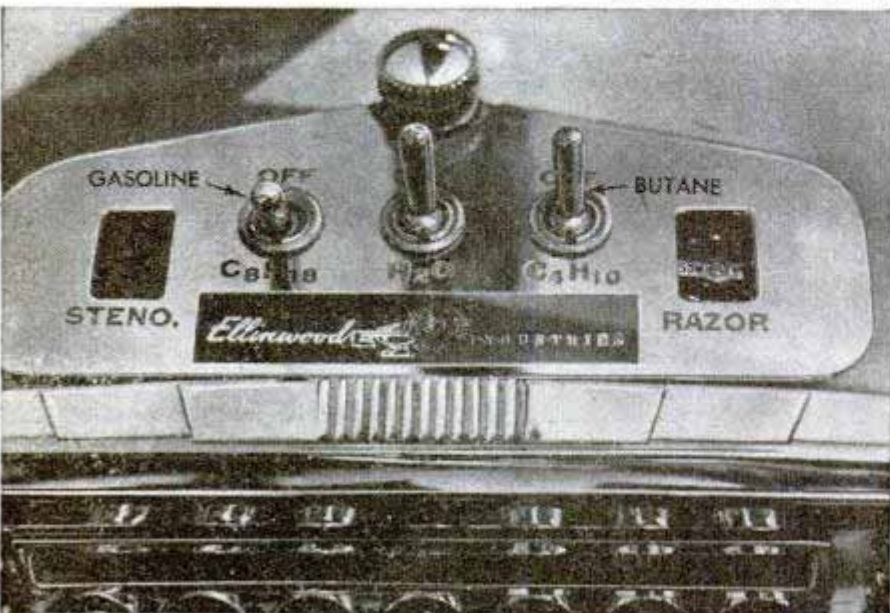
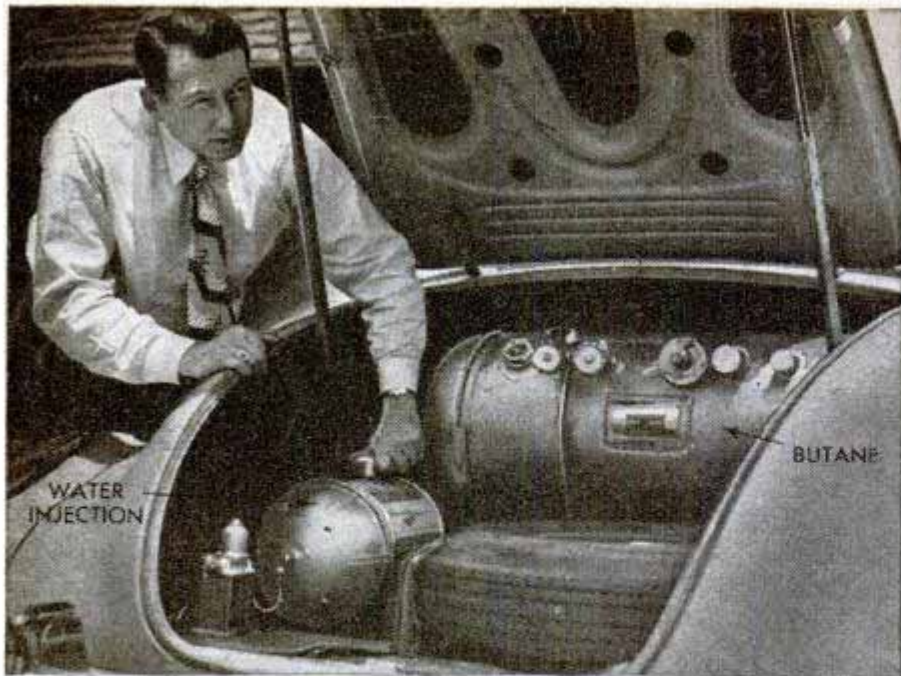
Pushbuttons

by making the garage doors operate only in response to a supersonic signal he is installing in his car.

There's no doorbell at his front door but chimes ring automatically when you approach the threshold. A "black light" infrared beam across the entrance takes the place of the doorbell button. The infrared circuit can also be connected to a concealed microphone and phonograph recorder to make records of conversations at the doorway.

His den, which he uses as a part-time office, has a paneled wall that rises out of sight when he pushes a pressure switch beneath the rug. In





When his visitors cross an infra-red beam, the door chimes ring

the alcove behind the wall are a reference library, drafting board and other tools for developing ideas.

One of his recent innovations is a pneumatic diving board for his private swimming pool. Normally the board and platform rest at ground level beside the pool. When the diver stands on the platform and presses a switch with his foot the board and platform rise to "high board" position. They are lowered automatically to the ground again when he dives from the end of the board. His last step at the tip of the board operates another switch. Ellinwood's pneumatically operated diving board is built almost entirely from the parts of a standard hydraulic automobile hoist.

Tanks for butane and water injection give extra power to his car

In his car Ellinwood has a special overhead window for watching planes. A special panel on the instrument board has a plug-in for the "Steno-corder" as well as a plug-in for an electric shaver. Between these two outlets are switches for changing his fuel from gasoline to butane and for applying water injection to his motor when he wants a burst of extra power.

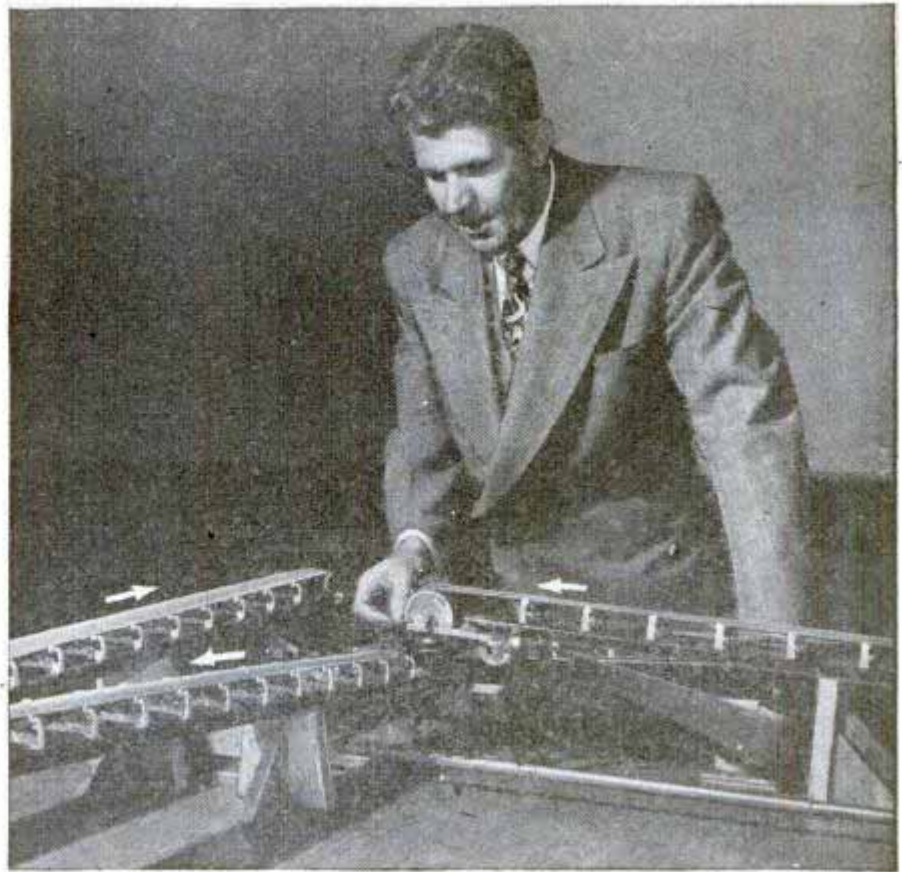
← Inventor can dictate letters while driving
↓ Panel on dashboard has injection switches and electric razor outlet

Garage doors open automatically when car crosses magnetic coil



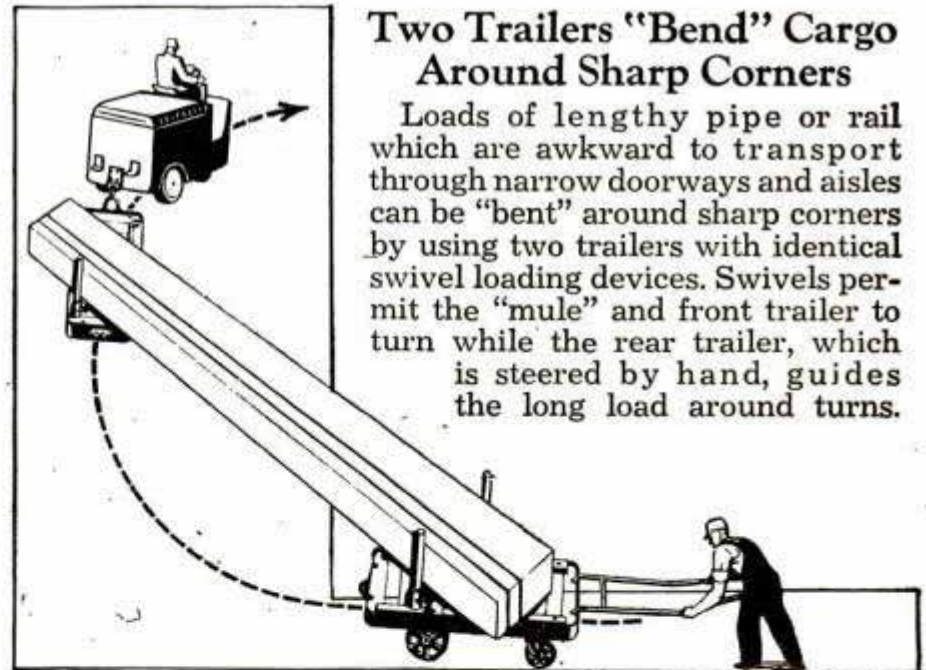
Two-Direction Conveyor Belt Carries Load on Return Trip

Twice as much work is accomplished by a two-way conveyor belt that brings back a load of material on its "return run." A table-top model of the belt built by Goodyear Tire and Rubber Company demonstrates its operation. The top cover of the conveyor moves bulk material in two opposite directions at the same time. The new belt's principal application is in the steel industry where ore can be hauled in and slag taken out at the same time.



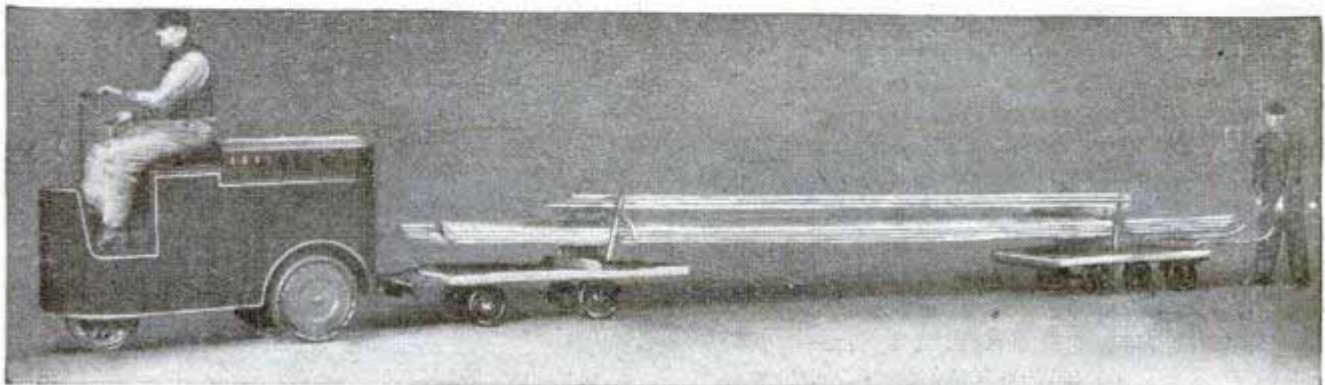
Nazi Sub 'Cushions' Fooled U.S. Spotters

Some Nazi submarines eluded American sonar-radio-buoys and other detection devices, it is now revealed, because of special rubber mountings cemented to steel machinery. These "cushions" prevented vibrations and eliminated telltale sounds. Two methods of bonding rubber to metal were used. In one, cement was applied directly to degreased and sandblasted steel and was employed for pieces to be used in compression. In the other, steel first was brass-plated and then the cement applied, a method suitable for mountings subjected to shear or torque. Cement formulas and details can be obtained from the Offices of Technical Services, U. S. Dept. of Commerce, Washington, D. C.



Two Trailers "Bend" Cargo Around Sharp Corners

Loads of lengthy pipe or rail which are awkward to transport through narrow doorways and aisles can be "bent" around sharp corners by using two trailers with identical swivel loading devices. Swivels permit the "mule" and front trailer to turn while the rear trailer, which is steered by hand, guides the long load around turns.



Portable Fluorescent Light Spreads Beam Over Half Circle



In contrast to a flashlight, illumination from a portable fluorescent light spreads over a 180-degree area. The unit weighs seven pounds complete with the B-battery which provides the current. It uses a standard six-watt fluorescent tube. The life of the battery is approximately 30 hours of continuous use and the fluorescent tube will last about 1000 hours. Fingertip control switches are located directly under the handle of the case.

Temporary Nonrust Coat Saves Metals in Shipment

Metal parts are protected against rust, corrosion or salt water during shipment by a temporary coating that can be removed by washing with gasoline. The mixture of wool fat, China wood oil, resin and white spirits was devised by the Germans. It has been made available by the U. S. Department of Commerce.

Pint-Size British Motor Bus Travels at 25 Miles Per Hour

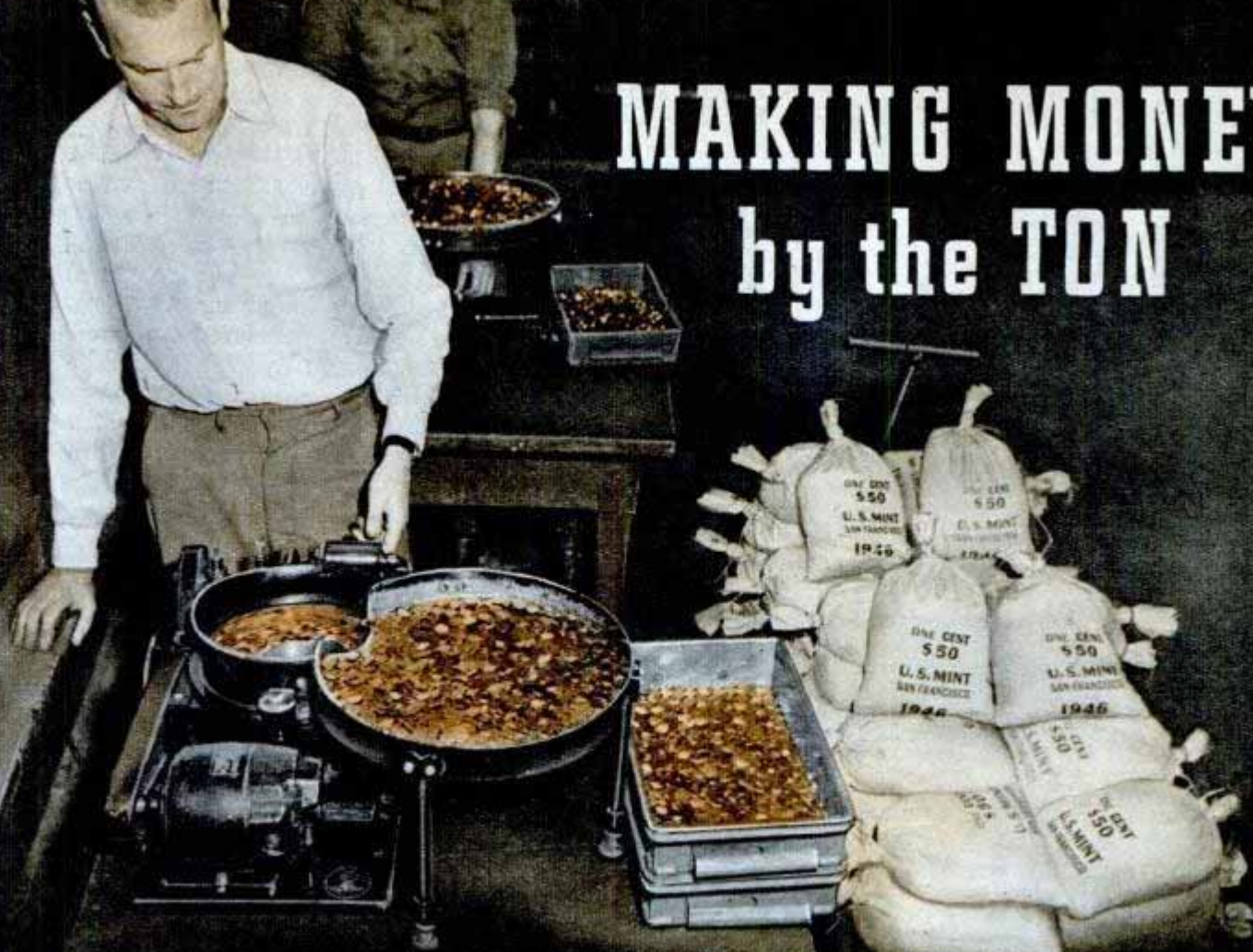
Only eight feet long and two feet wide, a midget motor bus built by a former British soldier is powered by a one-horsepower gasoline engine. The toy-size vehicle attains speeds up to 25 miles per hour and travels 60 miles on a gallon of gas. Approximately 1000 children paid their fares to take rides in the little bus during one day in Brighton, England.

Vacuum Leak Detector Uses Helium as Tracer

Tiny leaks in vacuum tubes are indicated by the "leak detective," an instrument which spots leaks so small that 15,000 years would be required for the contents of a quart bottle of air at atmospheric pressure to pass through such an opening. The instrument, developed by General Electric engineers, makes possible improved methods of obtaining the "high vacuum" necessary for more efficient radio, electronic and X-ray equipment. Using helium as a tracer gas, the instrument will detect the gas in a vacuum system in about one second.



MAKING MONEY by the TON



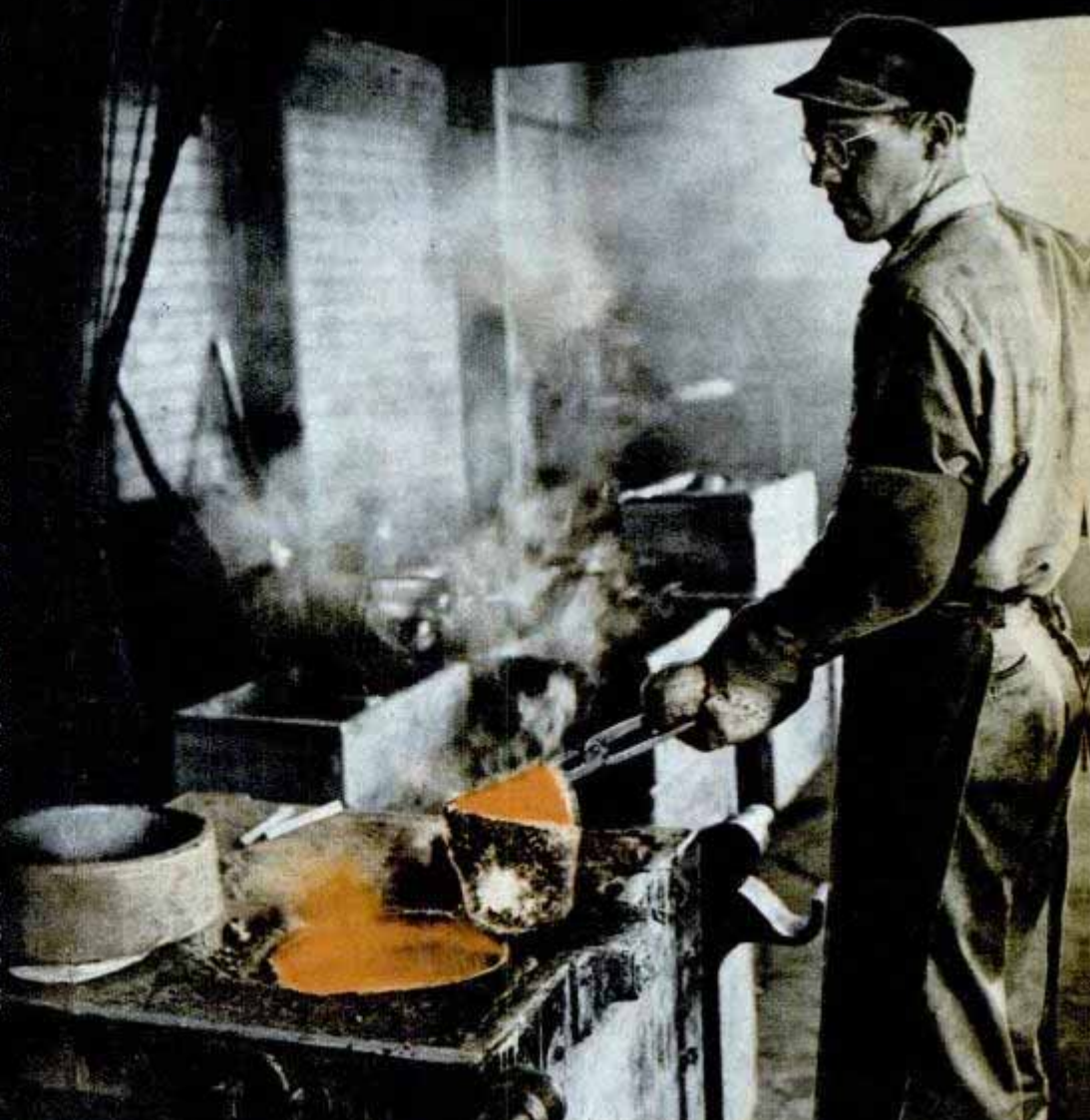
Machines unerringly count 5000 pennies for each bag. Below, sampling the white-hot alloy for silver coins

Forty-seven thousand tons of money! Whoever dreamed of a treasure trove like that?

It exists. In fact, you have part of it in your pocket. That enormous tonnage is the weight of the small change that America uses in its everyday transactions.

We require some \$1,300,000,000 worth of metal coins for running our dollars and cents economy. Your per capita share amounts to a double handful of coins worth a few cents more than nine dollars, of which \$2.23 is in pennies and nickels and almost six dollars is in dimes, quarters and half dollars. There aren't quite enough silver dollars to go around, so your share amounts to 99 cents.

Maintaining this supply of money is a tremendous task. The demand for coins is always increasing





Dual-strike presses like these turn out 80,000 coins daily, with silver dollars requiring four times more pressure than pennies



Copper blanks soon to be pennies get "squeezed" in device above to give them thick edges, vital for long wear. Weighing machine, below, checks coins to be sure they are within legal tolerance



and, too, replacements must be provided for the coins that wear out or are otherwise lost from circulation. This is the task of the United States Mint Service, under the supervision of Nellie Tayloe Ross, director of the mint. The service operates the central mint at Philadelphia as well as two others at Denver and San Francisco.

During the war the mints worked three shifts a day, for we were manufacturing money for half the world. Pennies and shillings for Great Britain, annas and rupees for India and centavos and pesos for Colombia, among others, were provided by the United States during the time the foreign mints were busy on special war jobs.

Mints can run short of money just like the rest of us. Recently Neal H. Callaghan, superintendent of the San Francisco mint, found that he was almost out of pennies. There were only a million and a half one-cent pieces on hand. Sales taxes and an increase in the price of cigarettes had created a run on the copper coins. Callaghan at once put all his presses to making one-cent pieces, at the rate of 1,000,000 per day. Finally a backlog of nearly half a million dollars worth was built up.

Pennies are in greatest demand today, and least wanted are silver dollars. Twenty years ago in most parts of the West you were apt to receive 19 hefty silver dollars as change when you offered a \$20 bill in payment for a dollar meal. Gradually the convenient paper silver certificates became more popular and now the San Francisco mint issues only about 5,000,000 silver dollars per year. Many of these go to Nevada for use as gambling chips.

The next time you inspect a silver dollar it's quite likely that you will find it appears to be brand new and yet is dated 1878 or 1880 or some other year late in the last century. It's the old-style dollar, in mirror-bright mint condition. This oddity is due to the fact that for a long time the mints were required by law to manufacture more dollars than were actually needed. Now they draw on their old stocks.

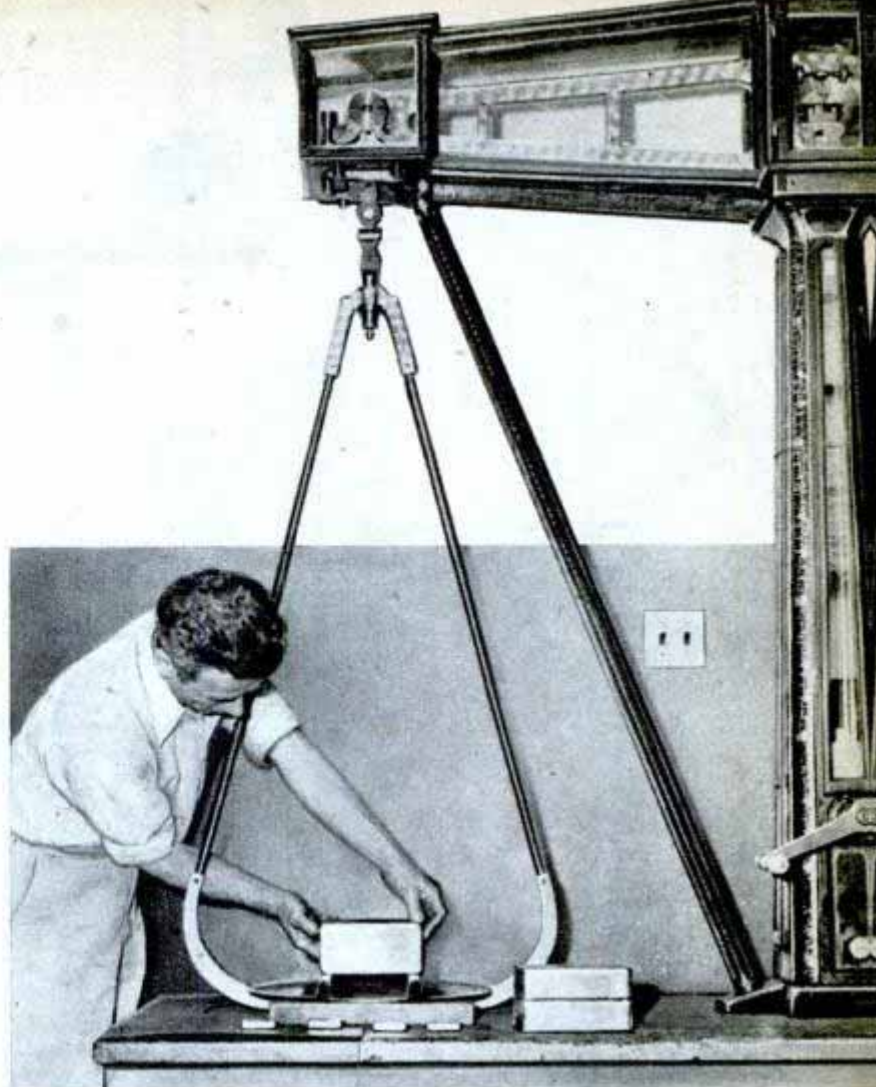
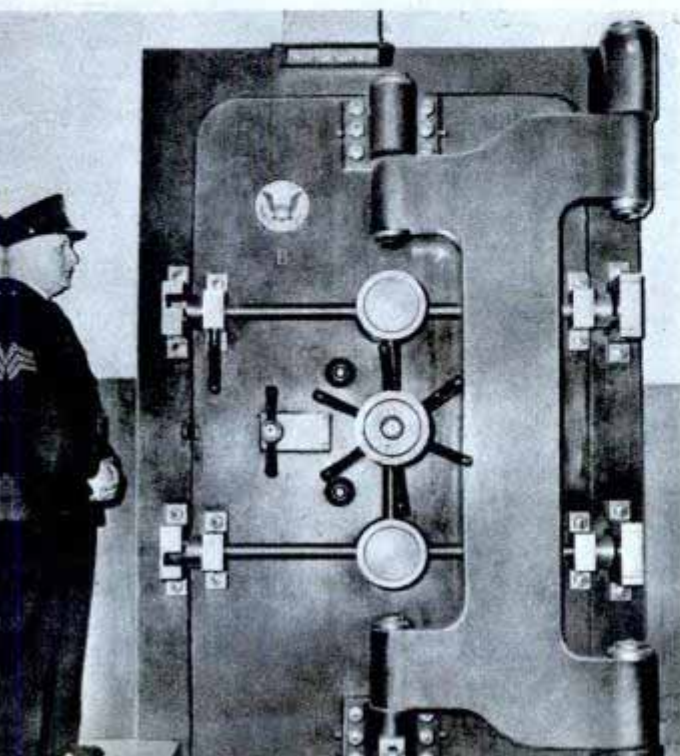
United States silver coins contain nine parts of pure silver and one part of pure copper. Copper

improves the handling and wearing qualities of the coins. One-cent pieces contain a small amount of zinc for the same reason. Coinage of the wartime zinc and steel one-cent pieces ended in April 1945. The face value of any coin usually is far greater than the value of the metal that it contains, the difference being a seigniorage charge that is made by the government for producing the coin.

The wartime five-cent piece is unique in this respect because it contains just about a nickel's worth of bullion. Nickels that were coined before the war and those coined since April 1946 consist of 75 percent nickel and 25 percent copper. That's the standard alloy. But nickel was needed for other purposes during the war and so a different alloy was adopted, consisting of 35 percent silver, 56 percent copper and nine percent manganese. The manganese provides the electrical conducting property needed for operating coin machines. At the price of 90 cents an ounce for silver the silver in a wartime nickel is worth just about five cents. These coins are identified by a slightly brassy appearance and a large mint mark initial over the dome of Monticello on the reverse side.

Although gold coins have been withdrawn from circulation the mints still buy gold and also sell it to licensed dealers for such uses as dentistry, jewelry manufacture and the miscellaneous needs of industry. Gold that is to be placed in storage is melted, stirred and cast into 400-ounce bars that measure $1\frac{3}{4}$ by $3\frac{1}{2}$ by $6\frac{1}{2}$ inches. This is the so-called standard certificate bar that is used in international trade. Each bar is worth \$14,000.

For added protection, part of the concrete floor has to be lowered before the vault door can open



Checking the weight of a 400-ounce gold certificate bar worth \$14,000. Below, cleaning the electrodes of the power unit that operates the mint's electrostatic air cleaners





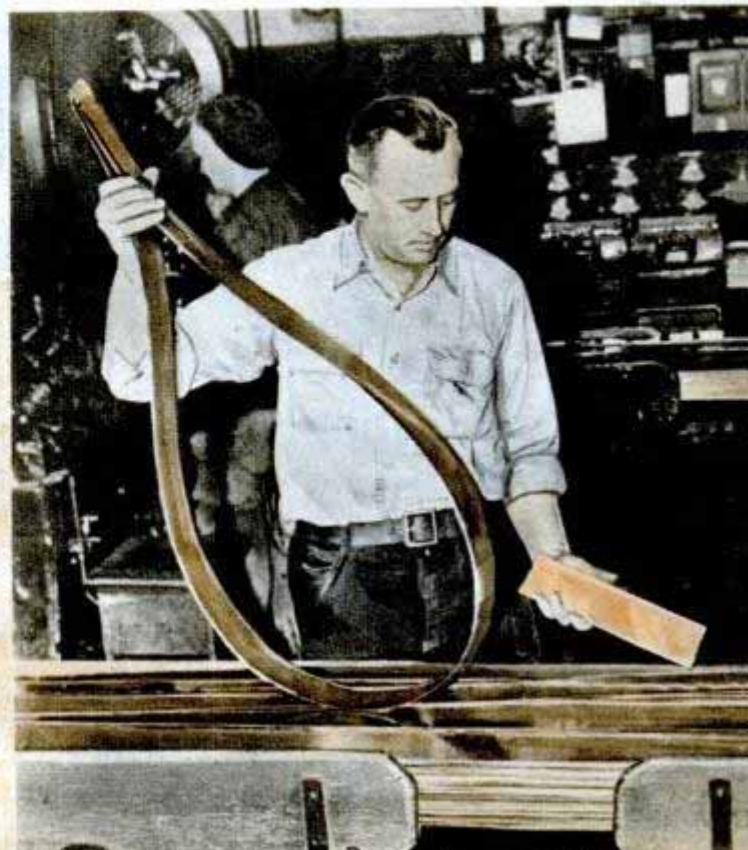
Making money for the public is simply a manufacturing process at the mints. When the San Francisco mint needs pennies, for example, the melting and refining department first weighs up batches of metal in the proportions of 950 parts of copper to 50 parts of zinc. The weighing is done on a huge balance or beam that has a capacity of 10,000 ounces and is accurate to within $\frac{1}{100}$ ounce.

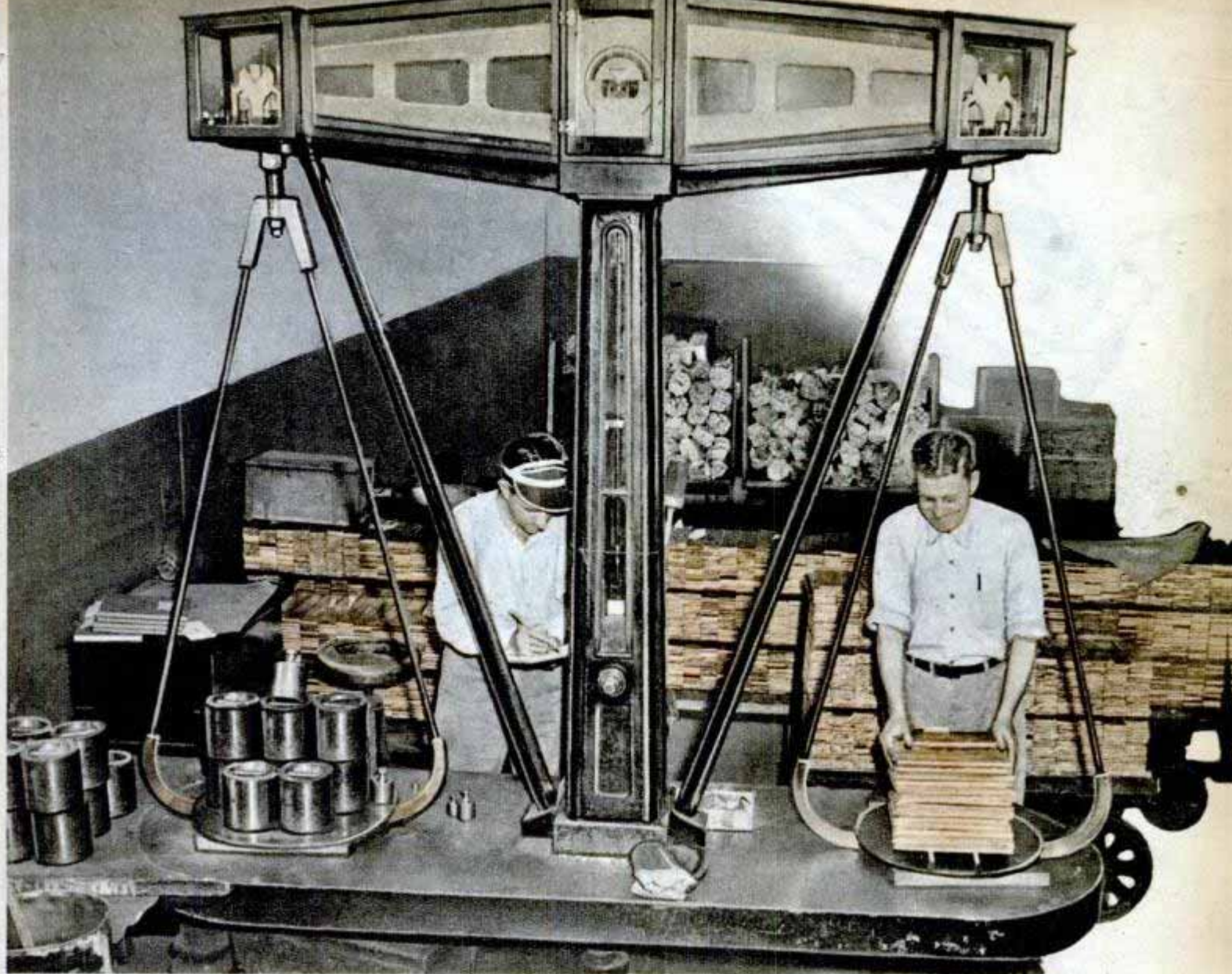
Each batch of the two metals is melted in an electric furnace, thoroughly stirred and then cast into bars that are $\frac{1}{2}$ inch thick, $3\frac{1}{8}$ inches wide and 13 inches long. Each melt is sampled twice and assayed to make certain of purity and percentages.

The bars then go to the coinage department. Here each bar is run through a series of rolls that reduces its thickness to $\frac{48}{1000}$ inch and stretches it into an 8-foot-long strip of metal. These strips then are fed into punch machines that punch out four blanks at a time, 500 blanks for one-cent pieces from every strip. The clippings left over are remelted.

The punching process hardens the copper blanks and so the next step is to soften

Silver bullion is melted down, refined and poured into form until needed. The eight-foot strip of copper and zinc below, rolled from a short slab like the one in the other hand, will provide blanks for 500 pennies





Weighing 5700 ounces of pure copper to be used in making one-cent pieces. Below, hopper in front of each press stacks coins and feeds them into place between dies, where designations are struck upon them



them in an annealing furnace. Then they are washed in abrasives and soap chips to remove the discolorations of annealing, rinsed, and dried in hot air centrifugal driers. From here the blanks go to a milling room where they receive a squeeze treatment that increases the thickness of their edges. Raised edges contribute to the wearing quality of a coin. At this stage all blanks that have been bent or damaged are culled out. Next the blanks are taken to the press room.

The San Francisco mint has 18 automatic high-speed presses. Each can be set to deliver 40 tons of pressure, needed for striking one-cent pieces, or they can be adjusted to produce as much as 160 tons of pressure for striking silver dollars.

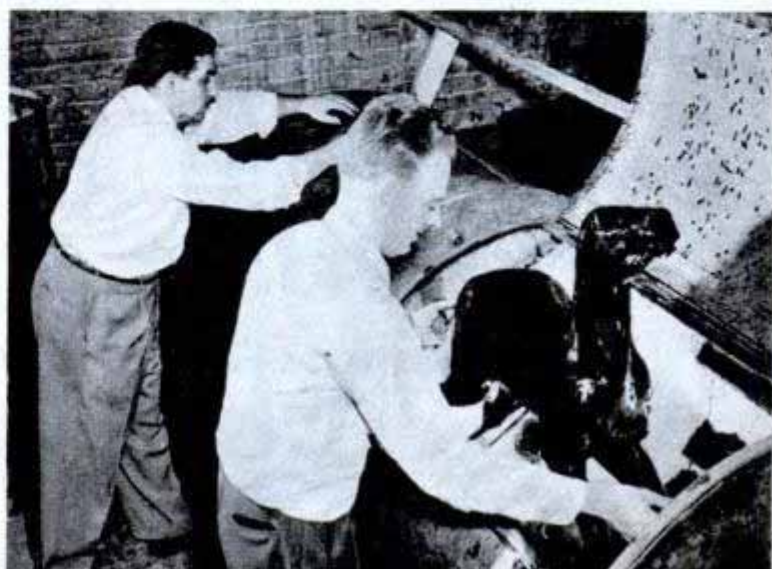
Coin presses usually strike one coin at a time but some of the presses at San Francisco can strike two. Such a press is capable of producing 80,000 coins in eight hours. The dual-strike feature, invented by Joseph Steele, superintendent of coinage at San Francisco, and William Kruse, superintendent of machinery, also has been adopted

(Continued to page 240)



Paper Horses Are Tough

Wild-eyed rocking horses, bashful ducks and lazy turtles are the training aids and toys made in a Chicago factory — not of wood or metal but of paper. Chip board, a coarse light cardboard, is torn into strips and coated with glue. Three layers of the paper are smoothed inside a mold (above left). After the mold is slipped off, the horses are mounted in a roomy oven (above) where the glue is baked dry. Sprayed with shining black adhesive, they're placed in a tumbling machine (below) and bombarded with tiny particles of rayon or wool to give the animals a velveteen appearance. Curved steel tubes are bolted to the body as rockers and a leather saddle and rope tail installed. The ducks and turtles are touched up by hand (lower left). There are no frames in the horses—just wooden legs. Yet the manufacturer reports they'll support a 250-pound man if the younger generation gives him a chance to mount them.



Man Tames 100,000-Volt Lightning Bolt With Guards on Power Line

Man-made lightning strikes a miniature power line and is quickly brought under control in a mobile electrical exhibit now touring the nation. Designed to demonstrate the latest type protective devices that stand guard over power distribution systems, the traveling lightning maker employs a surge generator to create 100,000-volt discharges that simulate thunderbolts. Spectators see exactly how power fuses, line reclosers, fused cutouts and lightning arresters go into action to prevent lightning from disrupting service and inflicting damage. The Westinghouse Electric Corporation built the mobile unit which includes all electrical apparatus required to operate and protect a real power line serving a 35-mile radius. The power fuses and other equipment are mounted on a panel depicting a panoramic scene of a typical community. Every phase of the demonstration is controlled from a small desk near the panel.



Calls "Beamed" to Catalina Link Island to Mainland

Catalina Island, 23 miles off the southern California coast, is now linked to Los Angeles and the mainland by a radio telephone system, the first established for regular commercial service. Tall transmitting and receiving antennas in conjunction with parabolic reflectors are set up on the island and on top of a Los Angeles building to handle the multichannel microwave system.

Thermostat With Electric Eye Reveals Position of Damper

Open and closed positions of furnace dampers are indicated by a visual signal flashed by an electric eye in a wall temperature thermostat. When the dampers are closed, the electric eye signal is off. A dim light discloses that automatic controls are in operation changing damper position. The eye shines brightly when the dampers are open. The signal is located at the top center of the wall thermostat in an aperture covered by a translucent red shell.



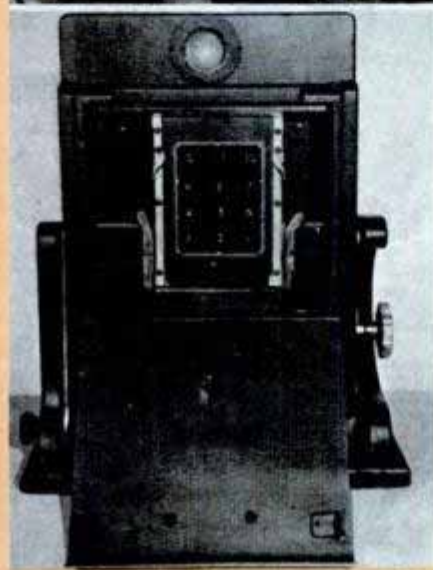
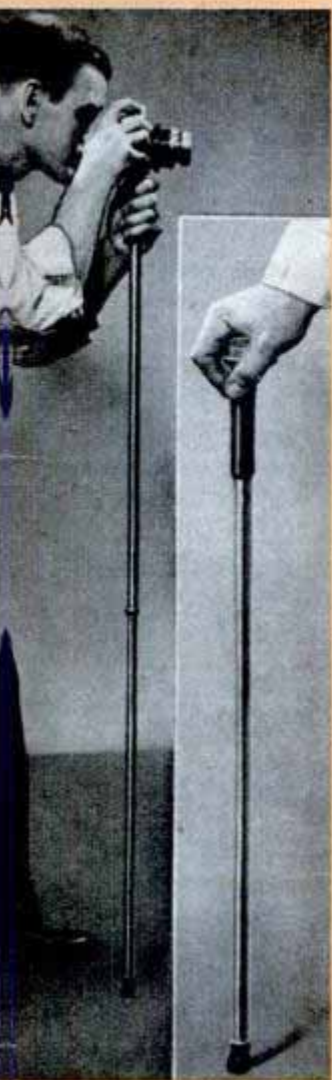
Photo darkroom becomes the decorative walnut cabinet shown at right when it's not in use. Doors and lid swing open to reveal shelves, enlarger, drain, timer, safelight and space for three trays



*For the
Camera
Fan*

Film viewer, lower left, becomes a projector for transparencies, left, by adding a lamp attachment
↓ Base may be used as table mount for small camera

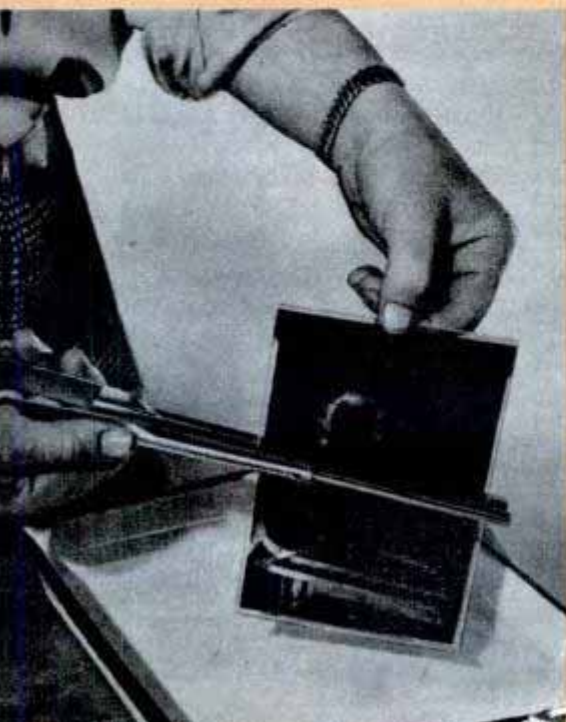




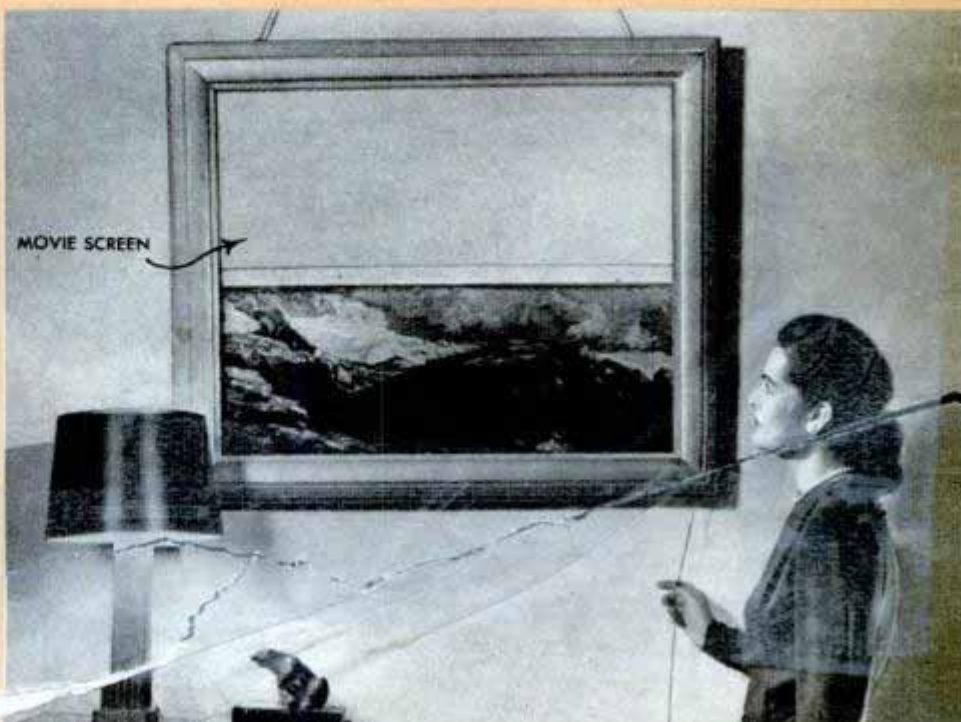
Monopode made of aluminum serves as camera support or lightweight cane, extends to 57½-inch length

Electric camera for identification photos or portraits takes 12 to 24 exposures on one negative. A single lever makes the exposure, moves the film to a new position and adjusts the camera to the proper range. A buzzer warns of the last exposure on the film. Photos can be taken in black and white or color

Squeegee wipes excess moisture from negatives or prints like a windshield wiper. A thin rubber blade dries each side of the paper



Movie screen rolls into its wood frame when not in use to reveal an attractive oil painting. Six different pictures are available in a choice of two types of frames



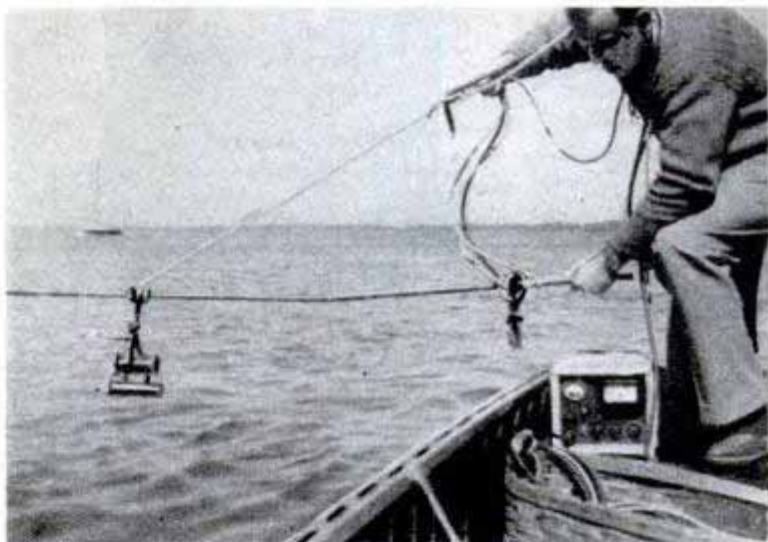
Three-Wheeled French Car Travels 70 Miles an Hour on Little Gas



Low gasoline consumption and fairly high speed are two advantages of a new three-wheeled French automobile. The little car seats four persons, three abreast in a front seat and one seated crosswise at the rear. A front-wheel drive model, the automobile is powered by a water-cooled flat twin engine which is said to give a top speed of nearly 70 miles per hour with gas consumption so low that the three-wheeler will travel more than 100 miles at moderate speeds on a gallon of gasoline.

Photoelectric Eye Takes Fish Census 12 Feet Beneath Surface

Science is probing far beneath the surface of muddy rivers and frozen ponds to learn what effect light has on the migratory habits of fish. At Lake Mendota, near Madison, Wis., a combination light meter and photoelectric fish detector counted the number of perch that hurried by when a beam of light was aimed down through the water 12 feet below the surface. Dr. Arthur D. Hasler of the University of Wisconsin and Dr. Lester V. Whitney of Southwest Missouri State Teachers College designed the equipment and conducted the tests.



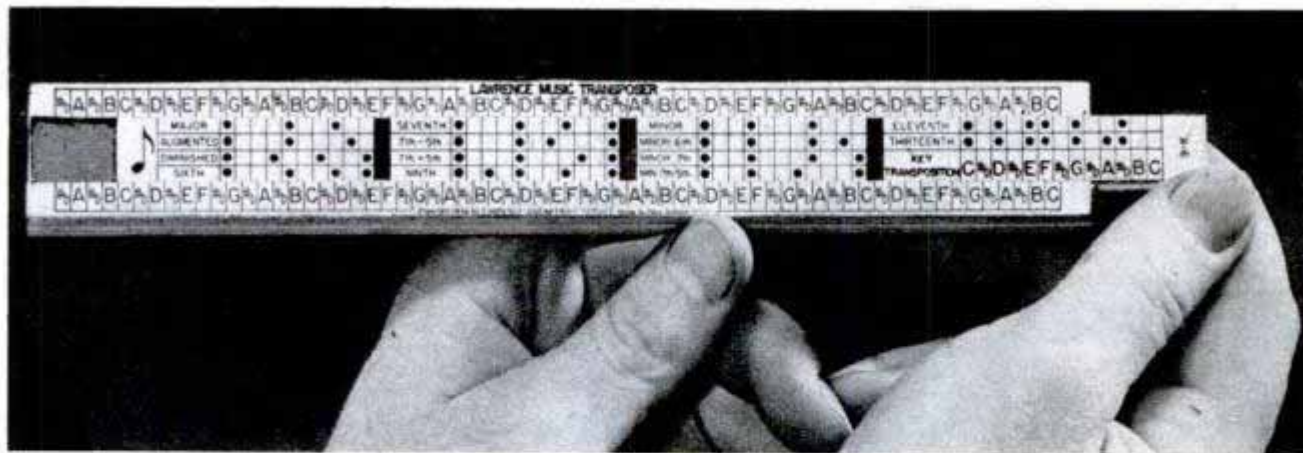
Blasting Gun for Cleaning Picks Up Dust and Reclaims Abrasive



Dust and dirt knocked loose from the exterior of buildings, ships and trains are absorbed by a giant vacuum cleaner which even reclaims steel grit it uses for abrasive. In one continuous operation, tiny steel pellets are bombarded from a blasting nozzle against a surface to dislodge grime which, with the abrasive, is sucked back to a tank where the abrasive is separated for further use.

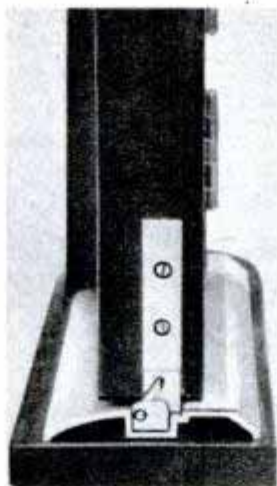
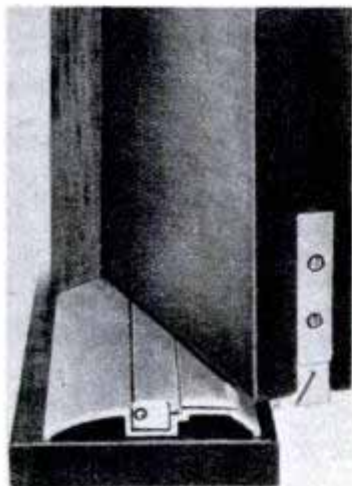
Information, including manufacturers' names and addresses, concerning products described in this issue may be obtained by writing Bureau of Information, Popular Mechanics, 200 East Ontario St., Chicago 11, Illinois

Slide Rule Figures Chord Notes by Formula for Music Arrangements



Many music arrangers now figure chords with a calculating instrument that looks and works like a slide rule. By setting the rule so that a red dot is directly below the key desired, the notes for a chord are clearly indicated by the red dot and other blue dots. To transpose from one key to another, the slide is moved so that the

known key in red is directly above the desired key in blue. All notes of the new key will then be found in blue, below the original notes in red. Other slide rules have been designed to help photographers determine the correct lens aperture, to assist in solving pricing and inventory problems, and to select cutting speeds for machines.

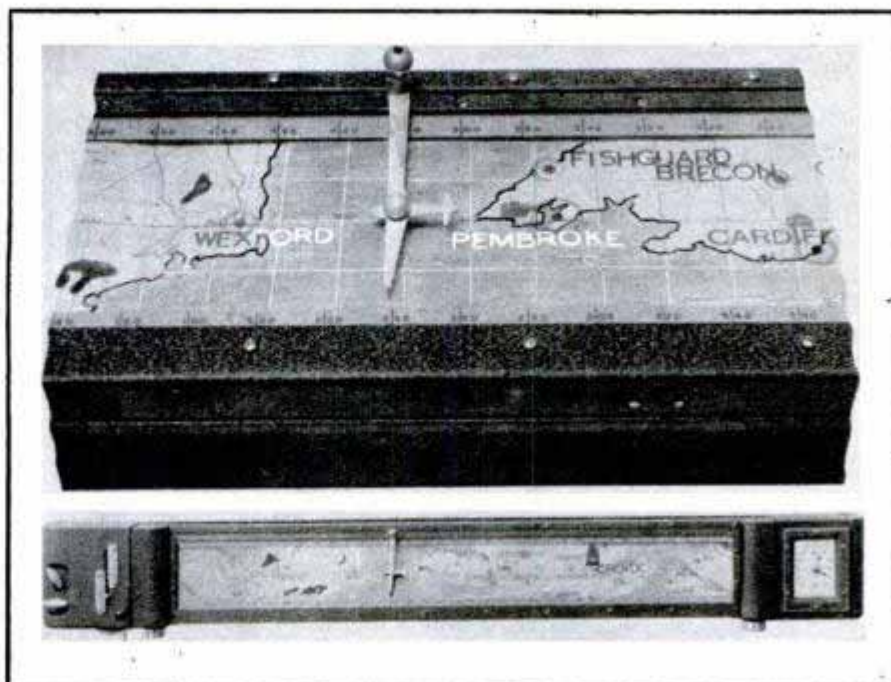


Weather-Tight Door Saddle Keeps Out Rain or Draft

Driving rains and cold drafts are prevented from seeping under doors equipped with a door saddle forming a weather-tight seal. The device is made of aluminum. As the door is closed, a slotted metal key engages the riser in the saddle, which is attached to the floor. The riser is pulled upright and forms an effective vertical barrier against rain or air. When the door is opened, the riser is disengaged by the key and lies flat in the saddle.

Clock-Spring Model Shows Miles Flown

Air lines passengers can check their flight position at all times on a cabin flight-position indicator developed in England. The instrument consists of a model airplane and a long strip map of the air route. The model airplane travels along the map as the air liner flies toward its destination. A clock-spring mechanism, preset to move across the map at speed corresponding to that of the air liner over its route, drives the model along the map flight-path.



What's on the Shelf?

America's search for more oil now turns to the ocean floor surrounding our coastline



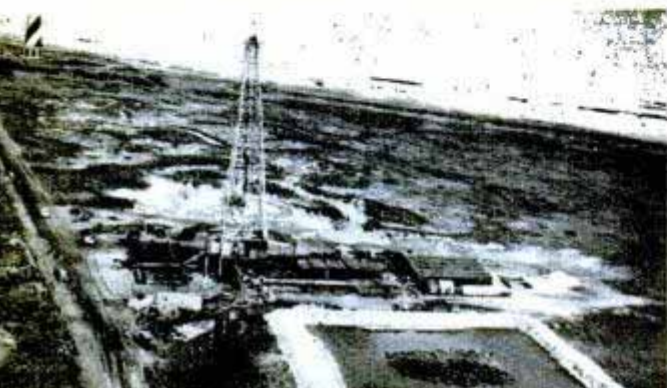
Tightening the drill pipe on a derrick boat working at Lake Salvador in Louisiana



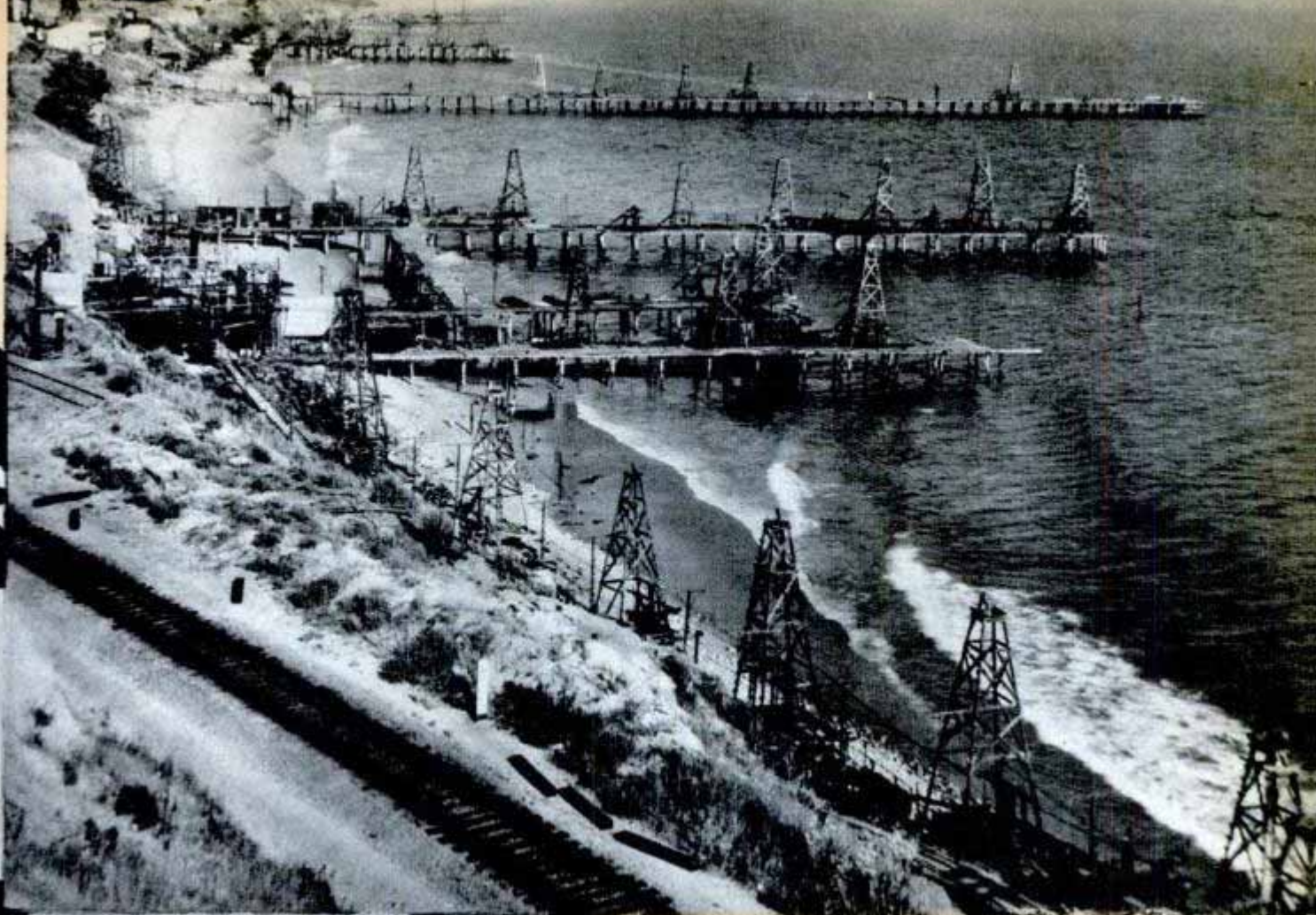
Catwalk towers above an oil well chute, ready to connect derrick and boiler barges



Standard Oil Co. of N. J. photos
Drilling for oil in Galveston Bay, and below, an air view of well drilling operations close to Cape Hatteras, N. C.



Derrickman perches on a board as he rides downward from his platform to adjust pipe



Oil companies are reaching out to tap tideland petroleum pools in search for more oil

By John L. Kent

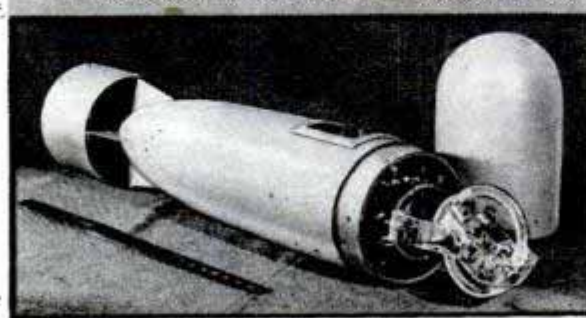
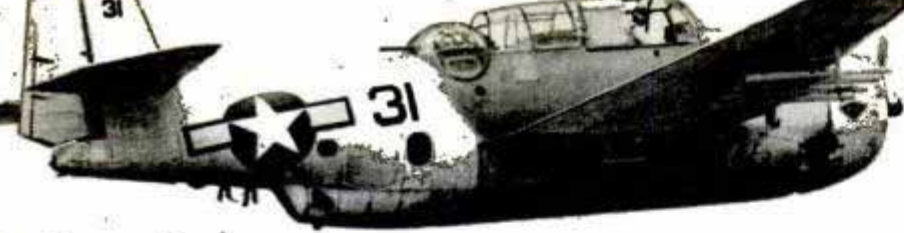
HUNDREDS of scientists, engineers and geologists are getting ready for the greatest treasure hunt in modern times. The buried riches for which they will search include oil and other minerals spread over an area of 760,000 square miles, 50 percent larger than Alaska.

The area of this impending exploration is uninhabited—since it is uninhabitable, being on the ocean floor surrounding the coast of the United States. This section of the sea bed, a continuation of the mainland, is known as the continental shelf. It is looked upon as a new source of mineral wealth, especially oil.

These 760,000 square miles of underwater land were declared exclusive territory of the United States by proclamation of the President last September. Limits of the area are fixed by a depth of 600 feet.

Continents do not drop off sharply into the ocean, as a general rule, but slope gently for a distance which varies from a few miles to several hundred before the real depths of the oceans or seas are reached. Generally, submerged land contiguous to the continent and covered by no more than 100 fathoms (600 feet) of water is considered as the continental shelf.

