

50 PAGES ABOUT CARS - PLUS ALL REGULAR FEATURES

POPULAR MECHANICS MAGAZINE

WRITTEN SO YOU CAN

In Color—America's Most Significant Cars . . . Which Gas Is Best For Your Engine? . . . The '58 Cars and Their Specifications . . . Foreign Cars . . . Will Success Spoil Volkswagen?

FEBRUARY 1958
35 CENTS

*1909 Model T—
page 144*



*1958 Thunderbird—
170*

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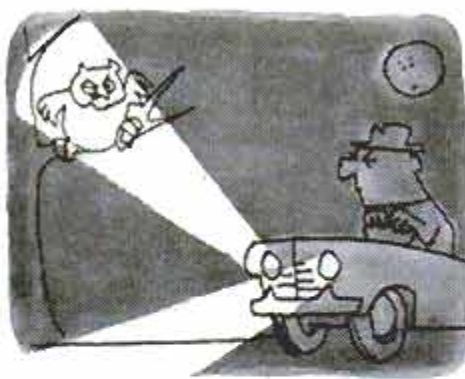
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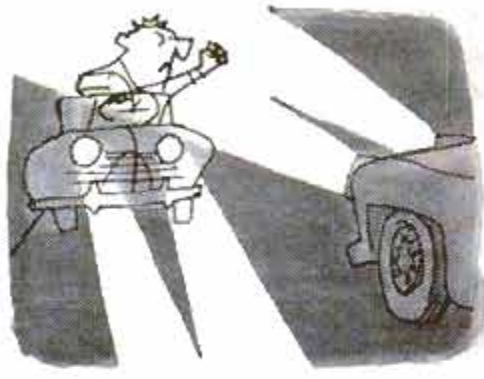
How to get more light on the road from your present headlamps!



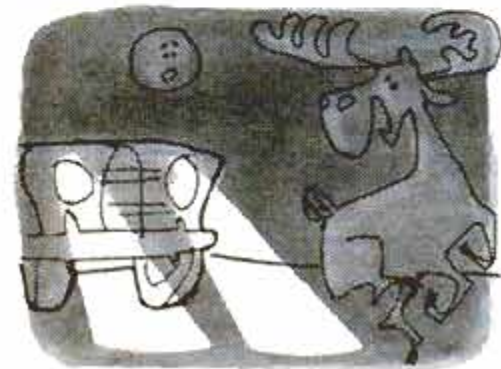
1. Since headlamps are detachable, they are subject to road shock and vibration which can jar them out of position and mis-direct their light.



2. A very slight change in their position (so insignificant you can't even see the change) makes a big difference in the light you get down the road.



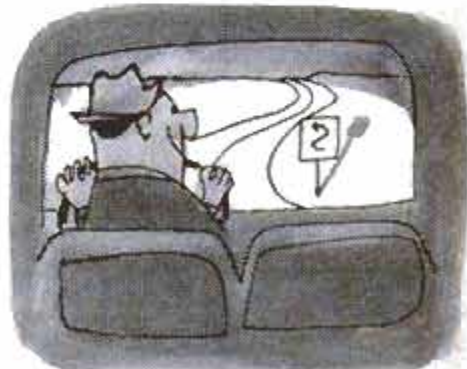
3. Ever have oncoming motorists "flash" their lights...believing you were driving with your "brights"?—when it was your *lower* beam... aimed high!



4. When headlamps are aimed low, the beam is too short... and you might not see in time to stop in time.



5. Your dealer can tell if headlamps are mis-aimed, and he can aim them accurately in minutes, even in daytime.



6. So, to get *more* light where it is needed... from your present headlamps... have them aimed *today!*

... and, if your headlamps are over 2 years old,
here's how to get even more light!

Take a look at your *unlighted* headlamps. If they look like those at right, even re-aiming won't give you all the light you need. They should be replaced with new G-E *All-Weather* Headlamps that are all glass... their reflectors always stay shiny. When driving on the *lower* beam, G-E *All-Weather* Headlamps let you see better in fog, rain or snow and against the glare of oncoming traffic. Their *upper* beam reaches far and wide for safer driving on the open road.

Get a pair of G-E *All-Weather* Headlamps today—and have your dealer aim them when he puts them in. You'll see the difference tonight. General Electric Co., Miniature Lamp Dept., Nela Park, Cleveland 12, Ohio.



WATER DROPLETS inside the lens not only scatter the light, but they also help discolor metal reflectors. This can't happen with G-E *All-Weather* Headlamps—moisture can't possibly get inside.



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BLACKENED BULBS in old-style headlamps block out the light from the filament and cause a dangerous drop in light output. This can't happen with G-E *All-Weather* Headlamps because there are no inner bulbs!

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Next Month...

THIS IS Swish, one of the trimmest and sleekest runabouts ever designed. Plans for building the 15-footer are included in next month's 25-page section devoted exclusively to boating





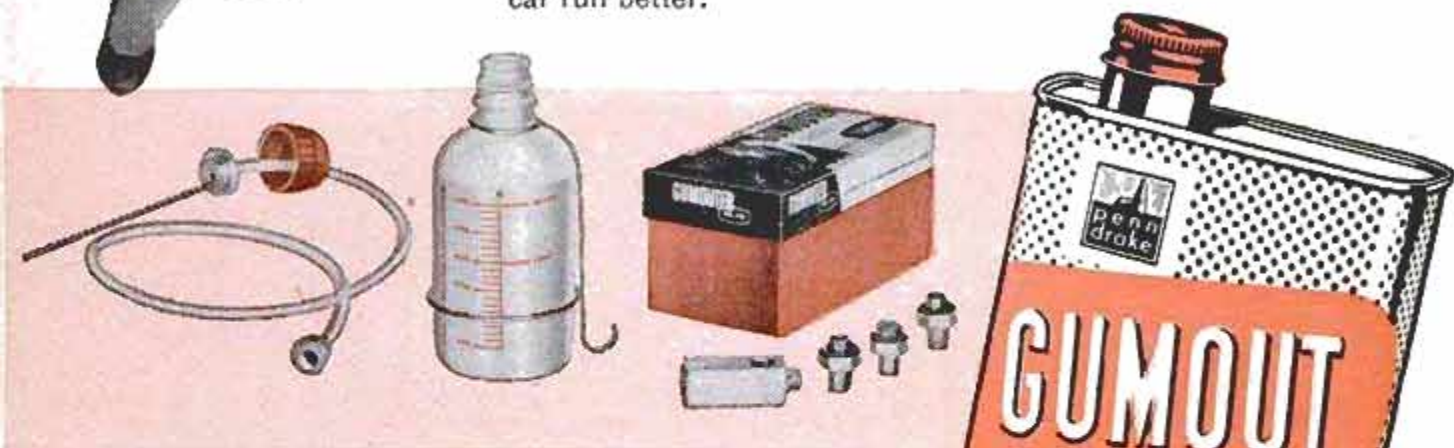
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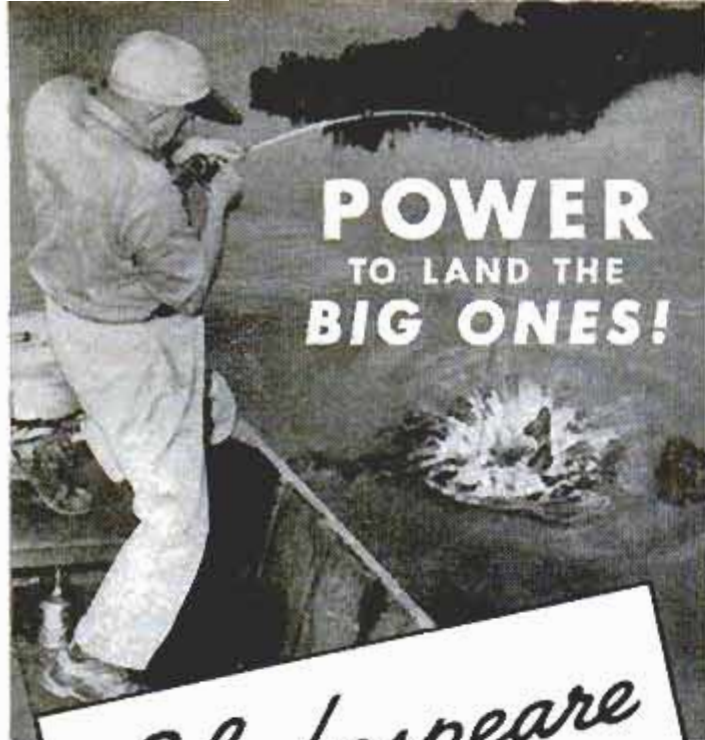
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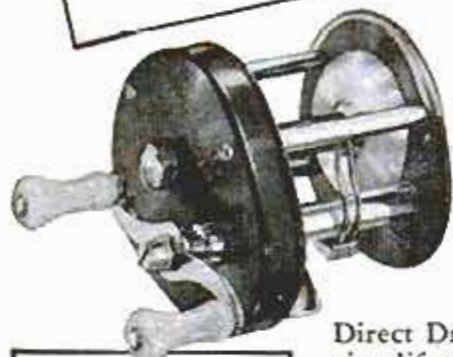
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**ACROSS THE
DESK**



Introducing an Artist

New to our pages is the artist who painted the portraits of America's most significant automobiles, the color feature opening our Sixth Annual Automobile Section on page 145. He is Ed Vebell of Westport, Conn., Chicago-born and schooled, 36 years old, married and the father of two children.



During World War II he was feature illustrator on the *European Stars and Stripes*, and afterward remained in Paris working in his own studio for more than five years.

Between family and art jobs, he tells us, "I squeeze in as much fencing as I can. . . . I first became interested in fencing from an article in *Popular Mechanics* and have been at it ever since. I've since represented the United States on two Olympic teams and also made it the third time, which was the Melbourne games. But I was hurt in training and was flat on my back in a hospital when the team departed for Australia. I've since bounced back and took fourth place in (1957) National Championships."

To the Editor:

Enclosed you will find a photo of an item we have received here. It is of brass and the end to the right of the picture is similar to a mouthpiece. The tube extending from that is hollow and is pivoted in the yoke in the center. The tube can be adjusted, permitted to slide through the center pivot, by a setscrew barely visible behind one side of the yoke. The piece

(Continued to page 10)

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3 IN THE HOSPITAL, I HAD PLENTY OF TIME TO THINK



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FAST! I'M INTO HYDRAULICS ALREADY. AND I THOUGHT I WAS TOO OLD TO LEARN

5 SIGNING UP FOR THAT I. C. S. COURSE WAS THE SMARTEST THING I EVER DID

8 THEN A FEW DAYS LATER, MR. WALSH CALLED ME IN...

JIM, I'M KEEPING YOU HERE AND PUTTING YOU ON SALARY. YOU'LL BE GETTING ABOUT \$20 MORE A WEEK. AND AT THE RATE YOU'RE GOING, I EXPECT I'LL HAVE TO RAISE THAT IN SIX MONTHS

HERE'S WHERE YOU COME IN! LET I. C. S. SHOW YOU THE WAY TO MORE PAY, RAPID ADVANCEMENT, REAL JOB SECURITY! MAIL THIS COUPON TODAY!

6 ONE MONTH LATER... GOOD TO SEE YOU BACK ON YOUR FEET, JIM. IT'LL BE AWHILE BEFORE YOU'RE BACK IN THE FIELD. SO WE'LL FIX A TEMPORARY DESK FOR YOU IN THE OFFICE WHEN YOU'RE READY

I'M READY NOW, MR. WALSH

9 THAT EVENING, JANE AND I WENT HOUSE HUNTING

OH, JIM! IT'S A DREAM HOUSE!

AND THANKS TO I. C. S. IT'S A "DREAM" THAT CAN COME TRUE!

MODEL HOUSE

7 THEY GAVE ME SOME SIMPLE ASSIGNMENTS... AND I SURE SURPRISED THEM!

SAY, WHERE DID YOU LEARN ABOUT PUMPS?

SAME PLACE YOU DID, JOE... I. C. S.

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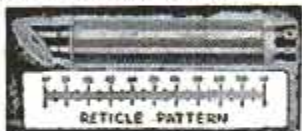
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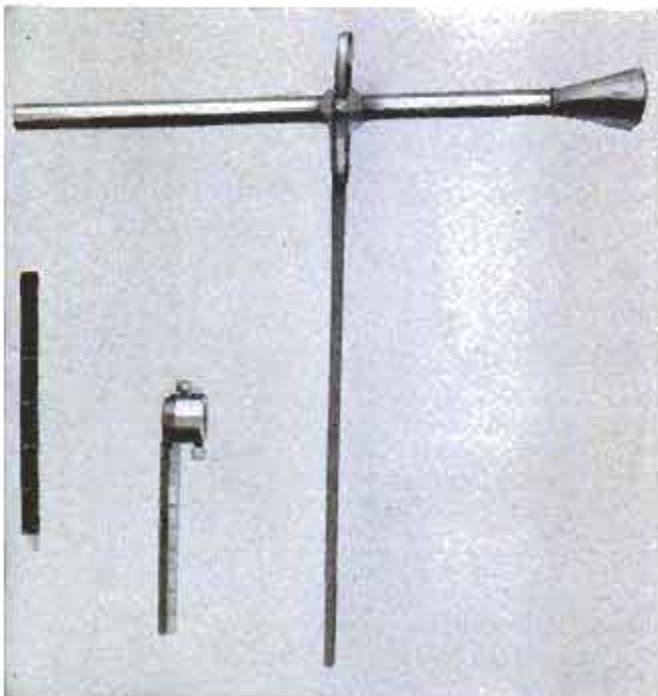
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extending downward from the yoke is 1/4-inch-square material.

The smaller fitting, also of brass, to the lower left of the photo, does not fit the larger piece but must be part of it.



We thought you or some of your readers might be able to identify it. We were informed that during a TV program which featured the inventor, De Forest, he used a similar instrument, so it may be used in electronics. We cannot associate it with any nautical usage.

Any information you can supply will be appreciated.

Robert H. Burgess,
Curator of Exhibits,
The Mariners Museum,
Warwick, Va.

Who knows?

To the Editor:

I have hesitated in writing to you ever since I received my July copy of *Popular Mechanics*, but I have read and reread the article in that issue on Hiller's Aerial Sedan many times and I do agree that it has many possibilities for the military, but also it would be the answer to a rural mail carrier's prayer. My route is 58 miles, all dirt roads. You don't know how many times I have longed for something like that; I wouldn't care if it didn't rise but just a few feet above the ground—you would be out of the mud (mud that even a Jeep can't go through at times). I certainly hope they can get something developed in the near future.

I have hired a Flying Farmer to drop the mail for me, but that doesn't prove too

(Continued to page 14)

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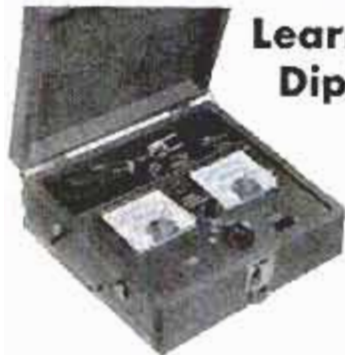
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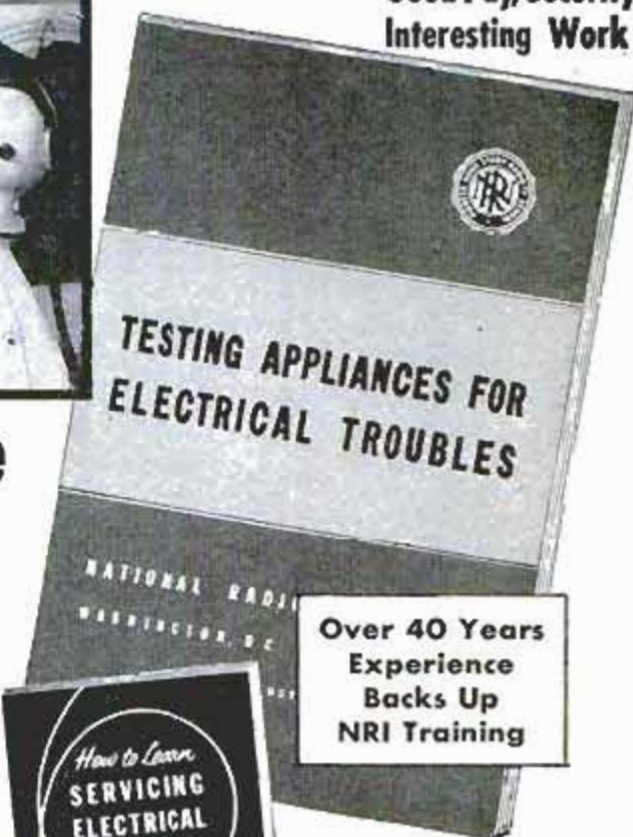
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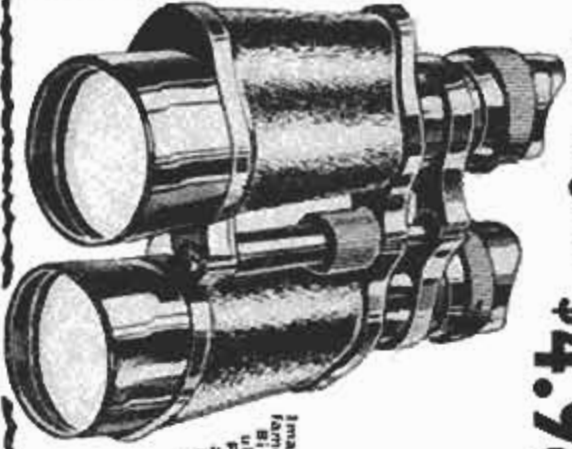
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plus postal fees with your postman when he delivers your package. Examine the telescope 10 full days and then return it for a full refund. This is the unbeatable beauty of the Milky Way; the unforgettable brilliance of the Big Dipper; the eerie, yet romantic grandeur of the moon's peaks and craters; the solemn majesty of Jupiter with its 4 tiny moons. Focus your Powerhouse on distant stars at sea, on natural wonders, on far-off villages. Whether it's 10 miles or 10,000 miles, you get sharper, better, closer-up views you never dreamed possible!

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(Continued from page 10)
satisfactory because you cannot pick up the outgoing mail; in one of these you could.

Glenn C. Hitchcock,
Renfrow, Okla.

To the Editor:

I am enclosing herewith a photo which I think will be of particular interest to you. I recently constructed this boat following the plans which appeared on page 287 of the August 1938 issue of *Popular Mechanics* magazine. The one modification of the plans I made was to cover the hull with glass fiber instead of canvas. Although the



photo shows my four-year-old daughter, Sheila, in the boat, it is large enough for one man. I have found it an ideal craft for fishing on nearby mountain lakes.

E. R. McCafferty,
Star Route,
Naches, Wash.

Our thanks to Mr. McCafferty for the picture of Sheila aboard the Sheila. The plans for the boat, published almost 20 years ago, still look good!—Ed.

To the Editor:

May a woman driver reply to your recent article concerning cheaper-operating cars or is *Popular Mechanics* strictly a man's mag?

I'm referring to the article quoting the motor companies as saying the American public won't buy a cheaper car. I have three questions to ask them: 1. Who wants necessarily a cheaper-priced car? 2. If so, why are so many foreign cars seen on the road? 3. Is it possible the motor companies are sticking their heads in the sand or do they make a bigger profit from the foreign-made cars they all seem to sell?

If they would produce a beautiful car with better gas mileage but not necessarily a cheaper-priced car, it would sell. Ask any dealer for a cheaper-running car and he invariably shows you a car stripped of

(Continued to page 168)

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Olds on the R. F. D. Route

One of America's "most significant cars," shown on page 146, was the 1901 Oldsmobile, and its adoption on the rural routes of the post-office department is credited to the founder of *Popular Mechanics*, H. H. Windsor, Sr., who was also publisher of *R. F. D. News*.

E. L. Warner, Jr., present Oldsmobile Publicity Director, reported this to us when he learned of the inclusion of the 1901 model in our color feature this month.

"I believe," wrote Mr. Warner, "that *Popular Mechanics* can take some credit for helping initiate the use of automobiles for mail delivery. . . . Following is an excerpt from an early history of Oldsmobile:

"Even on this dot-and-go schedule, extraordinary strength and durability marked the Oldsmobile curved-dash runabout. We have seen that in 1901 Oldsmobile was the first light car to make the rough passage from Detroit to New York. In that year Milford M. Weigle and F. F. Faurote introduced into the United States postal service a wire-wheeled Oldsmobile runabout which is said to be the first gasoline car used in any postal service in the world. It carried mail on contract under tests so successfully that a fleet of Oldsmobiles was soon being used for that purpose. Credit for initiating this idea of the automobile in postal delivery, belongs to H. H. Windsor, editor of *Popular Mechanics* and the *R. F. D. News*, who invited F. L. Faurote, then advertising manager of the Oldsmobile works, to address the annual convention of rural letter carriers at Indianapolis in 1906."

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Wouldn't you like to be making as much as \$1,000 in a month? Of course not everybody makes such profits starting out, but look at these profit reports: A Florida salesman earned \$600 in 1 month. An Ohio man earned \$2100 in 2 months. A New

York salesman earned \$1500 in one month. A New Hampshire man added the Presto as a sideline and picked up an extra \$1800 in 20 months. Men everywhere, even in off hours, are rolling up amazing profits. How about you?

WHAT'S THE SECRET?

PRESTO contains an amazing new chemical—"Chlorobromomethane" or "C.B." The Germans developed "C.B." as a secret defense against fire during the war. After the war, a famous American firm, The Dow Chemical Company, acquired the formula from the U. S. Government and began manufacturing it here. Then we (Merlite Industries) designed a handy, yet amazingly effective, fire extinguisher to contain and release this new wonder-chemical. In comparing the effectiveness of "C.B." in fighting fires, The Dow Chemical Company's report states, "It has been proved that 'C.B.' is about 1.5 to 6 times as effective as other common extinguishing agents on an equal weight basis." This means that Presto can be made light and handy so even a woman or child can use. No pumping, no heavy tank. Just twist the knob, and flames disappear!

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(Continued from page 14)

all good looks. Why? Does a bit of chrome and better interior raise the gas consumption automatically?

Each year the emphasis seems to be on more speed, and why, I don't know. Each safety-check report says speed is one primary cause of accidents, speed laws are being lowered, not raised, and our roads are not improving to take this speed. Yet it continues to increase.

Most of us women drivers aren't too wild for more speed. Safety for our families causes us more concern. This has been ignored.

Gasoline prices here in California are going up rapidly. How long can we afford to drive a gas hog?

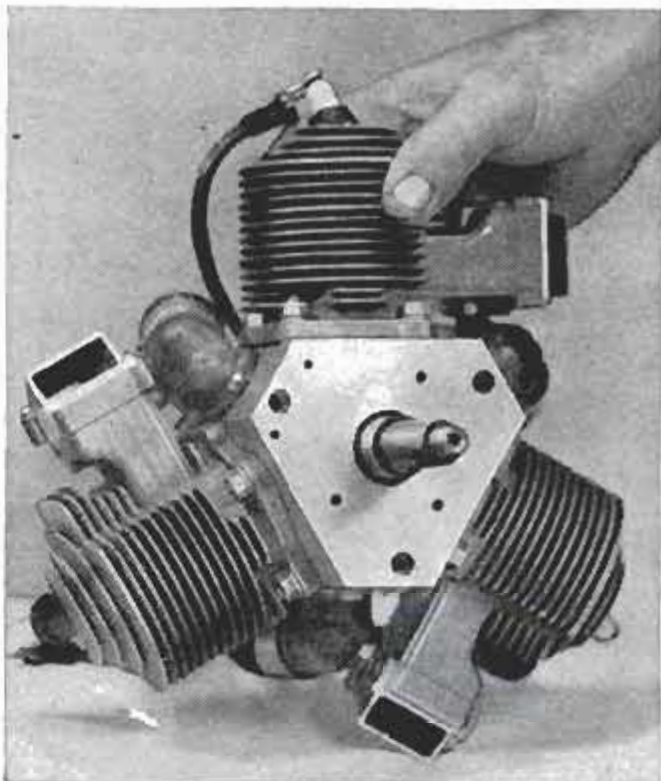
It seems to me a challenge worthy of any auto company to make a car that doesn't cost a fortune to run but that we can still be proud to own. It can be done and I'm waiting to purchase one. Aren't you?

Yours for cheaper gasoline bills,
Mrs. Howard Underwood,
San Joaquin, Calif.

Radial Engine for Air or Water

From Ray Stits of Stits Aircraft, Riverside, Calif., comes news of a lightweight, two-stroke radial engine being developed

by W. C. Johnson, engineer, of 6631 Elgin St., Los Angeles, Calif. Intended for small aircraft, helicopters or boats, the three-



cylinder prototype shown here weighs 14 pounds, develops 13 horsepower with 15-cubic-inch displacement. A self-contained

(Continued to page 16D)

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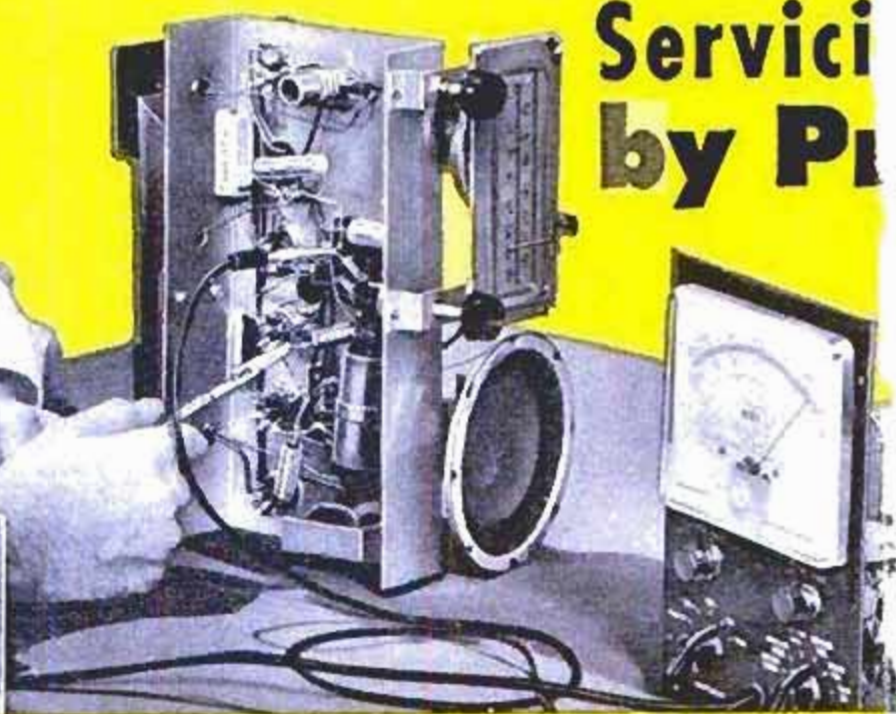
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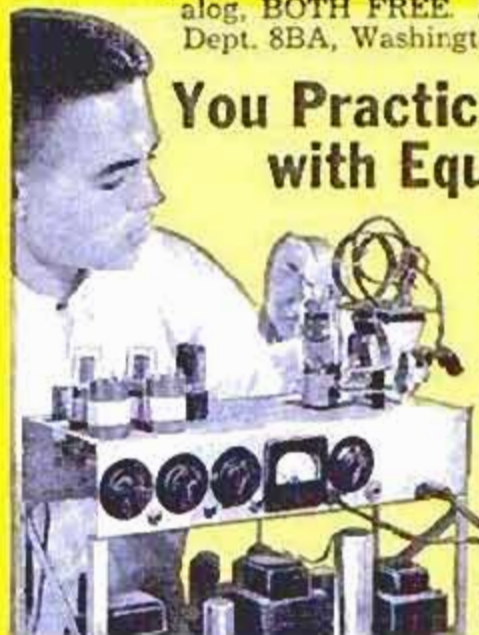
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To the Editor:

A familiar sight in South Hampshire in England is this well-preserved 1911 Model-T Ford belonging to local garage owner, George Hammond. It is probably one of the best-maintained Fords of its age in the



country and is in constant daily use, not just kept for gala occasions! It is typical of George Hammond and his veteran car that during a recent summer he answered a call for towing from a stranded motorist with it. Despite the look of absolute astonishment on the waiting motorist's face, the ancient Ford towed him in quite safely and efficiently! George Hammond is seen here at the wheel outside the Kings Head Hotel, Wickham, Hants. Without a doubt, every British motorist wishes that the prices shown on that board were applicable to present-day motoring.

J. Gray,
4, The Pightle,
Maids Moreton,
Buckingham, Bucks.,
England.

To the Editor:

The *Popular Mechanics* "History of Speed" paintings (Feb. 1957) were shipped back to you yesterday. We certainly appreciate the privilege of displaying these originals in our museum during the last six months. They have been viewed by more than 5000 visitors each week during that time and we are planning to have the set of smaller replicas framed attractively as a part of our permanent museum display. Thanks for your cooperation.

Al Bloemker,
Indianapolis Motor Speedway Corp.,
Indianapolis, Ind.

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If you believe that you have an invention, you should find out how to protect it. The first step is to have a search made of the prior pertinent U. S. patents. If a report on this search indicates that the invention appears patentable you can apply for a patent, and the specifications and claims should be prepared.

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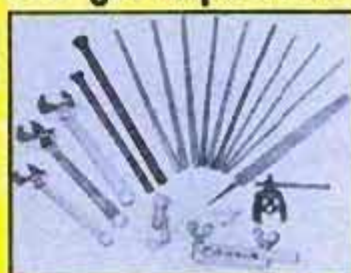
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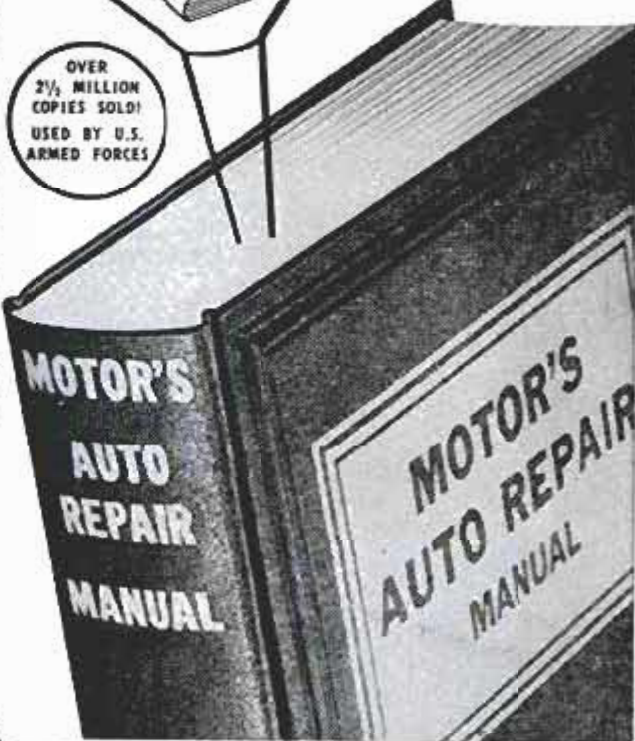
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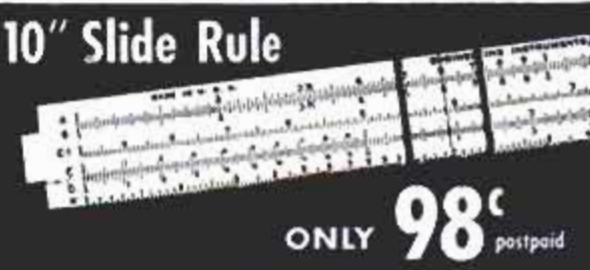
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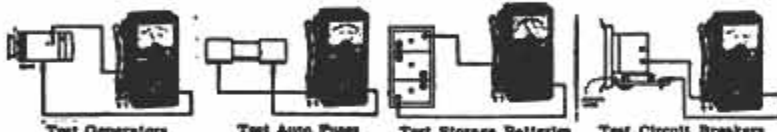
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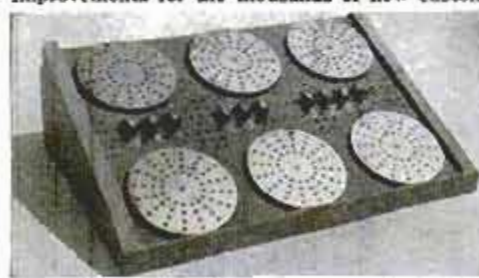
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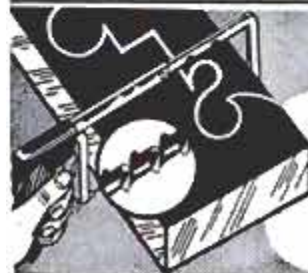
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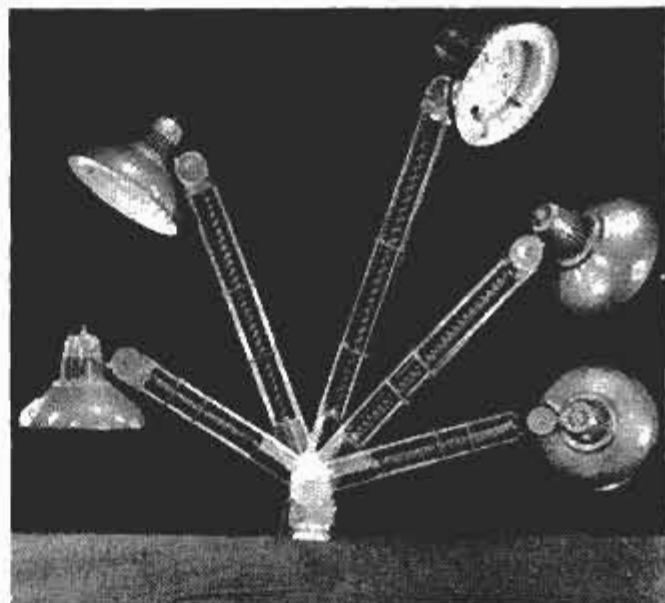
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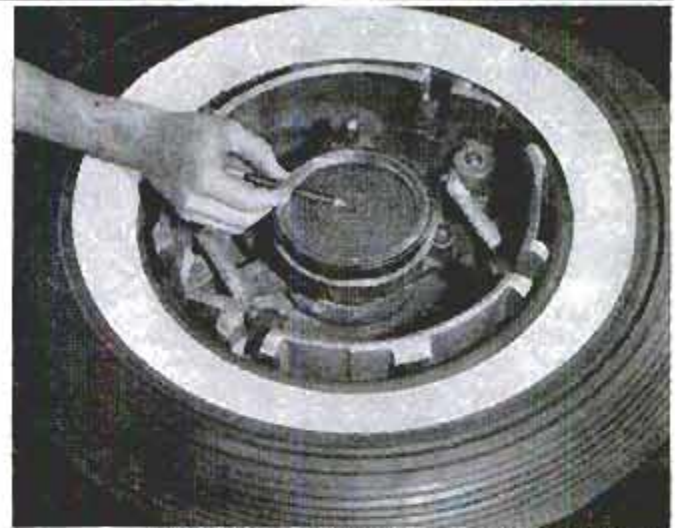
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BRUSH Plating outfits for plating articles in the home and shop. No tanks necessary, silvering mirrors, spare or full time. Free particulars. Gunmetal Co., Ave. H, Decatur, Illinois.

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WANT To make big money at home? \$10.00 profit in an hour possible with invisible mending. Make tears, holes, disappear from clothing, fabrics. Steady year-round demand from cleaners, laundries, homes. Details free. Fabricon, 6234 Broadway, Chicago 40, Illinois.

WHOLESALE—Thousands nationally advertised products. Buy, sell. Amazing profits. New, free plan. Associated Wholesalers, 1016-D Starr, Burlington, Iowa.

OPERATE Mailorder folio business! Free details. Ballard's, 425 East Catherine, Louisville 3, Ky.

MAKE Flexible molds. Cast plaques, figurines. Free sample. Tooker, 1045-R Fairview, Hamilton, Ohio.

NATURAL Molding rubber, extra thick. Free sample. W. Wooley, 1016-A Donald, Peoria, Illinois.

BIG Money raising fishworms and crickets. Free literature. Carter Farms, Plains, Georgia.

VENDING Machines—No selling. Operate a route of coin machines and earn amazing profits. 32-page catalog free. Parkway Machine Corporation, Dept. 26, 715 Ensor Street, Baltimore 2, Maryland.

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WANT More business? Here's an amazing opportunity to increase your sales. Talk to thousands of interested readers of "Mechanica Popular." Our Spanish Edition covers the Latin American countries like a blanket. They're real mailorder buyers. Classified rate 75¢ per word. Try an ad in our next issue. Classified Advertising Department, Popular Mechanics Magazine, 200 East Ontario Street, Chicago 11, Ill.

START Home business making statuary, plaques, novelties, garden furniture, artificial marble flooring, liquid marble. Make your own flexible molds. Amazing profits. Only \$1.98. Free literature. Popular Mechanics Press, 631 No. St. Clair St., Chicago 11.

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

COPUBLISH Mail Sale Advertiser, leading mail order paper. Details, latest copy, dime. Vanroy Shirk, Lebanon, Penna.

LEARN Photo-negative portrait retouching. Men, women. \$5 hour possible spare or full time at home. Easy, glamorous. Work for photographers by mail order. Full details sent free. Duval, 100 So. Vermont, Los Angeles 4.

YOUR Own name brand business. No investment; no inventory. Part time or full time. Sell famous brands of appliances, housewares, silverware, radios, vacuum cleaners, lamps, tools, clocks, watches, jewelry, etc., etc., over 1000 items. Join thousands of successful independent dealers. Send for free catalog and dealer price list. H. B. Davis Corp., Dept. 11, 145 W. 15 St., New York City.

11,000 NEW Prospects daily. Baby record books, shoes, albums. Sell mailorder. Use our literature. Write: No-Co-Ro, Capitola, California.

BAKE New greaseless doughnuts in kitchen. Sell stores. Free recipes. M. Ray, 3605 South 15th, Minneapolis 7, Minnesota.

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MONEY For you! Big profits! Cast plaster figurines, bookends, plaques at home with XL rubber molds. No experience needed! Write for illustrated, 40-page catalog, only 25¢! Plastic Arts Studios, 3403 So. Madison Street, Department 6, Muncie, Indiana.

PLATE Baby shoes, jewelry, gifts, bronze and colored pearl. Free booklet. Platex, 11029 South Vermont, Los Angeles 44.

FREE Catalog. Contains hundreds of businesses, farms and income properties throughout U.S., Canada. Specify type and location desired. Deal direct with owners. U. I. Buyers Digest, 1608 Hillhurst, Dept. PM-3, Los Angeles 27, Calif.

LIQUID Rubber. Make flexible molds. Free sample. Chaney, 1907-A East Road, Jacksonville 11, Florida.

BOOKKEEPERS, Accountants. Operate a bookkeeping service. Part or full time. Amazing simplified system. Wonderful money-making opportunities. Complete information free. National Bookkeeping Publishing Co., Suite 307, 3435 Broadway, Kansas City 11, Mo.

WE Pay \$3.50 lb. dried. Grow mushrooms. Cellar, shed and outdoors. Spare full time, year round. We have 25,000 customers. Free book. Washington Mushroom Ind., Dept. 172, 2954 Admiral Way, Seattle, Wash.

\$250 WEEK Cleaning venetian blinds. Patented machinery. Free literature. Robinson, 7213B, Indianapolis 1, Indiana.

FREE Book "505 Odd, Successful Businesses." Work home. Pacific, Oceanside, Calif.

I Want to send you proof of the wonderful pulling power of Popular Mechanics classified pages. What's your proposition? Write me today. Include literature if possible. F. W. Johnson, Manager Classified Advertising, Popular Mechanics Magazine, 200 E. Ontario St., Chicago 11, Ill.

INTERNATIONAL Mailorder business. Complete setup service—Not just instructions. Hermes, 152 West 42, New York City 36.

PLASTERCRAFT Molds, liquid rubber, plasters, flocks, candle supplies. Catalog and manual free. Blue Rapids Supply, Blue Rapids, Kansas.

MARY-Mac agency—motorized vibrator. Cushions, chairs, tables, belts. Mary-Mac Factory, 1012 Powhattan, Dallas, Texas.

FREE Pollo "\$5,000-\$45,000. Unlimited Vacations." No merchandise. Unknown! Work home, sparetime! Haylings, Carlsbad, Calif.

FREE Folder. "How to Make \$3,000 Yearly. Sparetime. Backyard. Raising Earthworms!" Oakhaven 38, Cedar Hill, Texas.

