

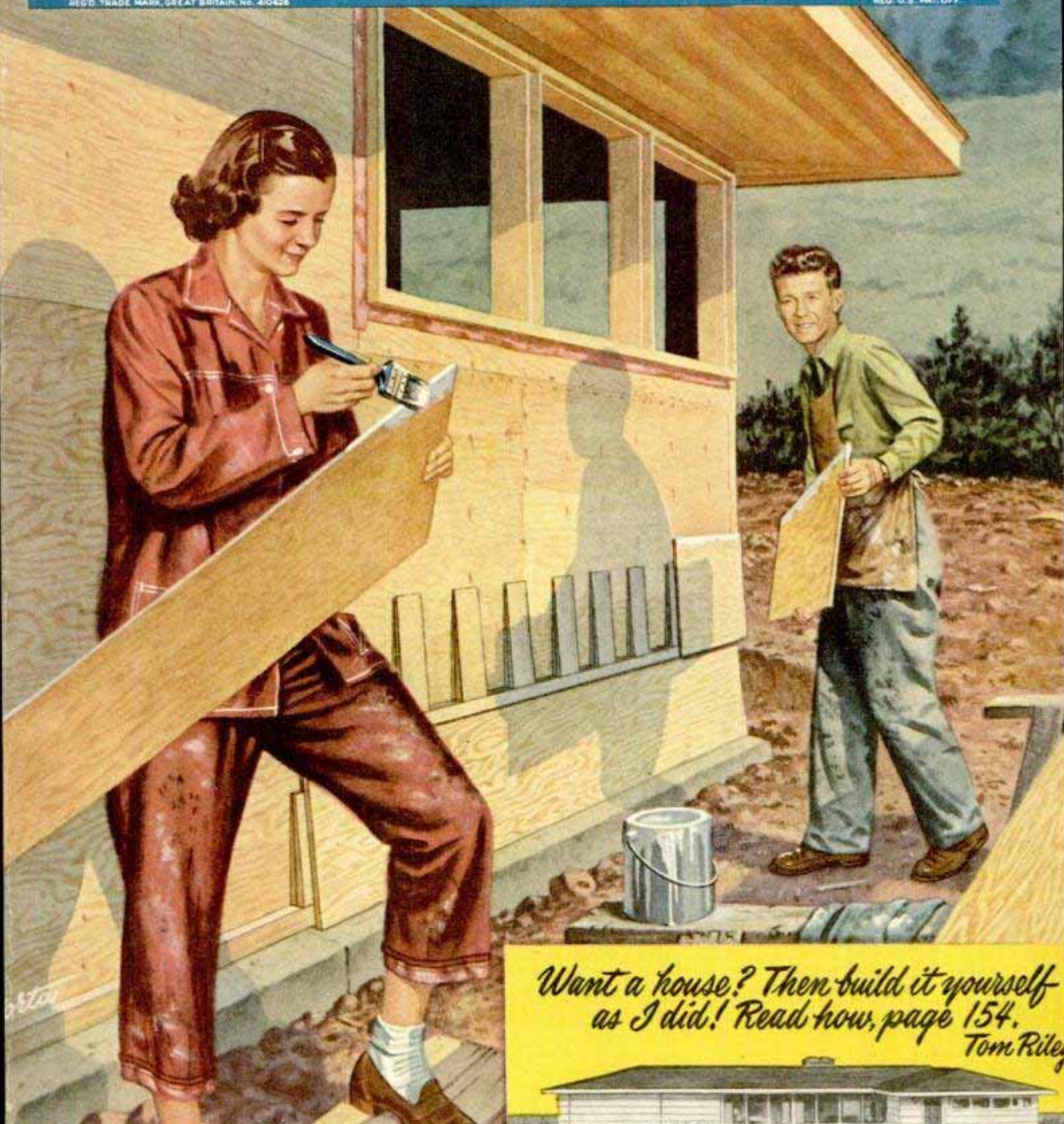
POPULAR MECHANICS

MAGAZINE

WRITTEN SO YOU CAN UNDERSTAND IT

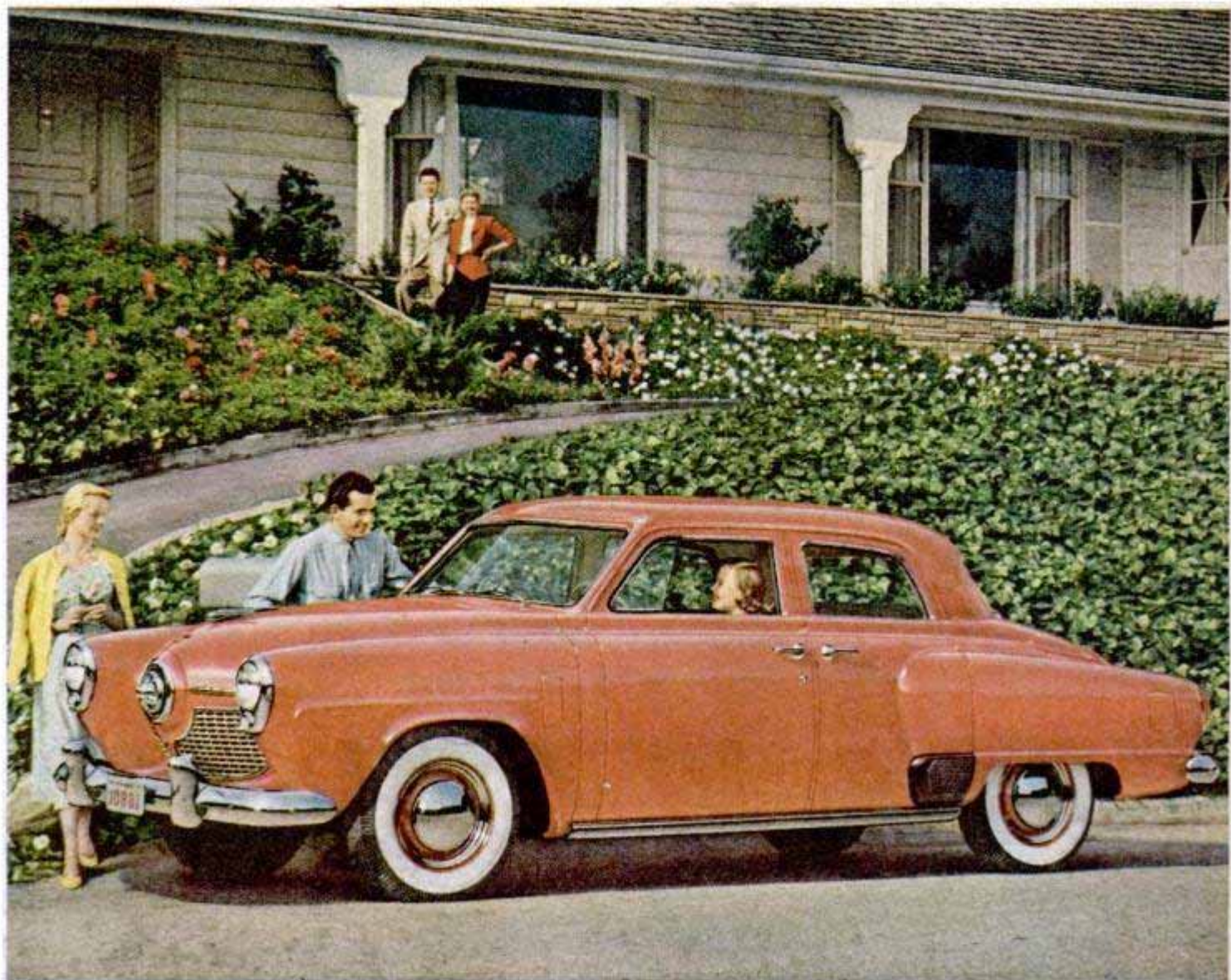
REG'D. TRADE MARK, GREAT BRITAIN, No. 410426

REG. U.S. PAT. OFF.



*Want a house? Then build it yourself
as I did! Read how, page 154.
Tom Riley*





Paul Hesse photo

Decorative and other specifications subject to change without notice.

Drive this 1951 Studebaker Champion and save!

Top value of the top 4 in the lowest price field!

The gas economy you want! The low upkeep you want!

The dependable performance you want!

The Studebaker Champion is one of the 4
lowest price largest selling cars!

SEE THE EIGHT AMERICA RATES AS GREAT...THE 1951 STUDEBAKER COMMANDER V-8

Wheel trim rings, and white sidewall tires if available, at extra cost

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Scientists Create "TAILORED LIGHTNING" For Better Motoring



ELECTRICITY LEAPS from storm clouds to top of Empire State Building as shown in this dramatic night photograph. Engineers harness electrical energy like this to "fire" gasoline in your engine.

In the great engineering laboratories of The Electric Auto-Lite Company in Toledo, Ohio, a group of Auto-Lite Ignition Engineers have been probing inside engine cylinder walls, peering at "blow-by-blow" spark performances, charting the behavior characteristics of man-made "lightning" across the spark plug gap. From endless tests they've determined what your engine's ignition system needs most, and then set about producing spark plugs to fill the bill. Net result: Ignition Engineered Auto-Lite Spark Plugs . . . the spark plugs that are *world famous* for quality and performance.



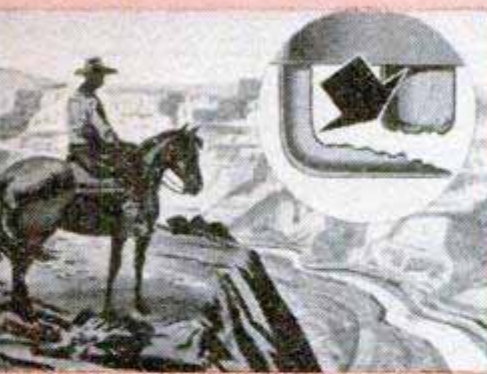
FRANKLIN'S KITE experiment was first demonstration of electrical nature of spark discharges between clouds. Date: 1752.



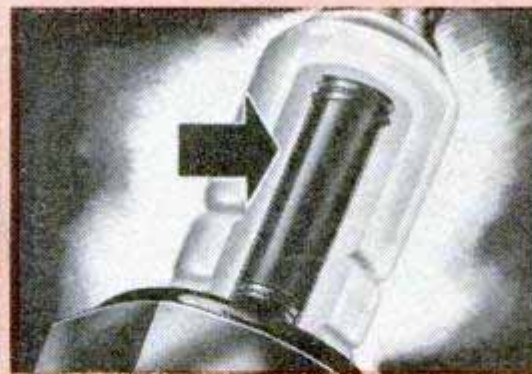
"FIRING PIN" of the car engine. Your spark plugs fire as many as 15,000 fuel charges per minute with tailored precision.



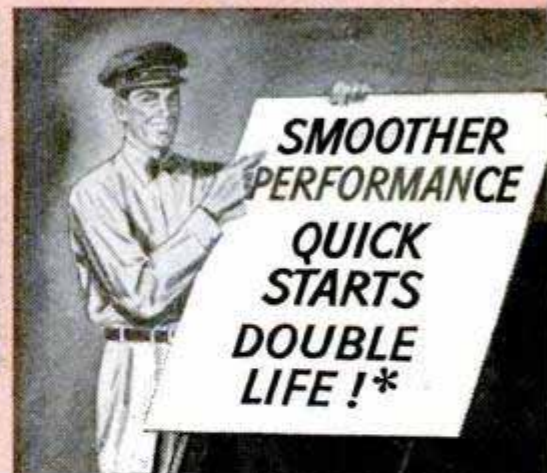
RELIABLE STARTING is one important benefit resulting from Auto-Lite research to assure correct materials, dimensions and design.



RIVER CUTTING CANYON resembles way urging of electricity wears away electrodes. For solution see next picture.



TINY UNIT called a "Resistor" permits wider initial gap setting, makes possible these advantages of Resistor Spark Plugs:



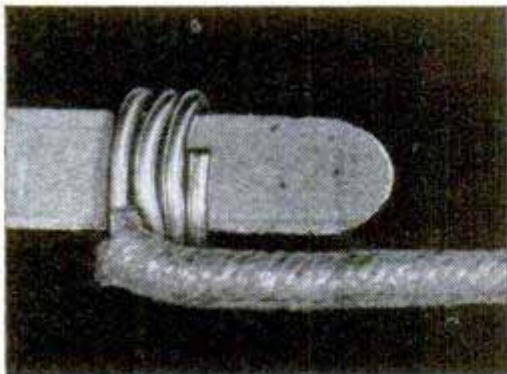
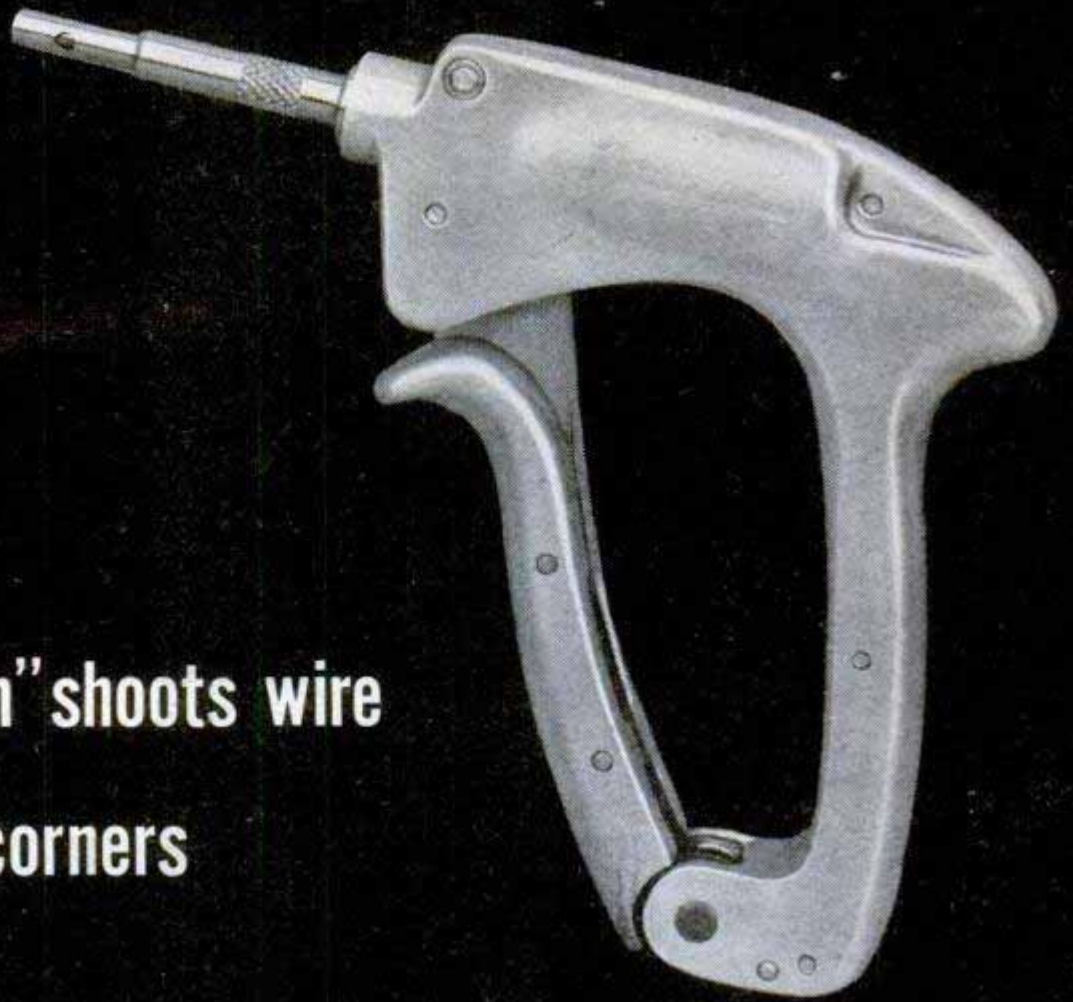
**SMOOTHER
PERFORMANCE
QUICK
STARTS
DOUBLE
LIFE!***

All car, truck and tractor owners benefit from the exhaustive research performed by Auto-Lite Ignition Engineers . . . the men who design the coil, distributor, spark plugs, wire and all the other parts of the complete ignition system used as original factory equipment on many leading makes of America's finest cars and trucks. *You're Always Right With Auto-Lite.*

THE ELECTRIC AUTO-LITE COMPANY
Toledo 1, Ohio Toronto, Ontario

Ignition Engineered
AUTO-LITE
SPARK PLUGS

This "gun" shoots wire around corners



Close-up of connection made with new tool—neat, tight windings.

IT DOESN'T take long to wrap *one* wire around a terminal and snip off the end. But *hundreds of millions* of such connections are being made each year.

Now this job is done much more efficiently with a new wire wrapping tool invented at Bell Laboratories. This "gun" whirls wire tightly around terminals before solder is applied. The connection is better and there is no waste wire.

The hand-operated wrapper shown here is for the telephone man's tool kit. Power-driven wrappers developed by Western Electric, manufacturing unit of the Bell System, are speeding the production of telephone equipment. The gun's small nozzle reaches where fingers couldn't—a big advantage these days when parts are made smaller as well as better.

Bell Telephone Laboratories scientists devise many special tools to help your telephone system meet growing demands—and keep your telephone service one of today's best bargains.

BELL TELEPHONE LABORATORIES

WORKING CONTINUALLY TO KEEP YOUR TELEPHONE SERVICE BIG IN VALUE AND LOW IN COST





MEN WITH SKILLS GET AIR FORCE RATINGS!

Radio repairmen are among hundreds of kinds of skilled specialists . . . men who keep your U. S. Air Force on top . . . needed now by your Air Force.

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For your skill, your Air Force offers better pay and opportunities than ever before . . . in a great Air Force you'll be proud to serve, with a rewarding sense of a job well done in your nation's defense.

Find out where you fit. Visit your nearest U. S. Army and U. S. Air Force Recruiting Station now . . . and get details of these new Air Force offers:

VETERANS: You can now enlist, if qualified, in your old grade or *better* . . . skip basic training . . . and be assigned initially to a nearby Air Force Base.

NON-VETERANS: You can enlist for basic training . . . and get a rating to match any critically needed technical skill or training you have.



Get on Top . . . Stay on Top . . . with the U. S. Air Force!

Here is some interesting news about your automobile

Just suppose you are driving at 40 miles an hour on a level road. The power, of course, comes from the gasoline you feed your motor. Yet 50% of the power generated by the motor doesn't do a thing to make your car go farther or faster, or climb a steeper hill.

Why? Because that power never gets to the rear wheels. It is used to overcome *engine friction*. And we don't ask you to take our word for it—America's automotive engineers have *proved* it.

Now, along comes a motor oil that proves it *further reduces* this engine friction. Which means the engine delivers the same power with *less gasoline*.

It's simple as ABC: The *less engine friction*, the *less gas* it takes to run your car.

This has been strikingly demonstrated in recent months. Hundreds and hundreds of cars—cars of all makes and ages—cars that had been using *every* nationally known brand of motor oil—were given the Dynamometer Test. This is a machine devised by engineers to measure the power an engine delivers to the rear wheels.

And what happened? After the oil in these cars had been changed to Macmillan, the *same power was developed with an average of 8% less gasoline*.

The minute you change to Macmillan, you'll get an increase in power and gasoline mileage. You cut down on "drag"—your gasoline "pushes" easier than before. After your second or third drain, you'll get an average increase in gasoline mileage of 8%!


That's because Macmillan has not only reduced engine friction but also has reduced carbon and gum deposits in the combustion chamber, on rings, valves, and valve stems. This results in higher compression because of better piston seal—smoother operation, and less tendency for the motor to ping.

Do you know what this means in money? Figuring gasoline at an average of 25¢ a gallon, it means you save 2¢ a gallon—simply by changing your motor oil to Macmillan.

That's a big saving— isn't it? Yet it's small when you realize *how much more* you save in repair bills. Because: The less friction, the less wear and tear on your car. New motors stay newer longer.

Finally, remember this Macmillan Motor Oil not only *fights friction* but *removes carbon* from your motor—cleans your motor as you drive.

Ask for this fine motor oil at independent dealers where you see the sign of the big red "M." It means Money in your pocket, Mileage in your car. Try the *OIL* that makes your *GAS* go farther!


President

MACMILLAN PETROLEUM CORPORATION

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P.S. *If you are unable to locate a Macmillan dealer, write to me and I'll be glad to direct you to the one nearest you. R.S.M.*



a little

Pyroil

makes a **BIG** difference in your car

A pint of Pyroil in the crankcase, a few ounces in the gas tank, and you'll notice a big difference in your car. Why? Because Pyroil has the extraordinary property of making ordinary oil cling to engine parts. This coating of protective lubrication eliminates friction between piston rings and cylinder walls. Pyroil stops costly wear and tear caused by metal-to-metal contact. It assures instant lubrication when you step on the starter—it prevents oil from draining off vital parts when you turn off the engine.

Yes, a little Pyroil (at so little cost) will make a big difference in the life of your car. Ask your gas station attendant to add Pyroil—add miles to your car.

Pyroil for Aircraft Engines

Use Aircraft Pyroil B for lubricating oil, Aircraft Pyroil A for gasoline.

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An attractive Pyroil metal savings bank — takes coins up to 50¢ pieces. **MOTORISTS**, it's yours for the asking—sent postage paid.



Manufactured and Guaranteed by Pyroil Company, 115 Pyroil Bldg., La Crosse, Wisconsin

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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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in this corner.....

THE EDITORS



FILL 'ER UP WITH LPG. Some 200,000 bus and truck drivers and power farmers are saying it as they drive alongside the big propane-butane pressure tanks at filling stations around the country.

And now private motorists are beginning to join the line. It isn't cheap, converting your car from gasoline to liquefied petroleum gas; but once you've converted, you "fill 'er up" at much lower cost per gallon and you have a sweet-running, knock-free engine.

Take it from Jud Purvis, a Chicago motorist who converted his car to LPG and will vouch for its carbon-free performance. He tells how it's done in a featured article next month.

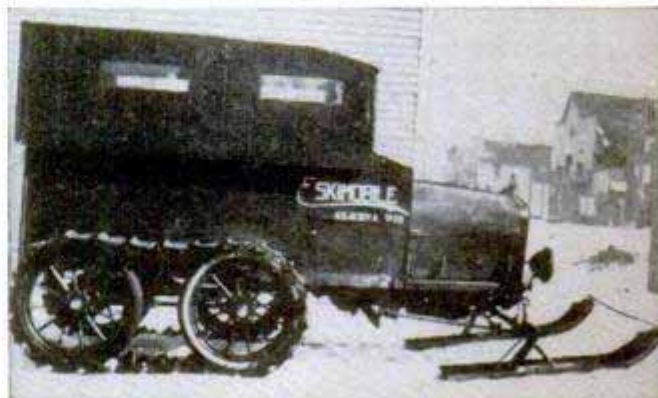
White-Hot Ingot Takes 200-Mile Ride

In Canada, steelmen have come up with a novel time and labor-saving technique—they recently shipped a white-hot ingot 200 miles by rail. The project was so successful that it has become routine. The 130,000-pound ingots, at a temperature of 1600 degrees Fahrenheit, are packed in vermiculite, an insulating material. During the trip the temperature drops only 195 degrees. Normally, an ingot would have to be cooled six weeks before it could be shipped, then reheated for 10 days at the receiving point before it could be worked.

To the Editor

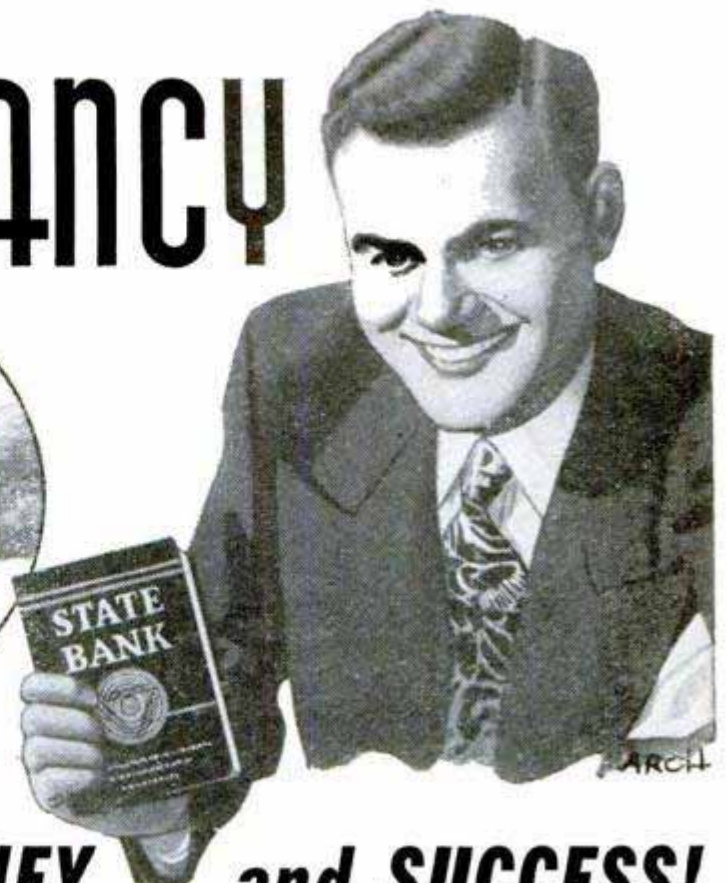
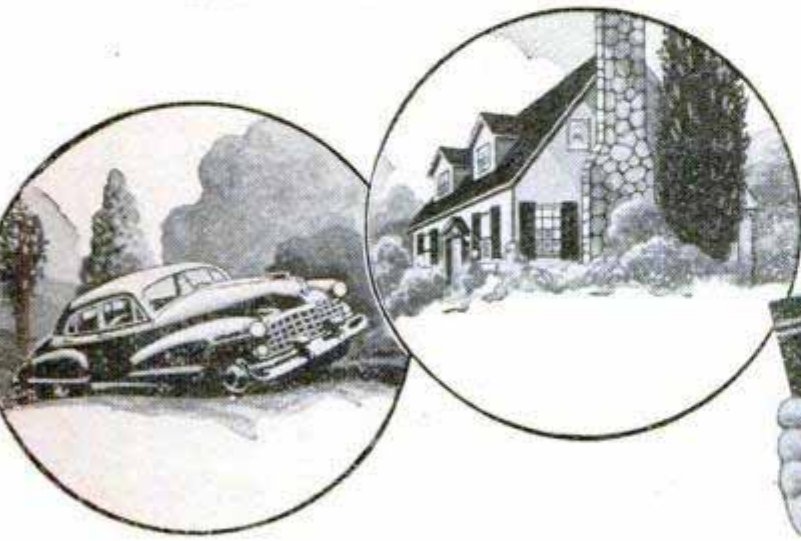
While looking through the December 1950 issue, I came across a letter to the editor from a man who owns an "Eskimobile." He sent a picture of what was called the "Mail Buggy." He told how much he enjoyed it, but said he did not know to whom the tribute of construction should go.

The original machine was made about



(Continued to page 8)

5 reasons why ACCOUNTANCY



offers you MORE MONEY . . . and SUCCESS!

REASON #1. If you were an expert accountant right now, chances are you would find yourself among the highest-paid of all professional men and women. Even back in "depression years," surveys showed that accountants earned more on the average than men in other major professions.

REASON #2. The demand for accountants is great—everywhere. All businesses must have trained accountants to cope with ever-growing requirements. It's a profession offering wide opportunity—always—to the man who knows.

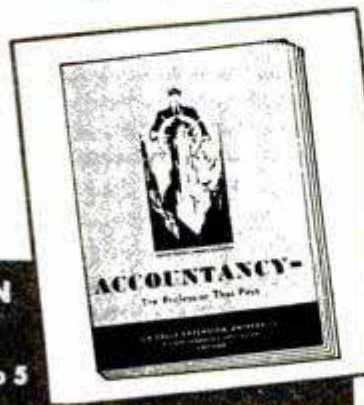
REASON #3. You can fit into any business, anywhere in the country—because accounting principles are universal. Think what this means in terms of security and independence!

REASON #4. Accountancy is open to all. Any man or woman of good intelligence, who enjoys figure work and is willing to follow LaSalle's systematic "problem method" plan, can rapidly qualify for a highly profitable, enjoyable

lifetime career . . . and he doesn't have to finish his training before beginning to "cash in."

REASON #5. Without losing a day from your present work, you can prepare in spare hours at home, at low cost, under LaSalle's step-by-step "Problem Method" of "learning by doing." This famous plan accounts for LaSalle's remarkable record of having trained nearly 10 per cent of all Certified Public Accountants in the U. S. . . . and of having put many thousands of others into high-paying careers.

Send today for LaSalle's interesting booklets, "Accountancy, the Profession That Pays," and "Success Reports." Learn about the five great fields of opportunity . . . and LaSalle's time-tested plan for helping men and women to rapid advancement, higher income, greater prestige and professional standing. The coupon below will bring these fact-filled booklets to you—without cost or obligation. Mail the coupon NOW.



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TRAIN IN MIAMI--AIR CAPITAL OF THE WORLD

(Continued from page 6)
1922. It was first manufactured in a little town in middle-western Wisconsin. It was planned and made by two brothers—my dad and uncle—John and Henry Swansen. When the original Eskimobile was planned, these men had in mind to make a machine



that could be used for all kinds of work and pleasure.

There were many different types. The first to be constructed was the Eskimobile. From this developed the Stilt-Mobile, Ski-Mobile and Snow Cat. These were designed to serve well in the kind of weather we have around here—an extreme amount of snow in the winter and lots of mud in spring and summer.

Many of the mobiles were sold in Illinois, Minnesota, Ohio, Iowa and Canada, and we have heard of one in Arizona...

I am sending you some pictures to illustrate the facts I have stated here. The pictures will show you some of the different styles and some of the things they are used for. The picture of the Stilt-Mobile was taken in a wooded area near Almena. This picture is of Mr. and Mrs. Homer Person and their record kill in big bucks.

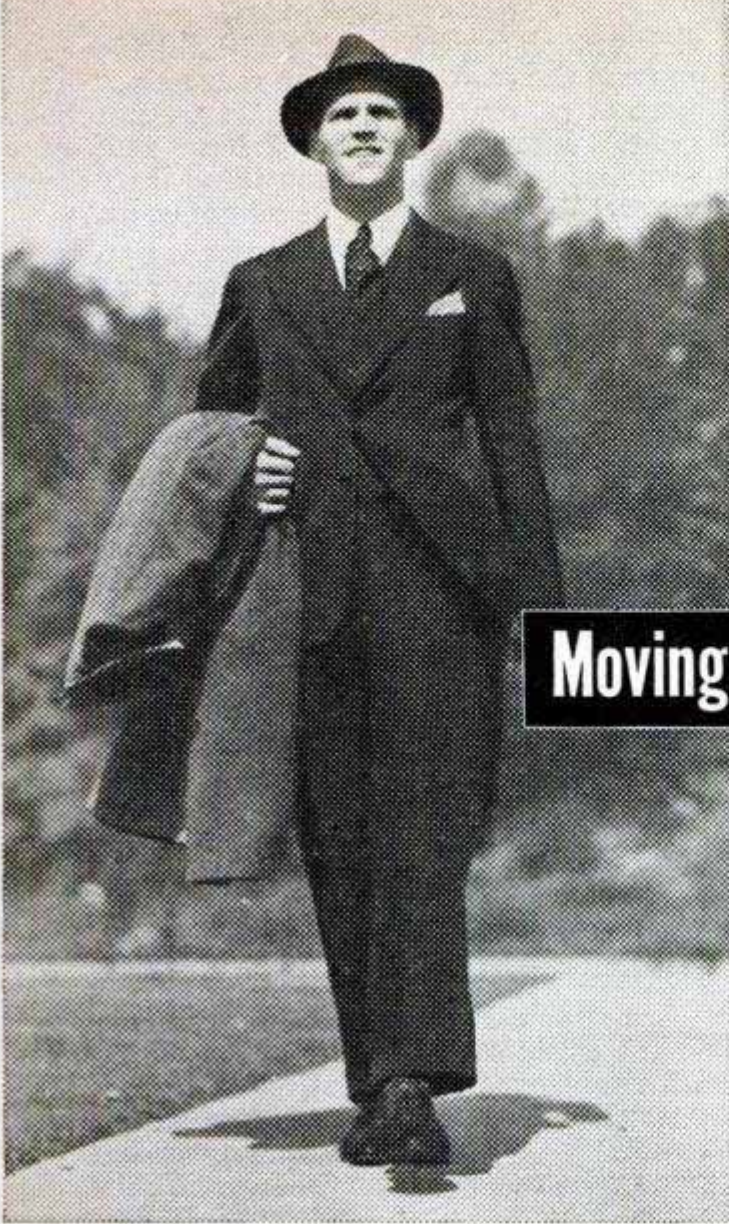
Yours truly,
Mary Swansen,
Almena, Wis.

Letter to the Editor

(Reader Edward L. Cady, noting comments on the rear-engine car by Arthur W. Stevens, Boston, Mass., in the February Editor's Column, writes as follows:)

When I was serving "apprenticeship" in the auto business in 1911... engineers were

(Continued to page 10)



Moving Up Fast...

Everybody liked Dick Gray. He was a man's man. A star athlete. A whiz of a basketball player. A good husband. A hard worker.

But with all those interests, Dick Gray had a busy day *every* day. And Dick Gray was ambitious. He *could* study at a local college nights, but that would take hours of commuting. That's when a friend told Dick about I.C.S. and how he could study at home in his spare time.

Since then, Dick has completed three I.C.S. courses in jig-time. He's moving up fast in the company for which he works. And he's kind enough to say he owes it to I.C.S. Sure, we helped, but Dick Gray really owes his success to Dick Gray.

On the rolls of I.C.S. under many different names there are thousands of "Dick Grays." Maybe you are one. If not, it just takes your name on this coupon to put it there!

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Law <input type="checkbox"/> Commercial Art <input type="checkbox"/> French <input type="checkbox"/> High School <input type="checkbox"/> Illustration <input type="checkbox"/> Postal Civil Service <input type="checkbox"/> Retail Bus. Management <input type="checkbox"/> Secretarial <input type="checkbox"/> Stenography <input type="checkbox"/> Traffic Management <p>Chemical Courses</p> <ul style="list-style-type: none"> <input type="checkbox"/> Chemical Engineering <input type="checkbox"/> Chemistry, Analytical <input type="checkbox"/> Chemistry, Industrial <input type="checkbox"/> Chemistry, Mfg. 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Telephony <input type="checkbox"/> Radio, General <input type="checkbox"/> Telegraph Engineering | <p>Electrical Courses</p> <ul style="list-style-type: none"> <input type="checkbox"/> Electrical Drafting <input type="checkbox"/> Electrical Engineering <input type="checkbox"/> Electric Light and Power <input type="checkbox"/> Lighting Technician <input type="checkbox"/> Practical Electrician <input type="checkbox"/> Power House Electric <input type="checkbox"/> Ship Electrician <p>Internal Combustion Engines Courses</p> <ul style="list-style-type: none"> <input type="checkbox"/> Auto Technician <input type="checkbox"/> Diesel-Electric <input type="checkbox"/> Diesel Engines <p>Mechanical Courses</p> <ul style="list-style-type: none"> <input type="checkbox"/> Aeronautical Engineer's, Jr. <input type="checkbox"/> Aircraft Drafting <input type="checkbox"/> Forging <input type="checkbox"/> Heat Treatment of Metals <input type="checkbox"/> Industrial Engineering <input type="checkbox"/> Industrial Instrumentation <input type="checkbox"/> Industrial Metallurgy <input type="checkbox"/> Machine Shop <input type="checkbox"/> Machine Shop Inspection <input type="checkbox"/> Mechanical Drafting <input type="checkbox"/> Mechanical Engineering | <ul style="list-style-type: none"> <input type="checkbox"/> Mold-Loft Work <input type="checkbox"/> Patternmaking—Wood, Metal <input type="checkbox"/> Reading Shop Blueprints <input type="checkbox"/> Sheet-Metal Drafting <input type="checkbox"/> Sheet-Metal Worker <input type="checkbox"/> Ship Fitting <input type="checkbox"/> Toolmaking <input type="checkbox"/> Welding—Gas and Electric <p>Railroad Courses</p> <ul style="list-style-type: none"> <input type="checkbox"/> Air Brake <input type="checkbox"/> Diesel Locomotive <input type="checkbox"/> Locomotive Engineer <input type="checkbox"/> Locomotive Fireman <input type="checkbox"/> Locomotive Machinist <input type="checkbox"/> Railroad Section Foreman <input type="checkbox"/> Steam and Diesel Loco. Eng. <p>Stationary Engineering Courses</p> <ul style="list-style-type: none"> <input type="checkbox"/> Boilermaking <input type="checkbox"/> Combust. Engrg. <input type="checkbox"/> Marine Engineering <input type="checkbox"/> Power Plant Engr. <p>Textile Courses</p> <ul style="list-style-type: none"> <input type="checkbox"/> Cotton Manufacturing <input type="checkbox"/> Rayon Weaving <input type="checkbox"/> Woolen Manufacturing |
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OUTSHAVE ALL

OTHERS 5 TO 1

Including Our Own Old Blades!



You get
this 1951 blade
only in the **NEW**
GOLD PACK!

20 Blades Only 73¢
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IN AUTOMATIC
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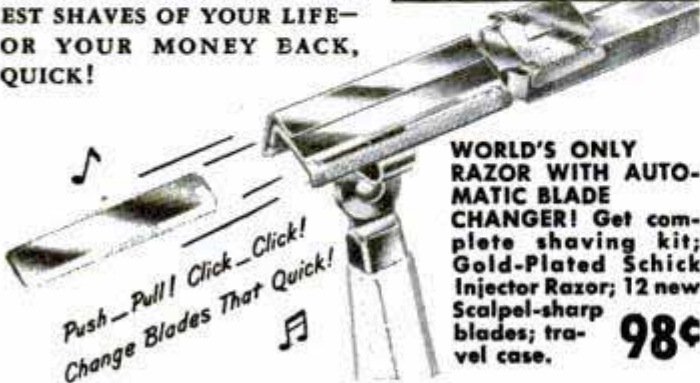
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On Every Point
Important To Shaving:

SMOOTHER SHAVES 5 1/2 to 1
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Men in 10 cities—
nationwide—com-
pared NEW 1951
SCHICK INJECTOR
BLADES with what-
ever they had been
using. About 80% of
the men had a prefer-
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votes were in the
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Special, new surgical steel!
Scalpel-sharp! Precision-
ground! And *only* these
NEW 1951 SCHICK INJEC-
TOR BLADES are made to fit
your injector razor perfect-
ly! So we guarantee this:
EITHER YOU GET THE FIN-
EST SHAVES OF YOUR LIFE—
OR YOUR MONEY BACK,
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Push—Pull! Click—Click!
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WORLD'S ONLY
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Gold-Plated Schick
Injector Razor; 12 new
Scalpel-sharp
blades; tra-
vel case. **98¢**

SCHICK INJECTOR RAZOR & BLADES

doing much experimenting with the idea of putting the engine over the rear axle. The verdict at that time was, "It cannot be done." Every year since I have read of somebody trying the same thing, and the verdict still is the same, "It cannot be done."

When the power of the motor is applied to the rear axle, it has a tendency to lift the front end. With the early models, with short wheelbase and the engine in the middle under the seat, they have actually been known to "rare up" and tip over backward when going up a steep hill. Farm tractors still do this sometimes. So in order to have the car hold the road on hills and at high speed on curves, it has been necessary to put the engine up front to hold the front end down . . .

Sincerely,
Edward L. Cady,
5415 34th Ave.,
Kenosha, Wis.

Letter to the Editor

The interesting article, "Rockets on a Timetable," by Richard F. Dempewolff in your November issue has come to my attention. On a level of general information, it is most interesting and informative.

I wish to call your attention particularly to the misinformation the article contains with reference to high-strength hydrogen peroxide. Your attention is invited to the caption for the picture on the lower left of page 98 which reads as follows: "Fuel experts load a big rocket with hydrogen peroxide. Chemical, which will explode if touched, rolls off plastic suits." This caption is deliberately misinforming since we can state, categorically, that hydrogen peroxide will not "explode" by being touched with anything.

Noah S. Davis, Jr., Manager,
Special Projects Dept.,
Buffalo Electro-Chemical Co., Inc.,
Buffalo, N. Y.

Mr. Davis is right. Hydrogen peroxide will not explode on contact with most clean substances, provided it is not in a sealed container. However, a dirty or catalytically contaminated material, which is combustible, can be made to burn by spilling hydrogen peroxide on it. Rocket scientists in the Viking program have used hydrogen peroxide at White Sands for a couple of years without mishaps. "On the other hand," they say, "most of us have a lively respect for the potential dangers of hydrogen peroxide when not handled properly." Fires started by hydrogen peroxide being spilled on contaminated material can be easily extinguished with water.

WHAT Every AUTO MECHANIC Wants to Know

A motor vehicle is a machine of many parts, each part designed and constructed for its own special function.

All good mechanics, like good doctors, should know the working theory and operation of each part and understand what causes trouble and how to remedy it.

LET AUDELS AUTO GUIDE SOLVE YOUR PROBLEMS

Every auto mechanic, helper, serviceman and operator can use a copy of AUDELS AUTOMOBILE GUIDE. The information it gives saves time, money and worry. Highly indorsed by all users. It presents the whole subject of auto mechanics from A to Z in plain language and simple terms.

This Big Practical Book gives full information with working diagrams covering the principles, construction, ignition, service and repair of modern cars, trucks and buses.

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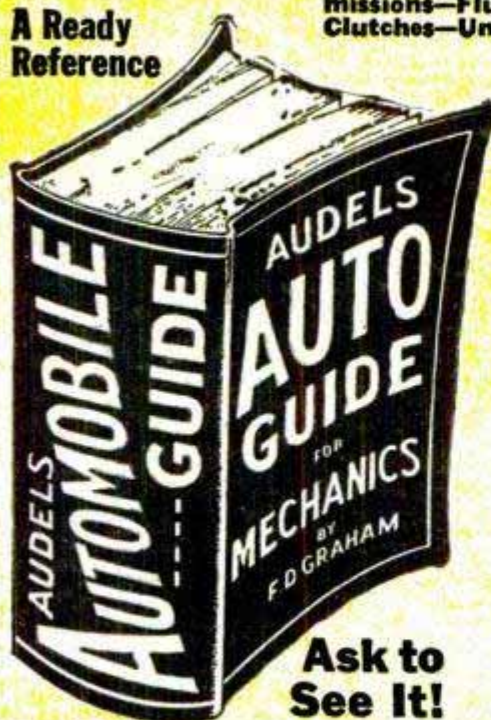
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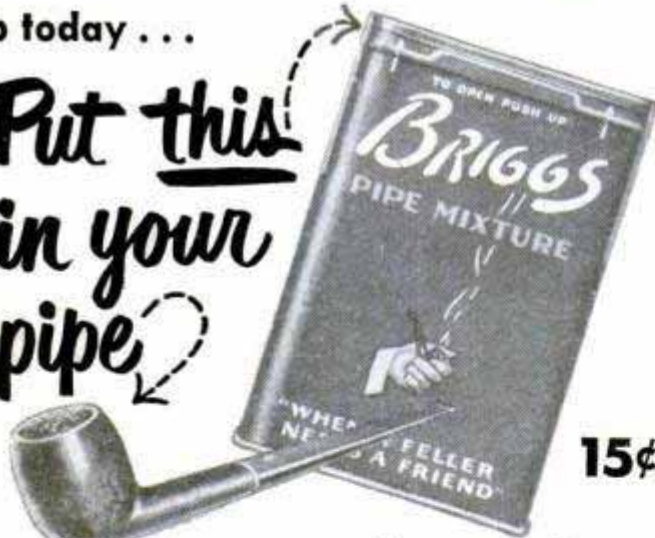
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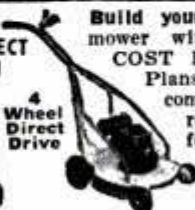
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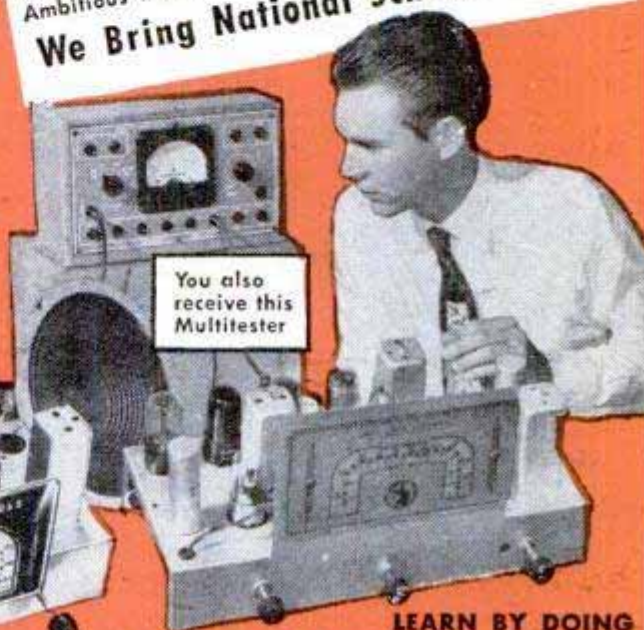
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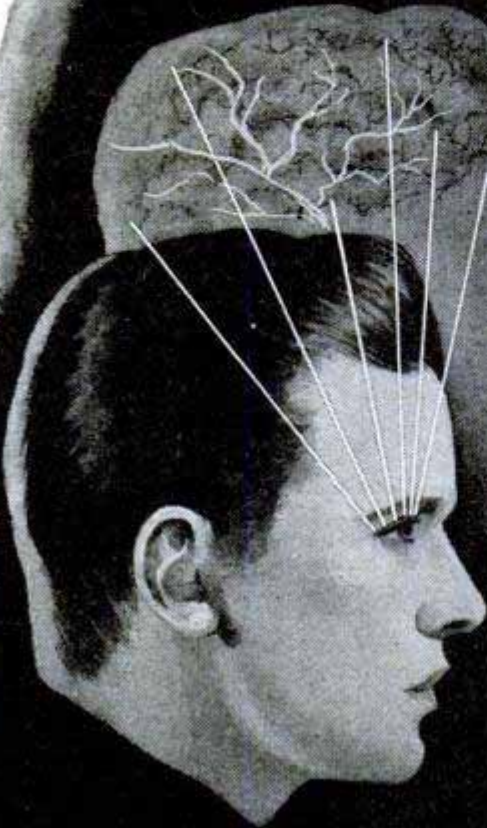
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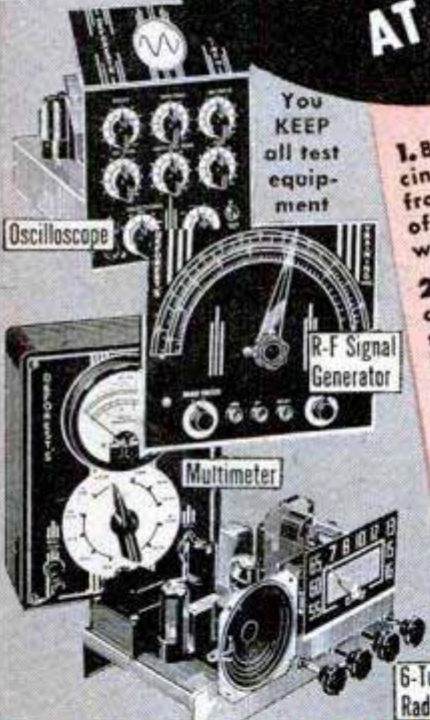
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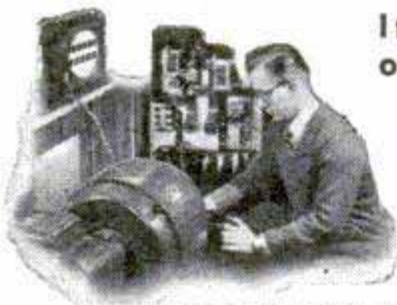
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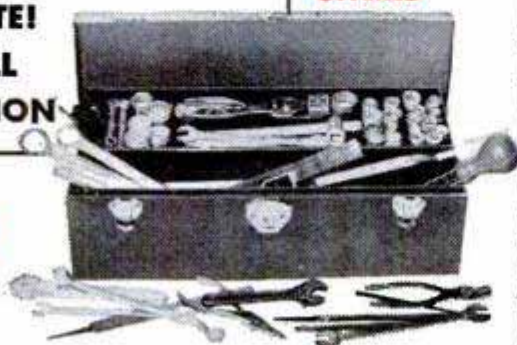
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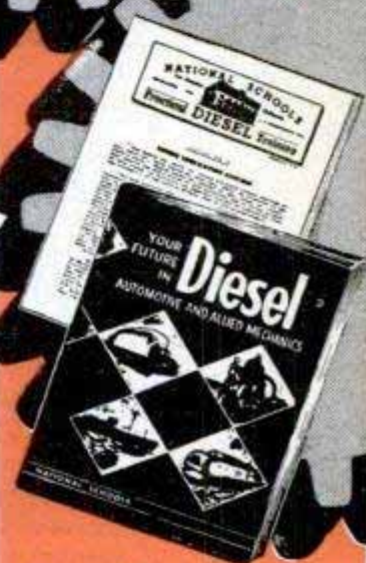
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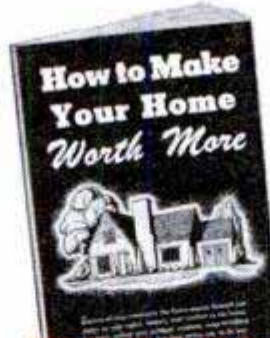
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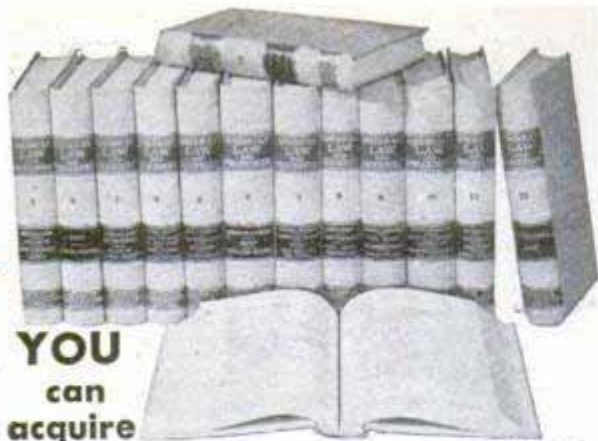
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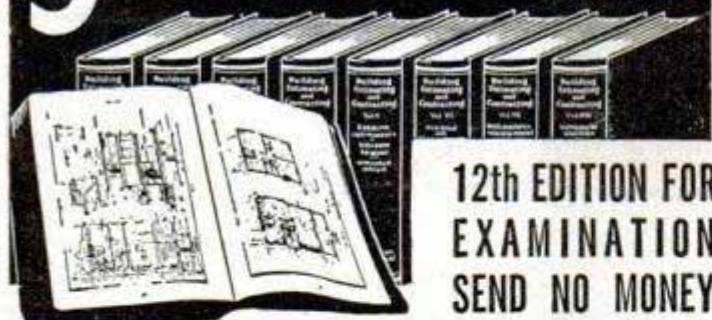
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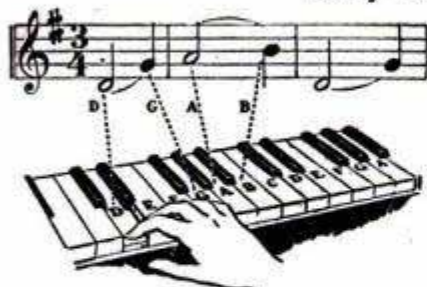


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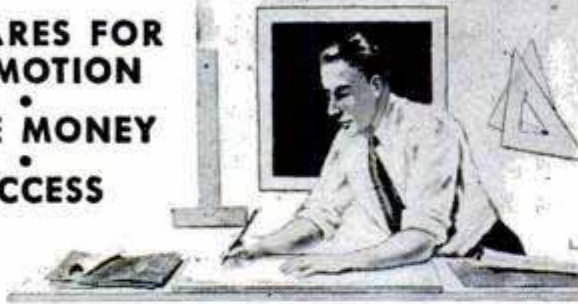
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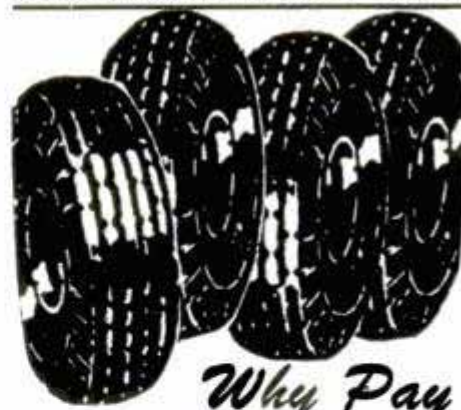
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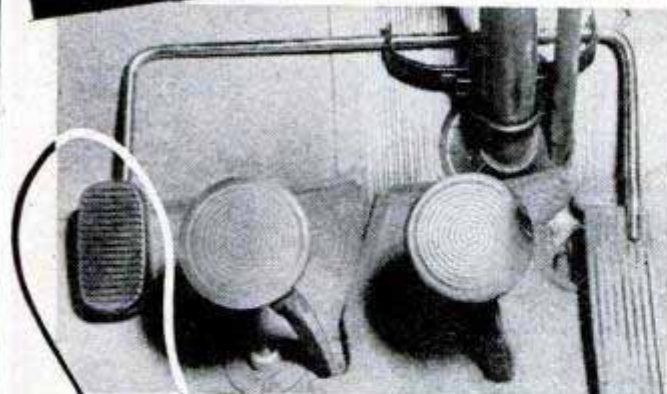
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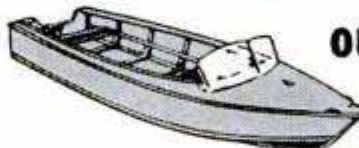
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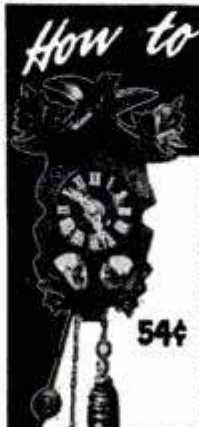
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COLOR Concrete with chemicals. Marble-glaze cement benches, pottery, garden ornaments. Home—shop. 10c brings sample, pictures. Hollywood Cementcraft, 8527-R Wonderland, Hollywood 46, Calif.

START Mailorder bookshop — Everything furnished. 25c brings booklet, samples, exciting ideas. General Publications, Ossining, N. Y.

THOUSAND Articles wholesale. "Supply Source Directory" 10c. Ideal Service, Park Ridge 30, Illinois.

BE Appointed state notary public now! Details. Stationers, Helotes 50, Texas.

OPERATE Profitable mail order business. Write Walter Service, 4159-A East 112th, Cleveland 5, Ohio.

DOLLARS In personalized baby record books. Sell by mail. Use same literature we do. No-Co-Ro, Oakland 6, Calif.

LEARN Professional candy making profitable home business. Details free. Pate, Kissimmee, Florida.

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

FABULOUS Earnings—Fascinating pastime. Growing genuine, living miniature (ming) tree. New sensational business or hobby. Astounding information free. Dwarf Gardens, Box 355B, Briggs Station, Los Angeles 48, Calif.

BRUSH Plating outfits connect to a battery. No tanks necessary. Good paying business at home plating autoparts, bathroom fixtures, bicycles, reflectors, silvering mirrors. No shop or experience required. Outfits furnished. Free booklet. Gunmetal Co., Ave. H, Decatur, Ill.

CASH For your idea, 280 manufacturers need inventions, patented or unpatented. List free. Invention Bureau, 208-M Clinton, Oak Park, Ill.

OWN A printing business. Good profit printing cards, stationery, etc. in spare time. Easy rules furnished. Have home shop. Send dime for complete printer's supply book and samples. Kelsey, Inc., Z-24, Meriden, Conn.

\$25 WEEKLY Working two hours daily. No canvassing. No manufacturing. Lycke, Box 2471-A, Cleveland 12, Ohio.

RECAST Old batteries into new. Latest achievements. Battery Laboratories, Minneapolis.

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

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

POPCORN And potato chip equipment. Long Eakins Company, 5160 High, Springfield 99, Ohio.

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

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

CO-PUBLISH And advertise in The Central Mail Advertiser. Sample copy 10c. Low rates. Large circulation. Bagby Printing Co., Georgetown, Ohio.

MAKE Money at home—Ideas galore to choose from. All fully illustrated and described. Write: Spens Distributors, Box 5511-M, Chicago 7, Ill.

BUY It wholesale! Manufacturers, distributors offer 850,000 items. Literature free. Olsen, 1231-A East Third St., Duluth 5, Minn.

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

RAISE Earthworms for gardening and fishing. Information with each order. \$7.00 per 1000. James Vetraino, 5826 Harding, Detroit 13, Mich.

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

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

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

COLORGLAZED Concrete pottery made without molds. Patented method. Cemetery products, novelties, tiles. Basement leak-sealing. Money-making projects. Booklet, details free. Men only. National Potteries Company, Grand Rapids, Minnesota.

MONEY in new greaseless doughnuts. Start in kitchen. No smoke. Sell stores. Free recipes. M. Ray Company, 3605 South 15 Ave., Minneapolis 7, Minnesota.

MONEYMAKING OPPORTUNITIES

DRAFTING Pays big money, is light, interesting work. Learn drafting at home in spare time. Professional set drafting instruments, portable drafting table, drafting equipment given you. Easy payment plan. Free book. Christy Trades School, 4432 N. Kedzie, Dept. DC-106, Chicago 25.

FIFTY Different mail order and hobby publications for only 25c. Information galore. Stevens, 716 West Fourth, Michigan City, Indiana.

MEXICAN Jumping beans 150% profit. Details. Mann's, 5330 No. Natoma, Chicago 31.

\$200 WEEKLY Reported! No selling. Free booklet. T. J. Surface, Roanoke 4, Virginia.

\$35 WEEKLY! Home! Two hours daily! Invisible reweaving instructions and 27 other amazingly unusual ways! Walsh, 894 Main, Buffalo 2, New York.

EARN Money at home with money-making hobby! No canvassing. Up to \$100 monthly, possible. 25c brings complete plan. Satisfaction guaranteed! Stevens Hobbies, 12-A Orchard, Wellesley Hills 82, Massachusetts.

EARN Important money, full or part time selling novelty tie clasp. Free details. Columbia Supply, 1060 Ferguson, Newport News, Virginia.

WOULD You pay 3%—first \$350 made? Book "505 Odd Successful Businesses" free! Work home. Expect something odd! Pacific-21, Oceanside, Calif.

MAKE Backyard profits! Unusual opportunities! Details free. Pickett's, Florence, Kentucky.

BUY 450,000 Articles wholesale. Directory 10c (refundable). Publishers, Box 1302-P6, Detroit 31.

DEFENSE Welding jobs pay. Welders needed. Train quickly. VA contract. Hobart Welding School, Box M-516, Troy, Ohio.

SELL! Buy! Trade! anything. Read, "Trading Post Magazine" 20c. Thorne's, 525 Dewey, Jackson, Michigan.

SELL Snowballs—\$7 buys ice shaver that shaves into the cup and enough flavor and cups for thousand Snowballs. \$2.25 buys buys regular shaver and flavor for 500. Illustrated circulars free. Snowball Company, 9334B Lemturner, Jacksonville 8, Florida.

CAN You make \$40 a week, typing at home, in your spare time? Write Hood's, Kannapolis 12, N. C.

WANT To sail merchant ships? Outstanding wages to \$400.00. Beginners \$220.00 monthly. Only \$3.00 delivers bargain. American Seamens Guide, 545 5th Ave., New York City.

OLD Car tires, turn them into dollars. Don't delay. Instruction 50c. Fenn, B61W, Readfield, Wis.

A Shortage? Hardware specialties, cutlery distributors prices. List items. Woodworth, Walworth, 1M5, N. Y.

HOME Electroplating units \$8.95. Includes tank, rectifier. Free details. Reed Engineering, 620 So. Inglewood, Inglewood, Calif.

MAKE Money while sleeping. Two column, penny candy or nut machines. Hurry for these beauties. Ellis, Box 167, Long Beach, California.

MAKE Money at home. 101 ideas for full or spare time earnings. Proven winners. All for 25c. Thomas F. Patrick, c/o State Farm, Pikeville, Tennessee.

"WATERLESS (Lanolin) Hand Cleaner." (Oil base.) Make, sell. No machinery. Build profitable business. Complete formula \$1.00. Ideal Service, Park Ridge 3, Ill.

DOLLARS Three ways with "Kitty-Kat" readi-cut baby shoes. Complete local and mail order plans. Write No-Co-Ro, Oakland 6-K, California.

RAISE Your business value, standing, as state notary public. Information. Stationers, Helotes 50, Texas.

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

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

INDEPENDENT Income! Make leather belts, billfolds, purses. Big catalog and genuine steerhide keyholder, 10c. Tandy Leather, Box 397E, Tulsa, Okla.

LEARN How others earn money at home! Write—A. Sizemore, 4917 Kostner, Chicago 30, Ill.

QUICK Profits taking magazine subscriptions, handling greeting cards. Cassell Publishers Service, Westfield, N. J.

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

FORMULAS, PLANS, ETC.

A Mechanic's hand cleaner. Make your own. No sand or ammonia. Costs approx. 10c per lb. Used by mechanics and machinists for years. \$1.00 brings instructions. Vilnox, 300 N. Gay St., Knoxville, Tenn.

FORMULAS Unlimited. recipes, trade secrets, processes. 3c stamp brings literature and 5 household formulas. American Home Service, Box 96, Cresco, Iowa.

FORMULAS. Latest, best. Catalog and chemical instruction sheet 10c. (refundable). Nelko Chemical Service, 3462-F Merchandise Mart Sta., Chicago 54, Ill.

MILLER'S Modern manufacturing formulas make products that get the business and pay! Fifty years supplying the best. Literature free. Liscomb Miller, Chemical Building, Tampa, Florida.

WATERLESS Hand cleaner. (No ammonia.) Easily made. Good profit. 2 dependable formulas \$1.00. Nelko Chemical Service, Box 3462HC, Chicago 54, Ill.

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

MAKE—Sell cleaners, soaps, polishes, flavors, cosmetics. No machinery. Formula literature free. Kemico, Park Ridge 16, Illinois.

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

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

PLASTICS

PLASTICS—This catalog is your bible. Wholesale, retail quantities. Lucite, plexiglas, acetate, sheets, rods, tubes. Casting, molding plastics. Dye manufacturer. Internal carving supplies. Findings, supplies. Catalog, 10c. 25c airmailed. Gem-O'-Lite, Box 6862, North Hollywood, Calif.

\$200.00 BUYS 399 Sheets 20" x 50" ruby transparent 7½ gauge. Thomas, 4884 Felton, San Diego, Calif.

MOLDING Rubber, \$2.95 qt.; \$9.95 gal. prepaid. Plastercraft Supply Co., 3051 St. Clair Ave., Cleveland 14, Ohio.

HI-Profits, internally hand carved plastics, gifts, jewelry. Free catalog. Pilot Plastics, 67 C-Fulton St., New York City 7.

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

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

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

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

CHEMICALS And apparatus for industrial, analytical, and private laboratories. Catalog 15c. Dept. M-50. Biological Supply Co., 1176 Mt. Hope Ave., Rochester 20, N. Y.

HELP WANTED

\$5 HOUR Easy! Sell name plates for houses. Free sample, order blanks. Write: National, 214 Summer, Boston, Mass.

AGENTS WANTED

IS \$210 A week worth a penny postcard to you? Then rush card with name and address for special free trial plan that sells amazing new automatic refrigerator defroster "like hot cakes!" Write to Mr. Lewis, D-Frost-O-Matic Corp., Dept. PMC-5, 6 N. Michigan, Chicago 2, Ill.

MAKE Money easy. Sell everyday cards, 21 for \$1.00, black plastic, metallic and others, children's books, personalized stationery, note paper, wrappings and novelties. Send for samples today. Howard P. Ellis, Dept. PM-5, Pitman, N. J.

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

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

FREE Sample nylon stocking of world's only nationally advertised hosiery line actually guaranteed against runs, snags or excessive wear, regardless of cause! It's amazing but true. Every weight from sheerest 15 denier to heavy 70 denier—all gauges to luxury 60 gauge. Amazingly low prices, starting at \$1.08 prepaid for sheerest 15 denier 51 gauge. Not sold in stores. Good Housekeeping guarantee seal. Also complete line men's hosiery guaranteed one full year or replaced free. Full variety lingerie in crepe, satin and nylon, featuring all nylon slip at \$2.95, satin slip at \$1.58, etc. Housecoats and robes. Kendex sales people will earn one million dollars this year. Get your share. No money or experience needed. Pay nothing now or later. Just show free outfits. Write orders. We deliver and collect. Advance cash plus huge bonus. Earn money spare or full time. Become manager; appoint others to sell for you; earn steady income on their sales. Man or woman—young or old, you can earn more money than you ever thought possible. Everything you need is furnished free and prepaid, including nylon stocking, samples of materials, sales books, 36-page salesmanual, color cards, etc. Simply write your name and address on postcard and mail to Kendex Corporation, Babylon 53, N. Y.

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

SCARCITY Line. Power mowers—\$59.95. Sensation. Special deal—delivered. Rotacut-RP, Excelsior Springs, Mo.

SELL Gold wire jewelry. Fast profit. Repeats. Free outfit offer. Phillips Jewelry, Belleville, Michigan.

SO Easy to sell what everyone wants, when they can get it only from you. That's why ReSilvit, the scientific new magic compound, is pouring big profits into pockets of agents and demonstrators. Spare and full time openings. Quick action needed. Get free details today. American Enterprises, 156 East 52nd Street, New York 22.

FERTO-Pot, plant late pot, and lawn-seeded Ferto-Soil, for patching or building new lawns. Commission 33½%. Allen Co., Pittstown 2, N. J.

MEXICAN Feather pictures. Unusual novelty. \$1.00 (stamps) brings \$2.00 worth samples. Refunded if unsatisfied. Aztec Art P, Apartado 762, Mexico City, Mexico.

AGENTS 110% Profit selling new precision built Addomatic adding machine. Adds to 999,999 accurately. Only \$10.00. Artcraft Industries, Westmont, Illinois.

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

BUY Thousands of nationally advertised products direct from manufacturers and distributors. Write for "Buy Direct and Save." Service Publishing, 1420-A Investment Bldg., Pittsburgh 22, Penna.

YOU Teach Hawaiian woodwind in 10 weeks. Musical instrument including course \$20.00. B. E. Richman, 5516 Chester Avenue, Philadelphia, Penna.

BUY Wholesale. 25,000 items, catalogue 25c. Matthews, 1472B1 Broadway, New York City.

BUY Nylons direct from mill. Make good profits on fast selling nylons. Quick delivery on any quantity. Write for confidential wholesale price list. Joy Hosiery Mills, Delawanna 13, New Jersey.

MEXICAN Feather pictures. High profit selling gift shops, etc. Adelphi, Box 57-B, Bellefonte 6, N. Y.

HI-Profits, internally hand carved plastics, gifts, jewelry. Free catalogue. Pilot Plastics, 67C-2, Fulton St., New York City 7.

100% PROFIT. Easy repeat sales. Cash bonuses. Sell embossed business cards. Free information. Economy Printing, 23-P W. 6th, Eugene, Oregon.

GREETING Card bargains. Personalized gift items. Raum's, 4154 Fifth Street, Philadelphia 40.

NYLONS—New "2500-High-Twist" nylons. Direct from mill. Free sample outfits. Guaranteed longer wear, resist runs and snags 40% more. Its 40 turns per inch "High-Twist" in 2500 threads, by laboratory tests prove they outwear all the others. Just few months ago it was believed impossible. We now sell more stockings than ever before. Earn \$1.00 a box, or make more money buying dozen. Box 3 (60-15) \$3.40; (51-15) \$3.15 prepaid. Amazing new "3-step" plan gets orders for nylons. Hand-over fist! Ergim Hosiery Mills, 992-PM Columbus Ave., New York.

MAKE Hollywood stars perfume at home. Big profit. Full information. Write Emly Mfg., P.M.-12, Box 319, North Hollywood, California.

ULTRA-Blue stock signs—6c, sell 35c. 1000 slogans, 7"x11", comedy, religious, general. Free sample. Lowy, 812-MY Broadway, New York 3.

AGENTS: Sell lawn-mower sharpeners to home owners. Write for details. Accurate Sharpener Mfg. Co., Milwaukee 12, Wisconsin.

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

SELL Greeting cards—Big profits! Quick sales! Catalog free! Elfco, 432 North Wells, Chicago 10.

FREE Samples. Big profits showing amazing "Glow-in-the-dark" specialties. House numbers, pictures, plastic novelties, ashtrays, keyholders, religious and nursery objects, etc. Madison Plastics, 303 Fourth Ave., New York 10, N. Y.

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

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

JEWELRY Factory desires salesmen, distributors, jobbers. Pickcraft, 19 Bank Street, Attleboro, Mass.

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

\$5 HOUR Easy! Sell name plates for houses. Free sample, order blanks. Write: National, 214 Summer, Boston, Mass.

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

DRESSES. 18c; Coats \$1.00, blouses 35c. Free catalog. Crown, 164-P Monroe Street, New York.

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

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

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

BIG Spring sales! Scat Wick Deodorant gets rid of unpleasant odors quickly. Sample Scat and Kitty \$1.00. Write for 16-page catalog of household items. Sunshine Sales, Dept. WP-8, Loudonville, Ohio.

PAINTS—All kinds. 65c gallon up. Private label. Big profits. Certified Products, Louisville, Ky.

HIGH-GRADE SALESMEN

ADVERTISING Book matches—Cash in on big demand; sell union label matches. Cuts for all businesses and political parties. Free powerhouse selling kit, low prices, protection guaranteed on repeat orders. Cash commissions. Superior Match Co., Dept. M-551, 7530 Greenwood, Chicago.

WRITE 3 Words—Collect \$7.65 on 10-second demonstration to merchants. Write on glass with amazing magic crayon—Presto! 5 color advertising message takes fire, glows like brilliant neon. Three sales daily bring \$22.95 profit. Rush postcard for details. Complete sales kit, free! Max-lume Co., 125 W. Hubbard, Dept. CL-85, Chicago 10, Ill.

EARN Big money fast! Sell finest-quality advertising work uniforms to garages, factories, filling stations, etc. Free selling kit. Topps, Dept. 535, Rochester, Ind.

IS \$210 A week worth a penny postcard to you? Then rush card with name and address for special free trial plan that sells amazing new automatic refrigerator defroster "like hot cakes!" Write to Mr. Lewis, D-Frost-O-Matic Corp., Dept. PMC-5, 6 N. Michigan, Chicago 2, Illinois.

MAKE Over \$100.00 weekly, demonstrating and taking orders for fun-provoking advertising rubber dollars (stretchers), designs, slogans, rhymes, to clinch orders for any business, with worth-while cash deposit. Headquarters for unusual, dramatic, attention-compelling ad-specialties. Write for sales kit. Meinhardt Co., 421 Lincoln Ave., Dept. PM, Chicago 18.

AD Matches! Sell amazing designs—20, 30, 40 and 240-light book matches. Bigger spot cash commissions; every business a prospect. Low prices for high quality. Repeats. Start without experience; men, women; full, part time. Buy nothing! Sales kit furnished. Match Corp., Dept. PM-17, Chicago 32, Illinois.

WANT To make real money? You can positively make \$50.00 a day and up selling a brand new item going to every type of food and beverage store, factories, laboratories, hospitals, etc. First time advertised. Write for free details today. Johnson-Hartman, 53 West Jackson Blvd., Dept. PM-5, Chicago 4, Illinois.

PART Time or side line salesmen to represent factory selling advertising pencils. 25% commission. Union Pencil Co., 389 Broadway, New York City.

EVERY Woman wants lovely monogrammed personal stationery. Easy profitable sales. Show samples for immediate profits. Carson Products, 15-D East 8th St., Kansas City 6, Mo.

SELL Our waterproofings, floor mastic, cement hardener, etc. (30 items) to maintenance men, building owners, contractors. Can start part time. Commission. Territory. Write Haynes Products Co., Desk 6, Omaha 3, Nebr.

BIG Profit selling perfumes. Trial oz. \$1.00. Details free. Roberts, 432 Fremont Ave., Springfield, Ohio.

"MARY-Mac" gas water heaters—Factory. Steady income. Permanent. McDaniel Manufacturing, 1012 Powhattan, Dallas, Texas.

\$2600 NEXT 9 Weeks—Season starting. Sell calendars, specialties, matches. Prospects everywhere. Advanced commissions. Experience unnecessary. Samples free. Continental Calendar, 542-A South Dearborn, Chicago.

BIG Money taking orders. Shirts, ties, Sox, pants, jackets, sweaters, shoes, uniforms, etc. Sales equipment free. Experience unnecessary. Nimrod, 4922-AN Lincoln, Chicago.

A Fine income, your own nylons free! Show nylons, lingerie, men's socks with amazing free replacement guarantee against runs, snags, tears. Write for free sales kit. Group organizers invited. Rosalee Hosiery Co., Clifton 58, N. J.

\$5 HOUR Easy! Sell name plates for houses. Free sample, order blanks. Write: National, 214 Summer, Boston, Mass.

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

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MAKE Up to \$35-\$45 week as a trained practical nurse! Learn quickly at home. Booklet free. Chicago School of Nursing. Dept. M-5, Chicago.

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

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INVESTIGATORS Trained, men-women. learn fascinating profession. Spare time study. Big pay. Folders free. Investigator, Box 490, Times Square Station, New York 18, N. Y.

LEARN Sign painting. 152 lesson course. Results guaranteed. Stewart Sign Co., Box 287M, Pasadena, Calif.

DRAFTING Jobs available. Qualify at home. Information free. Write today. Monroe Institute, PM-5, Alton, Illinois.

DEFENSE Welding jobs pay. Welders needed. Train quickly. VA contract. Hobart Welding School, Box M-514, Troy, Ohio.

WELDING Training profitable. Learn quickly. Magnificently equipped non-profit school. VA contract. Hobartweld, Box M-515, Troy, Ohio.

AMAZING, New, scientific way to remember. Free details. Memory Institute, P.O. Box 261-M, Staten Island 1, N. Y.

MEMOROLOGY, Science of memory, amazingly simplified \$1.00. Money back guarantee. Memorology Studio, 2016 Sunnyside, Chicago, Illinois.

WAKE Up your success powers. End money worries. Overcome handicaps. Get ahead. Our Behavior Control home study plan produces results or no cost. Free booklet and details. President Ballard, 1008 Washington Bldg., Louisville 2, Ky.

WORK For U.S. gov't. Thousands of emergency program positions open. Men-women. Experience usually unnecessary. Qualify now! Start high as \$66.34 week. Free 40-page book shows jobs, salaries, sample tests. Write: Franklin Institute, Dept. T24, Rochester, N. Y.

EARN While you learn. Day or night classes. Thorough courses in: Automobile Mechanics, Diesel Mechanics, Motor Tune-Up, Auto Body and Fender, Welding, etc. Living accommodations. Veterans may earn \$210 to \$290 per month while in school including subsistence. Fully accredited to train veterans. Thirty-two years' experience training men. Nashville Technical College, Dept. #256, Y.M.C.A. Bldg., Nashville 3, Tennessee.

RAPID Writing, like shorthand. Lessons ten cents. Elliott, 4426 Carrollton, New Orleans.

YOU For president of your own credit-collection business. Many who answered our ads now have their names on office doors. Franklin Credit, Roanoke 7, Va.

PIANO Tuning pays. Learn this profitable profession at home. Our Tunometer and mechanical aids make learning easy. No knowledge music necessary. Diploma granted. Largest and oldest school—53rd year. G.I. approved. Write for booklet. Niles Bryant School, 78 Bryant Bldg., Washington 16, D. C.

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EARN \$10,000 Annually! Learners \$2,700. Unlimited opportunities in Merchant Marine. Instruction-Employment Manual \$1.00. Refundable. Titan Company, 45 Clinton St., Newark 2, N. J.

INVESTIGATOR Training. Phillips Secret Service System, 1917-B North Kenneth, Chicago 39.

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

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

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USED Correspondence courses and educational books bought, sold, rented. Catalog free. Educational Exchange, Summer-ville, Ga.

STUDY To be a doctor of psychology or metaphysics. Obtain Ps.D., Ms.D., D.D. or Ph.D. degree. Chartered by state. Write for free book telling how. The Neotarian Fellowship, Desk 8, Dwight Building, Kansas City 6, Missouri.

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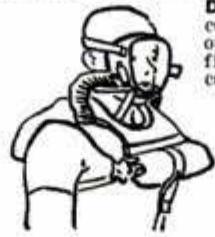
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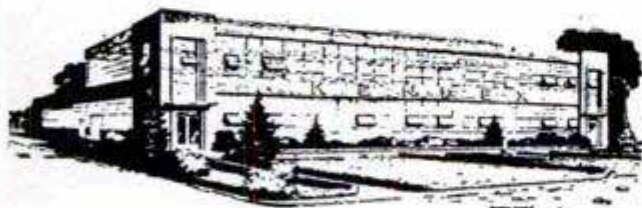
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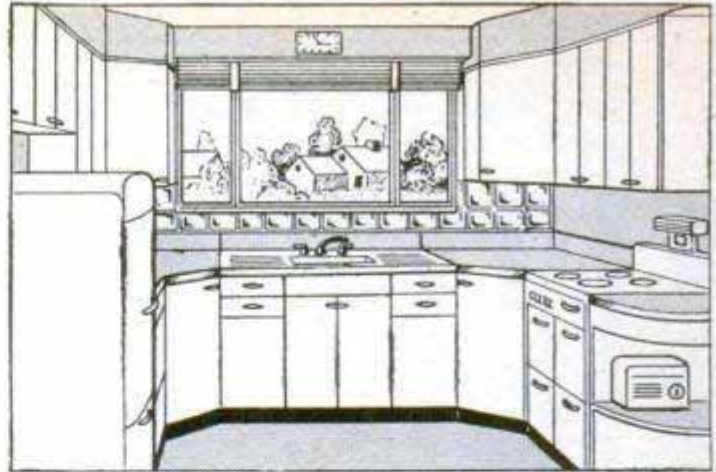
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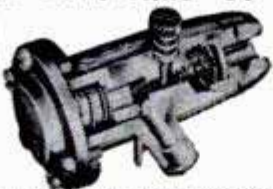
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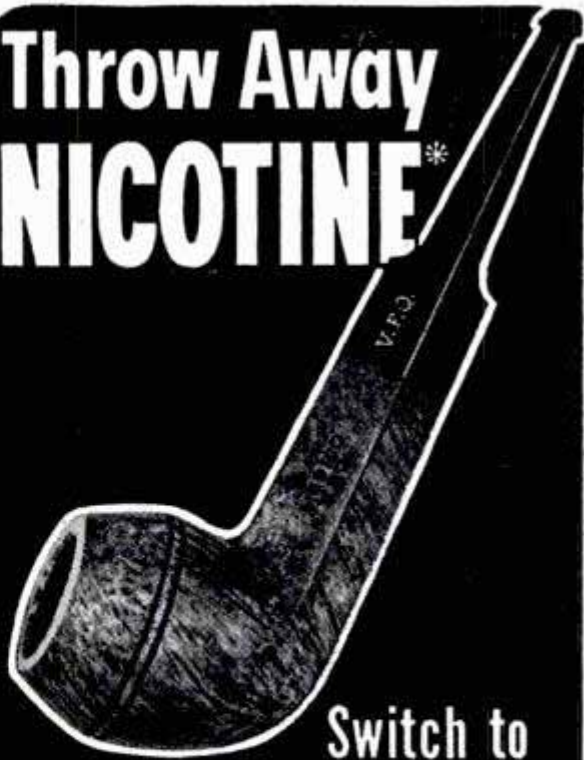


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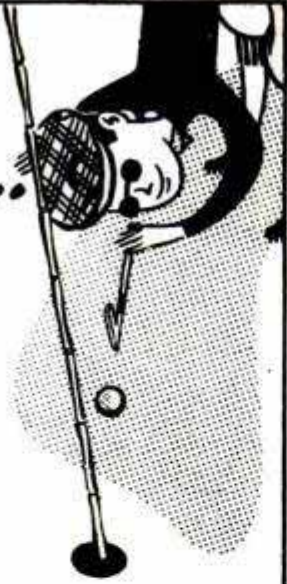
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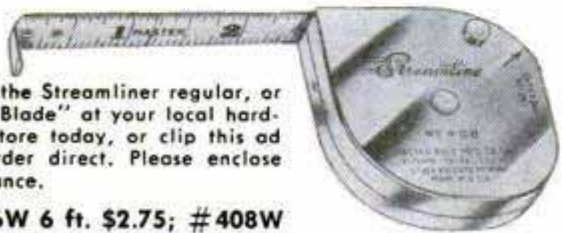
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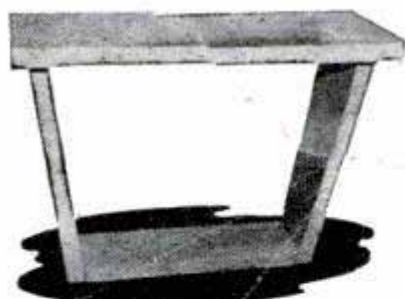
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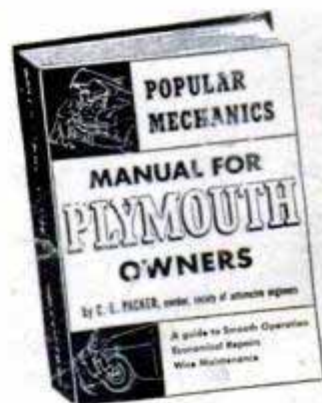
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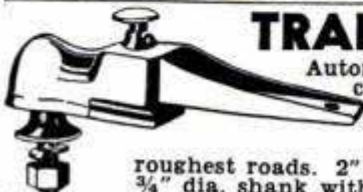


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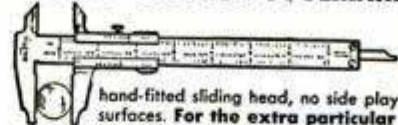
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SWEDISH ALCOHOL STOVE — The Punker cooks a good meal whether in camp or during an emergency. Made of galvanized steel with brass fittings. Burns like gas. Specify enamel top for home use or galvanized top with guard rail for marine use. Style 11 AA with DOUBLE BURNER \$17.90.

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BY RESTORING WORN PISTONS TO ORIGINAL FIT AND EFFICIENCY**

Perfect Circle's new Nurlizing process greatly reduces the cost of engine overhauls by making old pistons re-usable—with absolute safety.

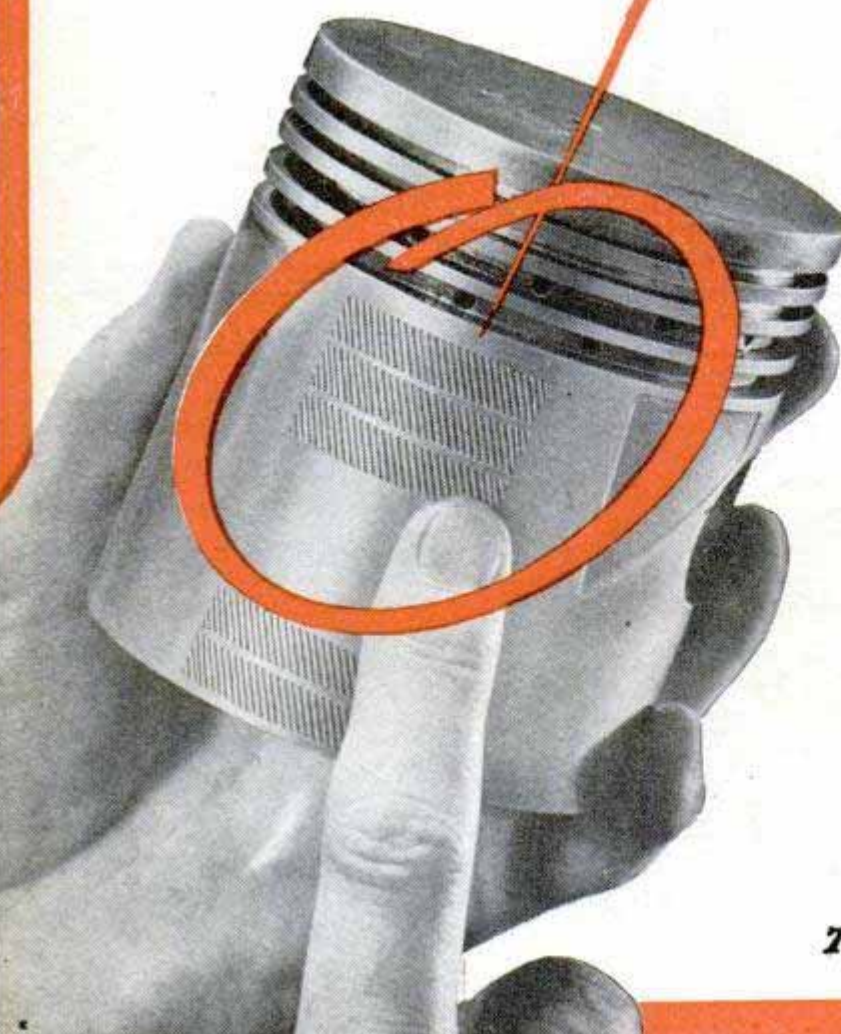
At last, worn pistons can be resized for close, correct fit in cylinders without danger of scuffing or scoring! This restored fit means *restored power* and eliminates piston slap—and the interrupted surface of the Nurlized piston assures better lubrication at all times.

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The Most Honored Name in Piston Rings



DOCTOR KIRK: This is the Oakland police. We'd like some help on a murder case. Would you examine two coats and a pocket knife if we bring them over tonight?"

Dr. Paul L. Kirk sighed as he put down the phone. As professor of biochemistry at the University of California he was in the midst of writing a paper on "micro and drop scale titration of oxalate." He'd have to drop that, he supposed, while he solved this latest police puzzle.

The officer who delivered the evidence told Doctor Kirk what had happened. Someone had broken into a residence by smashing a window, surprised the owner, and stabbed him.

The brown coat that the officer held in his

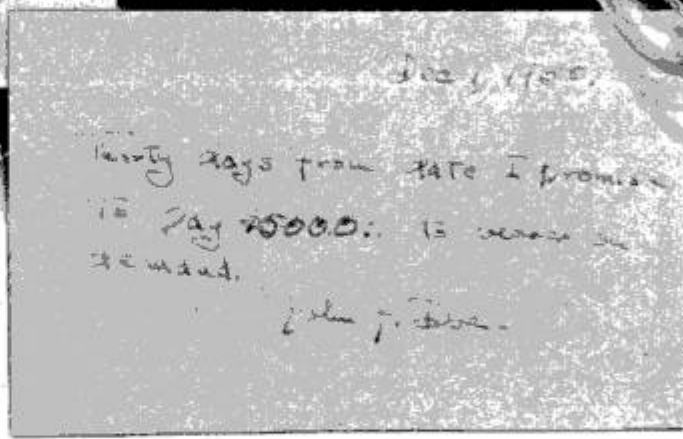
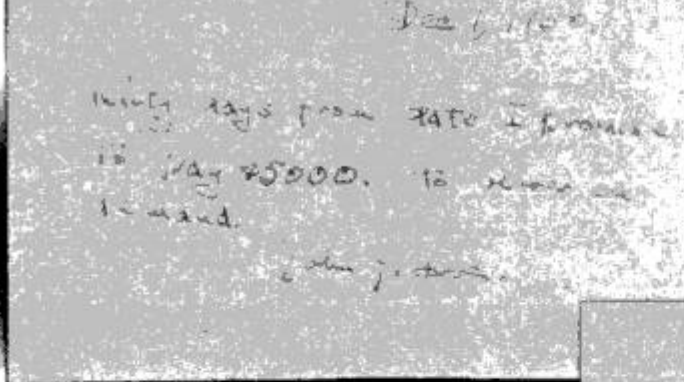
Sherlock Holmes of the California campus is Dr. Paul L. Kirk, a fabulous man who doubles as professor of biochemistry and criminalistics

Quick, Watson, the Micromanipulator!

By
Thomas E. Stimson, Jr.

How can you weigh an invisible speck that will tip scales at less than a thousandth of a millionth of a gram? Dr. Paul L. Kirk assembles a quartz torsion balance that will perform the operation. He is wearing magnifying glasses to see tiny rods





Here is an example of a \$50.00 promissory note that was raised to \$5000 by using ordinary laundry bleach. Fumes of ammonium sulphide used on the paper show (at right) how the original writing appeared

hand had been worn by the slain man; the other, a green coat, had been taken from a person who the police suspected had committed the crime.

Specifically, the police wanted to know if the two coats had been in recent contact with each other, as during a struggle, and whether the knife that was found on the body belonged to the suspect.

Doctor Kirk had his answers shortly after midnight. Using a dust collector of his own design that he attached to a vacuum cleaner, he cleaned the front of one coat and placed the debris that he got from it in a container. Then he cleaned the other garment.

Each coat yielded a small pile of dirt, dust, cloth fibers and miscellaneous material. With a strong glass and a microscope the scientist began to examine this evidence.

The debris from the green coat contained hundreds of green fibers, as could be expected. With them, however, were numerous brown fibers that were identical with fibers from the brown coat. Contrariwise, the brown coat yielded bits of green material that exactly matched the yarn of which the green coat was made. It was apparent that the two coats had been in rubbing contact with each other.

The debris from the green garment also contained some tiny fragments of glass. Whoever had worn the coat probably had broken a window quite recently.

Final evidence came from the knife in spite of the fact that it had been wiped clean of fingerprints. Doctor Kirk scraped from the inside of its case a small amount of debris and compared this material with the lint, dirt, tobacco crumbs and other substances that he vacuumed from the left pocket of the green coat. The proportions

didn't match. Then he tried the right pocket. This time the ingredients were identical. The man who wore the green coat was indisputably linked with the knife and the slaying.

Short, wiry, bursting with energy and perpetually busy, Doctor Kirk is a fabulous character on the U.C. campus. He is not only professor of biochemistry but also professor of criminalistics in the university's school of criminology. He is one of the few educators in the country who holds a full professorship in two unassociated fields. Essentially, he says, he is a gadgeteer who likes to devise equipment that will help solve research problems.

As an offshoot of biochemistry he became a pioneer and leader in ultra-microchemistry, the science of studying bits of matter that are much too small to be analyzed by ordinary methods. He designed his own micromanipulators for handling fragments of material that are visible only in the field of a microscope. Another time, he attached a magnetic vibrator to a glass rod that is hardly thicker than a hair so that he'd have a tool with which to stir a fraction of a drop of liquid. Today, many of his ultramicro tools are being manufactured commercially in Berkeley.

One of Doctor Kirk's Tom Thumb laboratories can fit into a suitcase, in contrast to the usual chemical lab that often spreads over several rooms. Ordinary units of measure are too cumbersome for ultra-microchemistry and new terms have had to be created. A lambda, for instance, is equal to $\frac{1}{1000}$ milliliter. A gamma represents $\frac{1}{1000}$ gram.

During the war an important part of the atom-bomb program was stymied until he was called in. The fission experts had pro-

duced their first tiny speck of plutonium and the next step was to learn how it would react in various chemical combinations. This was possible only by weighing the sample before and after treatment, and as yet there was no balance or weighing machine in the world that was sensitive enough. The entire amount of plutonium could hardly be seen by the naked eye.

To weigh it, Doctor Kirk designed and built a new kind of machine that can weigh an invisible amount of matter.

His delicate instrument is sensitive to five thousandths of a millionth of a gram, and it takes about 28 grams to make one ounce. The mere act of loading material onto the pan of the instrument often must be done under a microscope. It's called a quartz torsion balance.

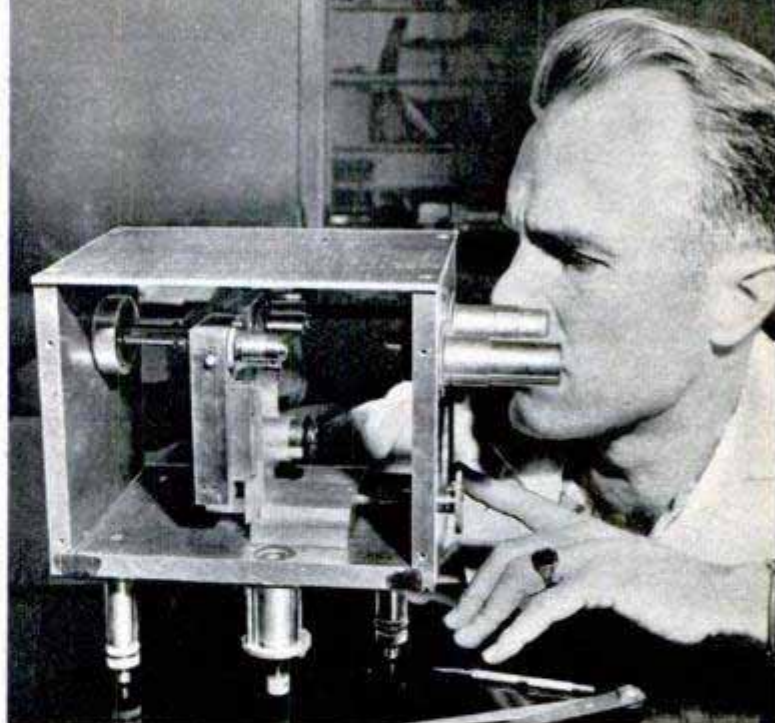
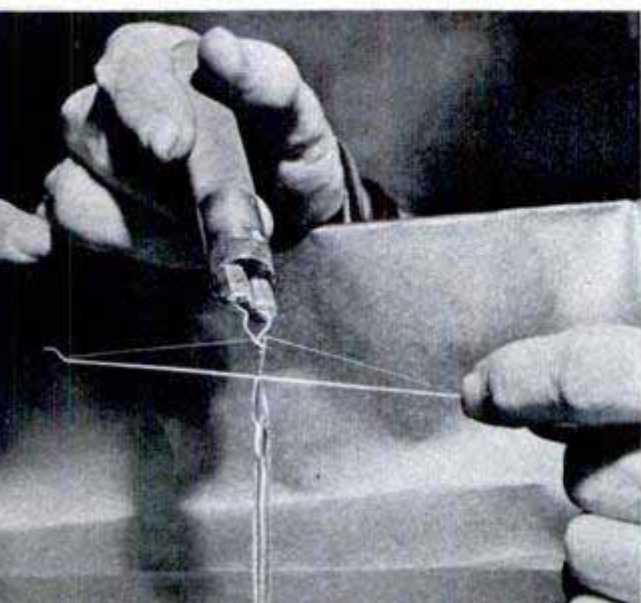
Thin fibers of quartz glass were used for construction because quartz is the strongest material in relation to weight that could be used. The main beam of the balance is four inches long, is not much thicker than a human hair, and is reinforced by a cantilever strand that is even finer.

At each end of the beam is attached a suspension member that is so thin that it can't be seen unless it's held at a certain angle against a light. Even then you don't see the fiber itself, simply the diffraction band of light that the fiber creates. Appropriately, parts of the balance were built with the aid of a gas flame that was too small to be seen by eye alone.

"The finest of the quartz fibers were created by placing a quartz rod in a large gas flame," Doctor Kirk remarks. "The flame itself did the blowing. Molten quartz streamed upward in the form of a minute rod, so light in weight that the heat of the flame projected it against the ceiling where it collected.

"We hunted for the fibers by looking for their diffraction bands against a light. When we found a piece we would tab an

Main beam of sensitive balance consists of thread of quartz-glass rod. The tool is an electric heater



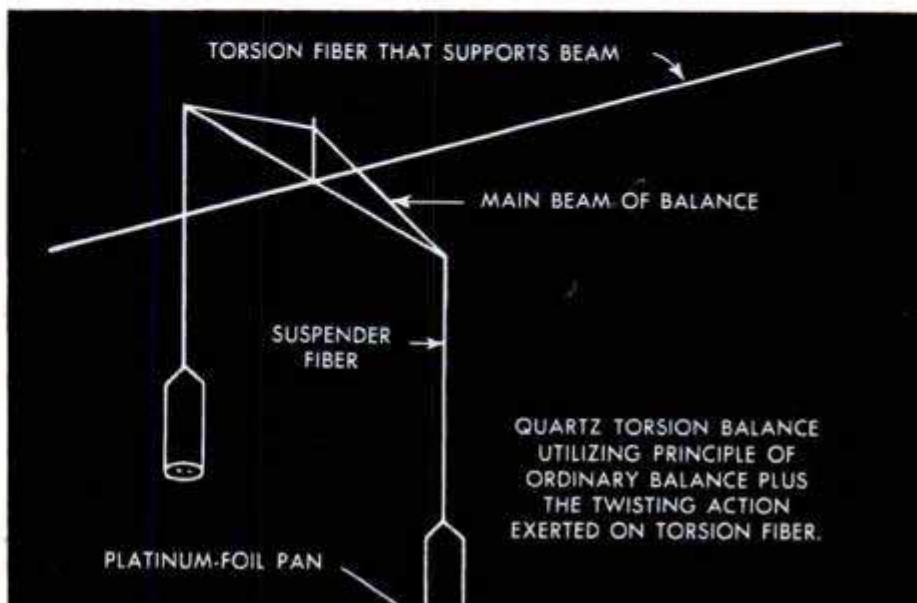
Heavy metal case houses balance for weighing invisible bits of matter. Case has built-in microscopes

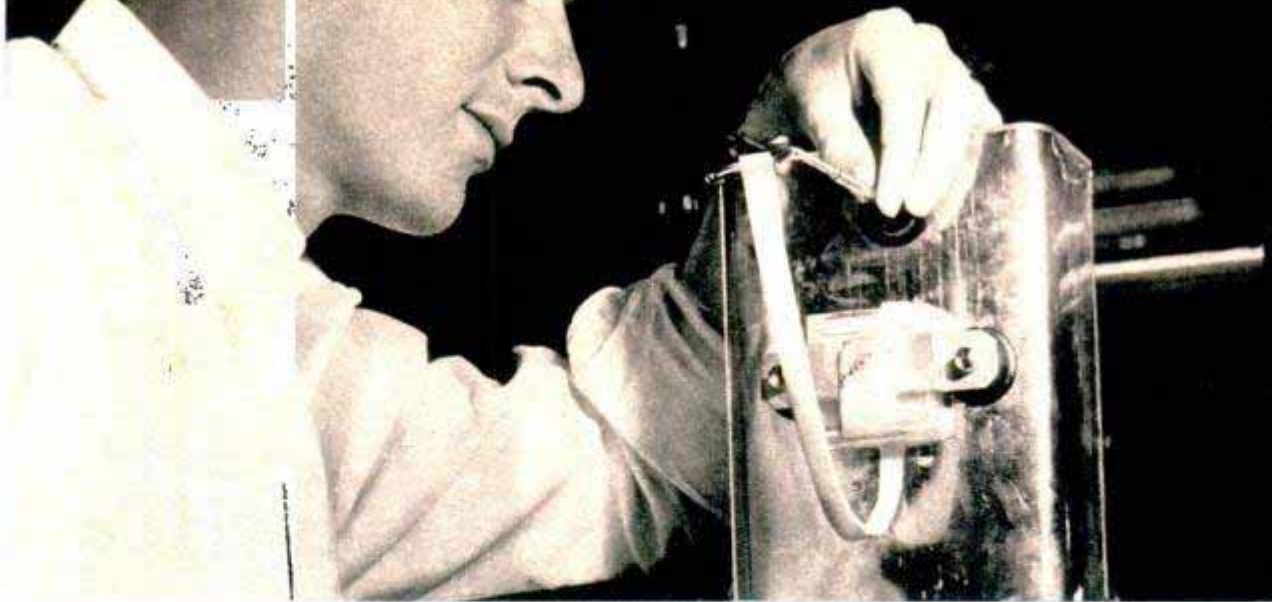
end with cellulose tape. The bit of tape served as an anchor and also told us where the rod was. Final selection of short lengths was made under a microscope."

The quartz balance is a combination of an ordinary gravity balance and a torsion balance. The torsion member is attached at right angles to the center of the beam and the torsion member twists under load. The instrument is mounted in a heavy metal case that also contains built-in microscopes for taking the readings.

The original speck of plutonium proved to weigh four micrograms. Doctor Kirk built four ultramicrogram balances in all for the AEC and since then others have been built for that agency. Now Doctor Kirk is trying to borrow one that isn't in use. Unless a lot of red tape can be untangled he'll have to build his own, a long task for which he can hardly spare the time.

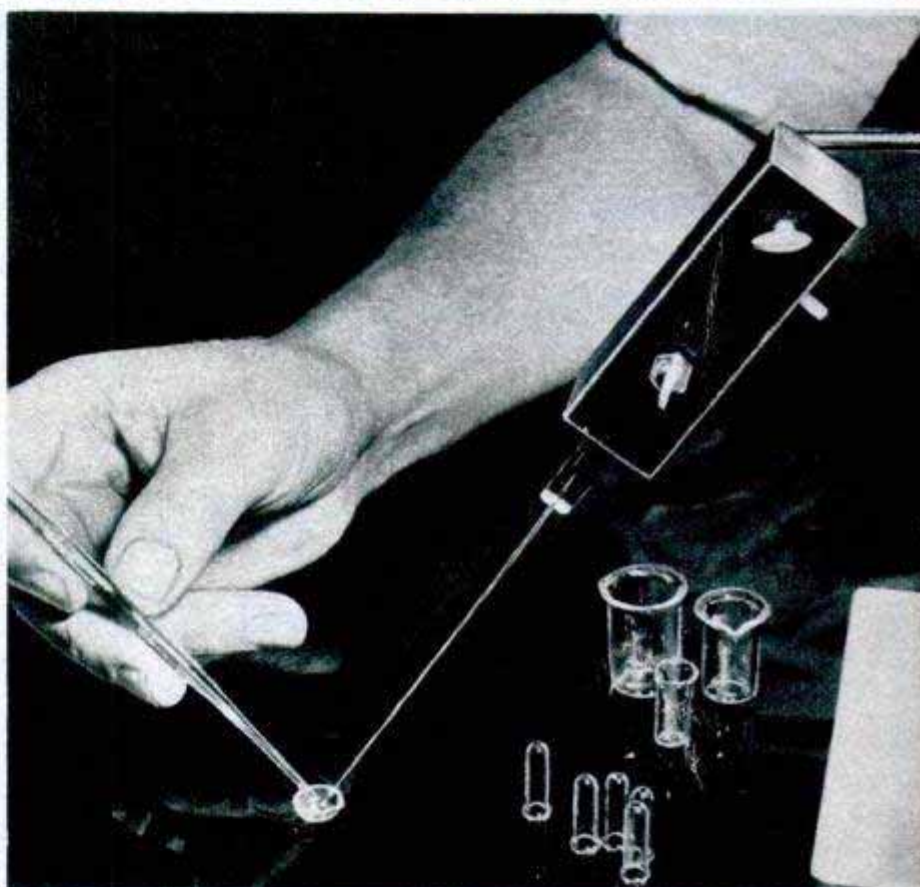
Long slanting line in diagram represents the glass fiber which twists to reveal weight on the "scales"



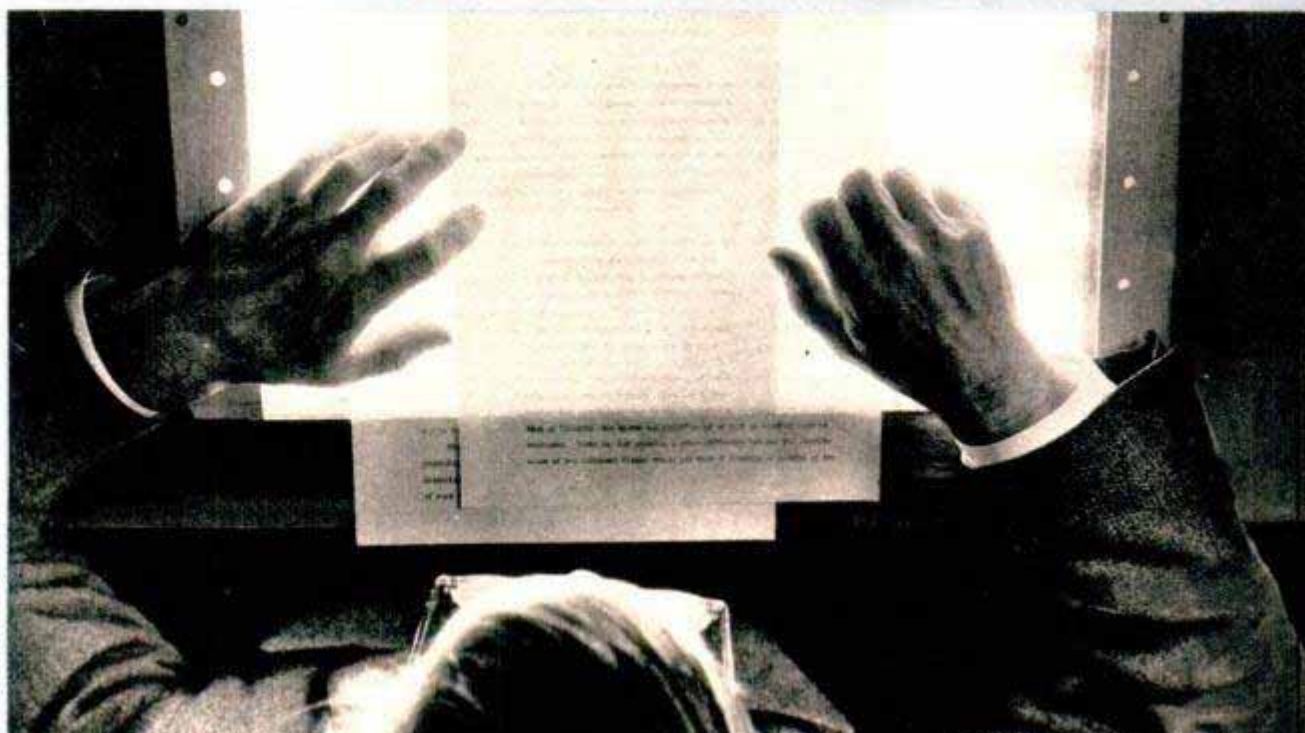


Above, filter-paper apparatus is used to remove smear of blood for analysis from a gasoline can. The device is held to the can by rubber suction cups and has a moistened pad to wet paper and blood

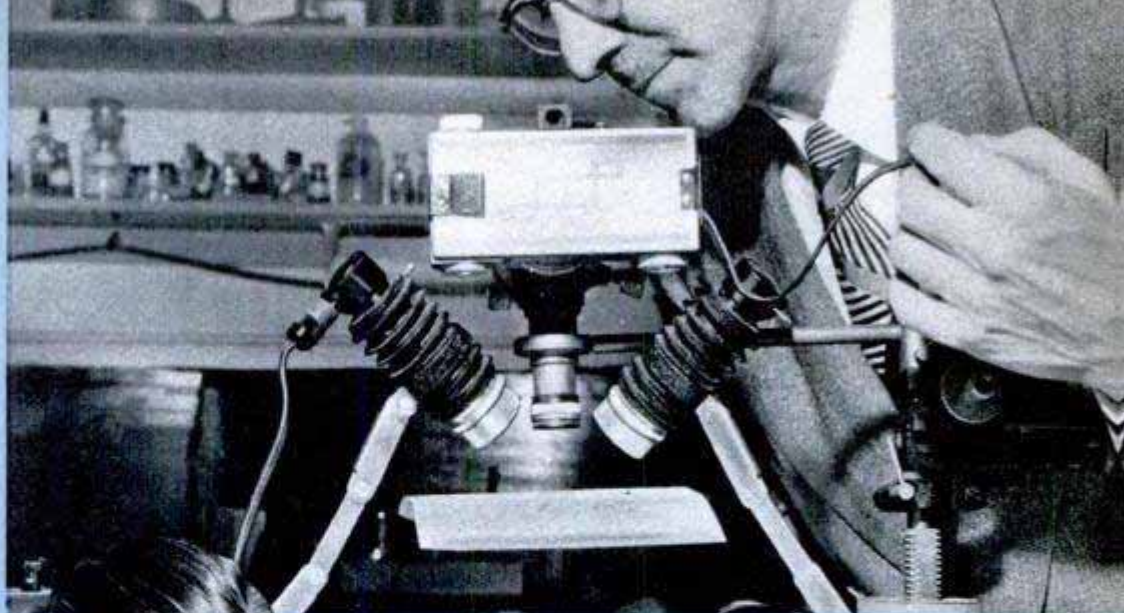
In ultramicrochemistry, parts of drops of liquids are tested in minute flasks shown at right. Here Doctor Kirk is stirring the liquid with a magnetic vibrator and an attached needlelike glass rod



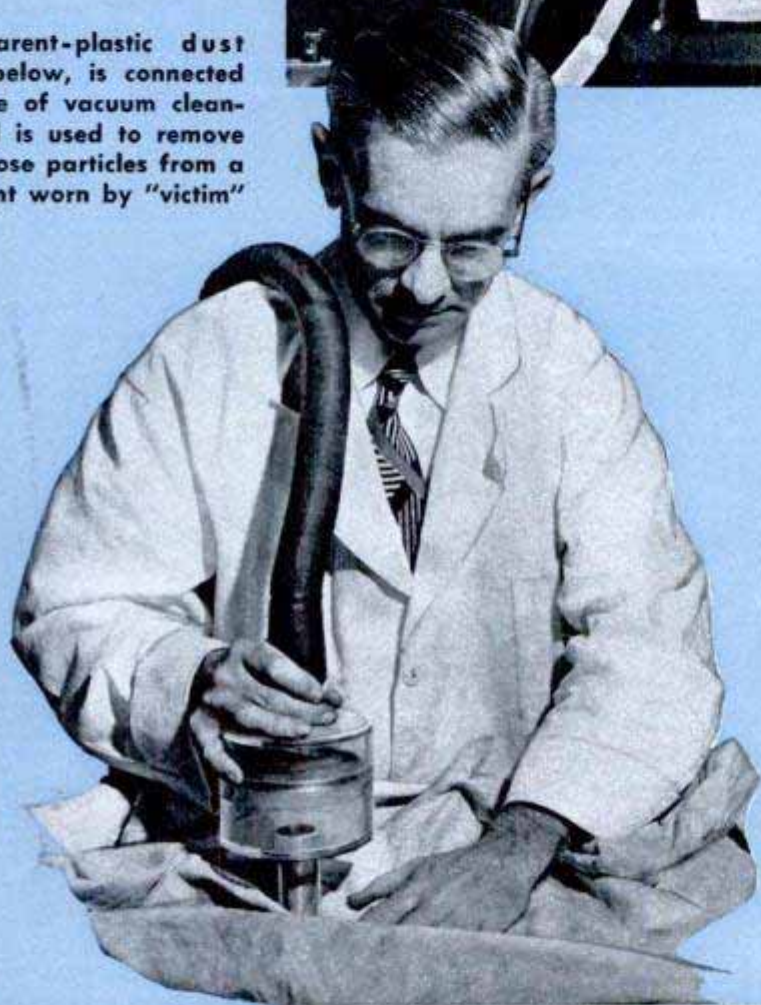
Glass-faced illumination box shines its light through two pages of typewritten material to compare letters in determining if both pages were written on the same machine. The box saves many hours



In his criminology laboratory, Doctor Kirk uses an inexpensive camera, magnifier and lights to photograph portions of suspicious-looking document



Transparent-plastic dust trap, below, is connected to hose of vacuum cleaner and is used to remove any loose particles from a garment worn by "victim"

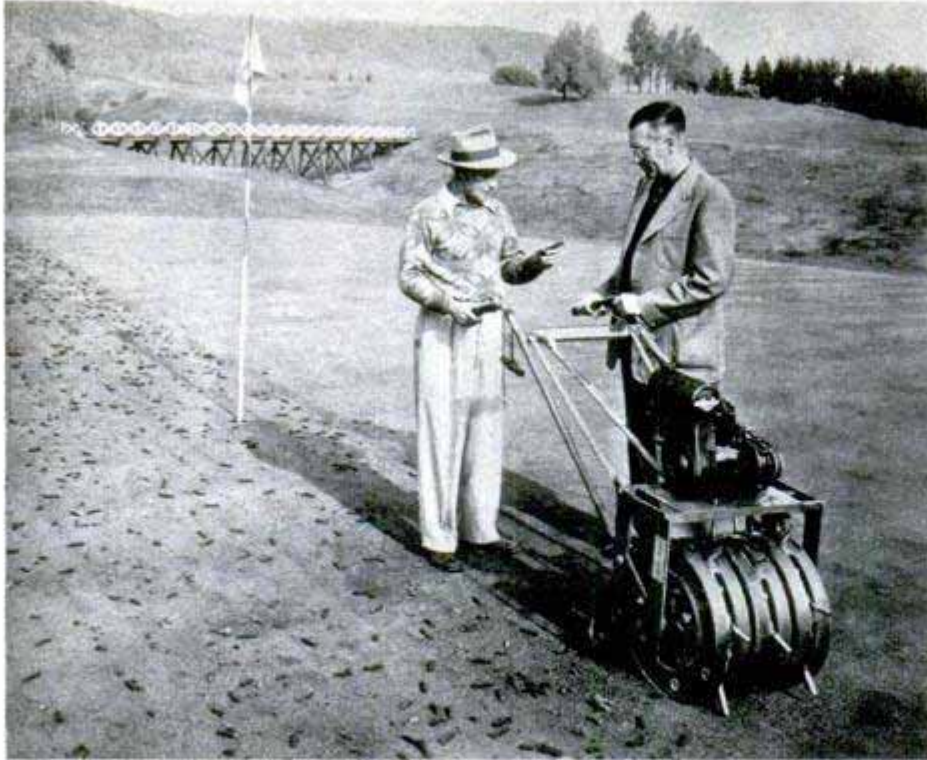


During that part of the school day in which he teaches criminalistics (examination of physical evidence) the scientist tries to give the criminology students some training in all phases of the subject. After all, he says, physical evidence is much the same no matter what type of crime is involved. He is also devising simple, inexpensive methods and equipment for examining evidence. He feels one trained specialist with \$5000 worth of equipment should be able to do just about as much police work as is usually handled by a staff of several people backed up with \$40,000 or more invested in facilities.

He put one cheap tool together on the spot when he was trying to learn if some bits
(Continued to page 242)

Girl works through arm-holes in cabinet to weigh minute particles on quartz helix balance (invisible in the photo). Care is taken to avoid any air currents





Soilaire Industries, 1200 Second Ave., South, Minneapolis, Minn.

"Earthworm"

As easy as mowing the lawn, a gasoline-operated device makes the ground porous after it has been compacted by rain and traffic. Covering 700 square feet of ground an hour, the motorized "earthworm" has floating tines that dig up cores $3\frac{1}{4}$ inches long. The tapered tines are hollow and automatically eject the earth cores. The floating-tine action prevents scuffing or gouging the surface. According to the manufacturer, aerating the soil enables it to use fertilizer more effectively and requires less water.