The continental shelf on the east coast



Bell Telephone Laboratories photo

Navy's magnetic "doodle bug," suspended from plane, was designed to detect enemy subs but now may be employed in aerial prospecting for oil and other minerals. The inset shows a closeup of the device

from Cape Hatteras north ranges from 60 to 250 miles in width. South to Florida it is 40 to 60 miles wide, although near Miami it is reduced to about 20 miles in width. Along the coast of the Gulf of Mexico the shelf is quite wide and that part of it belonging to the United States has an area of some 149,000 square miles.

Along our Pacific coast the shelf is narrower, averaging approximately 25 miles in width. Off Alaska the shelf widens considerably and under the waters of the Ber-

ing Sea extends for several hundred miles.

This newest treasure hunt will utilize the most modern scientific instruments and devices, some never before used for mineral prospecting purposes. The Department of the Interior has announced that new oil deposits along the Pacific continental shelf will be detected by means of radar adapted for underwater use. The radar equipment is to be built into special submarines.

Geological surveys of submerged areas have already been satisfactorily made by seismic methods. One company has made a systematic seismograph survey to a distance of 26 miles off the Louisiana coast.

Seismic surveys are based on records of the underground rock and soil strata. To obtain this record, a hole is drilled in the area where oil is anticipated, and a charge of dynamite is exploded in it. The record of the ground motion is registered on seismograph instruments. A geologist interprets the record and "reads" the depths and structure of the various strata of sand and rock. Knowing that oil is found only in specific strata and under certain conditions, the experienced oil prospecting engineer is in a position to recommend drilling operations or abandonment of search in that vicinity. This widely used method has already been adapted for un-

Reeling out geophone wires from a seismograph recording boat to locate underwater minerals. Right, recorder





Dynamite charge explodes at Cape Hatteras, N. C., during seismograph survey. Right, sighting the "shot" points.

derwater use. All drilling, blasting and recording is done from barges and boats on the surface.

Another method suggested for surveying the continental shelf is the magnetic survey, which can be made rapidly from airplanes. This survey furnishes information on the magnetic properties of subsea formations and aids in the recognition of structural features.

Since geological outcroppings known as "salt domes" usually herald the presence of oil, reflection and refraction seismic surveys are to be made from boats or instruments on the sea bottom to locate these deep salt domes. Another method of locat-

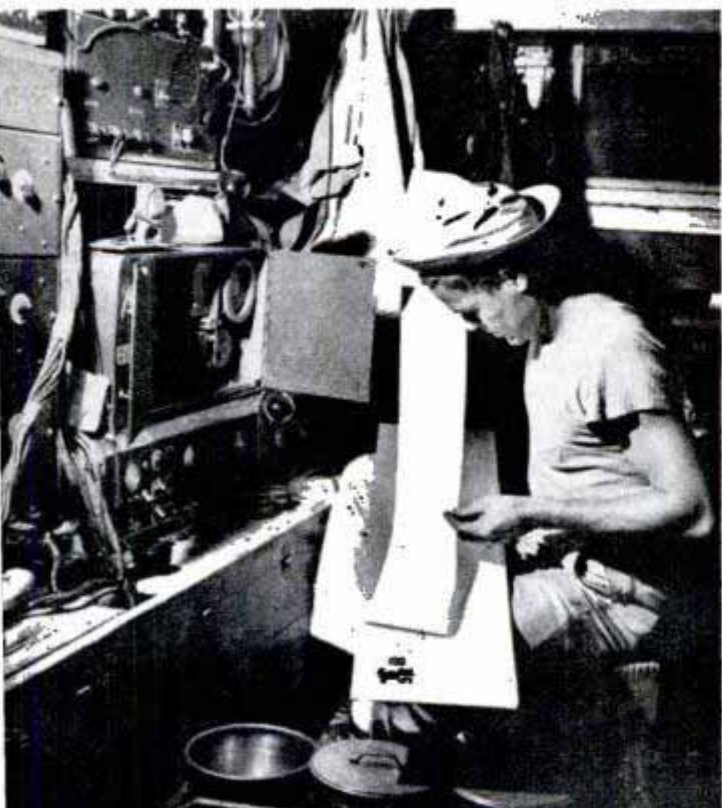
ing salt domes is by the gravimetric survey. This survey is done on the sea bottom, and the use of submarines and submarine diving bells has been suggested.

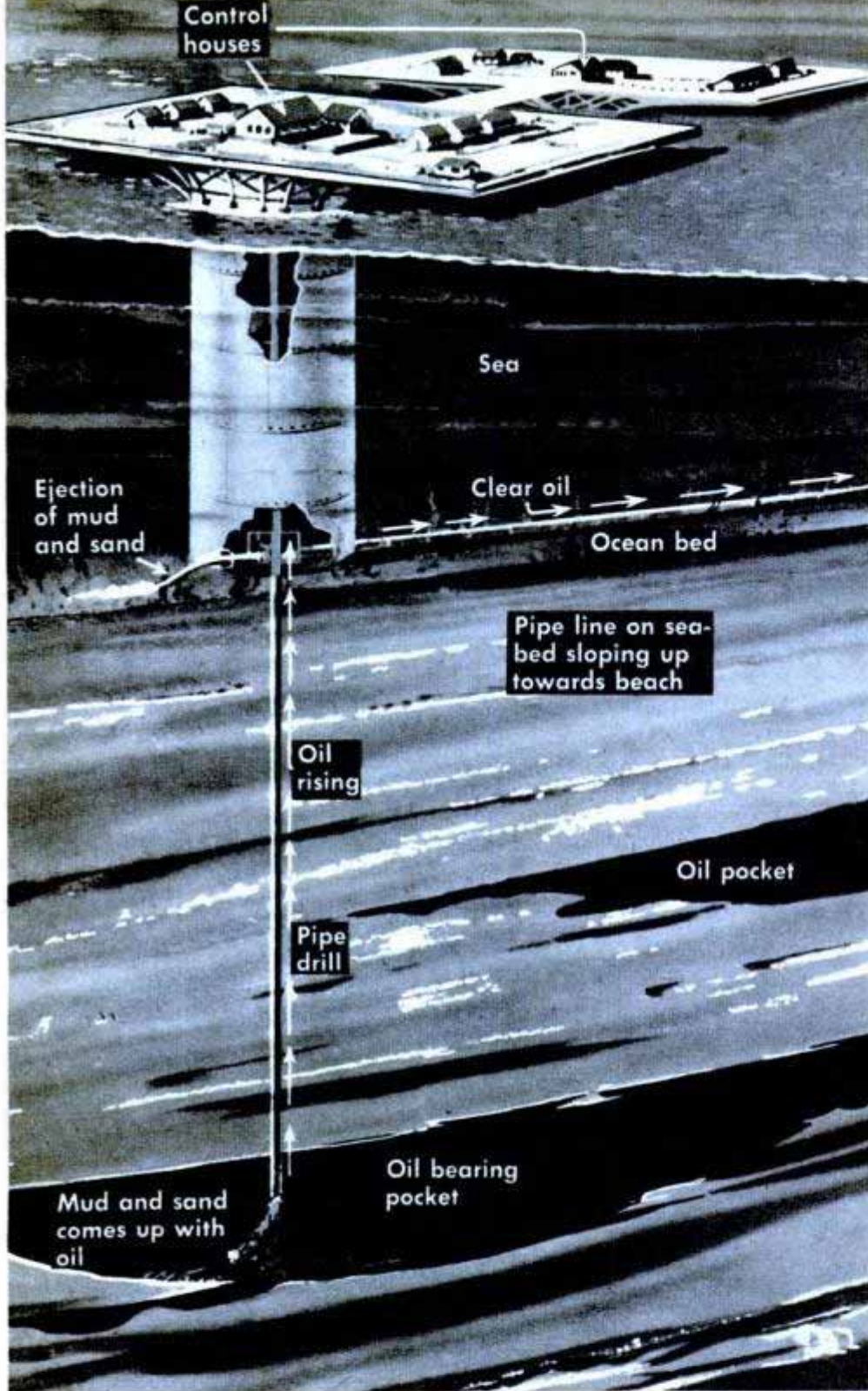
While the continental shelf in the Gulf of Mexico offers greatest promise of oil-bearing structures, additional areas of the continental shelf off the Pacific coast may produce oil, and there are indications that oil-bearing structures might be found off Alaska. Department of Interior experts believe there is a strong probability that oil-bearing strata may extend as far as 100 miles into the Gulf of Mexico.

Professor John L. Rich, University of Cincinnati geologist, believes the shoals of the Bahama Banks may hide a submarine oil field. Situated between the Bahama Islands and Cuba, the shoal area has a depth varying between six and 30 feet. Professor Rich flew over the region making aerial photographs from a height of 10,000 feet. He reported that the giant sand bars and ripples of the Bahama Banks bear a striking resemblance to the patterns of certain productive oil and gas sands in Ohio. Based on his photogrammetric maps, he urges further investigation of the Bahama Banks as a possible oil-bearing area.

In the Gulf Coast region, petroleum production began with the discovery of oil in the famous Spindletop dome near Beaumont, Texas, in 1901. Since that discovery, hundreds of salt domes and related structures have been located in the area. The existence of these productive salt domes immediately along the coast of the Gulf of Mexico and the extension of prospecting into the marshes, bayous and coastal bays of Louisiana made it evident that the oil

Seismograph record examined aboard geophone boat





Drawing by E. G. Lambert of the London Sphere shows the novel method of oil extraction used off coast of Trinidad. Oil reaches shore by pipe line

productive province extended outward beneath the waters of the Gulf.

As early as 1927, Dr. David White of the U. S. Geological Survey announced his opinion that domes existed beneath the Gulf. At that time Dr. White suggested that the topography of the entire bottom of the continental shelf be surveyed by the then new method of sonic sounding.

Continued prospecting and drilling into partially submerged areas near the Louisiana coast eventually led to discovery in 1938 of the Creole field, about a mile

offshore from Cameron Parish and under 25 feet of water. A second field, Sabine Pass, was discovered in 1941, nearly two miles offshore from Jefferson County, Texas. Several other fields have been developed in bays along the Gulf Coast. Nothing, however, compares with the possibility of drilling for oil 50 or even a hundred miles from shore—in the open ocean. This is not at all impossible.

Indeed, this ocean area may be our last totally unexplored great domestic source of petroleum. And petroleum is one of the trinity of coal, iron and oil on which a nation's industrial greatness is based.

Just before his retirement as Secretary of the Interior, Harold L. Ickes declared:

"Of the three most important mineral contributors to our industrial greatness, and to the foundation of our position as a world power, we are probably most lacking in petroleum.

"Regardless of how much oil remains untapped elsewhere in the world, the national interest of the United States requires that we should have available at home, within easy reach, a supply of oil sufficient to care for this nation's needs in any future emergency."

The importance of oil to our national defense

cannot be underestimated. It was lack of oil and the gasoline derived from it that was in great measure responsible for the Germans' defeat. The U. S. Strategic Bombing Survey revealed that Germany went to war in 1939 with reserve stocks of only:

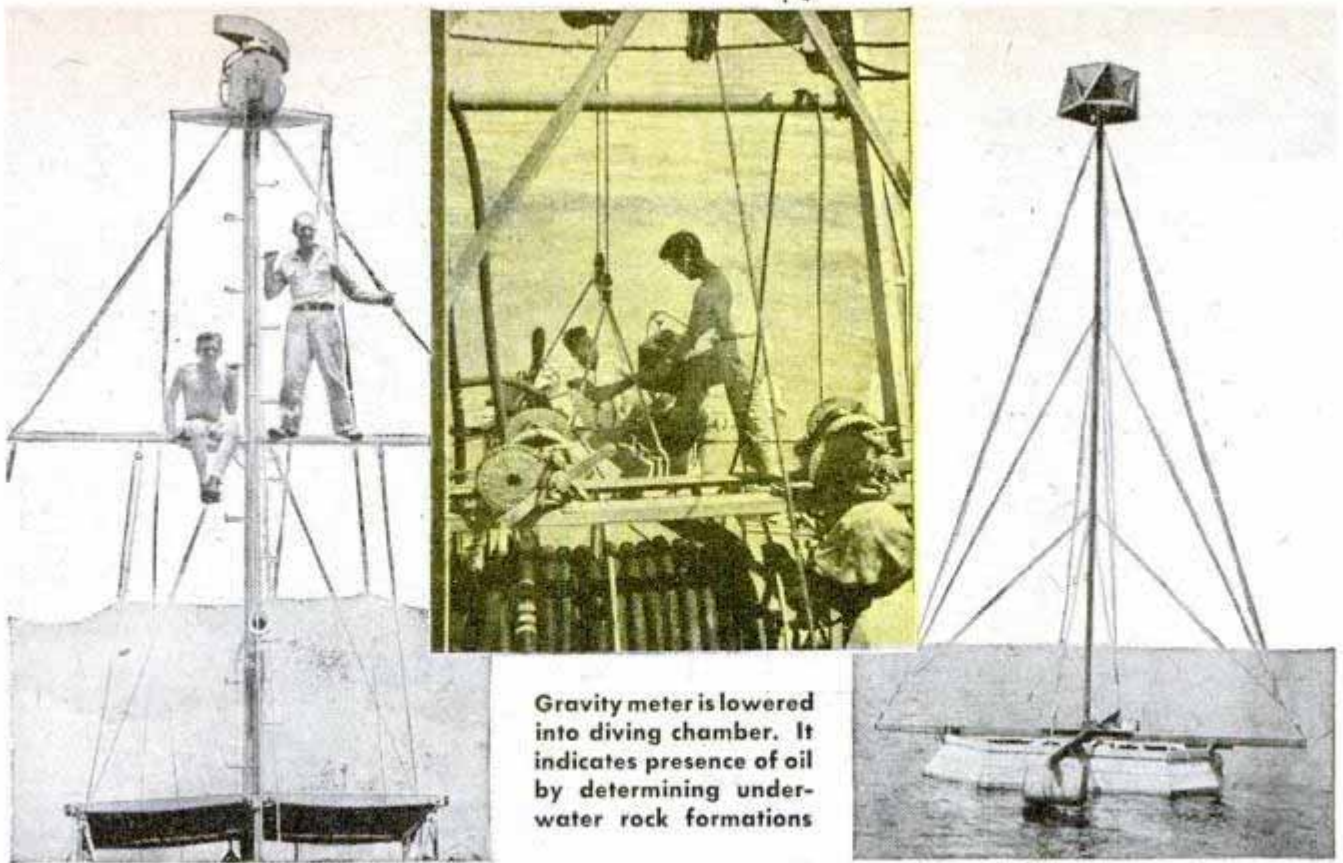
3.1 months' supply of aviation gasoline.

1.9 months' supply of motor gasoline.

2.4 months' supply of rubber.

Germany never recovered from this precarious position and throughout the war her oil stocks, particularly critical items

(Continued to page 260)



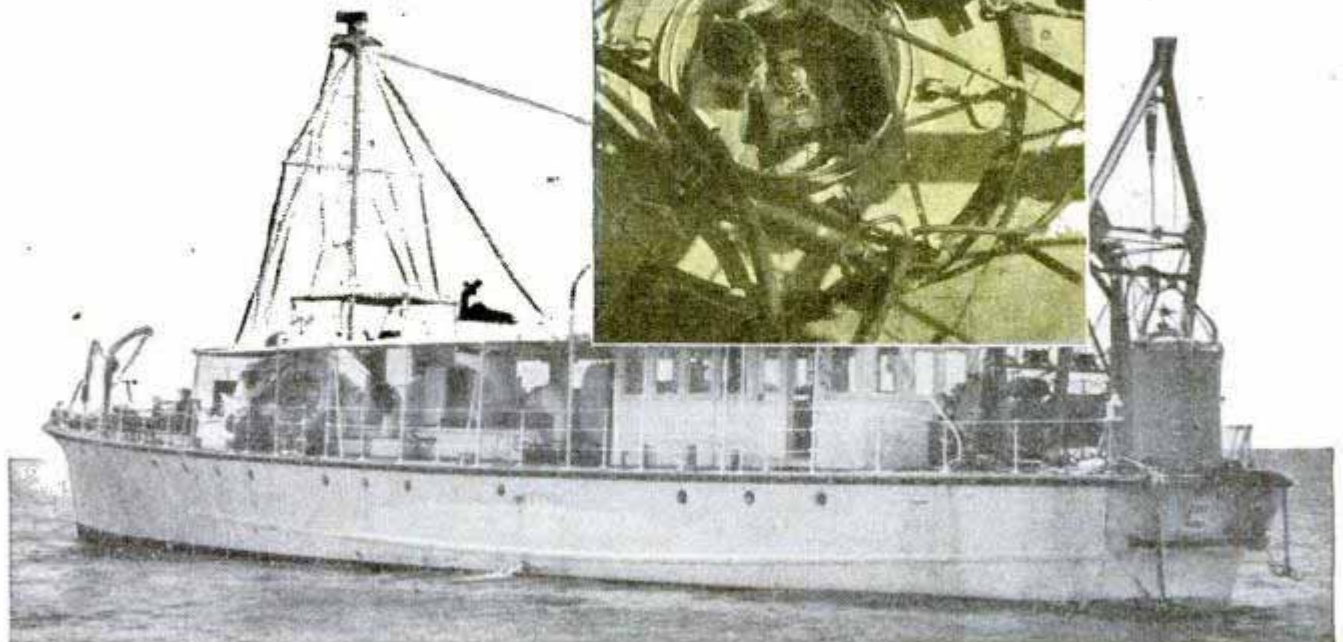
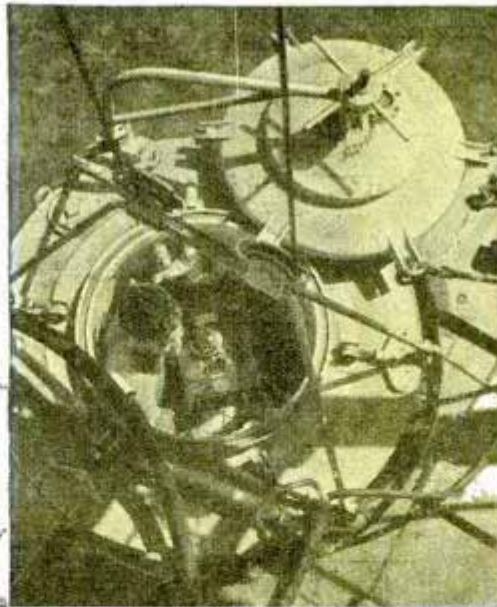
Gravity meter is lowered into diving chamber. It indicates presence of oil by determining underwater rock formations

Radar Plots Underwater Oil Wells

RADAR and a two-ton diving chamber are aiding petroleum scientists of the Standard Oil Company (New Jersey) in locating pools of oil beneath the ocean. Scientists are searching the waters of the Bahamas in an 11-foot ship, periodically low-

ering the diving chamber to the ocean floor. Inside the chamber a gravity meter furnishes indications of the presence of oil by determining rock formations. By bouncing radar signals off targets in the area, engineers plot the most promising test areas.

Radar antenna (top left) bounces signals off targets anchored in the area (top right) to plot ship's location when promising rock formations are found. Ship below is first oil research craft equipped with radar. Inset shows diving chamber returning from floor of ocean



One Steering Wheel Is Removable In Dual-Control Car



To permit normal use of dual-control driver-training cars, Bill McKinley of Vancouver, B. C., designed removable controls. When the car is not being used for instruction, he removes the teacher's right side steering wheel.

Photos Developed in Daylight With Light-Tight Tank

After being loaded in darkness or under a dim light, a photographic tank equipped with light-tight pouring and drain vents develops pictures in daylight or under the



brightest light. Molded from Bakelite in one piece, the tank accommodates 12 films or plates in regular hangers in sizes up to 4 by 5 inches. With a solution capacity of a half gallon, the tank can be filled or emptied in 32 seconds. The hanger shelf has three dividing sections to segregate the hangers into groups of four and prevent sliding. Sloping ends of the tank serve as handles to facilitate agitation.

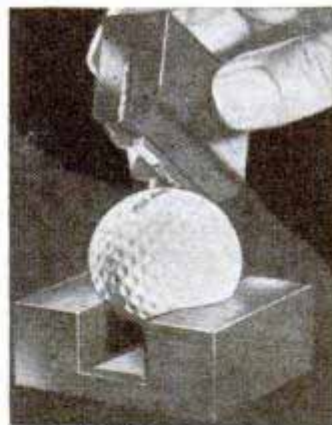
Triple-Duty Paintbrush Cleaner Holds Three Brushes

Three brushes covered with three different colors of paint can be cleaned simultaneously in a can of cleaning liquid that has a wire hanger to hold the brushes securely. After soaking a few hours in the cleaner, brushes emerge like new, ready to be wiped dry and used again.



Indelible Golf-Ball Marker Has Its Own Ink Pad

Owners can stamp their names indelibly into the surface of golf balls with a marker consisting of a pressure handle that bears the name in metal type, and a ball holder containing an ink pad in a grooved slot. Slight rotary pressure of the inked type impresses a person's name on the ball. The name is set by the manufacturer.

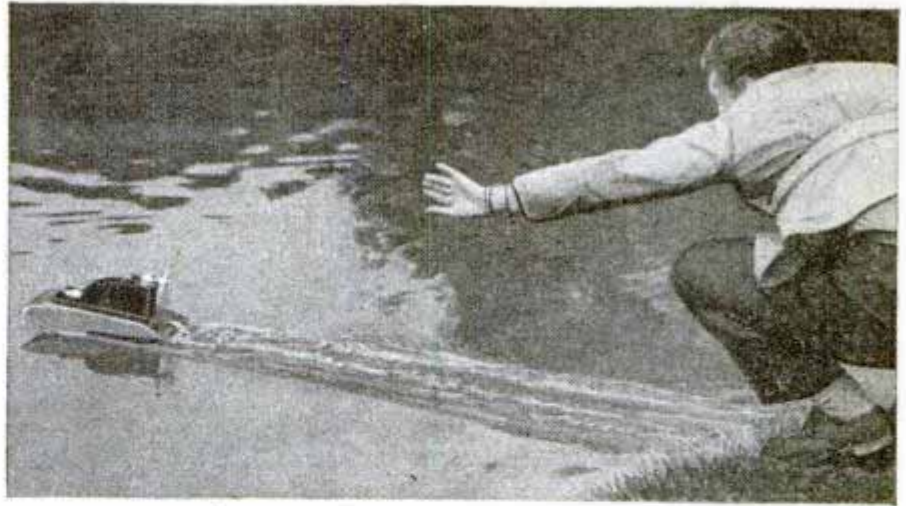


"Triptane" Rating for Gasoline May Replace Octane System

One of these days your gasoline may be rated with a "triptane number" instead of the present octane system. The National Bureau of Standards has proposed a rating in terms of blends of triptane and normal heptane, plus one tenth of one percent tetraethyl lead. Triptane is a relatively new compound of exceptionally high anti-knock rating, and its use in modern aviation fuels has outdated old octane ratings.

Racing Model Hydroplanes Split Waves at 30 M.P.H.

Pint-size hydroplanes achieve speeds up to 25 or 30 miles an hour on ponds and sheltered inland lakes. Their builders make them of balsa or other light wood and alter their design to fit engine size. They are built low so that slight winds and ripples cannot overturn them. All the variations of stepped and three-point suspension racing hulls can be incorporated in the 12-inch speedsters. Some craftsmen use half-inch to three-quarter-inch wood for the sides and up to quarter-inch wood for the bottom. The motor and two small batteries are mounted aft so that the sides protect them from spray. Propeller size depends upon the size of the craft but blades must be short enough to clear the water. If the metal rudder is preset at the proper angle before launching, the hydroplane will circle in a wide curve and return to its original starting place.



Tiny hydroplanes are made of balsa or other light wood. Many variations of stepped racing hulls are possible



Electric Eye of Metronome Flashes in Time With Beat



Simply plug an electric metronome into any alternating current outlet and it gives an even tone beat. An electric eye is synchronized to flash with the audible tempo of the instrument. The beat may be made loud or soft by adjusting the volume control and the tempo can be varied from 40 to 208 beats per minute.

Many of the products described in this issue are already available or are ready to be marketed. For additional information on these products, including the name and address of the manufacturer or distributor, simply write to Bureau of Information, Popular Mechanics, 200 E. Ontario St., Chicago 11, Ill.



Build Yourself a Railroad

SCORES of new trains will be rolling on schedule this winter—indoors. There is quickened interest in model railroading now that engines, cars, rails and model-making equipment are easier to get.

In every section of the country, in attics, basements, spare rooms and garages, men build and operate their own railroad systems. With some it may be only a few cars, a single engine and a few feet of track; with others it's an elaborate system complete with scenery and some such colorful name as the Lazy Lonesome Valley Road or the Hollow Tree Line.

It should be remembered that there is considerable difference between railroading with toy trains and true model railroading. Commercial toy trains usually are not actual reproductions of real trains. The dyed-in-the-wool model railroader insists on trains that are exact scale miniatures of life-size trains and he often seeks to reproduce sections of real railroad systems.

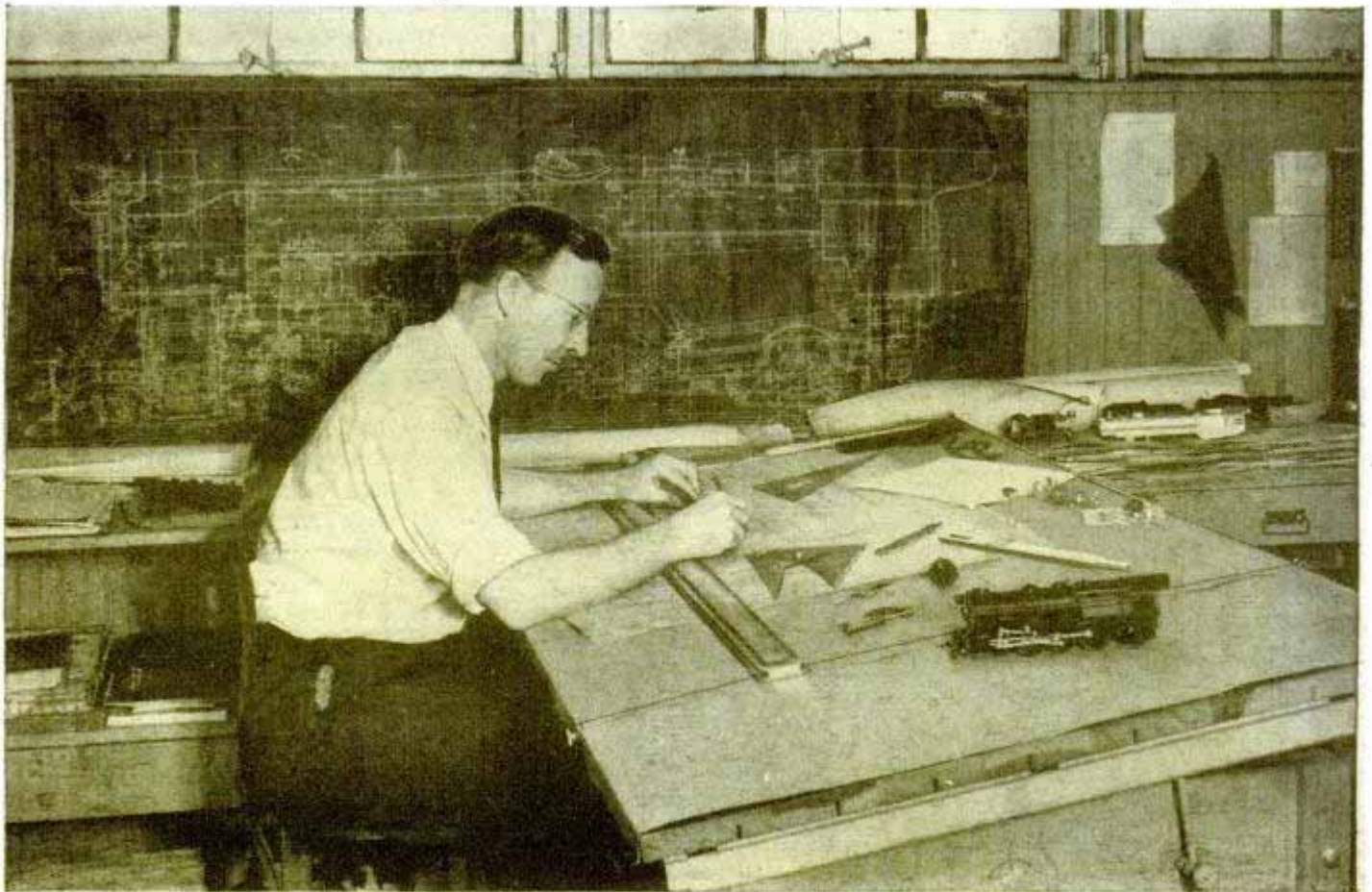
Model railroading breaks down naturally into five basic interests: track construction and arrangement, locomotives, rolling stock, signals and controls, and scenery.

Some enthusiasts are interested in all branches of this exciting hobby. Others concentrate on one or two. For example, a man with engineering ability who is handy with tools may devote himself entirely to building a model locomotive and never own a piece of track. At the other extreme is the man who spends his time creating a model village or landscape where the train becomes simply a bit of action to enliven the scene.

However, the average model railroader will follow all phases of the hobby to some degree. He will aim toward developing a system with an interesting track arrangement, as many locomotives and pieces of rolling stock as he cares to build or buy, signals and controls to manipulate his trains and a colorful background for realism.

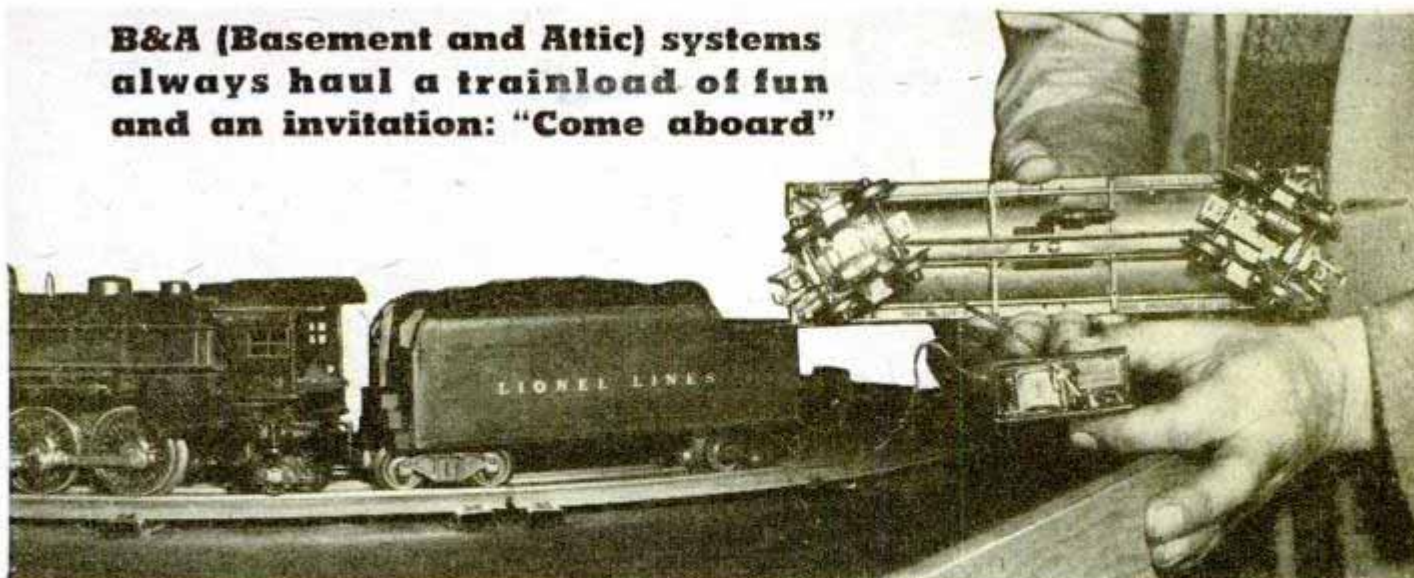
There are three standard commercial sizes of miniature track and trains. These are: the HO for those who require the smallest or who wish to keep down expense; O gauge which is the largest and most popular; and OO gauge for those who want something in between. There are other gauges, but you will do well to ad-

For exact scale-model American Flyer locomotive, engineers reduce original blueprints of full-size engine





B&A (Basement and Attic) systems always haul a trainload of fun and an invitation: "Come aboard"



Electronic control system developed by Lionel Corporation reverses trains, blows whistles and uncouples cars. Signals are broadcast from one-tube transmitter to wrist-watch-size radio receiver installed under each car

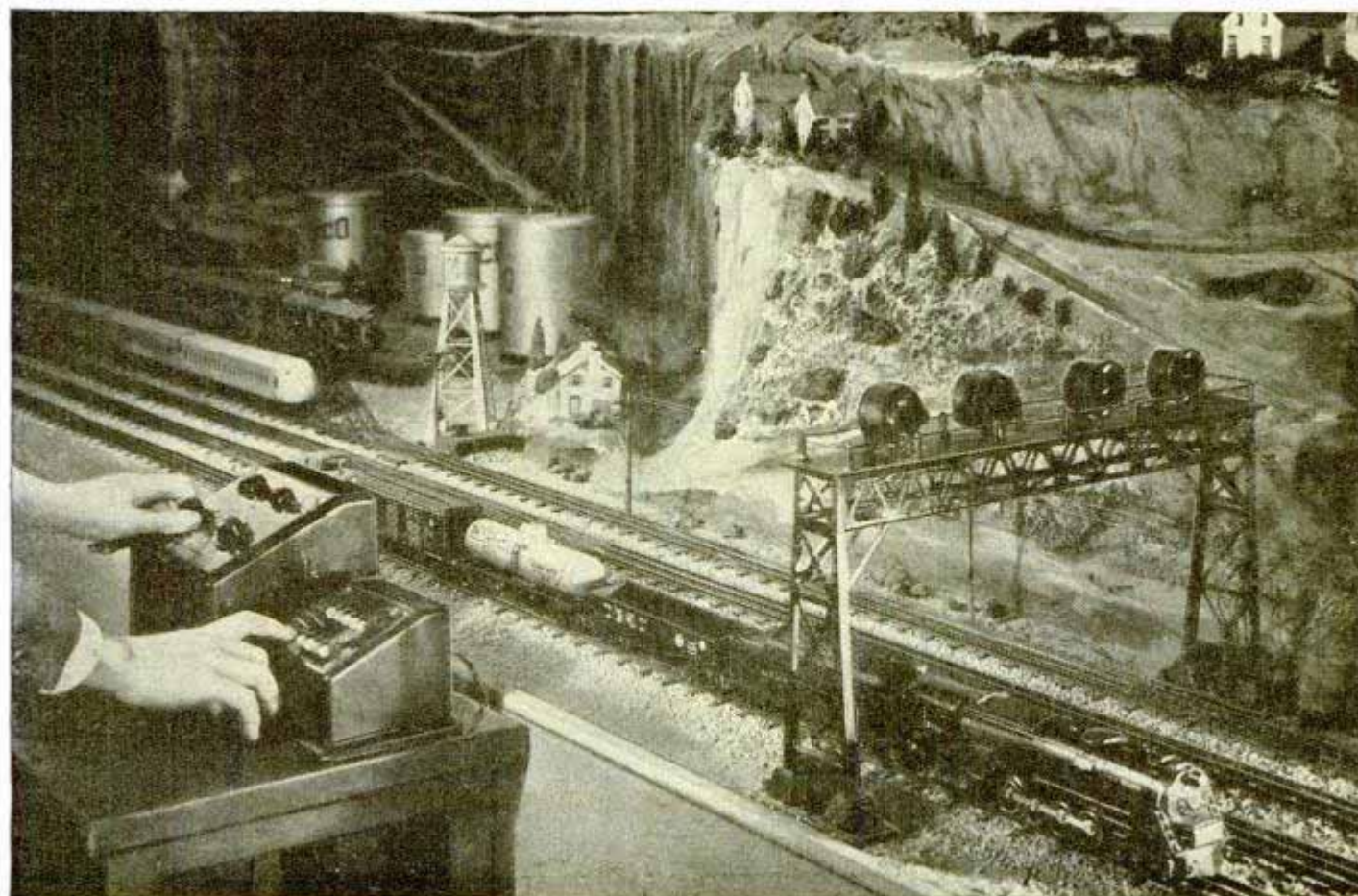
here to one of the standards in case you wish to exchange or sell equipment or run your trains on a friend's track.

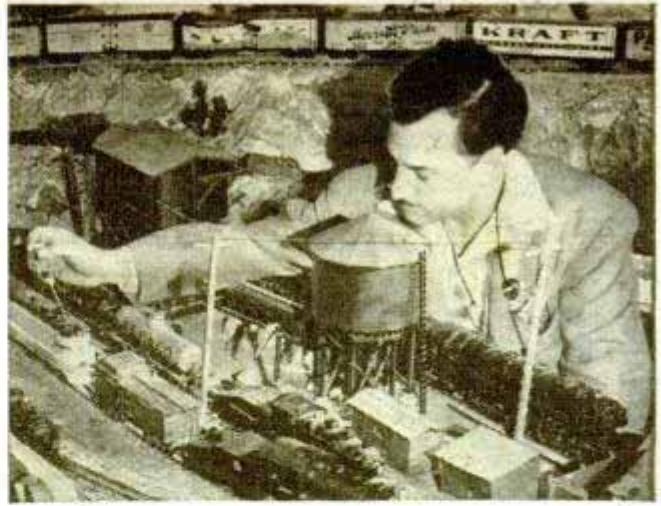
Next, you should make a careful layout of your proposed system on paper. Make a scale drawing of your available space and within it plan the layout of your track. It helps to think in terms of operation.

Make dummy trains of paper and push them over your diagram to see how they will meet switches, crossings, turntables, sidings or stations and how they will enter and leave yards.

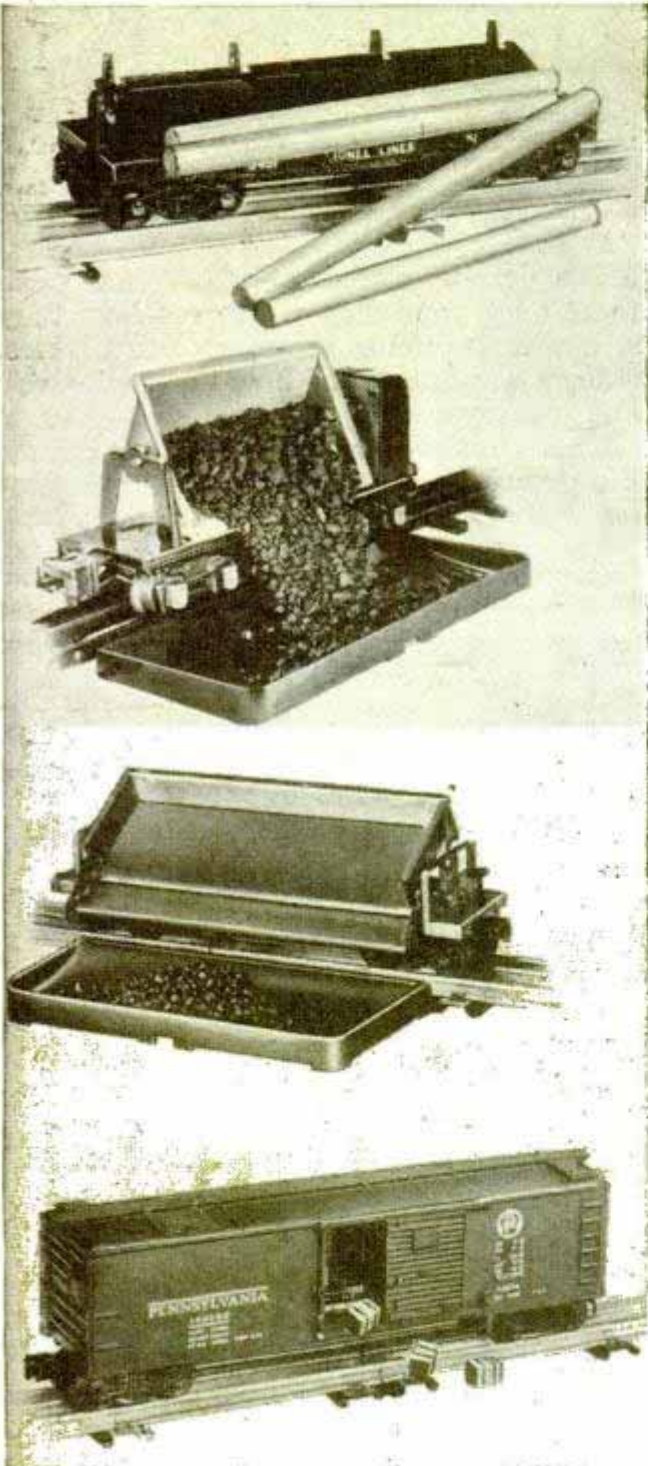
There are two systems of track layout: the point-to-point and the loop. Point-to-point has a terminal at each end where

This train has a locomotive with a smoke-producing device synchronized to puff with action of driving rods. Transmitter under right hand of operator has 10 buttons which are depressed to control train operations





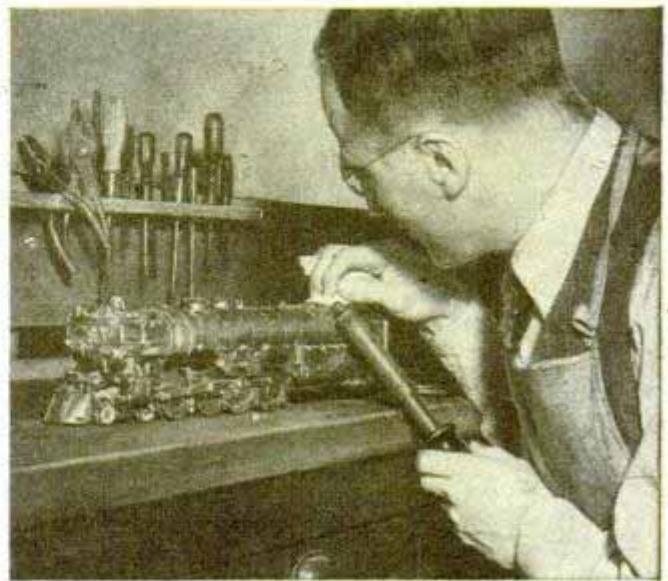
Centinela Valley Model Railroad Club of Hawthorne, Calif., serves miniature town of Caldwell, left. Before starting above, operator makes final check

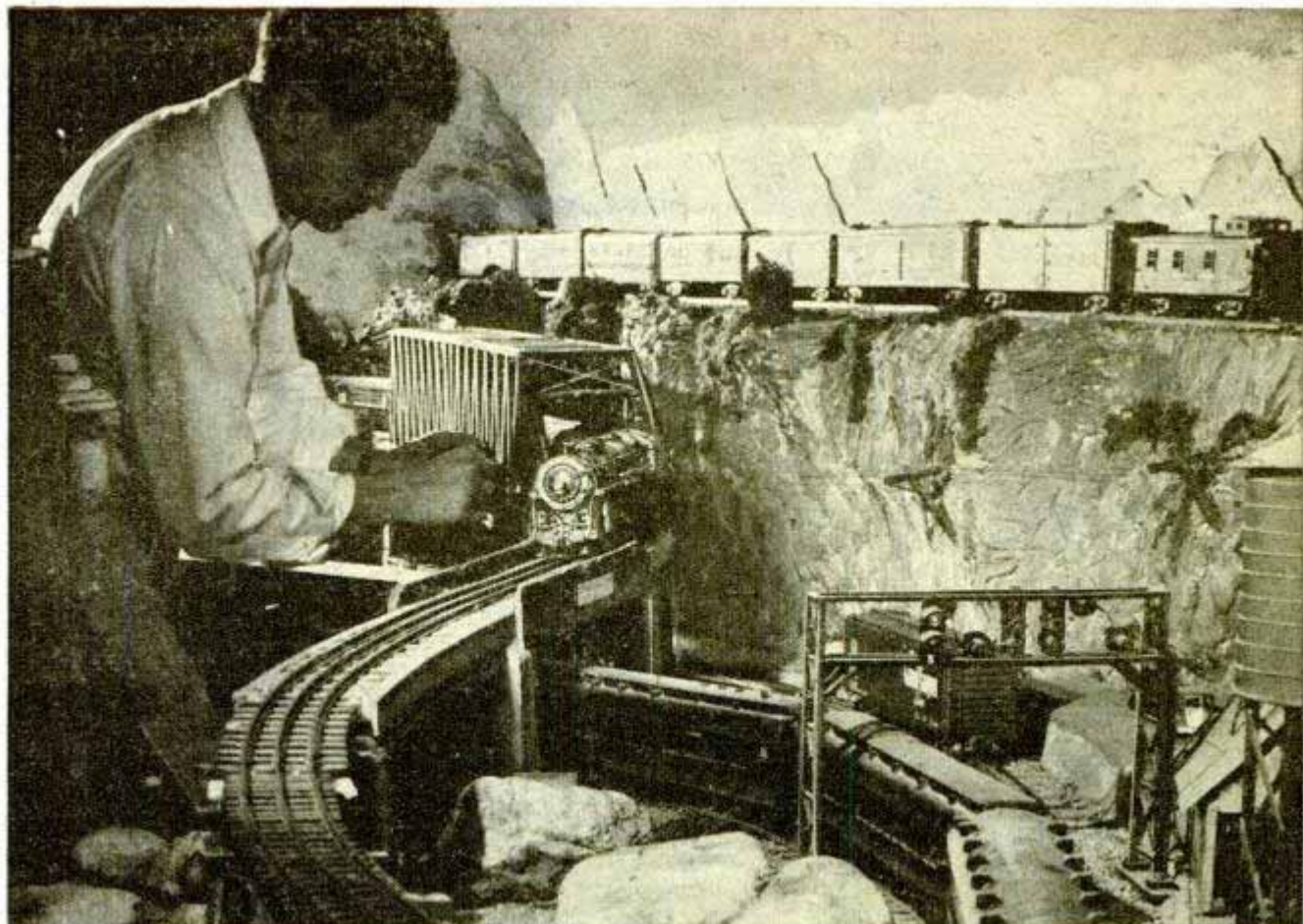


trains must be reversed or backed out. The loop provides for continuous one-way operation. To these basic patterns may be added any number of branch lines, sidings, blind sidings and crossovers. The locations of auxiliary lines, and switches to control them, should be included in your layout before construction begins.

With your layout complete, you are ready to build. Most model railroads are constructed on tables about four feet above the floor. The table is formed of 1 by 4-inch lumber with crosspieces to support the roadbed. Over this framework you spread ordinary window screen. Cover the screen with a mixture of plaster and wood sawdust. The screen can be cut or twisted to resemble mountains, valleys or rivers, and when dry it is painted to resemble a landscape. Backdrops and profile pieces give a

Models, left, do same hauling jobs as full-size cars. Careful craftsmanship results in locomotives like one below constructed by F. A. Nichols of Appleton, Wis.





Model railroading includes the construction of background terrain, model communities, track and trestles

three-dimensional effect which can be accentuated by concealed lighting. The use of props such as people, animals, houses, trees, stations, automobiles or tunnels is limited only by the size of your layout and your own ambition. But remember this basic principle: everything should be planned in advance and carefully constructed to scale.

With locomotives and rolling stock, opportunities for individual expression are almost unlimited. You may want to start with a toy train. The Lionel Company makes both O and OO-gauge equipment, and the A. C. Gilbert Company makes O and HO-gauge equipment. The chances are that sooner or later you will want to build your own train exactly to scale.

Good craftsmen can start from designs supplied by many railroads and locomotive companies. But this is a long, exacting task. The beginner who has some skill with tools would do better to purchase one of the many kits available. In them the more intricate parts are already made and construction is more of an assembly job. You can also buy scale models ready to roll.

Signals and control boards are governed by your layout. Ordinarily a model railroad is divided into divisions and blocks

just as is a real railroad. Wires lead to a central control point where rheostats regulate speed and lever switches start and stop engines and couple and uncouple cars. Sectional keys are associated with each block for operating switches, lights and signals.

In nearly every large city there are model railroad clubs. If you do not want all the expense and work of building your own system, or if you haven't the room, you may wish to join or organize such a club. In Pelham Manor, N. Y., for instance, a group of fans got permission to build their system in an abandoned station of the New Haven line. Now, as they maneuver their model trains, they get the added thrill of hearing real trains thunder by outside. Many such clubs are affiliated with the National Model Railroad Association which now has over 5000 members. Equipment bearing the NMRA emblem conforms to standard.

You'll find railroading is a hobby that will fascinate your whole family—if not the whole neighborhood.

ⓘ Tiny ball bearings 1.5 millimeters in diameter and small enough to be used to replace jewels in a watch have been made by a Russian engineer.



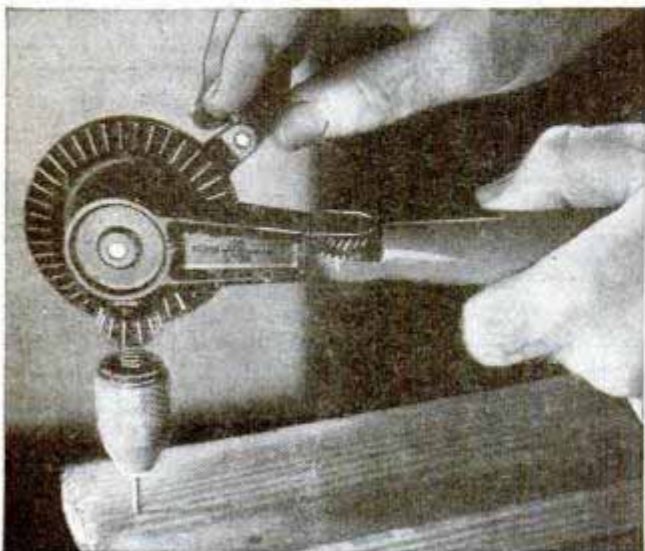
Folding Crutches of Aluminum Double as Sturdy Canes



Made of sturdy but lightweight aluminum alloy, a folding crutch equipped with Neoprene rubber handgrip, armrest and tip can be adjusted for use by child or adult and is convertible into a cane. The crutch consists of a single shaft of satin-finish aluminum and a pair will support persons weighing as much as 400 pounds.

Hand Drill Works at Odd Angles On Hard-to-Reach Jobs

Areas ordinarily inaccessible to an upright hand drill can be reached with a drill which works in seven different positions



while its handle can be set at any angle along a 180-degree arc. Extended length of the drill is 10½ inches. Chuck size is ¼ inch. Extra bits can be stored in the hollow handle.

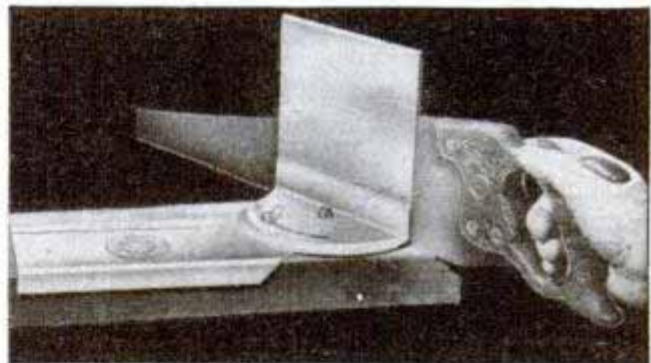
Luminous Dial for Telephone Saves Turning on Light

With a luminous dial there's no need to turn on bright lights at all hours of the night when dialing a number. A dial that glows in the dark can be slipped over the regular telephone dial to make night dialing easy.



Lightweight Steel Miter Box Has 90-Degree Gauge

Weighing only 2½ pounds, a miter box equipped with a 90-degree gauge fits any size board and accommodates any saw blade. Suitable for such work as framing doors and windows, the miter box eliminates the need for precutting wood before



assembling the frame. The saw guide is made of cadmium plated 16-gauge cold rolled steel. It is secured at the proper angle with a quarter turn of a wing nut.

Midget D.C. Current Converter Fits Phonograph or Clock

Phonographs, clocks, electric razors and other electrical equipment designed to operate on alternating current can now be used with direct current by means of a vibrator inverter which converts the d.c. to a.c. Weighing only 14 ounces and measuring 2¼ by 4 by 4½ inches, the compact unit can be installed in the corner of a phonograph cabinet or some other convenient location. With an input of 115 volts d.c., the inverter's output is 110 volts, 60 cycle a.c., providing a maximum load of 25 watts.

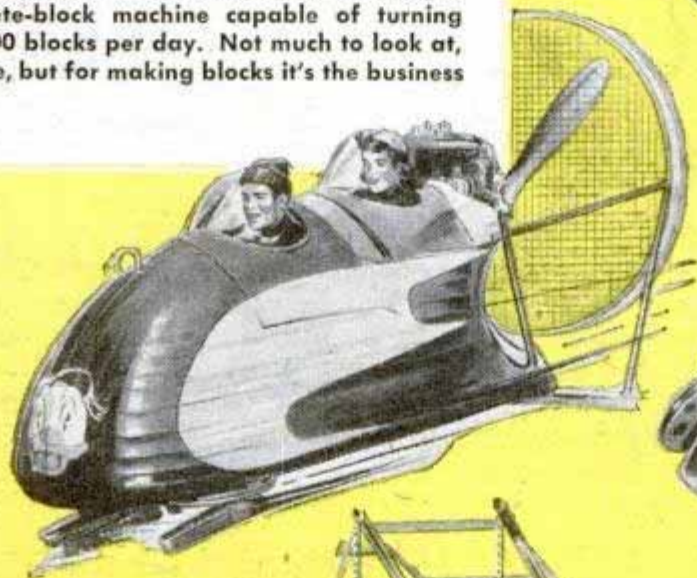
The Craftsman

We have it direct from Santa that he doesn't at all mind a little competition. One look at the Christmas-gift story on pages 190 to 195 and it won't take you long to figure out how to say "Merry Christmas" from your own workshop. Then for the fellow who likes a bit of speed with his winter sports there are complete constructional details on a propeller-driven iceboat beginning on page 186. The original boat has been clocked at speeds up to 100 miles per hour and, brother, on the ground that's getting somewhere! On pages 207 to 209 we've described a dual-purpose film viewer designed for camera fans who like building their own equipment. But we've saved the big story for the last: On pages 217 to 222 are full directions for building a concrete-block machine capable of turning out 800 blocks per day. Not much to look at, maybe, but for making blocks it's the business



XMAS GIFTS

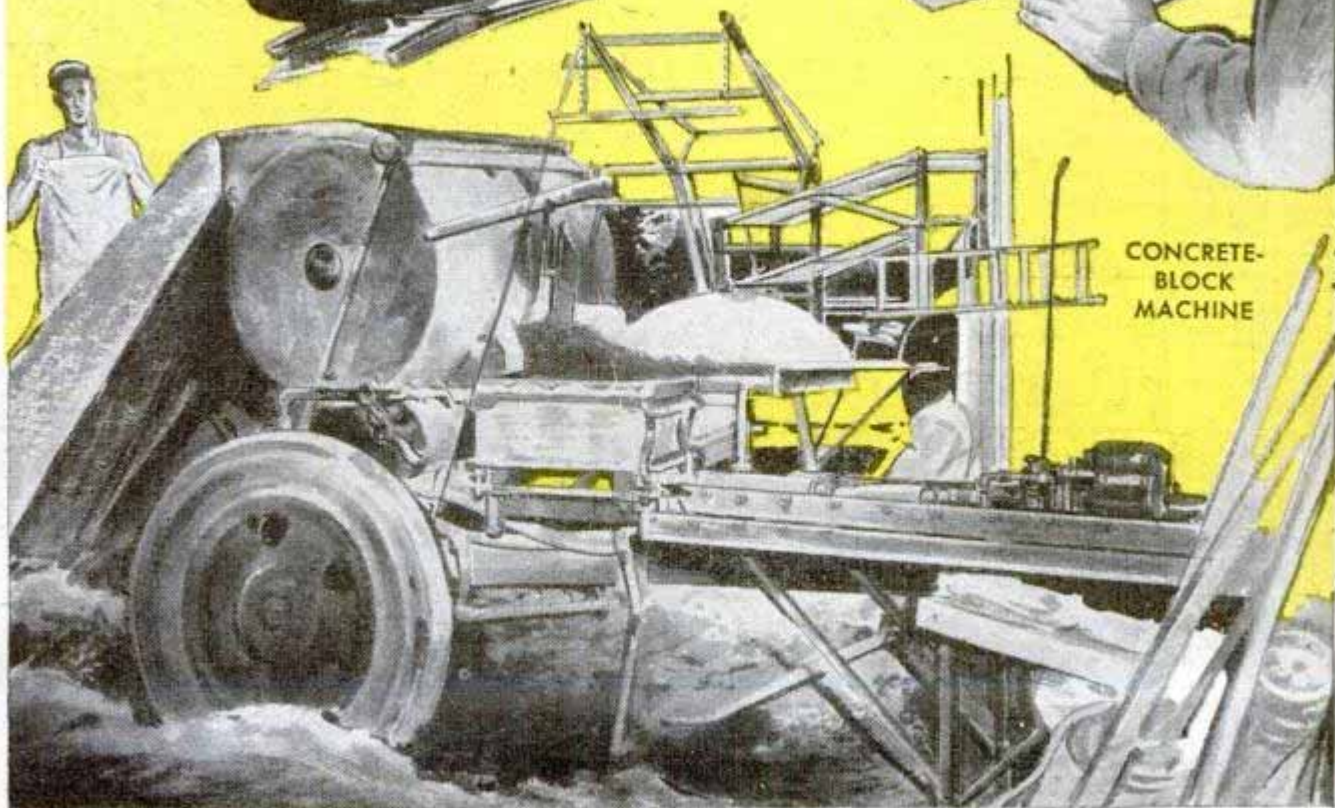
ICEBOAT

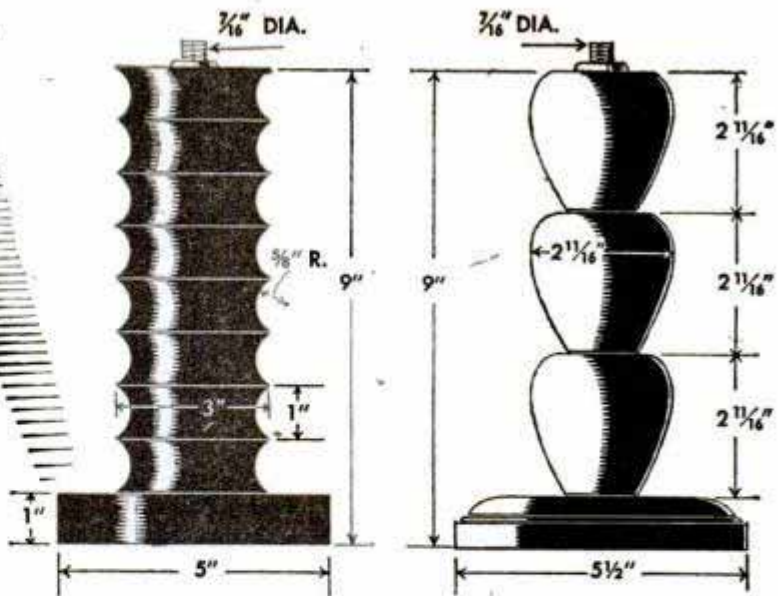
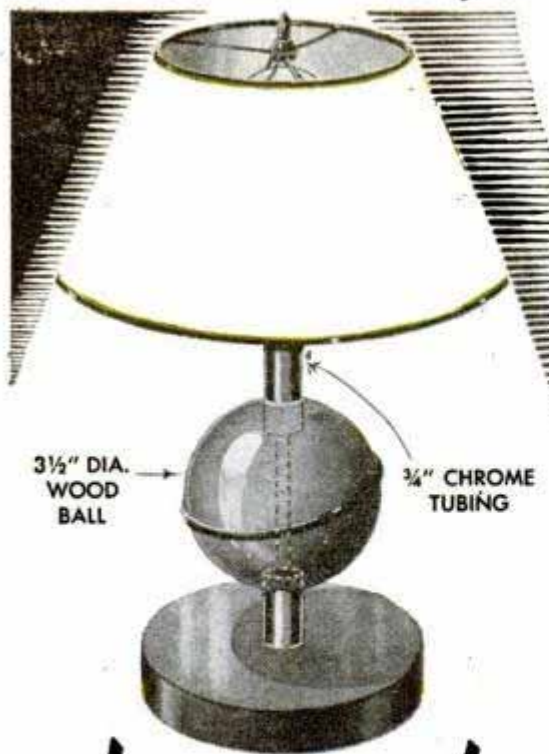


FILM VIEWER



CONCRETE-BLOCK MACHINE





Light Up!

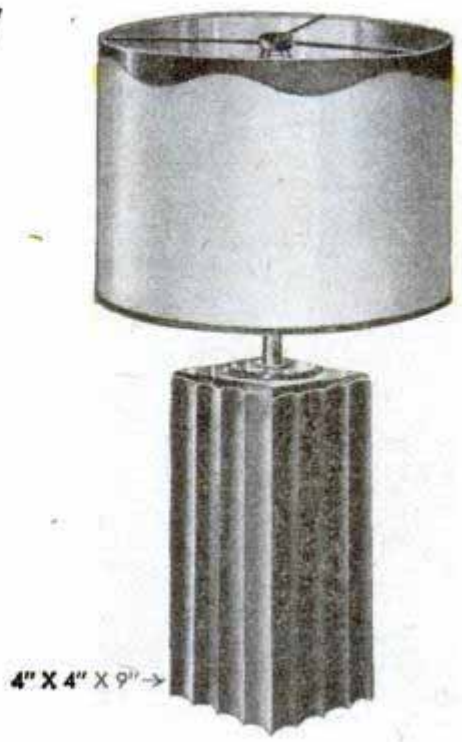
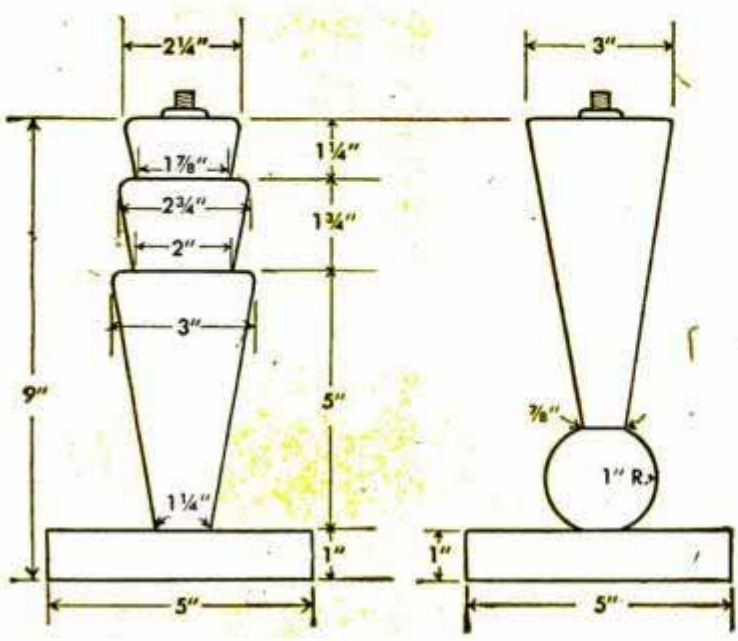
WITH THESE 9 LITTLE LAMPS

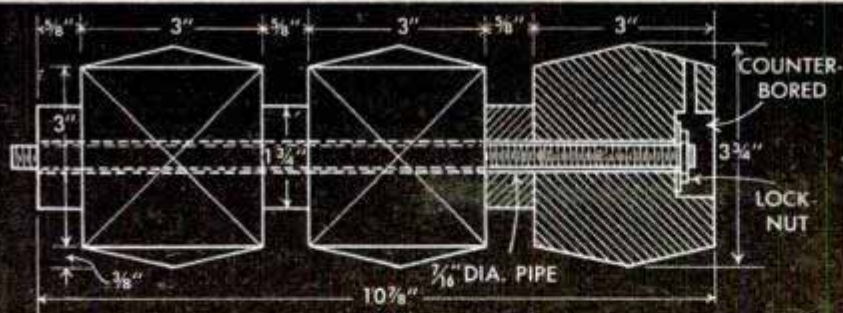


IF YOU'RE a woodturner at heart, here's a chance to make the chips fly. Take your choice of nine little table lamps that can be made of scraps of fancy wood, plastic, or both, some being made and finished completely in a lathe. With the exception of the fluted lamp below, the component parts of all lamps are "tied" together by a 3/8-in. fixture pipe. The fluted lamp consists of a solid block, counterbored at top and bot-

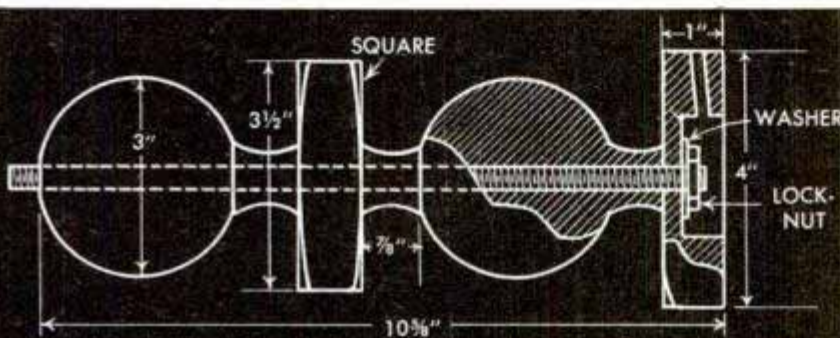
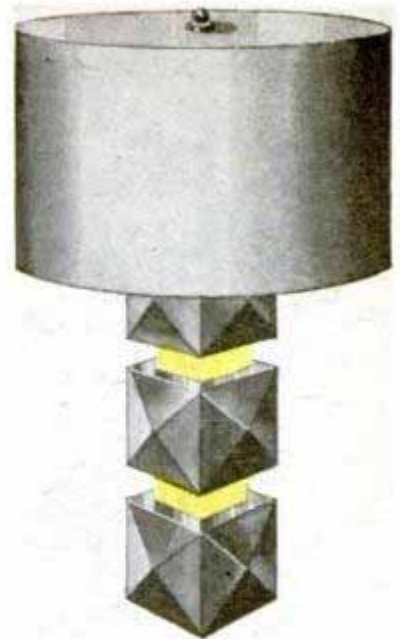
tom for locknuts, the top nut being concealed by a brass washer. The pipe extending above the base is encased in a 3/8-in. tube and the socket is screwed tightly against it. A hole is drilled through the side of the base for a lamp cord. If necessary, the fluting on the base can be done by hand, using a 3/4-in. gouge and then sanding smoothly with a round-nose block.