MAKE \$46 From square foot plywood;igsaw necessary. Free details. Woodart, Bridgewater, Mass.

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MINIATURE Golf plans \$1.00. Lil-Putt, Box 294, Rock Island, Illinois.

GROW Orchids at home. Profitable, fascinating. Successful home grower explains special light, temperature and humidity conditions orchids need. Free: Full details, Orchids, 100 S. Vermont, Los Angeles 4.

EARN \$10,000 Yearly raising Angora rabbit wool for us. Information 25¢ coin. American Angora Company, Malta 12, Montana.

IMPORTING. Modern dropship method. Details free. The Hazen Company, 6601M—8th Avenue N, St. Petersburg 10, Florida.

DOLLARS In every mail. Profitable mail order operates in your home, farm, or office. Send for free details. Webb Imports, 8729½ Warvale, Rivera, Calif.

\$100.00 WEEKLY Spare room. Raise redworms soilless way. Odorless. Charlie Morgan, Box 116E, Bushnell, Florida.

MAKE Strange plastic building material of waste, easily. Water, fire, wear and termite resistant. Bays Laboratory, Oklahoma City, 9.

TYPIST Operate profitable mail-order business. Stamp brings details. General Sales, 336 Roosevelt St., Creve Coeur, Ill.

BIG Money in mailorder. Merrill Hilstad, Box 182AP, Hatfield, Penna.

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EARN \$50 To \$60 daily repairing typewriters, write New England Training Service, Carmel 2, Maine.

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RUBACREAM! Concentrated latex cream! Makes molds quicker! Thicker! Instructive literature free! Castcraft Studios, 508-PM Marion St., Brooklyn 33, N. Y.

OPERATE Mail-order printing brokerage. Details free. Advisory Service, Hartsdale, N. Y.

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EVERYBODY Likes candy. Make professionally home. (Our 47th year.) Ragsdale Candies, B107, East Orange, New Jersey.

WE Love our mailman—He leaves over \$1000.00 monthly in our rural mailbox. My college professor husband drafted a scientific home mailorder method. We bought a Texas ranch, live as we always wanted. Now we sell the Ranch Mailorder Method. Operates anywhere. Inquire: Eveningshade Ranch, Boerne, Texas.

CANDIED Popcorn and potato chip equipment. Eakins, Box 933-A8, Springfield, Ohio.

BE Appointed state notary public now. Write, Stationers, Boerne, Texas.

MAKE Big money. Work from home. Ground floor opportunity. Booming business. Art-Stone, Box 856, St. Louis, Mo.

MONEYMAKING OPPORTUNITIES

MAILORDER Opportunities, offers, plans. Armstead, 512M Pamcoe Street, Tallahassee 3, Florida.

EARN At home. Details free. Hauser House, 2308-P Grand Ave., Phoenix, Ariz.

HOW To gain quick promotion—More money; right where you work. Absolutely foolproof. Write: Ern-Mar Company, Clermont 1, Florida.

SELL Hi-Fi, complete systems only \$69.50. Home dealership plan. Big profits. Small investment. Dynamic Electronics, Box 188, Forest Hills, N. Y.

WIN Contest money. General Contest Bulletin gives hundreds of tips. Lists current contests, rules. Sample magazine 25¢. General Contests, 1609½ East 5th, Duluth, Minnesota.

\$1 To \$20 Checks daily! Write simple sentences, paragraphs, poetry for pay! No experience necessary. I tell you what to write, how to write, supply large list of buying editors. Begin writing for pay, today! Will Herman, 1726 W. 25th St., Cleveland 13, Ohio.

KILL Pests for profit! \$1200.00 monthly proved! Rid homes, farms, business of termites, rodents, pests. New shortcut methods! Learn everything two weeks! Free success plan. APCOA, Dept. 1F, 15015 Ventura Blvd., Sherman Oaks, Calif.

CIGARETTES—Improved roller makes 20 for 9¢. Facts free. Moberly, Box 821, Owensboro, Kentucky.

\$36-\$200 WEEKLY Plating baby shoes, making jewelry, novelties, etc. at home. Details free. JO-CA Electroplater, 7840-D Northwest Sixth Court, Miami 50, Florida.

MAKE Money gathering wild roots, herbs, weeds, leaves, tree seeds, flowers, plants! Over 200 varieties! Listed buyers for all you can ship! Sensational free-books offer! Revealing details, 25¢. Fortune Mart: 221-A Lincoln, Worcester 5, Mass.

HOTTEST Mail order plan ever! Sell photos, films, art novelties. Huge proven profits! Free details! Profits Unlimited, Dept. 1F, 15015 Ventura Blvd., Sherman Oaks, California.

MAKE \$5,000 Yearly sparetime raising mink, chinchillas, nutria, etc. Free booklet reveals proved plans. Write Furs, 588 Mt. Pleasant Road, Toronto 1, Canada.

MAKE Big easy profits making costume jewelry at home in spare time! Quick, easy to make; easier to sell! Details free! Don-Bar, 3511 W. Armitage, Dept. B-192, Chicago 47, Ill.

EARN At home with your telephone. Details free. Kendon Company, 635-A Main, Hartford 3, Conn.

\$6000 FOR Mister. Mrs.—\$3500! Free "Secret Journal" plan. Magical! Work home! Publicas, Oceanside, Calif.

MAKE Money mailing sample business cards. Vosacek Printing, 4444A Ute, San Diego 17, Calif.

PRINTING, Office supplies wholesale. Save 50%. Royal, Box 368-A, Cleveland 27, Ohio.

SPARETIME Profits, opportunities. Free information. Ed. Polaski, Box 372, Miami 47, Fla.

\$5,000.00 ANNUALLY Possible for you in mailorder. Free information. Ransie, Box 1719-A, Richmond 14, Virginia.

TYPISTS! Make money at home! Mailers, 2 Madison, Greencastle, Indiana.

BIG Money earned while asleep! Neighbors think I struck oil! They've hunted my big secret 8 years. Not another scheme, but legitimate, sound proposition easily handled by anyone. Nothing like it! No selling! Details \$1.00 (refundable). Grant, Grantham 1, Penna.

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"NEWEST Products Report," popular mail order magazines, interesting mails 25¢. Burke & Brown, 61 Haven, New York City 32.

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BRONZED Baby shoe mountings. Prompt delivery! Foster, 1520 Ardmore, Chicago 26.

JOIN Cooperative moneymaking mail opportunities service. Free literature. Bayou Enterprises, 119 North Sterling, Lafayette, Louisiana.

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START Big-pay business at home in spare time. No experience needed to operate little table-top machine for bronzing baby shoes. Make \$5.46 profit on every pair. Full particulars free. Send postcard to Mason, 1512 Jarvis, Room CM2A, Chicago 26, Ill.

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MAKE MONEY writing short paragraphs! No tedious study. I tell you what to write, where and how to sell; and supply list of editors buying from beginners. Many small checks add up quickly. Write to sell, right away. Send for free facts. Benson Barrett, Dept. C-27-N, 7464 Clark, Chicago 26.

EARN Cash at once, sending us easy orders for magazines your friends, neighbors want. Instant profits! We show how. For free kit, everything you need, write McGregor Magazine Agency, Dept. 320, Mount Morris, Ill.

START Home mail order business. I made enough money to retire. Now own \$18,000 home, Cadillac car, have money in bank. Amazing facts free. Norris Cole, 217 49th Street West, Bradenton, Florida.

YOUR Name on giant mailing list. Hundreds of opportunity offers. Send 25¢ and state offers or mds. desired. Direct Mail Service Co., Box 581, Bakersfield, Calif.

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AMAZING Successes through franchises! Become exclusive franchise holder your territory. Information rushed. National Franchise Reports, 333 North Michigan, Chicago 1.

\$60.00 WEEKLY, Sparetime — Easy! Home Venetian blind laundry. Free book. Burt, 2434ER, Wichita 13, Kansas.

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\$15,000 PROFIT in one year possible, on \$5.00 cash and just 3 hours attention weekly! Experience unnecessary! Fabulous but true! Proof, complete detailed plan, only \$1.00. Satisfaction or refund! Columbia Enterprises, 8203-P, Grubb Road, Silver Spring, Maryland.

"HOME Business Digest" has money-making opportunities galore. Sample 25¢. Donovan, 79-PM Greenbelt, Levittown, New York.

ATTENTION Typewriter owners. Make handsome profits. Write today. Groves Company, 682, Hastings 8, Nebraska.

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FREE Folio "\$5,000-\$45,000. Unlimited Vacations." No merchandise. Unknown! Work home, sparetime! Haylings, Carlsbad, Calif.

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.

BIG Money raising, fishworms and crickets. Free literature. Carter Hatchery, Plains, Georgia.

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

SELL Titania gems. Far more brilliant than diamonds. Catalog 10¢. Diamonte, 2420-M 77th, Oakland 5, California.

VENDING Machines—No selling. Operate a route of coin machines and earn amazing profits. 32-page catalog free. Parkway Machine Corporation, Dept. 27, 715 Ensor Street, Baltimore 2, Maryland.

FREE Book "505 Odd, Successful Businesses." Work home. Pacific, Oceanside, Calif.

DOLLARS Every day! It's magical—You keep all the dollars. Setup free. Otto Miller, Box 588-W, Oshkosh, Wis.

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BIG Profits importing gems. Free info. 5761 Zelzah, Encino, Calif.

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PLEXIGLAS. Acetate, vinylite, polyester, fiberglass, epoxy, styrofoam, mold materials. 28 page instructive, informative wholesale-retail catalog. 25¢. Gem-O-Lite, 5527 Cahuenga Blvd., North Hollywood, California.

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PLASTIC Sealing cards, photos, etc. Billfold size 50¢. Machine method. Permaize, 330 E. Center St., Kalamazoo, Mich.

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CHEMICALS, Glassware. Catalog 25¢. Laboratory Sales, Box 161-A Brighton, Mass.

CHEMICALS And apparatus for industrial, analytical, and private laboratories. Catalog 25¢. Dept. M-50. Biological Supply Co., 1178 Mt. Hope Ave., Rochester 20, N. Y.

EXPERIMENTERS: Bargains catalog. 25¢ (refundable). Hagenow Laboratories, 2414 Clark, Manitowoc, Wisconsin.

ILLUSTRATED Catalog: Chemistry, mineralogy, biology 25¢. Tracey Laboratories, Evanston, Illinois.

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MAKE Big money selling the Security hand pressure dry chemical fire extinguisher. First time offered for direct sales. Write today for free information. Big commissions. Hudson Mfg. Co., Sheridan 4, Michigan.

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IT'S Easy to sell our big line business printing, calendars, advertising specialties and political advertising. Big cash commission each sale, even first day. Full or part time. Experience unnecessary. Prospects unlimited. Big sales kit free. National Press, Dept. 6, North Chicago, Illinois.

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MEN, Women, make money spare time plus new car as bonus for encouragement. Amazing hosiery guaranteed to wear without holes, snags and runs, or replaced free. For example, lovely 60 gauge nylon guaranteed for as long as 1 1/4 years, or replace free. Write Wilknit, 1782 Washington, Greenfield, Ohio.

60% PROFIT On cosmetics—Famous nationally advertised Hollywood cosmetics pay 60%. Make \$25 day up. Hire others. For free samples, details, write Studio Girl, Glendale, Calif. Dept. 1282G.

WANTED, Part-time fire extinguisher salesman. Out-O-Matic, 1737D E. 31st, Denver, Colorado.

MAKE Big profits selling household items at discounts. Clausens, 26 Maple, Litzitz, Penna.

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BIG Profits selling Hold-Tite car trunk holder 98¢. Ohlaco, North Madison 5, Ohio.

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SHINE Cars without polish. New invention. Lightning seller. Cars gleam like mirror. Samples sent on trial. Kristee 76, Akron, Ohio.

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AUTOMOBILE Specialty salesman: Patented Davis Ball Boot protects drive line parts and transmission. Saves repair bills, saves lubricant. Every Chevrolet and Ford owner, every garage and parts dealer a logical prospect. Attractive, exclusive territories now open. Write for details. Davis Ball Boot Company, Inc., 2301 Yale Street, Houston, Texas.

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Southern Watches, 5-PM So. Wabash, Chicago 3.

ELECTRIC Guitars, amplifiers, wholesale. Free catalog. Carvin PMW, Covina, Calif.

JOHN Catalog club. Send \$1.00 (refundable) for 8 wholesale catalogs. Stark, Box 9897, Houston 15, Texas.

BUY Wholesale! Thousands nationally advertised products! Send postcard! Southland Products, Lincolnton, N. C.

BUY Wholesale! Over 10,000 nationally advertised products. Appliances, cameras, sporting goods, housewares, watches, typewriters, tools, clothing, etc. Send postcard today. Buy-Rite, Box 258, Hawthorne 4, New Jersey.

BIG Multicolor wholesale catalog! Housewares, appliances, clothing, silverware, cookware, luggage, binoculars, radios, phonographs, cameras, recorders, projectors, typewriters, shavers, sporting goods, toys, tools, sewing machines, watches, jewelry. Name brands. Huge discounts. Postcard: Selbyco, Decatur 153, Illinois.

FREE Wholesale catalog. Gifts, appliances, books, housewares, watches, jewelry, cookware, tableware, dinnerware, cutlery, etc. Discounts to 80%. Topval Corp., Lindenhurst 924, N. Y.

FREE Wholesale catalog. L. A. Isenberg, R.R. 1, Dorsey, Illinois.

WHOLESALE Catalog clothing, shoes, linens, housewares. Bostonian 14-C Dock Square, Boston 8, Mass.

BIRCH Kitchen cabinets. Free catalogue. Charlotte Wood Products, Charlotte, Michigan.

TWENTY Wholesale catalogs—List 50¢. A-to-Z, Box 422, Fallon, Nevada.

WHOLESALE! Appliances, tools, clothing, jewelry, everything! Free catalogs! United Wholesalers, 1265-M Broadway, New York 1, N. Y.

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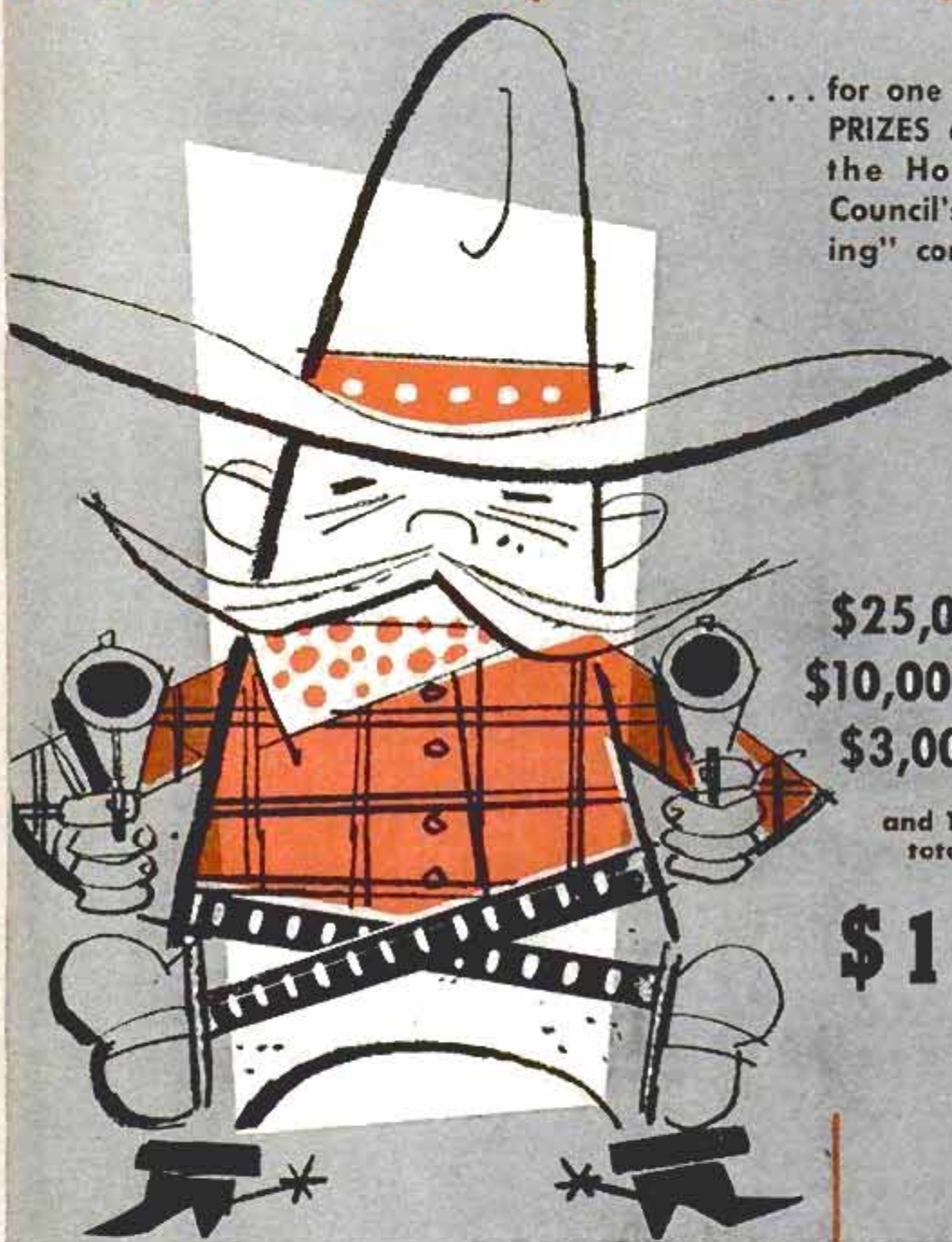
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Improvement Council em-
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\$4.00 Worth of
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produces this
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Business.

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amazing and foolproof ever invented.
Simple to operate. Two men can produce five fireplaces a day.

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My check , money order for \$_____ is enclosed.

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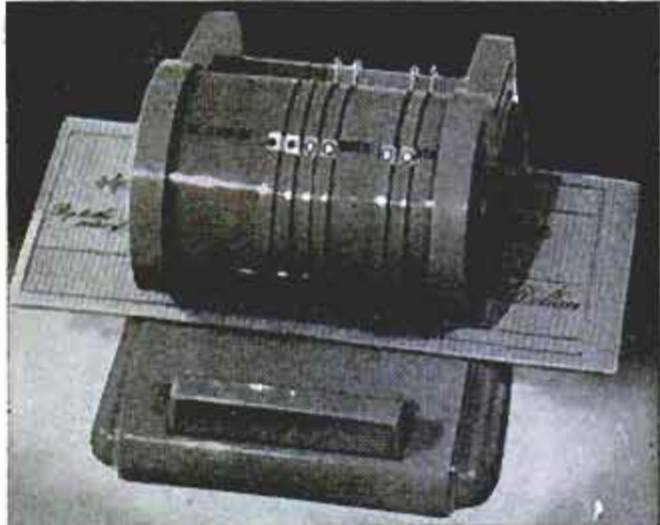


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it's the best motor oil money can buy!

QUAKER STATE OIL REFINING CORPORATION, OIL CITY, PA.
Member Pennsylvania Grade Crude Oil Association



Applied Research Corp., P.O. Box 1316, Erie, Pa.

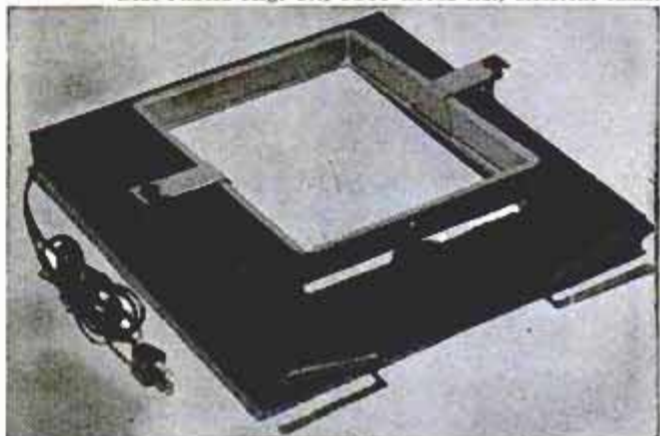
Small Check Protector Has Ink-Holding Type

Using an indelible ink, a new check-protecting machine can print 10,000 checks without re-inking. The rubber type of the protector contains microscopic honey-combed cells which hold a large ink supply. The inexpensive machine is simple to operate. You just write the amount of the check by setting six levers, then depressing the printing bar. The machine is small enough to fit in a desk drawer.

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Best Photos Mfg. Co., 5801 Beeds Rd., Mission, Kans.



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Christmas dinner for the U.S. Navy last year (1957) required 230,000 pounds of turkey.

The ONLY spark plug in the world
with the PATENTED* AUTOMATIC
"BUILT-IN-BRAIN"

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THERMO-REACTOR
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AVAILABLE IN 2 TYPES

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Engineered SPECIFICALLY for today's new car, high compression, high horsepower engine, or the older car with a tight, high compression engine in good condition!

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(OIL FIRING—NON FOULING)
Engineered SPECIFICALLY for older engines, and worn engines using excessive amounts of oil.
SELF-CLEANING—WILL NOT FOUL!
Actually FIRES IN OIL!

Aldor's specially designed single hi-efficiency "D-H" electrode can be instantly and accurately adjusted to perfect gap, unlike many so-called multiple electrode "miracle" plugs!

Millions in daily use in the U.S. and in over 30 foreign countries; Designed to outlast and outperform any other plug!

Patent #2442945*

Thermo-Reactor plugs also sold under the following trade name



Some plugs are designed for stop-and-go city driving, and will misfire, cause pre-ignition and dangerous power loss when used in higher speed highway driving:

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2 STATION PLAZA, BAYSIDE 61, N. Y.

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Factory service schools and field-extension training programs have been set up nation-wide by many automobile and automotive parts manufacturers in order to supply the industry's demand for all-round mechanics and specialists. Expert instruction and working practice are stressed in classroom and service laboratories. This photo shows the excellent facilities for training provided by one of these schools.

Carter Carburetor Factory Service School, St. Louis

SKILLS for AMERICA

CAREER SERIES TWO

THE AUTOMOBILE MECHANIC

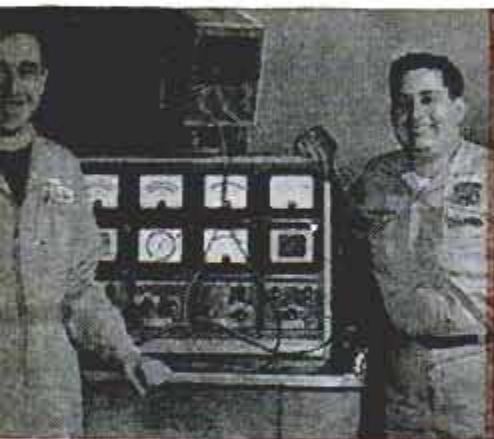
"America moves on wheels"* is a familiar expression to all of us. It is the answer to the growth of our commerce and communications, the spread of our cities and suburbs, and the extension of travel horizons from coast to coast and beyond. It also explains why the automotive industry provides more jobs than any other single American manufacturing and service industry.

To keep the 62,000,000 passenger cars, trucks and buses in use today moving smoothly and surely is the job of the automobile mechanic. His responsibility is great; and is one on which we all depend. His trade is skilled and specialized, requiring a large measure of training and experience. America is able to move only because of the automobile mechanic. It's no wonder that this trade is the largest repair occupation in the labor force, employing over 700,000 mechanics.

Of all the skilled mechanical trades to choose from, the opportunities for immediate employment are most real for automobile mechanics who are trained and competent in their work.

Car dealers, independent auto repair shops, fleet truck, bus and taxi operators need more skilled mechanics than ever before. One estimate by The Automobile Manufacturers Association states that U.S. garages are now short 40,000 good mechanics, and that 40,000 new ones will have to be trained each year to keep up with the motoring public.

The demand for mechanics will continue indefinitely with population growth, automobile production, trend toward 2-car families, and increased farm mechanization. This is an excellent trade for any young man with mechanical ability. Advancement possibilities provide an attractive future for mechanics who are capable and experienced. Whereas beginning mechanics earn from \$1.00 to \$1.50 per hour, experienced men are earning from \$2 to \$3 per hour and more. A few highly skilled body-repair men and supervisors are earning more than \$10,000 per year. In a large repair shop, a mechanic may advance to supervisory positions, such as foreman, service



"The combination of training and experience on the job is the only way to personal success in the automotive service trade today. The mechanics we hire must be trained to meet our standards of service. We believe wholeheartedly in the value of trade courses." Ross J. Arbisi, Partner (left); Sam A. Carvana, Partner (right), Winn-Mor Auto Service, Rockford, Illinois.

"Skilled mechanics are hard to find when needed today. Yet, a trained, experienced man can do well in this business—own his own garage or repair shop. Our mechanics must be trained, that's our policy. To help supply our business and community with skilled mechanics, my brother and I have devoted 11 months to our own training and the teaching of specialized repair work to service station operators and other garage mechanics. This is how much we believe in trade education." Donald E. Carlyle, Owner, Carlyle Auto Service, Rockford, Illinois.



salesman, or service manager. Many experienced mechanics eventually open their own independent repair shops.

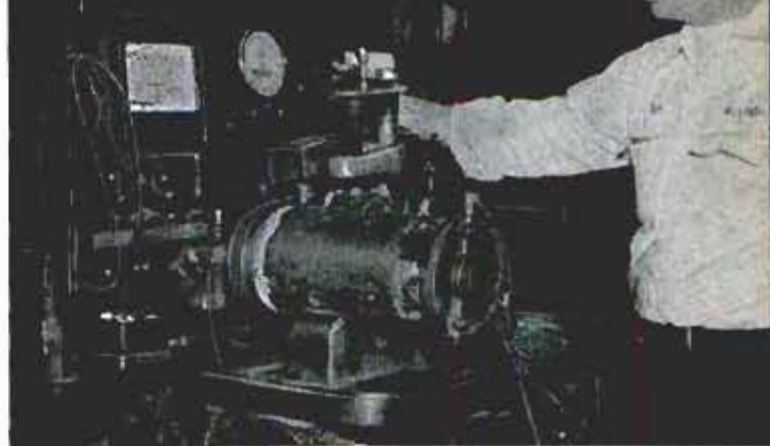
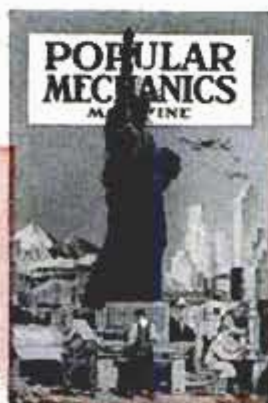
The automobile mechanic today is a highly skilled craftsman whose work of necessity must be exact and whose training must be thorough since motor vehicles of all types have become increasingly complex. To keep up to date on yearly model changes in equipment, parts and motor design and operation, the mechanic must constantly study trade journals and new instruction manuals issued by manufacturers. Because of the complexity of automotive systems and increased maintenance requirements, the automobile mechanic trade has developed its own specialists. Specialists are particularly in demand in such fields as automatic transmission, ignition and carburetor work.

Every phase of the automobile mechanic field offers challenging opportunity and interesting, varied work to the young man today. However, proper training and education in this skilled trade is absolutely necessary to be successful. In fact all of the mechanics and repair garage owners Popular Mechanics has talked with state that trade education and the experience it provides is the first and most important point on which they judge a new mechanic. A mechanic is only as good as his training.

The future is ready for you in the automobile service and repair industry if you train to meet the requirements. Employers are looking for your ability; advancement and an independent business of your own can be had. If this skilled trade holds interest for you, we suggest you begin your training at the earliest opportunity.

Vocational or factory service schools are particularly qualified to educate the automobile mechanic. They offer expert instruction, equipment, tools, and service laboratories in which to study. Many of these trade schools are represented in the pages of Popular Mechanics. We suggest you contact them directly. They will be glad to offer you the same thorough instruction that has been given to many thousands of other expert mechanics who have graduated from their schools.

• American Trucking Associations



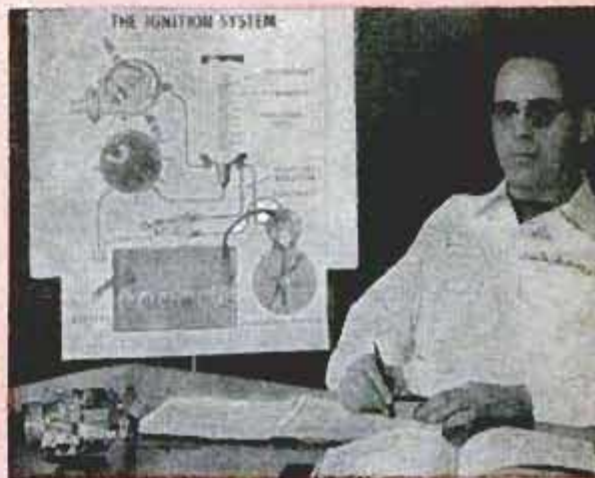
Automobile servicing has become a specialist's trade today. Here, an automotive electrician tests a heavy duty generator against manufacturer's specifications.

Keeping automobiles operating at peak performance requires the use of sensitive instruments such as the Distributor Tester, an important tool of the tune-up specialist.



Do Your Part to Develop SKILLS for AMERICA

"We are automotive service-distributors. Our firm started in 1940 with five employees and three regular customers. Now we employ 31 and serve 700 separate accounts including truck fleets and car dealers. Our company has grown because of our firm belief that trade education is the only answer to offering modern service considering yearly model changes in equipment, parts and accessories. Personally, I have attended nine automotive industry trade courses; other members of our company have taken 16 courses. Each year, our best mechanics spend eight weeks taking trade courses. I'd advise any man who wants to become a mechanic to train to acquire your skill, and then continue training while you work. It's the only way to get ahead in this field." Victor H. Braun, President, Braun's Auto Electric, Inc., East St. Louis, Illinois.



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46-4
midget diagonal

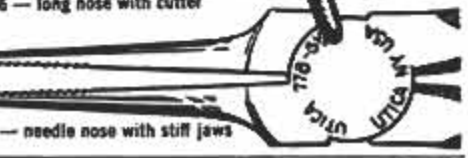
819-12" long shank screwdriver



262-5 1/2 — transverse end-cutter



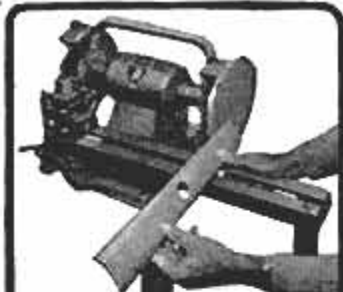
654-6 — long nose with cutter



778-6 1/2 — needle nose with stiff jaws

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Send Free Plan on lawn mower business and Special Combination Offer.

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Only Hastings Oil Filter Cartridges keep oil clean *all the time*, because only Hastings has Densite filtering material.

Densite is different! Millions of selected cotton fibres—pressure packed—trap even the most microscopic dirt particles. Only Densite keeps oil clean from filter change to filter change, when replaced as normally recommended.*

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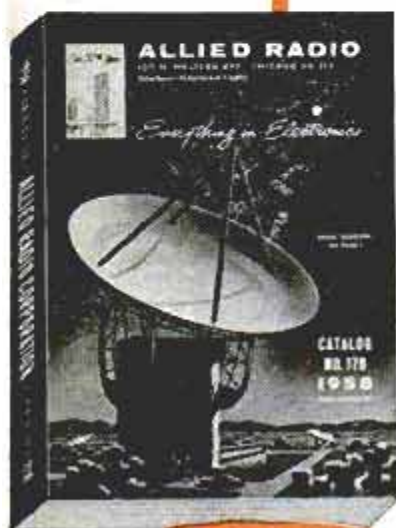
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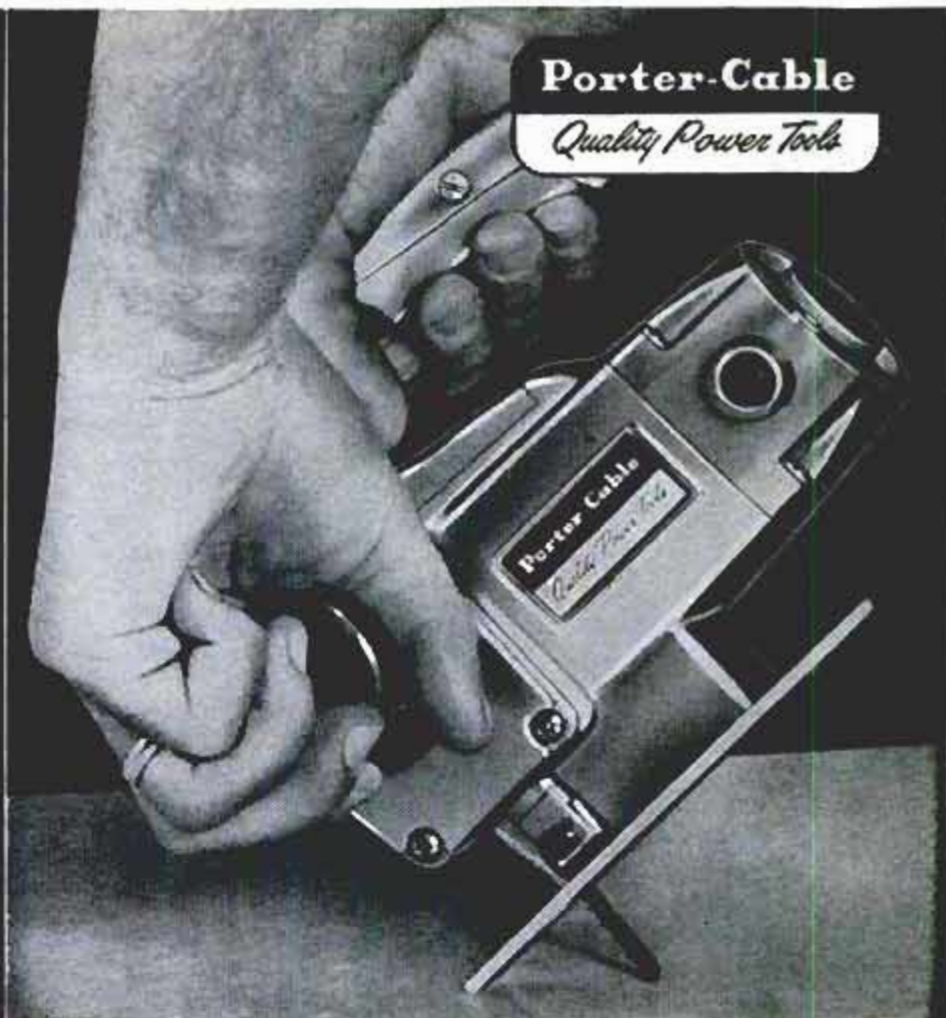
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NOTICE—It is the intention of this magazine to provide its readers with information regarding the latest developments in the mechanical arts. Except where otherwise indicated, this magazine has no information as to any unexpired patent in respect of the developments reported herein. In the event that commercial use is to be made of any of the developments reported herein, it is suggested that legal counsel be consulted to avoid liability for patent infringement. It is not the purpose of this magazine to encourage patent infringement but, as indicated, it is the intention of this magazine to report on the latest developments in the mechanical arts.

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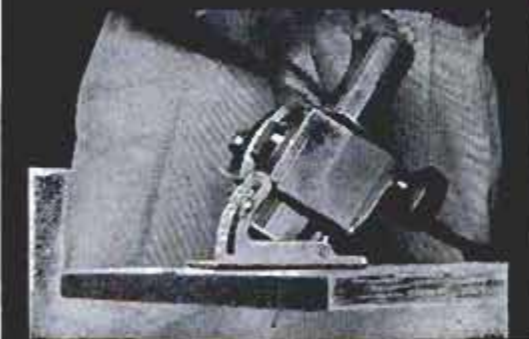


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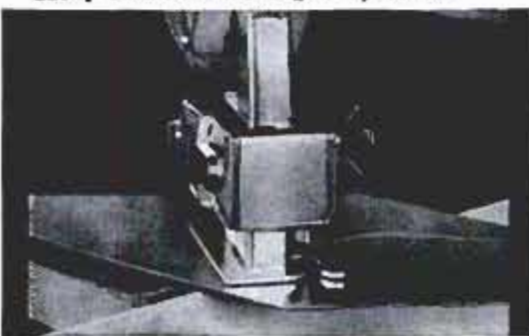
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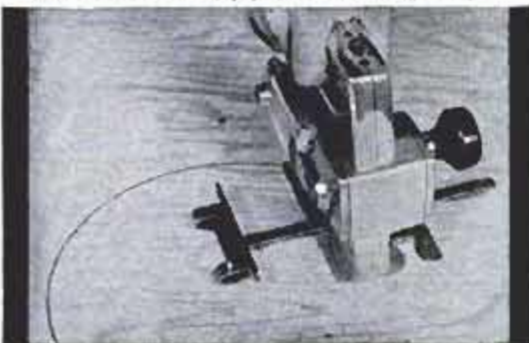
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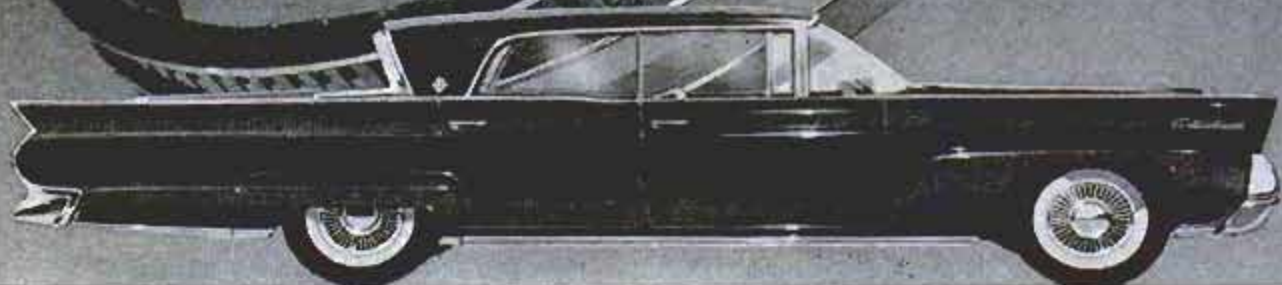


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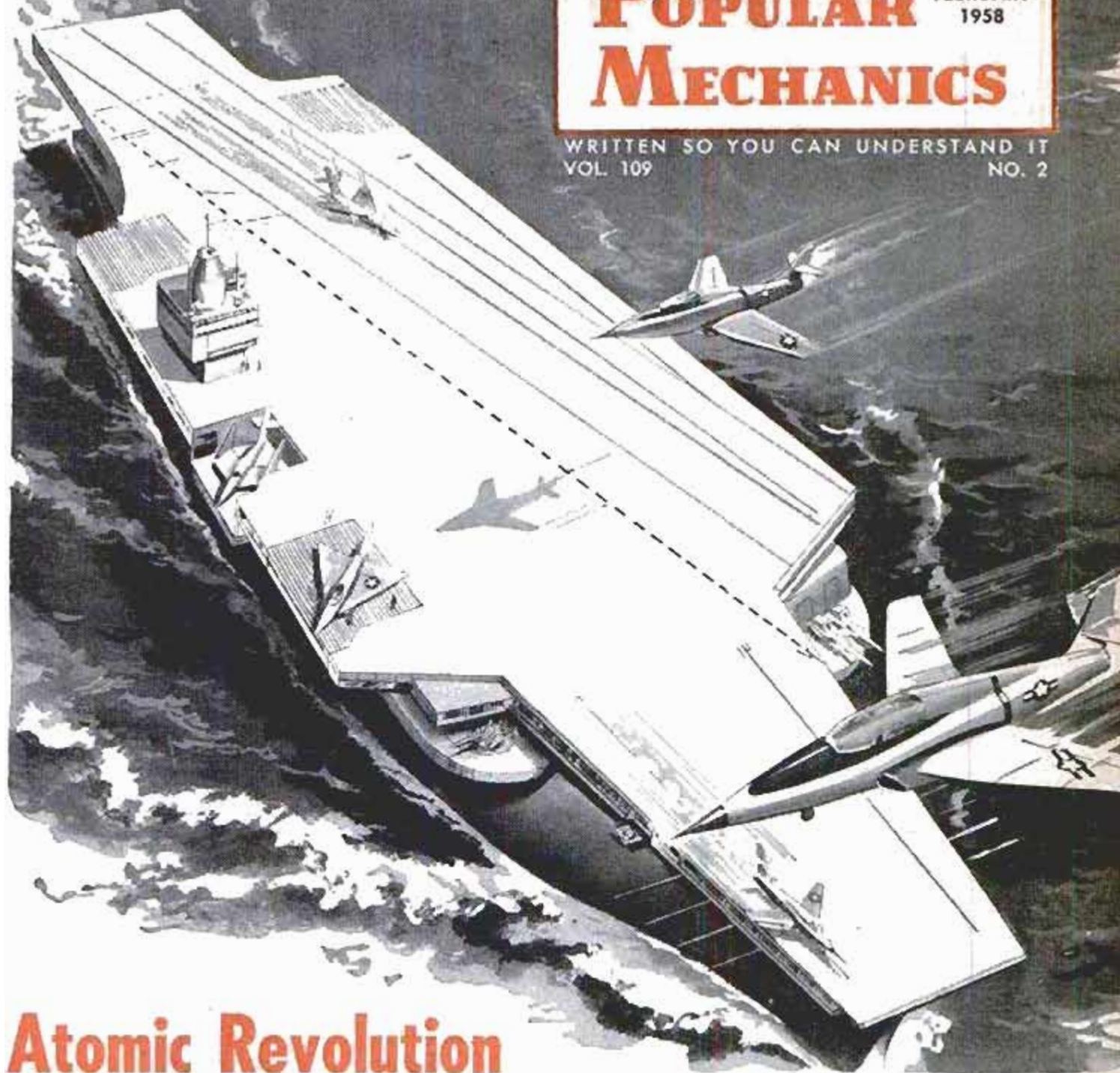
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VOL. 109 NO. 2



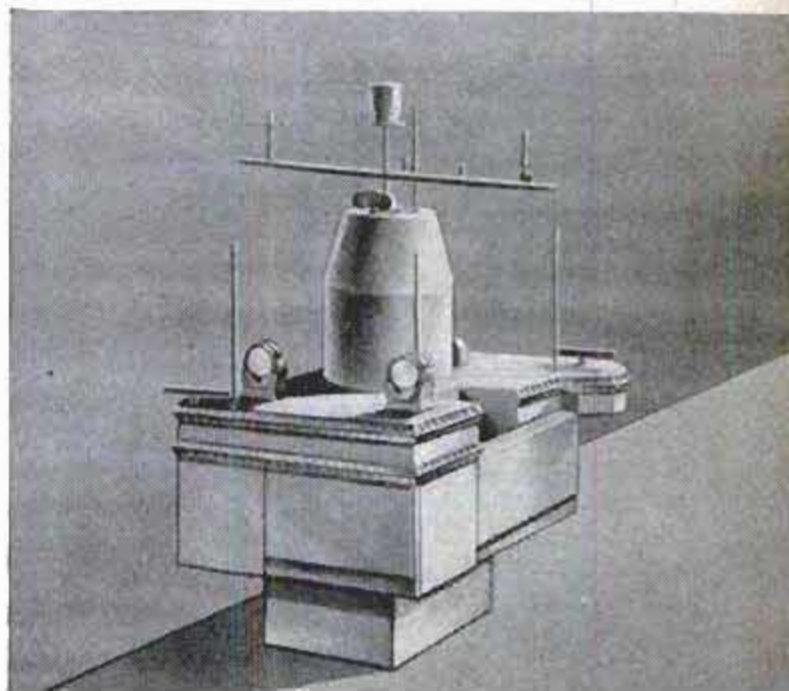
Atomic Revolution In the Shipyards

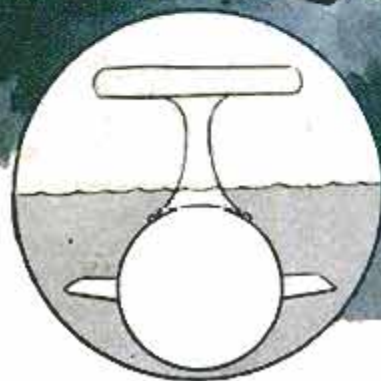
By Michael Day

*Richard
Dempsey*

IT WAS 75 YEARS after the invention of steam power before the first steamship appeared," Rear Adm. Albert G. Mumma, chief of the Navy's Bureau of Ships, pointed out recently. "But in just 12 years after atomic power was unleashed, our first nuclear subs were operating. In another five years we will be well on our way to a complete nuclear fleet. This spells a real revolution in ship design."