Grass Trimmers

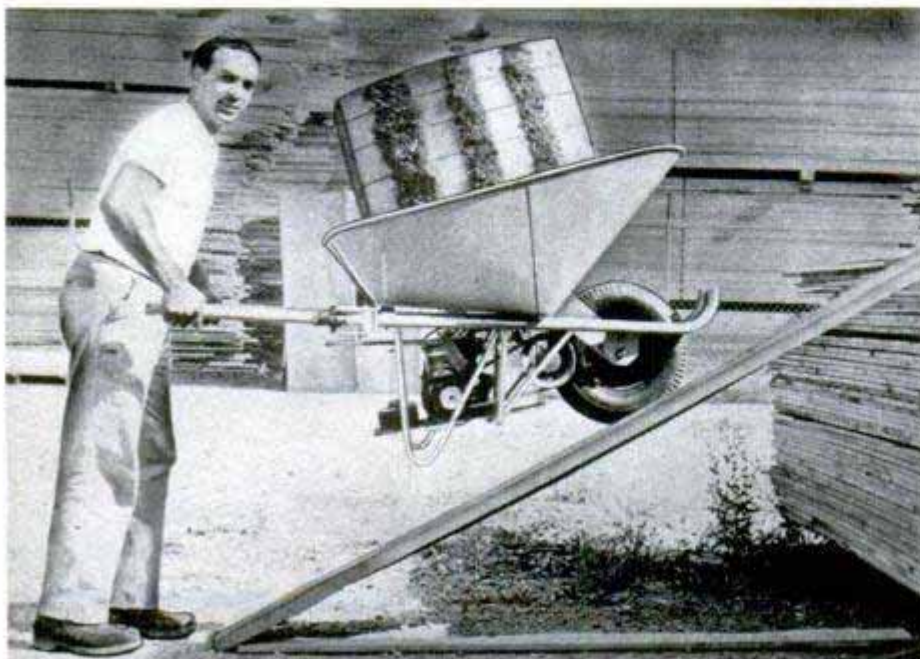
That tiresome chore of trimming grass around sidewalks, trees and other objects becomes a quick and easy operation with either of two power trimmers. One of the trimmers, a professional model, is completely self-contained, being powered by a tiny gasoline engine. It weighs only $11\frac{1}{2}$ pounds complete. The second trimmer, designed for the homeowner and small-estate caretaker, is powered by an electric motor and weighs only seven pounds. Both use a rotating blade that is



E. F. Britten & Co., 22-26 South Ave., W., Cranford, N.J.

Above, left, a heavy-duty trimmer has a light gasoline engine built into its compact cutter head. Right, the smaller model has an electric motor

designed to create a partial vacuum, drawing the strands of grass into the cutting circle.



S and S Vending Machine Co., San Jose, Calif.

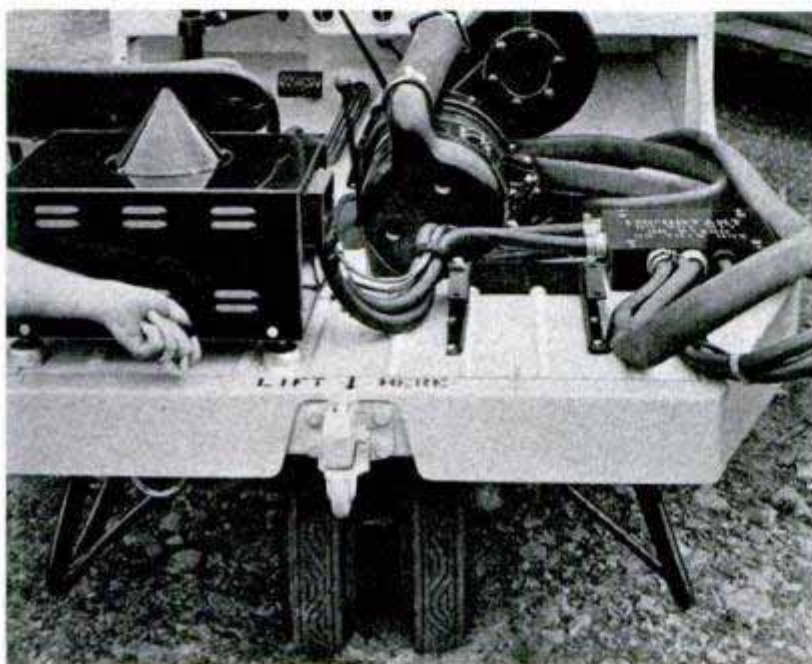
Power Wheelbarrow

If you've ever pushed a loaded wheelbarrow, you'll appreciate a power model that is driven by an air-cooled engine. The lightweight engine, mounted beneath the bed, drives by friction on the tire tread. It will pull a full load up a 40-percent grade. On a downhill run, compression acts as a brake to ease the laborer's job. Speed on the level is at a comfortable walking pace. The engine controls are located on the right handle.



Willys-Overland Motors photos

Driven by a center power take-off, generator in the mobile midget plane starter, left, supplies either a.c. or d.c. It is less than 36 inches high and just 52 inches wide. On the deck of a carrier, right, turning tail wheel permits it to execute right-angle corners



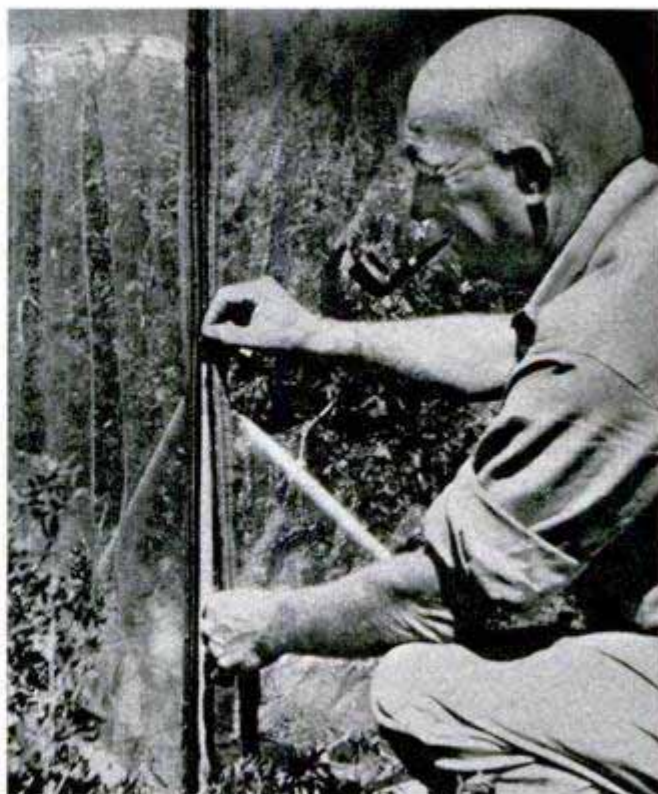
Midget-Jeep Power Plant Starts Shipboard Jets

Small enough to travel beneath airplane wings on crowded carrier decks, a new three-wheel midget Jeep acts as a mobile electric power plant for starting jet fighters. Less than 3 feet high, 19 inches lower than the standard Jeep, only the tail wheel turns and it can execute right-angle corners. The amount of power needed to start a jet airplane makes it impractical for single-engine fighters to carry sufficient battery capacity to do the job. The mobile midgets will replace the power lines formerly strung across flight decks and the generators on hand-drawn dollies that proved too slow and cumbersome.

Zippered Homes for Bumblebees

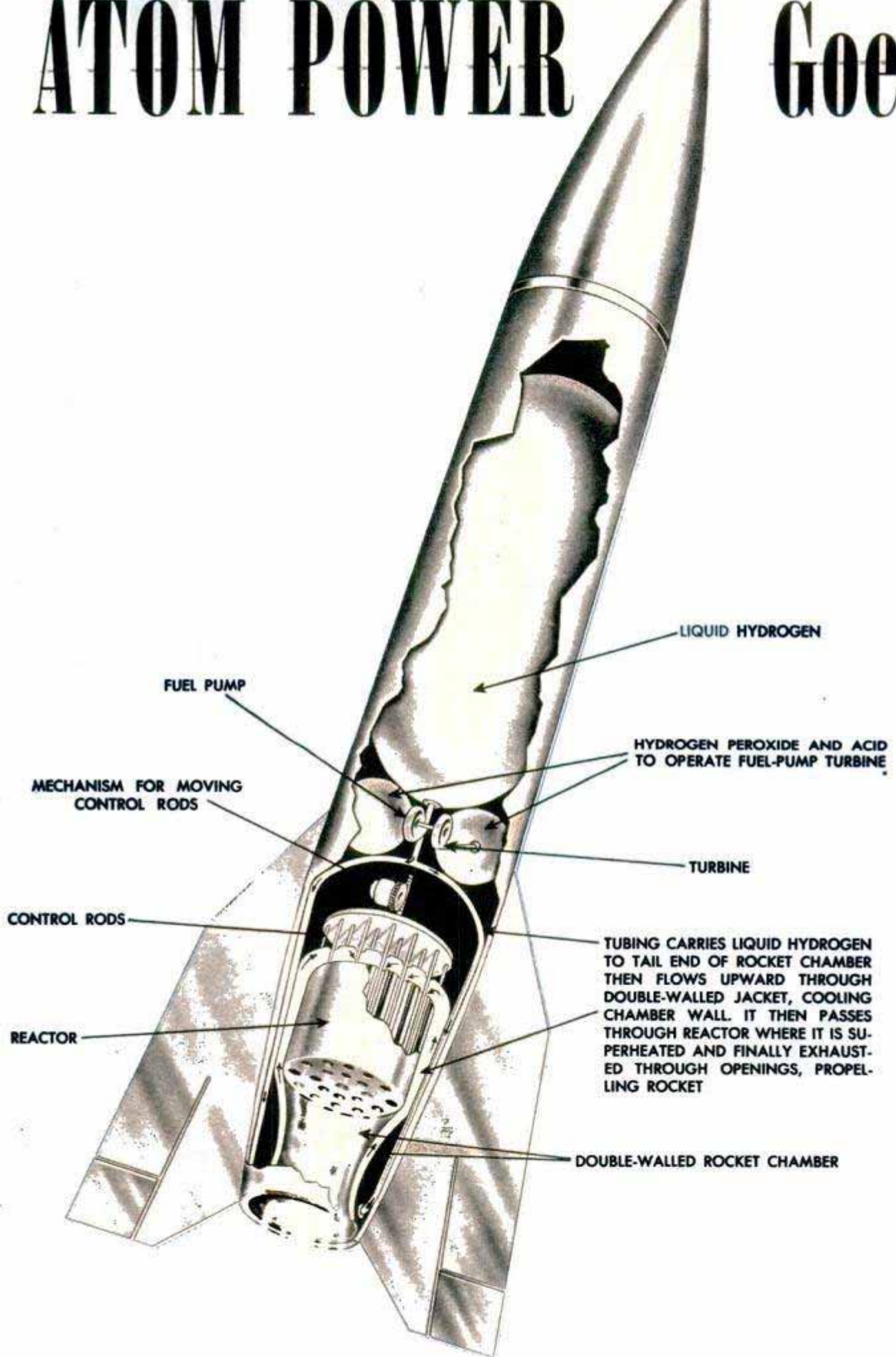
Cages, complete with zippered doors, provide living quarters for bumblebee "workers" at the Utah agricultural experiment station. Plant scientists, testing a new strain of alfalfa, wanted to speed the production of seed by quick pollinization. They found the bumblebee a vigorous and fast pollinizer, an ideal worker for the job. The research men installed wooden frames around their experimental plots and covered them with plastic screens. Inside each of these cages they placed a family of bumblebees. Zippers were found to be the best means of opening the cages for care of the alfalfa and the bees. The result of resettling the bees — rapid pollinization and a better yield of seed.

Electric wire sheathed in a new jacket that is highly resistant to the effects of gas and oil has been designed by the General Electric Company for use in filling stations and oil refineries.



ATOM POWER

Goes



into GEAR

By
Richard F. Dempewolf

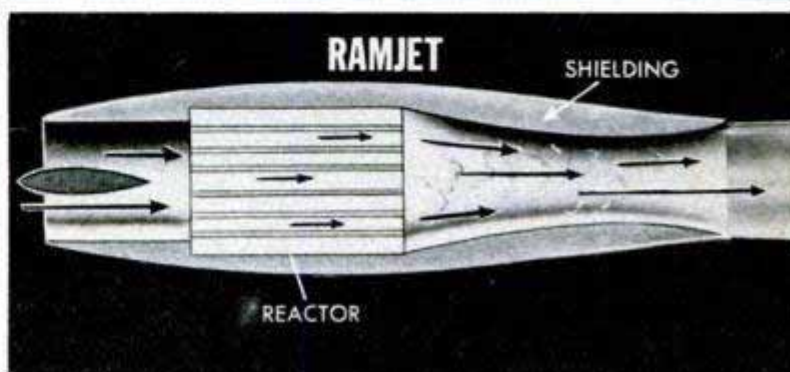
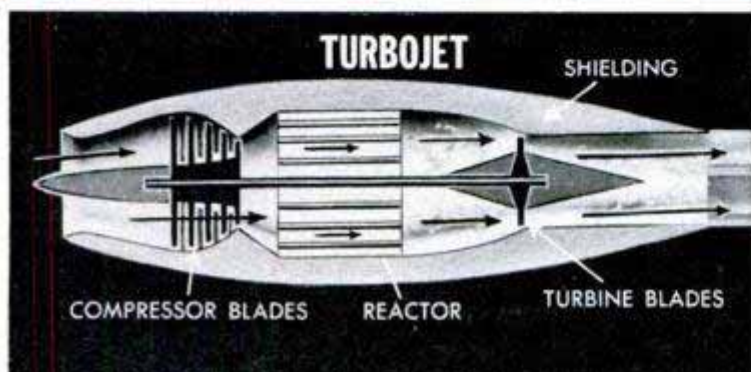
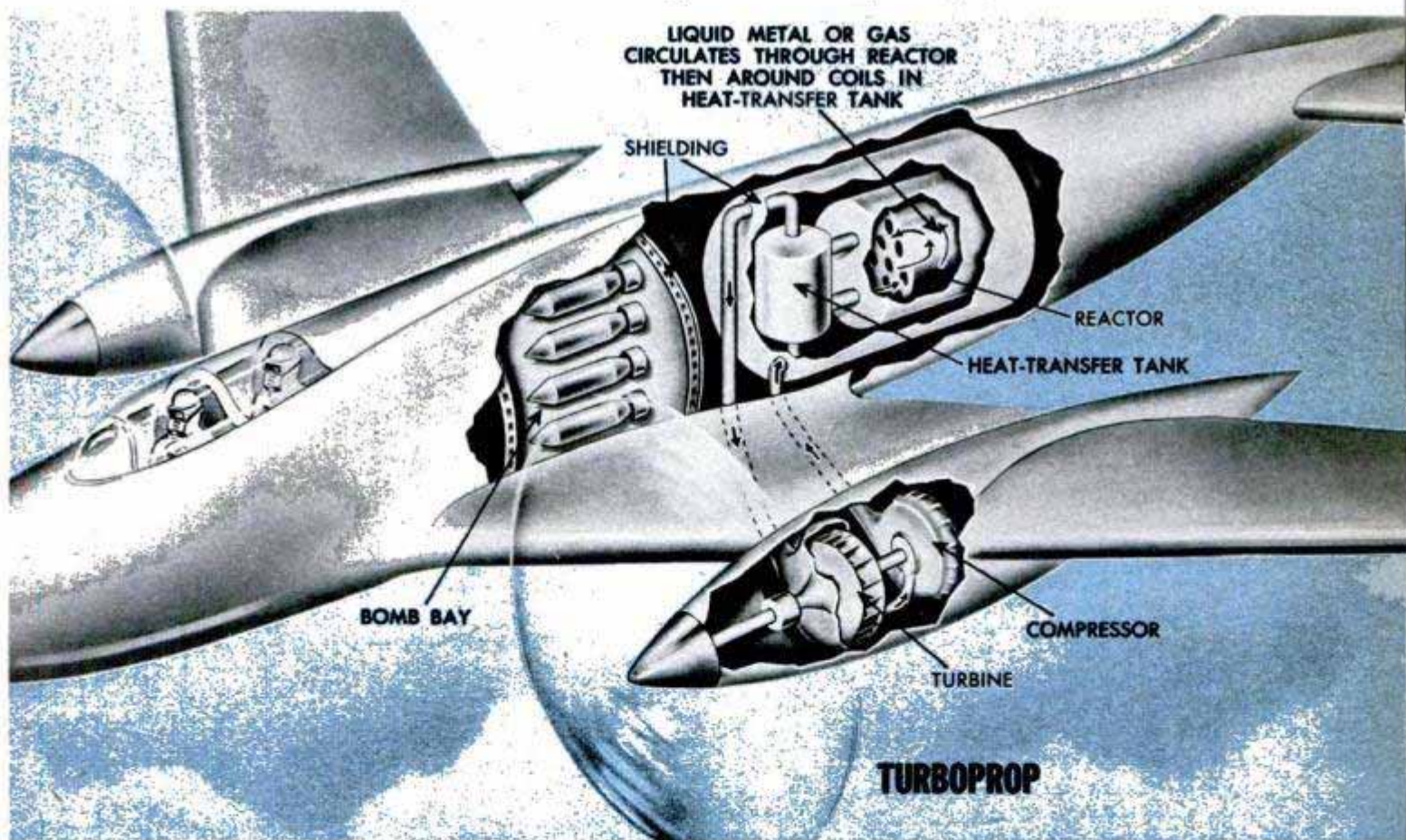
WE'LL NEVER SEE uranium pills to run cars or home heaters. Neither will we see those atom furnaces that would melt the Greenland icecap and make a tropical garden of Alaska. Such nonsense was forecast by post-Hiroshima enthusiasts whom Dr. Lawrence Hafstad, the Atomic Energy Commission's boss of atomic piles, calls "subsophomore slapstick artists." But atomic power today is far from the hopeless will-o'-the-wisp that some pessimists would have us believe.

Here and abroad, vast new reactor programs are in high gear. An atom-powered ship that can cruise for months without refueling is no longer pure "pie in the sky." At Britain's huge Harwell atomic station, experimental work on a submarine pow-

ered by uranium fuel has reached a stage where experts are now working out figures and designs for the prototype. Our own plans for a high-speed atom-powered submarine with vastly increased range are complete. One Navy land-based prototype of the reactor that may power the ship is already being constructed under the supervision of Westinghouse at AEC's reactor-testing station in Arco, Idaho. Another is being designed at the Knolls Atomic Power Laboratory operated by General Electric for the AEC at Schenectady, N. Y. It's all part of a whopping \$90,000,000 AEC atomic-power program.

More money and fresh brains have been thrown into the top-secret U. S. project for harnessing atomic power for aircraft and

On opposite page is an artist's conception of the atomic-powered rocket. Liquid-hydrogen fuel would permit flights above earth's atmosphere. Below, three types of nuclear-power plants for tomorrow's aircraft





Expectantly, the scientists at the Brookhaven reactor await the start of the first chain reaction in the pile on August 22, 1950. The air is tense because nobody can predict precisely when the fissioning will start

the target date for such a plane—bigger than a B-36—has been advanced (though it's still secret).

At Harwell, nuclear-power units are being devised for the generation of electricity. In fact, such atomic power already is an actuality. Right now, from the big U. S. pile at Hanford, Wash., hundreds of thousands of potential kilowatts in heat are continuously being produced as a by-product of that reactor. So far, that potential power has been carried off by the Columbia River only because there hasn't been time or money to build the kind of plant that could convert it to usable electricity. There's enough heat, however, to raise measurably the temperature of the river downstream of the pile.

Besides all this, two other new atomic piles—neither concerned with the bomb program—are being built at Arco, Idaho. One will test various materials under the bombardment of atomic fission, in the hope of finding, among other things, newer lightweight shielding materials and substances to contain the fierce atomic fires in nuclear ship and aircraft engines. The other Arco pile will experiment with an idea physicists have recently begun to suspect—that atomic fuels can be used to create more and more atomic fuels.

What will these submarines and airplanes and power stations look like? How will they operate?

The engine for our nuclear submarine will be a conventional turbine, turned by

steam produced in a heat-transfer process from the atomic fires in the reactor. Carrying heat from a furnace to a steam-producing boiler in a conventional system is achieved by running a liquid through a system of pipes circulating between the furnace (where it heats up) and the boiler (where it gives up the heat to make steam). In an atomic furnace, any old liquid won't do. It mustn't absorb too many neutrons and thereby slow down the reaction.

To find the right agent, the Navy has been experimenting with many materials, among them searing-hot liquid metals. A suitable heat-transfer agent already has been found, according to Vice-Admiral Charles Lockwood. Special metal alloys to withstand the tremendous heat of the pile have been discovered. Special shieldings of new, secret materials, are lighter and less bulky than cumbersome concrete and are just as effective in confining radiations.

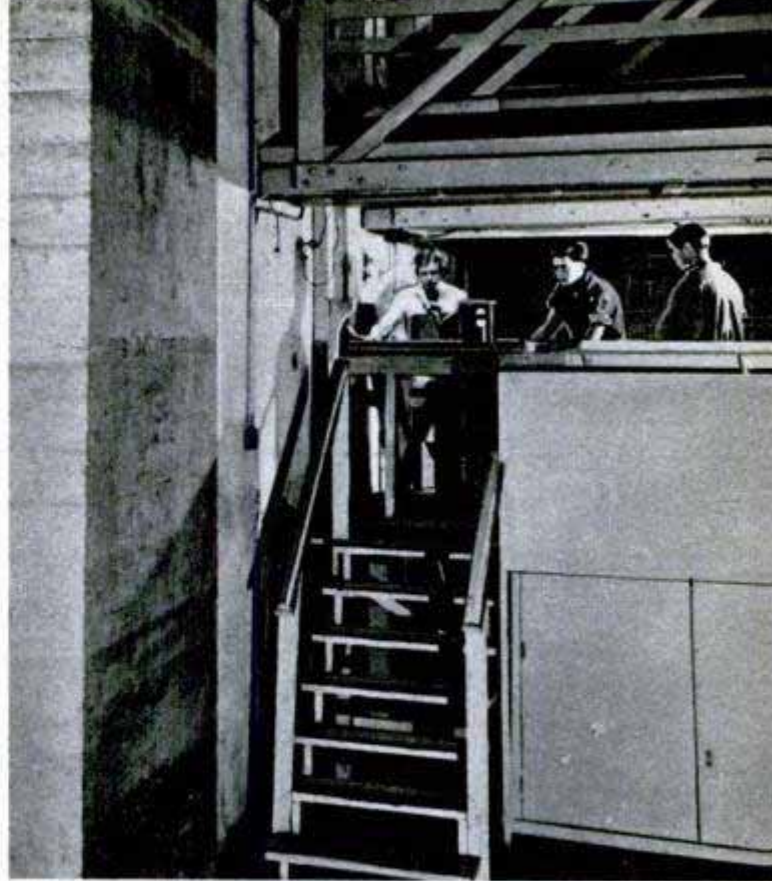
What the whole engine will weigh has not been told, though Britain has released some probable figures on an atomic ship engine capable of delivering 100,000 shaft-horsepower. The pile would be contained in a metal tube 20 feet long. With shielding, the unit would weigh 1000 tons more than a regular turbine—an amount of extra weight equal to the fuel now needed for only 36 hours of sailing in a large ship.

America's atomic submarine, according to Vice-Admiral Lockwood, will outrun, outfright and outmaneuver any underwater

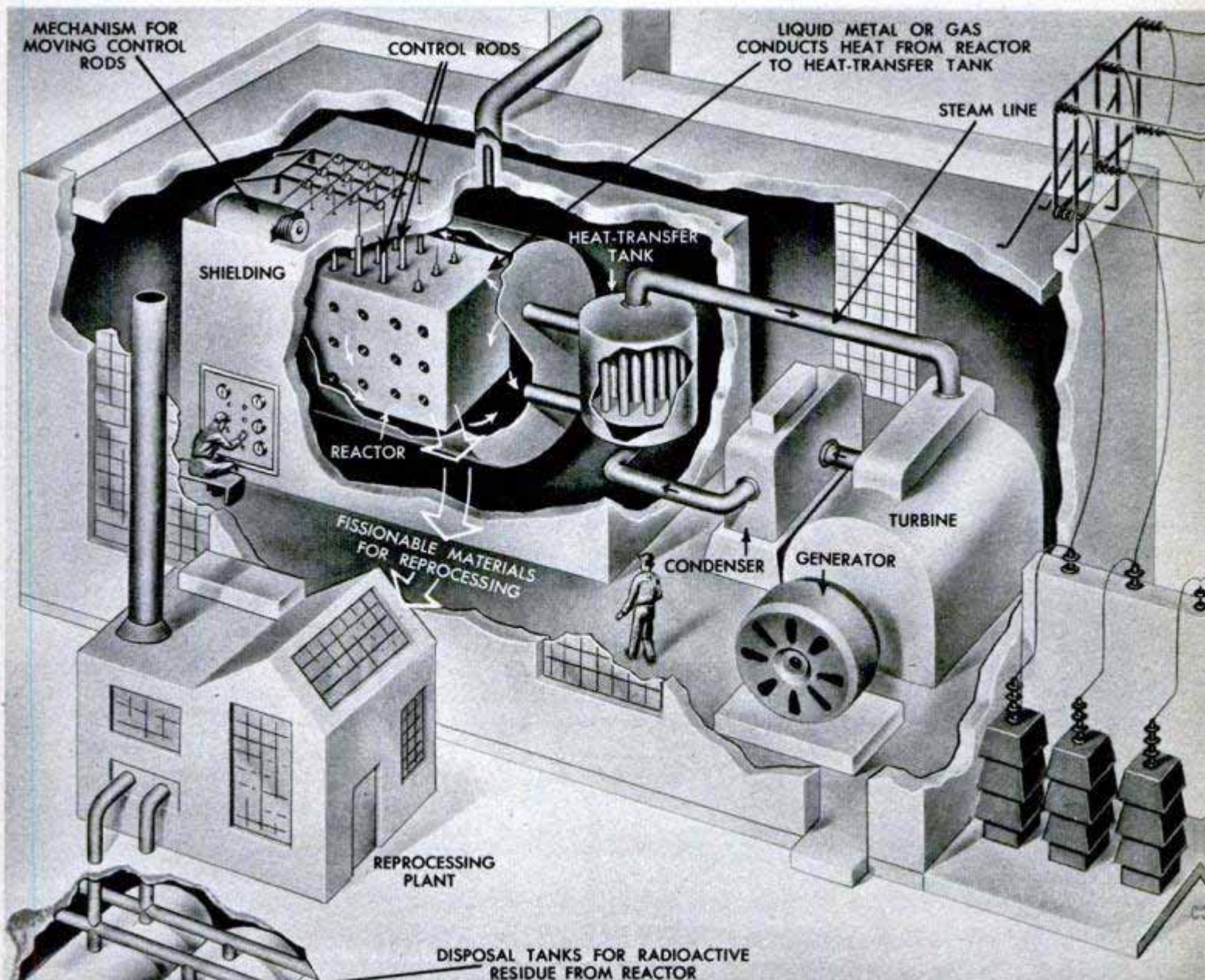
or surface craft in the world. She'll have four times the horsepower of her most powerful diesel sisters. Her atomic furnace will contain plutonium—a man-contrived atomic fuel made by bombarding U-238 with fissionable uranium. Her range will be globe-girdling, since one dose of fuel will last a long, long time. Her super-streamlined hull, designed primarily for underwater cruising, will make her faster when submerged than when operating on the surface—an unheard of thing in modern subs. She is expected to cruise down there at 25 to 30 knots, and will be able to stay down for interminable periods.

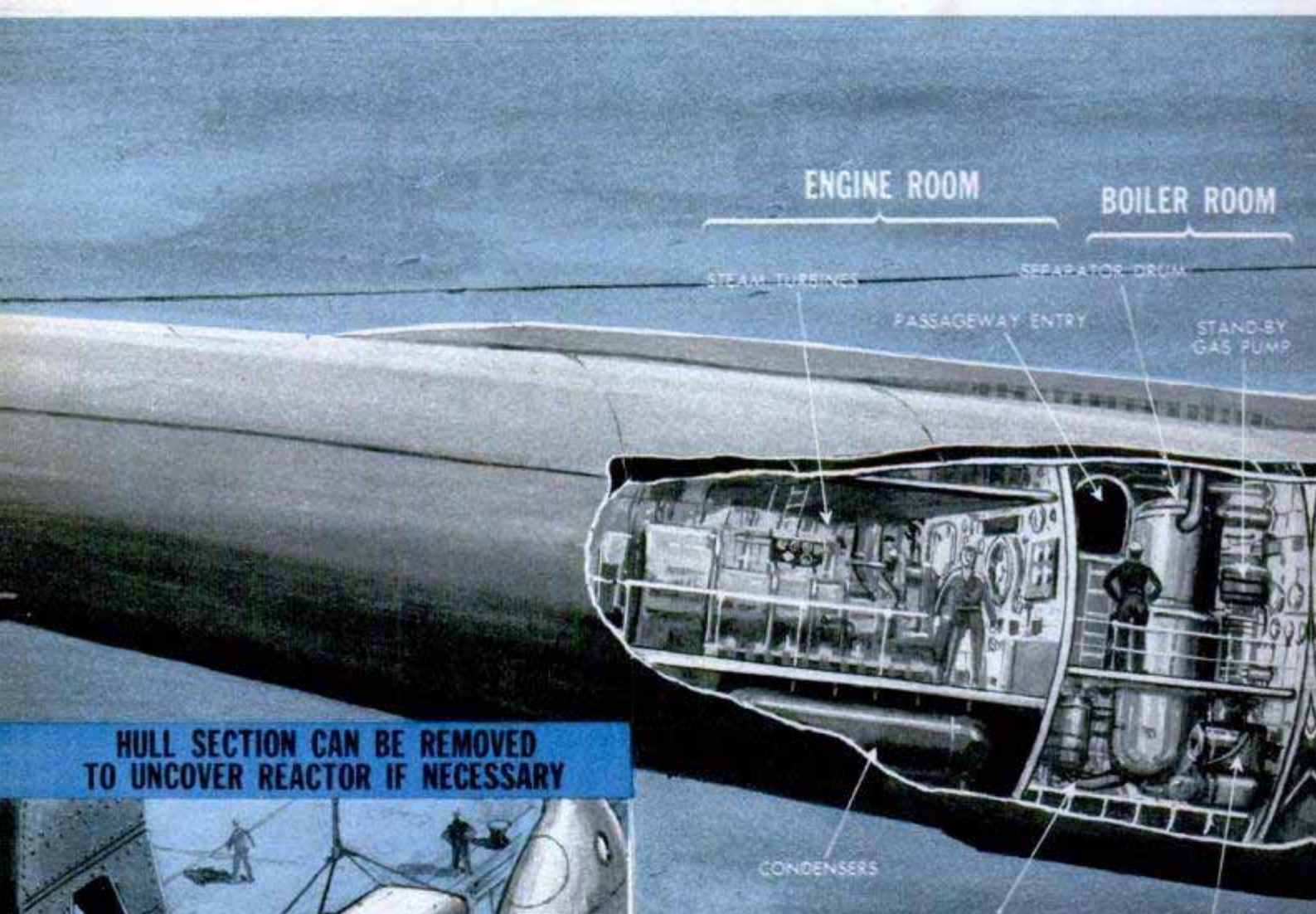
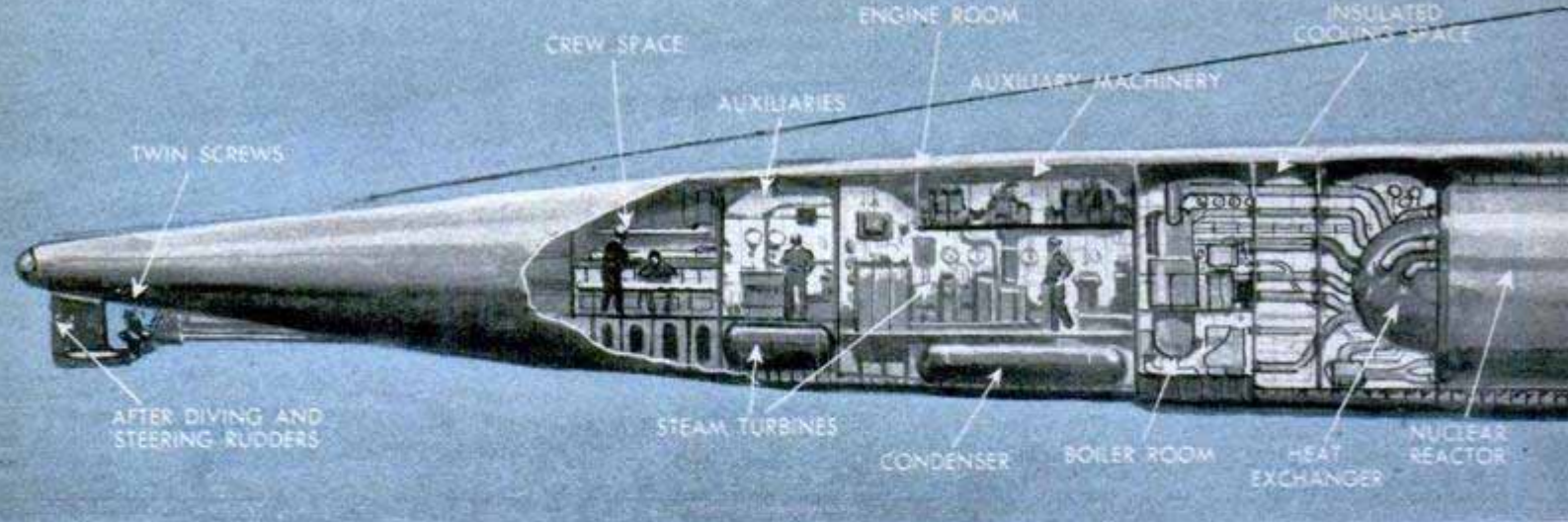
No air, of course, is needed to make her atomic furnace burn. Hence, no bulky snorkel will poke above the surface to cut a wake and give her away. Air for the crew can be banked at three to four-day intervals and a small, inconspicuous, retractable snorkel will do the job without any need to surface. The size of the atomic engine is small enough so that much of the space previously taken by some 700 tons of diesel oil and storage batteries will actually be saved for more torpedo storage.

(Additional drawings on next two pages—story continued to page 234)

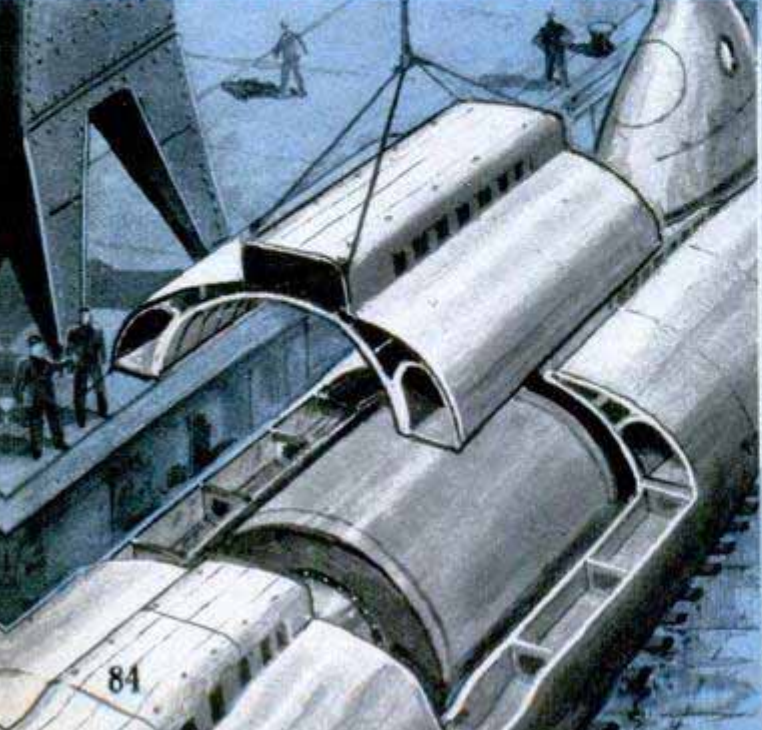


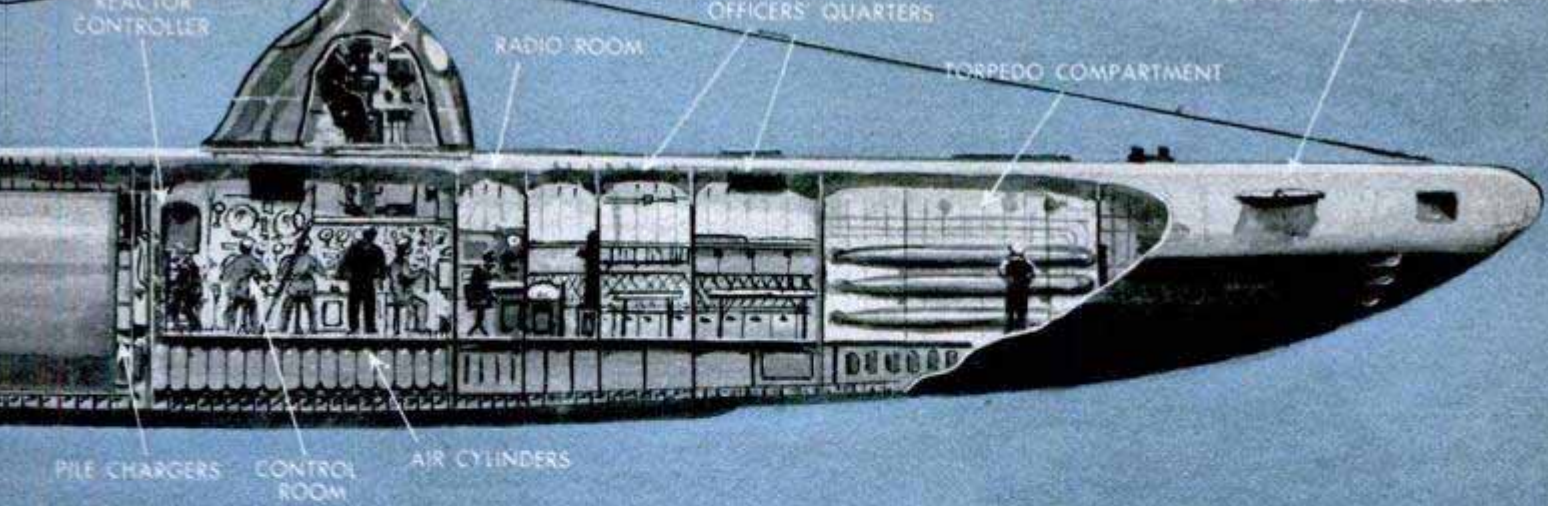
Above, the operating end of the pile at the Argonne National Laboratory. Below, an atomic-power plant



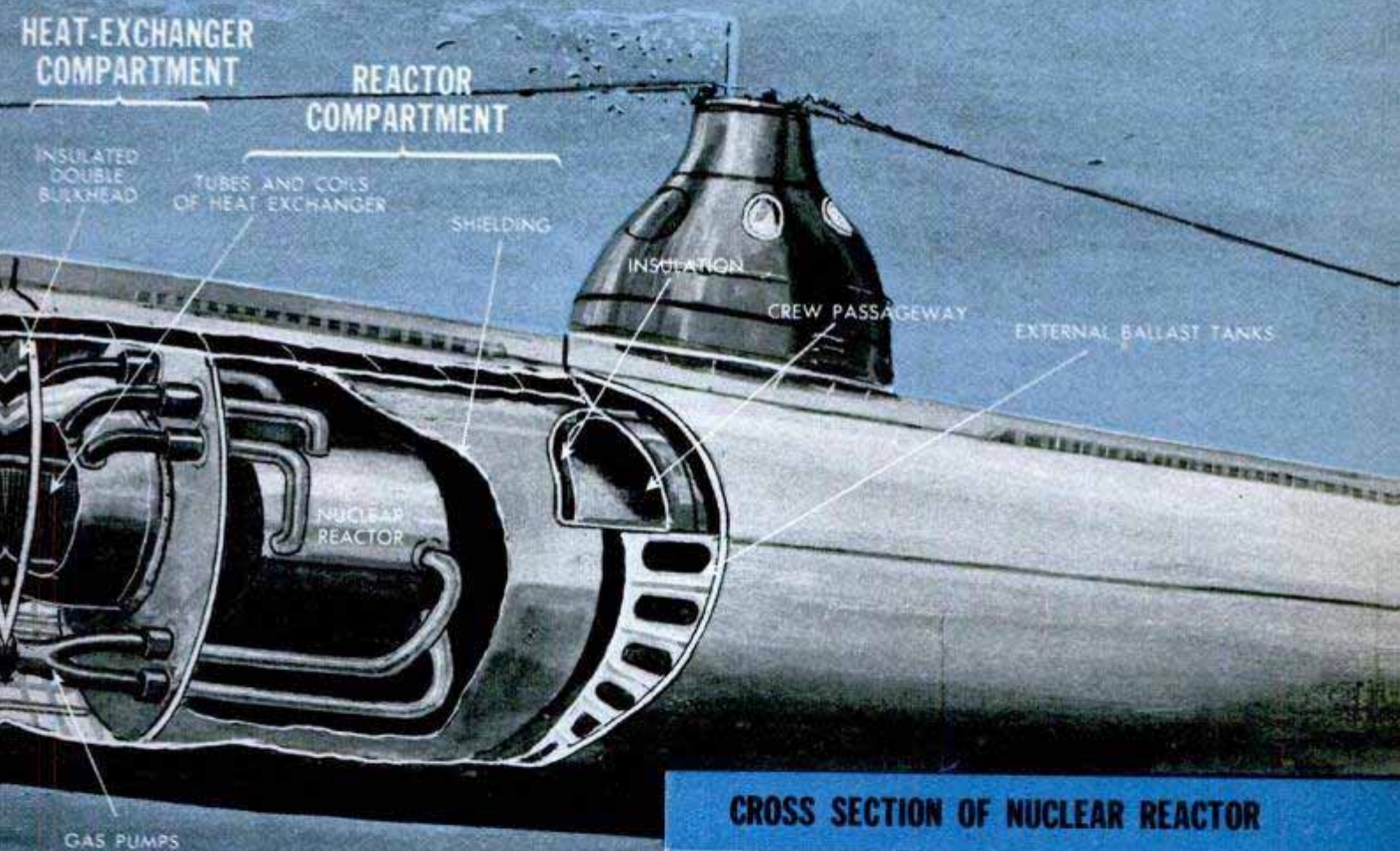


HULL SECTION CAN BE REMOVED TO UNCOVER REACTOR IF NECESSARY





ATOMIC-POWERED SUBMARINE



CROSS SECTION OF NUCLEAR REACTOR

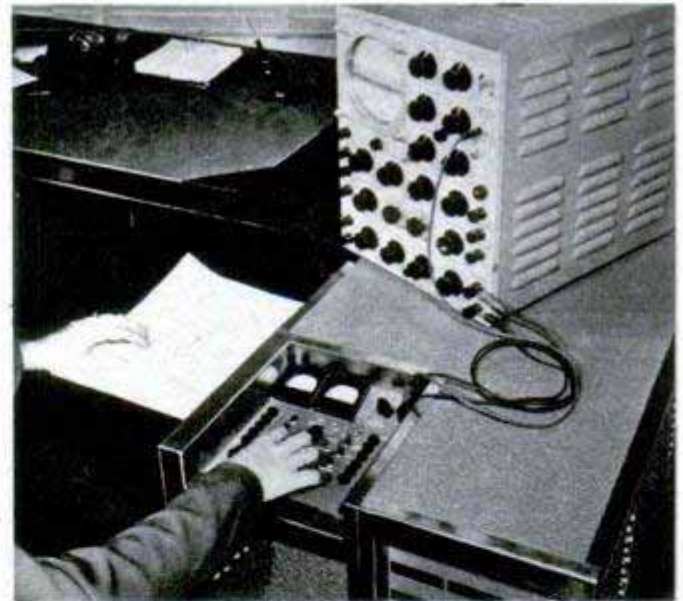




Atomic Survival Jacket

Designed for persons who live through the initial blast of an atomic bomb, a survival jacket contains many of the items that might be essential for existence. The jacket in no way protects the wearer from radiation or other bomb effects. It was designed by Michael Shore and Benn Reyes of Chicago, who offer the idea free in the

hope that civil-defense groups will use any version of the jacket applicable to their needs. Pockets contain such items as sulfa powder, a blood coagulant, bandages, burn salve, adhesive tape, water-purifying tablets, iodine ampules, sulfaguanidine tablets, knife, scissors, rope, flashlight and matches. A panel on the jacket carries the name, street address, and city and blood type of the wearer.

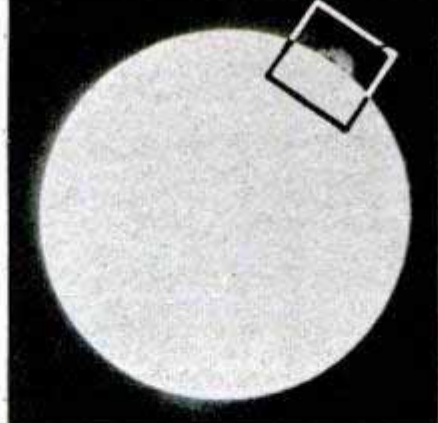


Desk-Size Electronic "Brain"

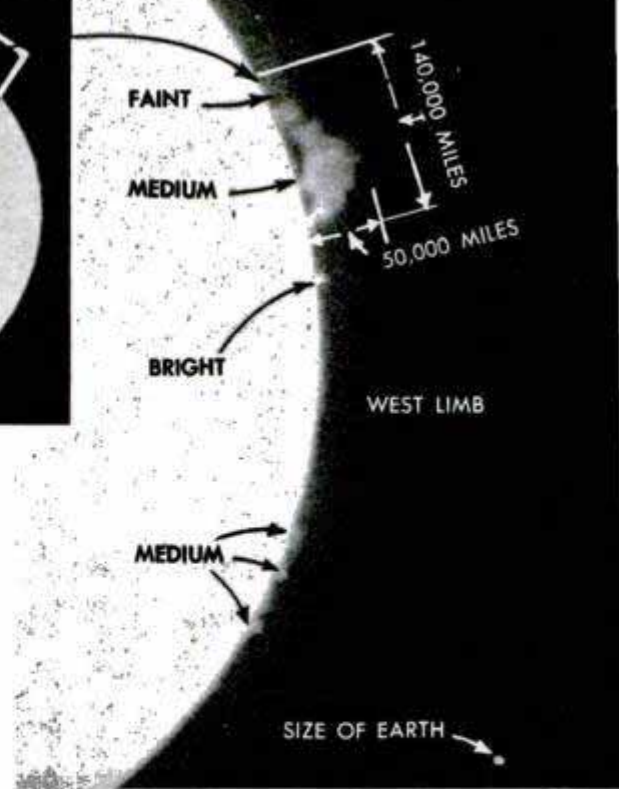
Smaller than an office desk, an electronic "thinking machine" has a mathematical capacity that places it in a class with the warehouse-size computers used in large universities. Known as "Maddida," it was designed and built by engineers of Northrop Aircraft, Inc., Hawthorne, Calif. The machine has fewer than 100 tubes, very few compared with those required to operate jumbo computers, and only one moving part, a spinning magnetic drum that "re-

members" about 10,000 digits. A simplified typewriter keyboard on the control panel is used to put the problem into the machine for solution. The computer will be used to predict the best designs for ship hulls, underwater rockets and torpedoes by solving complex mathematical formulas.

☐ A new cold-weather boot developed by the Naval Clothing Depot is rubber inside and out, with wool insulation sandwiched and sealed in as an interlining in the sole, tongue and around the foot and ankle.



Left, astronomer looks through filter mounted on telescope. Top, the first successful photo through filter. Right, enlargement of section outlined above showing the sunspots clearly



The Navy Shoots the Sun-- Spots and All

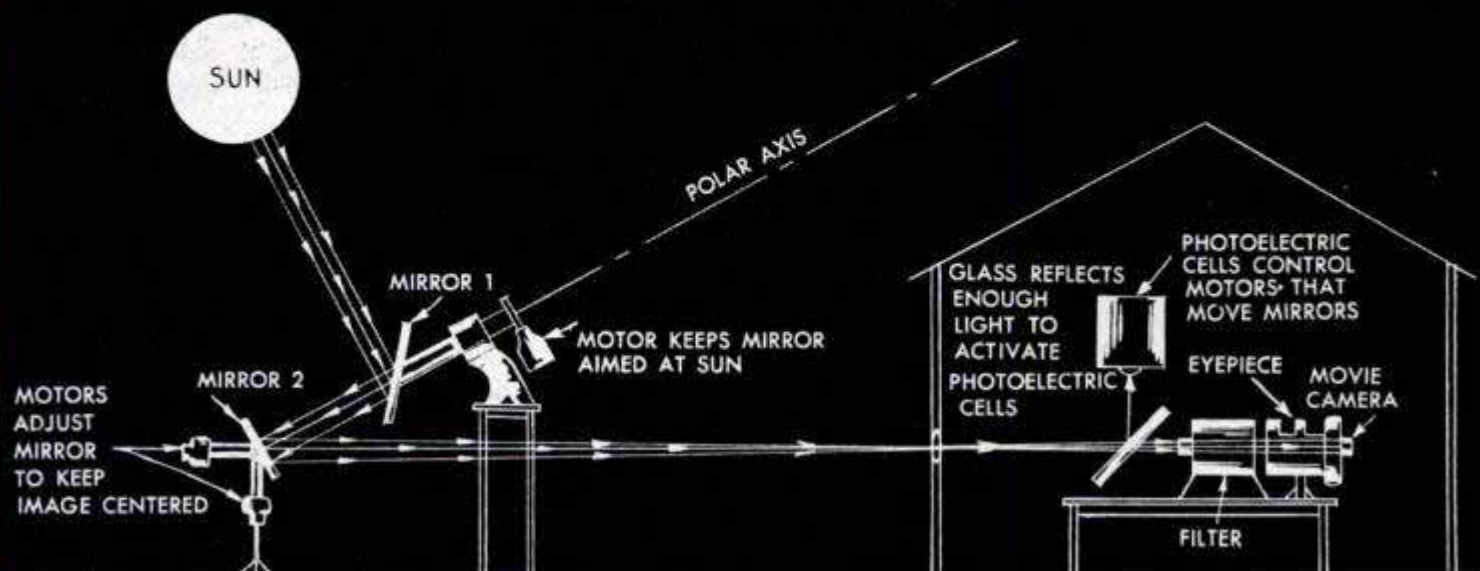
SUNSPOTS—cores of burning gas whirlpools on the rim of the sun—periodically throw the world's communications into a tailspin. Telegraph and radio messages are jumbled when the sunspots are severe.

Astronomers have been trying to learn more about this phenomenon for years. Aiding them is a new filter being used at the U. S. Naval Observatory. A barrel-shaped instrument about a foot long, it filters out all light except the red incandescence radiated by hydrogen. Because this is the principal gas on the sun, the filter

permits simultaneous observation of the sun's face and corona. Previously, an artificial eclipse (made by holding a baffle plate between the sun and the eye or film) was used to permit study of the corona.

The new filter, made by Baird Associates, is one angstrom wide, which means it allows only $\frac{1}{3000}$ of the visual color range to pass through it. Dr. William Markowitz of the observatory is using the filter to make the first motion picture ever made of the entire process going on around the surface of the sun.

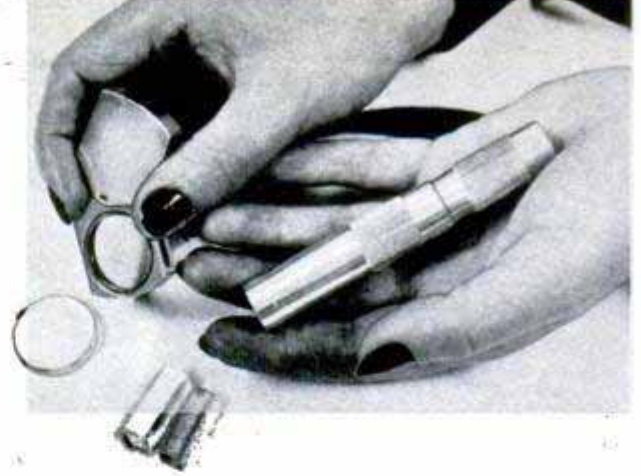
Movies of the sun are taken through the new filter with this setup. Photocells keep mirrors properly aimed





Supercold Plus Heat Makes Superhard Steel

Stainless steels three times harder than those ordinarily available are produced by a newly developed process that uses the supercold of liquid nitrogen. The steel is immersed in the liquid nitrogen at 300 degrees below zero and then quickly transferred to an oven where the temperature is 750 degrees Fahrenheit. A similar superhard steel can also be produced by rolling or forging it as soon as it has been withdrawn from the supercold bath. However, this process does not produce the hardness of the cold-plus-heat method. The steel becomes exceedingly hard because the atoms are shifted into a totally different arrangement, say scientists at the Westinghouse Research Laboratories where the process has been undergoing development.



"Atomic Dog Tags"

Two different types of "atomic dog tags" for detection of radioactivity by individuals have been developed by the Navy. The small devices would be carried by personnel in danger of attack. One instrument, which has a swinging metal cover, uses a type of salt crystal that is normally transparent, but turns blue when exposed to gamma rays. The other, shaped like a fountain pen, uses silver-activated phosphate glass as the sensitive element. Gamma rays convert the glass into phosphor, which takes on an orange color under ultraviolet light.

Underwater Telephone Cables Have Built-In Amplifiers

Two underwater cables running between Florida and Cuba have compact amplifying stations built right into the cable and spaced every 40 miles. The cables, normally one inch in diameter, bulge to three inches in the 25-foot section that contains the amplifier. Specially developed tubes, said to be able to function unattended for about 20 years without failure, are used in the amplifier circuit. The cable was designed by Bell Telephone Laboratories.



"Flying Barrel"

Called the "Flying Barrel," a new jet fighter built for the Swedish Air Force has a top speed of over 650 miles an hour. In addition to four 20-mm. nose cannon, it has eight rocket-firing mounts beneath the wings. The engine is a British Ghost.

☐ Wastepaper is needed for America's defense. Don't throw it away.



Detroit Listening Post

By Siler Freeman

SATISFIED with its two big innovations for 1951, the V-8 engine and hydraulic steering device, Chrysler is extending their use this summer into a model so far kept under cover. This is the Saratoga, which has been missing from the 1951 line.

The Saratoga being shipped to dealers next July, is the Windsor with the Firepower 180-horsepower engine and Hydra-guide as optional equipment. Heretofore, only the New Yorker and the Imperial have been sent out with these features.

Unlike the two larger models equipped with Firepower and Hydra-guide, the Saratoga will not have Fluid-Torque, the automatic transmission. Wheelbase is 125½ inches. Some structural changes have been made to accommodate the larger engine. It will be offered in the six-passenger sedan, club coupe, convertible, the Newport hardtop, Town and Country Wagon, and the eight-passenger sedan and limousine.

It is not surprising to find the new engine extended to the Saratoga. The corporation hopes, barring a "hotter" international climate, to extend the engine to DeSoto and possibly Dodge, although perhaps not exactly in the same size as the present V-8.

But extending Hydra-guide to the Saratoga is some indication of the great faith that David A. Wallace, president of the Chrysler division, has in the new device.

Only recently I had occasion to discuss Hydra-guide with Mr. Wallace. The Chrysler president became lyrical in his praise.

"The V-8 engine is a great advance over all other engines of similar design," he said. "But in Hydra-guide, I think we have the greatest advance made in the modern automobile since four-wheel brakes.

"I myself tested it the other day. I had an Imperial model equipped with Hydra-guide placed between two other cars at the curb. I had the cars on either side moved so there was only 18 inches of space to maneuver. Moving the steering wheel with one finger while the car was standing still, I drove it out from between the two others in just three moves."

But Chrysler will not have a monopoly on the device for long. It is reliably reported that General Motors is working on a

similar steering aid, and is rushing it into production. Under ordinary circumstances, it might have reached the market this year in the projected 1952 models. But it is doubtful if tooling can be obtained, with the rush of defense work swamping the shops. Oldsmobile had been slated to use it first, just as it was the first to get Hydra-Matic and the high-compression engine.

Another "first" for GM cars which may reach the market in the 1952 models is a new automatic transmission on which Cadillac engineers have been laboring for a long time. It is reported to combine the best features of all three automatic transmissions now in use on GM's cars. Again the matter of rushing through the tooling holds the fate of the innovation.

Buick this month is sending its dealers the first samples of its Special hardtop. This has been held back by Fisher Body's inability to keep up with the divisions in their varied assortment of body styles.

It will be Buick's latest effort to broaden its coverage of the lower-priced field. The division was just nosed out of third place in the 1950 production lineup by Plymouth.

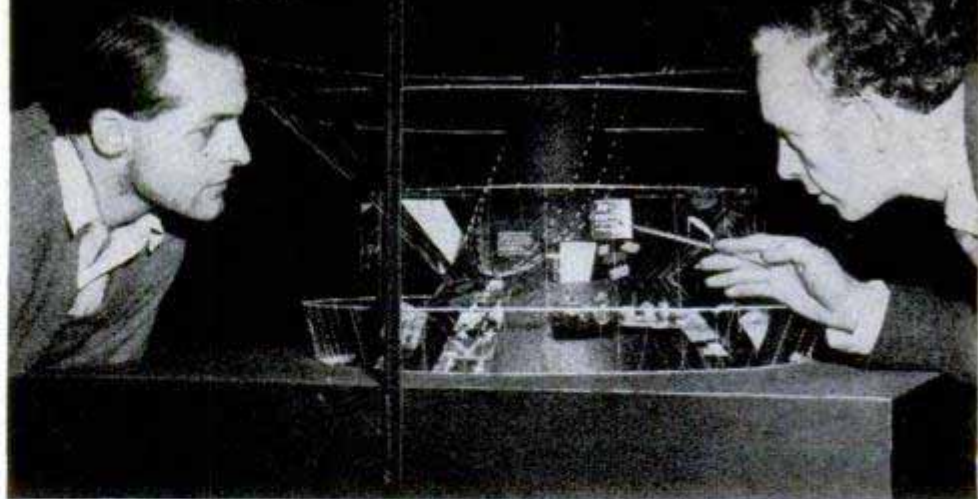
Meanwhile, the tool and die shops are pushing hard to get out a vast amount of work on 1952 models before July 1. At that time, the machine-tool industry is going to be under government controls for about 70 percent of output.

Ford is reported to have the biggest changes due both in body styling and in engines. A V-8 and an overhead-valve six are both in the works. Already there is a three-month delay in the projected schedule of new-model announcements.

Studebaker of South Bend is another company which has made extensive changes. But like the first postwar models, they may go on a high shelf before they are actually seen in production.

In the midst of all its activity, the industry has taken time out to mourn one of its greatest figures. The sudden passing of Fred Zeder, vice-chairman of Chrysler's board and long the top man in its fine engineering staff, has saddened not only his own confreres but many men in competitive companies.

Full-size version of atomic-energy display, shown in model at right, is 30 feet high at center. In cradle of steel cables, 250-foot "skylon," left, is an eerie spectacle at night when lighted. The supporting pylons are painted black



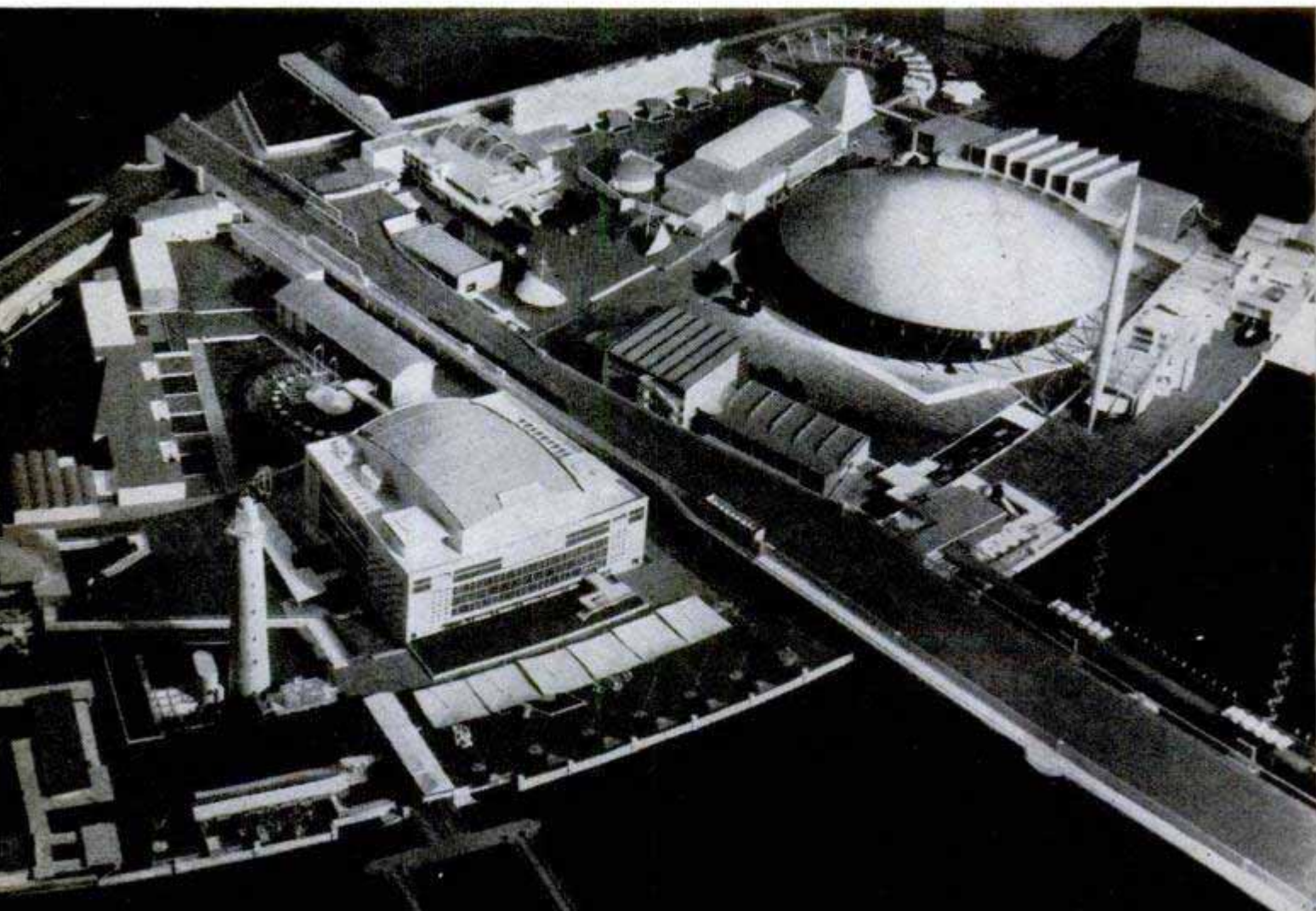
British Official photos

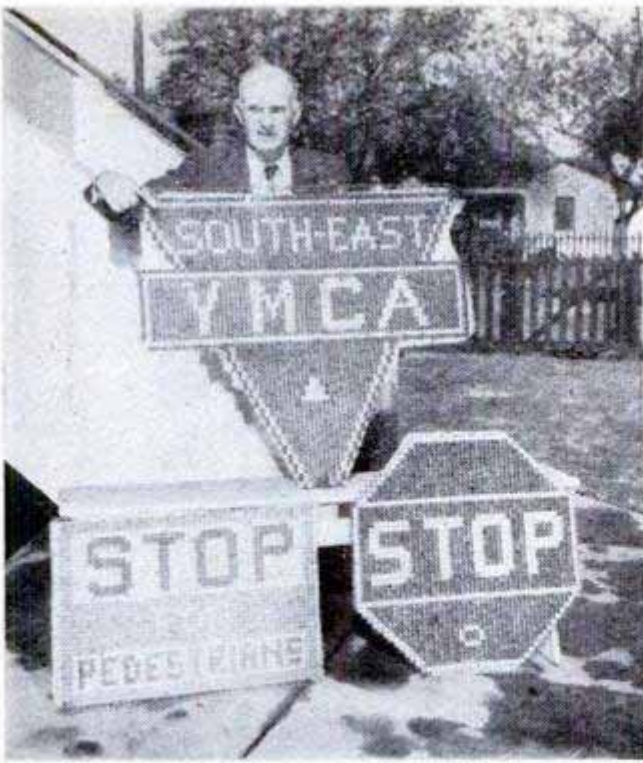


Aluminum roof of Dome of Discovery, below right, in model of exhibition area along Thames River, will be 365 feet across. Visitors, by means of umbrella-shaped aerial on tower at left, can see radio waves from sun

FESTIVAL of BRITAIN

ONE NATION'S contribution to civilization—past, present and future—is the theme of the 1951 Festival of Britain. After being officially opened by King George May 3, it will last through September. It follows exactly a century after the Great Exhibition of London, a smaller, but in many ways similar, event. The largest of London's three major displays will illustrate advances in science, technology and industrial design. Others there will be devoted to books, films and music. Glasgow's exhibition will emphasize the evolution of industrial power, and the growth of the Irish-linen industry and scientific farming will be described at Belfast. A 10,000-ton "display ship" will carry the festival to principal port cities and another mobile exhibition will tour the provinces.

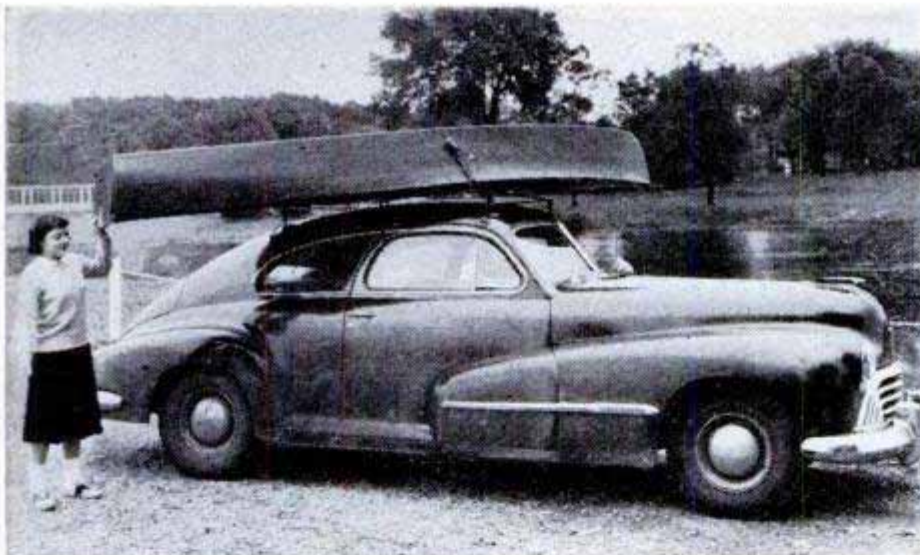




Marble Signs

Making brilliant signs with thousands of glass marbles is the unique hobby of Roy E. Swain of Huntington Park, Calif. The signs

glow in either natural or artificial light. Swain places the marbles between layers of wire mesh, and then welds the mesh to prevent theft of the "aggies." One huge sign required 15,000 marbles.



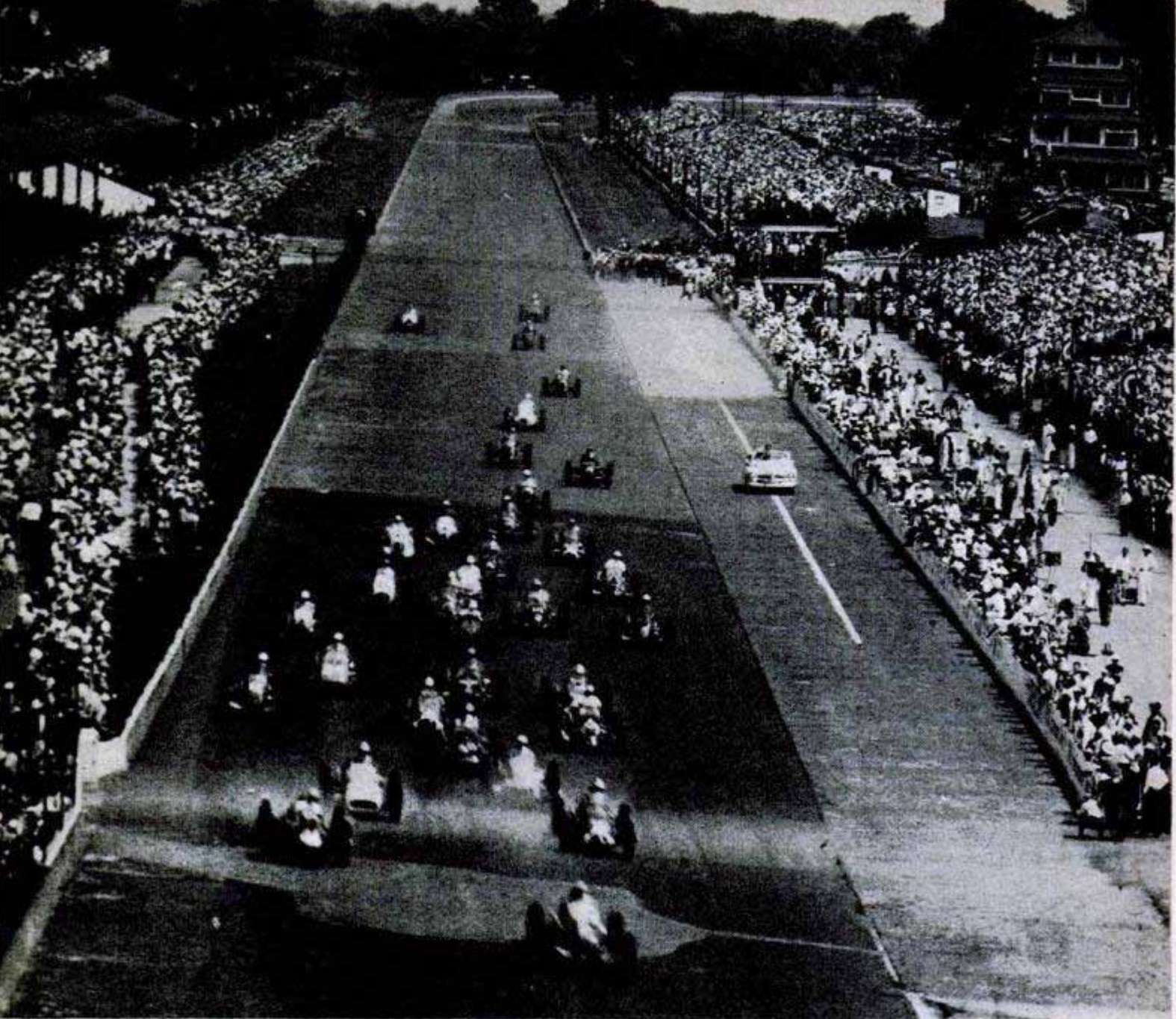
Pro-Weld Co., 1835 Cooper St., Jackson, Mich.



Boat Swung Aboard Car by One Person

Any small boat can be loaded on a new car-top carrier by one person. A swinging bar on the carrier permits the boat to be partially secured before it is on top of the car. The boat is raised by the prow and leaned against the swinging bar. This leaves both the operator's hands free to strap the craft to the bar. The stern then is lifted and "walked" to the rear of the car, where it also is strapped in place. The carrier fastens to the car top with suction cups and clamps, and can also be used to carry other bulky objects such as lumber or ladders.

☐ America's defense effort requires thousands of products made from wastepaper. One of your local civic organizations will be glad to pick up your old magazines and newspapers.



With a rocketing roar of their motors, America's finest racing cars head into the first turn at Indianapolis

They'll Burn Up the SPEEDWAY

By Ewart Thomas

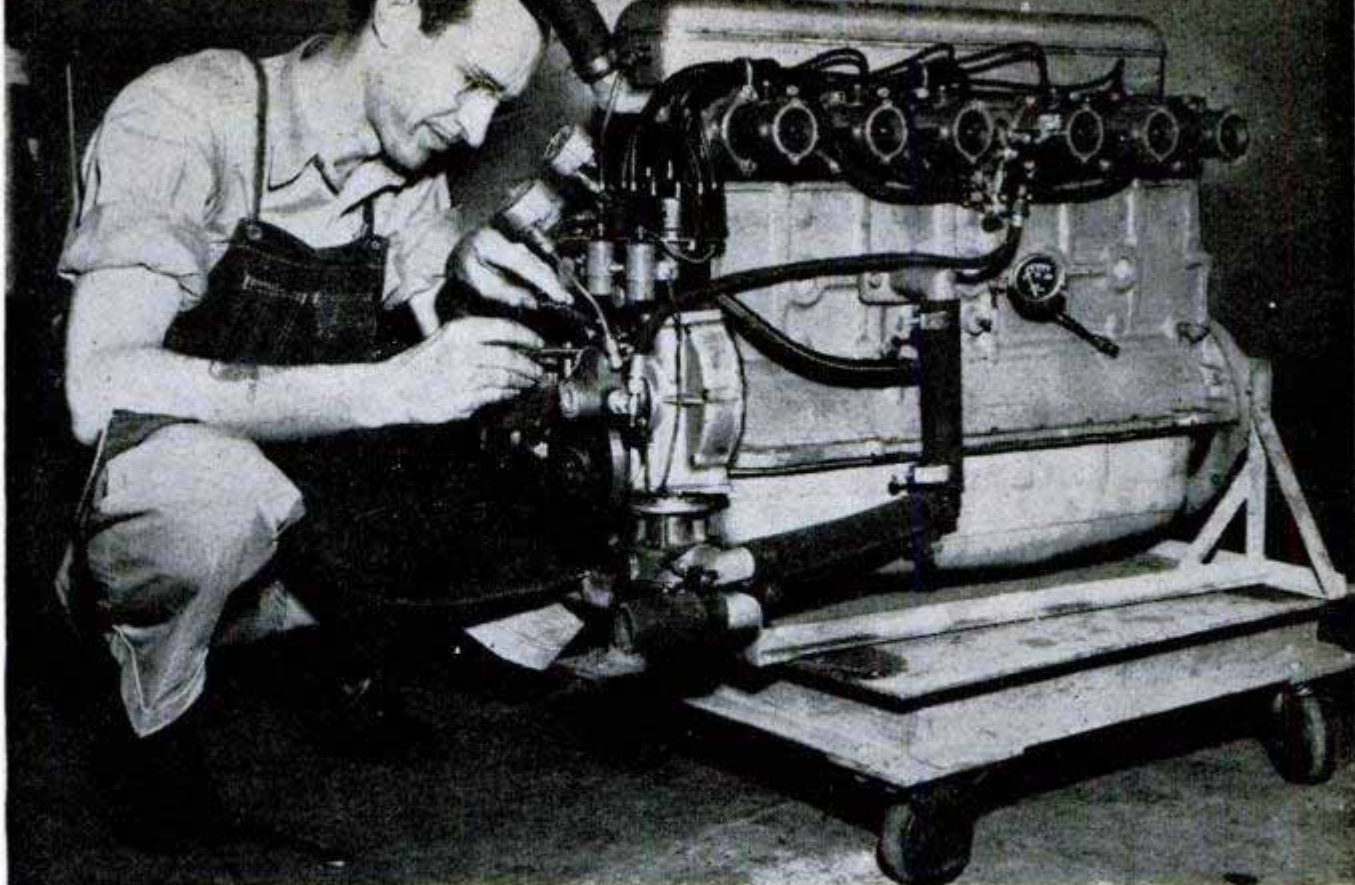
CAN A HOT ROD win the Indianapolis race?

Probably not, though a group of enthusiasts from Los Angeles is going to find out on Memorial Day. They are challenging the field of professional cars with a home-made racing machine of their own design. The car has been entered in the 500-mile race, its backers expect that it will qualify in the time trials, and there's always a chance that it can finish among the leaders.

The amateur automobile looks like a projectile, and is powered with a rebuilt truck engine. This engine, in a different chassis, produced an estimated speed of

218 miles per hour at the Bonneville hot-rod nationals last year. For Indianapolis it is geared down to a top speed of 160 miles per hour to produce better acceleration coming out of the turns.

The car was built by John Koehnle and friends in a back-yard garage. Stock parts include a Ford transmission, Ford hydraulic brakes, a 1925 Franklin steering assembly that was selected for its smoothness and quick steering, and parts of a '49 Lincoln radiator. Most of the rest of the car is hand-built. The frame is made of sections that bolt together so that any section can be replaced in case of damage.



Rebuilt truck engine, fitted with overhead valves and fuel injection, will power the hot-rod entry this year

The car stands 38 inches tall, has a 100-inch wheelbase and weighs about 1900 pounds. Its full cost was \$7500, about half of the cost of the average Indianapolis entry.

Its power plant is a six-cylinder GMC truck engine rebuilt by Wayne Horning to develop 285 horsepower at 5000 revolutions per minute, running on a mixture of 90 percent methanol (alcohol) and 10 percent nitromethane. Compression ratio is 12.4 to 1 and can be raised or lowered by changing pistons. Horning designed a new cast-iron head that makes use of overhead valves, extra-large intake and exhaust ports and shallow combustion chambers. The engine uses a fuel-injection system instead of the usual carburetors. ~~see A form~~

From the standpoints of design and construction, the hot-rod entry is a fast, sturdy car. It needs to be, for this year's race on the big track at Indianapolis will be the fastest and toughest in history, barring bad weather or accidents.

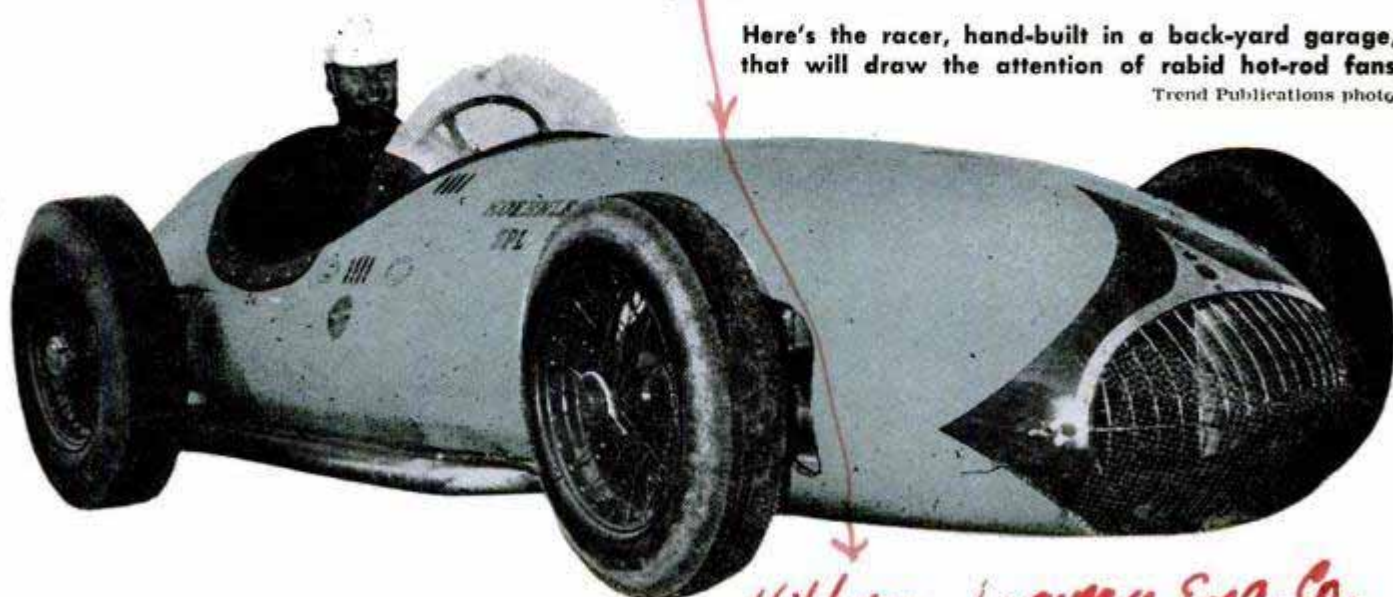
There are three reasons why the drivers expect to drive at record speeds this year:

First, Firestone has modified its Indianapolis racing tire so that it is more sure-footed than in the past. Tests made last summer show that with the new tires a car can average from two to five miles per hour greater speed at Indianapolis with the same safety.

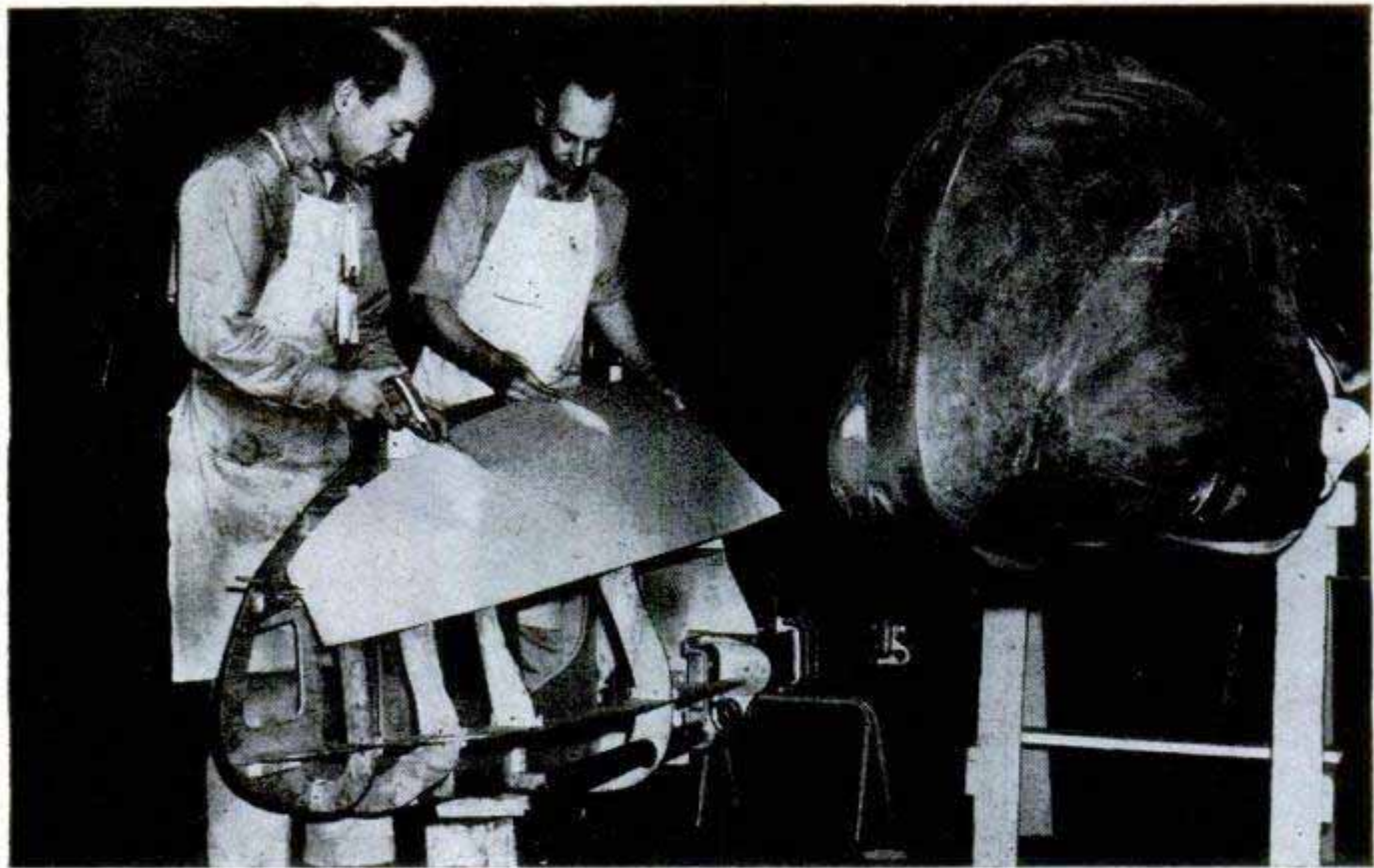
Second, about half the cars will use the Hilborn fuel-injection system instead of

Here's the racer, hand-built in a back-yard garage, that will draw the attention of rabid hot-rod fans

Trend Publications photo



Hilborn-Jraverse Eng. Co.
5641 Hannum Ave.



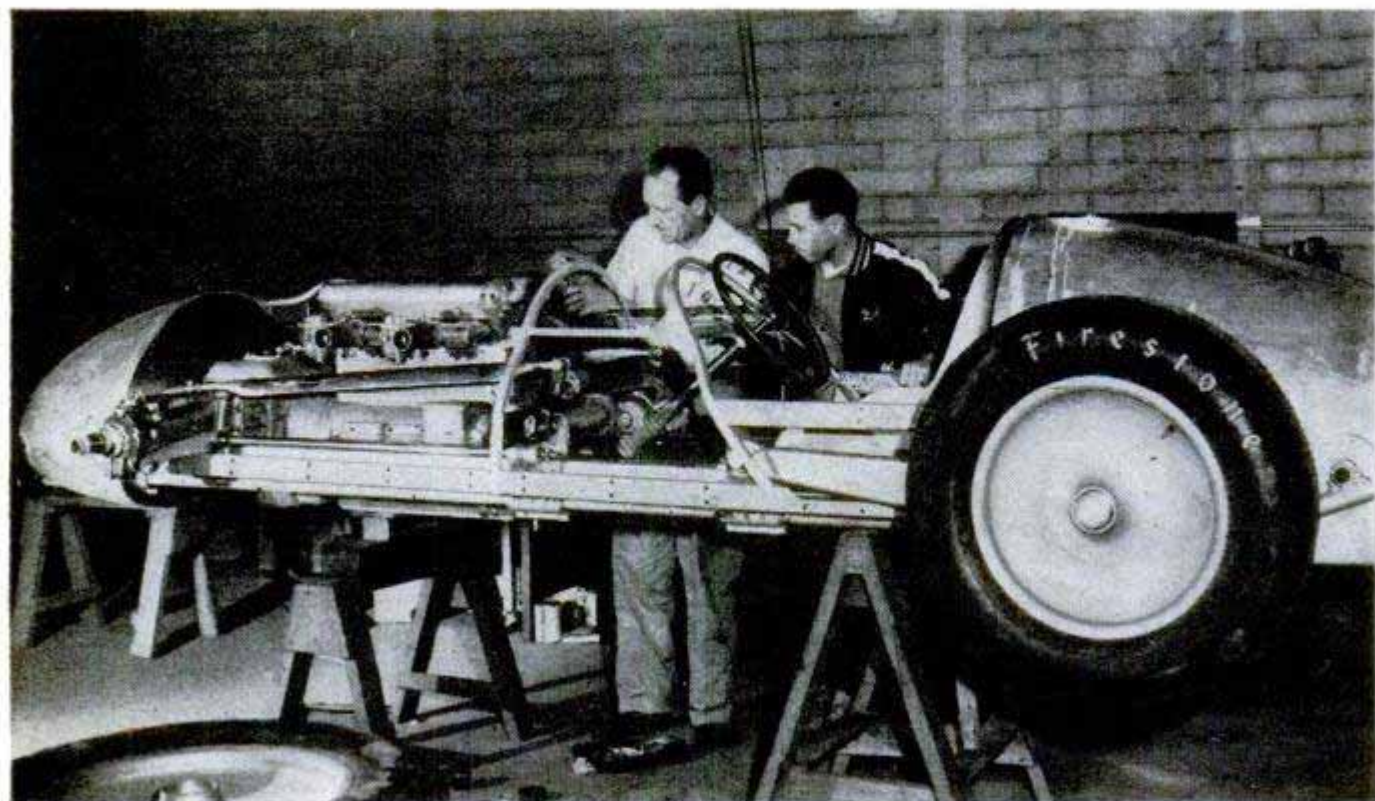
Car-makers, using the wooden mockup at right as a guide, cut a pattern for body panel of an Indianapolis entry

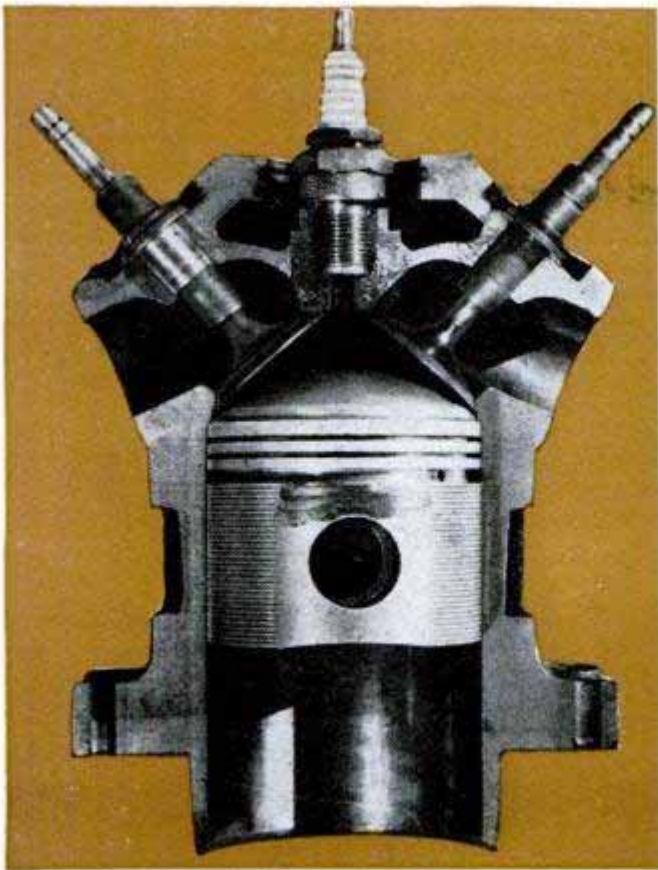
carburetors. With the standard 270-cubic-inch Meyer & Drake racing engine this system is said to increase the original 297 horsepower to as much as 335 horsepower, at the same time allowing greater fuel economy. A separate air intake is used for each cylinder with the fuel-injection system. A high-pressure pump injects fuel to each intake port at the time the valve opens. The fuel is broken up into a fine spray

and enters the combustion chamber under a positive pressure of 25 to 30 pounds.

The third reason why high speeds are anticipated is that many of the cars entered for the 500-mile classic are practically identical. It's almost true to say Indianapolis is becoming a stockcar race, so closely are America's leading race-car designers in agreement as to what constitutes the ideal car for winning that classic.

Front-wheel-drive car entered this year has aluminum and magnesium body parts which cut weight 350 pounds





Cutaway cylinder from the 550-horsepower, supercharged Novi engine shows tiny combustion chamber

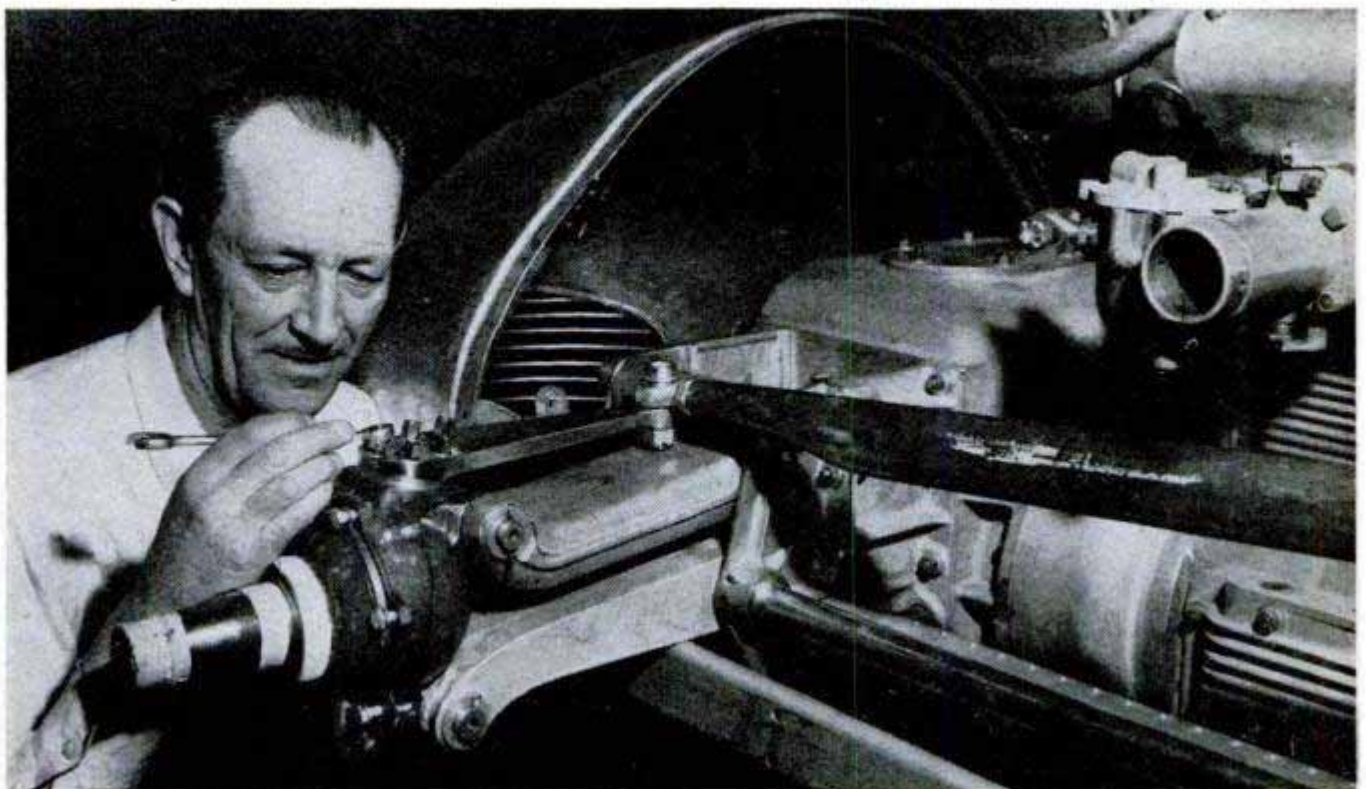
This composite "Indianapolis Speedway Special" is powered with a 270-cubic-inch Meyer & Drake (Offenhauser) four-cylinder engine, has a wheelbase of 100 inches, torsion-bar suspension in front and possibly in the rear, and is as light as possible. The average car weighs no more than 1800 pounds. Rear drives predominate, although several will be of the front-drive type.



Driver sits in partly finished body while car builders measure the angle and position of steering wheel

At Indianapolis in the past a driver who was leading the field would drop his speed to maintain no more than a safe margin in front of the second-place car. For the 500-mile distance, that reduced the possibility of mechanical failure. This year, with so many of the cars identical or practically so in performance, it will be a race all the way to the checkered flag.

Front-wheel bearings of aluminum-built car are mounted on novel kingpins to keep wheels in perfect alignment





Here's a dramatic moment during last year's race. Car had stopped for fuel, which overflowed and caught fire

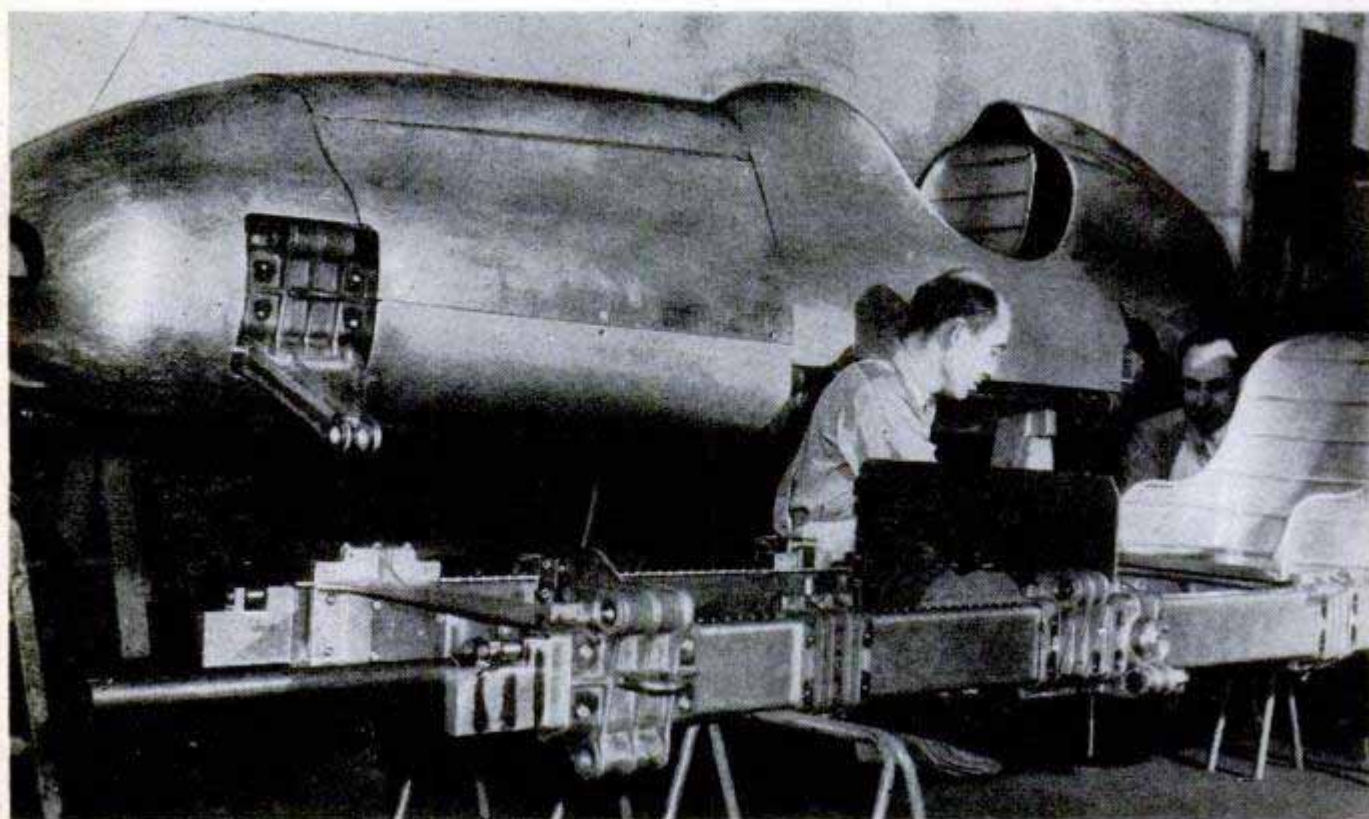
As many as eight of the cars will be identical Kurtis-built racing machines of the type that won last year at an average speed of 124 miles per hour.

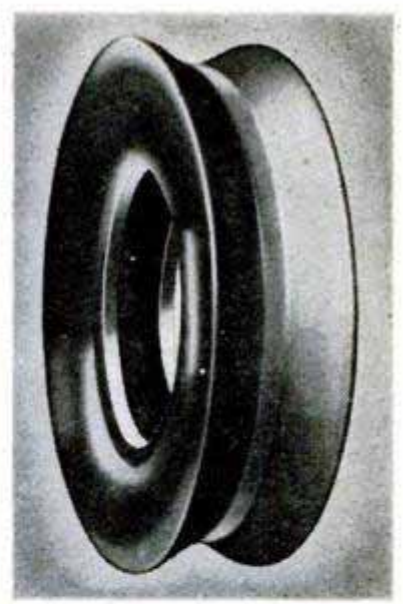
In the Kurtis cars the main fuel tank in the tail has a capacity of 47 gallons and is built up of rubber and fabric, similar to some aircraft fuel tanks. Many of the race cars, in fact, are using rubber fuel tanks

this year. The Kurtis cars, in addition, carry 26 more gallons in metal fuel tanks built under and on both sides of the driver's seat.

Lesovsky and Shroeder, two well-known builders, have completed two new minimum-weight race cars that are designed for dirt-track racing as well as for use at
(Continued to page 258)

Working against time, car builders start frame of one of the last-minute entries for this year's race

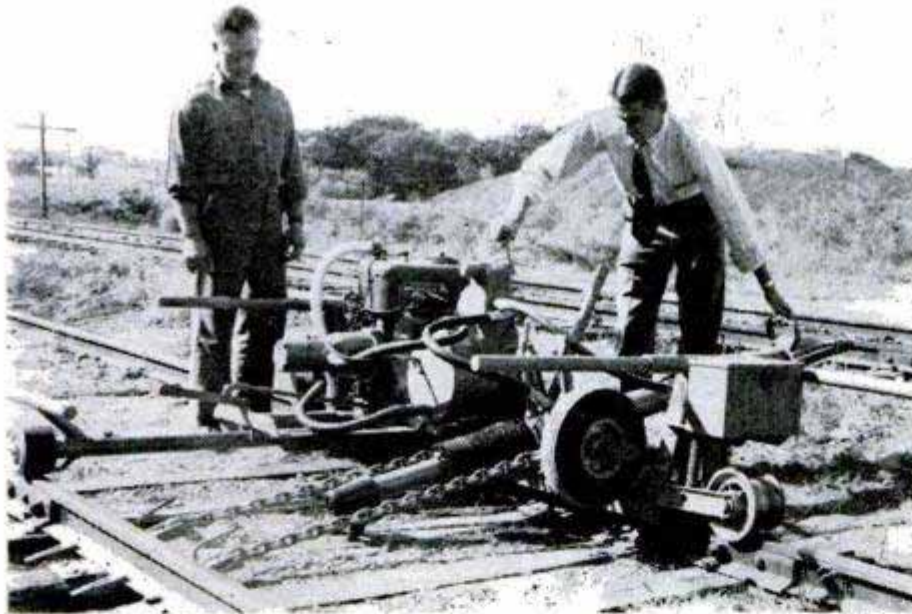




Pneumatic Tire Has Grooved Tread

Corn planters do a better job of firming the soil around the seed when they are equipped with an unusual pneumatic tire developed by the B. F. Goodrich Co., Akron, Ohio. This special tire is constructed with high shoulders and a low center, forming a deep, V-shaped tread. The

grooved tire does a more efficient job than the steel wheels now used on planters. It can be used to plant in wet soil, something that is not possible with steel wheels. It also firms the soil better, produces less side-slip on hillside planting and causes less dust in dry weather.



Fairmont Railway Motors, Inc., Fairmont, Minn.

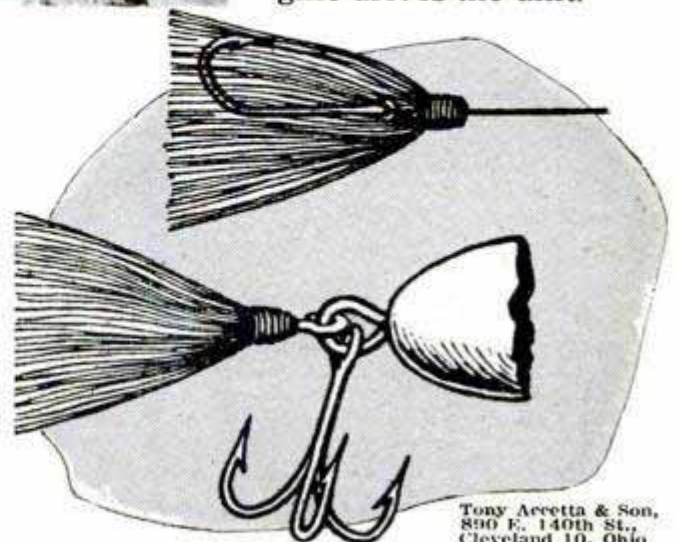
Hydraulic Ram Removes Ties

Exerting a push of 16,000 pounds, a hydraulic ram forces the stubbornest tie out from under the rails in a minute or less. Two men operate the machine which anchors itself to the rails with two chains. The ram has a double-pronged head that digs into the tie, forcing it forward. In three strokes, the ram pushes the tie from under both rails. A two-cylinder gasoline engine drives the unit.

Straight From Paris?

Latest item for the angler's wardrobe is a nylon skirt for his fishing lures. The little skirt can be used to replace worn bucktails, feathers and rubber skirts on plugs and other baits. It is held in place with a screw eye. The skirt also can be used individually, rigged as a fly.

Studies of an age-old layer of rock in southwestern Colorado have revealed that four species of plants, previously unknown, grew in that area during America's Cretaceous period—about 100,000,000 years ago.



Tony Arcetta & Son,
890 E. 140th St.,
Cleveland 10, Ohio

The OWNERS REPORT on



THE POPULAR MECHANICS MOTOR SURVEY AS CONDUCTED BY FLOYD CLYMER

I am the owner of a 1951 Studebaker. Model Champion 8-cyl. 6-cyl.
I have owned it about 4 months. Speedometer mileage is now 10,000

I use only regular gasoline - I use premium (high test) gasoline

My approximate gas mileage in the city is 20 MPG; in country, 23 MPG.
Gas mileage INCREASE by using overdrive is about _____ MPG.

I CHANGE OIL every 4,000 miles; I ADD OIL - one quart every _____ miles.

My car has : Standard Trans. Overdrive Studebaker Automatic Drive

How does the car handle on the road? Better than any we've had

Maneuverability seems to be: Excellent Average Unsatisfactory

Acceleration is: Outstanding Fair Poor

Curb and Road Clearance is: Satisfactory Too high Too low

Why did you buy a Studebaker? We need a car that would give us

high gas mileage and good durability.

What features about the car do you especially like? We like the gas

mileage and the automatic drive.

Do you like Studebaker's CLIMATIZER? yes; HILLHOLDER? yes;

Self-adjusting BRAKES? yes; APPEARANCE? yes; VISIBILITY? yes

What is your opinion of new V-8 ENGINE? _____

What do you dislike about the car? The only things I can think

of are the place where the starter is located and the tires.

Have you ever owned a Studebaker before? yes If so, how many? one

Would you buy another Studebaker? Yes Possibly No

Do you secure good dealer service? Yes Fair No

How would you rate your new Studebaker? Excellent Good Average Poor

GENERAL INFORMATION

What type of engine would you prefer in your car of the future? In-line V-type: 9 6

Cylinders: 6 8 Valves: Side Overhead one valve just

Based on my present experience, I want my next car equipped with: Standard Trans.

Overdrive Studebaker Automatic Drive Other type of automatic trans.

Please state reasons: no gear changing, better take off

Do you like the new low-pressure, super-cushion tires? no

Do you carry the recommended pressure? Yes No How much more? 4 more lbs.

Please check all answer boxes () Your reply will be held in strict confidence.

Please mail promptly to:

FLOYD CLYMER

My Name: _____

Address: _____

Overdrive Studebaker Automatic
Excellent Average Unsatisfactory
Fair Poor
Satisfactory Too high Too low
wonderful

Report at left is from a
Champion owner who has
driven his '51 Studebaker
10,000 miles in four months

the '51 STUDEBAKER

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

By Floyd Clymer

FROM MAINE to California busy Studebaker owners took time to fill out the detailed Popular Mechanics questionnaires about their cars and send them in. The returns came from 24 states and the District of Columbia.

Studebaker owners are definitely articulate about their cars as testified by the hundreds of words written on the backs of the questionnaires. As a glance at the percentage chart will show, the '51 owners as a group are pleased with their cars. Of course, there's an occasional brickbat along with the good sound criticism. The survey brought forth a general round of cheers for the visibility that Studebaker pioneered so successfully in postwar cars. Owners also like the snappy pickup of the V-8 Commander and the Champion's fine maneuverability. Economy of operation is another favorite feature.

Our survey shows that 55 percent of the owners have bought Studebakers year after year. Their reasons range all the way from the man in Tombstone, Ariz. (population 822), who says he buys Studebakers because the only dealer in town sells them,

Excellent Average Unsatisfactory
 Fair Poor
 Satisfactory Too high Too low
 Had a Studebaker before _____
 you especially like? Economical - easy to handle
 TIZER? _____; HILLHOLDER? Yes;
 ? _____; APPEARANCE? Yes VISIBILITY? Yes
 ENGINE? _____

Valves: Side Overhead
 In-line V-type: 8 6
 I want my next car equipped with: Standard Trans.
 Studebaker Automatic Drive Other type of automatic trans.
 Super pressure, super cushion tires? no
 How much more? _____ lbs.
 Your reply will be held in strict confidence.
 My Name: _____
 Address: _____

ENGINE? _____ APPEARANCE? Yes VISIBILITY? _____
 The car? A little too small a motor for a coupe but in town it could use more H.P.
 Had a Studebaker before? Yes If so, how many? 1
 Studebaker? Yes Possibly No
 ? Yes Fair No

With "picture" windows all around, the test car, a Commander Starlight Coupe, has excellent visibility



Bought overdrive	68%
Bought Studebaker Automatic Drive.....	24%
Bought standard transmission	8%
Average gasoline mileage, Champion (country) 23.1 m.p.g.	
Average gasoline mileage, Champion (city).....	19.6 m.p.g.
Average gasoline mileage, V-8 (country).....	18.9 m.p.g.
Average gasoline mileage, V-8 (city).....	17.1 m.p.g.
Use regular gas.....79%	Use premium gas.....21%
Mileage increase by overdrive.....	3.4 m.p.g.
Change oil	96%
Average mileage for oil change.....	1449
Add oil	4%
Average mileage for adding oil.....	1180
Maneuverability excellent	83%
average	17%
unsatisfactory	0%
Acceleration outstanding	44%
average	53%
poor	3%
Road clearance satisfactory	98%
Road clearance too low	2%
Champion model (6-cyl.).....	74%
Commander or Land Cruiser (V-8).....	26%

BEST-LIKED FEATURES

Visibility.....	99%	Hillholder.....	97%
Climatizer heating system.....	95%		
Brakes	94%		
Body styling and appearance.....	78%		

(These percentages are based on the fact that some owners commented on more than one feature.)

How does car handle on the road?

Excellent	51%	Very good	37%
Satisfactory	7%	Fair	5%

Why did you buy a Studebaker?

Price and economy	38%
Previous Studebaker experience	32%
Studebaker reputation and owners' opinions.....	16%
Styling, general appearance	7%
Various other reasons	7%

Opinion of new V-8 engine

Excellent	48%	Very good	27%
Satisfactory	23%	Unsatisfactory	2%

RATING OF CAR

Excellent	56%	Good	34%
Average	8%	Poor	2%

GENERAL INFORMATION

Prefer V-type engine.....	54%	Prefer in-line engine	46%
Prefer eight cylinders.....	54%	Prefer six cylinders.....	46%
Prefer overhead-valve system	61%		
Prefer side-valve arrangement	39%		
Prefer conventional transmission with overdrive.....	66%		
automatic transmission	29%		
conventional only	5%		
Prefer Studebaker Automatic Drive.....	88%		

(The above figure means 88% of the 29% preferring automatic transmissions.)

Prefer auto. trans. other than Studebaker auto. drive.....	12%
Owners who like low-pressure tires	77%
Previous Studebaker owners	55%
Will buy another Studebaker	70%
Might buy another Studebaker	29%
Will not buy another Studebaker	1%
Dealer service good	70%
Dealer service average	23%
Dealer service poor	7%

Most disliked features . . . Sedan rear doors opening from front, dash location of rear-view mirror.

to the 12-time buyer who has a new Land Cruiser with overdrive and says: "The ride is tops . . . I have had satisfactory Studebaker service since 1935. Why should I change?"

Not all the '51 owners are sold on the torpedo design of the front end. Sprinkled through the reports are such comments as "dislike front end . . . I think the '49's front is better looking . . . bit radical in front-end appearance . . . dislike 1951 grille . . . perhaps the front end is slightly radical." In all fairness to Studebaker, however, the great majority of owners approve of the styling.

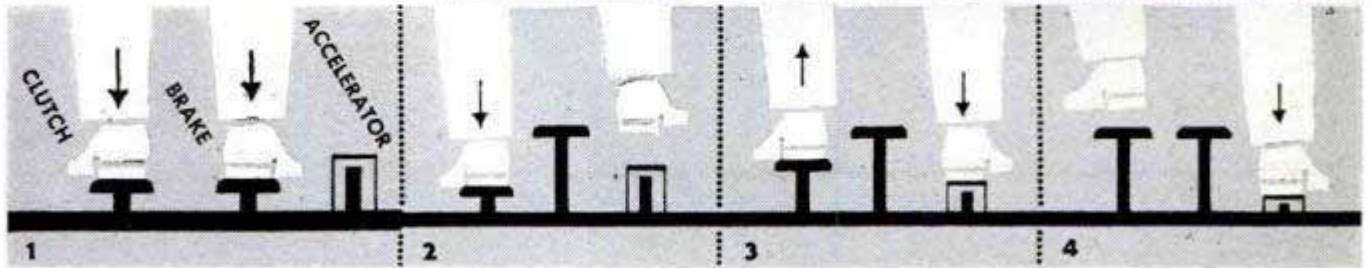
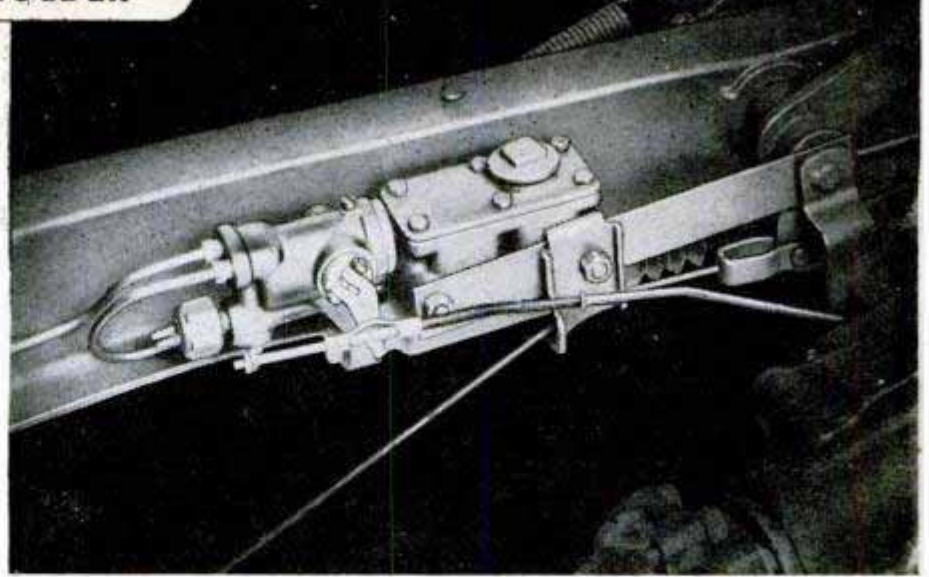
Several owners mentioned that they dislike the way the rear doors on the sedan open from the front. (I do too.)

A V-8 owner wrote, "The car has exceptional acceleration and practically no engine noise at driving speed." Another said, "I have owned Studebakers for 25 years and every one was a good car." The owner of a new V-8 observed that "the simple automatic transmission operates through driver's choice and not by itself." A Champion Automatic Drive owner says, "For the money, it is the best buy on the market." A V-8 owner says, "This car is excellent, and it has plenty of power in the mountains and is very fast on the open road. I have owned 10 Studes since 1910." Another says, "The V-8 is good . . . but has considerable tappet noise." (This is not uncommon in any overhead-valve engine.)

Clymer uses a portable machine to record his test observations. Also shown are vacuum gauge and gas-consumption meter



Available in Studebakers for many years, the hillholder is among the best extras ever offered, Clymer says. It is mounted on the master cylinder, right. The sketches, below, show how it works. 1. The car is stopped normally. 2. Foot can be removed from brake pedal, but car won't roll backward while clutch is depressed. 3. To drive ahead, the clutch is released and the accelerator depressed. 4. This releases the brakes as car moves ahead



One owner writes: "It has a 'feel' on the road that no other car has and I have owned many different makes."