By Wayne C. Leckey

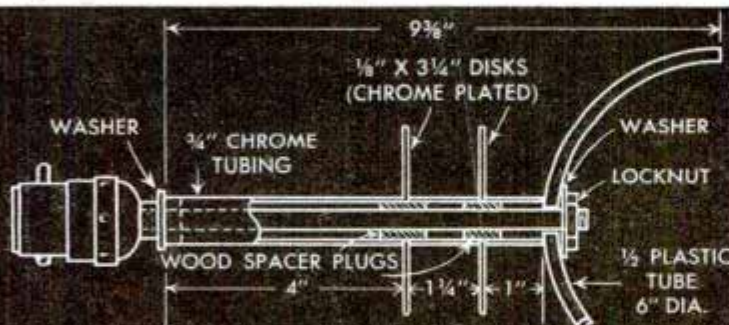




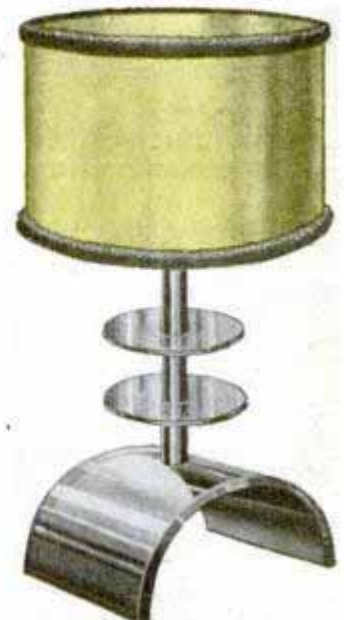
Finished in bone white with spacers of colored plastic, this stunning table lamp takes on a classic-modern appearance. The blocks are shaped identically and drilled through the center for a length of pipe. The bottom block is counterbored for a washer and locknut and then drilled through the side for a lamp cord. With a socket screwed to the top, the whole lamp is held together by the locknut. The diamond effect on the faces of the blocks can be shaped quickly on a disk sander, or the faces may be left plain. The lamp base should be covered with felt or rubber to prevent marring



Strictly a lathe job, this boudoir lamp is turned in two sections and later connected by a pipe and locknut in the manner previously described. To facilitate centering the pipe hole lengthwise through the pieces, the work can be drilled beforehand, the holes plugged and the work then mounted in the lathe. A cardboard template will be helpful in checking the roundness of the ball turnings and in shaping both alike. Rounding the faces of the square spacer and base of the lamp is done by mounting the pieces on the lathe faceplate. You can counterbore the base at the same time



Here plastic and metal are combined. The base is formed of a 5-in. length of plastic tube cut in half and sanded and polished. The other half can be used in making a pair. The lamp post is in three sections with wood spacer plugs serving to align the pieces when assembling. Assembly is made by inserting the plugs half way in the ends of the sections and then placing the metal disks over the plugs. Tightening the locknut after the socket has been wired and fitted to the pipe "ties" the whole thing together like the others

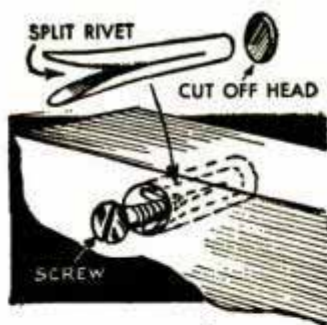


Emergency Powder Gun Is Made From Envelope and Tubing



Needing some sort of an emergency powder gun to blow flea powder on a pet, one housewife used an envelope and a piece of rubber tubing. The tubing, about $\frac{3}{4}$ in. long, was placed in the envelope with the powder. Then a pin hole was cut in one corner of the envelope. By alternately squeezing and releasing the tubing, a bellows action was obtained that forced the powder over the animal.

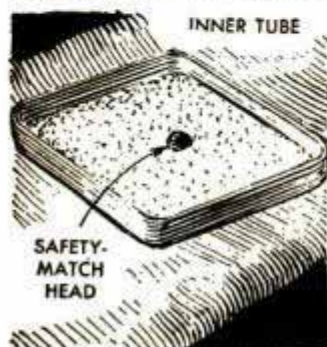
Split Rivets Will Hold Screws In Concrete or Brick



A split rivet can be used to anchor a small screw in concrete or brick. The rivet should be a loose fit in the hole into which the screw is to be driven. Cut the head off the rivet and insert it in the

hole with the split end outward. Then drive the screw between the halves.

Igniting Patch-Heating Mixture



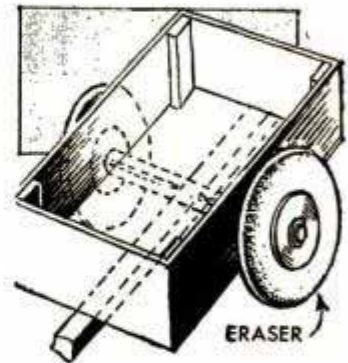
The heating mixture supplied in shallow metal pans for applying hot patches to inner tubes can be ignited, even in a high wind, very simply by the following method. To the surface of the

compound attach a safety-match head, using cellulose cement. To ignite the mixture, rub the match head against the abrasive strip found on the match boxes.

Kenneth Murray, Colon, Mich.

Round Erasers Used as Wheels For Children's Toys

Round type-writer erasers provide attractive wheels for toys. The wheels can be mounted with nails or small screws. The metal and rubber parts are painted to improve their appearance.



Way to Anchor Aquarium Grass

To keep the grass in a fish bowl from floating to the surface, one aquarium enthusiast uses wire solder. Short lengths are cut and the roots of the grass are wrapped around these pieces. Since water has little effect on this metal, it will not corrode.—J. Makowsky, New York City.

Rear Compartment Tool Rack Prevents Noisy Rattle

Tired of hearing the tools in the rear compartment rattling around, one motorist built a rack to hold them. A board was bolted to the back of the car and webbing was tacked to the board to provide pockets.

Robert S. Long, New York City.



To Replaster a Ceiling...



First step in renewing a badly cracked or sagging ceiling is to locate the joists and cover them with furring strips of lath, nailing the strips over the old surface in line with the joists



Next, plasterboard is nailed to the strips to form a smooth surface to which the new plaster will bond tightly. Place the sheets so that the joints are staggered and meet on centers at the strips



Strips of metal lath are used over joints, staggering them as shown. First coat is troweled about 1/4 in. thick and roughened with a whiskbroom while soft to provide a "key" for second coat



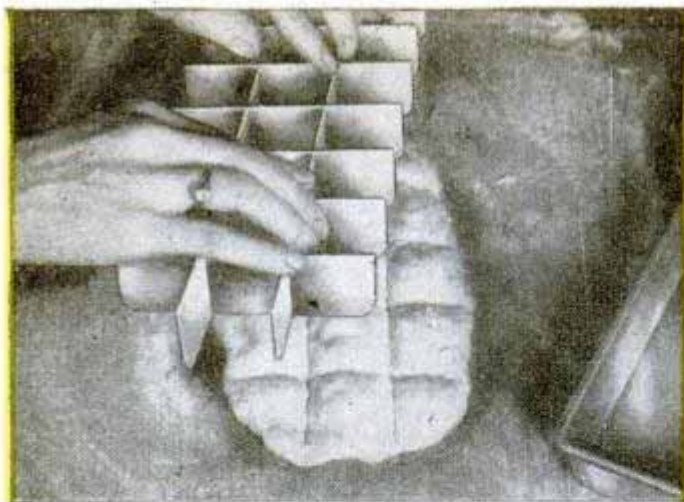
Second coat is applied 1/4 in. thick when the first is thoroughly dry. It should be pressed in to adhere to the rough surface of the first coat. For a three-coat job, second coat also is roughened



The final or "setting" coat should be 1/8 in. thick. It is applied when the second coat is nearly dry, but not too dry or the moisture will be drawn from the mixture, making it difficult to trowel



Final coat may be troweled to a hard finish, or it may be given the "sand-float" finish shown. This is done with a wooden trowel in a circular motion (Photographs courtesy U. S. Gypsum Company)



To cut biscuits in a hurry, use the divider from an ice-cube tray. After mixing the dough, roll it to the right shape and cut with the divider. When baked, separate the biscuits at the dividing lines

Tired of using rubber pads, metal plates and other unsightly objects to keep the feet of kitchen furniture off the linoleum, one housewife cut circular pieces of thick celluloid and placed them under the feet

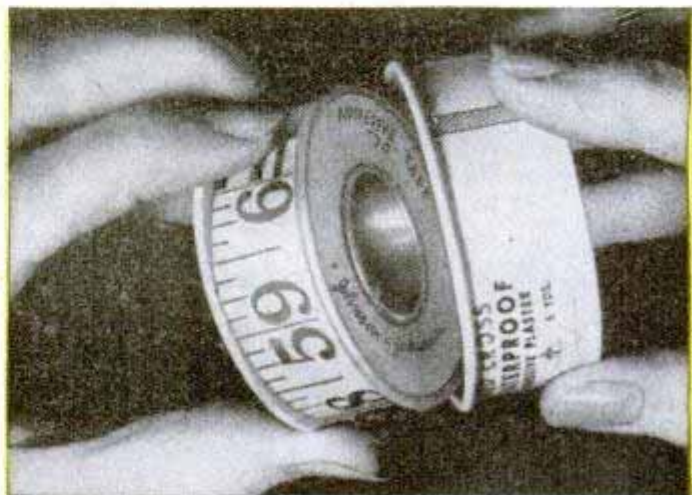
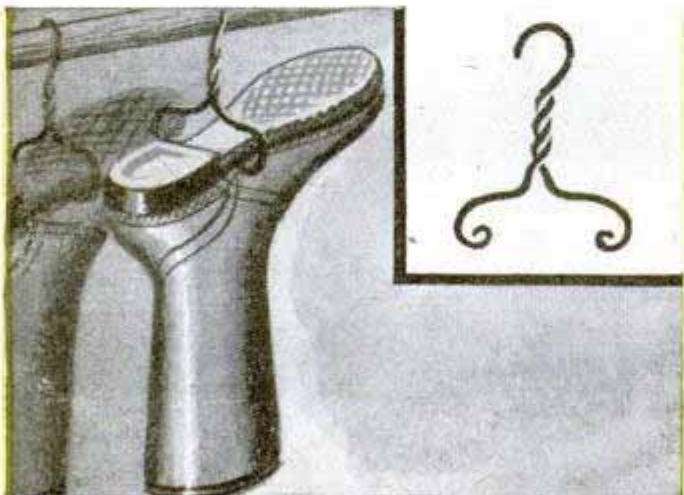
Solving Home Problems

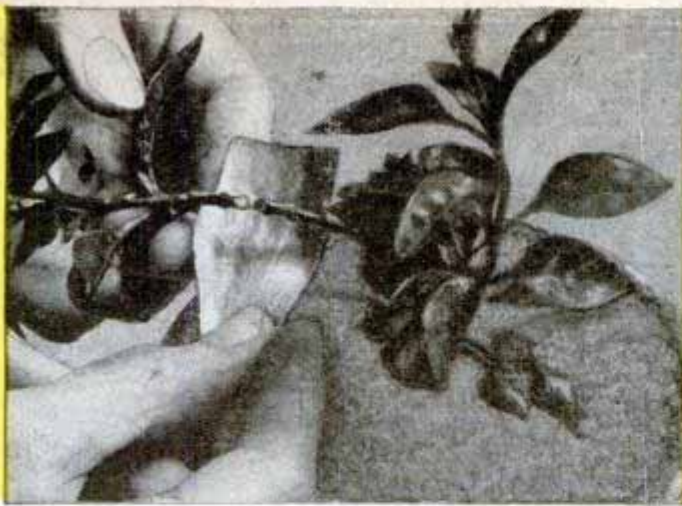


When storing or drying boots, use this converted clothes hanger to keep them off the floor. The hanger is cut and bent as shown, the space between the eyes being governed by the width of the sole

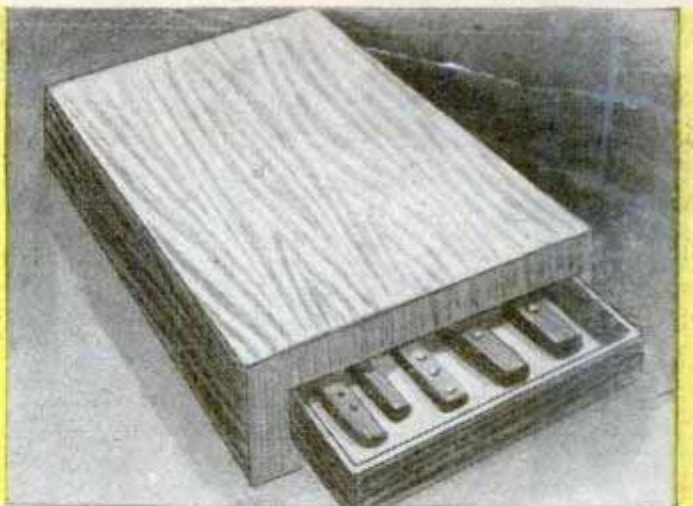
An old toothbrush will provide excellent service as a comb cleaner. Trim it to the correct size by cutting off all bristles except the three end rows

If a tape measure is wound on the spool of an adhesive tape container, it will not kink and become limp. Stored in this way, it's ready for use and will not become entangled in the workbasket

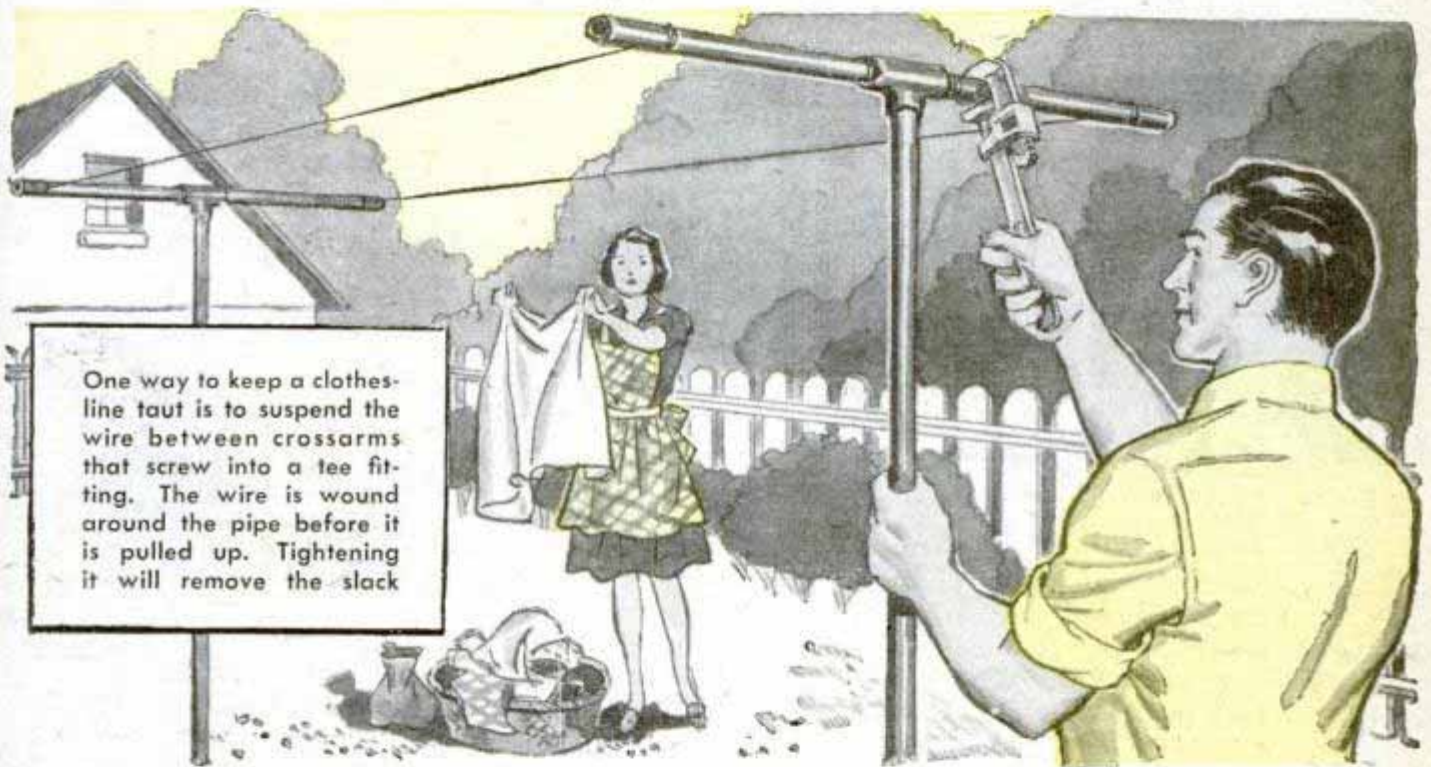




Wrap a piece of onion skin around the broken stalk or branch of a house plant to hold it securely until it has healed. This makes an inconspicuous patch and one that may save your favorite plant



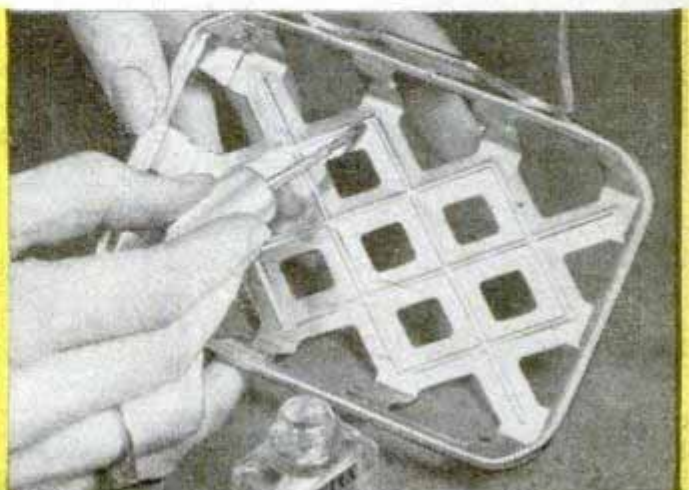
Made with a built-in drawer, this cutting block will hold most of your knives and other cutlery. The drawer is lined and spacers are provided to separate the knives so the edges are not dulled



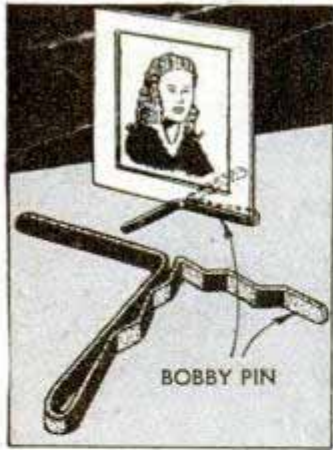
One way to keep a clothesline taut is to suspend the wire between crossarms that screw into a tee fitting. The wire is wound around the pipe before it is pulled up. Tightening it will remove the slack

In rainy weather, place a large desk blotter inside the front door so that wet rubbers and galoshes can be dried on it. When not in use, the blotter can be rolled up and kept in a hall closet

Brushing that steel soap dish with colorless nail polish will prevent unsightly rust spots from appearing where the protective coating has worn off. These spots cause the soap to stick to the dish



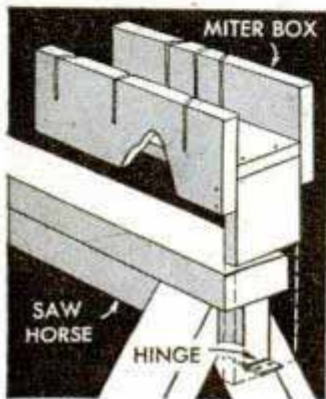
Bobby Pin Keeps Photo Upright



To hold a small photograph or picture upright, bend the legs of a bobby pin outward and then slip the picture between the parts of the legs which are still in contact. Cotter pins could be used in the same way.—G. E. Hendrickson, Argyle, Wis.

Miter Box Hinged to Sawhorse

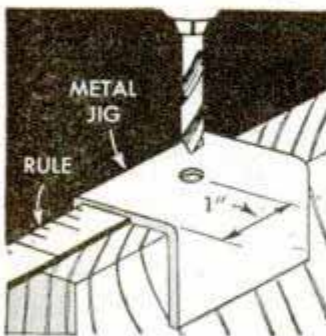
Because the carpenter work around his home required frequent use of a miter box, one man hinged it to the end of a sawhorse.



When in use the box rests on top of the sawhorse, but when the latter is in use the box folds down out of the way. The sides of the box extend down and fit over a vertical member of the sawhorse to provide additional steadiness.

Jig Guides Drill in End Grain

When building bookcase shelves and similar projects where it is necessary to drive the screws in end grain, a sheet-metal jig will aid in guiding the pilot drill for the screw starter holes. The jig is bent to fit over the board and has a hole of the proper size drilled in the center of the top. A rule is used to mark off the holes and, since it is 1 in. from the edge of the jig to center of the hole, this must be added to the dimension on the rule to get the correct distance. If the jig has a tendency to "creep," a clamp will hold it.—W. H. McClay, Pasadena, Calif.



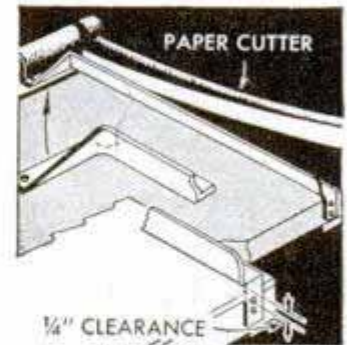
Renewing Hunting Knife Handles

Many hunting knives have handles made of leather or composition washers which tend to become soft or spongy after continued use. To restore the handle on such a

knife, lay it in the sun or a warm, dry place for several days until the material is thoroughly dry, then apply several coats of clear shellac. When it is dry, the handle will be firm and waterproof.

Cutter Guard Protects Fingers

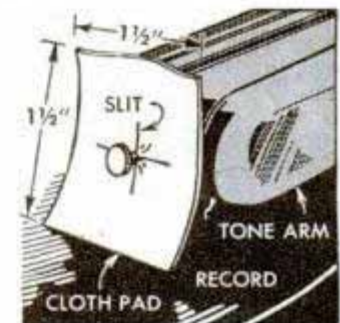
Made of 1/2-in. angle iron, this guard will prevent you from getting your fingers too close to the knife when using a paper cutter. The bottom of the guard should be about 1/4 in. above the board so that it will be easy to slip paper under it. One end of the iron is bent at right angles to fit around the knife hinge and the other end is bent down so that it will fit over the board. Screws hold the guard in place.



H. H. Fogg, West Somerville, Mass.

Pad Sweeps Dust Off Records

Scraps of velvet, velour and similar fabrics can be used to make a "sweep" that will brush dust off a record as it is being played. The squares of cloth have cross slits in the center



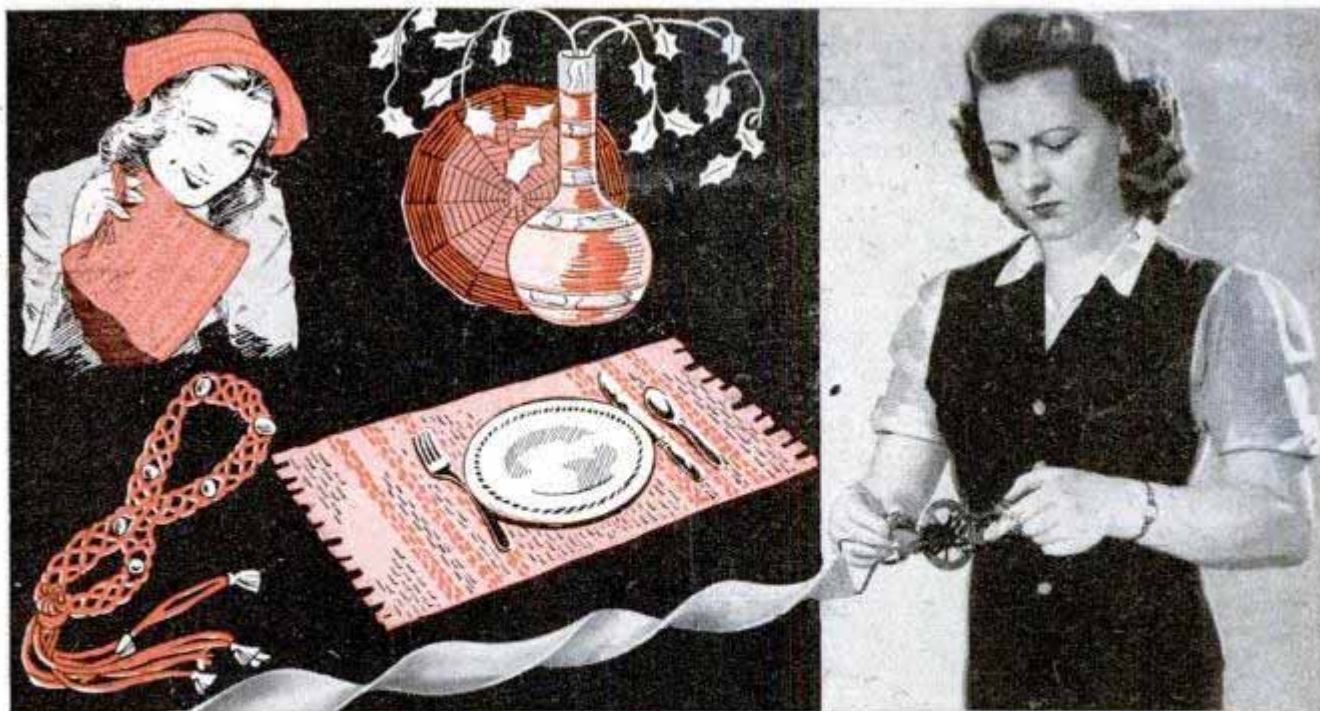
to slip over the needle tightening screw on the tone arm. The pad should be adjusted to clean the record in the path of the needle as the disk is rotating. It may be necessary to use cellulose tape to hold the cloth in the desired position.—Roger Hall Davis, Chicago.

Rolled-Metal Tube Holds Posters

As a method of keeping posters from being torn when tacking them on billboards in windy weather, one billboard maker made a tube with an open seam. The poster is rolled and inserted in the tube with one end projecting through the seam. This end is tacked first, the remainder of the poster being tacked in place as it is unrolled from the tube.



Colorful Novelties From Crepe-Paper Raffia



Raffia made from crepe paper can be crocheted, woven or braided into many useful and colorful items of wearing apparel and also fashioned by the same methods into decorative articles for the home. The sketches above suggest only a few. Here's a quick way to twist the crepe paper into cord of a uniform size: First cut a "bolt" of the paper into strips about 1½ in. wide, cutting through the entire thickness of the bolt each time. This gives you twelve or more streamers, each about 10 ft. long.

Next bend a short length of medium-heavy wire to form a hook shaped like that shown in the photo above. Loop one end of the streamer around the hook and fasten with Cellophane tape. Insert the hook in the chuck of a small hand drill and thumbtack the other end of the streamer to a door jamb or small block of wood placed on a table. Then simply turn the crank of the hand drill, at the same time keeping a light tension on the streamer.

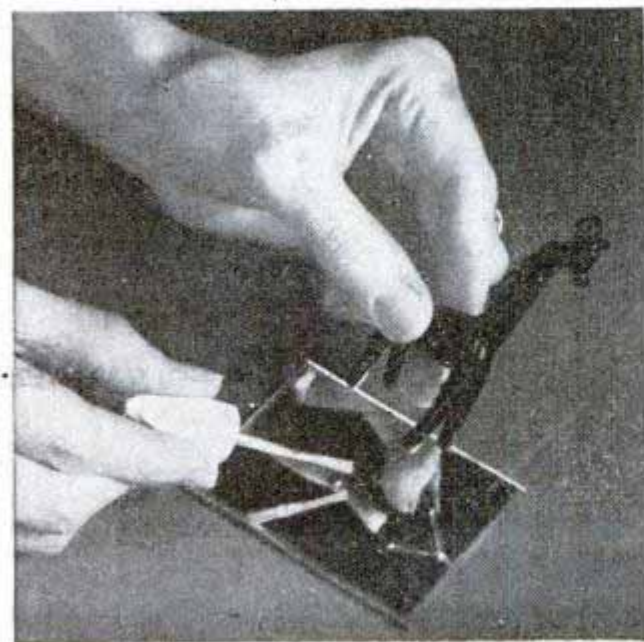
Augusta Nixon, Buena Park, Calif.

Fragile Figures Glued to Mirror Will Not Break Easily

Many a lightweight ornamental figure has been broken because a stray breeze or the jar of a closing door has caused it to fall. If the figure is mounted on a small,

pocketbook-size mirror, using colorless nail polish as an adhesive, this will not happen. The mirror not only anchors the figure but, by reflecting it, makes the display more attractive. The small mirrors are obtainable in many sizes.

Benj. Nielsen, Aurora, Nebr.



Corner Boundary-Line Markers

Hollow concrete blocks, when arranged in the manner shown, make ideal corner boundary-line markers, the hollow part of the block being filled with soil in which flowers or small shrubs have been planted. Such markers are easy to set up and they greatly improve the appearance of the lawn. — Beatrice E. Reese, St. Petersburg, Fla.



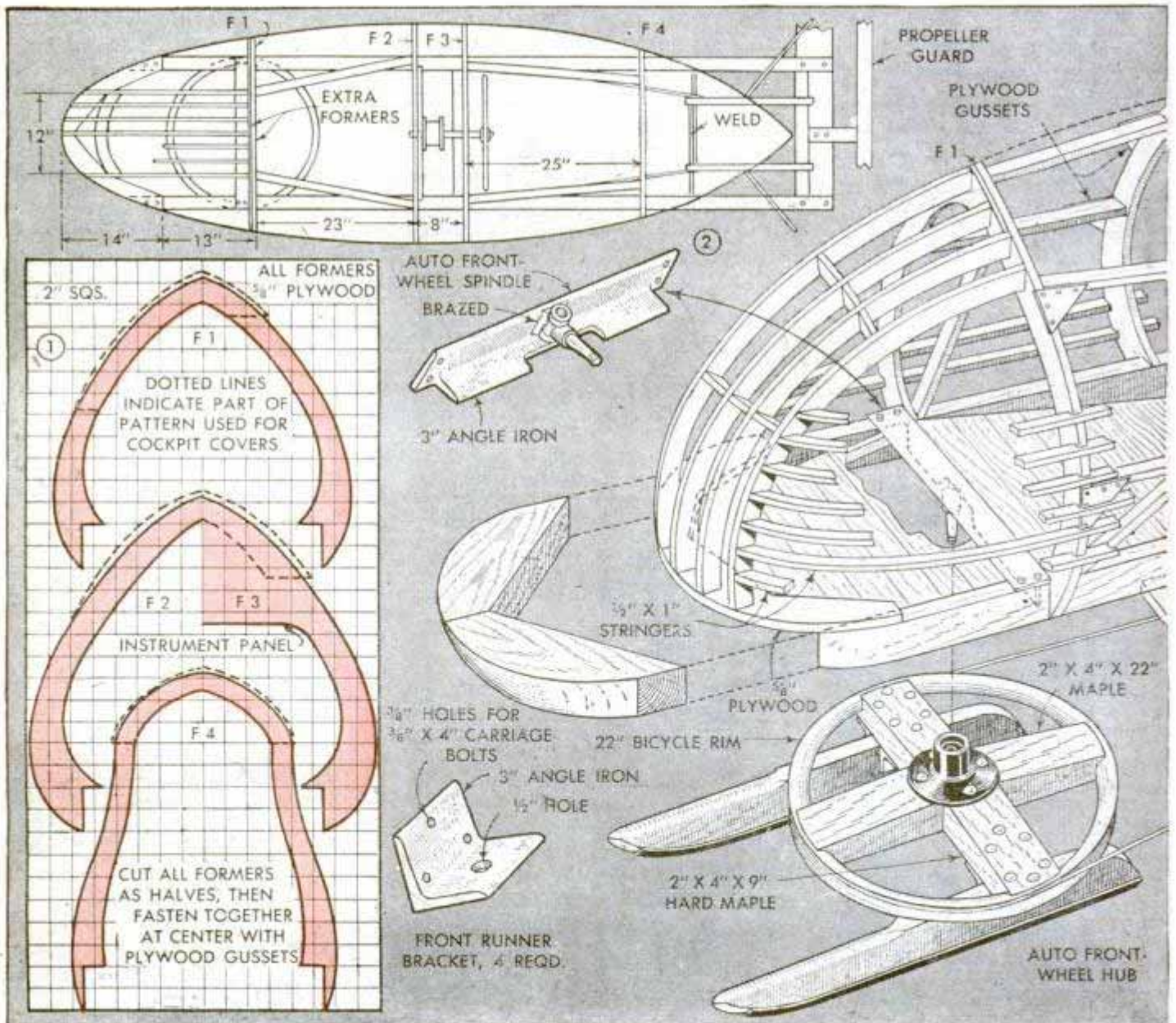
W.T.M. Concrete

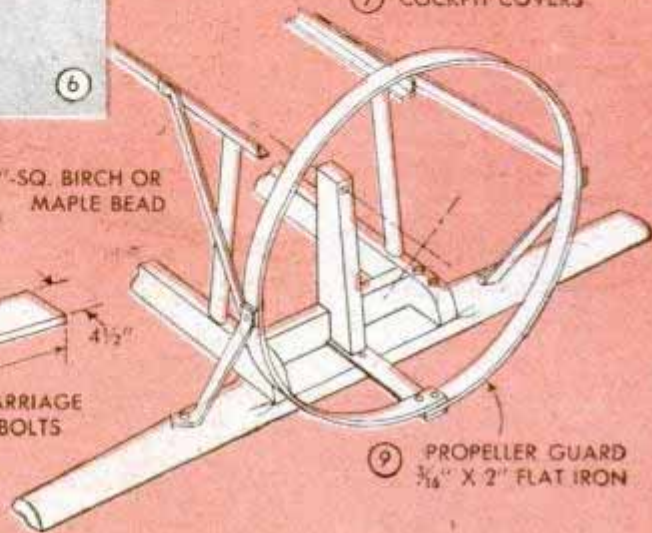
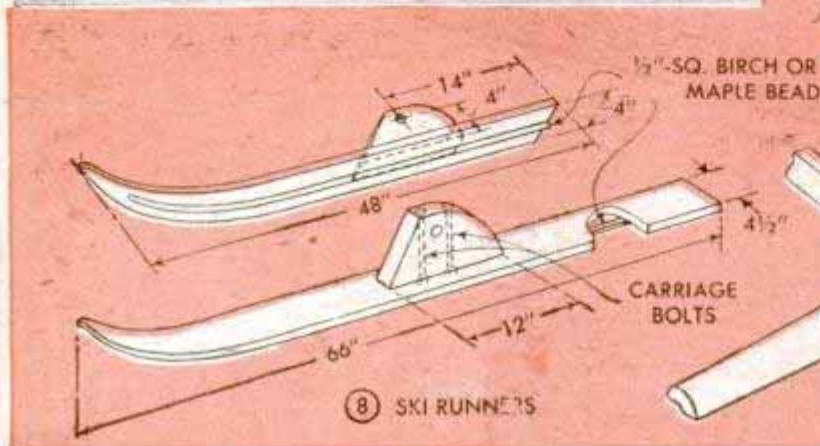
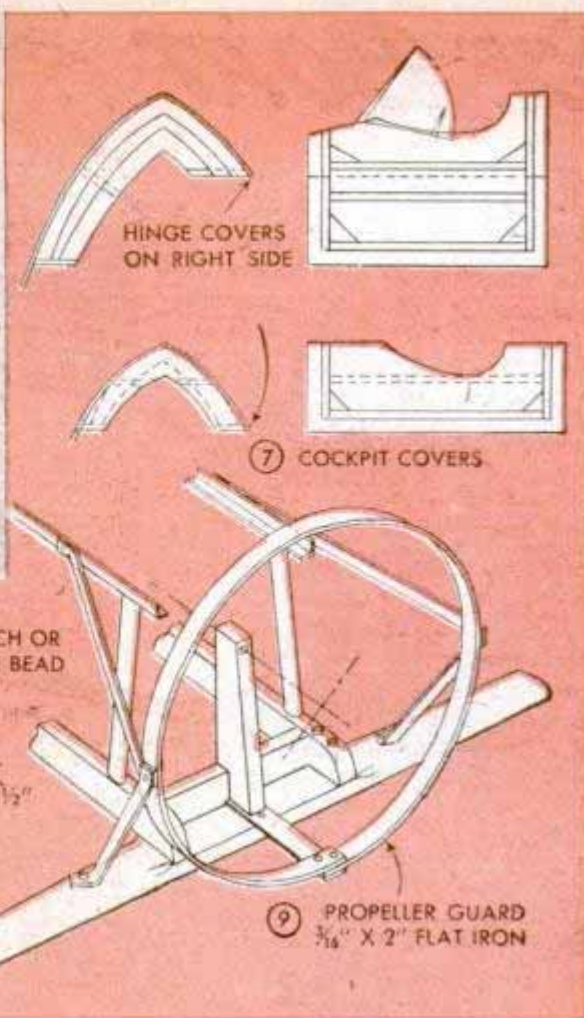
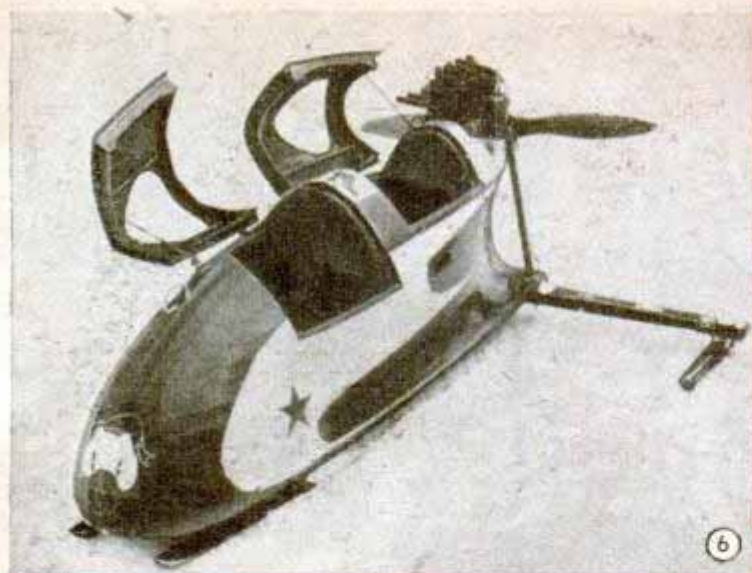
"Meteor" AERO-DRIVEN

By Paul R. Bussler

SPEEDS approaching 100 miles per hour on ice and a mile a minute on snow are claimed by the builder of this streamlined aero-driven ice boat. The original was powered by a four-cylinder motorcycle engine, although a twin-cylinder one, converted for the purpose, can be used. The engine cradle or mount may vary somewhat in each particular case; otherwise, construction remains the same. The chassis consists of two 8-ft. lengths of 2" by 4-in. stock bolted to a runner plank as detailed in Fig. 5. At the front, the rails are cut to receive a round nose block, which is fastened permanently later. Next, cleats are nailed to the inside of the rails and 3/4-in. floor boards nailed to them in the manner shown. The king-pin assembly is improvised by brazing the spindle of an old Chevrolet front wheel to a length of 3-in. angle iron cut according to Fig. 2.

The fuselage formers are shown on squares in Fig. 1 for enlarging to full size, and Fig. 2 gives the position of each one. For economy, each former can be cut out in two parts and later joined at the center with a wood or sheet-metal gusset. If plywood is not available, the formers can be cut from solid stock and joined in the same manner. After the formers are fastened in place, the nose of the fuselage is framed as in Fig. 3. This is made up of seven plywood formers, a center one with three on each side. Fig. 4 gives the profile of the center one; the others are shaped and fitted, as the work progresses, to produce a nicely rounded nose. The upper ends of the formers are screwed to F1, while at the bottom a plywood plate, matching the contour of the nose block, permits fastening the formers with screws





from the underside. With this done, the nose block can be fastened permanently.

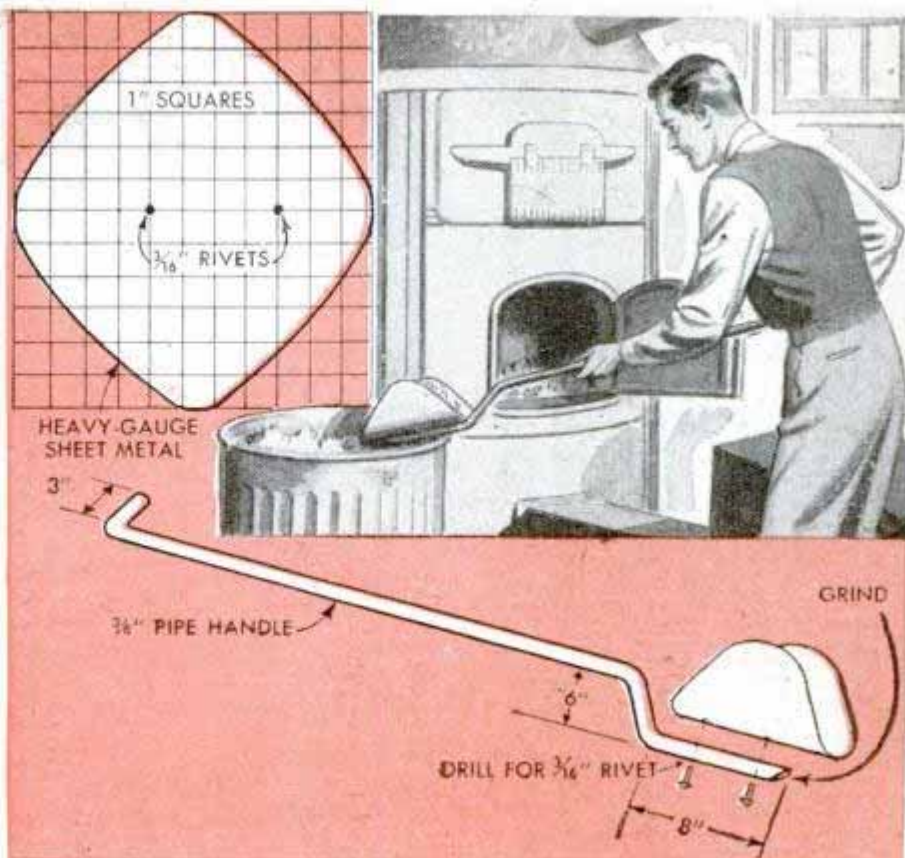
From the nose you work on back, adding the rails and gussets between each former where indicated in Fig. 3. Note that F2 is fitted with a crosspiece to support the steering-wheel shaft, and that the space between F2 and F3 is covered with thin plywood down to the first crossrail on each side. Next, the stringers are added. These are narrow strips that run lengthwise from the nose to F4 to produce a framework for the cloth covering. The strips are glued in notches $\frac{1}{2}$ in. deep and spaced about 2 in. apart in the edges of the formers. The front ends may have to be steamed or kerfed to produce a sweeping curve. The board carrying the pulleys can be fastened next, also the pressed-board floor panel.

The front-runner assembly consists of an old bicycle rim, which is fastened to half-lapped crossmembers having a Chevrolet front-wheel hub bolted to them exactly in the center. The cable connecting the runners with the steering wheel is threaded through the pulleys and wrapped several times around a 2-in. spool pinned to the steering-wheel shaft. Both front and rear runners are pivoted in chocks cut from 3-in. angle iron. The runners detailed above Fig. 4 are for use on ice, while those shown in Fig. 8 are recommended for snow.

You'll do best to build the cockpit covers right in their openings, tacking the formers to the fuselage formers temporarily and then gluing and nailing $\frac{3}{32}$ -in. plywood to the edges. When dry, the unit is lifted out and braces and corner blocks are added according to Fig. 7. The shape of the formers for the cockpit covers is given in Fig. 1. Note that they must project $\frac{1}{2}$ in. above the others to be flush with the stringers. In Fig. 6 you can see how the covers are hinged along the right-hand side and how they are fitted with check cords. Heavy celluloid, supported by sheet-metal brackets, provides suitable windshields, and slit sections of rubber hose applied to the rough edge of the head openings pads the edges. As previously mentioned, the engine cradle may require changing somewhat to suit the engine being used, but it should be well braced in the manner shown. This is also true of the propeller guard detailed in Fig. 9. Rigidity of these parts is essential if the boat is to perform satisfactorily. Seats, gas tank and covering remain. Muslin is used for the covering and drawn firmly over the framework and tacked to the underside of the chassis and to a stern post bolted to the chassis. Then the cloth is coated three or four times with airplane dope to make it taut, after which it is painted.

Cleanout Tool for Stoker Fits Around Retort

Here's a handy cleanout tool for your stoker that fits the curvature of the firepot. It's made of heavy-gauge sheet metal with a $\frac{3}{8}$ -in.-pipe handle. Cut the sheet to the shape indicated on the diagram and drill holes for two $\frac{3}{16}$ -in. rivets where shown. Then round the sides to form the two "wings" of the scoop. The handle can be any convenient length. The 6-in. offset is about 8-in. long and the end is ground at an angle to avoid catching on the firepot or retort when the tool is being used. To facilitate handling the scoop, the end of the handle is bent at right angles for a grip so that the scoop cannot turn and spill ashes. — Thomas J. Mahan, East St. Louis, Ill.



Quick-Drying Putty to Fill Wide Seams in Linoleum Floor

When laying inlaid linoleum, the space between the corner fittings may be larger than you wish. This can be filled by using a putty made of linoleum and shellac.

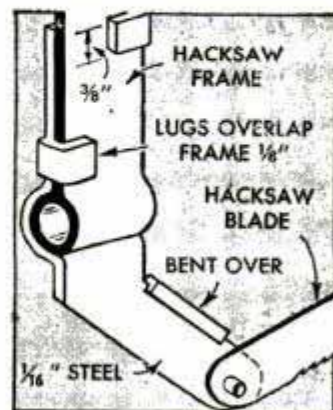
Scrape off shavings from the color you want with the back of a knife so the shavings will be very small. Mix these with enough shellac to make a thick paste. Apply this to the crack with a putty knife and you will have a permanent repair. If the linoleum is marbled, scrape off shavings that will have all the colors.

Delmer R. Brizendine, Forest Grove, Ore.



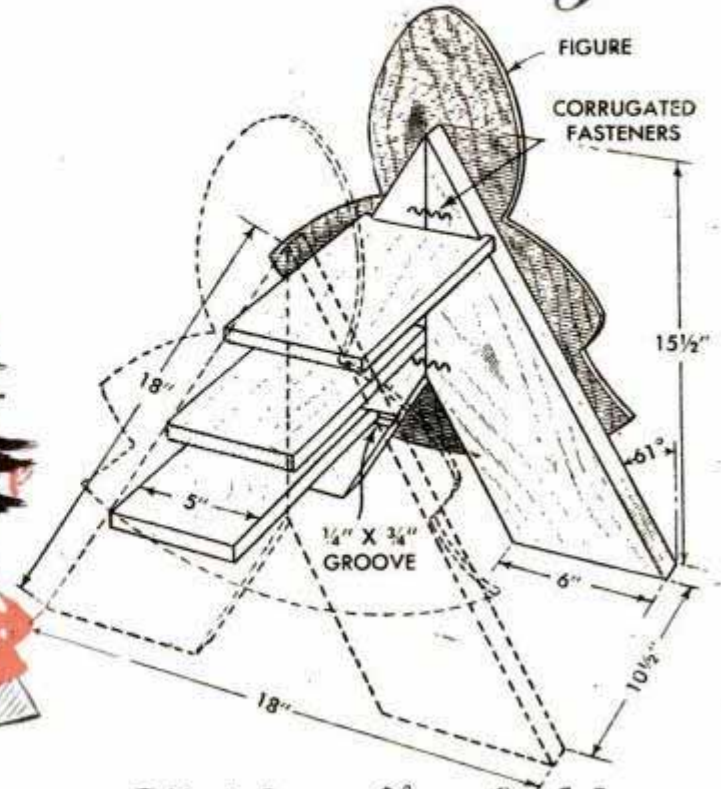
Increasing Capacity of Hacksaw

By adding an extension to the hacksaw frame, the depth to which the saw will cut is increased greatly. The angle at which the steel extension is cut must be such that the blade will fit on the pin. Two lugs overlap the saw frame to hold the extension in place and the third length that overlaps is to furnish rigidity. — C. L. Meehan, Lakeview, Ont., Can.



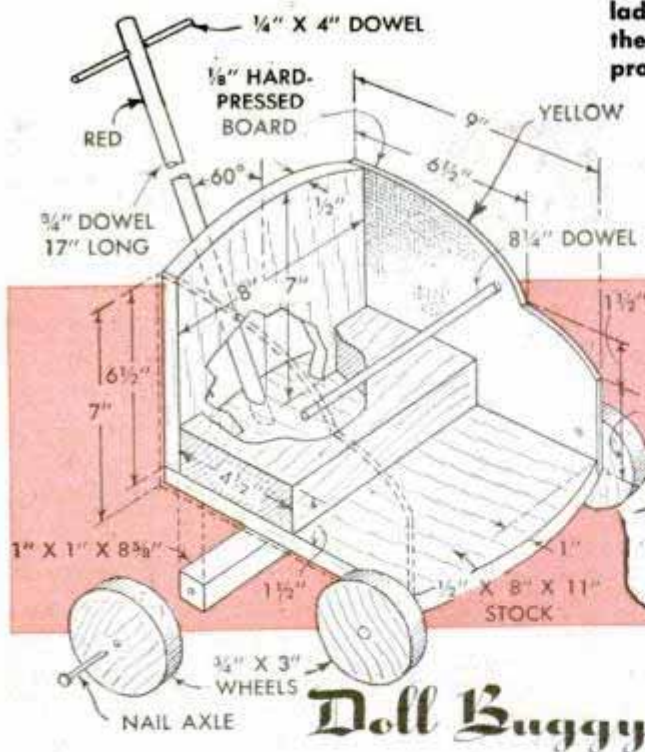
ⓘ Never wash eggs before storing as the unwashed shell carries a protective coating that is a natural seal for the shell pores.

15 Christmas Gifts



Kiddies Stepladder

Easily assembled, this stepladder will help little 'tots get at drawers and chests that are hard for them to reach. The clown which ornaments each side of the ladder is detailed on page 192 and construction of the steps and sides is indicated above. To lend the proper note of gaiety, paint the clowns in bright colors

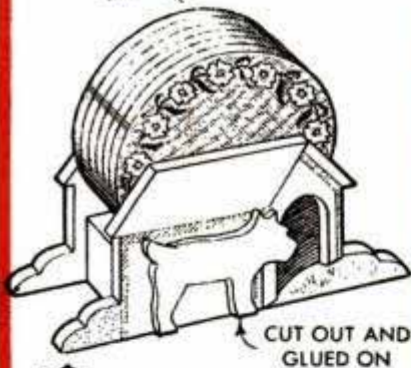
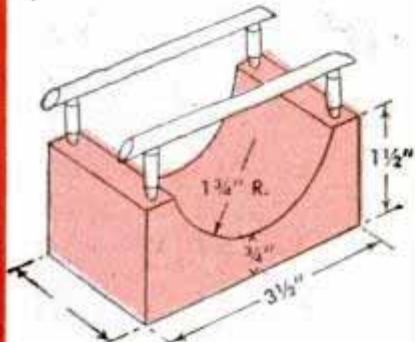
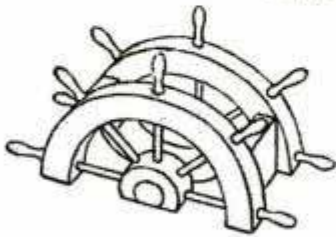
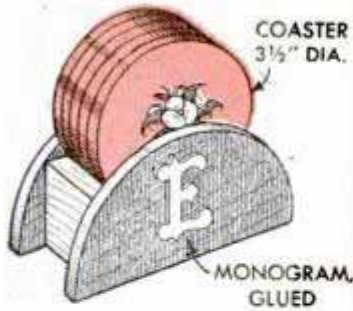


Doll Buggy

Here's a doll buggy that will make the young miss in your family very proud. While it's a little harder than the stepladder to cut out and assemble, the young man of the house might like to make it for "sis." A bright enamel finish in contrasting colors will decorate and protect the surface of the buggy



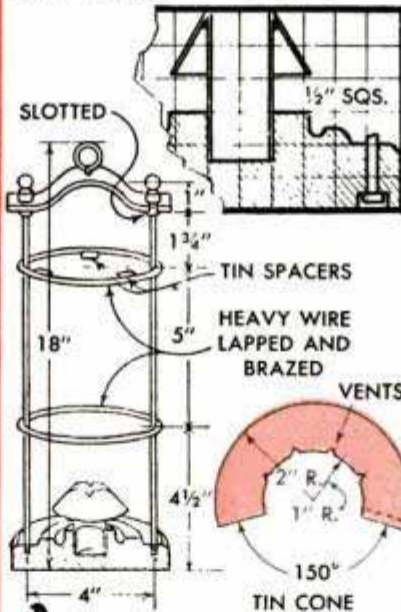
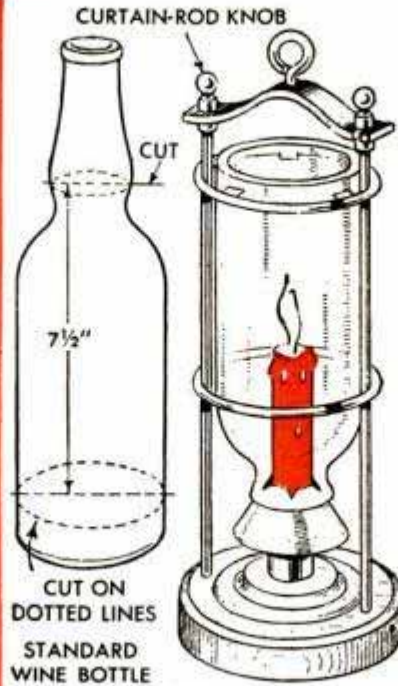
from Santa's Workshop



Coaster Holders

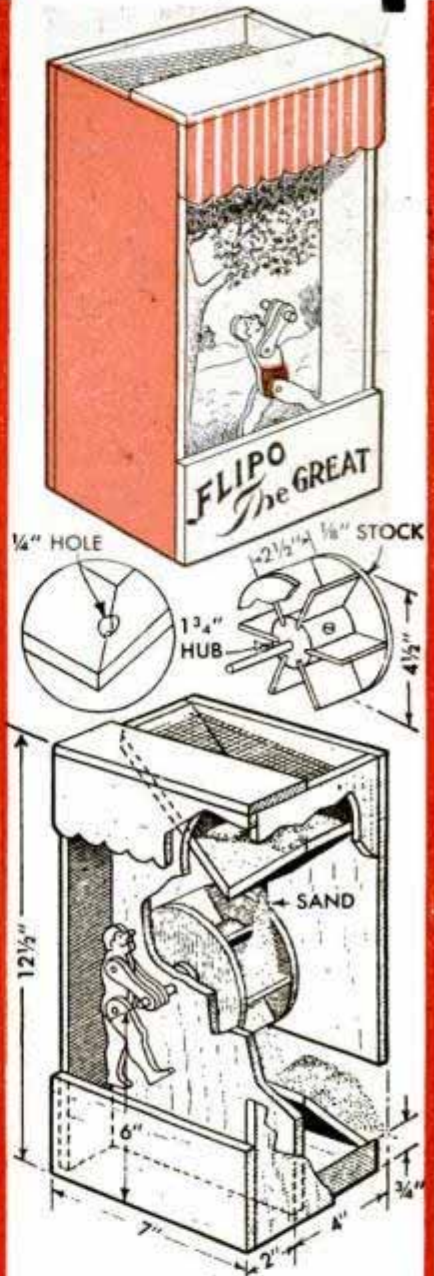
Made in short order with a disk cutter, these coasters may be of plywood, plastic or hard-pressed board. They are decorated with decalcomanias, or designs can be carved or painted on. Then they should be protected with several coats of spar varnish. A set of about six or eight will be sufficient. The base for the holder is of the dimensions given, the width depending upon the number of coasters in the set. Several ways of decorating the sides are suggested here

NOVEMBER 1946



Antique Candlestick

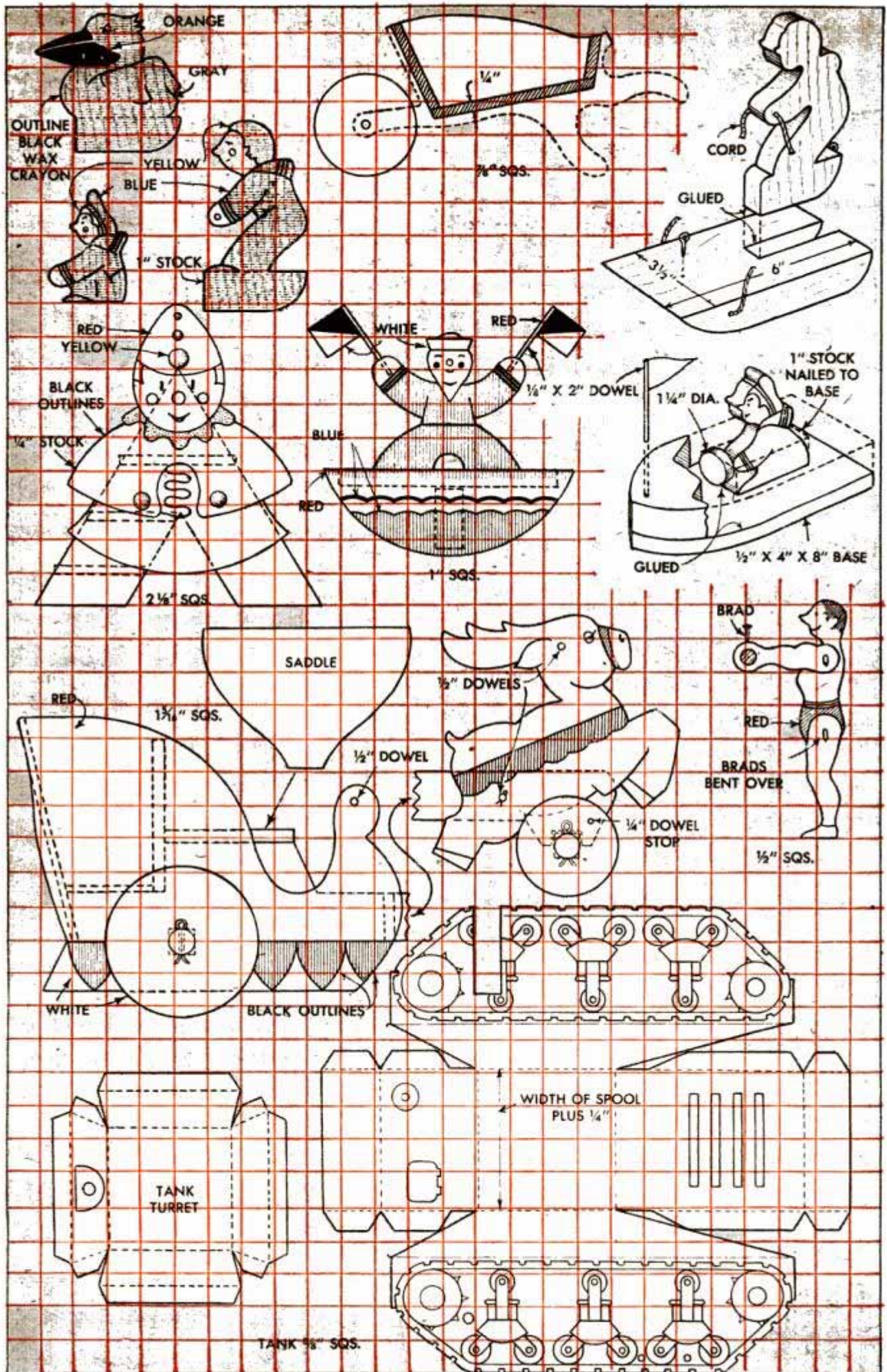
Novel and attractive, this antique candlestick needs only some light curtain rod, heavy wire, a hardwood base and a wine bottle for its construction. The base is turned on a lathe and the tin cone, that acts as both a candle holder and a support for the bottle, is assembled next. The uprights with brazed rings and flat-iron handle are inserted in the base and the candlestick is complete except for the bottle. The neck and bottom are cut off with heated resistance wire



Sandmill Toy

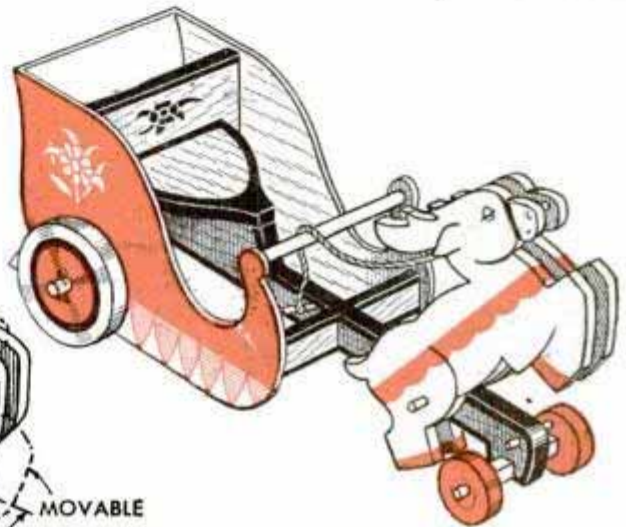
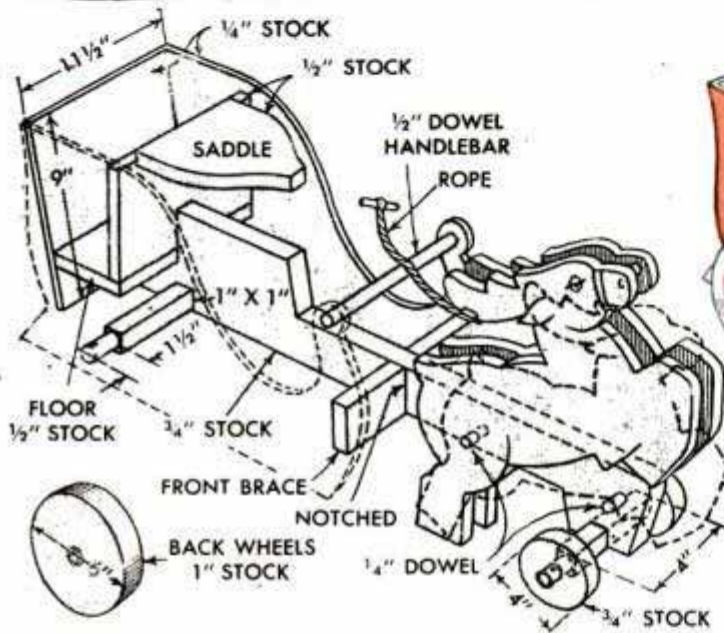
For the very young, a sandmill toy such as this one will provide endless hours of amusement. Just pour a little sand into the hopper and the obliging Flipo will turn handsprings backward or forward, depending on which way he is pinned to the axle. Make the box of any suitable wood about 3/8 in. in thickness and assemble with brads and casein glue. The hopper is removable and the hardware cloth on the top screens the sand. Flipo himself is sketched on page 192