Only protrusion on deck of the big nuclear-powered carrier above will be "electronic" island, at right





Still in the realm of "dreams and schemes" is this plan of Maritime engineers for a whale-shaped craft with superstructure for crew above water, cargo and reactor area below

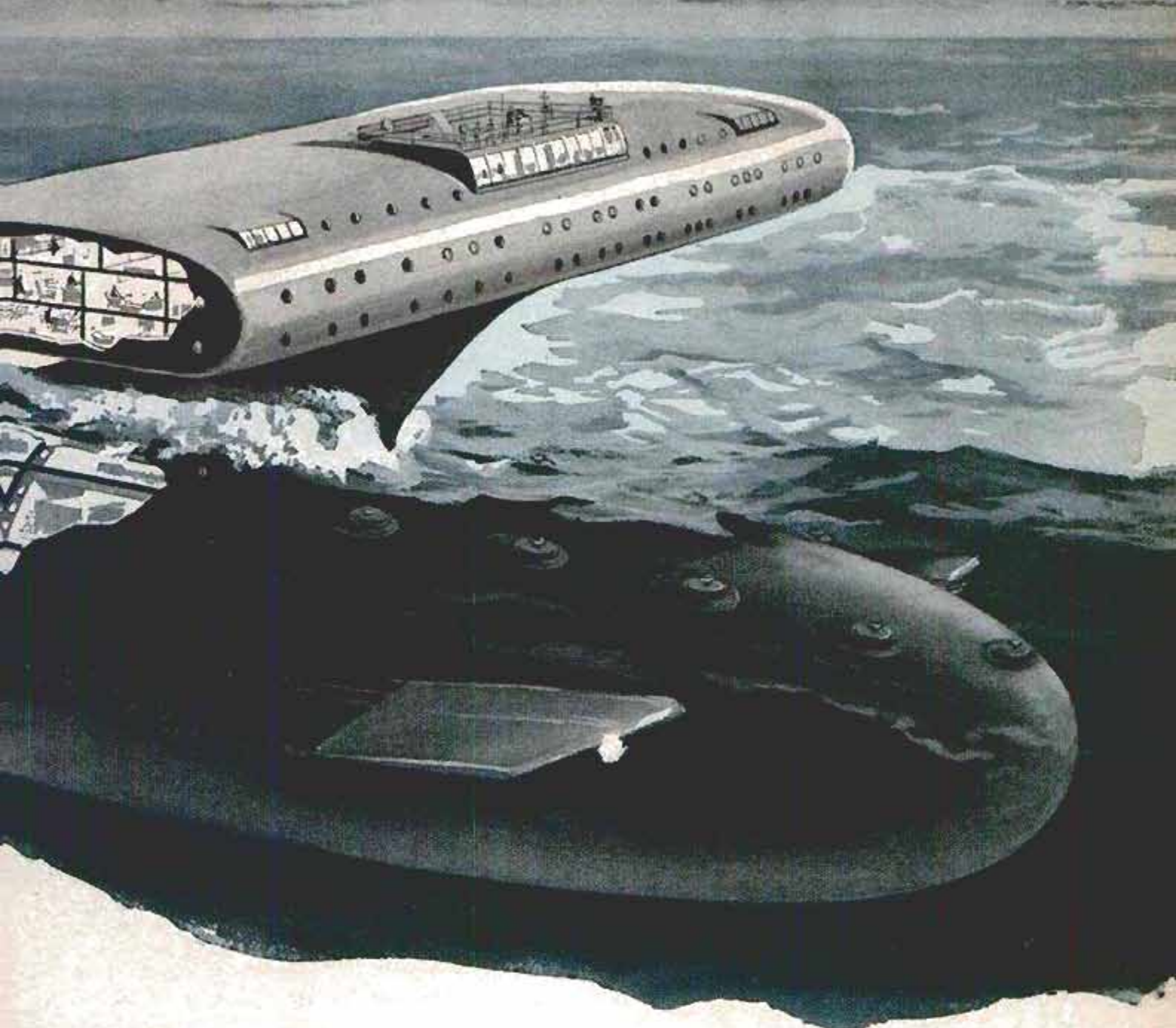
Even a nautically minded Buck Rogers might boggle before the new breed of ship that is destined to thunder down the world's ways in the next half decade as a result of this "revolution."

In the United States alone, the *Nautilus* and *Seawolf*, our operating nuclear-powered submarine prototypes, already have spawned a whole new seagoing family of atomic ships that will start hatching this year. By 1961, nineteen atomic subs will be launched or a-building. Whale-shaped nuclear "attack subs" will "fly" at phenomenal speeds under the sea the way a plane flies through the air, pilot and co-pilot strapped to bucket seats while crew members grab for leather loops like subway straphangers as the weird craft executes high-speed turns at a 30-degree bank. We're building small hunter-killer A-subs; a giant radar picket sub powered by two reactors and displacing a thumping 5450 tons (biggest World War I fleet-type subs displaced only 1900 tons); guided-missile A-subs, each housing a Regulus stinger in a below-decks missile hangar that is itself the size of a current fleet submarine; fast, fleet-type A-subs with minimum shielding, in which crews will crawl through lead-lined tunnels around the reactor section. Besides

undersea craft, a mammoth keel will soon be laid for the biggest ship in the world—our 85,000-ton atomic super carrier, driven by eight separate nuclear power plants. And within three years, the fantastic two-reactor guided-missile cruiser *Long Beach*, her stackless deck bristling with weird launchers and rakish "birds," will take to the water with an estimated speed potential of 40 miles per hour. In addition to Navy plans, a joint Atomic Energy Commission-Maritime Administration program will put our first atomic cargo-passenger liner afloat sometime early in 1960.

Though sponsoring the most spectacular atomic splash in the ocean, the United States isn't the only entry in the A-ship race by any means. The British Royal Navy's first atomic submarine is already on the drawing boards and her engineers are studying the economics of a 65,000-ton nuclear-powered oil tanker. Sweden is also building an A-tanker.

In a Leningrad shipyard, Russia early in December launched a 22-knot atomic ice breaker whose 16,000-ton displacement would make her the world's mightiest. More recent announcements over Radio Moscow hint at a winged A-ship that will ride about a foot above the water.

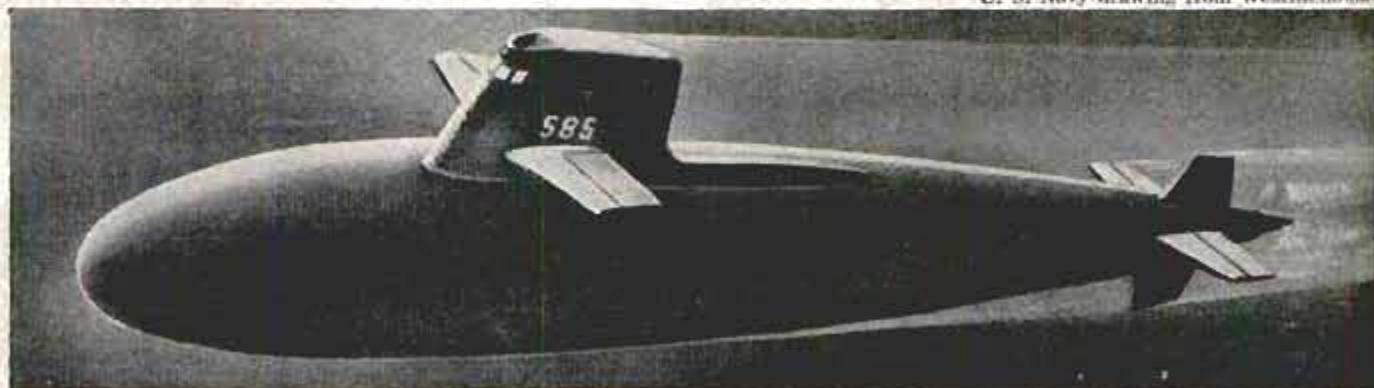


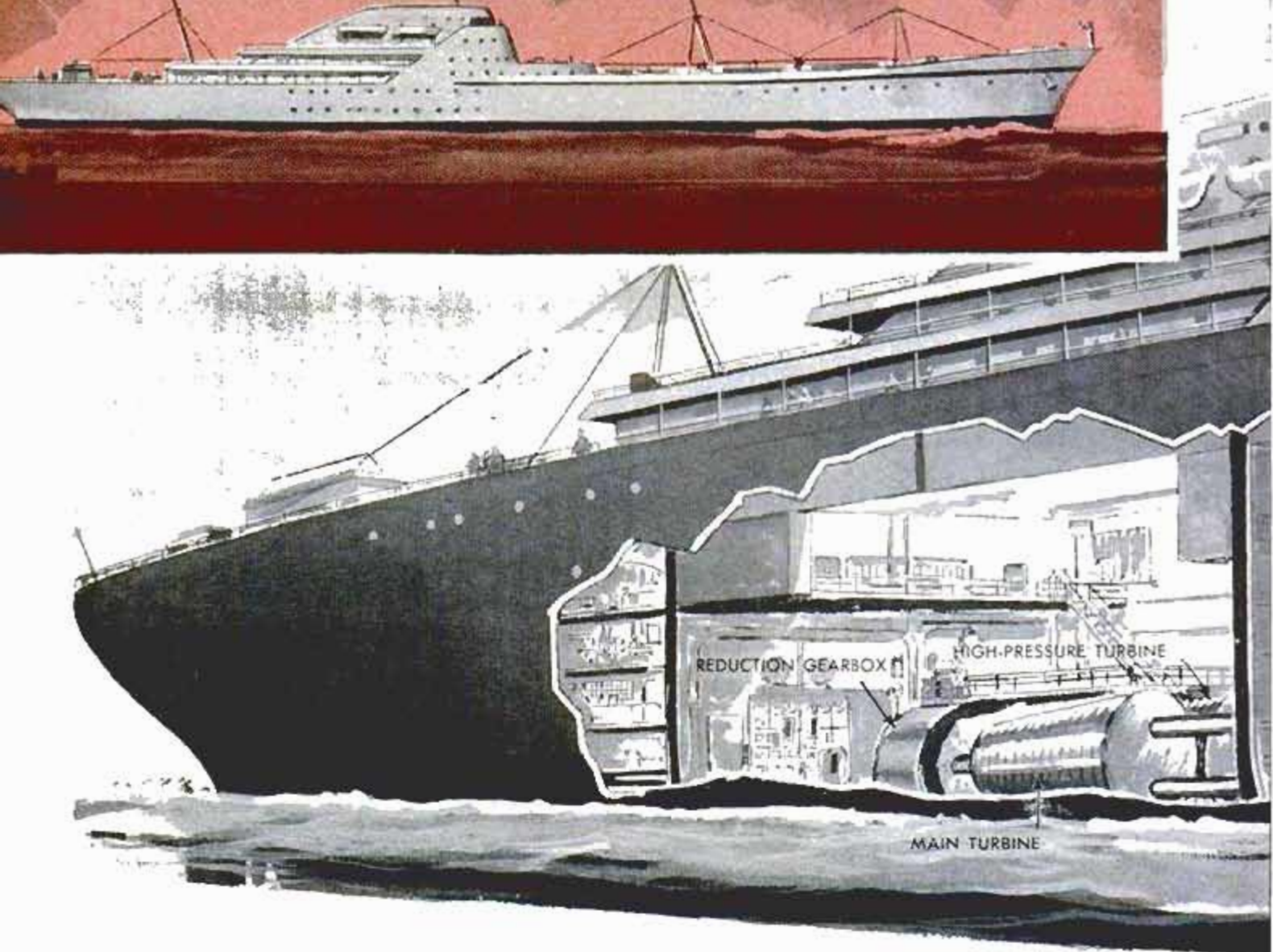
Japan has already blueprinted plans for one of the most unusual A-ships of all—a 30,000-ton submarine atomic tanker, 540 feet long, that can run its cargo smoothly beneath the surface in any weather. Snorkel-type intake and exhaust equipment will provide air for the crew, enabling the unique A-tanker to ride submerged for a month at a crack.

Just what these ships will be able to do, what it will be like to ride them, how their seagoing atomic piles will change their appearance and performance, still is partly veiled in secrecy. But curious details keep emerging. Scouting through the Navy's Bureau of Ships and the busy design section of the Maritime Administration you begin to feel the impact of atomic

Artist's conception of the USS Skipjack, an atomic-powered submarine with diving planes on the tower

U. S. Navy drawing from Westinghouse



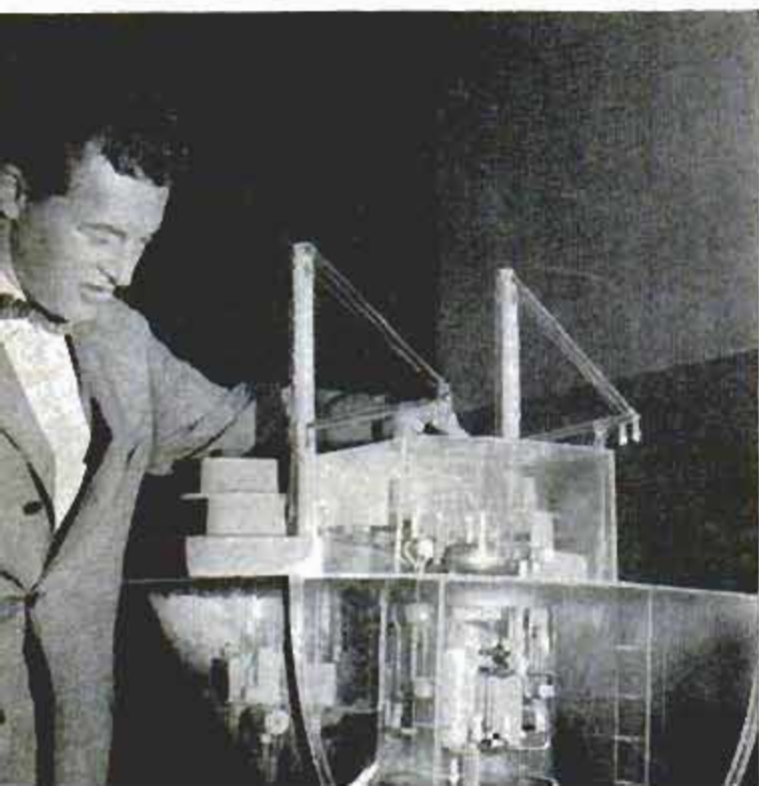


Drawings of atomic merchant ship show (top) how it will look at sea and cutaway of atom-power plant

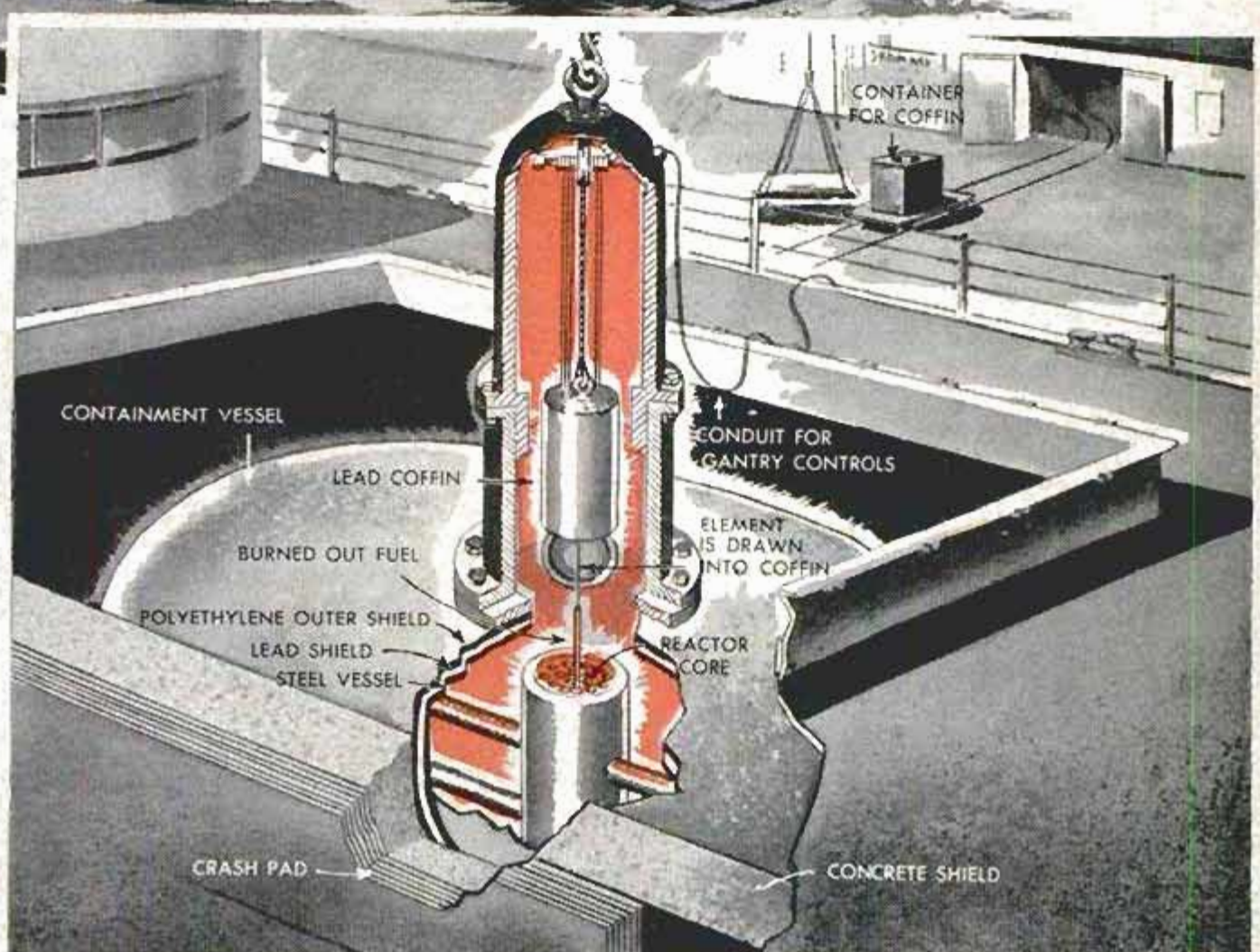
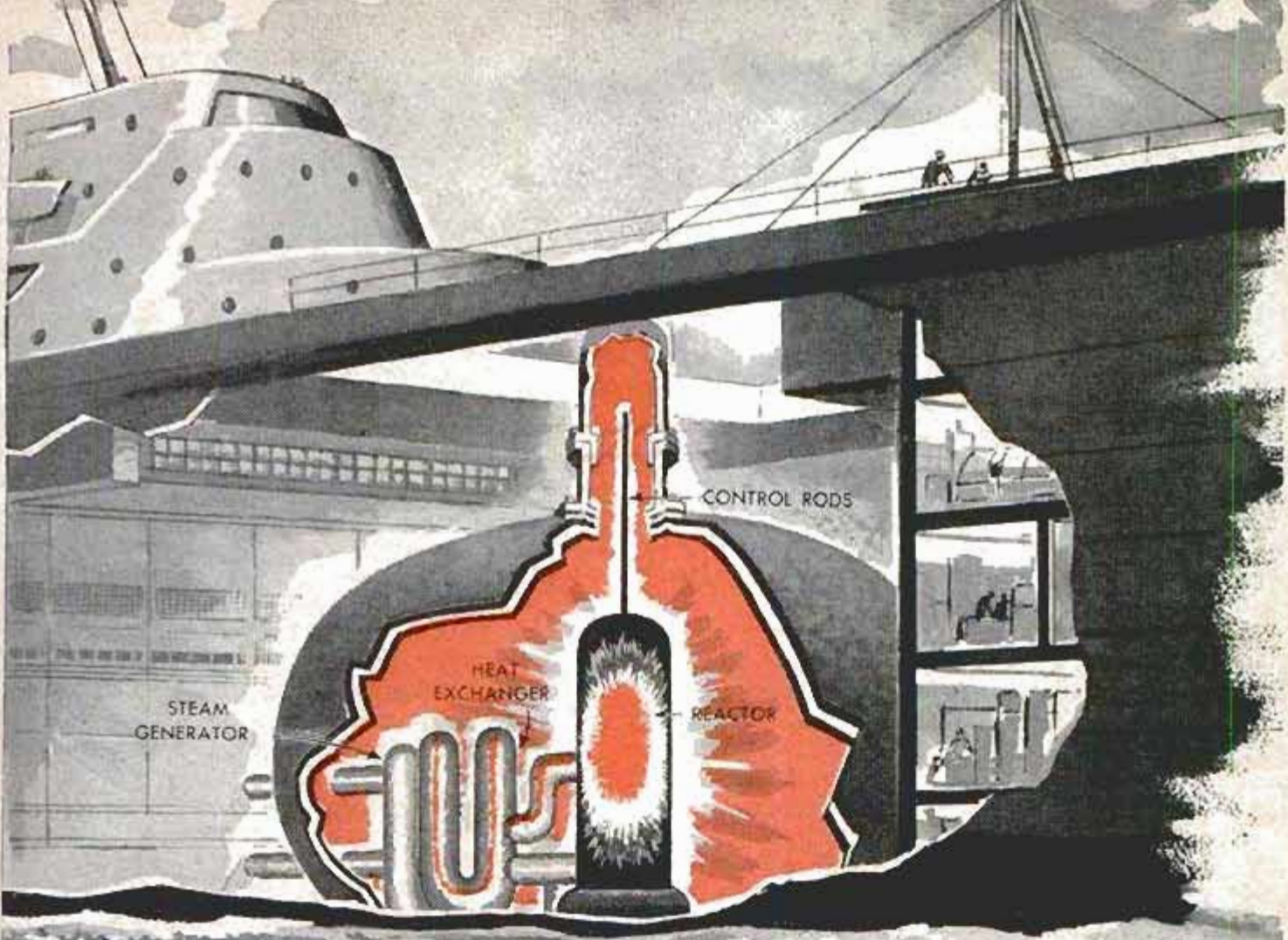
revolution as stories of some of these fantastic ships fall upon your ears.

Most exciting to the Navy of all its atom

Richard P. Godwin, project director of the atomic merchant ship, inspects model of reactor for tanker



ships is the nuclear super carrier. This \$314,000,000 seagoing airport is due to start building this year. Without doubt it is the most complex weapon ever contrived by man. Stretching more than a long city block (1100 feet) from stem to stern with an over-all width of 251 feet, and 25 stories high from keel to the top of the odd lid on its island, this Gargantua surpasses the mighty *Forrestal*-class carriers that it will eventually outmode. She has 4000 square feet more flight deck and 2000 square feet more hangar deck than her *Forrestal*-type forerunners. A crew of more than 4000 will be needed to man her, and her eight separate reactors, hitched in tandem pairs via geared turbines to each of four massive shafts, would be capable of producing electricity for a city of a million people—with enough juice left over to push the ship as well. Each reactor, labeled LSR (for "Large Ship Reactor"), will be an expanded version of the pressurized water reactor that has so successfully powered the *Nautilus*. How fast these fabulous power sources will push the floating airfield through the water no one will tell—if





Drawing shows nuclear-powered guided-missile cruiser. Keel for Long Beach, first of type, was laid Dec. 2

they know—but educated guesses have placed her speed at 30 miles per hour or better. Like the atomic-powered *Nautilus*, which steamed nearly 70,000 trouble-free miles before her first refueling, the atomic carrier reportedly will be capable of similar range between core loadings. Her exact endurance is secret.

A look at the big scale model of the CVA(N) (the "N" is for nuclear) in the glass case outside Adm. Mumma's office makes the difference between it and a *Forrestal*-class ship immediately apparent. Along each side, from streamlined sponsons (spoon-shaped bulges built to deflect slamming action of the sea) sprout strange-looking Terrier guided-missile launchers instead of guns. New-type cranes fold away in wells beneath flight-deck level. Instead of a complex array of mechanically revolving antennas, air intakes and stack, an unadorned island juts from the flight deck like an old frontier blockhouse on a prairie. That strangely shaped affair cloaks one of the big atomic vessel's most closely guarded secrets. It is, as one admiral put it, "the first electronically integrated island." A few guarded statements by Navy experts carry a hint of what this means.

Under its three-tiered cap, which designers already have dubbed "the layer cake," a powerful type of radar scans horizons in a brand-new way. On older ships masts were festooned with cumbersome rotating "bedsprings." Big metal smokestacks blocked signals. Using new radar techniques to compete with all that plumbing would have required massive antenna systems. "In the nuclear carrier the island is stackless," explains Capt. W. I. Bull, Buship's Assistant Chief for Electronics, "and thus can be used to maximum extent by radar antennas . . . that scan electronically rather than mechanically."

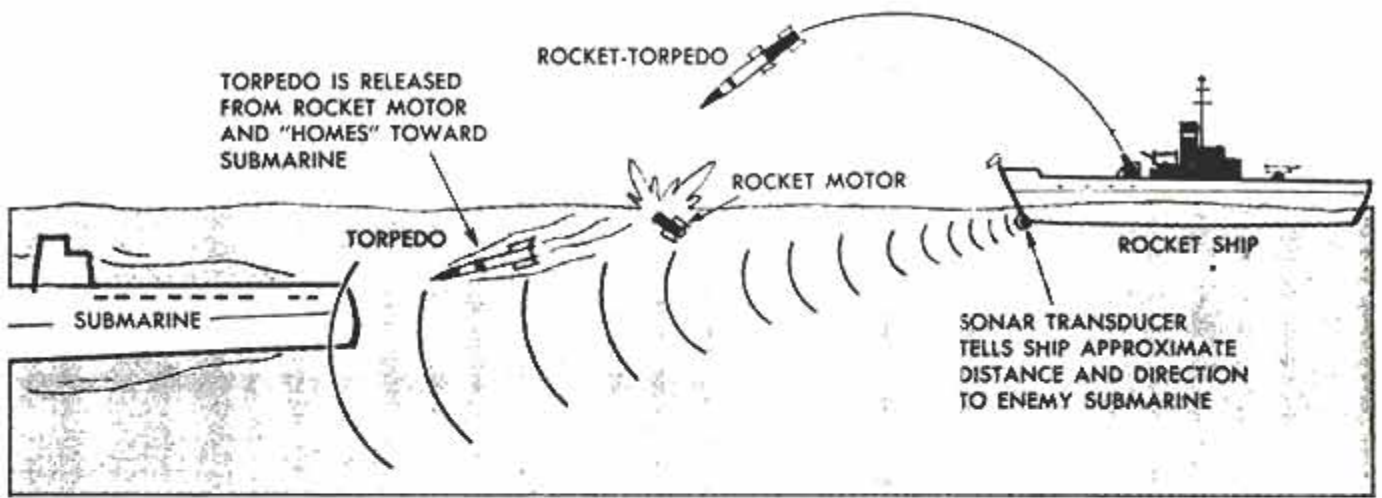
Hence, on the atomic carrier, you'll see no jungle of weird-shaped gadgets in the superstructure. Beneath its layer-cake dome, electronic beams, circling the horizons under guidance of electronic sweeps, will maintain powerful, uninterrupted vigilance. It will, according to Capt. Bull, "increase our acquisition range by a factor of three or four."

Removal of the smokestack will make living on the new carrier different for jet squadrons and ship's personnel. There's no smoke problem, according to Rear Adm. A. M. Morgan, assistant chief of Bureau for Ship Design and Research. When older conventional carriers head into the wind to take on aircraft, hot stack gases sometimes drift back over the angled deck into the path of the landing planes, producing turbulence and affecting the lift factors. Corrosion caused by those gases won't be bothersome anymore. From a bubble on the inboard side of the island, the flight officer will have a view of the whole flight deck—unblocked by stacks or masts.

Though it looks small, the island actually towers 11 stories from hangar deck to the top of its strange dome. A small personnel elevator will rush top brass from hangar spaces to pilot house on the 010 level when they're needed in a hurry.

Jet pilots on the new ship will be briefed in ready rooms on the gallery deck and below the hangar deck. There's more space on this ship's gallery deck since her flight deck is the "strength deck." No expansion joints will mar its surface. Climbing into heavy, high-altitude gear, pilots will walk, like men from Mars, to elevators that will lift them to the flight deck. The same elevators will move stretcher cases to sick-bay areas without danger of jostling on stairs or Escalators.

(Continued to page 274)



Fired from deck of ship, rocket-assisted torpedo, equipped with homing device, seeks out enemy submarine

Rocket-Assisted Torpedo "Homes" on Enemy Submarine

Reported to be the Navy's newest weapon for knocking out enemy submarines, is a rocket-assisted torpedo equipped with a homing device. The RAT (for Rocket-Assisted Torpedo) eliminates the old process of pinpointing the submarine's location by sonar and then dropping a depth charge in its vicinity. When the launching ship's sonar detects a submarine in the distance, the RAT is fired in that direction. As the

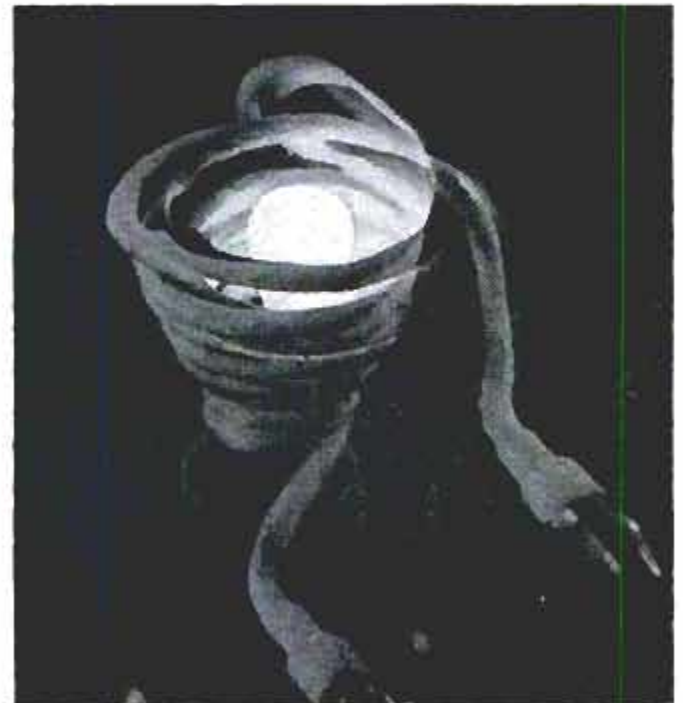
torpedo drops into the water it separates from the rocket motor and steers in a circle, its sonar head sending out pings. When sonar connection is made with the target the torpedo heads directly toward it. It is also believed possible to drop the torpedo from an airplane without the rocket motor. Many types of ships, in fact any kind of floating platform, could be equipped with a RAT launcher.

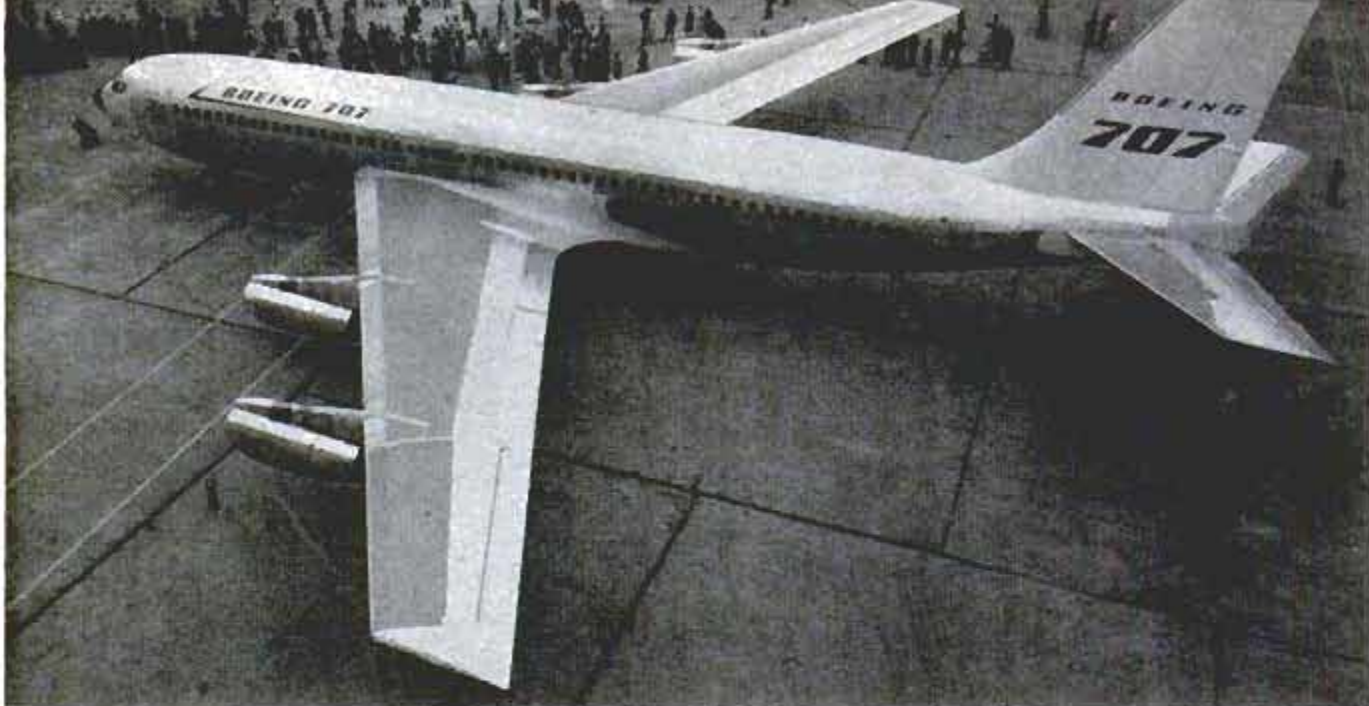
Molten Metals "Float" in High-Frequency Electric Field

Temperatures up to 5000 degrees F. are generated in half a minute by the "levitation melting" process developed in the Westinghouse Research Laboratories. Small, highly purified ingots of metals such as niobium and titanium are made by this process. Compressed metal powder is

placed inside a copper coil in which electricity changes direction a million times a second. The field of force created by the current causes the metal to float as it is melted. When the electricity stops, the metal drops into a container. The melting is done in a chamber filled with inert gas.

Melting by levitation, left, is done in chamber of inert gas. Close-up shows ingot floating inside coils





Boeing 707 Jet Stratoliner Rolls From Production Line

First production-line jet airliner built in the U.S. is the Boeing 707, which has been ordered by 13 airlines. Powered by four Pratt and Whitney JT-3 turbojet engines with a maximum output of 10,000 pounds'

thrust, the 707 has a speed of 600 miles per hour. A prototype of the 707 has logged about 800 hours in the more than three years it has been tested. A military version of the 707 is the KC-135 jet tanker.

Army's Infrared Camera Has 30-Mile Range

Operating in the infrared range of the spectrum, the U.S. Army's new long-range ground-reconnaissance camera can photograph terrain features as far as 30 miles away. Infrared equipment allows soldiers to see enemy movements despite smoke, darkness or fog over a target or battle area.

Bar of Alloy in Oil Tank Stops Sludge and Corrosion

Installed in an oil-storage tank in about 30 seconds, a bar of special alkaline-alloy metal eliminates varnish and sludge in heating oils. The four-inch metal bar is suspended by a wire from the tank cap. It works by a chemical reaction that neutralizes impurities that would cause corrosion.





Electronic Machine "Memorizes" Depositor's Account

Magnetic strips attached to the back of the ledger card serve as a "memory" device for a new electronic accounting machine designed for commercial banks. The magnetic strips preserve in magnetic code all the necessary information about a depositor's account. The machine reportedly cuts posting time by 50 percent and reduces the

time spent in locating and correcting errors by 75 percent. It automatically determines if the depositor's account is overdrawn or if he has ordered payment stopped on a check. It picks up and verifies the old balance and the accumulated check amount. And if the operator selects the wrong account, the machine rejects it.