To the question, "Why did you buy a Studebaker?" one answer was: "Because my previous Studes have given me trouble-free and economical service; I get a high trade-in price . . . and because of my previous experience with Studebaker dependability." Several mentioned in the questionnaire that their Studebakers start easily in cold weather.

An enthusiastic owner of a V-8 with Automatic Drive said he averaged 17½ miles per gallon for 2200 miles, mostly at 80 miles per hour. Another V-8 owner (whose foot was lighter on the accelerator) reports that "on several trips under ideal conditions I did 27 miles per gallon, and on the whole the Studebaker is the best buy I ever made." More than half of the owners

make some mention of the car's economy of operation — gasoline, oil and general maintenance. One man writes: "My first Studebaker gave me 77,000 miles with no repairs." The percentage chart shows 38 percent giving the reason of price and economy after the question, Why did you buy a Studebaker? Actually the percentage of those mentioning economy as an outstanding feature of the car would run into a much higher figure because remarks on this subject are combined with other answers throughout the reports. An example is from a Kansas owner who says his four-door sedan "holds the road at high speeds for a light car. Easy on the oil and gas bill." This man gets 27 miles per gallon in the country.

A few owners dislike the location of the rear-view mirror (mounted on top of the instrument panel instead of at the top of

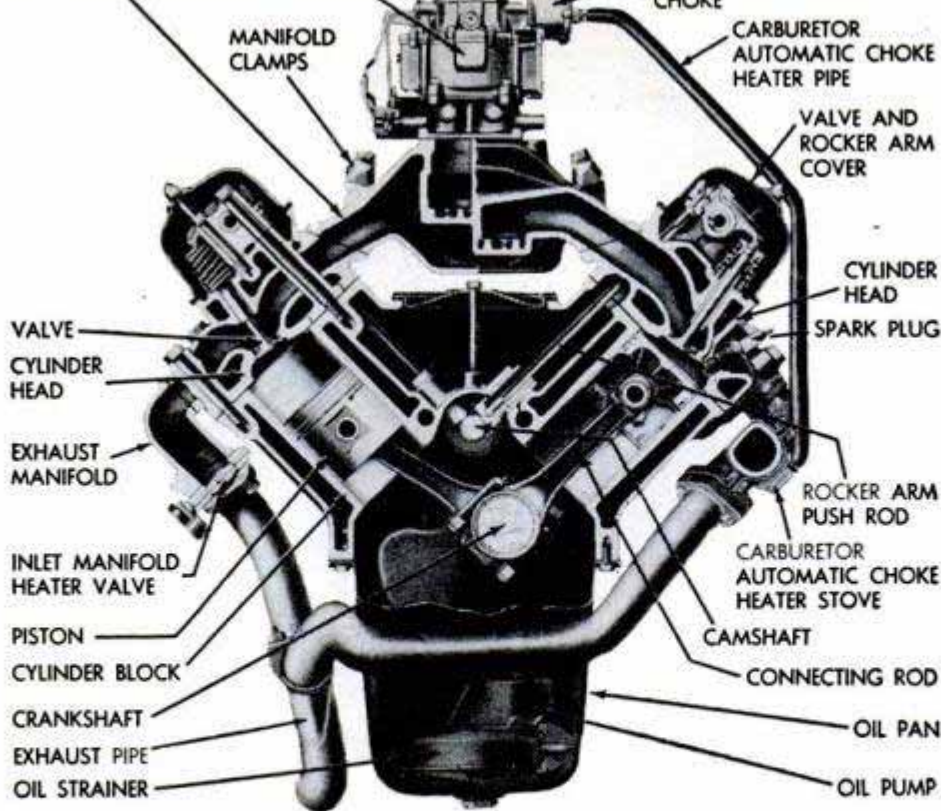
ACCELERATION TESTS

Studebaker Commander V-8 with Automatic Drive

Standing Start



(In tests using both Low and Drive ranges, shift was made at 35 m.p.h.)
Top Speed (by speedometer) — 102 m.p.h.
Actual top speed, about 7% less (speedometer variation).



Cross-section view from the front of the new Studebaker 120-horsepower V-8 engine with overhead valves. This is the engine Floyd Clymer tested

the windshield, as in most other makes). One man complains that "the power plant is excellent but noisy and slow to warm up when cold . . . and the springing is too soft." Still, he rated the car "excellent."

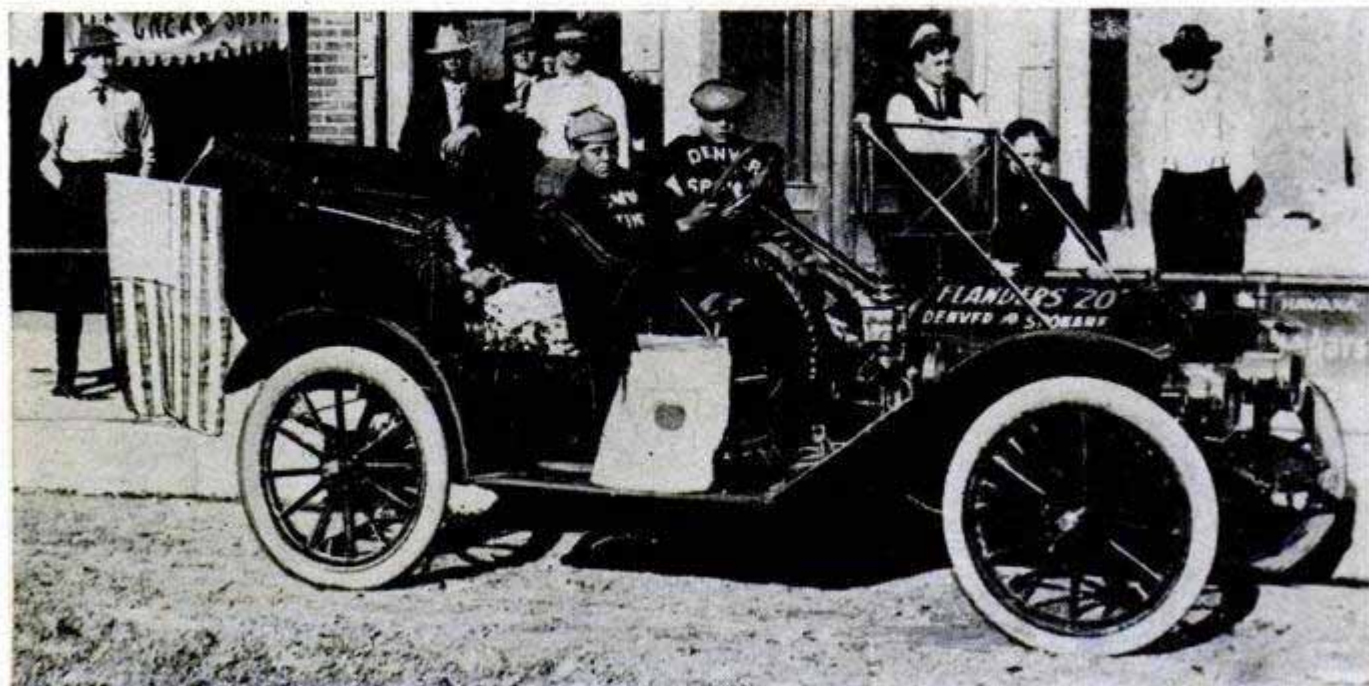
Another says, "The Studebaker is a good all-around family car, but the seats are rather low and I can't tell where the right-front fender is." After paying tribute to his Champion's visibility, an owner in New York says the front fenders should be set back six inches for "better protection and increased beauty and streamlined effect."

(I wonder what designer Raymond Loewy will think of that suggestion!)

The owner of four different model Studebakers says: "The engine is tops; it really takes a beating." Another: "I drove a 1950 Champion 36,000 miles without spending a cent for repairs, not even tires, so I certainly will stick with Studebaker."

While boosting the car in general, some other owners stated that the steering ratio is too low and they have to turn the steering wheel too much. One was satisfied with the car generally, but says, "There is not

In 1910, 14-year-old Clymer (at wheel) and his 11-year-old brother left Denver for Spokane in this Studebaker-Flanders. Battling sand, mud and mountains, they finally had to give up and complete trip by train



**CLYMER'S ECONOMY TEST OF
THE STUDEBAKER V-8 COMMANDER
WITH AUTOMATIC DRIVE**

MILES PER GALLON

At constant 30 m.p.h.....	25.42
At constant 50 m.p.h.....	19.71
At constant 60 m.p.h.....	17.95
At constant 75 m.p.h.....	14.32

MILEAGE AFTER CAR WAS BROKEN IN

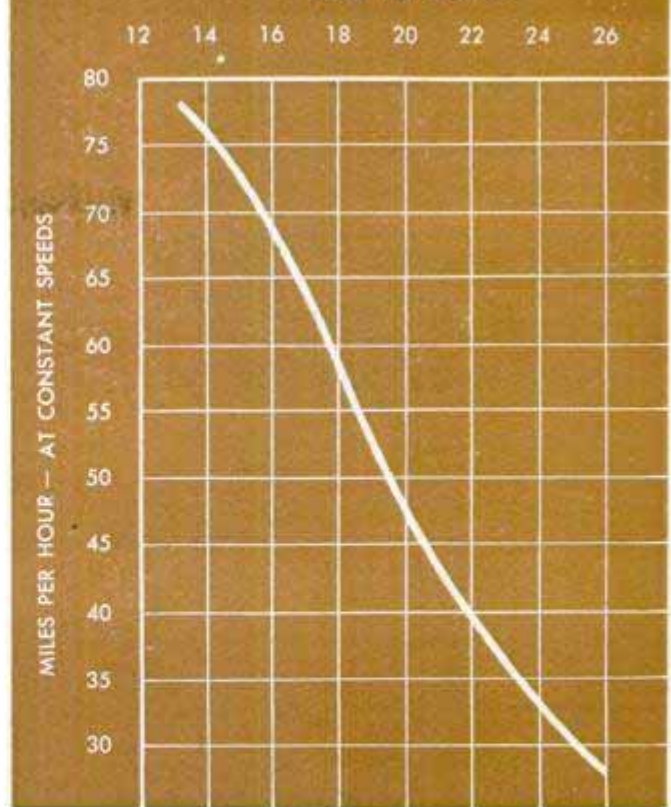
Omaha, Neb., to Cheyenne, Wyo.....	19.32
Cheyenne to Salt Lake City (High-speed driving, some mountains, strong head wind).....	14.61
Salt Lake City to Los Angeles.....	22.09

enough brake surface, and it requires too much pedal pressure to stop at high speed with six persons in the car."

One of the most popular reasons for buying a Studebaker—and probably every other car—is the recommendation by other owners. Other reasons, aside from economy and dependability, which showed up in the survey include, "because it's a light car and easy to handle in traffic," "good dealer service," "I liked the lines."

There were some humorous answers too. One man said he bought a Studebaker "because my father-in-law thinks it is the best buy and is helping finance the car," and "because it is so small and also big." (How's that again?) Another says, "I like the

To see how the Studebaker handles off the pavement, Clymer drove the test car over miles of poor roads



Automatic Drive because I'm too durned lazy to shift." A safety-first-minded owner was displeased because of "failure to put an ash tray on the driver's side, which is bad, as throwing cigarette butts out the window is dangerous and might start a forest fire."

A Champion owner says he likes the way the Studes eat up the road, and that he had driven 85,000 miles before the engine needed a valve job.

An enthused V-8 owner says his car has the fastest getaway of any car he has ever known. (I certainly agree with him that the V-8 Commander has excellent acceleration.) One man reports: "Studebaker is the only car I can buy in my town that is not loaded with extras. All I want is economical transportation and no frills."

Several owners are loud in their praise of Studebaker dealers' service. One of them says: "My Studebaker dealer takes personal interest in seeing that I get good service." A quick-on-the-trigger buyer says: "I just saw it in the window and it looked so sharp I bought it without even driving it, and I'm sure satisfied."

Complaints include "not enough head-room in my sedan," and "the starter pull lever is too close to the hood latch." (I agree with the latter.) Some reported "too many rattles."

Few Studebaker owners reported many serious dislikes and most of those who had a complaint still gave the car a satisfactory rating. Typical is the owner who said there is not enough room between the front and back seats and went on to give glowing approval of Climatizer and the car's visibility. Nearly every one who mentioned

(Continued to page 262)



Firestone Tire & Rubber Co., Akron, Ohio

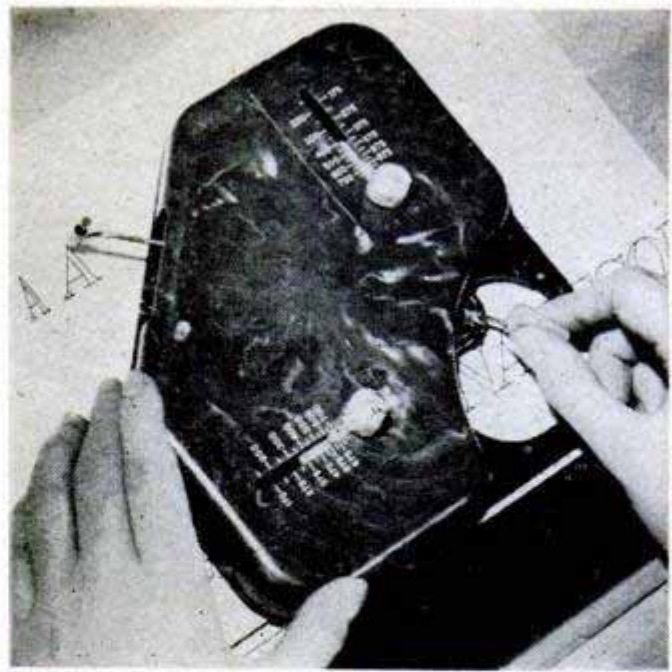
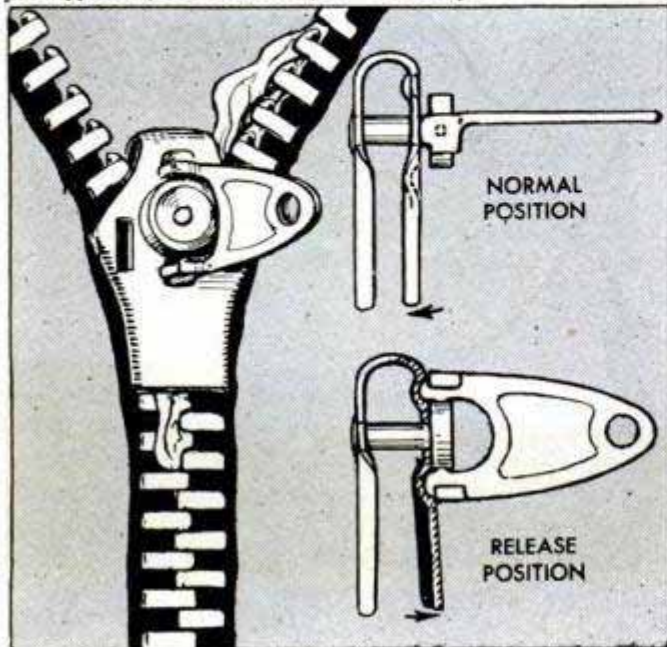
Punctureproof Tube Made Entirely of Butyl

Three layers of butyl retain the air in a new lightweight, punctureproof tube, the first of its kind to be made entirely of this synthetic rubber. The inner layer is a special soft butyl that flows around a nail or a similar sharp object to prevent loss of air, and the middle layer of specially compounded butyl resists tearing or enlargement of puncture holes. The surface layer is extra tough and heat resistant.

Nonsticking Zipper

You can't jam a new zipper that has a release mechanism for use when fabric or any material is caught in the teeth. A quick turn of the pull tab releases the imprisoned material without damaging either it or the zipper. It is available in many lengths and colors.

Lee Zipper Co., 350 Fifth Ave., New York City 1



The Varigraph Co., Inc., Madison 1, Wis.

Lettering Machine Adjusts for Size

You can make your lettering letter-perfect with a machine that uses any one of more than 60 templates, each with a different type face. In addition, you can adjust the width and height of the letters as you wish simply by setting two scales on the face of the machine. As you follow the lines of the template with the stylus, a lettering-pen point forms the letter in the size you want. The housing, made of lightweight Tenite, can be reversed for use by a left-handed person.

Crystals Amplify X Rays

Laboratory-grown crystals which amplify X-ray energy a million times may be put to work inspecting industrial products. When the crystals are excited by X rays, they release torrents of electrons which can be used to operate various mechanisms. For example, canned food can be passed between an X-ray machine and the crystal to locate partly filled cans and cans which contain foreign matter. The crystal, which was developed by General Electric X-Ray Corp., does the work that is ordinarily performed by a complex system of vacuum tubes and amplifiers.

Ore Reserves for 125 Years

If U. S. steel mills consume an average of 100,000,000 tons of iron ore annually, there will still be enough iron ore available for 125 years. Over half of an estimated 12,500,000,000 tons of reserve in the U. S., Canada and South America is in Brazil and the Lake Superior district. According to Wilfred Sykes, chairman of the Inland Steel Company's executive committee, the actual reserves will probably prove considerably larger than the estimates.

Ride As You Mow

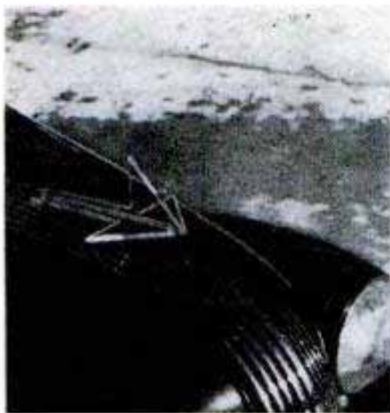
Now they've taken the walk out of lawn mowing with a power mower that you ride like a tiny tractor. Powered by a 2 or 3-horsepower engine, the mower cuts a 20-inch strip with its rotary blade. Hidden under the frame, this blade can be quickly sharpened with a file. The cutting height is adjustable from 1 to 3 inches. Attachments, including a heavy lawn roller and dump cart, are available for the machine which weighs 180 pounds.



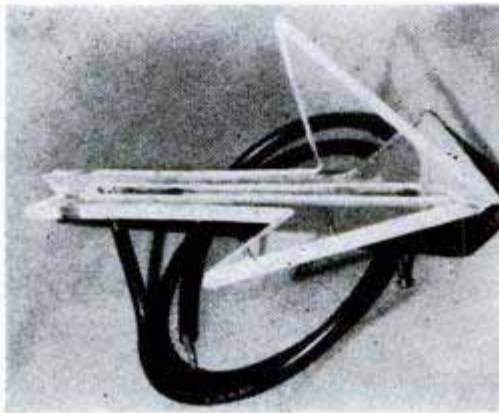
The Belknap Mfg. Co., Bridgeport, Conn.

Flashy Ornament

Connected to the ignition system, an arrow-shaped plastic ornament adds a colorful flashing light to the hood of a car. When the engine is idling, the neon tube inside the plastic twinkles on and off, but as the engine accelerates, the tube glows steadily.

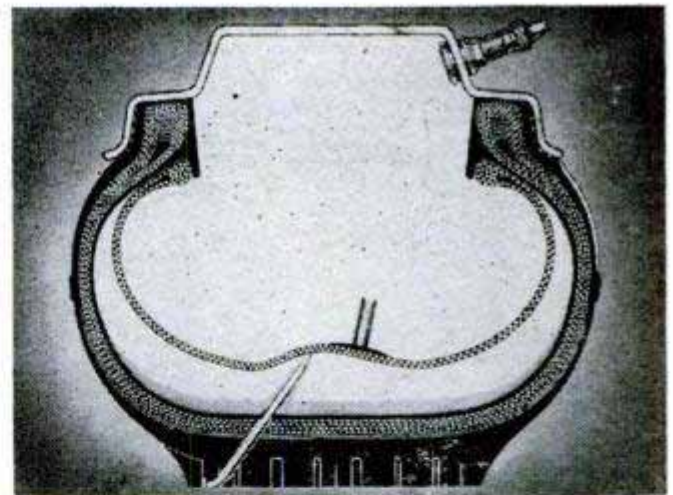


Flicker Lights Mfg. Co., Grand Junction, Colo.



Tubeless Tire Is Punctureproof

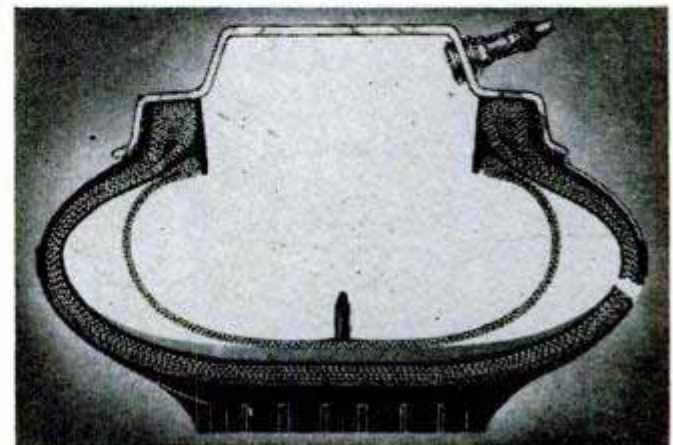
Punctures and blowouts are taken out of the danger class and changed to mere annoyances by a tubeless tire that is punctureproof and blowout-safe. Because no inner tube is used, the inside walls of the tire are coated with a self-sealing compound to prevent air loss. A nail cannot cause a leak because it is surrounded by this sealing compound as it punctures the tire. The compound stops any air loss, sealing the hole when the nail is withdrawn. When a blowout occurs, about two thirds of the air is kept in the tire by an inner diaphragm that has an automatic valve. This air pressure is ample to support the car safely at any speed.



Firestone Tire & Rubber Co., Akron, Ohio

Concrete Cuts Radiant-Heat Costs

Special aggregates for concrete reduce the cost of radiant-heating installations by 25 percent by increasing the heat conductivity of the concrete. This added conductivity permits a reduction in the piping used. Wearing qualities of the concrete are also improved, according to Products Planning Co., Blakewell Bldg., Pittsburgh, Pa., developers of the aggregate.



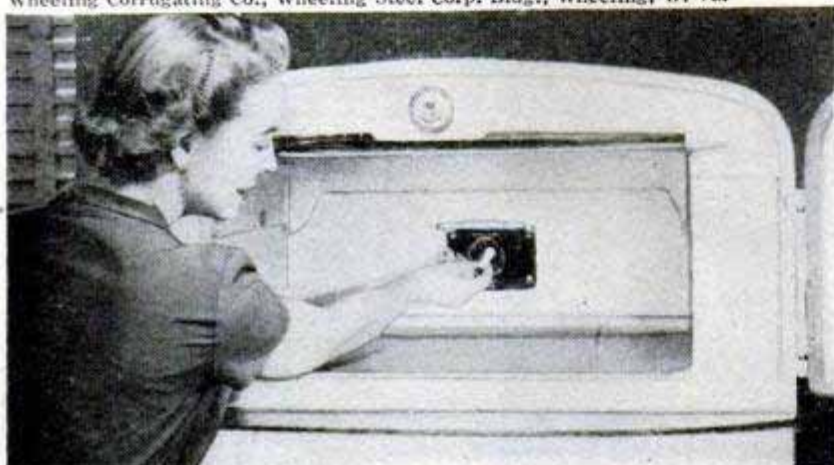
WHAT'S NEW

For Your Home



OUTDOOR ARMCHAIR is pleasing to see and to sit on. One-piece expanded-metal construction makes it light in weight, yet gives enough resiliency for comfort. An important extra is the sliding tray that becomes a handy chairside table at refreshment time. When not needed, the tray slips neatly out of way under the seat. Chair is both snag and rust-proof

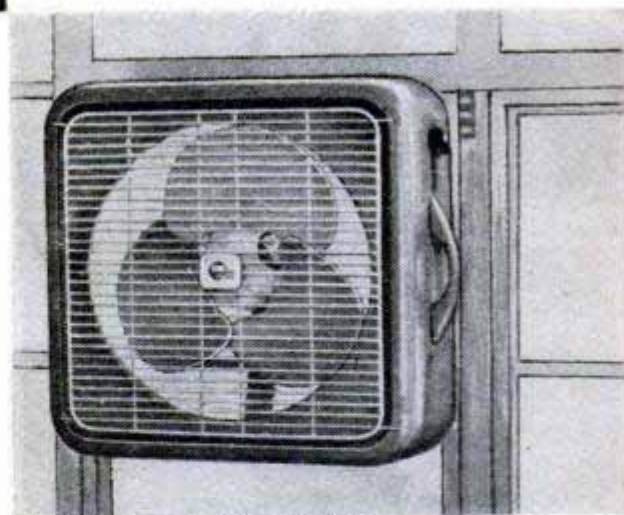
Wheeling Corrugating Co., Wheeling Steel Corp. Bldg., Wheeling, W. Va.



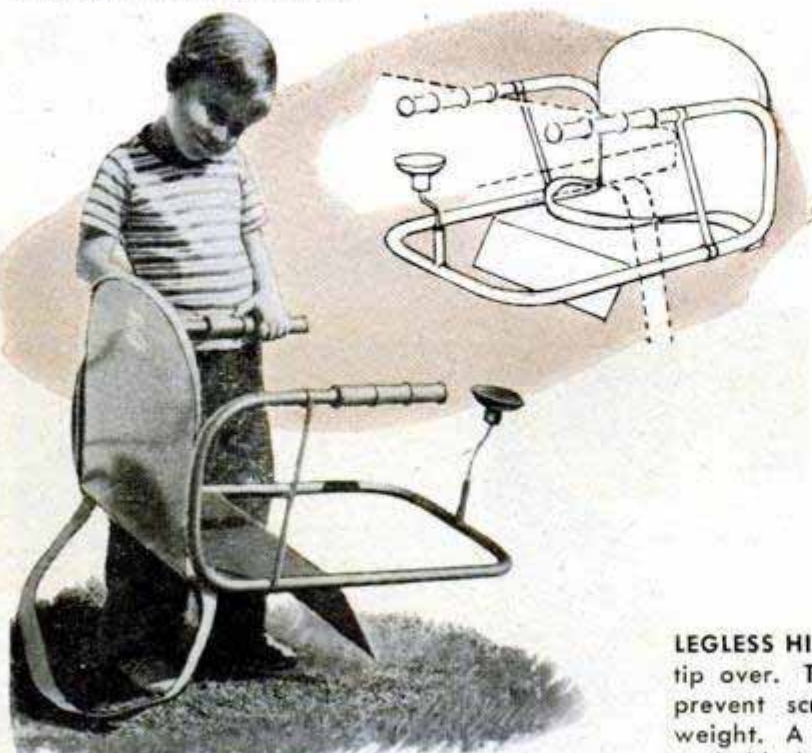
DEFROST CLOCK, left, automatically takes over once a day at a preset time and defrosts refrigerator. Both freezer and main food compartment are cleared of ice. Heaters and evaporators do the job so quickly that food remains frozen

Philco Corp., Philadelphia 34, Pa.

WINDOW FAN, below, is especially designed to mount on casement windows as either an intake or exhaust fan. Because of its shape, it will stand on floor or table to serve as a circulating fan

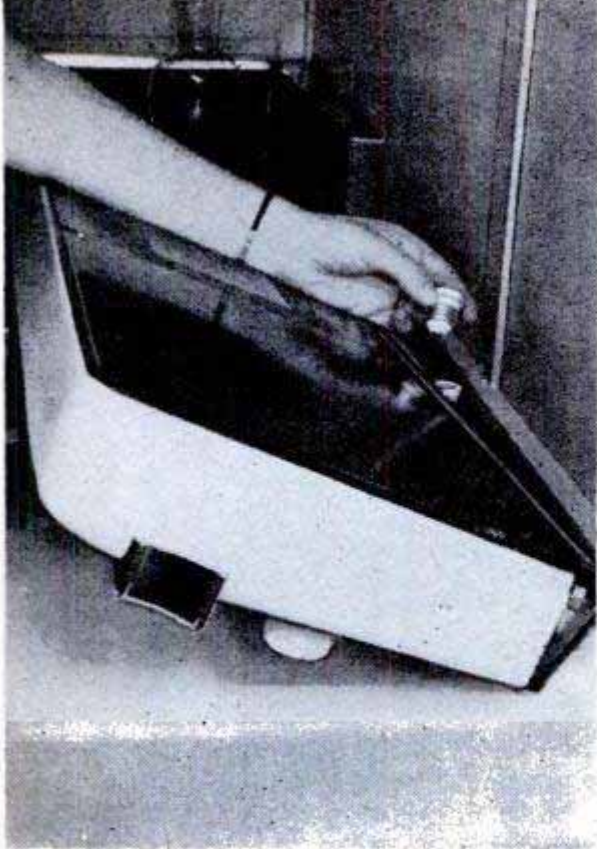


The Lau Blower Co., Dayton 7, Ohio



LEGLESS HIGH CHAIR hooks over the table top and can't tip over. Two extended arms, covered with rubber to prevent scratches, rest on the table, supporting the weight. A suction cup grips the underside of the table to hold the chair firmly. Lightweight, it is all metal

Sullivan Mfg. Co., 2114 West Monte Vista Road, Phoenix, Ariz.



Philco Corp., Philadelphia, Pa.

SPRINKLER HEAD, at right, is made of molded rubber and requires no washer. It won't scratch paint when used while washing the car. The aluminum faceplate forms a fine spray



Surf Mfg. Co., 333 N. Michigan Ave., Chicago 1

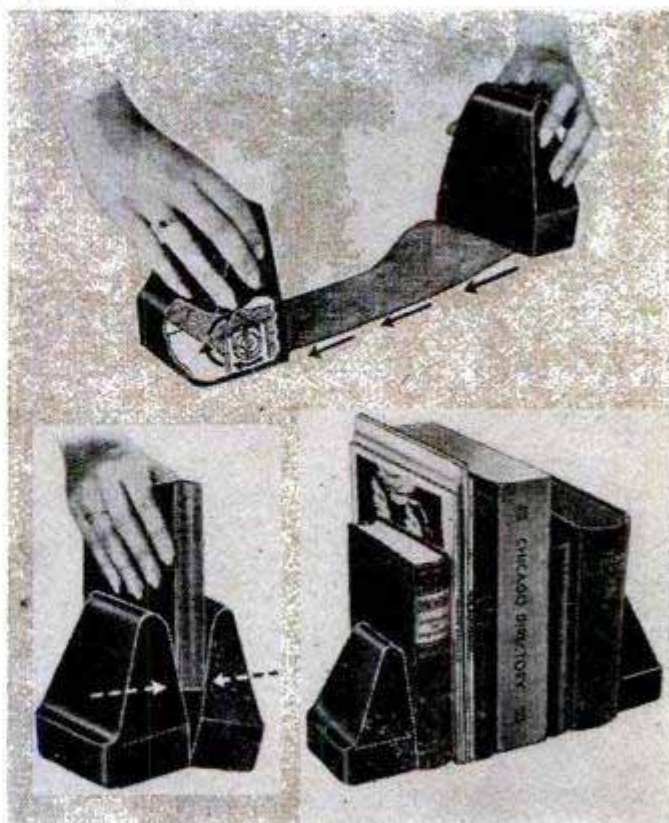
SLIDING GRIDDLE, above, on electric range enables you to make pancakes and broil the sausages with same heat! Above, left, range has hinged back for replacement of fuses

RADIANT PLATTER, below, keeps food hot for hours without drying it out. It does it with radiant heat. The platter is made of glass and detaches from a wood base for washing

BOOK ENDS, below, solve the book-display problem neatly. A spring keeps canvas band taut, holding books up. When you remove one book, the ends slide in to prevent toppling



Appleman Art Glass Works, Bergenfield, N. J.



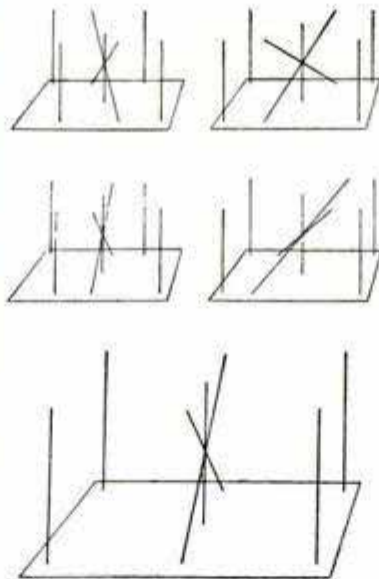
Lordell Corp., 219 W. Chicago Ave., Chicago 10



Survival Rifle

Lightweight survival rifles are being added to the emergency kits of the Strategic Air Command's bomber crewmen. The kits provide the means to keep them alive if they are forced down in remote areas

during long-range flights. The new weapon, which will fit into the pocket of a flying suit when disassembled, weighs 3½ pounds. With the stock extended its length is only 33 inches. Despite a short barrel, the rifle is fairly accurate up to 150 yards and will kill small animals needed for food.



Instrument Checks Eyes For Odd Visual Condition

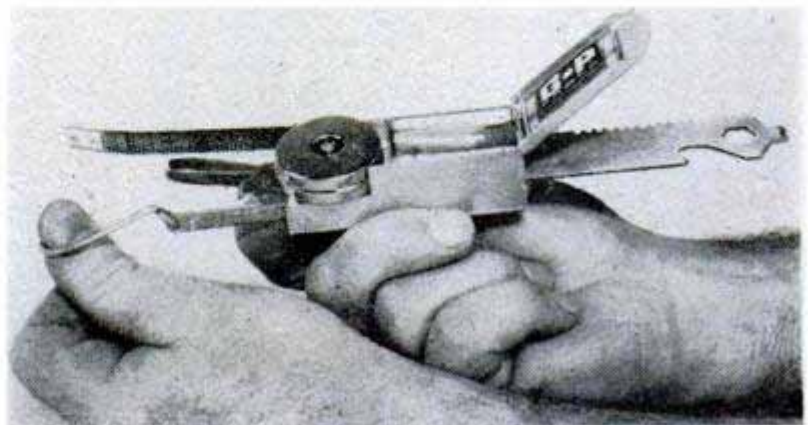
Eye specialists can detect and correct a strange visual condition called aniseikonia with the aid of a new optical instrument. Eyes afflicted with aniseikonia transmit two different ocular images to the brain. The victim often suffers puzzling headaches, eye pain, motion sickness and nervousness. Only a few instruments have been made in the past for detecting this condition, but the new instrument is intended for general office use. It enables an eye examiner to measure accurately the unequal images within the brain. Complex lenses then are prescribed by specialists to correct the patient's unusual visual condition.

American Optical Co., Southbridge, Mass.

Above, complicated lens system inside the instrument measures the unequal images within the brain where seeing takes place. At bottom right is the test pattern seen by normal eyes. Above are two sets of patterns seen by victims of odd visual condition

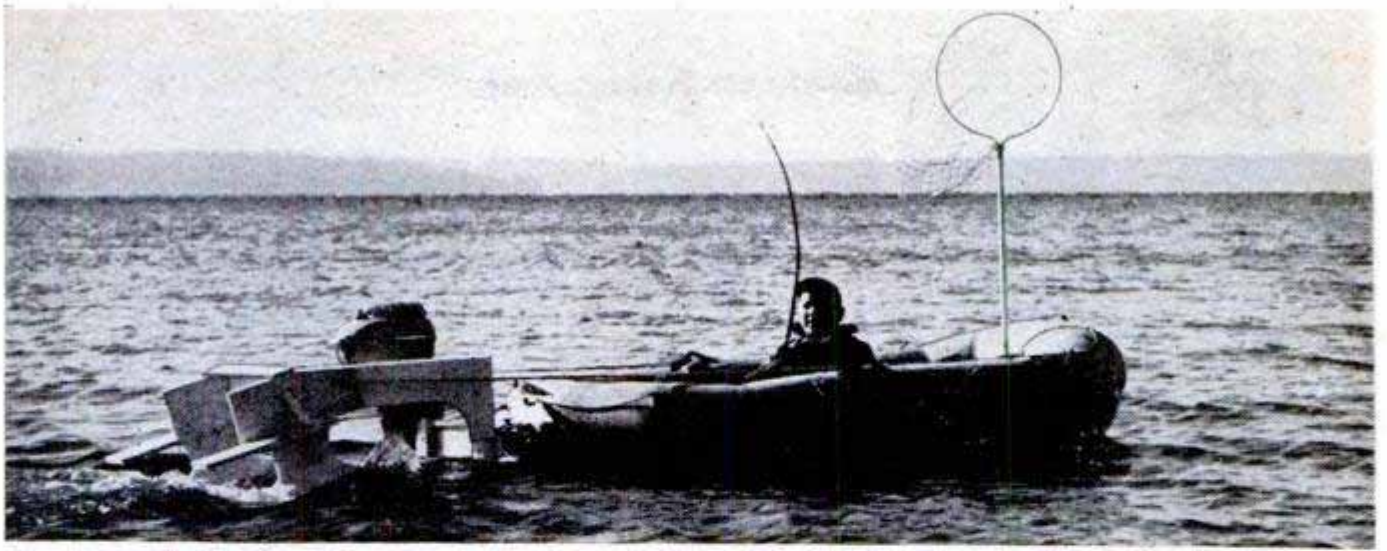
Angler's Aid

Just about all the accessories a fisherman may need are included in one versatile tool small enough to fit in the tackle box. There's a tapeline for measuring the catch and a scale for weighing it. Other parts of the tool are used for scaling fish, releasing hooks, cutting line, opening bottles and sawing. A miniature first-aid kit holds two bandages, tweezers, a razor blade and a vial of iodine.



Jiffy Specialty Co., Box 8022, Fort Worth 5, Tex.

POPULAR MECHANICS

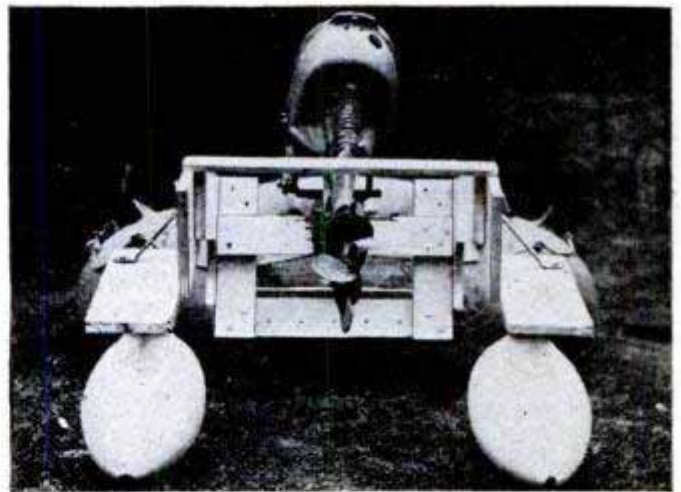
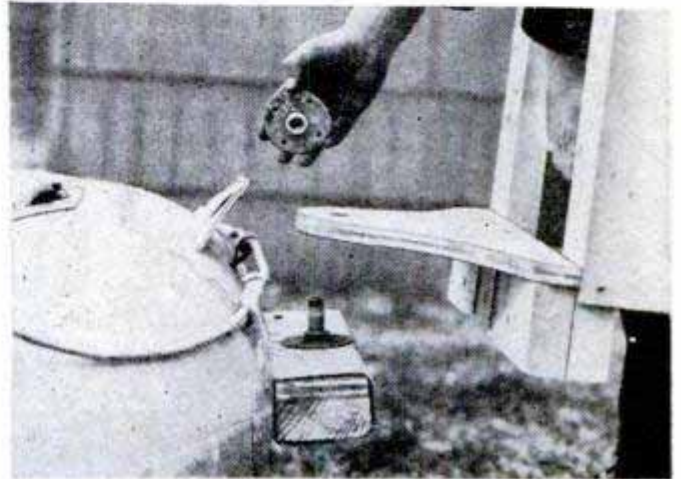


Floating Trailer Powers Rubber Boat

WHEN Robert R. Zastrow of Seattle, Wash., first tried to motorize his war-surplus rubber raft, he ran into trouble—the outboard motor broke away and sank unhesitatingly to the bottom of Puget Sound.

To prevent that from happening again, he decided to mount the motor on floats. By building a plywood “harness” for the motor and mounting it on two teardrop-shaped antennas from junked warplanes, Zastrow made a solid platform for his motor. This floating trailer is attached to the stern of the raft by a single pivot so that it can be swung from side to side to act as a rudder. The floats are set at a 30-degree angle to keep them from digging into the water. Zastrow uses the boat all year ’round for fishing in the sound and says it is seaworthy even in rough weather.

Top, with the outboard motor mounted on a floating harness, the small rubber boat is comfortable and seaworthy. Above, right, the “trailer hitch” for the motor float is mounted on a wood block inside the flap on the boat stern. Right, the motor float out of water. Below, the motor doesn’t hinder beaching



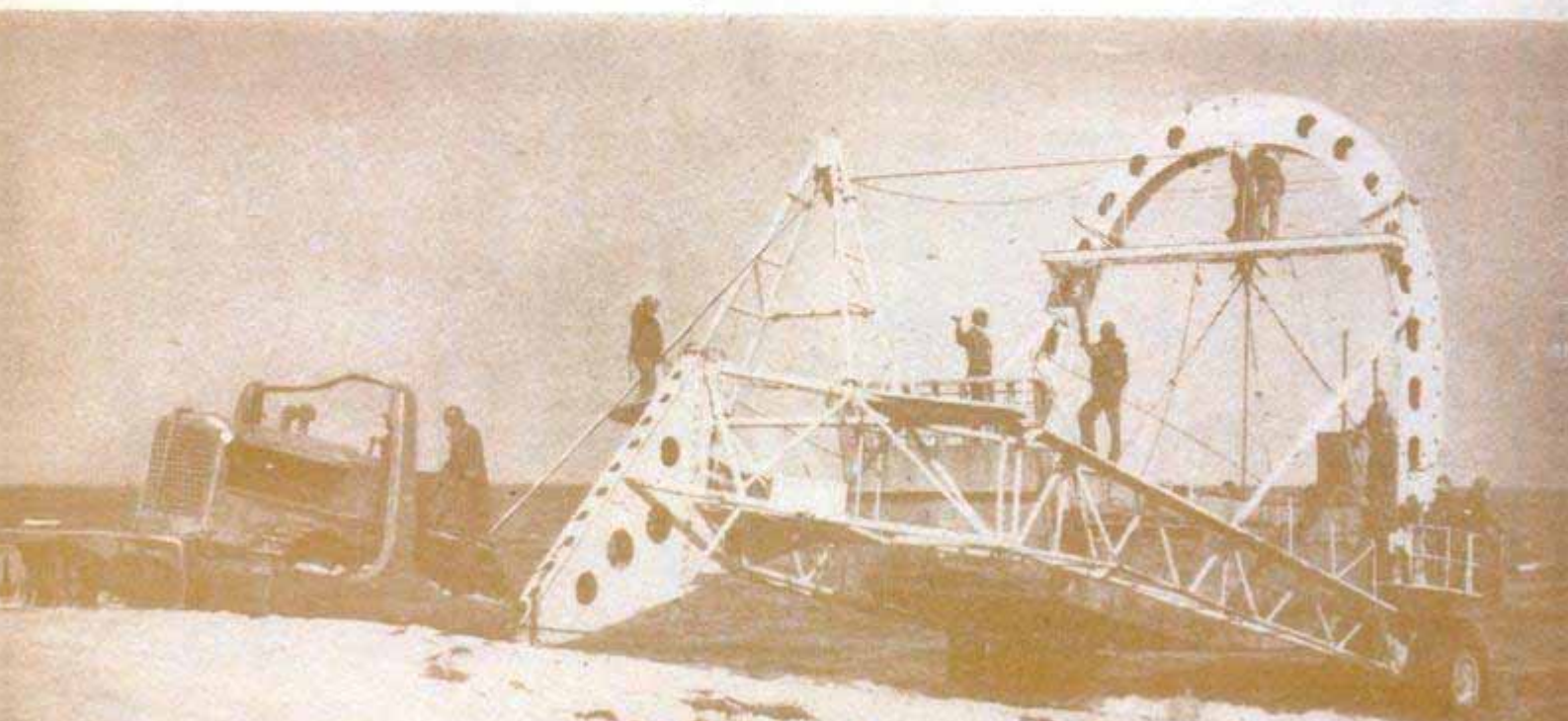


**WE'RE BACK
IN BUSINESS**
—the Seabees



Official U. S. Navy photos

As evidence that they are now a part of the Navy's amphibious forces, the young Seabees above get shooting tips from a Marine officer. The mobile, 19-ton crane hauling in a landing boat below lifts 75-ton loads





In settings remindful of the last war, troops and supplies came ashore in Korea over sturdy pontoon piers

By Andrew Hamilton

YOU HAVEN'T READ much about them, but the Seabees have been in the thick of the Korean fight ever since the great Inchon landing. When the Marines hit the Wolmido beaches, the Seabees were along too—building and fighting as usual.

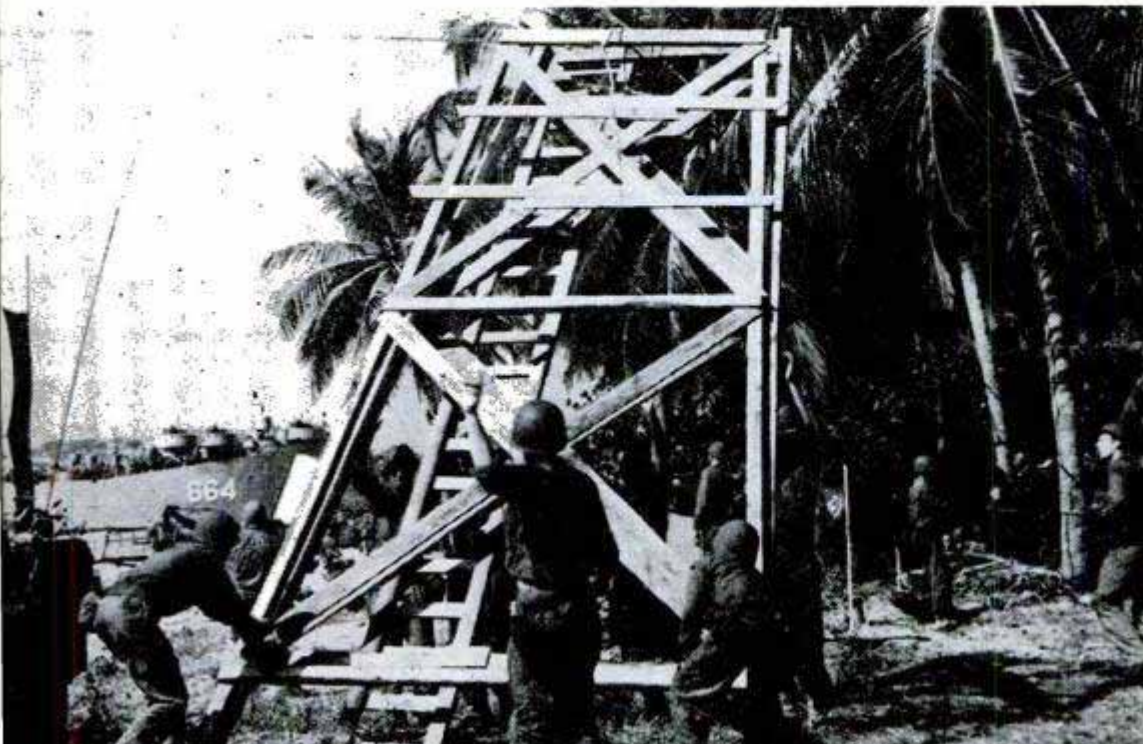
They laid pontoon causeways for the unloading of troops and materiel. They rebuilt docks and warehouses. They helped to carve out emergency air strips. They “liberated” North Korean locomotives.

And already new legends about their activities are growing. When Communist snipers in a cave were annoying the Marines near Inchon, a husky Seabee cat-

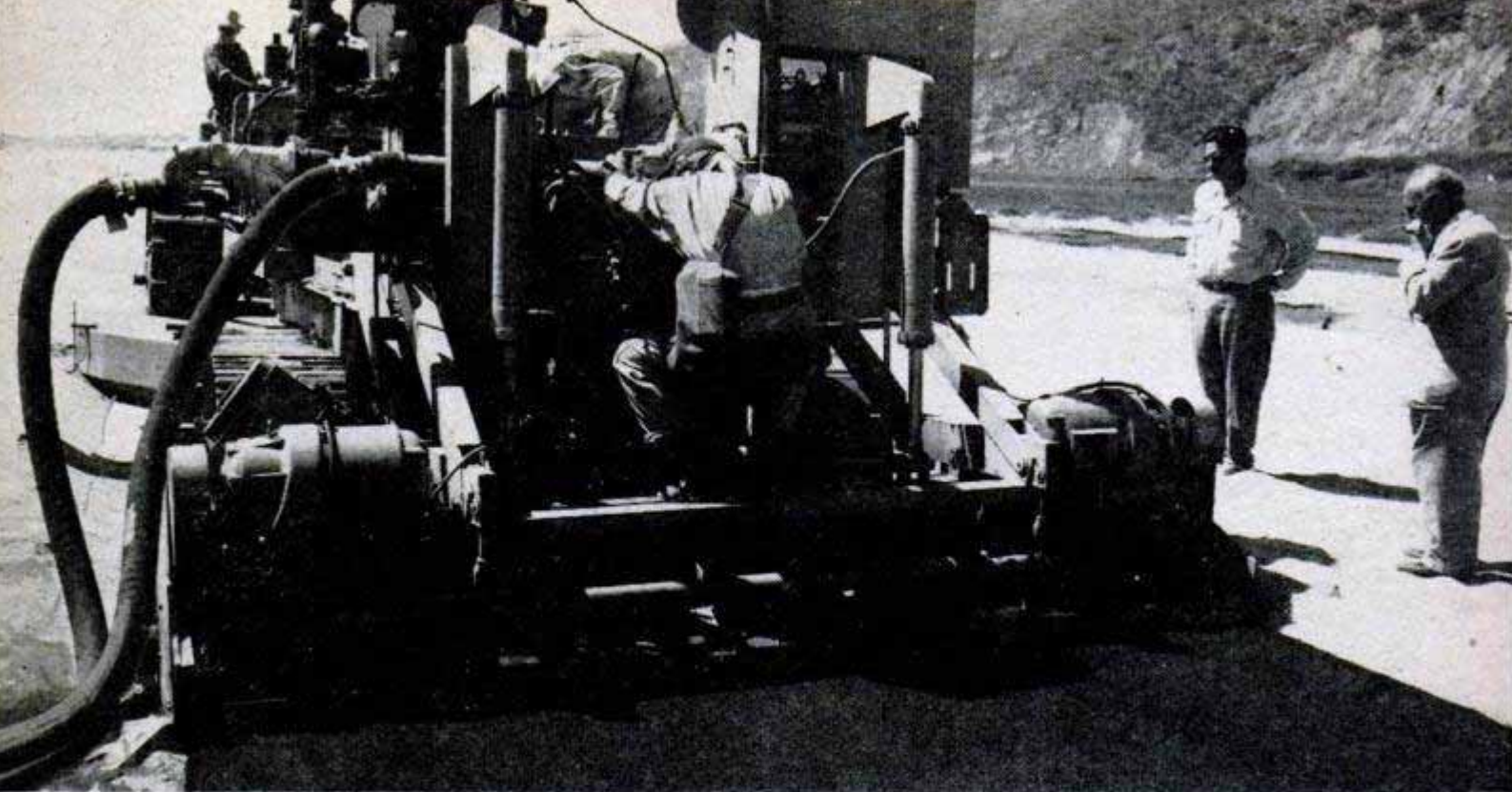
skinner—as was done frequently in World War II—dipped his 'dozer blade, sealed up the hole and went back to grading a road.

It's a new kind of Seabee organization. The old “can do” spirit is still there—as Korea has proved. But there are new kinds of men, and they're organized differently. They have improved tools and techniques with which to work.

In World War II the Seabees participated in every major amphibious operation conducted by American fighting forces—even including the Rhine crossing. They built 111 air strips, 301 advanced bases, 441 boat and ship piers, 558 ammunition magazines, 700 acres of warehouses, hospitals for 70,000 patients, storage for 100,000,000 gallons of



Carpenters erect a control tower for beachmasters during training maneuvers in Caribbean



Sand mixed by this machine with a compound made partly from corncobs produces an asphalt-hard pavement

gasoline and housing for 1,500,000 men.

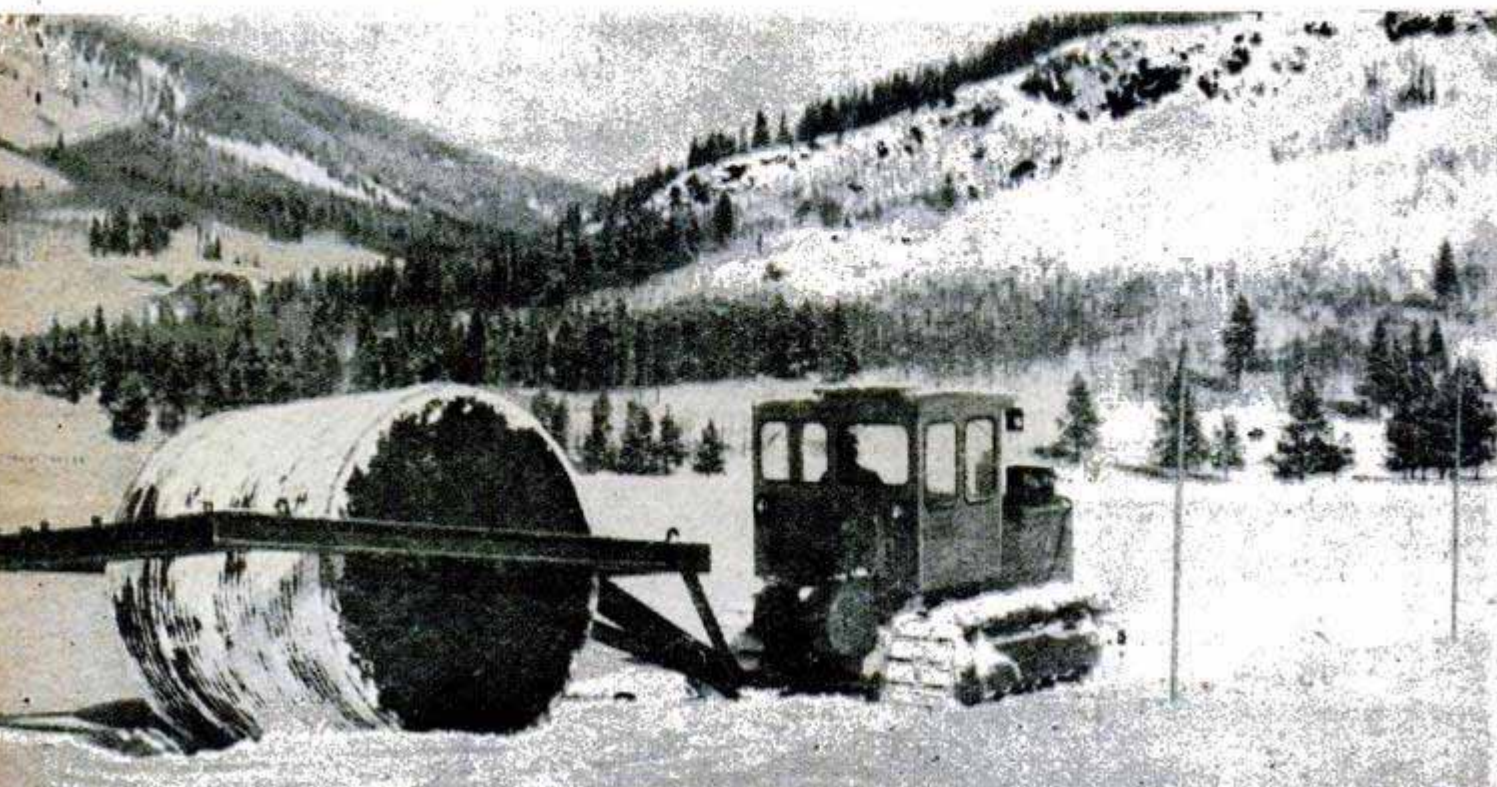
At their peak strength the Seabees had 247,000 officers and men. Four years later there were only 6000—mostly caretakers and maintenance men at the Navy's overseas bases. Now, however, the Seabees are rapidly expanding both active and reserve units, and by the end of 1951 the Navy plans to have a reserve force of at least 75,000.

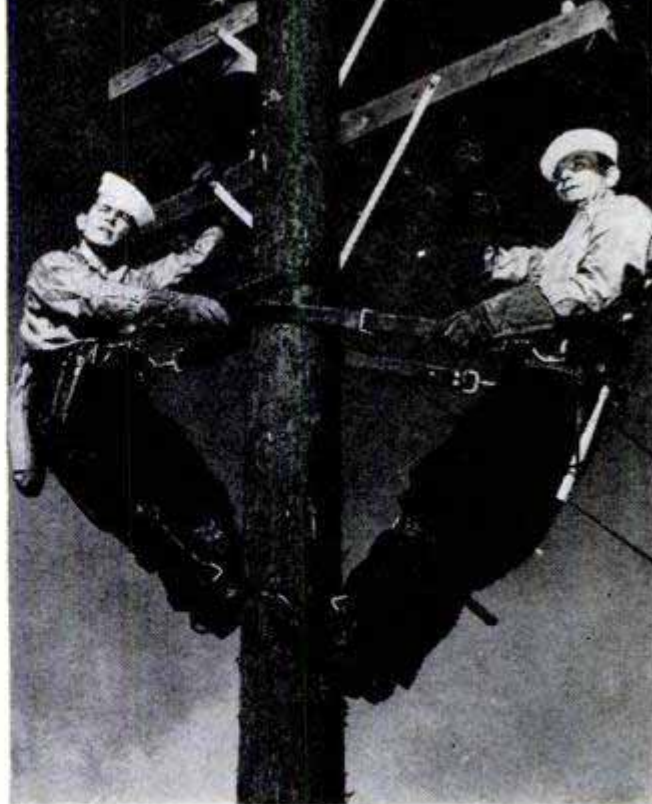
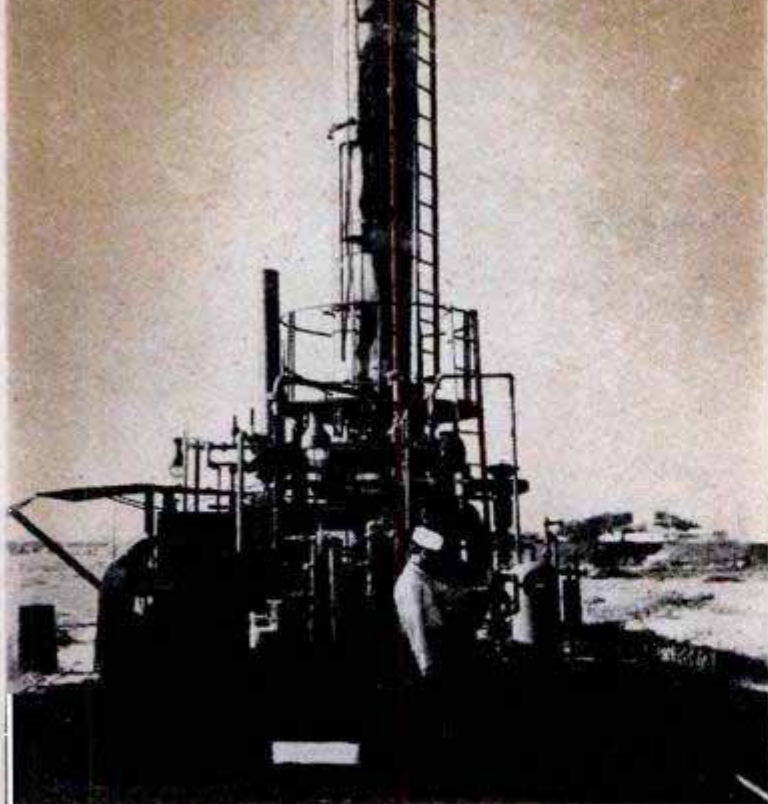
The Seabee of World War II was the plumber who fixed your leaky faucet, the crane operator who dug the foundation for the new City Hall, the carpenter, the steam-fitter, the electrician, the steel riveter.

Representing more than 60 skills and professions, they were older men (some units averaged 34 years in age) who joined the Navy as a patriotic duty. They held so many petty-officer ratings that, as an individual group, they were one of the highest paid in the war.

The new Seabees are being recruited from the Navy's "boot camps"—17, 18, 19-year olds—and trained from the ground up. Reservists, too, most of whom saw action in World War II, are being called back to duty. But many of today's Seabees didn't know a Stillson from a sheep's-foot roller

Since the next war may be fought in the Arctic, the Seabees are working on devices like this snow compacter





Adapted to amphibious operations, the Lumus topping plant, left, is the world's smallest refinery. A 17-year-old volunteer, on left side of pole, gets expert instruction in how to put up a transformer bank properly

before they donned Navy blue uniforms.

Ratings are different now, too.

"In World War II," said a reservist not long ago, "the Seabees were so new that the Navy didn't know how to classify them. Most of 'em got machinist's and carpenter's ratings—no matter what job they did."

But today the Seabees are classified and trained in seven major skills:

Builders—light construction, such as housing; heavy construction, such as docks and piers.

Drivers—including heavy construction equipment as well as automotive.

Surveyors—mapping and construction layout.

Electricians—including power and communications linemen.

Mechanics—both gasoline and diesel.

Steelworkers—structural and riggers.

Utilities men—boiler-room operators, plumbers, firemen, etc.

One of the important peacetime developments has been the integration of Seabee battalions into the Navy's over-all amphibious forces. Much experimental work has been done at Little Creek, Va., and Coronado, Calif. New techniques for using pontoons, those ever-valuable "building blocks," have been worked out. Ingenious machines, such as the giant Gilhoist crane for salvaging damaged landing craft have been perfected.

Once scattered all over the map, Seabee training is now concentrated at the big 530-acre Hueneme Naval Station, 60 miles north of Los Angeles. Here are the U. S.

Naval Schools, Construction—NAVSCON for short—which turn out newly trained Seabees at a rate which has been stepped up 750 percent since the Korean War began. There is an "A" course for beginners and a "B" course for those with some skills, but who need additional training.

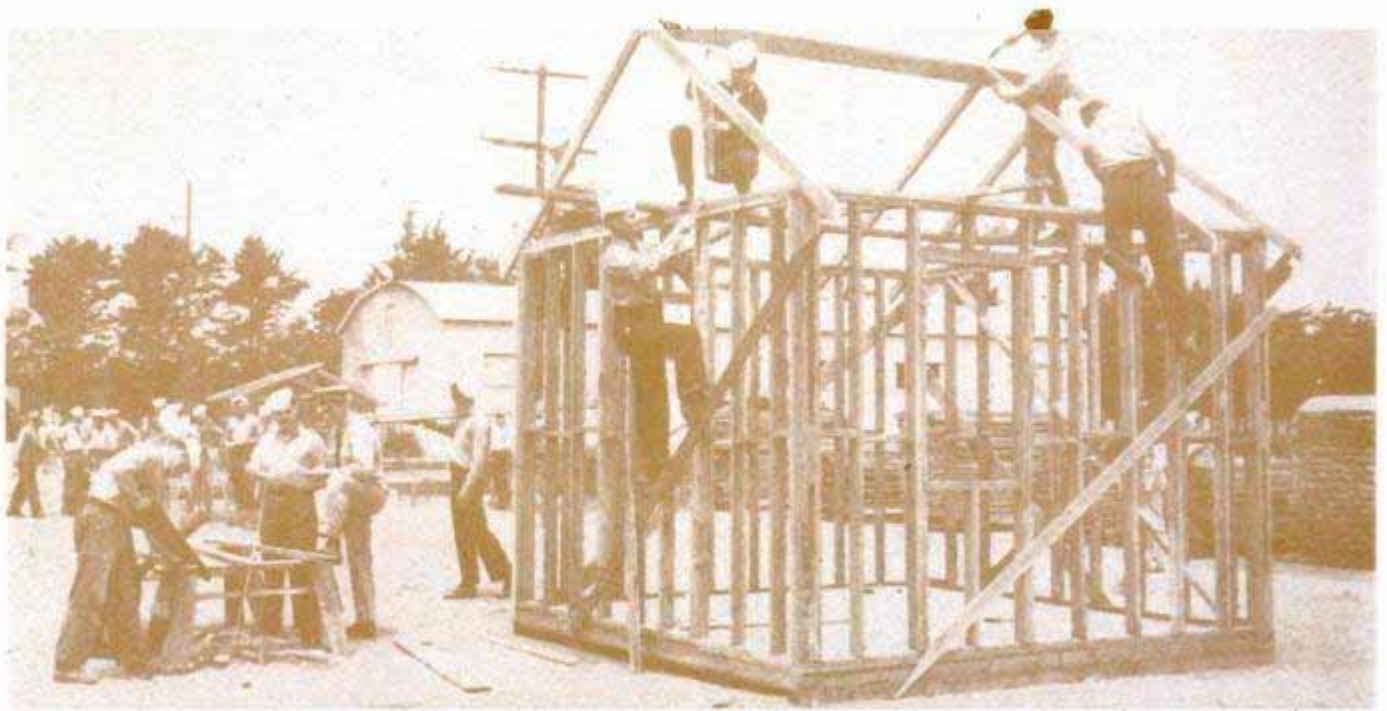
Also at Hueneme is an officers' school for the Navy's Civil Engineering Corps. These are regulars who are making a career of engineering, or reservists who are graduates of schools and colleges of engineering. CEC officers provide the leadership for the Seabees. They know the job and "speak the language."

After Seabee officers and men are trained at Hueneme, they are organized and equipped for reassignment overseas. Part of their training consists of salvaging badly needed bulldozers, cranes, trucks and carryalls out of an enormous pile of "rusted and busted" equipment left over from the last war.

In World War II there were as many as 41 stevedoring battalions in existence at one time, comprising a total of 1350 officers and 40,000 men. Now, the stevedoring chores have been turned over to the Navy Supply Corps, and Seabee units are organized as follows:

(1) **Mobile Construction Battalions**—slightly larger than the World War II counterpart, now consist of 34 officers and 1083 men. The main emphasis is on building—barracks, airfields and roads.

(2) **Amphibious Battalions**—the same size as Mobile Construction Battalions, but



To qualify for new rating as a builder, trainees have to learn to erect buildings speedily and efficiently

especially trained to make amphibious landings and to build under fire.

(3) Special Detachment—these vary in size depending upon assigned job. Their principal work is maintaining a naval base.

Also at Port Hueneme is the Seabee Museum—consisting of the largest collection of Seabee battalion banners, plaques, handiwork, displays, mementos, captured Japanese equipment, scale-model ships and bases and memorable photographs ever gathered under one roof.

Associated with the great Seabee training center at Port Hueneme is the Bureau of Yards and Docks' Civil Engineering Research and Evaluation Laboratory. Housed in what was formerly the Navy's School of Justice, it contains an amazing array of devices, equipment and machinery. The 200 projects under way there will provide many new tools and working techniques for

the Navy's versatile seagoing craftsmen.

Because of the titanic struggle to get men, machines and supplies from ship to shore, the laboratory is conducting experiments in sand compaction. A machine has been developed which sprays the beach with an aniline-furfural compound (made partly from corncocks). Mixed and vibrated, the sand becomes as hard as asphalt paving. Within an hour it will accommodate a Jeep and within three hours will take tanks and bulldozers.

Another ingenious machine is a new type of pile driver captured from the Germans. Instead of cumbersome steam engines or compressed-air tanks to provide driving power, a small, "one lung" diesel motor is built right into the pile-driver head. As the driving head nears the timber to be thudded into the ground, the motor gets an

(Continued to page 270)

CONSTRUCTION RATES

When a sailor wears one of these patches on his uniform, it means he is trained in a particular skill



SURVEYOR



CONSTRUCTION ELECTRICIAN'S MATE



DRIVER



MECHANIC



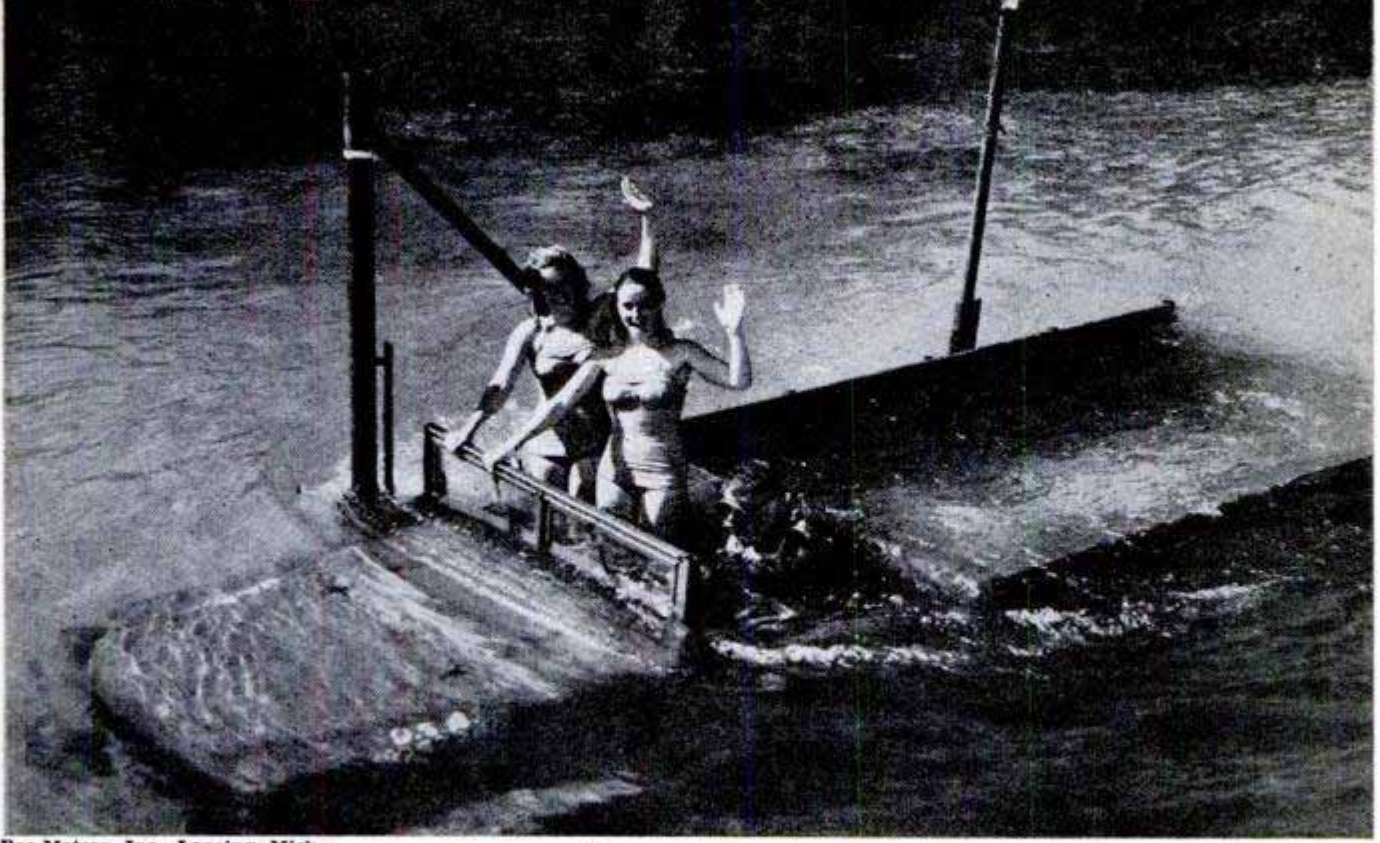
BUILDER



STEELWORKER



UTILITIES MAN



Reo Motors, Inc., Lansing, Mich.

Submarine truck has intake and exhaust pipes which protrude above water. Right, "mermaids" help GI in an underwater test

Underwater Truck

GI truck drivers can roll right along "Davy Jones" highway with a new Army truck that operates almost as well underwater as on the surface. The truck is designed to ford streams or move from landing ship through surf under its own power. With its six-wheel drive it literally can cruise along a river bottom. When the truck is submerged, only two pipes extend above the surface of the water, one for the engine exhaust and the other for the intake.



Atom Plane Soon?

Aircraft powered by atomic energy may be feasible soon. The Air Force and the Atomic Energy Commission have announced completion of the first phase of a program to produce an atomic aircraft engine. This work showed that an atomic engine is theoretically possible. Next step in the research will be to translate the theories into actual blueprints for an experimental model. Such a plane, if successful, could have the speed of a jet fighter, yet remain in the air indefinitely. Calculations show that the proposed craft could fly 80 times around the world on a pound of fuel. The research for an atomic aircraft engine is paralleled by work on a

similar engine for submarines. Sumner T. Pike, commissioner of the Atomic Energy Commission, has announced that the submarine engine already is partly built.

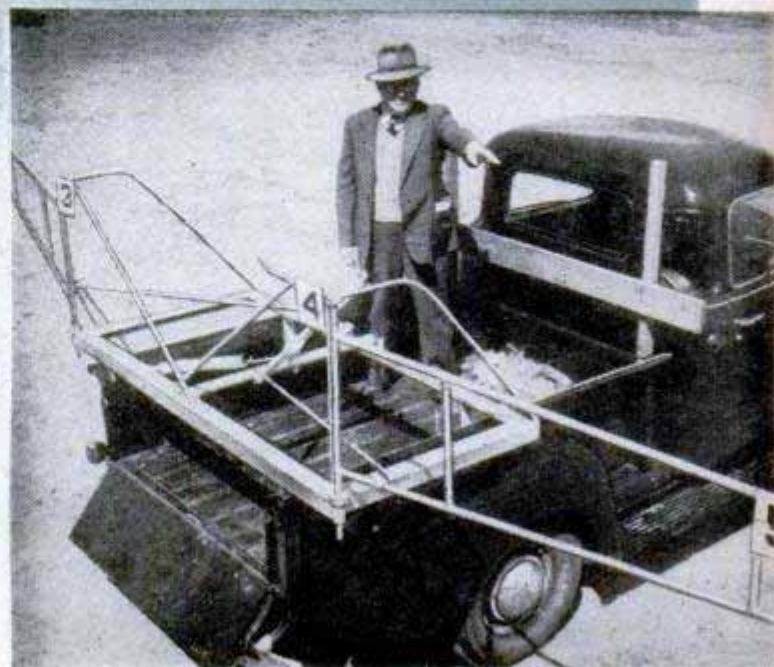
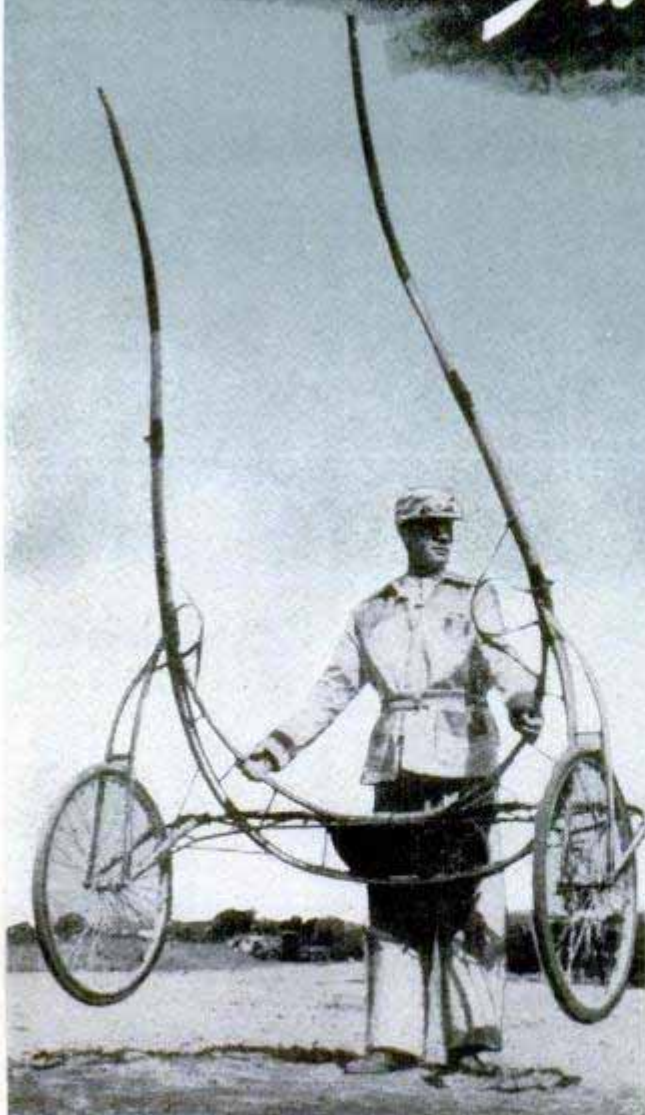
Information not listed on articles in the index, starting on page 12, frequently is listed in the WHERE-TO-FIND-IT LIST, which is available to readers without charge. A copy of this list may be obtained simply by sending a postcard to the Bureau of Information, Popular Mechanics Magazine, 200 East Ontario Street, Chicago 11, Illinois



THEY RACE FOR *Fun*

Story and photographs by
Marjorie and Grant Heilman

Below, the hobbyist horsemen made this starting gate themselves and it works as well as the high-priced commercial models. Left, a 30-pound sulky looks mighty fragile, but it is amazingly sturdy



BIG-TIME harness racing may be a millionaire's game," Irving Pettit says, "but we'll match the big tracks any day for pure fun, and our racing setup fits most folks' pocketbooks."

Pettit, president of the South Jersey Driving Club, can speak for several thousand active harness-racing fans from coast to coast whose hobby is riding sulkies behind fleet-footed trotters and pacers.

Everyone who races on South Jersey's homemade track at Paulsboro, N. J., thrills to the smell of sweating horseflesh and the thud of hoofs coming down the home stretch. Yet the 18 horses owned by the club's members cost an average of less than \$500 each. The members built their own track and do most of the maintenance.

"Why," Pettit points out, "one driver picked up a horse for \$50. Sure, he was lame and sore and out of condition. But a winter of good care plus some spring training and the horse was right in there, nose to nose with the rest of us. In fact, last year he won eight races. Fifty dollars isn't much for the fun that owner is having."

Board and feed run about \$30 a month per horse and, of course, the owner takes care of training and exercising—that's part of the fun.

Although jog carts for exercising, and sulkies for racing, cost about \$300 each new, they are almost indestructible and secondhand gear doesn't come high.

Part of the costs come back in the form of race money. For the most part, the South Jersey Club's races aren't run for prize money. They compete solely for fun. Every driver from other clubs gets the same amount of money, regardless of how he places. It's usually only \$20, but this helps pay the bills.



Horses ride to neighboring tracks in trailers their owners build themselves. Here is a two-horse model

At Fair time in Paulsboro, some 40 horses compete for prize money which may go as high as \$500 for a single race.

When the South Jersey group was organized it had no track. With their own labor, the members built stables and a half-mile track on a piece of cheap land.

A discarded highway scraper which they got for \$50 keeps the track scraped. When dust became a nuisance, they persuaded an

Homemade starting gate cost under \$100. At starting line, wings swing forward and truck speeds out of way





Drags made of wire fencing keep the surface smooth. The sprinkler was made from a dilapidated oil truck

oil company to donate a decrepit tank truck. A four-inch pipe bored with dozens of tiny holes was attached across the back of the 3500-gallon tank to make an efficient sprinkler.

To keep the track smooth, a couple of pieces of rusted woven-iron fence which the club got for nothing are dragged down the track behind a truck.

But the prize invention is a starting gate

built by the racing fans. The gate is made from galvanized pipe and can be mounted in a few seconds on the back of a truck. One major track boasts that its starting gate, permanently attached to a Cadillac, cost \$50,000. The South Jersey drivers chuckle and admit that their homemade gate cost less than \$100.

Naturally, none of the South Jersey racing devotees believes his horse is going to step out next year and win the Hambletonian or the Little Brown Jug. But there's surprisingly little difference in time between the race-for-fun horses and the Grand Circuit big shots. One winner at the Paulsboro track this past season was clocked at 2:05, and there's been many a big purse won at speeds slower than that.

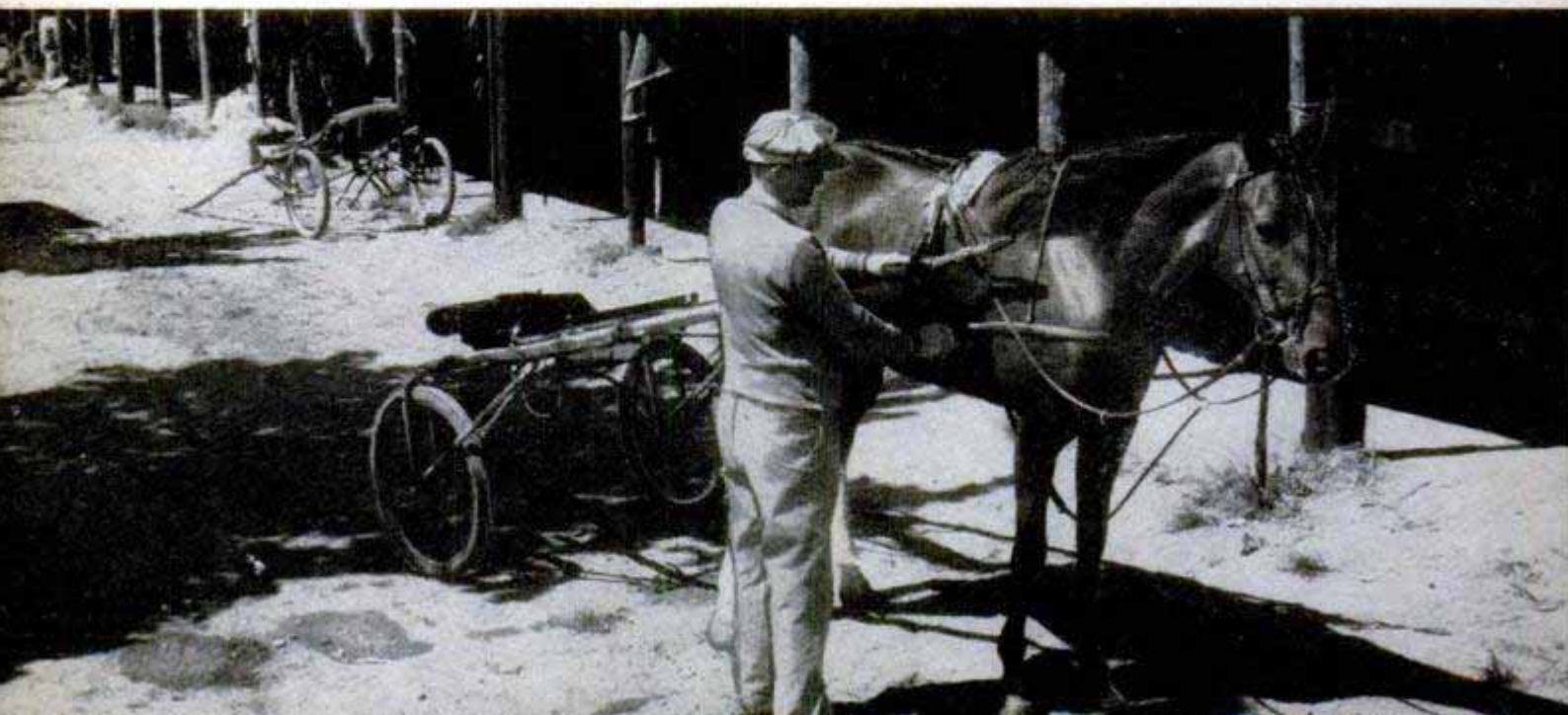
"Besides," explains a South Jersey driver as he wipes perspiration and track grime from his forehead, "it isn't the time you're racing against, it's the guy and the horse next to you. If you're neck and neck, it's just as thrilling whether your time is 2:20 or two minutes flat."

The horses are grouped according to an informal handicap rating, based on their records. And as a result most of the races are mighty close. As soon as a horse consistently outdistances his competitors he is shifted to the next faster group, where the going is tougher.

One of harness racing's big advantages as a participant sport lies in the fact that driver weight is not important. The smooth-rolling bicycle wheels of the sulkies have little more drag with 175 pounds of driver than with half that poundage.

Driving a harness horse isn't as strenuous as jockeying a thundering race horse down the home stretch in a tightly packed field. One of South Jersey's consistent win-

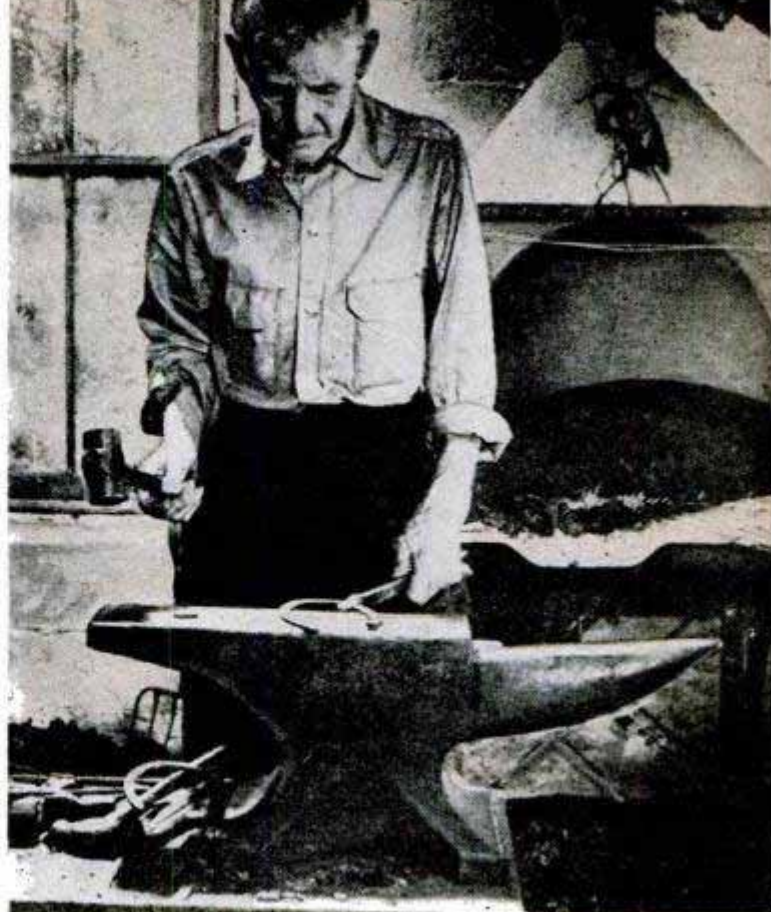
Racing is an exciting hobby for this driver who is preparing his horse for a workout on the Paulsboro track





Owners act as their own trainers and handlers. Here, a brace bandage is wrapped by an owner

Race horses need shoes so a blacksmith visits the track's shop often to keep their feet fit



ners is 15-year-old Bob Pyle. Many tracks boast girl drivers. In fact, more than one grandmother has come home a winner.

The horses, too, can race for most of their lives. An average horse may compete for 10 seasons. Single G, one of the all-time top winners, was still tossing dirt in the faces of other horses at 16. Last year a 20-year-old raced alongside horses young enough to be his great-great-grandchildren. This lessens the expense; a \$500 investment, depreciated over 10 years, doesn't amount to much.

A fully rigged harness horse is a sight to behold. If he's a pacer, he may wear a checkrein to hold his head up, a head pole (usually a billiard cue) to keep his head straight, hobbles to keep his legs in an even gait, boots to prevent his hoofs from scraping his legs and even a woolen shadow roll across his nose to keep him from seeing the

track directly ahead and shying from shadows. Trotters' gear is usually slightly less complicated.

Of course, few horses use all of these devices and at the smaller tracks, drivers share equipment.

The sport has been popular for years and South Jersey drivers say there's nothing like it for a hobby.

As one of them put it, "Once you've led the field as you lean around that last turn and you feel your horse stretch out toward the finish line—well, after that everything else seems tame."

These horses are trotters. Left-front and right-hind legs move forward simultaneously as do their opposites





Arrow points to magnetometer and the approximate spot in Chesapeake Bay where sunken barge was located

PLANE TOWS MAGNET TO FIND SUNKEN BARGE

ENGINEERS who are constructing the \$44,000,000 Chesapeake Bay Bridge solved one unexpected problem with an airplane and a magnetometer. During a severe storm three barges broke loose from the construction site, north of Annapolis, Md., and one of them disappeared. There was only one place the barge, which was loaded with specially fabricated steel beams, could be—on the bottom of the bay. Experts in submarine location work were consulted and none held any hope for quick success. In addition to losing the valuable boat and

its cargo, the sunken barge was a hazard to navigation. Geophysicists of the Geological Survey, Department of the Interior, came to the rescue with a DC-3 plane and the magnetometer ordinarily used for aeromagnetic surveys. A course of regularly spaced flight lines was plotted 500 feet apart and five miles long in the suspected area. On the tenth crossing the magnetometer "found" the barge. A small boat marked the spot with a buoy. While engineers cheered, the plane dipped a wing and went back to its regular job.

Work along 4.3-mile length of the bridge was not delayed by one lost barge. Sandy Point, Md., is in distance





Bjorklund Mfg. Co., 16 44th Place, Venice, Calif.

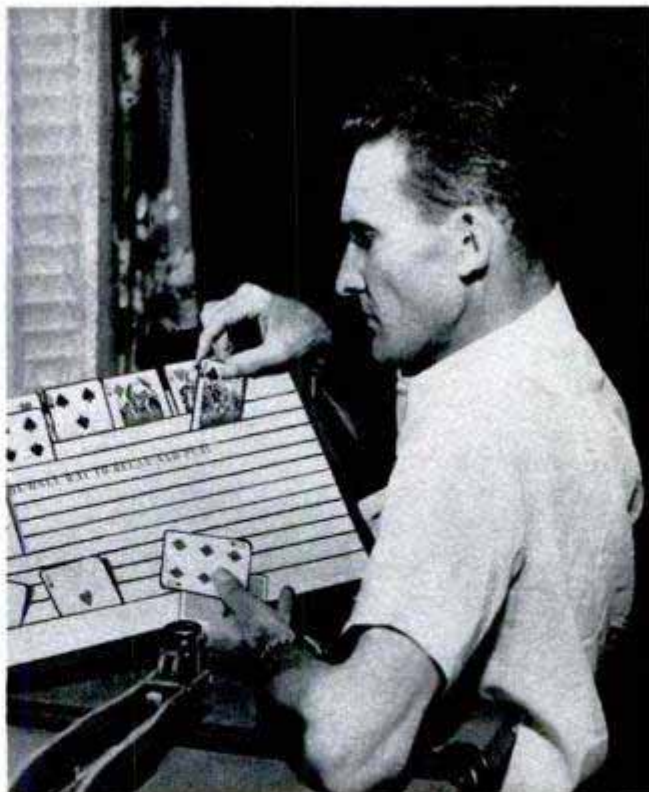
Key Lock for Revolvers Prevents Accidental Firing

Inserted in the trigger guard, a new lock completely covers the trigger to prevent a revolver from being accidentally fired. The lock can be removed only with a key. It prevents discharge should the revolver be handled secretly by children, and provides additional safety when the firearm is carried on a trip.

Card Caddy

Canasta players can hold as many as 30 cards easily with a circular card caddy. Cards can be removed or added without disturbing the rest of the hand. A rubber disk provides the gripping surface. You can even lay down the hand and pick it up again without closing the "fan."

Card Devices, Inc., Troy, Ohio



Hunter Sol-Board Co., 520 67th St., Houston, Tex.

Solitaire Lapboard

You can entertain yourself with a game of solitaire no matter where you are with a specially designed lapboard. The board has a series of slits across it in which you insert the cards as you play. The slits hold the cards firmly enough so the game can be played outdoors in the wind. It is excellent for bedridden persons because the cards stay in place even when the board is tilted upright.

Popcorn Packs Packages

Popcorn has been around for years, but now it has been given a new job—for packing fragile articles. The popcorn is lighter than shredded paper, thus reducing shipping costs. It takes about three pints of popcorn to equal the weight of one pint of shredded paper.

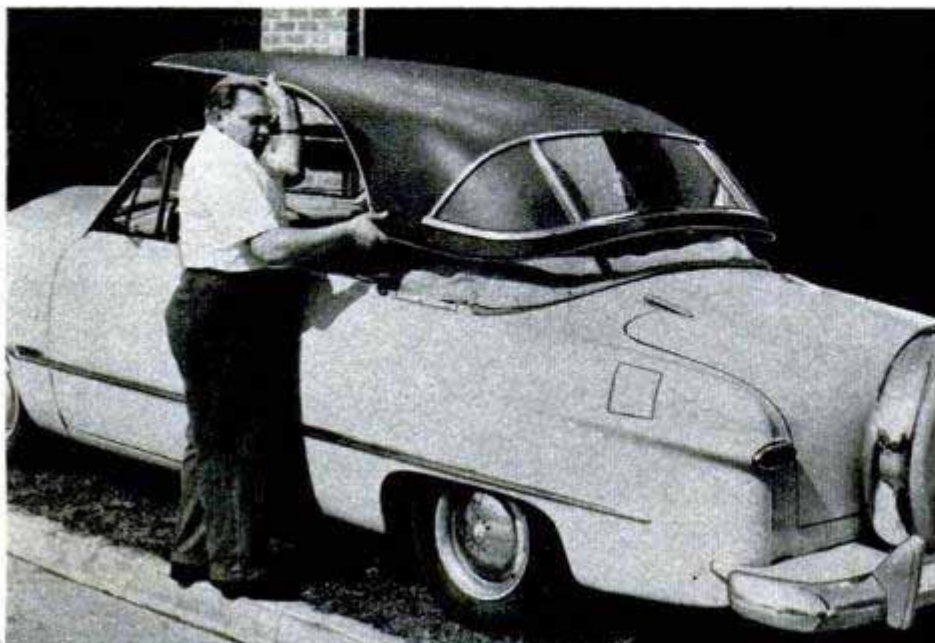




British Jaguar

Powered by the same engine that holds the world's stockcar speed record, the Mark VII Jaguar is the first entirely new model this British company has turned out since the war. The 160-horsepower, 6-cylinder engine has a compression ratio of 8 to 1. The same power plant that holds the speed record of 132 miles an hour, this remarkable engine has run continuously for 24 hours at an average speed of 107 miles an hour. Two unusual body features are found in the new Jaguar that sells for \$3875. There are 17 cubic feet of trunk space. This extreme roominess was made possible by removing the gasoline tank from its usual spot below the trunk and placing two tanks in the top halves of the rear fenders in space that is usually wasted. Another unusual feature is a tool kit that is recessed into the lower part of the front door.

Streamlined in a Continental manner, the new Jaguar is a luxurious powerhouse. Below, tool kit recessed into front door. Tools fit in small rubber pockets



Metal Top For Convertible

Ford convertibles can be converted a new way now that a demountable solid top is available. The sheet-metal top weighs 70 pounds and can be attached to the car in five minutes. The inside of the top is padded with upholstering material. It is not necessary to remove the cloth top from its storage well to make the conversion. The hard top provides a weatherproof roof for use during the winter months.



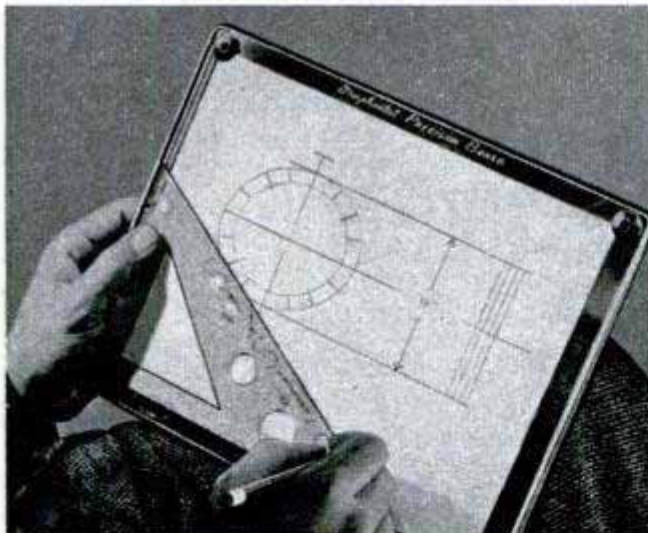
Remote-Control Dictation

Any number of persons can be "wired in" to a recording system which funnels all dictated letters and memos to one secretary. The system is designed for offices where several persons may have a small amount of dictation during the day, yet not enough to warrant individual recording instruments. A modified telephone is installed on the desk of each dictator. When



Thomas A. Edison, Inc., West Orange, N.J.

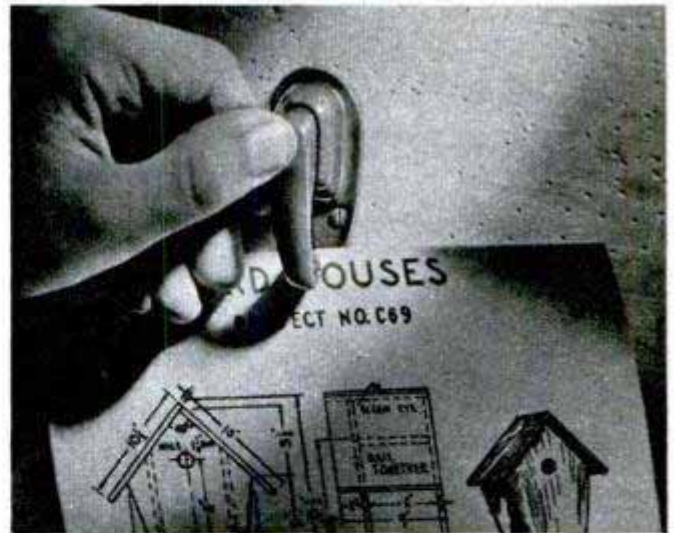
a person desires to dictate a letter, he picks up the phone, presses a switch and begins talking. At the secretary's desk the dictation is recorded on a plastic disk. Through another switch on the telephone, the dictator can play back the recording or make correction marks on the index slip. A red light on each phone indicates when the system is in use. Several letters can be recorded on the same disk, and a light indicates when the disk is approaching its end.



A. Patrick Co., 9 Grove St., Westwood, N. J.

Plastic Drawing Board Is Brief-Case Size

Small enough to slip into your brief case, yet large enough to handle precision drawing, a plastic drawing board is useful to artists who do their work away from a drawing table. Four clamps hold the paper securely and smoothly yet, being recessed, they do not interfere with the smooth surface. Two metal straightedges are retractable and eliminate the need for a T-square. Triangles are stored on the underside of the board, being held in place by tension clamps.



The Stanley Works, New Britain, Conn.

Holder With Rubber Rollers

There are no sharp edges to tear paper or clothing on a grip-type holder with a rubber roller. Secured by two screws, it can be used to hold hats, wall charts, towels, or women's purses.

Sources of available products described in this issue are listed on pages 12, 14 and 16. Sources of further information on other articles are given in the WHERE-TO-FIND-IT LIST, which is available without charge from Bureau of Information, Popular Mechanics, 200 E. Ontario St., Chicago 11, Ill.



Hemmed in on all sides by mountains, Venezuela's capital, Caracas, has to expand underground and up

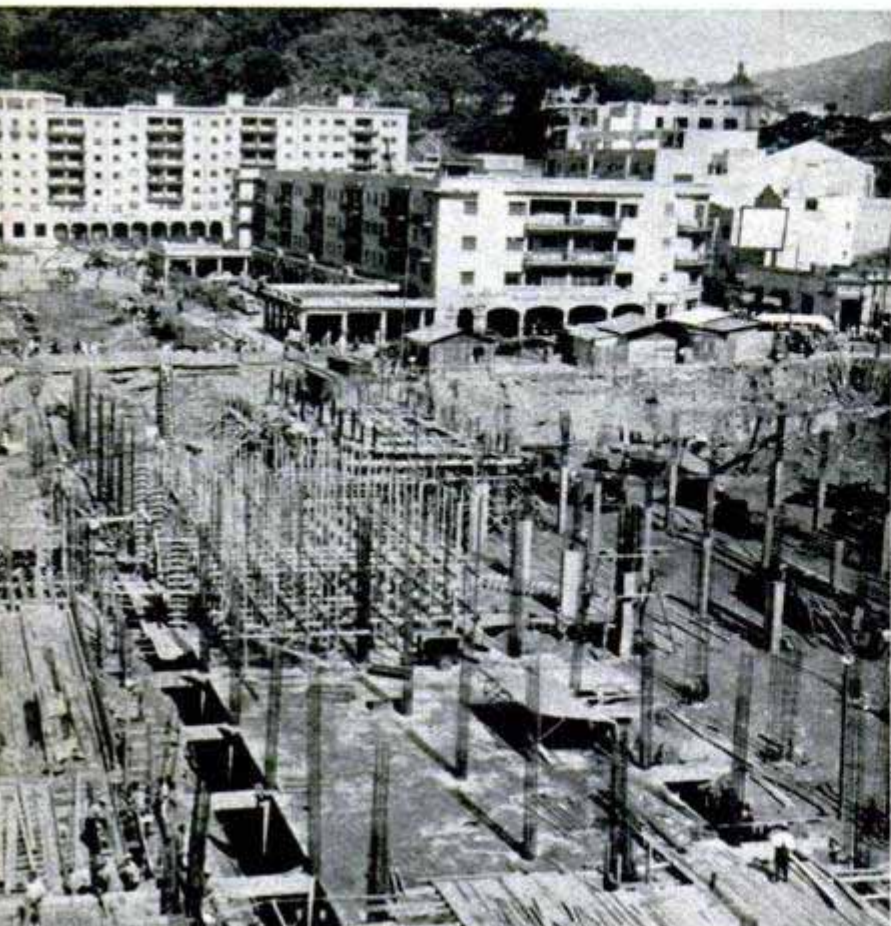
NEW CITY

THE CLATTER of big machines and heavy construction is shaking the capital city of Venezuela to the foundations of its ancient adobe and stucco houses. Out of the dust and rubble ultramodern skyscrapers spear toward the clouds. Neat, modern apartments with trim balconies sweep along the mountainsides. In the other

direction, broad, subterranean boulevards are tunneling under streets that once echoed only to the creak of basket carts, drawn by dejected donkeys.

Out on the slopes of the Cordilleras, where 11,000 goats once roamed unmolested, a vast "University City" is rising, dominated by a thousand-bed hospital with "saw tooth" walls and chute-the-chute fire escapes. A superhighway, leading from Caracas' 3000-foot valley floor to its sea-coast gateway, La Guaira, will reach across quarter-mile-high viaducts, bridging mountain chasms and tunneling under peaks to eliminate curves.

It all started a few years ago. Reason: Caracas was bursting its seams. The city, confined on every side by rugged Cordillera peaks of the coastal range, lies in a mountain valley 12 miles long and 3 wide. Its drowsy, dirt and cobbled streets, and quaint one-story provincial homes with palm-fringed patios, were fine for a few thousand persons. But, with the coming of oil 25 years ago, Caracas became a boom town. Now, 400,000 persons swarm in its narrow confines. The city has spilled down the valley, and climbed the mountainsides. Sixty thousand automobiles joined the swarms of chat-



Avenida Bolivar project handles traffic on three sublevels. Modern apartments similar to one in background will line the street



FOR AN OLD

Main ramp from the surface throughway to carry flow of traffic underground is at end of boulevard, also turnaround space

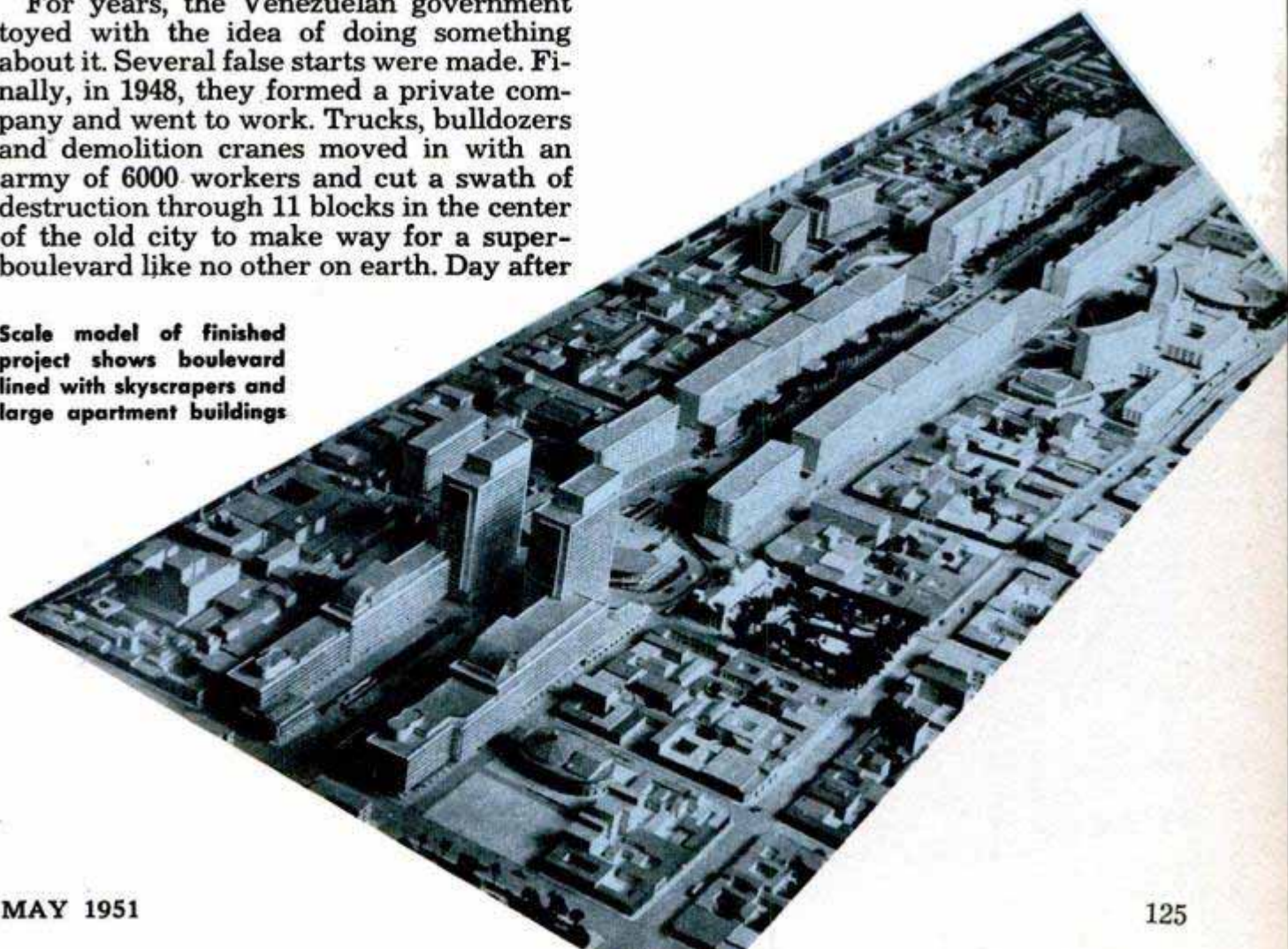
By Michael Day

tering people to triple the confusion. No place in the world has such traffic jams. Hornblowing is outlawed, so Caracas is a bedlam of drivers, all slapping the outsides of their car doors to chase away pedestrians who can't move anywhere without knocking someone down.

For years, the Venezuelan government toyed with the idea of doing something about it. Several false starts were made. Finally, in 1948, they formed a private company and went to work. Trucks, bulldozers and demolition cranes moved in with an army of 6000 workers and cut a swath of destruction through 11 blocks in the center of the old city to make way for a super-boulevard like no other on earth. Day after

day, the roar of crumbling masonry shook the valley. A five-story building at the head of the proposed trafficway, which former contractors claimed would take three years to demolish, was reduced to rubble in two days. Using 50 tons of dynamite to a single

Scale model of finished project shows boulevard lined with skyscrapers and large apartment buildings





Twisting Caracas-La Guaira road is city's 35-mile life line to sea. New road will be only 12 miles long

charge, and monstrous cranes with two-ton steel balls, the demolition crews bowled over the walls of the city's biggest hotel in 22 hours. Overnight, whole city blocks disappeared. Business and residential buildings for nearly a mile were mowed to ground level in a few months; then huge steam shovels began digging.

Today, the handsome Bolivar Avenue project is nearing completion. At its head stands a modern apartment development for 2400 families, El Silencio (The Silence), so named because of the death-ridden plague which visited the slum that once stood there.

The boulevard consists of a multitiered subtrafficway, already completed, that sweeps through the city. The main artery tunnels under the city's center for almost a mile then stretches for another half mile on the surface to the suburbs. Beneath the surface-feed highway, a second level is



Monument holding wrecked car along Caracas-La Guaira road serves as warning to Venezuelan drivers

reached by an intricate series of ramps. This is a parking area for 4000 cars. Under this is a third level, consisting of a national bus terminal, where fluorescent-lighted sidewalks and stores will give an aura of daylight to Venezuelan travelers. Beneath the entire stack dips the speedway for through traffic following the main highway. At one-block intervals on the bus-terminal level, one-way cross streets from the surface dip under the throughway and come up again on the other side, so traffic on the main artery will not be disrupted by local cross traffic.

At street level, there is a park and a mezzanine, with shopping center. When finished, three blocks of 27-story modern commercial buildings on stilts (to allow surface-feed traffic to go through them) will be erected above the highway. A long row of lower commercial buildings will line the "autopista" for six more blocks. Beyond

Architect's model of University City, part of rejuvenation project, shows schools, stadium and hospital





this will be built rows of modern six-story residential apartments—and the proudest project of all: University City.

In a half-square-mile natural amphitheater on the Cordilleran slopes, the 30 modern buildings of University City are almost completed. The hospital for the medical school sits at the head of the bowl, with four wings pointing out over the campus like fingers.

To give patients privacy in the wards, architects have devised serrated walls that “step” along the corridors like the teeth of a big saw. Each ward holds 12 beds, and each bed fits in a saw-tooth niche; hence, no patient can see another—except for the person across the room from him. In effect, he has a semiprivate room. From each floor, concrete-lined corridor ramps lead to the outdoors. In case of fire, the beds—all on big casters—can be rolled out without disturbing patients. The hospital’s capacity of 1000 patients can be chuted to safety, clearing the entire building in six to seven minutes.

With the millions of cubic yards of soil dug from the center of their city, Caracans began another project—filling in 1000-foot-deep valleys in order to build a superhighway to the sea. The present road, built by dictator Gomez, is a winding, treacherous two-lane suicide trail, rightfully dubbed the “Plate of Spaghetti.” Though it is only about 10 miles, as the crow flies, from Caracas to the sea-level town of La Guaira, the Plate of Spaghetti is 35 miles long. It has 395 switchbacks, nearly all of which hover on ledges thousands of feet above rocky valleys—with no guard rails. Only 10 percent of the road is straight.

Fiery Venezuelan drivers are used to seeing pictures of crumpled wrecks in their daily papers. They scarcely bat an eye

The 1000-bed hospital in University City has “saw tooth” walls in wards; beds fit into private niches

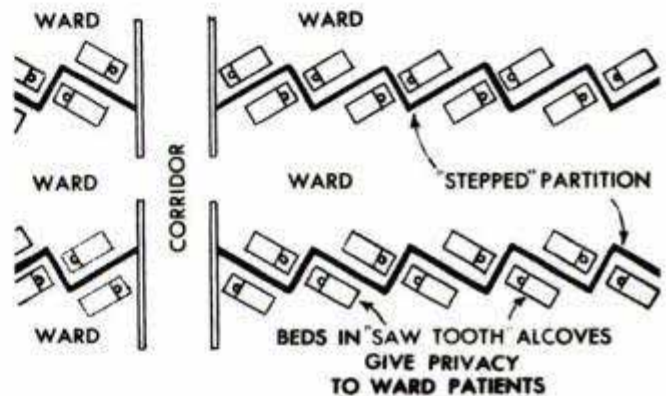
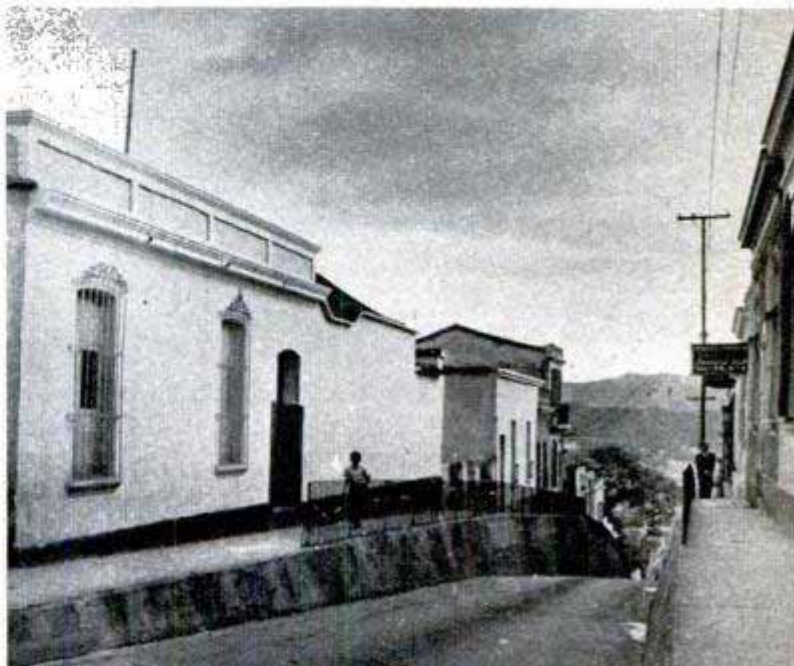
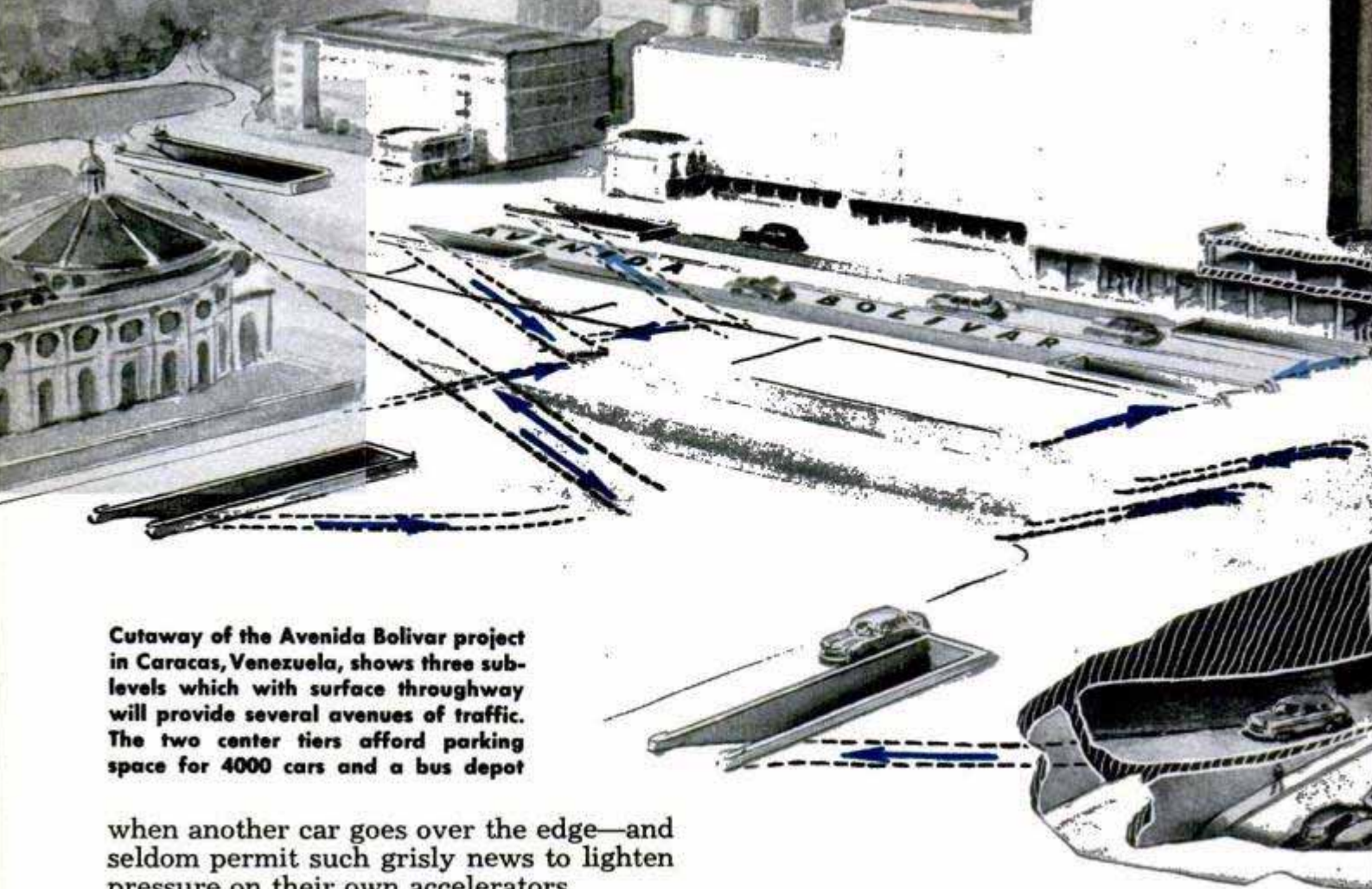


Diagram shows how beds are arranged in the modern hospital now nearing completion. The patient can see only the person directly across the room from him

Below, blocks of old-fashioned Spanish-type adobe and stucco houses were mowed down almost overnight to make room for the Avenida Bolivar project





Cutaway of the Avenida Bolivar project in Caracas, Venezuela, shows three sub-levels which with surface thoroughway will provide several avenues of traffic. The two center tiers afford parking space for 4000 cars and a bus depot

when another car goes over the edge—and seldom permit such grisly news to lighten pressure on their own accelerators.