191



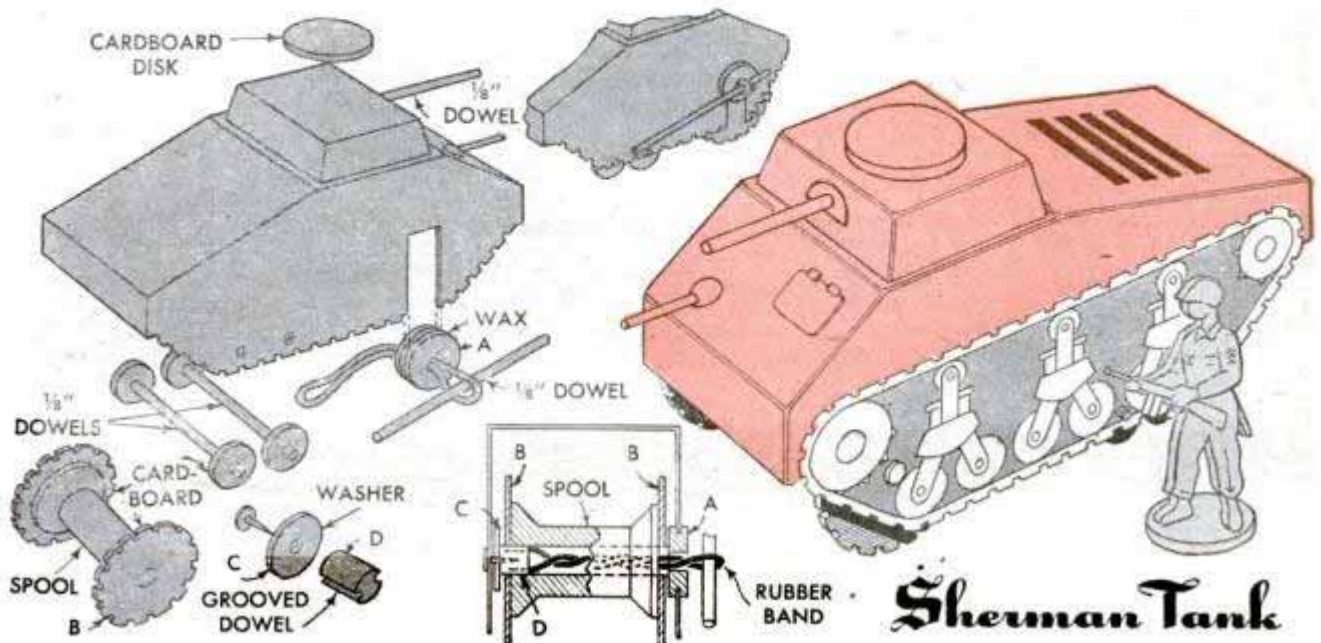


Signaling Sailor



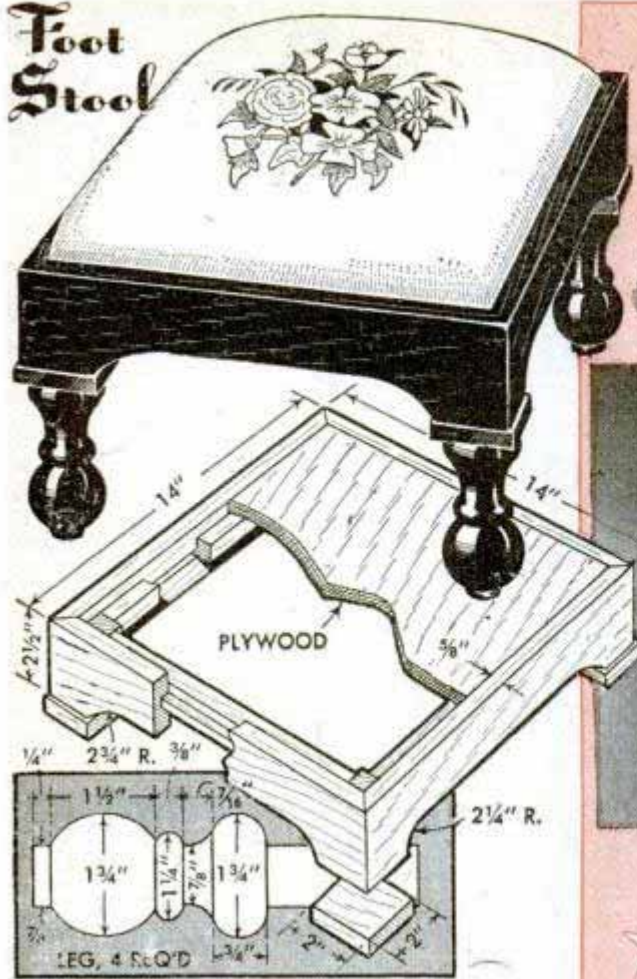
Reindeer-Sleigh Cart

Calling for attention, the signaling sailor is trying to attract the notice of the sailors and the pelican riding in the "aqua-train." Dimensions and suggested colors for these figures and craft are given at the top of the opposite page. Also shown at the center of the facing page is the cutout for the reindeer-sleigh cart which is illustrated above. Small boys will like to stage sham battles with replicas of the Sherman tank which is reproduced below and outlined on the page at the left. Rubber bands furnish the motive power to drive the tank

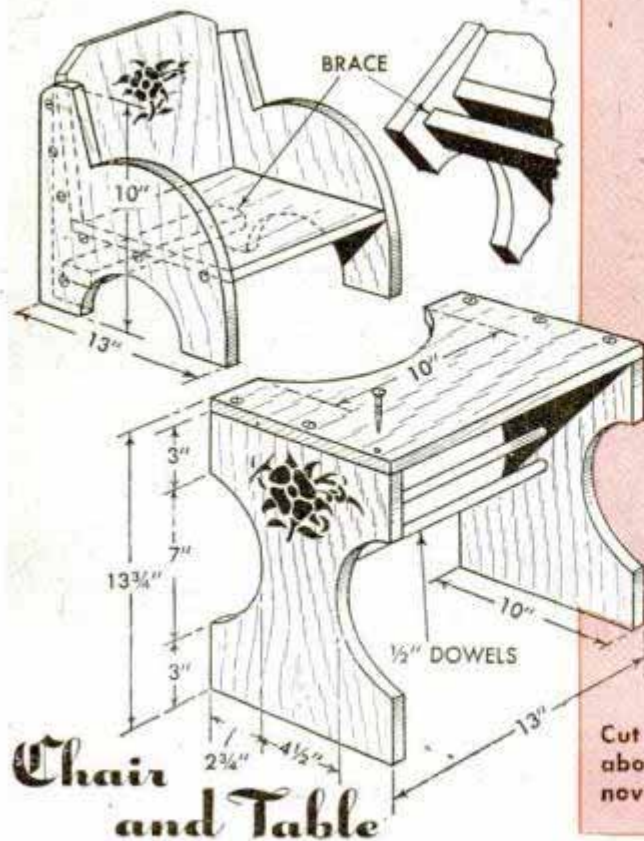


Sherman Tank

Foot Stool



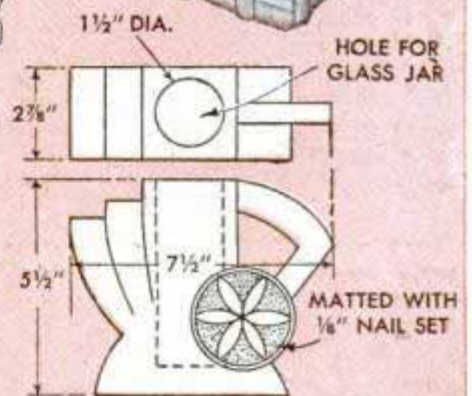
If some member of the family is handy at petit point, it will not be too difficult to make an attractive cover for this foot stool which has a plywood base and turned legs. Sturdy as well as being comfortable, the table and chair which are shown below will give your youngster furniture that is his "very own"



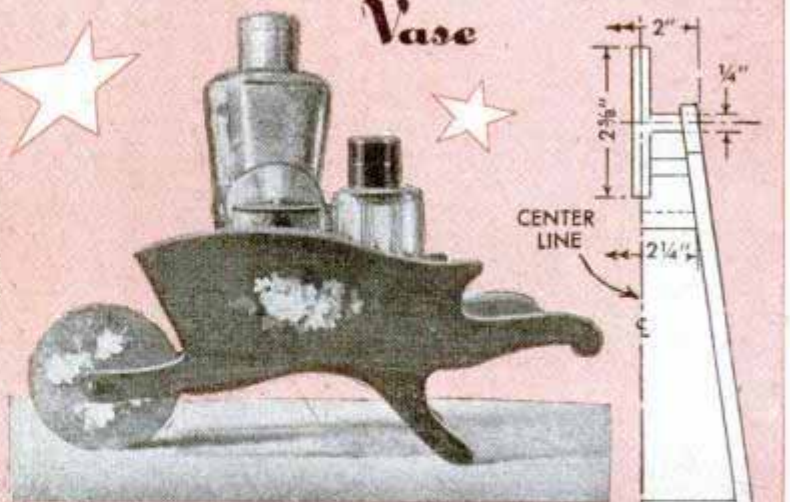
Chair and Table



Doll Playpen



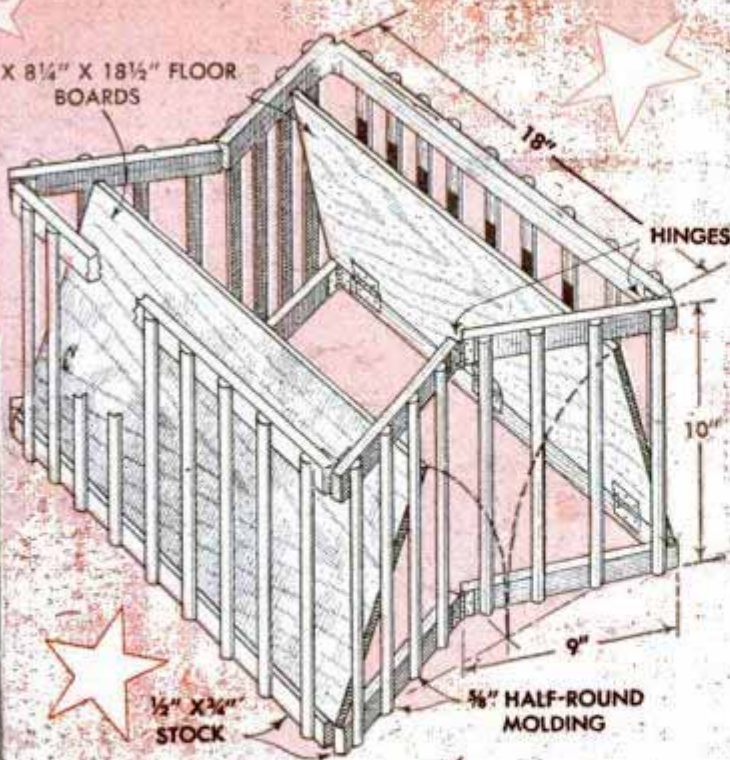
Vase



Perfume Barrow

Cut from one piece of wood with the handle added, the above vase is ornamented with copper. A perfume barrow is novel decoration for the vanity. Dimensions are on page 192

1/4" X 8 1/4" X 18 1/2" FLOOR
BOARDS

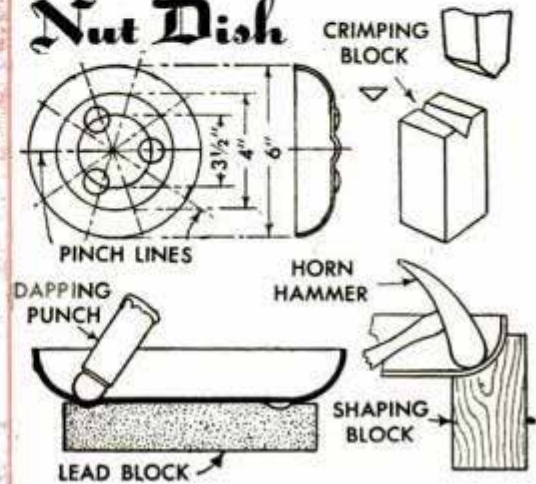


Because children like to play with toys which duplicate articles that are in the home, this doll playpen will receive a warm welcome. It has the advantage of being collapsible so it may be folded and put away when not in use. Half-round molding secured with brads nailed to longitudinal strips forms the sides and the floor is made of two boards. Hinges hold the pen together and, at the same time, permit it to be folded. The floor should fit tightly against the sides when the pen is opened to avoid pinched fingers. The size of the pen can be altered

In the winter you can be sure the baby will be snug and warm when bundled in the sleigh shown below. The seat is raised sufficiently from the floor to give protection from the cold and is tilted slightly to prevent the child from sliding out of position. A foot bar serves as a brace and a hand bar provides additional protection, as well as being used to hold additional blankets. Sides, back and seat are made of wood and the curved front piece is formed from light-gauge metal. Decals decorate sleigh



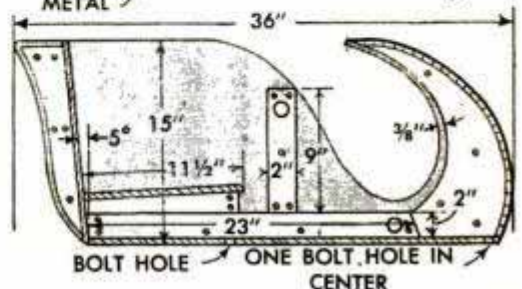
Nut Dish

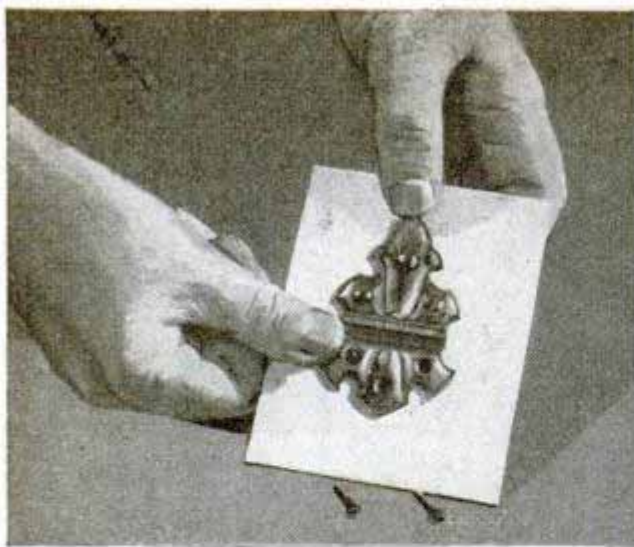


For the metal craftsman, this copper nut dish is an interesting project and makes an attractive gift. After the dish has been formed with the tools indicated, it is oxidized with a liver of sulphur solution to show the planishing effect to advantage. Buff with tripoli compound and jeweler's rouge to bring out the hidden highlights and then coat with clear metal lacquer



Baby Sleigh



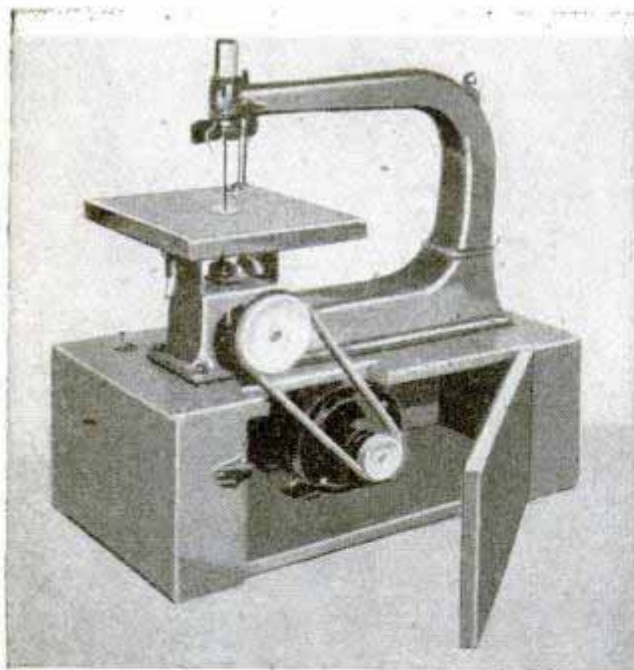


Hinge Screws Kept on Cardboard

When removing a hinge, make sure that the screws which fit it are not mislaid or mixed with others. Simply screw the hinge to a square of cardboard so all parts are kept together until the hinge is used again.

Jigsaw Mounted as Portable Unit

Mounted on a box to make a portable unit, this jigsaw has several advantages over some bench mountings. The height of the box elevates the saw to a handy working position when placed on a table. The door on the side of the box provides



for the ventilation of the motor and the box itself has space for blades, extension cord, etc. If desired, the entire unit could be fitted with a cover for protection.

Charles A. Bailey, Gary, Ind.

☐ Waxing the inside and outside of porcelain washing bowls will help prevent them from cracking.

Appearance of Open Wall Plaque Improved With Backing

To improve the appearance of open wall plaques which permit the wall to be seen through the design, paste a piece of colored paper on the back of the plaque. This is effective especially when the plaque and

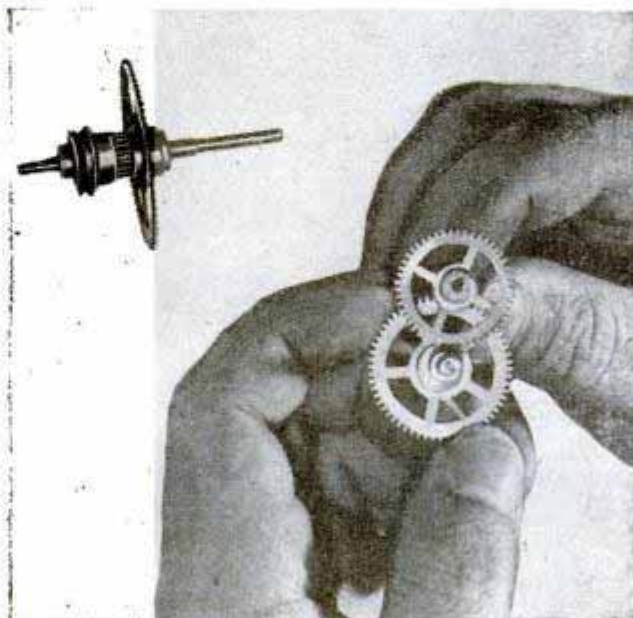


the wall are similar in color. The material of which the draperies are made, if available, will also produce a pleasing effect.

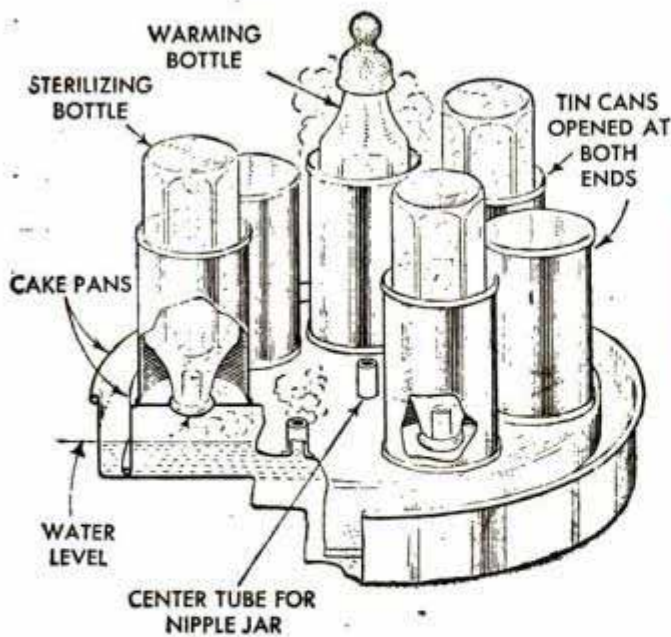
H. Schlossberg, Washington, D. C.

Reduction Gears for Model Work Obtained From Clock

If you need a set of reduction gears for a small machine or model, remove the wheels from an old clock and experiment until you find a pair that has a ratio which will give the speeds that are required. If the shafts are too small, drill them out carefully and substitute wire nails that have had the heads removed.



Multi-Jet Steam Unit Sterilizes Baby's Bottles



Mothers will find this efficient unit a real timesaver for warming and sterilizing a baby's bottles. It consists of two shallow cake pans, one inverted inside the other. Eight equally spaced holes are drilled in the bottom of the inverted pan and short lengths of $\frac{1}{4}$ -in. copper tubing are soldered in these holes so that the ends project about 1 in. to form steam jets. Seven soup cans, each with both ends cut out, are centered over the jets and soldered as shown. The cans serve as holders for the bottles. To use, fill the lower pan about half full of water and place the unit on the stove. Set the bottles to be sterilized in the holders, with

the neck of each bottle over a jet. The nipple jar is placed over the center jet. The average-size cake pan, half full, will contain enough water to boil about 10 minutes and this usually is sufficient for complete sterilization. The operation should be watched to see that the water does not boil away.

Maurice H. Baller, Washington, D. C.

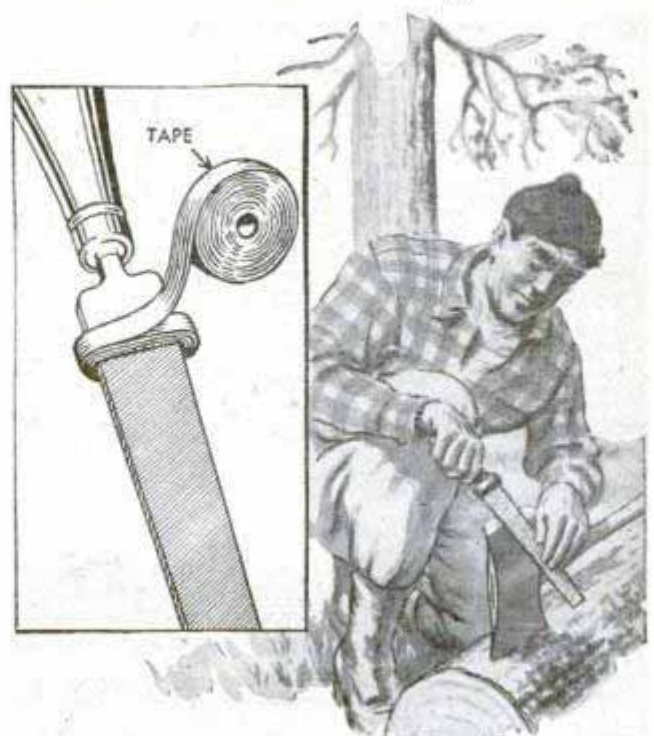
Friction Tape Wrapped on File Serves as Safety Guard

If friction tape is wrapped around a file near the tang, it will serve as a temporary safety guard to protect the fingers against accidental injury should the file slip when sharpening an ax or other edged tool. Several layers of tape should be applied to make the wrapping thick enough so that the ax cannot cut through it or slide over it on the downstroke of the file.—David B. Clapp, Livingston, N. J.

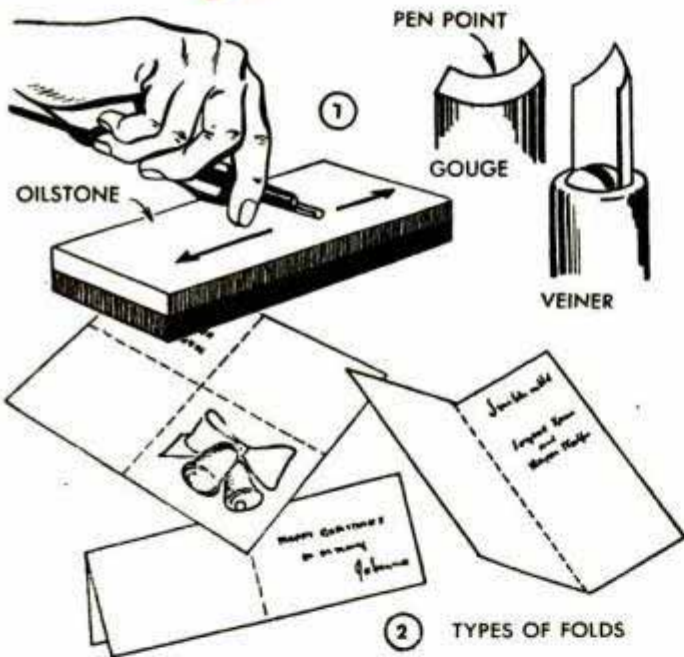
Removing Broken Wood Screws

To remove a screw broken off in wood, use a spoon bit and bore with a counter-clockwise motion down to the end of the screw. Then remove the screw and plug, fill the hole and rebore for a new screw. A $\frac{3}{8}$ and $\frac{5}{8}$ -in. spoon bit are good sizes to have in your kit.

Worn-out brooms will do duty as floor polishers if the straws are trimmed evenly and covered with woolen socks or felt hats.



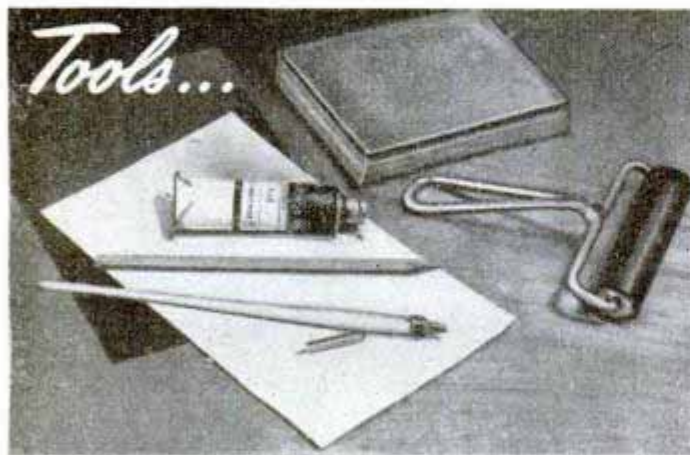
Say Merry Christmas with



By JACK and JAN HOLMES

GREETING cards sent to your friends will be less commercialized and have a more intimate touch if you make them yourself. Almost endless designs are possible, and you can even characterize them to suit the recipient. Equipment to print them consists of a carved linoleum block, a tube of printer's ink and a roller for applying the ink. Figs. 3, 4, 6 and 7 give the idea briefly. You will need a penholder and a few pen points which are oilstoned as in Fig. 1 to make chisels for carving the linoleum. Fig. 2 suggests different ways of folding the completed cards.

The designs shown above are only to get you started. You can sketch your



③ A linoleum block, carbon paper, tube of printer's ink, roller, pen holder and a few pen points are all you need

④ After transferring the pattern to the linoleum, you carve the design in relief, using the pen-point chisels

your own GREETING CARDS



Your "Best Wishes" will have extra meaning when they are sent on cards of your own exclusive design. You'll have fun, too, carving these linoleum-block "engravings"

own or trace them from the pages of magazines, catalogues and newspapers. Keep in mind that the lettering must be done in reverse. The linoleum block should be smoothed with fine sandpaper, and, if it is black, coat it with a very thin layer of showcard paint. The lighter finish will help show the tracing lines. With the carving tools, cut out the spaces to be left white, Fig. 5. The block should again be sanded after carving.

You are now ready to print. Thin the ink on a piece of glass, marble or other surface by adding a few drops of kerosene. Roll until thin and even, then transfer the solution to the linoleum block, rolling one way only until the surface is inked completely. Drawing paper or construction paper cut



to the correct size can be used for printing. At least 12 folded newspapers should be placed on the floor as a base for the paper to be printed, which then is placed in position and the block centered on it. Pressure is applied uniformly by rocking the ball of the foot back and forth for a few seconds on top of the block.

Block printing can be used for a number of things other than greeting cards. Students can design clever invitations to parties and adults may well use the same method to print unusual place cards and score cards.

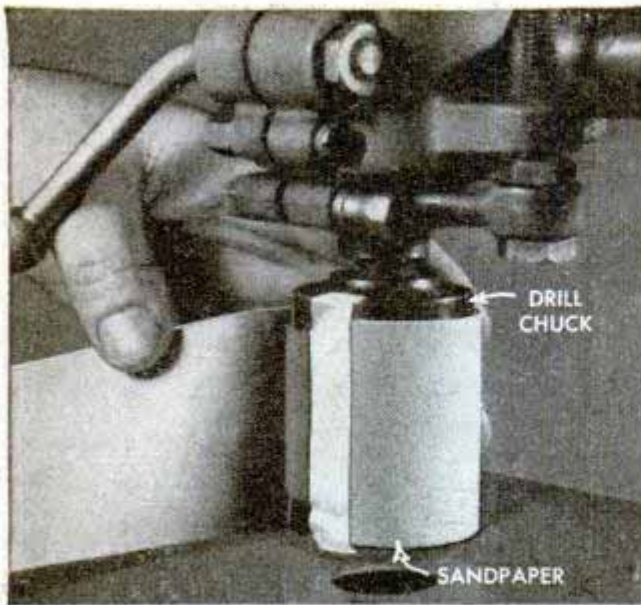


⑥ The roller is charged with ink by passing it over an ink-coated glass, and then rolling across the linoleum cut



⑦ You "go to press" by centering the cut on the card, which is placed on a padded surface, and standing on it

Drill Chuck Used as Drum Sander Finishes Curved Work



Needing a small drum sander and not having one available, one craftsman used the chuck on his drill press to serve the purpose. Although not recommended for continued use, this method is satisfactory in an emergency. Cut a strip of sandpaper the correct length and width and attach one end to the chuck with adhesive or cellulose tape. After wrapping the sandpaper around the chuck, fasten it at the top and bottom with rubber bands. Wrap the paper in the direction opposite the rotation of the chuck.

Clock Case Made From Skillet

Unique and practical, this kitchen clock has the movement taken from an ordinary alarm clock mounted on an aluminum skillet. A hole is drilled in the center of the pan for the pinion to which the clock hands are fastened. The dial numbers are painted on in a bright, attractive color and the rest of the skillet is left in its original finish.—Paul Hadley, Philadelphia, Pa.



Uses for Burned-Out Flash Bulbs

Used photoflash bulbs make good targets for either stationary or aerial practice with a .22-caliber rifle. When hit, they explode with a very satisfactory "pop." Anglers also have discovered their value for practice in the use of plugs. The caster who can break a bulb floating on the water from

a reasonable distance can be sure of his ability to place a lure at the right spot.

Claude M. Kreider, Long Beach, Calif.

Hand Grinder Mixes Casein Glue

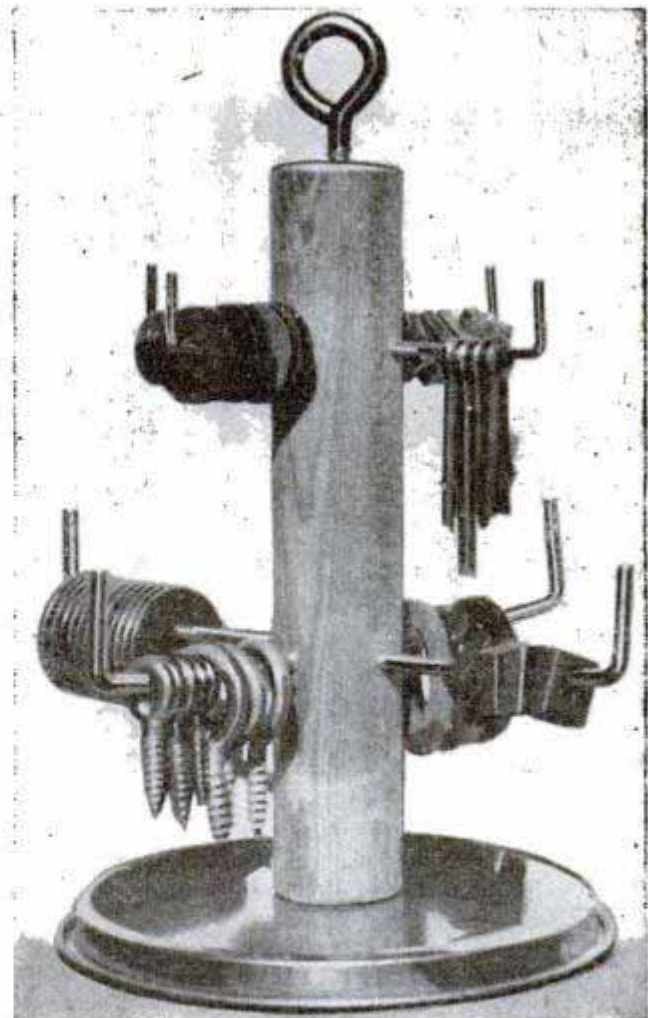
Mixing small batches of casein glue can be facilitated by inserting a round-head bolt in the chuck of a hand power grinder and using it for mixing. The bolt head provides just enough action to mix the glue in a short time.



Small Parts Stored Conveniently On "Carryall" Stand

Small but frequently used items such as screw eyes, cotter pins, nuts and washers are held conveniently on this "carryall" stand. The standard is a short length of dowel into which curtain-rod hooks are screwed. A lid from a paint can, which serves as a base, is attached to the dowel with a screw.

Ronald Eyrich, Milwaukee, Wis.



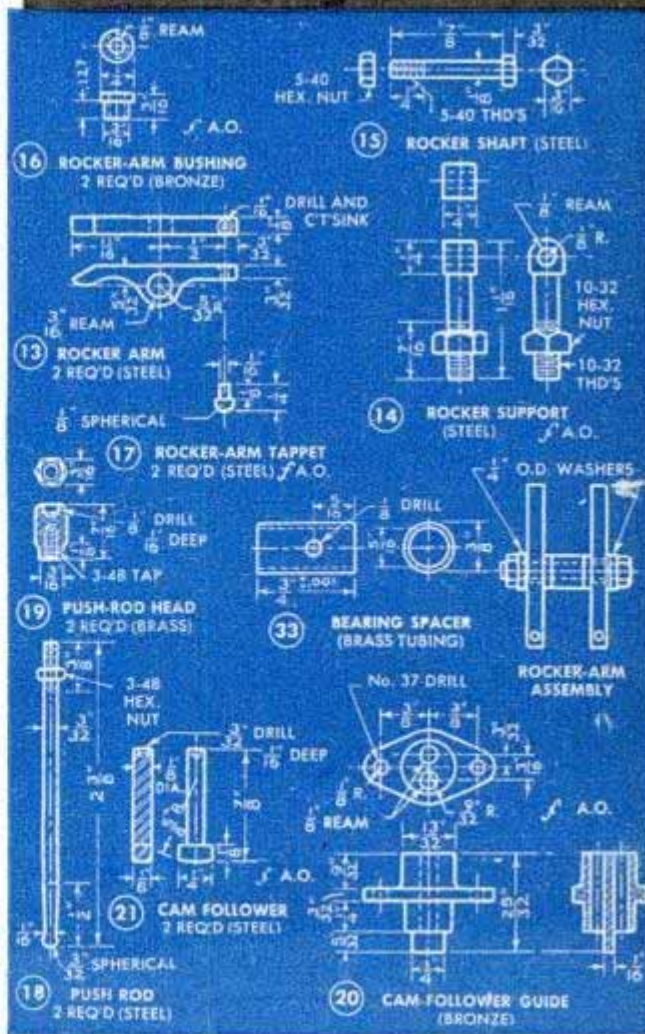
MODEL GAS ENGINE

PART II

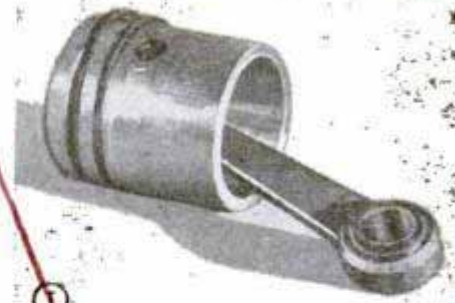
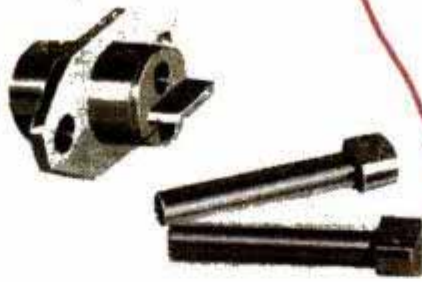
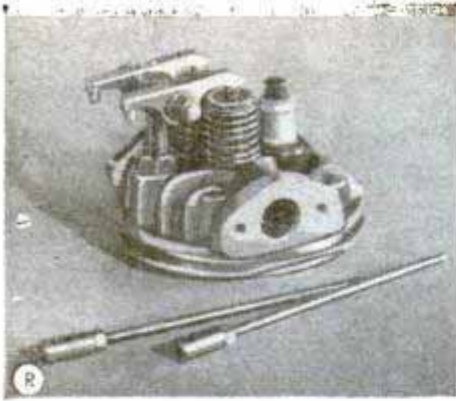
By Gary Moore

WITH all the principal engine castings except the carburetor machined to size, as described last month, the job is made ready for the more detailed work on the moving parts. Here again the figure numbers given correspond to the key numbers of the parts shown in the assembly drawing, Part I. Nearly all of the work on the rocker arms, Fig. 13, is done with hand files. With care and selection of the right files anyone can do a creditable job on these two parts. The rocker-arm support, shaft, and the bushings and tappets, Figs. 14 to 17 inclusive, are ordinary lathe jobs. These parts are shown assembled in photo R, together with the adjustable push rods, Fig. 18. These are turned to diameter in a collet chuck, polished with crocus cloth and threaded on the upper end for the heads. The lower portion of each push rod is tapered and the end is ground spherical as indicated. Push-rod heads, Fig. 19, are turned from hexagon stock and tapped to screw onto the push rods. Lock nuts are made by redrilling and tapping standard hex nuts. The cam-follower guide, a small bronze casting, Fig. 20, is turned to diameter on one end and the flange is faced. It then is reversed in the chuck and the operation repeated. Holes for the cam followers, or lifters, are spotted and drilled. In this operation care must be taken to get the holes located accurately so that the lifters will center on the cams. The lifters, Fig. 21, are turned down from $\frac{1}{8}$ by $\frac{1}{4}$ -in. steel to an easy sliding fit in the guide holes. Large ends of the lifters are crowned to a $\frac{5}{8}$ -in. radius and opposite ends are drilled to house the ball ends of the push rods. Completed parts are shown in photo S. Here it's well to note that in the assembly care must be taken when fitting the cam-follower guide on the angular crankcase boss to assure that it bears on the whole of the trued surface, that is, the joining surfaces should meet "without light" between and the guide should be perpendicular to the cam shaft. Otherwise these parts soon will show undue wear.

When setting up for machining the piston, Fig. 22, chuck it first by the lug, bore the skirt to diameter and turn down the outer diameter to within the limits of the hold dimension. This should give a smooth push fit in the cylinder bore. Ring grooves



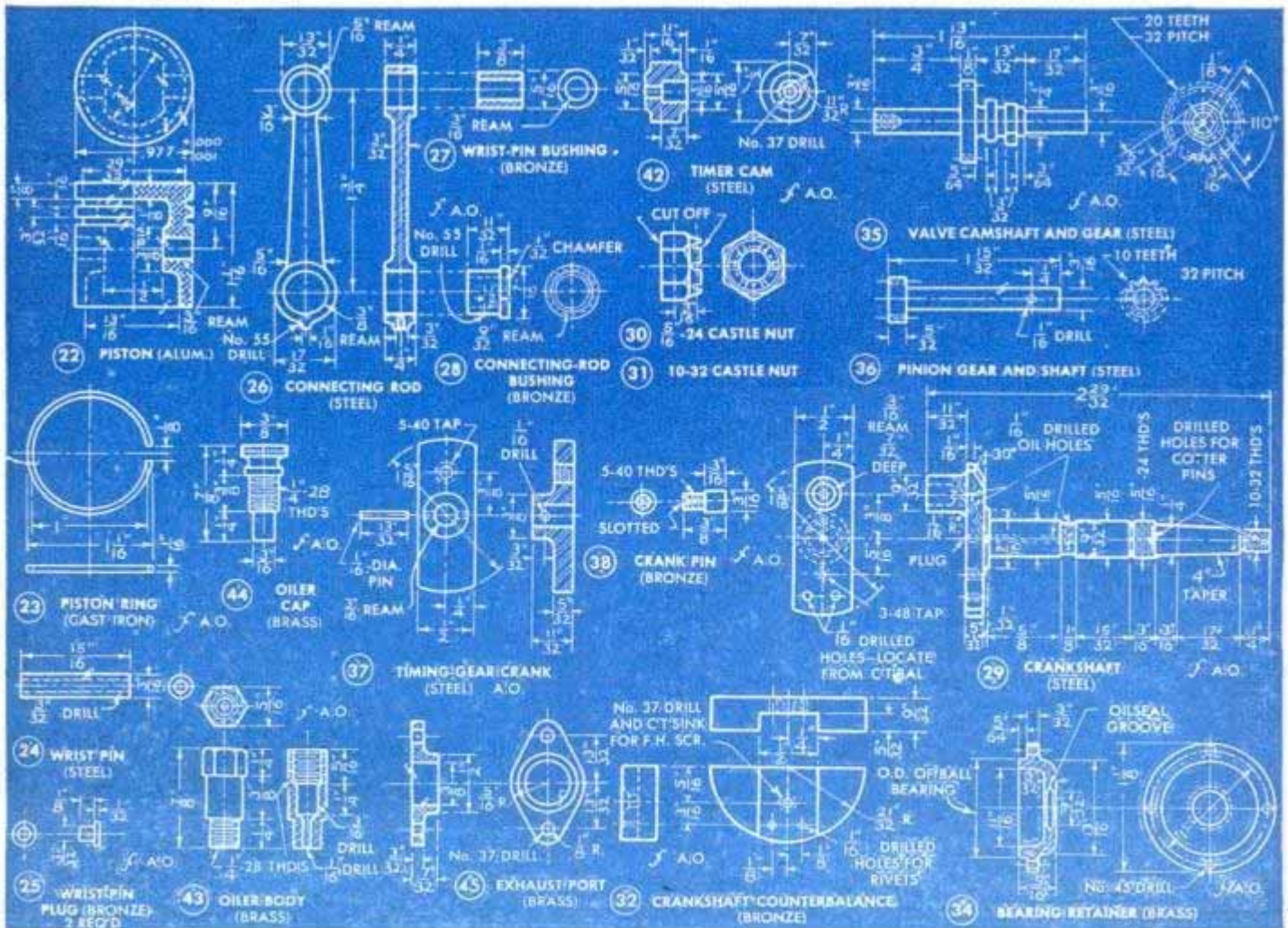
clockwise from the fly wheel end

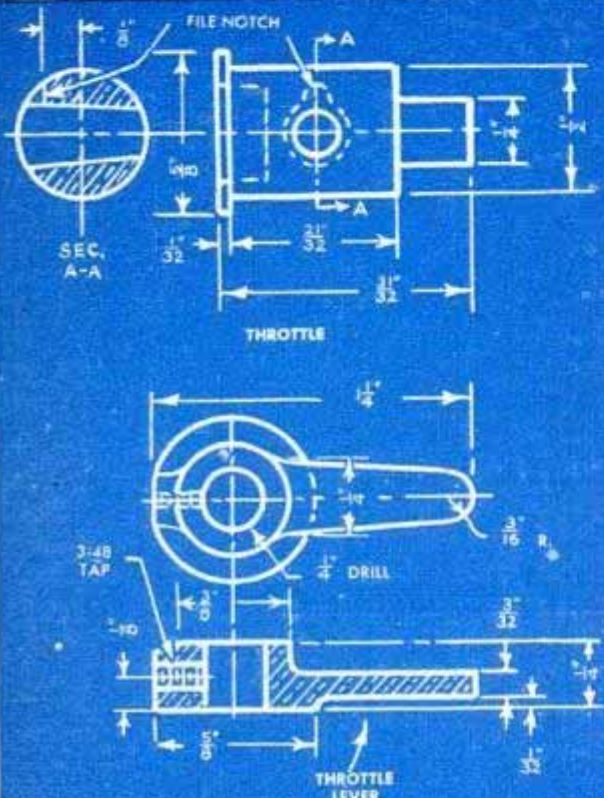
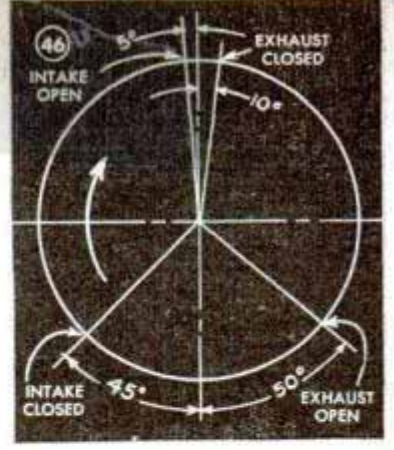
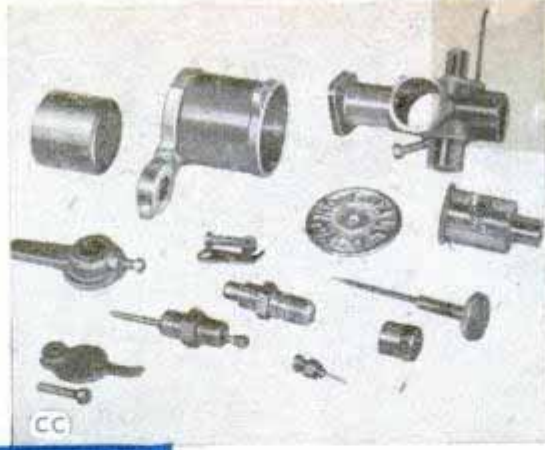
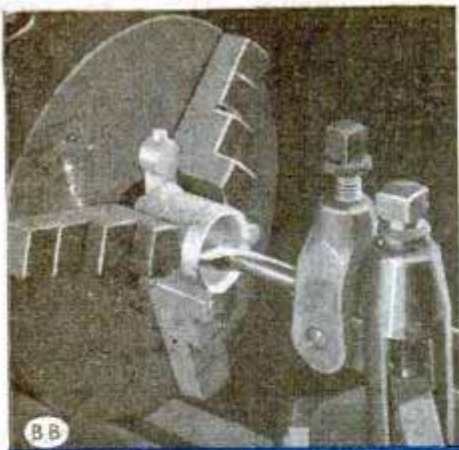


are cut with a parting tool just wide enough to allow the rings free movement. This done, reverse the work, cut off the chucking lug and face the piston head smooth and flat. Wrist-pin holes are drilled and reamed in the lathe, the drill bit and reamer driven by the live spindle and the piston supported in a crotch center. The wrist pin, Fig. 24, is turned and ground from drill rod and drilled hollow to cut weight to the minimum. Bronze plugs, Fig. 25, cover the ends of the wrist pin and protect the cylinder walls. The connecting rod, Fig. 26, is filed from steel bar stock to the rough shape. Then the holes are drilled and the large and small ends are trued up with the work mounted on a mandrel. Bushings, Figs. 27 and 28, are turned and drilled from

solid bronze rod to a light press fit. Piston rings, Fig. 23, can be purchased or turned from cast iron to the dimensions given. The completed job is shown in photo T, ready for assembly into the engine.

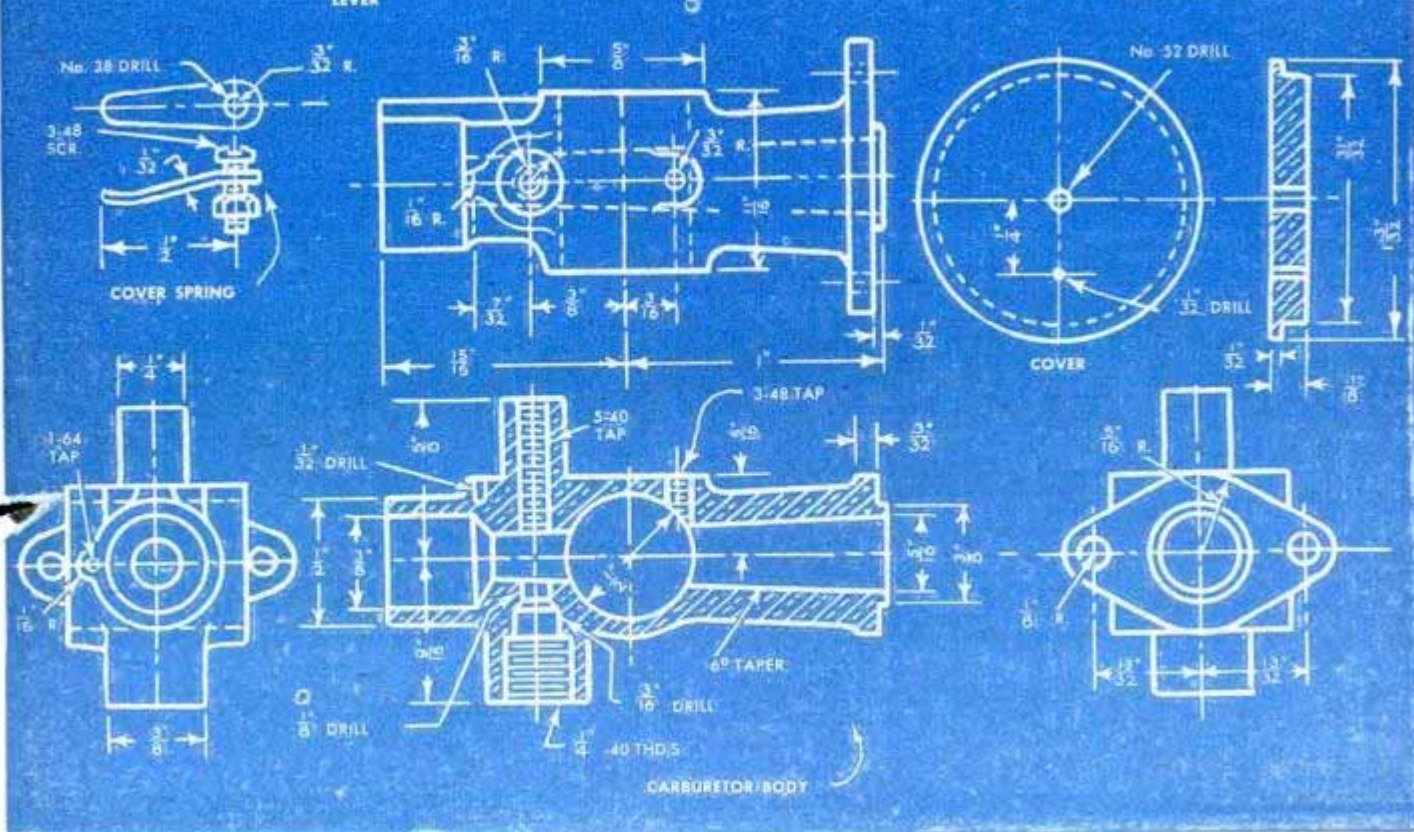
Next comes the crankshaft, which is really a two-part affair. It is detailed in Fig. 29 and the timing-gear crank, which drives the timing gear, is shown in Fig. 37. Also see photos V, W and X which show the completed parts. Crankshaft is turned from solid bar stock. The crank pin is turned first, then holes for the crank pin, Fig. 38, and the $\frac{1}{16}$ -in. hole for oil passage are drilled as in Fig. 29. Next the waste is sawed away and the part remounted between centers as in photo U, turned down to the dimensions indicated and threaded





The timer body, Fig. 40, requires only one lathe operation, boring the mounting hole as in photo Y. The balance is merely locating and drilling the required holes and snagging and finishing the casting with a file. The breaker arm is a standard automobile part and is actuated by the timer or breaker cam, detailed in Fig. 42. The breaker arm is shown as part No. 41 in the assembly drawing, Part I, but is not detailed here. The cam is held in place and adjustment for position provided for by means of a screw turning into a tapped hole in the end of the camshaft. Photo Z shows the assembly complete ready to mount on the timing-gear housing. Fig. 47 details the carburetor parts full size and photo AA shows the rough castings. Photo BB shows the setup for boring out the shell or fuel chamber. You will note the absence of the finish symbol in Fig. 47, which means that

47 CARBURETOR

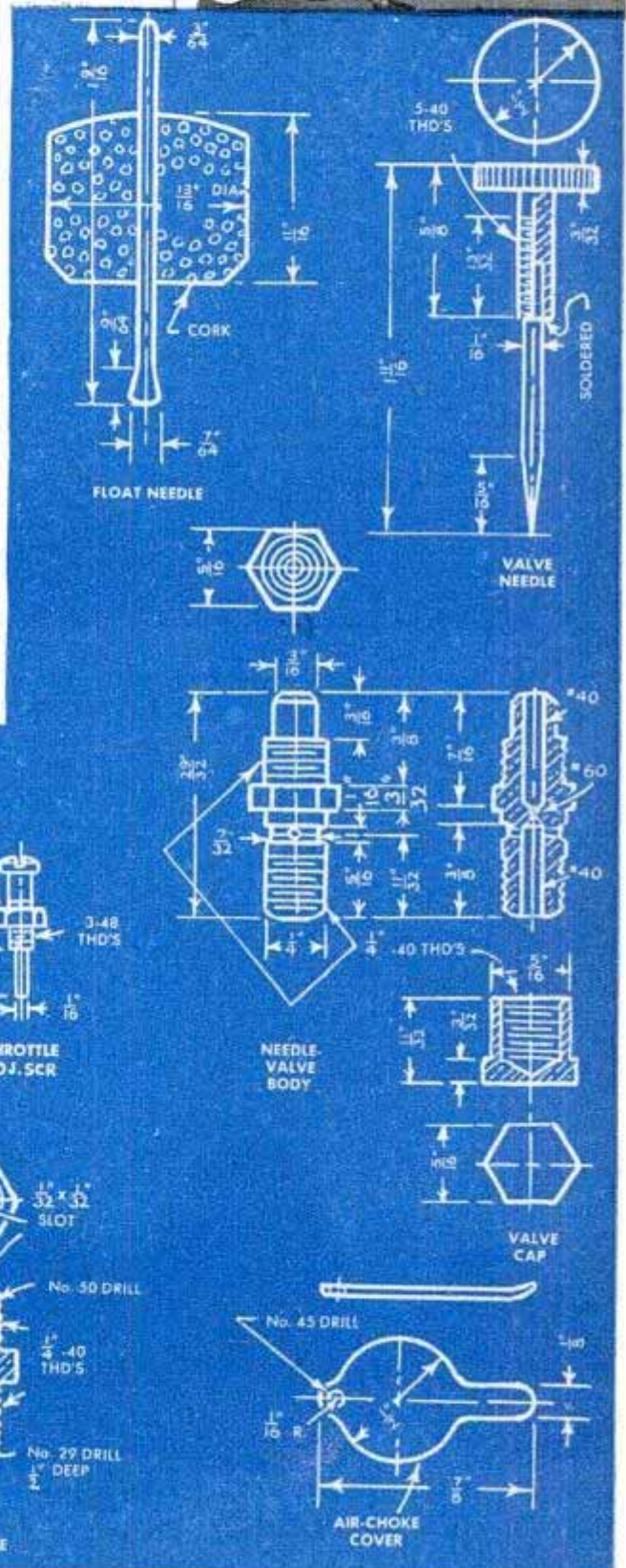


INLET OPENS 5° BEFORE TOP DEAD CENTER, CLOSES 45° AFTER BOTTOM DEAD CENTER. EXHAUST OPENS 50° BEFORE BOTTOM DEAD CENTER, CLOSES 10° AFTER TOP DEAD CENTER

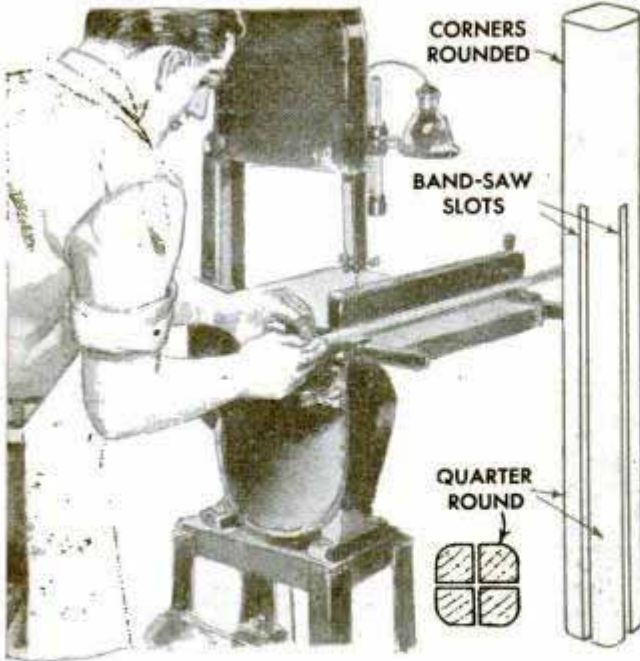


the rough castings are finished only on meeting surfaces, such as flanges, tapers, etc. The valve needle and thumbscrew are turned from brass rod. A short length of nickel-steel wire is soldered to the lower end and tapered for $\frac{7}{16}$ in. of its length. The numbers 40 and 60 on the detail of the valve body denote the numbered drill sizes. A float needle is made from nickel-steel wire with the head turned separately and driven on, and the cork float is sanded to shape from an ordinary bottle cork. One thing to be especially careful about is the exact size of the $\frac{1}{32}$ by $\frac{1}{12}$ -in. slot filed on one end of the float valve. Take several trial measurements to be sure of the size. Finally photo CC shows completed carburetor parts, photo DD shows the unit assembled and in photo EE you see the completed engine, ready for the final assembly and test.

THE END



Quarter-Round Strips Can Be Cut From Length of Square Stock



Quarter-round molding strips of almost any size can be made from a length of square stock. First the corners are rounded slightly, after which the stock is ripped along the center, leaving a small portion uncut at one end to hold the strips together. Then the stock is turned over and sawed again to produce four strips of equal size.

T. G. Sutherland, Chicago.

Extension Arms on Stepladder Provide Wall Clearance

If space is lacking, it is sometimes necessary to lean a stepladder against the wall in the closed position. However, when standing on the top step it is difficult to maintain your balance. These extension arms will hold the ladder away from the



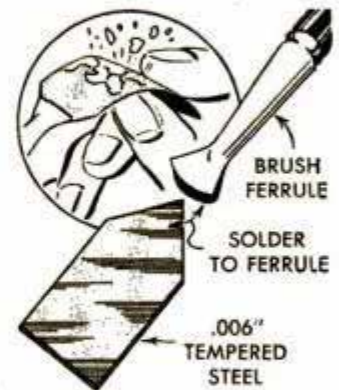
wall and at the same time permit you to work in close quarters. The slotted arms are pivoted to the ladder with bolts and wing nuts and can be folded out of the way when not in use.

Spreader Made of Spring Steel Distributes Glue Evenly

Finding that a glue spreader made of wood tended to splinter and that a stiff brush would not get the glue into the cracks, one craftsman used a spreader cut from spring steel. The tool was cut from .006-in. spring steel

and tempered to a dark blue. Then it was soldered to a small paintbrush handle after the ferrule had been altered as shown. After the glue has dried on the blade, flexing the metal, as indicated in the circular detail, will remove the glue.

I. H. Guskin, Watertown, Mass.



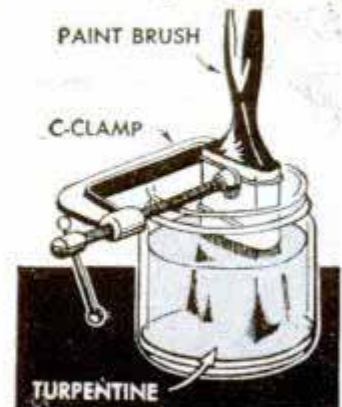
Removing Rusty Wood Screws

Drive the head of the screw with a nail set and hammer. Since screws rust in wood, this will serve to break the rust seal and the screw then can be removed easily with a screwdriver. When driving the head, care should be taken not to break it, as might happen if the screw is very rusty.

Francis W. Henry, Pottsville, Pa.

C-Clamp Support for Paintbrush

To support a paintbrush at just the right level in a jar containing cleaning solution or linseed oil, attach a C-clamp to the ferrule of the brush at the right height. The bristles will not rest on the bottom, and it will not be necessary to drill a hole through the brush for a supporting wire or nail, as sometimes is done.—D. J. Bachner, Jackson Heights, N. Y.



When erasing chalk from small blackboards, tufts of ordinary absorbent cotton can be used to substitute for felt erasers. The cotton is kept in the original container and tufts are withdrawn as needed.



VERSATILE FILM VIEWER

1 CAN BE USED WHEN EDITING MOVIE FILM



2 AS AN ILLUMINATED TRANSPARENCY VIEWER



3 OR FOR AN ILLUMINATED RETOUCHING EASEL



BY ROBERT SCOTT



This viewer serves the three-fold purpose of a transparency viewer for all film from 8-mm. to the 4 by 5-in. cut-film size, an illuminated retouching easel for negatives and an aid in editing 8-mm. or 16-mm. movie film, Figs. 1, 2 and 3. It also can be used in editing 35-mm. film by fitting an adapter.

Body of the viewer is made by cutting a 2-gallon can diagonally in half as you see in Figs. 5, 7 and 8. Lines where the cuts are to be made can be marked with a metal scriber. The diagonal cuts are made with a sharp, thin knife blade or similar tool. A pair of canvas gloves should be worn to protect the hands from injury. Smooth

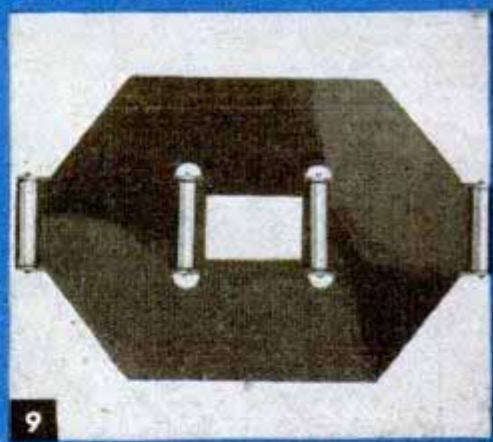
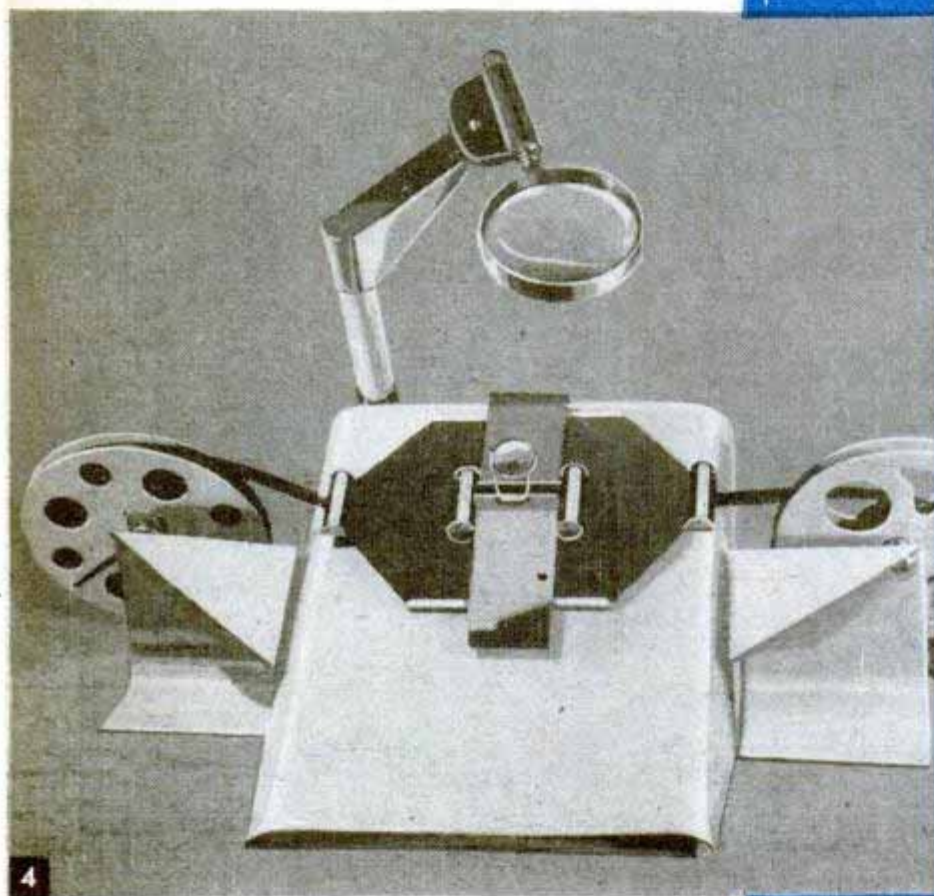
the cut edges with emery cloth or a file.

Figs. 5 and 8 show how two strips are left attached when cutting away the unwanted portion of the can. These are later rolled to form feet which raise the back about $\frac{3}{4}$ in. above the surface on which it rests. The air vent thus made, in addition to the opening at the front and the three louvers above the lamp socket, provides ample ventilation for the 25-watt bulb. If the viewer is to be used on a polished surface, the feet and the two front corners can be covered with several layers of photo tape or felt to prevent damage to the surface. Openings for the opal glass and lamp socket are cut by placing the work on the end grain of a wooden block and cutting along carefully marked lines with a ham-

mer and a sharp cold chisel. Louver slots in the end of the can above the lamp socket are cut with a knife. The opening for the lamp socket should be just the right size to grip the threads of the socket firmly when it is turned into the hole, Figs. 5 and 7. In making an assembly of this type, of light sheet metal, be especially careful to avoid bending or denting the material. Dents and bends are difficult to hammer out flat.