Canadian Otter aircraft sprays water from pontoon tanks, above, during test at Sault Ste. Marie. Refill pipes force water into tanks as plane taxis

Flying Fire Extinguishers Fill Water Tanks on the Run

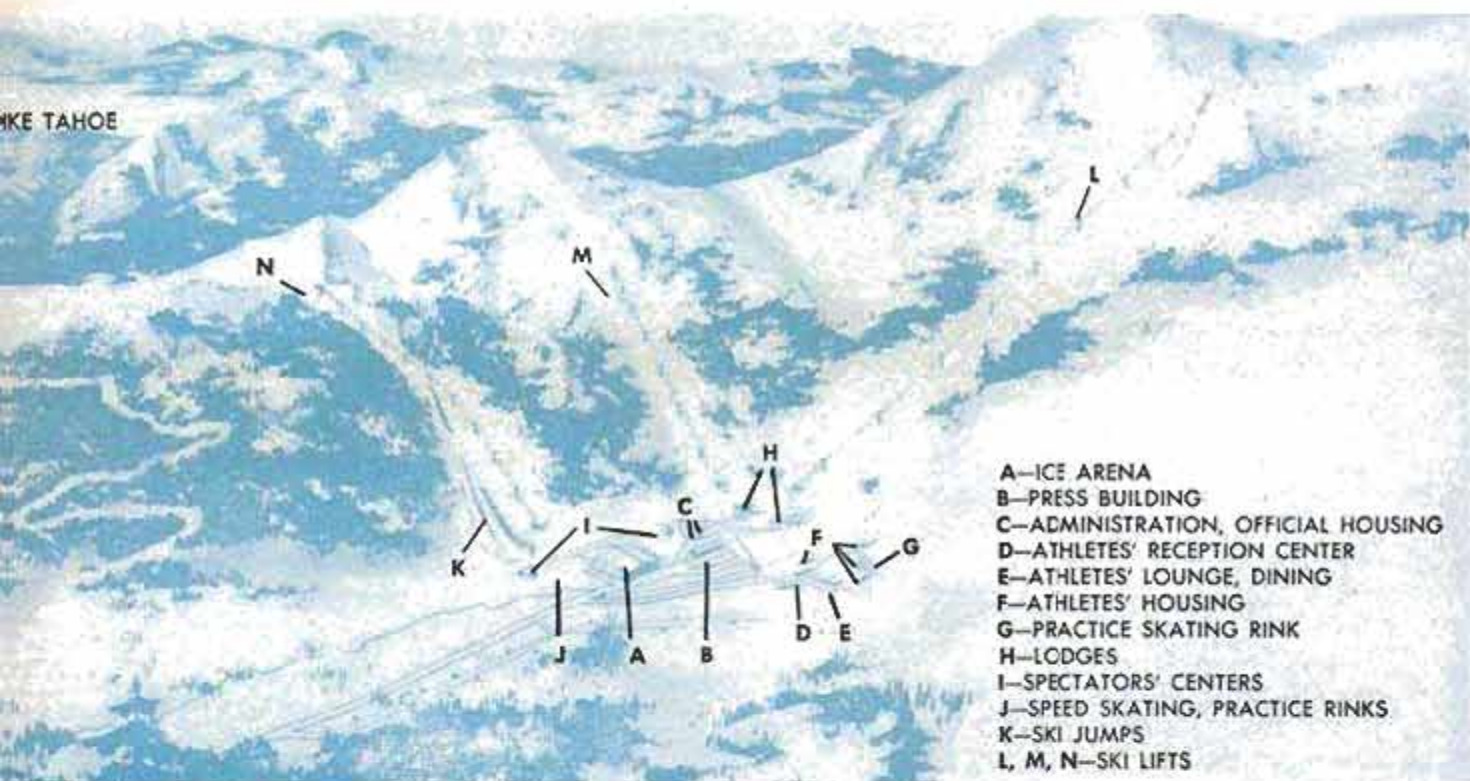
Equipped with 100-gallon water tanks on their pontoons, fire-fighting planes of Ontario's Department of Lands and Forests can taxi along the surface of a lake and refill the tanks without stopping. The tanks have refill pipes which drag through the lake and force water into the tanks at a rate of 10 gallons per second. The pilot takes off again and, when over the brush fire, turns a switch which causes the tanks to rotate, dumping a spray of water.

Ontario Dept. of Lands and Forests photo

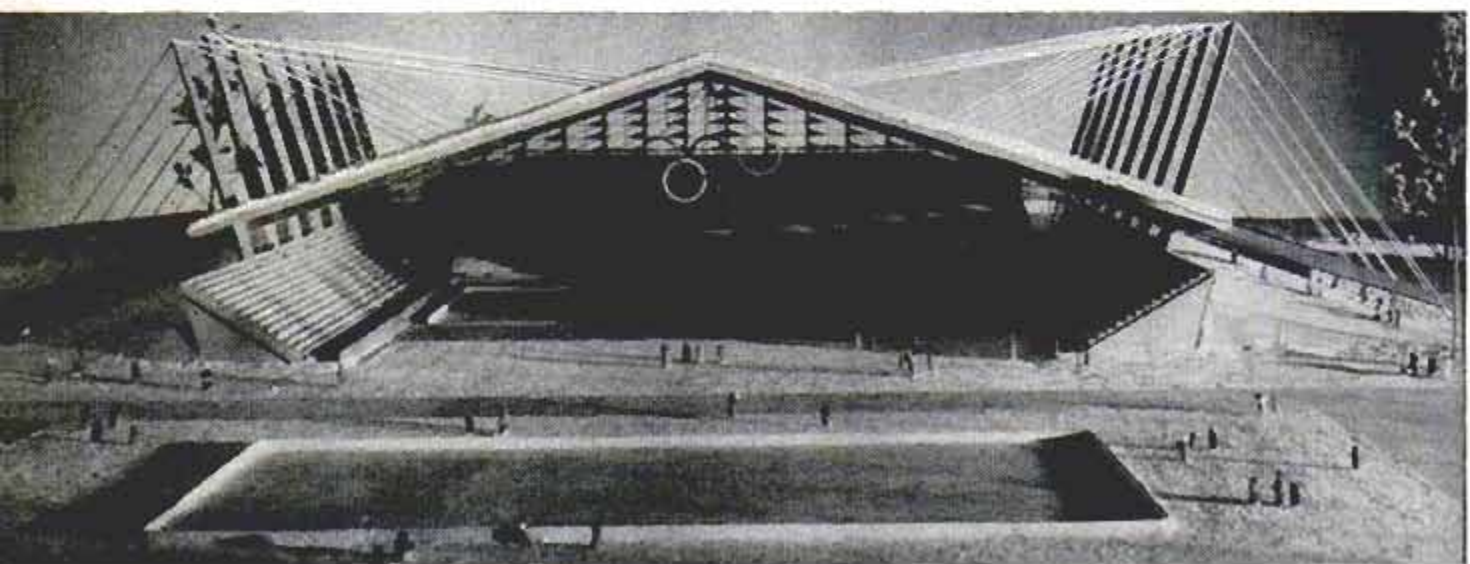




Aerial view of Squaw Valley where the State of California is spending \$10,000,000 to get ready for the 1960 Olympic Winter Games. Squaw Peak is at left center. The valley will become a permanent sports area



Olympic officials expect 30,000 spectators a day will flock to this remote valley with its "Olympic Village" when games are on. Below, model of the ice arena which seats 8000. Speed-skating rink is in foreground





There's lots of snow on slopes of Squaw Valley which averages 10 feet a year and stays on until July 4

IN SQUAW VALLEY, Calif., engineers are installing heating ducts under parts of the valley floor. Later they will build sidewalks on top of the ducts. The hot air in the ducts will keep the sidewalks free of ice and snow all winter long.

This job is part of the task of transforming a little-known mountain valley into a tailor-made site for the Eighth Olympic Winter Games, scheduled for early 1960. In the past these international games have been held at old and famous winter resorts where the competition areas were not always ideal. At Squaw Valley, for the first time, all facilities are being designed from the start to Olympic specifications. The State of California is spending \$10,000,000 on the job.

Squaw Valley is a few miles north of Lake Tahoe and about 10 miles from Truckee, a town on the U.S. 40 trans-continental highway. The valley floor is at an elevation of 6200 feet and is surrounded by mountains that include Squaw Peak with an elevation of 9000 feet, Granite Chief, KT-22 and Papoose Hill. The valley was the scene of the 1957 National Alpine Championships. There are three ski lifts in addition to rope tows.

The main ski lift, called the world's largest although not the world's longest, is 8200 feet long. It carries pairs of skiers up the side of Squaw Peak and has a capacity of 600 skiers per hour. From its upper terminal, an upper tram carries 300 skiers per hour to the top of the peak itself.

Another lift, on KT-22, is called the "flying saucer" because of its speed. The chairs travel at the rate of 925 feet per minute,

SQUAW VALLEY PREPARED FOR THE WINTER GAMES



more than twice the speed of most lifts, yet each chair comes to a stop to pick up passengers.

At the 1956 Olympic Winter Games at Cortina, Italy, there wasn't enough snow for many of the events. Tons of it were brought in by rail and wagon and spread on the slopes. Squaw Valley doesn't expect to run out of snow. An average of 10 feet per year falls in the valley and a tough winter is apt to lay down more than 20 feet of snow. The winter-sports season starts before Thanksgiving and is still going strong on the Fourth of July. For the Olympics, snow removal from the roads and spectator areas is going to be a big task.

The area is not regarded as avalanche country, but to avoid any chance of disastrous snowslides the Forest Service will maintain an avalanche guard and plans to knock down any snowdrifts with a 75-millimeter recoilless rifle before the drifts grow large and possibly hazardous.

Today the games are a good two years away, but from the standpoint of preparing



This scale model of Squaw Valley was constructed to help work out the locations of the Olympic buildings

the facilities they are only 10 months in the future. That's because there are only five months each summer in which construction can be carried on. The building program is proceeding on a tight, rush schedule.

Here are some of the facilities, designed by Corlett & Spackman, and by Kitchen & Hunt, architects, for the Olympics:

Main chair lift at Squaw Valley is 8200 feet long and has maximum capacity of 600 skiers per hour

Olympic Arena. This will be an enclosed structure the size of a football field, with a 300-foot, clear-span roof rising 90 feet above the skating rink. The roof is supported by overhead beams and cables in somewhat the manner of a guy derrick. Seating capacity, including temporary bleachers, accommodates 8000 spectators around the 85 by 190-foot skating and ice-hockey rink.

Heated sidewalks in the Olympic Village will provide easy access to buildings despite deep snowfall





It's a long way down from top of main chair lift to valley. Lift is called largest but not world's longest

The rink will be artificially refrigerated. Waste heat from the refrigeration equipment will be used to melt snow that otherwise would collect on the roof, to help heat the building and to reduce condensation. In addition to the skating contests, the arena will be used for the opening and closing ceremonies of the games. A large speed-skating rink, out of doors, may be viewed through the glass that walls one end of the arena.

"Olympic Village." The 1200 athletes and their coaches and trainers will be housed in beautiful lodges located on a secluded and private meadow less than 600 yards from the arena. The lounge and dining areas for the village are to be built on a natural knoll that looks out over the valley. Facilities include boot shop, barber shop, beauty shop, post office and laundry. Roofs of the buildings are designed to take snow loads of 100 pounds per square foot.

Spectator Centers. Two or more large glass-walled structures are to contain such facilities as restaurants, lounging areas, information centers and ticket counters. The spectator centers are to be located on the valley floor adjacent to the finish lines of many of the competitive events, and it will be possible to watch the competitions from inside the buildings.

Auxiliary Structures and Services. These include an administration building, hotel for officials, a special building for the press, radio and TV representatives, and a complete system of roads, parking lots for officials and the necessary public utilities.

Courses Laid Out

The competition courses were laid out with the help of the International Olympic Committee and include a spectacular, breath-taking, downhill ski run that begins just below Squaw Peak's summit. The course drops 2500 feet to the finish gate some two miles downhill. The first quarter mile of the course is down a 60-percent grade and the skiers will make speeds of 75 or 80 miles per hour over this portion of the route. The second phase crosses a forested slope that averages 34 percent, and continues down a 49-percent face to a sharp turn. From here, control gates will mark the course down a roller-coaster creek bed to the finish. One bump halfway down this part of the course spilled half the contestants at the recent Alpine championships. Other bumps are to be graded into the course before 1960.

Slalom courses have been laid out on KT-22, the mountain that gets its name from the fact that a skier needs to make 22



At midday the sun is so warm at Squaw Valley that bathers enjoy the heated pool with snow all around them

kick turns in descending its steep face. Two ski jumps are planned for Papoose Hill.

California had planned a mile-long, championship bobsled run but not enough countries expressed interest in bobsled competition to warrant the cost of construction. Already designed, it was to have been the longest and fastest in the world, with four sharp hairpin turns. Including artificial refrigeration for maintaining the slick ice on the floor and walls of the run, the cost was estimated at close to \$1,000,000.

30,000 Spectators Daily

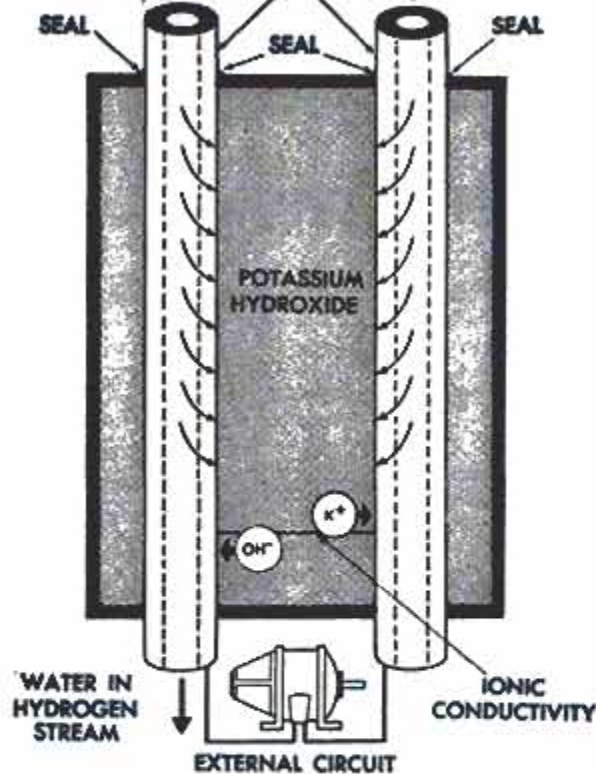
Officials expect 30,000 spectators a day during the games, with as many as 60,000 people on week ends. There's no space in the valley for public parking, and spectators will leave their cars in huge auto parks at Truckee or Tahoe City, then ride into the valley on shuttle buses that will operate on virtually a 24-hour basis. The roads leading into the valley will be closed to private cars. Overnight accommodations for thousands of spectators are available at the numerous resorts at nearby Lake Tahoe and at motels and hotels at Truckee and at Reno, Nev., about 30 miles distant.

From the valley floor, spectators will be able to watch many of the events merely by turning their heads in the right direction. The ski jumps on Papoose Hill will be

visible through the glass wall of the Olympic Arena, and large-screen, closed-circuit TV will be used in the arena to bring spectators the start, progress and finish of the slalom, downhill and cross-country competitions. Other large TV screens will be installed in the spectator centers.

For close-up viewing of the events, there will be bleachers and terraced areas alongside the ski jumps, and spectator areas adjoining the slalom and downhill events. Spectators will use the ski lifts to reach these viewing points.

California expects to stage the most successful winter games in the history of the Olympics, but its interest won't end when the games are over. Squaw Valley is to become a permanent sports area in winter and recreation area in summer. All the improvements that are being built by the state are permanent in nature. The Olympic Arena is suitable for recreational skating and for figure-skating carnivals all year 'round. The Olympic Village will be transformed into a 300-room hotel. After the Olympics are over, too, public parking for more than 1500 cars will always be available in the valley. The ski lifts and jumps are to be maintained. California expects that five years after the Olympics, a quarter to one million people per year will be enjoying the sports facilities at Squaw Valley. ★ ★ ★



Fuel Cell Changes Chemical Energy Into Electricity

Capable of producing thousands of watts of electric power economically is a new type of chemical fuel package that is portable and virtually maintenance-free. It consists of specially treated, hollow porous carbon electrodes in a cell filled with

potassium hydroxide. Hydrogen and oxygen gases enter the cell through the electrodes and the chemical reaction releases electrons at the hydrogen electrode. As the electrons reach the oxygen electrode they provide electric power.

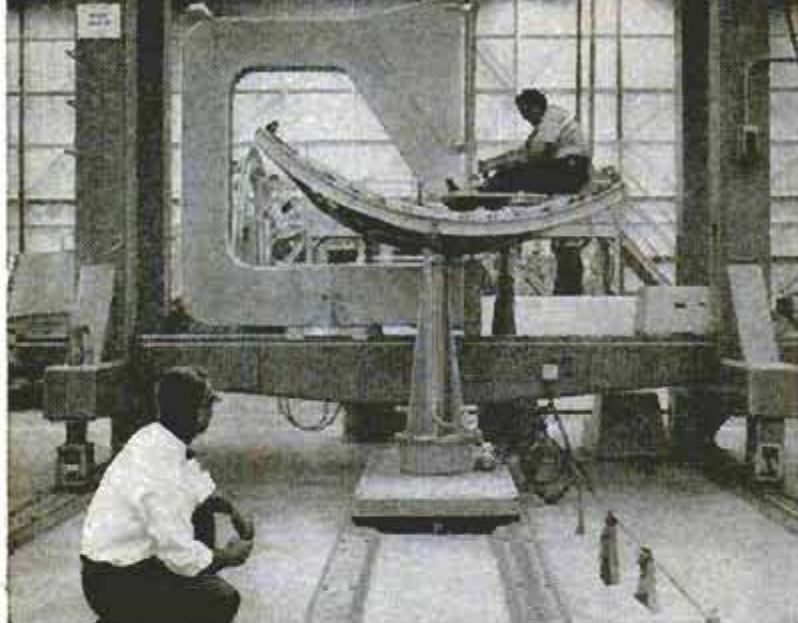
"Wonder" Metal for Rockets

Scientists refine samples of the "wonder" metal niobium by heating it to nearly 4400 degrees Fahrenheit in a vacuum. The high-purity niobium is studied as a possible structural metal for future rockets, missiles, jet engines and nuclear reactors.

Smokestack Takes a Trip

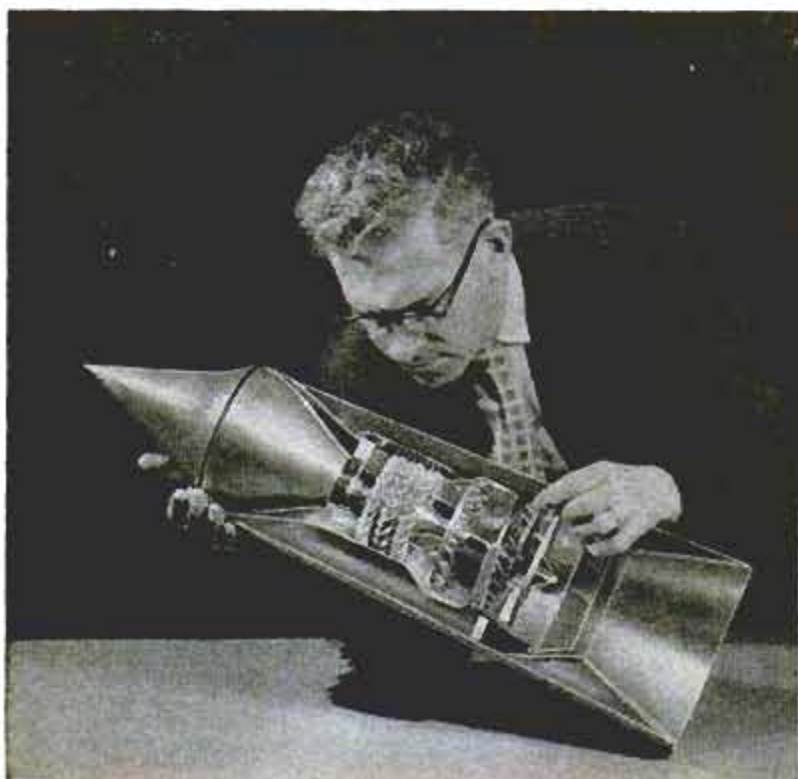
About three times the length of many trailers you see on the highway is a special rig used to haul a 40-ton metal smokestack. The 115-foot-long stack was photographed in Philadelphia as it was being trucked to a chemical company in New Jersey.





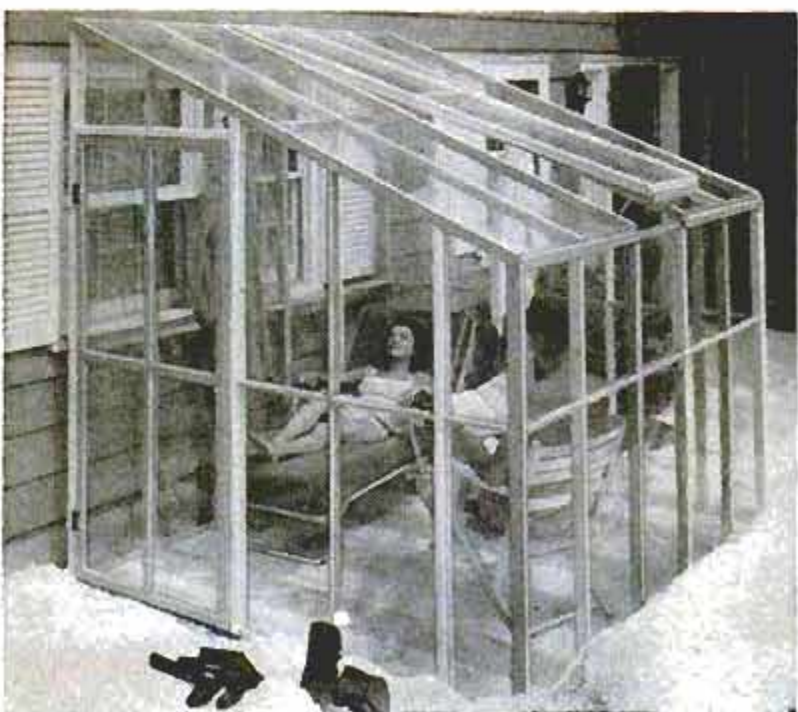
Gantry Riveting Machine Speeds Aircraft Jobs

Quicker and better riveting for DC-8 jetliners is possible with a new type of fastening machine developed by Douglas Aircraft Company engineers. A wing or fuselage panel on a simple platform is placed between the rails of a gantry. A sensing unit keeps the curved panels at right angles to the riveting mechanism as the rivets are set. The new machine also has a device which shaves off the excess rivet metal. The riveter is hand-positioned.



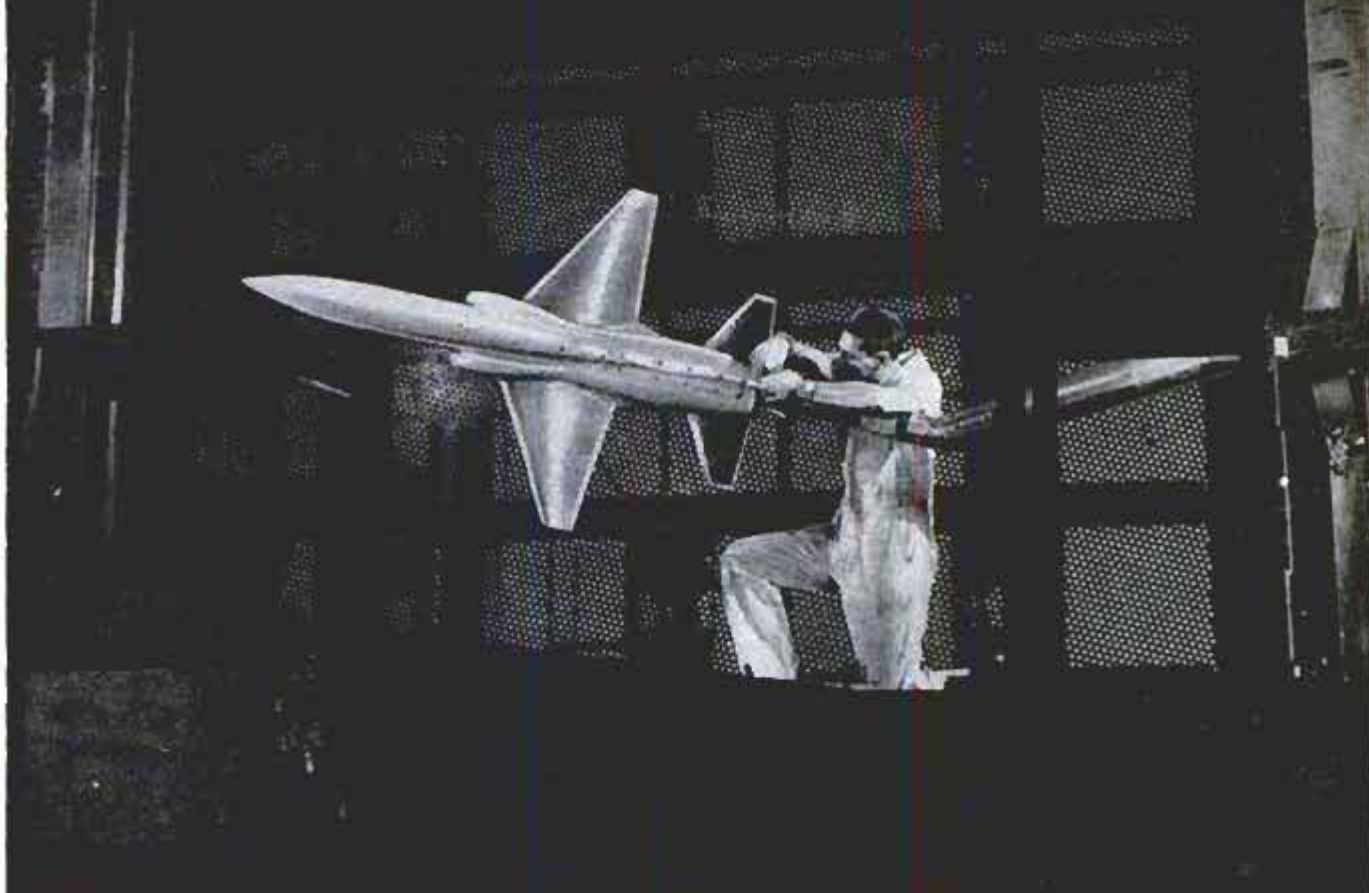
2600-M.P.H. Turbojet Engine In "Theoretical" Model

Scientists at the Lewis Flight Propulsion Laboratory, in Cleveland, have developed a model of a turbojet engine which theoretically could move airplanes at a speed of 2600 miles per hour. The design of the Mach-4 engine is based on studies of aerodynamic and combustion factors needed to power an aircraft at speeds four times that of sound. The Mach-4 engine is still in the idea stage. But the model indicates it would have a highly expanded exhaust nozzle and a large air inlet. It would be much shorter than present engines, utilizing only three instead of a dozen compressor-blade rows. The engine could be very short if it burned high-energy fuels.



Winter Sun-Bathing Shelter Covered With Plastic Sheet

Sheets of semirigid plastic are used to cover a sun-bathing shelter made of two by fours and attached to the south side of a house. The tough plastic sheet is not only unbreakable but is more transparent than glass and is superior in transmitting ultraviolet light. Sheeting of this type can also be used as cover for starting frames for seedlings, for carports, windbreaks on patios, as storm sash, to enclose porches or as an inner liner for greenhouses. The plastic is available in 36 and 42-inch widths in rolls of 100 or 300 feet.



First Supersonic Basic Trainer Gets Wind-Tunnel Tests

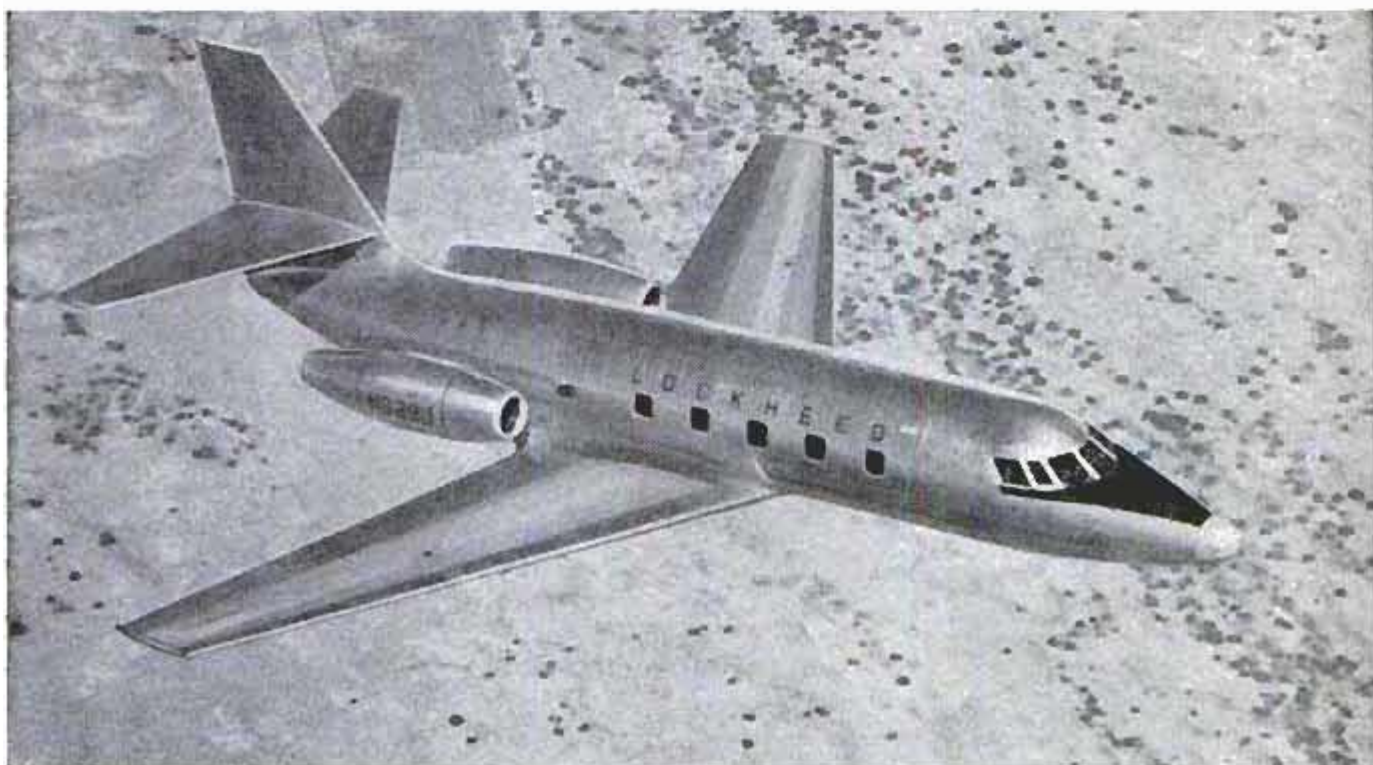
Cornell Aeronautical Laboratory's 1000-mile-per-hour wind tunnel is being used to test a model of the world's first supersonic basic trainer. The Northrop T-38,

developed for the Air Force, is scheduled for actual flight tests this year. Extensive wind-tunnel tests of the stability of the trainer have already been performed.

Jetstar for Training or Transport Cruises at 550 Miles Per Hour

Cruising speeds up to 550 miles per hour were recorded by the 10-passenger Lockheed Jetstar during recent flight tests over California. The new aircraft will be used

as a jet "utility" plane to train pilots, bombardiers and navigators. It's also designed to rush top brass and high-priority cargo from one military site to another.





Two-Way Snow Remover Features Brush and Blade

Among this winter's new products designed for cleaning the snow and ice off sidewalks and driveways is a combination brush and blade on a long pole. For light, powdered snow you can sweep the pavement with the brush side, which has long, plastic bristles. For heavier, wet snow, slush puddles and patches of ice, you just flip it over and use the 14-inch steel blade. The two-way snow-and-ice-removal tool is lightweight.



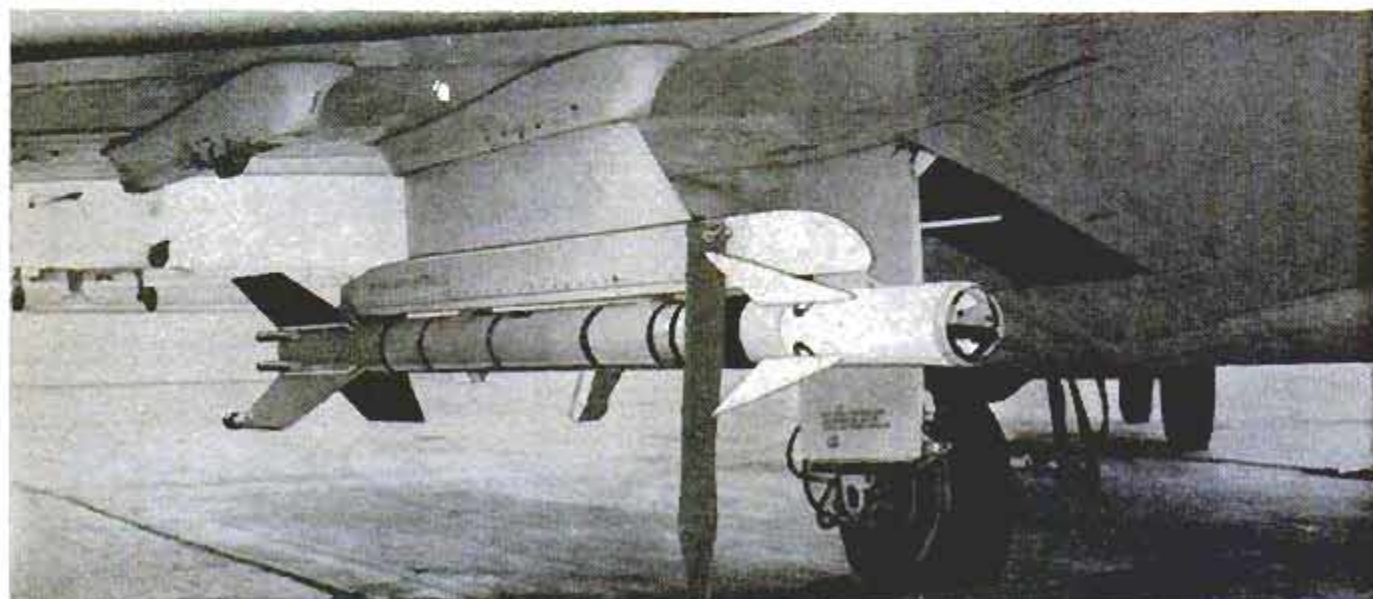
Flash Bulbs Are Smaller

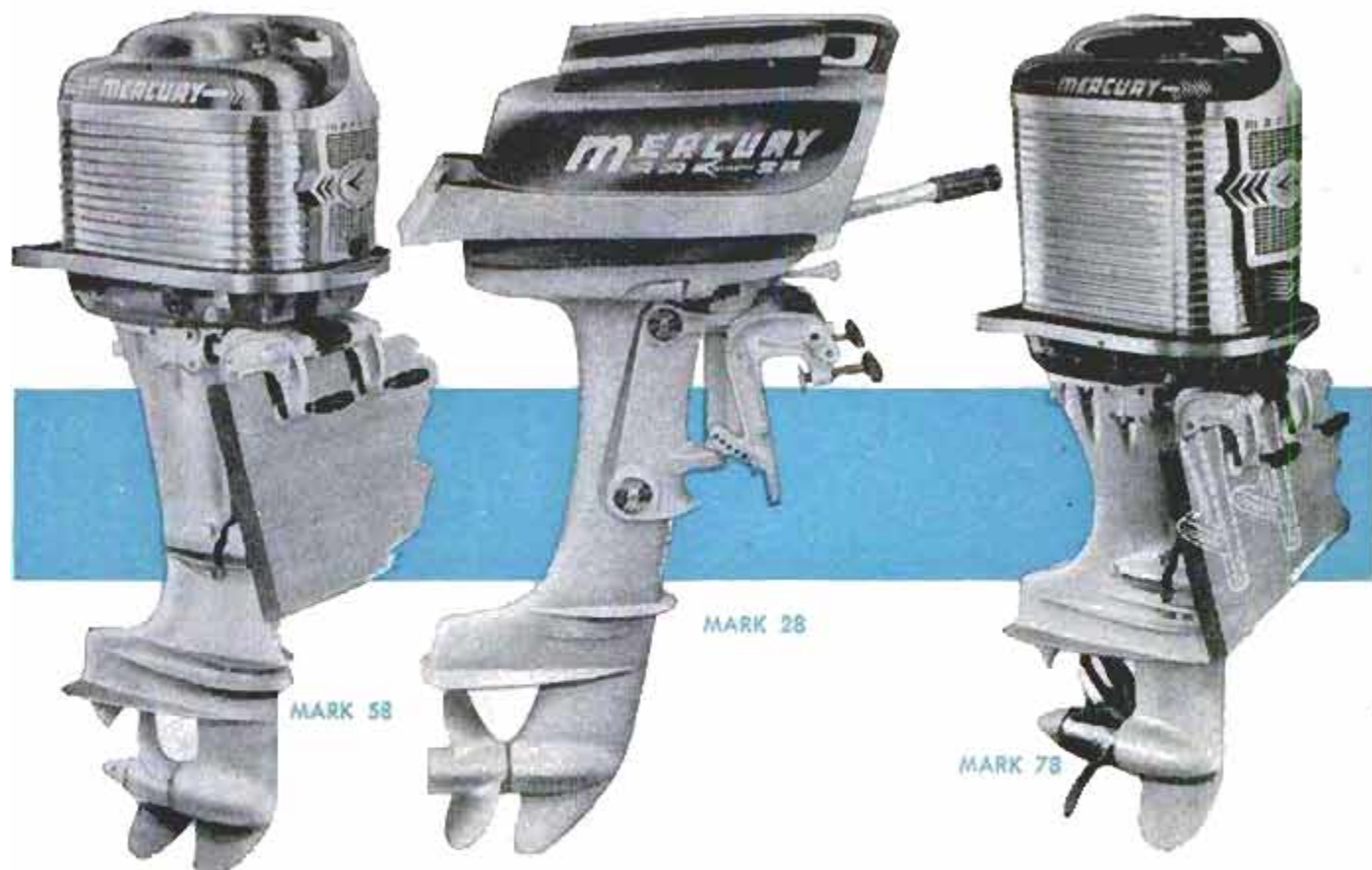
Shredded zirconium foil replaces aluminum as the combustible element in a new flash bulb that's only one fourth the conventional size but produces the same amount of illumination. Both clear and blue bulbs will be available in the new size.

Sensitive Sidewinder Missile Tracks "Hot" Enemy Targets

Infrared guidance is the secret of the Sidewinder's accuracy. The Navy recently announced that its air-to-air missile is able to hit a flare pot on the wing of a target plane. The missile can track a target through any series of evasive actions. It

simply runs down the source of infrared energy emitted by hot engines and exhausts of military equipment. Although its detection system is extremely sensitive, the Sidewinder is simple enough for technicians to handle without special training.





Six-Cylinder Outboard Motor Packs 70 Horsepower

MOST POWERFUL outboard motor for 1958 is the new Mercury Mark 78, a six-cylinder, in-line engine packing 70 horsepower. The new motor is an example of the trend by the entire industry toward larger motors to power family cruisers. Two other new Mercury motors have also been announced: The four-cylinder Mark 58 rated at 45 horsepower, and the two-cylinder Mark 28 at 22 horsepower. A feature of the Mark 78 is a single-lever control that combines starting, speed and shifting. The lever has a thumb button on top of the handle. The operator pushes

the lever forward and presses the button to start the motor. As the lever is pushed farther forward, speed increases. To reverse, he pulls the lever back, stopping the motor. Pressing the button again starts the motor in reverse. Another innovation in this motor is a piston-type shock absorber which absorbs most of the impact energy when the lower unit strikes a submerged object. The '58 line of Mercury accessories features a single-lever control for smaller motors and a steering system operating through a flexible steel cable instead of ropes and pulleys.