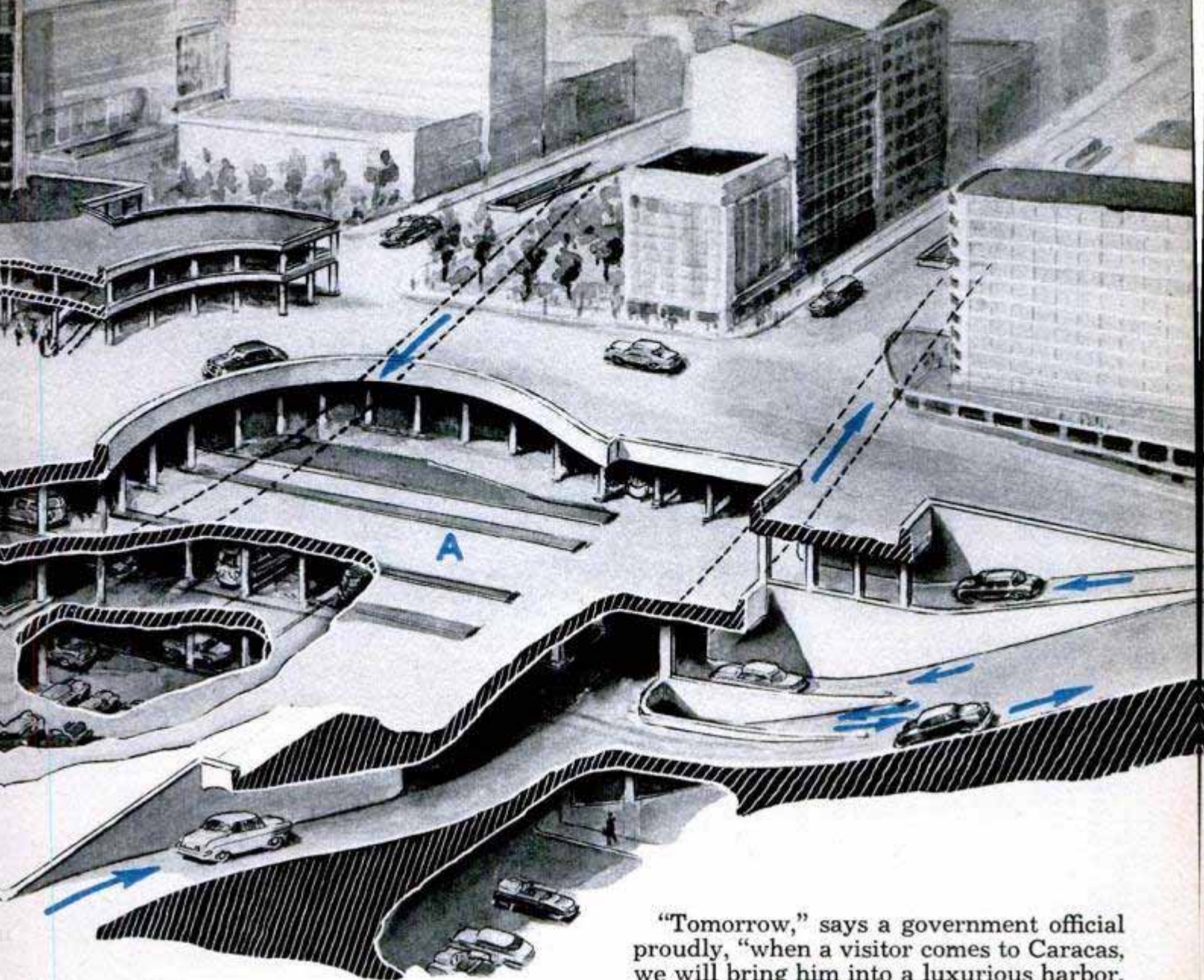
Government people are not so nonchalant. The old road is Caracas' life line. Down it go coffee, tobacco, cocoa, orchids for the outside world. Up it comes virtually everything needed to sustain a great part of Venezuela, for the country imports practically everything necessary to life. Daily the road groans under the pounding of 2500 vehicles. Hence, the new "autopista" will be a tremendous boon.

From Caracas, it will make a beeline for the coast, riding over chasms, cleaving through mountain peaks that are being chopped off to make way for it. A steady six-percent grade will bring it out at sea level on the coast after an 18-minute run of 12 miles. The present trip takes more than an hour. Four miles of the road will bore through the coastal range via a huge sloping tunnel, entering at about 700 feet altitude and coming out at about 400. Half a million cubic feet of granite will be blasted out. Eight big faults, or slip lines, in the mountain rock will be injected with concrete and reinforced. The tunnel will be equipped with recesses for disabled cars. A motor-powered suction system, operated in chambers carved out of live rock above and below the thoroughway, will ventilate the entire length of the tunnel. Though many Caracans hold their heads over the tunnel project, Don Luis Roche, the Henry Kaiser of Venezuela and the man who conceived the idea, has no qualms about it.

"Faith moved mountains in Biblical days," he says. "Now it is going to perforate them."

Not content with building a stupendous road to the harbor, Caracas is also building a complete new harbor at the port city of La Guaira. Tremendous breakwaters are stretching out into the Caribbean Sea. Old waterlogged piers are coming down to make way for modern steel and concrete structures, with warehouse facilities on the first level, stores, restaurants, movies and other passenger facilities on the upper level. Revolving derricks, with the world's biggest "dustpans" hooked on the ends of their 100-foot beams, lower under the tailboards of double-barreled trucks that dump 20 tons of rock at a time into them. Then they swing around, deposit their staggering loads in steel barges that cart the rock out to the breakwater line and dump it. The 60-foot, reinforced-concrete piles are made right on the spot in special wooden molds. They are run out to the pier site on a miniature railroad and lifted from the cars by cranes that swing them into position and hold them while a massive pile driver hammers them into the harbor bottom.

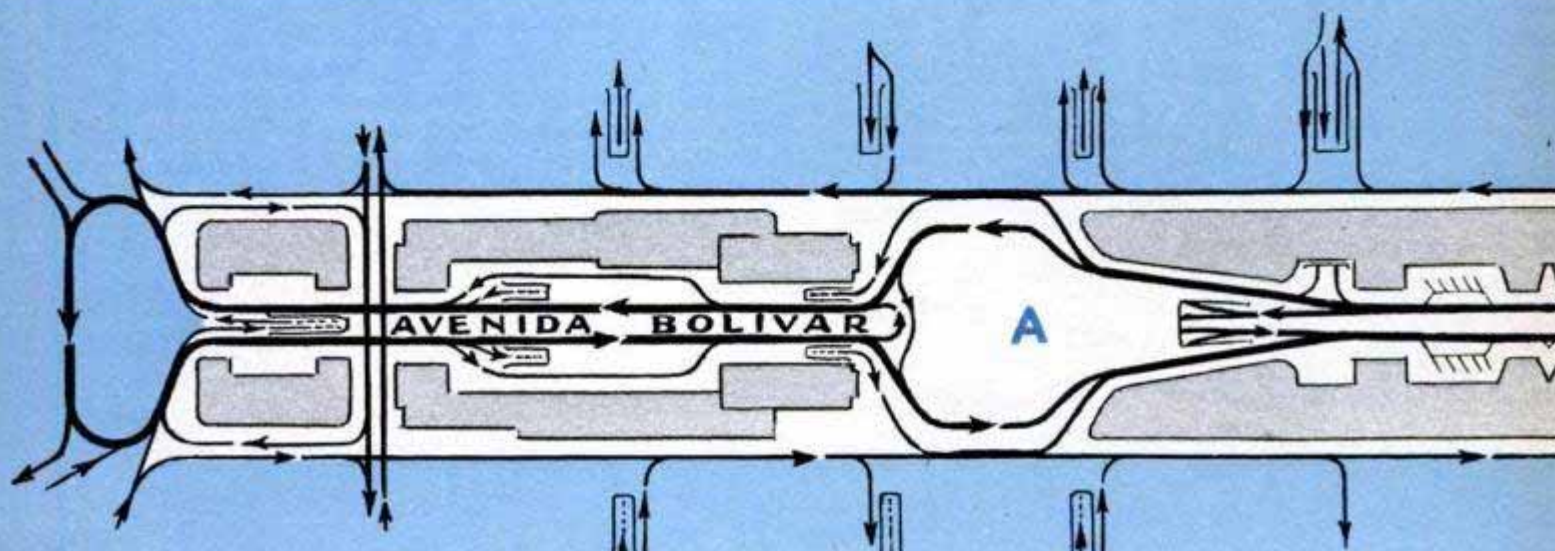
At one point, the contractors found a rock ledge on the harbor bottom. Ordinary concrete piles crumbled when pounded against that surface. They solved the problem by welding hard steel points on a steel frame,

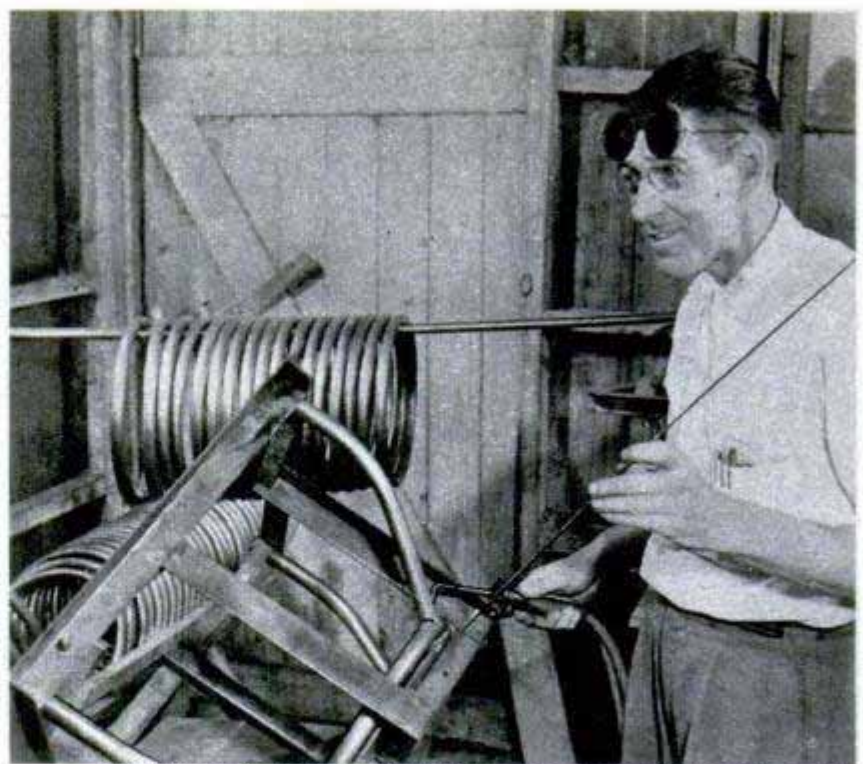


and pouring concrete around this husky skeleton. These piles will drive, point first, into the hard rock. When finished, the new harbor will have facilities for about 25 coastwise ships, a turn basin—a sort of marine turntable—vast new warehouses and piers to handle every conceivable kind of shipping with the most modern equipment.

“Tomorrow,” says a government official proudly, “when a visitor comes to Caracas, we will bring him into a luxurious harbor, whisk him under mountains and through the sky to our city, zip him under our teeming streets and out into the air at the very door of his hotel. And what he will see is the city of tomorrow in every direction. He will be able to walk around without danger of risking his life every time he steps off the curb. In fact, he will see very little traffic. It will all be underground.”

Point “A” in diagram corresponds with marking of cutaway at top of page. Arrows show the flow of traffic



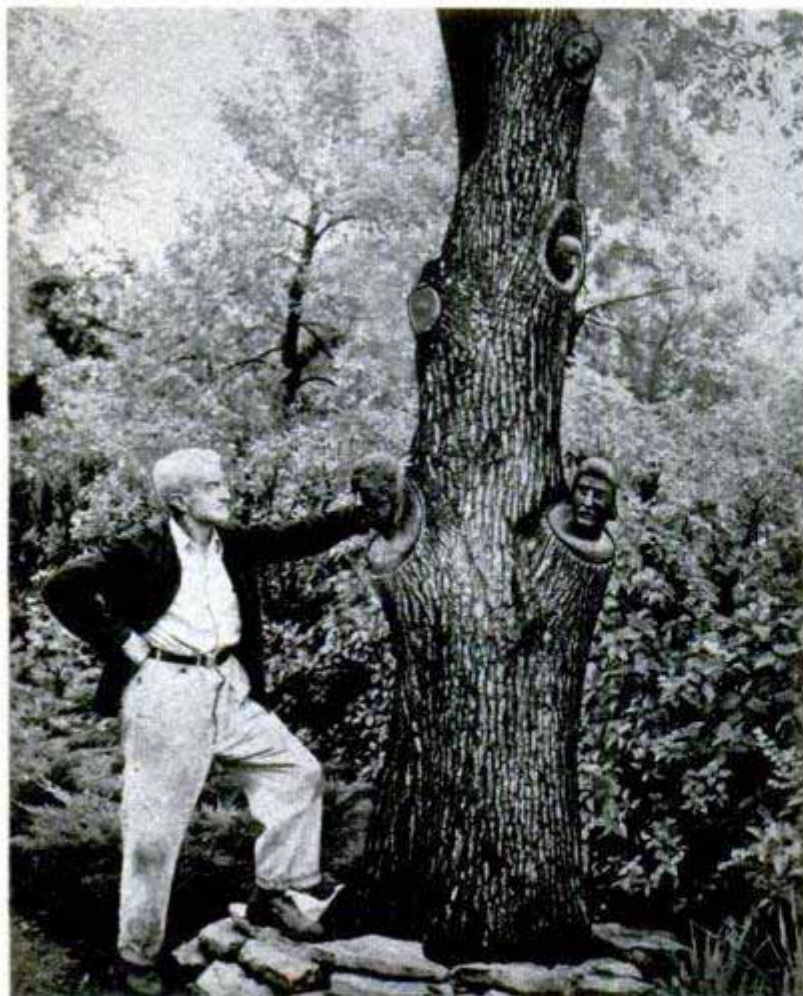


John Harper, Westinghouse Electric Corp., Transformer Division, Sharon, Pa.

Walker for Tots

Little John Benner of Sharon, Pa., has learned to walk in record time, thanks to the ingenuity and welding experience of his grandfather, John Harper. A welding expert for Westinghouse, Harper designed and built a "wee walker" for Johnny. It consists of four tubular-steel legs welded to a tubular ring. Harper put large casters

on the legs and a canvas "saddle" inside the ring. Johnny, placed inside the saddle, scooted in any direction with ease. Rubber bumpers on the legs protect the furniture from scratches. Neighbors liked the walker so well they started placing orders, and now Grandfather Harper is turning out walkers in batches of 500 in a barn he has converted into a workshop for his growing business.



A Treeful of Heads

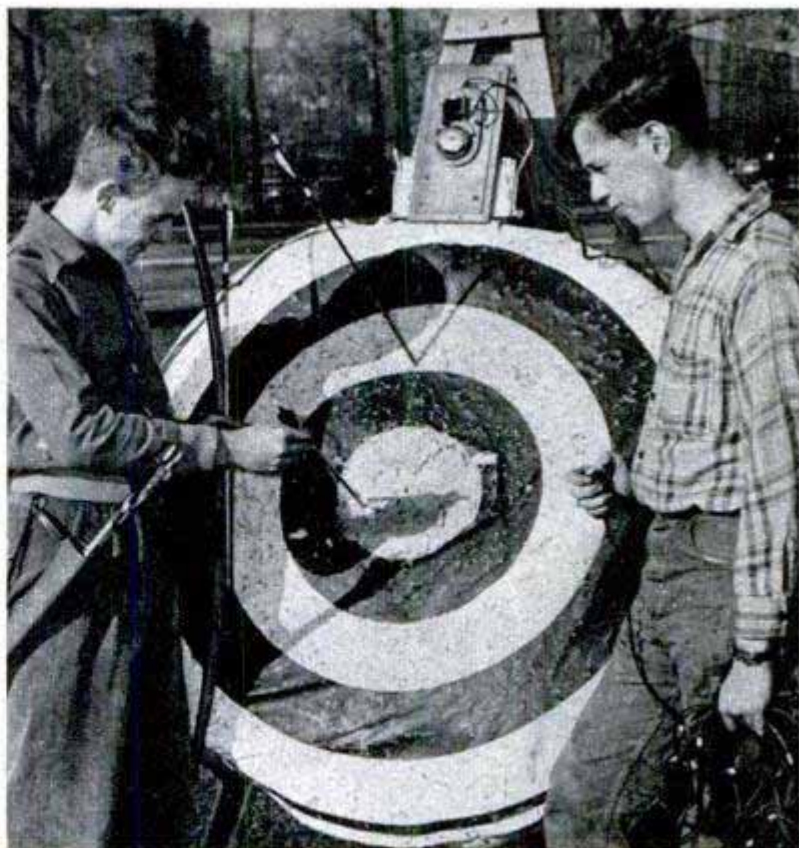
Strangers who walk into the yard of Louis van Zandt in Elmhurst, Ill., are startled to see heads popping out of a tall elm tree. The 72-year-old Van Zandt has been carving various-sized heads on the stumps of limbs for years as a hobby. A printer by trade, he is now retired and says the pastime is a way to keep busy.

Ventilating Fan Has Thermostat

Placed in your bedroom window, a twin-fan ventilator cools the room to the preset temperature and then automatically shuts itself off. If the room temperature rises during the night, the fans go back into action again. There are two fans in the ventilator unit, which can be used to suck cool air in or blow the hot air out. Made by the General Electric Company, it can also be removed from the window and used to circulate air anywhere in the house.

Blind Archers "Hear" Target

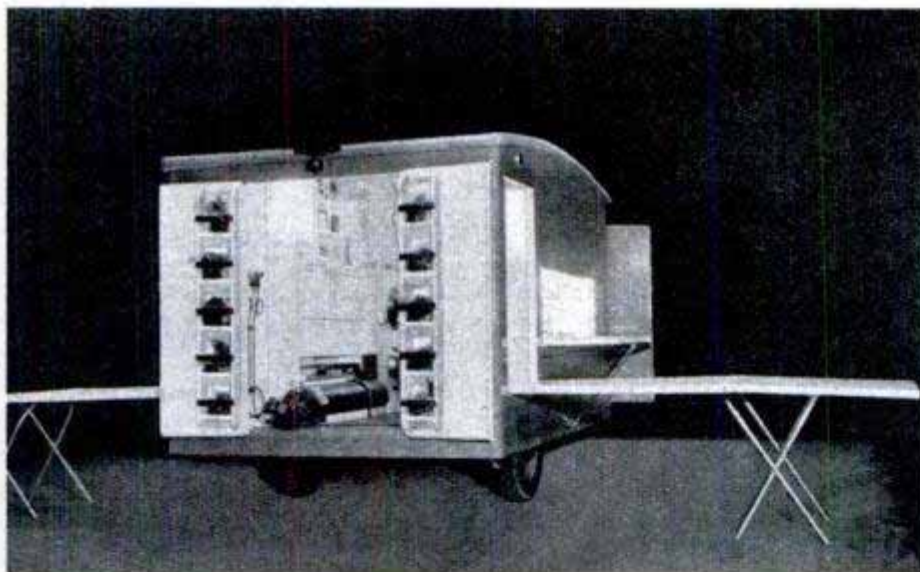
Sound from a doorbell attached above the target gives blind archers a "sight" on the bull's-eye. An assistant with an extension wire and button operates the bell from a safe distance away. The new archery aid was devised by John Hordines, athletic director at the New York Institute for the Education of the Blind, Bronx, N. Y.



Canned Water for Defense

Water packaged in tin cans may help solve the problem of providing uncontaminated water in the event of atomic attack. Dr. Myer Selby, research director of the Multiple Breaker Co., 82 Commonwealth, Boston, Mass., "developed" the canned water, under contract with the Air Force. Oddly, it is more difficult to can than most foods because it takes on the taste of the can or can lining. Doctor Selby's method keeps the water both sterile and palatable. Many authorities predict that normal water supplies would be

dangerously contaminated with disease or radioactivity if a city came under an atomic-bomb attack.



Trailer Hospital

Emergency medical treatment is provided by a 12-foot hospital trailer designed for use in the event of an A-bomb attack. Two operating tables fold down from the sides of the trailer, and equipment inside the unit can dispense oxygen to 10 victims simultaneously. The 2200-pound mobile hospital also carries plasma and the necessary transfusion equipment.

Obstacle Course Slows Speeders

Spaced barriers, extending inward from alternate sides, discourage speeding on the Youghal Bridge in Ireland. There is enough distance between barriers to allow two cars to pass on the way across.

☛ About 81,000 calls a month are made from motor vehicles equipped with radio-telephones.





WESTERNERS are RIDIN' HIGH!

By Rafe Gibbs



WESTERNERS are still at it—pioneering, that is. Only this time they are not cracking a bull whip as they stalk beside a slow-moving ox team. They are fingering the controls on a panel maze as they sit in a swift-traveling airplane high over the spaces that have remained, for the most part, wide open.

Clergymen, doctors, cowboys, farmers, legislators and men from many other walks of life are utilizing planes in going about their business. Results in many cases have been spectacular. Highly practical, too.

For instance, there's the case of Father Blase Schumacher. He had to say two masses every Sunday morning in two different states. The first mass was at 9:30 a.m. in Vernal, Utah, and the second at 11:30 a.m. in Rangely, Colo., 50 miles away.

Father Schumacher found that he had to race his car on the straight stretches to get to Rangely in time for the second mass.

Left, symbol adopted by the flying legislators of Idaho is orating politician standing on soaring desk



Injured fire fighter is rescued by helicopter from remote area in Angeles National Forest, Calif. Below, right, pilot acts as spotter for men on ground

Then one Sunday morning he was delayed at Vernal. Being a sky pilot, both literally and figuratively, he finally decided to borrow a parishioner's plane and fly to Rangely. The trip took less than 30 minutes and, promptly at 11:30, with chalice in hand, Father Schumacher strode to the Rangely altar. The next Sunday he started flying regularly to the Colorado town.

The Rev. Norval Hegland was assigned a Lutheran flock scattered over 3000 square miles in the cattle and sheep country of South Dakota. But he was the man for the job because he was also a flyer.

The people of his sprawling parish previously had enjoyed little social life, so the flying pastor made arrangements for some of that along with church services. In good weather, he scheduled picnics in ranch yards following the services. It soon became a common sight to see him stepping from his plane in a cow pasture, with a Bible in one hand and a five-gallon can of ice cream in the other.

And just as clergymen of the West have turned to the plane in looking after spiritual needs of their far-flung parishes, doctors have turned to it in looking after physical needs. Especially in the mountain country where roads are poor, a doctor often must have wings himself to beat the stork.





Los Angeles Times photo

Helicopter fitted with specially designed seed hopper is made ready for grass-seeding operation on range

Most famous of the West's many flying doctors is Amos Little of Helena, Mont. Doctor Little has even streamlined the procedure of reaching a patient when no landing field is near. He has himself and kit flown to the scene where he is needed, then simply jumps out of the plane — with a parachute.

At Marfa, Tex., Dr. J. P. Searls uses his plane on emergency calls to outlying areas. When a ranchman accidentally lodged a piece of steel in his eye, Doctor Searls operated, then loaded him in his plane and

Flyers dropping supplies by parachute to men working for Forest Service are accurate as bombardiers

U. S. Forest Service photo



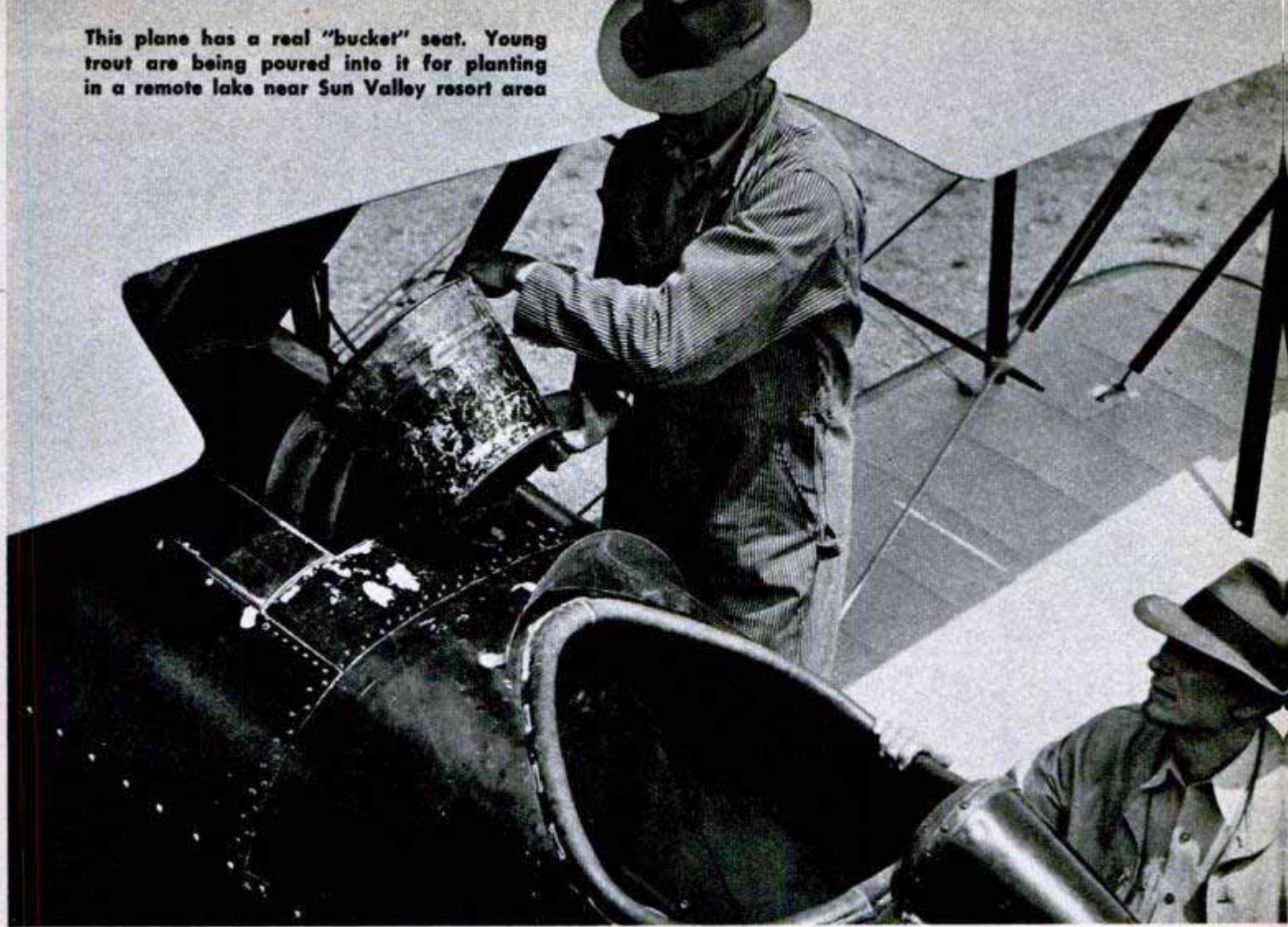
flew him to El Paso for special treatment.

Among all the occupations and professions, farming and ranching provide the most fertile fields in the West for airplane salesmen. Many farmers and ranchers have taken to planes simply because they can cover so much acreage so fast. Dusting crops with airplanes has long been standard practice, but now experiments are being conducted with air seeding. Good results are being obtained, too, especially in reseeding depleted range land.

The men who wear high-heeled boots and high-crowned hats have long debated the efficiency of rounding up wild horses by air, but now are generally agreed that this is the best method. One cowboy in a plane can do the work of five in the saddle. Sometimes, too, an unusually smart horse that cannot be trapped at all on the ground can be outwitted with a plane.

An example of this occurred in Wyoming. For years, a glistening palomino stallion, with his omnipresent harem of mares, had defied all attempts to capture him as he roamed the Teapot Butte area north of Crowheart. Time and again the mares would be driven into a trap, but the stallion, neighing his defiance, would gal-

This plane has a real "bucket" seat. Young trout are being poured into it for planting in a remote lake near Sun Valley resort area



lop off into a brush hideout. When the roundup was over, he would acquire a new harem and keep his old freedom.

Then cowboy Roy Lamoureaux of Casper, who has helped round up more than 2500 head of horses from the air, got on his trail with a plane. Lamoureaux had participated in the capture years ago of Desert Dust of motion-picture fame, and even from the air, the puncher-pilot could see that the palomino stallion was every inch the equal of Desert Dust. He determined to have him.

Flying low, he began his drive toward a trap set up in the sage-dotted hills. The stallion started his brush-dodging routine, but each time he took cover the winged waddy flushed him out. His last bound of the day landed him in the trap.

Rounding up cattle by air is not so practical, because too much high-priced beef can be worn off. The plane, however, is just the thing for patrolling a ranch.

Consider the flying Fuhrimans of northern Utah — the 61-year-old father, A. J., and his four sons, Delbert, Earl, Lee and Duane. All of them fly. They own two airplanes to cover their extensive holdings,

Flying just 30 feet above the water, pilot pulls a lever to drop 2000 rainbow trout into mountain lake





Skilful helicopter pilot shows how he flies low to spray weeds on a canal bank near Prosser, Wash.

and more often than not both planes are in the air.

The Fuhrimans use their planes for keeping an eye on their cattle, but they also find them highly practical for flying between ranches to change water on irrigated land.

"Then," said Delbert, "we use 'em just to run errands. And they're mighty handy when it's a half hour before dinnertime and you're out in the sagebrush, 50 miles away."

Commenting editorially on the use of airplanes by Utah farmers, the Salt Lake Tribune recently said that in over three fourths of the state there are Flying Farmer organizations affiliated with the National Flying Farmers Association. The Tribune added:

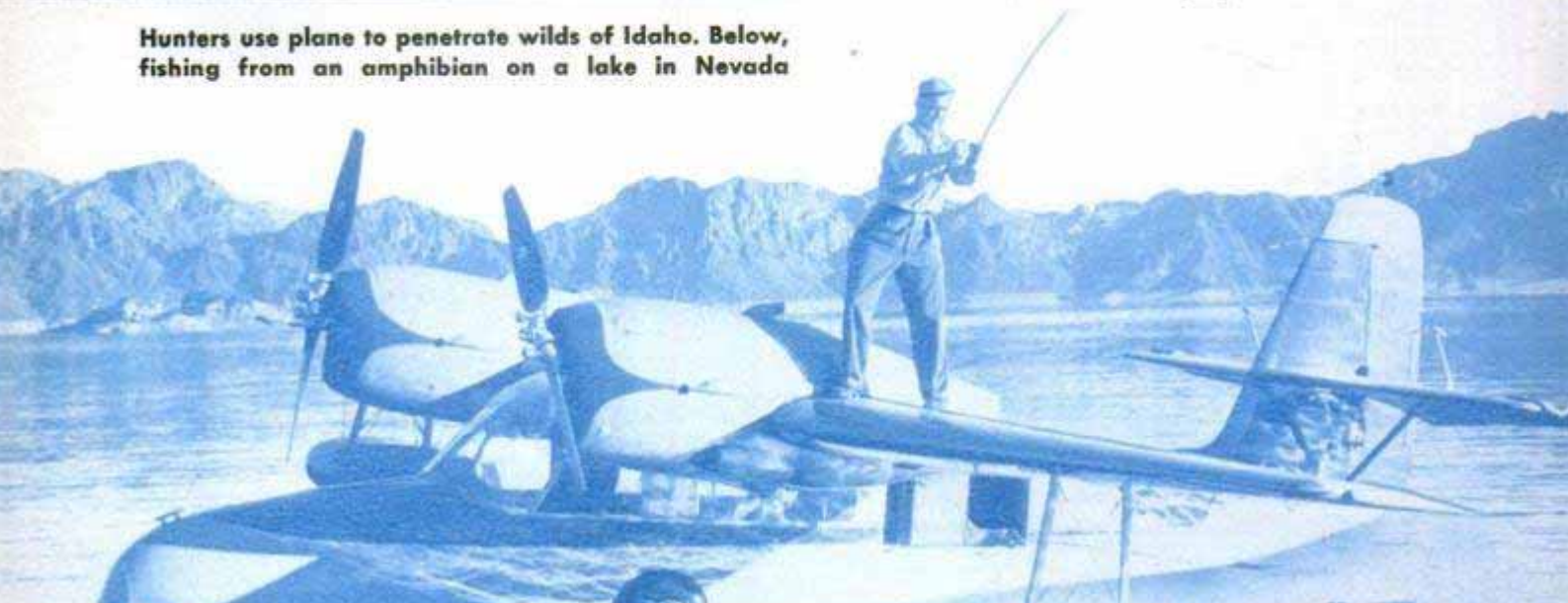
"We wonder just how long a farmer who doesn't own his own plane can keep from being called an 'old fogey.'"

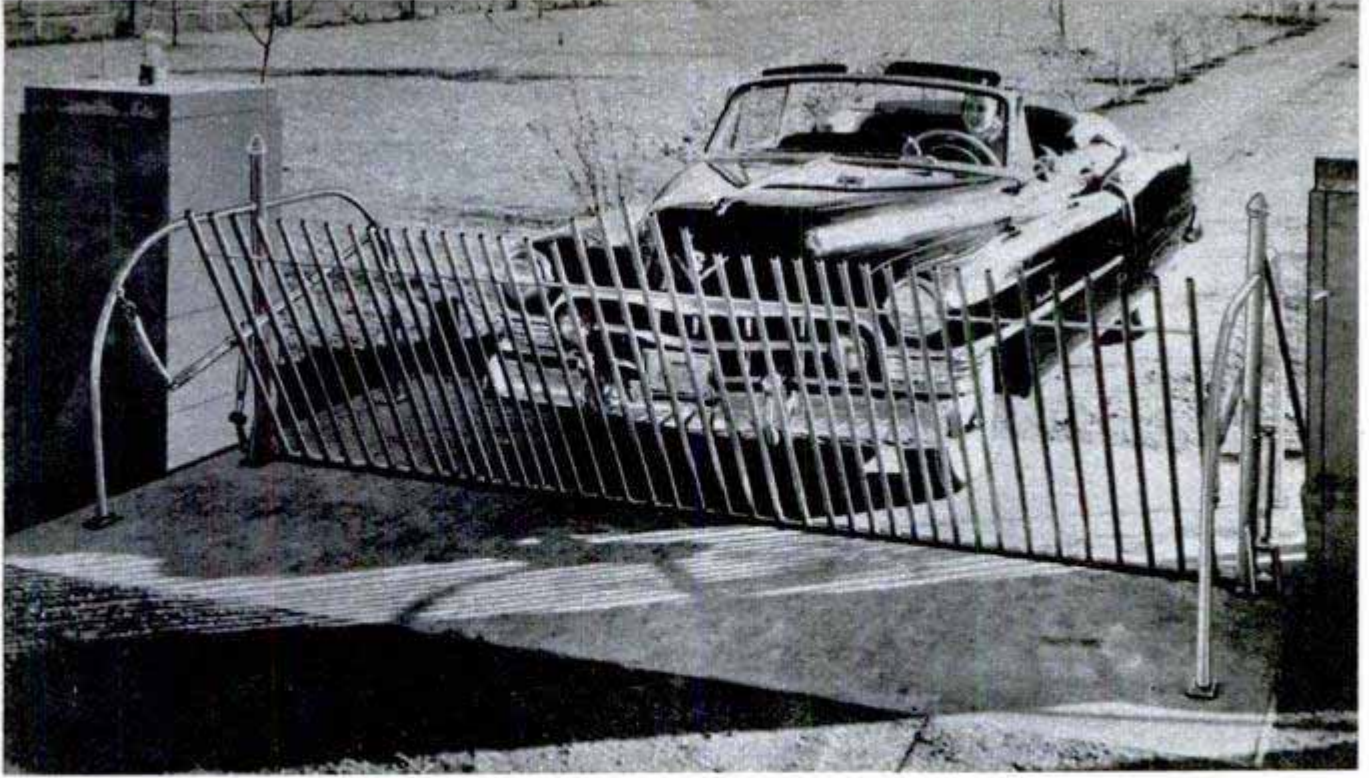
But Idaho goes the State of Utah one

(Continued to page 226)



Hunters use plane to penetrate wilds of Idaho. Below, fishing from an amphibian on a lake in Nevada



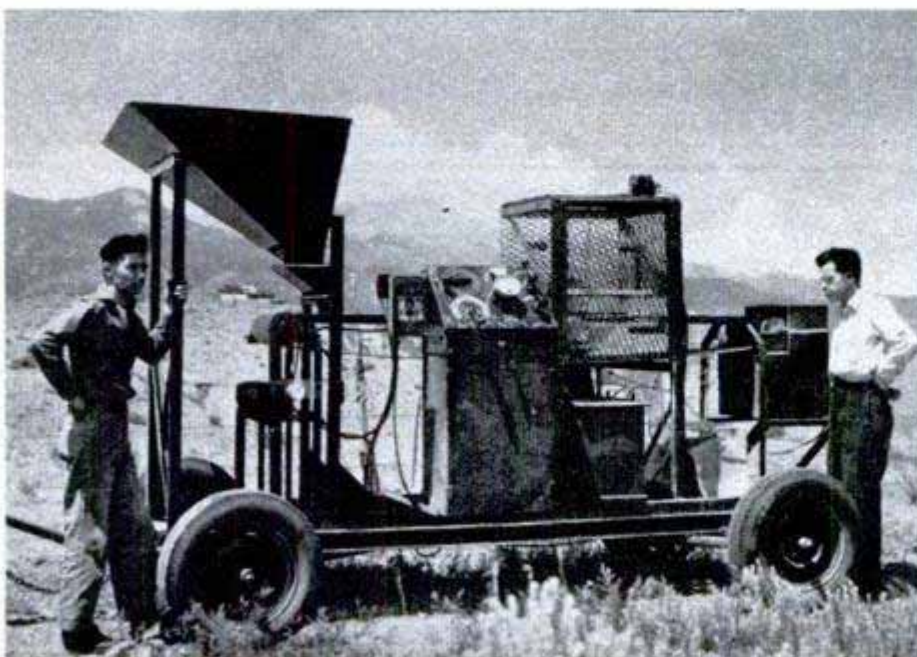


Hawley Mfg. Co., 1130 Lockwood Dr., Houston 20, Tex.

Push-Over Gate

You don't have to get out of the car to open or close an automatic gate because you drive right over it without damage to either the car or the gate. The bumper of your car pushes the gate down to the ground as you drive through. When the car has passed over, the gate shuts itself automatically. Hydraulic checks prevent the gate from rising to the vertical position until the car has had time to get through the opening.

Driver remains seated and the car pushes the gate open. Once the gate is down, hydraulic mechanism prevents it from rising for several seconds



Thomas Maestas, Colorado Springs, Colo.

Electric "Sluice" Aids Gold Miner

It may not look as romantic as a '49er's sluice box, but an electric gold separator does take out more gold and that's what a prospector wants. Gold-bearing earth is carried between two high-voltage electrodes by a conveyor belt. Nonmetallic particles, being nonconductors, take on a static charge and jump up and down. Revolving paddles skim them off as they bounce. The free gold remains on the belt.



Interstate Engineering Corp.,
2250 E. Imperial Highway, El Segundo, Calif.



Above, left, if your knives are dull, sharpen them on a vacuum cleaner. Furniture dull? Shine it with the vacuum, above. It's also a power drill, left. Making this versatility possible is an air-powered turbine



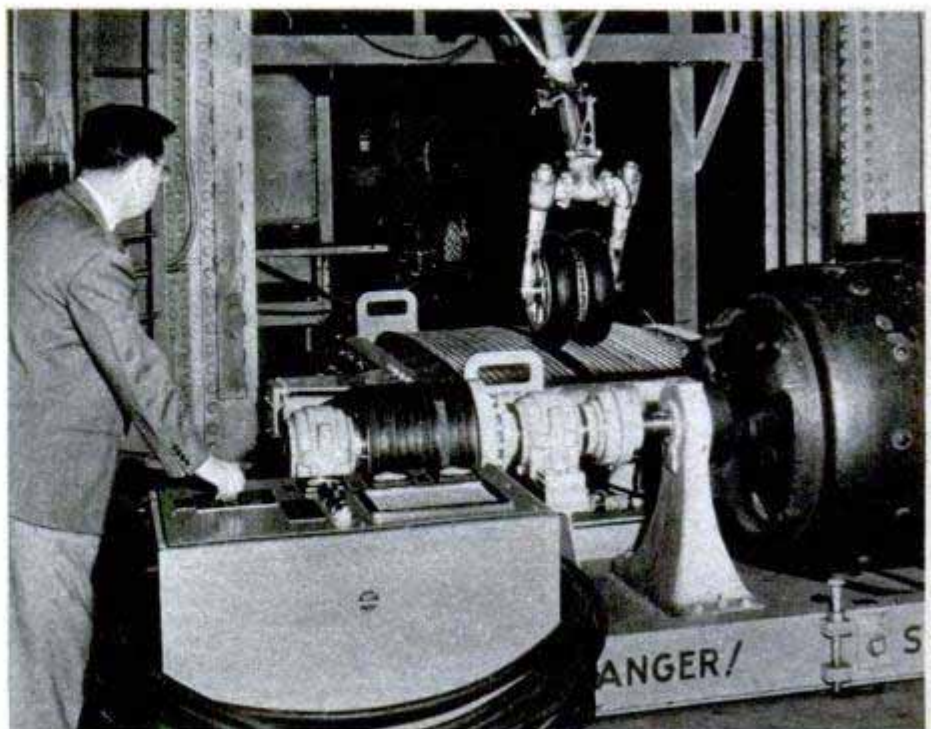
Vacuum-Cleaner "Workshop"

Vacuum cleaners now drill holes, sharpen knives and polish furniture, doing all these jobs with air pressure. A turbine-equipped head containing two rotating brushes provides the power take-off for the tools. A chuck, furnished with the cleaner, mounts on the shaft of the turbine. Two wool buffing pads are used to polish floors, cars and silverware while a pair of contra-rotating bristle brushes scrubs floors to remove even the stubbornest dirt. Designed by a vacuum-cleaner manufacturer for use with his product, the turbine head can also be used on several other brands.

Test Runway For Landing Gear

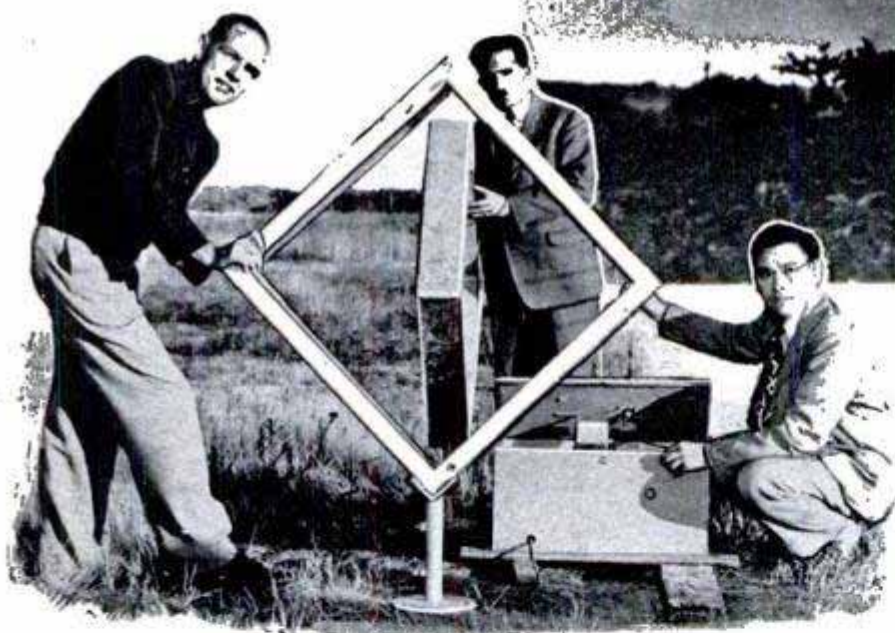
All the punishment taken by airplane landing gears is duplicated by the Air Materiel Command's new test "runway." It consists of two large endless belts driven by an electric motor over a series of rollers. Aircraft gear are dropped onto the moving belts to simulate landings up to 160 miles an hour.

☐ The same blight which wiped out the American chestnut tree is now threatening to destroy chestnuts and oaks in Italy and Switzerland.



Blue lightning helped an Oklahoma scientist and his college crew of research workers discover the secret of forecasting and tracking the world's most violent storm

Field equipment outside the tornado-tracking station at Oklahoma A & M College consists of two directional antennas and an antenna that is coupled with a cathode follower. Dr. Herbert L. Jones, director, in center



Now They're **FORECASTING TORNADOES**

By Ben Funk

THE UNITED STATES has been helpless against tornadoes in the past, simply because weathermen couldn't tell—until too late—the difference between a brewing twister and an ordinary thunderstorm. High death tolls and incredible destruction were inevitable. Now, after four years of relentless effort, a research team from the Oklahoma Institute of Technology, of the Oklahoma Agricultural and Mechanical College, has cracked the baffling secret—

how to forecast a tornado. This spring, it is holding its first full-dress rehearsal of a system designed ultimately to save thousands of lives.

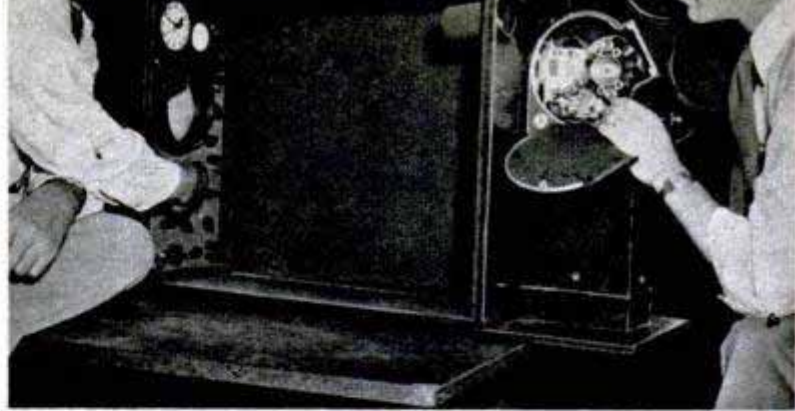
A tornado generally starts like this. A moist, balmy mass of air leaves the Gulf of Mexico and pushes northward. About the same time, a cold front enters the tides of the upper atmosphere to the north and glides southward. These mighty masses then collide, and the atmosphere, thrown

suddenly off balance, erupts in furious confusion. While torrents of rain bombard the earth, aerial convulsion develops into a great spinning movement that whirls faster and faster until a long, twisting black funnel pokes out of the pitch-black storm clouds. The funnel reaches out until its lower end clutches the ground and then it begins a wild and dreadful journey over the plains. Head for your storm cellars—this is the world's most violent storm.

Every spring and summer these great black funnels wreak their maniacal fury on U. S. towns. Tornadoes have struck in every state and the District of Columbia, but the areas most frequently hit are the great central valleys of the United States. Kansas, Iowa, Texas and Oklahoma have had the greatest number. Oklahoma lies at the "tornado junction," that part of the Great Plains area where north and south air currents frequently clash.

The tornado that took the highest death toll in the country raked the Ohio Valley on March 18, 1925, killing 689 persons and injuring 1980. The St. Louis tornado of 1927 was the worst property-destroyer on record. Damage was estimated at \$22,000,000.

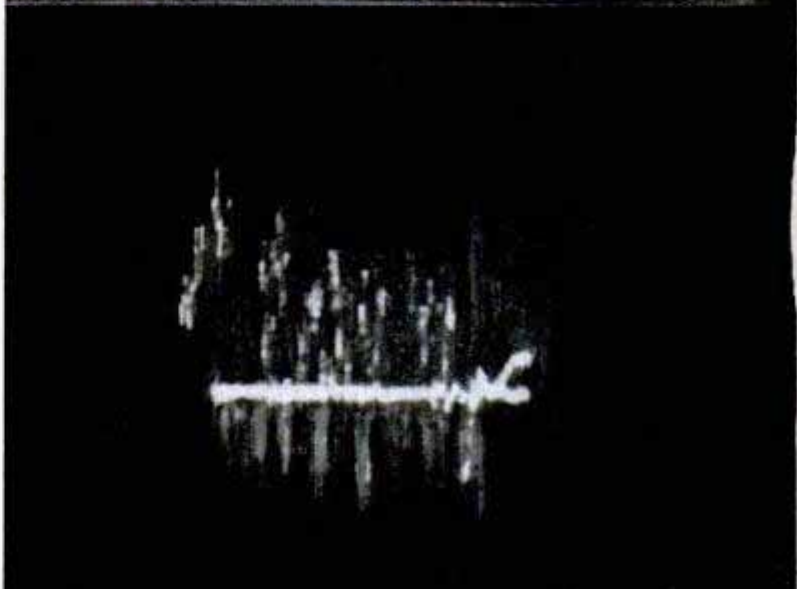
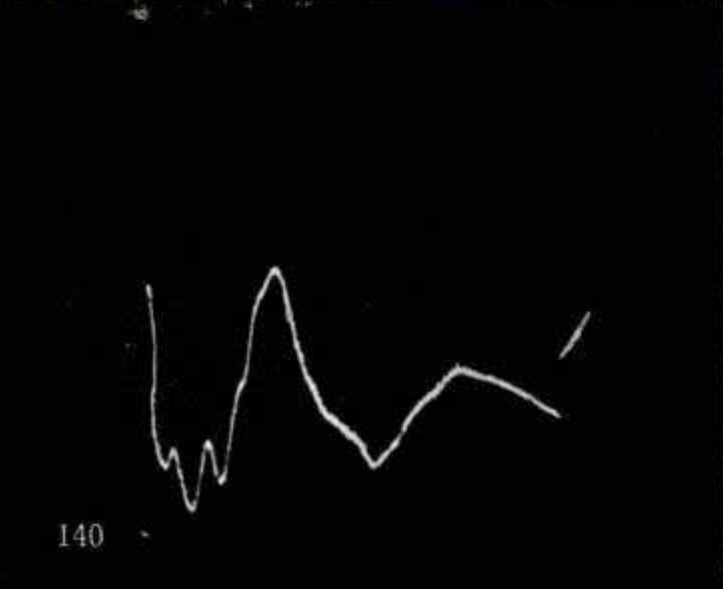
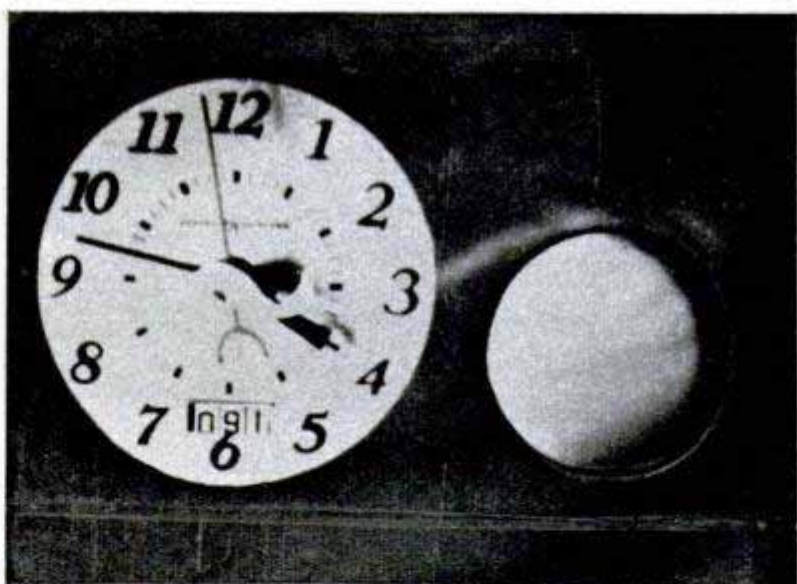
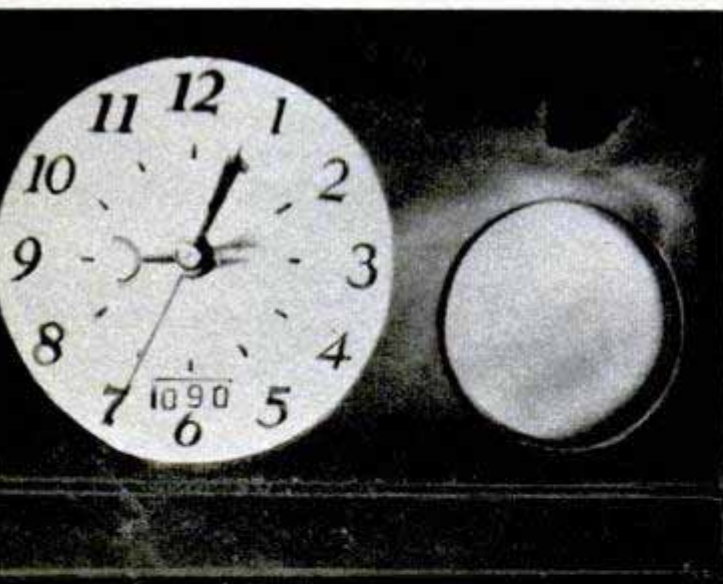
Tornadoes average 300 yards in diameter, although they have been observed from a



Camera automatically photographs flashes of lightning as recorded in waves on oscilloscope screen

few feet to more than a mile across. The average path is about 12 miles long. While forward speeds up to 150 miles an hour have been reported, these are extremely rare. An automobile can easily outrun most tornadoes without breaking any speed limits. Around the edges of the tornado, however, will be spinning winds that may reach a speed of 500 miles an hour, flattening trees, houses and brick buildings as easily as a sharp scythe cuts through a stand of grain. And at the center of the funnel is a low-pressure area with a suction so powerful that it can cause buildings to explode

Below, left, ordinary lightning looks like this on oscilloscope screen; tornado lightning is shown at right



from the outward heave of the air inside them.

Until science finds a way to break up a tornado before it starts to move, nothing can be done about the property damage which it wreaks. But the ability to spot a twister in its formative stage, track its movements and warn people ahead of it will save thousands from death and injury. This is the key which the research team at the Oklahoma Institute of Technology has found.

Using electronic equipment which photographs and identifies "tornado lightning," these researchers get an instantaneous tip-off whenever a twister begins to form in the skies within a radius of 150 to 200 miles of the station which they have set up at Stillwater, Okla. Using direction finders and radar—devices already proved in tracking hurricanes and other types of storms—the team locates a tornado and trails it like a bloodhound. The next step is to establish a preliminary network of electronic stations—four would blanket the state of Oklahoma—and begin working out a method of warning communities that are located in the path of tornadoes.

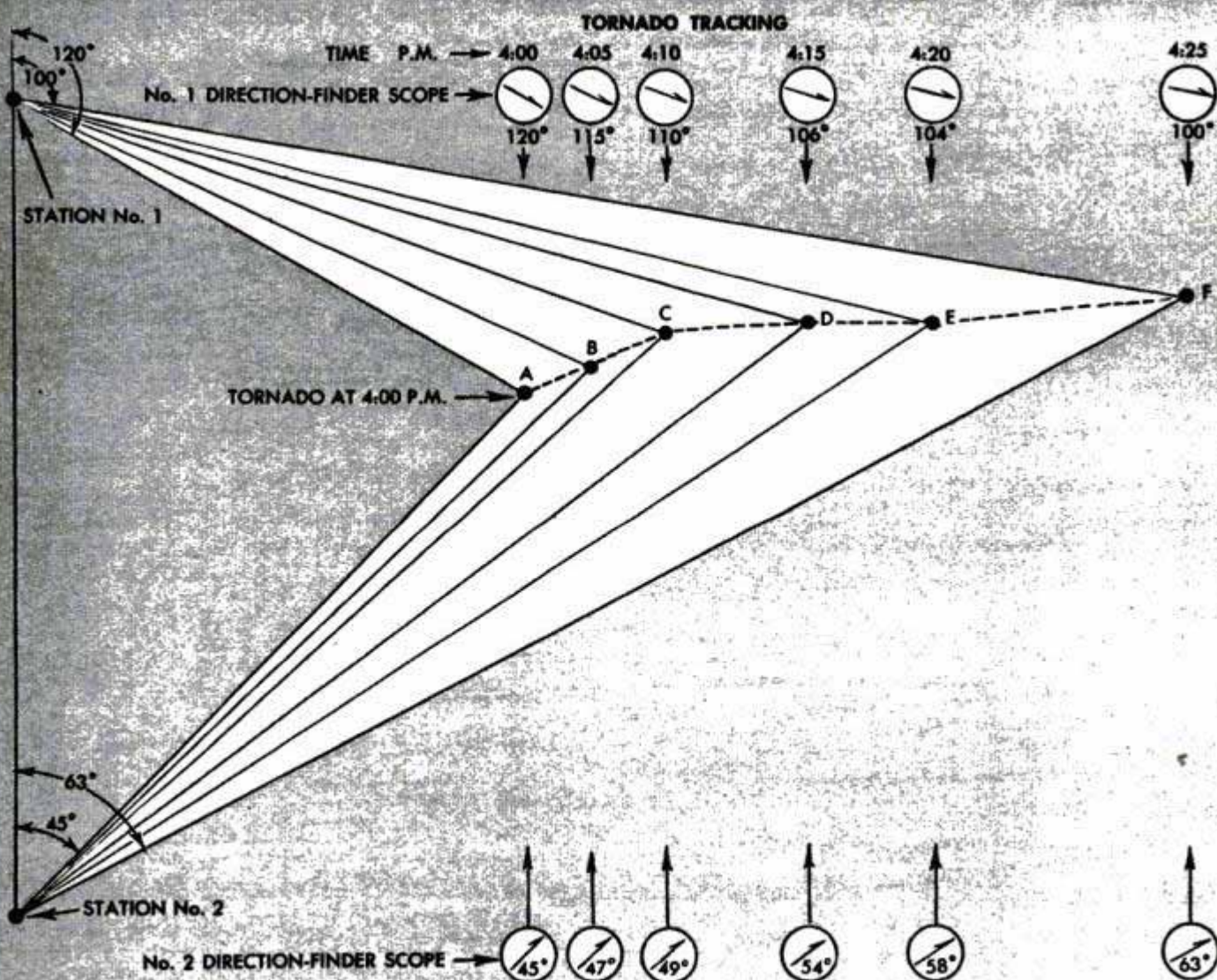
Dr. Herbert L. Jones, boss of the Oklahoma team and professor of electrical engi-

neering, began talking tornado-tracking as soon as he arrived at the Oklahoma Institute of Technology in 1946, after 10 years on the faculty of the University of New Mexico and six years of telephone laboratory work. He was encouraged by Dr. Clark A. Dunn, director of the institute's engineering research.

The first step was to collect every available eyewitness account of tornado activity. After questioning scores of people, one clue stood out like a beacon—tornado lightning was different from ordinary lightning. William Kruckenberg, of the department of engineering extension at Oklahoma A and M College, reported that when he watched a tornado pass his father's farm near Enid, Okla., the lightning discharges were bright blue, almost violet in color, and far more vicious and intense than thunderstorm lightning. This tallied with an account by Prof. Alexander Langsdorf, Dean Emeritus of Engineering at Washington University, who observed the St. Louis tornado of 1927 from the window of a streetcar. He reported that the lightning discharges had peculiar characteristics and noted that St. Elmo's fire streamed along the trolley rails and engulfed the car.

(Continued to page 246)

By triangulation, two tornado-tracking stations in Oklahoma locate a storm and follow its destructive path





The Austin Co., 19 Rector St., New York City 6

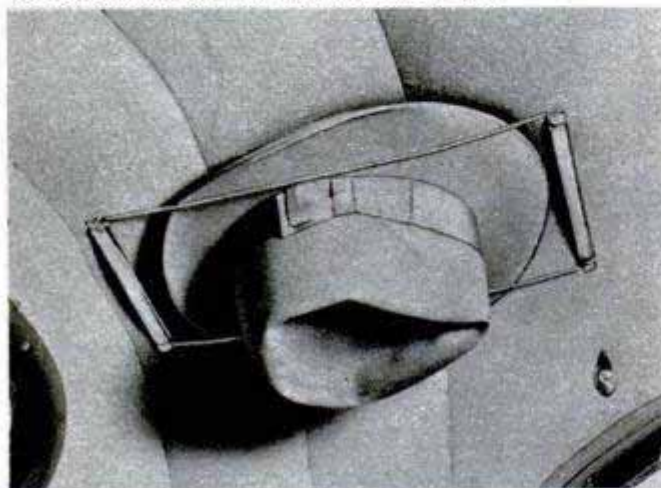
Radioactivity Checker

Laboratory technicians who handle radioactive materials can check the contamination of their hands and feet with a new instrument that measures beta-gamma rays. The operator merely stands upon a platform and thrusts his hands into special compartments in the instrument. In a few seconds the machine gives five different readings, representing the radiation from the palm and back of each hand, and the feet of the worker. If any one reading is too high, the laboratory employee must report for decontamination.

Pinup Hanger for Hats

You can hang your hat on the ceiling of your car with a hat rack that pins to the upholstery. Adjustable from 8 to 13 inches in length, the hanger consists of two springs that hold the hat brim firmly but without damage.

The Auto Hatrack Co., 829 15th St., Denver, Colo.



Lifesaving "Bathrobe" Protects Rocket Workers

Men who handle liquid rocket propellants for the Air Force require special clothing to protect them from the toxic fumes of such propellants as red fuming nitric acid and aniline. Fumes from either of these liquids are lethal if absorbed by the body in quantity. To protect workers, the Aero Medical Laboratory at Wright-Patterson Air Base, Dayton, Ohio, has developed a coverall-and-hood assembly fabricated from vinyl-impregnated Fiberglas. To keep the workers cool inside the suits, two methods are used. One is a forced-air system in which cooling air is pumped inside. The second cools by water evaporation. In this method an outer shell of cotton is soaked with water and worn over the coverall. Air for breathing is supplied by a tank worn on the back.

14,000-Horsepower Jet Engine

With thrust equal to 14,000 horsepower, the new Westinghouse J-40 engine is believed by its manufacturer and the Navy to be the most powerful turbojet in the world to qualify for quantity production. Its performance is expected to be almost doubled by addition of an afterburner to reheat the exhaust gases and by other developments now in progress. From starting to full power, operations of the engine are accomplished by one cockpit control.



Student works carefully on a silver teapot of his own design while instructor provides expert advice

Roll-top desk of redwood required months of work, gave student experience for a career in woodworking



They Learn CRAFTS FOR CAREERS

By Alfred Eric

IN A DOWN-TO-EARTH school at Rochester, N. Y., a few dozen students from all over the country are learning every phase of a chosen craft from design to marketing. Students at the School for American Craftsmen don't concentrate on art for art's sake—they study craft as a paying career.

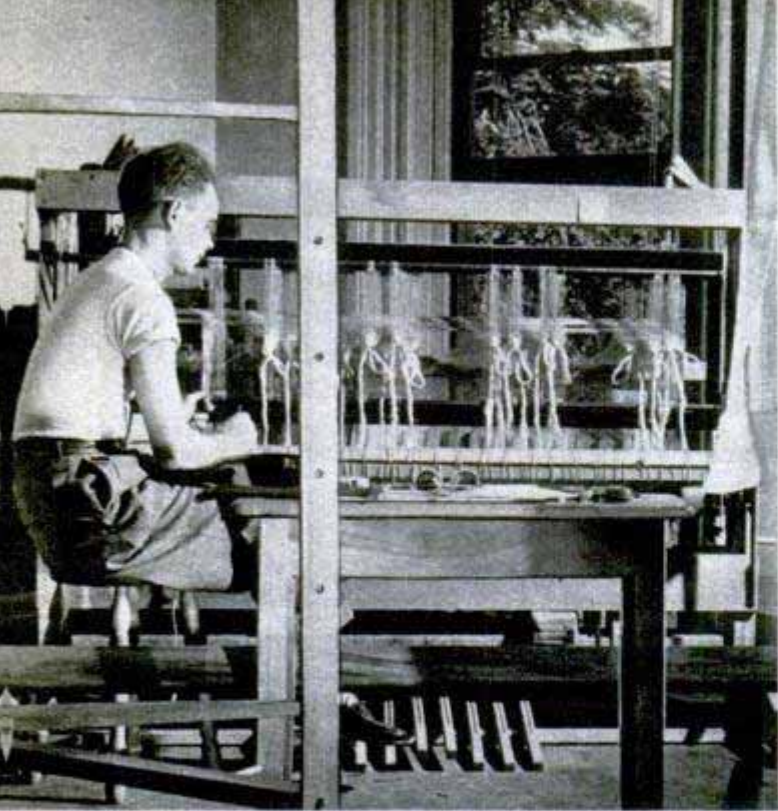
Production training—the making of salable articles—is not sneered at in this school. As soon as the student's skills permit, he goes on production work.

Students must meet rigid entrance requirements, as only a few dozen are enrolled at a time. The student can select as his field any of four hand arts: metalcrafts, which include the making of jewelry, flat silver, holloware and enameling; ceramics, including ceramic sculpture; textiles, with emphasis on design, weaving and printing techniques; and all forms of woodworking and furniture design, a field that includes joinery, turning, carving and finishing.

Instructors emphasize the sale of craft articles. Students are lectured on pricing and market trends by experts in the various fields.

Instead of writing a thesis, the student designs and makes a "journeyman piece" which the faculty must approve before he is recommended for graduation.

In rare cases, students of unusual ability take a third year of work at the school. Most alumni find their craftwork profitable as soon as they leave the school.

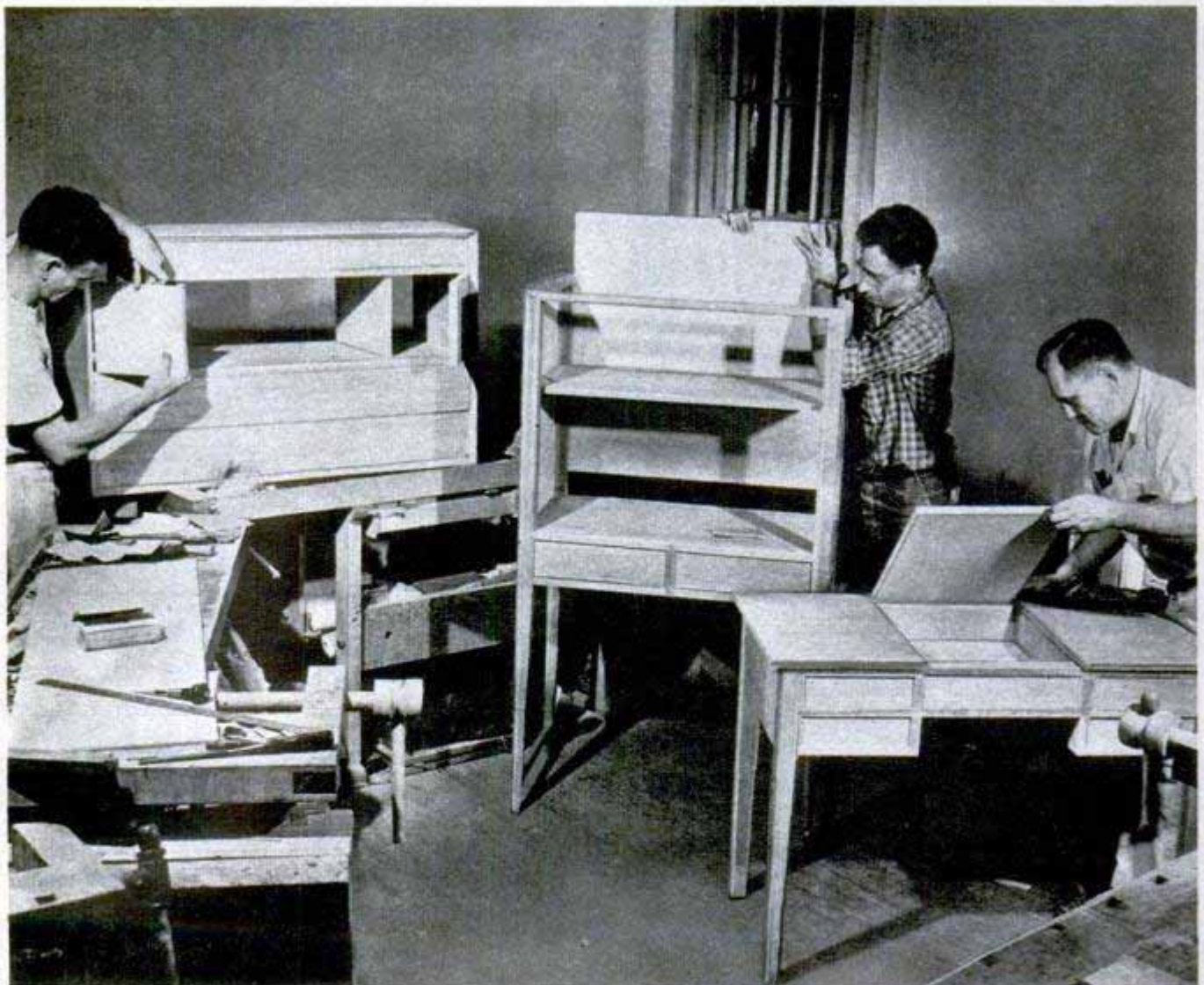


One of the school's most successful students, Karl Laurell, already is deluged with orders for textiles



Out of kiln comes a new ceramic piece. Student in this field learns to master hundreds of glazes

Students, from left to right, work on a primavera commode, a walnut cabinet and a modern dressing table. All three students are in their second year at the school and these projects are their "journeyman pieces"





Beautiful—and salable—products come from the textile department. These students are learning how to make silk screens of their own design



Novice ceramic craftsmen not only learn "throwing" but also making and repairing of kilns



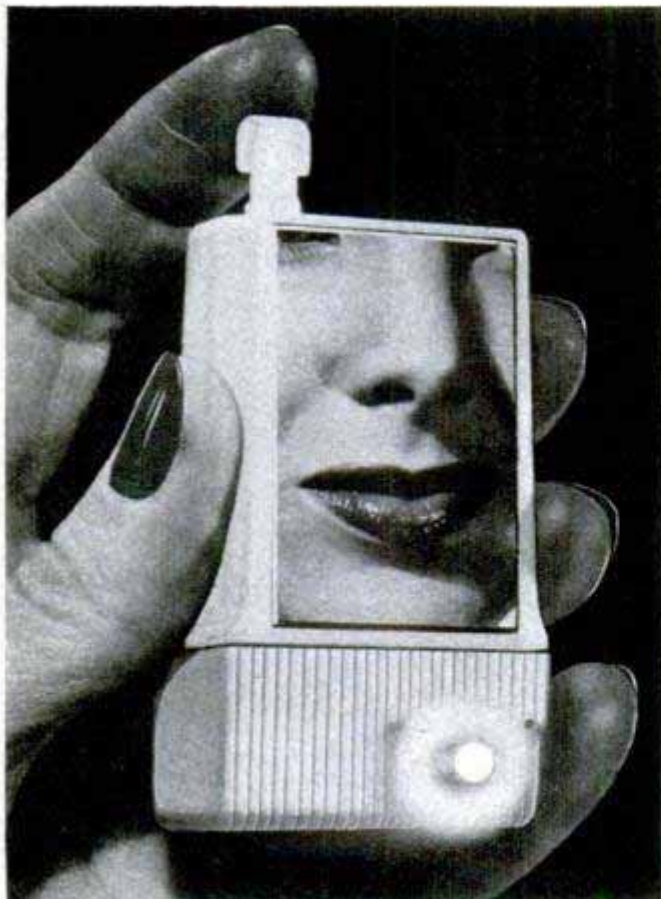
Furniture, wood pieces, ceramics—everything shown—represent the craftwork that comes from the novel hand-art school



Palomar "Core" Becomes Telescope

Because a piece of glass 40 inches in diameter and 20 inches thick was left over when the world's largest telescope on Mount Palomar was completed, Los Angeles now has an interesting scientific "light gatherer." The piece of glass, which formed the "core" of the 200-inch telescope before it was removed, now is a mirror, ground to 2/1,000,000-inch concavity. It has been

mounted as a stripped, indoor telescope which demonstrates how the big telescope works. The observer looks at the mirror, 105 feet away, through an eyepiece. The mirror picks up the picture of a transparency about the size of a postage stamp, 119 feet away. The viewer is able to read every letter of print on an object the equivalent of 224 feet away.



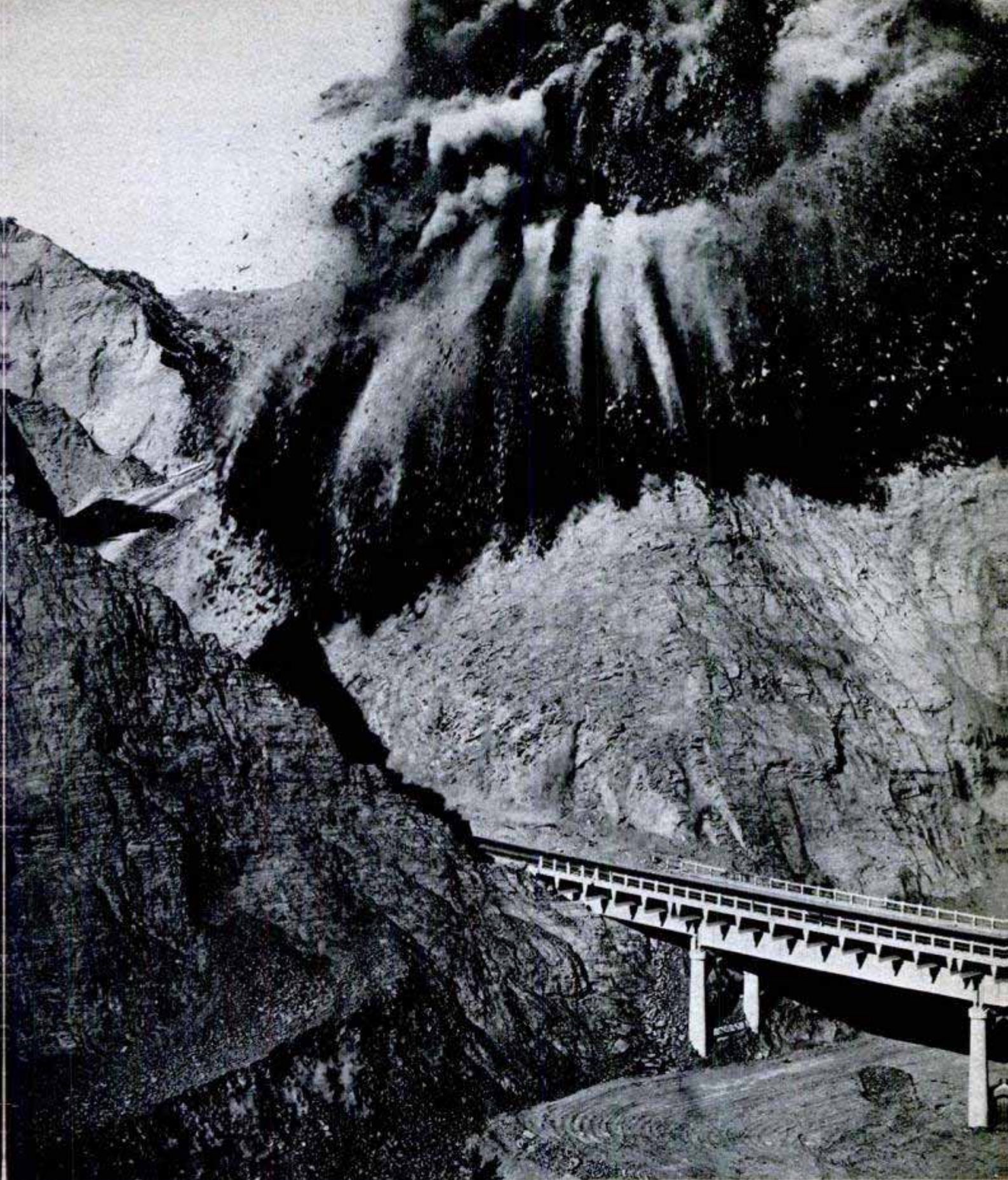
Pocket Mirror Lights Its Way

Serving a double purpose, a combination mirror-flashlight provides illumination for milady as she applies cosmetics in the car, theater or other dimly lit places. There is a spring clip on the case so the light can be attached to the sun visor of the car or to a pocket inside her handbag.

India to Double Irrigated Acreage

India's irrigated acreage will be nearly doubled on completion of a river-harnessing program already begun. The country now has 50,000,000 irrigated acres. Largest of all, and modeled after the Tennessee Valley Authority, the Damodar Valley Project is scheduled for completion in 1955 at a cost of about \$175,000,000.

If you do not find the information you need in the **WHERE-TO-BUY-IT INDEX**, starting on page 12, sources of further information are available without charge from Bureau of Information, Popular Mechanics Magazine, 200 E. Ontario St., Chicago 11



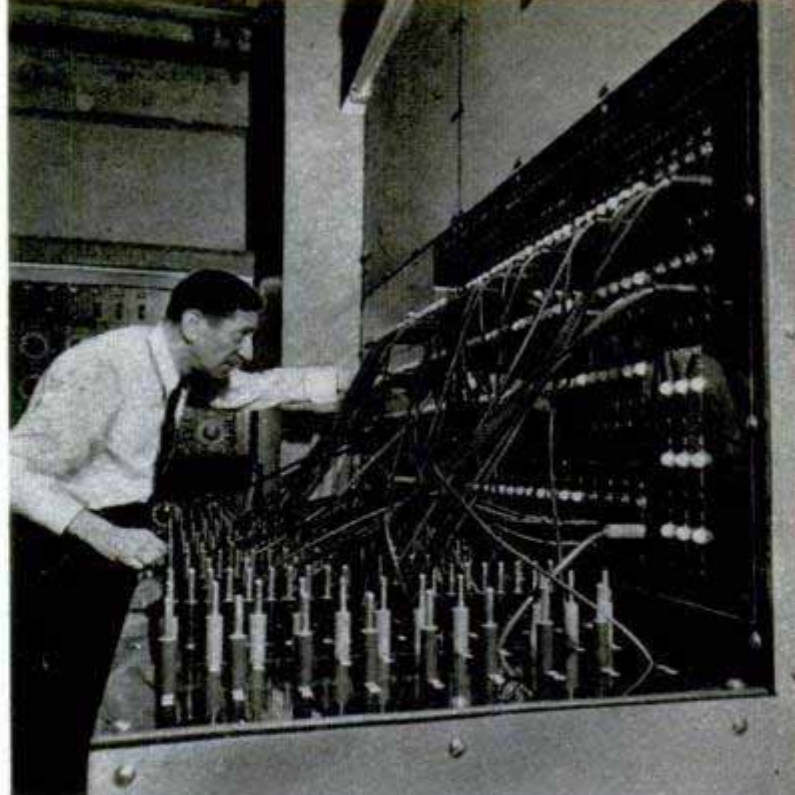
A MOUNTAIN GOES UP IN SMOKE

CALIFORNIA highway engineers are cutting down a mountain with a series of spectacular blasts so that a highway at its base may be widened. The top of the mountain was blown off by the exploding of low-strength powder in 350 holes, each drilled

24 feet into the summit. Traffic was halted 42 minutes while bulldozers cleared fallen rock from the highway. The widening is being done on the so-called Ridge Route portion of U. S. Highway 99 connecting Los Angeles and San Francisco.



Cameraman focuses for close-up, while high overhead another stands ready for shot from floating island



On the electrician's jumbled jack panel more than a million lighting combinations can be prerigged

THREE-DECK TV STUDIO

CUT IN THE OVERHEAD," snaps the technical director into his hand mike. The close-up picture of the orchestra leader on the six TV monitor screens dissolves slowly into a helicopter's-eye view of the entire ensemble. The effect is something like peering over the rim of the Grand Canyon. In the cavernous studio, more than half a football field in length, you gaze through a vast tangle of cables, lights and battens to see what happened. The scene is now being scanned by the lens of a heavy TV camera perched on a floating isle of steel plates three stories above the studio floor. Lost on the huge floor, five other cameras, some on towering boom dollies, stand ready to scan any one of half a dozen other full-size sets.

NBC's new studio 8-H, carved from the honeycomb interior of New York's Radio City, is a modern TV wonder. Its floor area measures 92 by 168 feet, and it towers three stories high. More than 1000 lamps ranging from 100 to 5000 watts pave the vast ceiling. The jack panel, where more than a million different lighting combinations can be prerigged for any sequence, is a jungle of crisscrossed wires when a show is in progress.

All lights, as well as scores of backdrops, are hung on battens that can be raised or lowered at will from a forest of pull ropes along the back wall.

Around the perimeter of the huge studio

are all the facilities of a full-fledged theater. Behind the 30-foot-deep stage (for dramatic shows) are 15 dressing rooms. Along one side is a mezzanine where clients can watch their performers, and an audience gallery that seats 94. Beneath is a plush-lined make-up room. There's a roomy sound-effects booth on the floor level and a vast chorus room tucked away in one corner. Audio, video and light control rooms are stacked two tiers high on one end.

In the main video control room there's a monitor screen for each of the six cameras on the floor—plus three others for preview. "By having a separate monitor for each camera," explains the engineer, "we can, if we want, cover any scene from six different angles, watch the six results up here in the control room, and telecast only the best one for the audience."

NBC engineers are especially proud of their "floating island" high above the studio floor. The platform has an access ladder like the extension on the fire department's "big rig." Hinged to the edge of the island, it is hauled up flush with the ceiling when not in use. TV cameras are planted on the platform for high shots and trick effects.

Another unique piece of equipment in the new studio is a "transistor." This is a motor-driven rotating disk, mounted on a cast-iron truck. Special paintings are mounted on the disk and revolved slowly before the camera to televise weird effects.



Here's one view from high on the floating island. Platform makes possible long angles and tricky shots

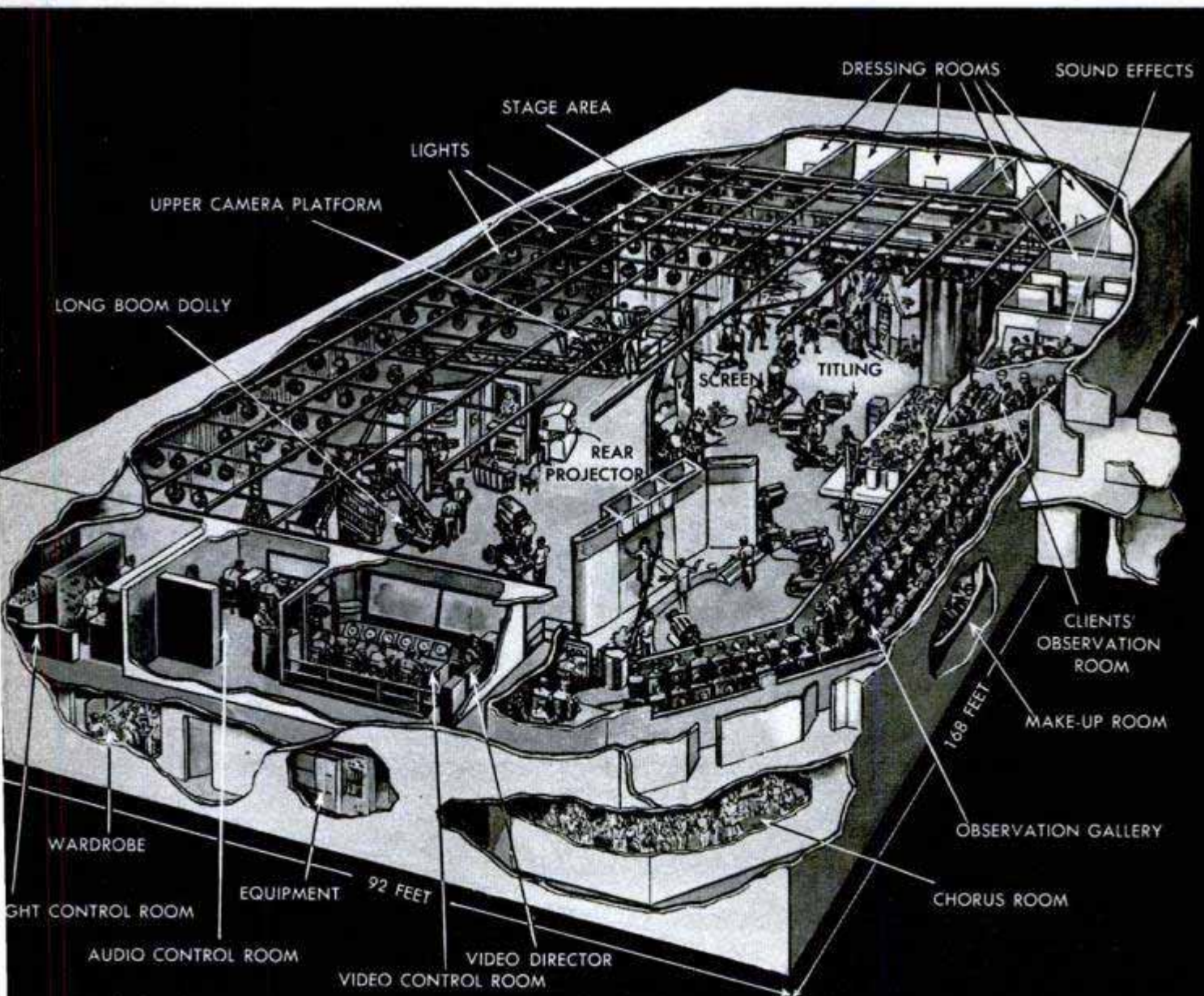
Studio, about half the size of a football field, has scores of backdrops, all the facilities of a theater

By running shaded color before the camera's eye, fade-ins and fade-outs can be achieved, for example. Stylized rain and snow can be made to fall across the video screen and fantastic ghosts televised.

There's also a hand and motor-driven "crawl" for titles—a revolving drum on which any amount of text can be reeled off before the camera at any speed.

To carve TV's most lavish studio out of Radio City's interior labyrinth of plaster and steel took some doing. The 32-foot I-beams that support the massive ceilings and walls were hoisted up elevator shafts in 16-foot sections and riveted together in the studio space to avoid carving big holes in the building's outer shell. The tremendous demolition job to make room for the studio's cavernous interior had to be done without pneumatic hammers and other noisy tools so sound wouldn't travel through the building's steel skeleton and disrupt broadcasts going on in other studios while the work was in progress. Tons of debris were carried out to waiting trucks during predawn hours for the same reason.

But results were worth it, according to NBC engineers. "There isn't a show going we can't produce here now," they boast.

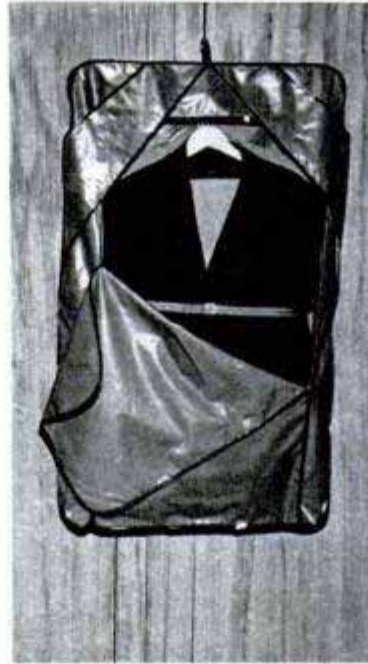
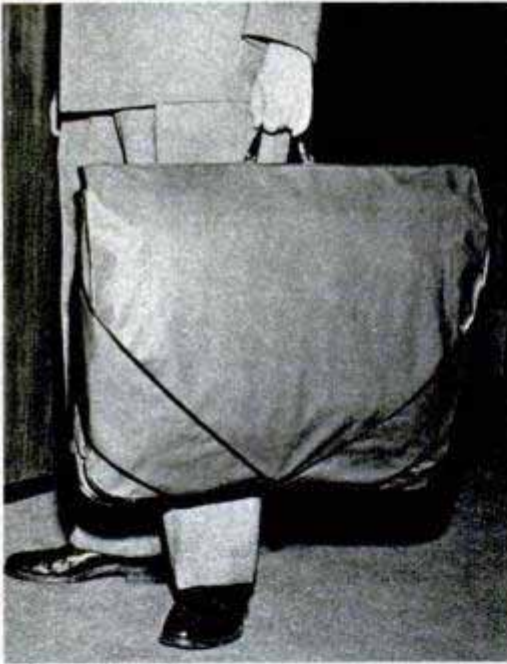




Forest-Fire Fighter

Carrying its own water supply, a forest-fire-fighting vehicle is a one-ton Jeep truck with a disk plow mounted on the rear. Because the Willys truck, a larger version of the familiar Jeep, has a four-wheel drive,

the fire fighters can drive it just about anywhere. It carries a 100-gallon water tank. The plow, operated by a hydraulic lift, turns over the turf to form firebreaks. Pennsylvania's Department of Forest and Waters has put 24 of the vehicles into fire-fighting service.



Garment-Bag Suitcase

Made of heavy vinyl plastic, a new garment bag can be folded into a suitcase and carried by a handle. The empty bag is hung up and packed with clothing, which is held in place by straps. The case then is zipped shut, making it moisture and dust-proof, and folded into a suitcase. It can be unfolded and hung in a car or closet. The bag is available in two sizes, one for suits and the other for dresses.

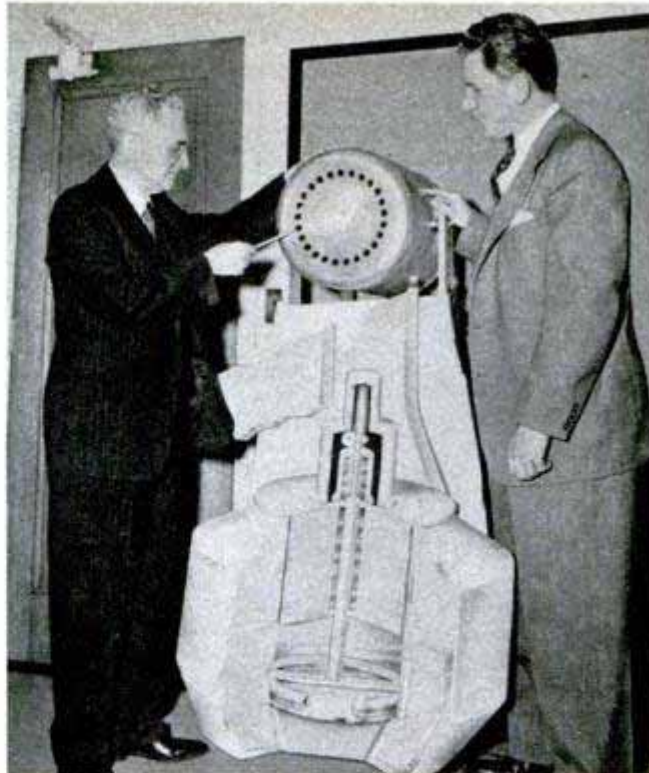
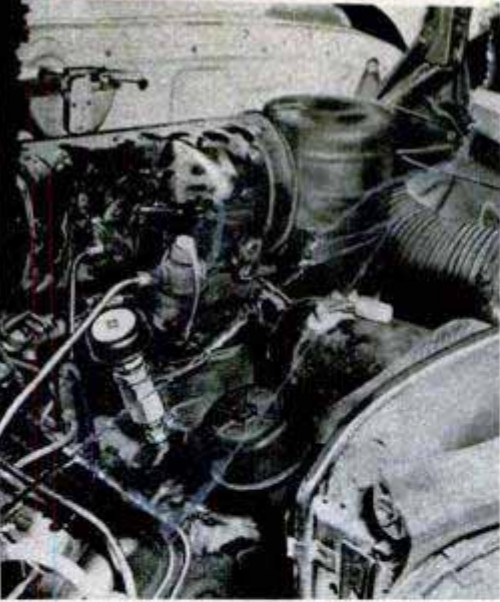
Protex Products Co., 347 Fifth Ave., New York City 16

Hinged Tail Gate For Rescue Boats

With the hinged tail gate down, casualties can be taken into a new rescue boat without the rough handling necessary when they have to be hoisted over the side. The craft has a complete radio-communication system and carries emergency medical supplies.

☐ It takes 65,000 gallons of water, weighing 270 tons, to process a ton of steel.





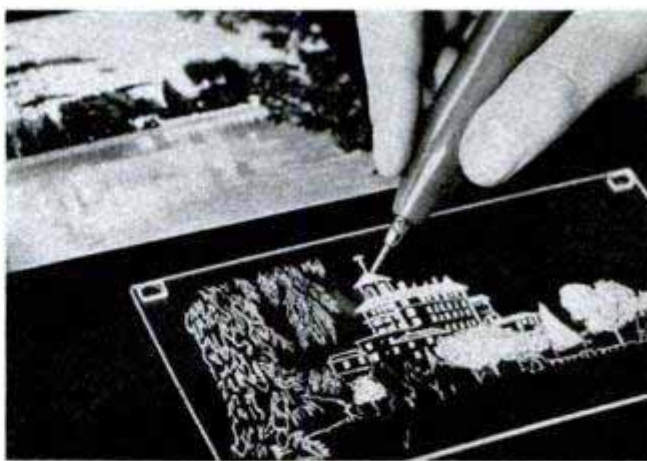
Auto-Vac Sales Co., W. 17th and Ave. B, Scottsbluff, Neb.

Engine Attachment Fights Carbon

Installed directly into the intake manifold, an air-metering attachment prevents carbon and sludge formation in any gasoline-burning engine, according to the manufacturer. Upon normal deceleration of any engine, unexploded gasoline is always left in the combustion chamber. This is caused by a suction which draws excessive amounts of gasoline through the idling jet and sucks oil up and off the cylinder walls. The gasoline cannot burn properly while the motor is operating on a deceleration basis and the butterfly of the carburetor is closed. The manifold attachment meters a proper amount of air for a combustible mixture any time an engine exceeds an idling vacuum. It not only keeps spark plugs and valves clean, but reduces fuel consumption. Fleet operators have reported savings up to 60 percent in oil and 15 percent in gasoline consumption. The attachment can be put on in 30 minutes.

Radium Keg Battles Cancer

Fifty grams of radium, the largest unit of radium in the world for medical use, have been installed in a newly designed radium-beam therapy apparatus for cancer treatment. The keg-shaped container is of lead and mercury with an outer protecting jacket of steel. It is being used at Roosevelt Hospital in New York.



Electric Stylus "Pen" ▶

Shaped and used like a fountain pen, an electric stylus weighing only seven ounces cuts intricate designs into a variety of materials. Operating on 105 to 120-volt alternating current, the stylus will not overheat, cause objectionable noise or interfere with radio reception. It may be used to work on leather, metals, plastics, chinaware, glass and porcelain. By placing a drawing under a mimeograph stencil, you can use the unit to trace the drawing. The stylus may be used to cut identifying data on motion-picture and X-ray film.

Our defense effort requires thousands of products made from wastepaper. Your local Boy Scouts or some other civic organization will pick up your wastepaper, sell it and use the money for a good cause.

Murray Industries, Inc., 502 W. Colorado Ave., Colorado Springs, Colo.

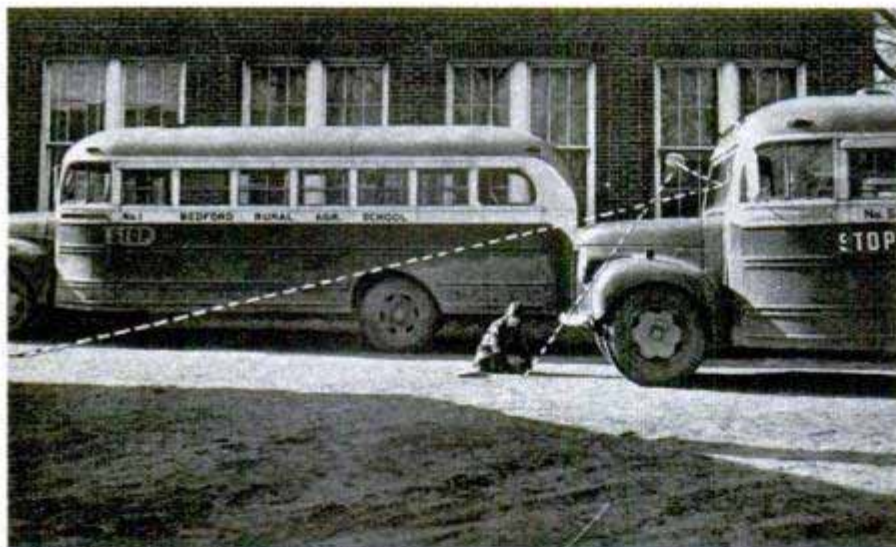


C. H. Masland & Sons, Carlisle, Pa.

Nylon Tent

Made of nylon, a new tent weighs only 10½ pounds including poles, yet it is large enough to accommodate two sportsmen.

The tent rolls into a compact bundle carried by two handles. The poles fit together to form a framework. The tent is suspended beneath the framework by rope and can be erected in four minutes.



Safety Cross Mirror Co., Lambertville, Mich.

Front-View Mirror Protects Children

Drivers of school busses and other vehicles operating near children's play areas are given added forward vision by an outside mirror that mounts above the windshield. Developed in Michigan, the mirror cuts the blind spot in front of the bus from 20 feet to 3 feet, enabling the driver to see small children who cross in front of the bus at stops.

Tick-Tock Eyes

Owl eyes that follow you across the room are the latest novelty in Japanese clocks. About 12 inches high and 6 inches wide, Mr. Owl is built along the lines of a cuckoo clock with a single weight on a chain drive. The lightweight celluloid eyes are controlled by thin wires. Every time the pendulum ticks, the eyes look left; when it tocks, they look right.

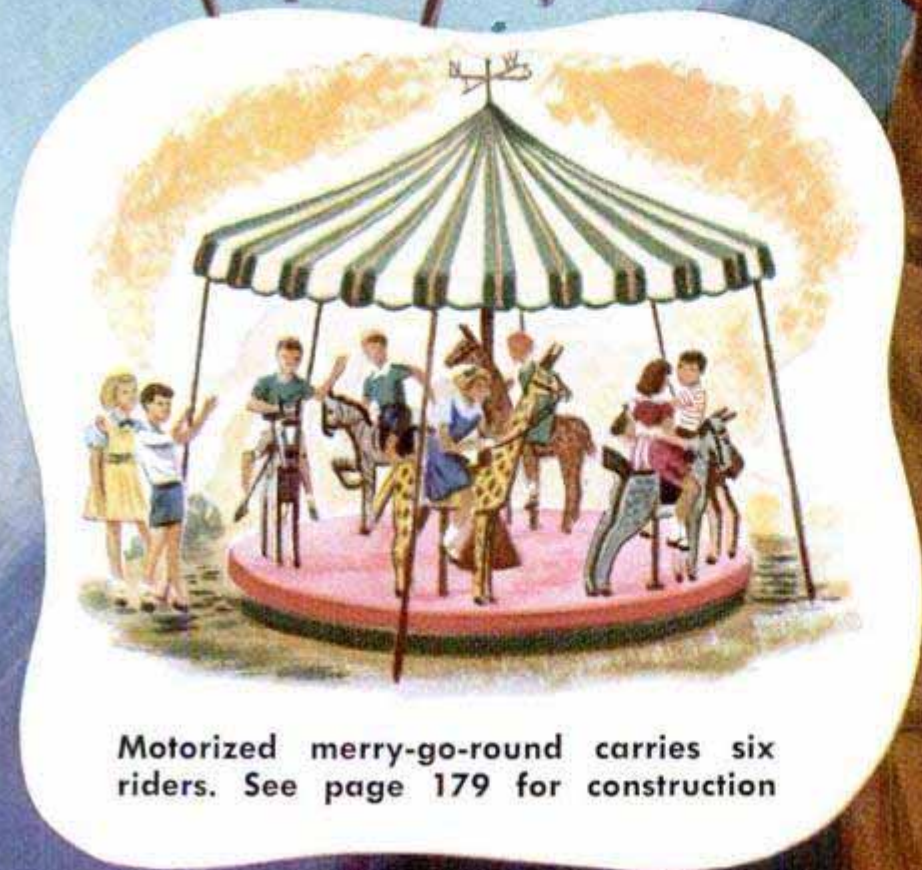
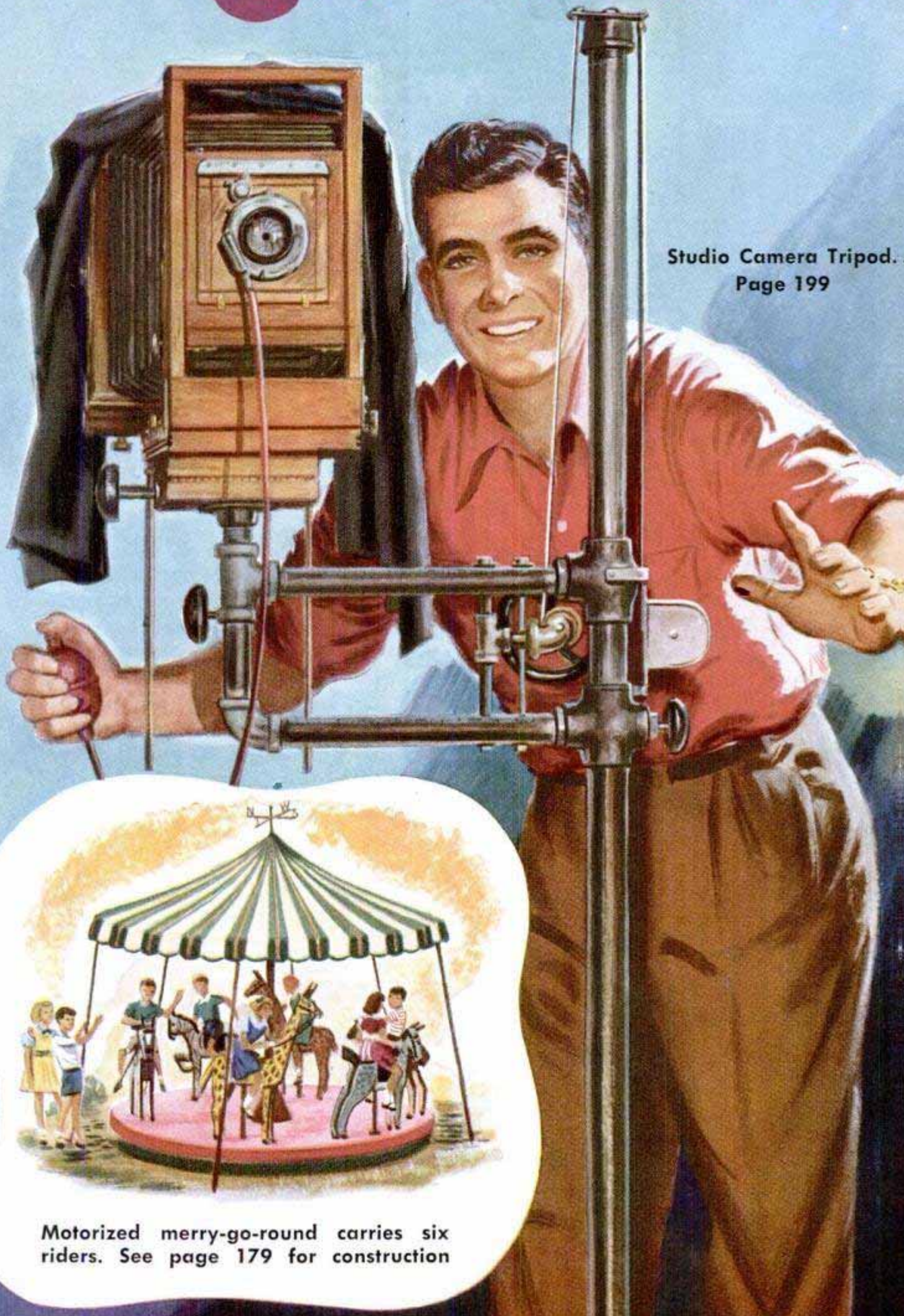
☛ Insects and disease do more damage to forests in the U. S. each year than do forest fires.



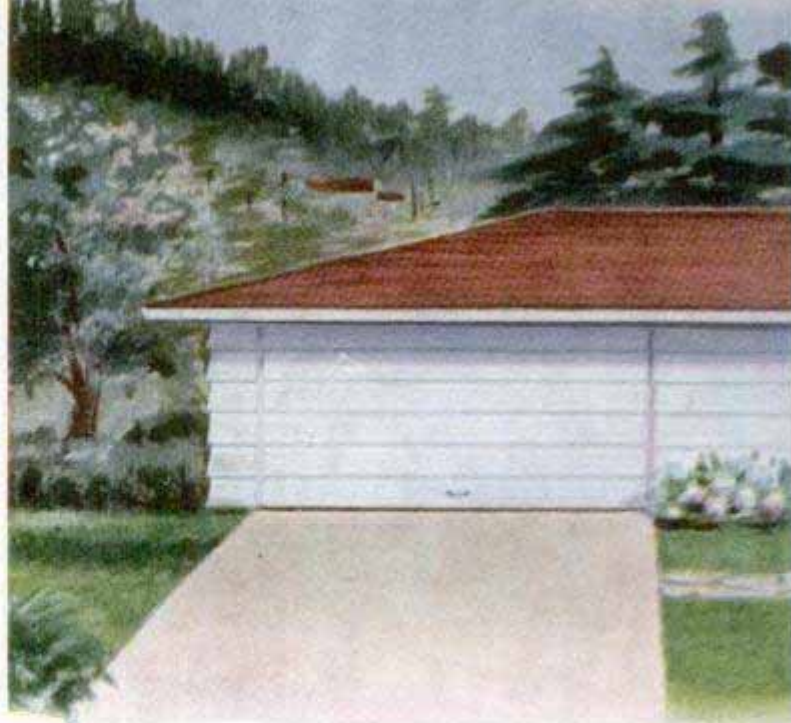
Tezuka Clock Co., Ltd., Tokyo, Japan

POPULAR MECHANICS

Studio Camera Tripod.
Page 199



Motorized merry-go-round carries six riders. See page 179 for construction



How I Built

PART I

By Tom Riley

ARE YOU AS FASCINATED AS I AM by the simplicity and rambling lines of this beautiful 81-ft. ranch house? Yes, it's mine and it didn't cost half the amount you would imagine. Materials for the completed house shown above, cost me only \$7450, and, for approximately \$5000, you can build the basic version pictured at the bottom of the page. This is the same house less garage and breezeway, with the den being used as a carport. I first built it as in the photo below, just to show how it would look, and then added the garage and breezeway. With the help of a friend, Norman

Here is the basic version of the complete house—minus garage and breezeway. Carport at left later converts to third bedroom when house is extended

Build this modern dream home yourself and save 60% of its cost as I did. You can have seven rooms—1484 sq. ft. of floor space—plus breezeway and two-car garage, as above, without basement for \$7450. Or, six rooms and carport, as below, for \$5000. That's what the materials cost me to build it myself in Portland, Ore. It is modern in every way, thoroughly insulated and is built mostly of plywood, both inside and out, to simplify construction. Begin now. It's not difficult.

Tom Riley



*mentioned in Series available
in Bureau of Files*



the POPULAR MECHANICS Ranch House

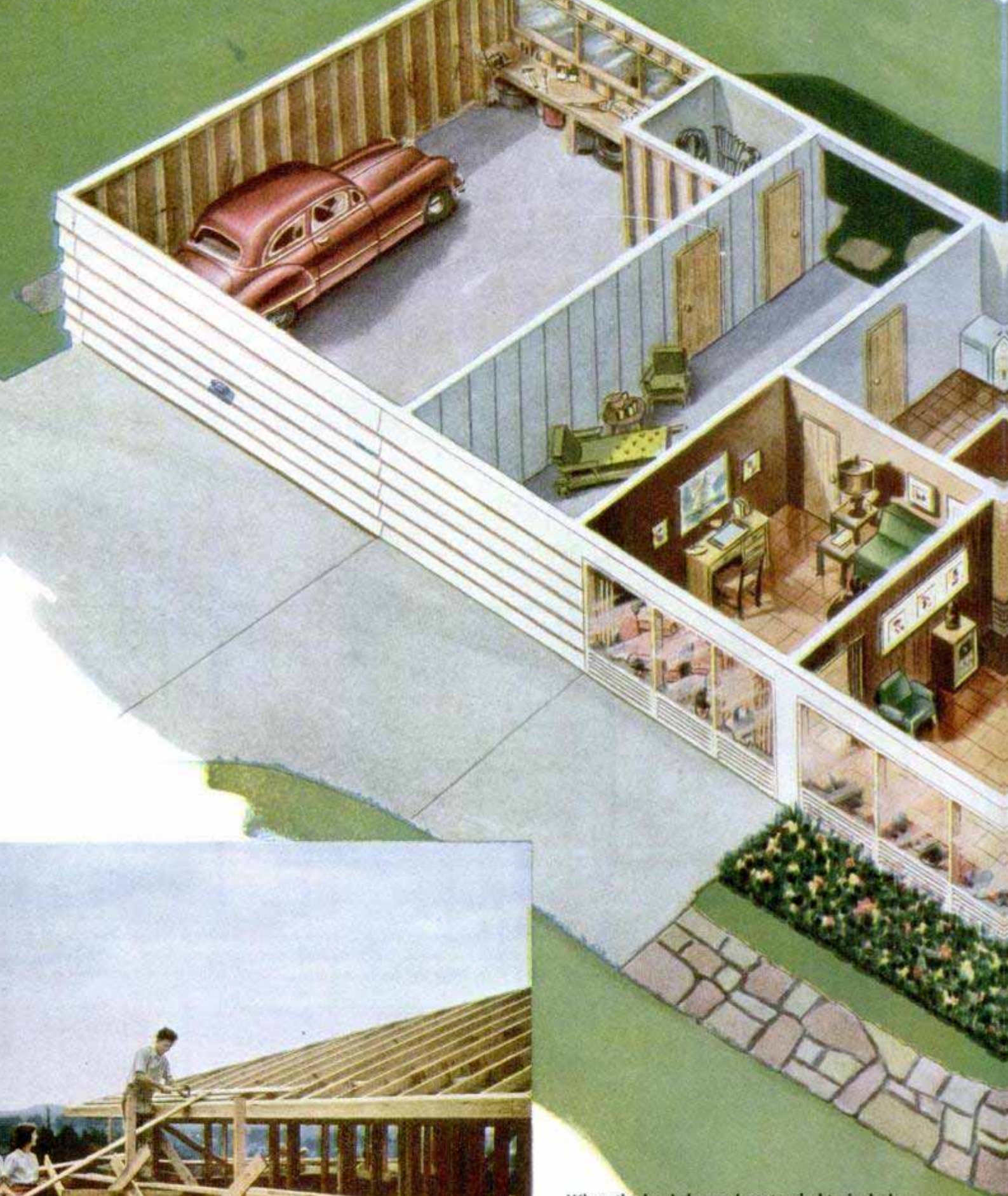


Chapman, I did the entire home in less than a year and saved an estimated \$10,000 at current prices in the Portland area.