A piece of opal glass $4\frac{1}{4}$ by $5\frac{1}{2}$ in. is used to diffuse the light. The opening is cut to fit this glass and, to hold it centered above the bulb, a $\frac{3}{8}$ -in. tab is cut at the upper and lower ends of the opening, running the entire width. These tabs then are bent to make a sliding fit for the ends of the glass,

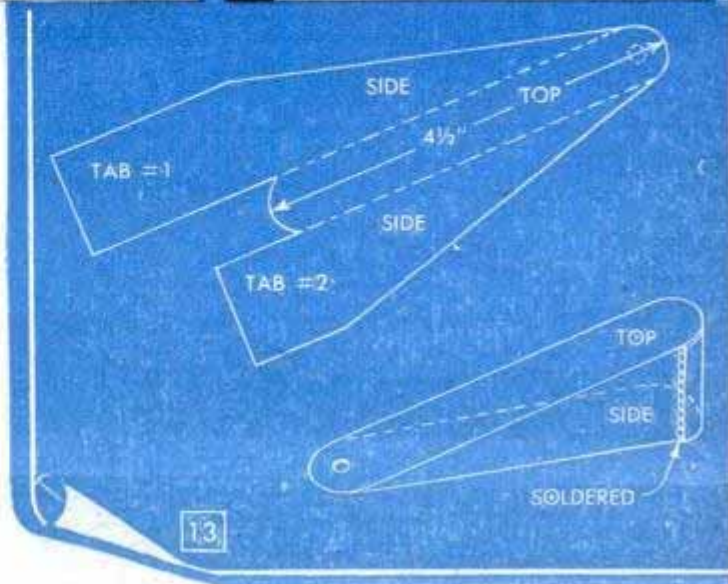
made from a piece of light sheet metal. It is large enough to cover the opal glass and it has a 1 by $1\frac{1}{2}$ -in. opening cut at its center. The film is guided by four wooden rollers, Figs. 2 and 4, attached to eight semicircular tabs cut out of the metal and bent at right angles to the adapter. The exact size of the tabs and rollers is not important but there should be about $\frac{1}{16}$ in. clearance between the roller and the surface of the adapter. Also, the rollers should turn freely. A small hole is punched in each of the tabs and nails or brads are inserted in the ends of the rollers through these holes.



holding it in place as in Figs. 6 and 7.

The adjustable magnifier holder, Figs. 3, 8 and 13, is made to hold a standard reading glass. It consists of a short wooden dowel and three other parts made of light sheet metal. The clamp, Fig. 8, is fastened to the viewer with two bolts and it clamps around the dowel with the aid of a bolt and wing nut, permitting the dowel to be locked in any position. A $4\frac{1}{2}$ -in. metal arm, detailed in Fig. 13, fits tightly over the top end of the dowel, and a swiveling clamp which holds the magnifying glass is connected to the arm by a bolt and wing nut. This arrangement permits the magnifier to be adjusted quickly and easily.

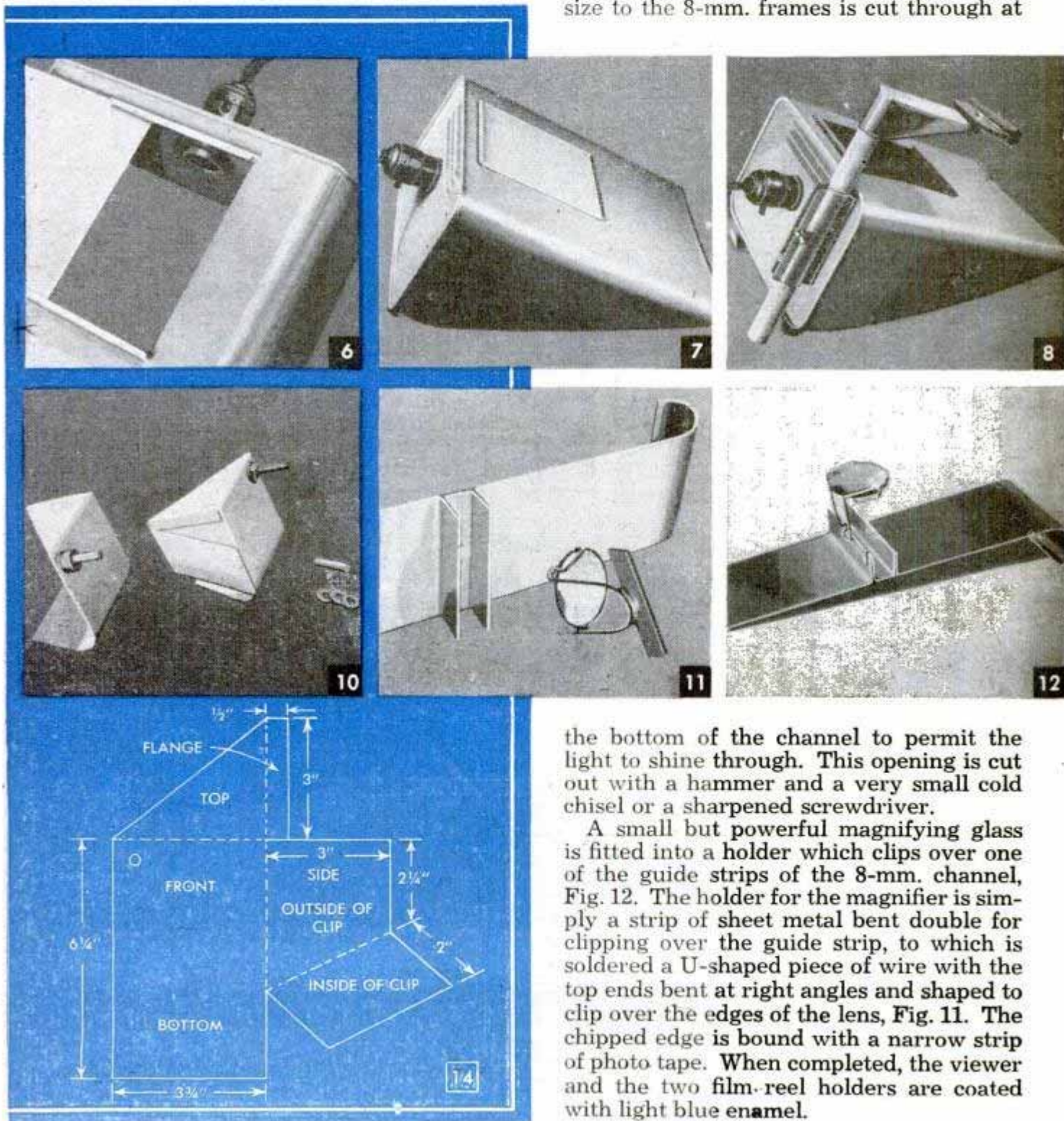
The adapter for 35-mm. film, Fig. 9, is



Using the viewer as an editor for 8-mm. or 16-mm. film requires only the addition of reel holders which clip to each side of the viewer and a film guide which fits over the center of the 35-mm. adapter, Figs. 4, 11 and 12. Fig. 4 shows the viewer being used for editing 8-mm. film. If you wish to use it for 16-mm. simply make the reel holders a little wider to accommodate the larger reels and make the film guide to fit 16-mm. film. The reel holders, Fig. 10, are each formed from a single piece of sheet metal. They are so made that they clip to the sides of the viewer and can be removed when not needed. Fig. 14 details the pat-

tern for the holders. Two $\frac{1}{4}$ by $1\frac{1}{2}$ -in. stove bolts serve as shafts on which the reels turn. They are fastened to the holders with a square nut and washer and the exposed threads are covered with a close-fitting sleeve made of sheet metal. Three washers are used on each shaft to permit the reels to turn freely.

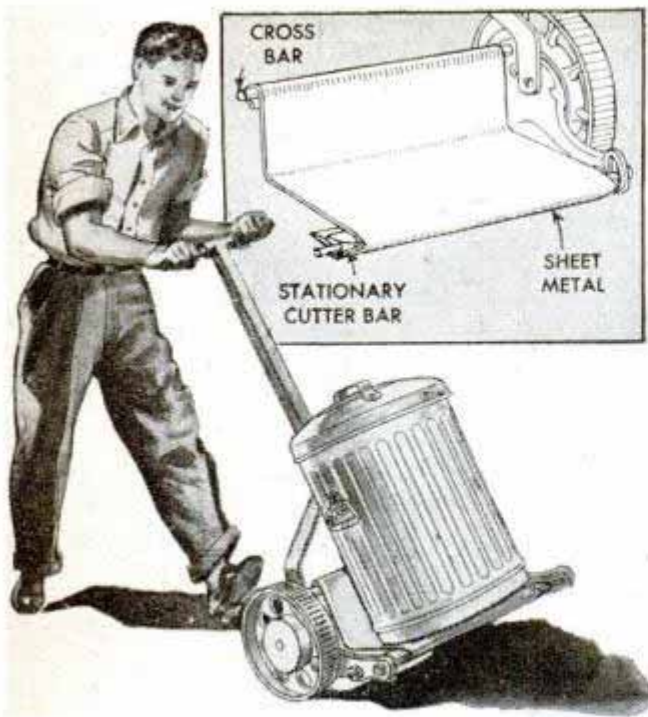
The movie-film guide, Figs. 11 and 12, is made from a single strip of sheet metal $1\frac{5}{8}$ in. wide, rolled down at the top so it hangs over the upper end of the viewer as in Figs. 1 and 4. The 8-mm. guide is made by bending the strip at its center to form a channel 8 mm. wide with guides $\frac{3}{8}$ in. high at each side. A small rectangular opening equal in size to the 8-mm. frames is cut through at



the bottom of the channel to permit the light to shine through. This opening is cut out with a hammer and a very small cold chisel or a sharpened screwdriver.

A small but powerful magnifying glass is fitted into a holder which clips over one of the guide strips of the 8-mm. channel, Fig. 12. The holder for the magnifier is simply a strip of sheet metal bent double for clipping over the guide strip, to which is soldered a U-shaped piece of wire with the top ends bent at right angles and shaped to clip over the edges of the lens, Fig. 11. The chipped edge is bound with a narrow strip of photo tape. When completed, the viewer and the two film-reel holders are coated with light blue enamel.

Mower Converted to Hand Truck Will Carry Light Loads



By removing the entire rotating cutter bar assembly from an old lawn mower, you can make a hand truck that will carry light loads. A piece of sheet metal that fits between the wheels is bent at right angles and the back and lip are secured by bending them around the cross bar and the stationary cutter bar.

C. C. Spreen, Detroit, Mich.

Sandpaper on Poison Container Indicates Danger in Dark

It's easy to mistake a bottle containing a perfectly safe liquid or pill for one that has



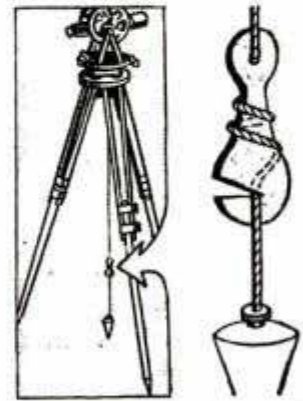
a poison when searching through the medicine cabinet in the dark. To prevent this, glue pieces of coarse sandpaper on the sides and caps of such containers. It's difficult to make a mistake when bottles are identified in this way. For a bottle that has sides which are more or less flat, a sheet of sandpaper is used; for a bottle that has rounded surfaces, the paper is cut into small pieces.

Mrs. Glad Lee, Los Angeles, Calif.

Adjusting Length of Plumb Line

Here's a reel that you can attach to a plumb bob quickly and easily. The reel should be cut from some nonrusting metal, such as aluminum or brass, and burrs are filed from the edges so the cord will not be cut when handling the line and reel. To adjust the

plumb bob, wrap the cord around the reel until the bob is at the right height, then engage the cord in the notched end.



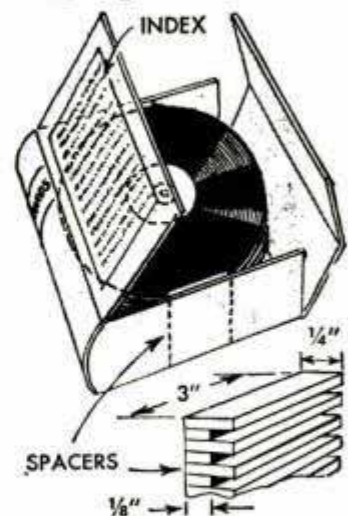
Unused Chimney Can Be Covered

When a chimney is not in use, the opening should be covered so that rain will not fall down the stack. One way of doing this is to lift the cap on the chimney and insert an asphalt shingle between it and the brick. After the cap has been replaced, the edges of the shingle are trimmed so they will not project beyond the chimney.

E. C. White, Medford, Okla.

Files Hold Phonograph Records

Old file cases can be converted to phonograph record holders with the addition of spacers. The type of records contained in the case—vocal, dance, symphonic, etc.—can be labeled on the back and an index to the individual records is lettered on the side that opens.

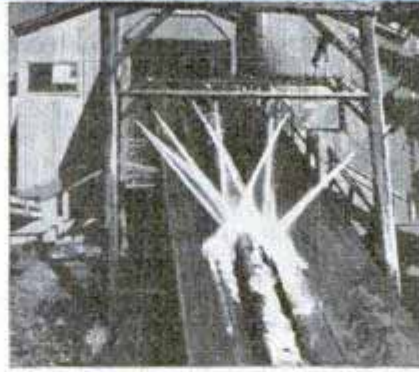


☐ If you have a cherished vase on display it is a good idea to weight it with sand. If this is done, there is much less chance of knocking it over.

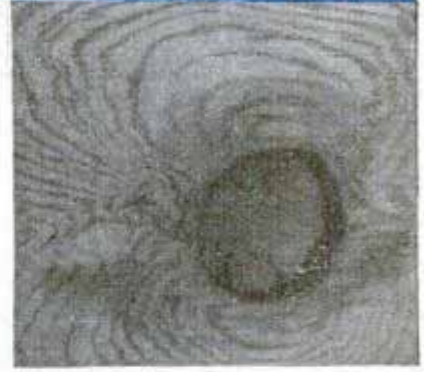
CRAFT QUIZ



1. This wood eventually will be—
 (a) Plywood (c) Core stock
 (b) Paper (d) Veneer



2. Log is entering a mill on the—
 (a) Runway (c) Bull chain
 (b) Skidder (d) Douser



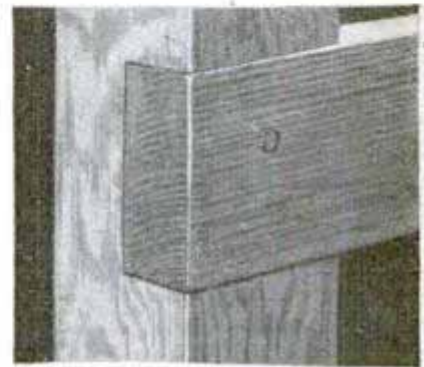
3. Board with loose knots graded—
 (a) Select (c) # 3 common
 (b) # 1 common (d) 1sts and 2nds



4. Lumber sorting table is called—
 (a) Long John (c) Wood path
 (b) Green chain (d) Grader



5. If you want him, yell—
 (a) Puler (c) Windjammer
 (b) Boom man (d) Water skate



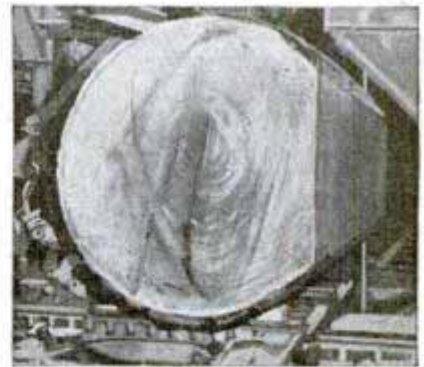
6. A "two by four" is—
 (a) 1 5/8" thick (c) 3 1/2" wide
 (b) 4" wide (d) 8' long



7. Forest harvest is called—
 (a) A hot seat (c) A cold deck
 (b) A skid road (d) A log jam



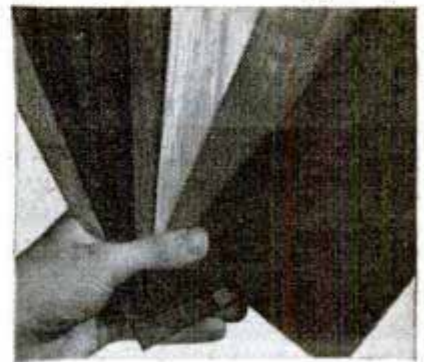
8. This chap is a—
 (a) Bucker (c) Grease monkey
 (b) Widow maker (d) Topper



9. Here's a log at the—
 (a) Headrig (c) Carrier
 (b) Tailgate (d) Dump



10. Steam engine in the woods is a—
 (a) Bull (c) Monkey
 (b) Snort (d) Donkey

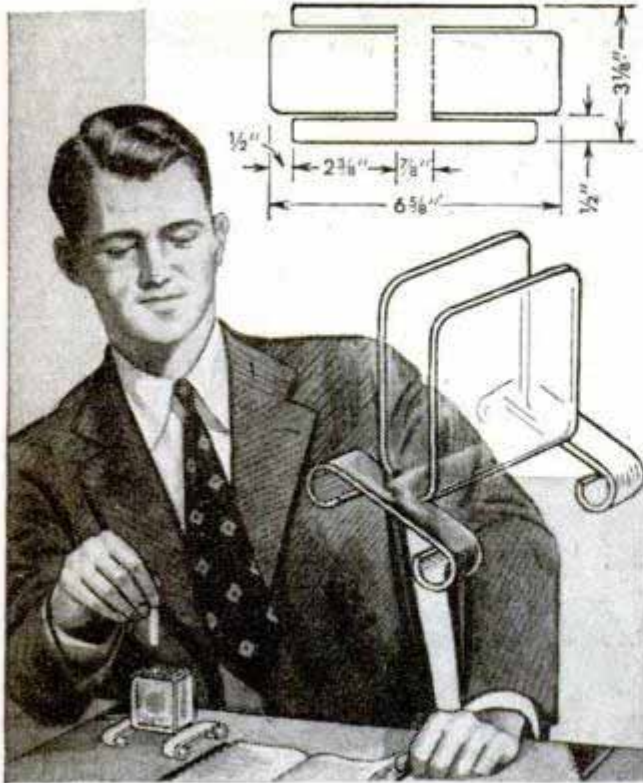


11. Odd wood here is—
 (a) Prima vera (c) Rosewood
 (b) Teak (d) Walnut

Photos courtesy American Forest Products Industries, Inc.

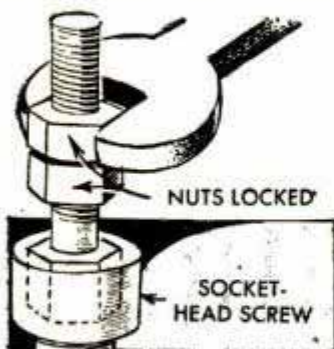
ANSWERS: 1—b; 2—c; 3—c; 4—b (lumber is green and unseasoned on this grading chain); 5—b; 6—a (dressing always reduces the named mill dimension); 7—c; 8—a; 9—c; 10—d; 11—c (tech. rosewood and walnut are very dark in color)

Plastic Cigarette-Package Holder Will Decorate Desk



Made from $\frac{1}{8}$ -in. sheet plastic, this holder will keep cigarettes from spilling over the desk. Cut the material with a fine-tooth hacksaw and round off the corners with a file. Then smooth the edges with fine sandpaper until no cutting or filing marks are visible. Heat the plastic in an oven and bend to the shape illustrated. A $\frac{7}{8}$ -in. strip of wood is used as a form to bend the sides and the curved feet are bent around a dowel. Gloves should be used to handle this material after it is removed from the oven. After bending each strip, fasten with masking tape to hold it in place. It may be necessary to reheat the plastic and repeat the bending process.

Wrench for Socket-Head Screws



A wrench for socket-head screws can be improvised by using a hex-head bolt that fits the recess in the screw. Turn two nuts onto the bolt. Then fit the bolt head in the socket and tighten.

Piano Hinge Is Used on Folding Table-Tennis Table

In many cases it is desirable to have a table-tennis table that can be folded when not in use. I find that a piano hinge is ex-

cellent for this purpose, as it keeps the table from warping or twisting and does not interfere with the playing surface in any way.—Robin F. Tiesier, Easton, Pa.

One Way to Avoid Spilling Salt Carried in Lunch Box

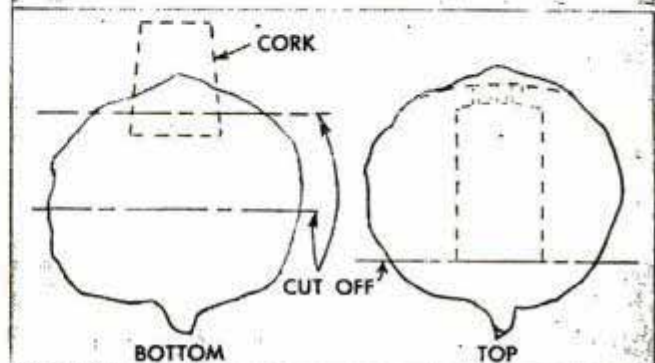
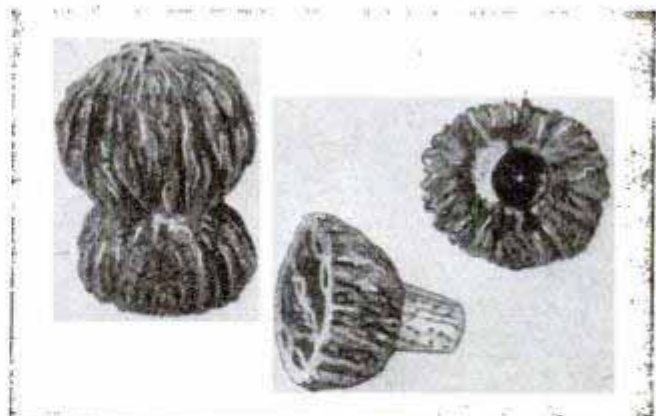
To avoid spilling salt and pepper carried in his lunch box, one workman places a piece of waxed paper over the open mouth of the container and then screws on the cap. When lunch time comes the paper is removed and the shaker is used. After use, the paper is replaced in the top of the cap. On shakers that do not have screw tops, the paper can be held in position with rubber bands.



Salt Shakers Cut From Walnuts Are Novel Decoration

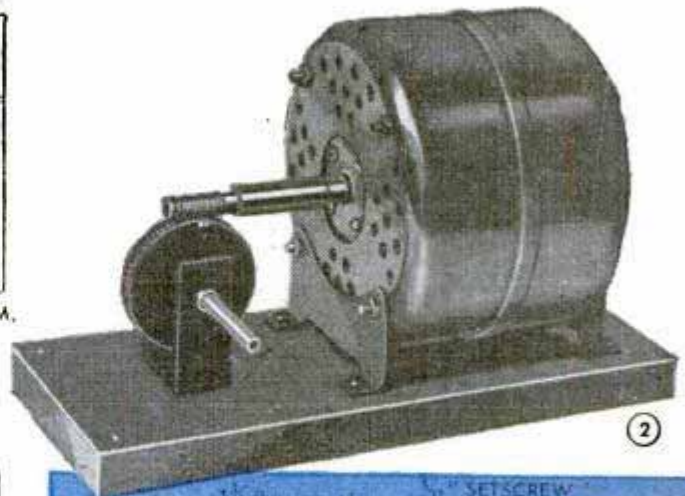
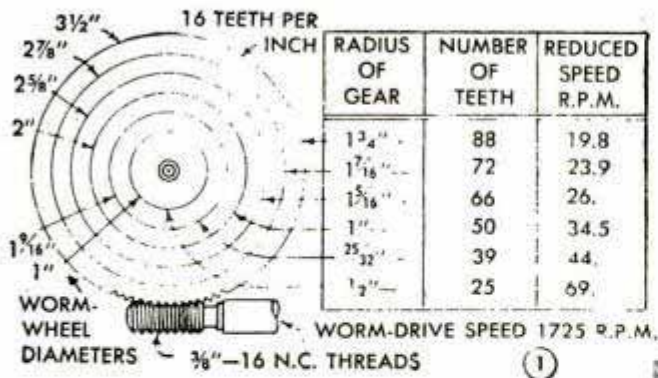
For those who like a touch of novelty in table appointments, these salt and pepper shakers made from black walnuts furnish an unusual touch. The base for each is a walnut half, with the end cut and recessed to provide a blind hole in which the cork is glued. To make the body of the shaker, a hole is drilled in a whole nut to fit the cork snugly and small holes are drilled in the top. The shakers are sanded lightly and finished with clear shellac.

R. M. Madden, Kansas City, Mo.





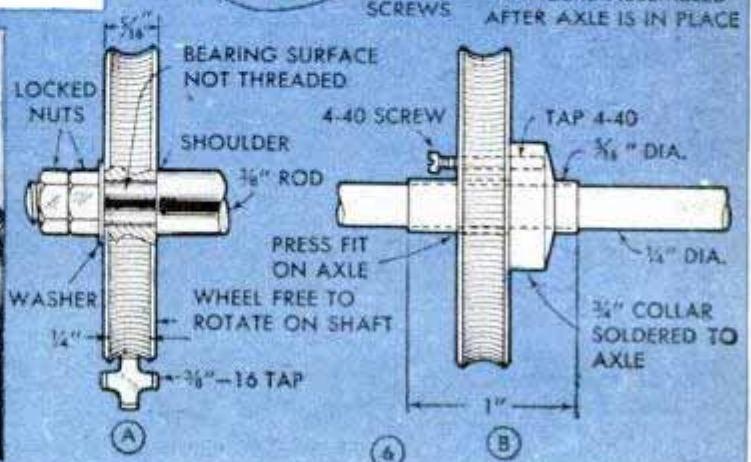
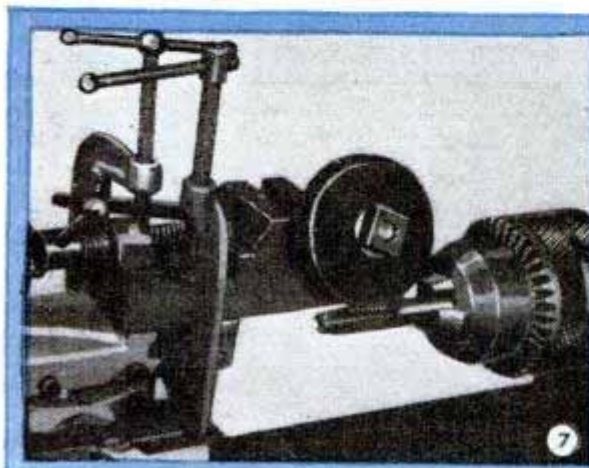
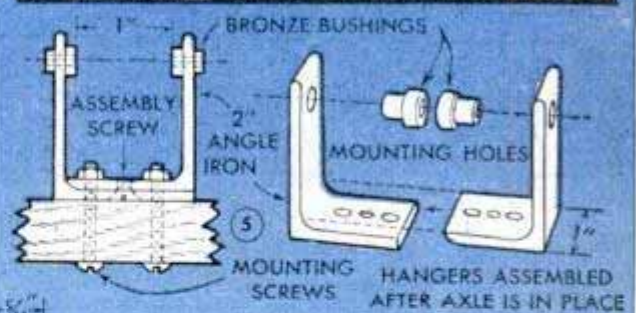
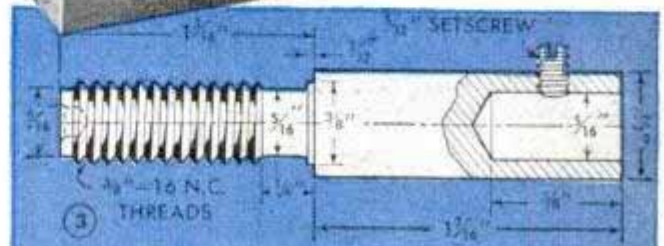
Shop Notes

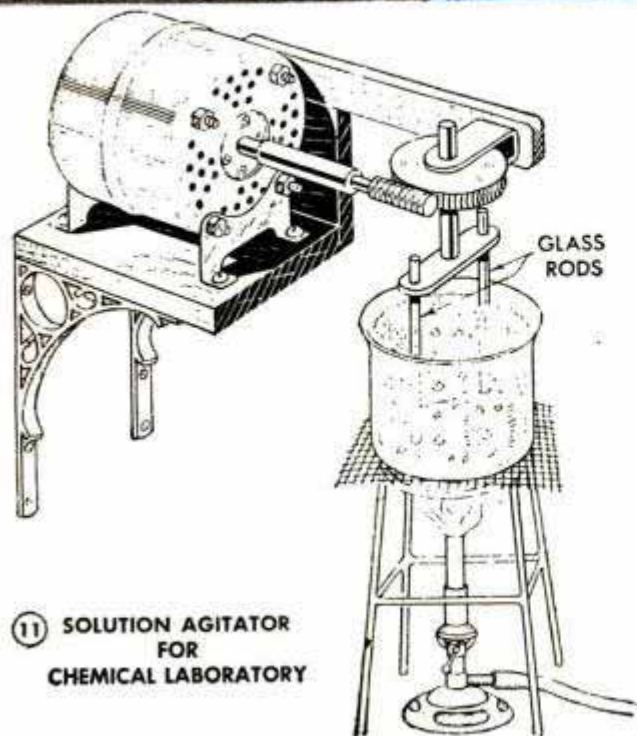
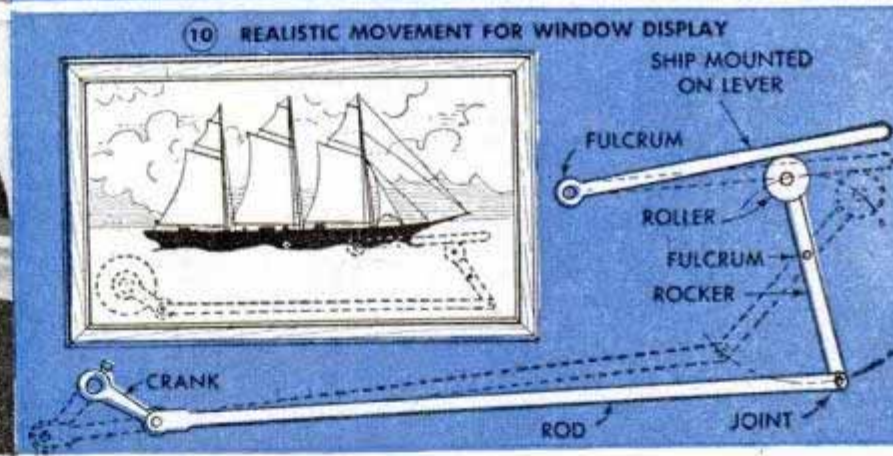
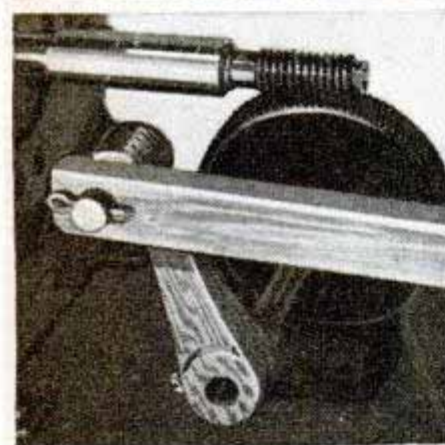
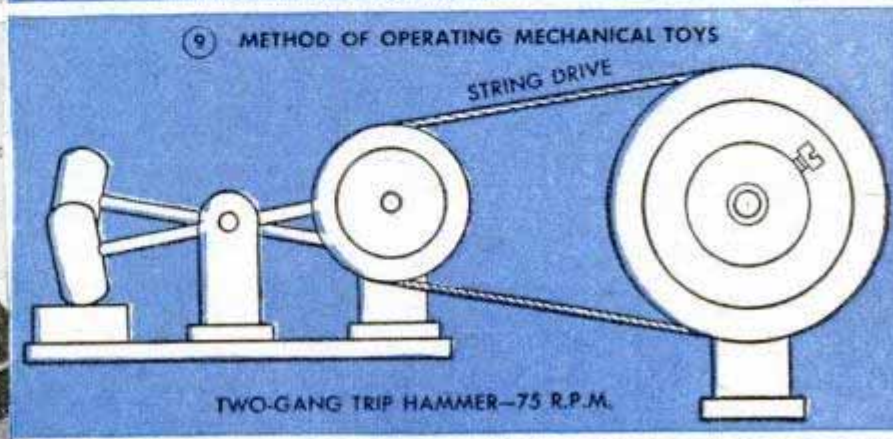
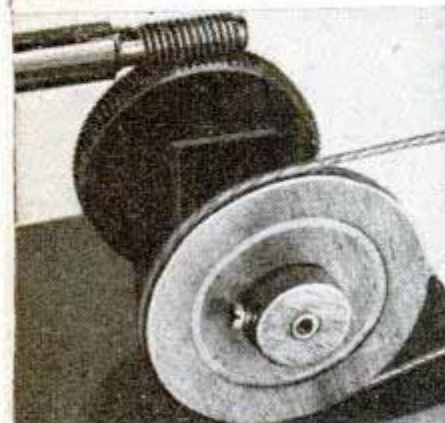
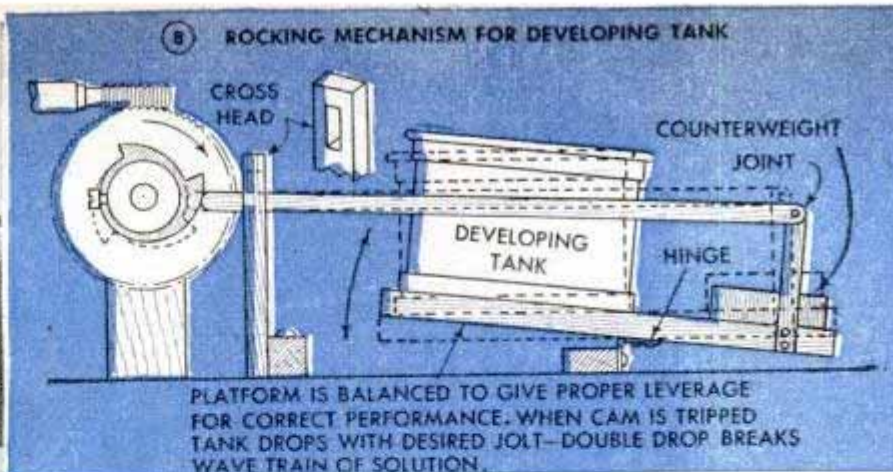
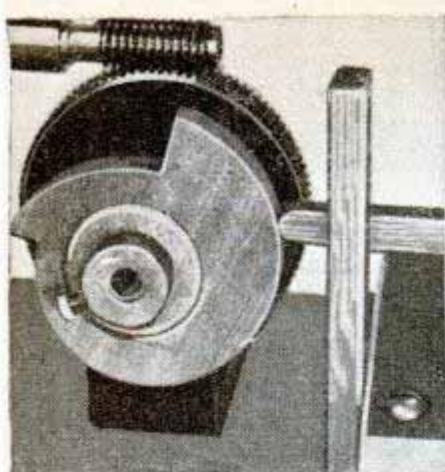


Make Your Own Speed Reducers

By Alexander Maxwell

IF YOU have liquid solutions that call for steady, monotonous stirring, photo developers that require measured agitation, mechanical toys or slow-motion window displays which must be power driven, then you have use for these simple speed reducers. By consulting the reduction table, Fig. 1, you will see how the speed of a 1750-r.p.m. motor can be reduced for various purposes. Any small motor, Fig. 2, will do for light drives. Fig. 3 gives the general dimensions for a 3/8-in. worm and Fig. 4 shows how the threads are lapped with a hard slipstone after cutting in the lathe. The worm should be of steel and for low-powered motors and light loads it need not be hardened. The wheel can be of bronze, Bakelite, mild steel or even a close-grained hardwood such as maple. When turning down the blank for the worm wheel, Fig.



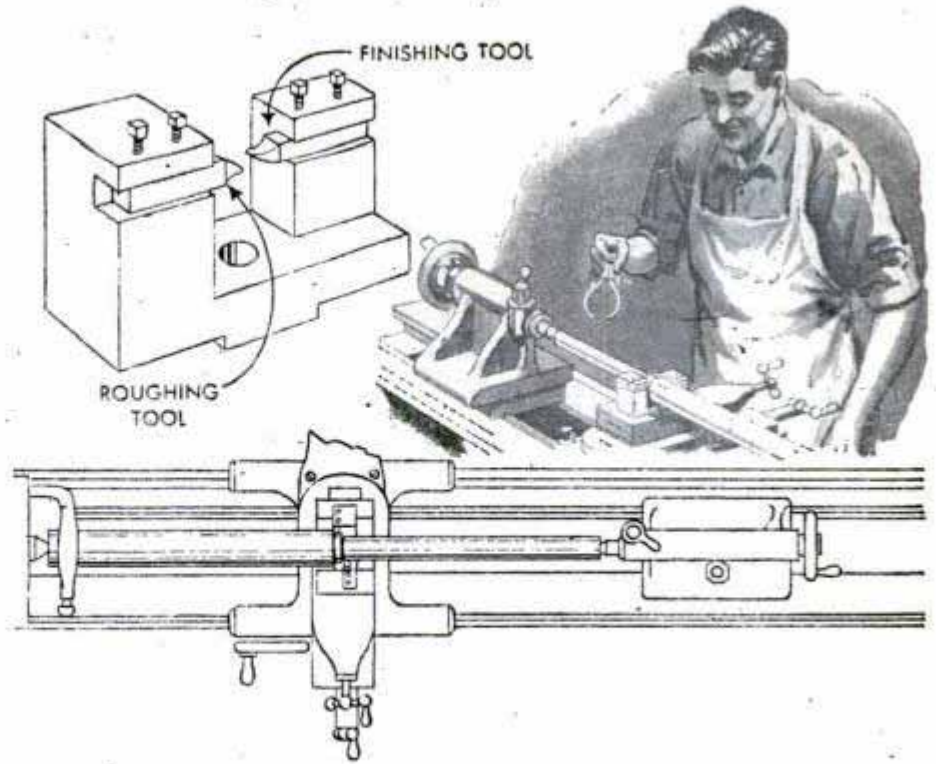


6A. allow a slight plus or minus on the diameter required, as you will note from Fig. 1 that the teeth do not come out in even fractions of an inch. Mount the blank on a short arbor as in Fig. 6A, lock it in a drill vise and then mount the whole thing on the lathe tool post as in Fig. 7. The cutter you see in Fig. 7 is a $\frac{3}{8}$ -in. tap held in a chuck driven by the live spindle. In feeding the wheel into the cutter, advance it slowly and take extremely light cuts. Continue until the teeth are cut full depth.

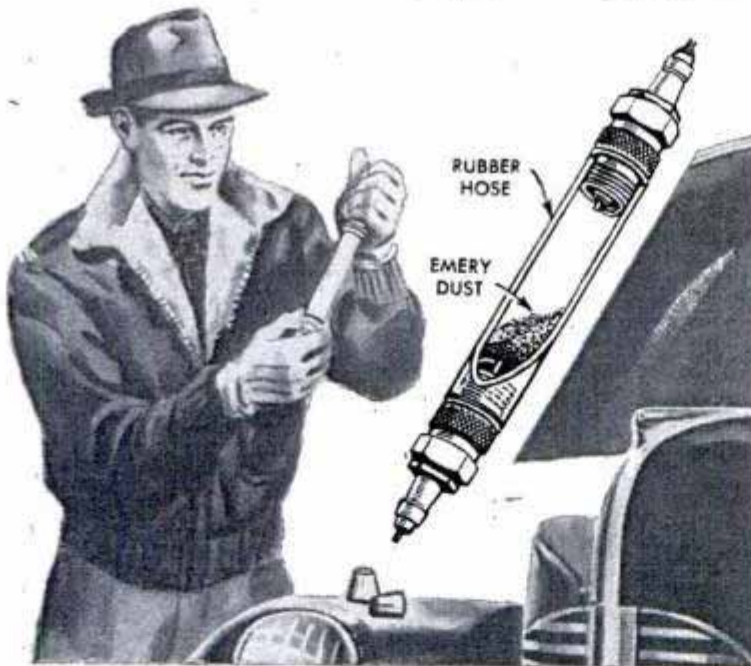
Mount the wheel on a shaft as in Fig. 6B. Hangers cut from angle iron and fitted with bronze bushings as in Fig. 5 support the wheel when mounted with the motor on a base as in Fig. 2. Adjust pressure of the worm by using wedges or shims under the motor mounting feet. Figs. 8 to 11 inclusive show a number of practical applications of this type of reduction drive.

Twin-Tool Holder Speeds Machining of Shafts

With this double holder you can eliminate several separate operations when turning shafts. It can be formed from ordinary steel to the shape indicated in the upper left-hand detail. The roughing tool runs ahead of the finishing tool. When in use, the roughing tool is turned upside down. When in use, the roughing tool is set to cut to the desired depth in the work.—Adolph Brauns, Bronx, N. Y.



Clean Your Own Spark Plugs With a Hand "Sandblaster"

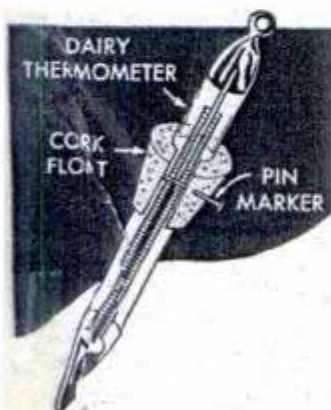


An 8-in. length of garden hose and a few ounces of medium-grade emery dust are all that are needed to "sandblast" dirty spark plugs. The emery is placed in the hose and a spark plug is "screwed" into each end. After several minutes of vigorous shaking, the plugs should be clean. Before the plugs are replaced, they should be washed thoroughly in gasoline to remove all traces of grit. When not in use, the ends of the hose are plugged with rubber stoppers to retain the emery.

Making Small Steel Springs

In making small springs of round steel, use a good grade of oil-tempered material and wind it cold. Because of the recoil, it may be necessary to experiment until the right size mandrel is obtained. Spacing is controlled by the feeds on your lathe. For round or flat steel springs, using an untempered spring steel, heat to a cherry red and then form, maintaining this heat as closely as possible while shaping the spring. Then bring the piece to a cherry red again and quench in fish oil. When the spring has cooled sufficiently, hold it over a flame until the oil starts to burn off.

Cork Floats Dairy Thermometer



A large cork, drilled to receive a dairy thermometer and float it in the milk, may be made more serviceable by slotting one side to make the column of mercury visible. A straight pin inserted across the slot will serve as a marker.

Beeswax makes an excellent lubricant for use when tapping or turning copper, brass, aluminum and similar materials.

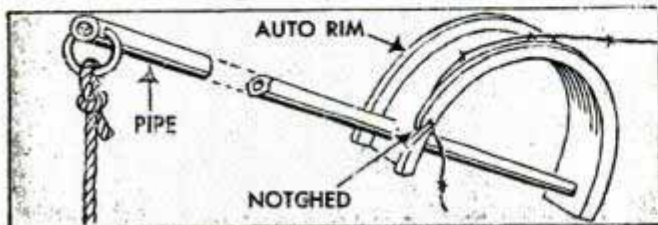
Barbwire Spool Handled Safely In Metal Feed Basket



To avoid the numerous—and more or less serious—injuries that accompany handling spools of barbwire on fencing jobs, one farmer uses a metal feed basket to carry or load the spool with safety and convenience. The basket is laid on its side to roll the spool in or out.

Stretcher Made From Auto Rim And Length of Pipe

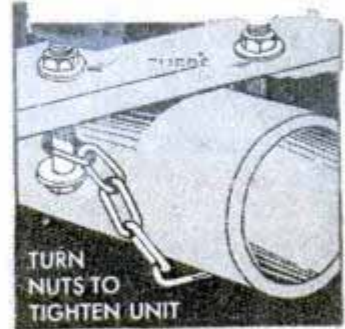
Made from a section of auto-tire rim and a length of pipe, this wire stretcher will enable one man to take up the slack in short runs of barbwire fencing. The rim is



cut in half and drilled, receive a 7-ft. length of 1 1/4-in. pipe. A notch near one end to engage the rim acts as a fulcrum for the wire. In use the lever. A rope can be used as the lever when tightening the wire, which should be securely fastened in the notch to avoid any danger of slipping.

Temporary Hanger for Piping

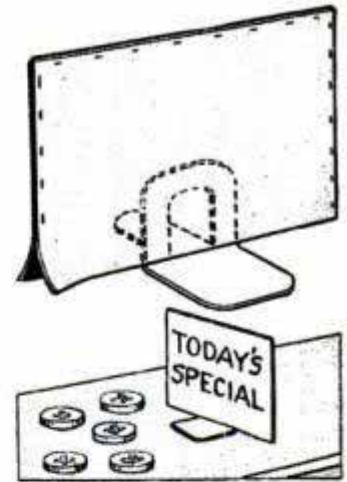
As a temporary hanger to support overhead piping, a short length of chain and two bolts will serve. A bolt is slipped through each end of the chain and fastened to an overhead member.



Washers are placed under the nut and head of the bolt. The bolts should be drawn up tight enough to hold the pipe rigid, but not so tight that "creeping" caused by expansion and contraction would be restricted.

Book End Supports Display Card

Showcards that are lettered on both sides for display on a counter or showcase may be supported with metal book ends. The signs are made of lightweight cards and are stapled, back to back, around three sides to form a pocket which fits over the book end.



Exterminator Applied to Crevices Through Oilcan Spout

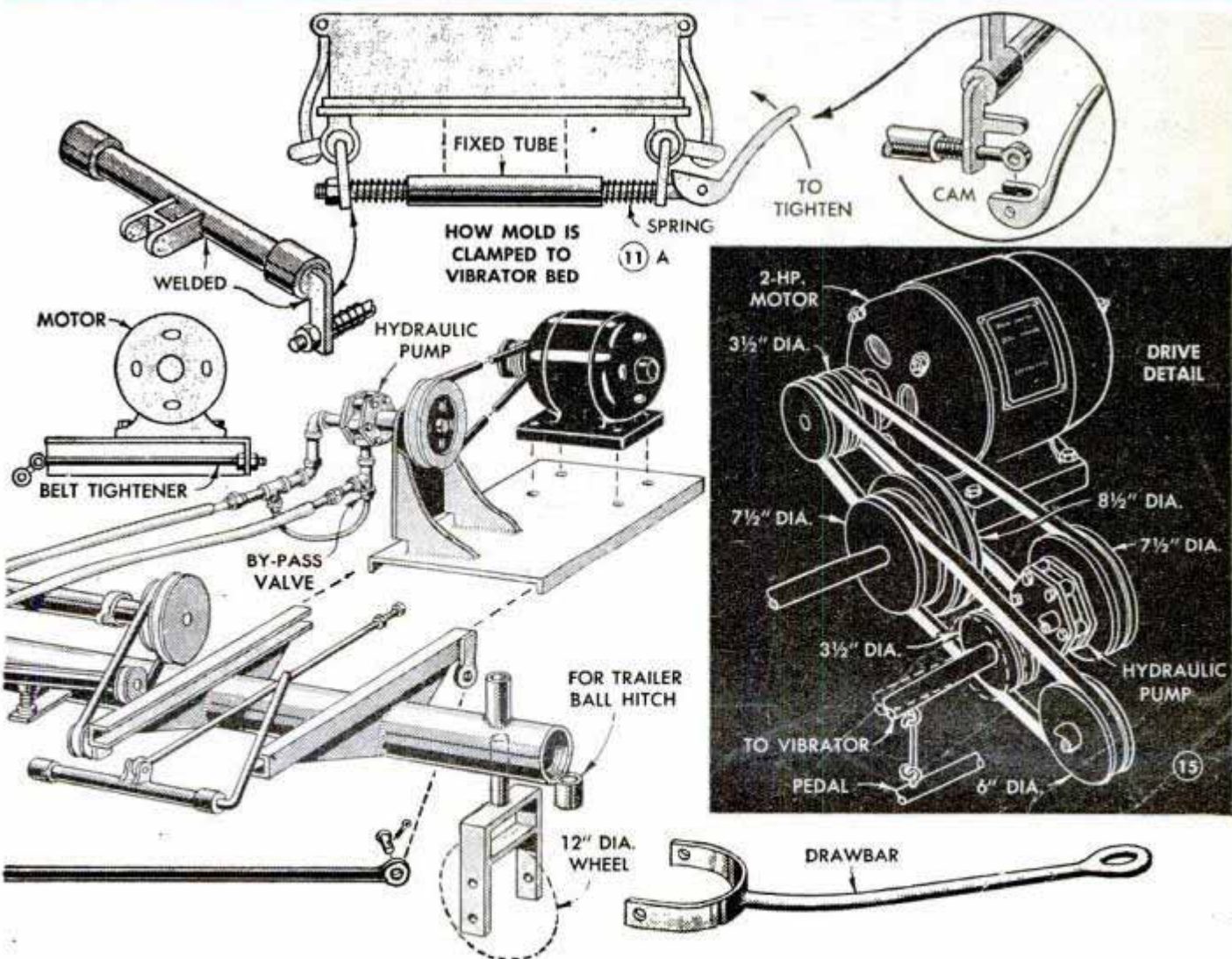
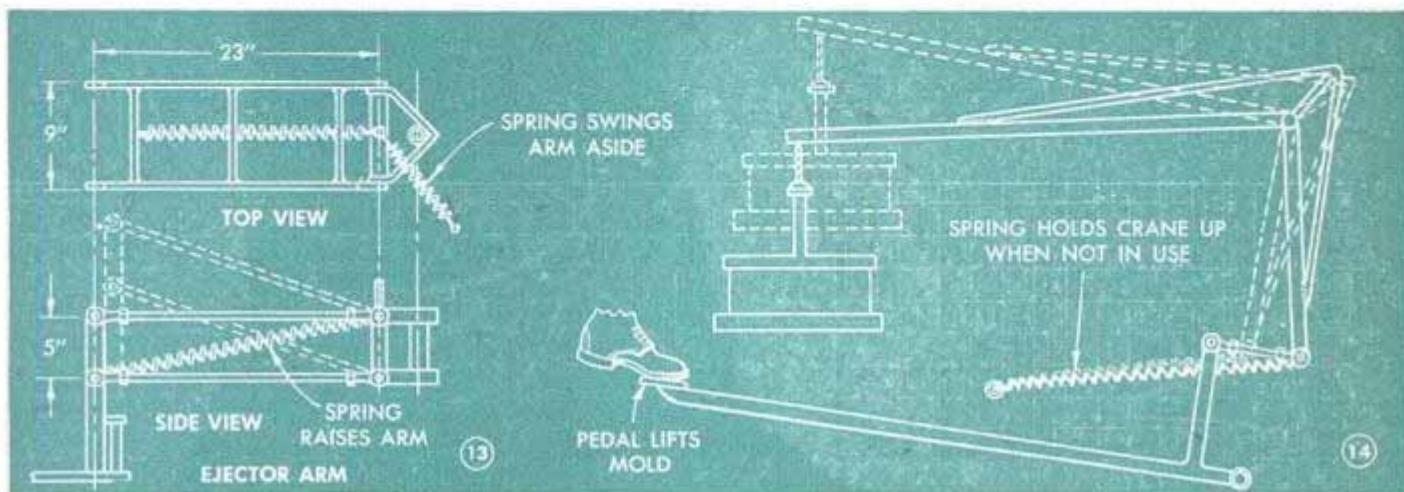
Inaccessible cracks and crevices in the chicken house can be reached with lice exterminator by using an oilcan having a long spout. If a dry powder is used it should be a fine grit that does not tend to stick together or to the container. It may be necessary to cut off a part of the spout so the hole will be big enough.

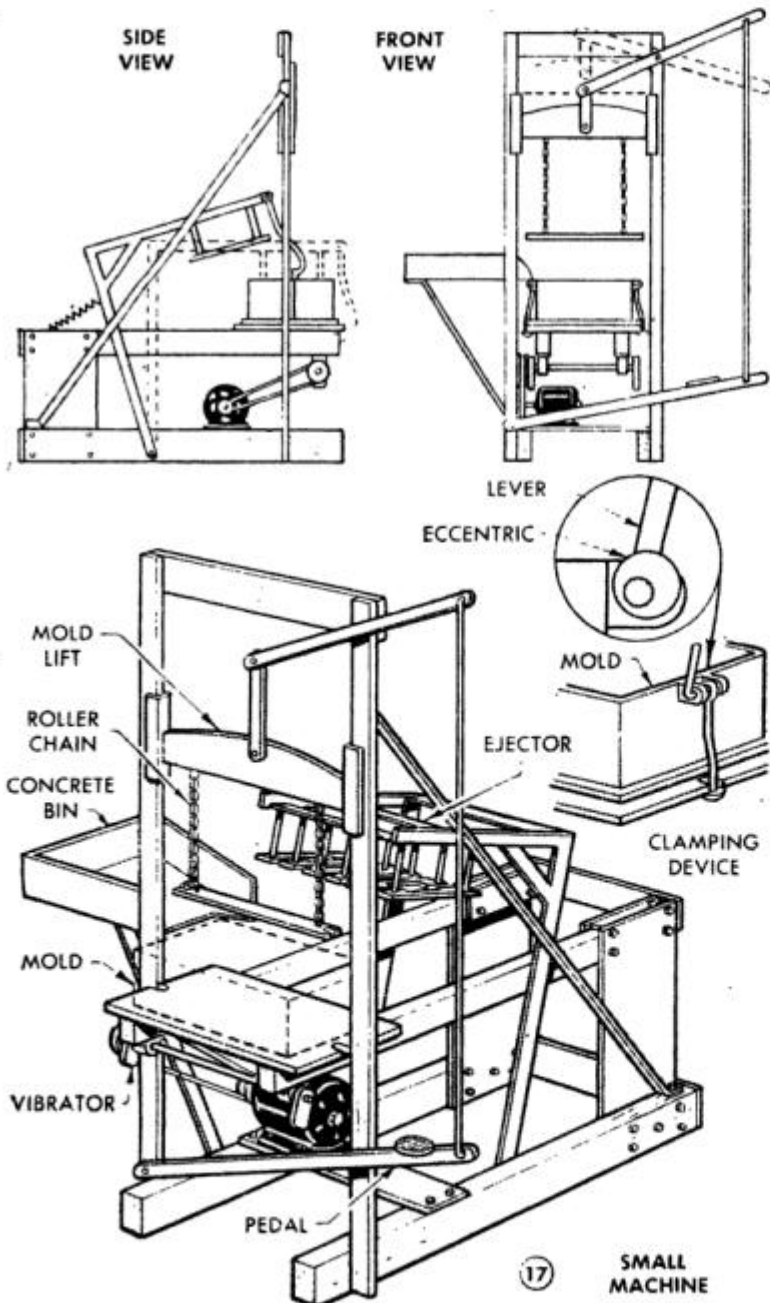
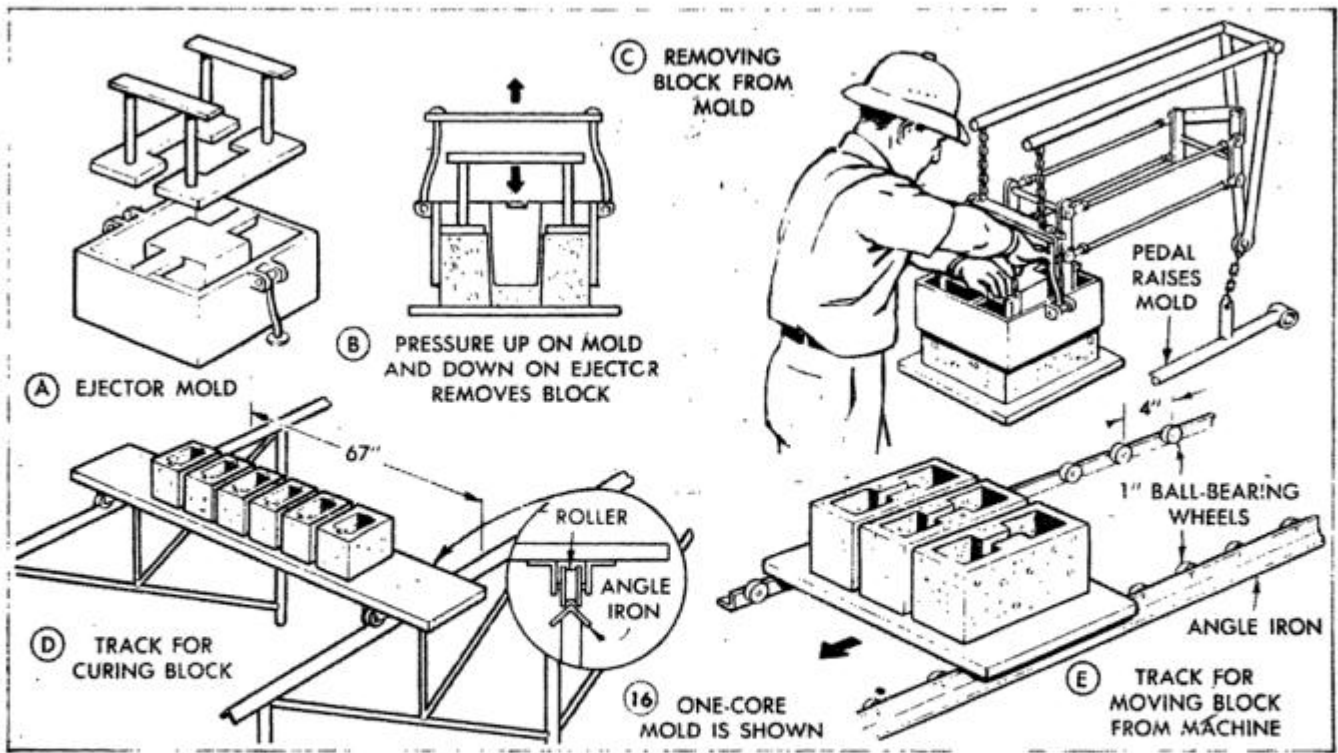


The hopper is raised for dumping by a hydraulic cylinder, Fig. 11. Arrangement of the hydraulic system is shown in Fig. 12 and the drive to both the hydraulic pump and the mixer is detailed in Fig. 15. Raising and lowering of the hopper is controlled by a 3-way valve, Figs. 11 and 12. By-passing the hydraulic fluid allows the pump to be operated continuously, thereby simplifying the drive. The vibrator shaft, Fig. 15, is pedal-operated and runs only when the pedal is depressed. One belt from the two-step cone pulley passes around an idler. The pulley driving the vibrator is located

between the driving pulley and the idler as shown in Fig. 15. When the pedal is depressed the center pulley engages the belt, and "throw" of the off-center weights, Fig. 11, vibrates the mold. The mold must be held rigidly in place for this operation and Fig. 11A details the quick-acting clamping device especially made for this purpose.

The mold and the ejector, Figs. 2 and 3, are made for three blocks. There are two cores in each compartment of the mold and note especially that each core is vented, Fig. 2, and tapered slightly so that it will draw easily without breaking the edges of





the block. Cores can be cast from a rich cement-sand mixture or they can be made of heavy sheet metal, welded. Where facilities and materials are available, they also could be cast from aluminum.

Fig. 16, details A to E inclusive, shows a one-core mold, A and B, which is suitable for certain special types of blocks. Detail C supplements Fig. 6 and shows more clearly the procedure and placement of the hands in ejecting the block from the mold, while details D and E suggest types of elevated tracks or rails for moving blocks away from the machine and to the curing yard, as in Fig. 7. Curing racks of any convenient size may be assembled from hardwood boards, steel angles and flanged rollers as in Fig. 16 D. Detail E suggests one way of providing for easy handling of the blocks from the machine to the curing racks.

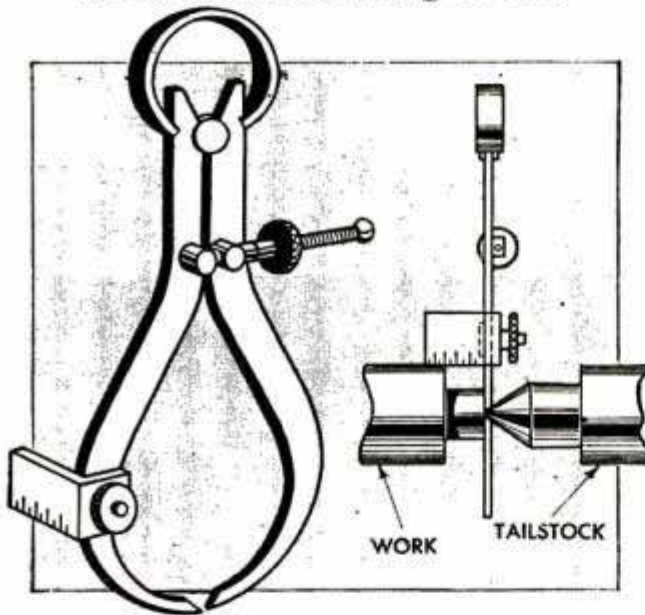
General assembly views of a hand-operated machine for making a few blocks at a time are given in Fig. 17. Here most of the work is done by hand, only the vibrator being motor driven. It's easy to build for either a one, two or three-block mold. Proportions of the mix which have been found most satisfactory are 7 parts pea gravel, 12 parts sharp sand, 2 parts silt and $2\frac{1}{2}$ parts portland cement. The amount of water is determined by experiment as it depends on the dampness of the aggregate.

Trash Cart Has Scoop That Pivots With Handle

Here's a handy trash cart that will pick up leaves and other debris in the scoop and, when the handle is reversed, dump the trash into the bin. The cart is pulled by the user instead of being pushed. The wheels are taken from an axle assembly and fitted with a flat-iron cradle that holds the bin. The handle is made of pipe and the scoop is fastened to it and braced in such a manner that it will pivot with the handle.—Wm. P. Houser, Organ, N. Mex.



Scale Attachment for Calipers Aids in Measuring Work



When turning a shoulder on shafting or other round work, it is frequently difficult to measure the length of the shoulder. If the dimension is not critical, a scale can be attached to a pair of calipers to obtain a quick reading. It is formed of flat iron and fastened to one leg of the caliper with a screw and knurled nut for easy removal. In use, one leg of the caliper is held flat against the end of the shaft and the desired dimension is read on the calibrated scale.

H. Moore, Kirkstall, Leeds, England.

Mechanics' Hand Soap Paste

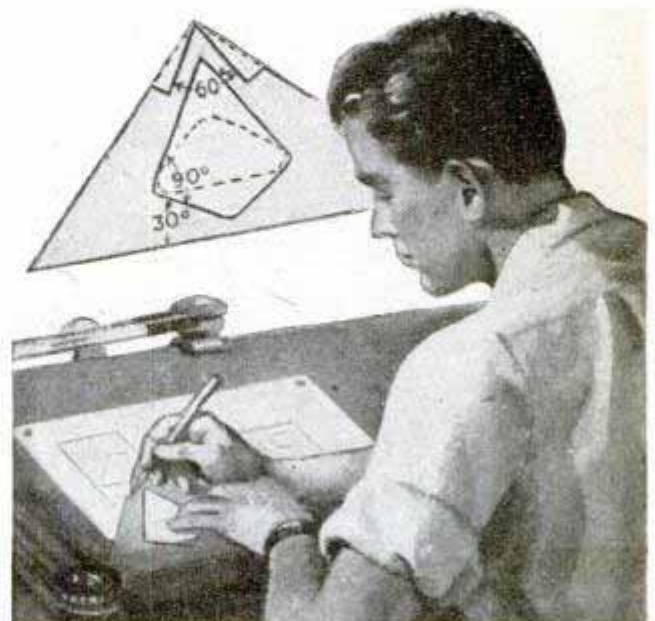
For a hand soap that will get the dirt out, try the following mixture: white soap chips, 1½ lbs., borax, 6 oz., dry sodium carbonate, 3 oz., coarse pumice, 2 lbs., glycerine, 2 oz., and water, 3 pints. Dissolve the soap in

2 pints of water by heating and dissolve the borax and sodium carbonate in the remaining pint. Mix the solution thoroughly, add glycerine, stir in the pumice and then pour into suitable containers. You can vary the amount of water for a heavier or softer paste.

Modified Triangle Saves Time And Speeds Drawing

To eliminate the bother of changing triangles, a 45-degree triangle can be modified to serve as a 30, 60 and 90-degree triangle as well. The dotted lines show the original triangle and the solid lines show it after the new angles were cut. The 60-degree angle is made at the apex of the original 90-degree angle and the 30 and 90-degree angles are formed by altering the shape of the inside triangle.