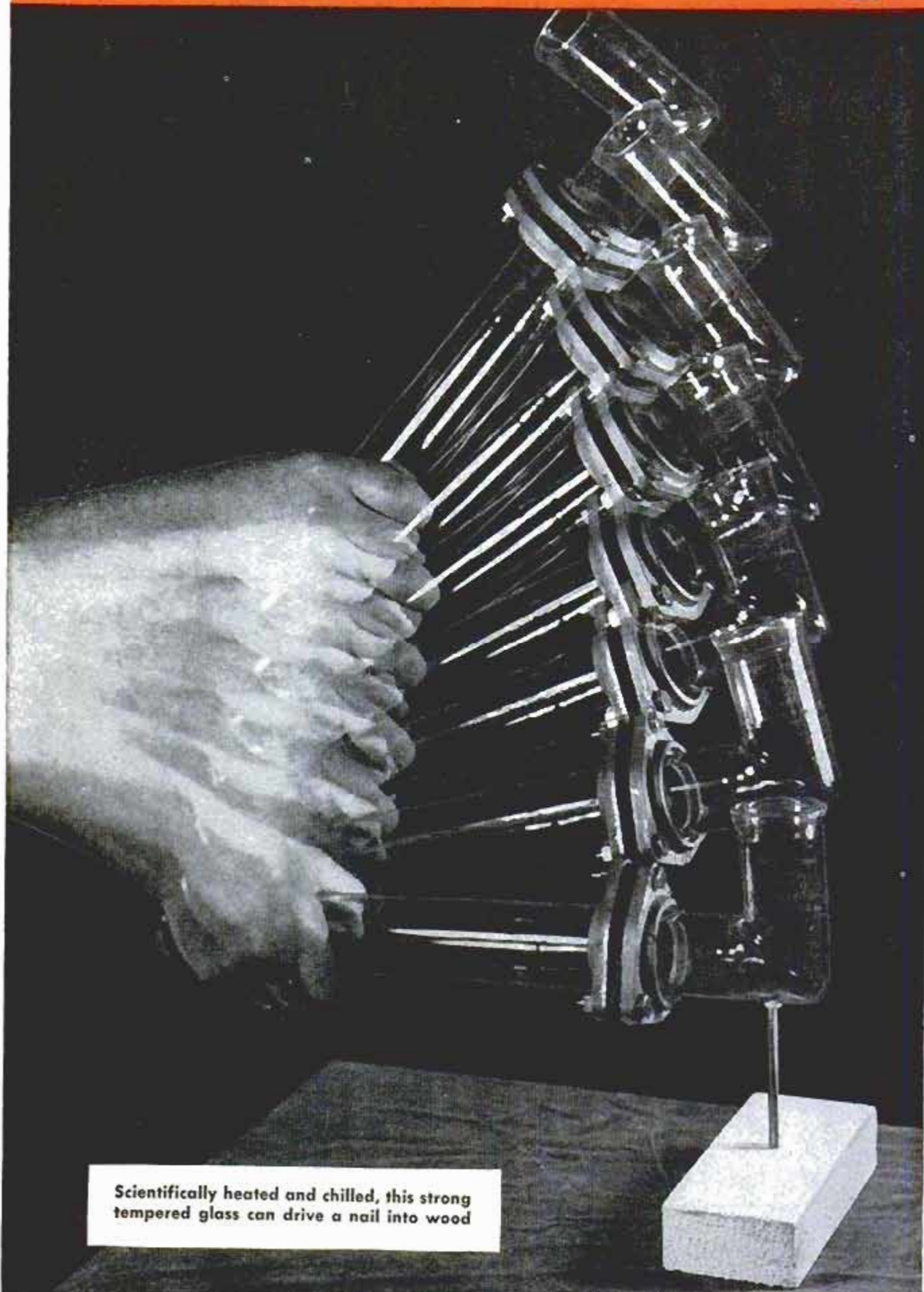
Single lever with a thumb button combines starting, accelerating and shifting

Another single control is available for small motors

"Automatic transmission" drum replaces twist grip for remote control



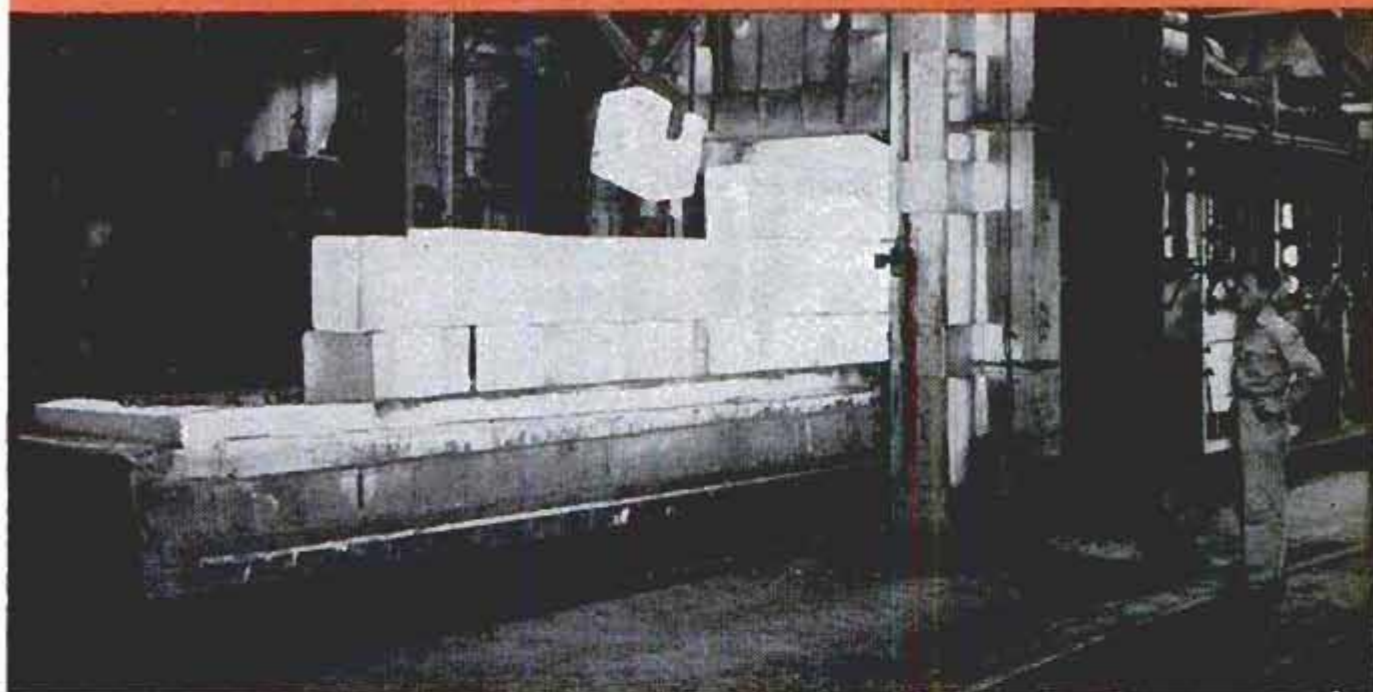
The Weird Things



Scientifically heated and chilled, this strong tempered glass can drive a nail into wood

Photo by Corning Glass Works, Corning, N. Y.
POPULAR MECHANICS

They Do With Heat!



Modern heating methods now harden steel-die blocks for presses in three hours instead of usual 30 hours

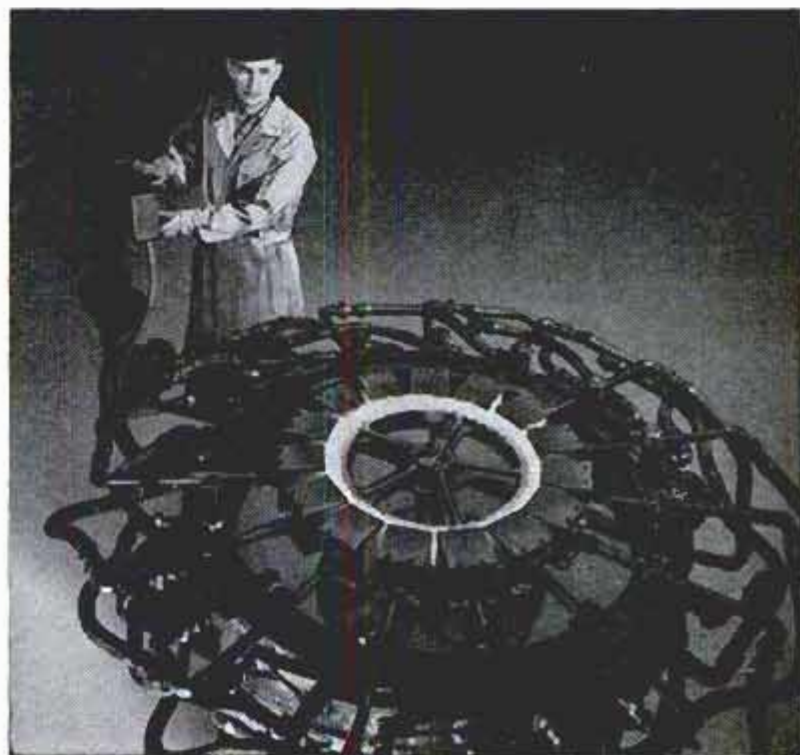
By **Richard F. Dempewolff**

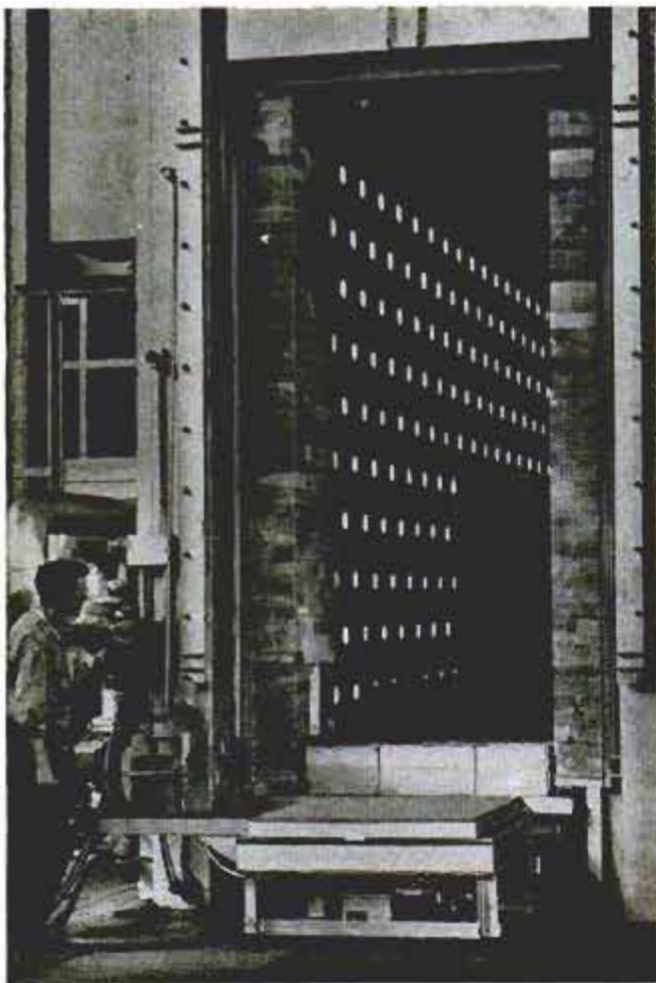
FRED HESS RUNS a bake shop in suburban Dresher outside Philadelphia. Like any other baker, his primary tools are ovens and heat, but that's where the comparison ends. His ovens vary in size from ceramic bowls no bigger than teacups to vast firebricked tunnels totaling a mile in length. They measure their fierce, gas-fired flames in thousands, not hundreds of degrees. Inside a chain of sprawling new million-dollar buildings that resemble a modern university, his "chefs," dressed in everything from dungarees to asbestos-lined aluminum suits, are silhouetted by the white incandescence of the infernos they create, as they ply their specialty of using heat as a tool for solving people's problems.

If, for instance, you want to peel a carload of onions without shedding a tear, put 30 million holes in a square inch of material, take the fuzz off a mile of fabric, remove the bristles from 100,000 hogs without searing their skin, bend glass around a sharp corner, or dry printer's ink faster than the flick of an eyelash—Fred Hess's "kitchen help" will show you how to "cook" your way out of your dilemma.

The Selas Company, of which Hess is president, began as a gaslight-equipment company in Germany in 1901. Today, it is a specialist in heat engineering—a master chef to modern industry. Its job is to use controlled heat as a tool in producing things that would be impossibly expensive by

Radiant-heat burners that are the size of teacups focus furnace heat to harden "selectively" the teeth of a tractor gear





Inside the furnace where the die blocks are cooked, the radiant burners show up as blinding white disks

other means — or just plain impossible.

Heat, Hess will tell you as you stroll past long rows of roaring kilns and ovens, is the processing tool that is developing the new materials for tomorrow's satellites, space rockets and electronic gear. Blades in a modern jet turbine reach about 1650 degrees F., and present alloys with nickel, iron or cobalt bases can take up to 1800 degrees. But already engineers are designing engines that will have to stand much greater temperatures. So the heat wizards are working on new alloys of molybdenum and chromium they hope will not melt or lose strength at the super heats they'll encounter. Radomes that house delicate steering mechanisms on our new supersonic missiles will melt under friction with the atmosphere unless our industrial "cooks" come up with a material for them which is better than we have today. But they will. They're hot on the trail of a ceramic—alumina—which will not melt until it reaches a toasty 3720 degrees F. The heat experts are also working toward new ceramics for TV vacuum tubes, which must stand higher and higher temperatures as power output goes up. Nuclear physicists are crying for special materials to withstand not only the intense heat of atomic piles but also to hold up against radiation and corrosion.

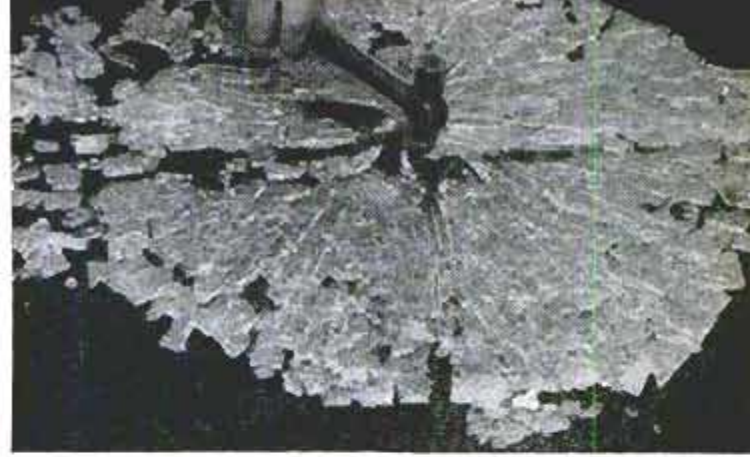
Selas' big secret is heat precision. For

Hot exhaust gases waft away threads of glass fiber to be gathered as glass wool for draperies, insulation





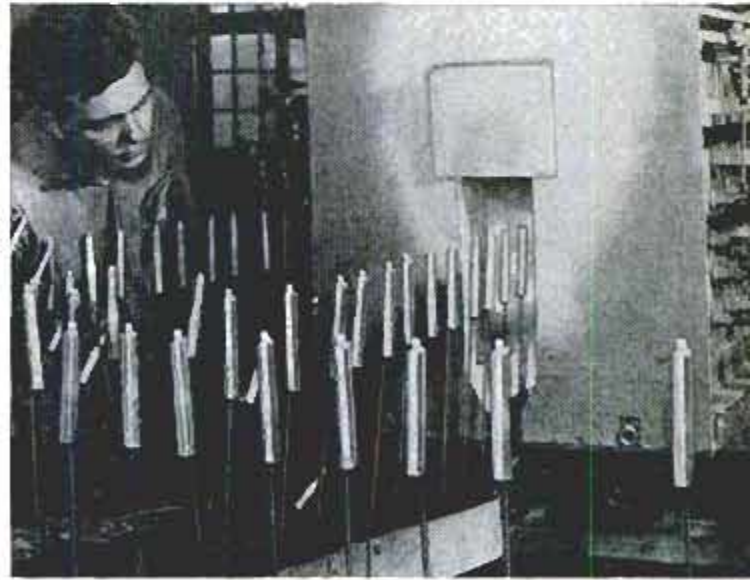
Above, man is about to strike splinterproof tempered glass that has been heated and chilled on schedule



Above, on being hit by hammer, this splinterproof glass breaks into thousands of harmless fragments

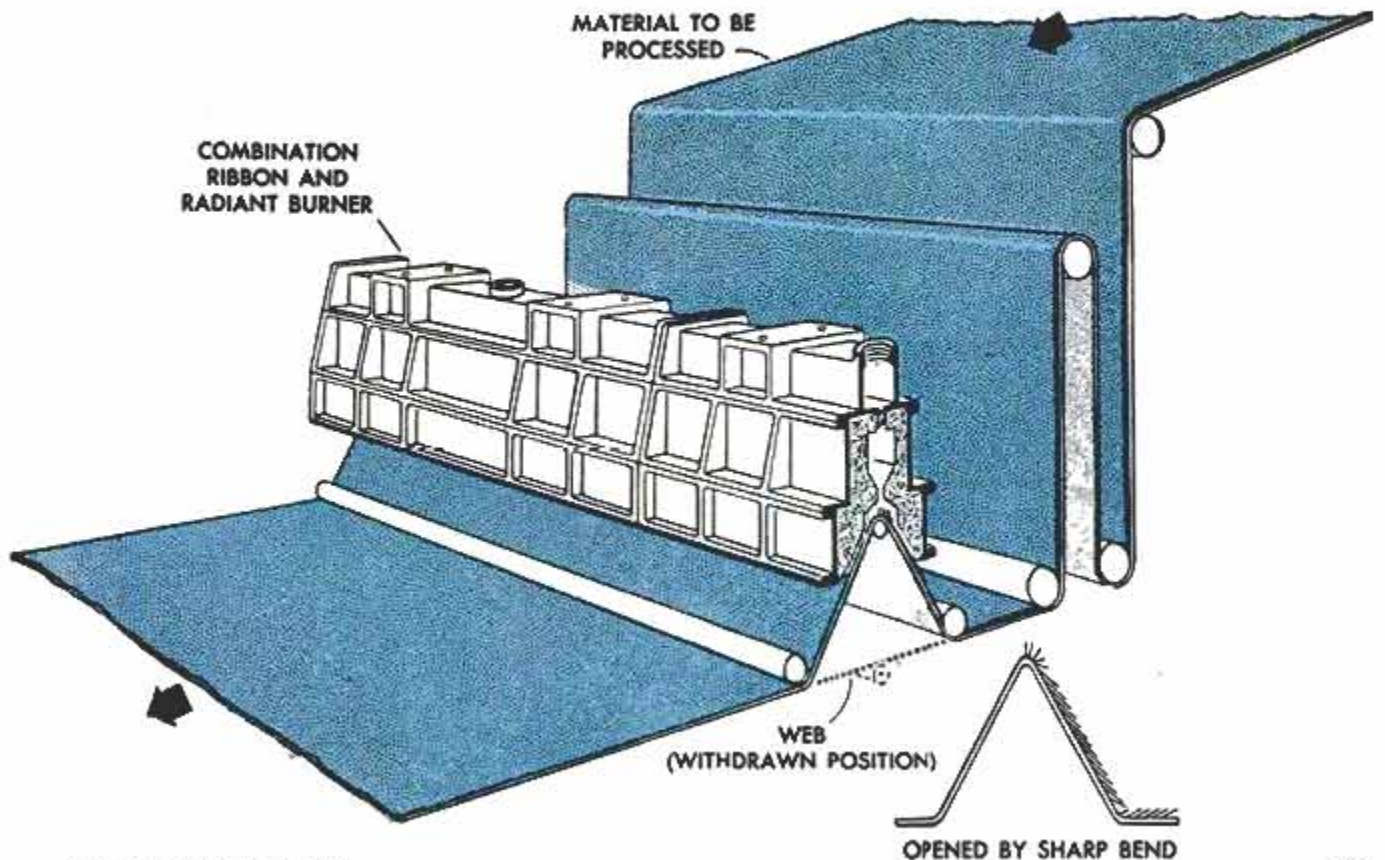
while the chefs in those roaring kitchens may cook with 5000 degrees F., the recipes they use may be done to the proper turn within a particle of a second. A little more might set everything afire; less might not do the job.

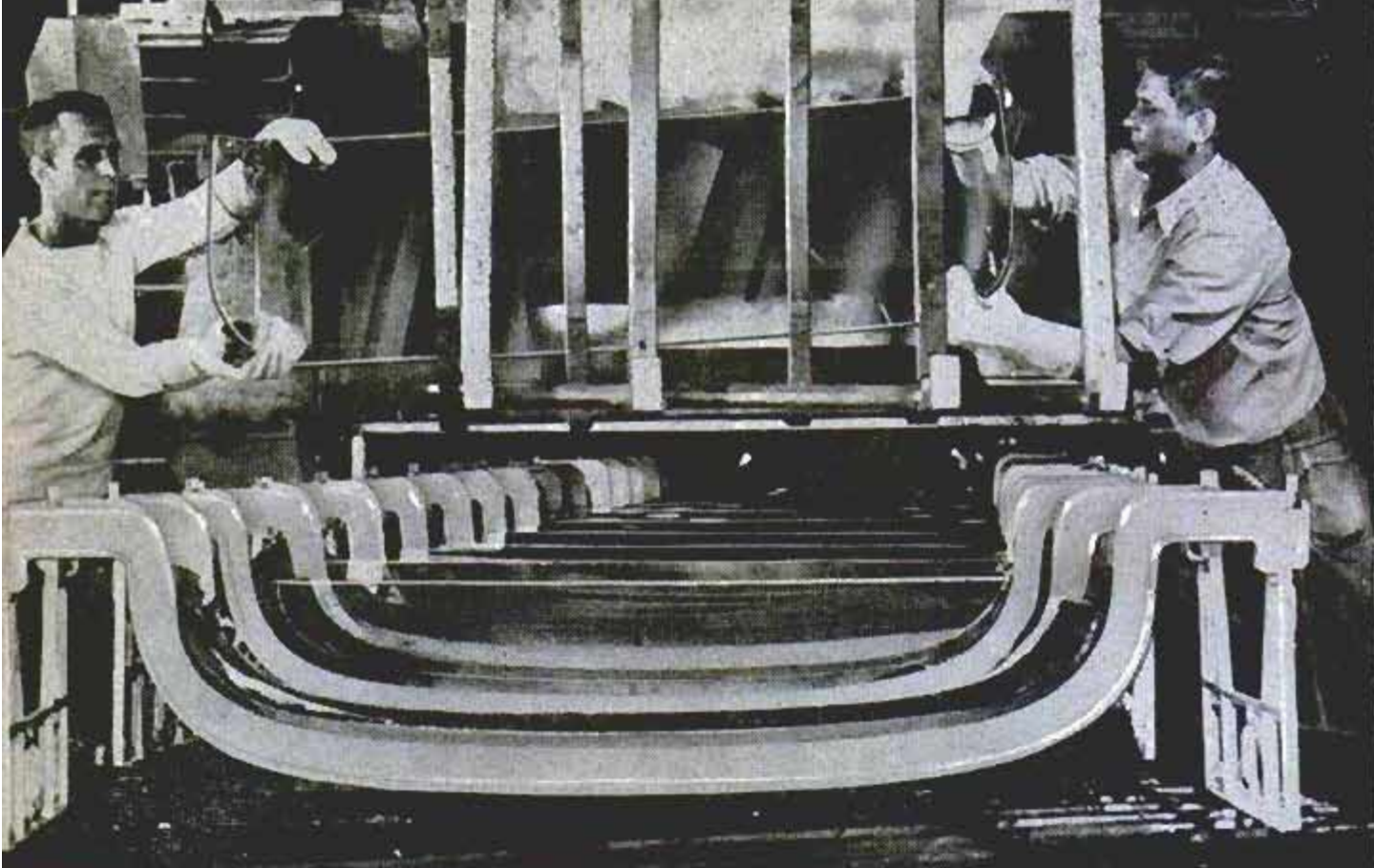
Take the pigs, for instance. Some time ago a meat packer came to Hess with a problem. Hair on the hog carcasses couldn't be entirely removed without a time-consuming searing job being performed on each individual pig. And the incidence of scorched flesh was pretty high. Selas built the packer a radiant-gas oven through which the carcasses move on a mass-production trolley line. Radiant burners inside are positioned so that they outline the contours of a typical hog carcass; hence all parts of the beast are the same distance from the flames. "Each carcass," says Hess,



Above, annealed aluminum tubes for toothpaste made by heat-treating methods that eliminate brittleness

Below, fuzz is singed from corduroy fabric by automatically drawing it through burners at preset heat



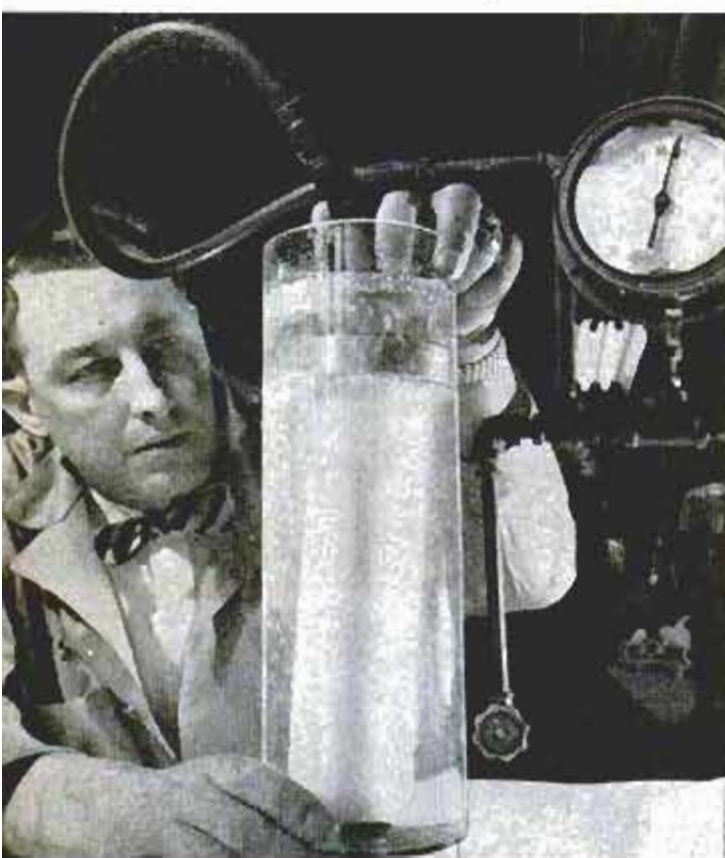


Wrap-around windshields and rear windows for cars are molded by heat-softened glass that drops into forms

"is exposed to a blast of 3400 degrees for a fraction of a second. A switch, activated by the leg of the hog going through, lights and extinguishes the burners. It burns off every hair—without raising the temperature of the skin a single degree!"

Later, a similar oven was devised for a large canner, to burn the pinfeathers from

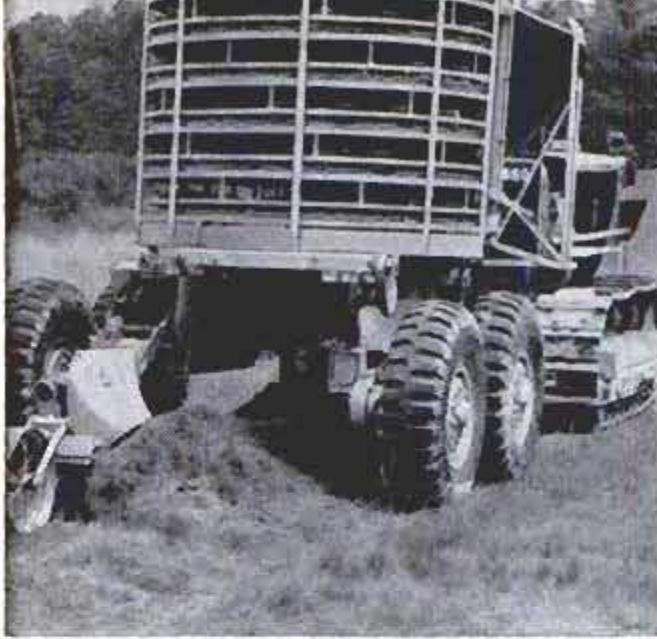
Its fabrication made possible by heat, the ceramic filter under test here has 100 billion pores, so fine that even bacteria cannot pass through them



chickens. The same canner had the onion-peeling problem. Peeling onions mechanically in abrasion machines is messy, time-consuming and causes tearing in the crews that have to clean the machines. By subjecting the ornery vegetables to open gas flames in a kiln, Selas was able to sear off the hard outer layers without scorching those beneath. Today one oven is peeling onions at a rate of two tons per hour, and nobody has to sweep up any crumbs.

Typical of the touchy heat jobs Hess's experts have put their talents to was the business of defuzzing fabrics. Most newly loomed cloth has a surface of fuzz and may be covered with bits of thread and "fly" that must all be removed before the material is sold. Mechanical means of doing the job were tedious and costly, so the textile people came to Hess. Could he do anything about it? Selas' kitchen help went to work on a row of gas burners under which the loomed fabric would pass on its regular rounds to the rollers. After days of research, the cloth—corduroy—was flash-heated at 1800 degrees for exactly seven seconds. Six wouldn't do it, and eight would scorch it or set it afire. So close are tolerances for this burner, that when black cloth, which absorbs more heat, is passed over burners set for white material, it burns to a crisp. Today, however, these burners are singeing fuzz from fabric in most of the nation's mills faster than any

(Continued to page 256)



Army Machine Automatically Plants Land Mines Under Turf

With minimum disturbance of the natural cover, a new machine developed by the U. S. Army slices the turf and conceals a string of antitank mines under it. Only

the tractor operator is needed to plant the automatically armed mines at a predetermined rate. The round magazine is removed for reloading by a conveyor system.

Outrigger Skis Balance Snow Sleigh

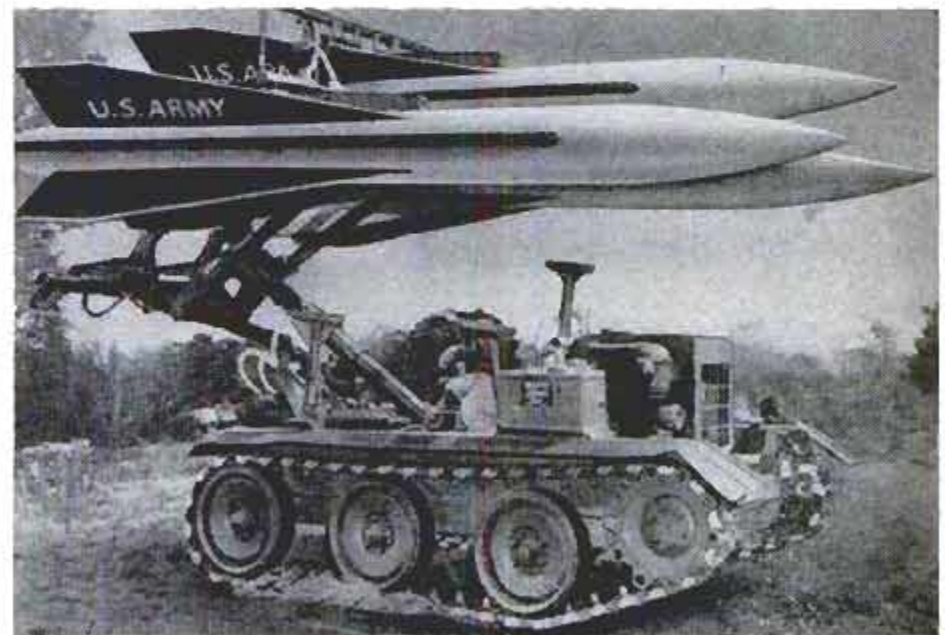
Cruising over snow-covered terrain at speeds up to 60 miles per hour, a propeller-driven sleigh can bank on sharp turns and steep hills like an expert skier. An outrigger connecting the rear skis to the fuselage and directional control of the front ski help simulate the ankle movements and body twisting of a man on skis. The sleigh uses a 65 to 125-horsepower aircraft-type engine.



Missiles Toted On Rough Terrain

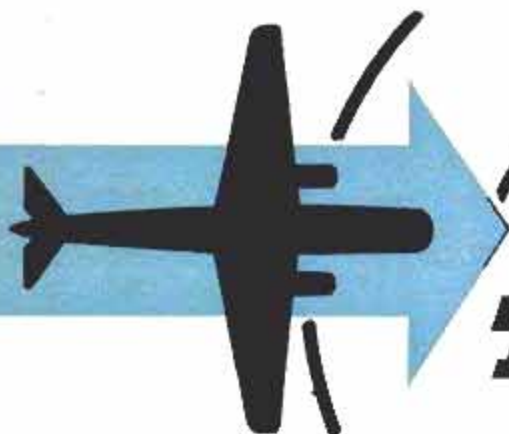
Carrying three Hawk Bird missiles at a time, a tractor-driven Army missile loader can move the weapons quickly over rough or muddy terrain.

☐ For dessert, we have instant seaweed pudding. A New Bedford, Mass., inventor has patented the recipe, a dry-powder mix combining a seaweed extract, salts, flavor and color. Cold milk is added.





Control-tower operations are taught from this mockup of an airport control tower



Air Traffic School



By
Thomas E. Stimson, Jr.

CAA instructor is at the console of a jet-aircraft trainer where he can set up problems for student to solve in nearby cockpit



Students are "pilots" of "aircraft" approaching the field, landing or departing. "Tower" gives instructions

YOUR SAFETY as an airline passenger is based in part on a collection of models, mockups and gadgets that is housed in a group of old buildings alongside the Oklahoma City airport.

Here, at the Aeronautical Center of the Civil Aeronautics Administration a wide array of rebuilt and homemade contrivances are used as training aids for the more than 500 CAA engineers and safety agents who supervise all aspects of air transportation.

These men never finish going to school. They are recalled from their ordinary duties on regular schedules to take refresher courses at Oklahoma City or to receive special instruction in the newest navigational aids being developed.

One big classroom contains nine Link trainers, each rebuilt to simulate some special aspect of air travel. In one trainer a student agent may acquaint himself with using the high-intensity approach-light system installed at some airports. In another Link he learns how to use the omnidirectional radio range. Later, he may switch to a third trainer to become familiar with ADF, the automatic-direction-finding system.

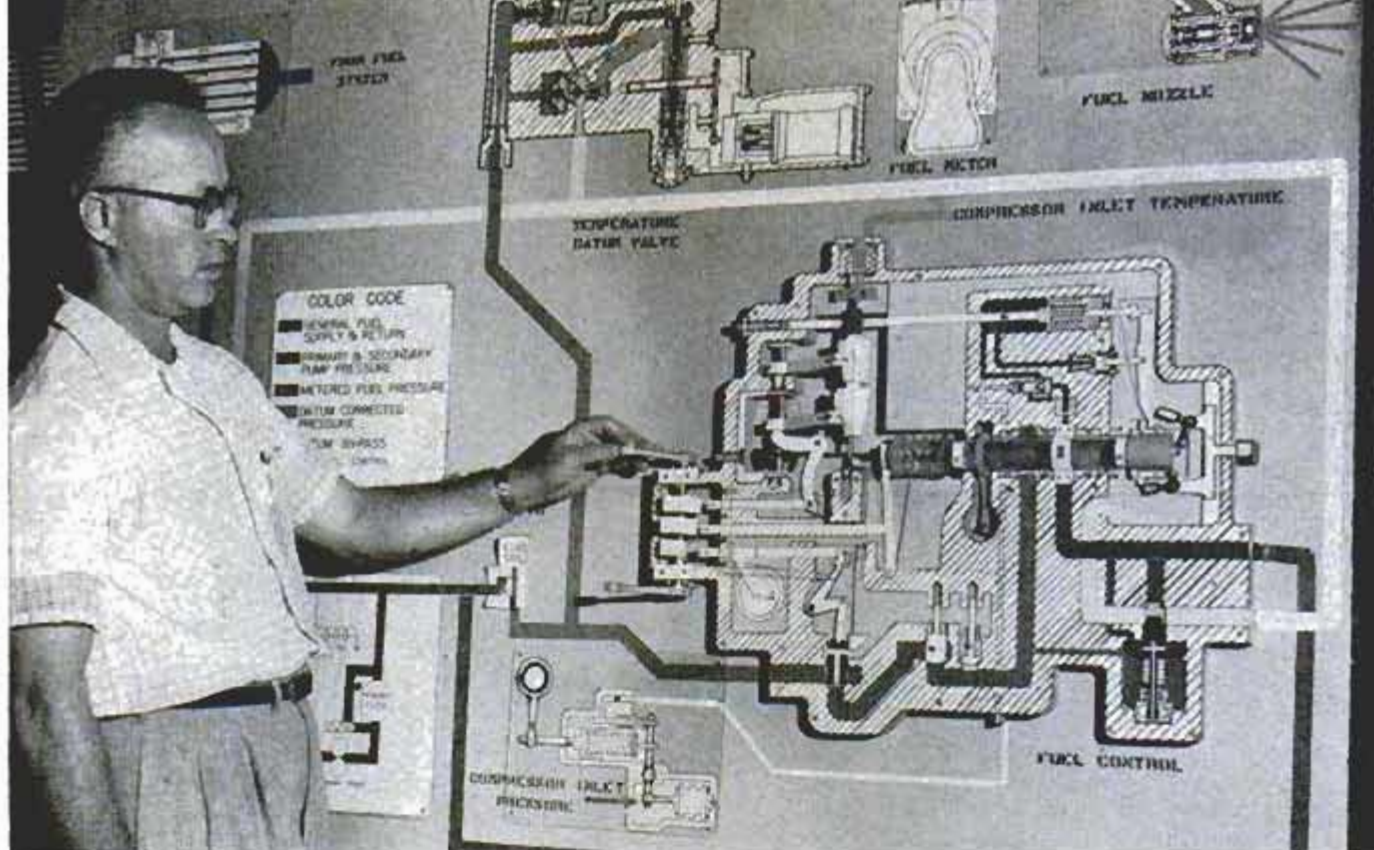
An entire building is devoted to teaching the use of modern airport-radar equipment. On the newest types of radar the usual

ground "return" can be eliminated, leaving only a picture of the runways, the adjacent navigational facilities and aircraft that are in flight or that are in motion on the ground.

One classroom contains a table-top model of a typical airport complete to runways and hangars. In the same room is a full-size "control room," such as is found in an airport's control tower. Students wearing earphones and seated around the model

Model of aircraft on the swinging arm demonstrates the VOR (very high frequency omnirange) radio-navigation system





CAA technician checks the operation of the fuel system for Lockheed Electra turboprop passenger transport



Above, students assign airspace to planes in traffic-control studies. Below, plane traffic is "stacked" at a busy airport



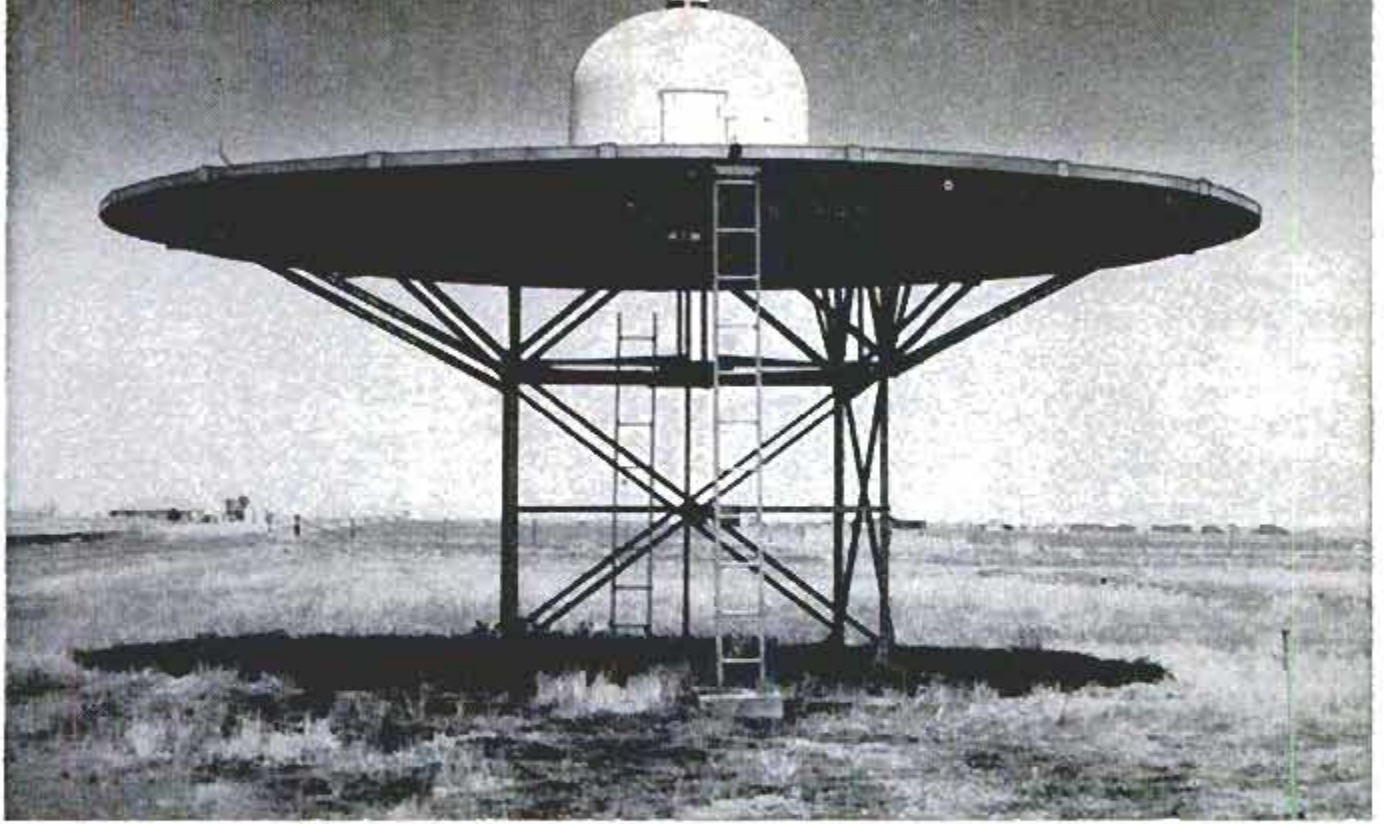
airport operate tiny planes in conformity with orders phoned them from the "tower"; later, they take their places in the control room itself to be drilled in all aspects of control-tower operation.