Like most people today, my wife, Vinita, and I needed a home—and we wanted a beautiful ranch house that was modern to the nth degree. But skyrocketing labor and other costs made our savings for a new home look mighty insignificant, and each day our home seemed farther away. Vinita suggested we build it ourselves—she would help with the lighter work. We had read how some people were personally building every part of their homes and how others were helping out on the carpentry or the electrical work. In fact, we learned that *one out of every five* new homes is self-built. But building a house just wasn't for us. Riley was far from

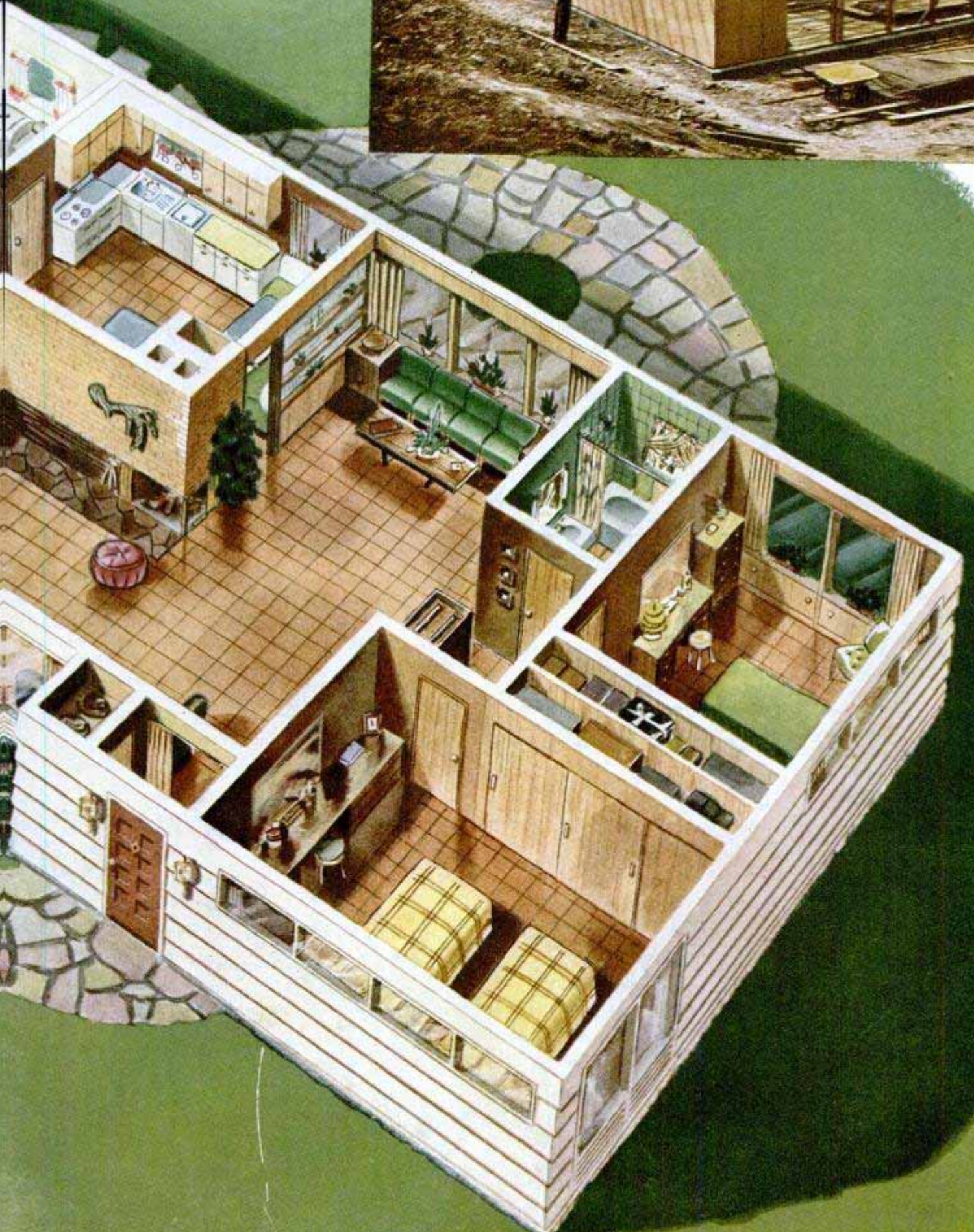
Having decided on a ranch-type home, James Ward, craft editor, and Norman Guess, book-department manager, point out to Tom Riley, left, how the build-it-yourself book must treat construction

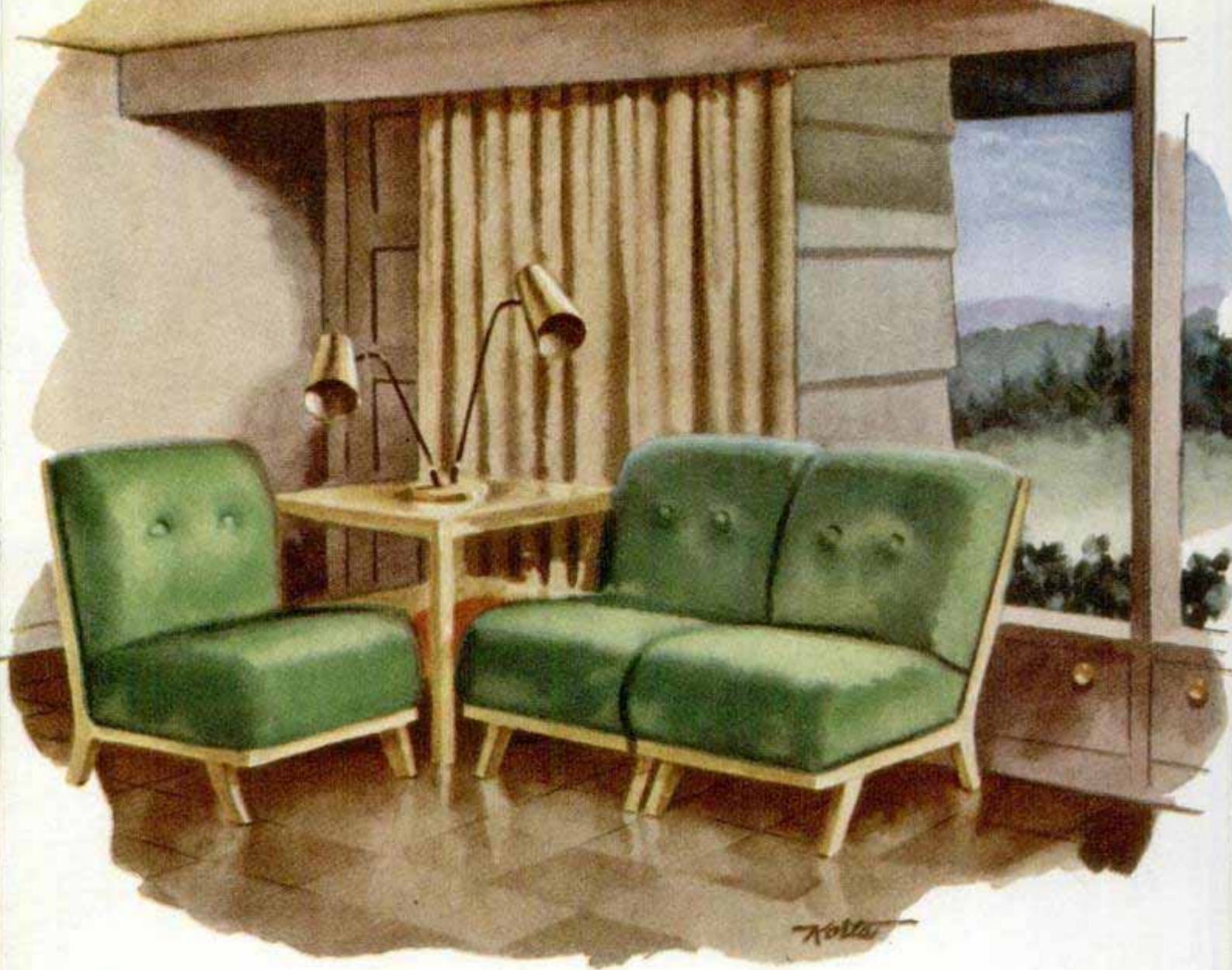




When the basic house is extended to include the garage and breezeway, the room formerly serving as a carport offers several possibilities. It can serve as a third bedroom or, if your hobby is photography, you can build in a darkroom as Tom did. If you like the idea of a half-bath, one can be located off the utility room as in the floor plan on the preceding page. The extra room also can be used as a den or study

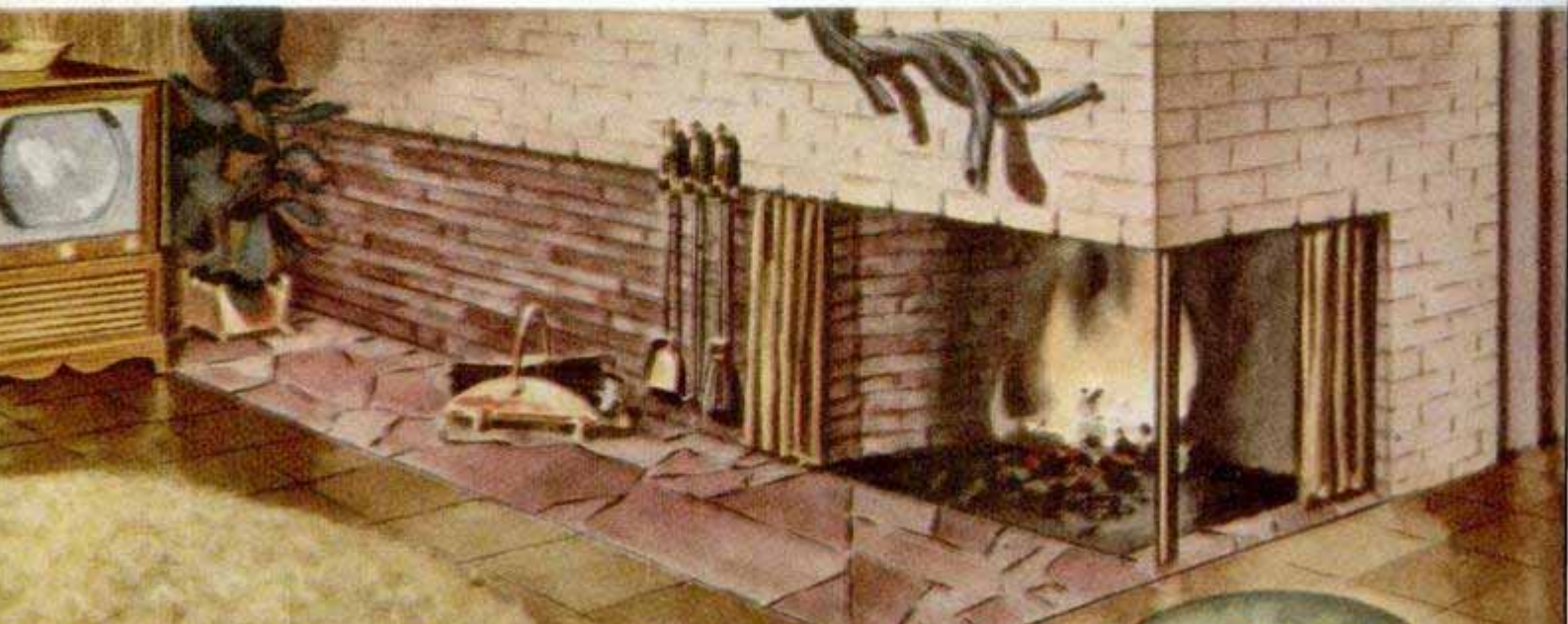
"Prefab" roof trusses simplify construction and require no bearing wall across living-dining area. Here Riley is telling his helper how much to tap each truss to align it at the ridge. This photo shows the basic house being partly sheathed with special, inexpensive, unsanded plywood





The spacious living room lends itself to innumerable furniture arrangements. Draw draperies covering the huge picture windows are ensconced with a room-length cornice board, and louver-type ventilators along the base of the windows are opened by pulling out hinged panels. Sofa corner illustrated faces fireplace, while door in background is front entrance

A 7-ft. brick wall incorporated in the island fireplace divides the living room and kitchen. Striking combination of face brick and natural stone is enhanced by the use of brass fireplace accessories, mesh screen and a brass post at the corner of the fire pit. The stone hearth is laid so that its surface is about level with that of the cork-tile floor



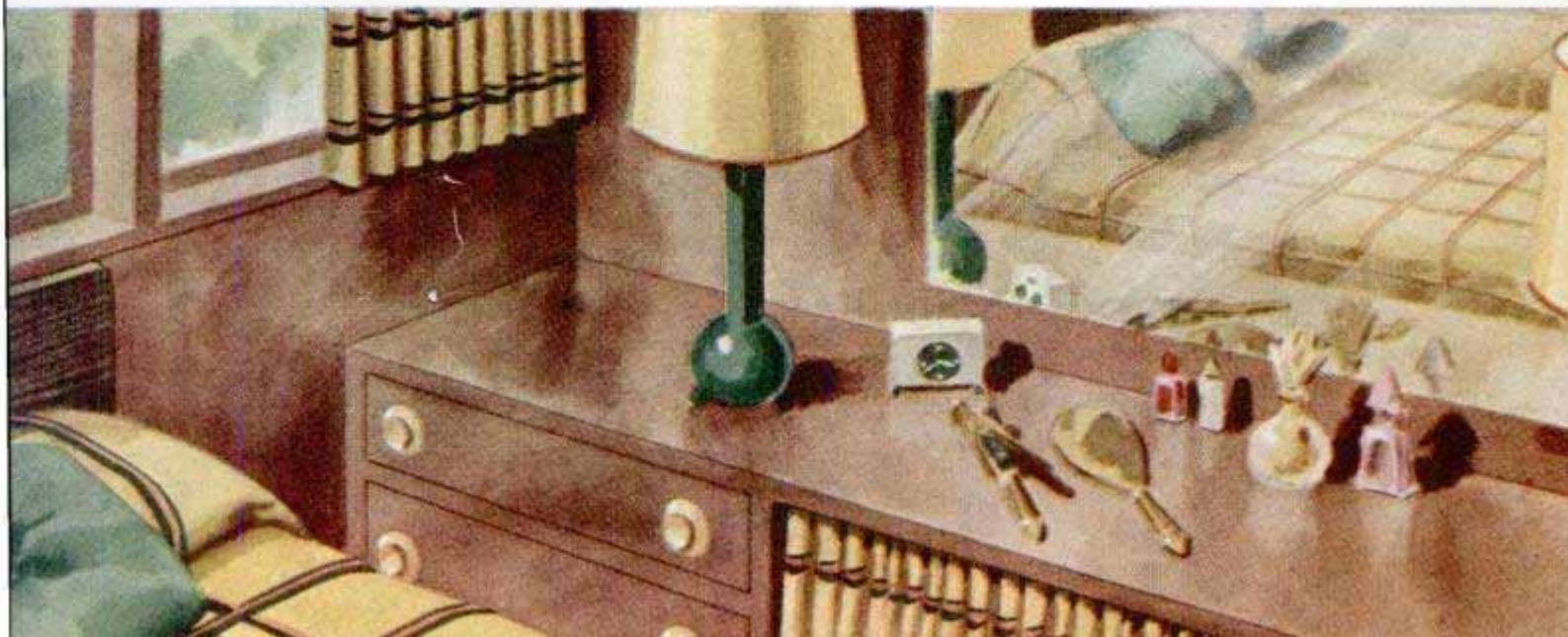


Living-room extension doubles as dining area by raising the "boomerang" coffee table when serving guests

being a carpenter. I had little experience nailing boards together and such lingo as toenailing, bridging and furring was Greek to me. But, the more we thought and read, the more interested we became—maybe it isn't as difficult as it seems, and we would be getting more of the home we wanted with the money we had.

Then fate stepped in. The editors of *Popular Mechanics* asked if I would care to build another of their famous build-it-yourself houses and be a sort of guinea pig to prove further that it can be done by anyone willing to work and follow instructions. Being a free-lance writer, the editors knew

Functional linen closet, right, conceals cold-air register and includes indirect light in the top. Well-ventilated bedrooms, below, feature generous wardrobe closets plus plenty of space for built-ins





Light, roomy and efficient, here's a kitchen for real living. Breakfast booth is purchased inexpensively

from my background that I understood very little about carpentry. They reasoned that if I could do it, anyone could. The challenge was too great to pass up, so I agreed to do the job.

After deciding on a rough plan and general shape of the house, the services of Mr. John J. Whelan, noted architect, were secured to design the home. Architect Whelan is widely experienced, having designed three embassies in Washington, D. C., the swank Lanai Rooms in the Broadmoor Hotel in Colorado Springs, Colo., as well as the home of columnist Drew Pearson. Also, he has designed many ranch-type homes and likes to specialize in built-ins,

which are featured in this home. As I went along, part of my job was to take pictures of every step and gather data which was later to be compiled in a how-to-do-it book completely detailing the construction. *Popular Mechanics* would furnish the plans if I would contribute the work. Sure, there were nights when I was tired, but I guess that everyone knows that building a house is 90 percent sheer physical labor. Under the supervision of *Popular Mechanics*, our dream home gradually took shape and I soon found to my surprise that building a house required no great amount of skill. For the most part it was rough work—nothing like a piece of cabinetwork.

Offset formed by fireplace wall houses furnace, refrigerator and cabinets. Note niche for china cabinet

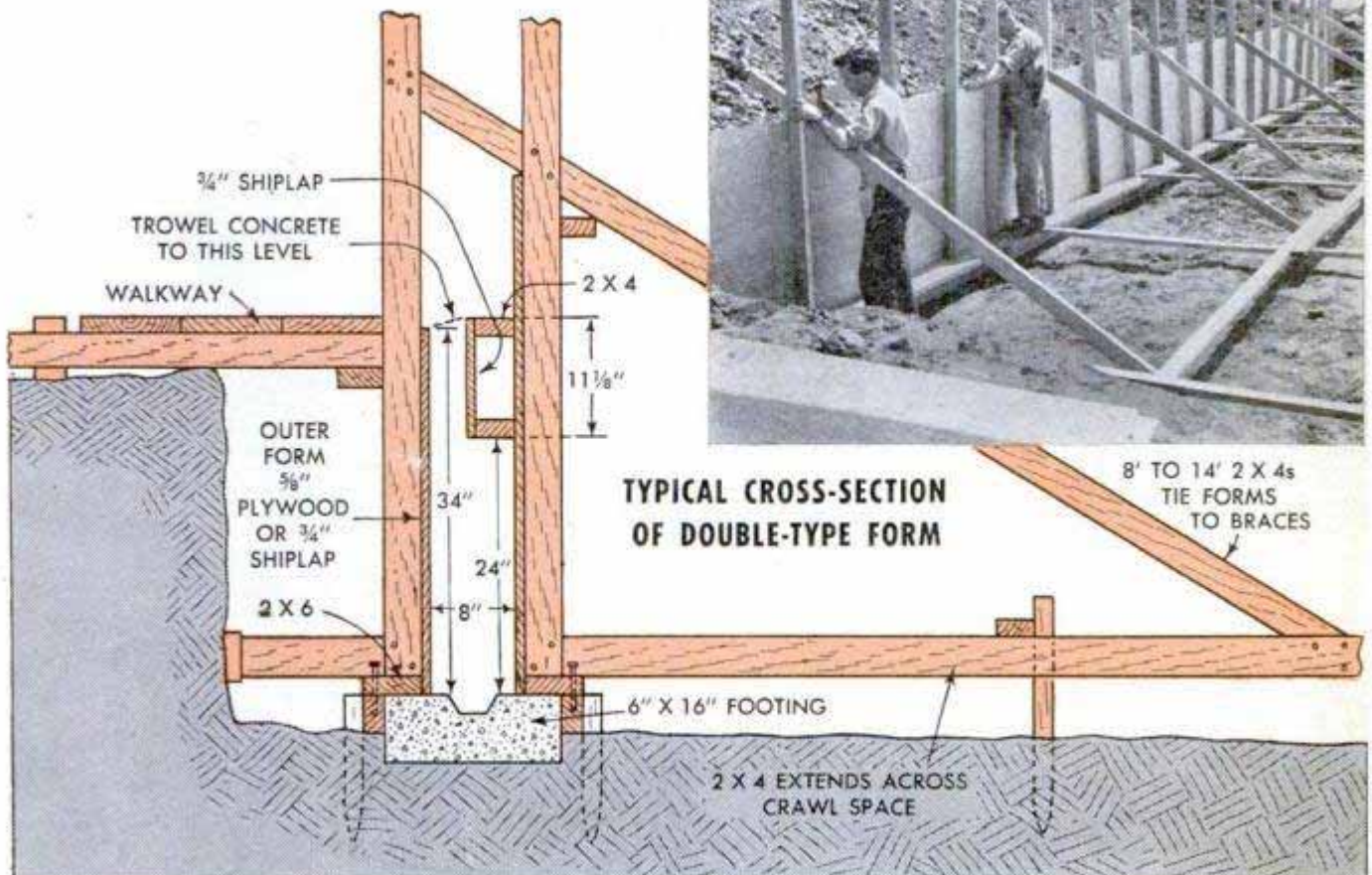
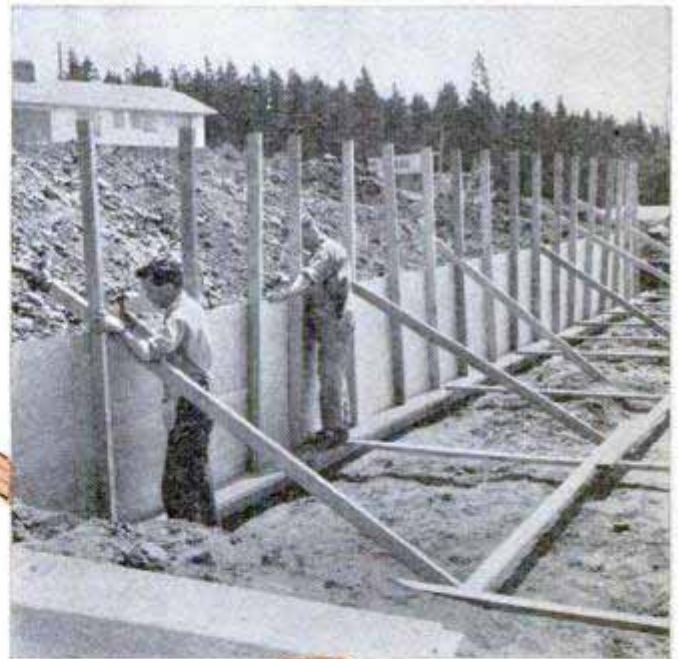


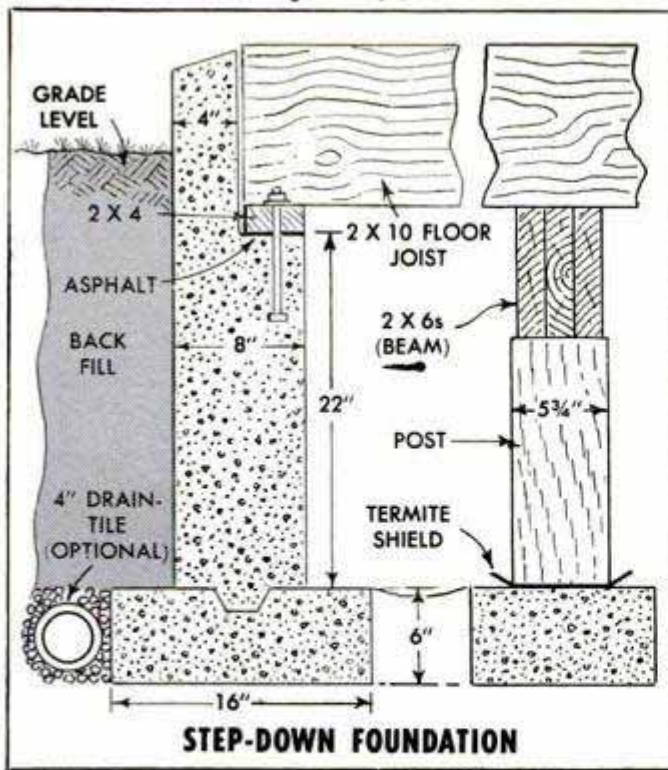
Aware of the tremendous upswing throughout the country toward building your own home, as attested by the thousands of books and plans sold on two previous homes, the craft editors turned to a ranch-type dwelling for their third model home. Desiring the ultimate in simplicity, they decided on plywood construction throughout and selected a floor plan of 4-ft. interior module. This meant a minimum of cutting as whole panels could be quickly slapped in place. Also, it meant dry-wall construction which would eliminate the cost of plastering, and permit the builder to do that much more of the job himself. It lent itself to applications of the new and beautiful combed, striated, embossed and straight-grained plywoods. In addition, the editors wanted to present a house that, for the most part, could be prefabricated during the winter in your basement and hauled to the site ready for setting in place. They wanted a plan that could be adapted easily to a full basement if desired. And finally, they wanted a plan that was expandable—a basic plan whereby you could build for your present needs and later add the garage and breezeway as time and money permitted. The basic design provides for either three bedrooms or two bedrooms and a carport, with room for still a fourth bedroom by converting the breezeway.

The house throughout is open-planned, and architect John J. Whelan went all out to provide a home in which room furnishings can be arranged to suit your present needs as well as your future ones. You'll



Above, this is the next step after pouring the footings. Here I am checking the inside corner of the anchor plates for the foundation forms. Below, using sheets of $\frac{5}{8}$ -in. plywood, Norman Chapman and I are beginning to erect the forms along rear of house





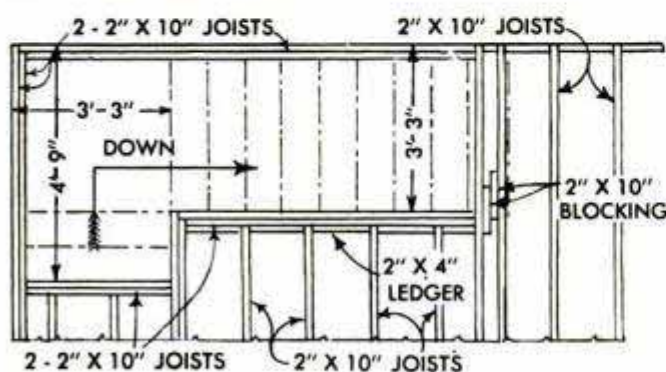
Each beam on which the floor joists rest is built up by spiking together three 2 x 6s on edge. As the joist plan indicates, two separate beams are required

notice in the open planning that the usual space-consuming hallway between bedrooms and bath is eliminated by use of the "island wall" idea which serves a twofold purpose by creating a wall in the form of a practical storage cabinet. The same idea is carried out similarly in the island-type fireplace as it forms a brick wall separating kitchen and living room and also incorporates built-in shelves on the kitchen side. The bedrooms and living room feature floor to ceiling windows with built-in louvers at the bottom for ventilation. A large sliding-door wardrobe closet is built-in in each bedroom with "clerestory" windows being installed in one wall to allow freedom of furniture arrangement. *Popular Mechanics* plans to have my home at 3944 S. W. 36th Place, Bridlemile, Portland, Ore., open for inspection May 5 to May 20.

But let's get to the actual construction. Naturally, limited magazine space does not permit giving every detail, or presenting the many variations, so my only hope is that I can acquaint you with the basic steps in construction. This is the first of a four-part story, and the book and plans will take



Footings for the beam posts and the "island wall" fireplace, which are 12 in. thick, are poured at the same time as the foundation footings. Below, Norman Chapman, my helper, is spiking the joists

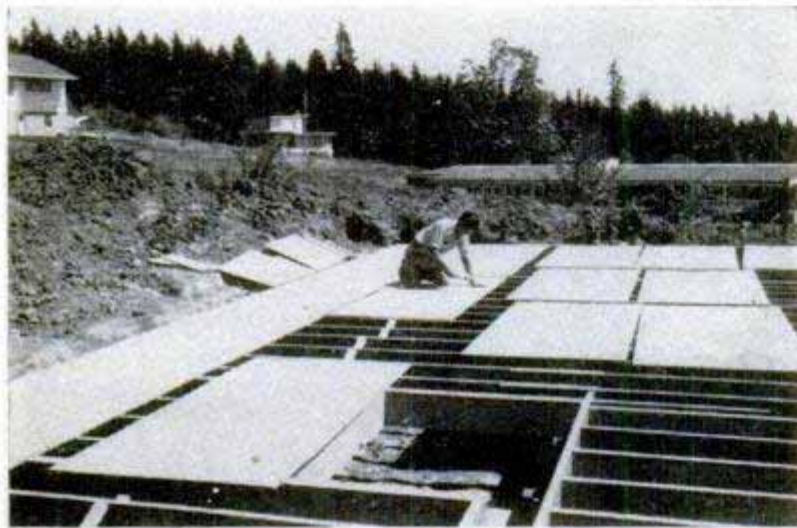


JOIST PLAN FOR BASEMENT STAIRWAY





Above, architect Whelan, right, explains how trimmings from plywood subfloor are economically used later as truss gussets. Below, see how fast and easy the subfloor goes down. Plywood sheets previously used for forms are cleaned off and laid so that the joints are staggered four feet on the floor joists



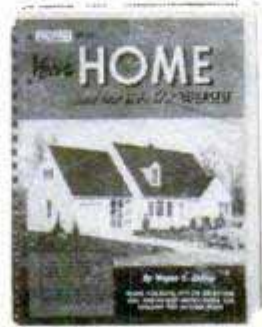
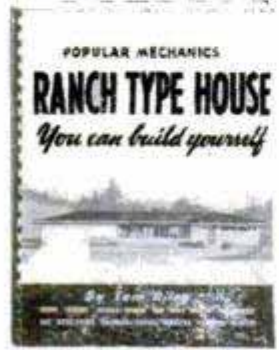
over where the magazine articles leave off. After laying out the building lines, you're ready to excavate. Even if the house is built without a basement, some excavation is necessary to provide crawl space under the floor, and I urge that you have this work done to speed the job and save a lot of hard labor. Forms for the 6 x 16-in. concrete footings, which support the foundation walls, come next and these are made by simply staking and leveling 2 x 6 planks on edge in the bottom of the excavation. When the footings are poured and have hardened, you can start erecting the double forms for the foundation walls. These forms are assembled directly over the footings as shown, using 2 x 4s and 5/8-in.-plywood sheets. Wherever possible, the 2 x 4 material is used without cutting or, at least, the cutting is held to 8-ft. lengths so that the lumber can be reused as wall studs. Like the 2 x 4s, the 5/8-in. plywood also is "borrowed" and later used as subfloor material. The plywood, which is called Plycord grade, is unsanded interior type and less expensive than even the "reject" plywood often used for this purpose. Attach the plywood to the 2 x 4s with 6d finishing nails so it can be easily dismantled, but use 16d nails to fasten the 2 x 4s together. A keypoint of the low, ground-hugging lines of

Now There Are Three

The beautiful ranch house shown on the preceding pages is our answer to your thousands of requests for a build-it-yourself home of this type. Like its two predecessors in *Popular Mechanics'* family of build-it-yourself homes, it, too, will be described in a book, which will give step-by-step instructions enabling anyone to build it. The book and blueprints will be available September 1.

The other two homes, for which similar books and plans are already available, are a beautiful, expandable-type frame house described in the book, **YOUR HOME AND HOW TO BUILD IT YOURSELF**, and a concrete-block house detailed in a book called *Popular Mechanics'* **CONCRETE BLOCK HOUSE**. Books and blueprints give easy-to-follow instructions which make it easy for the handy man to build any of these three houses.

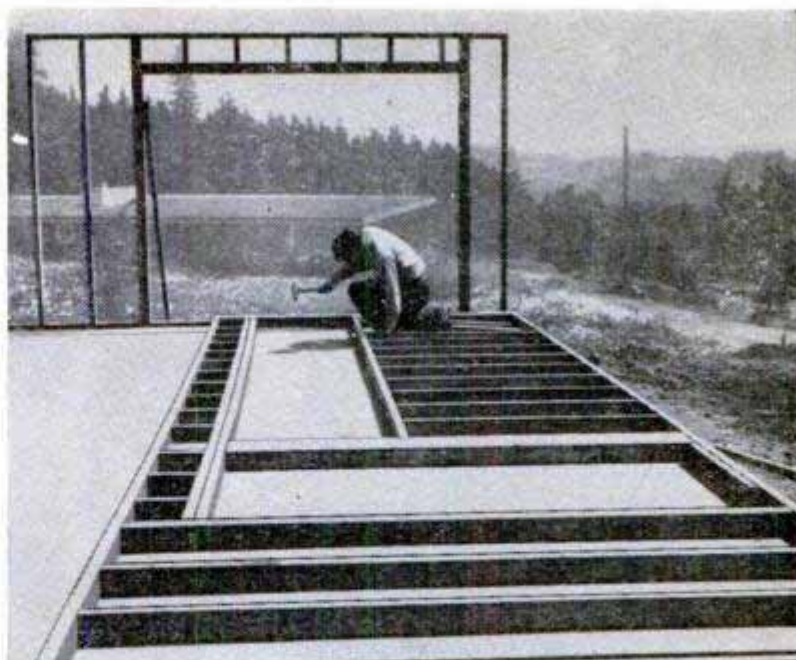
	Book	Plans	Book and Plans
Your Home and How to Build It Yourself.....	\$3.00	\$12.50	\$14.00
Concrete Block House	2.00	12.00	12.50
Ranch-Type House	3.50	13.50	15.00



All books available from Popular Mechanics Book Dept., 202 East Ontario Street, Chicago 11

the house is the step-down foundation which brings the floor of the house just 6 in. above lawn level. The step or shelf is framed with 2 x 4s and rough shiplap. Placing some of your 2 x 10 floor-joist lumber on the outside bracing of the forms not only adds additional bracing but will give a smooth runway for wheeling and pouring the concrete. Troweling a thick coating of asphalt on both the side and bottom of the shelf after the forms are removed makes for good construction and affords protection from dampness. Sills (2 x 4s) are placed in the asphalt and anchored with bolts previously set in the concrete or with drive-in concrete nails. If the house is to be built with a basement, the step-down foundation is forsaken for the conventional type which will allow windows to be installed above or partially above grade, and the stairway is located in a corner of the utility room and framed as shown in the lower detail on page 163. When built without a basement, an opening is left in the foundation at one end of the house to permit access to the crawl space under the joists.

The lapped ends of the floor joists are supported on a built-up (laminated) 6 x 6-in. beam or lintel which is supported by short sturdy posts that rest on 12-in. footings, 2 ft. square. The joists are placed on edge and spaced according to the joist plan. Note that the joists under the partition walls are doubled, some being blocked apart to leave openings for the plumbing and the furnace cold-air ducts. Joists around the fireplace opening also are doubled, metal joist hangers being used at the points indicated and abutting joists being supported by 2 x 4 ledger plates. The joists rest on the foundation sills and lap each other across the beam. Here they are spiked together and toenailed to both beam and sill. Short scrap pieces of 2 x 10 stock are nailed between the joists at the outer ends,



Typical 2 x 4 stud walls are "prefabbed" flat on the subfloor, all windows and door openings being framed in place before walls are erected. Two men can raise 20 to 30-ft. section easily

and 1 x 3 cross-bridging is placed in the center of the joist spans. Nail only the upper ends of the bridging pieces at this time. The lower ends are nailed after the subfloor has been laid.

The subfloor goes fast and consists merely of nailing down the 5/8-in.-plywood sheets previously used in the concrete forms. Do not be concerned about waste in trimming off excess ends of the plywood as any leftovers can be used for gussets in the roof trusses. After the floor is down, the 2 x 4 walls are erected. Each complete wall is conveniently "prefabricated" right on the subfloor of the house, window and door openings being framed in place, and then raised and braced as a unit. Two men can easily raise a 20 to 30-ft. section.

In the prefabricating or "bench built" method, which was developed by architect Whelan, all walls are assembled in 4-ft.-wide sections with door and window openings framed in place, sheathed and ready for erecting. This method will be explained in detail in Part IV of my story.

(To be continued)

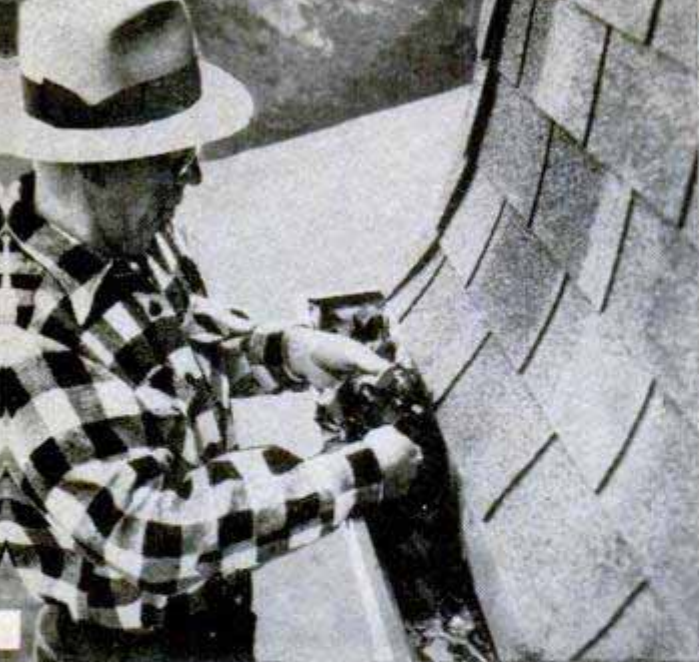
Plastic Rods Decorated in Lathe by Use of Warmed Knurling Tool

Plastic rods can be decorated with a knurling tool in a lathe as follows: Warm the knurls to the highest temperature the hand will bear, but be careful not to overheat, which would spoil the temper of the knurls. Then run the work at a high speed, about 1000 r.p.m. for 1/2-in. rods. Apply the knurling tool gently at first, while traversing the carriage back and forth by hand, and gradually increase the pressure. The warm knurls at this high speed will build

up a surface temperature on the plastic sufficient to mold the knurl, while the core remains cool. In the event of a mismatched knurl, remove the piece from the lathe and heat it over an electric heater, which will readily smooth out the knurl.

Howard D. Wildman, Schenectady, N. Y.

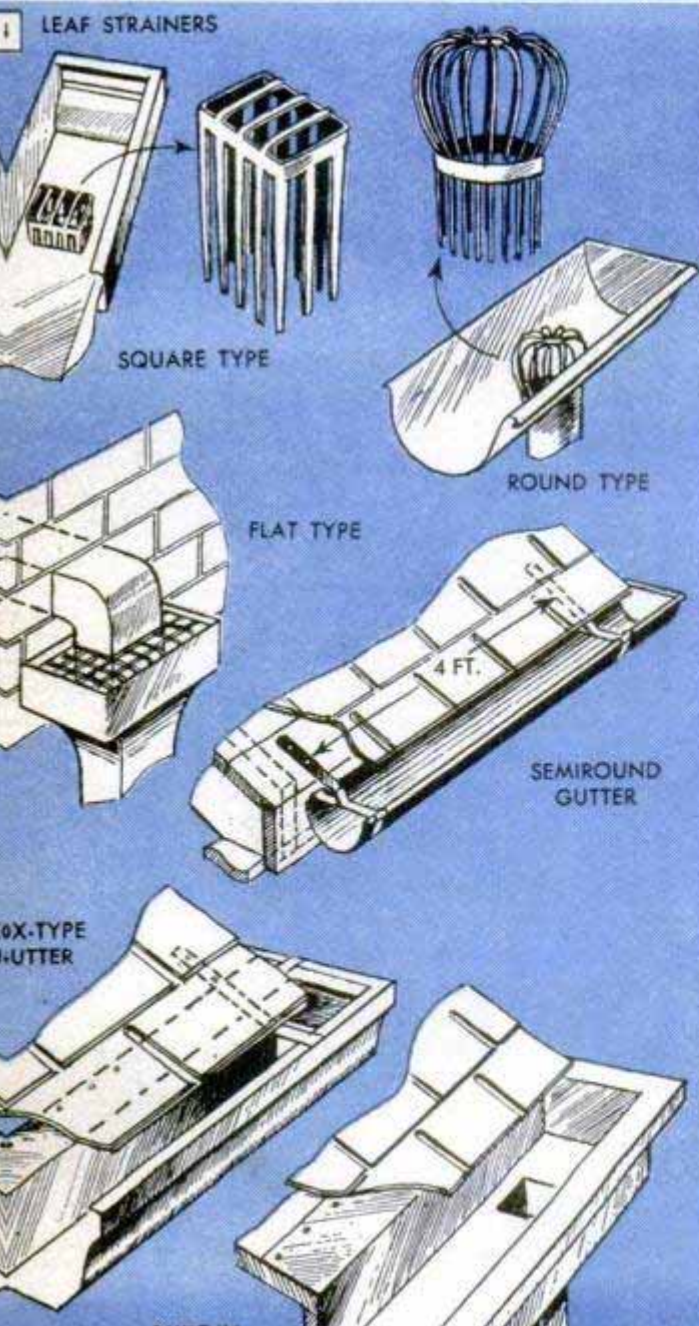
☞ A pipe cleaner dipped in ammonia or alcohol will clean medicine droppers, which are to be saved for future use.



Clean gutters thoroughly after leaves have fallen. Most stoppages are caused by leaves but can be avoided in downspout leaders if strainers are used. After leaves and debris are removed, gutters are flushed with a hose and then checked for leaks and drainage pitch

Adding Years to

Do they leak or overflow? Are they protected against rust? Any homeowner can



By E. R. Haan

IT'S EASY to put off inspecting and cleaning the gutters and downspouts on your home from year to year until they finally deteriorate to a point where they are beyond repair and must be completely replaced. Yet, it is possible to lengthen the serviceable life of these important fittings from five to ten years by thoroughly cleaning them and making minor repairs on a yearly schedule that any homeowner can carry out himself. Leaky, damaged and partially clogged gutters not only give unsatisfactory service, but they also can be the indirect cause of other, more serious, troubles, such as water getting into the attic or seeping into brick walls, causing unsightly efflorescent stains, Fig. 5, and a gradual deterioration of the brickwork near the cornices. For these reasons, regular servicing of the gutters is a sure way of reducing home-upkeep costs.

Keep gutters clean: Immediately after the leaves come down in the fall is the time to get busy and clean out gutters and downspouts to avoid stoppage resulting from accumulations of leaves and dirt. Even if leaf guards or strainers have been installed at the downspout openings, an accumulation of wet leaves will prevent proper drainage and may cause water to overflow and seep into the walls of the house. Rotting leaves combine with cinders and soot to form an acid that hastens rusting of the sheet-metal gutters. For these reasons, it is essential to remove the leaves, and other debris, as soon as possible after



ROOF GUTTERS

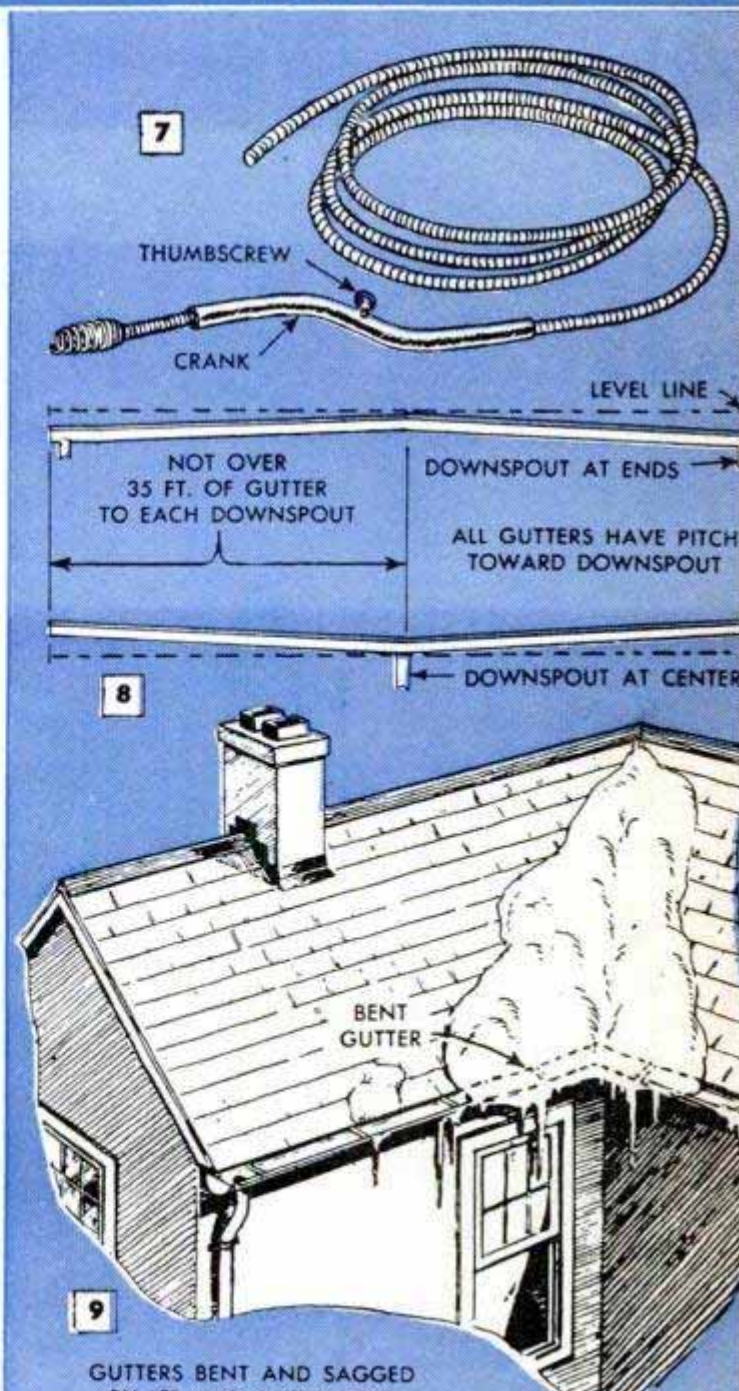
prevent and cure these common troubles to make the gutters last much longer

Photo at left shows efflorescent stains on brick wall subjected to water seepage from roof or gutter. Water may also enter house and cause serious damage. Tight stoppages in downspout may be loosened by using ordinary sink-drain auger, then flushed with hose

they collect, Fig. 1, and then flush the gutters with a hose, Fig. 2. While flushing, inspect both gutters and downspouts for leaks and repair them immediately.

Clearing stopped downspout: If the gutters are not fitted with leaf strainers, Fig. 3, leaves may accumulate in the leaders, Fig. 16, and completely close the passage. In cold weather, water may collect and freeze in clogged elbows and downspouts. Although these parts are corrugated for the purpose of preventing damage from freezing, a large amount of water freezing solidly behind a leaf dam may expand the metal sufficiently to force open the rolled joint. An auger of the type used for clearing obstructions in sink drains, Figs. 6 and 7, can be used to loosen tightly packed leaves in either the leader or downspout. After the mass has been loosened, insert the hose in the leader with the water turned on at full pressure. Sometimes full pressure from the hose alone will do the trick. Where the downspout connects directly to the storm sewer, masses of wet leaves and dirt may collect at the bend below grade. This usually can be cleared by removing the downspout and inserting a drain auger at the joint where the lower end of the downspout enters the bell tile above grade. After the obstruction is cleared, flush with a hose.

Down pitch of gutters: To drain properly, gutters usually are pitched down slightly toward the drop outlet at the end as in Fig. 8. Exceptionally long runs may be fitted with a drop outlet at both ends, or one in the center as shown. Ordinarily, each downspout will handle 30 to 35 ft. of gutter





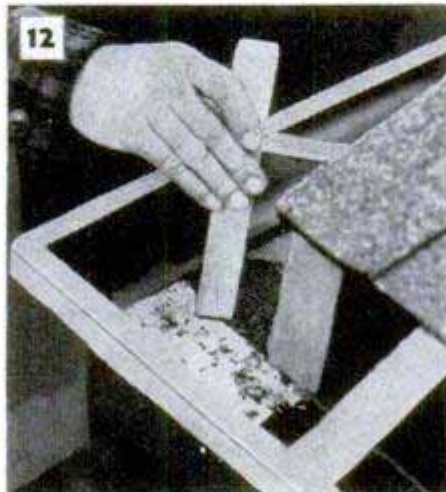
Sheet-metal gutters of all types should be protected with asphalt-base corrosion preventives. After gutters are thoroughly cleaned, material is applied with brush

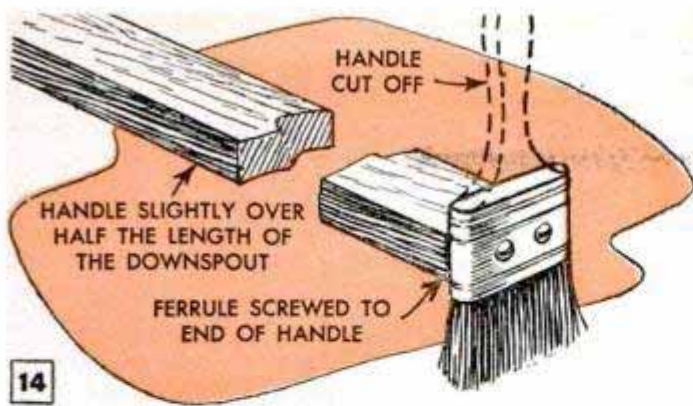
length. On some types of homes a noticeable pitch of the gutters detracts from architectural lines and in this case the gutters are installed horizontal, or level. This also is true of attached wooden gutters which usually are installed in this manner. Gutters installed level must not be permitted to sag, as otherwise some water will be left standing to evaporate after each summer shower. This accelerates rusting and provides an ideal breeding spot for mosquitoes. If metal gutters become bent or sagged in places, the cause is usually ice or snowslides from a high, steep roof, Fig. 9. As a rule, the gutter is quite easily straightened if none of the hangers has been pulled loose. In case some hangers

have been loosened, it will be necessary to renail or replace them, as the gutter will sag permanently without their support.

Rust prevention: Gutters and downspouts of nonrusting metals, such as copper and aluminum, have been widely used in both new and old construction, but the semi-round and box types of galvanized sheet metal are perhaps the most common. When the galvanized coating is impaired, rust attacks the bare metal and eventually eats through, causing leaks. Sometimes soldered joints pull loose, either because of stresses caused by expansion of freezing water, or because of an inadequately soldered joint. For the same reasons, slip-joint connectors sometimes open and, generally, they should be replaced. Effective rust protection for the inside surfaces of gutters and downspouts is attained by applying a heavy coating of elastic roofing cement, smokestack paint or the asphalt-base compounds used on the underside of autos as a corrosion preventive. Any of these materials will adhere tightly to clean metal and, after drying, they are sufficiently flexible to expand and contract with the metal, thus providing an unbroken protective film. This film, in most cases, also resists acids which form when wet leaves and soot are combined. Asphalt-base coatings should be used only on the inside of the gutter, as they tend to bleed through oil paints applied to the outside of the gutters. The coating is simply brushed onto the bare, clean metal, Fig. 10, after rust and loose dirt have been removed. Small breaks in the metal generally can be stopped with ordinary roofing cement, but large breaks will require a fabric retainer. First, coat the surrounding surface with cement, as in Fig. 11, and then press a piece of muslin or light canvas against the wet surface, Fig. 12. Finally, another coat of cement is applied over the fabric as in Fig. 13. To coat the inside of a downspout, alter an old paintbrush by cutting off the handle and

Small breaks in the metal can be closed by a fabric patch. First, apply compound with a brush as in Fig. 11, then press the canvas patch in place as in Fig. 12. Apply final coat over the fabric, including edges





14

screwing the ferrule to one end of a long strip of wood which serves as a handle, Figs. 14 and 15.

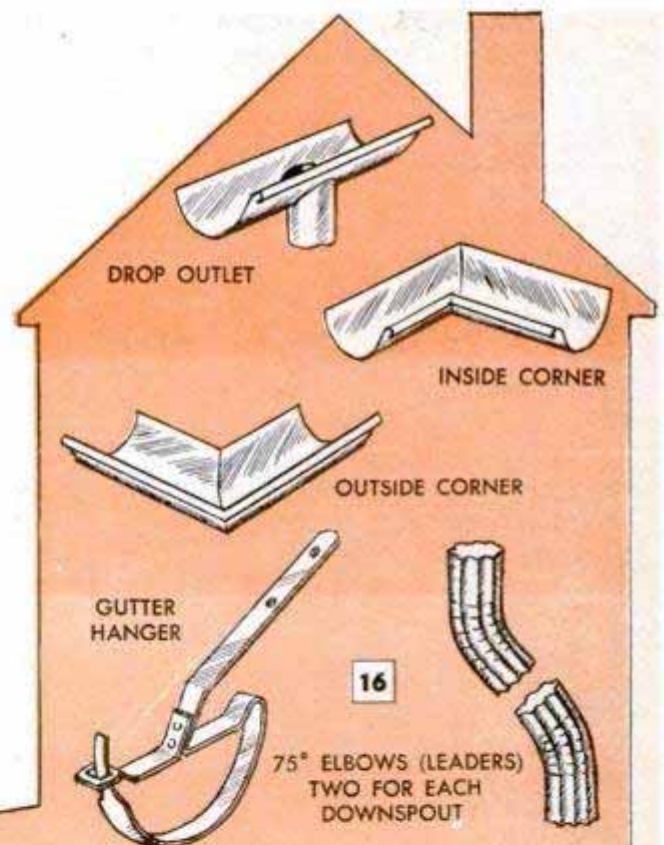
Replacing gutters: Gutter and downspout units and accessories of the semiround type are detailed in Figs. 16 and 17. Box-type gutters, Fig. 4, also are used extensively and the fittings and method of attachment vary considerably. Ordinarily gutters come in 8 to 12-ft. lengths, with 10-ft. lengths being perhaps the most commonly furnished. Corner fittings and drop outlets are separate units. Leaders connect gutters to downspouts in most types of installations. When ordering the materials and parts for a major replacement job be sure to include a sufficient number of hangers, Fig. 16, to permit a 4-ft. spacing throughout the length of the gutters. Order 1-in. nails for fastening the hangers and obtain all the slip-joint connectors required. Order leaf strainers for each drop outlet, and also get the proper type of downspout hangers, or bands. If only one or two sections of the gutter require replacement, measure the old ones and renew with the same type and size. When hanging new gutters, don't forget to make sure that the pitch is the same as that of the one being replaced.

Installing gutter hangers: New hangers should be nailed to the roof boards and not over the shingles, as exposed nails are likely to rust away in time and cause a leak. Removing shingles to expose the roof boards

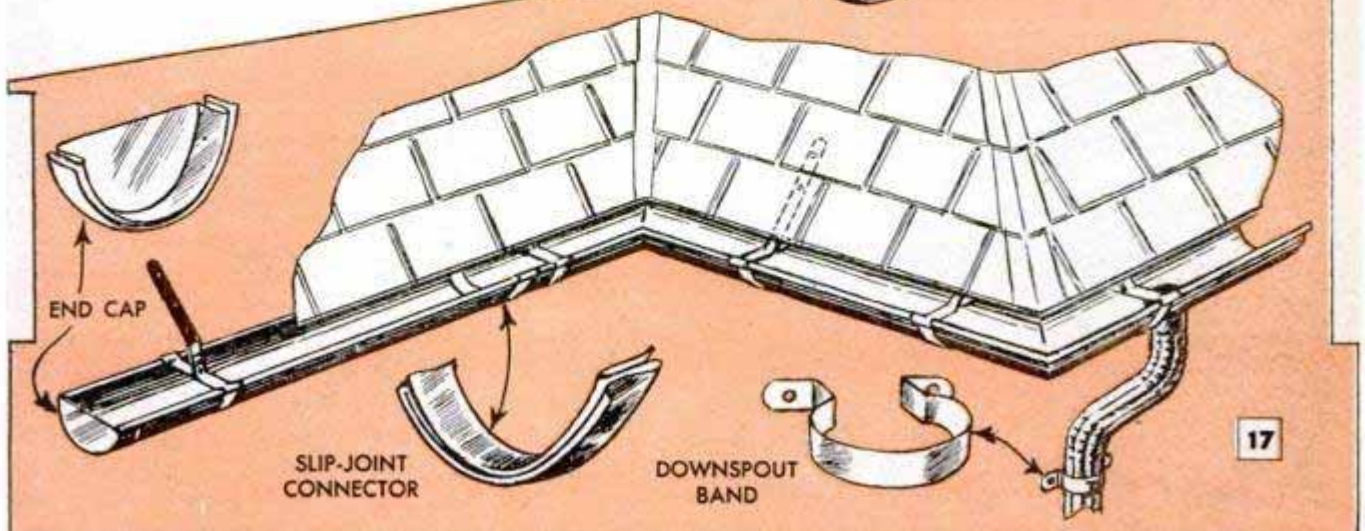


15

Applying protective compounds to the inside surfaces of downspouts pays off by greatly increasing the useful life of these parts. Material is applied to the inside surfaces with an improvised brush



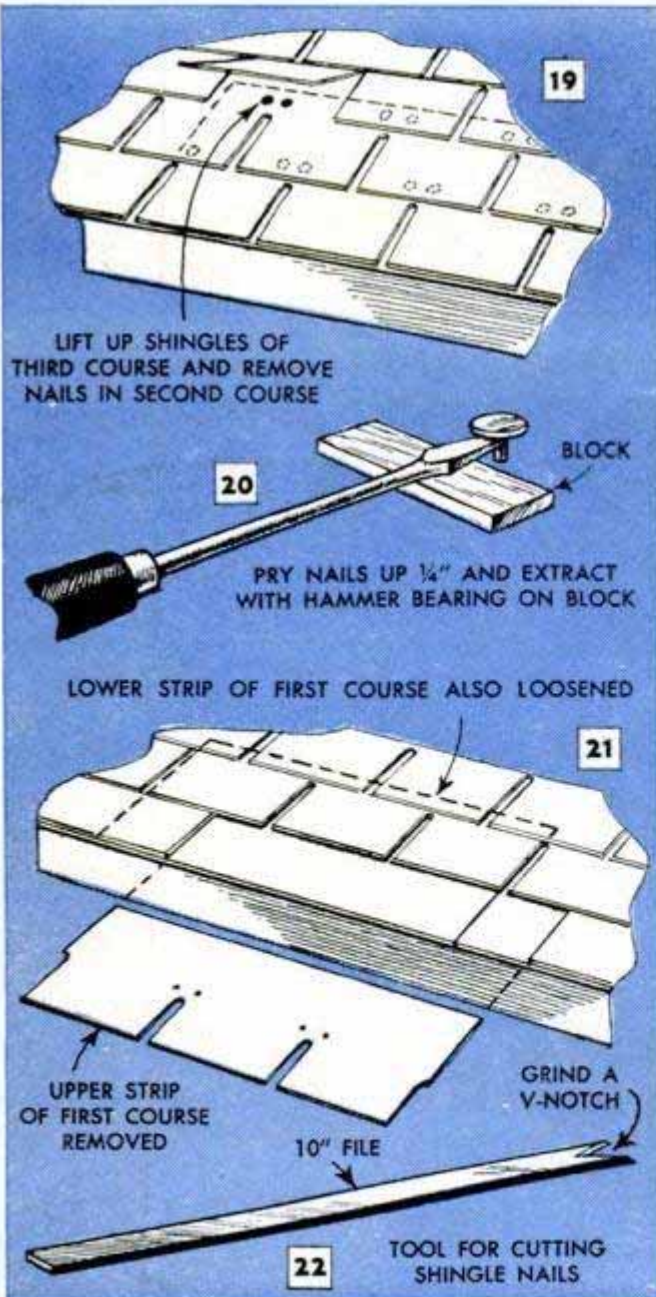
16



17

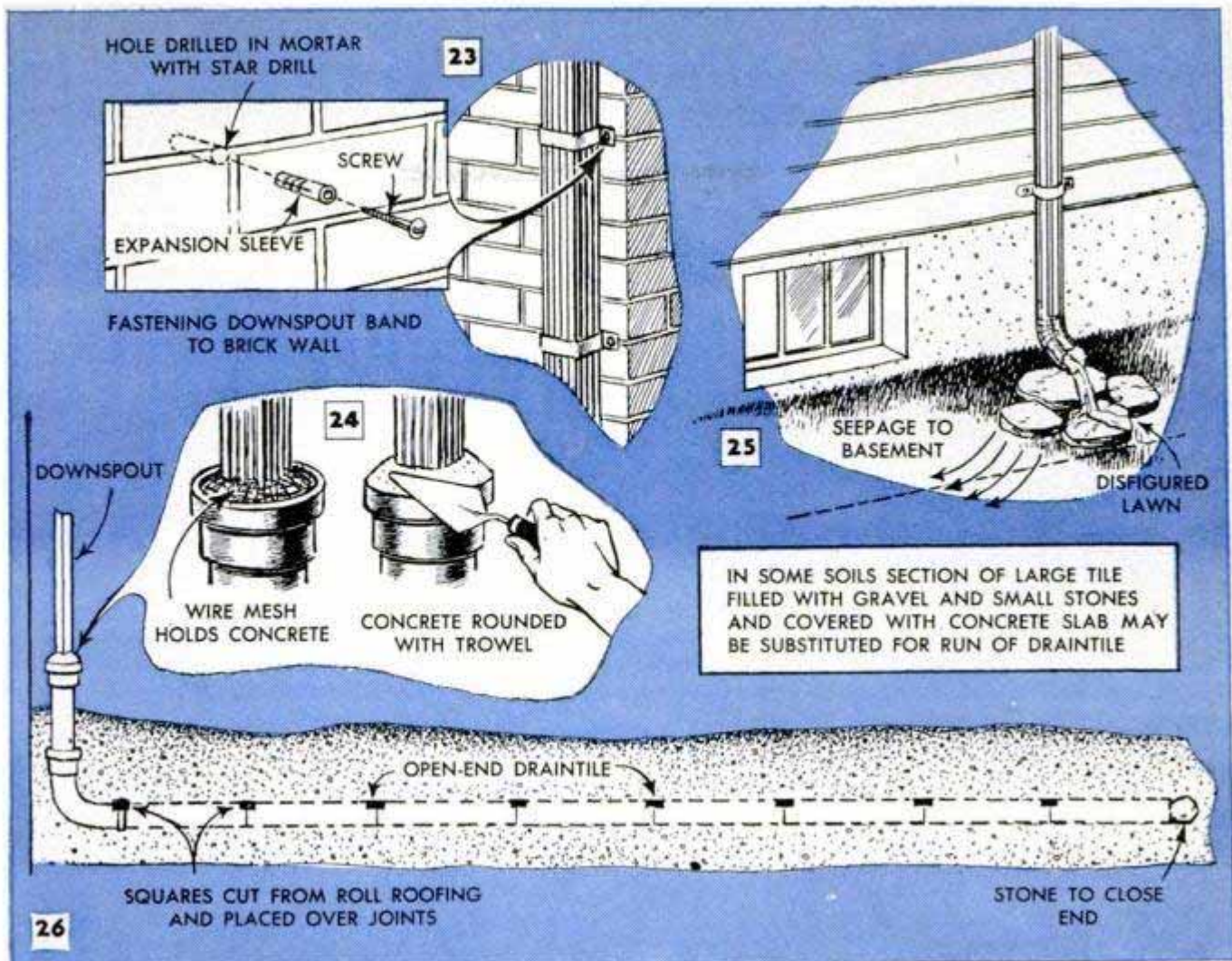


When applying new gutter hangers on old roofs, shingles should be lifted so that hanger can be nailed directly to the roof boards. On asphalt-shingle roofs, the individual shingles are easily removed for this job



must be done with care to avoid damage. First, remove the nails from two or more individual shingles of the second row, or course. The nailheads are exposed by simply lifting up the butt ends of the third course as in Fig. 19. Pry up the nailheads with a wide-bladed screwdriver as in Fig. 20. To prevent damage to the shingle, place a strip of $\frac{1}{8}$ -in. metal or a short block of hardwood under the screwdriver blade as shown. Remember that the nails holding the second course of shingles usually go through the upper ends of shingles in the first course. Finally, removal of the nails holding the first course of shingles, which usually is of double thickness, permits you to pull the shingles out as in Fig. 21, exposing the roof boards. In some types of construction, especially on wide cornices, there will be a layer of roll roofing under the first course. It is not necessary, of course, to remove this, as the hangers can be nailed over it, provided all nail holes are sealed with roofing cement before re-laying the shingles. After prying off the old hangers and nailing on the new ones as in Fig. 18, drive the nail part way down, and then coat the area around the nail with roofing cement so that when the nail is driven down fully, the cement will form a watertight seal around the nailhead. Now, replace the double course of shingles, making sure that they are located in the same position as they were originally. Drive the new nails slightly to one side or the other of the old holes and, before driving them clear down, apply roofing cement around the heads to form a seal. Be sure all old nail holes are filled with cement. Finally, the loosened shingles of the second course are nailed down again to finish the job. The procedure is repeated at each new hanger position. In a general way the same thing applies to wooden shingles. However, these are more rigid than asphalt shingles and require a few variations in procedure. It is necessary to cut the nails holding each shingle with a special tool improvised from an old file, Fig. 22. The V-notch at one end is ground to a beveled edge and in use the tool is forced under the shingle until the V-shaped cutting edge contacts the nail. A few light taps on the outer end of the tool generally cuts the nail cleanly. When replacing a wooden shingle, the two lower nails are started at approximately the same position as the original nails. Fill the old nail holes with roofing cement. Pry up the shingles of the next course above, slip a piece of sheet metal over the nailheads and press the upper shingle down to force the nails home. Don't tap the shingle with a hammer as you may break it.

When hangers must be attached to metal

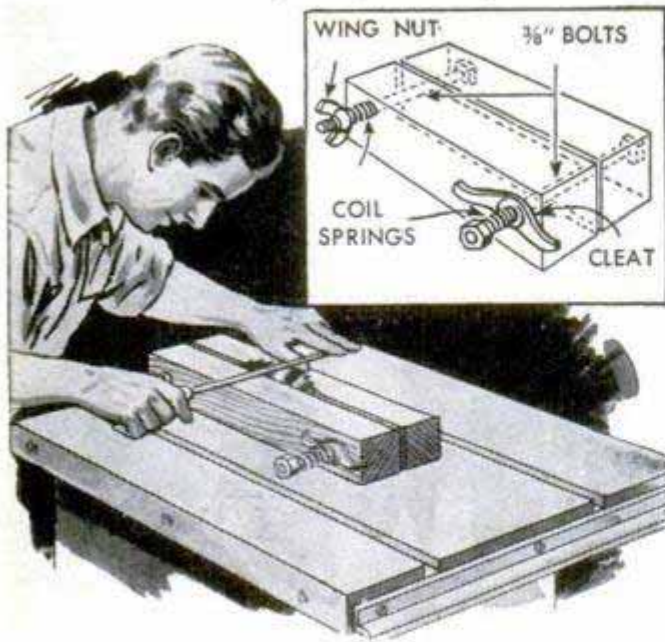


roofing, it's a common practice to solder them in place. Before soldering, the metal must be thoroughly cleaned, fluxed and preheated with a blowtorch. Downspout bands are simply nailed to wooden trim surfaces. However, when fastening the bands to brick, it is necessary to use masonry nails or screws. Screws are driven into expansion sleeves which are placed in holes drilled in the masonry with a star drill as in Fig. 23.

Cementing downspout into drain tile: When downspouts are connected to drain tile leading to the storm sewers, the opening where the downspout enters the tile should be sealed with cement mortar supported by wire mesh pressed into the bell end of the tile. Usually the bell end is only a few inches above grade and if the opening is not closed tightly, small stones, dirt and trash may clog the tile. To seal the joint, first cut and bend a disk of $\frac{1}{2}$ -in. wire mesh to fit into the open end of the tile. Bend up the edges of the wire disk so that it will wedge tightly in place. Then cut a round opening in the disk so that you can insert the lower end of the downspout. After the latter is in place, mix a heavy cement mortar and trowel it into the opening, building it up at the top to form a sloping surface that will shed water, Fig. 24.

Installing splashers and drain tile: When water from the downspout is discharged at ground level, some provision must be made for spreading the flow of water, as otherwise the force of the stream of water will wash away sod and soil. Also, if drainage from the foundation is poor, water may seep into the basement. Where there is ample drainage away from the foundation, a few flat stones placed below the end of the downspout may suffice as a splashers, Fig. 25. However, unless the arrangement is only temporary, it is better to install concrete splashers of sufficient size to direct the water away from the building in a spreading flow. In some soils, a run of open-end drain tile installed below grade as in Fig. 26, will serve as a dispersal unit. Sometimes, builders install a long run of tile in this manner and place a section of large drain tile (24 to 36 in. in diameter) at the lower end of the run. The large drain tile section is placed on end with the bell end up and filled with coarse gravel and small stones to form a dry well. The top of the tile is closed with a cast-concrete cover. Sometimes a tile elbow is cast integral with the cover and the lower end of the drain tile is led into the elbow. In gravelly or sandy soils, this installation works quite satisfactorily.

Bench-Saw Blade Filed Quickly If Held With Spring Clamp



Touching up the teeth of a circular-saw blade is done in a jiffy if the blade is kept from rotating by this easily released clamp. The clamp jaws are formed from two blocks of wood, 10 or more inches long depending on the size of the blade. The blocks are joined together by two bolts passed through aligning holes drilled near the ends of the jaws. Short coil springs are slipped over the ends of both bolts. One spring is held in place with a wing nut, and the other spring is slipped on the second bolt over an awning cleat. This spring is tightened against the cleat with a regular nut. To use the clamp, the jaws are set over the saw blade and the blade is raised until it projects $\frac{1}{2}$ to 1 in. above the jaws. Both nuts are tightened to apply enough pressure on the blade to keep it from rotating while being filed. After the exposed teeth have been touched up, the awning cleat is drawn back with the fingers, thus releasing the clamping pressure and allowing the blade to be moved in order to expose the next two or three teeth.

A. H. Waychoff, Phoenix, Ariz.

Screwdriver Bit Holds Screw



A self-holding screwdriver is a convenience, but is not always at hand and trying to start a screw in a tight place without one is no easy task. One solution to the problem is to hol-

low-grind the blade of an ordinary screwdriver and then upset the screw slot with a prick punch so that the blade can be slid

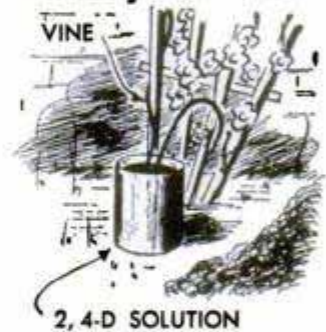
into the slot from one end. By upsetting the slot just the right amount with the punch, the screwdriver blade is made to grip the sides of the slot sufficiently to hold the screw firmly in place for one-handed driving in a corner or recess.

Ed Packer, Chicago.

Weed Killer Works Locally

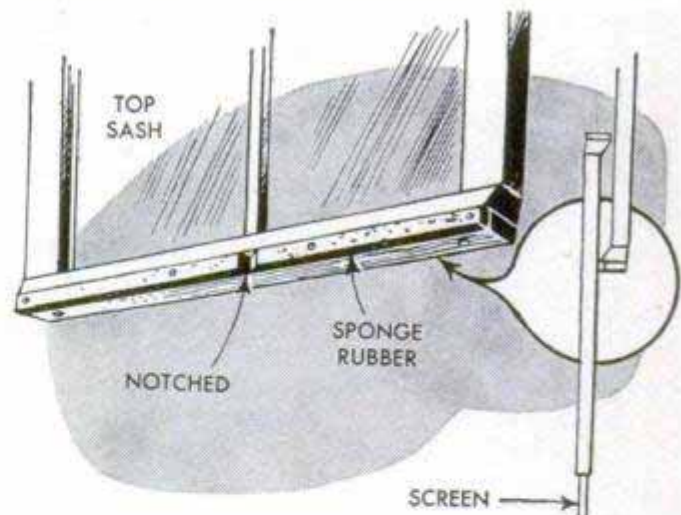
Where vines have grown among valuable plants, it is usually impossible to spray them without killing the other plants. In such cases a solution of 2,4-D works successfully when applied locally. Bend several of the vine ends into a can of 2,4-D and weight them down. The vine is killed by absorbing the 2,4-D in heavy concentration.

Adrian Hughes, Hillsboro, Ore.



Sealing Double-Hung Windows Against Insects

If small insert-type screens that fit under the bottom edge of the lower window sash are used, insects will enter between the rails when the lower sash is opened unless some means is provided for keeping them out. A good way to do this is to attach a wiper to the bottom of the upper sash which will press against the glass panes



and thus afford a seal. The wiper is made by cementing or nailing a strip of sponge rubber to a wooden strip, which, in turn, is screwed to the lower edge of the sash as indicated in the detail. The rubber should be notched to clear any vertical members on the lower sash.—Thomas M. McCormack, West Rutland, Vt.

☞ Book pages should never be bent back as this weakens the binding of the book.

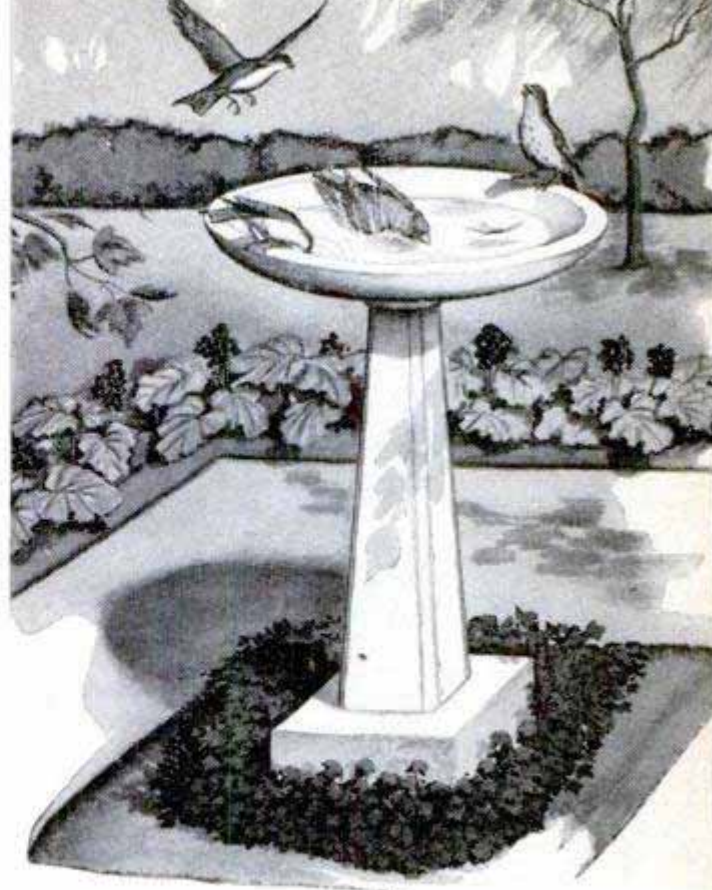
CONCRETE BIRDBATH

By Raymond Schuessler

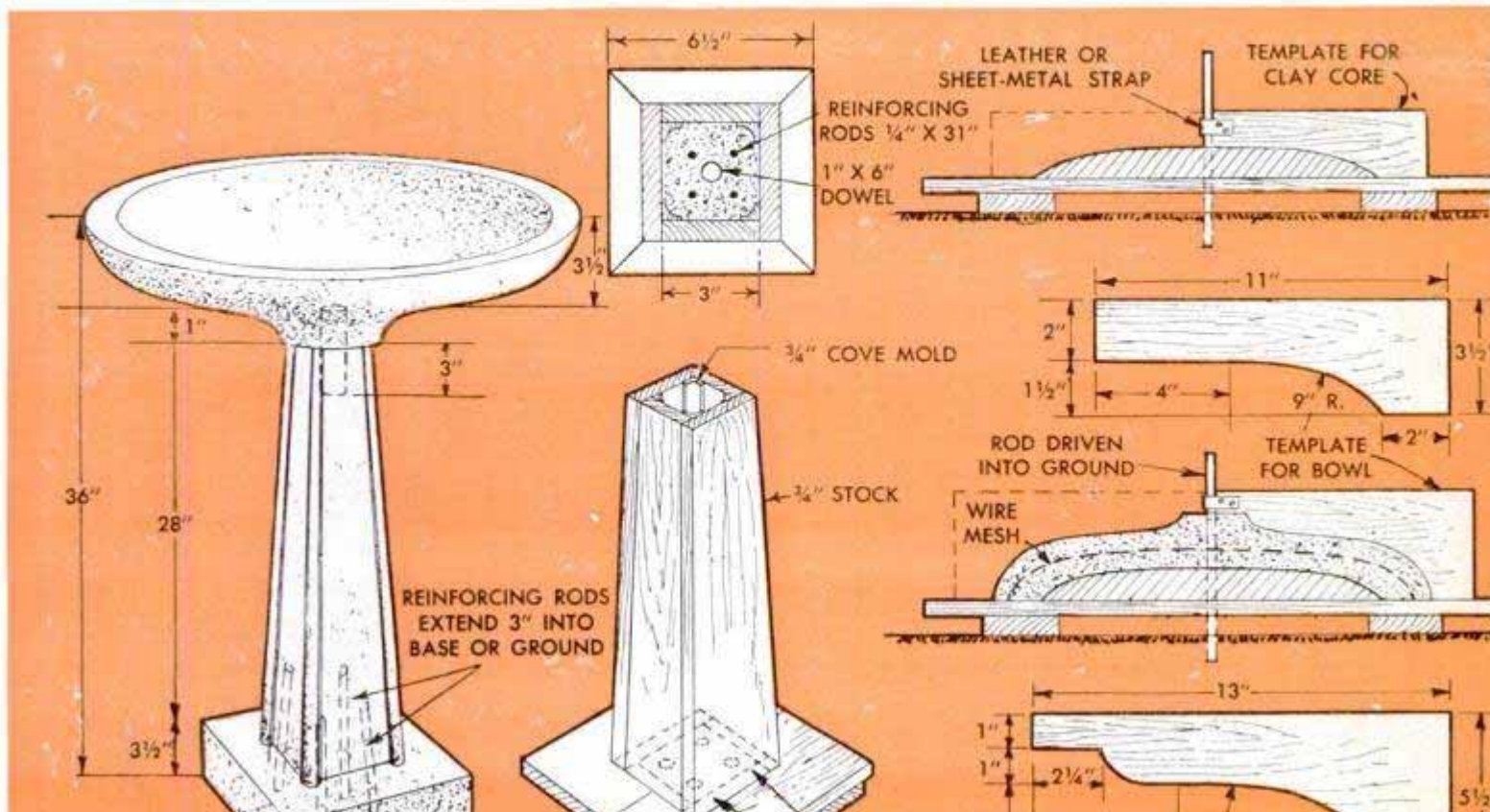
CAST INEXPENSIVELY from concrete, this birdbath forms an eye-catching lawn ornament that will attract many of the songbirds in your vicinity. The base and pedestal are poured, while the bowl is molded from a stiff concrete mix. The bowl can be replaced with a sundial or metal sphere if either of these is preferred.

The pedestal is poured in a tapered form which is built as in the center details and greased to prevent sticking. Note that the bottom of the form is drilled to allow four 31-in. reinforcing rods to extend below the pedestal. After the pedestal has hardened, the bottom is removed from the form and the pedestal, still in the form, is supported with a framework over a form for the 3½ x 10-in. base. If preferred, the base may be poured first with the reinforcing rods embedded in the center. Then the pedestal form, minus the bottom, is set over the reinforcing rods and the pedestal poured. Note that a 6-in. hardwood dowel is embedded in the top of the pedestal in order to engage the hole in the center of the bowl.

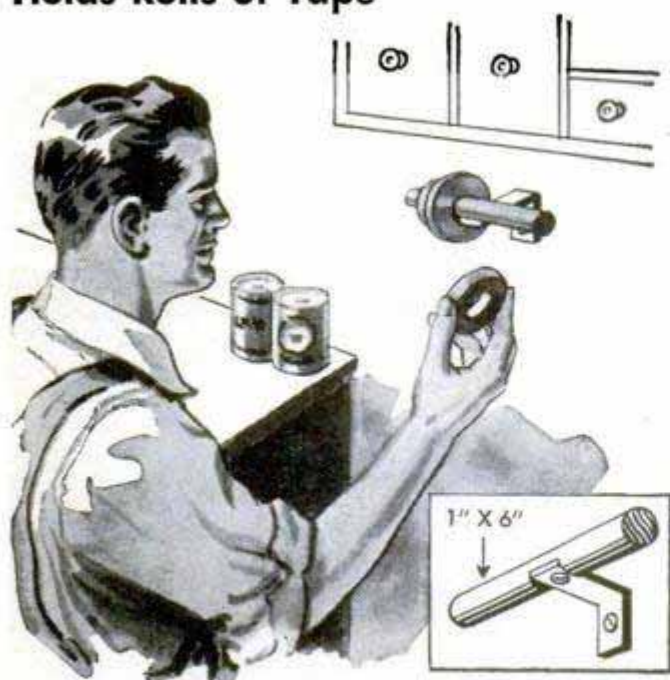
The concrete bowl is molded on a square wooden platform. This is drilled to receive a dowel or metal rod of the same diameter as the supporting dowel embedded in the pedestal. Wooden or sheet-metal templates



pivoted on the center rod are used to form the contours of both inner and outer surfaces of the bowl. A clay core, built up on the platform and shaped with the smaller template, is allowed to dry, and then a 1-in. layer of stiff concrete is troweled over the clay. Wire mesh is placed over the concrete and a second layer is troweled over this. Finally, the concrete is shaped with the larger template. When the bowl dries, it is set on top of the pedestal and the center hole is filled with concrete. On soft turf, the birdbath is set on a concrete footing.



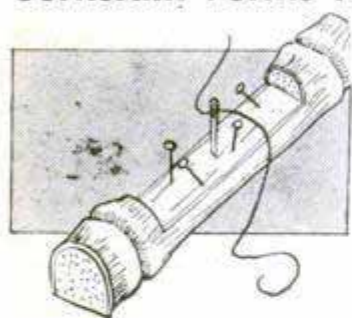
Dowel Mounted on Shop Wall Holds Rolls of Tape



Have you ever needed a piece of friction tape in a hurry and then spent five or ten minutes rummaging through drawers and boxes trying to find the roll? If so, you'll want this simple holder which keeps the rolls of tape right at your finger tips. In addition, you can tell at a glance when it is time to buy another roll of friction or masking tape. Just saw a 6-in. length from a 1-in. dowel, or a broom handle, and cut a shallow notch at the center of the dowel for an angle bracket. Screw the bracket to the dowel, mount the unit on the wall and merely slip the rolls of tape over the ends of the dowel crosspiece.

John J. Rea, Urbana, Ill.

Cornstalk Forms Pincushion



Cutting away one side of a section of cornstalk to expose the pithy center will provide a serviceable pincushion. The opposite side of the section is flattened so it will not roll. If

a golden, shiny stalk is selected, the pincushion will need no decoration.

Fred Cornelius, El Paso, Tex.

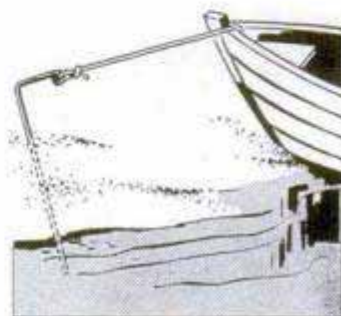
Crawl Space Floored With Roofing To Reduce Moisture Under House

The crawl space under a house without a basement can be made drier by completely covering the soil with strips of roll roofing. Heavy roofing—55 lbs. to 100 sq. ft. or heavier—is recommended. It has been

found that this will practically eliminate condensation of moisture under the house, thus giving added protection against rusting of steel, rotting of timbers, deterioration of insulation and short-circuiting of electrical wiring. In many cases, crawl spaces floored with roofing are dry enough to permit storing garden tools, lumber and lawn furniture. A distinct advantage for homeowners in temperate climates is that the amount of ventilation in the crawl space can be reduced by as much as 90 percent. This is important when it comes to keeping the floors warm during the winter months.

Rod Anchors Boat In Sandy Shore

Instead of the usual bucket of cement or other clumsy anchor for securing a small boat to a sandy shore, use a 30-in. length of 1/2-in. steel rod, which can be pushed into the sand to hold the boat fast. Point one end of the rod and form a large eye on the other end. Bend the end having the eye at right angles as shown. An anchor of this type is light in weight, highly effective and easy to carry in a boat.



Clinton R. Hull, Costa Mesa, Calif.

Waxing Thread Aids Stitching

Leather and heavy work-clothes material are easier to stitch if the thread is coated with candle wax. If the candle is hard, soften the wax somewhat before passing the thread over it. So the wax coating won't be noticeable on colored threads, use candles of matching colors.

Paper Cup Protects Small Plants

A cone-shaped paper cup makes an excellent shield for protecting small plants from cutworms and the like. After cutting the bottom from it, place the cup upside down over the plant.

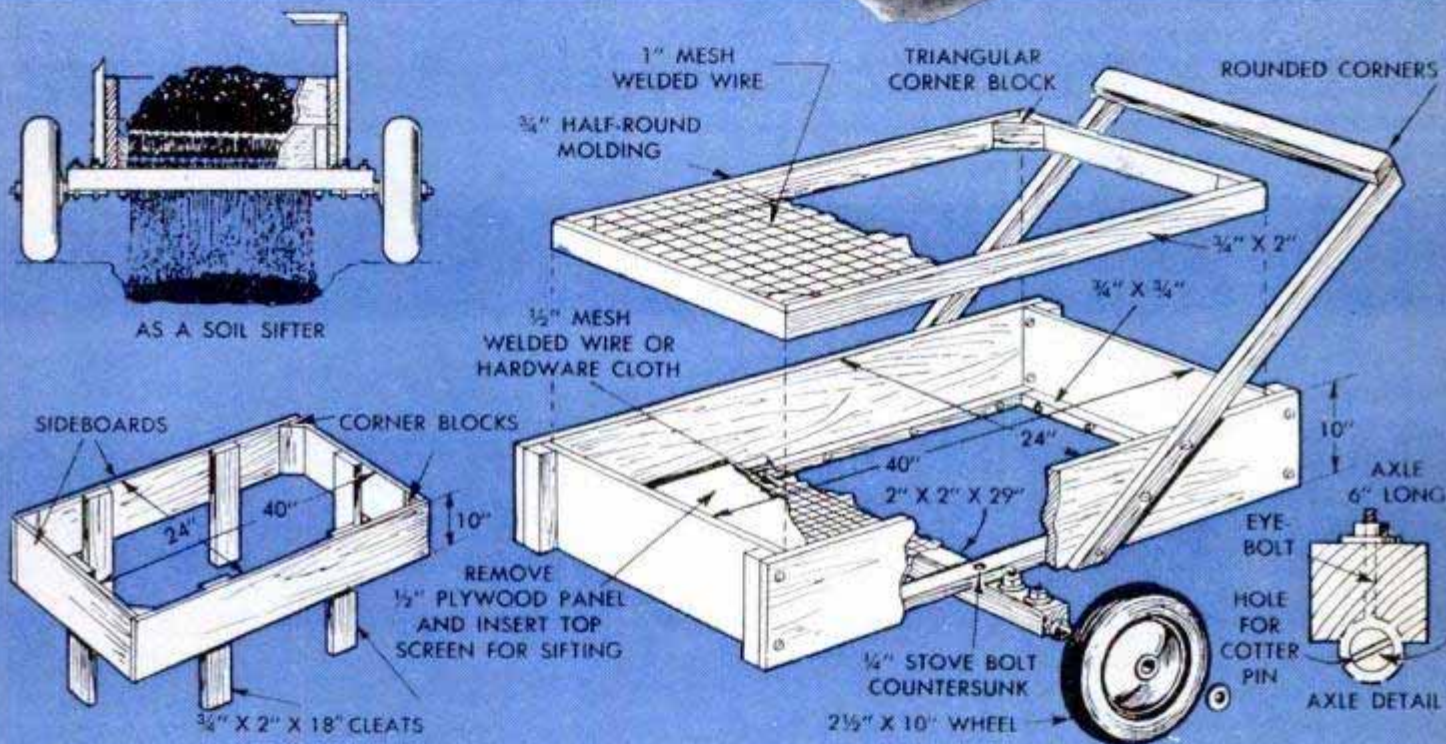


Carrying a pair of cutting pliers and a screwdriver on fishing trips will pay dividends when it is necessary to repair tackle or an outboard motor. These tools can be kept handy in the fishing-tackle box.

GARDEN CART

doubles as soil sifter

Gardeners will appreciate the simple construction and labor-saving features of this dual-purpose cart. The box is fitted with a permanent bottom of $\frac{1}{2}$ -in. wire mesh over which a plywood panel is placed when hauling garden tools, fertilizer, leaves or loose soil. Remove the plywood bottom, replace it with a frame covered with 1-in. wire mesh and you have an efficient soil sifter. If desired, sideboards can be added for extra capacity. All surfaces should be covered with two coats of spar varnish.

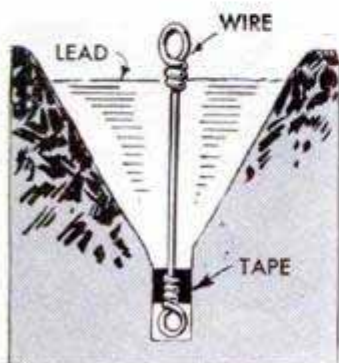


Hole in Ground Provides Mold When Making Lead Fishline Sinkers

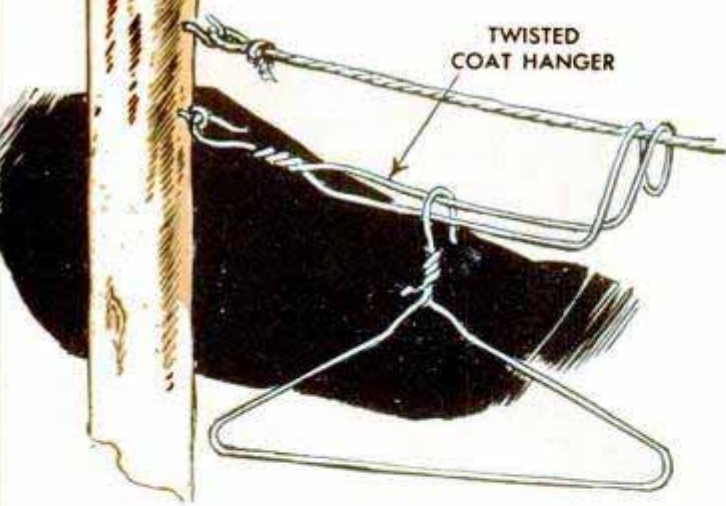
The next time you need some fishline sinkers or some sinkers for use on a seine, trotline or throw line, they can be molded right in the ground. Just make a small hole in the ground of the desired shape, using a knife or stick, and fill with molten lead. The

lead can be melted in an old tin can or other suitable container. Be sure that the container is dry as any moisture may cause the lead to spatter. When pouring the molten lead into the mold, you should wear leath-

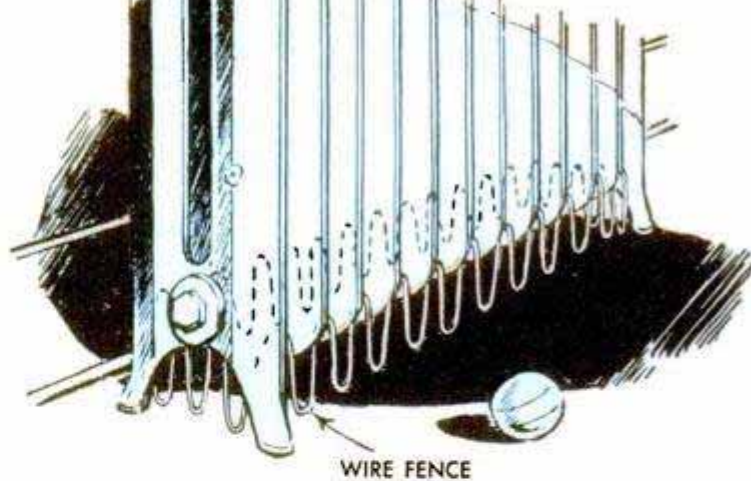
er gloves and goggles and take extreme care as moisture in the ground may cause the hot lead to spatter up on your hands or into your face. Before pouring the lead into the mold, insert a wire with an eye formed on one end or on both ends, depending on the purpose for which the sinker is to be used. If the eye is formed on both ends, wrap tape around the lower one to prevent the molten lead from running down and filling in the eye.—Charles Hardy, Los Angeles, Calif.



☐ You will find an apron with button-on pockets very handy when working in your shop or making repairs around the home. The pockets in which you keep brads, nails, screws, etc., can be readily attached or removed from the apron as needed.



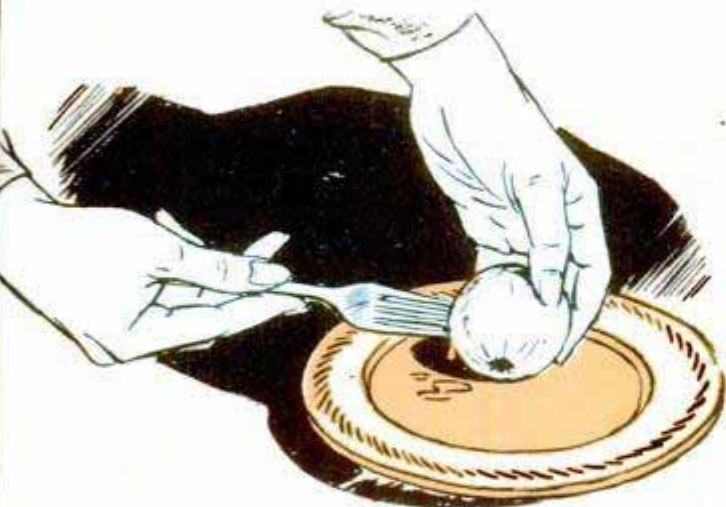
AIRING GARMENTS on an outdoor clothesline is done without danger of their falling to the ground if the hangers are put on a rack made from a wire coat hanger. The latter is bent to fit over the line and engage a screw hook driven into the clothes pole



BURNED ARMS, sometimes suffered by children while trying to retrieve toys that have rolled under a hot radiator, can be eliminated by installing a fence, which is bent from stiff wire, around the base of the radiator. The fence is merely pulled out for cleaning



INEXPENSIVE WOODEN SPOONS of the type used on picnics are just the thing for stirring small cans of paint. A separate spoon may be used for each color and discarded when finished, saving the need for cleaning tools sometimes used as stirring rods



A FEW DROPS OF ONION JUICE for flavoring cooking can be obtained quickly if the onion is simply pierced with the tines of a fork. As the skin is left intact, the onion will keep considerably longer than if it had been peeled and scraped in the usual way

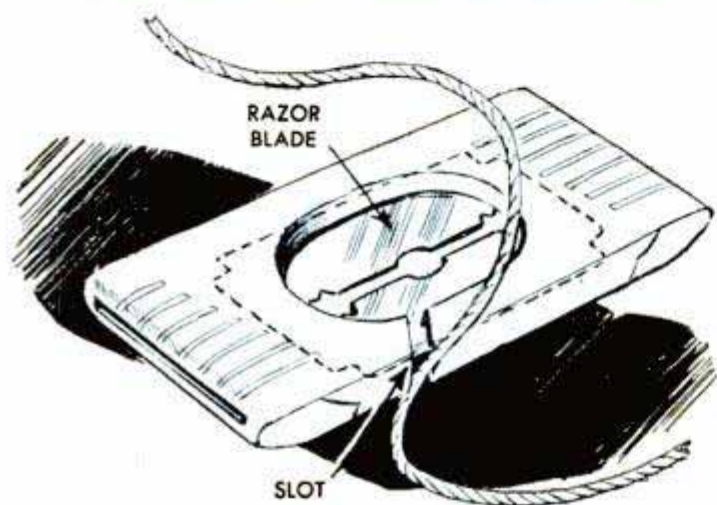
Solving HOME PROBLEMS



AFRICAN-VIOLET SLIPS can be started with greater chance of success if the end of the leaf stem is suspended in a tumbler of water. With a rubber band, fasten a piece of wax paper over the top of the tumbler, and pass the stem through a slit in the paper



HARD-TO-OPEN BOTTLE CAPS of the screw-on type are no problem if they are loosened by using a nutcracker as a wrench. Enough pressure is applied to allow the nutcracker teeth to grip the cap firmly, but be careful not to break the neck of the bottle



FOR CUTTING TWINE quickly and safely, make this handy cutter from a plastic razor-blade dispenser. Cut or file a slot through both plastic sections, and replace a used blade in the dispenser. The slot in the back section should be about $\frac{1}{2}$ in. deep



IF A THIMBLE IS TOO LARGE for the finger tip, use adhesive tape to pad the thimble so it will fit comfortably. Cut the tape into short, narrow strips and apply the strips, one at a time, to the inside of the thimble until the proper size is attained



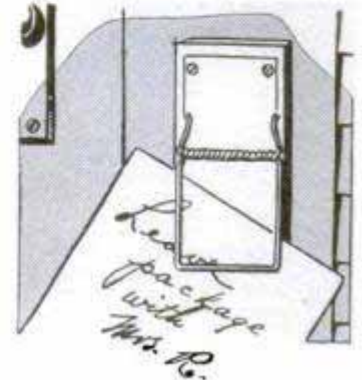
TO KEEP THE FOOD in your picnic lunch cool and tasty during the warmest weather, stand an ice-filled fruit jar in the center of the hamper and pack the food around it. After the hamper is packed, cover it with a towel or folded tablecloth tucked in tightly at the sides. If desired, pour concentrated fruit juice or double-strength tea over the ice, keeping in mind that the melted ice will dilute the beverage

Flat-Iron Bumpers for Inside Doors Prevent Interlocking of Knobs

Do you have doors in your home located in such a manner that they open back to back? If so, these simple bumpers, which were used effectively by one homeowner, can prevent the knobs from interlocking. In this case, the bumpers were bent from $\frac{1}{8}$ -in. flat iron, $\frac{3}{4}$ in. wide, and were fastened to the doors with screws. Brass, copper or even plated metal can be used if desired. Width of the hook or curve on the bumper should be just a little greater than the distance that the doorknob projects beyond the surface of the door.

Mousetrap Holds "Not Home" Notes

An ordinary mousetrap mounted near your front doorbell serves as an effective holder for written messages. Remove the trigger attachment and paint the trap to match the trim of the house.



Burning Brick Is Fireplace Novelty

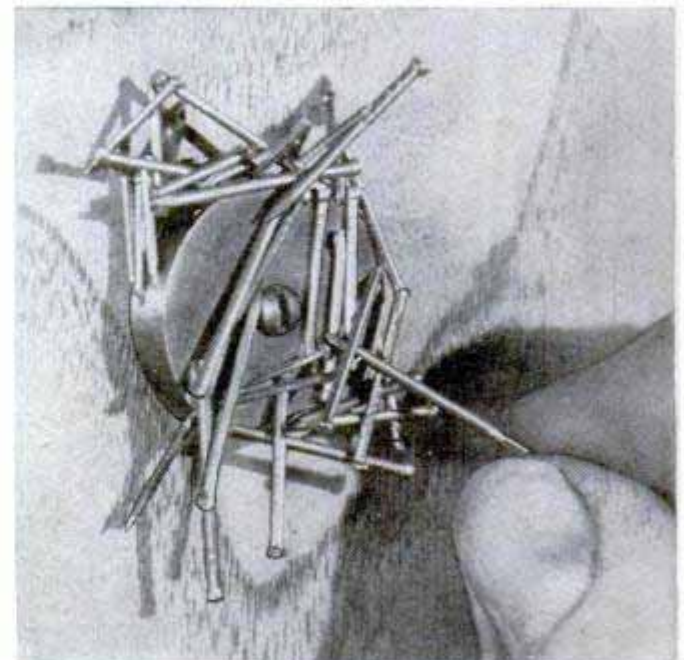
An ordinary brick, soaked in kerosene for 48 hours and allowed to dry for an hour, can be ignited to provide a novel effect in a fireplace. It can be extinguished, if desired, and re-ignited a day or so later, since the kerosene will not evaporate for several days. The total burning time for the brick is five or six hours.

Edward C. Widdis, San Fernando, Calif.

Steel Magnet Screwed to Workbench Keeps Small Metal Parts at Hand

Have you ever had an assembling job that required the use of small nails or other small steel parts, and found that the parts were soon scattered over the bench and difficult to find? A small magnet will keep the parts right where you want them. Any type of magnet will do, but a disk-shaped alnico magnet is best. A hole can be drilled through its brass core and a screw used to mount it on the bench or near-by wall.

Walter E. Burton, Akron, Ohio.

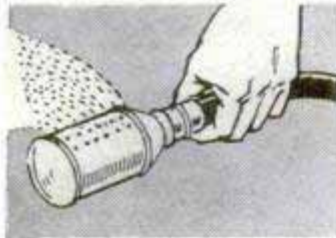


Bread Cleans Painted Fabric

To clean delicate painted fabrics, dip a ball of soft bread into benzine and rub gently. After cleaning, hang the fabric in the open until all benzine odor has evaporated. Work in a well-ventilated room and keep benzine away from open flame.

Screw-Top Can Forms Sprinkler Unit

A pint or quart can, having a neck at the top which is threaded for a cap, can be quickly converted to a garden-hose spray nozzle. Punch three or four rows of holes in the side of the can and turn the threaded neck over the nozzle coupling of the hose. In most



cases, the can will fit as it is. If not, the female fitting from an old hose coupling can be soldered to the neck of the can.

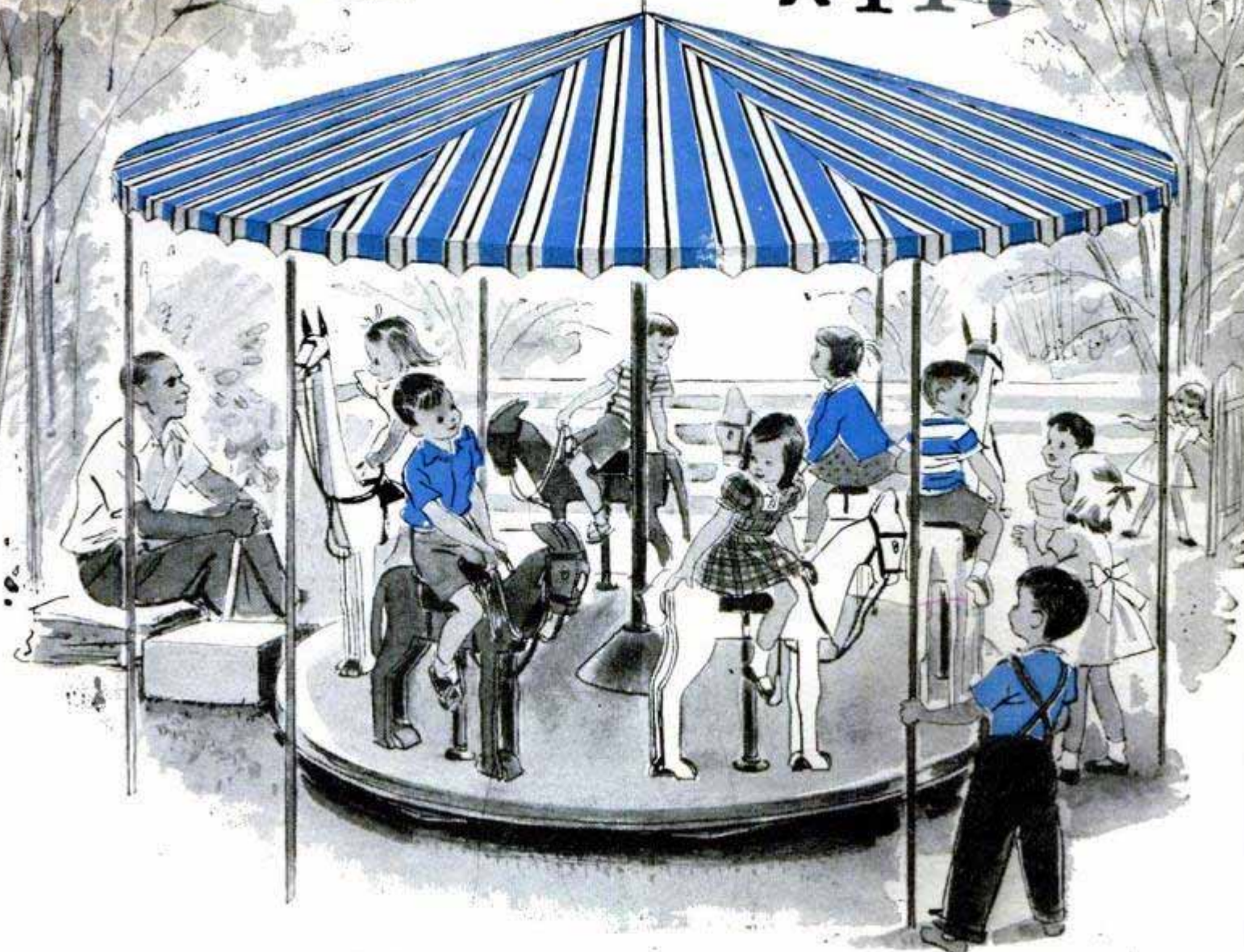
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A410

MOTORIZED MERRY-GO-ROUND

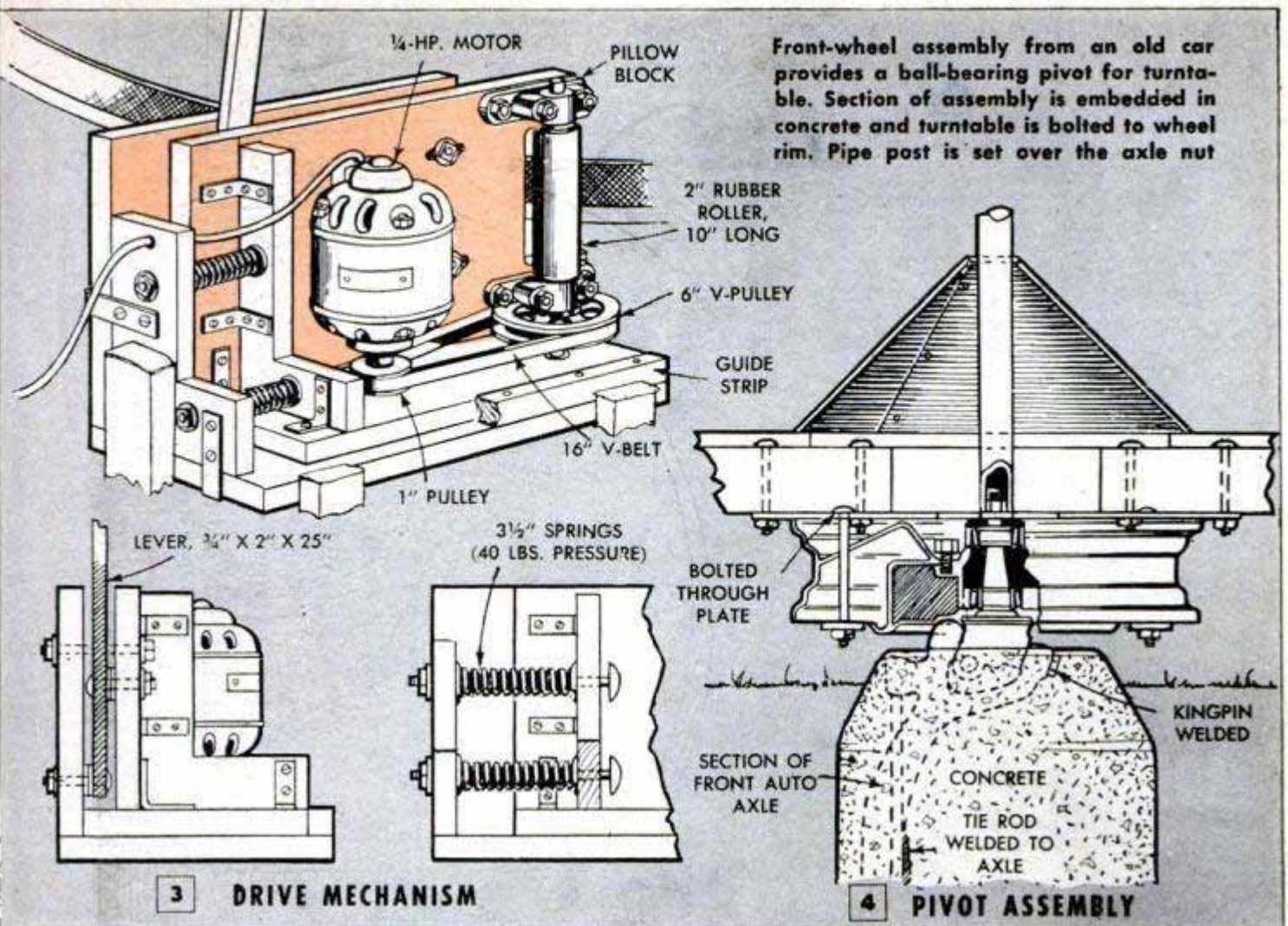
By Roy Tichenor W T M 52

Transform your back yard into an exciting "kiddie park" by building this motor-driven merry-go-round. When the neighborhood youngsters walk under the gay canopy and mount the little animals for a merry ride, you'll have as much fun as they

ADAPTED from the original version designed and built by C. P. Parker of Cincinnati, Ohio, this pint-sized merry-go-round gives the youngsters a thrilling ride in a realistic carnival atmosphere. There's no pretending necessary when it comes to this toy—it has everything but the music. A ¼-hp. motor mounted at one side of the turntable, drives the merry-go-round at a moderate rate of speed—not fast enough to result in serious injury if one of the riders should accidentally fall off. The smaller children may be strapped in the saddles, and an adult or older, responsible child should be on hand to drive the turntable and help the tiny tots on and off the six wooden animals. The merry-go-round set-up is shown in the illustration above and

the side view, Fig. 2, on the next page.

Although the turntable of the original merry-go-round pivoted on an assembly of pipe and thrust bearings, the front-wheel assembly from an old car, installed as in Fig. 4, forms a self-contained ball-bearing pivot that will serve the purpose admirably. The car axle is cut apart approximately at the center, the tie rod is welded to the axle and the kingpin is welded to the yoke to hold the wheel spindle in a fixed position. Then a hole is dug in the ground, making it somewhat deeper than the length of the axle section, and filled with concrete. The axle is pressed into the wet concrete and, before the concrete sets, the wheel rim is carefully leveled in both directions. Prop the wheel rim in the leveled position with



bricks or wooden blocks until the concrete sets. Note, in Fig. 2, that the wheel has been set in a shallow hollow scooped out of the ground. This is optional, and is done to lower the turntable so the smaller children will have less trouble boarding it and also to bring it in contact with the drive roller.

The turntable consists of a frame of 2 x 4-in. stock bolted to a steel plate and covered with flooring or 1/2-in. waterproof plywood. The plate, in turn, is securely clamped to the wheel rim. This is done by passing bolts through the plate, which is placed on the top of the wheel, and two lengths of flat iron on the underside of the wheel, as in Fig. 4. The flat iron must be long enough to rest on the edges of the rim. Note that a hole is cut in the center of the plate to provide clearance for any projection of the wheel spindle and also to permit setting a center post of 1-in. pipe over the axle nut. Eight 2 x 4 members radiate from the plate and are joined to the outer frame segments with plywood gussets as in Fig. 1, section A-A. The flooring segments at the outer edge of the turntable are bandsawed on a 4-ft. radius and the edges are covered by a band of 1/2-in. exterior-grade plywood, 3 or 4 in. wide. The strips of plywood banding are fastened to the edge of the turntable flooring with countersunk flat-headed

screws. The plywood band probably will have to be assembled in four or more sections, and these should be joined together only at points where the band is screwed to the frame. Use half-lapped joints and drive the screws through the lapped portions of the plywood. After assembly, the band is faced with a strip of belting, which is cemented or tacked in place, to provide a friction surface for the drive roller. Should you wish to floor part of the turntable before mounting it on the car wheel, remember that at least two opposite wedge-shaped sections must be left unfloored until the steel plate has been bolted to the rim. Otherwise, it will be extremely difficult to gain access to the underside of the wheel.

The canopy frame is made of 1/2-in. rod or pipe and a flat-iron band. The top ends of the support rods are bent to engage holes drilled in a large pipe flange which is turned on the top of the center post, and the lower ends of the rods are pressed firmly in the ground. The awning top is made up in wedge-shaped segments which are sewed together and placed over the metal framework. A wooden plug, drilled and driven in the top of the center post, can be used to support a pennant.

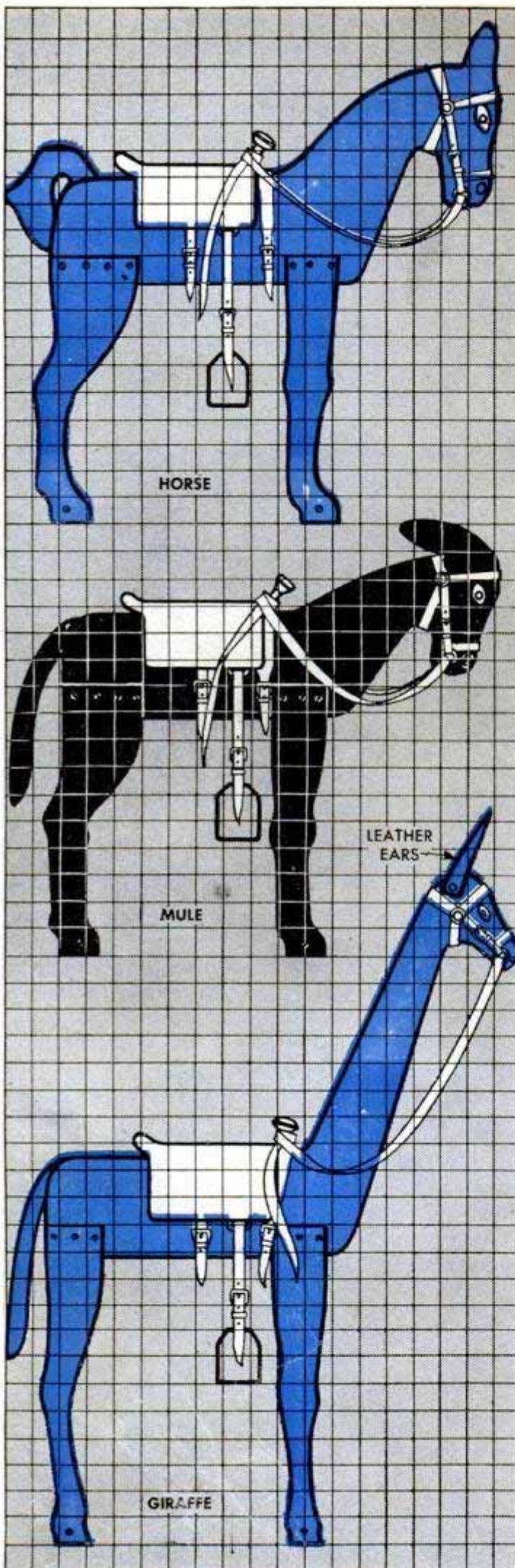
The drive mechanism, Fig. 3, consists of a rubber-faced roller which is belt-driven

by a ¼-hp. electric motor. The roller can be improvised from a washing-machine wringer or typewriter platen, or it can be made by covering a hardwood turning with a piece of inner tube. The entire drive unit is installed upright on a "floating" mount and is held against the turntable with two coil springs, thus bringing the rotating roller in contact with the belting on the edge of the turntable. The drive-unit mount rides on a wooden base. This is set on the ground alongside the turntable and kept from shifting by means of wooden stakes driven in the ground. A lever bolted to both the mount and the base is used to disengage the drive unit by pulling it away from the turntable. The mount is anchored by two bolts passed through slots in the side of the mount and a wooden guide strip nailed to the base.

→ The three pairs of wooden animals are made from 1-in. stock or plywood. The patterns are given at the left, each square indicating 2 in., and the parts are assembled as shown in Fig. 5. A pipe upright turned into two floor flanges supports each animal. One flange is screwed to the underside of the animal and the other is bolted to the turntable floor, while the feet are screwed to wooden blocks fastened to the floor. The wooden saddles on the animals can be covered with leather or plastic material, or simply painted. The harness can be improvised from old luggage straps or light belting, and the stirrups formed from rod or flat iron, welding the ends together.