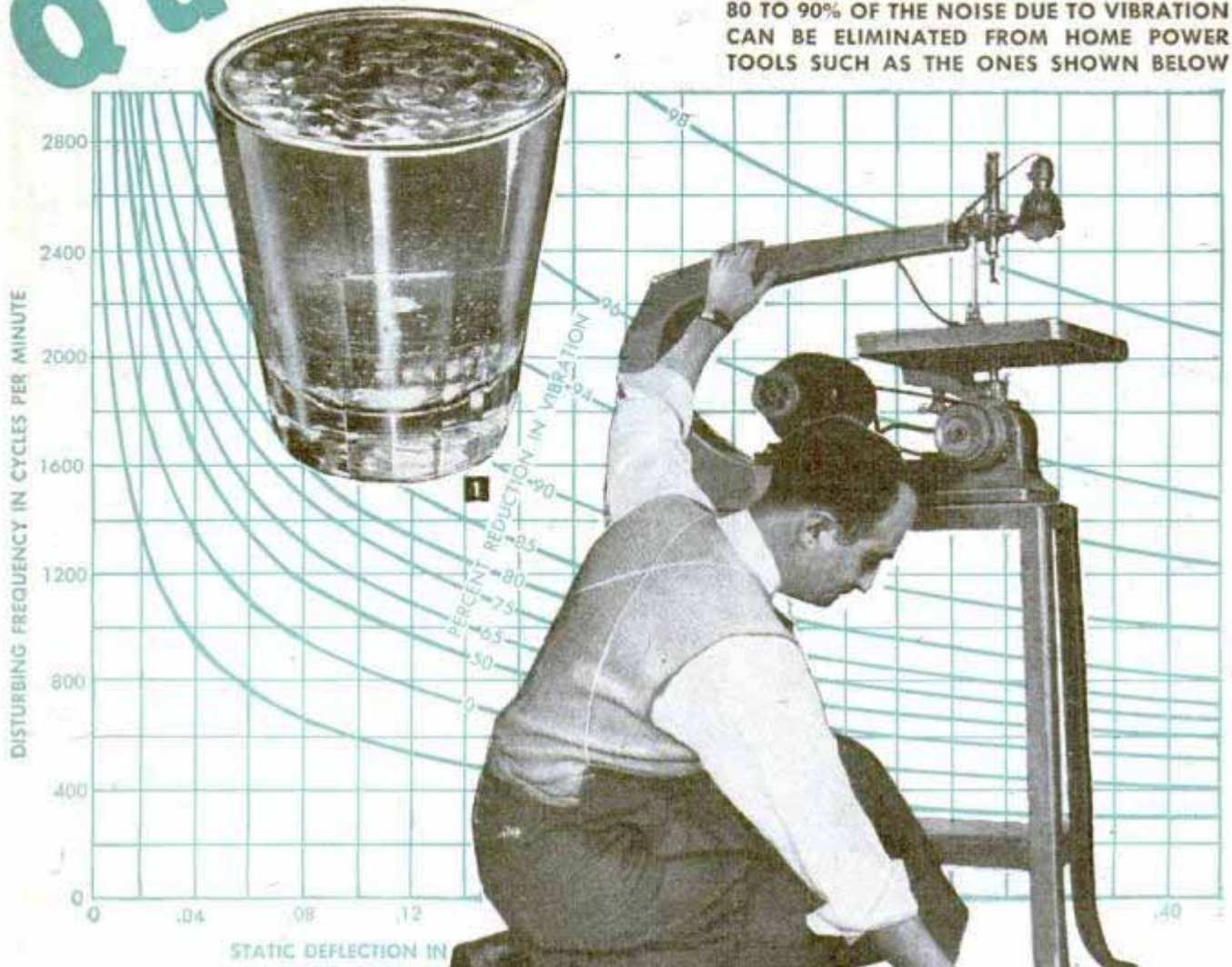
D. A. Williams, Detroit, Mich.



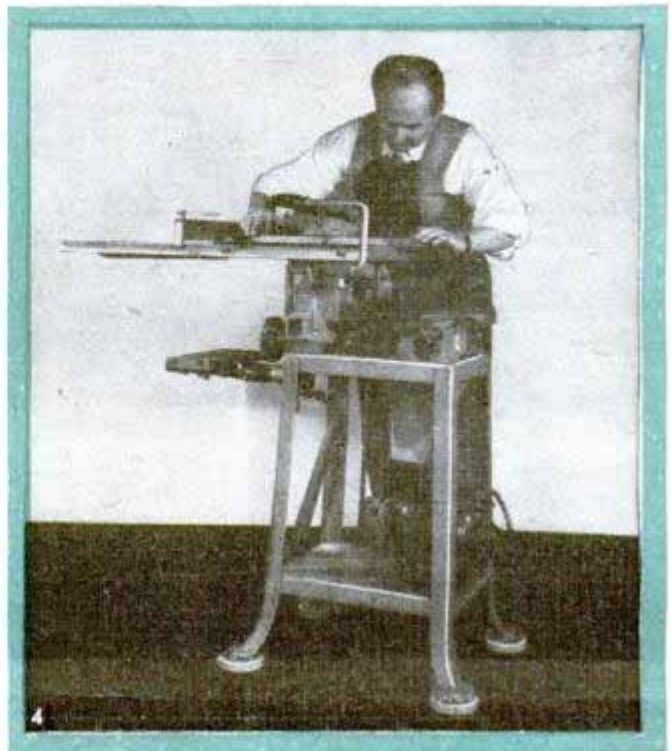
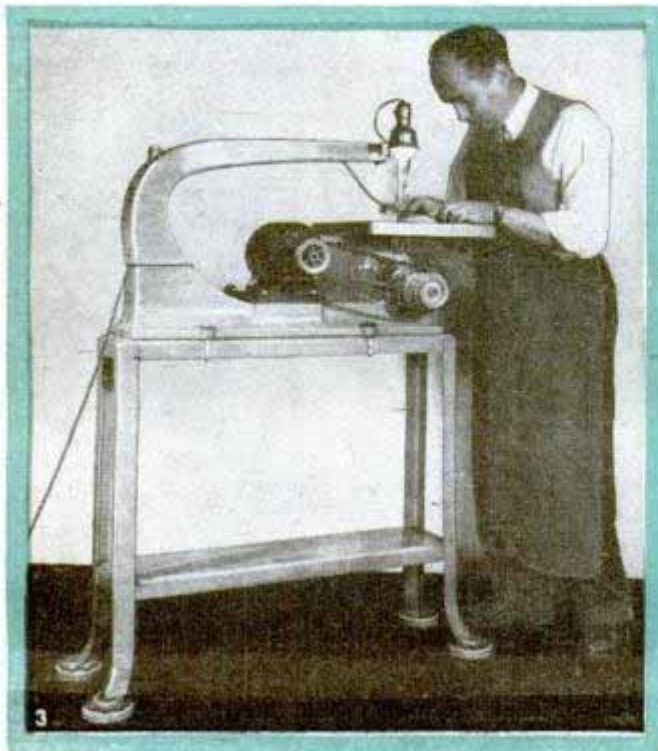
Quiet!

VIBRATION-

80 TO 90% OF THE NOISE DUE TO VIBRATION CAN BE ELIMINATED FROM HOME POWER TOOLS SUCH AS THE ONES SHOWN BELOW



Vibration insulators are merely slipped underneath the legs of the machine stand, no attaching screws being necessary



DAMPEN YOUR SHOP TOOLS

VIBRATIONS set up by power tools can be annoying, especially when the shop is in the home or an adjoining building. In some cases there may be an objectionable vibration set up by transmission of the mere hum of moving parts to connecting floors or walls which amplify the noise. Methods of applying vibration insulation to small power tools are use of rubber shims and cushion mountings for motors and parts, where applicable, and use of insulators under feet of supporting bases. In the first case both rubber shims and cushions can be used in the vertical or horizontal positions, while in the latter application direct compression and shearing-type insulators may be used. Rubber is most practical for workshop tools. Shearing and compression methods of loading rubber are illustrated in Fig. 20. For a visual check on vibration amplitude place a glass of water, Fig. 1, on the floor near a running machine or directly on it and notice, by reflected light, the strength and size of the "waves" set up on the water surface. Vibration rates can be plotted as indicated by the chart, but for practical purposes this is not necessary. Designing of insulators for use under the base of small power tools such as shown in Figs. 3, 4, 5 and 6 calls for the employment of engineering principles. An efficient design will reduce vibration by at least 80 percent. Ideal vibration insulators for the home-shop power tools can be made of ordinary materials and one design will be suitable for most small tools mounted on stands. It

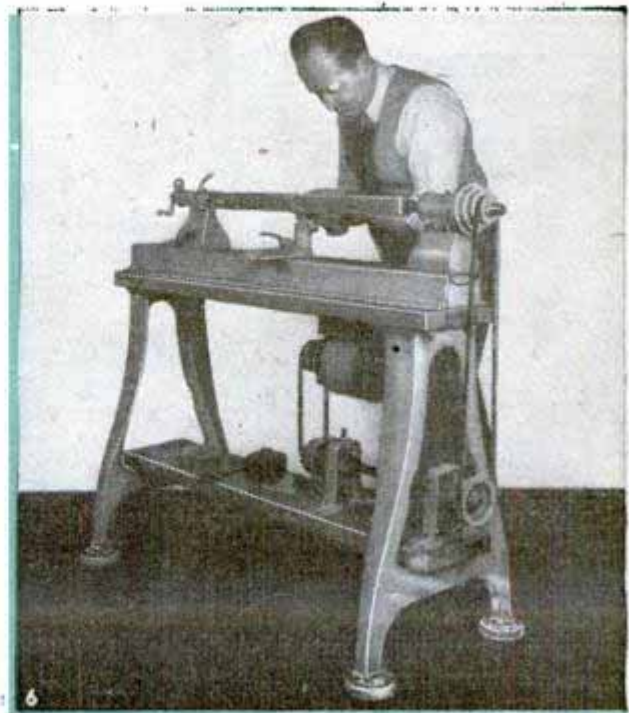
By Kenneth Murray

combines both shearing and compression actions, Fig. 19,

and is self adjusting. Materials required are $\frac{3}{4}$ -in. plywood, a "live" automobile inner tube and a length of $\frac{3}{8}$ -in. dowel. Saw the plywood into the required number of 5-in. squares, one for each insulator, four insulators for each tool stand, and from each cut a round blank $4\frac{3}{8}$ in. in diameter on the bandsaw, as in Fig. 7. For rapid production use a jig clamped to the saw table, Fig. 8. Each square is centered over the projecting pin, pressed down and rotated against the blade. The same jig with a second pin is used for sanding.

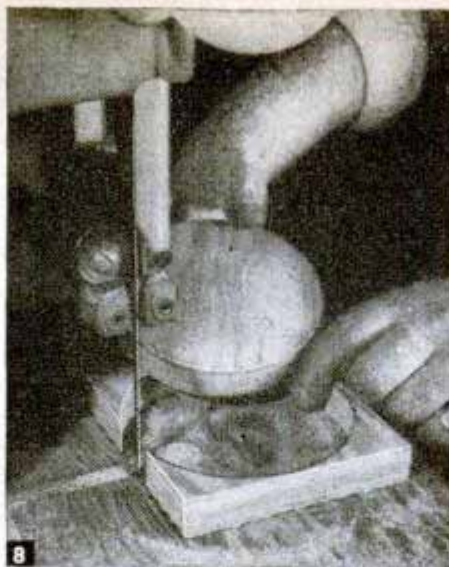
With a compass set in the hole left by the pin, mark a 3-in. circle on each blank. A $\frac{3}{8}$ -in. pilot hole then is drilled through each blank just inside the circle. The drill-press table must be set at a 3-degree angle, Fig. 9. With the jigsaw table at a corresponding angle, cut out the center of each blank as in Fig. 10. The outside section forms the base of the insulator and the inside disk is the platform on which the leg of the tool stand rests. Plug the hole left in the edge of the platform with a short piece of dowel, using glue.

Each platform piece must be sanded down smoothly, and to keep the bevel, center the piece on the second jig pin and tilt the sander table to a 3-degree angle, Fig. 11. Disks are cut from the inner tube, using a $4\frac{1}{4}$ -in. cardboard template, Fig. 12. Lay two thicknesses on the base and press the platform into it as in Fig. 13. The platform should penetrate, under hand pres-

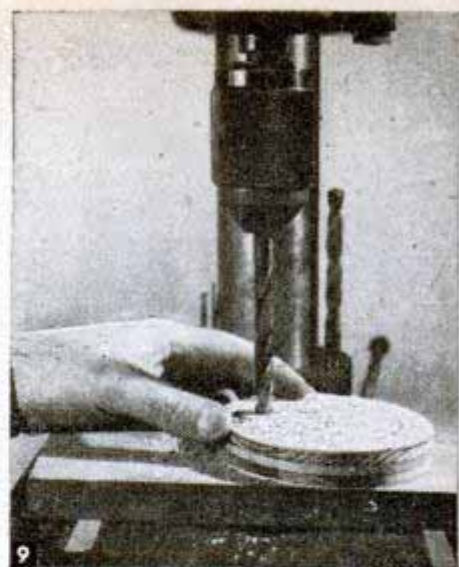




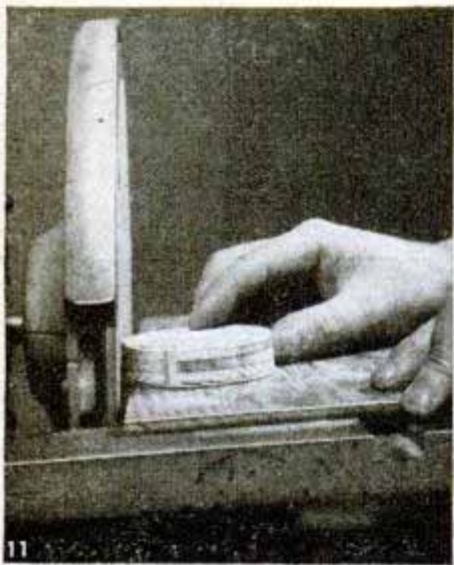
7
Disks sawed from squares of $\frac{3}{4}$ -in. plywood form the base of the vibration dampener for the common shop tools



8
To assure accuracy and uniformity of size the disk is sawed out by turning the plywood block on a pivot pin



9
Then a $\frac{3}{8}$ -in. hole is drilled in the waste wood inside a scribed line so that a jigsaw blade can be inserted



11
Disk is sanded smooth and the hole plugged with a $\frac{3}{8}$ -in. dowel. Sander table is tilted to a 3-degree angle



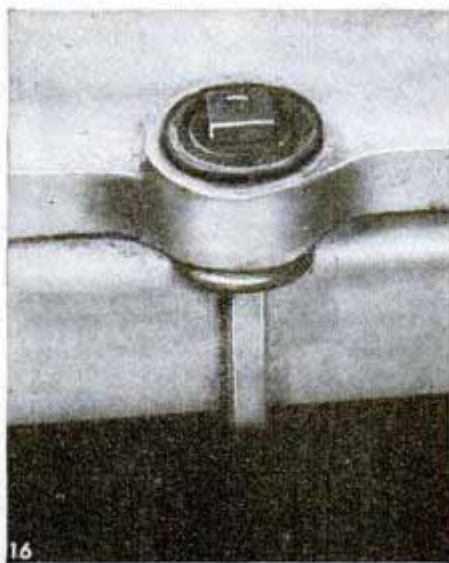
12
Using a cardboard template, disks are cut from "live" inner tube. Two rubber disks are required for each insulator



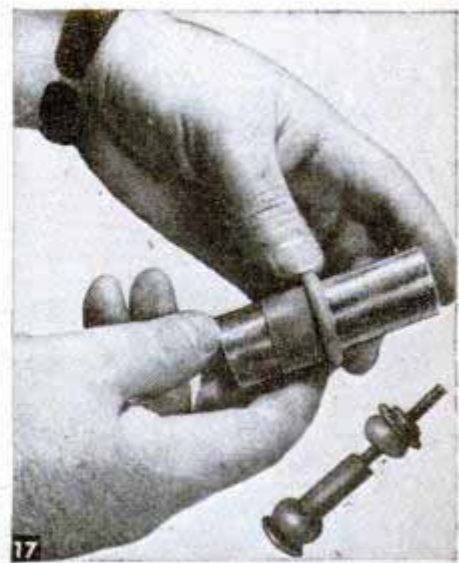
13
Over two thicknesses of rubber the disk should enter the ring not more than one fourth of its full thickness



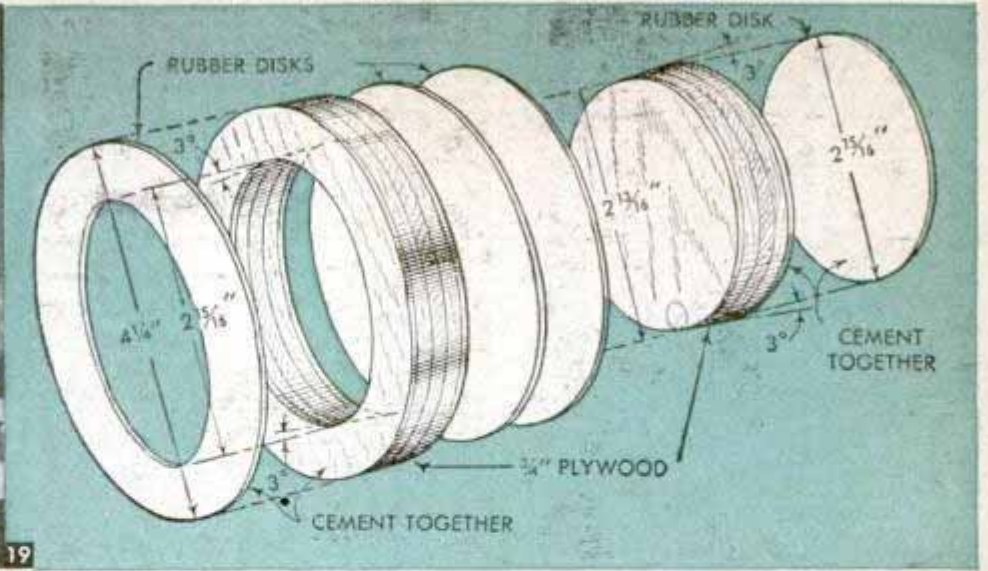
15
If the insulators are used under a drill-press base an additional semicircular block is provided for a bearing



16
Rubber grommets that have lost their effectiveness should be replaced with either new parts or improvised ones



17
A substitute for ready-made grommets—just coat a length of rubber tubing with cement and roll the ends back



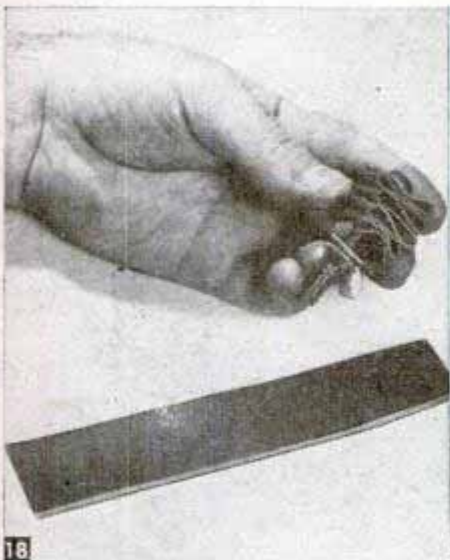
And finally, the center is sawed out of the disk leaving two separate parts, a ring and a matching inner disk

sure, one fourth of the way into the opening. Sand the outside of the base and give it one or two coats of shellac or varnish. Do not finish the inside surfaces. To avoid slippage in use, it is well to cement disks of rubber to the top of the platform and to the bottom of the base, as in Figs. 14 and 19. In use, the insulators are slipped underneath the legs of the power tool bases as in Fig. 2. Use of screws usually is unnecessary. When using insulation under a drill-press base of the type shown in Fig. 15, it may be necessary to add a wood block inside the outer flange.

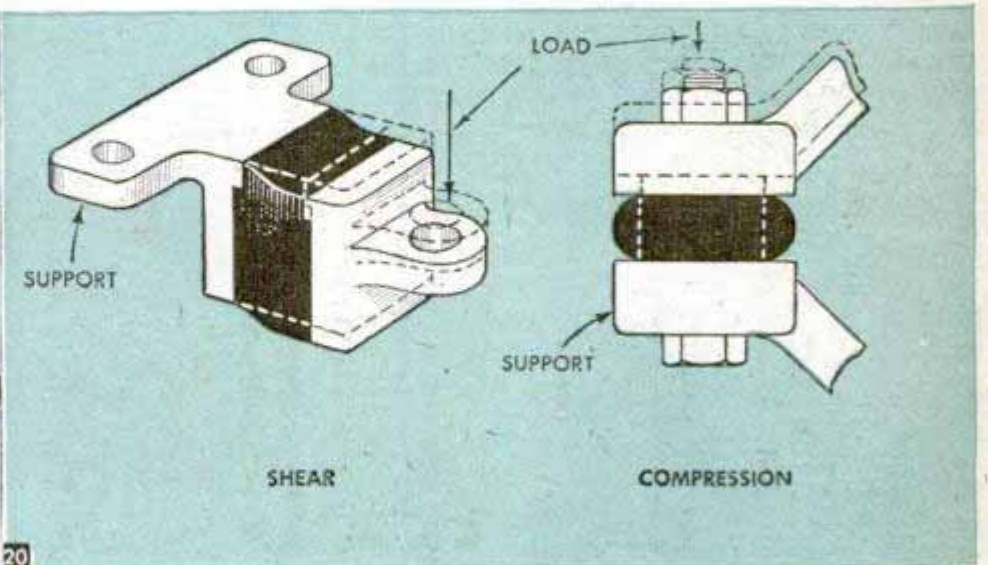


Where insulators are not bolted to machine bases rubber facings are cemented to both the disk and the ring

Some power tools are manufactured with rubber cushions or grommets between parts to absorb vibration, but where they are not supplied, homemade substitutes can be provided. Sometimes the cushions, affected by oil and age, Fig. 16, deteriorate so that they are no longer effective. Often new cushions or grommets can be purchased ready-made, but an efficient insulating cushion can be made from rubber tubing and rubber cement. Slip the tubing over a suitable circular mandrel and roll down one or both ends, as in Fig. 17. Thick sections of rubber can be built up by punching holes in a strip and folding it accordionlike on a mounting bolt, Fig. 18. To absorb slight vibrations completely, use rubber heels cut into disks and provided, if necessary, with mounting bolts. However, these are suitable only for compression-type dampeners.

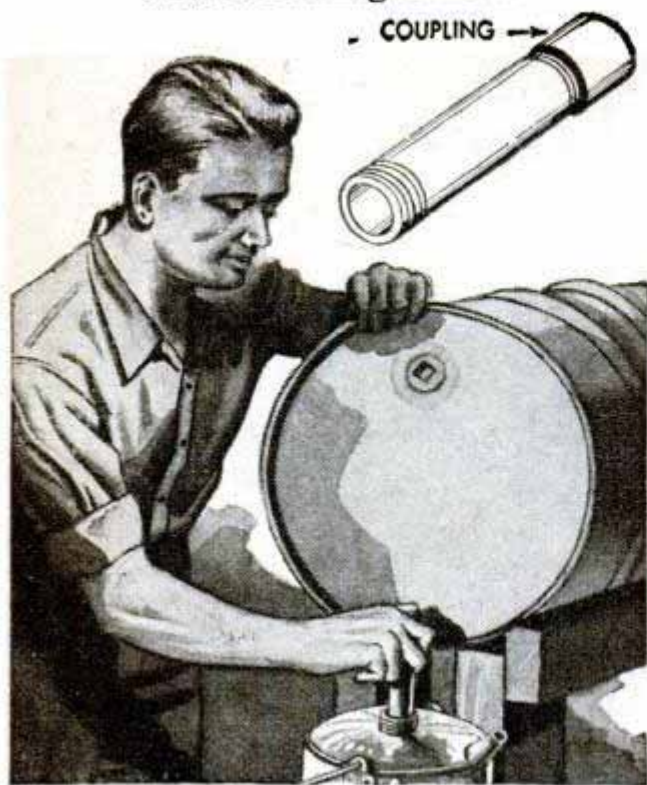


Rubber blocks are built up by punching holes in a strip, coating with cement and folding onto a mounting bolt



Shearing and compression methods of loading rubber are shown in the sketches above, which are only representative. The compression-type dampener is the most practical for home-workshop tools mounted on benches or stands

Pipe Extension Eliminates Funnel When Filling Oilcan



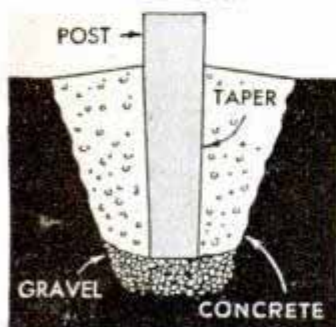
Where no funnel was available, I found that a short length of pipe could be used to fill a container from an oil drum. One end of the pipe was slipped over the spigot and the other inserted in the oilcan. Since the outside diameter of the pipe is slightly less than the opening in the container, a coupling screwed on one end prevents it from slipping into the container.

C. M. Pressey, Johnson, Vt.

Milk Cans Kept in Stock Tank Will Not Freeze

During cold weather it is necessary that milk awaiting delivery to dairies be kept from freezing. One dairyman sets the cans of milk in a stock tank that has a heater and the warm water keeps the milk from freezing.—Leo Beuerman, Lawrence, Kans.

Preventing Posts From Rotting

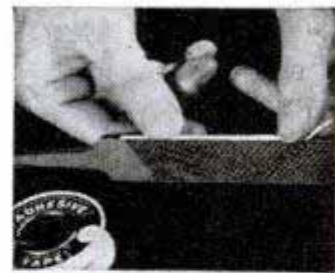


A frequent practice is to set fence posts in concrete with no provision for drainage of water that may work down around them and accumulate between the posts and concrete at the lower ends. To avoid this condition, set the posts on cinder or gravel bases and pour the concrete around them.

If the posts are tapered slightly, it will be easier to remove them should this become necessary.—A. Vena, Philadelphia, Pa.

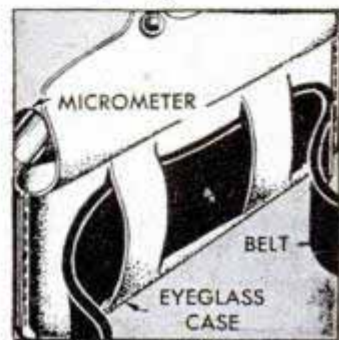
Taping File Protects Work Finish

When working in close quarters, unused faces of the file that might mar finished surfaces should be covered. Strips of adhesive tape will serve the purpose.



Spectacle Case Holds Micrometer

Slits cut in the back of a leather eyeglass case to form belt loops will convert it into a handy micrometer carrying case. Fastened to the belt, the instrument is always at hand. The usual size of case will accommodate a micrometer of from 0-1 to 0-3 in. and provide protection against damage when not in use.



Wire Screen Guards Fruit Trees Against Rabbits and Mice

Wrapping pieces of wire screen around young fruit trees will keep them safe from girdling by rabbits and mice. The screen is fastened to the tree with heavy wrapping cord. Unlike paper, which will become pulpy when exposed to rain and snow, the screen will remain during all seasons.

A. M. Wettach, Mt. Pleasant, Iowa.



Radio and Electronics

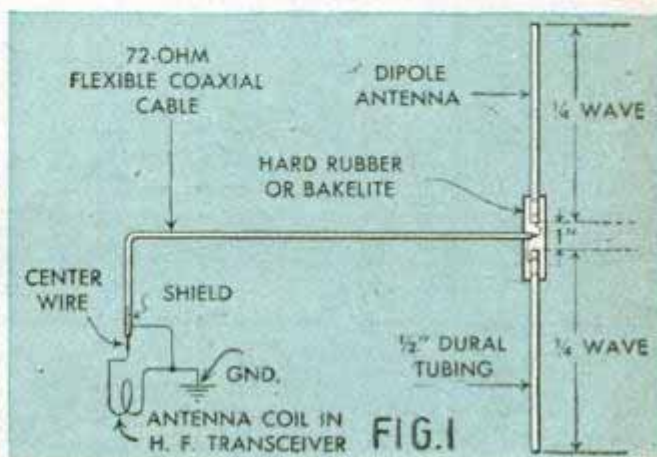
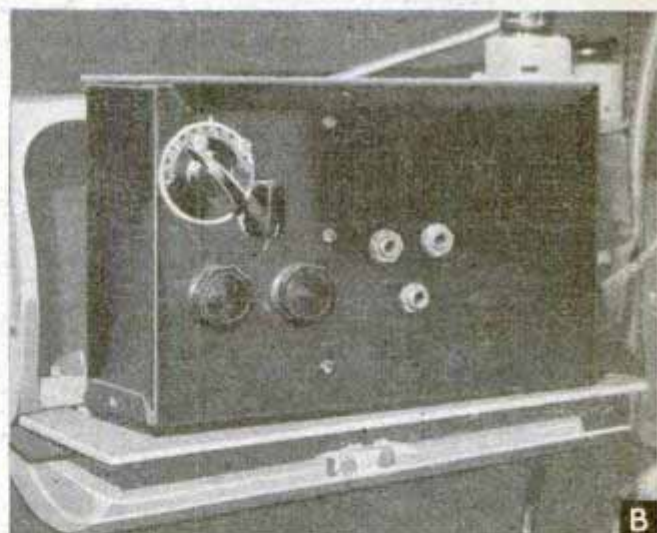


Transceiver Car Installation Without Drilling Holes

PERHAPS you have hesitated to try out that new h.f. transceiver in your car because you could not figure any way to do it without drilling a few holes. The photos and diagram Fig. 1 show a simple arrangement made by a "ham" in Colorado which enables him to either install or remove his combination transmitter and receiver in two or three minutes without drilling any holes in the car.

The glove compartment door provides a handy shelf for the homemade transceiver as illustrated in photos A and B; a piece of hard-pressed wood is cut to fit over the hinges as shown in photo A. The unit is bolted to the pressed wood piece which in turn is strapped to the door.

A dipole antenna is employed as shown in photo C; this is fed with a short length of flexible coaxial cable as detailed in Fig. 1. The dipole is mounted on the end of a $\frac{3}{8}$ by 2-in. wooden strip about 4 ft. long. This strip is mounted on two blocks of wood which are bolted to a piece of pressed wood cut so that it has the same shape top and bottom as the window in the car door. Simply cranking up the window clamps the pressed wood in place and supports the antenna clear of the car.



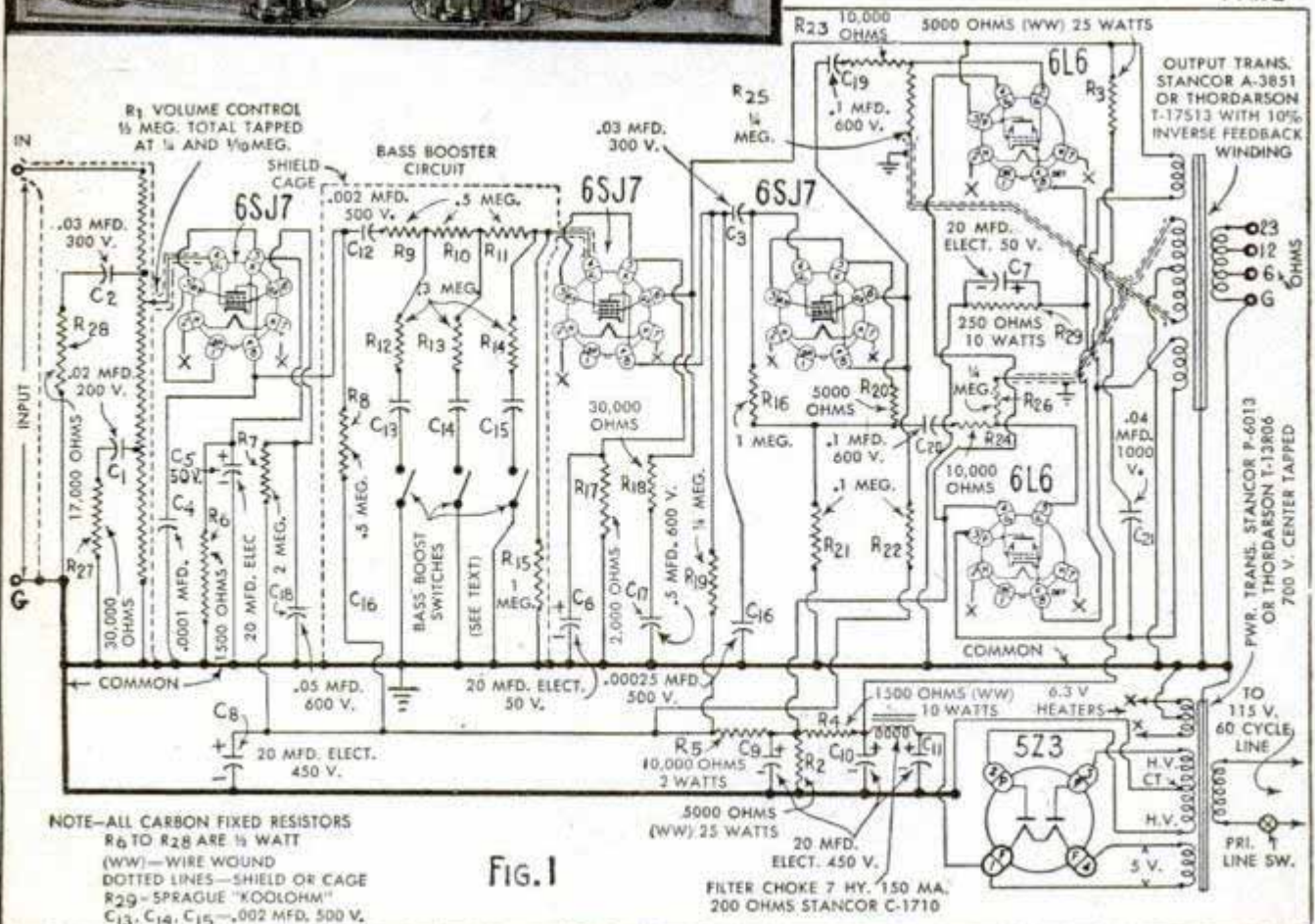
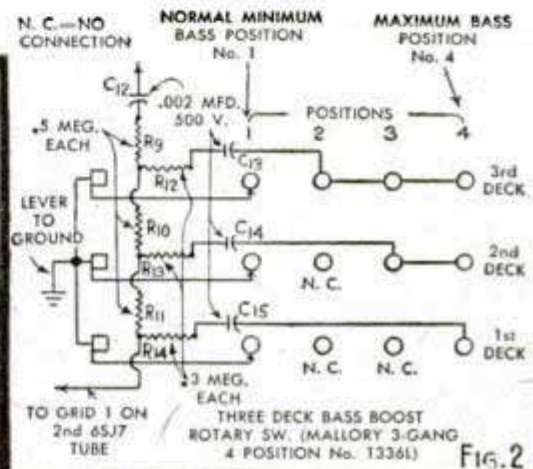
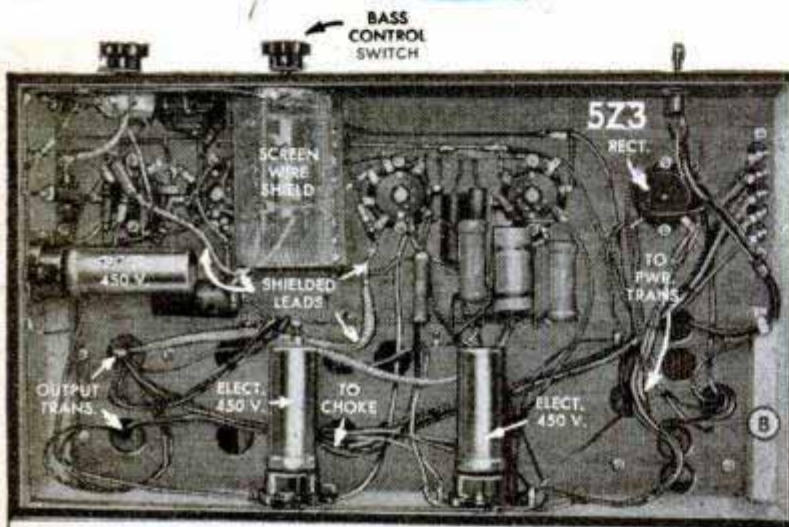
THIRTY-TWO WATT AMPLIFIER

By R. C. Hitchcock



THIS general-purpose audio amplifier has reserve power to serve 4 large speakers in emergencies and provide high quality music and public address facilities for school groups or outdoor activities. It may also be used with reduced gain for one permanent-magnet (PM) speaker or several extension speakers in the home.

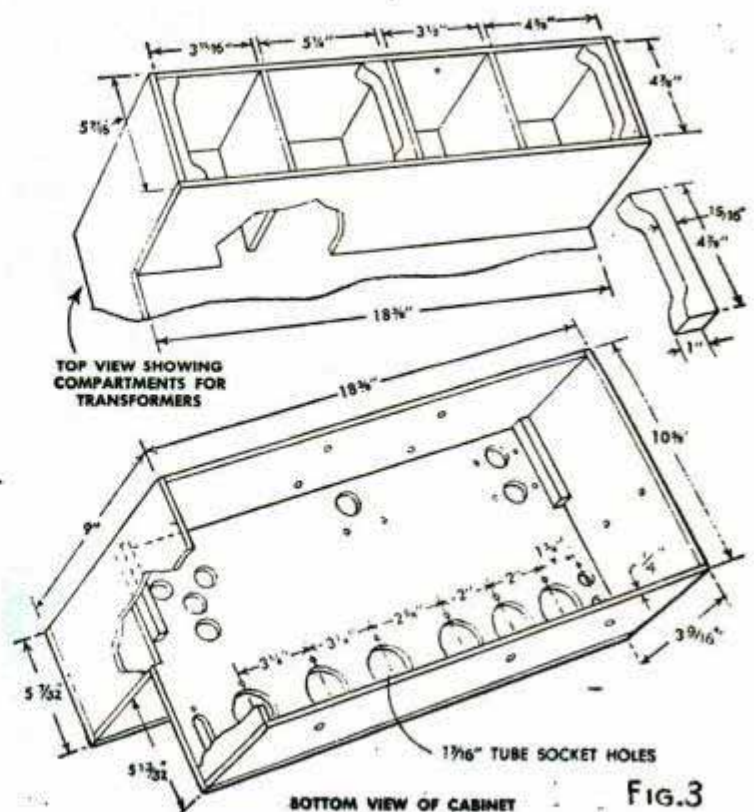
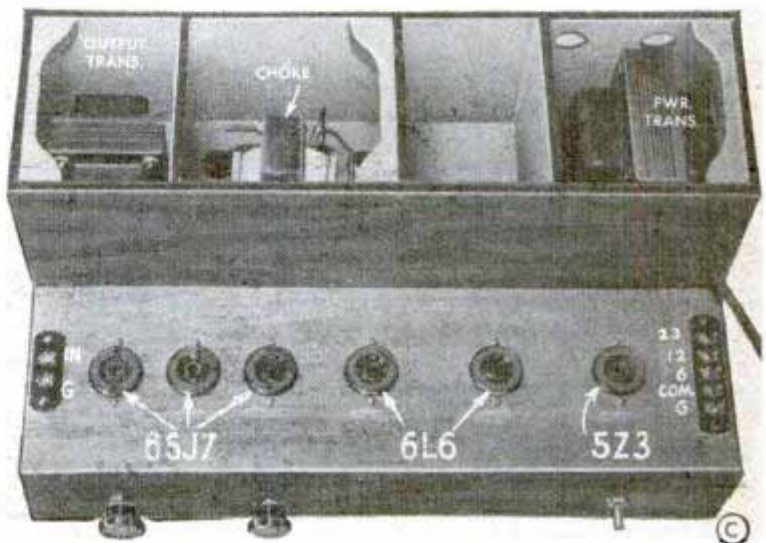
Such were the purposes in mind when the writer designed and built the model shown in photo A. It employs push-pull class AB-1 6L6 tubes, has a maximum output of 32



OPERATES FOUR PM SPEAKERS

watts and weighs only 22 pounds. The schematic circuit diagram, Fig. 1, shows the bass boost section connected by 3 single-pole single-throw switches for simplicity. This is actually done in the model with the 3-deck 4-position rotary switch, the hookup for which appears in Fig. 2. The switch may be seen in photo B, and it will be noted that it is enclosed in a circular screen-wire shield. This shield cage, and all shields indicated, are connected to a common bus-bar wire.

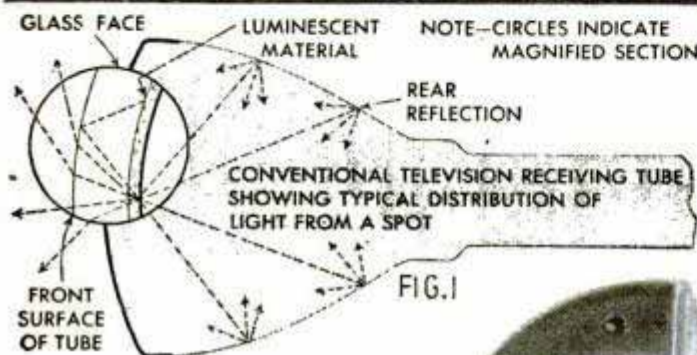
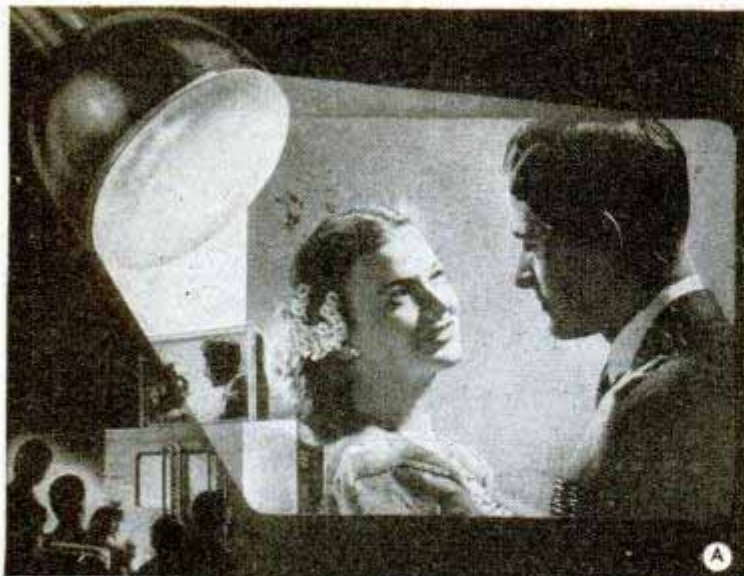
The rather unusual chassis is made of $\frac{1}{4}$ -in. plywood as detailed in Fig. 3; the top, sides and back are finished in Chinese red enamel and the front panels in natural wood with clear varnish. Photo C shows the screw-on top removed for easy access to the compartments that house the transformers and choke. There are three schemes for degenerative amplification necessary to protect equipment used in, and with, a high-powered amplifier. First, the 6SJ7 phase inverter tube, the cathode and plate of which are coupled to the push-pull grids of the 6L6 tubes. Second, the 10 percent degenerative feedback winding on the output transformer; to be sure that this winding on your output transformer is connected correctly refer to the manufacturer's instruction sheet. Third, the feedback from the plate of the upper 6L6 tube to the screen-grid of the second 6SJ7 tube. If oscillation occurs connect the wire to the other 6L6 tube plate. When making all oscillation tests use a 25-watt 110-volt lamp in series with a speaker and 6-ohm tap. Please note that no by-pass condenser is used from the cathode of the third 6SJ7 tube to ground. Keep plate leads away from all grid wires. Four 6-ohm permanent-magnet speakers can be connected, two in series and two in parallel, on the 6-ohm output terminals. Reference number for this article is R-349.



Radio blueprint list and detailed student material lists are always available from Popular Mechanics Radio and Electronics Department upon receipt of ordinary letter postage

"Mirror" in Television Tube for Brighter Pictures

By F. L. Brittin

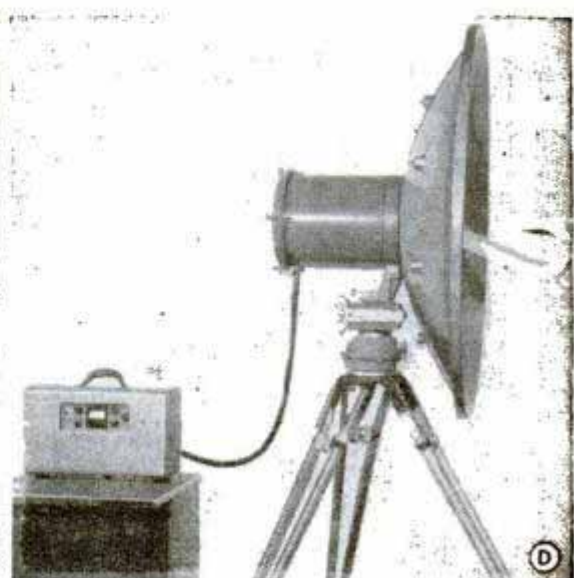
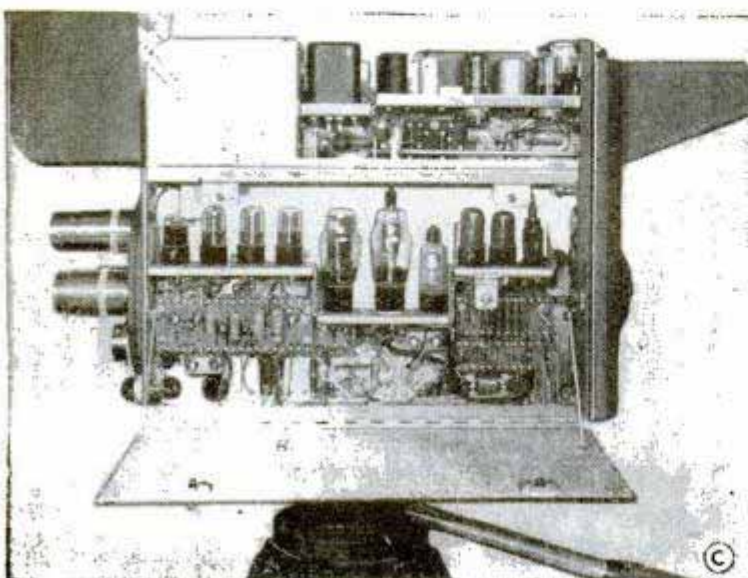


AN ALUMINUM coating about 1500 times thinner than this page is now used on the beam side of the fluorescent screen in the RCA 5TP4 projection-type cathode-ray television receiving tube. This light-reflecting metallic layer, applied by means of evaporation in a vacuum, is thin enough to permit the electron beam to penetrate, but is sufficiently thick to reflect back any light that might fall on it.

Fig. 1—a detailed enlarged section of the glass face of a conventional tube—shows how light losses occur, as at least 50 percent of the light generated in the screen is emitted toward the electron gun in the rear end of the tube. The improved tube, shown in photo B, includes the light-reflecting metallic layer, with the result illustrated in Fig. 2 and the manufacturer's pictorial contrast demonstration in photo A. It is said that the pictures are twice as bright when the new tube is employed.

Brighter pictures also are due to improvements in the television pickup "camera." The one shown in photo C affords easy access to the various tubes and parts. The video preamplifier compartment is in the lower section and the electronic view finder is above. An RCA image orthicon pickup tube, housed in a center compartment, is rated at light sensitivity approaching that of the human eye. A portable FM microwave transmitter, photo D, at

(Continued to page 244)



Designed right, to delight
the most critical hobbyist

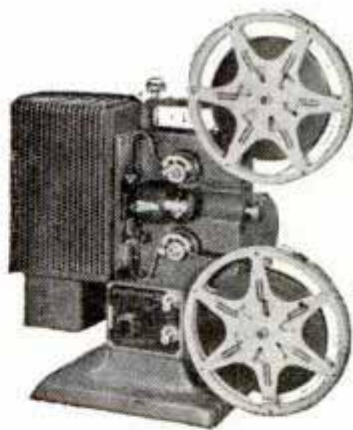
Ciné-Kodak Magazine 8

In this compact home movie camera you'll find the things you appreciate—sound design, simplified operation, the balance and “feel” of quality, combined with true film economy. Three-second magazine loading with full-color Kodachrome or black-and-white films; *Lumenized* $f/1.9$ lens; six accessory lenses; four operating speeds, including slow motion; Universal Exposure Guide.

Ask your Kodak dealer, too, about the economical Ciné-Kodak Eight-25—roll loading; with fixed-focus *Lumenized* $f/2.7$ lens, full-vision eye-level finder, footage indicator, Universal Exposure Guide. Ask about the popular “Magazine 16,” too . . . Eastman Kodak Company, Rochester 4, N. Y.

Carrying Cases—Wide choice of cases for Ciné-Kodaks, film, accessories. Handsome, durable . . . complete protection for all your movie-making equipment.

Kodascope Eight-33—Fast $f/2$ lens teamed with 500-watt lamp gives brilliant image on screens up to 30 x 40 inches. Finger-tip tilting, threading, framing . . . major operating controls grouped on centralized panel.



Ciné-Kodak Long-Focus Lenses “bring it up close.” Above, from left to right, (1) taken with standard 13mm. lens, (2) 25mm. lens, (3) 50mm. lens.

Kodak

**TO THE MILLIONS OF MEN WHO
THINK THEY CAN'T TAKE A PIPE...**

Why be a Pipe Exile?

Royalton
Smoke-Control

Assures Pipe Comfort through a great New Invention



The one big reason so many men give up pipes is that the smoke-volume in a standard pipe is too heavy—they can't "take it" . . . Royalton craftsmen set out to build a pipe that any man could smoke—that would allow the smoker to cut down or increase the draft to suit his personal preference . . . That pipe is here now . . . The Smoke-Control feature is a simple adjustable valve which widens or narrows the opening through which smoke flows. You can set this valve so that you draw in the exact amount of smoke for your taste and throat. Ask your dealer to demonstrate Royalton Smoke-Control.

Write for Interesting FREE Booklet . . . Henry, Leonard & Thomas, Inc., Dept. PM, Ozone Park 17, N. Y.

Put



in your



when the



fall—and

forget it till the first



● You don't *guess* with "Prestone" anti-freeze; you *know* you're safe from freeze-ups, no matter how suddenly the thermometer dives. There's no boiling away or foaming off ... no constant adding and testing. It prevents rust and corrosion too! Because there's not enough "Prestone" anti-freeze for everyone this year, you'd better get yours early ... see your dealer on that first chilly day. You'll have never a care till the warm days of spring—with "Prestone" anti-freeze.

The words "Eveready" and "Prestone" are registered trade-marks of

NATIONAL CARBON COMPANY, INC.

30 East 42nd St., New York 17, N. Y.

Unit of Union Carbide  and Carbon Corporation

SORRY— there still isn't quite enough "Prestone" anti-freeze for all who want it, because—

1 "Prestone" anti-freeze, like most other products, depends on the utilization of raw materials and equipment drawn from many fields. Recent industrial dislocations have affected our plant-expansion program, which was not authorized during the war. Planned for years, it is well advanced; but the real benefit will not be felt in 1946.

2 "Prestone" anti-freeze must be produced and *packaged* long before cold weather. Last spring and summer the food shortage diverted packaging materials to the need of starving millions, and adversely affected our ability to meet 1946 requirements. So your dealer may be selling "Prestone" anti-freeze from 5-gallon cans in addition to the familiar 1-gallon cans.



PRESTONE ANTI-FREEZE

TRADE-MARK

"YOU'RE SAFE AND YOU KNOW IT!"—ONE SHOT LASTS ALL WINTER



He's looking for bugs

HE'S HOPING, of course, that he doesn't find any. Because in the manufacture of files, the best way to keep out "bugs" (defects) is to keep looking for them. Nicholson inspectors do that endlessly—through scores of inspections and tests. They begin with the scrutinizing of every batch of steel and continue down to the "ringing" test for soundness and a final check on the appearance of the finished file.

Pictured above is a "spot" examination, through a hand magnifying glass, of a file that has just come from the cutting machine. Its purpose is to make sure that the file's teeth are properly raised and correct in shape for the kind of filing job they are to do.

It is "eternal vigilance" like this that helps to maintain the Nicholson high standard of quality and uniformity, and enables your hardware dealer to sell you Nicholson or Black Diamond files under the sweeping guarantee of *Twelve perfect files in every dozen.*

NICHOLSON
U.S.A.

NICHOLSON FILE CO.
22 Acorn St., Providence 1, R. I.
(In Canada, Port Hope, Ont.)



NICHOLSON
FILES FOR EVERY PURPOSE

Nature Fakers

(Continued from page 145)


above it is clouded with minute animal and plant life, the old problem of how to represent such water arose. After much consultation among the scientists, taxidermists, artists and carpenters, Arthur G. Rueckert, staff artist, suggested a plan.

A pane of ground glass was to be placed vertically in the exhibit, two feet from the front pane of glass and four feet from the back wall. This would allow clear visibility for two feet and then the objects would become hazy. As ground glass in itself is too opaque, something had to be done to make it more transparent. Mr. Rueckert knew that water poured on ground glass makes the glass almost transparent. What he wanted was something not that transparent, nor as opaque as the ground glass itself. He finally hit upon the idea of applying a coat of turpentine and a mixture of oils to the rough side of the glass. After experimenting with this formula, Mr. Rueckert found that if the surplus of this mixture was quickly rubbed from the glass a semi-transparent effect was produced.

Before the exhibit could be started, careful field notes had to be made. Scientists and taxidermists went on diving expeditions to one of our regional lakes. The flora and fauna were collected and color notes were taken.

As is true of most exhibits, very little of the actual plant or animal is used. The fish were carved out of balsa wood, as was the bird sitting on the water. The log along the bottom was a piece of mesh wire covered with painted wax. The water lilies were also made of wax. Old-fashioned Christmas tinsel served as seaweed. The larger waterweeds, like pickerel weed, were made from the new crinkled green celluloid tinsel. The fine, long strands of seaweed roots were green cloth-covered radio wiring.

(Continued to page 240)



Model Builders Attention!

	V	V-2	V-3
Hex	1/2"	3/8"	5/16"
Thread	3/8"-24	1/4"-32	1/4"-32
Thread Length	7/32	7/32	5/32
Weight, Grams	8	3 1/2	2 1/2

Actual Size V-Plug

Champion spark plugs for model gas engines give the same dependable performance as regular Champions. Sillment sealed. Sillimanite insulator. Alloy needlepoint electrodes for easy starting. One piece construction.

CHAMPION

SPARK PLUG COMPANY • TOLEDO 1, OHIO

The Favorite Spark Plug for Tough Jobs . . .

CHAMPION



On most construction jobs, dependable gas engine power is essential. Such tough and rugged service calls for day-in-and-day-out dependability from spark plugs—and here, as in all types of service on land, water and in the air, Champion Spark Plugs are preferred and used by the overwhelming majority. Here's powerful evidence that Champions make every engine a better performing engine. Champion Spark Plug Company, Toledo 1, Ohio.

**DEMAND CHAMPIONS
FOR YOUR CAR**

FOLLOW THE EXPERTS

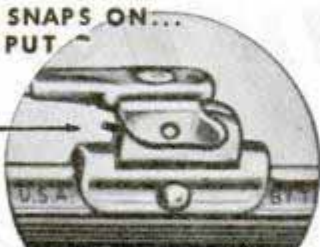
ANCO RAIN-MASTER

"Dead-Locker"

WINDSHIELD WIPER
ARMS and BLADES

BLADE SNAPS ON...
STAYS PUT

FINGER-
TIP
RELEASE



CAN'T FALL OFF
CAN'T BLOW OFF

(A war-born invention—by ANCO—first)
for military aircraft—now for your car.)

DON'T SHOOT YOUR GAS-PUMP MAN!

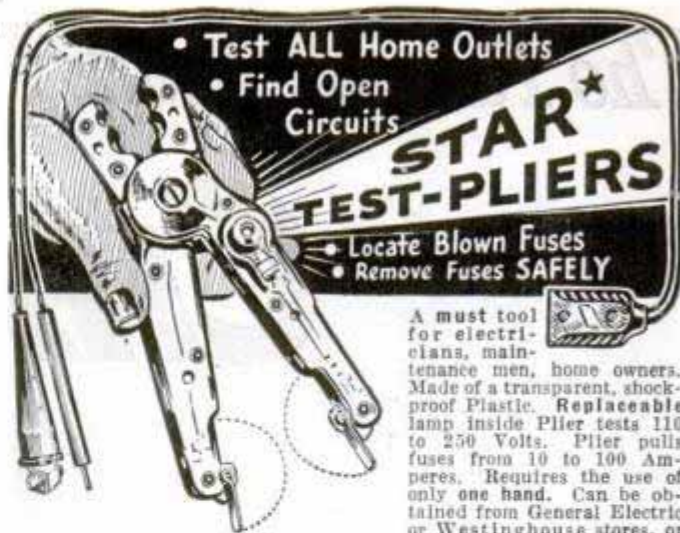
He's doing the best he can. Sure, he knows how dangerous it is for you to drive your car... in stormy weather... with your dull old windshield wipers that smear and smear. He'd gladly put on for you quickly a pair of keen new ANCO RAIN-MASTER Wiper Blades and Arms. He has them—Newest Models! But he forgets to remind you? Too busy? You can't shoot him for that!



After all, it's *your* car to protect. So *you* remind *him*. Get RAIN-MASTERS... patented features... original equipment on many makes of high grade cars and trucks... used in war—on our fighting tanks and trucks and ships and bombers too... because ANCO RAIN-MASTERS clean quicker, clean cleaner... last longer. May save you a costly smashup.

Ask for RAIN-MASTER Windshield Wiper Arms and Blades next time you buy gas.

THE ANDERSON COMPANY
Established 1918
GARY, INDIANA



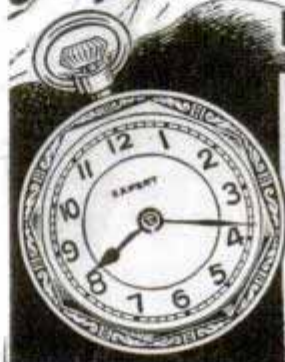
A must tool for electricians, maintenance men, home owners. Made of a transparent, shock-proof Plastic. Replaceable lamp inside Plier tests 110 to 250 Volts. Plier pulls fuses from 10 to 100 Amperes. Requires the use of only one hand. Can be obtained from General Electric or Westinghouse stores, or

from local electrical dealers. Order one TODAY.

Price \$2.75 without Leads, \$1.50 additional for Leads which provide greater reach and more flexibility.

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WEAR 10 DAYS
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NOW AVAILABLE

America's favorite compressed air rifles for indoor or outdoor shooting are back again! Available in .22 Cal. Single Shot and Magazine Loading types. At your dealer—or order direct. Ask for Crosman SUPERPELLS too—the better ammunition for all compressed air rifles: .177 Cal.—\$2.25 per M; .22 Cal.—\$2.50 per M.

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MINIATURE ENGINES

Gasoline—Steam
Air—Locomotive



THE WORLD'S
MOST FASCINATING HOBBY

Build them yourself — In your own shop
With your own tools



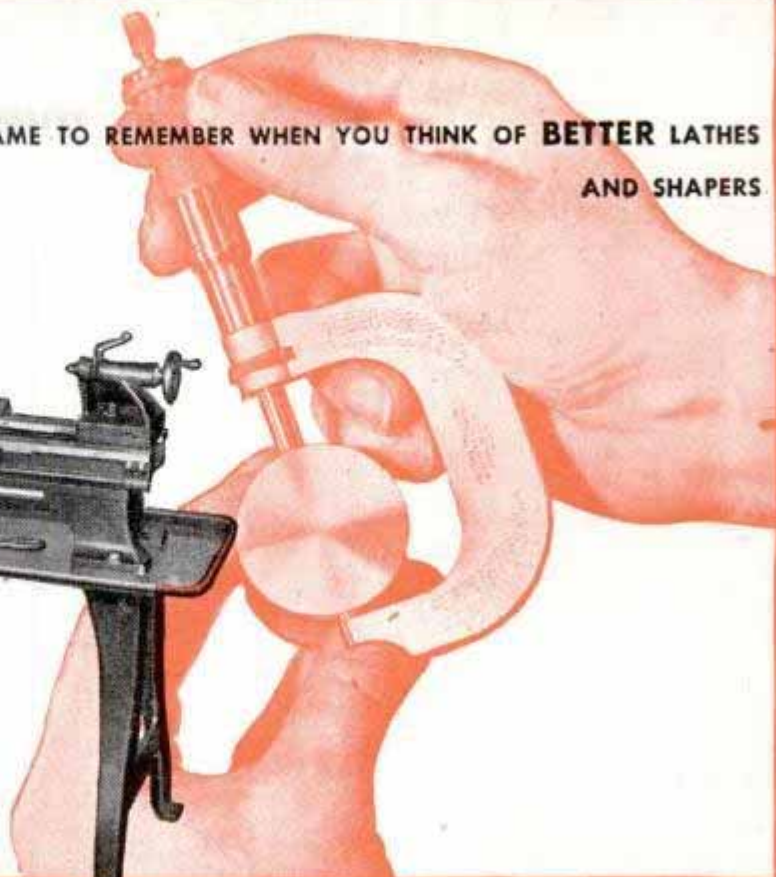
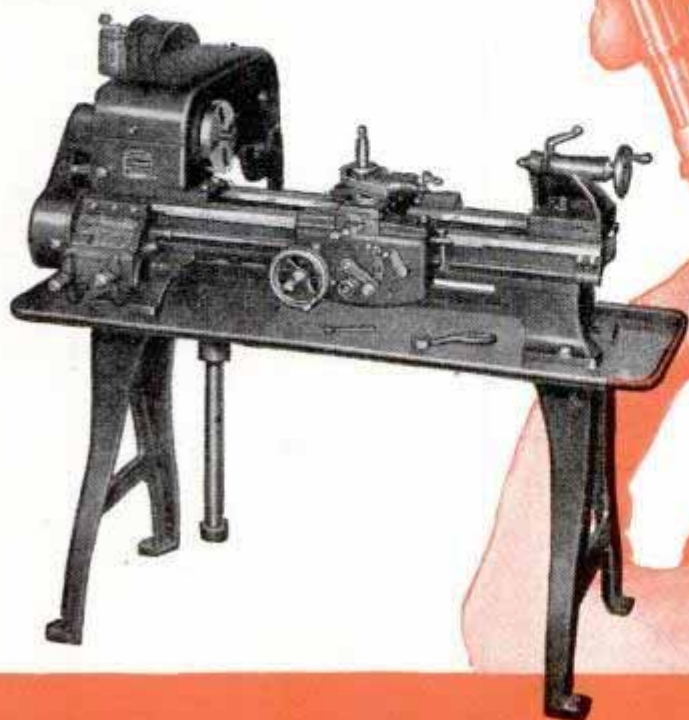
Send 10 cents for my illustrated catalogue listing the world's largest selection of miniature engine castings and drawings.

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Engineering Bldg., Chicago 6, U.S.A.

Logan

A NAME TO REMEMBER WHEN YOU THINK OF **BETTER LATHES**
AND SHAPERS



The Logan lathe

9 reasons why **LOGAN** Lathes are **BETTER** lathes

- 1 BALL BEARING HEADSTOCK**
for sustained accuracy.
- 2 RUGGED, ACCURATE BED**
within .0005" of parallelism.
- 3 SELF-LUBRICATING BEARINGS**
at vital points lengthen life.
- 4 BACK GEARS ENCLOSED
IN HEADSTOCK**
with shifter rack safely and conveniently
at your finger-tips
- 5 RUBBER CUSHIONED COUNTERSHAFT**
for smoothness and accuracy in working
area.
- 6 THREE POINT SUPPORT**
Steadies the countershaft, prevents
rocking.
- 7 ENCLOSED BELTS, GEARS, PULLEYS**
Prevents accidents. Keeps lathe clean.
- 8 AUTOMATIC BELT TENSION RELEASE**
Makes belt changing easy and safe.
- 9 PRECISION BUILT THROUGHOUT**
For tool room accuracy in your shop.

brings tool room accuracy to workshops

The craftsman who takes pride in the accuracy of his work will find real satisfaction in the jobs he turns on his Logan Lathe. The two V-ways and two flat ways of the Logan Lathe bed are precision ground to within .0005" of parallelism. Bearing faces on the Logan headstock are held to an accuracy of .0005". For lasting accuracy the Logan spindle is mounted on pre-loaded, grease-sealed New Departure ball bearings. Construction standards like these have identified the Logan name with accurate, dependable and economical performance in every field of industry. That is why the fact that he can now obtain the Logan Lathe for his own shop is important to every craftsman.

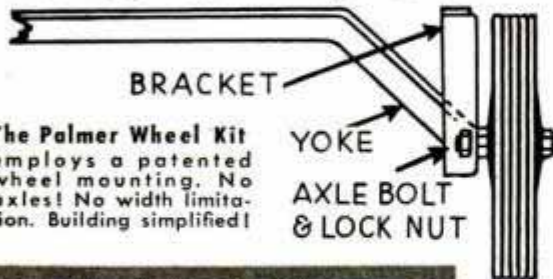
WRITE FOR THE LOGAN CATALOG . . . complete, illustrated descriptions of Logan Lathes, Shapers and Accessories.

LH-5

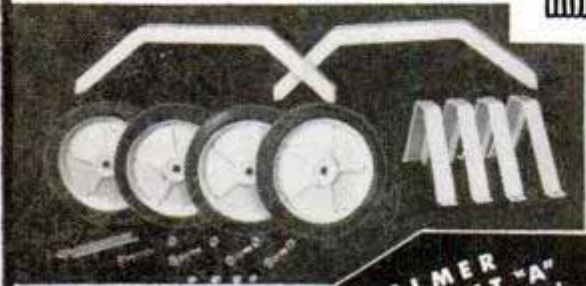
LOGAN ENGINEERING CO., 4921 LAWRENCE AVE., CHICAGO 30, ILL.

new!