Forty-One Courses Given

In still other classrooms the students learn how to dispatch aircraft along the airways, how much airspace to assign to each plane and the altitudes at which the aircraft are to be flown. Forty-one courses in all, ranging from advanced electronics to the operation of the newest types of aircraft, are taught at the Aeronautical Center.

Getting ready for the jet transports that will be flying soon, the CAA is beginning to familiarize its agents and engineers with jet flight. A new kind of trainer at the center consists of an enclosed cockpit in which a student sits, and a large control board at which an instructor sets up flight problems for a jet transport. On his control board the instructor feeds in such conditions as wind direction and velocity, altitude, air temperature and jet-engine condition. The student "flies" his cockpit to conform to the situations that are presented to him.

Fuel systems, control systems and electrical systems that are to



VOR (very high frequency omnirange) transmitting antenna at Oklahoma City aids air-navigation training

be used for the new fast transports are subjects of study. Conferences are held in which the reliability of each system is studied. The new traffic problems that the jets will bring also are being considered and procedures are being worked out for handling them.

In addition to CAA employees, several hundred students from the airlines and the armed forces are instructed in air-traffic control and associated subjects every year. "Standard procedure" is the keynote of all instruction. Each student is trained to handle every situation according to the rules. As a dispatcher, he directs incoming and departing traffic with standard phrases. The result is that, no matter where a pilot goes, he receives the same familiar service from the local control tower, with no chance of misunderstandings.

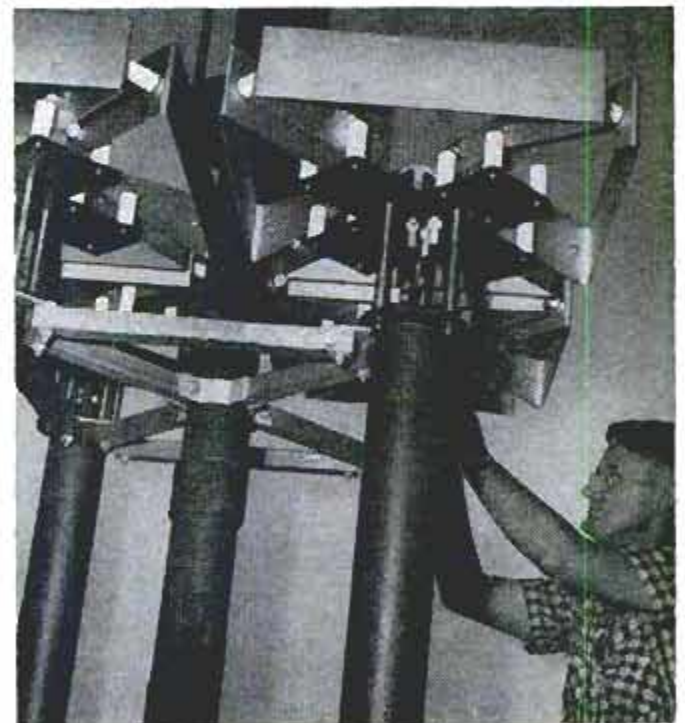
Standardization is applied to radio aids for navigation as well as to control-tower and airway procedures. Every radio range must be identical in operation. Every instrument-landing system must give the same familiar signals. Every omnirange must have the same accuracy. One of the jobs at the center is that of maintaining the electronic equipment on about 65 patrol planes used for checking the radio aids on the 90,000 miles of federal airways.

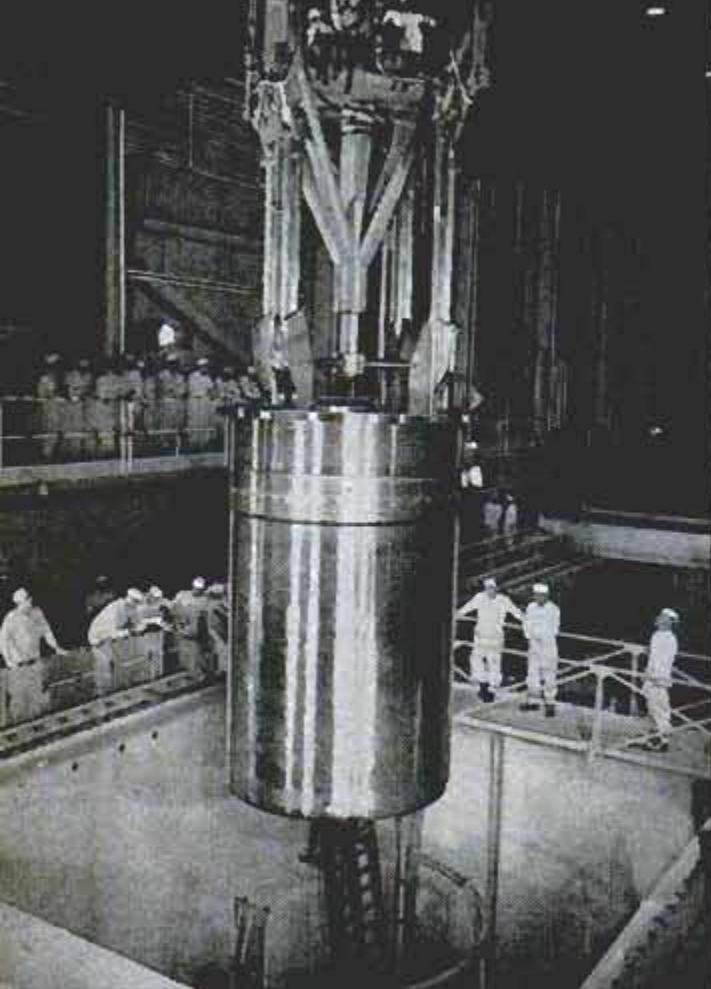
Sometimes a radio aid changes its characteristics without apparent cause; then a CAA patrol pilot cruises around the entire area searching for a source of interference. Often, it is found that a new bridge or a metal barn or silo has been built in the vicinity, causing the signals from the radio

aid to be absorbed or reflected. Once the source of interference is found, the radio apparatus can be readjusted to its original performance.

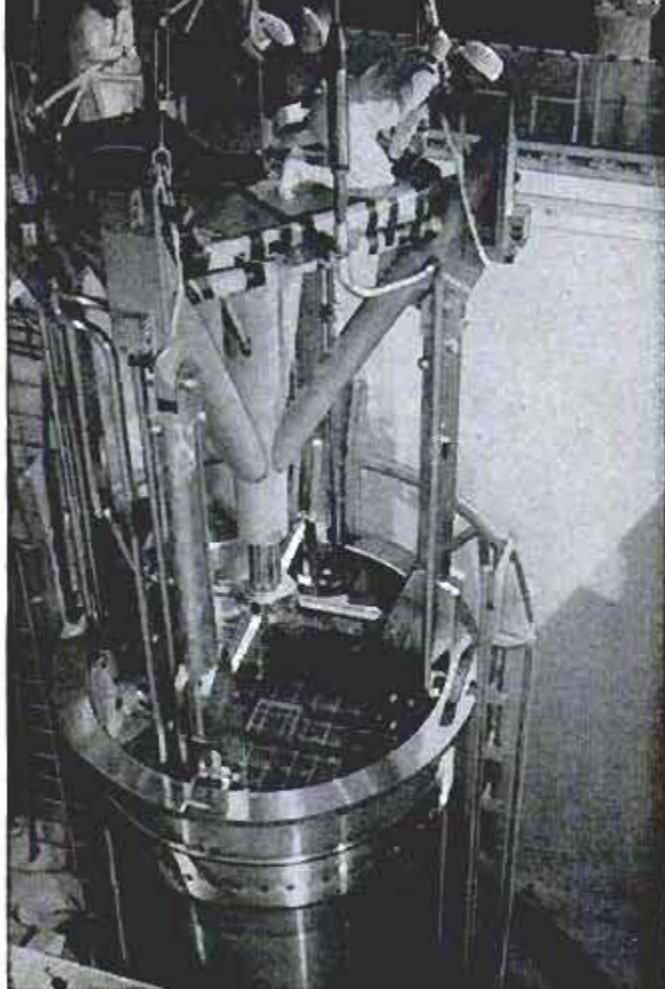
During the last few years several hundred traffic-control and communications experts from foreign countries have attended school at the Aeronautical Center, then returned to their own countries to align their systems to U. S. standards. Today, traffic control in most parts of the world operates on a common system based on the instruction at Oklahoma City. ★ ★ ★

Odd-shaped antenna is located inside the plastic dome of VOR equipment shown at top of this page





Atomic-power scientists supervise delicate maneuvering of nuclear core containing 14 tons of uranium



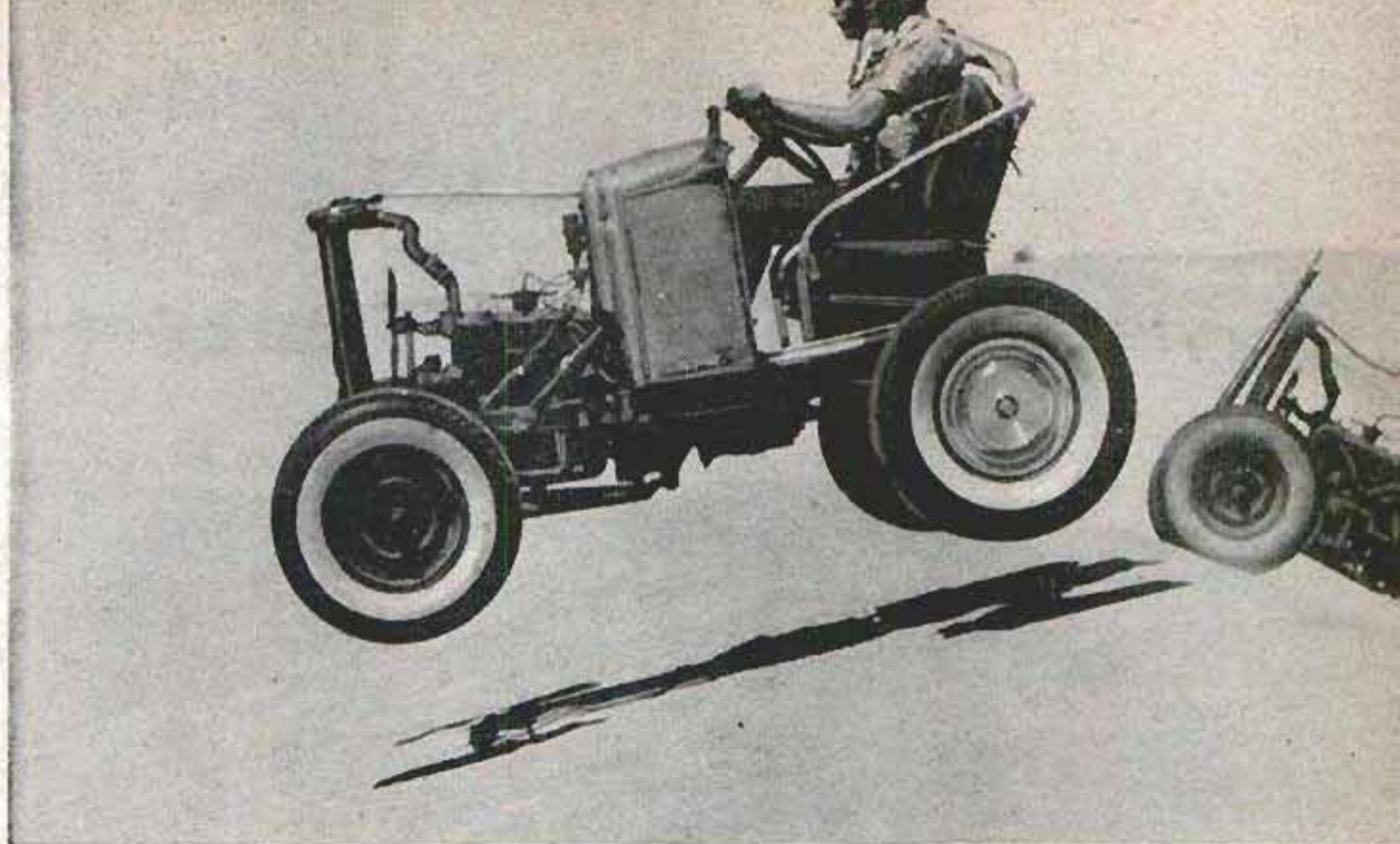
Multimillion-dollar nuclear core has less than inch clearance as it's lowered into pressure vessel

First Atom Power Plant Gets Nuclear "Furnace"

Resembling tray of cupcakes fresh from the oven, these rows of pads supported core before installation



CAREFULLY LOWERED into position in the nation's first full-scale atomic electric generating station, at Shippingport, Pa., is the nuclear core which is the heart of the system. The big stainless-steel cylinder contains 14 tons of natural uranium and 165 pounds of highly enriched uranium. The "hot" nuclear reaction that will take place within the core will, indirectly, produce steam to turn a turbine electric generator. The electricity produced by the station will go to industry and homes in the Pittsburgh area. Within the nuclear reactor will be 32 control rods for regulating the atomic splitting which produces heat for the process. When the rods, made of a rare metal called hafnium, are inserted, the atomic reaction is slowed. Withdrawing the rods speeds up the reaction. Water will flow through coolant loops in the plant at a temperature of about 525 degrees F. and under a pressure of 2000 pounds per square inch. The heated high-pressure water will be used to convert a second supply of water into steam which will produce a minimum of 60,000 kilowatts of power in the same way that coal-heated steam is used to generate electricity. Operation of the plant will be handled from a single control center.



Model-A "Dune Bugs" Beat Dig-In Problem of Driving on Sand

Cut a Model-A Ford down to an over-all length of eight feet, strip it to bare essentials, put dual rear wheels on it and you have a "Dune Bug." High-school boys in the Yuma, Ariz., area use that formula to build a \$30 car that will scoot over the

shifting sand dunes of the desert Southwest where even Jeeps are trapped when the wheels dig into the sand. The rear wheels have smooth 7.50 by 16 tires that spin instead of digging in when a stall threatens. Air pressure is limited to eight pounds.

Side Bars Protect Car Finish When Parked in Tight Spot

Annoyed by the time and cost of touching up dents and scratches put on his car in parking lots, Tracy Carrigan of Lansing, Mich., designed a set of side bars that help protect the finish. Besides preventing damage from opened doors of cars parked

alongside his, Tracy reports the side bars warn the driver when he is too close to a wall, a post, high curb or another car. Carrigan, manager of an automotive service-equipment company, says the bars could be produced commercially.



THE CHEETAH— *World's Fastest Animal?*



"On your mark, get set, go!" says John Hamlet to his pet cheetah, Ocala, in test to learn cat's speed

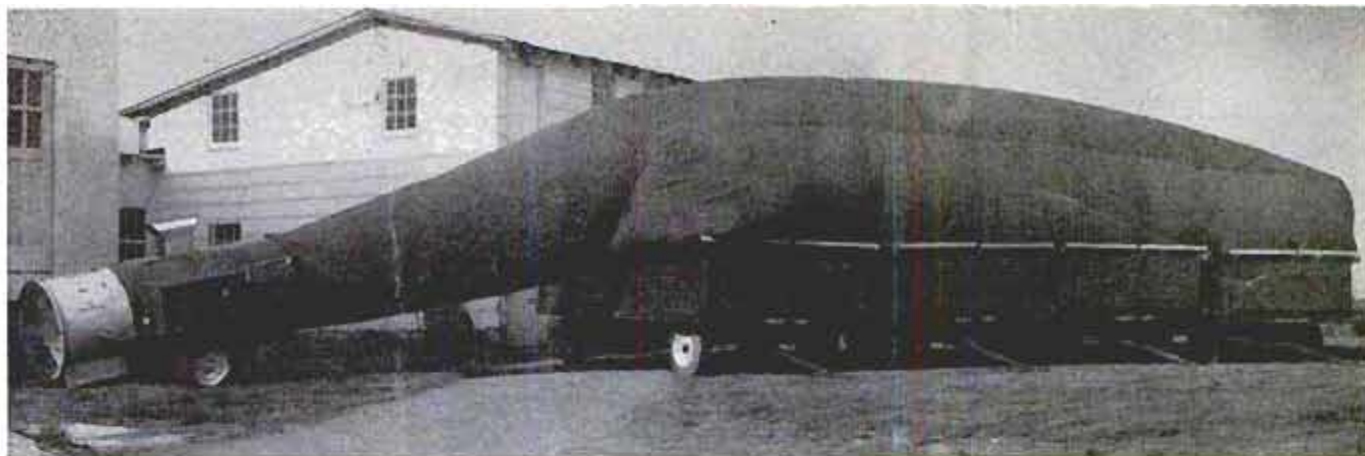
IS THE CHEETAH the fastest animal on earth? The dispute has raged for centuries among the experts. John N. Hamlet of Ocala, Fla., operates an animal exhibit and runs cheetahs to demonstrate their speed. Curious to know how fast they go, he rigged a meat-scented lure to be pulled by a cord attached to an up-ended bicycle wheel. Ocala, an almost full-grown male,

Ocala follows meat-scented lure pulled by line on bicycle wheel, as photographer gets ready for shot

was selected for the test. Timekeepers and photographers recorded the run. The result: Ocala was clocked from a trotting start to a top speed of 54 miles per hour in $2\frac{3}{4}$ seconds! He attained the same speed in a little over three seconds from a standing start. Zoo officials say cheetahs can run at a top speed of about 70 miles per hour.

Coming at you . . . Ocala makes quick stop at end of record run, kicking sand in photographer's face





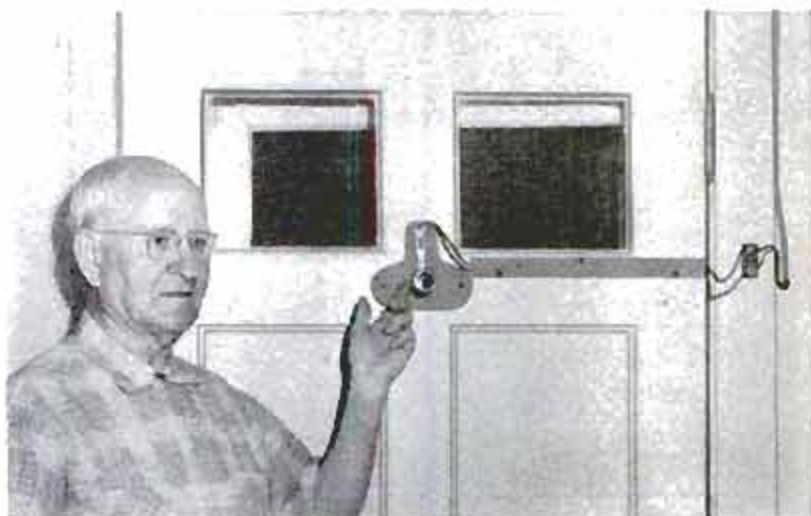
Drier Handles Four Wagonloads to Make "Hay in a Day"

Bales of hay are dried right in the wagons through a system of making "hay in a day." In this system, a mower-crusher cuts the hay, a rake rolls it into windrows and

a baler deposits the bales in a crop-drying wagon. Then a single drier handles four wagonloads under a huge canopy. Up to 10 tons of hay can be dried at once.

Telescope in Door Aids Meter Reader

When the meter reader comes to the Earl L. Crabb home in Howell, Mich., he uses a built-in telescope to read the figures on a gas meter 15 feet away. The two-section toy telescope is mounted at eyelevel in the center of the service door. When the telescope is extended for focusing, an electric switch automatically turns on a light above the meter. The light is turned off by pushing in the extended section.



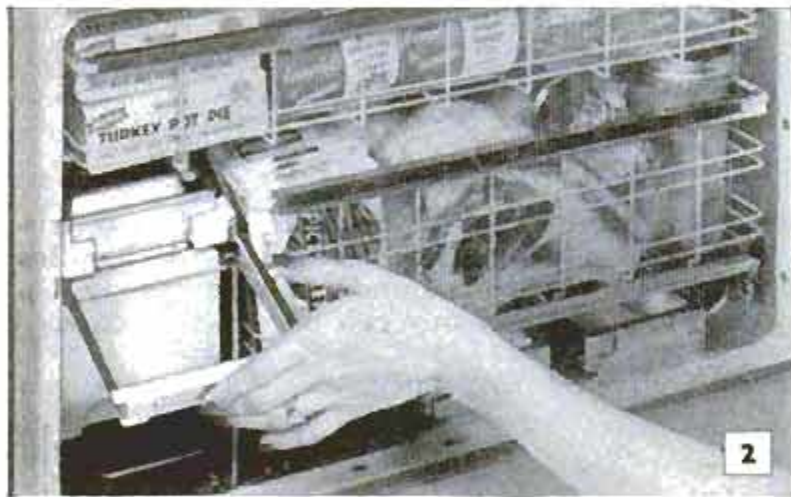
Four-Passenger Three-Wheel Car Runs on Motorcycle Engine

Powered by a single-cylinder air-cooled motorcycle engine, a four-passenger car built by a Belgian designer has a top speed of 40 miles per hour. Fuel consumption for the vehicle is 60 miles per gallon. A roller

chain drives the single rear wheel from the 1936-model DKW engine. It has three forward gears but no reverse. The seats are arranged back-to-back with the luggage compartment between seats.



WHAT'S NEW FOR Your Home



1. CEILING HEATER radiates warmth in bathrooms or other areas where wall space is scarce. It's controlled by a wall switch and uses 1000 watts of electricity from either a.c. or d.c. The ceiling location eliminates danger of shock or burns.
Modern Development Co., Box 196, Encino, Calif.

2. ICE-CUBE EJECTOR empties contents of ice trays into the refrigerator bin when handle is pushed. The ice trays are inserted upside down in a slot above the bin when the cubes are frozen. The slide-out bin keeps the cubes ready for serving.
Frigidaire Div., General Motors Corp., Dayton 1, Ohio



3. CUTTING-BOARD BOWL slides out on grooves to catch the slices of vegetables, fruits and meats. The bowl, made of plastic, can be used to store the sliced food in the refrigerator. The hardwood slicing board has a 10 by 14-inch working surface.
Mastercraft Products, 273-285 Congress St., Boston 10, Mass.

4. FOLD-AWAY IRONING BOARD has three self-locking sections that hold rigidly under ironing pressure. An asbestos-lined shelf beneath the board permits storage of the hot iron. The base is only 24 inches wide but the board opens to standard size.
Mutschler Brothers Co., Nappanee, Ind.



5. CABINET KITCHEN contains everything from three-burner range to food freezer in a unit that occupies only 5.4 square feet of floor space. Various models offer gas or electric cooking, oven, broiler, twin-basin sink and garbage disposer. Cabinet exteriors have a simulated-wood finish

General Air Conditioning Co., 4542 E. Dunham St.,
Los Angeles, 23, Calif.



6. PEELER SHARPENER will restore cutting edges if they become dull from peeling potatoes, carrots or other produce. The sharpener, made of carbon-treated steel, is drawn across the peeler blade. Tool has nylon handle, two kinds of sharpening edges and scored surface for honing

Adel Tool Co., 4013 Milwaukee Ave.,
Chicago 41

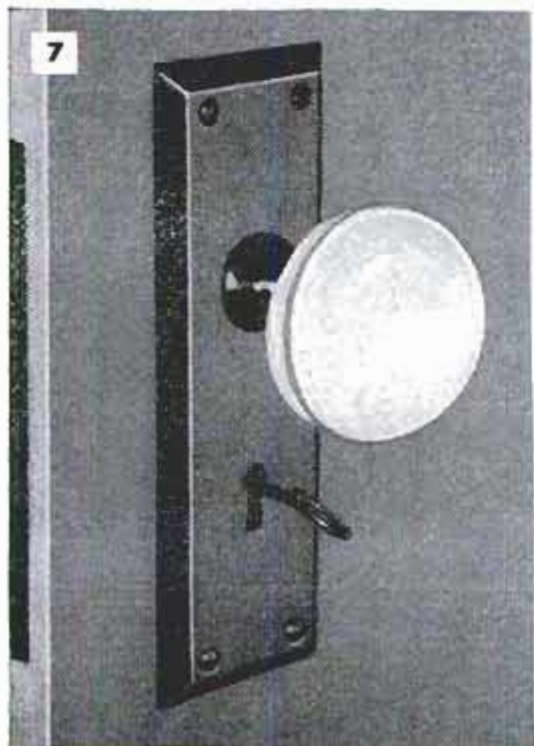


7. DOORKNOB CUSHION softens bumps on walls. The cushion is made of rubber and needs only be pulled over the knob. An inner ring makes an air pocket between the knob and cushion to reduce the noise and damage of doors banging against walls. They're sold in two sizes and colors

Clover Products, 1141 Atlantic Ave.,
Rochester 9, N. Y.

8. MATTRESS EXTENDER for tall people who find Hollywood-style beds too short. The extender attaches to the foot end of the box spring and lengthens the bed by six inches. It's easily removable if you want to take it along on trips. It's also handy to have when tall relatives visit

Better Sleep, Inc., New Providence, N. J.





Folding Pontoons on Amphib Swing to Wing Tips

Balancing pontoons on the Italian Fiat amphibian, above and left, swing into the wing tips. The problem of sealing the hull around the landing gear is solved by folding the retractable wheels into the body. Wheel hinges are well above the water line. The pusher prop reduces cabin noise.

Austrian Watergoing "Buses" Link Danube River Cities

Three 72-foot boats recently started service in Austria as Danube River "buses." One of the boats, the *Maria*, shown below, carries 56 passengers under the canopy and 37 on deck. Powered by two four-cycle, 150-horsepower diesel en-

gines, the boats travel upstream at eight miles per hour and make a little better than 18 miles per hour on downstream trips. Each has two three-blade propellers. The Danube "bus stops" include the cities of Linz, Ottensheim, Krems and Melk.





Push-Button Guide Shows Location of Stores

When shoppers in Caracas, Venezuela, want to know where a particular store is located they push a button on an electronic directory. This causes a light to flash on a map of the city, showing exactly where the store is. The directory is in Caracas' new Centro Bolivar business center.



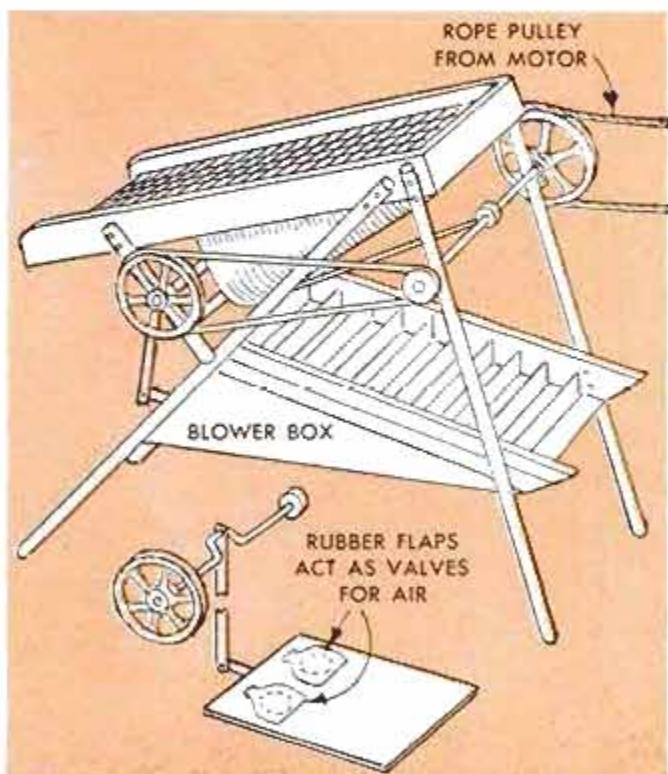
Cantilevered Carport Displayed in Germany

Driving in and out of a carport on display in West Berlin is easy—this one has fewer posts to hit. The cantilevered structure is made of attractive corrugated plastic on a frame of steel pipe. The arched garage was part of the International Building Exhibition.

Power-Mower Engine Operates Dry Gold-Mining Machine

Something new for prospectors is a portable dry gold-mining machine powered by a mower-type gasoline engine. Gold-bearing gravel is shoveled onto a screen which permits small particles to drop

through a trough to a riffleboard. A bellows, with flap valves, forces air through the blower box beneath the riffleboard. The air gusts boost dust and sand over cleats which hold back the heavier gold.



Why

By *Kenneth Anderson*

SHORTLY AFTER THE START of a recent holiday week end, a gang of burglars equipped for leisurely looting climbed to the roof of a safe-deposit company on Chicago's southwest side. They carried acetylene torches, tanks of gas and oxygen, goggles, sledge hammer, crowbars, chisels, electric fan, police radio, two brief cases and a supply of sandwiches and coffee. The yeggs crawled through a skylight and went to work on the ceiling over the vault.

Up to that point, the operation followed the same pattern as an earlier safe-deposit burglary in Seattle. With sandwiches, coffee and plenty of time, the Seattle safecrackers battered through an eight-inch-thick brick wall, burned the locks from two steel doors and cut through a steel-vault wall. They emptied 400 safe-deposit boxes and vanished.

The difference was that in Chicago the burglars never reached the vault. The sound of the first sledge-hammer blow was detected by an ADT Phonetalarm—a supersensitive microphone—concealed within the vault. It caused a red light to flash at an American District Telegraph central station and pin-pointed the scene of the crime by making a colored disk pop into a window of a box on the

In Seattle, burglars had sandwiches and coffee while they emptied 400 safe-deposit boxes. Vault lacked electronic alarms



Burglars Can't Win

Modern electronic alarm systems give crooks a rough time. Ultrasonic waves, infrared rays and supersensitive detectors can stop a safecracker before he gets his tools unpacked.

panel. (Labels on the box identify the protected property and the type of alarm.) Police converged on the building as the burglars, who had intercepted the police radio call, fled over neighboring roof tops.

The Phonetalarm is one of many electronic devices used to guard approximately \$53,000,000,000 worth of property in this country—including the gold at Fort Knox. They function without alerting the crook and help trap hundreds of criminals each year. ADT claims its electronic curtain of protection has proved 99⁹⁹/₁₀₀ percent effective over the past 10 years. A combination of electronic alarms will summon police if a burglar lifts his arm, takes a step, strikes a wall or floor, breaks a pane of glass, or lights an acetyle torch.

One of the newest devices, the ultrasonic alarm, floods a room with sound waves that are beyond the range of hearing for most humans. Any movement within the room upsets the pattern of the 19,200-cycle sound waves and trips an alarm at the central station. The burglar is not aware that he has "recorded" his presence in the room. The ultrasonic alarm often traps a thief who has concealed himself in a store before closing time. This invisible watchman has an added benefit: Rats and mice leave the property because they can't endure the high-frequency sound.

Another swift but silent burglar trap is ADT's Telapproach, which surrounds a safe or other object with an invisible electric field. The body capacity of a person approaching the electronic curtain upsets the balance of the system and trips an alarm. If you are old enough to remember the early radio sets, you may recall that the



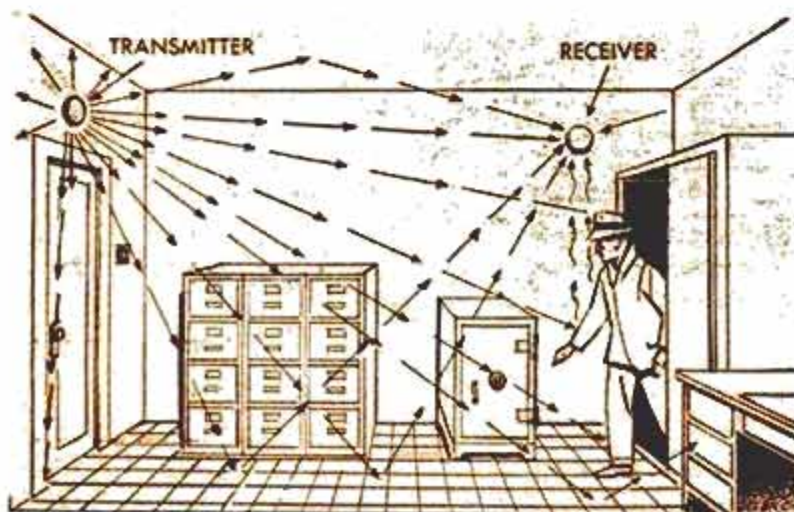
In the days before electronic alarms, thieves could put holes in brick walls without being detected. Noise now trips alarm

Detective looks for evidence in a rifled safety-deposit vault. In pre-electronic days, thieves smashed in concrete floor



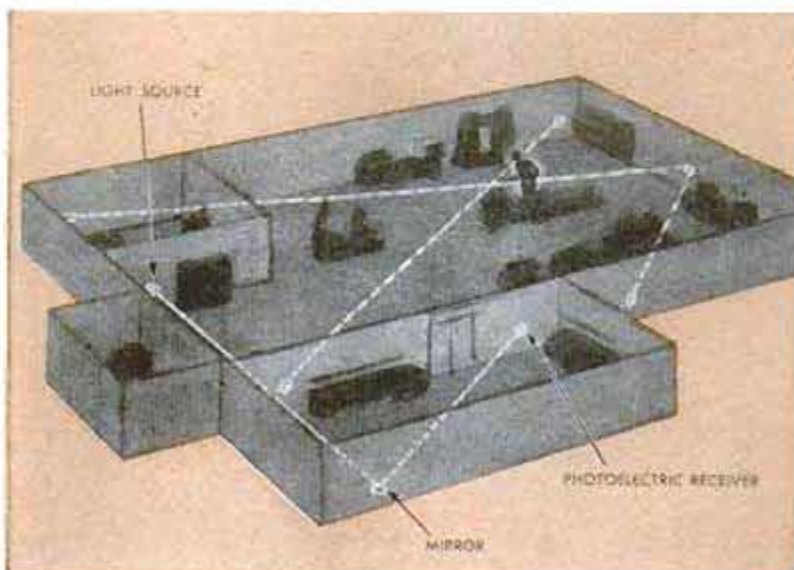


Engineer checks an experimental model of a new electronic alarm system designed for a bank vault. These alarm systems are so sensitive they are activated by the slightest sound



Drawing shows how ultrasonic waves trap burglar. The waves are sent from transmitter above door to receiver at right, being bounced off walls and floor. Intruder disturbs pattern

Photoelectric system below triggers burglar alarm when an intruder passes through the invisible beams. Silent alarm automatically notifies the police without alerting the burglar



set sometimes squealed when you put your hand near the tuning dial. The same principle is used in the Telapproach alarm but the burglar doesn't hear the telltale "squeal."

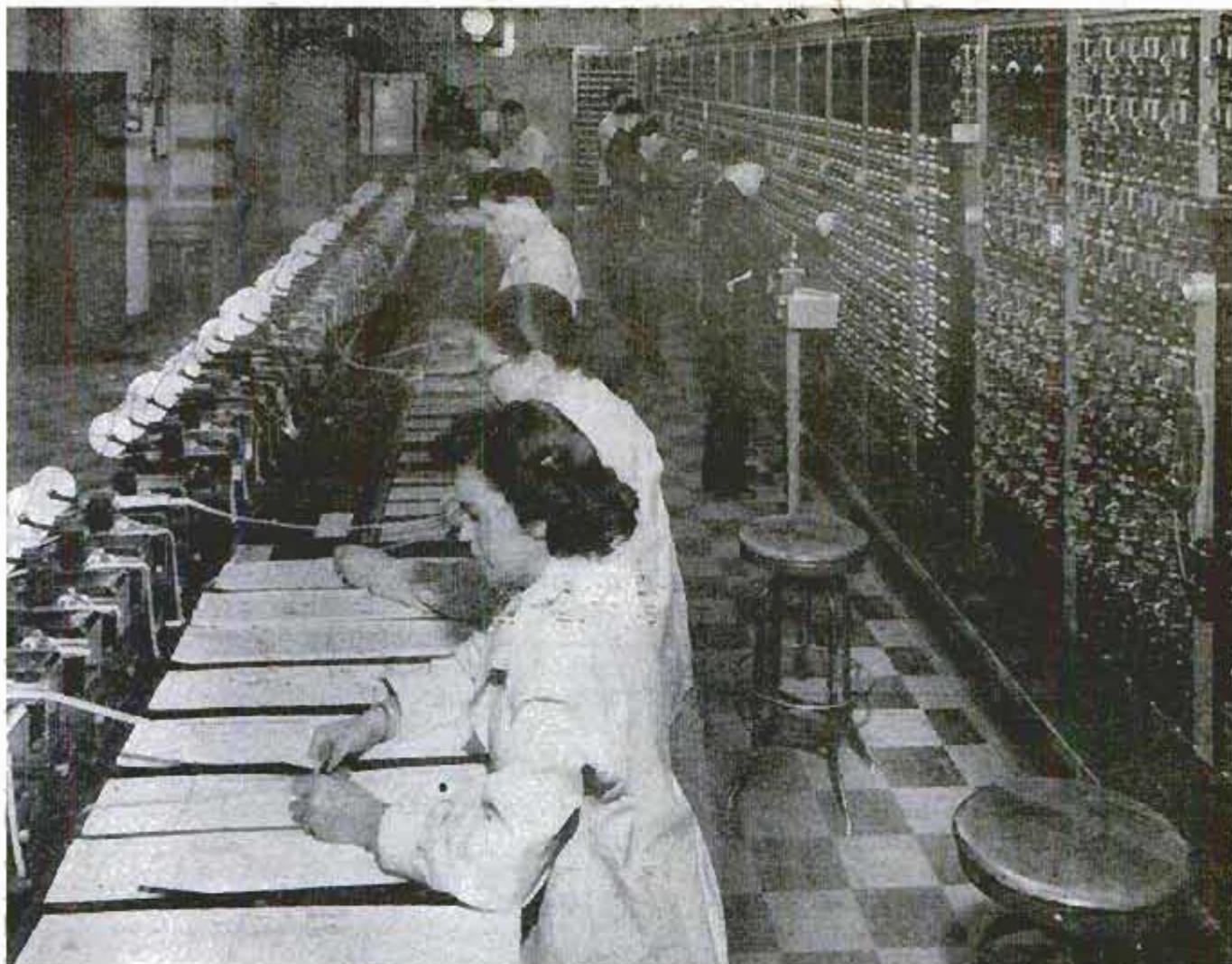
Also Protect Against Fire

Some other devices employed to trap burglars also protect property against fire damage. ADT engineers have developed a heat-detection instrument so sensitive it can spot a man 100 feet away lighting a cigarette. It has been adapted to both fire-alarm systems and vault-protection systems, where it detects the use of cutting torches.

Invisible-ray alarm systems, which use beams of infrared light and photoelectric cells, also may double in burglar and fire protection. A careless guest in a Chicago hotel recently tossed a lighted cigarette from his window and started a blaze on the roof of an adjoining haberdashery. A cloud of smoke wafted through the invisible-light beam and activated the alarm. Similarly, at a Detroit lithographing plant, ADT guards answered an invisible-ray burglar alarm and discovered a smoky, overheated electric motor was the culprit. Many industries now have photoelectric beams focused directly into their heating or air-conditioning ducts. A puff of smoke passing through the duct alerts the central station and causes the dampers to close and the air-circulation fans to stop.

Used as an anti-intrusion device, the photoelectric beam is effective both day and night. In outdoor systems, the beam can be projected for distances up to 350 feet. The usual practice is to build a maze of infrared rays by using mirrors to zigzag beams from several light sources. Some beams are close to the ground or floor so a burglar can't crawl under them while other beams are too high to jump over.