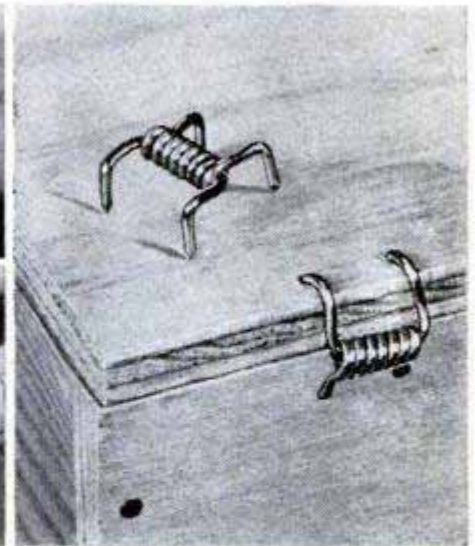
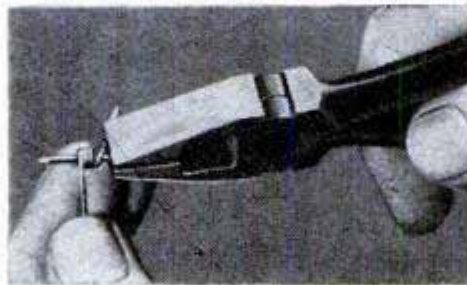
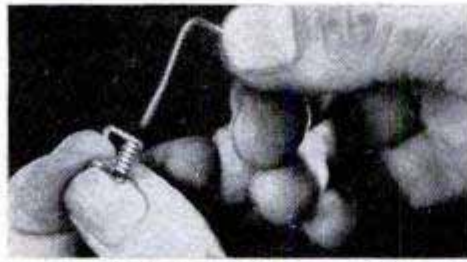


5 TYPICAL ASSEMBLY
POPULAR MECHANICS



Small Box Hinges Made From Scraps of Wire

Scrap lengths of stiff wire are suitable for making these inexpensive box hinges. The only tools needed are a pair of pliers and a nail or other mandrel slightly larger than the diameter of the wire used. The hinges are made in two parts which link together, one length of wire being wrapped around a nail to form a coil through which the other length is inserted. The inserted length is then bent to a U-shape. Construction of the



parts to be hinged determines the manner in which the hinges are attached. The photo shows a lid hinged to a wooden box, in which case the wire-hinge arms are bent

at right angles and inserted through holes in the lid and back of the box. The arms of each hinge are then twisted together on the inside of the box.

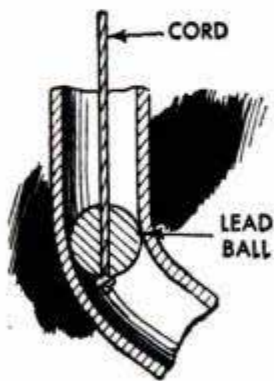
Ladies' Beauty Aids Are Helpful Tools for Modelmakers

When you need a gimmick that will reach into the deepest corner of an assembled fuselage of a model plane to work down a bulge on a rib, try an emery board. And, for getting up behind the drivers of a model locomotive to scrape down a bit of metal, a nail file will do the job in a jiffy. Don't overlook nail polish, either. The colorless kind is ideal for use on small polished metal parts to retain the luster. It is, in fact, the prototype of the expensive plastic paints that make it unnecessary to polish high-luster copper, brass, and steel except at infrequent intervals. Colored nail polishes have many uses, too, especially the dark, red-mahogany shades. For small touch-up

jobs on woodwork they are superior to shellac as an undercoat, because they dry instantly and can be painted over without even a short wait. Hand mirrors are ideal for looking into dark corners. Screws that often are driven blindly in a hard-to-reach corner can be carefully watched by left-handed juggling of such a mirror. Incidentally, careful manipulation often will reflect light into the corner as well as give a view of the work in hand. Fingernail scissors, the short but strong ones with curved blades, and the thin ones with needle-sharp points, are ideal for cutting light fabric to fit around snug places on a model plane.

George A. Strader, Elmhurst, N. Y.

Lead Ball Pilots Leader Cord Through Curved Piping or Tubing



Fishing light chain or wire through curved tubing, conduit or plumbing fixtures sometimes poses a real problem, especially if the run of tubing or pipe curves in more than one direction. Often a lead ball will turn the trick when all other methods fail. Select

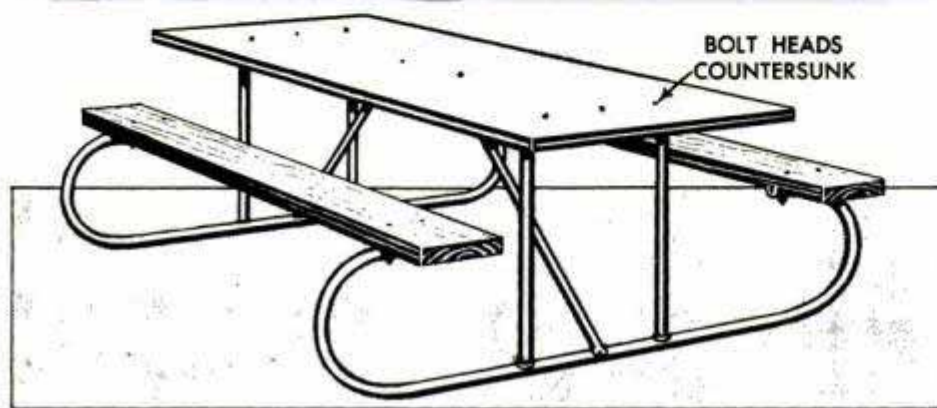
a ball which will pass freely through the tube or pipe and drill a small hole through the center. Then pass a cord through the hole and tie an overhand knot in the extreme end of the cord to keep the ball from slipping off. Be sure that the cord is long

enough to reach through the pipe or tubing. Attach the free end of the cord to the chain, wire or whatever is to be pulled through the pipe, and simply drop the ball into the open end. It will travel around sharp bends and through long runs of tubing without fouling if you are careful to keep the cord taut. If desired, the hole in the lead ball can be countersunk to provide a recess for the knotted cord, thus eliminating any chance of the knot to form a point of traction and cause the ball to bind inside the pipe.

W. F. Schaphorst, Newark, N. J.

☞ Try dampening an ironing-board cover before putting it on the board. Allowing it to dry in place on the board will result in a smooth, snug fit.

Pipe Frame Supports Picnic Table and Benches



This lightweight table-and-bench combination for the lawn features a pleasing design that results in a sturdy, nontip unit. The entire frame is made of 1-in. pipe, the bottom cross members being formed in the shape of a "C" to double back and support the 2 x 6-in. bench planks which bolt to the pipes. Two lengths of pipe, each bent to form an inverted "U," provide the legs. These are welded to the runners and bolted to the table top, which is a sheet of $\frac{3}{4}$ -in. exterior-grade plywood. Another length of pipe is bolted to the center of the table top and to each runner so that it will serve as a brace.—Grover Brinkman, Okawville, Ill.

Soap-Flakes Solution Used to Clean Decorative Feathers

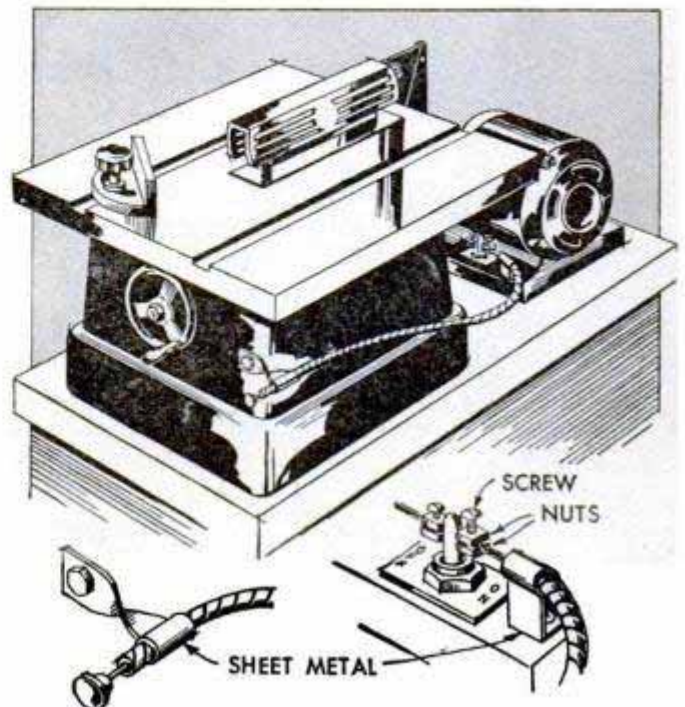
Decorative feathers used in trimming hats and other objects can be cleaned by moving them vigorously back and forth in a lukewarm solution of soap flakes. Use a wide jar or a container slightly higher than the length of the feathers. Rinse each feather immediately with clear, cold water by holding it under a faucet, and then place it on a white towel or sheet of white blot-

ting paper. When cleaning feathers of different colors, clean white and naturally colored feathers first. Should the soapsuds become tinted by a little excess coloring from artificially colored feathers, use freshly prepared suds for each color. Hang each feather separately by tying at the quill with a rubber band or string. Let them dry thoroughly away from heat.

Choke Wire Operates Toggle Switch From Front of Power Tool

A toggle switch for a power-tool motor is sometimes mounted on the motor base in such a position that reaching the switch is inconvenient or even hazardous. A device to permit operating the switch conveniently from the front of the tool can be made by attaching a length of automobile choke wire to the switch. The wire is threaded through a hole drilled in the toggle arm and is held in place by a stop on each side of the arm. The stops are provided by clamping the wire between two nuts which are turned on a machine screw. The choke wire is supported in front of the switch, and again at the front of the machine, with two sheet-metal brackets formed and bolted to the motor and tool base as shown.

Walter G. Franklin, Penn Yan, N. Y.

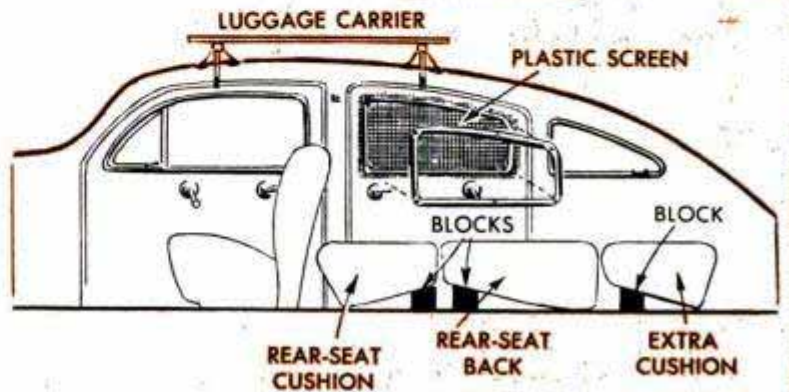


Shellac, applied to the end of a light-switch cord, will keep it from unraveling.



Your Car a Motel

Transforming the back seat of a sedan to a comfortable double bed will slash vacation costs



IF YOUR vacation plans include extensive traveling by car, take a few hours to set up a double bed in the back seat of the car, and drop the cost of sleeping accommodations from the vacation budget. An extra, secondhand seat cushion, and six wooden props are all the material needed for the job. First, remove the rear-seat back and take out any partition which separates the trunk compartment from the rear seat. Next, clean out the trunk and remove the spare tire. Prop the seat back and the two cushions with the wooden blocks so the tops of the three cushions form a level surface. Spreading your sheets and blankets directly on the cushions provides a satisfactory bed which can be made even more comfortable by placing a lightweight mattress over the cushions. As the trunk area is utilized for sleeping room, the spare tire

and luggage will have to be carried on top of the car. This is done by fitting a standard car-top carrier with a shallow luggage tray. The latter is made by mounting four sidepieces on a sheet of plywood or base made of boards. The plywood should be drilled for water drainage. A few screw eyes turned into the top edges of the sidepieces will facilitate lashing the items in the tray. You can have plenty of sleeping ventilation without worrying about insects if you remove the metal frame from one or both of the rear windows, cover the window opening with a piece of plastic screen and then replace the frame. This will keep out the insects, but won't interfere with raising and lowering the window. When the vacation is over, only a short time is needed to get the car back in shape for everyday driving.

Matthew Howard, Minneapolis, Minn.

Model-Railroad Tunnels Built From Asbestos-Paste Mixture

Asbestos paste mixed with portland cement forms an excellent material for covering model-railroad tunnels and terrain. After setting up a wooden framework and covering it with window screen, mix asbestos paste, 3 parts, to portland cement, 1 part, adding just enough water to bring the mixture to a spongy consistency. Then smooth the mixture over the screen wire with a small trowel or spatula. The mixture remains workable for about 20 hours,

allowing plenty of time to work out the details, and dries hard in a stone-gray color. Small stones, miniature trees, telephone poles, etc., may be set into the mixture before it hardens, and pieces of mirror can be used to simulate ponds and lakes. After the material is thoroughly dry, it should be given two coats of clear shellac and then painted to approximate the natural colors of the rock and vegetation simulated.

Dick Hutchinson, El Monte, Calif.



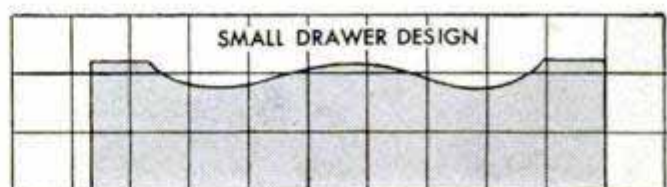
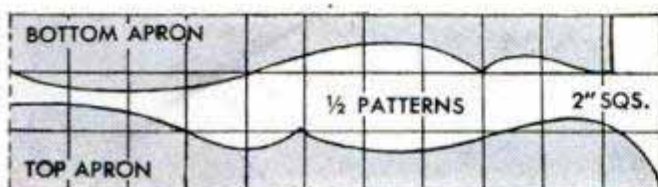
CHILD'S CHIFFOROBE

By I. M. Fenn

DESIGNED to complete the furnishings of a child's room, this attractive chifforobe offers generous wardrobe space, a chest of drawers with a full-width storage drawer and a special compartment for toys or linens. It looks its best when made from a close-grained wood such as poplar or birch, and finished in ivory enamel with the interior drawer fronts finished in the natural color of the wood. As the first step in the construction, build up the top to the required width by edge-gluing four to six strips of selected stock. Allow $\frac{1}{2}$ in. all around for trimming to finish size. Although the detail on the opposite page shows the edge of the top molded, this can be omitted if no shaper is available. While the glued-up top is drying, cut selected

stock for the drawer fronts, corner posts and the scrolled front and back aprons. Bandsaw the edges of the drawer fronts and the aprons, laying out the curves full size from the patterns given below. Round the bandsawed edges and sand smooth. Groove and rabbet the front and back posts. Frame the ends by fitting top and bottom rails and then glue and clamp the parts together. Note that the front posts are cut off square at the lower ends, flush with the scrolled edge of the apron, and are fitted with turned feet. Drill a hole in the lower end of each front post to take a $\frac{1}{2}$ x $1\frac{1}{4}$ -in. tenon. After turning out the feet, glue the parts together.

Note the assembly of parts in sections A-A and B-B, then build up the top and bottom frames, using grooved stretchers





and the tenoned rails. Note that the bottom frame is paneled to provide dustproof construction, and that the back stretchers are rabbeted to take the back panel. Build up the intermediate frame, then drill blind holes for $\frac{1}{2}$ or $\frac{1}{4}$ -in. dowels which join the frames to the posts. After making a trial assembly of the parts to check the fit, apply glue to the doweled joints and clamp the parts together. Check the assembly for square corners before the glue dries, and cut and fit the back panel while the assembly is in the clamps. Attach the panel with screws, but do not use glue in the joints. Now, note that the back ends of the inside drawer runners are housed in grooves cut in uprights fitted into the corners of the drawer compartment, and that this compartment and the special storage space

above are formed by a paneled partition supported on the intermediate frame. Make up this paneled partition first and join to the top and intermediate frames with screws and glue. Now, groove the back drawer-runner supports and screw them in place. The front-runner supports are ripped to the same width but are not grooved, the front ends of the runners being attached with screws as in the detail and section B-B. Rabbet the runners and glue and screw them in place. Attach the top, then fit plywood bottoms in the storage and wardrobe compartments. Now all that remains is the making and fitting of the drawers and doors. Construction of the drawers is clearly shown in the details, but note that the large drawer is fitted with a $\frac{1}{2}$ -in.-plywood bottom for added rigidity and also is fitted with a center guide. Doors can be paneled in the manner shown or the panels can be housed in grooves cut in the stiles and rails. The doors are hinged to close flush, but the lower drawer front is rabbeted all around and the outer edges are beveled to give a raised-panel effect. After the cabinet has been completely assembled, sand all exposed surfaces and apply a coat of sanding sealer. When this is dry, sand lightly and finish with two coats of ivory enamel. Apply a sanding sealer to the inside drawer fronts, sand lightly when dry, and finish in the natural color with two coats of varnish or one coat of water-white lacquer. The exposed center upright and the front drawer-runner supports also can be finished in the natural color if desired. Attach two pulls to the lower drawer.

Posthole Digger Holds Soil Intact When Transplanting Seedlings

A posthole digger (not auger) will be found very useful for transplanting seedlings over short distances in the garden. With it, you can lift the young plant from the ground, holding the soil tightly, transport it to the new location, and gently de-

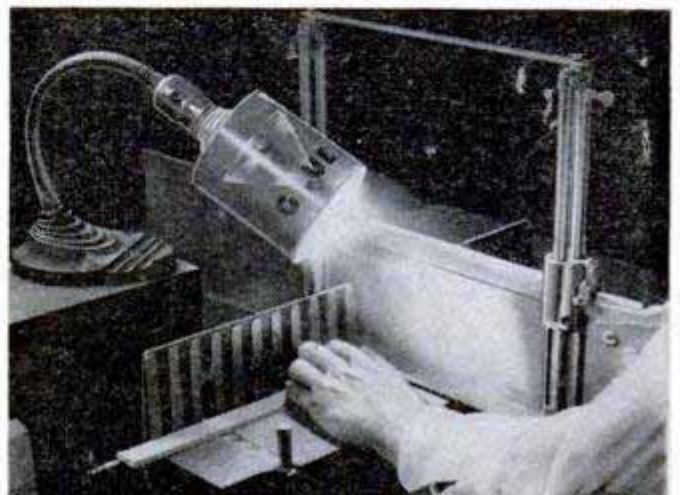
posit it in a hole which has been dug beforehand. Press the soil down gently with your foot. The large lump of soil removed with the roots in this way prevents disturbing them so that the plant will show no evidence of having been moved.

"Spotlight" Shade for Shop Lamp Improvised From Glue Can

If you use an old flexible type of desk lamp as a portable lamp in your workshop, an empty glue can of the type that has a screw cap will provide an ideal shade for concentrating a bright spot of light on your work. Most cans of this type will fit over the neck of the average lamp socket. If the can has a tendency to get hot, cover it with sheet asbestos to protect your hands.

Walt Seifert, Columbus, Ohio.

□ In the absence of a screwdriver bit for a drill brace, a small steel washer often can be inserted in the jaws of the chuck to serve as a substitute.

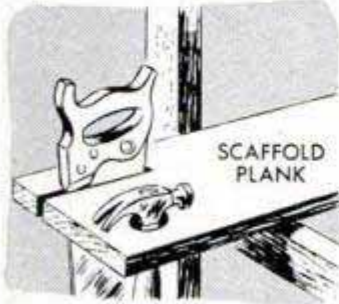


Flower Pedestal for Lawn or Porch Improvised From Sewer Tile

Standing a length of sewer, or drain, tile on end provides an attractive, durable flower pedestal for use in the yard or on a terrace. A large tile may be filled with soil and used in the manner of a flower box, while a smaller size may be used to support a flowerpot, the rim of the pot resting on the end of the tile. A colored or a clear, glossy finish can be had by applying a coat of enamel or lacquer.

Wilton Matthews, Long Valley, N. J.

Tools Held Safely on Scaffold Plank



One of the dangers of working on a scaffold is that a tool may be accidentally dropped on someone below. This danger can be minimized by slotting and drilling the planks to provide hangers for the tools. In this way the tools which are not being used are kept handy, but safely out of the way.

provide hangers for the tools. In this way the tools which are not being used are kept handy, but safely out of the way.



Oxalic-Acid Solution Cleans Leather Spotted With Grease

To clean grease spots from leather, first moisten the leather surface with water, using a wad of absorbent cotton or a small sponge. With another sponge or wad of cotton apply an oxalic-acid solution evenly over the soiled surface. This solution con-

sists of oxalic-acid powder or crystals, 1 part, and water, 10 parts. After the spots have been removed with the oxalic acid, apply saddle soap to the leather and polish with a soft chamois or woolen cloth.

Helen Lemberger, Chicago.

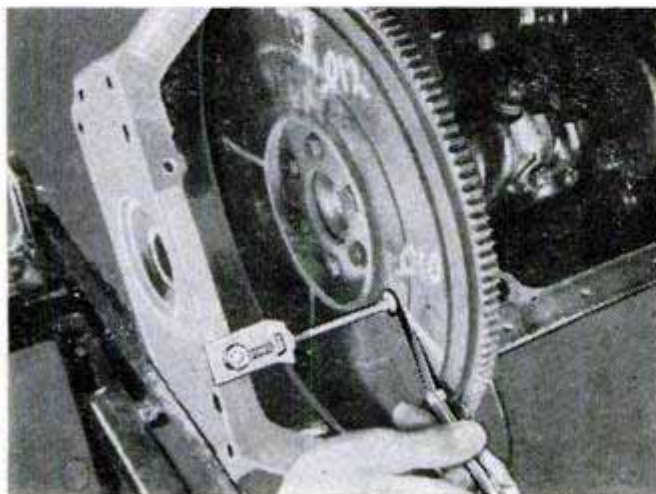
Carriage Bolt and Feeler Gauge Serve to Check Runout of Auto Flywheel

Although skilled mechanics use an expensive dial gauge to check runout when installing flywheels on motors, the person who does this job only on rare occasions can devise a fairly accurate substitute with an ordinary carriage bolt and a feeler gauge. The bolt is locked in a bracket by means of two nuts, one on each side of the

bracket, which, in turn, is mounted at some point on the flywheel housing as indicated.

The head of the bolt is located so that it almost touches the flywheel near the outer edge of the surface contacted by the clutch pressure plate. Chalk marks are then placed on the flywheel at 90-deg. intervals. By using a feeler gauge to get the exact distance from the bolt head to the surface of the flywheel in these four positions, the runout can be calculated easily.

For example, if a .010 feeler gauge is required to fill the space between the flywheel and the bolt head at one point, and 90 deg. beyond this point a .012 gauge is required, runout of the flywheel, would be approximately .002 of an inch. If a runout of .005 tolerance is permissible on your particular job, your flywheel is okay. However, if the difference exceeds the tolerance permitted, then the flywheel should be removed and the mating surfaces cleaned thoroughly. The flywheel is then replaced and the check is made again.



1 EVENING PROJECTS

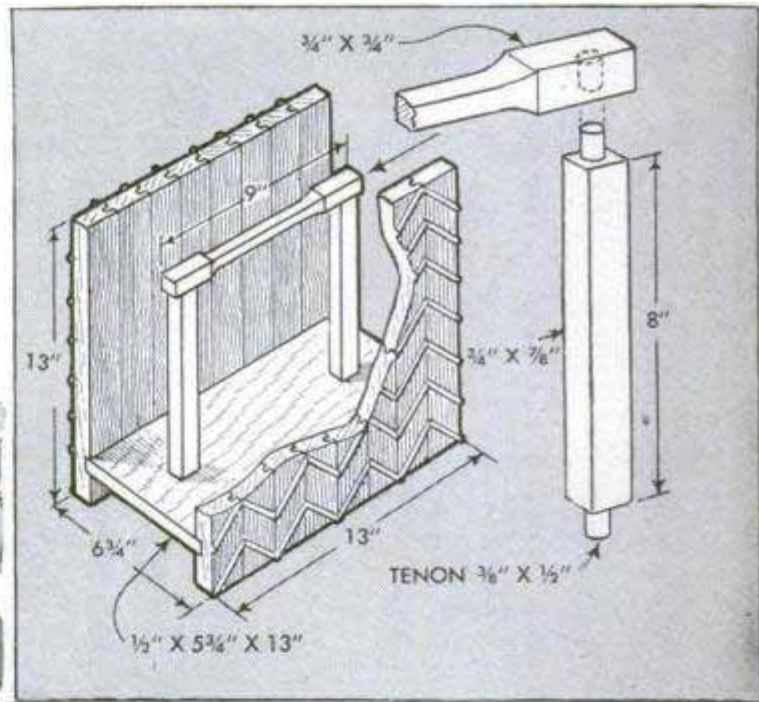


Mortar-and-Pestle Lamp

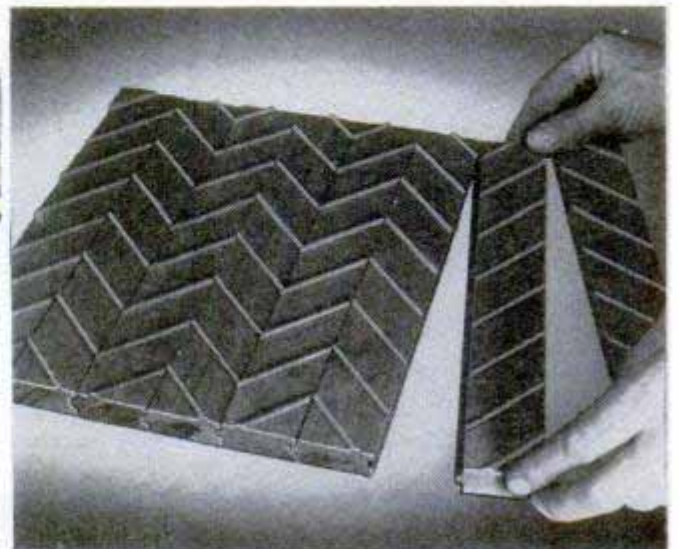
THE TWO exceptionally attractive projects pictured on this page provide a real test of craftsmanship, while a third one, on page 192, describes two toy locomotives of thread spools and scrap wood that can be made in an hour or two.

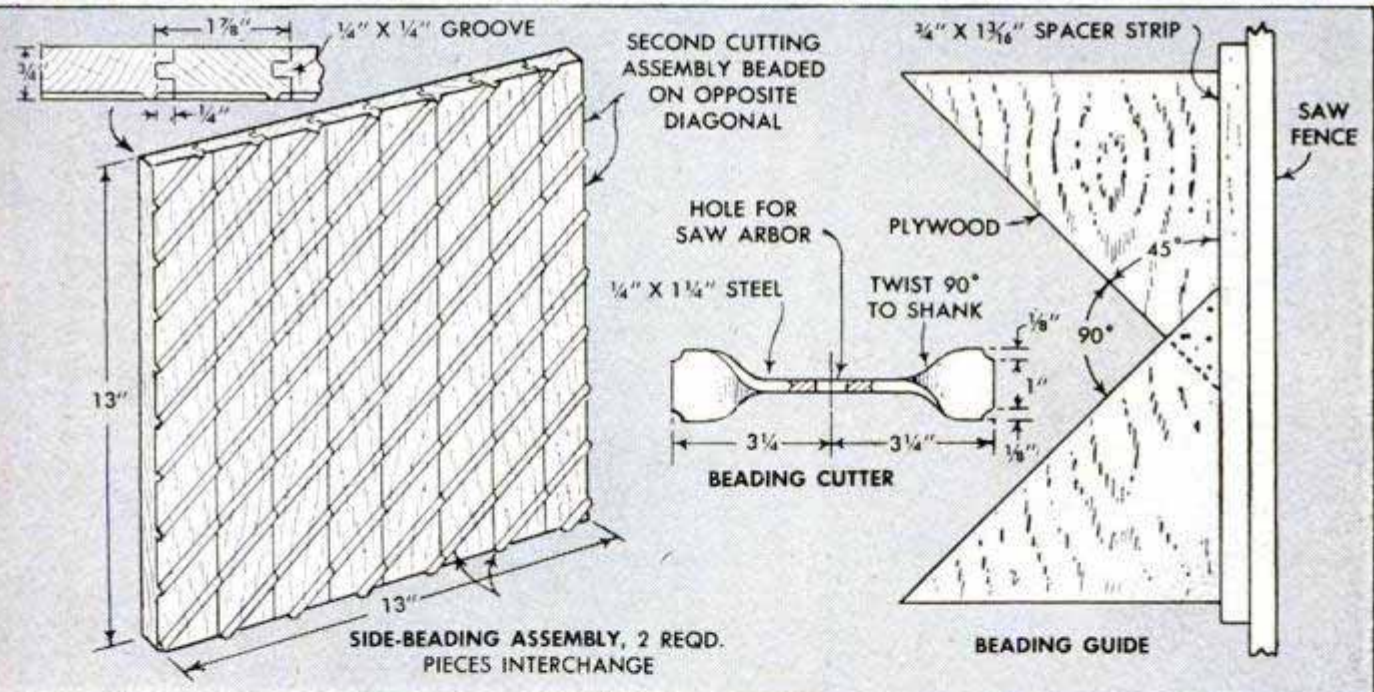
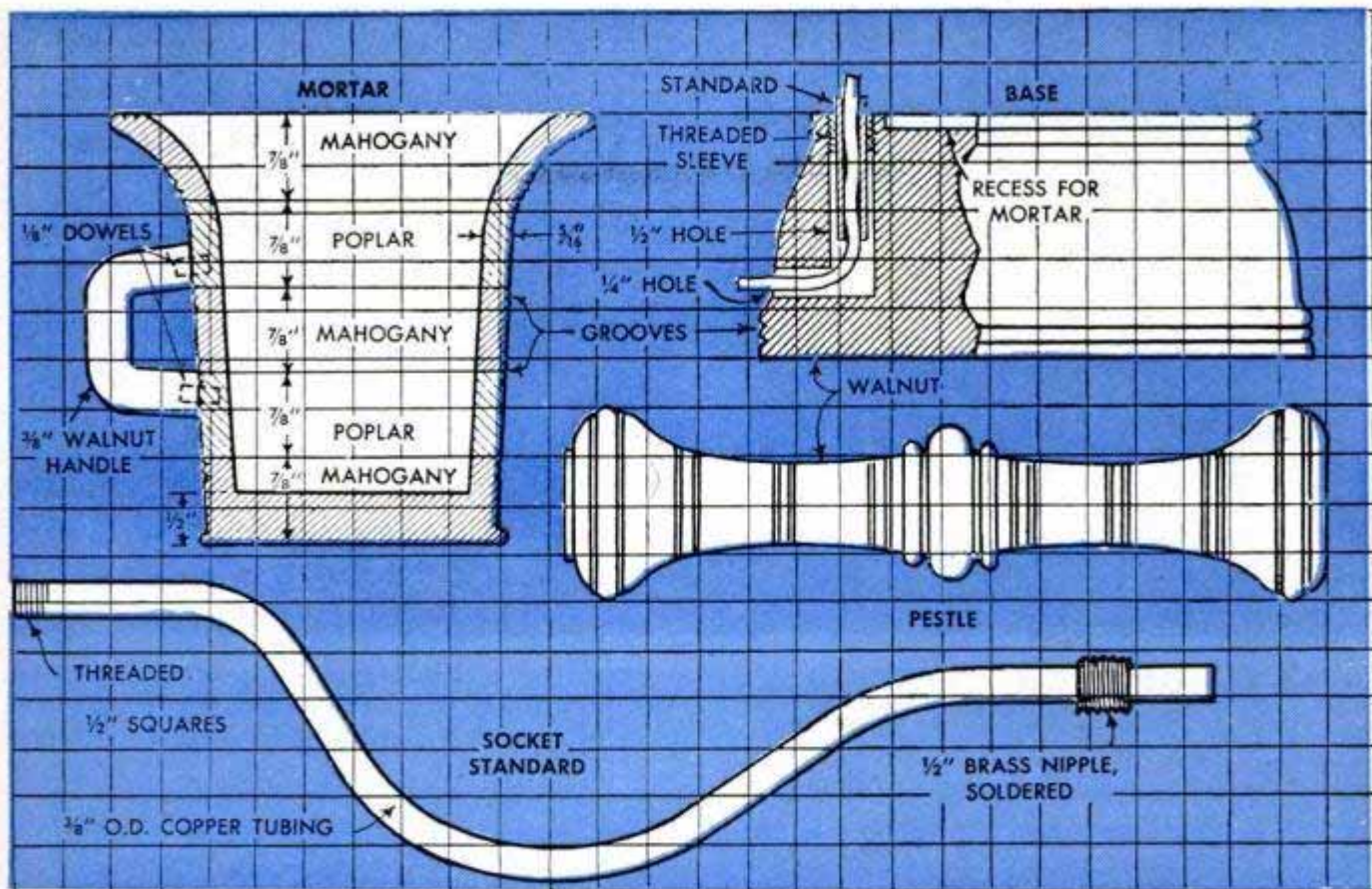
MORTAR-AND-PESTLE LAMP

The base, pestle and the mortar handles are of walnut while the mortar itself is built up of alternating rings of mahogany and poplar. If desired, another light-colored wood may be substituted for poplar. To turn the mortar, three roughly shaped rings of $\frac{7}{8}$ -in. stock are glued together with solid



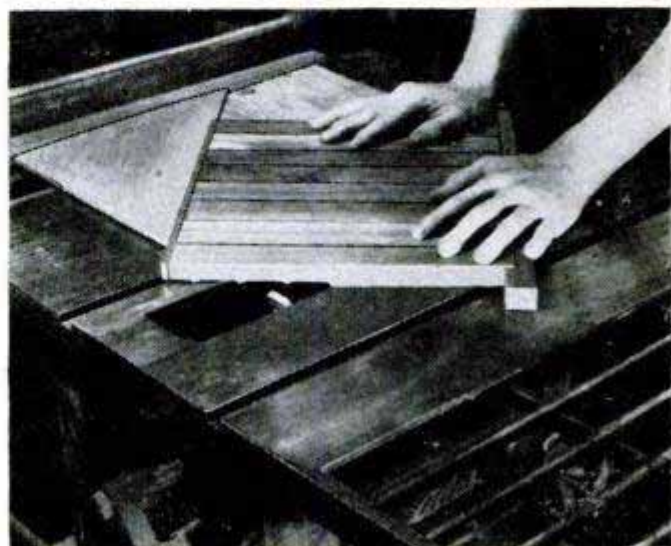
Embossed Magazine Rack





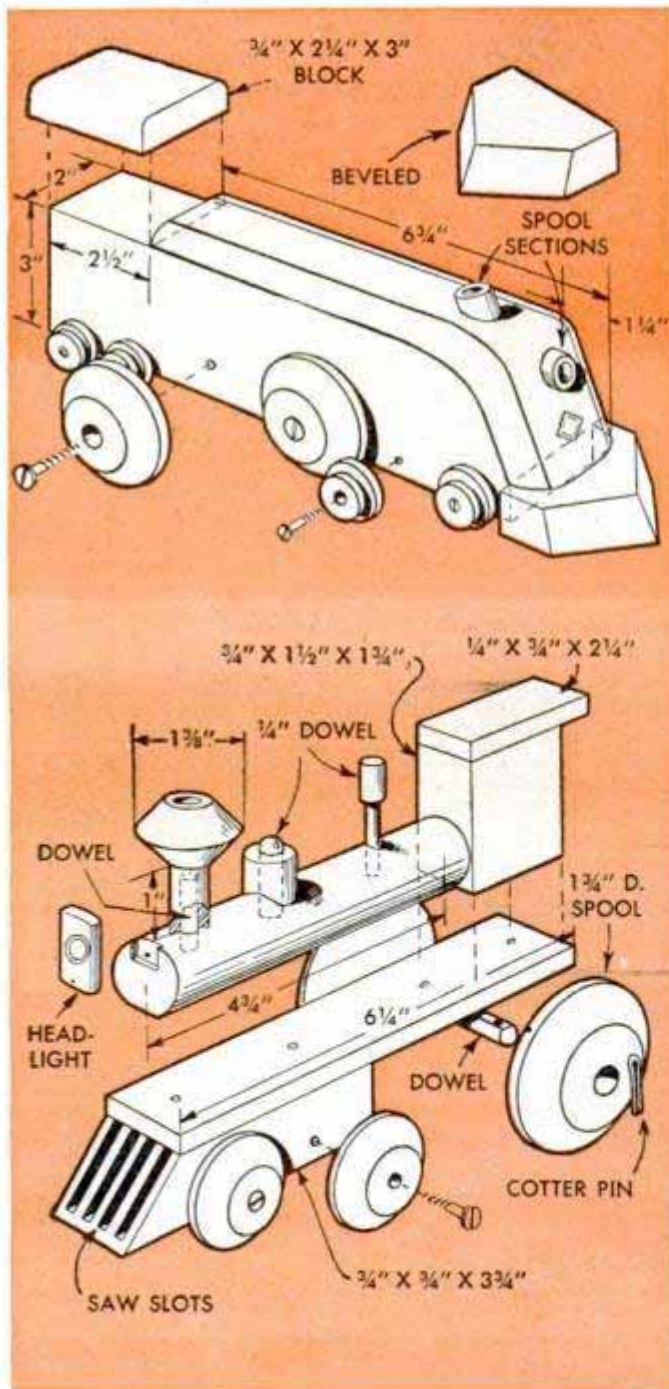
The photo at the left shows the numbered side segments being placed together in their proper order to form one side of the rack. These segments have been removed from both side-beading assemblies, detail above. It is important that the beading be done with extreme care in order to assure that the beads will match and achieve herringbone pattern pictured

Beading operation, with cutter mounted on saw arbor, is pictured at the right. The segments are clamped together by inserting one edge of the assembly in a notched cleat, shown directly under the operator's left hand, and tacking a strip of wood along the other edge. Notched cleat also is tacked in place, all tack holes being filled before finishing rack





Toy Locomotives



disks of the same thickness being glued to both ends. Note in the detail how the mahogany and poplar are alternated. The bottom disk may be screwed directly to the lathe faceplate, or it may be glued to a piece of waste stock. In the latter case, paper is sandwiched between the two pieces to facilitate separation, and the waste stock is screwed to the faceplate. For turning the outside contours, it is best to run up the tailstock center to help support the work. The handles, which are cut from $\frac{3}{8}$ -in. walnut, are doweled and glued to the sides of the mortar, while a solid walnut turning forms the base.

EMBOSSED MAGAZINE RACK

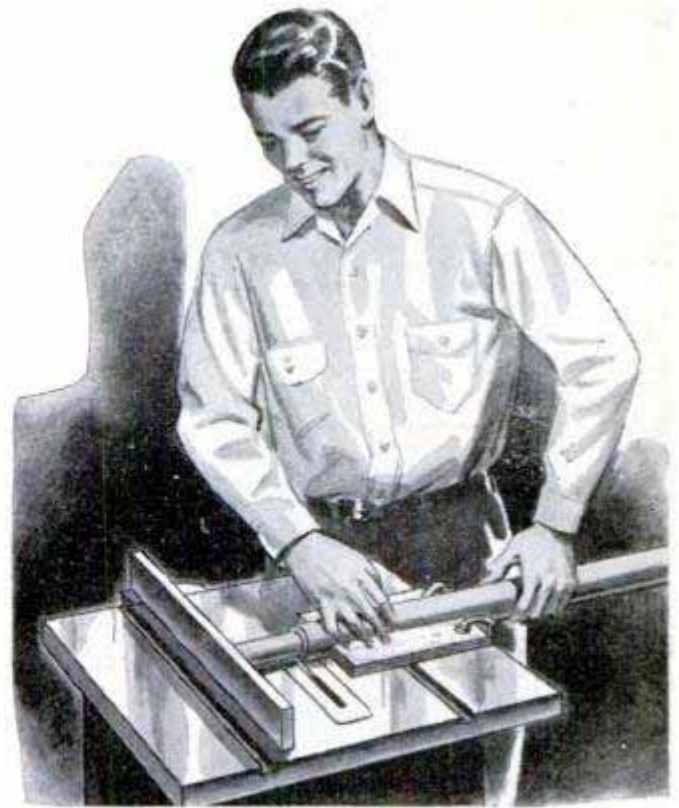
The embossed herringbone design of this modern magazine rack is achieved by using a homemade cutting tool along with a novel method of cutting and interchanging the side segments. Each side of the rack requires eight pieces of walnut or other hardwood, tongue and grooved. The pieces are matched as closely as possible for regularity of grain and placed together temporarily to form two side assemblies. Now, each piece is numbered consecutively so that it can be returned to its corresponding position after beading. In order to retain the matching grain selected for each side, it is necessary to shuffle the pieces and make up two beading assemblies so that when the pieces are reassembled in consecutive order, the grain will match and the beading will form the herringbone pattern. The beading is done on the circular saw with a special cutter and a guide, one side assembly being beaded on a diagonal opposite to that on the other. A $1\frac{3}{16}$ -in.-wide spacer strip is used to reset the saw fence after each bead is cut. With each pass of the work, the guide is left undisturbed on the saw table and the fence is backed away to permit inserting the spacer strip between the guide and fence. Thus, when the fence is brought up against the spacer strip and the latter removed, the fence will be in position to receive the guide for the next cut. After beading, the segments are returned to their original positions in the two side assemblies and finally glued together. The completed sides are grooved on the inner faces for the bottom of the rack.

TOY LOCOMOTIVES

Made of scrap stock and portions cut from thread spools, either of these locomotives is quickly assembled. The streamliner is simply a wooden block cut to shape and fitted with a cab roof and cowcatcher. The drive wheels are flanges cut from large spools of the kind used for shoemaker's thread and the trucks are cut from ordinary household-thread spools. The boiler of the old-time locomotive is made of broomstick.

Tenons Turned on Hardwood-Dowel Ends by Use of Circular Saw

Should it be necessary to form a tenon on the end of a large dowel, or other round piece of work, and there is no suitable tool at hand to do the job, a circular saw can be used as indicated. First, set the rip fence of the saw a distance from the blade equal to the desired length of the tenon, then clamp two wooden strips to the saw table to help hold the work in position. In use, place the work between the strips directly over the saw, which has been set about $\frac{1}{8}$ in. or less above the table surface. Then, very carefully rotate the work over the saw and, at the same time, move it back and forth horizontally across the saw. When all the stock has been removed to this depth, again raise the saw slightly and repeat the operation. Do this until the end of the work has been turned down to the desired size.



Improvised Wheel Flanges

Special wheel flanges for homemade grinders, circular saws and jackshafts are made easily by welding a hex nut to a large washer.



After the two parts are welded together, the threads are reamed out in order to straighten the hole through the welded parts and bring it to the required diameter. When necessary to attach

the flange to shafting, drill a hole through one of the flats on the hex nut and tap it for a small sockethead setscrew.

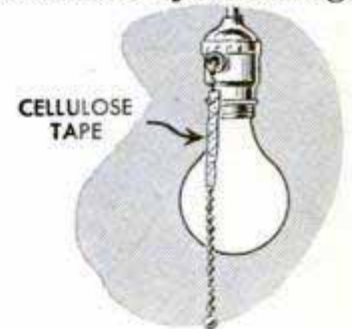
Evan Wright, Topeka, Kans.

Tangleproofing Pull Chain

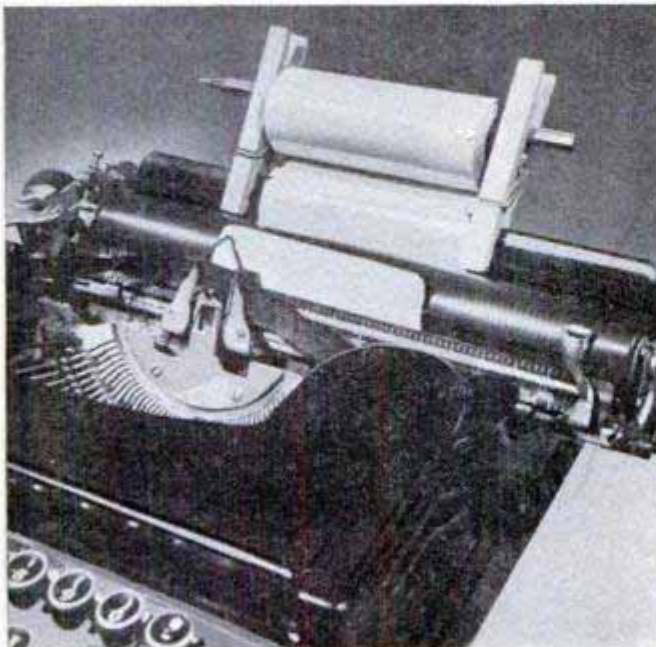
The tendency of the chain on a drop cord or ceiling fixture to snap back and tangle when pulled can be overcome by stiffening the chain with a strip of cellulose tape.

Merely wrap the tape around a short section of the chain near the switch opening as in the drawing.—

G. E. Hendrickson, Argyle, Wis.



Clothespins and Pencil Hold Paper-Label Roll to Typewriter Carriage



When typing labels which are fed into the machine from a long roll, the problem of supporting the roll on the typewriter can be solved with a pencil and two spring-type clothespins. Clip the clothespins to the typewriter, as pictured, spacing them so that the roll will fit between them. Then run the pencil through the center of the roll and wedge the ends of the pencil between the arms of the clothespins.

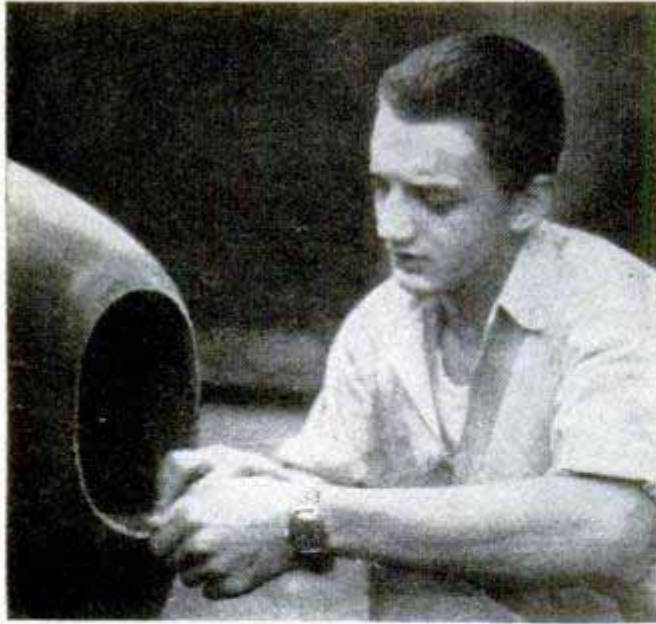
Louis Hochman, Sherman Oaks, Calif.

Cellulose Tape "Cleans" Envelope

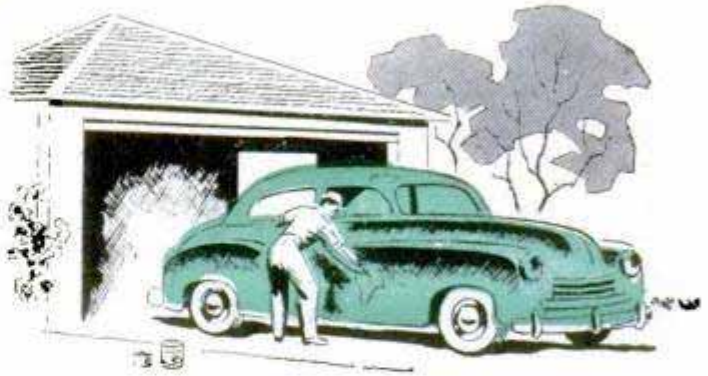
If you want to reuse a heavy Manila envelope, the stamps and any printing can be removed with cellulose tape. Completely cover the portions to be cleaned with the tape, and then simply pull the tape loose.

Andrew Vena, Philadelphia, Pa.

PRESERVING THE CAR BODY



Headlights are removed and rusted portions of fender sanded down to bare metal before applying primer



WHETHER you're a top-notch amateur mechanic or the fellow who doesn't know a differential from a wrist pin—and doesn't care—you can keep up the appearance and, in turn, the resale value of your car simply by protecting the body from rust. This may be done in two ways. The first, and preferable, way is to prevent rust by careful attention to the body and to control rust once it starts. The second way is to repair the damage after rust holes have actually appeared. Undercoating the car affords excellent basic protection from rust, and the undercoater can be applied with a brush. Even though you may not wish to do a complete job of undercoating, it is well worthwhile to coat at least the underside of the fender joints and also the areas where impact from road gravel is greatest.

If rust blisters appear in the enamel around the headlights, it is not sufficient to scrape off the blisters and touch up the exposed areas. The damage usually extends under the headlight rim. With the headlight removed, all traces of rust should be sanded from the body, and the bare metal coated with a primer especially made for this purpose. After the primer dries, it is sanded lightly, painted with a matching car finish and then "blended" with rubbing compound.

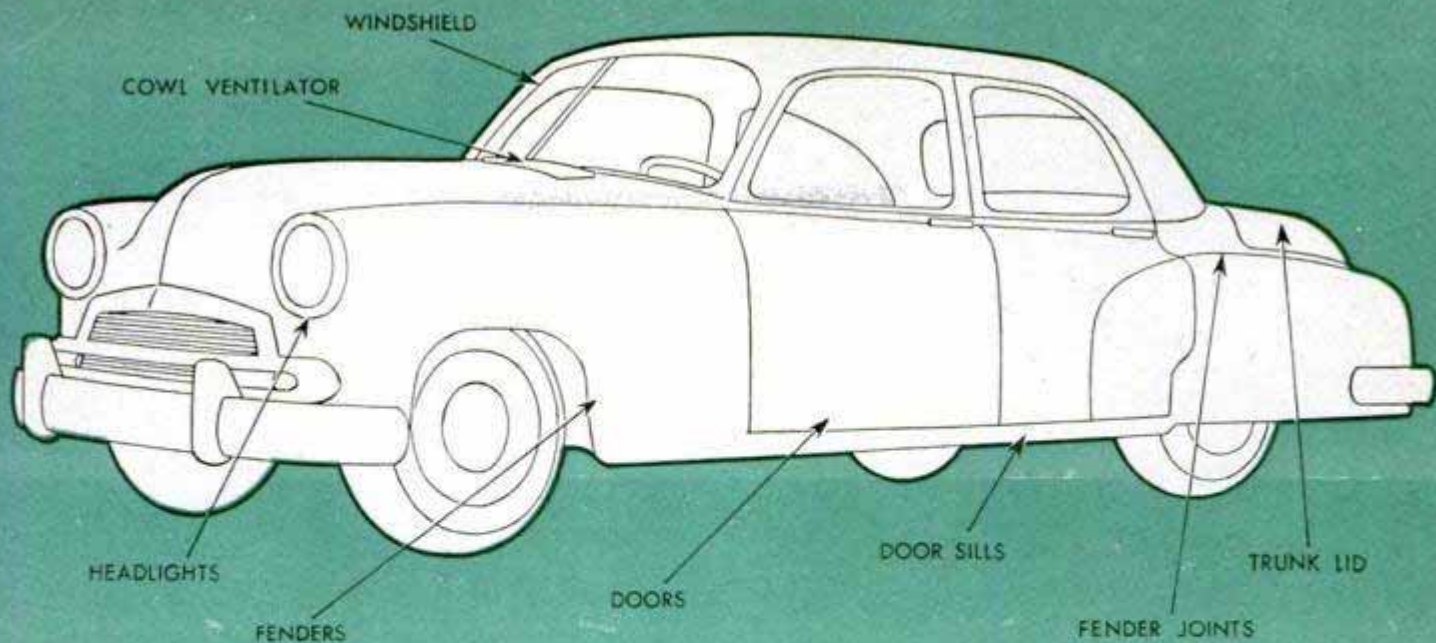
To prevent rusting of the steel car floor and also the edges around the base of the body, the rubber mat on the floor of the front-seat compartments must be kept in good condition. The mat can be repaired easily by applying patches of mat material with rubber cement. After the patch is cut to shape, it is positioned on the worn mat and outlined with a pencil or chalk. The area of the mat within the outline is cleaned with a wire brush and white gasoline, and after it has dried, both this surface and the back of the patch are covered with a thin, uniform coat of rubber cement. When the cement dries, press the patch to the mat.



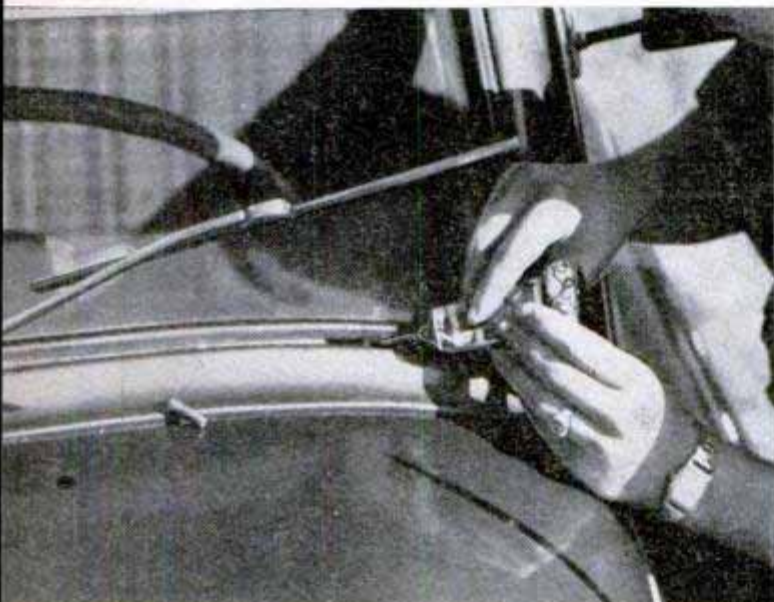
Worn floor mats can be repaired by applying patches of mat material, with rubber cement used as adhesive



Here, sheet-metal patch is welded to car body where metal was broken through by rust and flying gravel



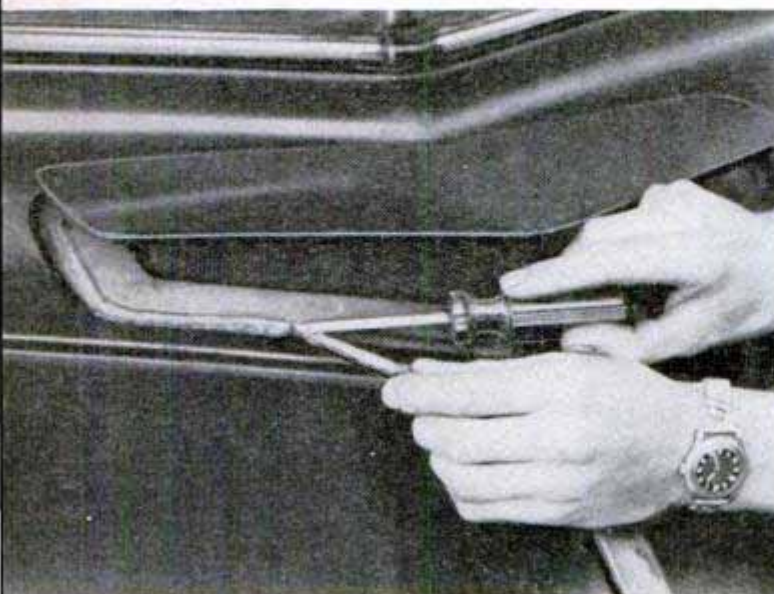
Areas indicated by the arrows in the drawing above are the spots you should watch most carefully for signs of rusting. Metal parts exposed to salt corrosion and pounding by road gravel are especially susceptible



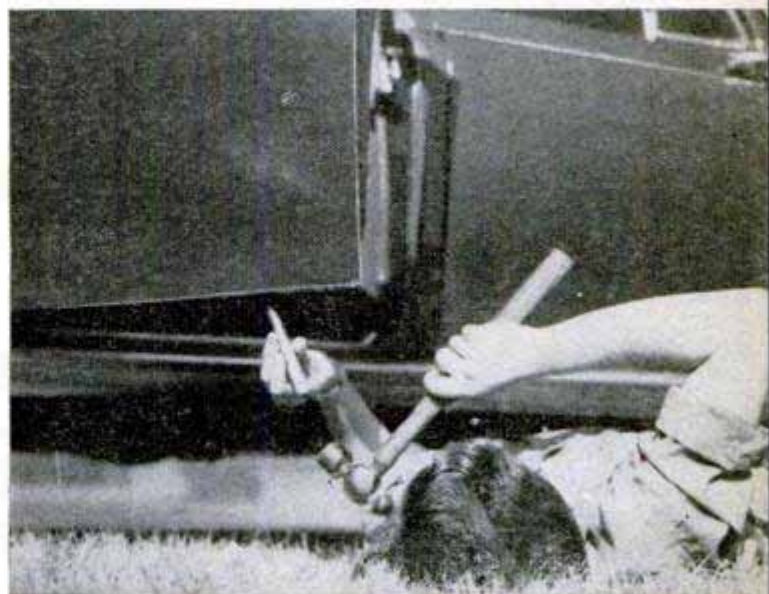
Sealing compound packed in tube is easily applied to the joint between windshield glass and molding



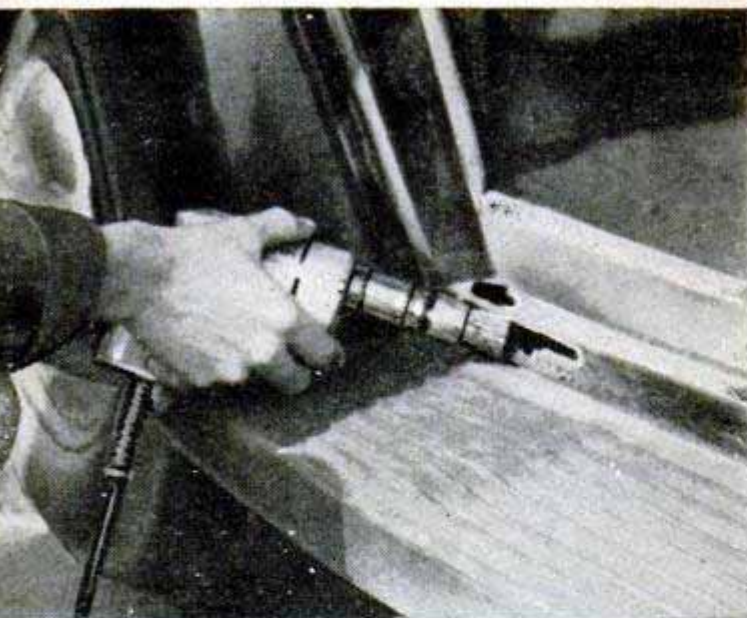
Deteriorated weather stripping on doors can be replaced with sponge rubber to assure a tight seal



Old gasket is removed from cowl ventilator and new gasket or sponge-rubber strip is cemented in place



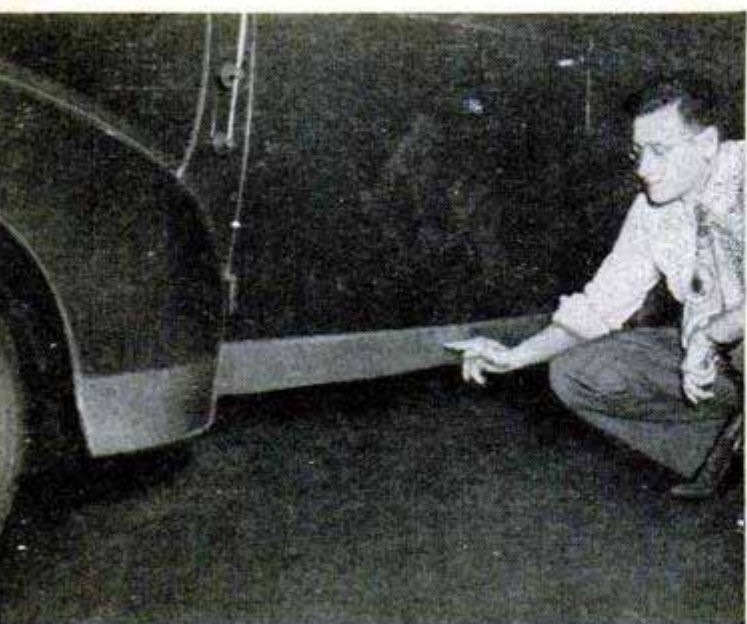
If drain holes are not provided in underside of car door, these can be made by means of a sharp punch



Using portable electric drill to drive wire brush speeds cleaning rusted areas before applying patch



Door-sill patch, which has been bent to shape, is fastened to the car body with self-tapping screws



Where lower edges of fenders and body are extensively damaged by rust, full-length patch can be used

Sealing any windshield leaks between the glass and the molding provides further protection from rust and also helps to keep the body watertight. Cement for this purpose can be obtained in tubes and is simply applied under the edge of the molding, if the latter is metal, or along the joint formed by the glass and a rubber molding. If there is still evidence of leakage, check the fit of the windshield-wiper shafts in their bushings and lubricate them if necessary.

To control rust at the cowl-ventilator drains, check them periodically for clogging and, if required, blow out the drain tube with compressed air. Also, replace a worn ventilator gasket with a new one or cement sponge rubber around the opening.

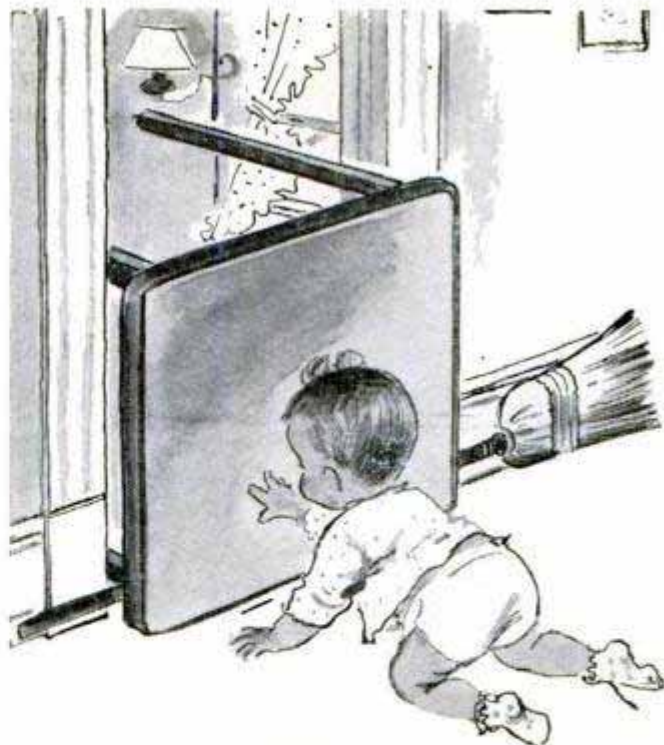
In addition to keeping the car snug and quiet, weather stripping on the doors prevents water, which enters at the top, from rusting out the door sills. The weather stripping should be replaced when it apparently is no longer serving its purpose. Drain-hole plugs that have not been removed from the underside of the door should be pried loose. If the door is not fitted with drains, punch two or three holes in the bottom edge of the door. Use a sharp punch and work it around the edge of the hole to draw the metal downward, as any edges projecting upward will not permit the water to drain out. Coat the edges of the holes with red lead, working it well up onto the inside surfaces.

Car-door sills which have rusted through can be patched easily. First, the metal around the break is cleaned thoroughly with a wire brush, or with emery cloth and steel wool. Then a cardboard pattern for the sheet-metal patch is made, and this is transferred to a sheet of body steel. The metal can be clamped between strips of hardwood and bent to shape with a mallet. The surface of the car body to be covered and the inside surface of the patch are coated with red lead, and the metal is fastened to the body with self-tapping sheet-metal screws.

Lower portions of the fenders and body can be patched in a similar manner. Note the full-length aluminum repair strip applied to the car in the lower left-hand photo. All rust must be removed and any bent portions of the body straightened. Then strips of sheet metal are cut to approximate length, fitted in position and shaped with a mallet. All mating surfaces are coated with red lead and the strips are attached to the body permanently with sheet-metal screws. A neater job can be had by soldering the repair strips in place, provided that aluminum or stainless steel is not used. If solder is used, the edges of the strips are dinged with a sheet-metal-worker's hammer and the joints filled with body metal or solder. Then joints are filed smooth before priming and painting.

Card Table in Open Doorway Serves as Baby Gate

When it is desired to keep a small child from going through a doorway where the door cannot be closed, open up a card table and insert it in the doorway as indicated. The handle of a broom run between the table top and the door casing will prevent the table from being pushed through the doorway. This idea is exceptionally useful where only a temporary means of keeping the baby in one room is desired. An improvised baby gate is also helpful in homes where space heaters are used and doors are left open to allow circulation of heat.



Tape-and-Clothespin Photo Easel



A suitable easel for holding photos or show cards, which are not more than 12 in. high, can be made from a piece of tape and a spring-type clothespin. Merely apply the tape to the back of the piece to be

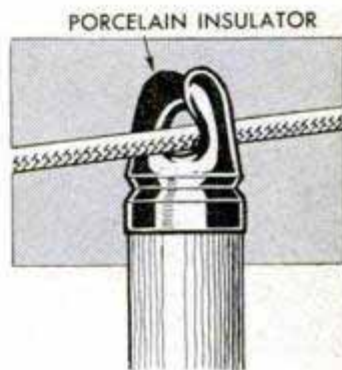
held, leaving a fold in the middle as shown in the illustration. Then clamp the clothespin to the fold at the necessary angle.

Armored Cable Opens Drains

For freeing clogged runs of soil pipe, a length of electrical armored cable sometimes can be used as a plumber's drain auger. This is possible, however, only where no sharp bends are encountered. To aid in twisting the cable inside the pipe, a 3 or 4-ft. length of rod can be inserted in the cable and bent to form a crank.—Edward M. Dewan, South Amboy, N. J.

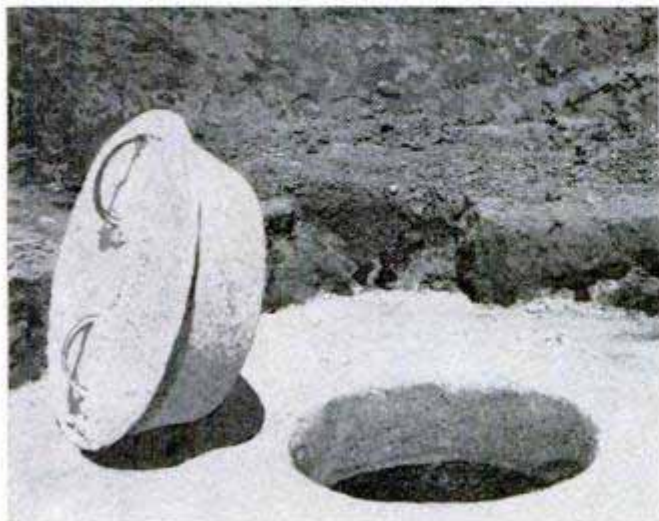
Insulator on Clothesline Prop Prevents Rust Soilage

An ordinary porcelain wire insulator, screwed to the end of a clothesline prop, serves as an excellent running eye for holding the clothesline to the pole. The porcelain surface of the insulator minimizes wear and will not rust, as metal running eyes sometimes do. Thus, the danger of soiling the clothesline in such a manner is avoided. The line is easily slipped into the opening of the insulator and is held sufficiently secure to keep the prop from falling off.



William B. Eagan, Louisville, Ky.

Dishpan Provides Effective Mold When Making Concrete Cover for Cistern



If you want to make a manhole cover for a concrete platform over a cistern, cesspool or septic tank, use an old dishpan of the type that has conical-shaped sides. Oil the inner surface of the pan and fill with concrete. Insert bent rods in the wet concrete to provide handles. The concrete can be removed from the pan as soon as it has set sufficiently to hold its shape. In making a cover of this type, the same pan is used to form the manhole when pouring the concrete platform.

Keith Heryford, Cedarville, Calif.

Wax-covered nut cups are useful for mixing small amounts of water-color paint.

C-Clamp Provides Camera Mount



A C-clamp fitted with two bolts forms an inexpensive "tripod" that can be mounted on a table top or the back of a chair. With a standard tripod head turned on either of the bolts, the clamp will hold the camera steady for portraits, time exposures and copy work, and is small enough so that it can be carried conveniently in the coat pocket. After the heads have been cut from two 1/4-20 bolts, the threaded portions are brazed in notches cut in the C-clamp. Note that the bolts are located to hold the tripod head upright whether the clamp is mounted vertically or horizontally. Outlet-box slugs are brazed to the jaws of the clamp and felt is cemented over the slugs to protect the finish of the furniture.

Wm. H. Lowry, Toronto, Ont., Can.

Tilting Easel for Close-Up Shots Formed From Bowling Ball



Using half of a bowling ball as a stage for table-top photography of jewelry and other small objects provides an inexpensive platform that can be tilted to support the subject steadily in almost any desired

position. A damaged bowling ball, which usually can be obtained from the local bowling alley, is sawed in two, black velvet is glued over the flat face of one of the halves, and this half is then set on the rim of a can. Although a 35-mm. movie-film container was used to support the ball as pictured, a coffee can will serve the pur-

pose. If the can should be too deep for your particular setup, cut off the side all the way around and bend over the sharp edge to afford a smooth bearing surface for the bowling ball. The stage tilts on the ball-and-socket principle, the weight of the ball holding it in position.

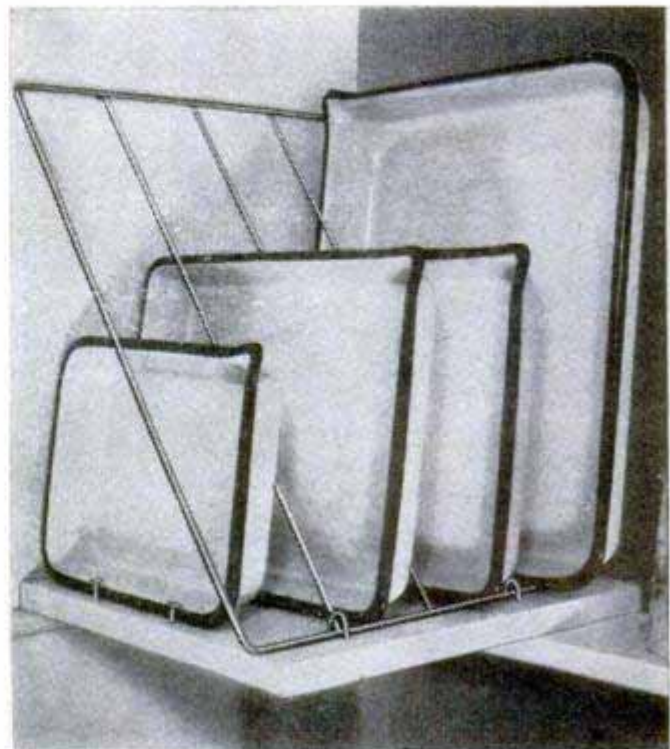
Nelson Edwards, Baltimore, Md.

Storing Battery Case

In storing a flash-gun battery case which has a cord plugged into a series outlet, be sure that the free end of the cord does not touch metal. If it should, the battery will run down and possibly corrode in the case. The safest precaution is to disconnect the cord from the case and wrap it around the case before storing.

Wire Rack Stores Photo Trays

When trying to find a place in his darkroom where photo trays could be stored out of the way and yet be conveniently at hand, one photographer hit upon the idea of using a wire dish-towel rack to hold the trays on edge. First, he screwed a board the same length as the rack to the top of a shelf in one corner of the darkroom. Then he set the wire rack against the wall, with one end resting on the board, and stapled the wire to the board to keep it from slipping. Galvanized nails driven into the board hold the trays in the rack. This also can be accomplished by nailing wooden cleats to the board to form individual channels for the trays. A hook, which was originally fastened to one side of the rack, was cut off so that it did not interfere with mounting the rack against the walls.



Studio CAMERA STAND

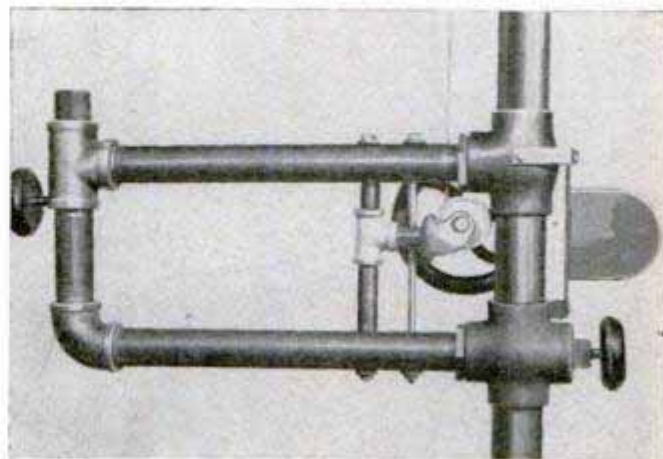
By Richard C. Collins, Jr.

BUILT mainly of pipe and fittings, this studio camera stand provides everything you need for studio work with a view camera. It adjusts from the floor to step-ladder height, and the tilting top will swing the camera through an arc of more than 100 deg. Casters permit the stand to be rolled from one location to another, and when in place the casters are retracted by kick levers, allowing the unit to stand firmly on a three-point support.

In order to support the high column and overhanging arm, the base, or spider, must be of extra-strong construction. Although in the details the hub, or web, of the spider is specified as being a 10-in. hardwood disk, it is better to use $\frac{3}{8}$ -in. flat steel. Three radial arms, spaced 120 deg. apart, are built up by bolting steel channels to a length of hardwood as in one of the sectional details. They are attached to the bottom of the metal disk with two round-headed machine screws in each arm. The threaded ends of the screws are cut off and filed or ground flush with the top face of the disk. Next, a $1\frac{1}{4}$ -in. floor flange is centered on top of the metal disk and holes are center-punched and drilled for machine screws, using the flange as a drilling jig. Before attaching the flange, the top is filed flat and square across to provide a seat for the slip ring, or eccentric. The ring is center-bored to fit over a $1\frac{1}{4}$ -in. short pipe nipple screwed into the flange. This ring forms the eccentric of the caster-retracting mechanism. The swiveling casters must be of the ball-bearing, plate type so that L-brackets, or bell cranks, cut from $\frac{1}{4}$ -in. flat steel can be welded to the plates as in the lower details. The top ends of the brackets pivot on a bolt which passes through a hole drilled near the end of each of the three arms of the base. Now, it will be noted from the extreme upper right-hand details that the caster-retracting assembly consists of the slip ring and six equally spaced members, three of which are $6\frac{1}{2}$ in. long with one end turned to form an eye as in the upper right-hand detail. These parts form the kick levers. The other three are short lugs bolted to the



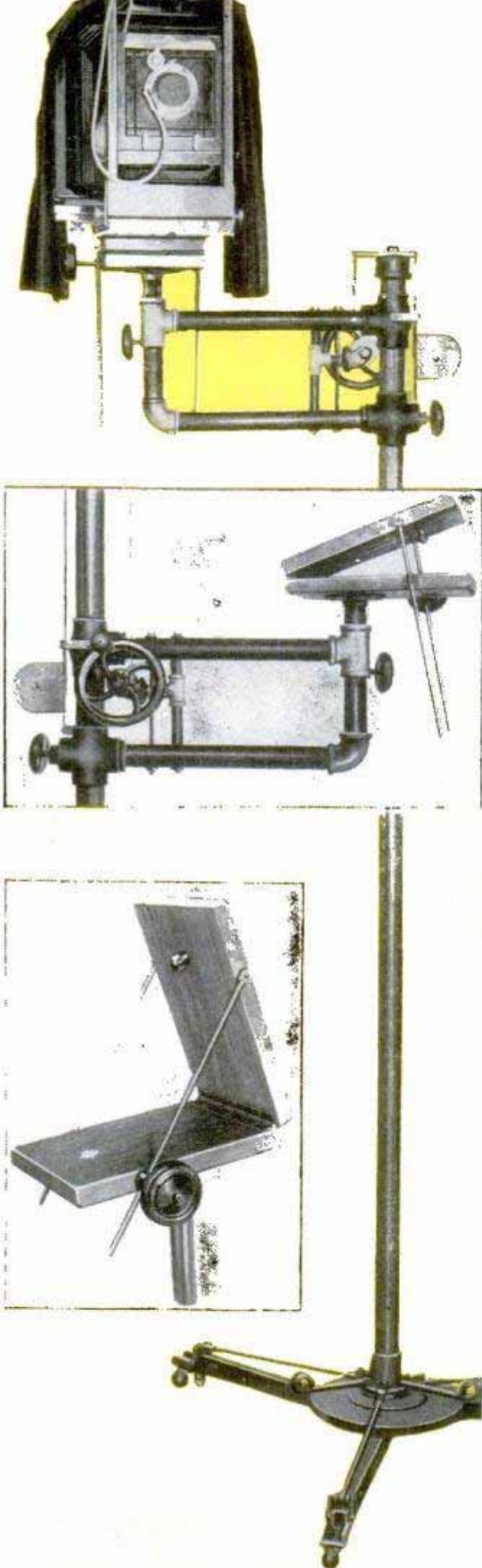
Both high and low camera angles are easily worked out by adjusting this studio-type camera stand



Weight of the camera and sliding arm are counterbalanced by spring sash balance on sliding members

ring and have a hole drilled near the outer end of each. They are located on the ring on a 120-deg. spacing as indicated. In the top view of the base, center right-hand detail, you can see how the lugs are connected to the caster brackets by means of $\frac{1}{4}$ -in. rods. Each rod is threaded at both ends and fitted with tapped connectors held in place with jam nuts. The inner ends of the rods are attached to the slip-ring lugs with bolts, while the outer ends are fastened to the caster brackets with removable pins and spacers held in place by small cotter pins. In service the slip ring becomes an eccentric and by moving the kick levers to right or left, the casters are raised or lowered. When in the lowered position, one of the lugs bears against a stop rod, or pin, as in the detail. The stationary feet are turned down, with one rounded end, from $\frac{3}{4}$ -in. steel shafting and are drilled and tapped for machine screws which pass through holes drilled through the radial arms. Note that the feet clear the floor by $\frac{1}{4}$ in. when the casters are raised.

The length of $1\frac{1}{4}$ -in. pipe that forms the column screws into a pipe coupling which is turned onto the short nipple above the slip ring. It's a good idea to file or grind the lower end of the coupling square to form a seat for the upper face of the ring. The camera-support arm is carried on two fittings of the type supplied for pipe railings. The upper one is a tee, the lower one a cross fitting provided with a $1\frac{1}{4}$ -in. pipe plug drilled and tapped to take a locking hand-wheel. The threads are reamed from the fittings and the pipe column is smoothed with emery cloth so that the parts will slide easily. The construction of the camera arm is simple, but there is one thing to keep in mind when assembling parts of pipe and fittings: Dimensions can never be precise due to the allowable variations in pipe sizes and also to the variations which may be caused by differences in tension on the threaded joints when tightening with a wrench. When assembling, try to draw all pipe joints to as nearly a uniform tension as possible. Even then there will be slight variations in the length dimensions. Before assembling the arm, note the pipe spacer and guide rod between the horizontal members and also the construction of the base for the sash balance which spans the sliding tee and cross. These parts are shown more clearly in the enlarged view of this part of the arm assembly. The pulley, or sheave, on which the lifting cable is wound, is supported in a caster yoke. A short pipe nipple is welded to the top of the yoke and the nipple is drilled through at the center for the guide rod. The cable sheave is pinned, or welded, to a shaft which projects far enough beyond the yoke on one side to per-





Milk Cartons Used in Darkroom To Store Photo Solutions

Milk cartons in either the quart or half-gallon size provide a good substitute for regular amber-glass bottles when storing prepared photo solutions. The cartons are easily capped, permit pouring the solutions with a minimum of dripping, and may be discarded after the contents are used. Because of their rectangular shape, the cartons take up comparatively little space on the darkroom shelf. The cartons should be washed out thoroughly before use and then labeled to identify the contents.

Safety Chain for Cable Release

To be sure that a cable release does not work loose from a camera and become lost, anchor it to the camera with a short length of lightweight chain. Wire one end of the chain to the cable and wire or clip the other end to a camera-strap, machine screw, or bracket, being sure that the chain will not slip in front of the lens. A spring clip for attaching the chain can be made from a large safety pin. The head is cut from the pin and the wire beneath the head is bent to form a small hook. Then the point is cut off so that this arm will be just long enough to engage the hook.



Frank T. Sokolik, Chicago.

Ice Dulls Unwanted Reflections

In photographing a vase of cut flowers, it is sometimes desirable to subdue overly brilliant reflections. An effective way to do this is to add a few ice cubes to the water in the vase. The reduction of the temperature in the vase will cause a fine dew to collect, dimming the surface reflections.

Popular Mechanics Book Shop

Money-Making Hobbies

Why not make your hobby serve a dual purpose—produce a profit as well as recreation. It also can serve as a means of getting extra cash to add equipment for extending your activities. This unusual book has hundreds of articles on arts and crafts which will help get your hobby started. It contains 160 pages of projects for the beginner as well as the advanced craftsman. Send \$2.00 for the book and get your hobby on a paying basis.

How to Tempt a Fish

It matters not whether you fish regularly, or take only one or two trips a year, this book will more than pay for itself on the first trip. There'll be no more stories that "the big one got away." There is a load of information on fly casting, bait casting and salt-water fishing as well as hundreds of hints on how to make and repair casting rods, how to make line driers and how to waterproof line. There are also instructions in how to retrieve plugs and lures as well as many more suggestions, including information on how to mount fish

or keep them fresh and how to transport live bait. A remittance of \$2.00 will bring the book to your home.

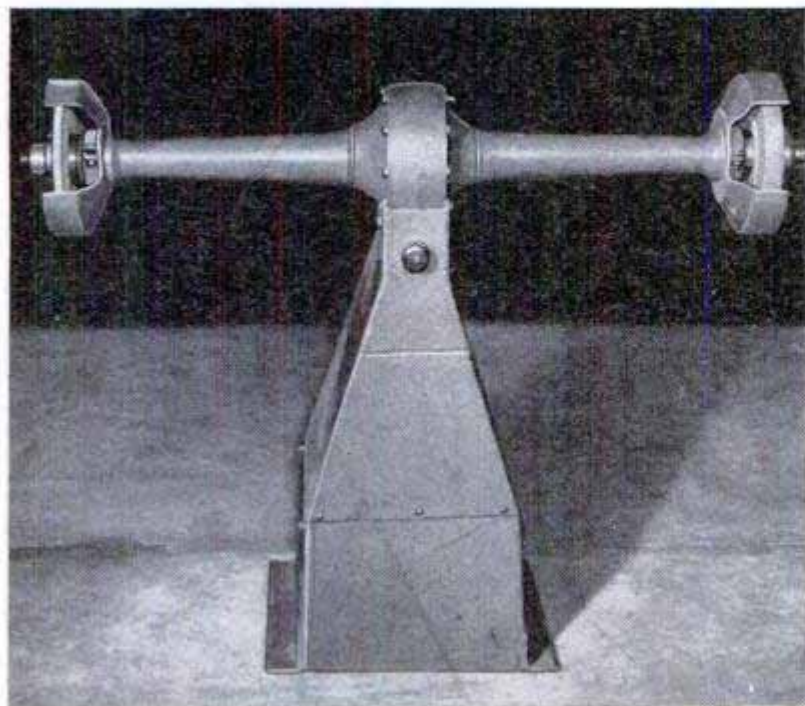
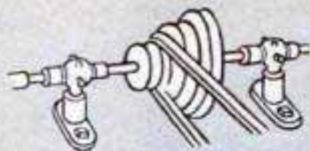
Outdoor Sports Manual

Here is a gold mine of helpful hints for hunters, fishermen, trappers, campers, archers, and boatmen. There are articles on sports equipment and hunting gear, as well as hints on fishing, hunting and other outdoor activities. Also included are projects you can make, such as boats, to aid in your sport interest. The book is a must for anyone interested in sports of any kind. Price \$2.00.

Kitchen Remodeling Plans

Are you planning to modernize or completely remodel your kitchen? *Popular Mechanics* plans will save you many dollars and show you how to do the job. Eight large plans show you layouts for various sizes and shapes of kitchens. There is also information on how to build cabinets, snack bars, shelves, stools, sink cabinets and other articles found in a modern kitchen. Entire set of eight 17x22-in. sheets, \$5.00.

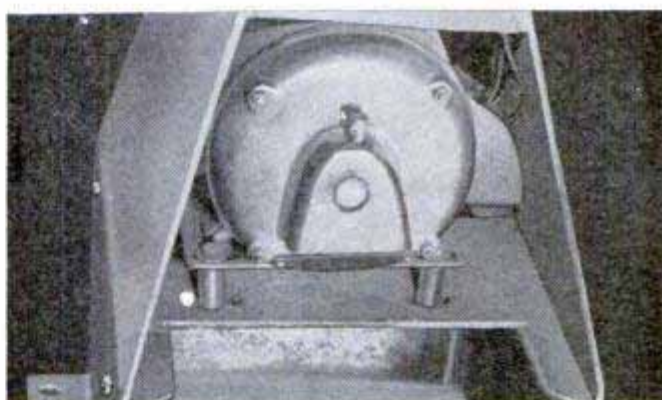
All books available from Popular Mechanics Book Dept., 200 East Ontario Street, Chicago 11



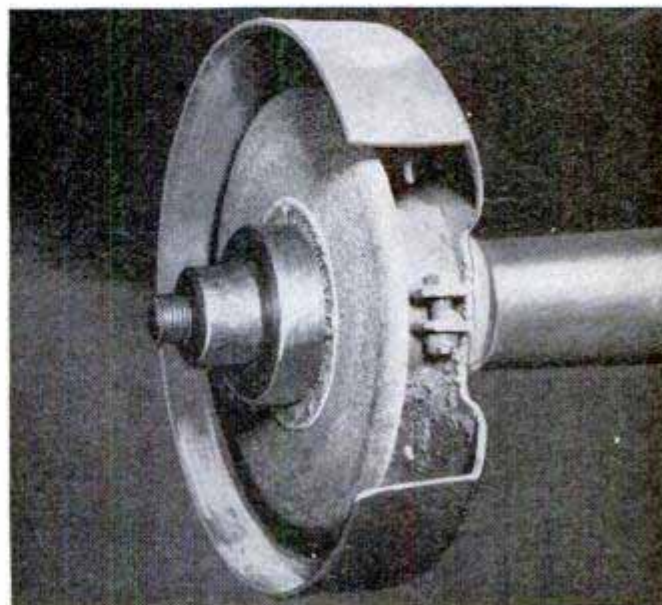
Heavy-Duty GRINDER

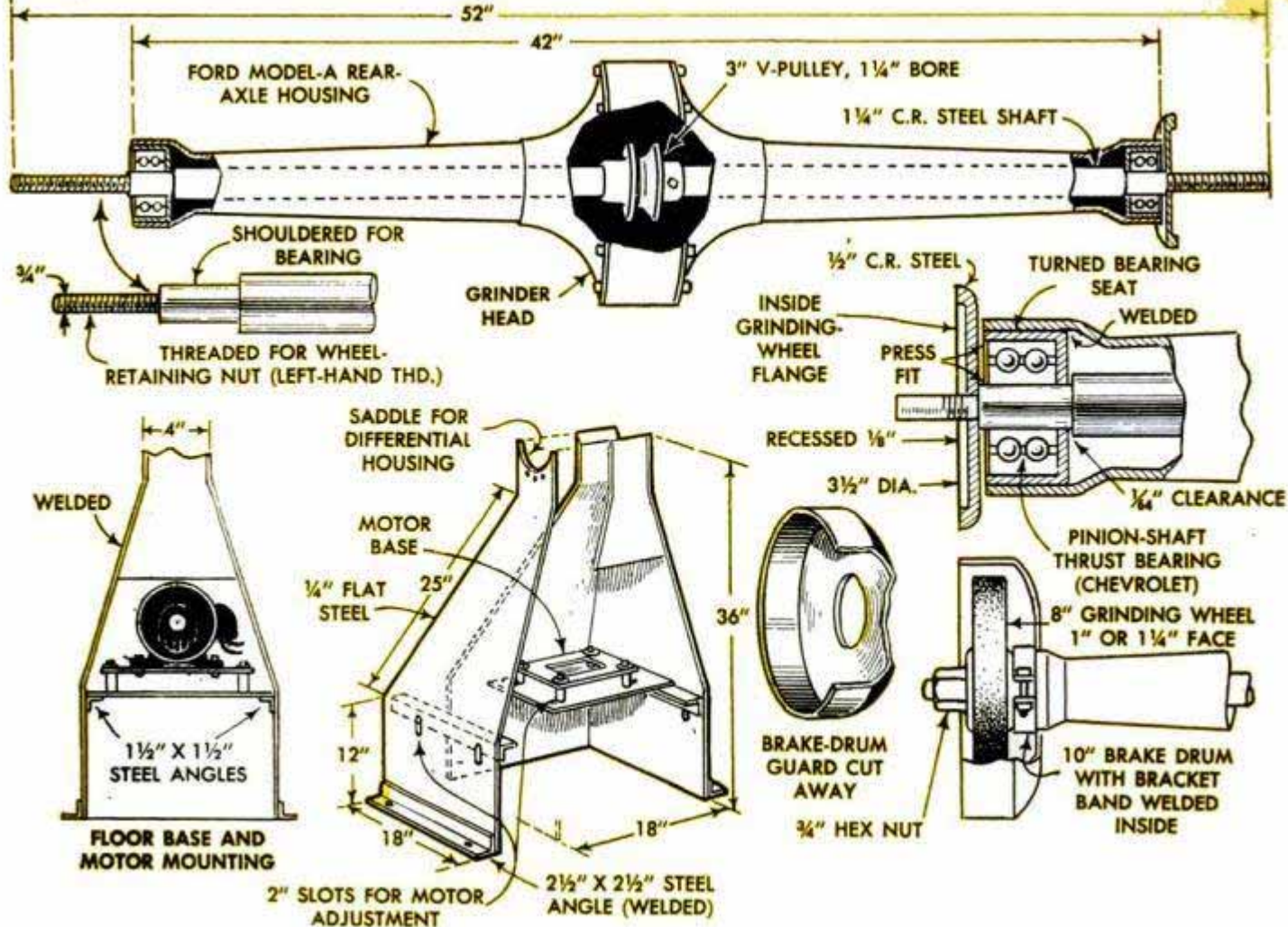
By L. H. Houck

ALTHOUGH this grinder was built and proved in a farm workshop, it has a much wider application due to the exceptionally long shaft housings which permit heavy grinding and polishing operations on a variety of large work. Plating shops will find it particularly useful for polishing plated work where large cloth buffs are used. In the farm shop it handles any grinding job that can be done on an 8-in. wheel. As you will see from the photo above, the machine is floor-mounted on a heavy pedestal made from welded steel plates. The motor is housed within the pedestal and drives with a half-crossed V-belt as in the center photo at the right. The grinding spindle is mounted in a Ford model-A rear-axle housing and runs on ball bearings. It is 52 in. long, double shouldered at each end from 1¼-in. diameter to ¾ in. in diameter in two steps. The intermediate step at each end of the spindle is ground to a press fit in a pinion thrust bearing taken from a Chevrolet rear axle. The small ends of the spindle are threaded right and left hand for the grinding-wheel flanges and retaining nuts. Flanges are machined from ¾ or ½-in. flat steel. One corner is broken (rounded over),



Above, motor is mounted inside pedestal on adjustable base and drives with half-crossed V-belt. Below, wheel guards are made from discarded brake drums fitted with bolt brackets which clamp to housing





As detailed above, grinder pedestal is made from $\frac{1}{4}$ -in. steel plates cut and welded to form a tapering column. Long spindle makes this unit especially useful for grinding and buffing operations on large, irregular work

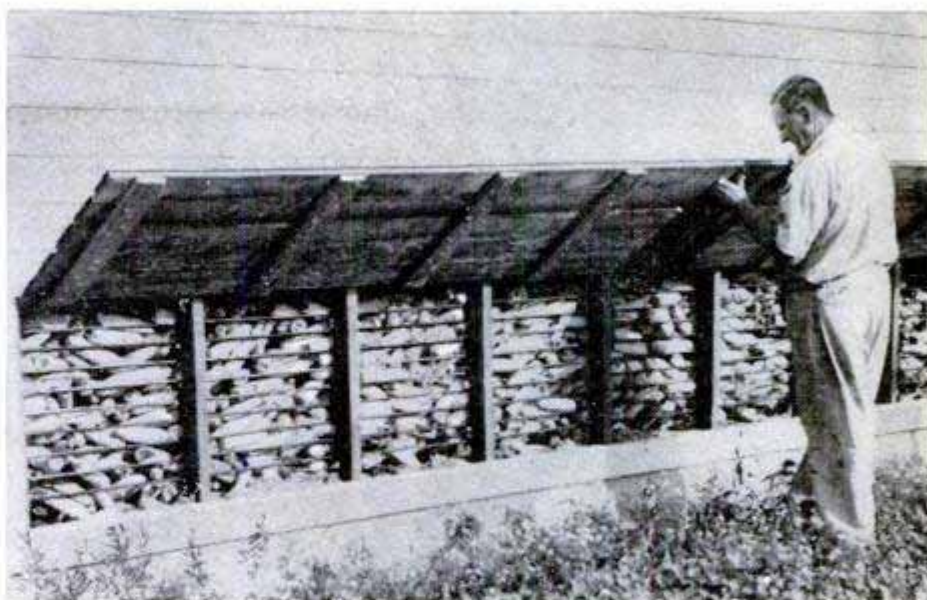
and the inner face of each flange is recessed $\frac{1}{8}$ in. as shown in the sectional drawing above at the right.

When assembling, place both the V-pulley and belt on the shaft as it is inserted in the housing. After the shaft has been positioned and the bearings have been pressed in place, the pulley can be properly located on the shaft and the setscrew tightened by reaching in through the drive-shaft opening. Only general dimensions are given on the pedestal-type base in the detail above, as some adaptation is necessary because of varying sizes of motor frames. Note that the $\frac{1}{4}$ -in. steel side plates are bent inward at a point 12 in. above the lower ends and that the edges are cut at an angle to give a width of approximately 4 in. at the top ends. The top ends of the side pieces are cut on a radius approximately the same as that of the differential-gear housing, and holes are drilled through the side pieces on the same spacing as those in the bell ends of the axle housing. In this way, the Ford model-A axle, which becomes the grinder spindle assembly, can be bolted to the top ends of the base pieces simply by removing six of the original cap screws and inserting longer ones. The front piece of the base is a duplicate of the side pieces ex-

cept that it is not cut on a radius at the top end. However, the back piece is only a short plate which serves as a filler, leaving the back of the base open for placement of the motor base and motor. All joints in the base are welded. Steel angles, which support the motor base, are bolted to the sides of the floor base as detailed. Note that the holes are slotted to allow for vertical adjustment of the motor when tightening or loosening the belt. When installing the motor, be sure that the pulleys are correctly aligned so that the half-crossed belt will run freely and without undue friction on the sidewalls of the V-pulleys. Use a $3\frac{1}{2}$ -in.-dia. pulley on a 1725-r.p.m. motor to give the correct grinding-wheel speed for heavy work. Higher speeds may cause the long wheel spindle to whip, with resulting danger of wheel breakage. Wheel guards are made from 10-in. automobile brake drums by cutting away a section of the drum to expose the face of the wheel as in the lower right-hand photo on the preceding page. The drums are attached to the spindle housing with bracket bands made from flat steel and welded to the inside of the drum. Mounted in this way, the wheel guards are quickly removed for buffing operations.

Corn Kept "Behind Bars" To Quicken Drying

To speed the process of drying his corn, as it lay stored in the crib, one farmer devised a method by which the corn at the bottom of the crib could be exposed to the air as well as that at the surface of the pile. The crib had been entirely closed, and as such, had the advantage of protecting the corn from rodents. However, the crib permitted little air to circulate through the corn until he removed the lower portion of one side and replaced the opening with a door, which was made of siding material and hinged to swing down from the top. To hold the corn in the crib, iron rods were stapled to the inner surfaces of the studs, extending the entire length of the opening and spaced just closely enough together to

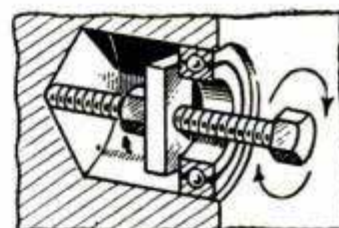


keep the ears of corn from being pushed through them. Now, with the siding doors closed at night, the corn is still not exposed to the rats, but with the door opened in the daytime, air enters the crib and the corn dries much faster.

Improved Puller Removes Bearings From Blind Holes

The next time you have a bearing to remove from a blind hole and there is no suitable puller available, you can improvise one with a long bolt, nut and a short piece of flat steel. The steel piece should be of the largest size that can be slipped through the opening of a bearing and stood on end behind it. It also should be drilled in the center slightly larger than the diameter of the bolt. In use, place heavy grease on the face of the nut and locate it at the bottom of the hole as near the center as possible. Insert the steel piece, stand it on end, and insert the bolt through the bearing and the steel piece. Then turn the bolt into the nut

and continue turning it. As the nut is turned up against the steel piece and the end of the bolt reaches the bottom of the hole, the bearing will be forced out. In order to prevent the nut from turning, it may be necessary to roughen both it and the back of the steel piece so that when the nut is held snugly against the steel piece as the bolt is turned, the nut will not turn too.



Frank Butrick, Alma, Mich.

Wheels Welded in Angle-Steel Frame Provide Sturdy Farm Gate

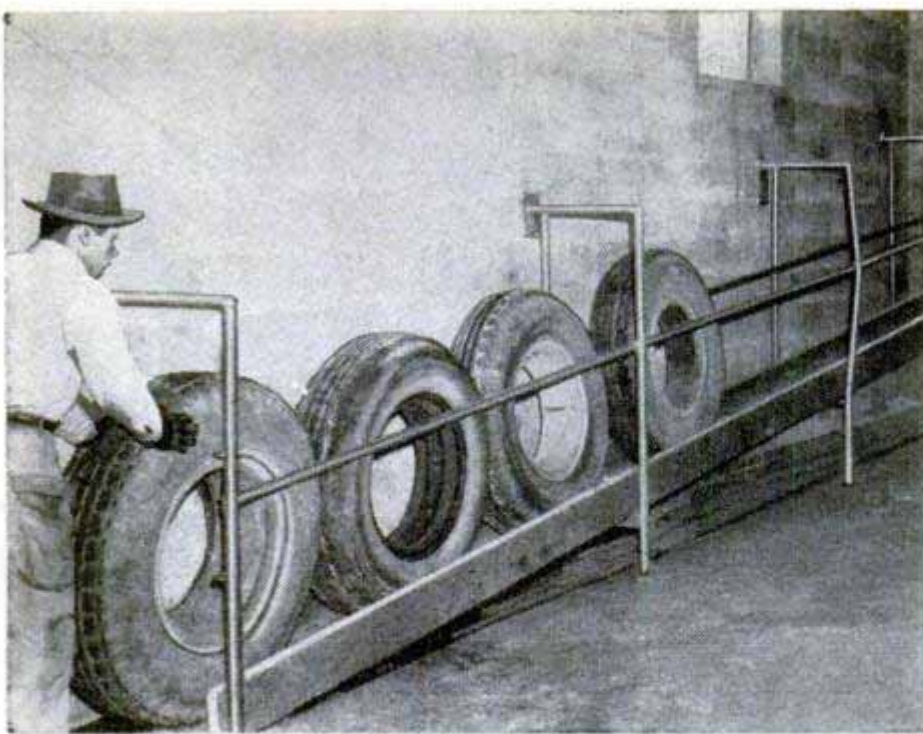
Old implement wheels of different sizes plus a couple of horseshoes were welded inside an angle-steel frame to produce this



attractive farm gate that is highly symbolic of its surroundings. The gate is hinged by means of heavy steel eyes which slip over large L-bolts in the gatepost. A hand latch welded to the other end of the gate locks it in the closed position.

Avoiding Countersink Chatter

When a drilled hole in a piece of metal is being countersunk, the tool often chatters, leaving a rough surface in the cut. One way to overcome this is to drill a small pilot hole first. Then countersink, centering the tool in the pilot hole, and afterwards drill the hole to the proper diameter.



RAMP MOVES TRUCK TIRES

Workers who unload a large volume of heavy tires will find this ramp a real time and labor saver. Lengths of steel pipe are welded to form a series of U-shaped uprights which are bolted to the wall as shown. Pipe railings are welded to the inside of each upright on both sides of the ramp and planks are bolted to welded cross members. Sideboards keep the tires on the ramp. —L. H. Houck, Jefferson City, Mo.

Proper Care Plus Yearly Inspection Makes Chimneys Fireproof

According to statistics, the chief cause of fires in farm homes is defective chimneys. Unlined chimneys are fire hazards for several reasons. Smoke-formed sulphuric acid, weather and heat attack the mortar between the bricks. In time, small openings or cracks form, or bricks work loose, and fire and inflammable gases escape into the dry framework of the house. A fire from this cause is very disastrous, because it gets a good start in hidden places before it is discovered. In addition, the rough interior of an unlined flue collects soot, which burns fiercely once it is ignited. Sparks escape from the chimney and fall on the roof, setting it on fire. Safety engineers recommend

the use of a clay flue lining, which forms a continuous fireproof shell within the chimney. The smooth surface of the lining allows no place for the accumulation of soot and provides a more efficient draft. Joints between the sections of flue lining should be sealed with mortar. Also, it is advisable to fill the void between the flue lining and the surrounding brick with cement mortar. After chimneys have been put in good condition, a few simple rules should be followed yearly. Inspect the chimney and heating system, clean flues, make necessary repairs immediately, and the destructive effect of fires on the farm can be minimized.

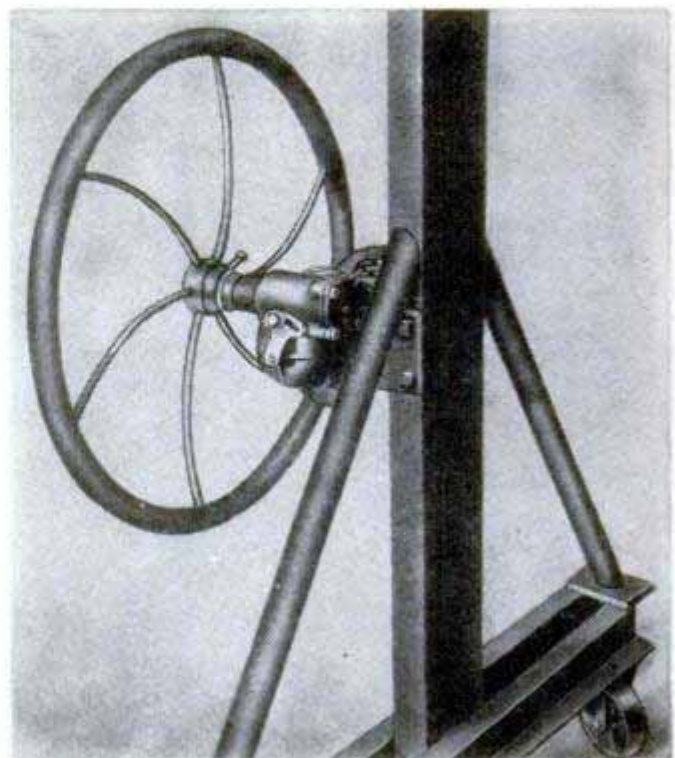
Handwheel and Steering Gear Speed Use of Shop Hoist

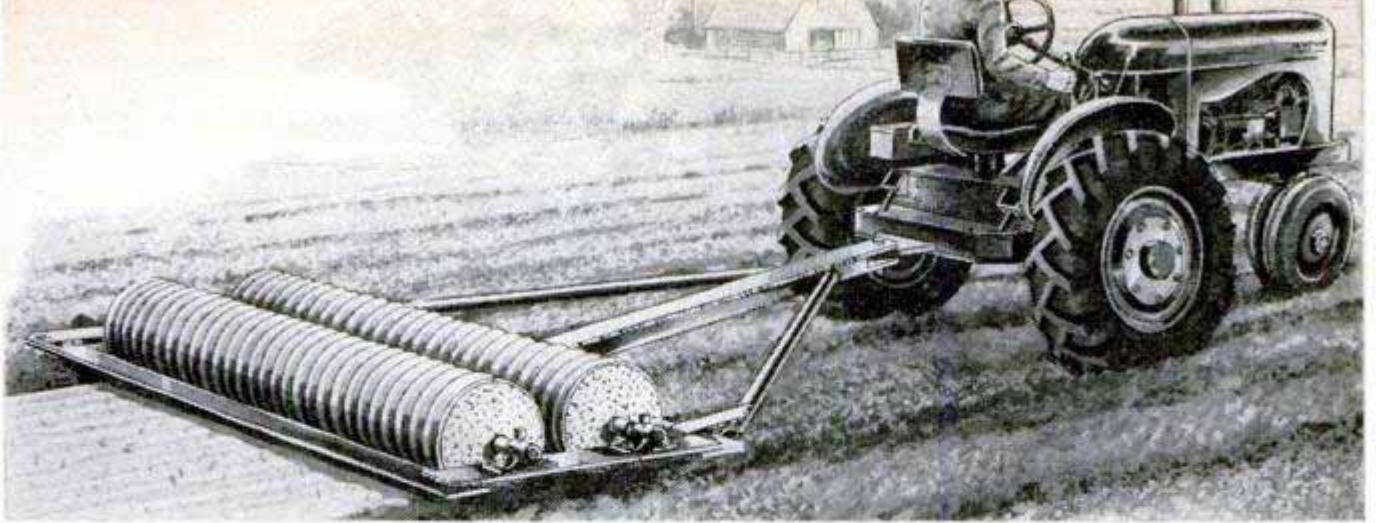
By replacing the regular crank on a shop hoist with a handwheel, one shop worker found that the operation of the hoist can be speeded up considerably. This is especially convenient when lifting light loads or when operating the empty hoist. The steering gear of an old car provided the worm-gear assembly which was used in connection with the handwheel.

Reversing Split-Phase Motor

To reverse the direction of a split-phase motor, wrap a cord around the pulley and spin the shaft backward. At the same time, switch on the current. The motor will continue to run in the reverse direction until switched off but, when again turned on, it will run in the normal direction.

A. O. Aldrich, Lansing, Mich.





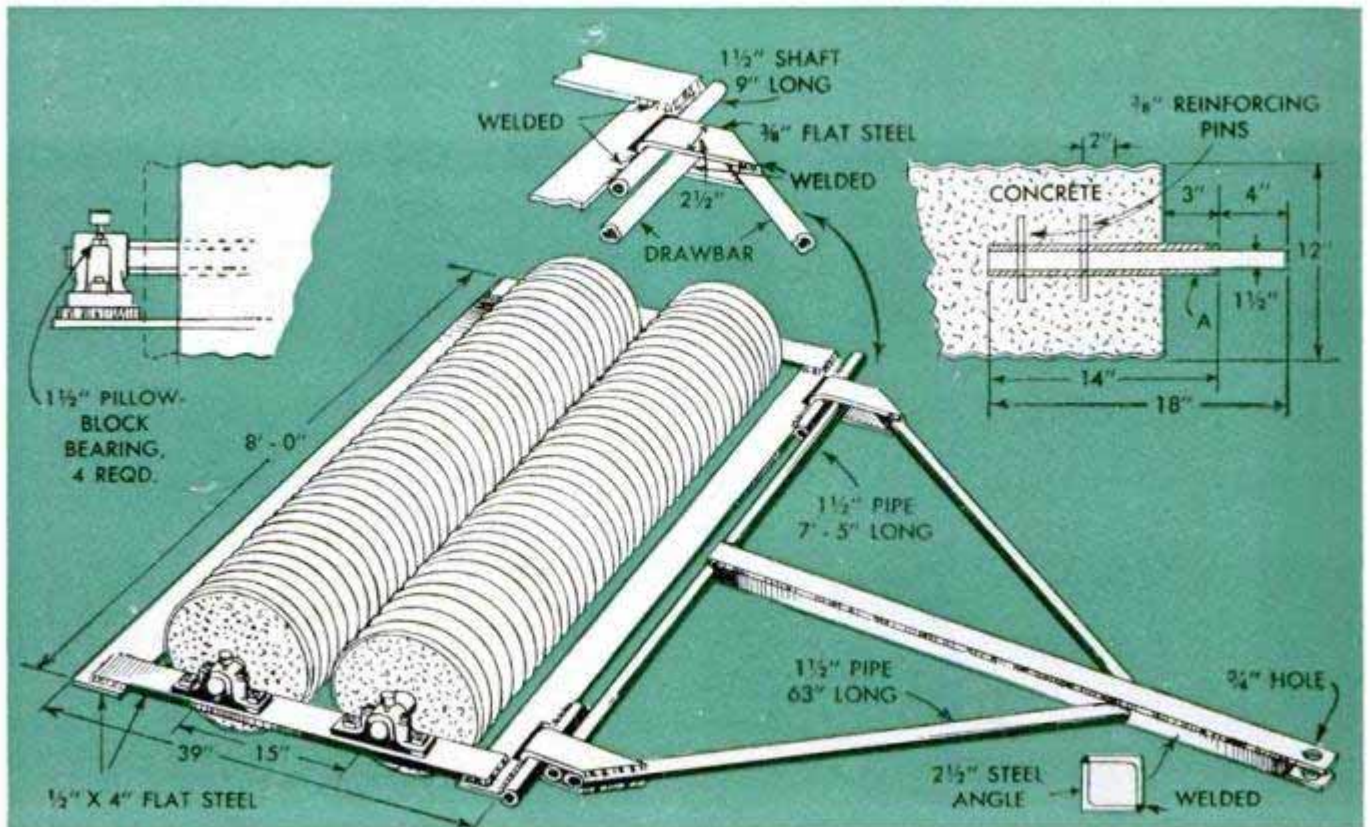
TRACTOR-DRAWN LAND ROLLER

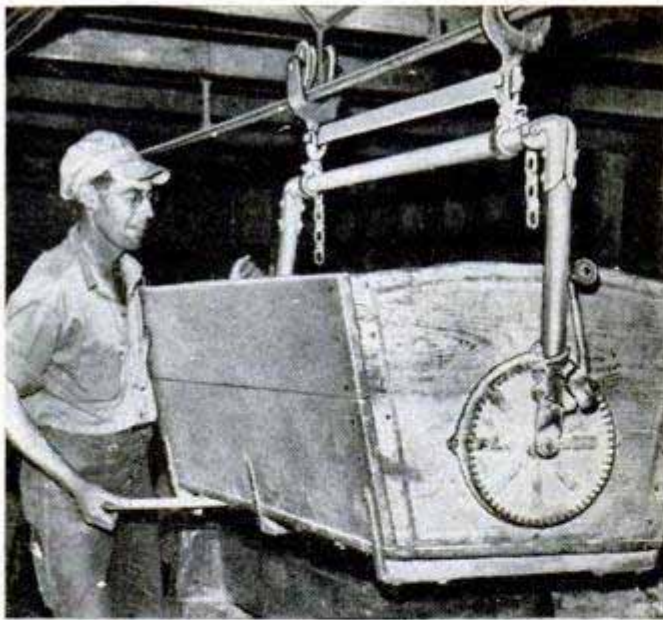
*Farm Manual
(1955 ed.)*

By W. B. Kennedy

IN PREPARING a seedbed for spring or fall planting, there are times when the soil should be packed lightly with a roller to crush surface clods and prevent undue loss of moisture on dry, windy days. Many farmers prefer to build a roller especially for this purpose by using two ordinary round metal culverts of the corrugated type filled with concrete. As the units are being filled with the cement, 1½-in. axles, or shafts, fitted in pipe sleeves are centered and cast into the ends as shown in the upper-right-hand detail below. The sleeve, A in the detail, serves as a spacer when the units are assembled in the frame. At one end of each roller the sleeve projects 3 in., while at the other end it projects 1 in. When

the rollers are placed in the frame, this gives approximately a 2-in. offset so that the trailing roller does not track the leading one. The individual rollers are mounted in a frame made by welding four lengths of ½ x 4-in. steel bar together at the corners and the roller shafts turn in pillow-block bearings fitted with compression grease cups or pressure fittings. Drawbar pivots, upper-center detail, are arranged for easy up-and-down movement of the frame and are assembled from pipe and lengths of flat steel bent to a U-shape and welded to the drawbar tee and the diagonal braces as shown. The drawbar is a box section formed by seam-welding two pieces of steel angle as in the sectional view below. The ends of the angles are cut away to form an eye for the clevis pin.





Overhead Carrier in Cattle Shed Serves Long Line of Feed Bunks

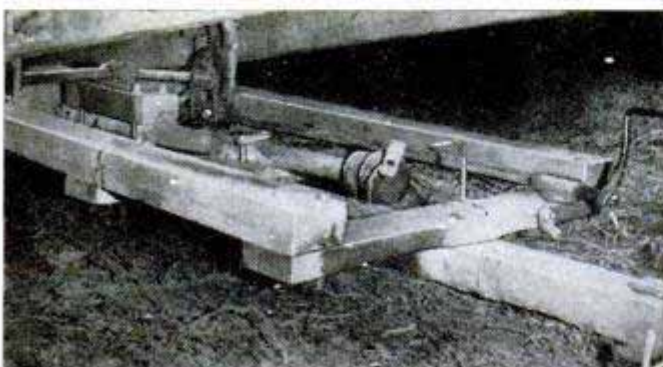
To save time and prevent waste in feeding a large herd of cattle, one farmer housed the feed bunks in a long, low shed connecting the barn and granary. An overhead track for a standard feed carrier runs the full length of the shed and directly above a line of feed bunks placed end to end. The carrier hopper is partitioned into two compartments and sheet-metal slides are fitted over rectangular openings cut in the bottom of the hopper near the ends. With this equipment, two kinds of feed grain can be quickly and evenly distributed to all the bunks with a minimum of hand labor.

A. M. Wettach, Mt. Pleasant, Iowa.

Air Pressure Opens Clogged Line

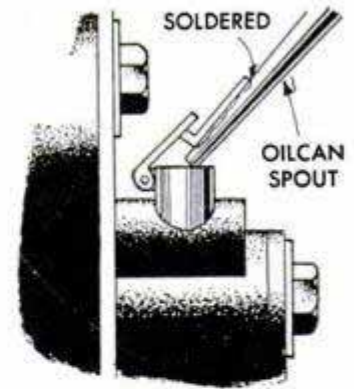
Small pipe lines which carry water from springs or reservoirs sometimes become clogged with moss or silt. However, the pipe frequently can be cleared of the obstruction in a short time by means of air pressure. Fit a tire valve into a pipe cap or plug and, when the line stops up, screw the cap on the threaded end of the pipe. Then, force air into the pipe with a tire pump. If a source of compressed air is available, this, of course, is more efficient.

Tilting Assembly for Trailer Bed Made From Grain-Binder Parts



"Lifter" Soldered to Oilcan Spout Opens Spring-Cap Oilers

Because of the difficulty in filling spring-cap oilers, one mechanic soldered a narrow strip of sheet brass near the end of the oilcan spout and then bent the end of the strip upward at right angles to form an L-hook.

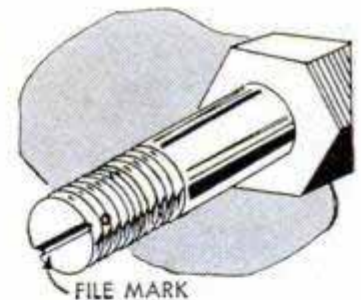


The projection of the L-hook is just long enough to catch under the edge of the spring cap and lift it so that the oilcan spout can be inserted into the oil cup. Pushing the spout downward slightly holds the spring cap open until the cup is filled with oil. Then, as the oilcan is withdrawn, it is turned sidewise to disengage the hook and allow the cap to close. With this simple fitting, one-handed oiling of bearings is made possible in the most inaccessible places.

A. E. Friend, Bloomington, Ill.

Cotter-Pin Hole Located By Mark Filed on Bolt

Here is a shop kink which will save you a lot of time when assembling a job with bolts and castle nuts, especially in a hard-to-get-at place. When the job is being disassembled clean each bolt and file a shallow



vee across the threaded end of the bolt, the vee being in precise alignment with the cotter-pin hole. Then, when adjusting the nut for pinning, it is easy to see at a glance just where the cotter-pin hole is. Use the same idea when assembling pulleys or gears which are pinned to the shafting.