PALMER WHEEL KIT eliminates "axle problems"



The Palmer Wheel Kit employs a patented wheel mounting. No axles! No width limitation. Building simplified!



PALMER WHEEL KIT "A"
contains four 8" steel wheels with solid rubber tires. (Grooved tread 1 1/4" wide). Four steel mounting brackets. Two steel yokes. Axle bolts, nuts and special wrench included.
Only \$6.75

The PALMER patented wheel mounting simplifies every wheel application! Only short, individual wheel axles are used. No cross axle to limit design of your wagon, utility cart or racer. Brackets and yokes are sturdy stamped steel; attractively finished in bright red baked enamel. Axle bolts are stainless steel... rust proof! Solid molded rubber tires with 1 1/4" treads wear longer than other types... do not mark linoleum or polished floors! Tires cannot loosen or slip due to special mounting process. Tests have shown 8" wheel able to withstand over 1000 lbs. vertical load.

PALMER WHEEL KIT "B"
same as "A" except wheels are small diameter (5 1/2") with 3/4" molded rubber tire. **\$4.39**

Individual Wheels

8" DIA. with 3/8" bushings . \$1.40
8" DIA. with 1/2" bushings . 1.48
5 1/2" DIA. with 3/8" bushings .94

The Ideal Christmas Gift for Ages 8 to 80!

NOW you can design and build *"Anything on wheels"*
Soapbox Racer
Tool Cart
Display Cases
Scooter
Mobile Caddy
Wheelbarrow
Market Carrier
Rubbish Cart
Bike Trailer
Toy Wagons
Boat Carriers
Movable Furniture
Luggage Mover
Milk Can Cart

THE PALMER MFG. CO., Dept. 1
8115 Clinton Road, Cleveland 9, Ohio

Please send me: (indicate number of sets)

- PALMER WHEEL KIT "A"
 PALMER WHEEL KIT "B"
 8" wheels, 3/8" bushings.
 8" wheels, 1/2" bushings.
 5 1/2" wheels, 3/8" bushings.

Enclose check or money order—all prices F.O.B. Cleveland, O.

NAME _____
ADDRESS _____
CITY _____ ZONE _____ STATE _____

When the fish and accessories were completed, installation was begun. Because of the ground glass partition, the material had to be arranged to give the illusion of no glass at all. Many of the fish were cut in two, and one half attached behind the ground glass and the other in front of it. The plants were also pasted in front of and behind the glass to give the appearance of a continuous length of plant. The only original materials used in the exhibit were the skeleton of a turtle, the outer skeleton of a crayfish and some small stones.

The ambition of these "nature fakers" is not to fool the public but to enchant them with natural beauty—unnaturally produced.

Making Money by the Ton

(Continued from page 157)

by the Philadelphia and Denver mints.

Each press automatically stacks the blanks that are fed into its hopper, moves the coins two at a time into position between the upper and lower dies, and then simultaneously presses the dies into the metal blanks. When silver coins are being struck, die collars meanwhile create the indented reeding on their circumference.

The coins now are finished and ready for final inspection in a machine that checks the weight of each individual coin at the rate of 7000 units per hour. Then they are dumped into the hoppers of machines that count them out into sturdy storage bags. Filled with bright new coins, the bags are moved to the storage vaults for eventual distribution to Federal Reserve banks upon the order of the treasurer of the United States. The mints do not supply coins directly to the public or local banks.

The hundreds of tons of gold and silver in the mints are safeguarded by complex detection and alarm systems, time locks, strong walls and well trained armed guards.

Even so, thousands of dollars worth of bullion would disappear every year if it were not that elaborate precautions of another kind are taken.

Necessarily, bits of metal escape in the melting and processing operations. Flakes and slivers fall on the floors or are washed away. Some floats off in the air as dust or fumes. These losses could add up to important shortages, and so extraordinary salvage operations are employed to reclaim the last microscopic bit of precious metal.

In the first place, all debris, including old shoes, old clothes, sacks and other materials that collect in the mint, is burned in an incinerator instead of being thrown

(Continued to page 244)

"King-sized
brakes"

"The liveliest performer in
the low-priced
field"



"Rest-Ride
springs!"

"That best-dressed look!"

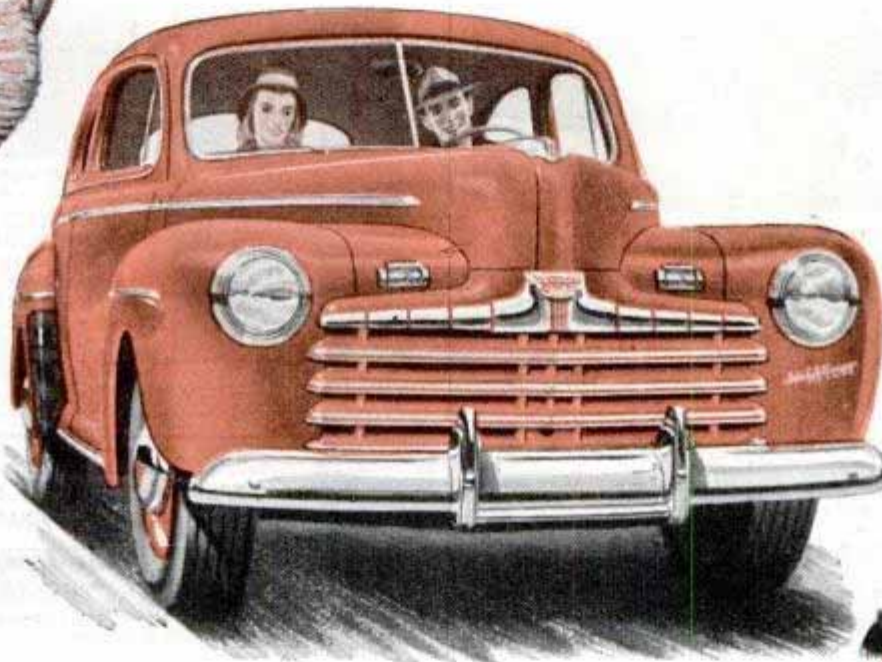


Ford's out Front WITH EVERYBODY!

"Extra large trunk...
that's no joke, son!"



"Wide-angle
vision!"



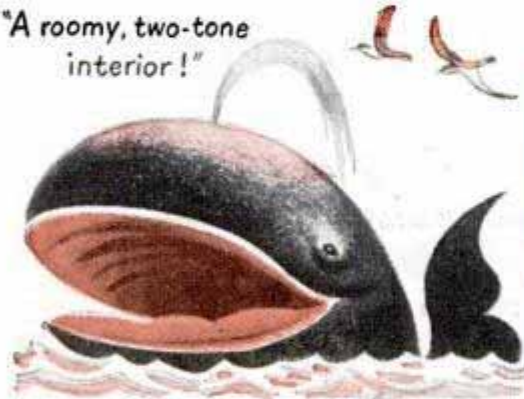
"Lifeguard body!"



"Aye,
and thrifty, too!"



"A roomy, two-tone
interior!"



There's a *Ford*
in your future

"A wise
buy!"



FOR *Building* AND *Repairing* CHRISTMAS TOYS



use PLASTIC WOOD

You can get a professional finish on those jobs for the kids! For a slick, smooth finish that takes paint, lacquer or varnish perfectly, use Plastic Wood as your filler. Repairs such as cracks, gouges or loose joints are quickly mended and the toy is back in apple-pie order! *Handles like putty—hardens into wood!*

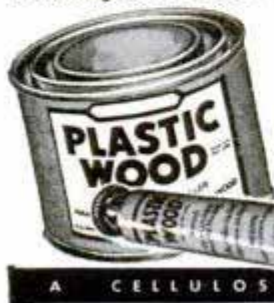
... dozens of other uses

FOR FILLING . . . FOR REPAIRING . . .

- Countersunk screws
 - Loose casters
 - Chipped furniture
 - Broken balusters
 - Nail and screw holes
 - Broken furniture
- You'll want Plastic Wood SOLVENT, too. Get both at one time. It is made especially to control the consistency of Plastic Wood . . . useful also in removing dried Plastic Wood from tools and fingers.

T. M. Reg. U. S. Pat. Off.

At all Hardware,
Paint and 10c Stores



PLASTIC WOOD

Tube or Can

A CELLULOSE FIBRE FILLER

SAY YOU SAW IT IN POPULAR MECHANICS

Do a Better Job WITH ONE OF THESE EMPIRE LEVELS

Smallest, most handy and accurate Level made. "Cigar-shaped"—no sharp corners to tear pocket. Aluminum stock. Only 3 oz. wt. 9" long. Has Level, Plumb, 45° Vials.

EMPIRE TORPEDO LEVEL



No. 26\$1.75



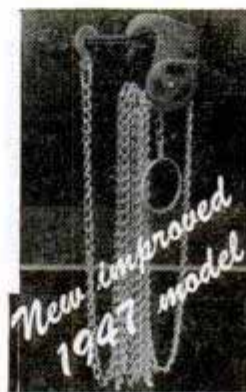
ALUMINUM LEVEL — No. 151

Cast and Machined, a Beautiful Tool, with Patented, Removable Level and Vial. With 2 Plumb, 2 Levels, 2 — 45° Vials. 18"\$5.00
24"\$5.50 28"\$6.25

Order EMPIRE LEVELS from your local dealer.
Write direct for literature.

EMPIRE LEVEL MFG. CO.
717 S. 6th St. Dept. P-243 Milwaukee 4, Wis.

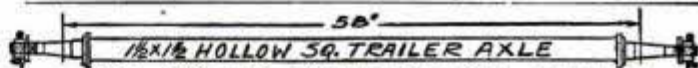
ONE MAN BOX CAR DOOR OPENER



One man can quickly, safely open or close the most pig-headed, stubborn freight car door with the simple, powerful Monarch Car Door Opener. Thousands now in daily use. NO strained muscles • NO slips or falls • NO broken or mashed limbs • NO fatalities • NO time wasted • NO "gangs" needed • NO time lost

Only \$22⁵⁰ Ea. F.O.B. Bowerston, Ohio

THE MINING SAFETY DEVICE CO. • Dept. PM, Bowerston, Ohio



CAP.—2000 LBS.—\$6.75 EACH F.O.B. DETROIT

STRONG MACHINE & AXLE COMPANY

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Hamtramck 12, Michigan

CORROSION TROUBLE?

Use an oil that prevents rust while it lubricates
—shop appliances
—household devices
—mechanic's tools

Hardware and Sports Dealers

It's THE Triple Action Oil
Lubricates
Prevents Rust
Cleans

3-oz. SPOUT CAN 40c

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SPECIAL SURPLUS SAVINGS ON PLASTICS

CLEAR GRADE A PLEXIGLAS

Sheet Size 12" x 20" — 1/4 Inch Thickness

\$3.39 per sheet

Also Plexiglas sheets new per sq. foot:

1/16\$1.13 3/16\$1.79
1/8\$1.46 1/4\$2.10

Add 10% for packaging on orders under \$10.
Add \$1 for packaging on orders over \$10.

ALSO . . . complete line of RODS, TUBES, SHEETS, ODD SHAPES in all types of plastics. Dyes, cements, buffing compounds. FRANKLIN PLEXIGLAS ANTI-STATIC WAX, BURNISHER AND CLEANER.

CADILLAC PLASTIC COMPANY

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DETROIT 2, MICHIGAN

POPULAR MECHANICS

IT'S A GRAND FEELING,
TO RUN A
MINIATURE RAILROAD



IT'S A GRAND FEELING, TOO,
WHEN YOUR CAR IS
CUSHIONED WITH MARFAK
CHASSIS LUBRICATION

Miniature railroading is fun, with remote controls, realistic whistles, and real smoke. And a smooth riding car is lots of fun, too.

That "cushioned" ride you feel when your car is lubricated with *Marfak* is evidence that *Marfak* is doing its job . . . is furnishing a lubricating cushion for your vital chassis bearings. And *Marfak* lubricates for longer, too, a thousand miles and more.

It's because *Marfak* is scientifically designed to do its job . . . its special adhesive and cohesive qualities resist wash-out, jar-out, and squeeze-out. *Marfak* clings to the bearing surfaces . . . sealing out dirt and grime.

Yes, it's a grand feeling when your car is "cushioned" with *Marfak* chassis lubricant. See your Texaco Man today, and say: "*Marfak*, please."



With ordinary grease . . . you're taking the road shocks again after a few hundred miles.

Marfak stays on the job hundreds of miles longer — means more velvet smooth riding.

TEXACO DEALERS



SKY CHIEF
GASOLINE



FIRE-CHIEF
GASOLINE



HAVOLINE AND TEXACO
MOTOR OILS



MARFAK
LUBRICATION



THE
TEXAS
COMPANY

Tune in . . . TEXACO STAR THEATRE presents the new Eddie Bracken show every Sunday night. See newspapers for time and station

THE ONLY BRUSH THAT

*Keeps the Air Clear
as it Cleans the Floor*

Also Eliminates
Sweeping Compound!



Arbitrin Sweeping fluid is put into a steel reservoir in the back of the Dustless brush.

As you sweep Arbitrin filters through the tufts — surrounds particles.

The dust itself is converted into sweeping compound — cannot rise into the air.

Dustless brushes used with Arbitrin sweeping fluid are 100 times more effective in controlling dust than ordinary floor brushes used with sawdust. When used daily, Dustless brushes actually reduce bacteria, normally in the air between sweepings, as much as 97%. These facts have been proved in tests made by independent health authorities. Dustless brushes are used in thousands of stores, factories, offices, schools, and institutions. They are unconditionally guaranteed to meet your requirements. Write today for sizes, styles, and prices.

MILWAUKEE DUSTLESS
BRUSH COMPANY

530 North 22nd Street • Milwaukee 2, Wisconsin

MANUFACTURERS OF DUSTLESS, SPEED SWEEP AND SPEED WASH BRUSHES

Milwaukee Dustless Brush Co., 530 N. 22nd St., Milwaukee 2, Wis.
Please send complete information about Dustless brushes and Arbitrin sweeping fluid.
Name.....
Address.....
City and State.....

away. Then the ashes are panned, using the same process miners employ to separate small particles of gold from river sands. The material is swirled around and around in a pan of water. Heavy metals collect at the bottom while light materials escape over the side.

Similarly, old furnace linings, bricks, pots, stirring rods and other worn-out ceramic equipment from the melting rooms are crushed and panned. Even after all the apparent metal has been removed this material still has recoverable values. It is sold at a standard price to private metal refiners who put it through other extraction processes.

Dust and sweepings from the floors are sold as "sweeps" to metal refiners. Per ton, the daily sweeps may yield from one to 150 ounces of gold and from 50 to 2000 ounces of silver.

Too, none of the wash waters from the metal rooms are allowed to empty directly into the sewers. They flow first to tanks where all suspended particles of metal settle to the bottom for reclamation at regular intervals.

Not even the air escapes from the mint building without a laundering. All the ventilation air from the metal departments, all the stack gases and all the melting fumes are ducted to huge electrostatic air cleaners. Several tons of dirt and dust are collected yearly by the air cleaners, from which are reclaimed as much as 100 pounds of gold, silver and copper.

Still other precautions are taken to maintain the purity of our money and to prevent losses. The beams that weigh metal or coin are tested for accuracy every morning. In addition to the assays by which each batch of metal is checked, special tests of the coins themselves are made from time to time. Bullion or money is never moved from one department to another without the exchange of signed receipts. Last of all, audits are made each year of the stocks on hand at each mint by a board of officials from one of the other mints.

"Mirror" in Television Tube For Brighter Pictures

(Continued from page 232)

the remote pickup location, and a similar-looking receiver at the studio or station transmitter, provide a highly directional wide-band radio link over distances up to about 15 miles without the use of wires or coaxial lines. The cylindrical unit back of the parabolic reflector houses either the transmitter or receiver, which is monitored

(Continued to page 248)



ANNOUNCING
The New 1947
HARLEY-DAVIDSONS!

They're ready! — the new 1947 models you've been waiting for! What streamlined beauties, these new Harley-Davidson Motorcycles! Rugged — powerful — with plenty of zooming speed. And when it comes to *dependable performance*, these great new models are backed by

the truly remarkable wartime records for stamina established by thousands of Harley-Davidsons . . . world champion motorcycles that proved they could "take it" through years of punishing service — and under toughest weather and road conditions in all parts of the world. Better see your Harley-Davidson dealer **EARLY** — if you want the thrill of owning a new 1947 Harley-Davidson!



HARLEY-DAVIDSON
Motorcycles

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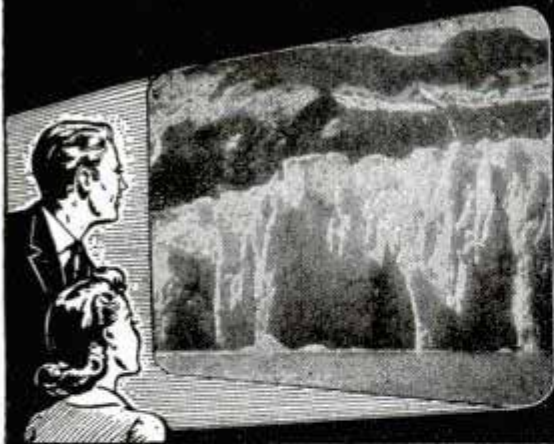
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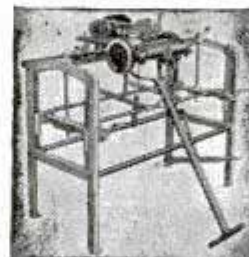
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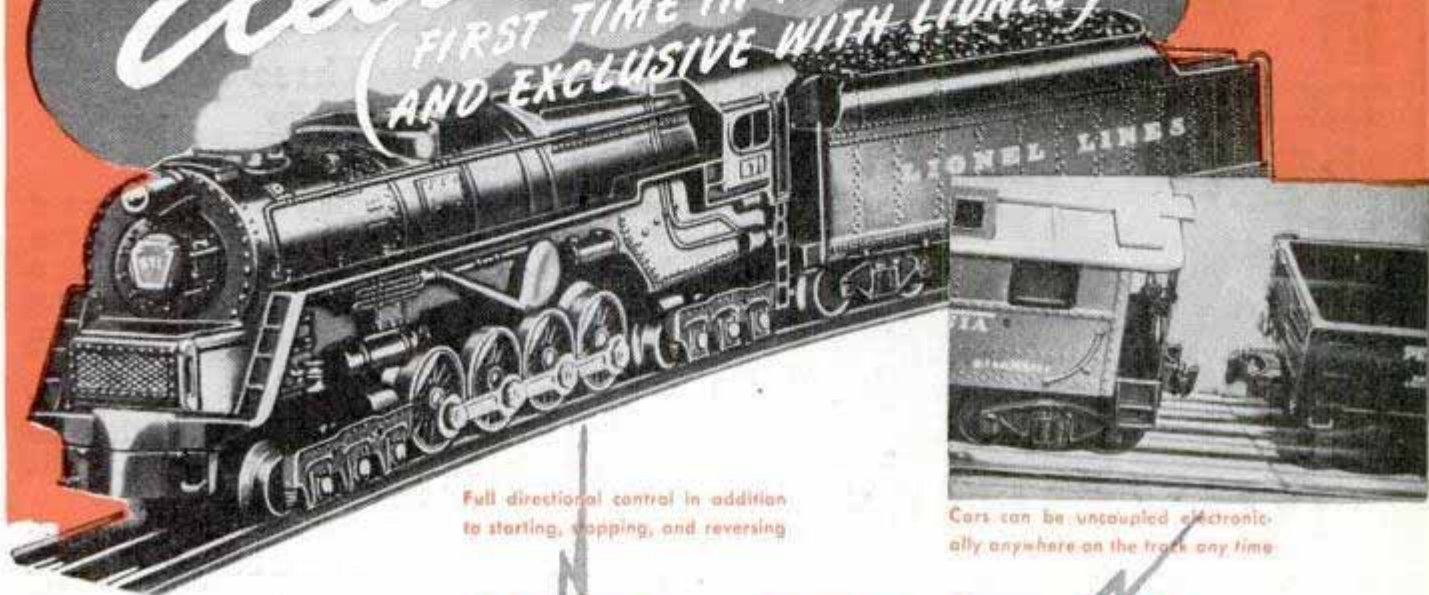
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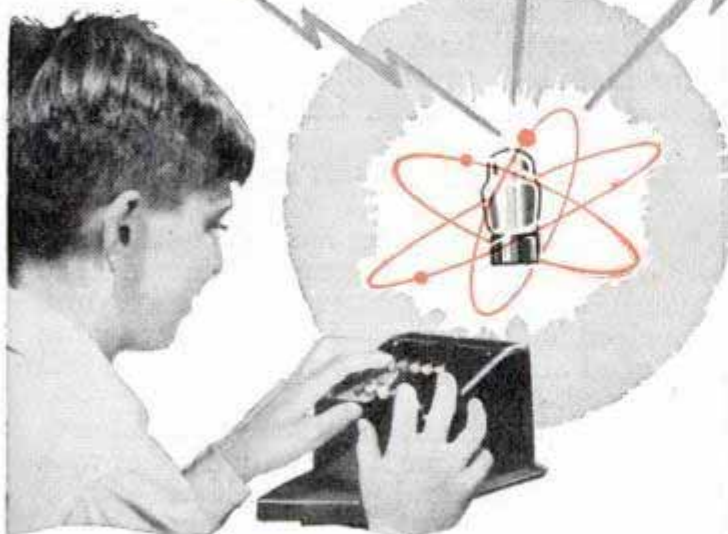
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How to Play Three-Cushion Billiards

(Continued from page 127)

average and expert players has observed that the ordinary player often hits the cue ball at the extreme left or right, putting a lot of spin on the ball but generally missing the shot. The expert uses a minimum amount of english.

The standard billiard ball is $2\frac{3}{8}$ inches in diameter. Now imagine a circle the size of a half dollar drawn in the center of that part of the ball that faces you.

Then mark this down "indelibly" in your mind: Never strike the cue ball outside this imaginary circle and you will eventually improve your game.

I can't emphasize this point too much. For one thing you will stand less chance of miscues. You've seen billiard players aim straight ahead but the ball skids off to the right or left? Well, often this is caused by hitting the cue ball outside that imaginary circle.

If you make a follow shot in which the cue ball follows the general direction of a struck object ball, hit the cue ball near the top of that circle. If you try a draw shot to pull your ball back toward you after hitting another ball, stroke the cue ball near the bottom of that circle. Left-hand and right-hand english, likewise, are obtained by hitting the ball on the left or right, but still within that circle.

In discussing stroke and follow-through, I'll start by explaining that whenever I see a player with an even, rhythmic stroke and a clean follow-through I know I'm watching a good billiard player or one who soon will be good.

To acquire an even stroke you must control your cue after it comes in contact with the cue ball. Hold your cue level—nearly parallel to the table top—for most shots. Follow through the cue ball regardless of whether the stroke is center ball, or is to

(Continued from page 128)

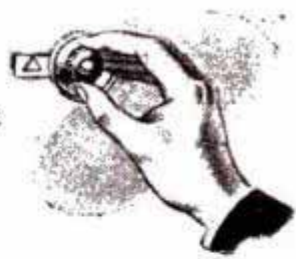
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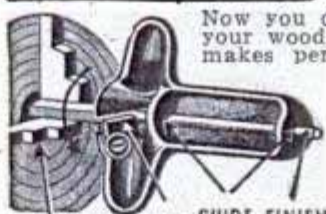


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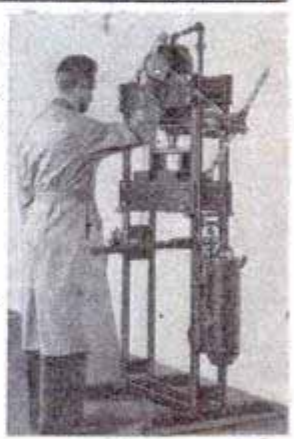
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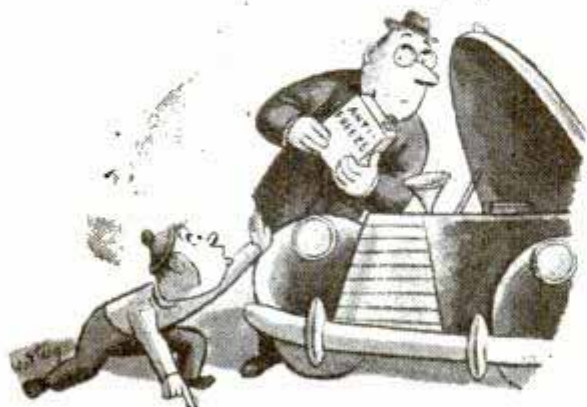
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impart follow, draw or english. Keep your cue on the line of aim and keep your bridge-hand on the table until after the stroke is completed. Never permit the cue tip to waver in the air after delivering your stroke. Never permit the cue tip to slide off to the right or left when putting english on the cue ball.

The speed of your stroke which, of course, determines the speed of your cue ball, often is the factor which decides victory in a billiard match. Speed has a lot to do with the action of the cue ball after it strikes an object ball.

For example, if you use extra speed, your cue ball (after hitting an object ball) will follow a path which forms a smaller (in billiards it's called "shorter") angle than if the ball had been shot with less speed. This is because a fast ball gives the english less chance to "turn" the ball to the right or left, depending on the type of spin imparted.

Experience will show you what speed to use but, in the meantime, if a short angle is required, use a hard stroke; if a long angle is needed, use an easy stroke.

To become a good three-cushion player you must study and practice the fundamentals until you automatically do the things I have recommended. Then you must become adept at visualizing the various angles through which the cue ball must travel to make various three-cushion shots.

Most players acquire that skill by watching good players and then practicing the things they learn. But if you want to eliminate a lot of guesswork, learn the Diamond System.

In order for me to fully explain the Diamond System, Popular Mechanics would have to turn over almost all the space in this magazine. I devoted an entire chapter to it in my book, "Billiards As It Should Be Played," copyrighted by the Reilly & Lee Company, Chicago, publishers.

I'll try here to tell you enough about the Diamond System to give you an idea of how it works. In the first place, it is based on a mathematical process using the in-laid diamond-shaped markers to guide the player in selecting the proper angle to make a shot.

Each diamond has two numbers—cue ball number and object ball number—which you must memorize from a chart. The numbers are not stamped on the rails because your position at the table determines the numbers you assign to each diamond. You always start counting the diamonds from the opposite end of the table from which you stand.

O.K. Now let's assume you have memo-

(Continued to page 256)

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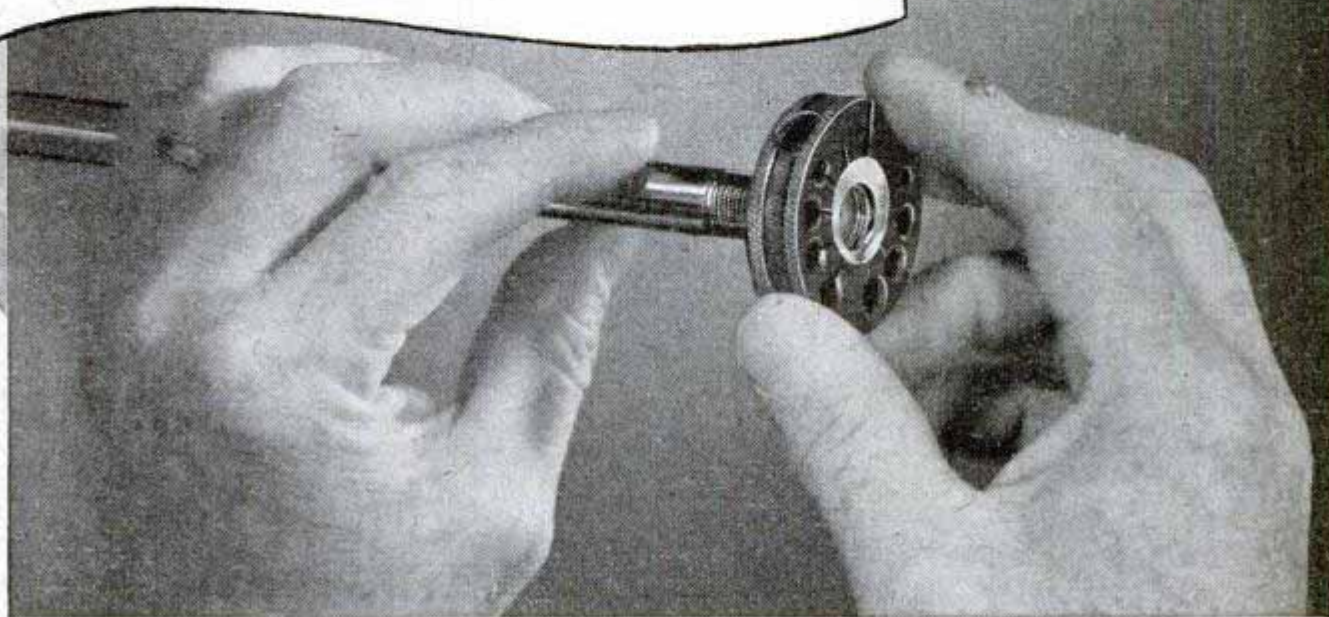
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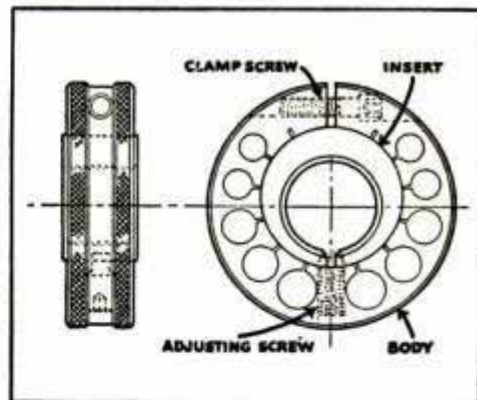
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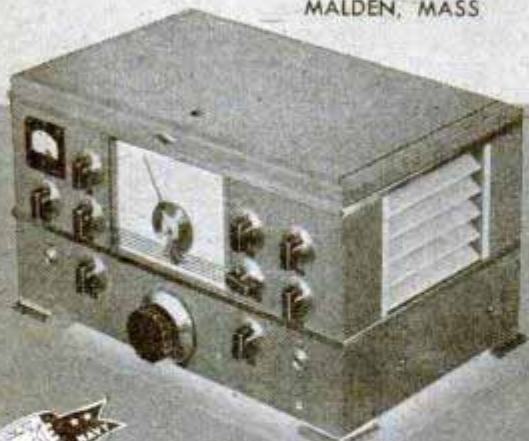


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rized the diamond numbers. Next you learn that the diamonds have a relationship with each other in that when your cue ball strikes a certain diamond (when traveling in a certain direction) it always will strike a second and then a third diamond (known to you). This means that you can scientifically determine the path of the cue ball to score a billiard.

I'll admit it sounds difficult. It is. You can't become an expert three-cushion billiard player by just banging the balls around a table. If you want to learn the Diamond System, be prepared for some serious study, possibly some instruction from an expert, and plenty of practice.

But keep this in mind. You can have a lot of fun playing the game even if you never learn the Diamond System.

Assembly Line Gobblers

(Continued from page 136)

ounces. Multiply 75 cents by 12,000 and you get a pretty good sized investment. The hens attain a maturity weight of 14 to 18 pounds, and toms from 22 to 30 pounds, with the average dressed weight 19 pounds.

Last fall the OPA wholesale ceiling price for dressed turkeys was in the neighborhood of 44 cents a pound. So, if Fox and his men can nurse 12,000 turkeys to maturity—and sell them at 44 cents a pound—the gross will be about \$100,000. Of course, feed costs, labor, equipment cost and maintenance, depreciation and other sums are deducted. Feed alone is a big item, since each turkey ate about \$4.50 worth of feed this year.

Under these circumstances the average man would look at each poult as a six-bit piece on legs which—if it stays alive long enough—will grow to be worth between \$6 and \$12. The poults, therefore, can be sure of careful handling.

Once over the hurdle of that first eight weeks, the turkeys are put out on the range. Fox has 40 acres in pasture (alfalfa and clover) where the turkeys live until they're ready for somebody's Thanksgiving table.

Fencing in an acre or two at a time, Fox divides his flock into three groups to minimize the danger of turkeys stampeding and trampling each other to death when a plane soars overhead or lightning crackles from the sky. If 12,000 turkeys were all massed together in one fenced-in area, a stampede might take a terrific death toll.

Once a week the fences and all equipment (shelters, feed and water troughs, etc.) are moved to a new pasture. This not only provides additional alfalfa and clover for the birds to eat, but the move to fresh

(Continued to page 260)

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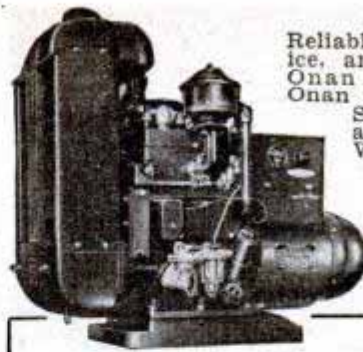
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The Handee Tool, famous "TOOLSHOP IN YOUR HAND" is packed with power and speed, designed for extreme accuracy, absolute dependability! It's the first and finest tool of this type for the skilled craftsman or the eager beginner. Handee grinds, drills, cuts, engraves, routs, polishes, carves, sands, saws, etc. And it works on any material—wood, metal; plastic, alloy, glass, leather, linoleum, horn, stone, bone, etc.

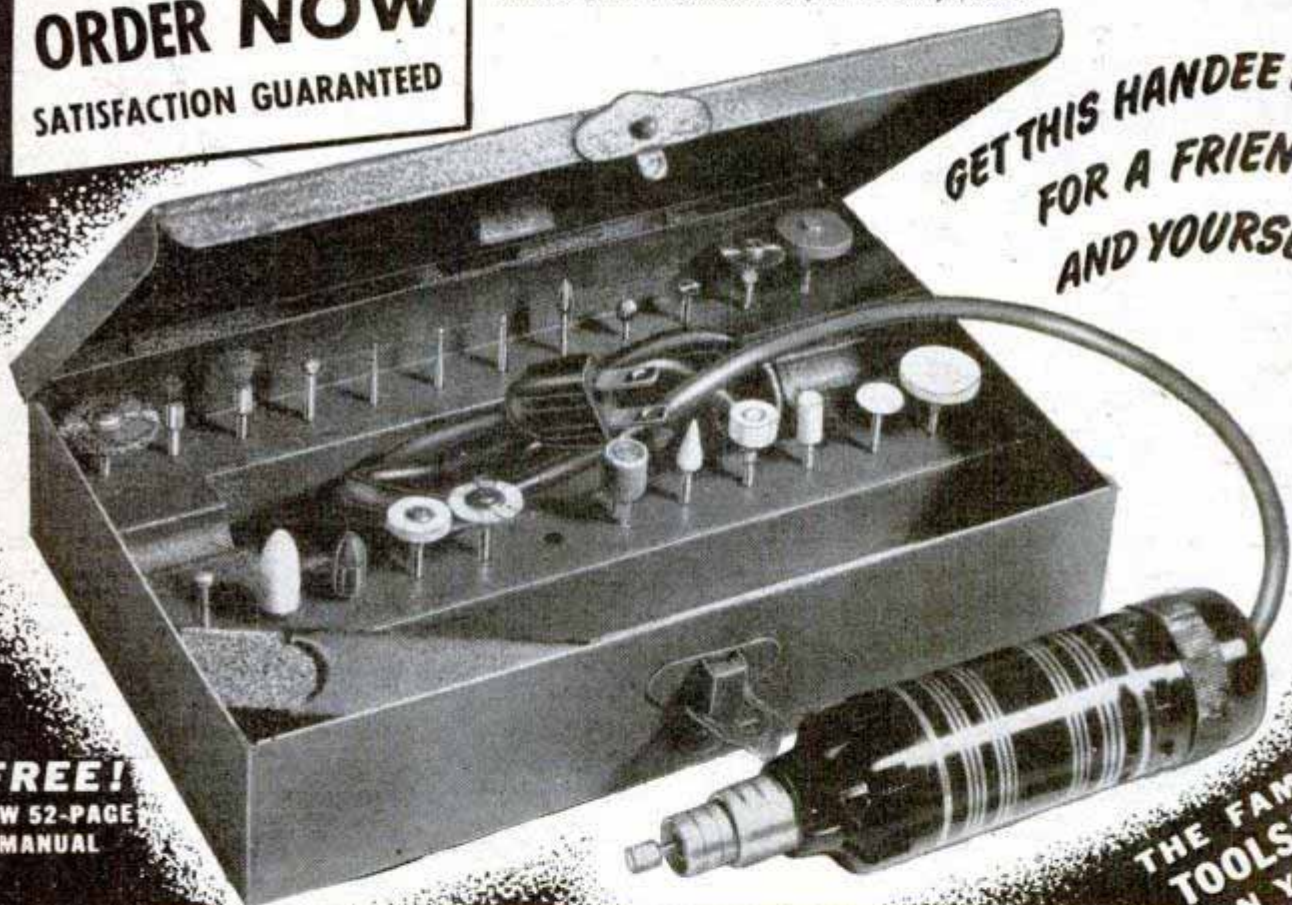
WHAT A THRILL! Smooth, steady power at the fingertips—a tool quick and sure, easy to guide as a pencil! Hundreds of useful articles can be made with Handee: ship, train and plane models, puppets, costume jewelry, initialed tumblers, wood carvings, etc.

EASY TO USE—Lightweight (only 12 oz.) and perfectly balanced, the easy to handle HANDEE runs at a cool 25,000 r.p.m., plugs into any AC or DC socket.

THE HANDEE KIT—Here is the very finest of all equipment—a practical combination that every craftsman will welcome. The Handee Tool, acclaimed the world over for its remarkable speed, power and long life . . . plus a complete assortment of 45 accessories including drills, steel cutters, saws, brushes, drum sander and bands, mounted wheels, etc . . . all packed in a handsome steel carrying case. Complete, postpaid **\$27.50**
Handee with 7 accessories (not in case) \$20.50.

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New! They fit Handee only! Both novice and craftsman do perfect work. Magically, easily, offhand carving, routing, shaping will be exact as to depth of cut, accuracy of line. Set of 6 attachments with instructions, postpaid, **\$7.95.**

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**WHIZZER BIKE MOTOR
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The real answer to dependable, low cost transportation. Fits any balloon-tired bike. Built by automotive craftsmen in the heart of the auto industry, the Whizzer bike motor installs easily and will carry you fast (5 to 35 miles per hour) and far (125 miles or more on a gallon of gas). Enjoy new freedom and adventures with your Whizzer. Use it for errands, shopping, business, recreation and work. Whizzer's 2½ h.p. will take you there and bring you back! Does not interfere with normal pedaling of bike. Put a Whizzer on your bike now. **WHIZZER MOTOR CO., Pontiac 15, Michigan.**

Simple, positive controls. Easy to ride, too . . . Whizzer doesn't change balance or riding qualities of bike!

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ground cuts down the menace of disease.

Because Fox used mechanical ingenuity in planning his turkey farm, this weekly move is made in three hours. The 71 pieces of equipment are all mounted on wooden skids for fast, effortless moving by tractor.

Evidence that moving from pasture to pasture pays off is seen by the fact that the turkey death rate at the Fox farm is less than 13 percent; the national turkey mortality rate (from disease and other factors, not including Thanksgiving) is 22.5 percent.

Among the pieces of portable equipment are six automatic water troughs 40 feet long and mounted on four by four-inch skids. Providing a total of 480 feet of drinking space, the troughs are lined with sheet metal and the water is fed through rubber hoses (2500 feet in all) at 40-pound pressure. The turkeys stand on wire platforms while drinking, thus decreasing dampness and disease. Each turkey is assured of fresh water by drains at the lower end of the troughs which prevent water from standing for long periods. Fox has two deep wells, drawing water from one but having the other ready in case the first one fails.

The 12,000 turkeys are fed by 20 one-ton gravity type hoppers (16 feet long) which are loaded from trucks in 20 minutes, and 200 feeders, four feet long and mounted 15 to a skid. Each four-foot feeder holds 33 pounds of feed. This all adds up to a "dinner table" 2240 feet long where the turkeys can eat all they want.

Thirty shelters, 12 by 16 feet, protect the turkeys from rain and strong wind and provide a roosting place for them to sleep and rest. Lanterns attached to each shelter are lighted at night to keep wild animals away.

"Raising turkeys isn't so tough after the first eight weeks," Fox explains. "Automatic equipment eliminates guesswork and many steps. And moving skid-mounted troughs and shelters by tractor to new pastures is the biggest time and manpower saver of all."

What's on the Shelf?

(Continued from page 168)

like aviation gasoline, were so tight that her whole military effort in the air and on the ground would have collapsed in three or four months had her oil supply dried up. That is why the U. S. Strategic Air Forces selected the German oil industry as a top priority target. Destruction of the enemy's oil stocks started right at the wells (remember the Ploesti air raids?) and carried on to the destruction of finished gasoline in tank cars and trucks.

(Continued to page 264)

FINE TOOLS NEED FINE OIL!



- Lubricates
- Prevents Rust
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Eliminates the hard work of clearing land of brush, saplings, and larger trees. Goes anywhere on its own power. Saws uphill as well as on level ground. Handiest saw ever built. Powerful motor. Belt pulley for many power jobs. Low operating cost. Costs too little to do without. Make big money clearing land. Write for low factory-to-user price. *Pats. Pending.*
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SEARGENT JIG SAW

This finely constructed all metal jig saw is just the thing you need for your shop.

SPECIFICATIONS:

Net weight, approx. 10 lbs.
Height, overall 16"
Length, overall 17 1/2"
Depth of Throat 12"
Table, heavy gauge metal 8 1/2" x 8 1/2"
Pulley 3" Stroke 3/4"
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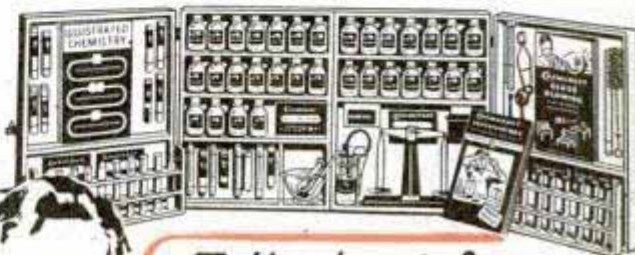
BOYS!



FOR FUN, THRILLS, EXCITEMENT GET

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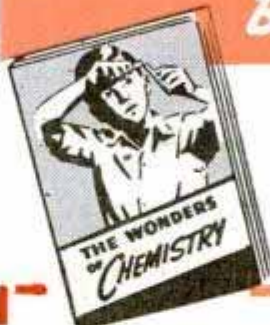
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MOST VERSATILE MACHINE
Is Now Available
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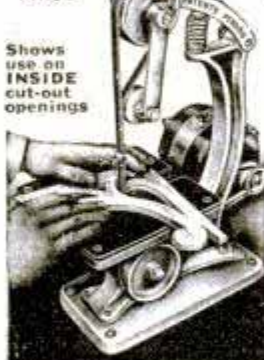
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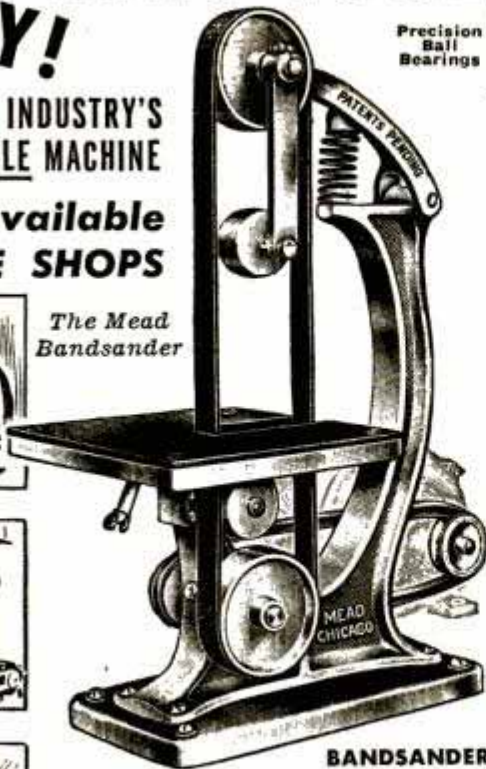
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**Cuts Fast, Clean — Saves
Filing and Sanding Work!**

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BEVELS • GRINDS • POLISHES
SANDS • CARVES • CLEANS**

Let the versatile war plant production-proved Mead Bandsander save you sweat and time on hand-filing and sanding jobs—on wood, metal, plastics! A god-send to home craftsmen, hobbyists, model-makers, pattern-makers, industrial shops. Handier than a grinding tool for sharpening drills, chisels, tool bits, garden tools. This all-around utility tool works equally well on irregular outside surfaces or inside cut-out openings. Gets into places no others can. For example, to work inside a cut-out opening, simply lead band through hole in work and in front of idler pulleys. You can work to the center of pieces up to 17" wide! Table tilts back or forward for bevelling or chamfering edges of any contour. Table top is rust-and-sweat proof. Bandsander operates on 1/4 h.p. motor at 1700-2200 r.p.m. Abrasive band surface passes work at 1600 feet per minute cutting fast, cool, clean. Narrow bands may be used for intricate patterns.

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NAME.....
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The development of our undersea oil resources might prevent just such conditions in the United States in some future war. For, in spite of the atom bomb, gasoline still powers the machines of war. Oil is still the main lubricant for the millions of bearings and moving parts in engines, and an important source of synthetic rubber.

The Department of the Interior is now preparing a program for the exploration and survey of the continental shelf, which will be such a major undertaking that it is believed only the government has the resources to make it.

Although the eventual cost of a comprehensive search for oil in submerged lands some distance from shore may be large, there is every reason to believe that the cost will be recovered through the discovery of new sources of petroleum. Even if national safety were not at stake in finding new sources of oil, the economic prospects appear to justify the exploration program.

On the Air . . . There've Been Some Changes Made

(Continued from page 109)

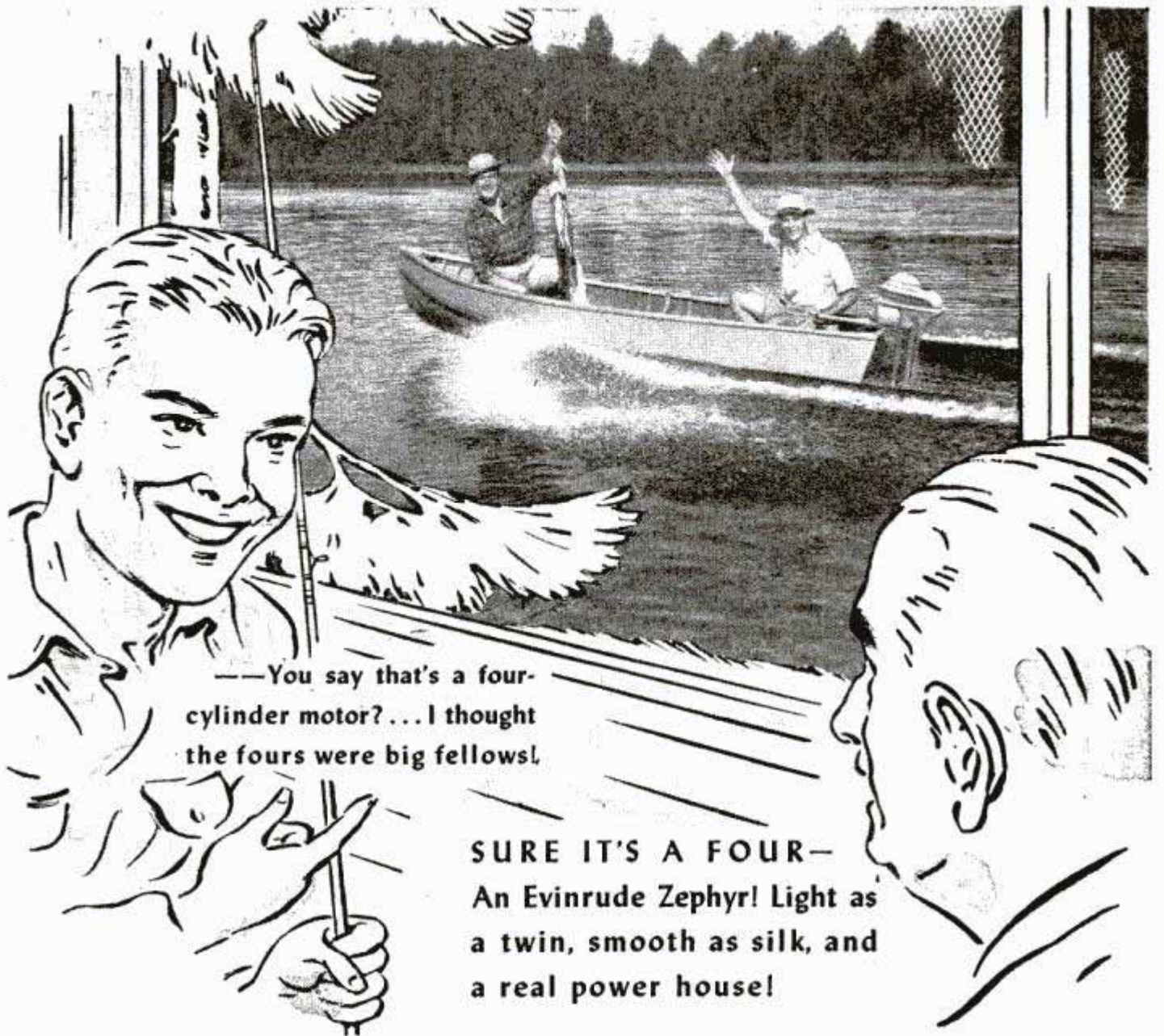
lengths at will—and for a time nothing could be done about it. The Department of Commerce issued licenses, but had no regulatory power, and broadcasters governed themselves by "gentlemen's agreements."

The listeners and the ethical broadcasters howled for federal regulation and in early 1927 Congress passed a bill creating the Federal Radio Commission. All licenses were canceled and the commission undertook to separate the sheep from the goats—to protect the constructive and public-spirited broadcasters while putting the pirates out of business.

In the interim something had happened that was to give force and direction to the industry. National advertisers had learned the value of radio as a sales medium; the linking of widely separated stations by telephone lines had reached a practicable point, and good radio shows were difficult and expensive to assemble. Temporary networks of stations were created to bring the best broadcast programs to the largest number of people.

The man with something to sell was ready to spend real money, and radio, as always, obliged him. In November 1926 the National Broadcasting Company was formed with 25 stations situated from Boston south to Washington, D. C., and west to Kansas City. In its first year NBC grossed \$3,750,000 in sale of time; last year NBC, the American Broadcasting Com-

(Continued to page 268)



—You say that's a four-cylinder motor? ... I thought the fours were big fellows!

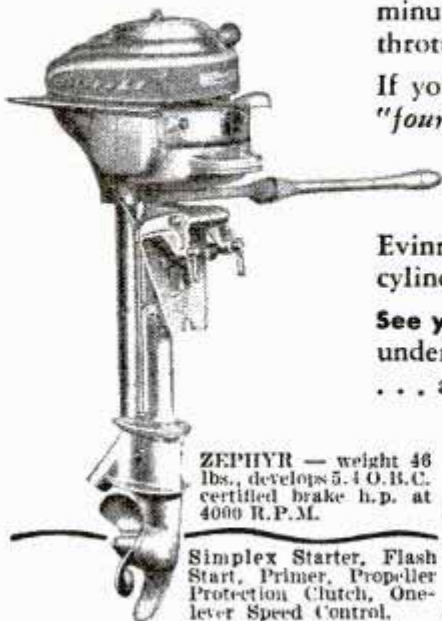
**SURE IT'S A FOUR—
An Evinrude Zephyr! Light as
a twin, smooth as silk, and
a real power house!**

Sounds almost too good to be true! But take the word of delighted "Zephyr" owners from coast to coast that *it is true!* Right in the range of two-cylinder power, weight and price you can enjoy matchless *four-cylinder* performance! The wonderful smoothness of 8,000 *balanced, overlapping* power strokes per minute! Exceptional starting ease! Thrilling responsiveness, and flick-of-the-throttle flexibility from slow trolling glide to surging top speed!

If you'd like a motor developing 5 horsepower or more, *you can have it in a "four"!* Four great "fours" to choose from — "Zephyr" and "Lightfour" for outstanding performance on family boats and fishing craft; "Speedifour" and "Big Four" for powering fastest outboard runabouts, cruisers, big utility boats. *Only Evinrude builds "fours" . . .* built into them is Evinrude's 37 years of outboard *Know How . . .* 18 years of leadership in four-cylinder engineering.

See your Evinrude dealer—look for his name in your classified phone directory under "Outboard Motors". Complete catalog of 8 Evinrude models sent free . . . address, EVINRUDE MOTORS, 5389 N. 27th Street, Milwaukee 9, Wis.

In Canada: Evinrude Motors, Peterboro, Ontario.



ZEPHYR — weight 46 lbs., develops 5.4 O.B.C. certified brake h.p. at 4000 R.P.M.

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OUTBOARD MOTORS

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You can't buy better Wheels! WALTON DELUXE WHEELS are America's finest—don't be satisfied with anything less to build vehicles of your own design!

Hardened Steel Roller Bearings
Two sets of scientifically engineered roller bearings and massive jumbo balloon rubber tires give them rocket speed and provide you with almost unbelievable velvet-smooth rides.

IDEAL CHRISTMAS GIFT! HUNDREDS OF USES! Excellent for carts, trailers, golf bag carriers, mobile industrial equipment. Tremendous production direct from manufacturer makes possible our low price for such fine quality!

3 COMPLETE WHEEL KITS

Choose from these kits to make coaster wagons, racers, four-wheel trucks, etc.
WK1 Four 8x2 Wheels, two 20"x1 1/2" diam. axles, 4 heavy hangers, 8 washers and cotter pins ready for use.

Specially priced **\$13.95**

WK2 Four 10x1 3/4 Wheels, two 24"x1 1/2" diam. axles, 4 heavy hangers, 8 washers and cotter pins ready for use.

Specially priced **\$14.95**

WK3 Designed for heavy-duty needs. Includes four extra-heavy, big industrial type deluxe Wheels, two 24"x1 1/2" diam. axles, 4 heavy hangers, 8 washers and cotter pins. Massive 10-inch rubber tires are 2 3/4 inches thick. Specially priced... **\$32.95**



WHEELS ONLY

8x2" in sets of two.
Each **\$2.95**
\$11.60 set of 4

10x1 3/4" in sets of two.
Each **\$3.25**
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10x2 3/4" extra heavy industrial type in sets of two. Each... **\$7.48**
Single Wheel **\$7.95**
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WALTON WHEEL COMPANY, Dept. J2
PLANKINTON ARCADE MILWAUKEE 3, WISCONSIN
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A TONIC . . . For World-Wearied Nerves

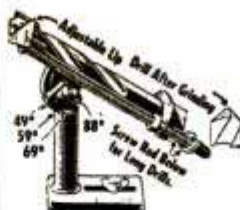
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200,000 IN USE!

Grinds your drills like factory in 25 seconds. Gives perfect center and clearance. Saves drills, time and money. No shop should be without the Super Drill Grinder. Guaranteed to do the work or money back. The Grinder that gives a rounded point!

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\$100 Cash for Inventors



We will pay \$100 cash to the person who develops the most practical civilian use for the Gunsight pictured here. These Gunsights were purchased from government surplus stocks. Precision built with the accuracy of a costly watch. We send you one of these valuable Gunsights on receipt of a deposit of only \$10. Their actual value is many times this small amount. When you finish with your experiments, return Gunsight collect and we will refund your deposit less \$2.50 to cover cost of express and handling. Or if you wish to keep this expensive instrument, send only \$12 additional as payment in full. For the most practical civilian use for the Gunsight, we will pay the sum of \$100 in cash. For example, many uses suggest themselves—Slide Projector for Colored Film, Light Source for Electric Eye, Film Enlarger, Gunsight for Shooting Gallery, Viewer for Movie Films, etc. The decision of the judges is final. Duplicate prizes in case of ties. Contest closes midnight, November 30, 1946, so rush your application for one of these valuable Precision-built government Gunsights.

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New Transformer for 110 V. AC, to give 5 to 40 volts in 5 volt steps, 10 Amps... **\$ 6.50**
New "Allied" Relays, Heavy Duty Contacts, with double pole double throw. Coil for 110 volts... **\$ 1.15**
New Delco-Westinghouse Generators (or use as a 5 HP Motor) 6 to 30 volts, 10 to 200 amps... **\$35.50**
For counters see Page 326 **GORRELL & GORRELL, Haworth, N. J.**

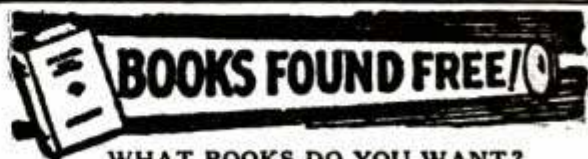
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GUIDE LAMP DIVISION OF GENERAL MOTORS CORPORATION

SAFE HEADLAMPS ARE "CORRECTLY AIMED" HEADLAMPS—HAVE YOURS CHECKED TODAY

FREE LAND

On March 1, 1946 I bought an 80-acre tract of thickly wooded land, and paid \$30 an acre for it.

The opinion of my surrounding neighbors was that I'd have a long grey beard before I dropped the last tree. The only way folks around here thought of clearing land was with the ax and cross cut, but I had seen the Lowther C-Saw at work in timber.

They've changed their minds now because they've watched me work with my Lowther C-Saw. They've seen me drop 335 18" to 30" oak trees (most of them up around 30") in 8 hours. I can clear 1 acre in 1 day. From that acre, I sell not less than \$61 worth of split posts—cut at least 3 cords of firewood, \$36. The trunks I sell for lumber at \$80 a thousand, or about \$240 worth an acre. This cleared land now worth five times what it sold for, isn't costing me one cent, besides it is paying me top wages for my work!

My Lowther C-Saw has established me in a business not only profitable but pleasant—after my return from war work.

Signed

Lonnie Peoples,

Wanatah, Indiana

pany, the Columbia Broadcasting System, Mutual Broadcasting System and the smaller networks grossed \$190,000,000.

This phase of radio business had come a long way since Frank Conrad gave the first sponsored program by naming the record shop which supplied him with the musical numbers he broadcast.

While not even its most enthusiastic admirer will claim that radio is perfect, from the technical and mechanical point of view it is better than it need be. Not one set in a hundred will handle the full range and reproduce with true fidelity the average signal broadcast by an AM transmitter today. Receiver manufacturers who offered sets which reproduce music with high fidelity—and at a higher than average purchase price—found to their sorrow that the public wouldn't buy them.

A number of independent consumer polls have proved that the average listener is disturbed by the high notes in a musical program and will adjust a radio to eliminate the treble, emphasizing the bass and giving an untrue "picture" of what is heard in the studio.

This is used as an argument by supporters of AM against FM, which, along with television, will serve to enrich the history of radio in the coming decades.

Speed Unlimited

(Continued from page 101)

speeds as high as 1500 miles per hour at an extremely high altitude.

Designed as a test plane, it will be filled with laboratory equipment to record all the factors it will encounter at supersonic speeds. The wings, with their sharp leading edge, sweep back toward the tail. In a cramped cockpit, the pilot sits and looks forward through the roof of his tiny cabin. There is no projecting bubble, just the slant of the fuselage toward the nose of the plane. Streamlining has been carried forward almost to its ultimate.

In preliminary trials the XS-1 was carried aloft and released from a mother ship to glide to earth. A hint of its tremendous speed is seen in its glides of over four hundred miles per hour, but test pilots say it is surprisingly easy to control and land.

We all are familiar with the pressurized and heated cabins of planes flying at high altitudes, due to the rarefied air and the intense cold. But in the XS-1, in addition to having a pressure cabin, the air is artificially cooled! Air friction, shock waves and solar radiation build up the heat to a point where the interior of the plane would

(Continued to page 276)



FELLING TREES

CUTTING LOGS

CLEARING LAND

HARRY A. LOWTHER COMPANY

141 W. Jackson Blvd.
Chicago 4, Illinois

Send me your fully illustrated circular #. 996 showing in detail the way the Lowther C-Saw works, and its many interesting and profitable uses.

\$85,000 IN AWARDS FOR BOYS



Roger H. Oetting, 14-year-old student at Foch Intermediate School, Detroit, was intrigued by the Napoleonic coach. His interest and perseverance brought him the \$5,000 first award in the Junior Division.



Leo C. Peiffer, 17, of Cedar Rapids, Ia., makes models as a hobby. It paid off with a \$5,000 scholarship, first award in the Napoleonic coach competition, Senior Division. He enters Iowa State College this Fall.



Virgil Max Exner, Jr., 13 years old, of South Bend, is a racing car enthusiast. With his \$4,000 first award in the Junior model car competition, he will enter Notre Dame, studying engineering and industrial design.

1,220 awards — university scholarships, \$2,000 to \$5,000 each, cash awards, trips — in the Fisher Body Craftsman's Guild 1947 model-building competitions

Here are 9 boys who are well started on the road of opportunity.

They are the major award winners in the 1946 Fisher Body Craftsman's Guild competitions — and each now has a scholarship, ranging in value from \$2,000 to \$5,000, to be used at the university of his choice.

Now 1,220 awards, totaling \$85,000 in value, are offered to boys between the ages of 12 and 19, inclusive, in the 1947 competitions.

You compete for these awards by building a model Napoleonic coach to plans supplied free — or by designing and building a model car to simple specifications. Both are real fun.

Any boy 12 years old or over and not yet 20 on September 1, 1946 may enter either competition. Junior and Senior Divisions with identical awards let you compete with boys in your own age division. There are no dues or entrance fees, and awards include cash, all-expense trips to the Guild Convention, and 8 university scholarships worth \$2,000 to \$5,000 each. (Duplicate awards are given if sons of GM employes win.)

A distinguished board of judges, including deans or presidents of 10 leading technical schools and universities, makes the awards.

To enter, you simply write for free membership in the Fisher Body Craftsman's Guild. In return, you receive a membership card and a full set of plans and instructions, all free. Competitions close June 15, 1947.

Why shouldn't *you* win one of these awards? Mail the coupon NOW and get started.



Robert J. Hartlieb, Jr., of Allentown, Pa., enrolled at 15 in the 1946 competitions. His model car scored so close to the Junior winner's that a tie was declared and an extra \$4,000 award was provided. Robert wants to be an engineer like his father.



Vincent J. Rauth, 19, son of a York, Nebraska farmer, walked off with the \$4,000 scholarship given as first award in the Senior Division of the model car competition. His hobby is aviation.



Eugene Schwietz is 15 and the son of a St. Paul, Minn., postal employe. He won second award in the Junior Division of the Napoleonic coach competition—a \$3,000 scholarship to be used when he is ready for college.



Walter Edwin Roth, Jr., 18, Detroit, Mich., "likes to build models." Entering the Napoleonic coach competition, Senior Division, he won second honors—a \$3,000 scholarship to complete his course at Wayne University.



Charles Clayton Bradley, 14, goes to Central High School in South Bend, Ind. When he finishes high school, his second place award, Junior model car section, will provide \$2,000 for a mechanical engineer's education.



David Wayne Whitman, 18, of Jackson, Mich., plans to be an automobile designer. With a \$2,000 scholarship, second award in the Senior model car competition, he starts at the General Motors Institute in Flint, Mich., this Fall.



MODEL CAR — You build a solid model, using only ordinary tools. Awards in each age division: Two \$4,000, two \$2,000 university scholarships; 588 cash state awards ranging down from \$100; 18 convention trips, all expenses paid.



NAPOLEONIC COACH — You receive complete plans and drawings, free of charge. Awards: Two \$5,000, two \$3,000 university scholarships; 588 cash state awards ranging down from \$125; 18 convention trips, all expenses paid. Junior and Senior awards are identical.

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An educational foundation sponsored by Fisher Body Division of General Motors

General Motors Bldg., Detroit 2, Michigan
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HINSCH Vacuum Control VALVE. Domestic and Foreign patents pending.

Why pay for new piston rings or a rebores job when you can prevent this NOW by removing the cause with a HINSCH Vacuum Control VALVE?

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- ★ Reduces oil-pumping and carbon, exhaust smoke and obnoxious gases.
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- ★ Reduces dilution of oil by gasoline.
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- ★ Prevents "loading up" — increases motor pep.

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The HINSCH Vacuum Control VALVE relieves EXCESS vacuum in all gasoline motors much as a safety valve relieves excess pressure in a steam engine. EXCESS vacuum (or suction) develops when you coast against your motor, when you shift gears, or when any gasoline motor decelerates. It fouls plugs, dilutes oil with gasoline, sucks oil right off cylinder walls; thus allowing abnormal friction and wear. The HINSCH Vacuum Control VALVE neutralizes EXCESS vacuum by automatically introducing a controlled amount of air (WHEN THROTTLE IS CLOSED). It allows your motor to operate normally at peak efficiency at all times. Does not interfere with vacuum-operated equipment.