Perhaps the most common burglar-alarm system depends on a thin strip of metal foil, such as you see on many department-store windows and office doors. If the glass is broken, the foil tears and the alarm is tripped. A hoodlum might think it would be simple to smash a small hole in the center



More than a thousand burglar-alarm systems in St. Louis are connected to this busy ADT central station

of the glass without breaking the strip of foil. But ADT engineers and insurance underwriters have learned from experiments that it's virtually impossible to break a pane of glass without breaking the foil if the foil is placed a certain number of inches from the center of the pane. And even a crack in the glass can trip the alarm.

A couple of years ago a turtle escaped from his pen in the pet department of a store. He waddled upstairs and started an alarm by scratching the foil on a door.

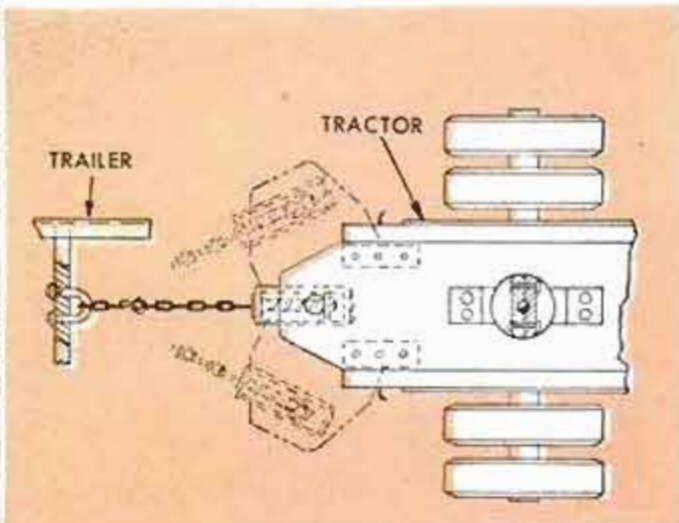
Since time is of the essence in trapping a burglar, one of the simplest yet most effective types of protection for a steel safe is a foil-lined wooden cabinet built around the safe. A yegg cannot reach the safe without first forcing an opening in the cabinet and he can't crack the cabinet without disturbing the electric circuit in the foil lining. Most burglars carry tools that can easily batter through the wooden panels, but the extra few minutes it takes for this task give the police the time they may need to catch the criminal.

Burglar Throws Switch

A burglar who entered a Louisville, Ky., department store tried the apparently

"easy" way of getting through a foil-lined cabinet. He simply threw the ADT burglar-alarm control switch from "night" to "day" position, thinking that would prevent the alarm from sounding at the central station. He didn't know that ADT alarm circuits can't be turned off or on without the knowledge of the men on duty at the central station. In fact, each alarm circuit is tested when a subscriber closes his office, store or factory—just in case some would-be burglar has tampered with the wiring. When the subscriber sets his alarm for "night" position, central-station employees check the circuit. If it is working, they signal the subscriber, usually by causing a bell to ring in the switch box. Opening and closing the alarm-wired door immediately after that tells the central station the owner has "locked up" for the night. ADT employees also make routine checks of the alarm circuits and test the sensitivity of certain devices, such as the Phonetalarm. The Phonetalarm in a fur-storage vault, must be adjusted to the number of furs protected since the pelts absorb some of the sound. The Phonetalarm ordinarily is so sensitive that ADT claims no bank vault equipped with the device

(Continued to page 270)



Pivoted Cylinder Reduces Trailer-Jackknifing Threat

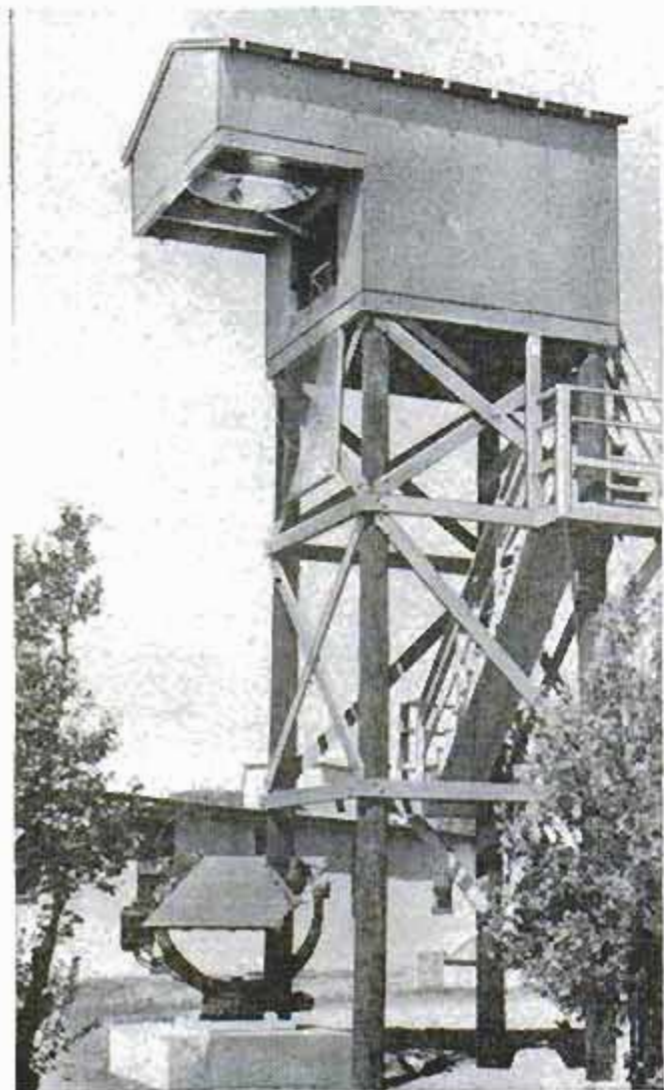
Extra protection against tractor-trailer jackknifing on curves and sudden stops is promised by a device that holds the trailer on its pivot. It consists of a cylinder mounted in a pivoting framework which,

in turn, is attached to the tractor's pivot plate. The cylinder has a powerful coil spring which controls a piston rod. A chain connects trailer and piston, which counteracts the trailer's momentum.

Swivel-Mounted Mirror Tracks Sun for Stanford Solar Furnace

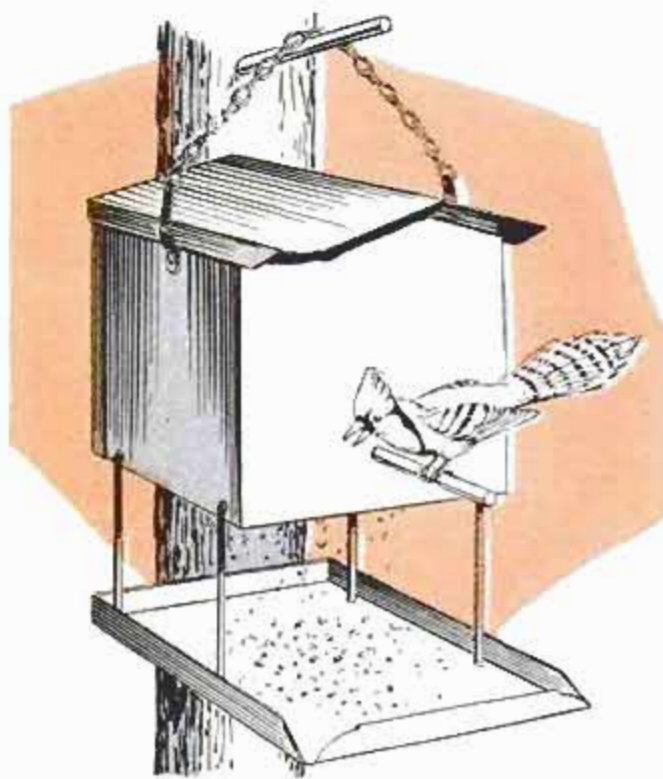
Generating heat up to 6000 degrees F., a solar furnace at the Stanford Research Institute uses mirrors mounted on a swivel to track the sun automatically. The sun-

light is reflected to a curved aluminum mirror, 32 feet above, which concentrates the rays. This permits the furnace to remain fixed instead of following the sun.



Bird Trips Feeder By Landing on Perch

Something new for the birds is a self-service "cafeteria" feeder. When a bird lands on the perch, it trips a lever to dispense an average meal. Several pounds of feed can be stored in it. The device is made of steel, comes painted and ready to hang.



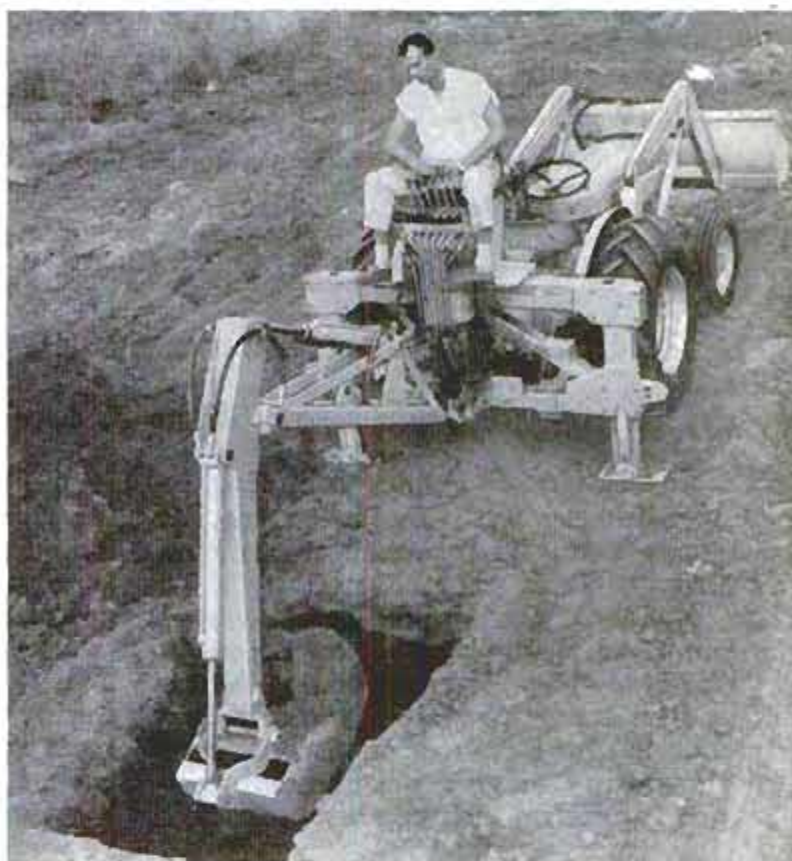
Tire-Skid Detector Thumps Pilot's Foot

Triggered by a sensory device in the airplane's wheel axle, a new kind of antiskid system warns the pilot of an impending skid by rapidly thumping the bottom of his foot. The foot thumper, a vibrating plunger that projects through a hole in the brake pedal, signals the pilot to ease his brake pressure to allow the wheel to rotate again. Pilots of high-speed aircraft may not be aware that the wheels are skidding during a braked stop unless the plane is equipped with a warning device.



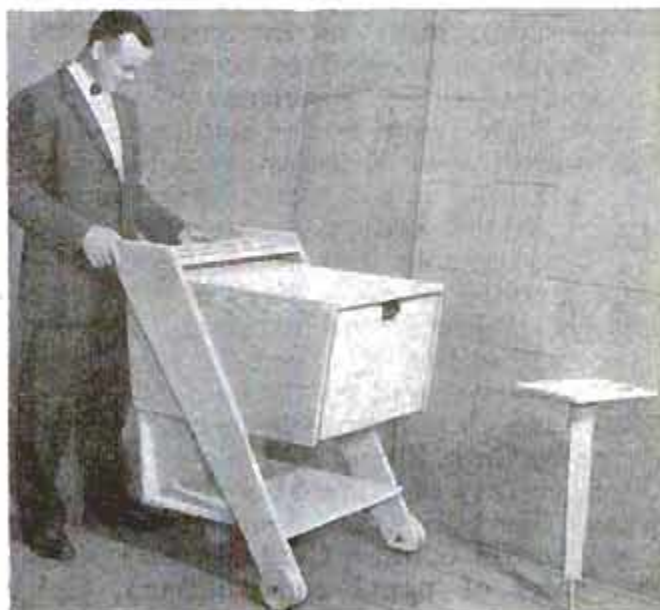
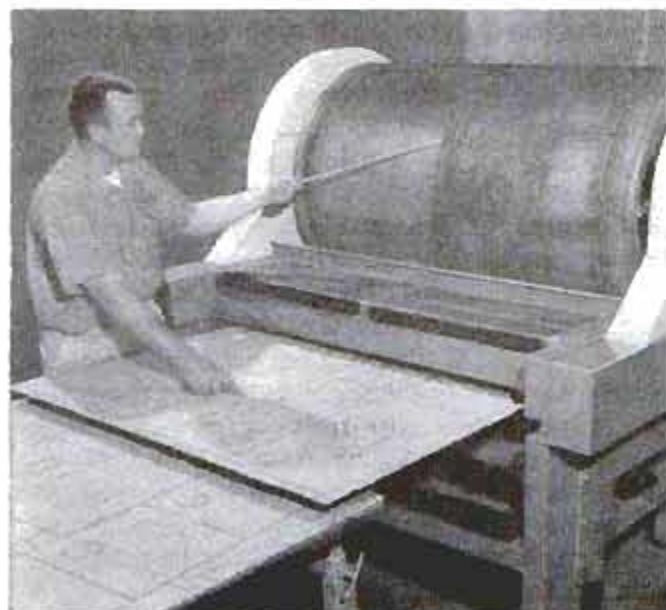
Backhoe Operator Always Faces Work

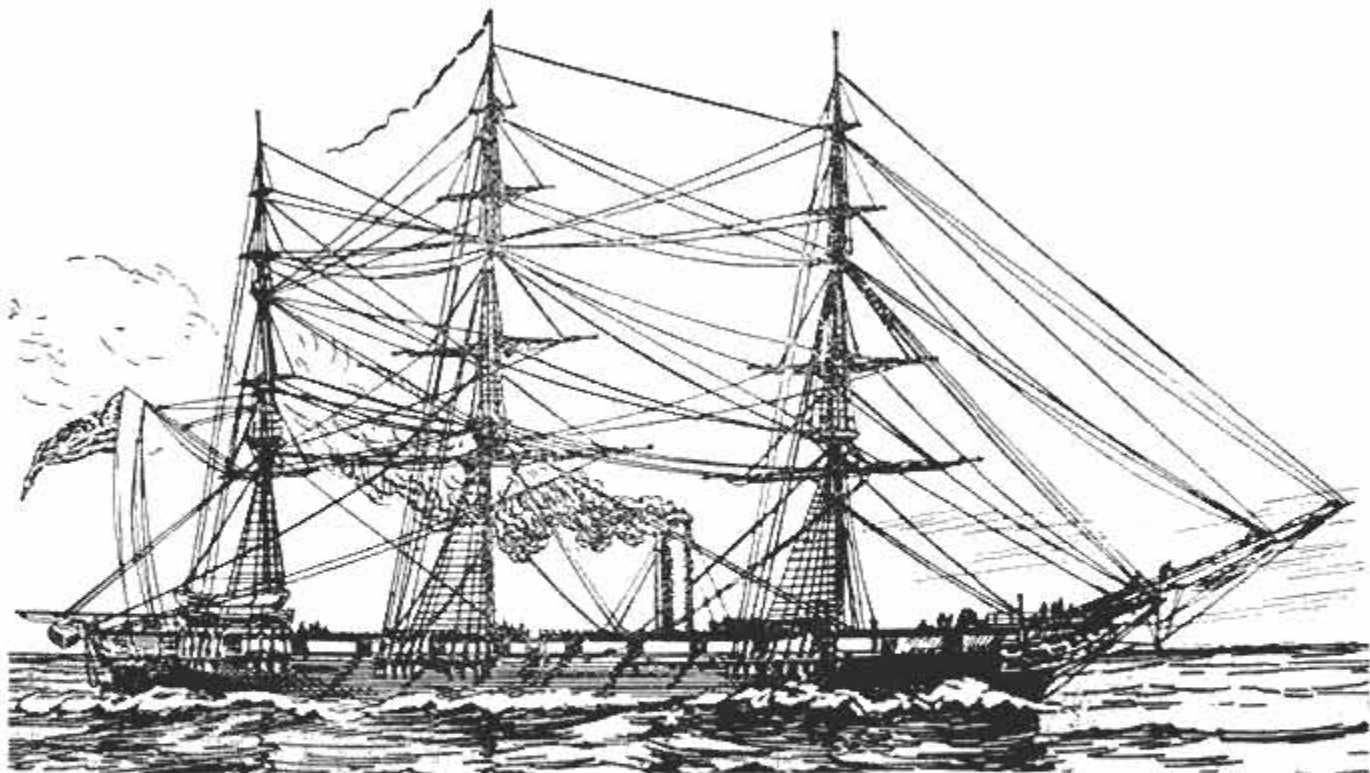
Problems of excavating around pipes and other underground objects are solved with power equipment that allows the operator to see where the bucket is digging. The seat travels with the boom so the man at the controls of the backhoe always faces his work, whether digging or loading trucks.



Patterns on Plywood

Now the do-it-yourself fan can buy a sheet of plywood with the project pattern already printed on the material. Photographs below show the machine used to print cutting lines on a 4 by 8 sheet of plywood and the outdoor serving wagon made from the pattern.





The Bettman Archive

Princeton, fitted for conversion to auxiliary sail, was launched in 1843 and changed course of naval history

The Saga of the USS *Princeton*

The world's first screw-propelled warship

By William R. Graydon

STOCKTON, CALIF., came within inches of winding up with another name. It might have been Woonsocket, Kearny or Shickshinny. Take your choice.

The incident that almost eliminated Stockton from the running took place on Feb. 28, 1844, when the USS *Princeton*, the world's first screw-propelled warship, lay at anchor in the Potomac off the nation's Capital, waiting to give a command performance for distinguished guests.

Commanded by Capt. Robert Field Stockton, the amazing propeller ship boasted something quite as intriguing as its steam-driven engines: Two huge, wrought-iron guns called the "Peacemaker" and the "Oregon." Designed by the brilliant Swedish inventor, John Ericsson, who also had originated the ship's plans, these extraordinary naval cannon reportedly could fire 213-pound shot up to three miles.

The promise of witnessing the big guns in action while cruising down the Potomac was a magnet for Washington's top brass. Marines were drawn to attention as President John Tyler was piped on board to be greeted by Capt. Stockton. Following Tyler were Secretary of State Abel Upshur, Sen. Thomas Hart Benton, Secretary of the Navy Thomas Gilmer, Capt. Beverly Kennon (chief of naval construction), Col.

David Gardiner (the president's father-in-law) and a host of other dignitaries. Mrs. James Madison, nearly 80, joined 200 prominent ladies who added a splash of color to the scene.

It was a proud day for Robert Stockton. The *Princeton*, which promised to revolutionize world shipping, would have remained nothing more than a blueprint if Stockton had not used all his zeal to bring her into existence.

Years earlier, Ericsson had offered his invention to the world's ranking sea power, England, and even built a screw-propelled barge to demonstrate his idea. But the British Admiralty tossed the invention aside, dismissing it as impractical. Stockton met Ericsson while visiting the U. S. consul at Liverpool. One excursion down the Thames on Ericsson's barge was enough to convince Stockton. The American asked Ericsson to build two iron boats of a similar design for the United States.

Earlier, Sir William Simonds, chief contractor for the British Navy, summed up the Admiralty's opinion by remarking, "Even if the propeller had the power of moving a vessel, it would be found useless in practice, because with power applied in the stern, it would be absolutely impossible to make the vessel steer."

Other British naval engineers put it more graphically: "When people can walk on their hands or horses are harnessed to the back of a wagon, then the Swede's outlandish idea might be practical."

Fortunately, Stockton had ample private means, because he had to shell out large sums on plans and models before he could convince his own Navy Department of the propeller's value. Ericsson joined him in the United States in 1839, but their initial efforts met a brusque reception. Crusty commodores eyed the project coldly. Paddle-wheelers might blunder their way about in river traffic, but a screw-driven man-of-war was something else. And nothing could replace sail in crossing the ocean.

Eventually Stockton wore them down, and in 1841 he was permitted to build the Navy's first steam-driven warship utilizing the propeller. Two years later, the *Princeton* was launched at Philadelphia.

Little wonder Capt. Stockton glowed with pride that mild winter day as his unique craft made its way down the Potomac with its distinguished guests. In turn, the visitors found much to interest them. Outfitted for conversion to auxiliary sail, the *Princeton* was the fastest steamship afloat. Her engines, snug below decks, were almost invulnerable to enemy gunfire, and could take her in and out of port at will.

Remarkable though the engines were, the ladies and gentlemen found themselves eyeing the two huge cannon with awe. Devised by Ericsson, the powerful cannon were the first of their type to be built of wrought iron. The "Oregon," on the stern, weighed seven tons while the "Peacemaker," a 10-ton gun, was on the bow.

Ericsson's inventiveness had not ceased



Courtesy U.S. Navy

Robert Stockton saw importance of Ericsson's invention. His efforts brought *Princeton* into existence

with the guns proper. He designed a new type of gun carriage to handle their terrific recoil, and also a self-acting lock that allowed the cannon to be elevated or deflected, a giant stride in naval armament. The soundness of the guns was revealed in a test-firing run when they were brought to bear on a dummy-ship target. Using only light charges of powder, the shots passed through timbers 57 inches thick. Six shots struck the same horizontal plank in the target at a distance of more than a half mile. The exhibition affected naval

Explosion of the big gun killed two cabinet officers. President Tyler escaped because he was below deck

The Bettman Archive





The Bettman Archive

John Ericsson designed the screw-propelled *Princeton* and the two huge guns which affected naval warfare

warfare as dramatically as Ericsson's propeller.

In addition to her heavy cannon, the *Princeton* carried twelve 42-pound carronades. With the ship gliding along between open reaches, Stockton demonstrated its firepower by firing each piece in rapid succession, winding up with an earth-shaking roar from the "Peacemaker." The ship shook with the concussion and the deck was clouded in smoke. Stockton commented, "It's nothing but honest gunpowder, gentlemen. It has a strong smell of the Declaration of Independence, but it's none the worse for that."

The guns made a favorable impression on the President, his party and the other guests. During the cruise down the river, the big guns were discharged time and again until the guests' curiosity had been satiated. Then the passengers went below. Passing under Fort Washington's battlements on the right, below Alexandria, the guests were treated to dinner.

After the meal the ladies remained at their tables while several male guests went topside for a smoke and stroll about the decks. Capt. Stockton, who had stayed below with the President, was preparing to offer a toast to Tyler when an officer informed him that some of the company wanted one of the guns fired again.

Stockton dismissed the aide with "No more guns tonight." A moment later the officer returned with a message from Secretary of Navy Gilmer, expressing his de-

sire to see the "Peacemaker" in action once more. The *Princeton's* captain took the request at face value, as an order, and went on deck to carry it out. When preparations had been made, Stockton placed himself on the breech of the gun, aimed and fired.

The blast came with a blinding flash as the "Peacemaker" burst with a roar, shattering 20 feet of the bulwark as it blew up.

Col. Gardiner and Mr. Moxey, former chargé d'affaires at The Hague, were killed outright, while Capt. Kennon fell back mortally wounded. Sen. Benton was felled by a head wound, and a servant standing next to him was killed. Secretary of State Upshur, uncertain of the guns all day and half-hidden by the foremast, was killed by a chunk of hot shrapnel, while Navy Secretary Gilmer was slammed to the deck in a lifeless heap.

President Tyler, about to join his friends topside, had been detained by one of the ladies and was on the point of excusing himself when the blast shook the *Princeton*.

Stockton, standing at the gun, had a miraculous escape, although he was badly scorched and temporarily blinded. Groping on the deck, he managed to retain command, even making sure the seriously wounded received immediate care. The ship was met at Alexandria by the *Joseph Johnston*, which carried the dead and injured back to Washington.

Sen. Benton and the other wounded, including Stockton, eventually recovered. The blast could have been a deathblow to the career of the *Princeton's* captain, but a naval court of inquiry absolved Stockton and Ericsson of blame.

Fully recovered by mid-1846, Stockton, now a commodore, was dispatched to New Orleans with the *Princeton* to transport the 3rd Infantry, including Lieut. Ulysses S. Grant, to the east coast of Mexico. Later he was assigned to relieve Commodore Sloat at Monterey, Calif.

A veteran of the War of 1812, Stockton played a vital role with Frémont and Kearny in the conquest of California, but in perspective these exploits were dwarfed by his staunch support of John Ericsson. Stockton's unyielding belief in his friend's inventions literally changed the course of U. S. Naval history.

Yet it almost turned out otherwise. The fatal blast that snuffed out the lives of cabinet members and missed killing or wounding President Tyler by a whim of fate, also came within inches of removing Capt. Robert Field Stockton from the scene.

Except for that narrow margin, the folks at Stockton, Calif., might find themselves writing another name on their return address. Say Shickshinny. ★ ★ ★



Is Population Outgrowing The World?

ONE TENTH of all the persons who have ever lived on our earth are alive today. That statement, more than any other, dramatizes the rapid growth of world population in our day.

Any precise census of the entire world is an impossibility. The sociologists who study the problem on a global basis, however, estimate today's population somewhere in the neighborhood of 2.7 billion persons and predict that it will reach 4 billion by the year 2000.

They estimate the daily net growth—new births minus deaths—between 110,000 and 130,000.

Is it time we became alarmed? More than 100 years ago the problem concerned the Rev. T. R. Malthus (1766-1834), political

(Continued to page 264)

BEGINNING WITH this page, *Popular Mechanics* presents its Sixth Annual Automotive Section—your yearbook of the industry. Highlighting the section this year is a full-color portfolio of the 16 most significant cars in American automobile history. These are cars of great social, mechanical or economic significance. This is just one of the many articles about all phases of the industry, ranging from the all-new Thunderbird to the Sputnik-like Heinkel.

America's Most **SIGNIFICANT CARS** *a Historical Portfolio*

Paintings by Ed Vebell

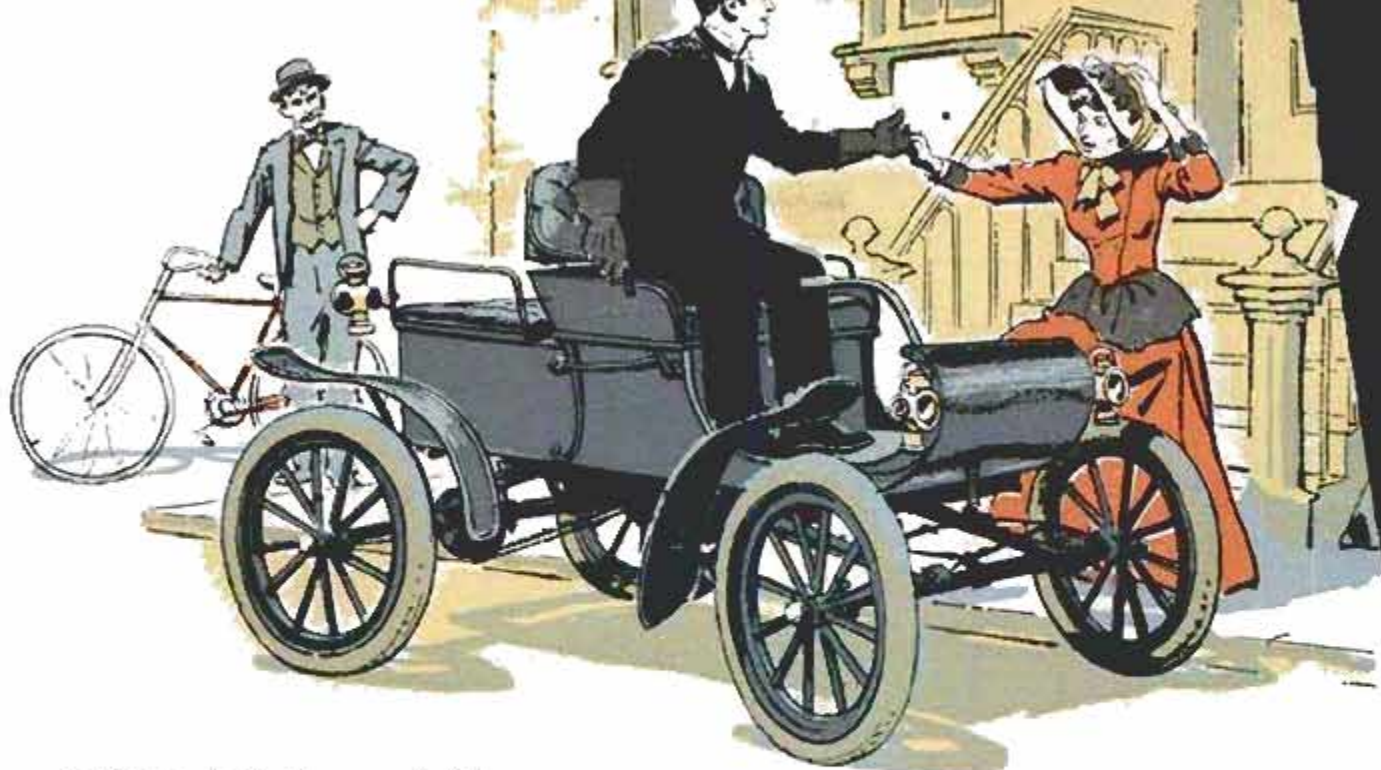
IT'S DIFFICULT to think of any material object of greater significance in American life than the automobile. It has influenced our cities, our farms, our homes, our recreation and our work.

It has permitted us to travel more than any people ever traveled in history before us. It has permitted cities to spread out and overflow into suburbs. It has, tragically, provided a means of involuntary manslaughter that makes predicting holiday death tolls a national pastime.

The automobile, we all must admit, has and will continue to have great significance.

Among the many thousands of makes and models of cars that have been manufactured in this country, most have had no lasting influence on either the nation or the industry. Like fashions in dress and architecture, they have often come noisily and gone quietly.

But there have been cars of great influence. These are the significant ones. *PM* asked five automotive historians (see page 153) to help us select the 16 cars that have been the most significant. The following eight-page color insert presents their choices. A longer list appears on page 153 so you can match your selections against those of the experts.

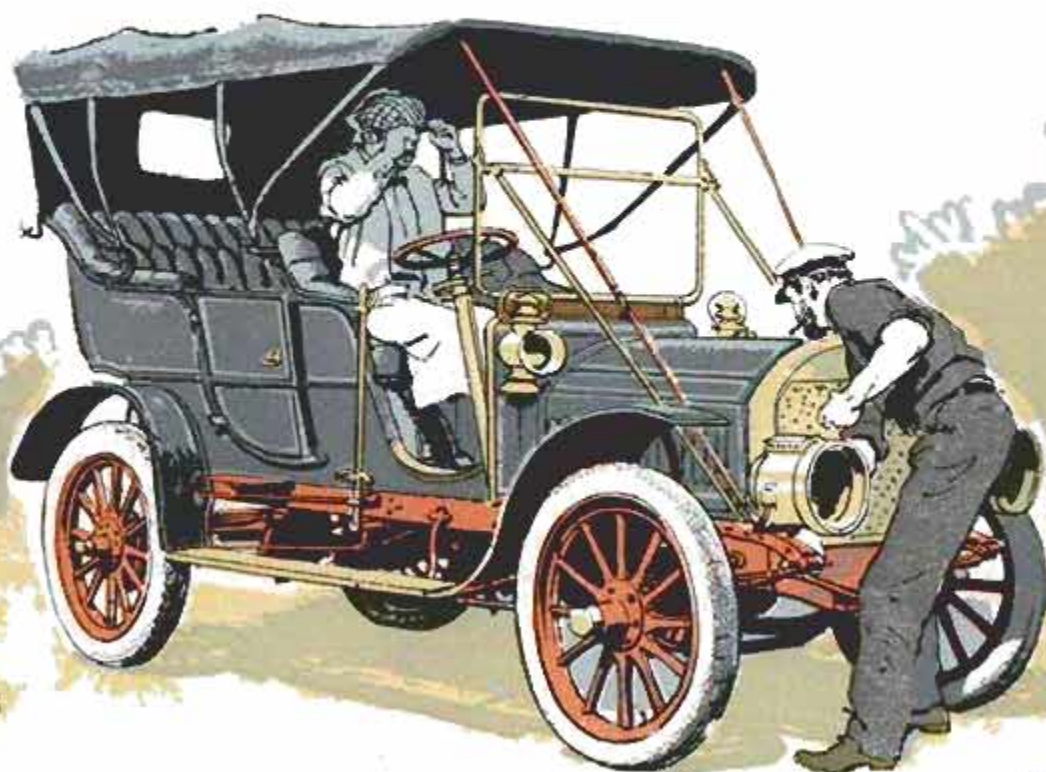


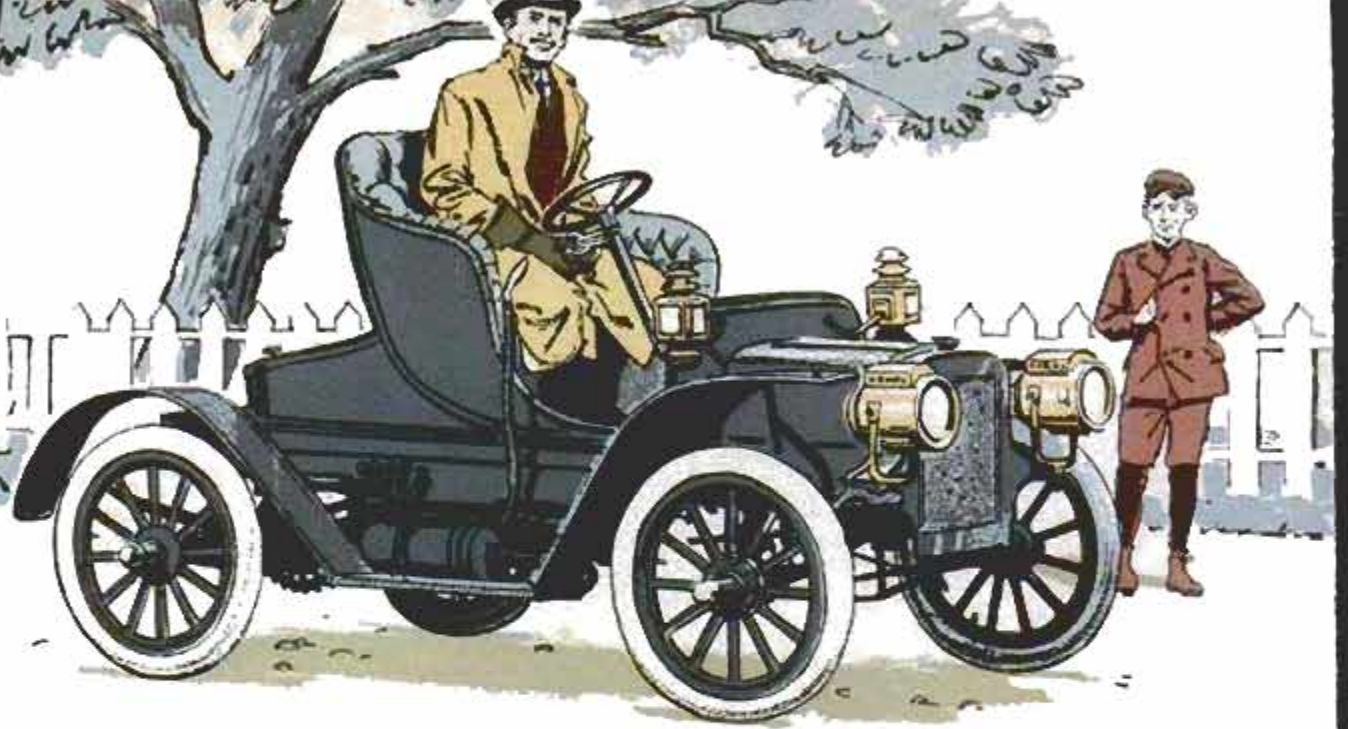
1902 Oldsmobile

Although primitive in design, the curved-dash Olds was our first mass-produced gasoline car. Reliable, quiet, it sold in volume. Production jumped from 425 in 1901, to 3299 in 1902, 5000 in 1904

1905 Pierce Great Arrow

Proving that cars could be top-quality machinery, this touring car established a reputation for reliability. It had a cast-aluminum body with rear doors, steering-column gear shift, battery ignition



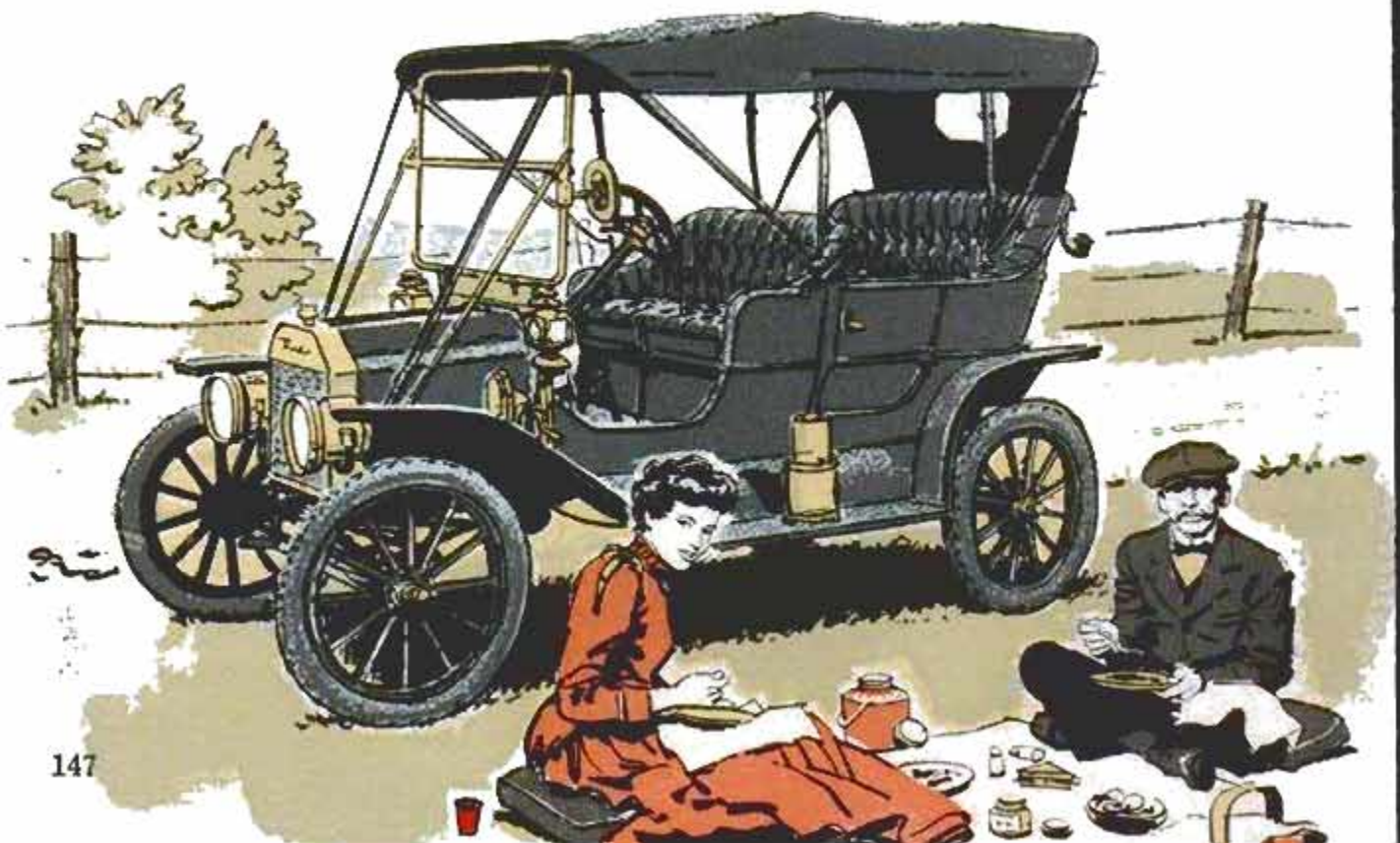


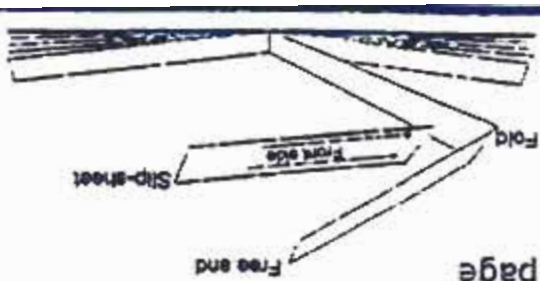
1908 Cadillac

Interchangeability of parts was proved when three 1908 Cadillacs were torn down, the parts of all three scrambled and the cars reassembled to run perfectly and win the famed DeWar Trophy