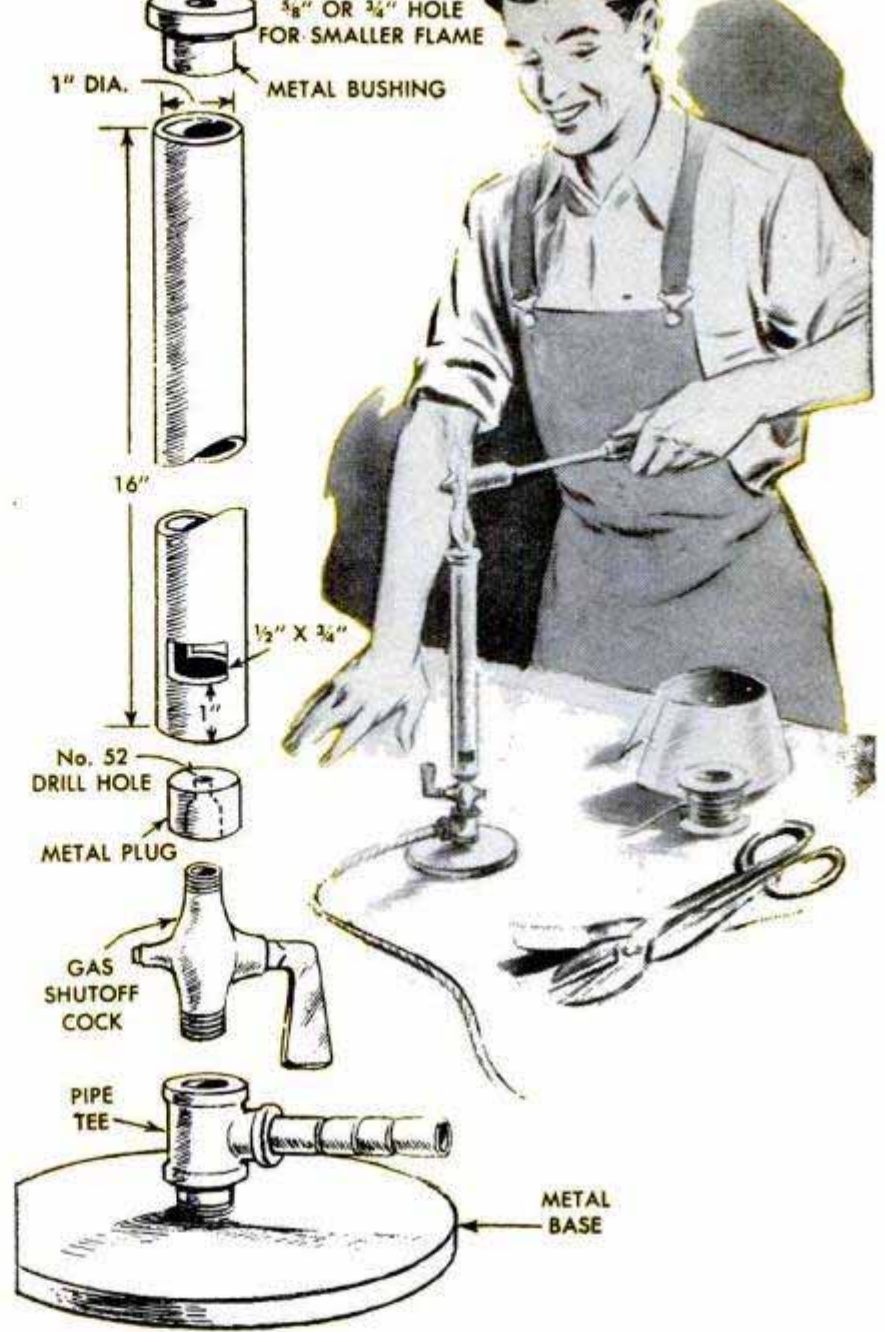
W. H. McClay, Pasadena, Calif.

The gear mechanism which lifts the ground wheel on a grain binder can be used in a like manner to tilt the bed of a trailer or truck. Mounted to the running gear as in the illustration, with the gear rack attached to the bed, a length of pipe is extended from the worm gear and fastened to a crank for turning.

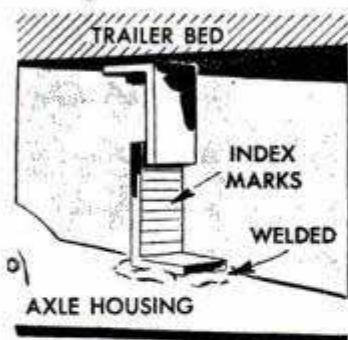
Some cold cream and a cloth kept in the car permit cleaning hands without water.

BUNSEN BURNER

Needing a large-size bunsen burner for a hundred and one odd jobs in my shop, I made one myself from a length of 1-in. tubing, 16 in. long, and a gas shutoff cock. Two air-intake openings are cut on opposite sides of the tubing, and a metal plug is turned to a tight fit in the lower end of the tube. A blind hole is drilled and tapped in the plug to take one end of the cock. A No. 52 drill is used to bore an orifice through the top of the plug. If a shutoff cock from a gas range is used, the regulating tip, as well as the three-cornered metal block on the inside, are removed. The other end of the cock is turned into a pipe tee, and the tee is turned onto a short nipple which is brazed or soldered to a metal base. Finally, a standard rubber-hose coupling is fitted to the side outlet of the tee. Note that a shouldered bushing may be fitted in the top of the tubing to reduce the size of the flame. The hole should be drilled through the center of the bushing. — Fred Alkire, Santa Barbara, Calif.



Simple Calibrated Indicator Shows Weight Carried by Farm Trailer



In order to determine the approximate load on his trailer and thus avoid overweight, one farmer used the method shown. A metal angle was welded to the rear-axle housing and a similar angle was

welded to the metal frame of the trailer, locating the two parts so that they overlapped but did not touch. To calibrate the indicator, loads of different weights were put on a trailer and weighed, a mark being made on the lower bracket to indicate the position of the upper bracket on each given weight. However, where accuracy is not too critical, one mark can be made on the lower bracket while the trailer is empty. Then the trailer

can be loaded to maximum capacity and a mark made on the lower bracket at the end of the upper one. The difference in weight between zero and maximum can then be divided into any equal number of marks on the lower bracket, thus saving the procedure of loading the trailer to different capacities and weighing it.

Herbert E. Fey, New Braunfels, Tex.

Metal Jacket for Acid Bottle

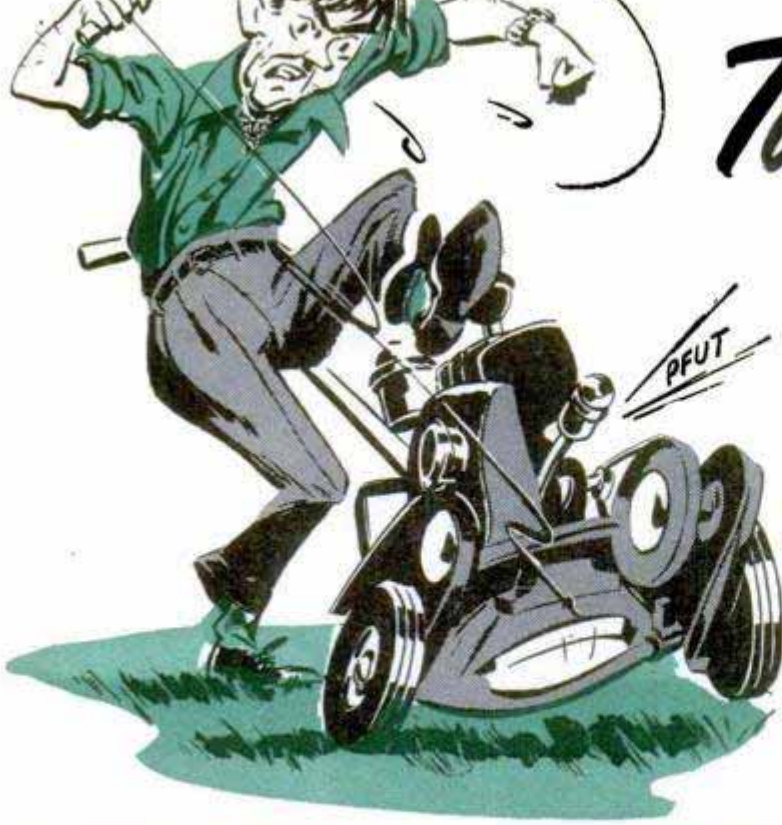
When acids and thinners are stored in gallon bottles, setting the bottle in a metal jacket will minimize the loss and reduce the hazard from the spilled liquid if the bottle should be broken. To provide a jacket for the bottle, cut the top from an empty 5-qt. motor-oil can, using a rotary-type can opener, and set the bottle in the can.

A. B. Patsch, Midland, Pa.

Taming that

BALKY MOWER

By Ed Packer

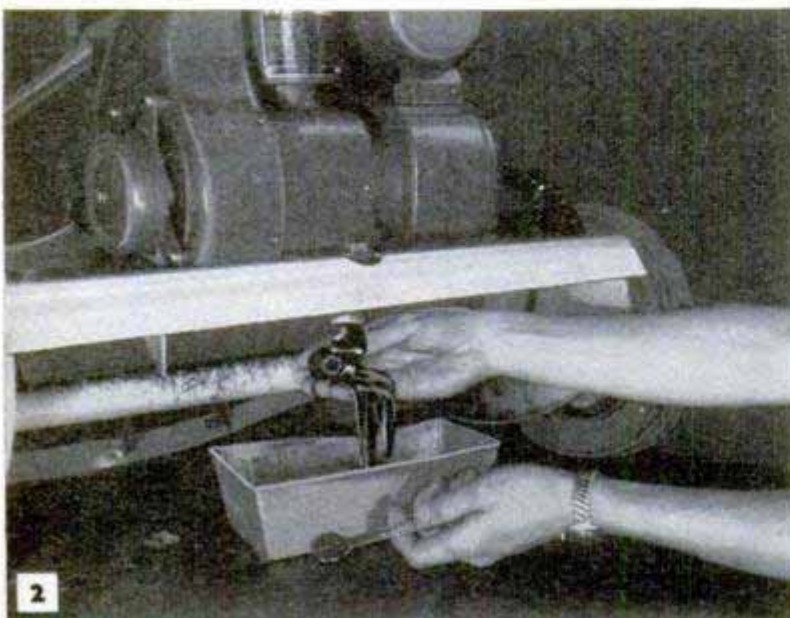


WHAT'S more downright irritating than a temperamental power lawn mower on a sultry summer day? You're all set for what should be only a comfortable walk over the lawn behind the mower, which ordinarily pulls itself and does all the work, but this time one, two, and perhaps three pulls on the starting rope produce nothing more than a desultory gurgle from the engine. In this situation the thing to remember is that after three pulls on the starting rope, you're not likely to get started at all without fixing something. Of course, the problem then is to find out what's wrong.

Assuming that there's plenty of fuel in the tank, you may discover right away what the trouble is by removing the spark plug and examining it closely. If the plug is dirty, fouled with raw fuel, and if the electrodes are eroded and widely spaced, you've already spotted one good reason for the engine's refusal to start promptly. As a rule the instruction book that came with the engine will specify the electrode gap as .025 to .028 in., Fig. 4. If it checks much wider, you'll have trouble starting the engine. While you have the plug out, hold the ignition wire about $\frac{1}{8}$ in. from the cylinder head as in Fig. 5 and spin the flywheel with the starting rope. A hot, blue spark should snap from the terminal to the ground. If the spark is weak, then the chances are that the breaker points in the magneto need adjusting and possibly dressing down a little. The magneto itself rarely is at fault, but sometimes oil from the crankcase will



Above, inspect and clean the sediment bowl in the fuel line at regular intervals. Below, change crankcase oil periodically. When refilling be sure to use oil of grade and quantity specified

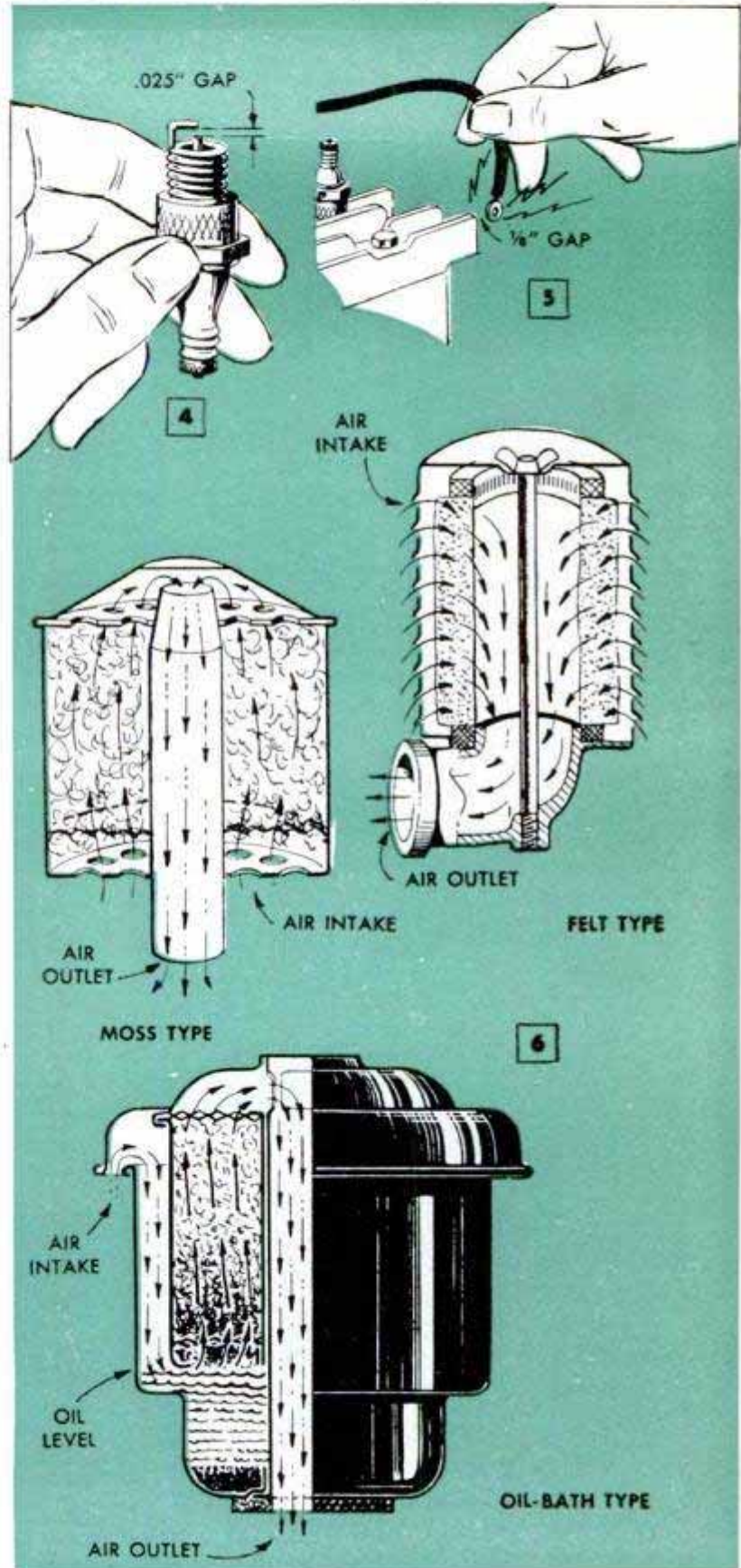


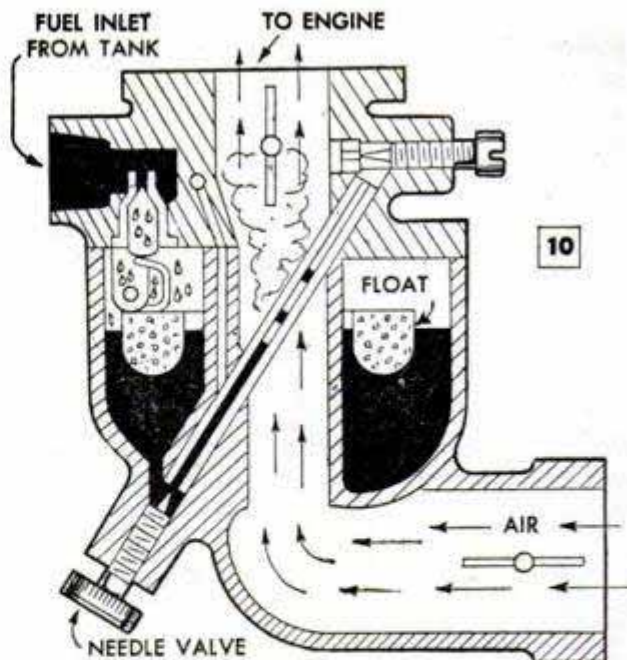
leak through a faulty oil seal at the flywheel end of the crankshaft and foul the magneto. A thorough cleaning and a new oil seal usually take care of this trouble. On some engines it is necessary to remove the flywheel to gain access to the ignition system. First, lock the flywheel so that it cannot rotate, then carefully loosen the nut on the tapered end of the crankshaft and use a wheel puller to start the flywheel off the tapered end. Clean the breaker points, Fig. 14, and space the gap, Fig. 15, according to the instruction book. While you're at it, you can make a pretty accurate check of the condition of the piston and rings by rocking the crankshaft against the compression, using a wrench on the flywheel retaining nut as in Fig. 15. The resistance to turning should be fairly uniform until the piston reaches the top of the stroke. If this is so, then it can be assumed that both piston and rings are still in good condition. On the other hand, if the compression feels "soft" and the piston comes up easily with an audible rush of air past the rings, then further servicing will be necessary to put the engine in good running condition. On most small engines of the type used on lawn mowers, it's a fairly simple job to install new rings and, if necessary, grind the valves as in Figs. 8, 9 and 11. When installing new rings, carefully check the end gap and the groove clearance as in Figs. 12 and 13. Usually end gap will be specified as not less than .007 or more than .017, and groove clearance as .005 in. These values are important, so it's a good idea to check on the specification for your engine. Occasionally, when you take the head off an older engine you'll discover warped and pitted valves and badly worn guides. In this case, both the valves and guides should be replaced and the seats refaced in the service shop.

Only rarely is the carburetor alone at fault when the engine refuses to start, unless, of course, it has been improperly adjusted or is clogged with sediment and dirt. Usually, periodic cleaning at long intervals is all that is necessary to keep a carburetor in good condition, but whenever it is removed



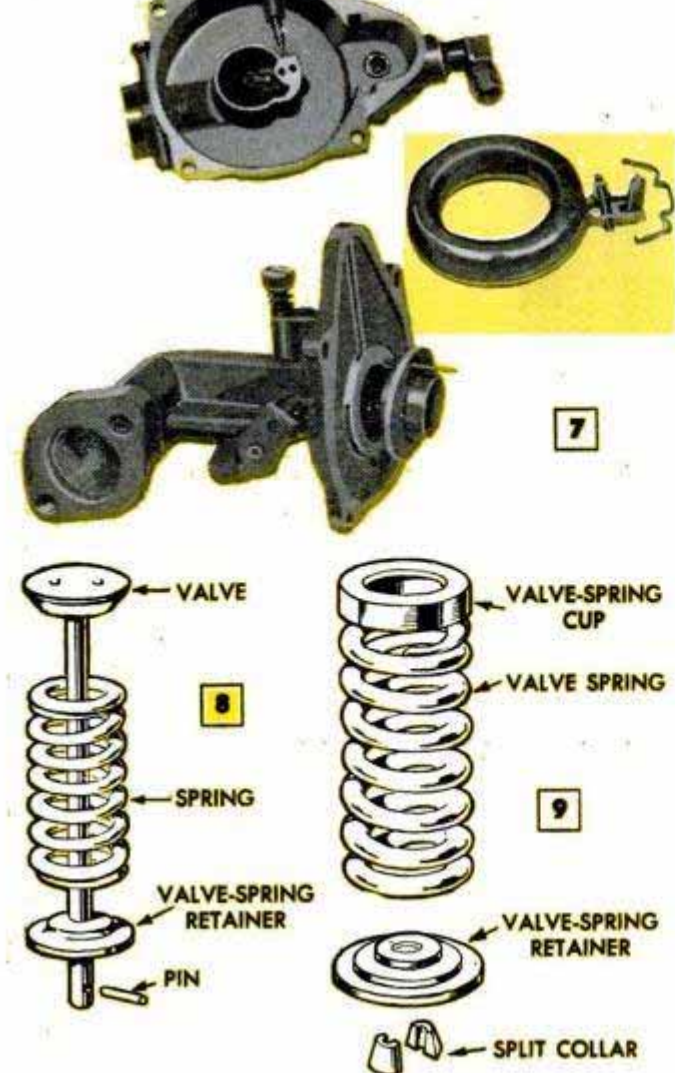
Clean the mower thoroughly after use to remove leaves and grass clippings from mechanism, especially from cylinder cooling fins



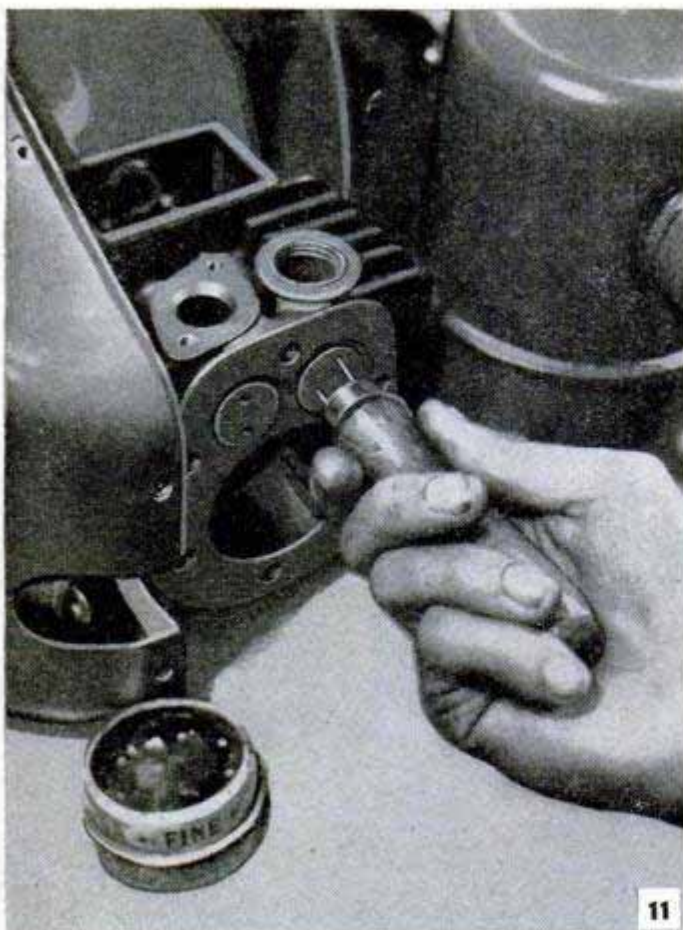


for any reason, always check the float level and, if necessary, adjust it to agree with the manufacturer's specification. When replacing the unit, use new gaskets and be sure that they are properly seated and the bolts drawn to a uniform tension. Air leaks between the carburetor and engine are a common cause of fuel-mixture troubles, and often the tiny leaks are difficult to locate and remedy. Careful placement of the gaskets usually prevents this trouble. If, at any time, it is necessary to adjust the needle valve or the idling adjustment, be especially careful not to screw the needles down hard onto their seats in the fuel jets. Don't attempt to clean the jets with wire or any other sharp-pointed tool. If the jets are clogged, always disassemble the carburetor and blow out the passages individually with compressed air.

A lot of starting headaches and costly major repairs can be forestalled by a simple servicing procedure carried out on a regular schedule. Figs. 1, 2 and 3 picture three things to do at short intervals during the mowing season. The first, Fig. 1, is a periodic check of the sediment bowl in the fuel line to the carburetor. Remove the bowl and clean it thoroughly and also renew the gasket occasionally. Change the oil and flush out the crankcase often, Fig. 2. Be sure to use oil specified by the manufacturer of the engine. All power-mower engines in the popular sizes are air cooled and generally are operated during warm summer days and evenings. To prevent overheating with resulting serious damage to the engine, clean out leaves, twigs and grass clippings as in Fig. 3, giving special attention to the cooling fins on the cylinder and cylinder head. Do this each time the mower is used and



Above and below, cleaning the carburetor and grinding, or lapping, valves are important servicing operations on older engines with long records of extra-hard usage

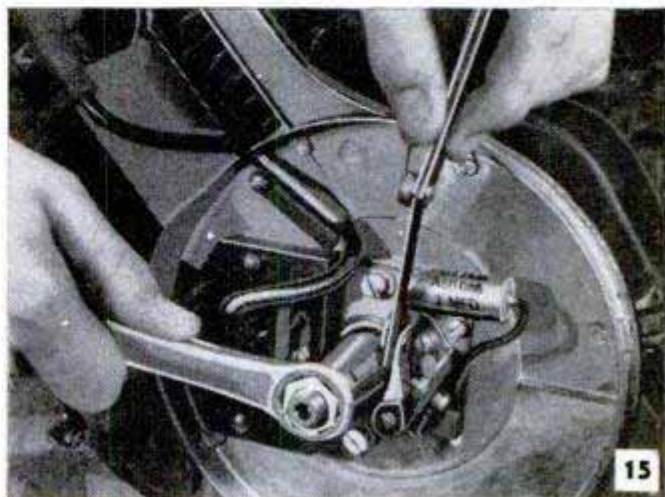


you'll avoid a lot of mysterious mechanical troubles that may otherwise develop. The fourth item on the regular servicing schedule is the air cleaner, which may be any one of the three types shown in Fig. 6. Small engines usually are equipped with either the moss or felt-type cleaner, while the larger sizes generally come equipped with the oil-bath type. All three types require regular servicing, and usually the manufacturer's directions for cleaning will be found on the cleaner housing. In any case, it's important to service the air cleaner at regular intervals, the frequency of cleaning being determined by operating conditions.

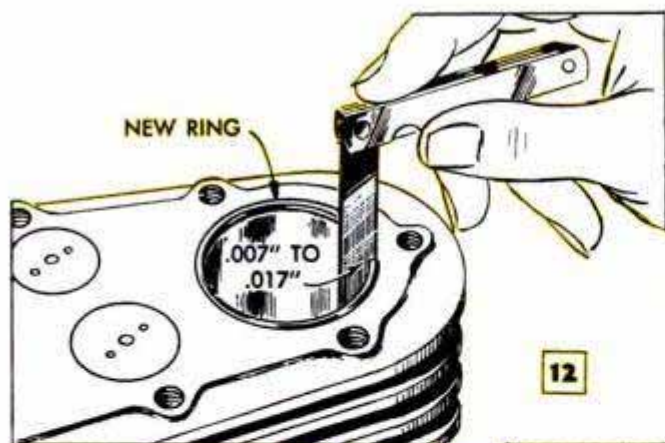
While you're servicing the engine, don't neglect the mower, as it requires regular lubrication, and the blades should be ground periodically to keep it in tiptop operating condition. Some mowers are fitted with a reverse gear by means of which the blades can be rotated backward against the cutter bar. Others are supplied with a special round belt which can be crossed for reversing the rotation of the blades. To sharpen, first set the cutter bar so that the blades engage it lightly and uniformly throughout the length. Then reverse the mower reel, paint medium valve-grinding compound on the edges of the blades, Fig. 16, and run the engine at its slowest speed. Don't neglect to clean and lubricate the driving clutch, Fig. 17, at regular intervals. Usually the operating instructions that come with the mower will give you all the information needed for proper servicing of the driving clutch. Follow the instructions in detail.



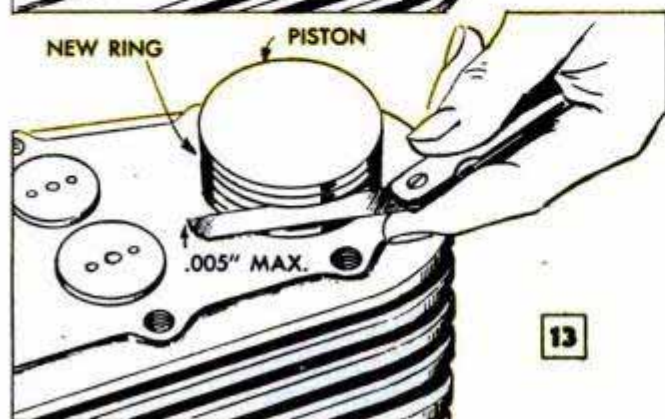
When truing breaker points, use a flexible hone made for the purpose. Clean ignition system thoroughly



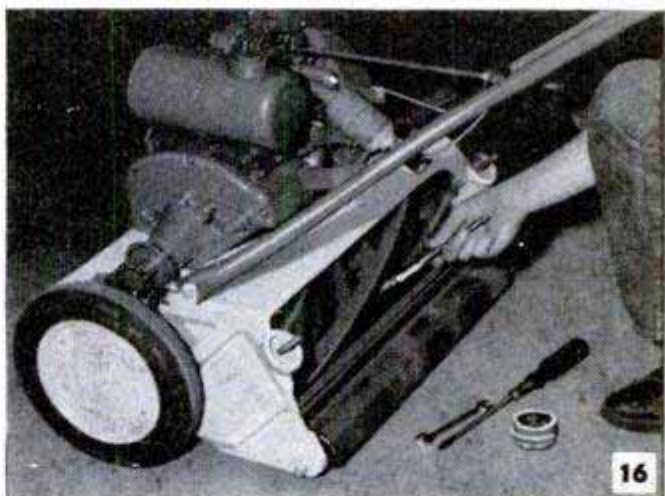
Then check distance points open with feeler gauge. Ordinarily, gap opening should be .20 in. but may vary



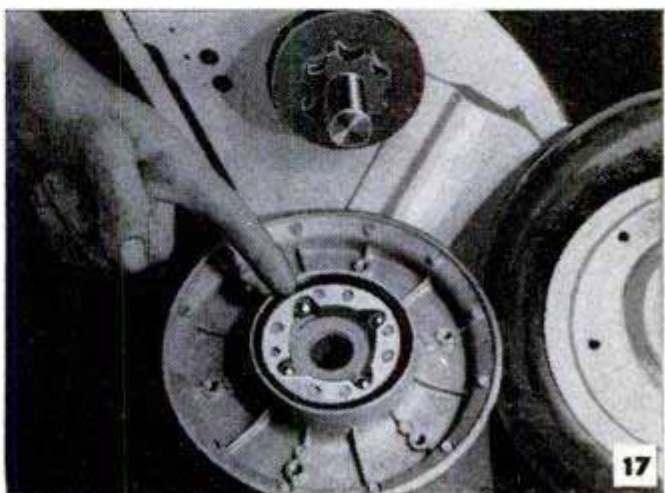
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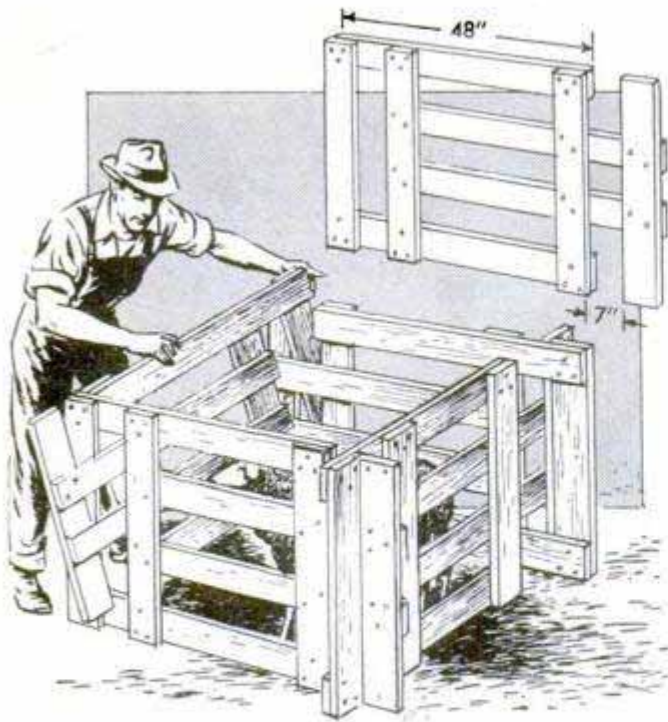
13



Above, sharpen mower blades regularly for efficient operation. Below, clean and lubricate drive clutch



Sectional Hurdle for Sheep or Hogs Assembled Without Fastenings



Sheep and hog raisers like these sectional hurdles because they are quickly assembled to form individual pens or adjacent partitioned pens in any number required without the use of fastenings such as nails, hooks or wire. Specially constructed interlocking corners built into the ends of each individual section make this possible. Use 1 x 6s for all parts. Cypress fence boards are the most durable, with white pine the second choice. In building the sections, first make a jig on which each section can be fully assembled and clinch-nailed. This procedure will assure uniformity in the size of the separate sections. If available, use copper clinch nails.

E. C. Hall, Norwood, Man., Can.

Automatic Hog Waterer Supplied From Stock Tank

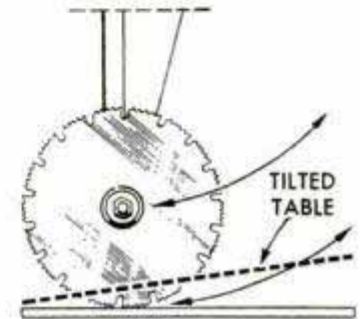
Solving the problem of providing a constant water supply for hogs which were allowed to run with cattle in a feed lot, one farmer anchored an automatic waterer of the cup type to a heavy timber which supported the regular stock tank. Then he installed a protective board, or fence, just back of the waterer and ran a horizontal length of pipe through the board to the outside. A short length of hose is forced tightly over the open end of the



pipe and extends to the water in the tank. Once a siphoning action is started a constant supply of water is assured.

Tilting Table on Swing Saw Increases Width of Cut

To increase the capacity of his swing saw for cutting extra-wide boards, one contractor made a special tilting table pivoted at the back edge so that it could be raised



about 2 in., as shown by the dotted line in the detail. This, in effect, extends the cutting arc described by the blade as it is pulled forward through the stock.

Arthur Shults, South Bend, Ind.

File Tang Removes Broken Studs

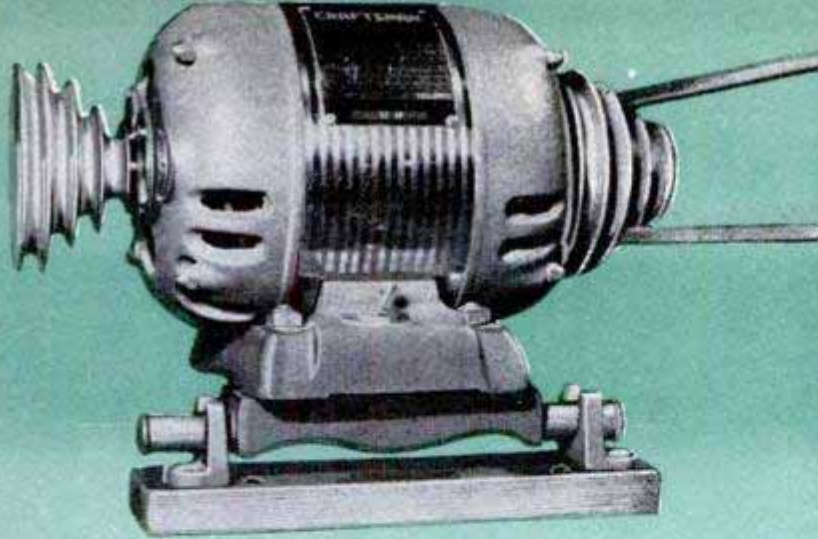
Broken studs often can be removed by using a file tang to back them out. A hole, slightly smaller than the width of the tang, is drilled in the top of the stud. Then the tang is pressed tightly in the hole and the file is turned slowly, either by hand or with a wrench. The same method also can be used to remove broken grease fittings and pieces of small-diameter pipe.

R. L. MacLean, High Bank, P.E.I., Can.

Large Capacity Shelled-Corn Feeder Made Portable by Adding Runners

Built comparatively narrow and fitted with wood skids, this 225-bu. shelled-corn feeder can be pulled easily to any desired location. Full-length troughs are built on both sides of the feeders where the flow of corn is regulated by an adjustable board. These can be raised or lowered to suit. The ends of the boards fit into channels formed by cleats nailed to the ends of the feeder. Three upright cleats keep the adjustable board from buckling outwards.



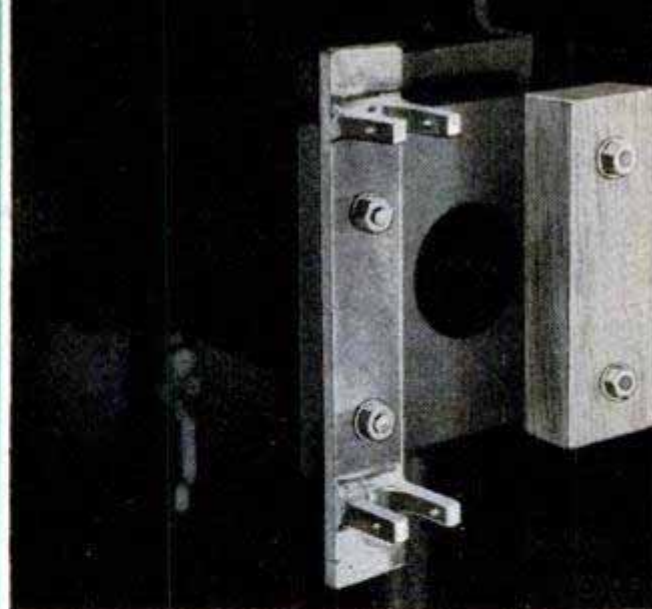


HORIZONTAL MOUNTING

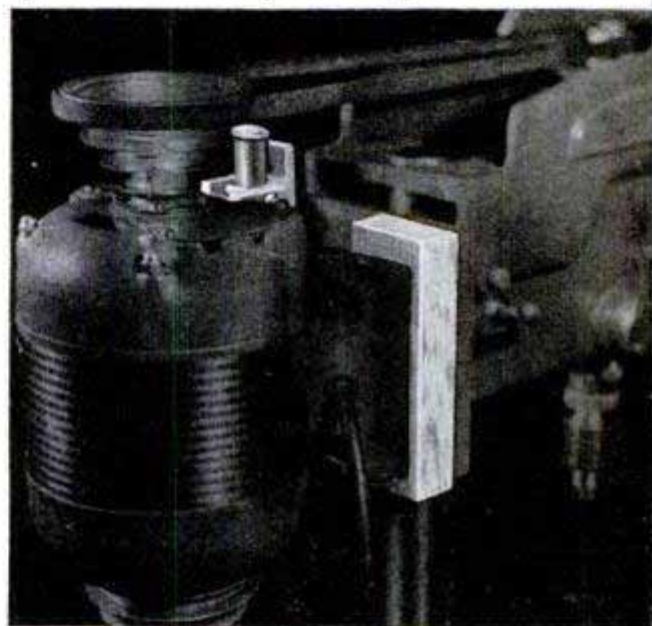
DUAL-PURPOSE motor mounting

By Robert G. Barnes

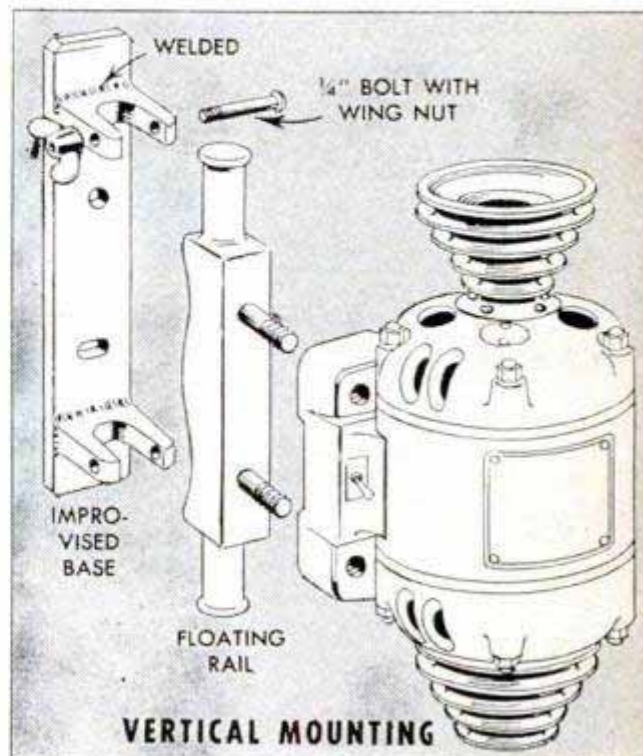
ORDINARILY, a motor mounted on a floating rail for operating a one-motor shop cannot be used with the same convenience on a drill press because of the necessity of removing the rail in order to mount the motor vertically. Confronted with this problem, one craftsman improvised a special base which permitted mounting the motor on his bench-type drill press without removing the rail from the motor. After the base has been made and fitted to the drill press, it may be left in place permanently. In the detail at the lower right, all dimensions have been omitted purposely, as the base must be fitted to the drill press at hand. Ordinarily, the base can be made from a piece of $\frac{1}{4}$ x $1\frac{1}{2}$ -in. steel plate about 9 in. long. Before cutting this piece, check the over-all length of the motor rail and cut the steel plate to approximately the same length. Center-punch mounting holes by measuring the center-to-center spacing of the slots in the motor-mounting plate on the drill press. Note that the lower hole in the base is elongated with a file to permit tilting the motor slightly when aligning the belt. Next, measure the center-to-center distance of the round flanged projections on the floating rail. This distance will determine the location of the yokes on the base piece. The yokes are cut from $\frac{1}{2}$ -in. flat steel plate, the width and depth of the U-shaped cuts being determined by the diameter of the projections on the rail. The arms of each yoke should be cut long enough to permit drilling transversely for $\frac{1}{4}$ -in. retaining bolts which are provided with wing nuts. These bolts hold the rail in place when in the vertical position. After drilling the yokes for the bolts, weld them to the base piece as indicated. Now, bolt the base to the drill press as in the upper right-hand photo and fit a block of hardwood on the motor-mounting plate to support the opposite side of the motor base as in the center photo.



Special floating-rail base and hardwood spacer block are permanently installed



Here's the motor in place and belted to the drill-press spindle. Note spacer block



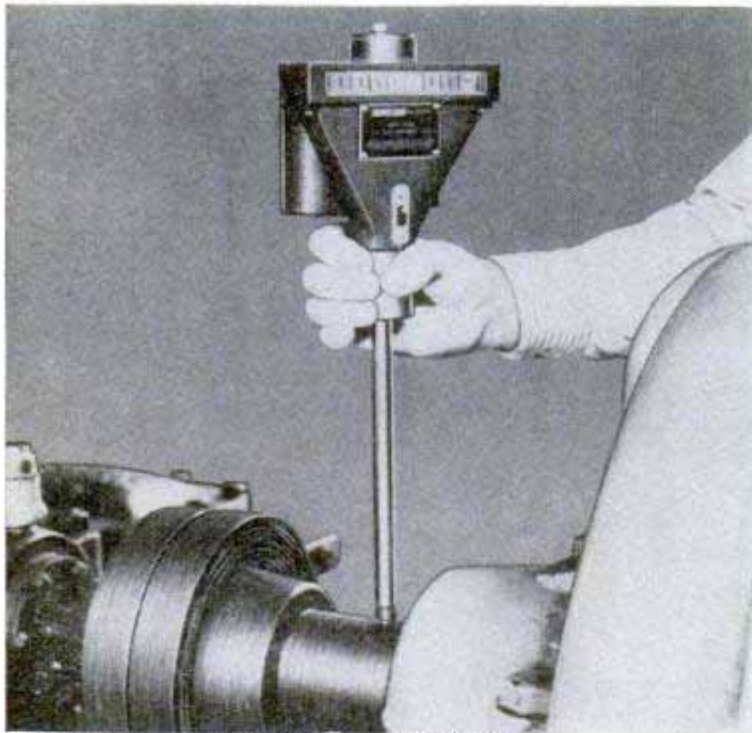
VERTICAL MOUNTING

SHOPPING



Mid-States Welder Mfg. Co., 8025 S. Ashland Ave., Chicago

MULTIPURPOSE SAW GUN, designed for use with a small portable electric drill, makes a handy power tool for mechanics, electricians, carpenters and others with cutting problems in either wood or metal. The blade cuts only on the pull stroke and, therefore, leaves a smooth edge on all types of work. For ordinary jobs, the unit uses a common hand-hacksaw blade inserted in a special holder in end of gun. Also uses all types of hand files



The Vibroscope Co., 6 E. 39th St., New York City

VIBRATION TESTER for high-speed machines employs an oscillating ribbon of light reflected from a mirror onto a dial calibrated in thousandths of an inch. Probe, or spindle, is provided for taking vibration readings direct from rotating shafts. Vibration amplitude is indicated by the width of the ribbon of light. For measuring vibration on stationary parts of the machine, a pickup plunger is used. When instrument is held vertically, its weight exerts sufficient pressure to bring the light beam to the center of the scale. The unusual shape of the instrument makes it possible to reach into otherwise inaccessible places on machines

HAND-TAPPING MACHINE eliminates tap breakage and work spoilage when tapping holes for small screws. Unit is provided with an adjustable worktable, or platen, fitted with a fence against which the work can be held for accurate, straight-line starting of the small taps. Tap is held in a collet chuck mounted on a sliding shaft fitted with a hand crank and adjustable depth stop for use when tapping blind holes. Worktable is carried on sliding parallel guide bars which can be locked in any convenient position. A removable panel for storage of wrenches, collets and taps is attached to the rear of the machine base, as shown in the photo

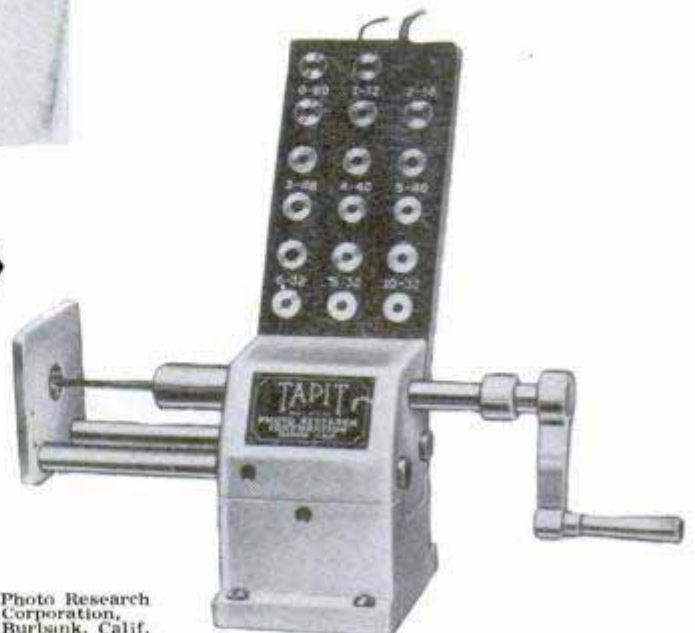
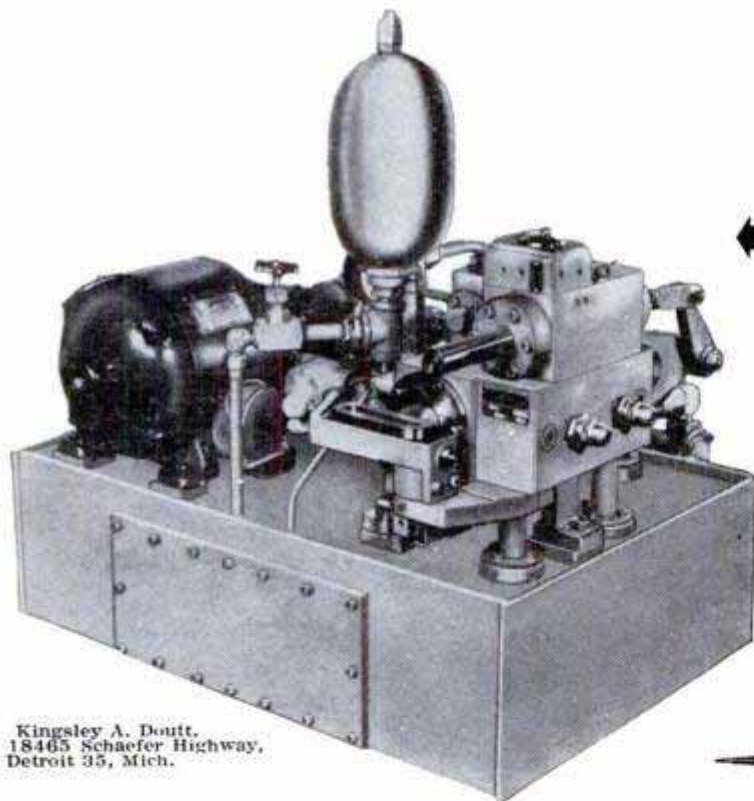
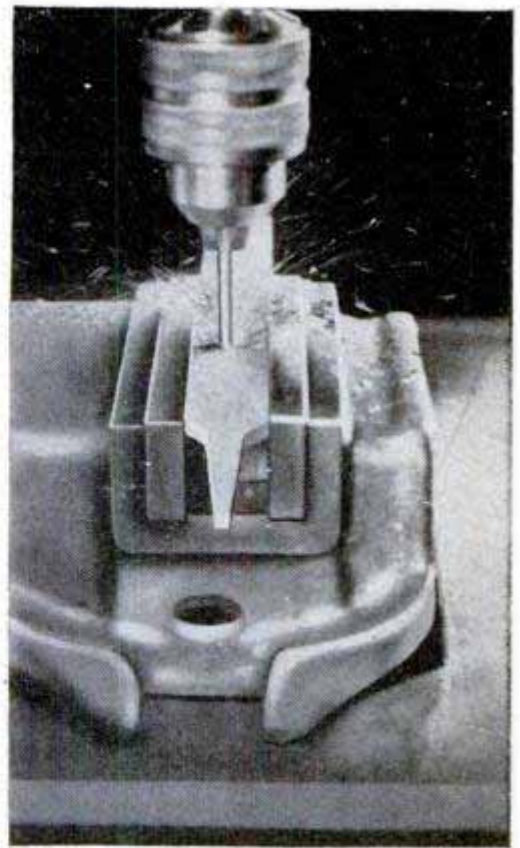
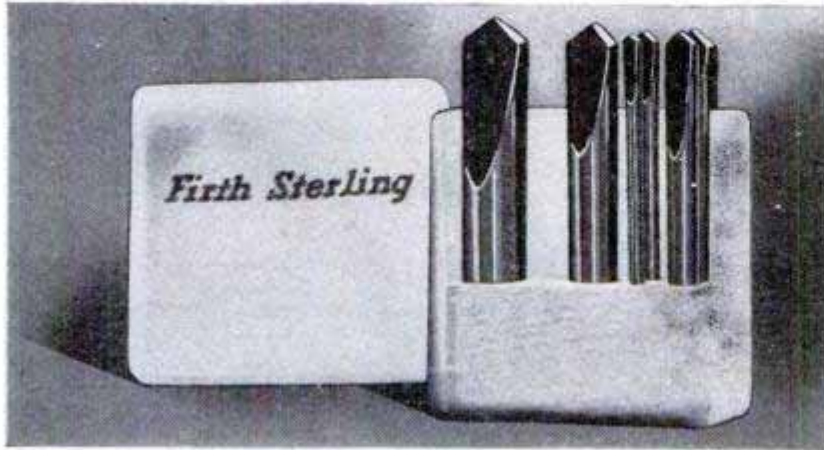


Photo Research Corporation, Burbank, Calif.

FOR TOOLS

NEW DRILL KIT for drilling hard metals has many applications in industry. Drill bits included in the kit range in size from $\frac{1}{8}$ to $\frac{1}{2}$ in. and are made from sintered-carbide rods. They are pointed and relieved for drilling metals to 66 Rockwell C hardness

Firth-Sterling Steel & Carbide Corp., McKeesport, Pa.



Kingsley A. Douth,
18465 Schaefer Highway,
Detroit 35, Mich.

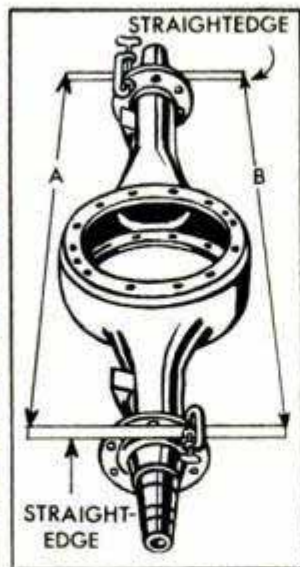
HYDRAULIC FLASH-WELDER CONTROL UNIT has been developed for use with any make of flash welder having a transformer capacity up to 500 KVA. Calibrated adjustments make duplication of setups as easy as turning a dial, and range of cross-sectional areas that any flash welder can handle is greatly extended by use of unit. In effect, it converts mechanically driven flash welders to full hydraulic operation. Unit requires no maintenance except inspection and lubrication

PRECISION LEAD SHARPENER for shaping inserted leads of draftsman's mechanical lead holders has been recently developed. It is electrically driven and sharpens leads by contour grinding, producing both round and chisel points in the variety illustrated in the photo at right. Principal advantage is that the draftsman can obtain a predetermined lead point consistently with only a simple adjustment of the sharpener. This feature makes it possible to do accurate line work on drawings without the necessity of constantly sanding and polishing the lead point by hand methods



Rajeon Mfg. Co.,
906 Kingston Ave.,
Racine, Wis.

Rear-Axle Alignment Checked With Straightedges and Tape



When it is necessary to disassemble the rear axle of a car or light truck in order to make repairs, it's important to check the axle housing for alignment before reassembling. This can be done quickly and without any special equipment by clamping straightedges to the machined flanges at the ends of the housing which carry the brake-backing plates. Bar stock is best for use as straightedges since it will not spring out of true. The detail and illustration show the setup for checking axle sag. A bend caused by a collision is detected by moving the straightedges 90 deg. from the position shown. In either case, when the checkup is made, the variations in the distances A and B should not exceed $\frac{1}{16}$ in. for a passenger-car axle and not more than $\frac{3}{32}$ in. for a truck axle. These are the maximum allowable variations. If the measurements are greater, the entire unit should be replaced.

Welder's Clamps Made in the Shop



Welders working on intricate fabricating jobs often need special C-clamps of a type and size not readily available from suppliers. Special-purpose clamps are quite easily made by cutting

the body of the clamp out of steel plate with a torch, the size of the clamp determining the thickness of the plate used. If care is taken to do an accurate job of cutting with the torch, no other finishing on the body of the clamp will be required.

Then a hex nut from a bolt of suitable size and length is welded to the body of the clamp as detailed, and a bolt of convenient length is turned into the nut to serve as a clamp screw. When the clamp is designed to span 6 in. or more, it probably will be necessary to thread a rod and bend the unthreaded end at a right angle to form a handle for turning the clamp screw.

John Krill, North Lima, Ohio.

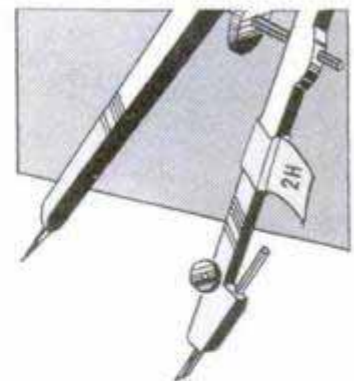
Impregnating Bristles With Soap Renews Water-Color Brush Tips

After a certain amount of use, the bristles of most water-color brushes fail to return to their original sharp point which is necessary for fine work. In many cases, working soap into the bristles and shaping them to a point will cause the bristles to retain the desired shape. To do this, simply dampen the brush with water and rub the bristles across a bar of soap several times. Twirl the bristles between the thumb and index finger until the soap is thoroughly worked into the brush and, with the fingers, draw the bristles to a point. Set the brush aside for a few days before attempting to paint with it so the bristles will have time to dry out completely.

Tabs Made of Masking Tape Identify Lead in Compass

One draftsman, who has occasion to use several compasses fitted with leads of varying degrees of hardness, identifies the lead in each one with a lettered tab made from a short length of masking tape. The symbol identifying the lead, such as 2H, 4H, and so on, is lettered with drawing ink on one side of the tape near the end. Then a short piece of the tape is cut off and wrapped around one leg of the compass in such a way that the lettered symbol is easily read at a glance.

H. Drouyn, Montreal, Can.



Combination Brooder-House Door

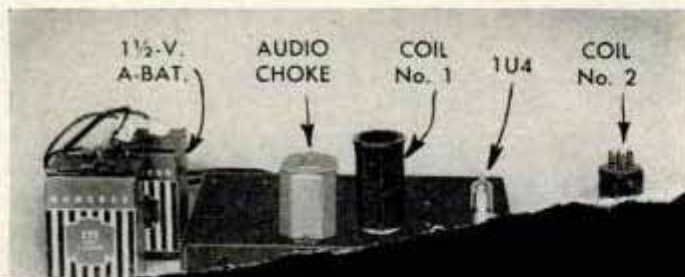
Using a combination storm and screen door on a brooder house permits the chicks to be viewed in all types of weather without disturbing them by opening the door. In cold weather, the storm window keeps heat from escaping while in warm weather the screen will provide ventilation and keep out insects.

Radio Television Electronics

RECEIVERS



BATTERY-OPERATED PROGRESSIVE



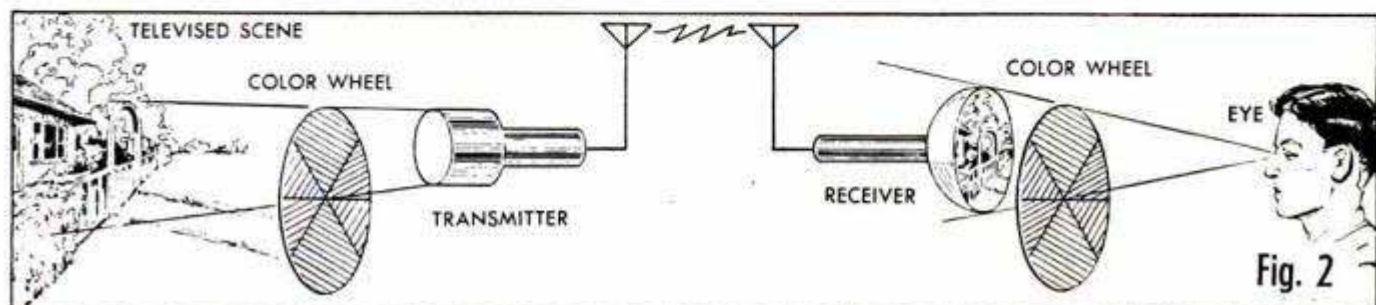
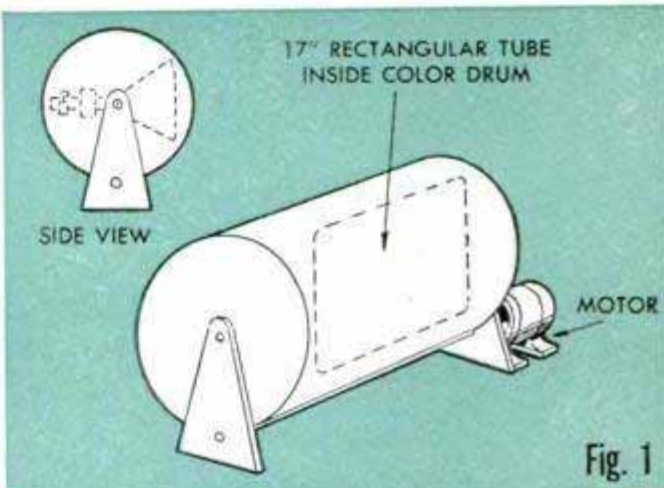
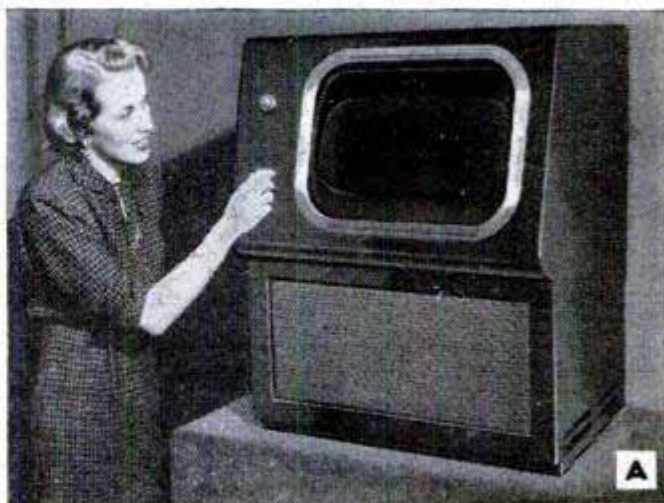
THERE are several good battery-operated radios in demand today. The course, the

CBS COLOR-TV RECEIVERS

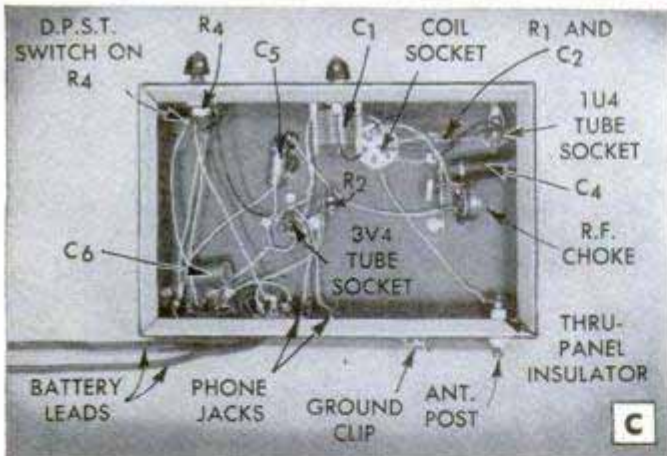
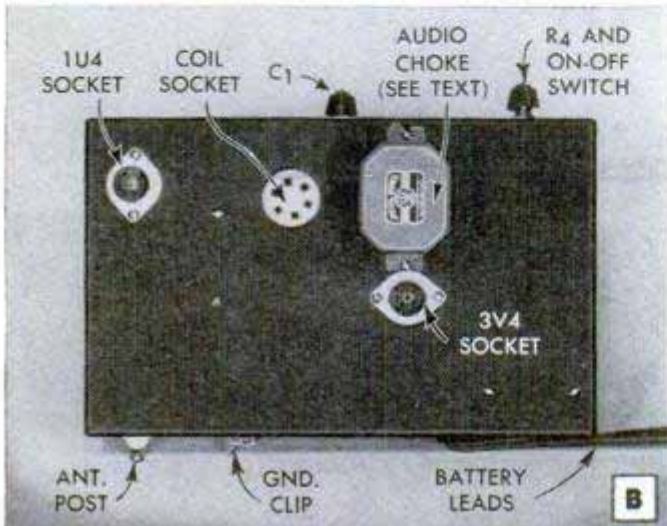
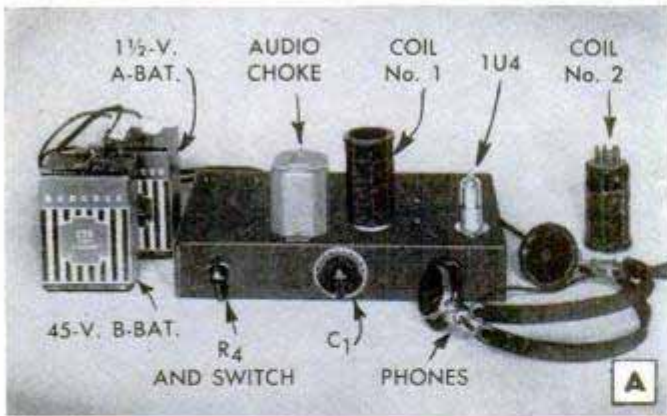
RECENT simultaneous color-television demonstrations in Chicago and New York, by the Columbia Broadcasting System, have attracted favorable attention. These public demonstrations have definitely shown the value that color television will have in the entertainment, advertising and educational fields. For the Chicago demonstration the CBS color program was fed from New York over the same coaxial cables used for networking black-and-white television to the Midwest.

One new color-TV receiver in the CBS demonstration group was the direct-view drum type illustrated in photo A. This shows color pictures on a 17-in. rectangular tube without a magnifier, in a console 34 in. high and 27 in. wide. The picture tube is inside the rotating color drum, as indicated in diagrams, Fig. 1. The color drum was originally developed by Dr. Peter C. Goldmark and his CBS laboratory associates in 1941, and was recently improved. A motor is employed to drive the color drum with its segments of television's primary colors.

Other types of TV color receivers using the conventional CBS system of flat, spinning color wheels, were included in the demonstration. The color converter, shown in photo B, slides to one side when the standard black-and-white programs are desired. Others were of the industrial type with the color-disk mechanism and enlarging lenses built in. The mechanical CBS color-TV system is illustrated in Fig. 2. As each red, green and blue color segment comes between the scene and the TV camera, the lens picks up chiefly that particular color. A similar whirling color wheel at the receiver, when synchronized with the one at the transmitter, produces the same effect on the TV screen. Persistence of vision blends the colors into a full-color picture.



BATTERY-OPERATED PROGRESSIVE



THERE are several good reasons why battery-operated radio sets are in demand today. The outstanding reason is, of course, the fact that they are independent of power lines, an important factor recognized by those who are planning civil-defense programs. The circuits are simpler for beginners and there is no possibility of hum and other baffling power-supply troubles. Modern battery sets compete very favorably with the a.c.-d.c. and similar sets, because the battery-operated miniature tubes have surprising "sock"—making possible very compact sets with good sensitivity for distant reception.

This No. 1 efficient broadcast-band progressive set will be followed at a later date with the second set which will be a full-fledged battery-operated loudspeaker set capable of pulling in short-wave stations from many foreign countries on other continents. It will retain the standard broadcast band but it will be especially designed for all of the important short-wave bands. As is customary with progressive sets, practically all of the parts used in set No. 1 can be employed with additional parts in the second set. This enables the beginner and student to build the first set and become familiar with it before attempting the second and more elaborate receiver and without wasting the useful original parts.

Set No. 1, illustrated in photos A, B, C and D, consists of a regenerative detector impedance coupled to a pentode output stage. The impedance coupling insures full plate voltage on the detector, and is one of the reasons for its excellent sensitivity. Two hand-wound plug-in coils are employed in this set; these are shown in photo E and are fully detailed in Fig. 3. The larger coil, No. 1, tunes the greater portion of

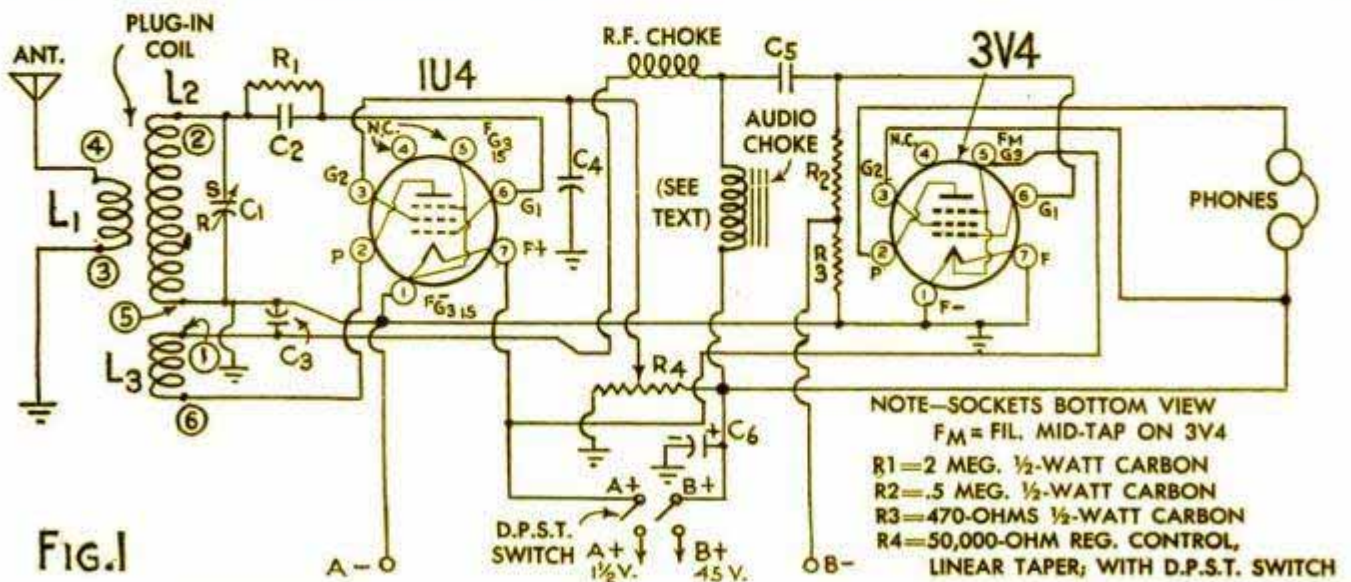
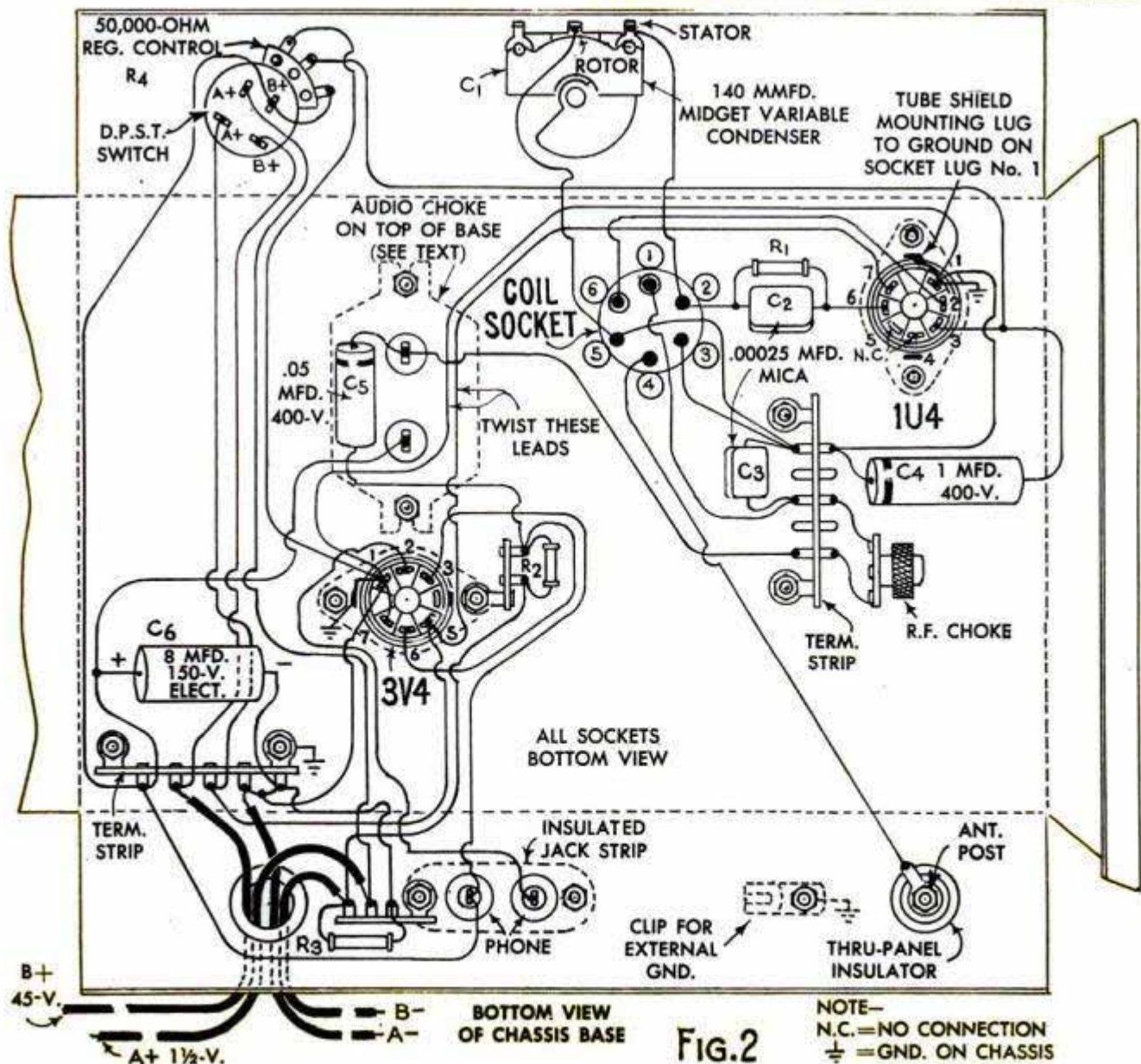
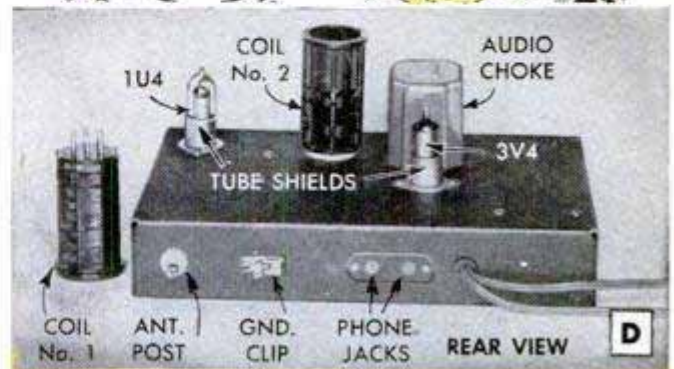
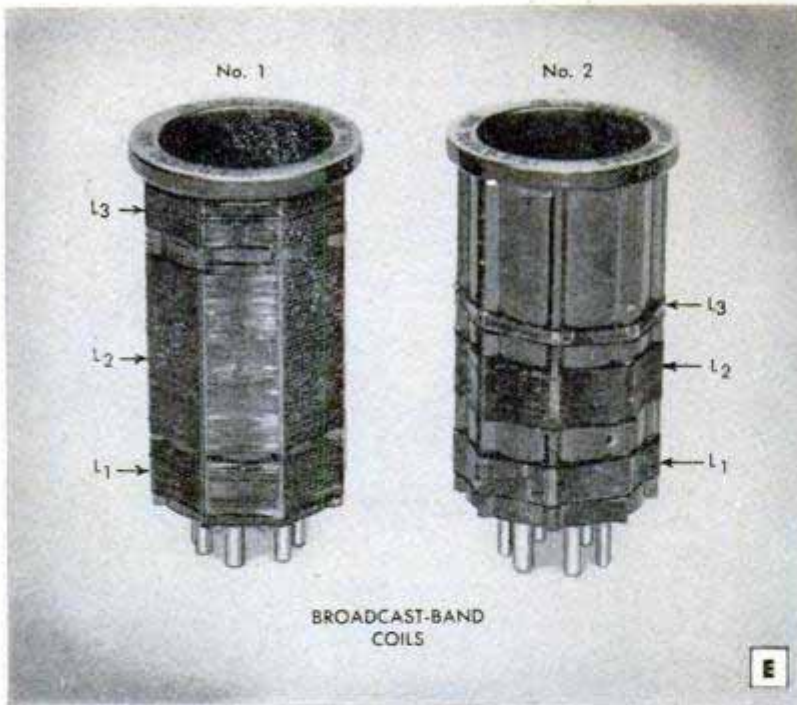


FIG. 1

SET FOR EXPERIMENTERS

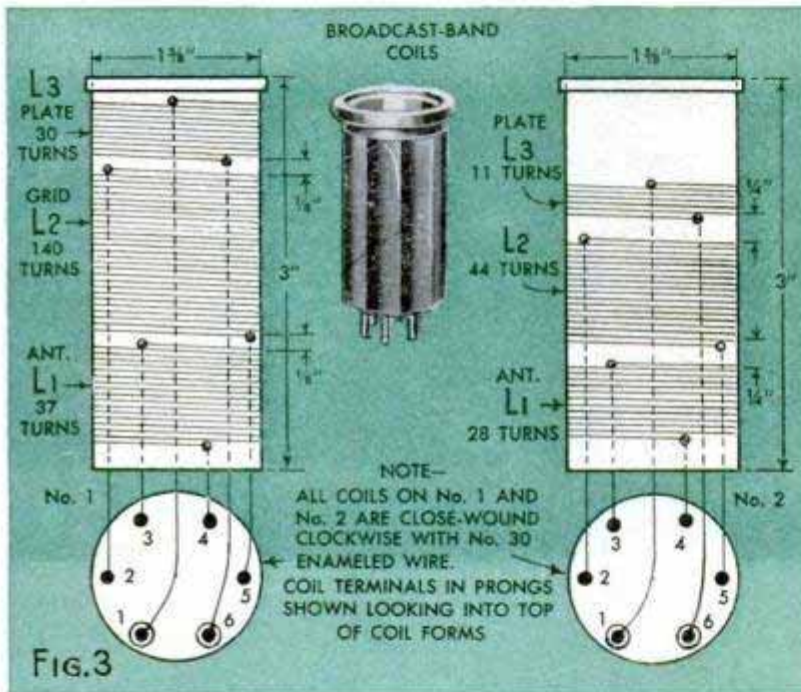
the standard broadcast band; coil No. 2 tunes the rest of the broadcast band and extends up to about 2000 kilocycles. The set is built up on a standard 2 x 7 x 11-in. black crackle-finished chassis base. All base-drilling details are shown in Fig. 4. Mount the various parts in the positions indicated in the various photos and pictorial wiring diagram, Fig. 2. When mounting the audio choke on top of the base, make sure that the terminals are centered in the chassis holes and clear the chassis. This is also important in respect to the terminals on the phone-jack strip mounted on the rear of the chassis base. Make certain that the holes in the chassis are plenty large at the points where the connecting terminals go through. The audio choke can be any 500-hy. type such as the UTC S-23 or similar unit. Any standard 3-1 ratio audio transformer with primary and secondary.



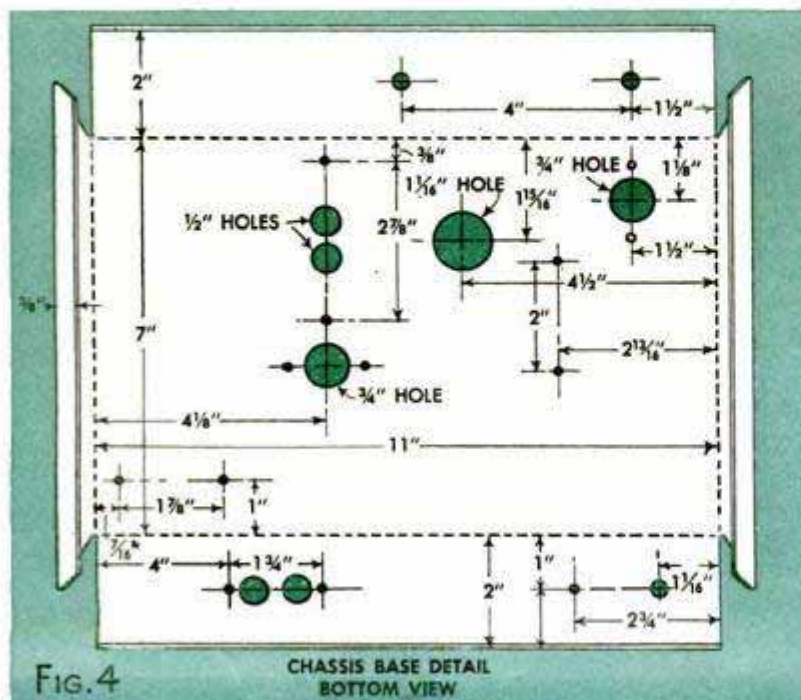


windings connected in series may be used instead.

Care should be taken in wiring, especially when making connections to the small tube sockets. Mark the positions of the various tube terminals on the underside of the chassis, as even an experienced set builder can become confused very easily. When winding the coils following the chart, Fig. 3, be sure that the various coils are "poled" properly with the connections to the pins in the six-prong forms made exactly as shown in the diagrams. The same coil terminals match the coil socket in the chassis base, and the corresponding coil terminals are numbered in the schematic circuit diagram, Fig. 1. Cross check all diagrams to be sure that your wiring agrees.



The set operates from a large 1½-volt A-battery and one 45-volt B-battery. A flashlight bulb (size not important) should be connected in series with the positive-B 45-volt lead to serve as a fuse. This protects the tubes from burnouts in case the B-voltage is accidentally applied to the tube filaments. With the batteries connected, and tubes and coil in, plug in the headphones. There should be a loud "click." If nothing is heard, recheck the battery connections and the circuit wiring. Connect the antenna and external ground wires, and if everything is working correctly you will hear a whistle as the set is tuned through a station. Backing off, or turning back, the regeneration control R4 should clear up the whistle and bring in the station clearly. For the local stations, an indoor antenna and a ground connection are all that is required. For greater distance use an outdoor antenna. With a battery-operated emergency receiver of this description, you are not cut off from outside news and vital civil-defense information should local power sources fail. Most of us do not realize just how important this could be. The No. 1 set is quite simple and all parts are easily available. Detailed student material list R-400 for this May 1951 battery-operated No. 1 progressive set is available from Popular Mechanics Radio and Electronics department upon receipt of ordinary letter postage.





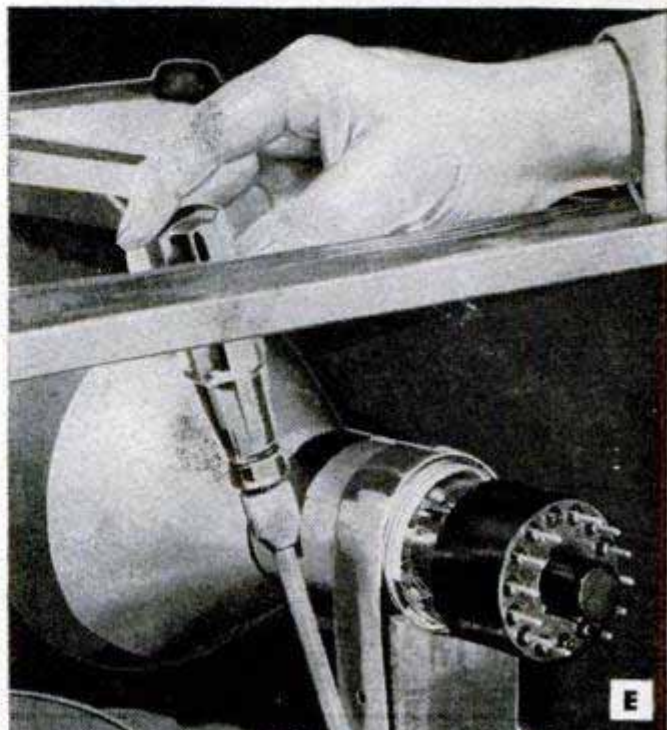
TELEVISION TODAY

NOW THAT warm weather makes television viewing indoors rather uncomfortable and especially in the daytime when the children should be out on the terrace or open porch, some TV-set owners are facing a problem. One owner in New Rochelle, N. Y., solved it in the manner illustrated in photos A and B. He replaced the existing French doors, that opened out on the terrace, with a large single door made of white pine, copper screening, optical glass and the necessary trim. Because of its size, the door required four stout hinges, half-lap joints and full dowel construction to give it the necessary rigidity. The height of the glass section will depend on the height of your TV screen. To facilitate moving the TV set into position at the door, as illustrated in photo A, the console was mounted on heavy rubber casters.

Today, the TV serviceman working in rural areas often has to transport TV antennas to farm homes. Photo C shows a specially designed homemade trailer that is used by an Indiana serviceman. When he reaches the location, he turns a crank that

raises the antenna mast until it is vertical.

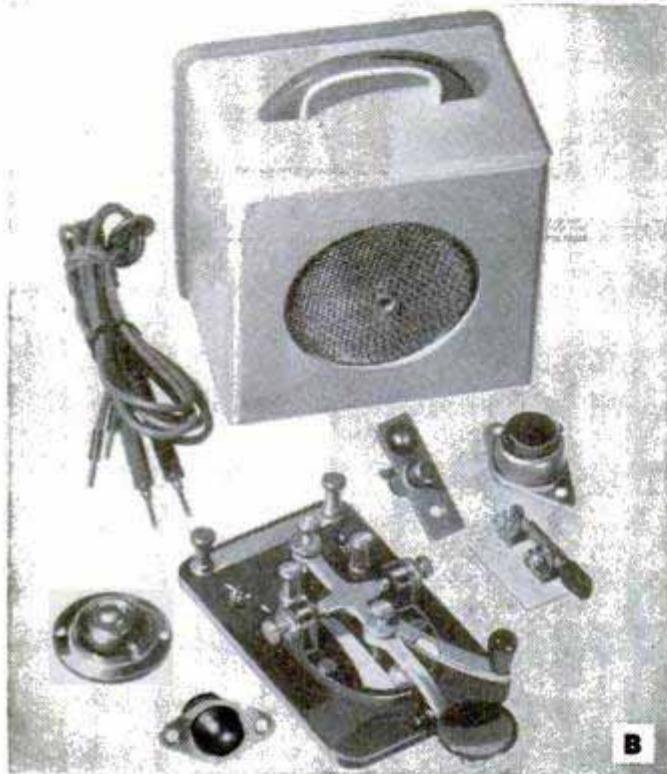
When it is necessary to remove a TV-picture tube from the shipping carton, use heavy gloves and goggles. Grasp the tube by the front end as shown in photo D. Certain types of TV tubes are mounted in the cabinet with a U-shaped bracket as shown in photo E. Care must be taken in tightening the locknuts as excessive pressure may result in breakage of the tube.



Hints for RADIO STUDENTS



LEARNING the International Morse radio code is of special interest today both to the beginner studying to prepare for "ham" radio amateur-license examinations, and to a large number of persons also preparing to take an active part in the civil-defense program. The learning of the code either by an individual, or by groups of students, is greatly facilitated through the use of a set of five double-faced phonograph records, containing specially transcribed lessons. The disks are 10 in. in diameter and work on any simple 78-r.p.m. record player as illustrated in photo A.

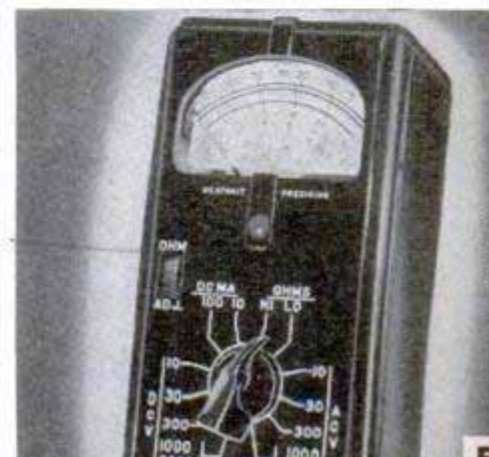
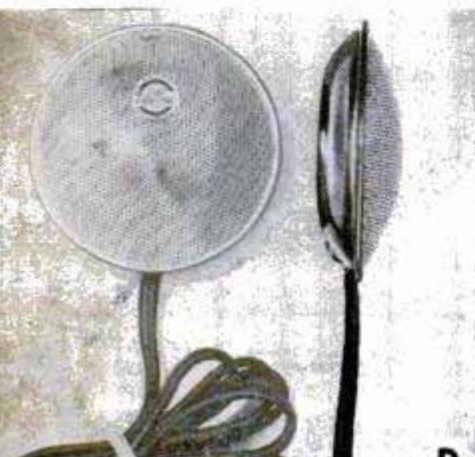


A new type of sound-generating device that may be used as a radio code-practice set, alarm or appliance-continuity tester, is shown in photo B. It employs no vacuum tubes and is powered with only one 1½-volt flashlight cell. It includes a 4-in. speaker, and generates an adjustable 400-cycle loud tone. It is claimed to produce no radio or TV interference. With the switches shown it can also be used as a window burglar alarm and, with the test leads, as a continuity tester.



Photo C shows an electric self-starting 24-hour clock designed for amateurs and short-wave listeners. It makes log-keeping easy in 24-hour time (0000-2400); shows time directly in all world time zones. The flat-type pillow speaker shown in photo D can be connected directly to any radio and can also be used as a dynamic microphone, requiring only two stages of amplification. The compact line adjuster illustrated in photo E permits operation of electrical devices at 115 volts when the supplied voltage is 65, 75, 90, 100, 115, 130 or 145 volts, 50-60-cycle a.c.

Photo F shows a student volt-ohmmeter that is available in an easily assembled kit.



DARKEN THE SKY IN YOUR PICTURES

without changing other tones

The **Kodak Pola-Screen** does the trick—in color and black-and-white. Place one in front of your lens for dark, dramatic sky effects without impairing other tonal values. The accessory **Kodak Pola-Screen Viewer** over the indicator handle of your Pola-Screen “previews” the varying sky tones. Pola-Screens also cut surface reflections in both color and black-and-white pictures. Price of Viewer, \$6.50; Pola-Screens, from \$6.50.

PHOTO TIPS FROM KODAK

WARM UP YOUR COLOR SHOTS with a Kodak Skylight Filter

With this filter you'll wipe out the bluish cast in outdoor color shots. Use it for pictures of mountain, marine, sunlit snow scenes . . . pictures made in open shade under a clear sky and on overcast days. Keeps other colors natural-looking. Prices start at \$1.60.



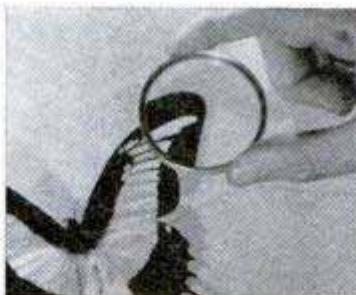
SHADE THE EYE OF YOUR CAMERA for better pictures

A **KODAK LENS HOOD** attaches in an instant—saves snapshots from sun flare. A “must” for taking those dramatic back-lighted pictures. Useful indoors, too, for pictures side-lighted with photo lamps. Prices start at \$1.60.

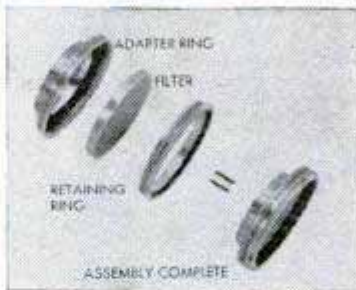


“MOVE IN” FOR CLOSE-UPS of flowers and table-top subjects

Slip a **KODAK PORTRA LENS** over your camera lens for black-and-white or color pictures at extremely close range. Portra Lens 1+ is lowest power; 2+ is medium; 3+ is highest power. Combine them for stronger effects. Prices start at \$2.50.



A SINGLE ADAPTER RING accepts Pola-Screen, Filter, Portra Lens, or Lens Hood

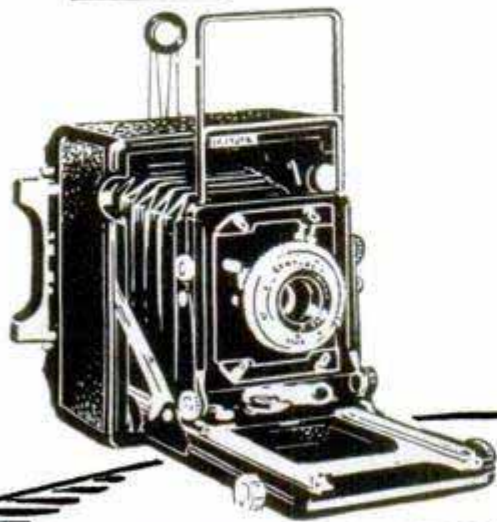


Basic unit of **Kodak Combination Lens Attachments** for attaching above items to camera lens. Series sizes to fit most cameras. Prices start at \$1.25.

BE SURE TO SEE ALL THESE LENS ATTACHMENTS AT YOUR KODAK DEALER'S. Eastman Kodak Company, Rochester 4, N. Y.
Prices subject to change without notice. Consult your dealer.

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The CENTURY GRAPHIC keeps pace with your skill!

A fine camera as it stands . . . ready to prove its versatility in a hundred ways. The Century is compact, efficient . . . the lowest-priced Graphic camera. It's rugged, dependable and built for your future! No matter how skilled you become, you'll never outgrow your Century, for it's designed to let you add the accessories you'll want as your technique develops . . . 120 Roll Holder, for economy with roll film . . . Graflarger, for enlarging through your camera . . . speedy Grafmatic, for action sequences . . . Graflite for flash perfection! Your dealer has the Century Graphic today, with fine coated f/4.5 lens, built-in flash sync., ground glass focus, Graflok back, complete for only \$109.50.

(Price subject to change.)



120 Roll Holder



Graflarger



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Graflite Flash

GRAFLEX

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Graflex, Inc., Dept. 83
Rochester 8, N. Y.

Please send details on:

- Century Graphic 120 Roll Holder
 Grafmatic Graflarger

Name _____

Street _____

City _____ Zone _____ State _____

Westerners Are Ridin' High

(Continued from page 136)

better. There, even the state legislators, many of whom have to travel long distances to the capitol at Boise, make extensive use of private planes. In fact, when 13 flying solons showed up at a session of the legislature, they formed their own organization, the Legislative Flying Club of Idaho. Their symbol is a winged and propellered desk with a solon standing on top and spouting oratory. Most distinguished member: Governor C. A. Robbins.

Use of private airplanes in flying over the mountains of the state at large has become so extensive that there is now a landing field or air strip for every other community. Idaho has approximately 340 communities, and more than 170 landing fields.

In Texas, the utilization of airplanes by cowboys has become so widespread that it is not unusual to see a plane, bulging with saddles, parked beside a rodeo grounds. The owners—bronc busters—use the plane to hop from one show to another.

Practicality of the airplane in geological research was recently demonstrated by Dave Burt and Starr Jenkins, students at the University of New Mexico, who parachuted into 100-yard-wide Glen Canyon in Utah, collected soil and rock samples for six days, then used rubber life rafts to float out on the Colorado River.

Among the heavy industries of the West, most extensive use of civil aircraft is made by lumbering and mining concerns. They haul supplies in large quantities.

Take the Clearwater Valley Light and Power Association of Lewiston, Idaho, which must patrol 1300 miles of line in the rugged mountains of north-central Idaho. It used to take days with car and by horseback or foot to find a break in the line caused by a falling tree or a snowslide. Now, with a plane, it's easy.

One day at 1 p.m. a rancher called Ed Tull, association engineer at Lewiston, to report a line break somewhere deep in the mountains.

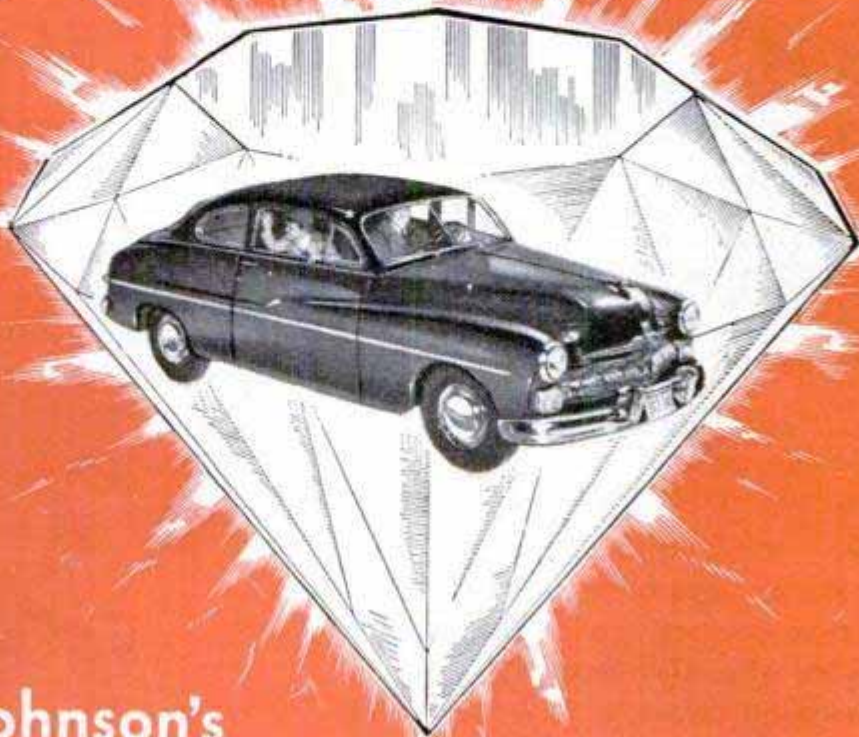
"We'll fix it this afternoon," Tull assured the surprised rancher, then proceeded to make good his word.

A licensed pilot, he flew over the area, spotted a fallen pine straddling the line, and dropped a note giving the location to the nearest ground crew. Before sunset, the crew had repaired the break. Power companies probably got the mountain airpatrol idea from the U. S. Forest Service, which began using it years ago in fighting forest fires.

The state fish and game department of

(Continued to page 232)

Here is the 20-minute auto wax —no rubbing!



Johnson's

Car-Plate

gives a lasting "diamond shine"!



Proved better on 5,000,000 cars!

Reader's Digest told the world about this sensational new way to wax a car . . .

And in less than 10 months, more than 5 million car owners have changed from old-fashioned hard-rub methods to the easy Car-Plate no-rub method.

This great new chemical discovery from the Johnson's Wax laboratories waxes a car in 20 minutes . . . gives brighter, tougher, longer-lasting wax protection!

Just spread on the clean finish of your car . . . let it dry . . . and wipe lightly. That's all you do.

Get Johnson's Car-Plate today at your service station or wax dealer's. 10-oz. can only \$1.00. (Does any car twice.)

HOW TO CLEAN BEFORE YOU WAX • Wax should always be applied to a CLEAN car. The finish should be free of road film and decomposed paint. For this reason it is important that you clean your car thoroughly before applying Car-Plate. For quick, easy cleaning, Johnson's Carnu is recommended. It does the job fast and safely—leaves a perfect surface for a sparkling Car-Plate finish.

"Johnson's", "Car-Plate" and "Carnu" are the trademarks of S. C. Johnson & Son, Inc. © S. C. Johnson & Son, Inc., Racine, Wisconsin, 1951



How to paint a room in 1/2 the time—

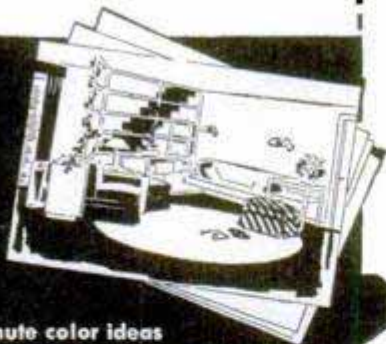
WITH
 **SPRED SATIN**
THE WONDER PAINT

You can apply it in half the time with brush or roller. Dries in 20 minutes to a gorgeous satin finish.

- ★ Covers most surfaces
- ★ Shows no laps or brushmarks
- ★ Washes perfectly, over and over
- ★ Has no offensive odor
- ★ New deep colors, ready-mixed

The secret of this amazing paint is its exclusive *synthetic rubber emulsion* formula. The rubber film forms a tight, durable surface that dirt cannot penetrate. See your Glidden dealer today.

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Up-to-the-minute color ideas
you can easily carry out in your own home!
Floor plans and color reproductions for 7
rooms. Practical, made-to-order
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Please send me your decorating kit. I enclose 10 cents (coin).
Tell me where I can buy Spred SATIN.

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Cultivating Garden

Q—What is the correct procedure in cultivating garden plants such as carrots, onions (from sets), tomatoes, sweet corn and potatoes? Should cultivation be shallow or deep, or should it be deep between the rows and shallow near the plants? Should the potato plants be hilled after they have attained their full growth?

F. C., New York.

A—Ordinarily, cultivation during the seasonal growth of vegetable plants is for the purpose of killing weeds, breaking surface crust which forms on some soils after heavy rains, and maintaining a fine soil mulch to conserve moisture. Where the garden is too small to permit the use of a tractor with cultivating attachments, the soil is worked either with a hoe or rake, or with the various types of wheeled hoes available to gardeners. The latter are made so that they will straddle the rows or, with certain adjustments, can be operated between the rows. Ordinarily, cultivation should be shallow to avoid cutting surface feeding roots of plants having spreading root systems. Also, if the soil is stirred deeply by continued cultivation during prolonged dry weather, it will gradually become dry down to the depth of cultivation. This may affect plant growth, particularly in certain types of soils in which the moisture level lowers rapidly during periods of dry weather. Early cultivations of most common garden plants can begin as soon as the seed has been sown and can go as deep as 2 in. or so for the first cultivation. Later cultivations should not exceed 1 to 1½ in. at most, and in fine, friable soils not more than 1 in. in depth. Experienced gardeners do not generally favor deep cultivation, hilling or ridging of any garden vegetable crop, the only exceptions to the rule being the occasional necessity of deep cultivation to loosen and aerate heavy, wet soils where drainage is poor during wet seasons. Also, there is a necessity of ridging a celery crop in the later stages of growth for the purpose of blanching. Many present-day gardeners who grow small patches of potatoes for the table, favor mulching rather than cultivation of this crop. Mulching is done immediately after planting the seed pieces, using peat moss, wheat straw, marsh hay or any other similar coarse material. Dry straw or hay should be spread uniformly to a depth of 6 to 10 in.

(Continued to page 230)

LAKE MEAD

NORTH CHANNEL

TRENT WATERWAY

OHIO RIVER

PUGET SOUND

GEORGIAN BAY

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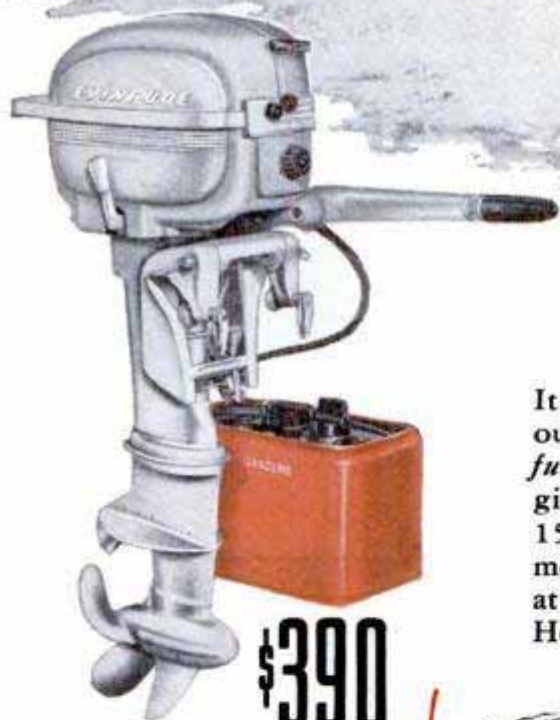
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It was bound to come... and it's here... the motor that makes outboard cruising not only completely practical but *tops in cruising fun!* Here's *Power* for the job... reliable *heavy-duty* power that gives the comfortable packet above an easy cruising speed of 15 miles an hour... top speed close to 20... and with two motors, close to 30 miles! Quiet, *flexible* power, superbly smooth at every speed from "wide open" right down to a drifting troll! Here's *new handling ease*... Gearshift with Neutral, Forward, Reverse... and Roto-Matic Speed Control... with complete Remote Controls available for placement at the helmsman's hand. And separate large-capacity Cruis-a-Day Tank. And ALL at the lowest price per horsepower in the field!

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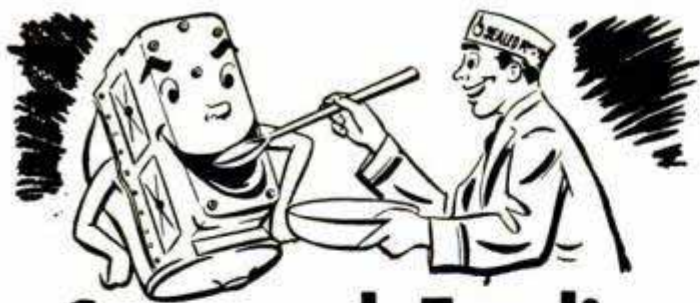
SEE YOUR EVINRUDE DEALER—let him show you the complete line of Evinrude models... Big Twin and Fastwin for cruisers, runabouts, large family boats... Fleetwin, Sportwin, Sportsman for smaller craft. Look for your dealer's name under "Outboard Motors" in the yellow pages of your phone directory. **CATALOG FREE!** Write for it today!



#25 O.B.C. certified brake H.P. at 4000 R.P.M. Approved high-speed operating range, 4000 to 5000 R.P.M.



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Care and Feeding of Engines

BY S. P. CORP

POSTPONE RETIRING TIME!

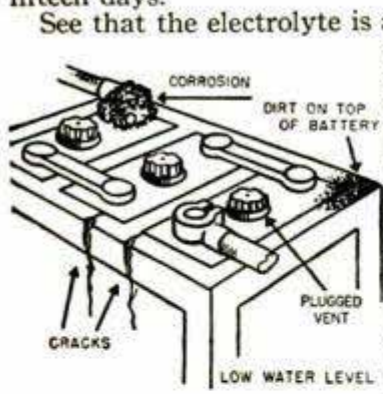
Moderate attention will help you postpone the retiring time of your tires. They should be switched every 5000 miles, and when you switch them, check each tire carefully. Probe any small cuts with an ice pick and remove bits of glass, small nails or other sharp particles which could penetrate the tube in time.

Make a habit of checking tire pressures every week. If one tire is much lower than the others, find the reason and correct it right then—to save yourself a lot of annoyance later on—as well as a few thousand miles of tire life. It helps postpone retiring time!



IT PAYS TO BABY BATTERIES A BIT

You're careful about oil. You're careful about gas. You watch your radiator with an eagle eye. Now, if you'll just give the battery in your car that same frequent, careful attention, you'll find it will pay off in several ways. It should be inspected at least every fifteen days.



See that the electrolyte is about $\frac{3}{8}$ -inch above the top of the plates. Check specific gravity with a hydrometer. A variation of 25 points or more between cells indicates that the low cell is weak. Look for a battery leak. At 80 degrees F. your battery should show 1.280 S.G. If it shows only 1.225, it is only half charged and needs charging.

If it shows 1.150 or less, it is in a complete discharge condition. If left this way, plates will sulphate, preventing recharge. Keep top of battery dry and clean. If wet, sprinkle baking soda on it, let stand a while, then brush clean. It pays to baby your battery!

MAY'S THE TIME FOR RINGS

Girls get engagement rings and wedding rings in May. Your car is a good girl—give her a set of Sealed Power Piston Rings—the best rings built! The Sealed Power MD-50 Steel Oil Ring controls oil even in badly tapered and out-of-round bores. There is a Sealed Power Ring Set specifically engineered to do the best possible job in your engine, whatever the make, model, or wear condition. Write for free booklet, "7 Ways to Save Oil." Address Dept. G-5, Sealed Power, Muskegon, Mich.

(Continued from page 228)



Finish Turning Gray

Q—Our walnut dining-room set seems to be turning a gray color from what was originally a natural finish on walnut. At first this appeared only in small spots, but now it seems to be spreading. What is the cause of this graying of the finish, and what can be done to correct it? Is it due to the use of furniture polish?
L. F., Tex.

A—It is not likely that the discoloration you describe is caused by the use of furniture polish—that is, if the polish has been properly applied. There are a number of causes of such a change in color of the original finish, but if we understand your description correctly, the most likely one is the bleaching, or bleeding, of the coloring matter in the filler which was used in filling the grain of the wood. Bleaching leaves the filler in its natural color. This particular discoloration sometimes occurs when a wood filler containing stain has been used and a clear lacquer applied over it as a finish coat. The remedy for this defect involves a process which is not easy to carry out without use of special equipment, but furniture refinishers sometimes sand the surfaces lightly with fine sandpaper, then spray on a coat of what is known to the trade as amalgamator. This material softens the original finish somewhat and tends to spread it, changing the reflective properties of the surface and forming a suitable base for new finishing coats. While this treatment generally restores the finish to its original color, in some cases, it will not be entirely successful. If it shows any indication of failure, then it is advisable to remove the defective finish to the bare wood and build up an entirely new finish. Of course, it often is possible to restore the original color, at least temporarily, by the use of shading lacquers applied with a spray gun. Where this is done it is necessary to use a non-raising lacquer.

Cleaning Furnace Filters



Q—Is there any way to clean the filters used in forced warm-air furnaces so that they can be used from year to year without the necessity of renewing them each heating season? I have tried brushing off the matted dust and lint that gathers on the upper surfaces but this did not prove entirely satisfactory.
R. M., Pa.

A—Cleaning of the filters by any ordinary means cannot be recommended without reservation. It is best to renew them at the beginning of each heating season and usually it is necessary to replace them at least once during the winter months. However, you can clean out a portion of the dust and matted lint which collects on the upper surfaces by directing a blast of air from a tire pump through the filtering material. This will blow out much of the lint that tends to collect on top of the filters. Remove the filters from the blower compartment, take them outdoors and direct the air blast from the tire pump through the openings in the thin sheet-metal retainer. Only a light air blast is permissible, as otherwise you may damage the filtering material. When replacing old or new filters in the furnace, be sure to locate them with the correct face up, as indicated by arrows on the ends. It should be understood, of course, that the method of cleaning described above is not a recommended season-to-season procedure.



MARFAK MADE HIS CAR RIDE SO CUSHIONY HE'S SPOILED

Marfak chassis lubrication protects the chassis against wear and friction — far longer! It resists squeeze-out and wash-out — sticks to vital points for 1,000 miles or more. So you get a wonderful “cushiony” ride! Get *Marfak* lubrication today. See your Texaco Dealer, *the best friend your car ever had.*



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Texaco Products are also distributed in Canada and in Latin America

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NEW!

Klean-Strip Remover Peels Off Paint



Throw away messy, dangerous solvents! Klean-Strip, the new-type remover, needs no

after-wash, will neither burn nor explode. Just apply with brush, or spray gun . . . then slide off the loose film. That's all there is to it!

Klean-Strip actually breaks the bond between wood or metal and the finish you want to remove. Peels off any paint, enamel, varnish, synthetic or lacquer. Works fast, leaves the surface clean, smooth and dry, ready for a perfect refinish job.

The next time you buy paint, get a can of Klean-Strip, too! Available at better paint, hardware, and department stores everywhere.

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Clean · No-Wash
Non-Inflammable



SIMPLE DESIGN
and FEWER PARTS
MEAN TROUBLE FREE
PERFORMANCE!



For lasting satisfaction you can't beat a Bendix* Coaster Brake. Built to give you quicker stops—easier pedaling and longer coasting—it's the outstanding performer in its field. Your bicycle dealer will put on the brake you want—so just say "Bendix Coaster Brake." *REG. U. S. PAT. OFF.

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WITH A **Bendix**
COASTER BRAKE

Ride
a Bike
- it's
Fun!

ECLIPSE MACHINE DIVISION of
Elmira, New York



Idaho recently started flying over trout streams just before the fishing season opens. Overanxious anglers are spotted and reported to ground patrols. Next step: justice of the peace.

Another government service that has found use for the airplane in the West is the Department of the Interior. Pilot Marvin Wolfe of the department, who used to fly the "hump" in the China-Burma-India theater of war, has become one of the West's leading coyote killers.

He flies over areas of Nevada, Idaho and Oregon, where there are no fur-bearing animals except coyotes. First he drops tempting chunks of beef, then he circles back and scatters strychnine pills around the meat. When the coyotes get a scent of the meat, they head for it on the double, pausing only to lap up the tasty looking pills. Sometimes they can stagger to the beef, sometimes they die before they get there.

Many coyote hunters, however, still get the livestock killers by flying low over them, and blasting away with a shotgun. Hunters also make extensive use of planes in flying into elk and deer country.

In the Clearwater area of northern Idaho, which offers the world's best elk hunting, pilots often have to buzz a mountain air strip to clear it of elk before landing.

Western fishermen, too, make good use of planes to reach isolated lakes and streams. In the Primitive Area of Idaho, planes are virtually a necessity. Many of the waters had to be stocked by dropping fingerlings from the air, and now it takes a plane to go after the grown-up products.

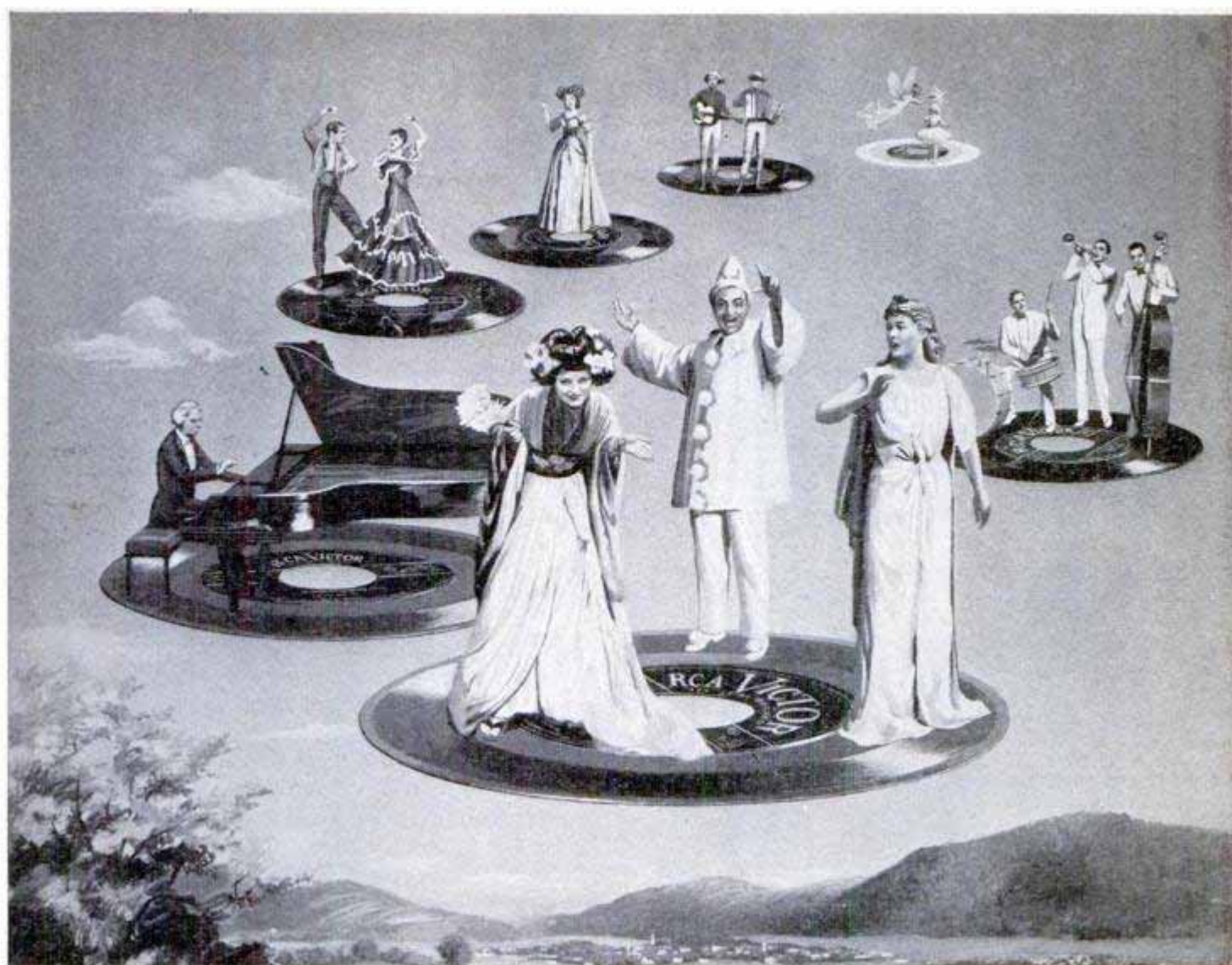
One of the West's most ardent air-traveling fishermen is Bob Savaria, operator of the airport at Hailey, Idaho. He can land anywhere—if there are fish to be had.