Thousands in Use!

... on trucks and passenger cars in the Pacific Northwest. One truck fleet operator says: "We find that our oil consumption has been reduced 60% and gasoline consumption 15%." ... Endorsed and sold by leading car dealers and parts distributors of Washington and Oregon.

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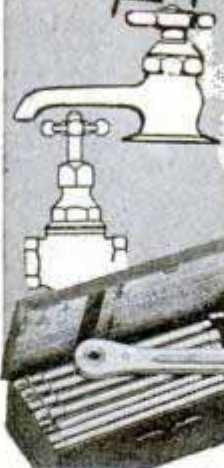
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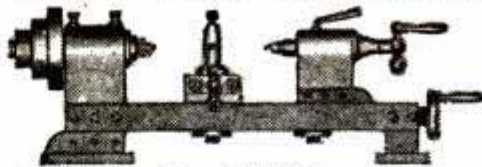
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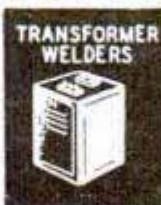
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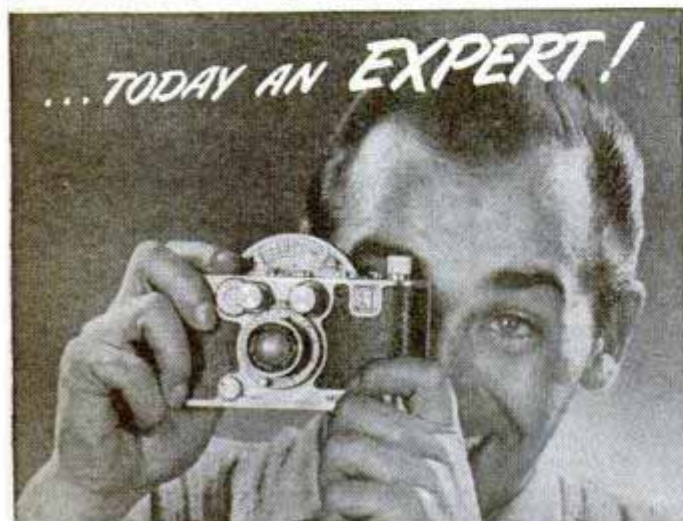
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reach 400 degrees. If he were not artificially cooled, the pilot literally would be cooked to death.

Air Force engineers had to develop refrigeration apparatus far lighter than any in use to meet the plane's requirements.

Since the rocket engines must carry oxygen to operate in rarefied atmosphere, fuel probably will be either liquid oxygen and alcohol, like that used in the V-2 rocket, or nitric acid and aniline, as used in the Ordnance Wac Corporal rocket. Both are very efficient with a slight edge in favor of the alcohol-liquid oxygen combination.

While able to take off from the ground, the XS-1 will be carried to a high altitude on its power tests to conserve fuel, then released and the rocket motor started. Climbing at a steep angle for several tens of thousands of feet, a point will be reached where, because of fuel consumed, the weight of the plane will be less than the thrust of the rocket motor. The pilot then will stand the plane on its tail and really start to climb. In the few minutes the fuel lasts, the plane will probably reach eighty or a hundred thousand feet—far higher than man has ever been before.

Scientists say that the plane will probably reach the twilight zone where stars of the first magnitude can be seen directly overhead as the sun sets or rises.

On this initial flight, the pilot will have two choices. He can see how high he can fly or he can climb for a few seconds, then level off under full power to see how fast he can go. It is highly probable that from his maximum altitude, on his glide toward the earth, he will travel faster than man ever went before.

The pilot will wear a pressure suit and a transparent fishbowl helmet that give him the bloated appearance of a deep-sea diver. Made of fabric and pink plastic, the suit gives him a fantastic appearance. If he runs into trouble, he presses a button and his detachable cockpit is hurled away from the plane with him in it. He remains in it until special devices have decreased the speed from supersonic to less than 500 miles per hour, and a safe altitude, below 30,000 feet, is reached. He then will be automatically ejected from the cockpit and his parachute will carry him safely to the ground.

Pilots flying the XS-1 will have problems of acceleration to overcome quite different from those encountered in pulling out of a fast dive. Measured in terms of gravitational force, at nine times the force of gravity pilots black out when they make a fast turn. Their blood is pulled from their brain to the lower portions of the body.

(Continued to page 280)

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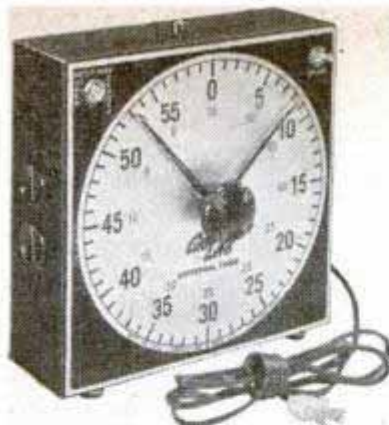
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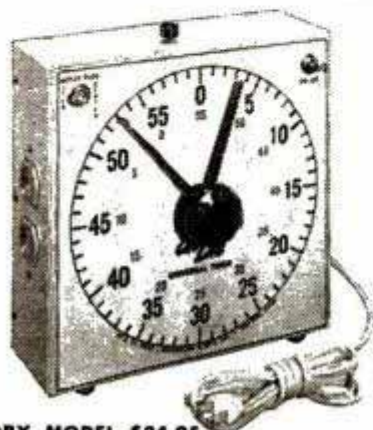
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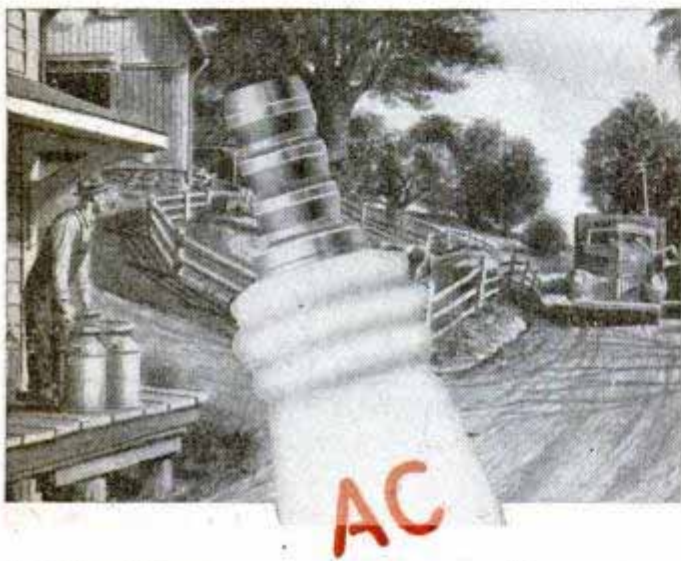
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When the XS-1 accelerates, it will be in a straight line and acceleration forces will make all movements of the arms and legs difficult and perhaps impossible. New methods of controlling the plane, perhaps with buttons, will have to be worked out. At top speeds, turns will have to be made tremendously wide to prevent blacking out. A second's indecision, and the pilot has traveled three miles.

Today, projectiles are the only objects that are able to cross the barrier of sound safely. The V-2 rocket with its speed of 3600 miles an hour is the fastest man-made object, faster even than artillery shells. Its speed of over 5000 feet per second makes a rifle bullet's speed of 3000 feet per second slow in comparison. However, pilots soon will be challenging this record. Man is indeed at the threshold of a new era of speed.

Forecast From Detroit

(Continued from page 92)

Don't look for automatic transmissions in Fords until 1948. But expect them then. They'll be standard equipment on all but the lowest-priced Ford cars then, engineers predict.

Studebaker, having gotten the jump with the first really postwar car in appearance, will continue to produce the same model without any significant changes. It's the car to watch, and its greater visibility for the driver may be copied, in modified form at least, by many other manufacturers.

Some of the competition refer to the new "all-around" vision of the Studebaker as "mobile greenhousing," but most engineers and salesmen believe that drivers of other cars will suffer from claustrophobia when they get back in their own cars after driving the Studebaker.

Packard won't come forward with new models until well into 1947. Its changes will be evolutionary instead of revolutionary, engineers predict. But its new styling contemplates integrated fenders and body, a wider and lower appearance and wider windshield moved forward considerably.

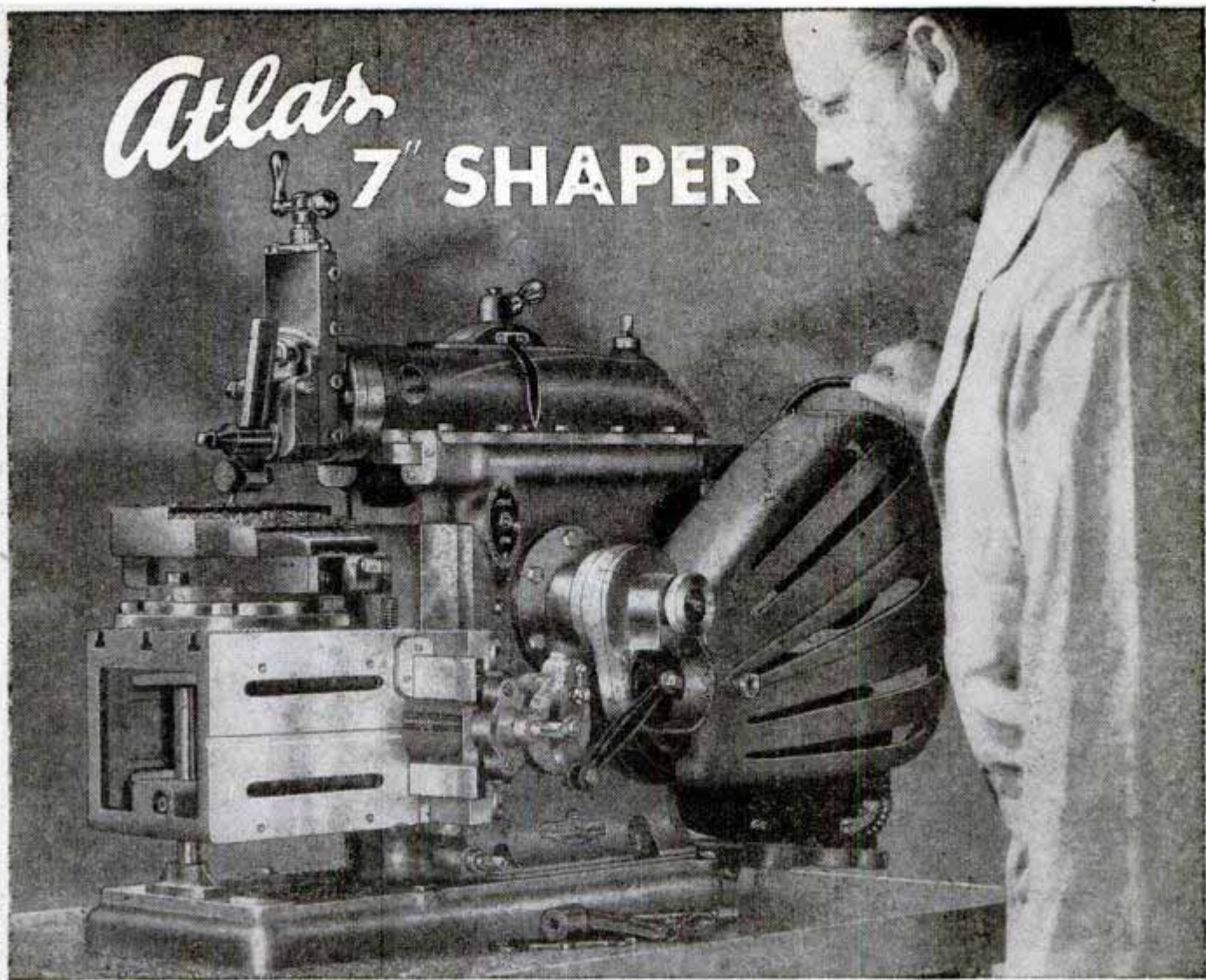
The new Packard power plant can be relied upon to provide more efficient power, for Packard has devoted its best talents toward maintaining its mechanical distinction. President George T. Christopher has announced that the jet-propelled automobile is probably 10 to 15 years away.

Nash models for 1947 will show engineering improvements. Although the company won OPA price increase allowances because of mechanical advances, nothing startling is predicted until its 1948 models.

(Continued to page 290)

Atlas

7" SHAPER



NOW YOU CAN ADD SHAPING TO YOUR SHOP'S WORK RANGE

The Atlas shaper has all the precision and power of larger shapers built down to scale for *compactness, quick set-ups, and low cost* for commercial and home shops.

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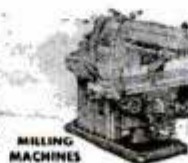
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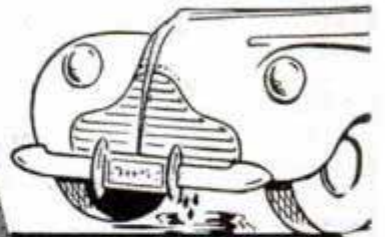


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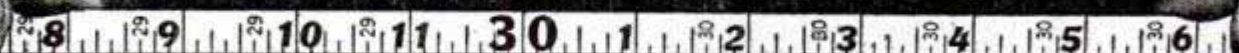
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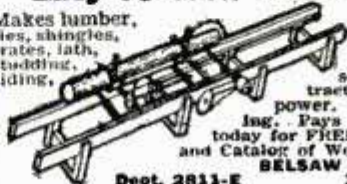
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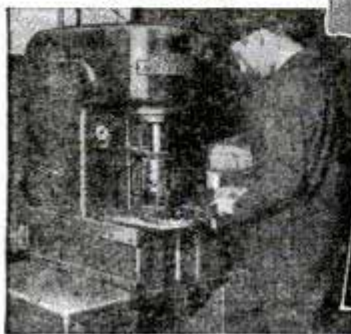
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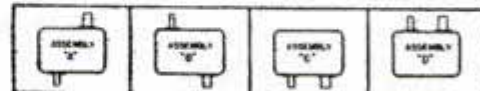
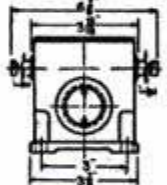
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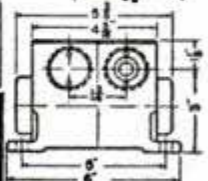
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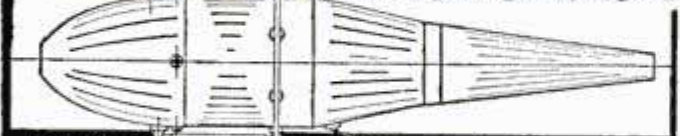
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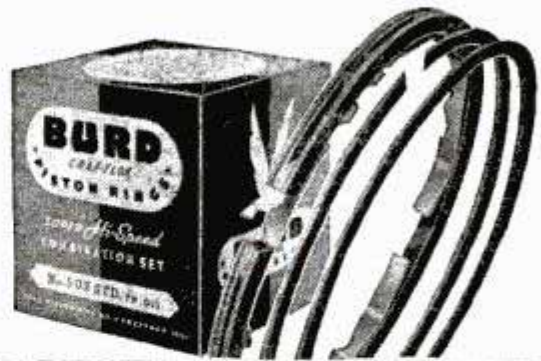
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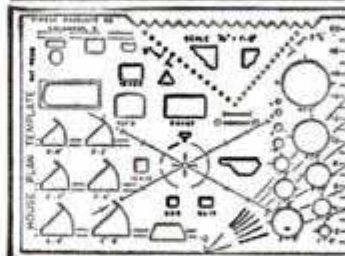
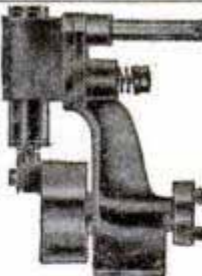
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In Toledo, Willys-Overland is prepared for the competitive battle with a small light car which will go into production early next year. The new Willys has a six-cylinder engine.

At Willow Run, a new organization including some excellent production men and top-flight engineers is struggling to get into full production—a goal apparently several months off. The conventionally powered Kaiser Special and Frazer cars have won wide support from wishful new car owners. The front-wheel drive car, dear to Henry J. Kaiser's heart, probably won't be perfected by the engineers assigned to the job until next summer. But Kaiser-Frazer will turn out cars in volume to take part of the huge market and probably gain a toehold in public buying habits before the real selling job for dealers begins.

In Chicago, Preston J. Tucker has a 10-year lease on the former Dodge plant, and the revolutionary Torpedo with its Cyclops headlight, driver's seat between two passengers and rear-engine design may get into production before 1948. There are many car makers who feel his obstacles are too big to be overcome before then.

Whether the Crosley car will change its midget models in 1947 is uncertain, due largely to pricing conditions, but there is an admittedly large market for a small car selling for less than \$1000. And thousands of buyers will buy as many Crosleys and Bobbi cars as the manufacturers can assemble until the Big Three and the independents with cars in the lowest price field get into mass production.

A check of manufacturers, designers and engineers shows the trend is toward lower, wider passenger cars with more glass for better vision, fewer projecting handles, improved instrumentation, greater operating ease—meaning automatic transmissions—and more comfortable springing.

The Ford announcement of its 1947 models probably will emphasize the rumored individual front-wheel coil-spring suspension, with improved side springs in the rear.

Weight in standard passenger cars will incline downward, because weight costs money at so much per pound. The heavier the car, the more expensive, with heavier, more costly engines, larger brakes, bigger tires.

Magnesium, which costs about 75 cents a pound, could drop to seven cents a pound and still be unable to compete with steel at two or three cents a pound. Magnesium and aluminum are less ductile than steel and it costs more money to draw and machine them. The waste in production is

(Continued to page 294)

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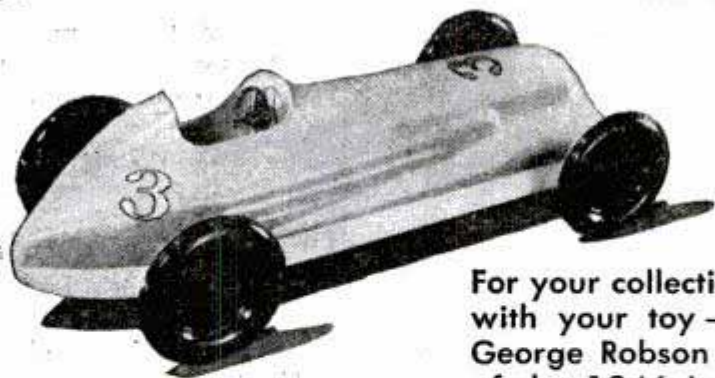
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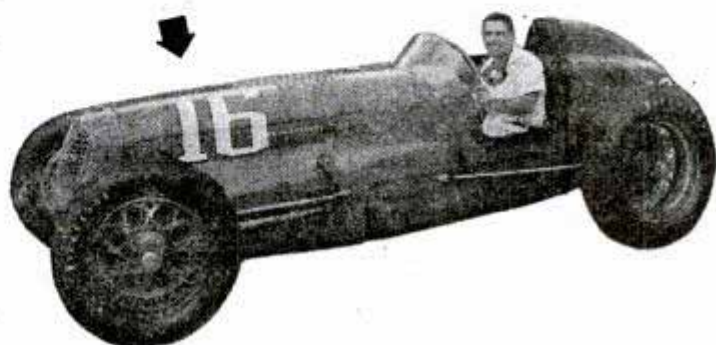


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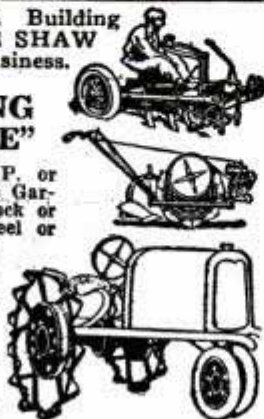
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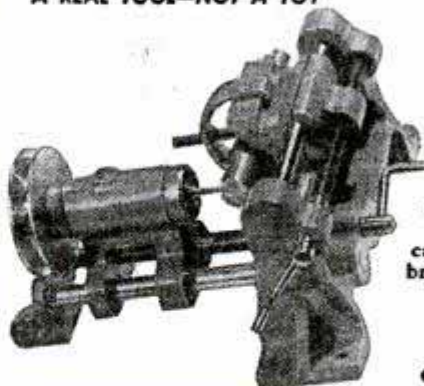
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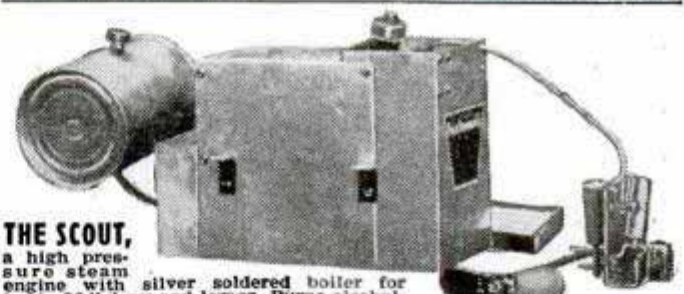
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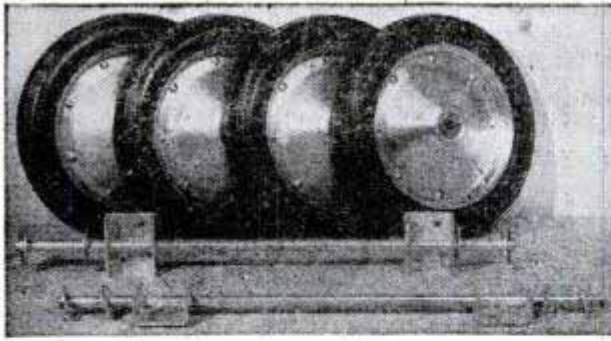
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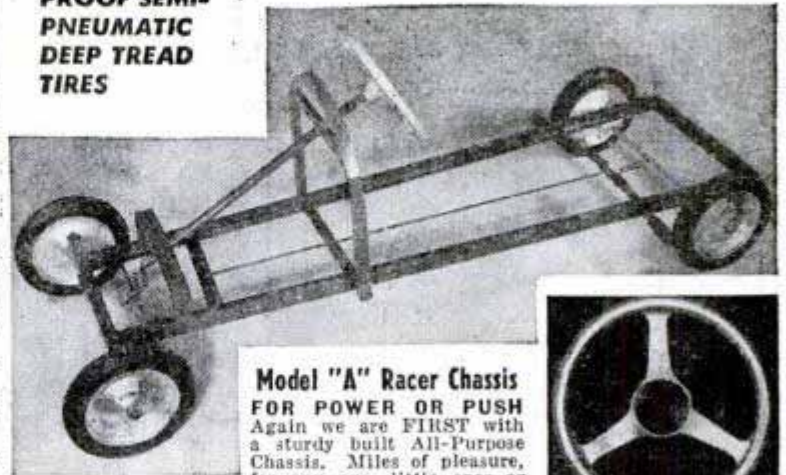
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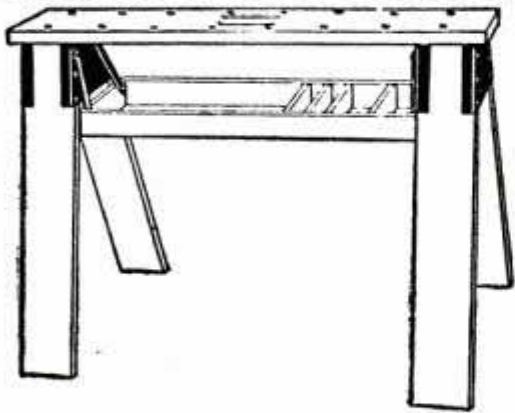


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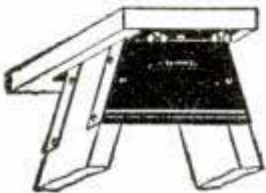
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The Society of Automotive Engineers, mirror of all things automotive except sales and promotion, believes that all action for more than two full production years will be concentrated in making substantial improvements in parts, material, performance and other hidden factors.

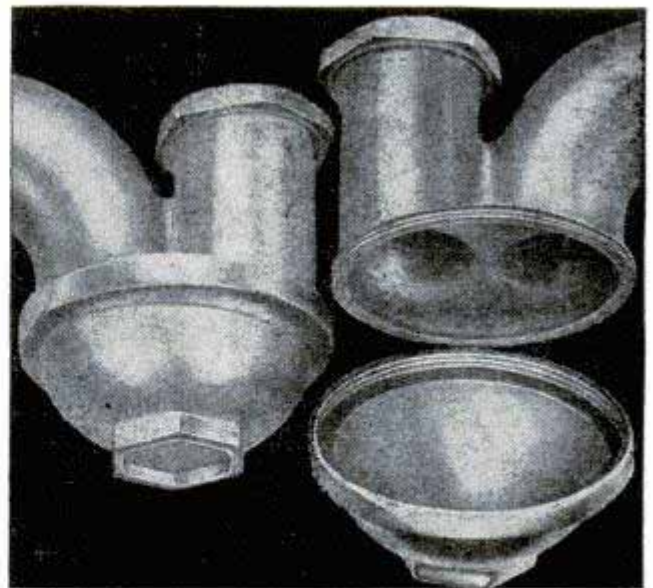
Some of the 1947 or 1948 models may introduce a rear axle which allows the rear wheels to be individually suspended by means of a universal joint on either side of the differential—a form of suspension used on some military vehicles.

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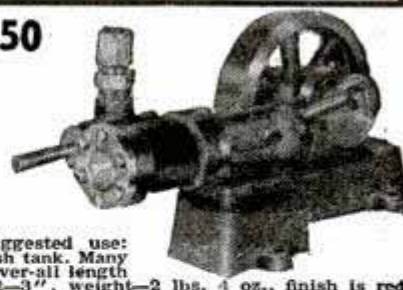


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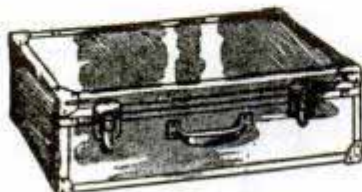
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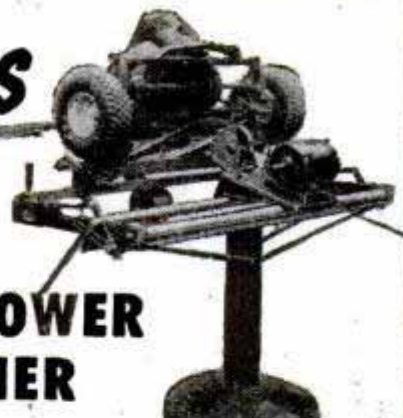


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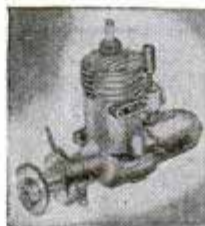
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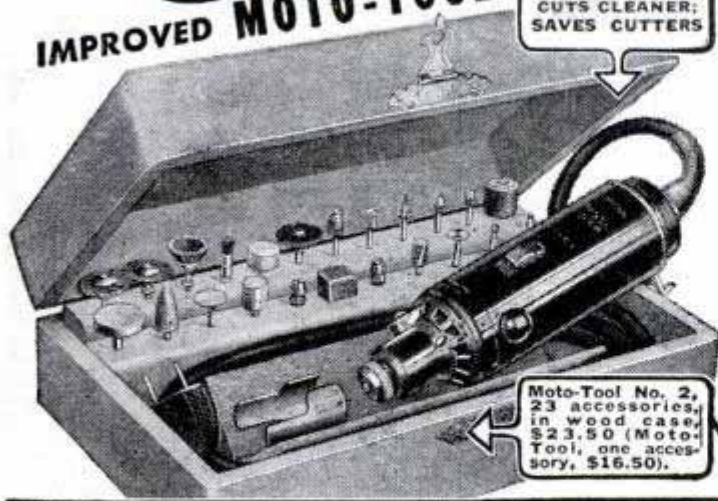
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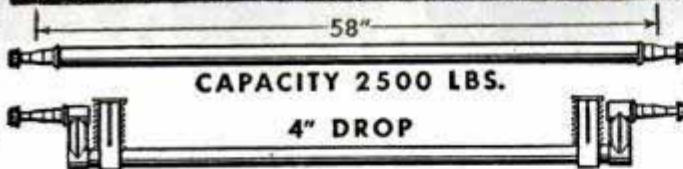
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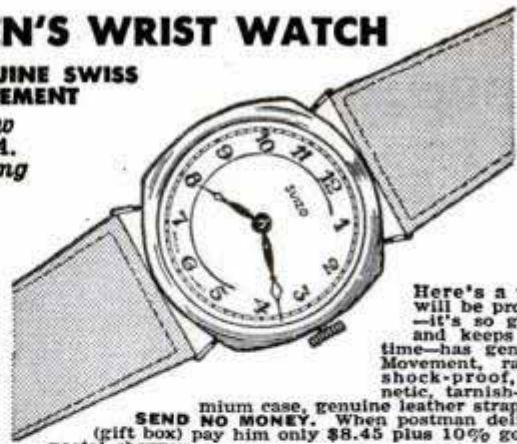
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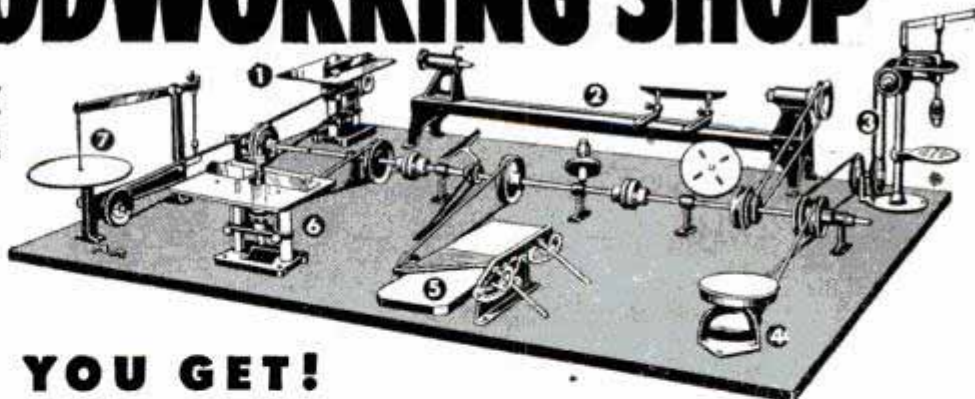
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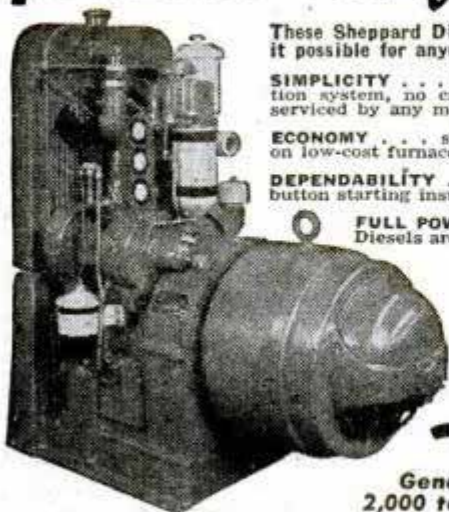
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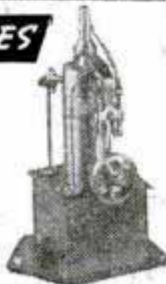
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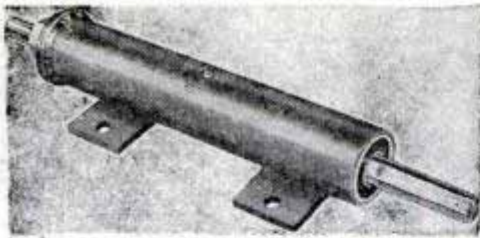


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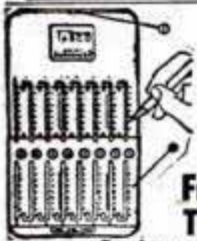
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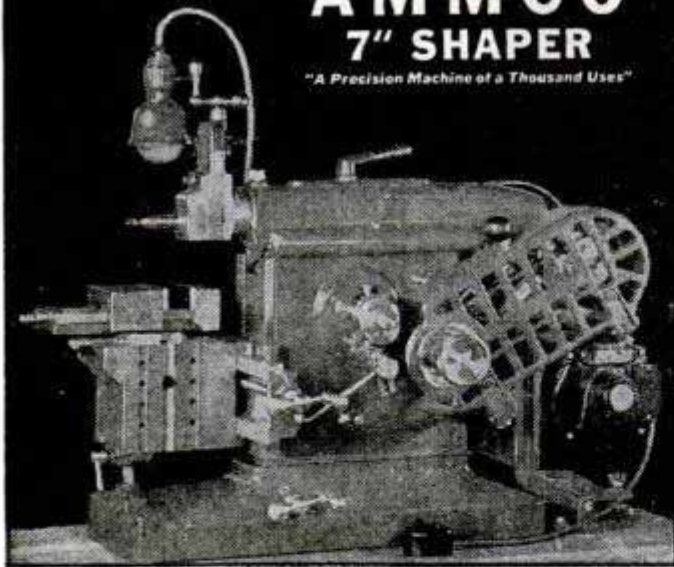
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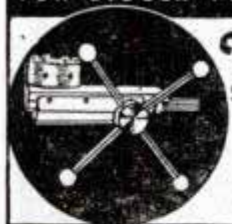
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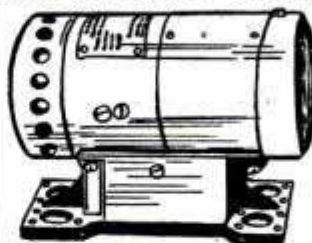
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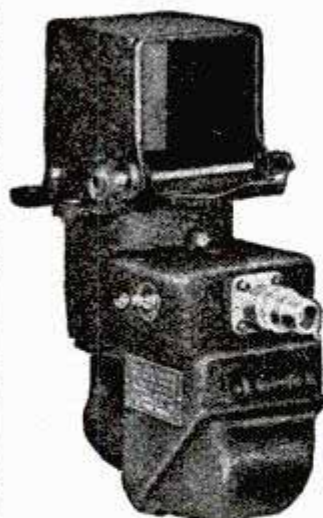
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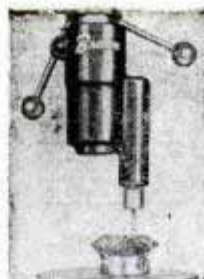
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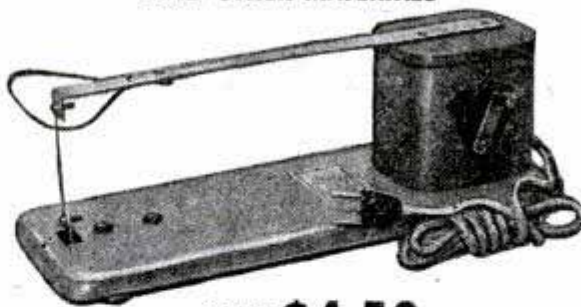
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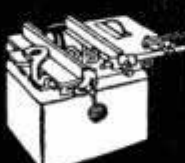
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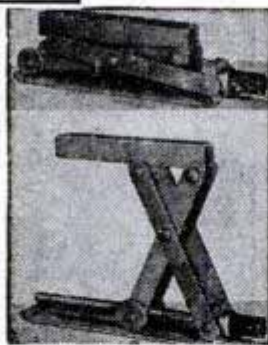
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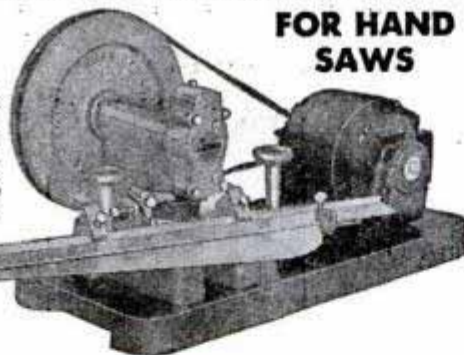
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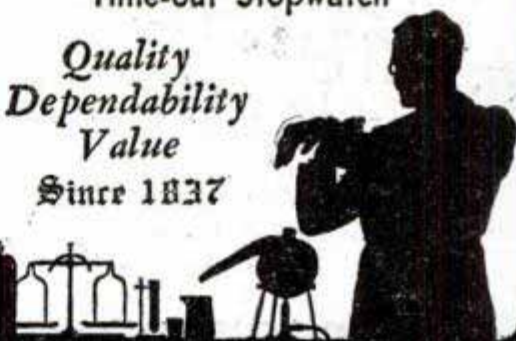
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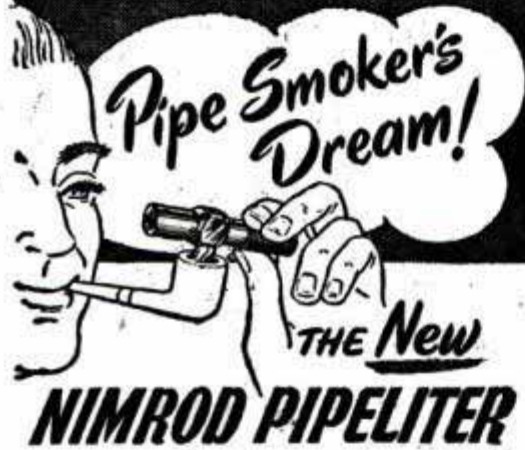


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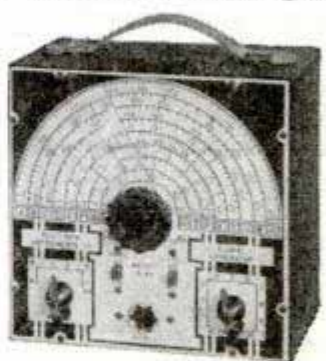
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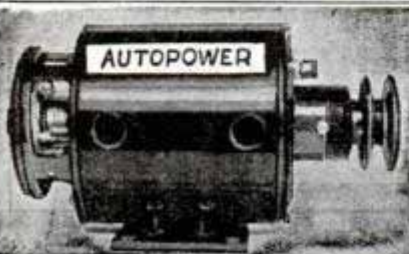
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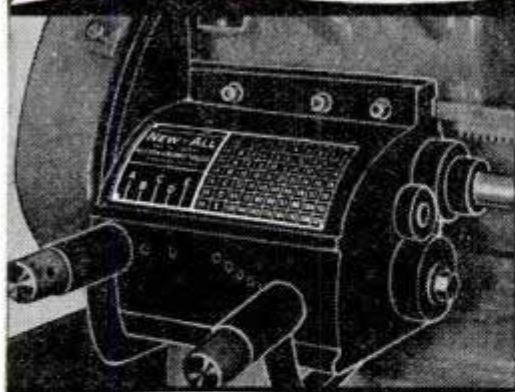
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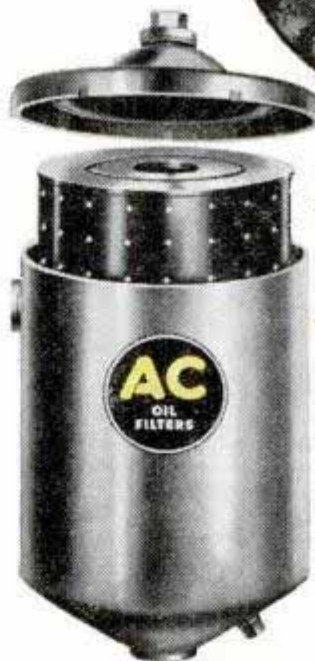
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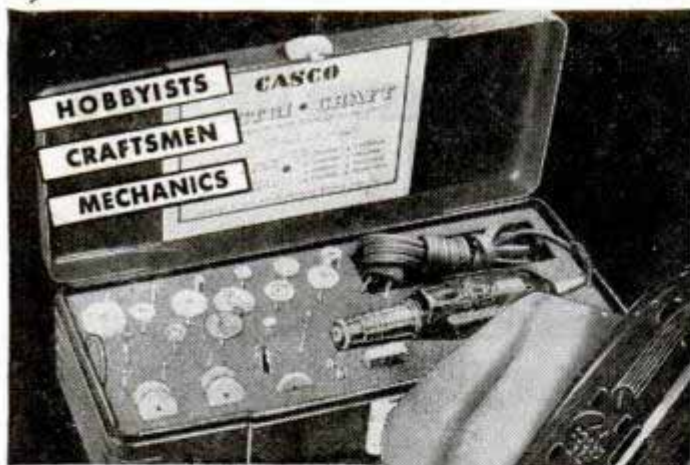
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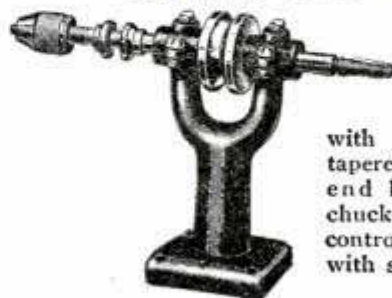
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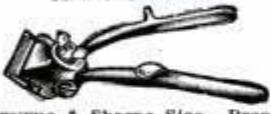
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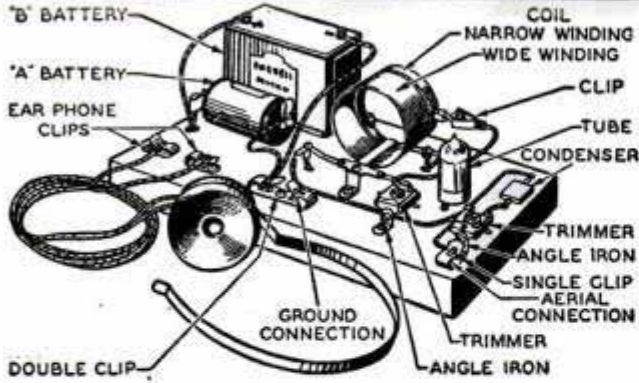
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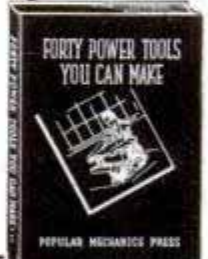
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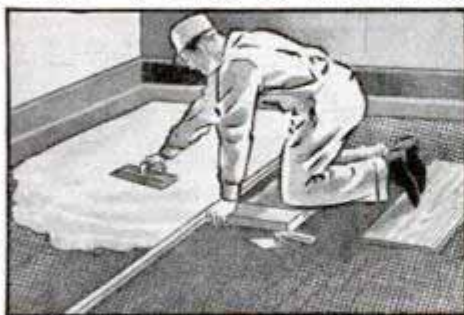
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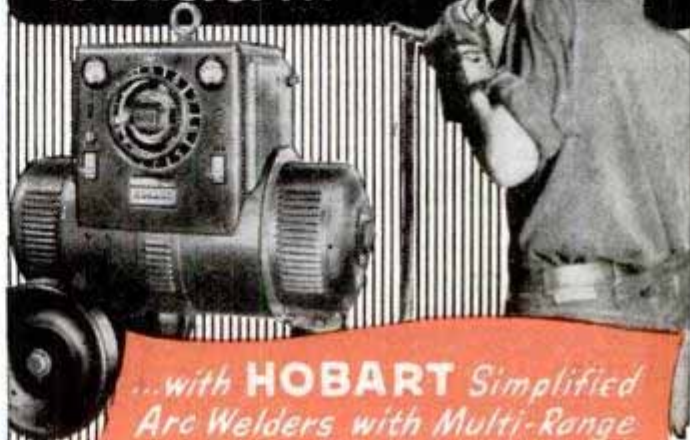
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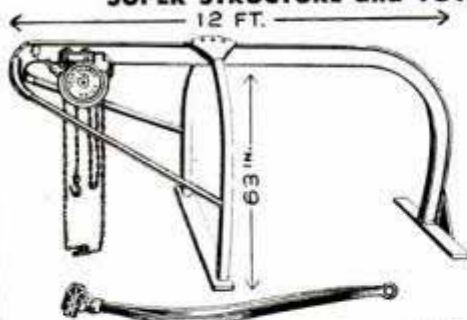
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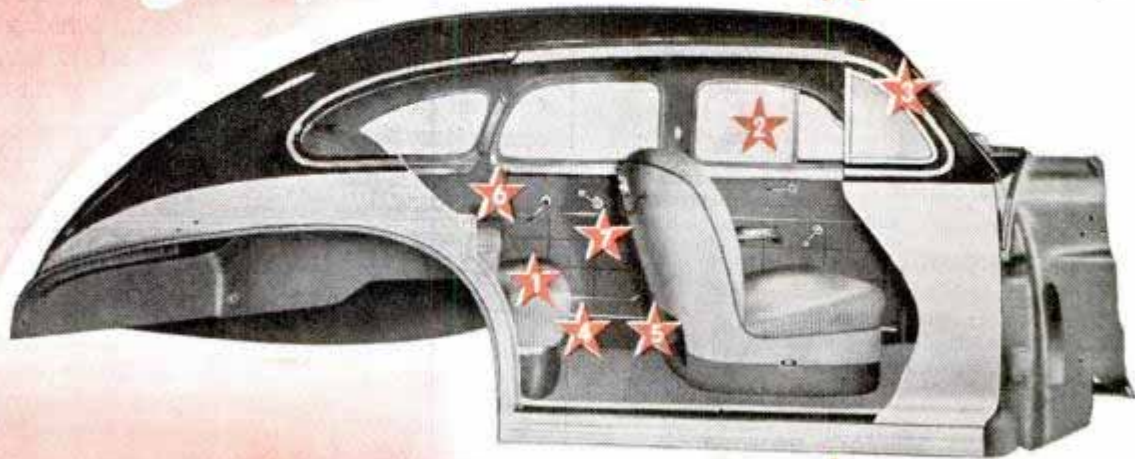
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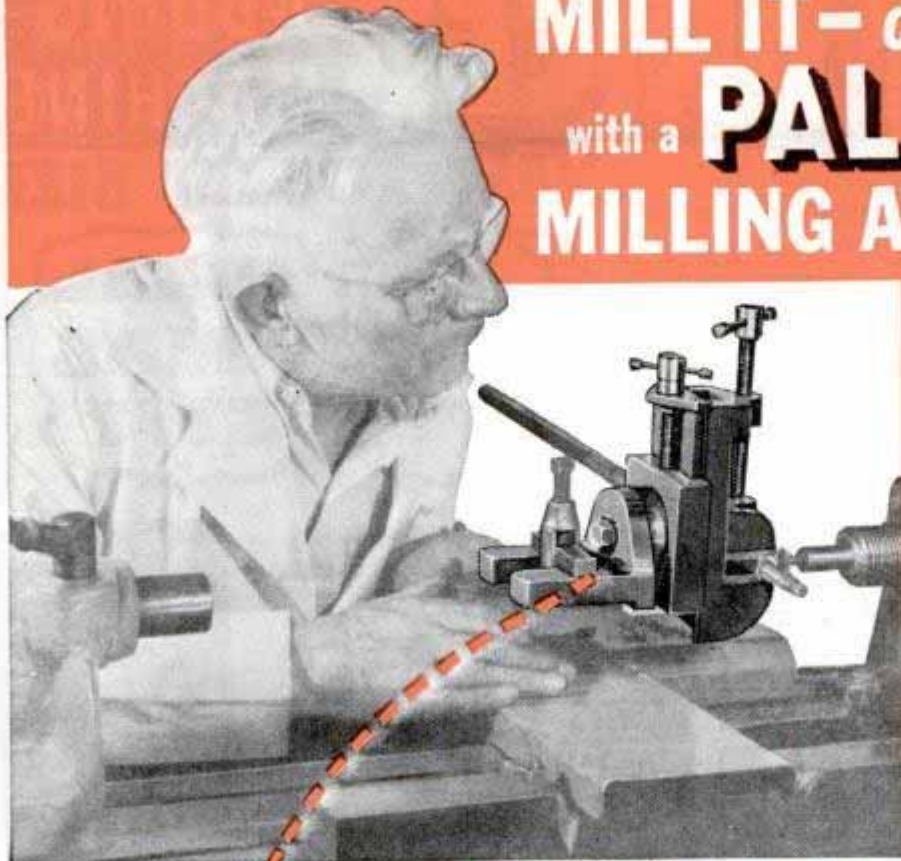
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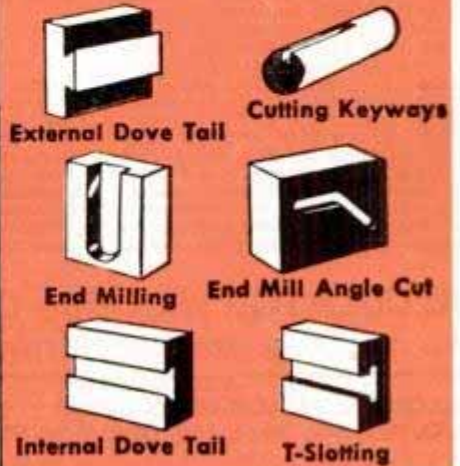
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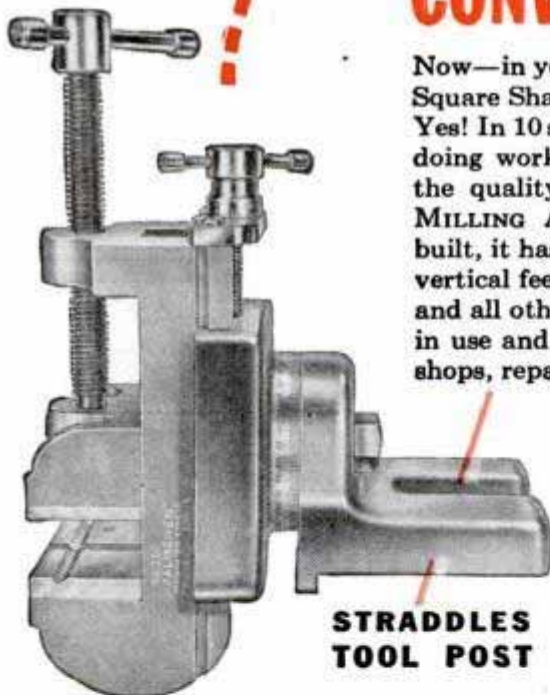


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30 PC. ASST. Known names—**NORTON—CARBURUNDUM—MACKLIN—MANHATTAN** in assortment of sizes from 1" to 10" diameter—1/4" to 1" thick and 1/8" to 1 1/2" holes. Invaluable for industry and home workshop. If wheels were bought singly, value would be over \$30.00. Amazingly low price for complete assortment of 30 new grinding wheels only \$4.95 postpaid. Send check or money order today.

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INDUSTRIAL WHEELS

- 4 1/2 x 1 1/4 x 1 1/2 50 S-3 Carb Alex Rec. 60c ea.
- 6 x 1 1/4 x 1 1/4 Type S 3860-18 BE Rec White Norton 70c ea.
- 10 x 1 1/2 x 1 1/2 Rubber Cut off wheels 544 also Shellac Cut off wheels 80 MSL 60c ea.
- 12 x 1 1/2 x 5 Norton Carb Macklin Beveled edge 1850-1-402 and 5760-16 and 1960-16 and 800... 75c ea.
- 14 x 4 x 1 1/2 Steel Rim H60 RR C80J-15 V; 37 C6017 V; H060-18 VW, 38-46J for Ex-cell-o or Carboly or Hammond Grinders \$5.00 ea.
- 20 x 2 x 12 Rec slides Red 38461... \$8.00 ea.
- 20 x 4 x 12 BW 60-M 48V at slides Face A; N46 E K 35 H Sterling Vit straight \$10.00 ea.



MOUNTED GRINDING POINTS
ASSORTED MOUNTED GRINDING POINTS with 3/8" shank—all new! Special "hurry-up" offer gets you **SEVEN \$1.00** post mounted grinding points. **ONLY \$7.00** paid

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Now A DYNAMIC HEAVY DUTY INDUSTRIAL WELDER

Available Now—Immediate Deliveries

Designed to Do High-Grade Welding *Inexpensively*

Maintenance men, farmers, mechanics, machine shops, foundries, auto, general repair and job welding shops using the DYNAMIC WELDER find it so indispensable and useful that they cannot afford to be without it. If inexperienced you can easily learn to do a variety of high-grade welding jobs by following the practical, simplified operating and welding instructions furnished.

WORKS ON IRON, STEEL, BRASS, BRONZE and OTHER METALS

Has eight metallic and carbon arc welding heat stages. Does work you would think only possible with a larger, more expensive machine.

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Repair Shop Owner says, "It will do more than you say"

"I want to say I operate a repair garage and am more than satisfied with the welder. It will do more than you say." C. P., Butler, Ohio

It's the Greatest Portable Outfit

"Now I am equipped for all kinds of welding and I must say it's the greatest portable outfit for welding any man could ever wish to own. I wouldn't sell mine for the cost of plenty welders I have seen which were very high in cost but not in convenience. You may put me on file as a booster of your wonderful welding product." W. J. B., St. John, N. B., Canada

Better Than I Expected

"I have done quite a little welding with my welder and will say it is better than I expected. The price, convenience, and variety of work that can be done with the Dynamic are the attractive points." W. R. P., Portland, Ore.

EASY TO OPERATE!

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GET DETAILS ON OUR 10-DAY TRIAL OFFER!

Once you see a DYNAMIC in operation you won't want to be without it. Its simplicity will amaze you. In a year the DYNAMIC only costs you about 6c a day. Comes complete, ready to operate, with helmet, rods, cables, electrode holder and operating instructions, etc. Nothing else to buy. Write today for Free particulars. Act now and get details on our amazingly low priced Dynamic Welder and 10 day trial offer.

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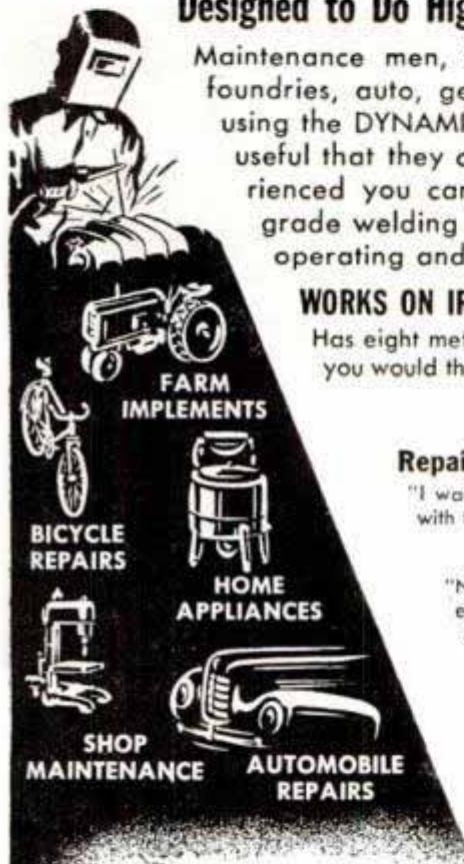
13 East 23rd Street—FM

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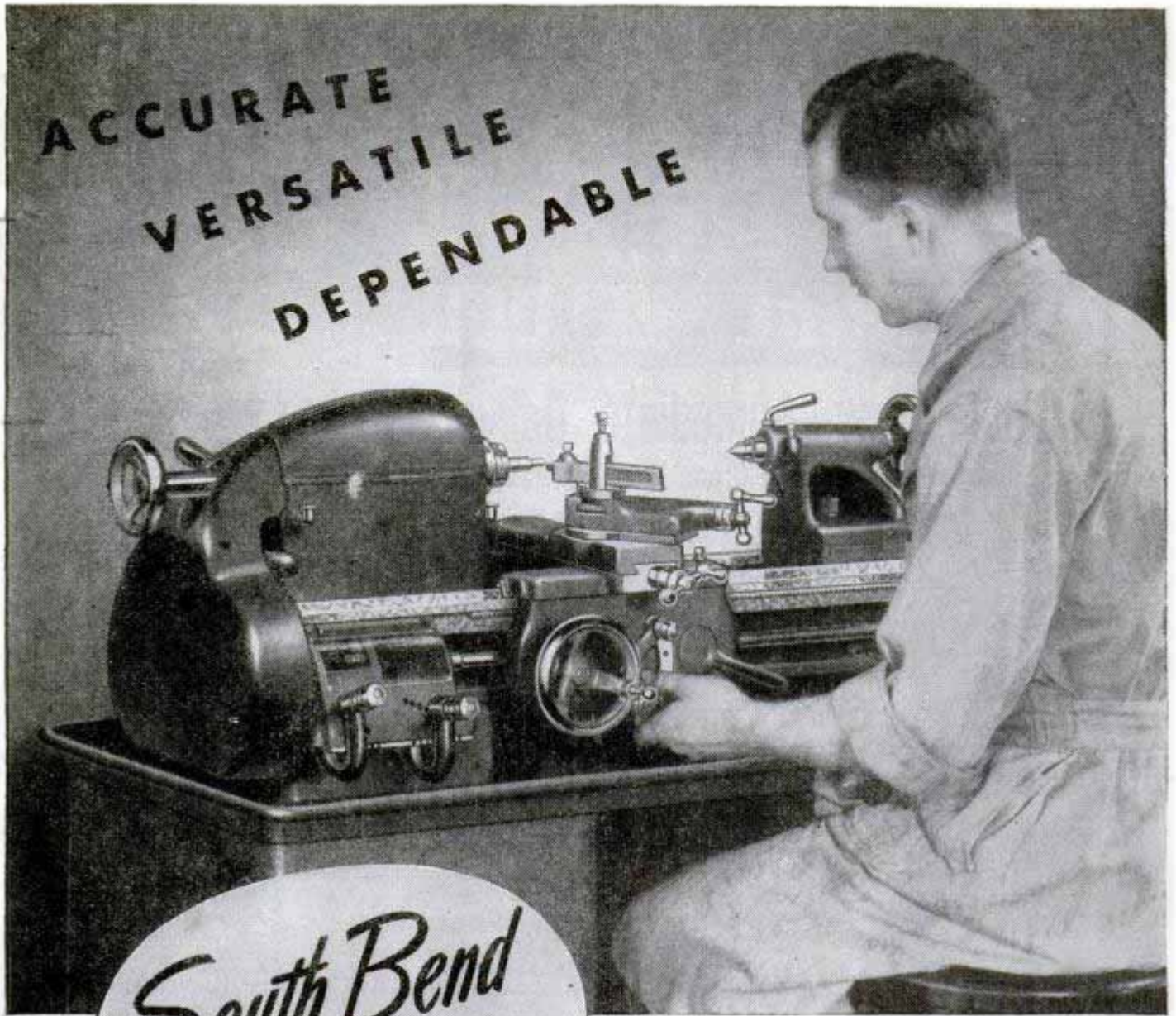
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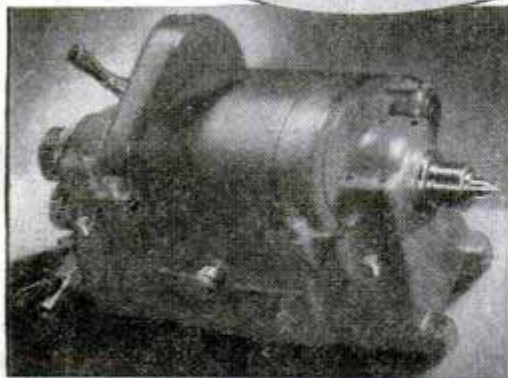
This portable Dynamic Welder, easily carried right to the job, can be operated from any convenient, properly wired 110 Volt 60 cycle line. Can also be supplied for 220 Volt 60 cycle operation and for other voltages and cycles at slight additional cost.



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VERSATILE
DEPENDABLE



South Bend Lathes



PRECISION-BUILT HEADSTOCK

The headstock construction of South Bend Precision Lathes is one of the reasons for their unvarying accuracy. Spindle bearing surfaces are super-finished to a smoothness of 5 micro-inches (.000005") which reduces wear and friction, permits higher spindle speeds, and assures precision.

Jobs worth doing are worth doing well. That's why the accuracy, versatility, and dependability of South Bend Precision Lathes are as important in the small shop as they are in the industrial toolroom and manufacturing plant. These qualities enable them to handle efficiently the many types of operations which regularly are encountered in tool and instrument shops, radio and appliance repair work, automotive and aviation maintenance and service, laboratories, model shops, and many other industries.

WRITE FOR FREE CATALOG. South Bend Precision Lathes are made with 9", 10", 13", 14-1/2", and 16" swings. Specify size lathe in which interested.



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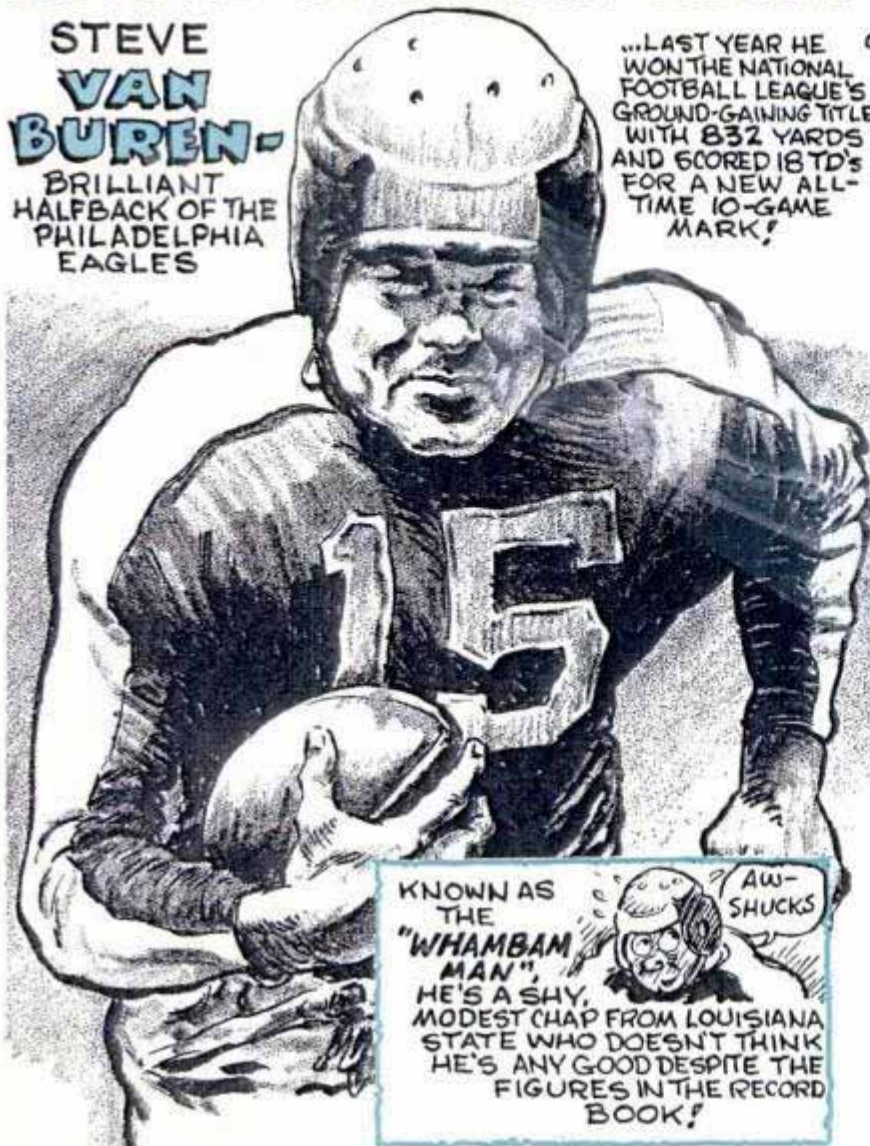
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BRILLIANT
HALFBACK OF THE
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WON THE NATIONAL
FOOTBALL LEAGUE'S
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WITH 832 YARDS
AND SCORED 18 TD'S
FOR A NEW ALL-
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MARK!



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GUY IS WITH
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HE LOOKS **SHARP!**
...STREAKING DOWN THE FIELD
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KNOWN AS
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"WHAMBAM
MAN",
HE'S A SHY,
MODEST CHAP FROM LOUISIANA
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HE'S ANY GOOD DESPITE THE
FIGURES IN THE RECORD
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AW-
SHUCKS



-PLUS
ONE IS SEVEN!

HE FEELS
SHARP!

...BOOTING THE BALL. STEVE'S
A GREAT PUNTER...WHAT'S MORE,
THE ONLY TWO PLACEMENT KICKS
HE TRIED DURING THE SEASON
HELPED HIM AMASS 110 POINTS FOR
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HE IS **SHARP!**
...STEVE ALWAYS USES
GILLETTE BLUE BLADES
WITH THE SHARPEST EDGES
EVER HONED..THAT'S BECAUSE
THEY GIVE HIM THE SLICKEST,
MOST REFRESHING SHAVES A
FELLOW CAN HAVE AND SAVE
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YOU CAN'T FOOL STEVE--
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SOMEWHERE high in the sky the stork is racing.

But the doctor will be at its destination first. Ready and waiting.

Whether bringing life or guarding it, the doctor's personal life fades into the background when duty calls.

But he isn't asking for any special credit. It's his job—and he does it.

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TEXAS and Rhode Island... lofty Colorado and the wheat-golden Dakotas... each and every state of the forty-eight was covered in this great nationwide survey of 113,597 doctors.

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