Someone asked him if that kind of fishing weren't dangerous, and he nodded.

"Yes," he said, "I flew into the Sulphur Creek area on a fishing trip and came near losing my life. A salmon I caught bit me, and it took a quart of sulfa pills and a battery of penicillin injections to check the poisoning."

Squeezing Water From Coal

Now generally wasted, Wyoming's slack coal may prove more profitable than raw coal for export in briquet form. A new process developed at the state university dries about one fourth of the weight from Wyoming's high-moisture-content coals, increasing its fuel value up to 25 percent. A study is underway to determine whether it is commercially practical to set up drying and briquetting plants in the state.



Music's immortals play again, sing again, in RCA Victor's "Treasury of Immortal Performances"

A treasury of Music's Immortals

Now artists whose names are musical legend live again for the modern listener. You can hear them, at their finest, in RCA Victor's "Treasury of Immortal Performances."

In recreating these performances on both 33 and 45 rpm, acoustical engineers drew on a vault of master records guarded for posterity by RCA Victor. But new electronic techniques, developed through RCA research, give the new records a richness and

quality of sound far surpassing that of the originals.

Because RCA Victor could draw on so vast a storehouse, there is something in the "Treasury of Immortal Performances" for every listener. Caruso sings light and serious music—as do Schumann-Heink, Mary Garden, and others . . . Paderewski is here . . . and, if your taste is for popular music, such greats as Berigan, Armstrong, Waller, in rare early records.

* * *

See the latest wonders of radio, television, and electronics at RCA Exhibition Hall, 36 West 49th St., N. Y. Admission is free. Radio Corporation of America, Radio City, New York 20, N. Y.



The magic of RCA Victor's "45" system—as an independent unit, or combined with radio or television—has led 55 record-makers to adopt it.



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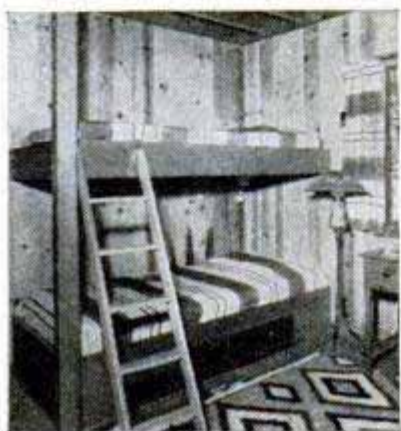
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REMODEL THE ATTIC

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PINES***



Rugged, he-man quarters for your young buckeroos are a cinch to build with colorful, easy-to-work Western Pines*. Or turn an idle attic into a cozy and hospitable guest room by building double-deck beds of these attractive, economical woods.

The smooth textures and straight, even grain of the woods of the Western Pines*—the wonderful way they grip paint, stain or wax—make them a joy to use on any workshop project. Cabinets, bookcases, tables, built-in fixtures for kitchens or rumpus rooms take on beauty and character from these glowing woods. They have long been favorites with home craftsmen who take pride in turning out a variety of useful and attractive home furnishings.

SEND FOR FREE IDEA PACKET No. 309!

Shows you how, with a little planning and ingenuity, you can work wonders all through your home with the versatile Western Pines*—and have fun doing it. Contains new, colorful illustrated booklet, "Enchanting Homes of Western Pines," "Bunk Bedroom Details," "How to Treat Knotty Pine Paneled Walls," etc. Write to Western Pine Association, Dept. 309-N, Yeon Bldg., Portland 4, Oregon.

These are the Western Pines

* IDAHO WHITE PINE
* PONDEROSA PINE
* SUGAR PINE

Atom Power Goes Into Gear

(Continued from page 83)

roomier crew accommodations and more elaborate sound and radar equipment.

To top it all, her atomic engine is expected to run so quietly that enemy electronic ears will not, in most cases, be able to hear her. Even if they do, her fantastic underwater speed will carry her safely out of danger before an enemy ship could turn around.

Even more intriguing than the atomic submarine, but also more complicated, is the idea of an airplane with a nuclear-driven power plant. It could fly nonstop around the world at supersonic speeds, ride out any bad-weather traffic stacked over an airport and would never be subject to a power failure on take-off or landing. For the past several years, at Oak Ridge, Tenn., the NEAP (Nuclear Energy for Aircraft Propulsion) division of the Fairchild Corporation, prime contractors for the Air Force's atomic program, has been busy designing possible nuclear-powered aircraft engines—including engines for the rocket that may one day overcome the earth's gravitational force and break away into space.

How the atomic reactor can be adapted to different types of aircraft engines is revealed briefly by Andrew Kalitinsky, chief of NEAP. All are thermal power plants, which means that the heat of the reactor is turned into the energy that drives the plant.

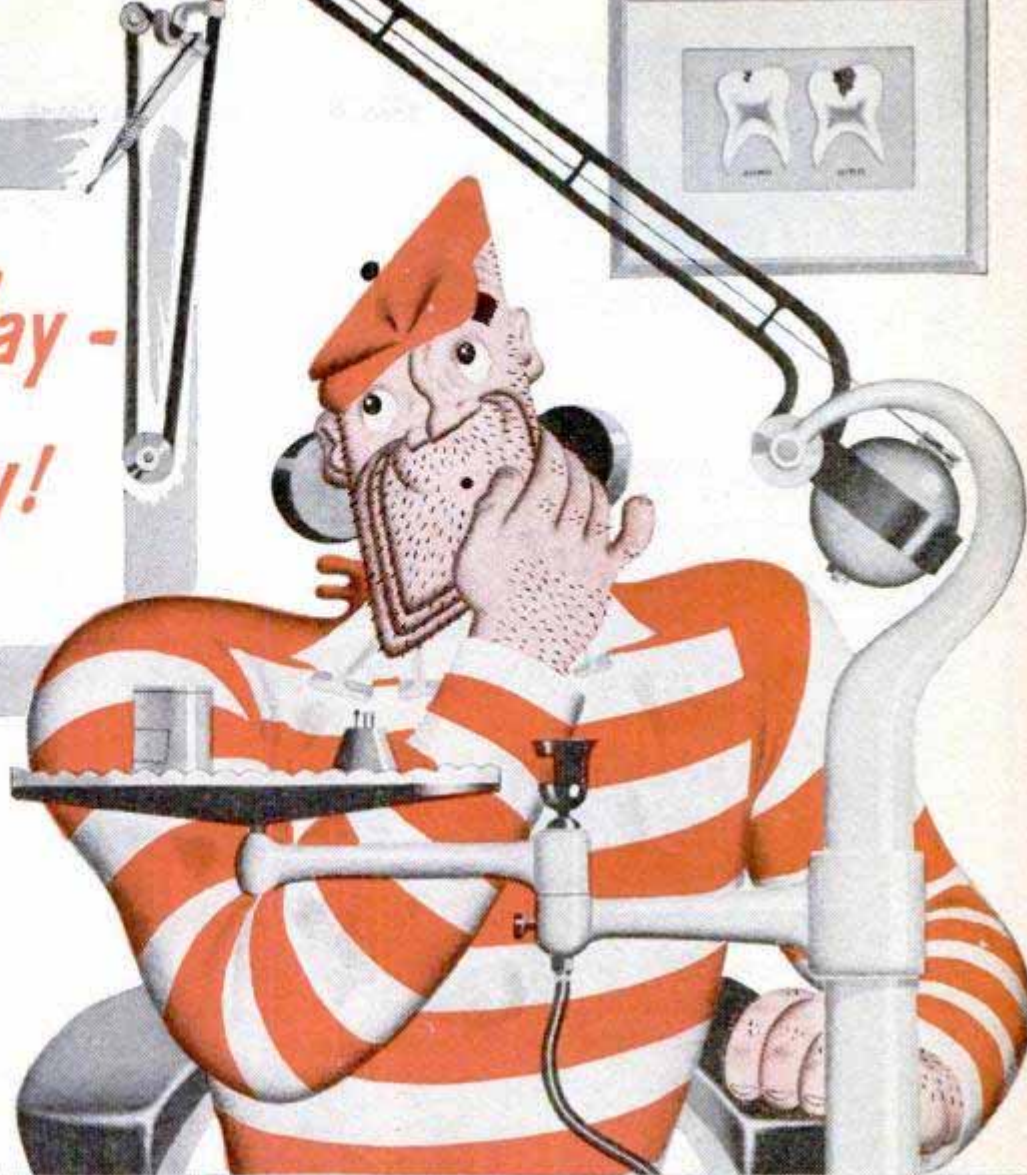
In the turboprop, the nuclear reactor heats steam, or mercury, in a pipe system that forms a closed loop between the reactor and the turbine. The violently heated vapor in the pipe expands rapidly through the turbine which, in turn, drives the propeller. The hot vapor, having passed through the turbine blades, then moves through an air-cooled condenser which cools it down. Pumps push it on through the system and back into the reactor again. Round and round it goes as it drives the propeller faster and faster.

"Since this plant requires the use of propeller and air-cooled condenser," Kalitinsky points out, "it will evidently limit the speed of the plane in which it is used." At that, it would probably move faster than anything with propellers today.

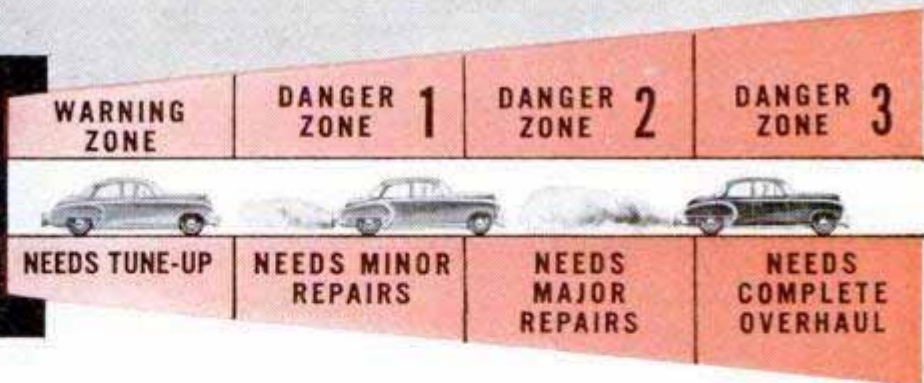
Less pokey would be the nuclear-driven turbojet. In this adaptation, the reactor simply replaces the combustion chamber of the standard turbojet. An auxiliary motor starts the forward turbine compressing air into the engine housing where it is forced through the reactor. Here the

(Continued to page 236)

*The more you delay -
the more you pay!*



**KEEP YOUR CAR
OUT OF THE
DANGER ZONE**



Watch out for oil-pumping. Usually it means your piston rings are worn. And you're headed for costly Danger Zone 3.

See your motor specialist at once. He'll show you how to get out and stay out of the Danger Zone. He'll show you that replacing piston rings early is relatively

inexpensive — but the more you delay, the more you pay.

Replace worn-out rings with Hastings Piston Rings and you stop oil-pumping, check cylinder wear, restore engine performance. It's the best money you can spend on your car.

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air is raised to incredible heat, expands violently and drives itself on through the rear turbine, which is connected to the forward one by an axle. Now the rear turbine picks up speed, turning the forward one with it, and taking over the work of compressing more air in the front. Finally, the hot air whooshes out of the jet nozzle in the rear, creating tremendous thrust. The upper limits of speed for a plane using such an infernal machine are anyone's guess. As Kalitinsky explains, the whole thing simply works on air, which is heated and expanded in the reactor — by convection, instead of by fuel combustion.

Similar in principle, but simplest of all is the atomic-ramjet design, which also works on expansion of air. Air enters the diffuser and is compressed by the forward motion of the plane (the plane must be going several hundred miles per hour before it will start working efficiently). Instead of supplying oxygen for the combustion of fuel in the firing chamber, as it does in today's ramjet, the air passes through the reactor, is heated and expanded, and explodes violently out the rear, shoving the plane forward at supersonic speeds.

Oddly enough, the nuclear rocket, if it is ever built, will have to use a combustible fuel — like liquid hydrogen, otherwise it couldn't operate outside the earth's atmosphere. The hydrogen would be pumped out of a tank, down through the reactor, where it would burn violently and expand out through the exhaust nozzle, driving the rocket upward. Such a nuclear rocket would have about three times the oomph of any rocket leaving the ranges today.

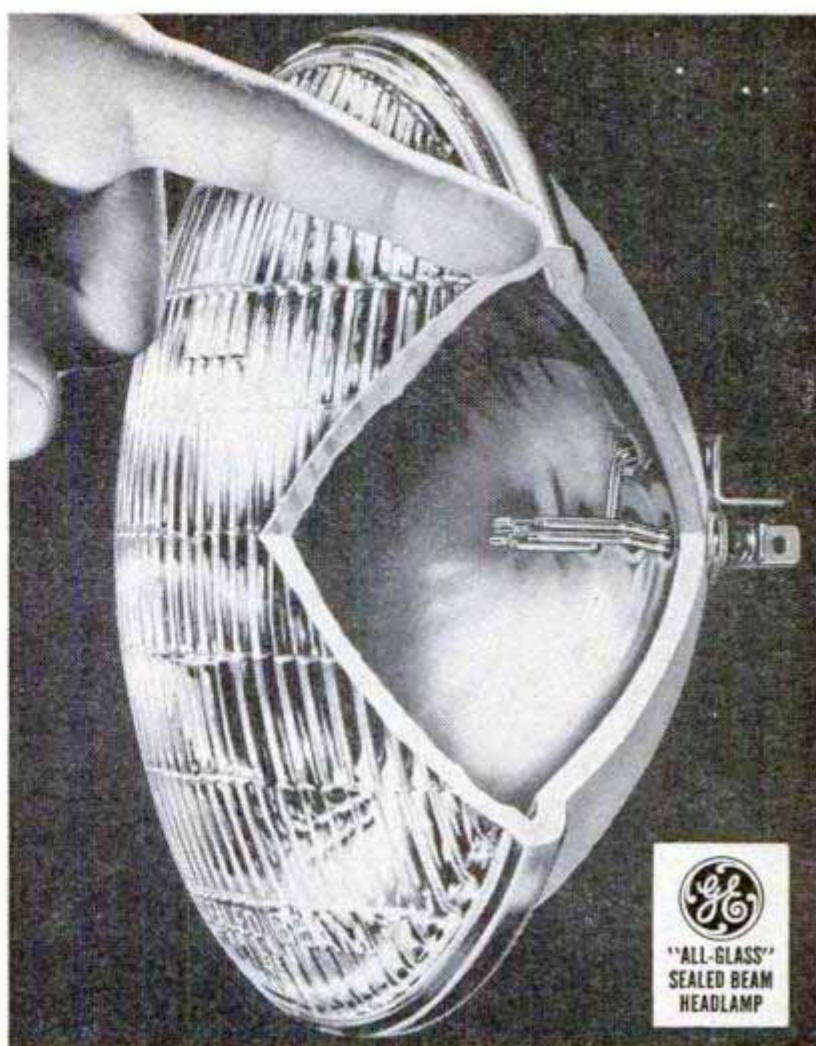
All these engines look fine on paper. But so far, atomic piles consist of a huge stack of graphite blocks, honeycombed with holes for uranium rods and control rods of boron or cadmium. All this is surrounded by layers of lead, graphite and concrete to the tune of about eight feet. How do you install that in an airplane? The answer is, you don't.

Materials-testing piles already have turned up effective shieldings of very dense materials that cut down the bulk and weight. "The first plane," says one top-flight scientist in the atomic-energy program, "will be a military one—not commercial. Hence, it can be parked in an isolated spot where some radiation might escape harmlessly. Crews may be protected from gamma rays by simple shielding across the fuselage." Such a shield might fit around the reactor like a tin can with its rear end left open. Radiations out the back would harm no one. Other shielding, encircling the crew, would have to absorb

(Continued to page 238)

**BECAUSE THEY ARE
ALL ONE PIECE—
G-E "All-Glass"
HEADLAMPS**

**DO NOT
GROW
DIM!**



**DIRT AND MOISTURE CAN'T GET IN
TO REDUCE LIGHT OUTPUT**

THE cutaway view above reveals one big reason why General Electric "All-Glass" headlamps do not grow dim. Lens and reflector are *one piece*, with filaments firmly anchored in the reflector, making the whole lamp one unit. Because it's a single unit, dirt and moisture can't get in to dull the reflector.

"All-Glass" headlamps give more light, right from the start. And they continue to give more. Tests show they average 99% as much light at end of lamp life as when new. New or old, G-E "All-Glass" headlamps help make your night driving safer and more comfortable.

Get ready for Summer driving by checking your lamps now. And be sure to ask for General Electric headlamps by name if you need a replacement.

**HERE'S HOW TO PLAY SAFE
WHEN YOU BUY SEALED-BEAMS**



1. FEEL THE SEAL

There is no seam where glass reflector and glass lens are fused into one piece. Dirt and moisture can't get in.

2. SEE THE G-E

It's on the back of the headlamp near the top. It's your assurance that your headlamps **WILL NOT GROW DIM.**



You can put your confidence in—

GENERAL  ELECTRIC



...with these
Wizards with Wood

Mending something that needs gluing? Making something that needs finishing? If it's made of wood, ask for Firzite, Satinlac and Weldwood Glue at hardware, paint and lumber dealers—or mail coupon for leaflets.

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To make things or fix things, use Weldwood Glue for all wood-to-wood bonds. Makes joints stronger than the wood itself. Mixes easily with water. Stain-free, rot-proof... highly water-resistant!

WELDWOOD®
PLASTIC RESIN GLUE

A MUST for Finishing Fir Plywood



Tame that wild grain with FIRZITE. Virtually prevents grain raise or checking... readies the surface satin-smooth for paint, stain or enamel. (For blond, pickled, or tinted effects on soft or hard woods, use White Firzite).

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For "natural wood" finishes on furniture, panelling or woodwork, there's nothing like Satinlac. Brings out natural grain and color beauty of any plywood or solid wood. Avoids that "built-up" look; will not turn yellow or darken with age. "Water-clear," easy to brush or spray, dries ready for next coat in 2 or 3 hours.

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neutrons. Every effort will be made to reduce weight.

What man has been able to do with one tiny type of uranium atom doesn't release more than $\frac{1}{1000}$ of the energy in that atom. Inside a working reactor, relatively few atoms of unstable U-235 are knocked apart by flying particles (neutrons). Each time a neutron splits an atom, the two halves of the atom fly apart, bump and jostle other atoms and create heat. Meantime, two or three neutrons from the split atom are freed. One may fly off to split other atoms and keep the chain going. The others may bury themselves in the shielding or be absorbed by the control rods or other working parts of the pile.

So far, the only latent power in the whole process that scientists know how to use is the heat from those atomic collisions. Some men feel sure that electricity will some day be produced directly from the fission process, but as yet there's no practical way of doing it.

It all sounds pretty feeble until you know that the tiny bit of heat energy released from one pound of fissioning U-235 is equal to the heat energy produced by 2,600,000 pounds of coal, or 360,000 gallons of gasoline.

That's the heat that will be used to drive the atomic submarine and airplane. It also will be used at Harwell, England, to convert atomic energy into electricity. Some kind of heat-transfer agent—probably one of the liquid metals—will run through the pile and pick up heat, then return to a boiler where it will turn water into steam which will generate electricity.

In all probability, Harwell will have its own refining plant to process raw uranium and extract U-235. Processing plants for the by-products of fission—like isotopes—and reprocessing plants for atomic fuels, may also be close at hand. Radioactive wastes may have to be held in huge underground tanks until radioactivity in them subsides.

All this makes atomic power expensive—one of the reasons why most scientists now estimate 20 years or more before such plants for public power are practical. Recently, the Monsanto Chemical Company discussed plans for a 75,000-kilowatt atomic-power plant at an estimated \$25,000,000, against \$10,000,000 for a comparable coal plant. No one will say for sure what the operating costs would be—but someone has estimated it as about the same as a coal plant, if coal were \$10 a ton.

Cost isn't the only fly in the atomic ointment. Suitable materials for building power units still are a headache. Nuclear

(Continued to page 240)

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** Prices slightly higher south of the Ohio and west of the Mississippi rivers.*



CRAFTSMAN "100" Bench Model
\$8250*
Cash
Without motor
Only \$8.50 Down
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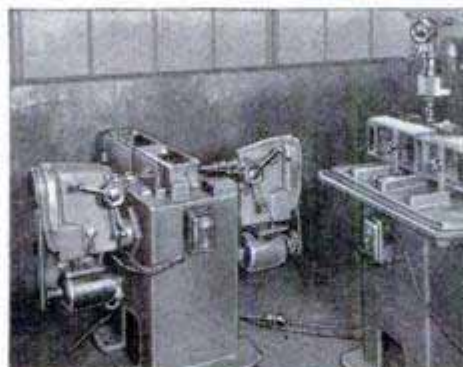
CRAFTSMAN "100" Floor Model
\$9250*
Cash
Without motor
Only \$9.50 Down

Drills to center
of 15-in. circle

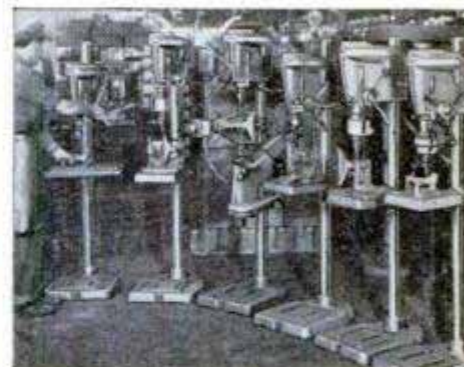
CRAFTSMAN flexibility makes possible dozens of operations like these!



Typical gang drill press set-up for tapping. CRAFTSMAN flexibility can save you money in hundreds of similar industrial applications like this!



Another example of CRAFTSMAN utility . . . two CRAFTSMAN drill press heads used horizontally in special set-up for production-line side drilling



CRAFTSMAN drill press battery set-up for progressive drilling, tapping. Versatility like this can cut costs for dozens of your own operations.

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Jacobs Rubber-Flex Hex-Key Chucks on home workshop power tools prove that their makers put quality first.

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piles aren't like high-temperature engines in which you just look for a harder or tougher steel. Fissioning atoms do queer things to most materials. Nitrogen comes out carbon; gold turns into mercury; sodium becomes magnesium; platinum turns into gold; glass comes out phosphorus.

"How would you like," Doctor Hafstad asked a group of airplane manufacturers recently, "to try to design aluminum plane engines which, during use, would slowly turn to cast iron or lead?" That's the kind of thing that happens in a pile.

A brand new reactor at Brookhaven, as well as the one now building at Arco, will be used to test materials and find just which ones will stay put under nuclear bombardment. When they are found, most of the structural problems in atomic-fueled engines will be solved.

But there's another roadblock if we're to have useful atomic power on a large scale. Fuel. Though uranium is plentiful, much of it is scattered all over the world in quantities so minute no miner in his right mind would bother to work it. There's plenty for present plans, but if we started to electrify the United States with all known get-at-able world uranium reserves, we'd only have enough to last a few years. Worse, all uranium isn't fissionable—only U-235, which amounts to about one part in 140 in pure uranium ore. The rest is U-238, which won't fission.

But in the early days of atomics, scientists discovered something: When U-238 was put in a reactor and bombarded, it changed, like many other things. Only this time the change was welcome. It became plutonium—which does fission. Since then, they've discovered another substance that does the same thing—thorium, which is vastly more plentiful than uranium. What's more, the physicists believe that U-235 will make twice its own weight in both other products. And, once U-238 or thorium are made fissionable, they, in turn, can be used to make more and more of themselves. It's something like compound interest and, in fact, the new pile devoted to this atomic-fuel "breeding" experiment, at Arco, is known as "Operation Bootstrap." If it works, our atomic-fuel reserves will be increased some 400 times. However, the laborious process of cycling and recycling fissionable materials to squeeze them dry will take years to perfect.

But that isn't so bad, because there will be plenty of interesting things to watch as the atom develops. It won't be an easy development. "Nobody," says Andrew Kalitinsky, "should expect to see an atomic-powered rocket take off for the moon this year or next."

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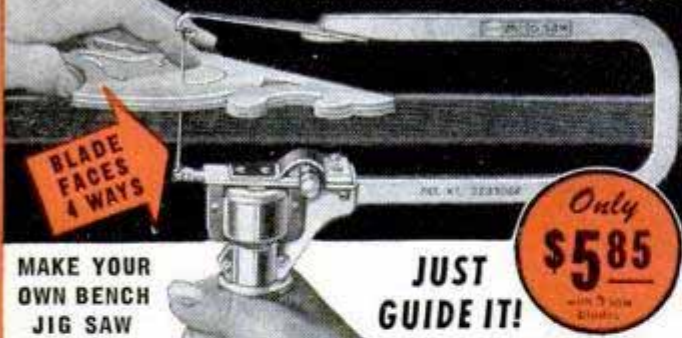
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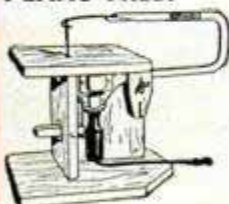
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Quick, Watson, The Micromanipulator!

(Continued from page 77)

of brown glass embedded in a shoe were identical with other glass fragments found on the rungs of a ladder. All the glass samples appeared to be identical and he wondered if they had the same density.

He prepared a gradient solution from methylene iodide and other heavy transparent liquids and poured it into a pair of tall glass tubes. The mixture is lightweight at the top and increases in weight or density toward the bottom. Anything that is placed in the solution will fall until it reaches liquid of exactly its own density, and there it will stay. Provided, of course, that its own density is within the limits of the precise solution that is used.

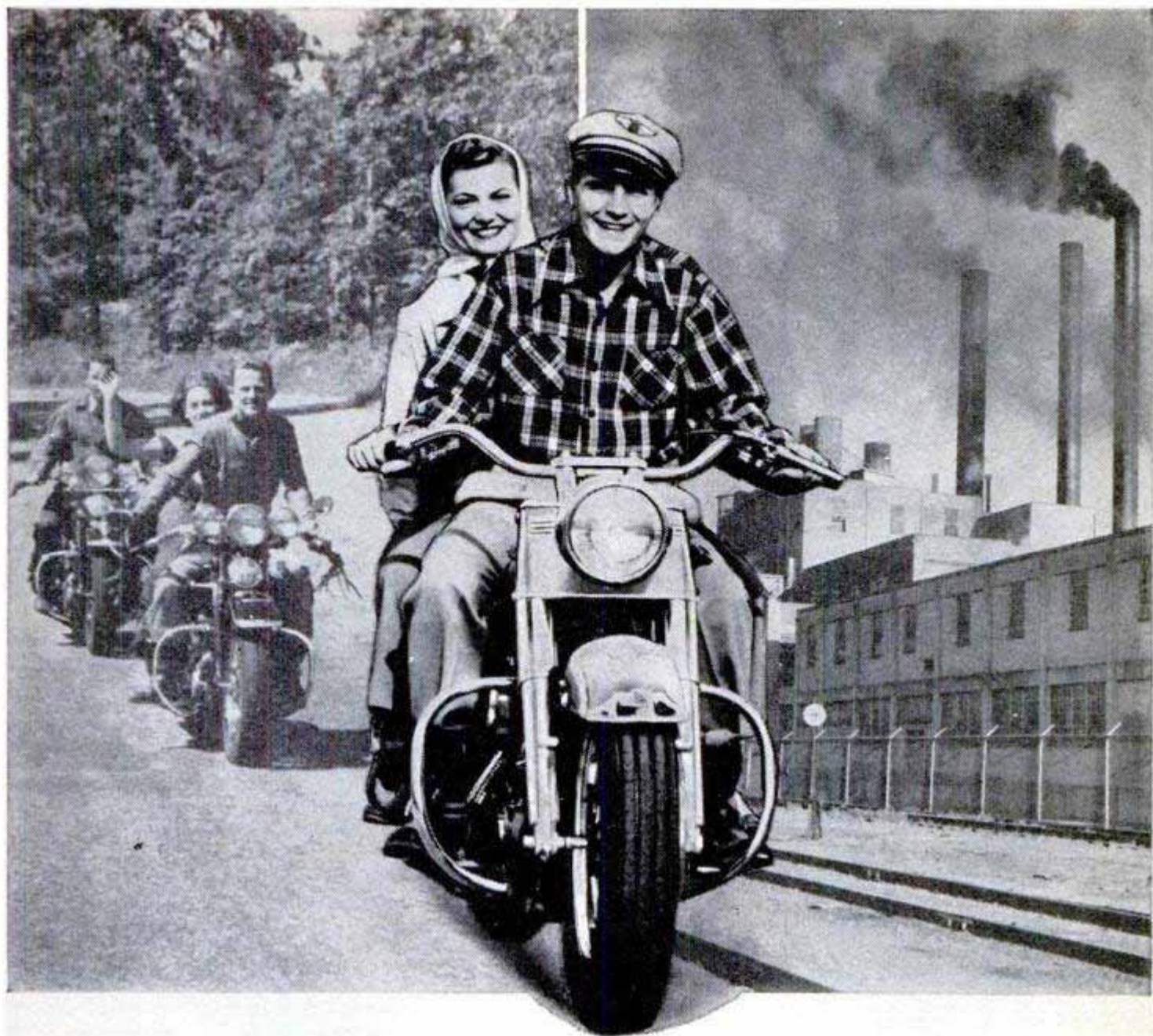
When Doctor Kirk dropped his fragments of brown glass into the two tubes he found that the glass particles came to rest at different levels. They were not of the same density and hence they could not establish the link that he was seeking between the shoes and the ladder.

The gradient tubes have proved to have scores of uses. They can "fingerprint" many kinds of materials. A sample of earth, for instance, will sink for a distance in a tube and then separate into several bands of material. Yet not one of a thousand other samples of earth that are taken from different locations will produce the same spectrum of bands. The gradient tubes have helped prove that a suspect actually was at the scene of a crime in spite of his denial, by showing that earth from his shoes and earth from the scene were precisely the same. The tubes produce rapid, positive results and for many purposes can do as good a job as equipment that costs thousands of dollars.

Instead of tediously measuring angles and lengths when comparing samples of penmanship or typewritten material in a case that involves the comparison of documents, Doctor Kirk uses a simple glass-covered box that contains fluorescent tubes. He lays one document on top of the other and places them on the glass top. The light that is transmitted through the papers allows a fast, accurate comparison of the symbols on each.

To read a message that he suspected had been written on one document and then erased, he made a cast of the paper surface with transparent plastic that he had warmed until it would flow into every indentation. When he held the plastic up to the light, later, the diffraction lines of the

(Continued to page 244)



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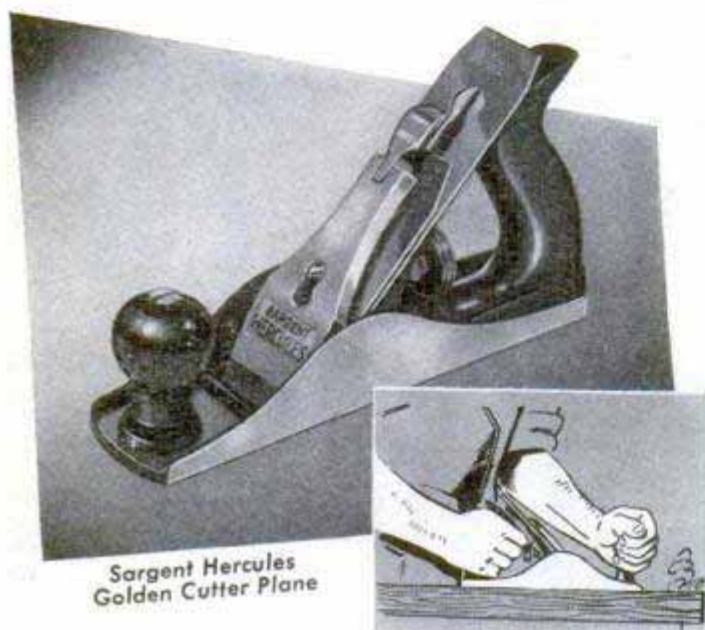
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material outlined every letter of the message that was invisible on the paper itself.

Another document that Doctor Kirk examined seemed to have an erased area but he was unable to read any message that might have been written there. Test after test failed. Possibly the writing had been done with an indelible pencil, he speculated, and thought of a new test.

With a nebulizer, a sort of refined atomizer, he spread a fog of alcohol over the paper. At once, legible traces of writing popped up like magic. His theory had been correct. An indelible pencil had been used and numerous grains of the indelible material had been retained in the paper at the time the writing had been erased. The alcohol spread the dye of these grains and now the writing was clearly visible.

There are all sorts of chemical "erasers" that can remove writing, and there are all sorts of ways to restore what a chemical has obliterated. Most inks contain iron and a message that is written in such an ink can be completely wiped out with ordinary kitchen or laundry bleach. Not a trace remains to the eye, but if the paper is exposed to the vapors of ammonium sulphide you'll find that the message pops back into sight again, as legible as ever.

Once when he was seeking a positive way of collecting a tiny smear of dried blood from the front of an automobile, Doctor Kirk placed a strip of filter paper over the smear and kept it moist. The blood dissolved and then collected in a band on the filter paper, ready to be taken to the laboratory for typing. The method was simple and it worked. It can collect blood from earth, leaves, or almost any material.

Today, Doctor Kirk is working on a couple of other gadgets that will further simplify the task of collecting and studying evidence that is associated with crime. And, not to change the subject, he's also turning over in his mind a new idea in biochemistry: the possibility of making a chemical analysis of a single cell. This would require a "super" ultramicro technique and would be a revolutionary development. He's positive that it can be done.

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Now They're Forecasting Tornadoes

(Continued from page 141)

The Oklahoma researchers determined, also, that lightning strikes with greater frequency during a tornado. One witness, a pilot who had seen two tornadoes and many thunderstorms from the air, said lightning comes from a tornado cloud "just one stroke after another."

Such reports led Doctor Jones and his assistants to believe that electrical discharges from tornado clouds might be identified.

"We figured that the energy in a tornado-type cumulus cloud would be considerably greater than that in a cloud from which a thunderstorm develops," Doctor Jones says. "The energy necessary to produce the initial whirl, and to permit the development of the funnel, had to be enormous. This suggested more frequent lightning and more voltage in each discharge."

After a comprehensive study of lightning-wave patterns, the research team set up an observation station at the Stillwater airport, away from electrical interferences in the city. There they installed an antenna which would pick up discharges from all storms within a range of 150 to 200 miles and relay them to an oscilloscope, which portrays electric currents as jagged lines on a television screen.

With each lightning discharge picked up by the antenna, three things happened simultaneously: (1) The lightning showed up as a saw-toothed line of light on the oscilloscope screen; (2) a stroboscopic light flashed on, illuminating the screen and the dial of a clock above it; (3) an automatic camera snapped a picture of the screen and the clock dial. As each flash was photographed, the film moved along automatically and the camera was ready to record the next flash.

Ordinary lightning showed up on the screen as a row of small, sharp teeth. Occasionally, a strikingly different type of lightning was recorded, with teeth much longer and wider, indicating a higher voltage. The team believed this was tornado lightning. When their equipment had taken hundreds of photographs of lightning from every type of storm in the area, they were sure of it.

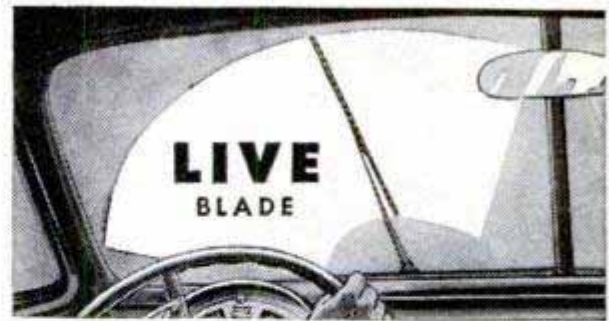
After each set of pictures was taken, and the type of storm later identified, it was catalogued. Finally, the team had a distinctive lightning-wave pattern that could be positively identified as always associated with tornadic storms.

At 2:45 p.m., April 30, 1949, the camera
(Continued to page 248)

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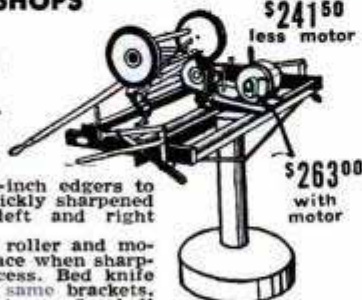
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After this historic discovery, it was smooth sailing. The oscilloscope told the team that a tornado was forming. Direction finders that would locate the tornado had already been developed. One was installed at Stillwater. This determined a line of direction from which the electrical discharges were coming. However, if the line of direction happened to be north and south, it did not show whether the tornado was north or south of the station, and did not determine the distance. Two direction finders were necessary to do that.

A second set of equipment is to be installed at the Will Rogers Airport in Oklahoma City. When a tornado forms in the area, each station will take a direction reading. The intersection of their two lines of direction will locate the tornado.

The system will be basically the same as that used during World War II to locate and track enemy aircraft and guide friendly planes in distress. The team will chart the running path of a tornado in much the same manner as enemy aircraft were charted in plotting rooms.

The Oklahoma researchers are turning over their findings to the U. S. Weather Bureau, which has the facilities for a nation-wide warning network. When the hoped-for warning system goes into full operation, it will remove the element of surprise from a tornado and give people time to find places of safety. One of nature's most terrifying phenomena will have been stripped of its power to kill.

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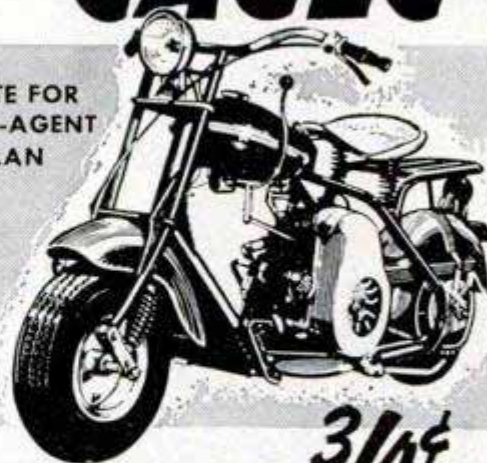


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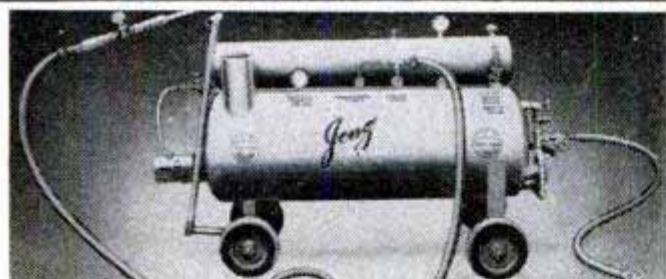
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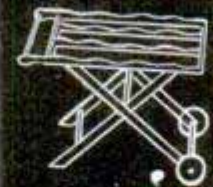
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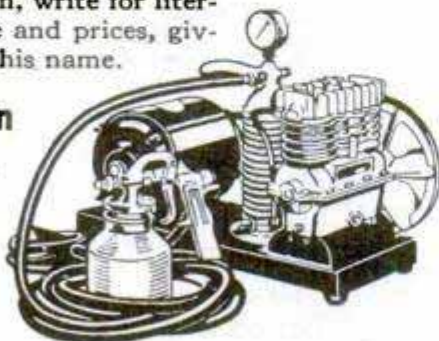
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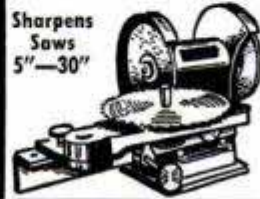
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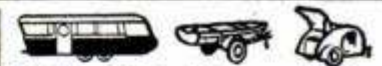


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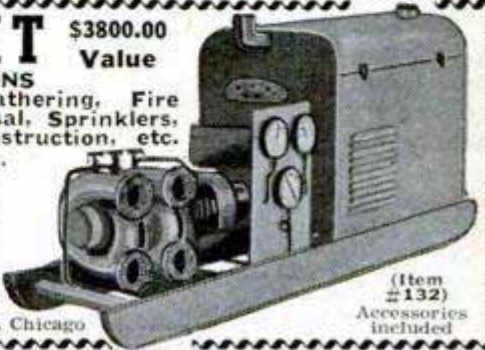
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- ITEM #103—Double acting hydraulic cylinder. 2 1/2" bore, 17" stroke. Clevis mounting. Will lift 4900 lbs. with 1000 PSI line pressure. 1 1/4" diam. shaft. 3/8" tubing thread ports. Overall length closed 28". **21.50**
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- ITEM #6—Double action hydraulic cylinder. 3" bore, 24" stroke, will lift 7070 lbs. with 1000 PSI line pressure. Steel barrel. 1 1/4" stainless steel shaft. Gov't. acq. cost \$176.00. Shpg. wt. 26 lbs. F.O.B. Chicago. **28.00**
- ITEM #42—Double action hydraulic cylinder. 4" bore, 18" stroke. Rated lift capacity with 1000 PSI line pressure is 12,500 lbs. Ship. wt. 30 lbs. F.O.B. Chicago. **32.50**

LOGAN HEAVY DUTY HYDRAULIC PUMP

For operating hydraulic cylinders and hydraulic motors on tractors, bulldozers, construction machinery, lift trucks, industrial applications, etc. Delivers 10 GPM at 1200 RPM at 1000 P.S.I. using 6 HP. Has a 3/4" inlet, 1 1/2" outlet. 3/4" shaft with flat and keyway for direct or pulley drive. Has flange with 4 bolt holes for convenient mounting. Ship. wt. 22 lbs. Overall dimen.: 7" L x 3 1/2" H x 5 1/2" W. A \$105.00 value FOR ONLY **22.50** F.O.B. Chicago (Item #29)

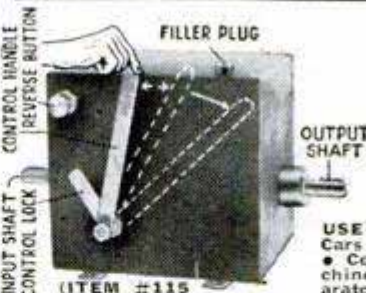


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For welders, plating, truck and marine use, D.C. appliances, lights, etc. Aircraft quality—lifetime grease sealed ball bearings. Heavy duty.

- Item #131—Brand new Electric Auto-Lite 12 volt Direct Current electric generators, rated 18 amps. Complete with blower and pulley. Use for trucks, tractors, boats, battery chargers, etc. Part No. GEF-4805A. In original sealed U. S. Army cartons. \$40.00 value. Shpg. wt. 27 lbs. **15.00**
- Item #90—Type P-1, rated 200 Amps.—28 Volts, 2500 RPM. Mfd. by General Electric, Ford, Delco-Remy and Westinghouse. Gov't. Acq. Cost \$300.00. Shpg. wt. 70 lbs. **22.50**
- Item #91—Type R-1, rated 300 Amps.—30 Volts. Mfd. by Jack & Heintz. Gov't. Acq. Cost \$380.00. Shpg. wt. 70 lbs. **35.00**



HYDRAULIC SPEED REDUCER

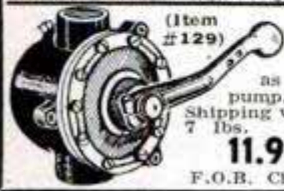
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USE FOR: Reamer Drives • Midget Cars • Feed Mills • Canning Machines • Conveyors • Lathes • Milling Machines • Motor Boats • Cream Separators • Garden Tractors • Pumps

Variable output speeds ranging from 0 to input speed now available. Merely move control handle until desired speed is attained. Then turn locking handle to maintain the setting. Internal relief valves prevent overloading. Use input power of 1/2 to 1 1/2 H.P. This Westinghouse-Oil Gear Unit converted to commercial use from 40 MM anti-aircraft traversing mechanisms consists of a variable displacement hydraulic pump feeding a fixed displacement hydraulic motor. These components are contained in a crackle-finish steel oil reservoir (capacity 2 qts.). Adjustable relief valves set at factory for 100 inch pounds of torque may be reset up to 180 inch pounds. Independent reverse control allows full output power and speed selection in either direction of rotation. Both input and output shafts measure 5/8" diam., include keyway. Input rotation is counter-clockwise facing shaft. Recommended input speeds not to exceed 750 R.P.M. Over-all dimensions 7 1/2" x 7 1/2" x 11 1/2". Gov't. acquisition cost, \$428.00. Shipping weight 26 lbs. Complete with 2 qts. of oil and full instructions. F.O.B. Chicago **54.50**

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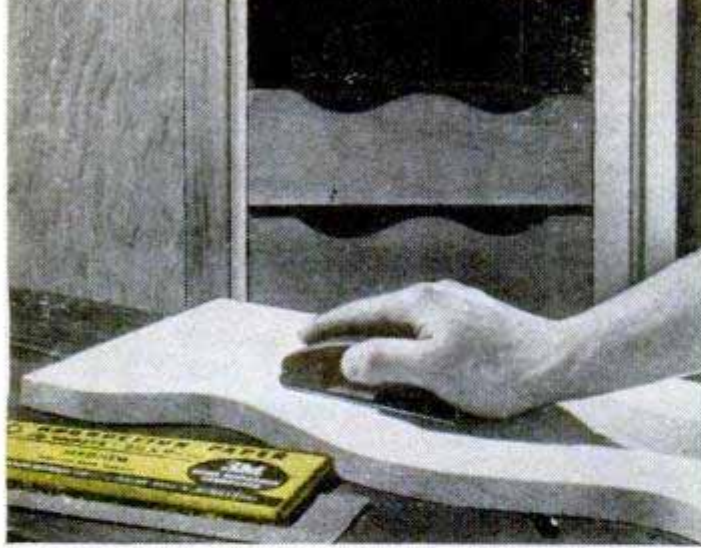


HAND FLUID PUMP Type D4 — Bronze and aluminum construction, 3/4" pipe thread inlet and outlet. Fine general utility hand pump. May be used as a sump pump, barrel pump, fuel transfer pump, etc. Shipping wt. 7 lbs. **11.95** F.O.B. Chicago (Item #129)

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1139 SO. WABASH AVE., CHICAGO 5, ILL.

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Send Payment or Purchase Order Today

(Continued from page 96)



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The professionals' favorite sanding block is now available for home craftsmen! Solid red rubber, easy to load, easy to handle for wet or dry sanding. Your hardware dealer has the 3M Sanding Block and the new line of 3M Home Workshop Sandpaper—the world's toughest woodworking abrasive—pre-cut to fit the 3M Block and many power tools.

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Indianapolis. The cars have aluminum frame rails and magnesium cross members, use a dual drag-link steering gear with no tie rods, and torsion-bar suspension all around. A third car being rushed to completion for Indianapolis consists of bare essentials only. It might weigh no more than 1500 pounds.

Front drives are supposed to have an advantage at Indianapolis because of a reduced tendency to slide when the track gets slippery from oil; on the other hand their construction is unavoidably heavier. Emil Diedt, another race-car builder, is trying to get around the weight objection this year by using aluminum for nearly all chassis parts. Fuel and oil tanks are of the same metal. Diedt expects that the new car will weigh 350 pounds less than any other front-drive car at Indianapolis.

From the standpoint of consistent winning, the nonsupercharged four-cylinder engine is by far the best for Indianapolis, and yet the smaller supercharged engine of 176 cubic inches' displacement is always a threat. Two cars powered with engines of that displacement have been entered this year in addition to the Novi team, the pair of front-drive cars that, on paper, are the cars to beat.

Each Novi Special is built around a 550-horsepower V-8 engine equipped with double overhead camshafts and a centrifugal supercharger. They are twice as powerful as most of the other cars in the race, and they have been dogged by consistent hard luck during the last several years.

For the 1951 race their chief mechanic, Jean Marcenac, has installed new blocks and crankshafts, beefed up to take terrific stresses. When all the bugs are eliminated from these advanced engines, the Novi backers feel sure, no car at the track will be able to keep close to them.

The Cummins diesel entry, which climbed from 33rd to 16th position before being forced out of the race last year by an accessory failure, will not compete this year.

Some 60 cars are entered in this year's race, but only 33 of them can start. That's the number of starting positions. The others will be eliminated in the time trials that are held during the several days preceding the race, during which each car gets a chance to roar 10 laps around the 2½-mile track to establish its qualifying time. This year some of the fans guess that the fastest car will qualify at 138 miles per hour, faster than anyone has ever gone around the track before.



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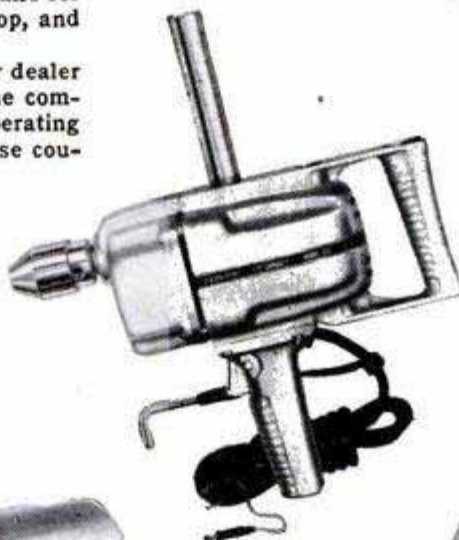
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Maximum Depth of Cut 2 1/8". Adjustable for Depth and Angle of Cut. Price \$41.95



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IT'S SHOPSMITH

FOR PRECISION

You can tell, just by looking at it, that multi-purpose SHOPSMITH is a tool of exceptional precision. And the facts prove it!

Pictured here is one of the most revealing tests a power tool can be put to. It's the dial indicator test for spindle "runout"—determines variations in the trueness of spindle rotation. Most power tool manufacturers are satisfied with variations of twenty-five ten-thousandths (.0025) of an inch. The allowable maximum for SHOPSMITH is fifteen ten-thousandths (.0015). And the records of all SHOPSMITHS, registered at time of final inspection, show an average "runout" of only eight ten-thousandths (.0008). That's real precision!

It's the same precision you find in other SHOPSMITH parts. The induction hardened spindle is machined to two ten-thousandths (.0002) of an inch. The two tubular steel ways are centerless ground to two thousandths (.002). The holes in each casting are bored simultaneously to assure perfect alignment of all parts.

But precision is only part of the SHOPSMITH story. SHOPSMITH is a rugged, heavy-duty tool—weighs over 200 pounds. It's compact—takes only 2' x 5' of shop space. It's flexible—converts from tool to tool in less than 60 seconds. And it can handle big work—has capacities equal to or greater than the most expensive, production-type tools.

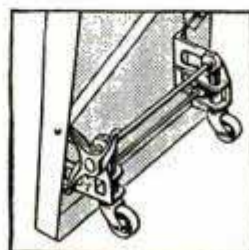
See SHOPSMITH demonstrated—at leading hardware and department stores or any Montgomery Ward store. And send today for your free copy of the illustrated, 16-page SHOPSMITH booklet.

\$189.50

complete 5-tool unit
without motor.*

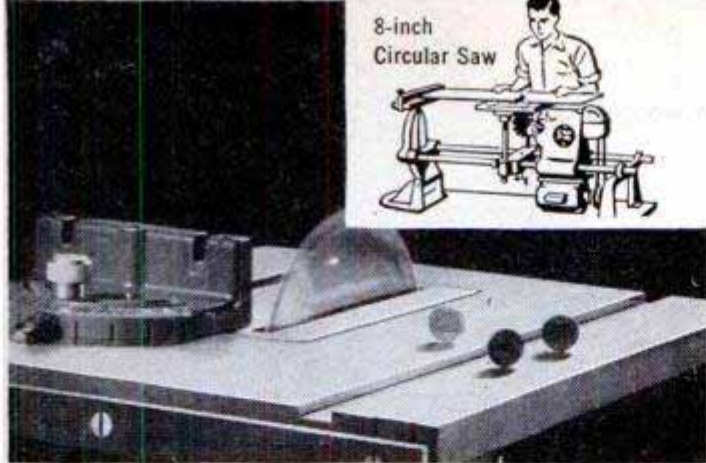
*Special SHOPSMITH motor
—heavy-duty, ½ h.p., ball
bearing, capacitor, 110 V,
60 cycles — \$34.50.

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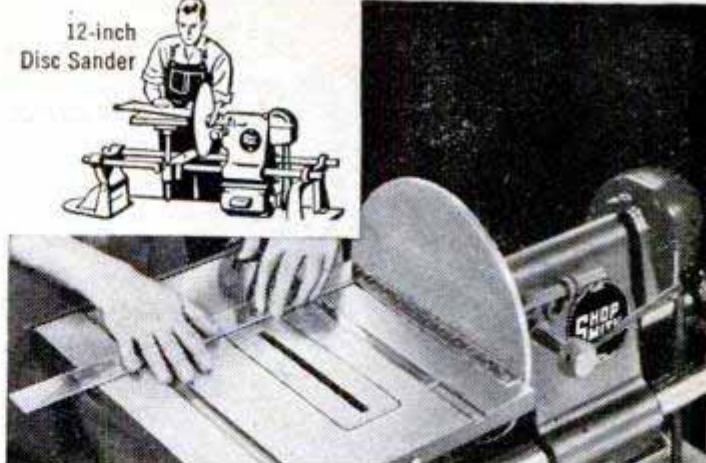


For moving, rolling or locking 225-pound SHOPSMITH. Mount easily on any wood or metal bench. Set by three-stage foot lever. At your SHOPSMITH dealer's. \$11.95.

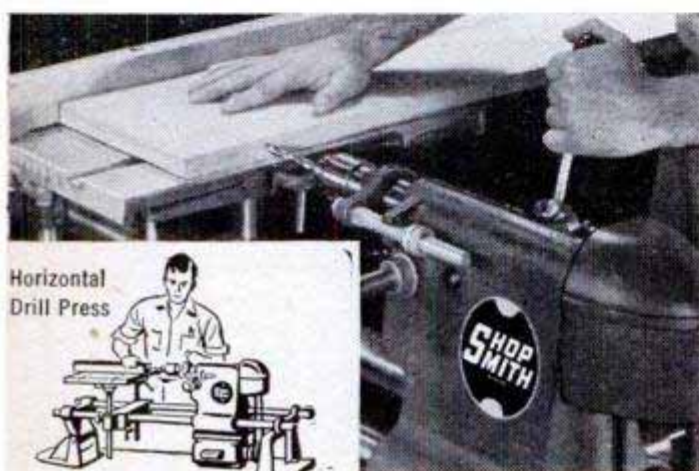




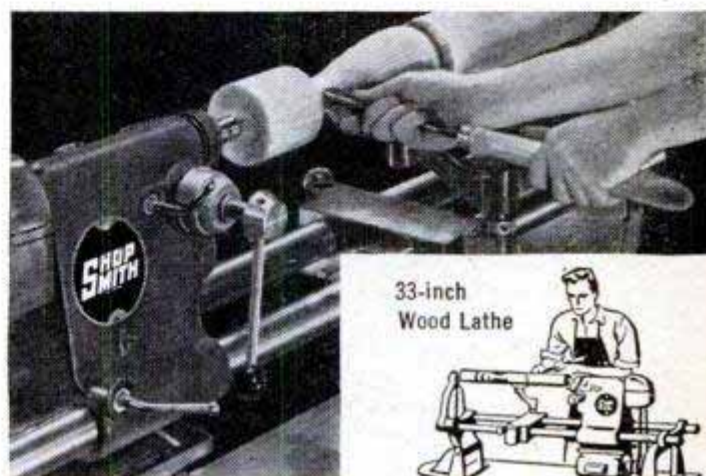
VIBRATION TEST. Nickels stand on edge while SHOPSMTTH saw whirls at full speed. Quiet, vibration-free operation is due to precision construction, four ball bearings in arbor, and extreme rigidity of tubular steel ways.



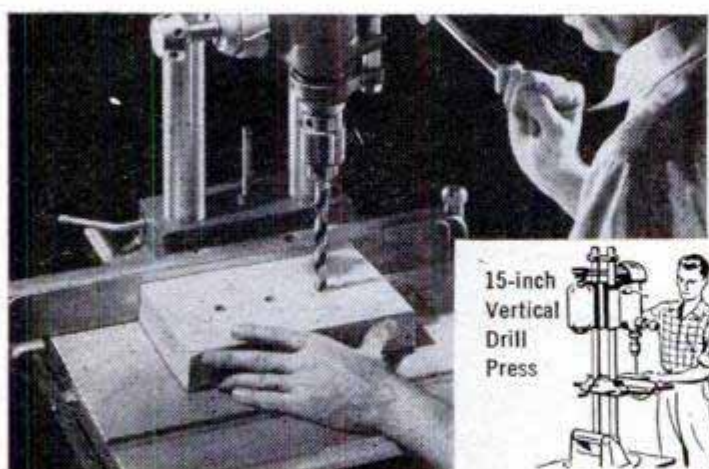
SQUARE FINISH. Carpenter's square demonstrates accuracy of SHOPSMTTH as a disc sander. Accuracy is automatic because of extra-large table, micro-graduated miter gauge, exclusive feature which permits disc to be fed into work.



NEW AND PRACTICAL. Horizontal drilling takes the limit off the length of the work you can handle, performs drilling operations that are impossible or which require special jigs on vertical drill. 4-inch quill feed. Adjustable depth gauge. Variable speeds.



RIGID LATHE BED. In less than a minute, SHOPSMTTH can be converted to a heavy-duty wood lathe with 15-inch swing, 33 inches between centers. Thick-walled centerless ground steel ways, stress-tested at over a ton, assure minimum vibration.



PERFORMANCE PLUS. For accuracy, capacity, precision features, you can't beat SHOPSMTTH as a vertical drill press. Jacobs key chuck takes drills up to 1/2 inch. Note use of rip fence as handy guide for accurate drilling.

PRECISION-MADE SHOPSMTTH IS A PRODUCT OF THE MAGNA ENGINEERING CORPORATION

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STOP SCRUM



before it stops
your car!

by "Hib"

Hi fellows! Time to start thinking about the warm weather driving ahead. Get rid of the old SCRUM (scale, rust, oil muck in the cooling system) that's been building up all winter.

Drain anti-freeze as soon as the weather's settled. Your filling station man is your local weather expert for car radiators . . . ask him.

Make the famous "Finger Test." Here's how: Take off the radiator cap and run your finger around inside the opening. See that finger? . . . that's SCRUM, and what it can do to your cooling system isn't fit to print here.



Here's the cure: After flushing, have your service man add a can of Warner Radiator Cleaner . . . leave it in for a couple of hundred miles. Warner Cleaner loosens up SCRUM and when it's flushed the second time—brother, it really comes clean!

Will a clean radiator rust? You bet it will! The minerals in the water and the electrolytic action between the various metals in your cooling system will make it gum up fast and lead to overheating.

So add a can of Warner Cooling System Protector to that clean radiator. Warner Protector coats the entire inner surface of your cooling system with a rustproof, corrosion-proof film. Keep that clean radiator clean!

Radiator leaks? A can of Warner Liquid Solder (non metallic) deposits tiny fibers to repair any small leak in the cooling system . . . no trouble at all!



WARNER-PATTERSON COMPANY
CHICAGO 5, ILLINOIS

The Owners Report on the '51 Studebaker

(Continued from page 103)

Studebaker's famed hillholder had nothing but praise for this feature.

Now for my own test:

I drove the Commander test car (a Starlight Coupe with Automatic Drive) from Chicago to Los Angeles, then from Los Angeles to Grand Canyon and return, a

ENGINE

	CHAMPION	COMMANDER
Type.....	6-cyl. 'L'-head, In-Line	8-cyl. OHV V-type
Bore and Stroke.....	3 in. x 4 in.	3 3/8 in. x 3 1/4 in.
Displacement	169.6 cu. in.	232.6 cu. in.
Brake Horsepower.....	85	120
Compression Ratio.....	7.0:1	7.0:1

GENERAL

Weight (4-door Sedan).....	2845 lbs.	3193 lbs.*
Wheelbase	115 in.	115 in.*
Tread, front.....	56 1/2 in.	56 1/2 in.
Tread, rear.....	54 in.	54 in.
Height	60 1/4 in.	61 3/4 in.
Over-All Width.....	70-11/16 in.	70-11/16 in.
Length	197 1/2 in.	197 1/2 in.*

Inside Dimensions (4-door Sedan)

Front-Seat Width.....	59 1/4 in.	59 1/4 in.
Rear-Seat Width.....	58 1/4 in.	58 1/4 in.
Leg room, front.....	39 3/4 in.	39 3/4 in.*
Leg room, rear.....	39 1/8 in.	39 1/8 in.*
Headroom, front.....	36 1/2 in.	36 1/2 in.
Headroom, rear.....	34 1/2 in.	34 1/2 in.*
Tire Size.....	6.40 x 15	7.10 x 15
Tire Pressure.....	24 lbs.	24 lbs.
Road Clearance.....	8 in.	8 in.
Turning Radius.....	R—20 feet, 7 in. L—19 ft., 10 in.	R—20 feet, 7 in. L—19 ft., 10 in.

Steering Wheel, lock to lock.....	4 turns	5 1/2 turns
Steering Ratio.....	19.5:1	24:1

*LAND CRUISER model: Weight, 3293 lbs.; Wheelbase, 119 in.; Length, 201 1/2 in.; Leg room, front, 40 3/4 in.; Leg room, rear, 39 3/4 in.; Headroom, rear, 35 in.; Same as Commander model otherwise.

CAPACITIES

Oil.....	5 qts.	6 qts.
Water.....	10 qts.	17 1/4 qts.
Gasoline.....	18 gal.	18 gal.

total distance of over 3000 miles. I traveled over all kinds of roads, through a snow-storm in Nebraska, over the Continental Divide (altitude nearly 7000 feet) in the Rockies of Wyoming, through the heat of the Mojave Desert and below sea level in California's Death Valley.

The new 120-horsepower, high-compression V-8 Commander is one of the fastest stock cars I have ever driven. On long open stretches it did over 100 miles an hour

(Continued to page 264)

THE SPORTSMAN

\$249⁵⁰

plus tax
FOB Pontiac

long, low,
and lively



THE AMBASSADOR

\$249⁵⁰

plus tax
FOB Pontiac

big, rangy, and
rugged



Here's your Whizzer!

**BETTER THAN EVER
FOR FUN AND LOW-COST RIDING!**

Yes, now's the time to get your Whizzer!

Three great Whizzer motorbikes to choose from—new Ambassador, full size, fully equipped, with many luxury features; Sportsman, a low-slung beauty with great riding qualities; and Pacemaker, popular-priced motor-

bike that's complete and ready to ride.

All Whizzer motorbikes powered by the famous 4-cycle, 138 c.c., 3 h.p. Whizzer motor. Up to 100 miles per gallon, speeds from 5 to 40 m.p.h. This motor, sold complete with attachments, can make any standard heavy-duty man's bike a motorbike.

See the Whizzer line at your dealer's, or write today for free booklet.

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America's
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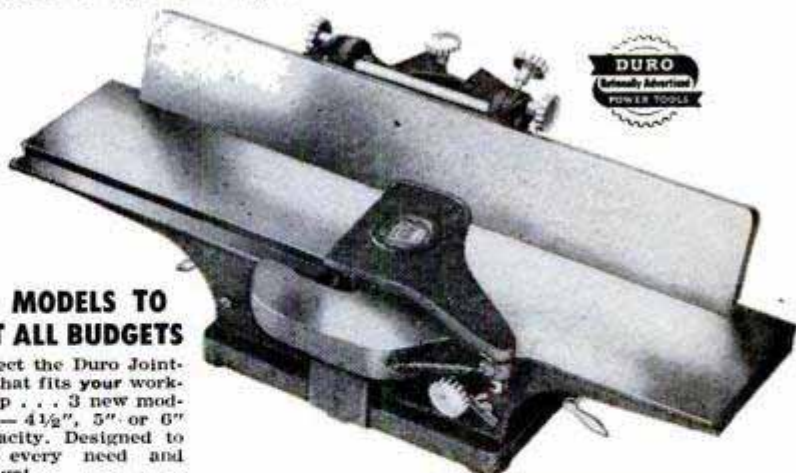
If you want advanced features, increased dependability and maximum safety at lowest cost—choose a Duro Jointer! The host of quality features include: a heavy cast, rear mounted safety fence; a cutter head with 3 high speed blades and grooved chip breakers for fast, clean cuts; heavy cast iron tables which adjust quickly, accurately; a cutter head guard for safety which swings back automatically; adequate rabbetting capacity—and many more time and labor-saving advantages.

3 MODELS TO FIT ALL BUDGETS

Select the Duro Jointer that fits your workshop . . . 3 new models — 4 1/2", 5" or 6" capacity. Designed to fit every need and budget.

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for full details, specifications and prices on DURO Jointers—and full story on the complete 1951 line of DURO Power Tools.



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2688 N. Kildare Ave.
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Please send me specifications and prices on the new DURO Jointers—and full story of the complete 1951 line of DURO Power Tools.

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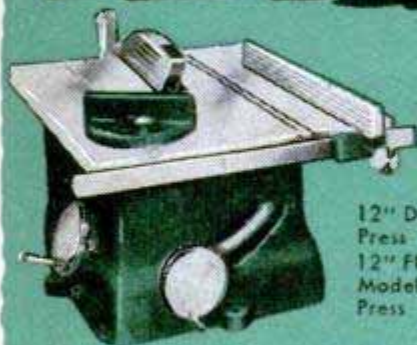
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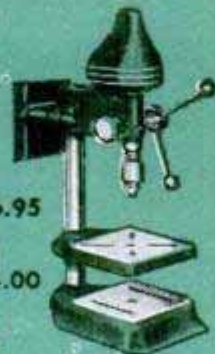
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MAKERS OF DURO CHROME HAND TOOLS

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America's Finest Tools at
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12" Drill
Press \$46.95
12" Floor
Model Drill
Press \$54.00

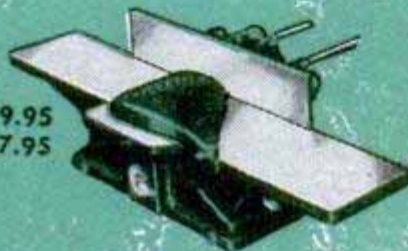


8" Tilting Arbor Bench
Saw . . . \$76.95



- Also
7" Tilting Arbor Bench
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6" Jointer-Planer . \$79.95
4" Jointer-Planer . \$47.95



12" Band Saw . \$79.95
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Saber
Saw. \$17.95



Belt and Disc
Sander . \$51.50



Spindle Shaper . . \$45.95



10" Wood Turning Lathe . \$45.95

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slightly lower in
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SHOPMASTER, INC.

1214 Third St. S., Minneapolis, Minn.

and it hit 95 without apparent effort and with a pleasing smoothness of operation. These were speedometer speeds and with all makes of cars I have found that these are from two to seven percent above actual speeds.

The new overhead-valve V-8 engine packs a terrific wallop. Acceleration and hill-climbing ability are outstanding. Incidentally, the Commander weighs 31 pounds less than the next lightest U.S.-built V-8 car.

I found Studebaker's economy very good with the new high-compression, 120-horsepower engine (see economy chart). However, readers should bear in mind, my tests show that owners of automatic-shifting transmissions, regardless of make, must sacrifice from one to three miles per gallon for the convenience of self-shifting devices. The conventional transmission, when properly handled, is still the most economical.

Studebaker engineers designed the V-8 and also the Champion engine for regular gasoline. I used regular for about half the test distance. I found that the 1951 Studebaker operates satisfactorily with ordinary gasoline under most conditions.

The car steers easily for one equipped with supercushion tires because of the low and variable steering ratio. This makes for ease in parking. However, it results in somewhat excessive turning of the wheel—a feature I don't especially like.

The car is extremely light in the rear end and, as in all modern cars, traction suffers on snow and ice due to this lightness. It corners with little effort, is easily controlled and takes the bumps nicely. Due to the low center of gravity, good balance, sea-leg rear shock absorbers and good springing, the Commander has excellent roadability, far superior to Studebakers built prior to 1950.

The front coil springing is much better than the transverse front spring used by Studebaker for many years. Rear springs are now 43 percent wider with four thin leaves, which improve the ride, and the suspension system is exceptionally good.

Its self-centering brakes are smooth and soft in operation. I did notice a tendency for brakes to fade when used often at extremely high speeds. The wide brake pedal is anchored to the shaft at each side, which makes for ease of operation and no pedal sideplay.

Studebaker's pioneering in styling is such that visibility is unexcelled, a desirable safety feature. Foam-rubber seat cushions, standard on the Regal Champion and all Commander and Land Cruiser models, are extremely comfortable.

(Continued to page 266)



Portable LIGHT PLANT

PUSH BUTTON START
500-700 watts 110-120 v. — 60 cyc. A.C. Powered by a sturdy dependable, easy starting, air cooled 1 3/4 hp. gas engine. No wiring necessary. Just plug in and operate. Plenty of current for any oil burner, freezer, brooder, pump, emergency lights, etc. which require up to 700 watts. Ideal for Civil Defense, Fire Depts.; trailers & camps. Complete with Voltmeter and built-in winding to charge 6 v. auto batteries. Wt. 85 lbs. Fully guaranteed. Be prepared if war or storm knocks out power lines.

(Item 24) etc. which require up to 700 watts. Ideal for Civil Defense, Fire Depts.; trailers & camps. Complete with Voltmeter and built-in winding to charge 6 v. auto batteries. Wt. 85 lbs. Fully guaranteed. Be prepared if war or storm knocks out power lines.
Reg. \$275.00 value. **\$143.50**
700-800 Watt Plant (Item 44) same as Item 24, but larger generator. **\$169.95**
1000-1200 Watt Plant (Item 45) same as Item 24, but larger gen. & eng. **\$199.50**

HEATING & VENTILATING FAN

(Item 10) Easily installed in furnace pipes. Forces even heat to all rooms. Over range, removes kitchen smoke and odors. Powerful continuous duty motor, 110-120 V. A.C. Quiet, super efficient fan moves huge volume of air (400 to 600 c.f.m.) 8" Fan, wt. 5 lb. **\$6.25**; 9" Fan, wt. 6 lbs. **\$7.45**; 10" Fan, wt. 7 lb. **\$8.45**; 12" Fan, wt. 8 lbs. **\$9.45**.



1/2" DRILL

(Item 33) DeLuxe model —powerful, smooth running, precision built. Handles toughest jobs. Cutler-Hammer switch, Jacobs key chuck, 110-120 v. AC-DC 300-450 rpm. Alum. alloy case for high strength and easy handling. Built-in blower assures cool operation. Cap. 1/2" in steel. 1 year written guar. Wt. 11 lbs. Should be \$65. Special. **\$34.50**



1/4" DRILL

(Item 34) Hi-power, long-life, smooth running. Alloy steel gears; built-in blower. Cutler-Hammer switch, Jacobs hand-tite chuck. 110-120 v. AC-DC 1000-1600 rpm. Cap. 1/4" in steel. 1 year guar. Wt. 4 lbs. Terrific value at **\$12.95**.

38 Pc. DRILL KIT

(Item 35) Includes above illness, guar. drill, buffers, polishing bonnet, sanding discs, grinding wheels, wood bits, steel bits, wire wheels, bench stand, paint mixer, burrs. Complete in heavy steel case. Wt. 13 lbs. 38 pc's., all highest quality. Complete kit worth \$38.50. Our **\$19.85** Spec. only.



HEAVY DUTY ARC WELDER

(Item 38) Use as portable or shop welder. 250 amps. D.C., Senior model. Made for years of trouble-free, continuous service. Will handle light or heavy jobs. Weld up to 1/2" plate using 3/4" rods. Built-in air-cooling system. Arc is easy to strike and hold, because of specially designed arc stabilizer. Hi-to switch and dial control gives wide range of welding heats. Run welder at 2600 rpm with tractor, jeep or 10 hp. gas engine, or 7 hp. elec. motor. Complete with instructions, guar. and double V belt or flat pulley. Wt. 110 lbs. A \$400 value at. **\$99.75**
WELDING KIT. Two 10 ft. leads, welding helmet, electrode holder, ground clamp, assorted rods. Sold only with welder at. **\$10.50**

GAUGE TESTER

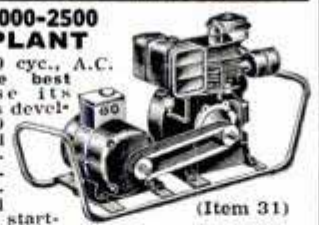
(Item 27) Precision made of solid bronze by Star Brass Co. Calibrated weights (incl.) acting against hydraulic piston, provides quick accurate testing of all pressure gauges up to 3000 lbs. per sq. in. Brand new in hardwood cases. Wt. 100 lbs. Reg. \$435.00. Our Spec. **\$135.00**

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High pressure, heavy duty, complete with swivel fittings, pipe thread connections. Ideal for farm equip., bulldozers, grease guns, airbrakes, etc. Any length. Minimum \$1 per lft. **INSIDE DIAMETER.** 1/4" 50c per ft. 3/8" 60c, 1/2" 80c, 3/4" 90c.

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GENERATOR ONLY and control box. Drive it with your engine or tractor. **\$169.50**



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(Item 36) Most perfectly balanced and smoothest running saw made. Advanced design provides max. power and light weight. Easily adjusted for all angles, depth and width of cut. Comes complete with 6 1/2" comb. blade, ripping guide and 10 ft. hvy. duty cord. Built-in saw-dust blower. Autom. telescoping guard. 110-120 v. AC-DC. Depth of cut 2 1/8". 1 year written guar. Wt. 12 lbs. Drastically reduced. **\$39.95**



ANGLE DRILL

(Item 23) Fits into chuck of any electric or pneumatic drill or flex. shaft. Operates at any angle in a full 360° arc. Makes possible drilling, grinding, carving, routing, etc. in close cramped quarters. Makes impossible jobs easy. Made by Kett Tool Co. Complete with built-in chuck (1 1/4" capacity) and adjusting key. Hardened alloy gears. Precision built for heavy duty. Lists at \$30.95—while they last. **\$9.95**



CARRY-AIR

(Item 32) Stainless steel tank—capacity 500 cu. in. at 400 lbs. press. complete with inlet and shutoff valves, press. gauge, detachable air hose, tire chuck. Fill at any service station. Carry air for tire inflation, blowing out lines, spray painting, insecticides, etc. One emergency pays back cost. Wt. 13 lbs. Worth \$20.00. Our price. **\$9.75**



POTTERS WHEEL

(Item 47) Complete, prof. equip. for making finest ceramics and pottery. Large dynamically balanced cast-aluminum reversible turntable with variable speed drive (38 to 140 rpm) controlled by foot-pedal. Built-in adjustable arm rests, water cup and wedging wire. 16x12" enclosed throwing table—ample area for largest pieces. Req. 1/4 hp. motor (not incl.). Can be set up on 20x24" table and stored on edge. Complete with pulleys, belts and instructions. Wt. 26 lbs. **\$59.95** \$145 value at.



VARIABLE SPEED DRIVE

(Item 48) Works on variable-pitch pulley principle. Provides instant variable speed range up to 1 to 1. Rugged constr., forced lubrication. Input up to 1/2 hp. Perfect for lathes, drills, grinders, potters wheels, centrifuges, midget vehicles, etc. Wt. 8 lbs. A terrific value at. **\$9.45**



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(Item 11) 1/4" Diam. heavy duty, double braid, suitable for gas stations, spray painting, air tools, etc. 20 ft. with standard swivel couplings. Wt. 4 lbs. Reg. \$3.50 val.—only **\$2.95**. Five 20 ft. lghths. (100 ft.). Wt. 20 lbs. Only **\$13.75**.

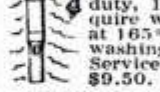
GAS ENGINE

(Item 25) Air-cooled. 1 1/2-2 h.p. Complete with gas filter, air cleaner, governor, fuel tank. Ready to run. Speed range 2000-3600 r.p.m. 5/8" shaft. Rope start. Ideal for pumps, air compressors, power tools, generators, etc. Factory warranty and instructions incl. One of the best made. Wt. 40 lbs. Worth \$72.50. Special. **\$46.50**



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(Item 26) Immersion type, heavy duty, 115v. A.C. 300w. Does not require watching. Thermostat shuts off at 165°. Keeps water hot for shaving, washing dishes, etc. Made by Cities Service. Wt. 4 lbs. Worth \$9.50. Our Special. **\$4.50**



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(Item 30) Penn Electric Model 110 B102, best made. For pumps and air compressors. Heavy duty. Will handle up to 250 lbs. press. and up to 5 h. p. Autom. unloader valve, for easy starting. 110-220 v. A.C. or D.C. 2 pole. Wt. 5 lbs. Reg. list \$17.50. Our Spec. **\$9.45**.



CLIP BOARD

(Item 17) Heavy Masonite, with self-adjusting spring hinge to hold up to 100 sheets of 8 1/2 x 11 paper. Push back cover for instant release. Flip cover shut and notes or drawings are protected. Perfect for pilots, engineers, students, artists, truck drivers. Wt. 2 1/2 lbs. Usually \$2.95. Spec. **\$1.10** 2 for **\$2.00**.



FIRE EXTINGUISHER

(Item 39) Fully charged at 1,000 lbs. P. S. I. or more) with CO2 (carbon dioxide), the proven miracle fire fighting chemical that smother's oil, gasoline and electrical fires. Play safe: keep one in your car, garage and home. Heavy ICC approved steel cylinder, valve and 3000 lb. gauge that shows available remaining pressure. REFILLABLE at nominal cost. Hose included for emergency tire inflator or air blast. Wt. 4 lbs. \$19.50 value. Special. **\$6.95**



GEM CUTTER

(Item 49) Complete Prof. Lapidary mach. for cutting, shaping, grinding and polishing precious and semi-precious stones. Precision built with big horiz. power driven gem cutter, built-in cutting lubricator; genuine 6" supercharged diamond saw, lap wheel, abras. whis., 2 scratch whis., 4 felt whis., grinding and polishing compounds, brushes, dop cement and sticks, cutting oil, ext. cord, asstd. gems, complete instructions. Requires 1/4 hp. motor (not incl.). Wt. 22 lbs. Worth \$99.50. Our Special. **\$39.95**



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(Item 46) Completely automatic. Wind and hang anywhere. Thermostatic element sets off loud clanging bell if heat reaches 140° (setting adjustable). A fool-proof burglar or signal alarm when used with trip cord attached to door, window, invalid's bed, etc. Sturdy metal constr. assures lifetime of protection. Ideal for homes, stores, whse., gar. etc. Wt. 3 lbs. Easily worth \$20. Special. **\$4.95**



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(Item 16) 40 ft. heavy duty, made of specially insulated No. 14 2-conductor wire. So tough that you can drive over it and yet amazingly flexible and easy to handle. Resists oil, grease or water. Extends electricity up to 400 ft. without voltage drop. Use indoors or out. Complete with heavy rubber plug and outlet. Wt. 2 1/2 lbs. Usually \$4.50—Special 40 ft. **\$4.95** Comb. 2-40 ft. and 1-20 ft. (total 100 ft.) **\$4.95** 100 foot length (one piece) **\$4.85**



WIRE SPECIALS

(Item 50) #14-2 cond. same as above, but no fittings, wt. 6 lbs. \$4 per 100 ft.
TRENCH-LAY WIRE (Item 51) Anaconda #10-2 cond., for buried service to barns, outdoor lights, etc. Absolutely impervious to soil and moisture. Wt. 25 lbs. per 100 ft. Special surplus price. 100 ft. coils, 19c per ft.; 250 ft., 18c per ft.; 500 ft., 17c per ft.

PARTS WASHER

(Item 20) Store gas or carbon tet. in 5 gal. safety can. Valve releases just the right amount into washing compartment. Parts are washed and drained on a "dunking" screen — no fishing for parts. Eliminates fire-danger, waste, spillage, evaporation. Wt. 14 lbs. Reg. \$19.50—Special. **\$5.95**



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Makes household jobs FUN for the whole family!

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TOOLS

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 SANDER-POLISHERS • BENCH GRINDERS

The instrument panel is easy to read under all conditions. Its nonglare black lighting is outstanding. The combination switch and starter is located at the left of the panel. This is found a little awkward. It would be handier on the right-hand side directly below the light switch.

The Climatizer heating and ventilating system is located under the right-front seat and distributes heat to front and rear.

Both Champion and Commander models have the same wheelbase this year—115 inches—and I find that length satisfactory. The Land Cruiser is four inches longer. Luggage space is average. There could be better counterbalancing of the rear-deck lid for easier opening.

Assembly and workmanship on the body are good. In my 3000-mile test, not a squeak or rattle developed and this is unusual in any new car, regardless of make or price.

What about Studebaker's new Automatic Drive? It came through with flying colors. For ordinary use in starting and driving, the Drive (D) position is used. The air-cooled unit is a combination of a torque converter and an automatic transmission. The hydraulically controlled gearbox bolted on the back of the torque converter provides three forward gear ratios and one reverse. Forward ratios are low, intermediate and direct. Only the low, intermediate and reverse ratios are used with the torque converter, which is by-passed in direct drive. The automatic shift to direct drive, determined solely by throttle position, takes place anywhere from 18 to 60 miles an hour. There is no "mushiness" or apparent loss of energy as the car gets rolling. The hydraulic drive provides an extremely smooth start, combined with quick-action change from low to intermediate gear. The engine can be started only when the selector lever is either in Neutral (N) or Park (P) positions, and in both these positions the power plant is disconnected from the drive line.

For use in mud or snow, or in climbing extremely steep grades, the selector is placed in Low (L). When descending steep hills, use of the low gear acts as a brake on the engine and even at fairly high speeds it can be used to slow the car.

There is a cork and buna-N-rubber-faced single-plate clutch between the engine and the torque converter, which is automatically applied at a time determined by the throttle position. Thus, at the will of the driver, the transmission is locked rigidly in a 1-to-1 ratio. With the converter locked out, engine torque is transmitted directly to the propeller shaft.

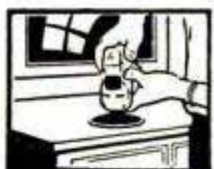
(Continued to page 268)



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DO DOZENS OF JOBS Both riding and walking tractors quickly and easily plow, cultivate, harrow, disc, bulldoze, spray, haul, grind, saw wood, etc. **LOW FACTORY PRICES** Buy direct or through your dealer. A year's guarantee!

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As with the standard transmission, the rear-axle ratio is 3.54 to 1. For an extremely fast getaway, I found that by using low gear until about 35 miles an hour and then quickly shifting to drive position with throttle wide open, acceleration is rapid. Studebaker has definitely eliminated creep at traffic lights. When the brakes are applied and the car stopped, a solenoid-operated check valve holds enough hydraulic pressure on the brakes to offset the torque in the converter of the idling engine. A touch of the throttle releases the braking pressure and the car moves instantly. This is the same principle as Studebaker's locking device, called the hillholder, that prevents the car from rolling backward on a hill even though the foot is removed from the brake pedal. This frees the foot to operate the throttle for a smooth getaway from mid-grade stops. Pressure on the throttle releases the hillholder.

For years, Studebaker has offered the hillholder and it is still available in the conventional transmission. In my opinion, it is one of the finest extras ever offered. Ninety-seven percent of all owners of hillholder-equipped Studebakers, whom we polled, approved it. The automatic hillholder is a built-in feature of the new Automatic Drive and, believe me, it is a good one.

Low and reverse selector positions are located next to each other. Thus the car can be rocked in mud or snow by a back-and-forth movement of the lever. The Park (P) position of the lever locks the rear wheels and serves as a parking brake.

Studebaker is one of the few cars offering three different transmissions in all models: (1) conventional three-speed; (2) three-speed with overdrive; and (3) Automatic Drive. Anyone can have his favorite transmission when selecting any Studebaker model.

I have followed with great interest the progress of the Studebaker Corporation. In 1952, it will celebrate its centennial anniversary as the oldest manufacturer of vehicles in the United States. The company may well be proud of its latest, and by far finest, line of automobiles—the 1951 Studebakers.

Next Month—

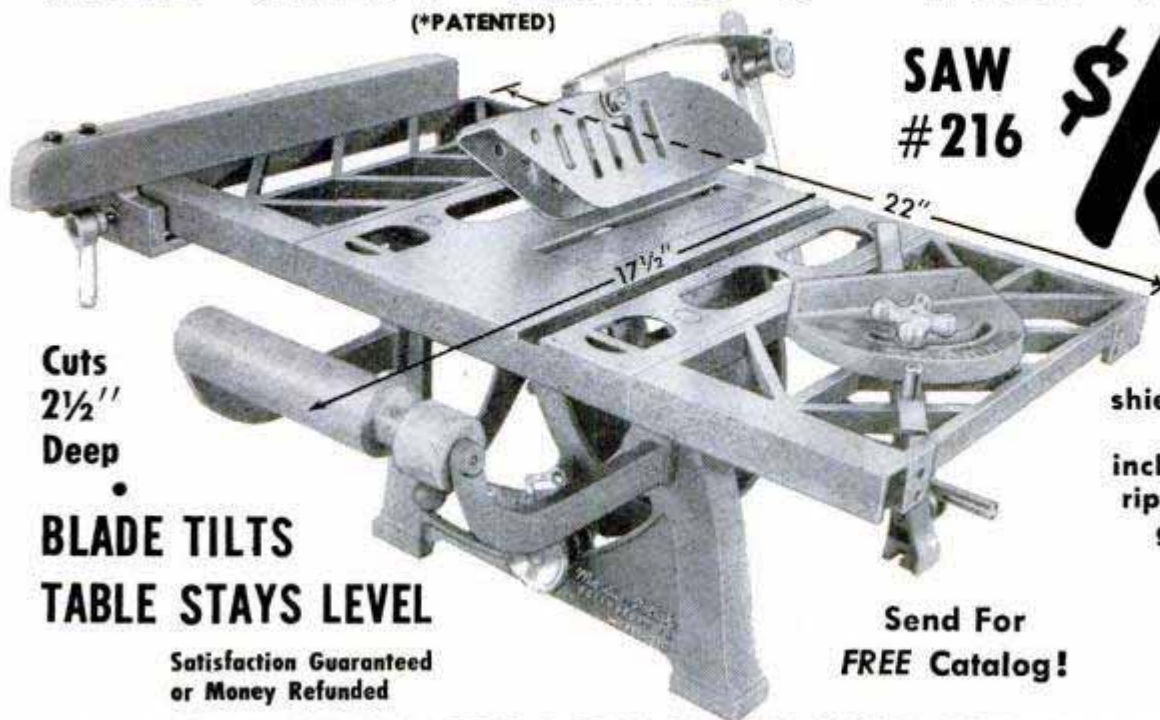
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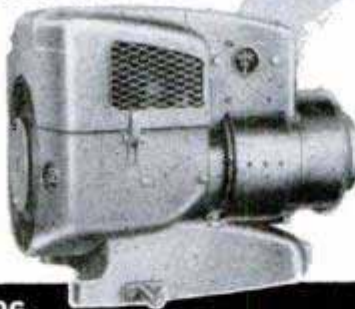
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—the Seabees**

(Continued from page 114)

extra squirt of fuel and a powerful downward push. Immediately afterward, the driving arm is reversed and springs back up, ready for another blow.

Scattered over the mile-square grounds of the laboratory are a number of other machines, all designed to improve the Seabees' efficiency in building overseas bases and installations.

There are rows of huge anchors with new stabilizing arms. There is a midget oil refinery, for emergency front-line use, that would fit into the living room of an ordinary-sized house. There's an improved portable distillation unit for making fresh water out of sea water.

Since the next war may be fought in the Arctic, much laboratory effort concerns techniques for operating machines and equipment in below-freezing weather. Interesting experiments have been made in churning and compacting snow by mechanical means and an Arctic Test Station at Point Barrow, Alaska, evaluates new materials, equipment and techniques.

Even the Quonset hut, which was pretty much standardized in World War II, is being restudied — both from a viewpoint of using it in Arctic climes and finding materials to substitute for near-critical steel. One has been built of aluminum at the Hueneme Laboratory—insulated so that it keeps out cold, holds in heat. In another experiment, Masonite products are being used to build a rectangular hut instead of the usual rounded steel Quonset.

In addition to developing new machines and techniques, the laboratory re-evaluates equipment now in use. After the Inchon landing, for example, there were complaints that barge couplings had failed. So Navy scientists and technicians took a couple of barges and locked and unlocked the couplings for as many as 10,000 times to study their operational weaknesses.

The only man alive who has ever dared to criticize the Seabees is General Douglas MacArthur. He told Admiral Ben Moreell, Chief of the Bureau of Yards and Docks, who organized the Navy's construction battalions:

"The only trouble with your Seabees is that you don't have enough of them."

He said it in 1944 and he was right. But more and more bluejackets today are wearing the insignia — a rugged-looking bee sporting a sailor hat, firing a tommy gun and carrying a wrench and hammer.

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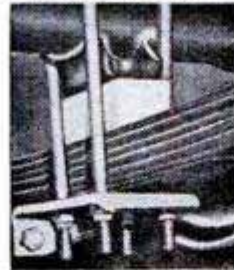
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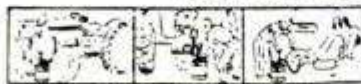
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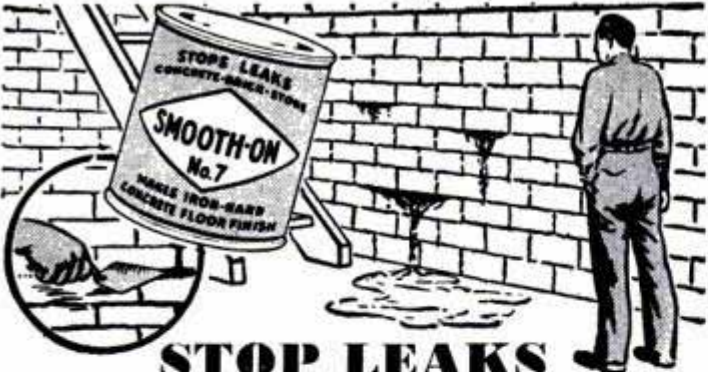
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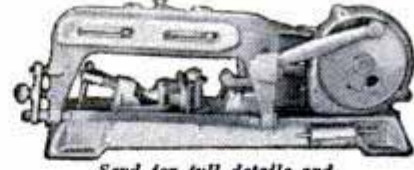
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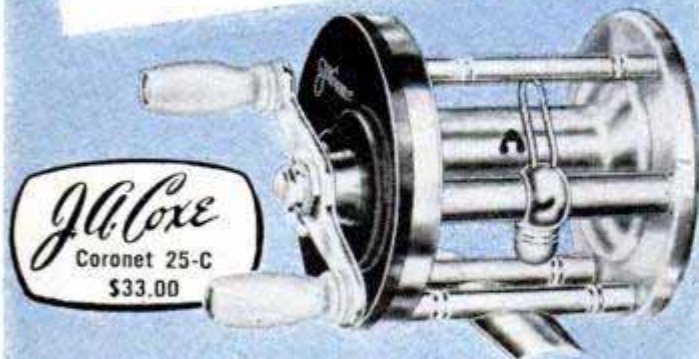
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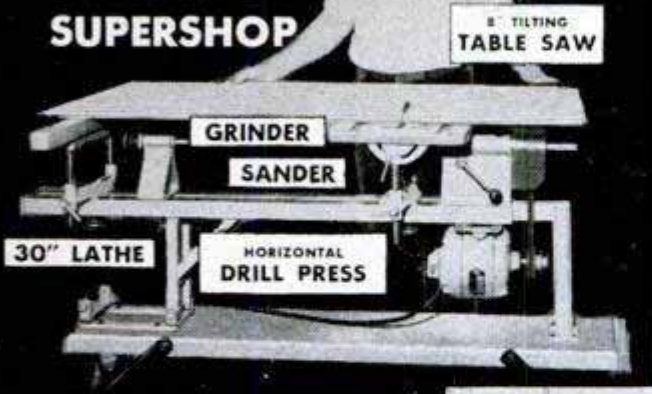
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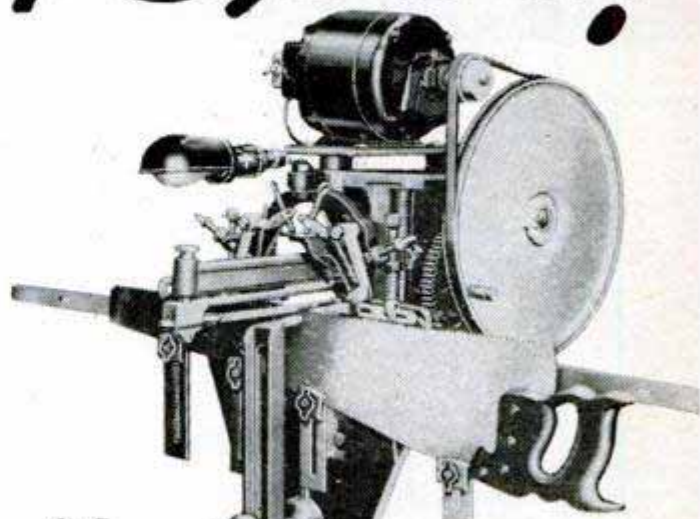
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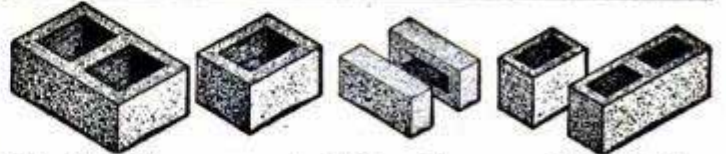
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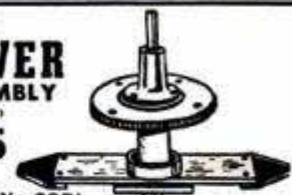
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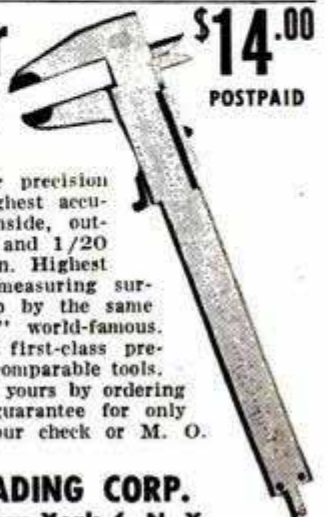


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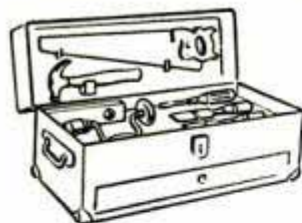
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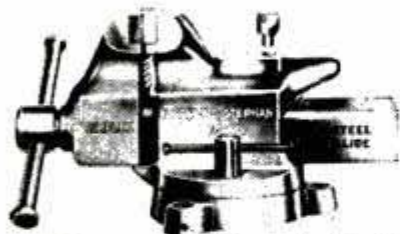
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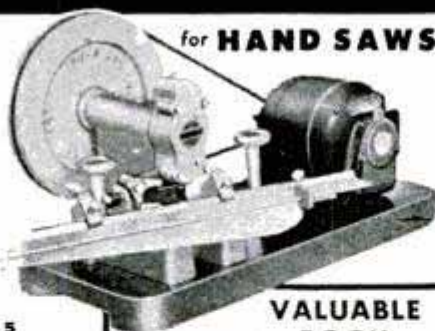
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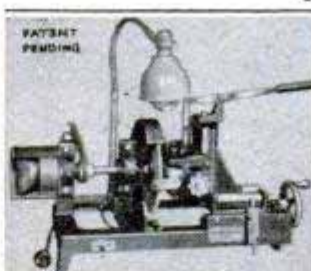
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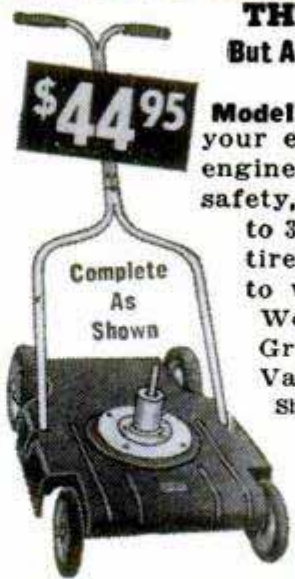
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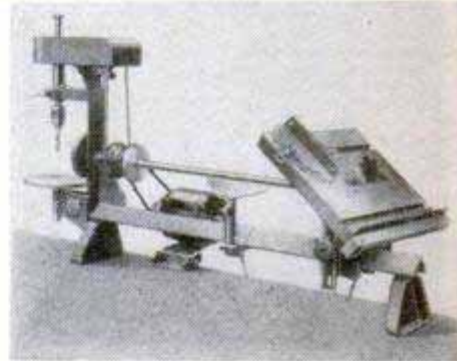
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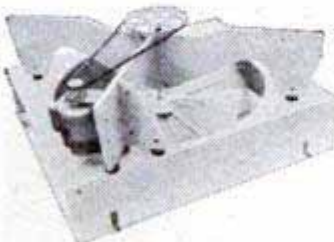
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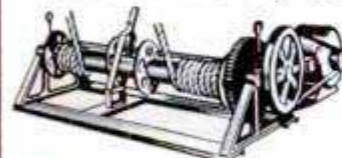
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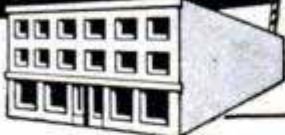


U.S.A. Model, 60 cycle, 110-120 Volt, A.C. Other Voltages, Cycles available. Buy at dealers. Or send price of article and we will ship direct postpaid.

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 Dept. D-51, OXFORD, MICHIGAN, U.S.A.

Gigantic "Warehouse Remodeling"

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SAVE up to 70%!

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We Pay Shipping Charges

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- Army Homelite Power Plant: 1500-w, 115-v, 60-c. New condition. Guaranteed. While they last. \$259.50
- Kato Generators. 5000-w, 115-v, 60-c. Single phase. Complete with 4-sheave pulley, controls, voltmeter, etc. Drive with tractor, old auto engine. New condition. Perfect. Cost over \$450. Special. \$259.50
- Power Plants. 110/220-v, 60-c. Large quantity. All types. 3, 5, 10 kw. Write for circular.
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- Build Welding Generator. Delco-Remy, 200 amps, 30-v. Full instructions. Includes control, fan, etc. Cost \$296. \$24.65

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- Hand Winch. Finest steel. Powerful, complete, with 50 ft. cable. 2500-lbs. 1 to 3 ratio. \$29.95
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- Motor Clutch. 1/2", 5/8" or 3/4" shaft size. Up to 1.5 h.p. \$7.50
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SENSATIONAL VALUE! 12-FT. FLEXIBLE STEEL GUY CABLE, 14-IN. TURNBUCKLE

Powerful 48-strand galvanized steel wire cable, 1000-lb. pull. Strong turnbuckle, 12-in. Adjustment. Wonderful for guy, strengthening gates, fences, buildings, doors, windmills—secure television antennas—excellent tow cable. Cost Gov't. \$1.10 each. Special—10 for \$3.89; 50 for \$16.47; 100 for \$29.32. Frt. Ppd.



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- WEED SPRAY OUTFIT Close-out sale. Finest 4-row, complete, less barrel. \$140 value. \$84.50
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- Acro Saw fits on any 1/4" drill, cuts full 1-15/16" \$ 9.95
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Ideal for Model Parts or Shop Work Mill-Grind-Drill-Index-Route curved or straight-Rabbit and Mortise on drill press or lathe. 8" Table, 4" Cross Feed, 360° Rotation, Accurately Graduated. Bolts to table. Order NOW! SAVE \$100. Only \$54.50. Less Rotary Feed \$42.75. Write for "HOBB-E" Tool Circular. CHICAGO TOOL AND ENGINEERING CO. 8365 South Chicago Ave. Chicago 17, Ill.



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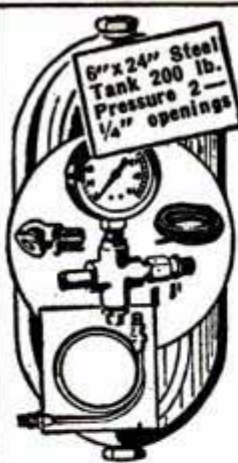
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Both valves in head, bronze bearings, splash lubrication. "V" belt drive, intake muffler and cleaner. Compressor has 2" bore, 1 3/4" stroke, 2.8 cfm up to 150 lb. pressure. Motor required: 1/4 h.p. at 100 lbs.; 1/2 h.p. at 125 lbs.; 3/4 h.p. at 150 lbs. or equivalent gas engine. Wt. 16 lbs. Replacement parts always available.

\$20.50

COMPLETE OUTFIT Compressor, pressure tank, air gauge, air chuck, 20-ft. hose, pop valve, copper tubing with 4 brass flared fittings for connecting compressor to tank, 4-way cross and 3 nipples. **COMPLETE OUTFIT, wt. 30 lbs.**

All Brand New Equipment

EQUIPMENT LESS COMPRESSOR, \$12.45



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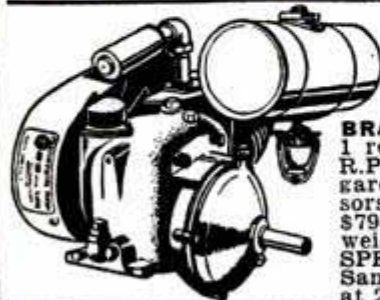
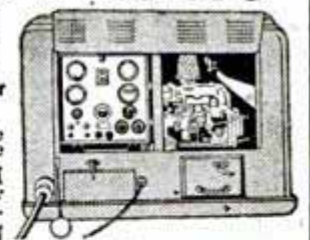
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\$895.00

Same unit, slightly used. Reconditioned, less cable. Fully guaranteed **\$595.00**

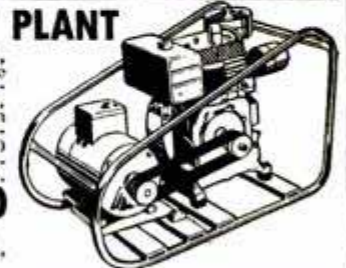


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BRAND NEW. 1 1/2 HP with 6 to 1 reduction gear. Operates at 450 R.P.M. For lawnmowers, scooters, garden tractors, pumps, compressors, generators, etc. List Price \$79.50. Shipping weight 54 lbs. **SPECIAL PRICE, \$47.50**
Same engine furnished at 2600 RPM **\$46.50**

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2000-Watt Generator, 110 V., 60 cy. A.C. with floating base for Automatic Belt Adjusting, 2-Groove Engine Pulleys, V-Belts, Bolts, etc. 4 1/2 H.P. Wisconsin Engine, Voltmeter, 2 plug-in receptacles. Develops up to 5000 Watt starting load. Portable tubular steel Skid Type carrier. Dim.: L. 34 5/8" x W. 17" x H. 20". **\$325.00**

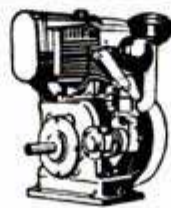


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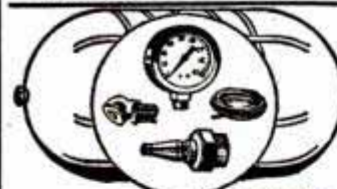


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BRAND NEW SAME CLUTCH FURNISHED WITH 3/4" BORE **\$8.50**



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1/4" Air Regulator, Gauge and filter. Wt. 5 lbs.



New **\$8.95**
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Quiet operating. Double wheel inlet, double width blower. For heating, ventilating, cooling, air washing, exhausting and forced draft. DIMENSIONS: 10" wheel; outlet 13 1/8" x 11 3/8"; inlet 8 3/4". Height 19". Width 18". Depth 16 1/2"; C.F.M., 1/4" S. P. 1600; outlet vel. 1575; wt. 45 lbs. **\$27.50**
BLOWER LESS MOTOR AND DRIVE **\$2.50**
with belt and variable speed pulleys extra. (Motor required, 1/4 h.p.)

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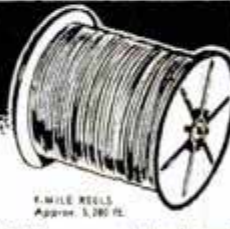
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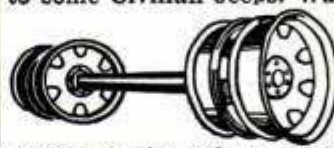
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Heavy duty trailer axle suitable for many types of trailer construction. Also excellent for building of heavy farm trailers and wagons. It is square type straight trailer axle complete with Timken roller bearings, hubs, and 6 hole 750 x 20 Budd Wheels. Without brakes. Axle is 2 inches square and 69 inches between wheel mounting flanges. Std. width.

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20,000 lb. thrust (push pull) using 1500 PSI line pressure as obtained from our hyd. pumps. Or will produce 40,000 lb. thrust with 3,000 lb. line pressure. CAN ALSO BE OPERATED ON LOW PRESSURE AIR SYSTEMS. 4" Bore, 1 1/2" dia. piston shaft, 18" stroke, length 30 1/2". Equipped with ball bearing loaded clevis type mounting and swivel type high pressure steel pipe bracket for easy use. Ideal for road, farm & shop machinery. Ideal for presses, etc. Cost Gov't \$390.00 **29.95**

We carry the World's Largest Supply of New Hydraulic Equipment featuring over 20,000 Cylinders in 61 Sizes & Types. Can also supply all accessories such as Pumps, Fittings, Valves, Tanks, Hose Fittings. Let us solve your Hydraulic problems. Write for information.

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Double action. Bore is 1". Shaft 1/2". Has a stroke of 2 1/2" to 4". Stroke can be adjusted with internal sleeve stops. Overall length is 8 1/2". Will take 1500 lbs. continuous duty. 3000 lbs. intermittent. Will lift or push to 1100 lbs. **5.75**

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Double action cylinder. Has a bore of 1-3/8" and shaft of 1". Stroke is 9". Overall length 15 1/2". Built for 1500 lbs. continuous duty. 3000 lbs. intermittent. Will lift or push up to 2300 lbs. . . . Can be adapted to hundreds of uses. **9.75**

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With built-in variable flow control valve in head. Positive displacement piston type. Displaces 450 cu. in. per revolution. 2 gal. per min. cap. at 1500 RPM or 1250 PSI. Pressure limit, 1250 PSI continuous, 1400 PSI for 15 sec. Operates at 3750 RPM, intermittent maximum 4500 RPM. Rotates either direction with out adjustment. **19.50**

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VT-1 VICKERS HYDRAULIC Transmission
Self contained, 2 H.P., constant torque at all speeds with variable volume reversible, piston pump (controlled by outside lever) supplying piston hydraulic motor. Automatic pressure, dash pot for smooth control. Power output RPM - 0 to 1/3 input RPM in both directions. Input RPM 1800 continuous. 4000 intermittent. Dash pot can be removed for greater RPM. Ideal for lathes, duplicator or set-up on mills, conveyors, small cars, drives, gearings, etc. **32.50**
4" SPLINE SHAFTS for input & power take-off. **2.50 ea**

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NEW! GEAR HEAD MOTOR



GHM-607 - Originally designed to drive large Aircraft Tow-Target reels. . . . Powered by 24 V. DC, 95 Amp., compound wound motor. Rated at 2 H.P. Turns 4,200 RPM and is geared down to 136 RPM at the power take-off shaft. 60 foot pound

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UNIT COMPLETE **10.95** MOTOR **4.95**
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No. 500 - New 1/2 H.P. - 27 Volt, D.C.-A.C. This motor can be readily adapted to deliver up to 1/2 H.P. on 110 Volts, A.C. by the simple method of rearranging armature brushes. Free diagram with each order. A sensational value. **5.95**

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AMMETERS 0-30-0-30+ 0-60-0-60+ 0-120-0-120+ 0-120-0-240 0-300 Any above ammeters. **3.95**
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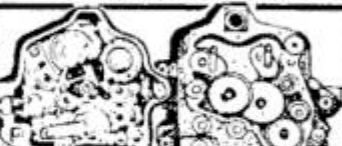
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Special 3/16" cable, 18 ft. long with turnbuckle ends. **99c**
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1/4" - 17 ft. | 1/2" - 38 ft.



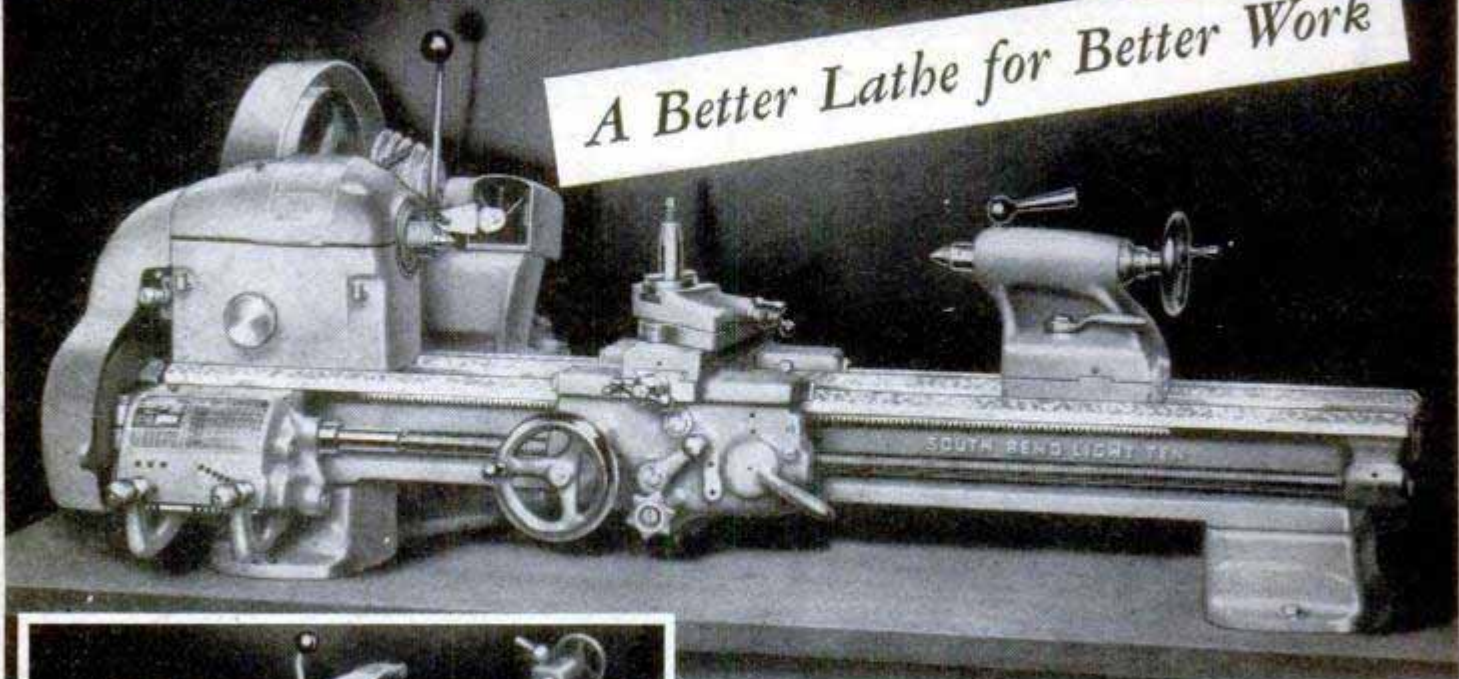
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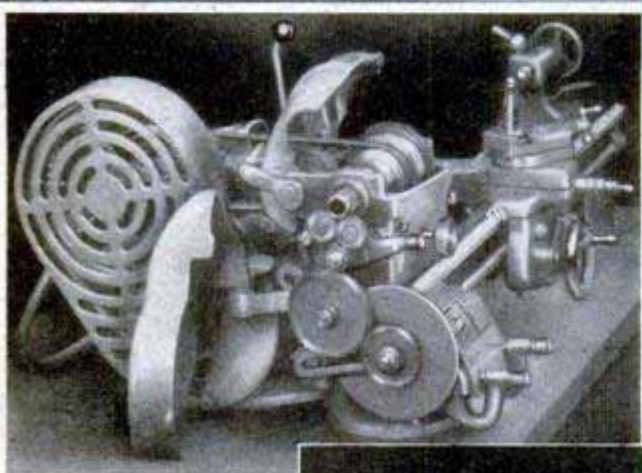
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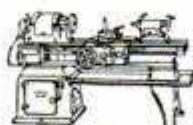
Light Ten Lathes

Lathe Attachments

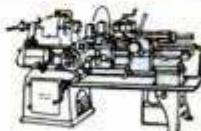
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Weight only 8 1/4 lbs

MontaMower is a new, efficient kind of lawn mower that literally "sells itself."

This live, 8 1/4 lb. precision machine first gathers then smoothly and easily cuts a full 16" swath through grass, dandelions, spike grass and tall lawn weeds (including those that ordinarily pop back up to cause you extra work).

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MontaMower does what no conventional mower can do! It cuts right up to walls, fences, trees, under foliage, around close quarter borders — it practically eliminates hand trimming!

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Trims close to buildings, trees and shrubs.

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women and children can operate it easily and efficiently. Improved metal handle has special device to adjust cutting height. Self sharpening, tool-steel cutting discs.

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"MY OWN 30-Day Test gave me a new pitch on cigarettes," says ace pitcher **Jim Konstanty**. "Camels hit the spot!"



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NADINE CONNER, opera star: "My own 30-Day Camel Test proved how much fun smoking can be!"



VAUGHN MONROE, band leader: "I enjoy every puff of a Camel! Camels taste great—and they're mild!"




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More people smoke
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Make the
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MILDNESS
Test—
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● No other cigarette can match Camel's rich, full flavor! And no other cigarette can offer you this proof of mildness:

In a coast-to-coast test of hundreds of men and women who smoked only Camels for 30 days, noted throat specialists, making weekly examinations, reported — not one single case of throat irritation due to smoking Camels!

Smoke Camels yourself for 30 days. Compare Camel's choice tobaccos for flavor and mildness... in your "T-Zone" (T for Throat, T for Taste). You'll see why so many smokers say...

ONCE A CAMEL SMOKER, ALWAYS A CAMEL SMOKER!



JOHN WAYNE, movie hero, says: "I found the cigarette I could enjoy as a steady smoke — Camels!"



KYLE MacDONNELL, television star, says: "Yes, I made my own 30-Day Camel Mildness Test. It was fun!"



OPERA STAR, Robert Merrill: "The cigarette I smoke must agree with my throat. Camels are really mild!"

R. J. Reynolds Tobacco Company, Winston-Salem, N. C.



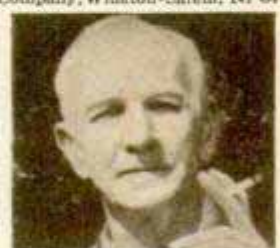
RIFLE CHAMPION Audrey Bockmann: "Camels scored a hit with my taste, too! And they're mild!"



DICK POWELL, movie star, states: "Camels give me more pleasure than I ever got from any other cigarette!"



RISÉ STEVENS, opera beauty, says: "I know how mild Camels are! My own 30-Day Test convinced me!"



LECTURER AND WRITER Dr. Archibald Rutledge: "I've smoked Camels for years! They're cool and mild."



"I'M A SINGER and my throat comes first! I picked Camels as my steady smoke!" **Anne Jeffreys**, stage star.