1909 Ford Model T

More than a car, the legendary Model T was a symbol of America on wheels. Over 15,000,000 were produced in 19 years. It was a simple, reliable machine with many minor faults, few major ones



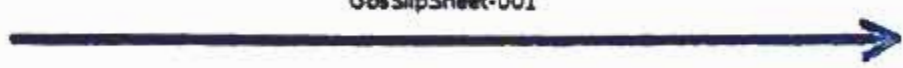


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 1. Front side touching the free page
 2. Arrow pointing to the fold
3. Slice the folded edge
4. Close the page and slip-sheet

Inverted Foldout slip-sheet



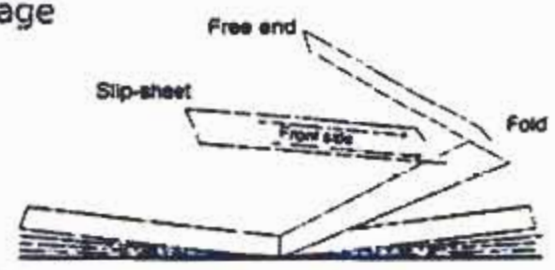
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Foldout slip-sheet

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2. Insert this sheet with
 1. Front side touching the free page
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4. Close the page and slip-sheet



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Inverted Back



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Back

1. Follow instructions on the other side



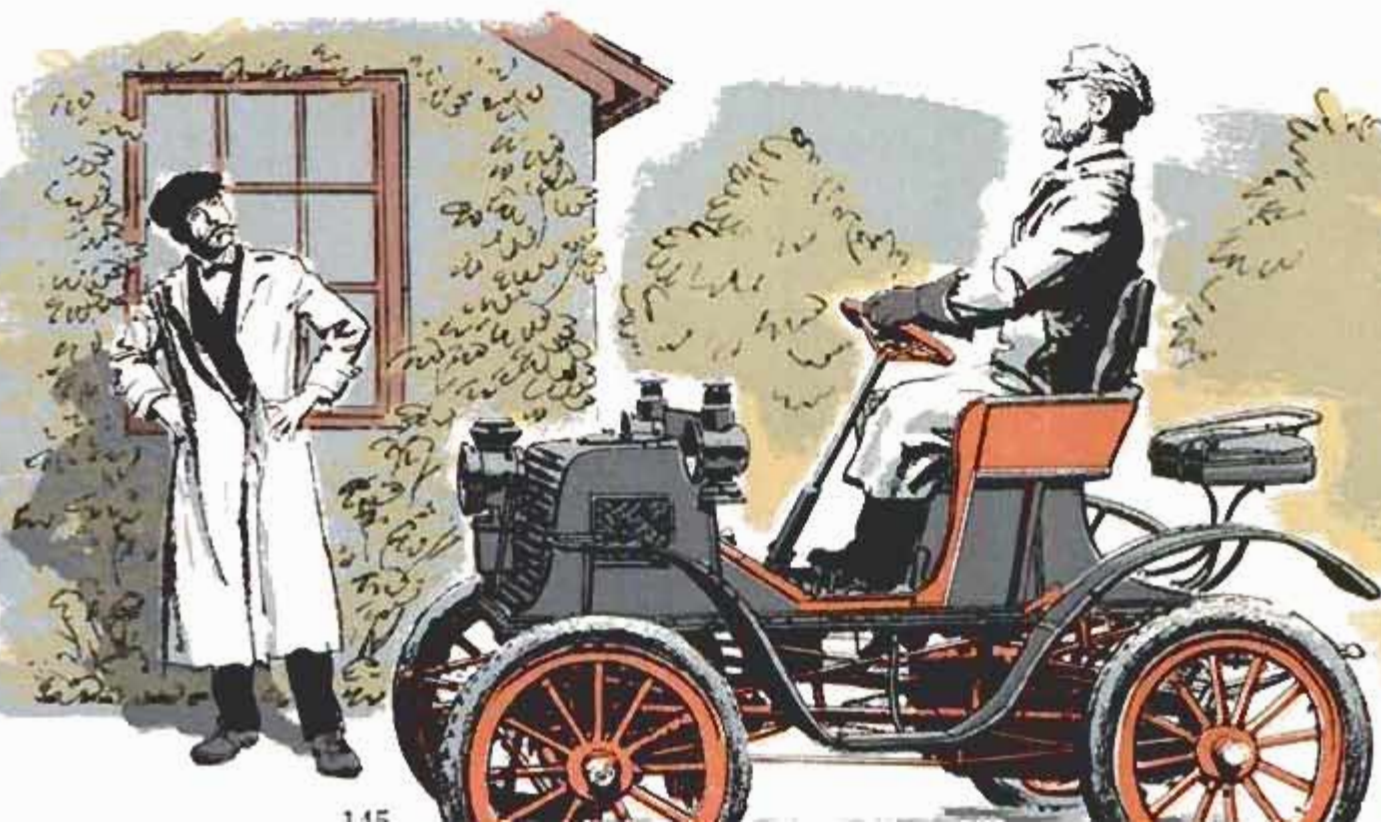
1896 Duryea

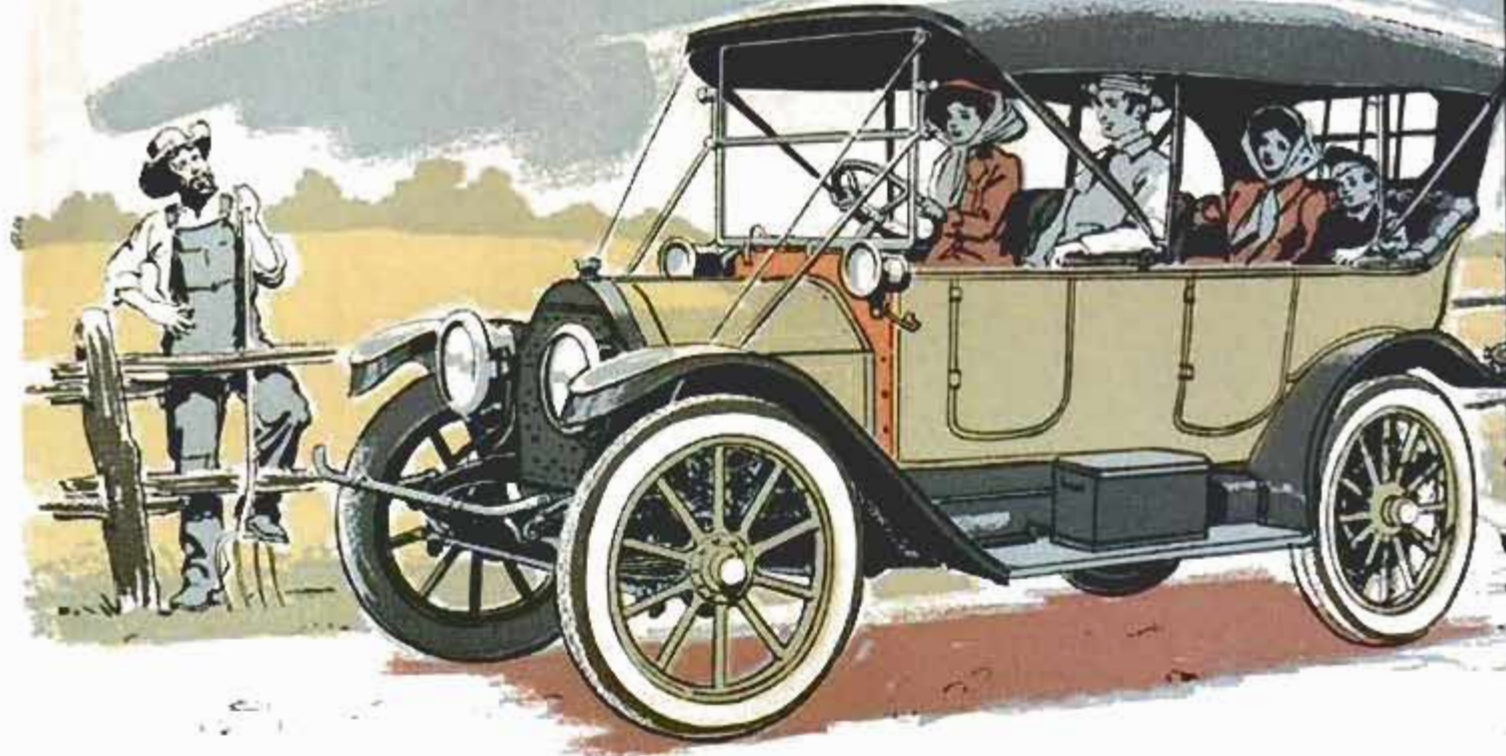
With this car, an industry began. First to be produced in quantity (13 were built in Springfield, Mass.), first to be sold to a customer, it was designed by J. Frank Duryea, now living in Connecticut

Box 4, MADISON, CONN.

1898 Columbia Mark VIII

Basic design has changed little since this car. It had left-hand steering by a wheel, front engine behind a radiator, sliding-gear transmission with clutch, shaft drive. Designer: Hiram Percy Maxim



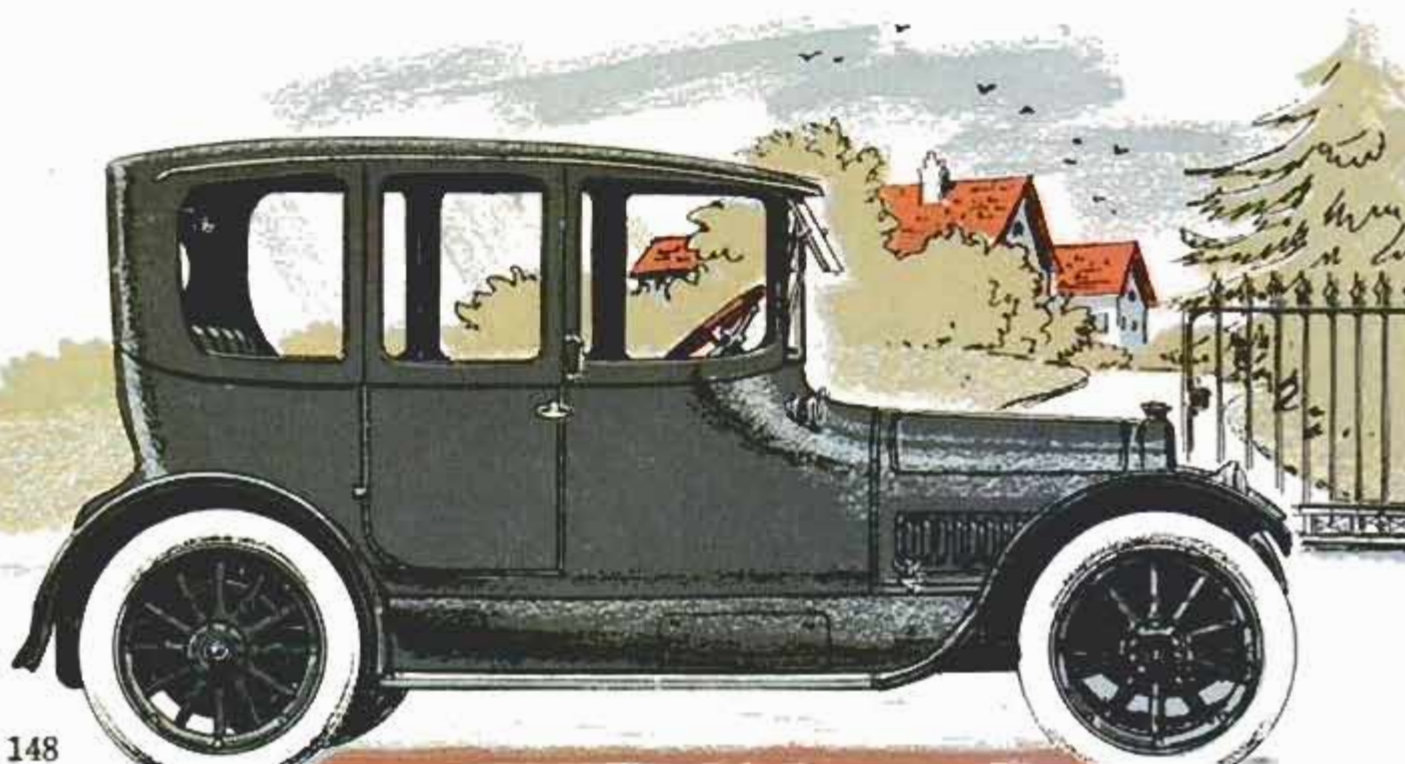


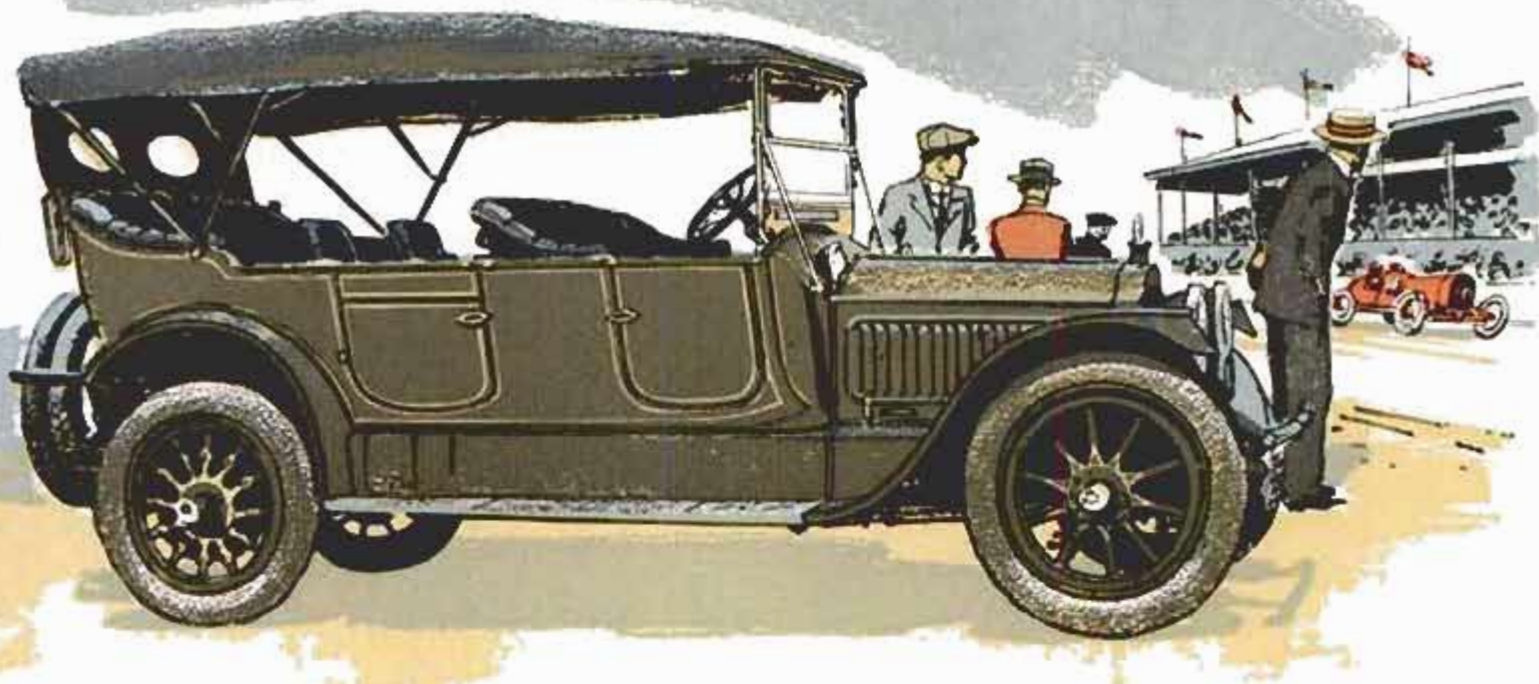
1912 Cadillac

Cadillac's self-starter of 1912 began the feminization of man's plaything, the automobile. Not the first nor the best self-starter, it was the first to be installed as standard equipment in America

1915 Cadillac

Forerunner of today's power plants, the Cadillac V8 was the first high-speed V8 engine in America. The reliable and well-designed engine was concealed beneath a stodgy, lackluster body





1916 Packard Twin-Six

SEE AUG 58, 12
+ OCT 58, 8

Smoothness and power were combined in the thrilling Packard Twin-Six, best of the 12-cylinder designs. Performance of this elegant car proved that there could be more to driving than transportation

1921 Essex Coach

When Essex offered the glassed-in comfort of a coach for a price just a bit higher than its open model, a revolution began. After 1921, the days of the windy and dusty open car were numbered



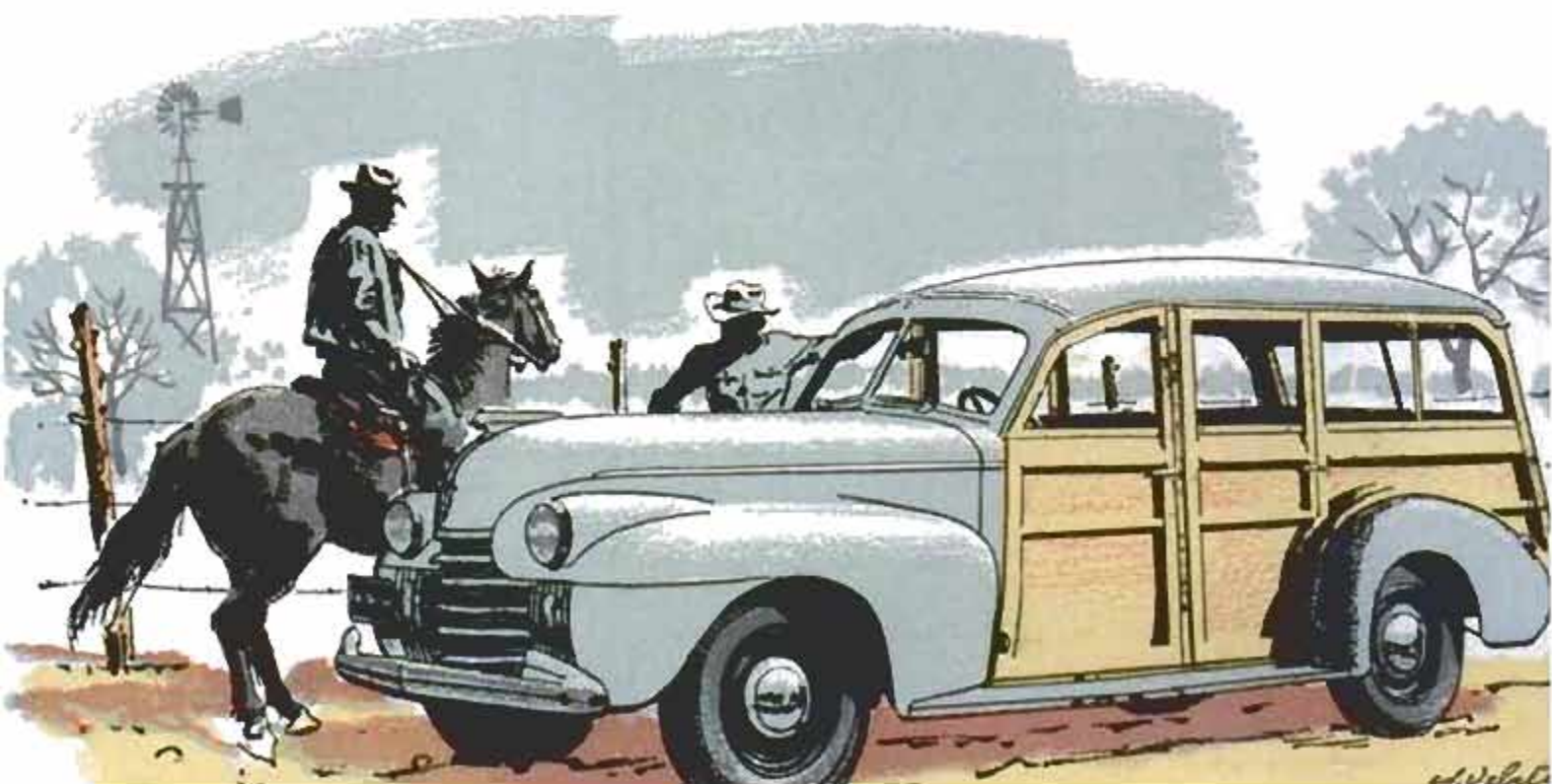


1934 Chrysler Airflow

Significant in failure, this pioneer attempt at streamlining taught that change must be gradual—a lesson still remembered. It also proved that no matter how advanced, an ugly design won't sell

1940 Oldsmobile

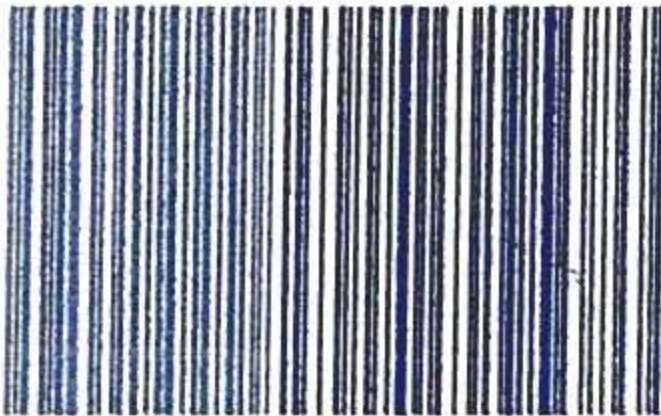
Nothing since the self-starter has been as significant as the automatic transmission. The 1940 Olds was the first to offer a reliable unit, an important step toward the fully automatic car



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Back

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Inverted Back

1. Follow instructions on the other side

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Inverted Foldout slip-sheet

1. Open the foldout page
2. Insert this sheet with
 1. Front side touching the free page
 2. Arrow pointing to the fold
3. Slice the folded edge
4. Close the page and slip-sheet



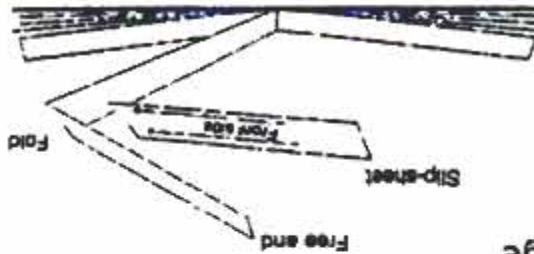
Foldout slip-sheet

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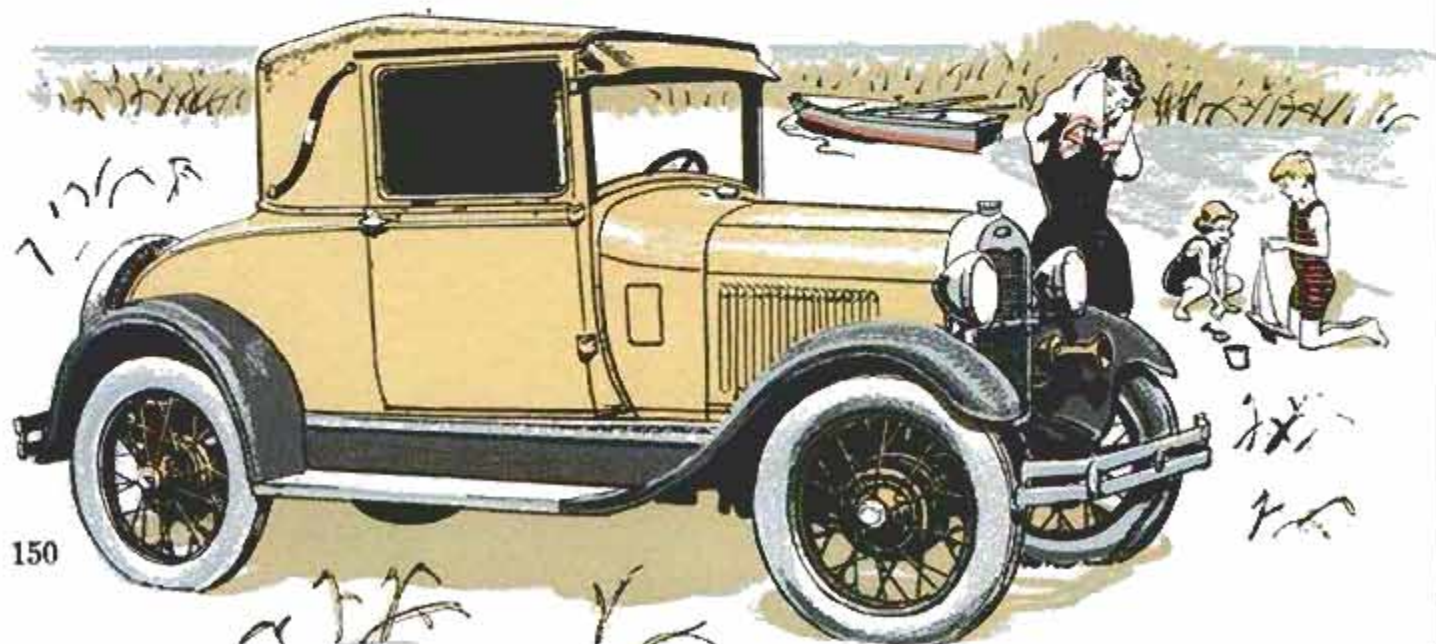


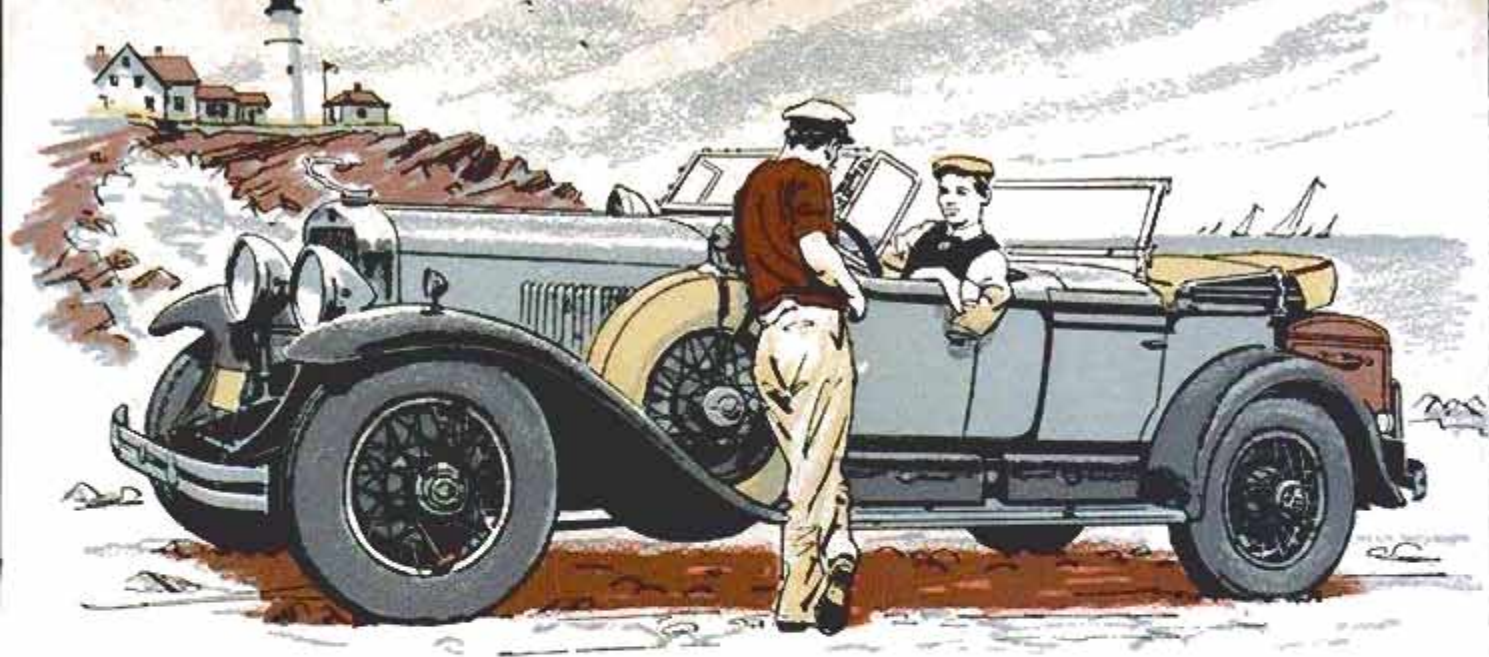
1924 Chrysler

With a high-speed, high-compression engine, with its four-wheel hydraulic brakes, small wheels and large tires, the first Chrysler was a pace setter for the industry both in style and in substance

1928 Ford Model A

After the Model T came the Model A. No financial success, the car was simple, reliable and rugged. It was basic automobile design at its best. Shatterproof windshield glass was a real safety first



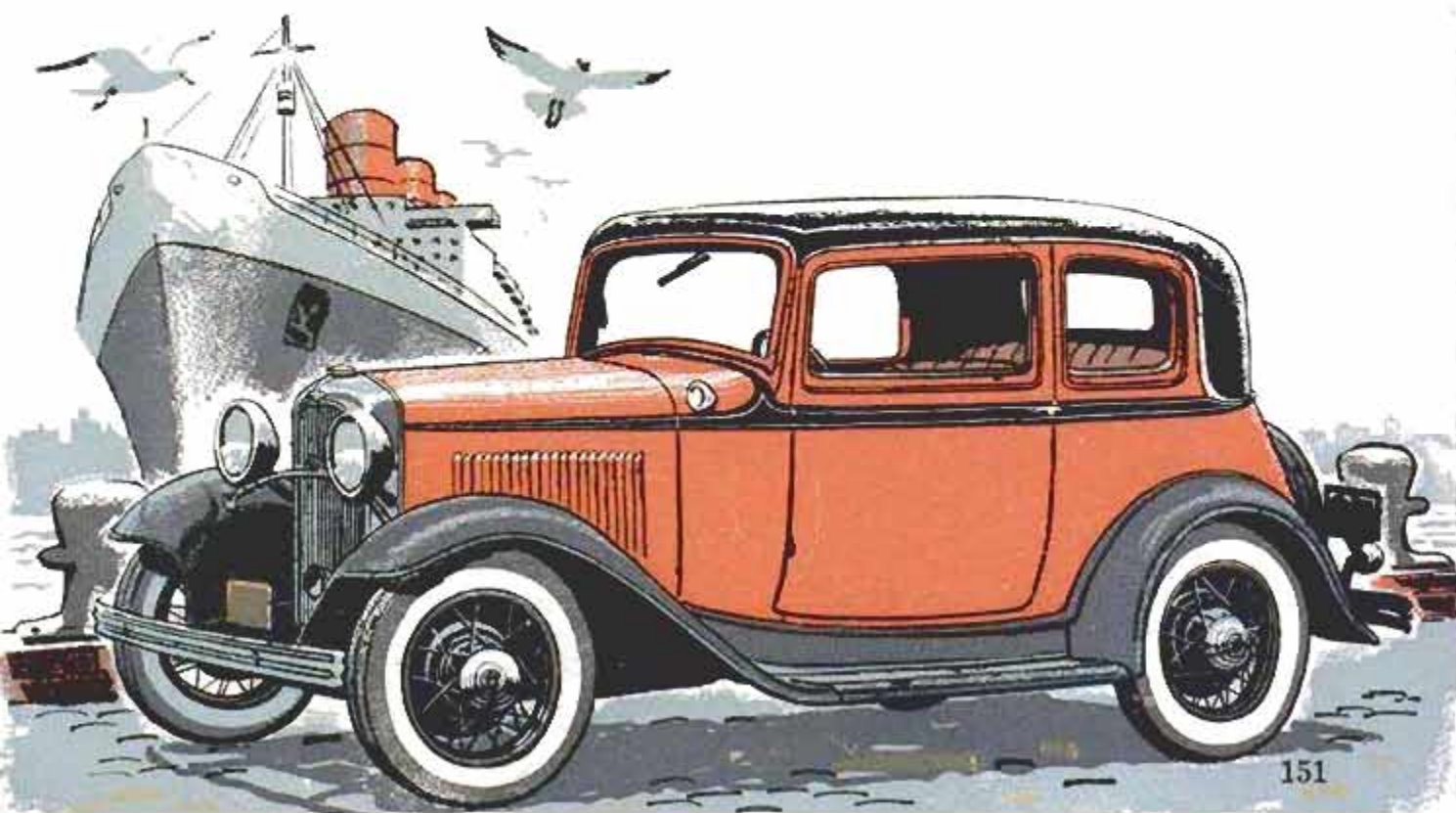


1929 Cadillac

Continuing to make driving easier, the 1929 Cadillac brought out its synchromesh transmission. No longer could you identify the novice driver by the grinding noises as he shifted the gears

1932 Ford V8

Bold, indeed, was the step Ford took when it introduced the powerful V8 engine into the low-price field, an engine so far advanced that it was built without major change for 22 years



Here Are the Experts

WHO HELPED PM SELECT THE SIGNIFICANT SIXTEEN

Popular Mechanics wishes to thank the following experts on American automotive history for their help in selecting the Significant Sixteen:

Christy Borth

DETROIT, MICHIGAN.
Special assistant to the
Managing Director
Automobile Manufacturers
Association

Henry Austin Clark, Jr.

Long Island Automotive Museum
SOUTHAMPTON, NEW YORK.
An outstanding authority on
old cars

Walter O. MacIvain

MANCHESTER, CONNECTICUT.
Editor of *The Bulb Horn*,
official publication of the
Veteran Motor Car Club of America

Smith Hempstone Oliver

LAKE WORTH, FLORIDA.
Former Associate Curator,
Head of Section of Land
Transportation,
Smithsonian Institution

David J. Wilkie

DETROIT, MICHIGAN.
Automotive Editor of the
Associated Press since 1939
and veteran observer of the
automotive industry

How Would You Have Picked Them?

To narrow down the list of great automobiles that have been built in the United States to the Significant Sixteen is an arbitrary job. Some cars are omitted that, some experts will feel, should have been included. So that you will know which cars came closest to being included, we are printing the list of cars in the final elimination round. From this list of 33 cars, the Significant Sixteen were selected.

How would you have picked them?

An Honor Roll of Great Cars

1896 Duryea	1909 Simplex	1925 Hudson
1897 Stanley Steamer	1911 Mercer	1928 Ford Model A
1898 Columbia Mark VIII	1912 Cadillac	1929 Chrysler
1902 Oldsmobile	1915 Cadillac V8	1929 Cadillac
1904 Sturtevant Automatic	1915 Packard	1932 Ford V8
1905 Franklin	1916 Hudson Super 6	1933 Chevrolet (Turret Top)
1905 Marmon	1924 Packard	1934 Chrysler Airflow
1905 Pierce-Arrow	1921 Essex Coach	1936 Lincoln Zephyr
1908 Cadillac	1921 Duesenberg	1940 Oldsmobile
1909 Ford Model T	1922 Rickenbacker	1940 Bantam Jeep
	1923 Oakland	1947 Studebaker
	1924 Chrysler	

REPRINTS OF THE SIGNIFICANT SIXTEEN

Reprints of these 16 paintings printed on one side only and suitable for framing are available (as long as the supply lasts) for 25 cents in coin to cover costs. Address requests to

Bureau of Information,
Popular Mechanics, 200 East Ontario St., Chicago 11, Ill.

THE 1958 CARS

DETROIT LISTENING POST

By Art Railton

ARE WE JUST going over the hump? Could be. This may be the year of the Big Switch. There's something different in the air.

True, there hasn't been any stampede yet, but there's more sales emphasis on economy than in many years.

George Romney, president of American Motors, and Crown Prince of the Compact-Car Dynasty, recently predicted that 350,000 imported cars will be sold in 1958. If true, that will cause pencil sharpening in Detroit.

In 1950, there were only 16,336 foreign cars sold here (most of them sports cars). In that year 6,326,000 American cars were sold.

In 1958, Romney predicts that there will be 350,000 foreign cars sold (21 times as many) and, he says, only 5,800,000 American cars (500,000 fewer than in 1950).

When American-car sales sag and import sales skyrocket, something's going to be

done. That you can bet your money on.

Rambler's new American represents the first time in memory that a company has reincarnated a discontinued car (the smaller Rambler of 1955). This is the equivalent of heresy in the automobile business. "Americans will never go backward" has been the Detroit slogan for years.

But Romney feels certain that now is the time to test that slogan. He plans to build 20,000 of these small cars in 1958. The sales will not, AM feels, cut into Rambler sales, but will be all-new business. Rambler, incidentally, virtually alone in the industry continues to sell in sharply increased volume.

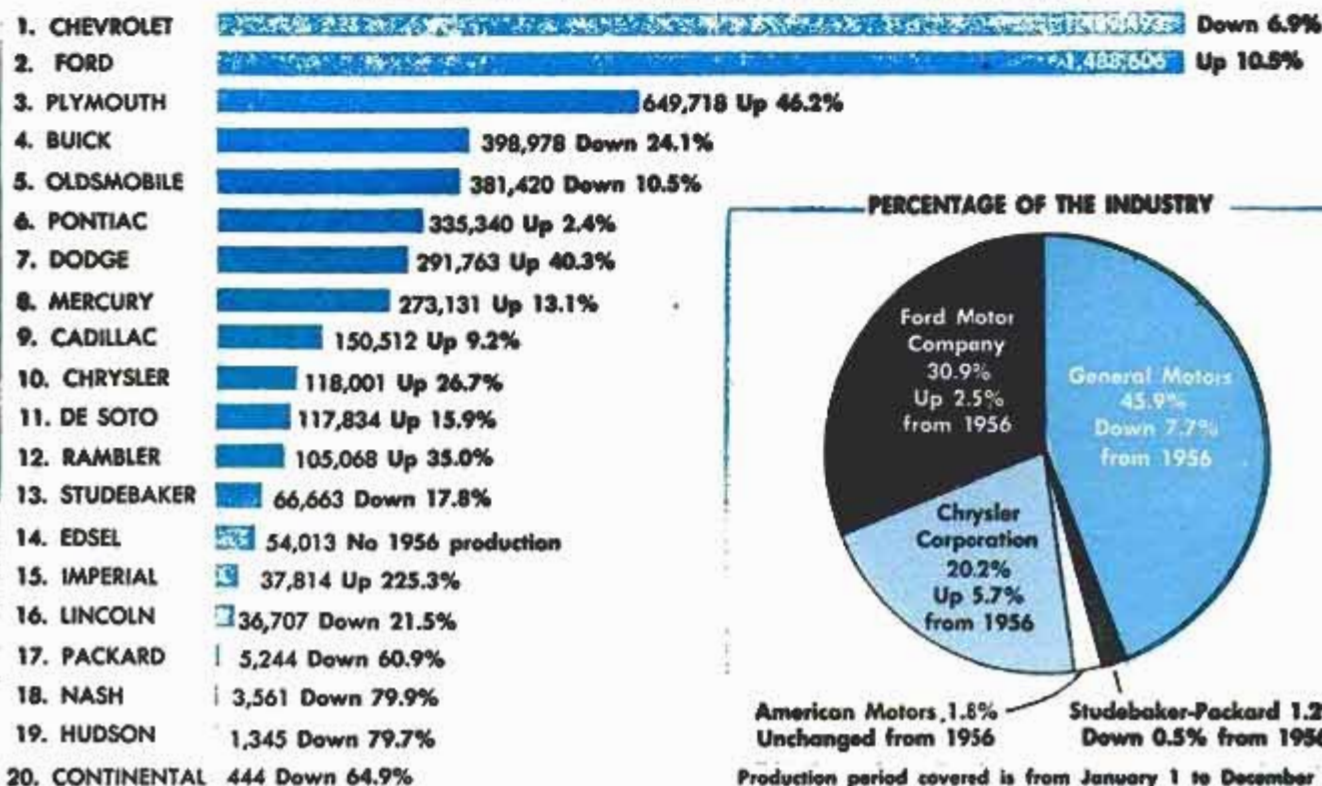
Mercury is considering a revival of its Medalist. Another indication of the Big Switch. This low-price line was dropped to make room for the Edsel between Ford and Mercury. But Mercury sales apparently are soft enough to cause talk of reviving the price leader.

Oldsmobile reduced horsepower and increased economy of its 1958 Eighty-Eight model (only slightly, to be sure, but an indication of the trends of the year).

Ford is pushing its lowest-price model in

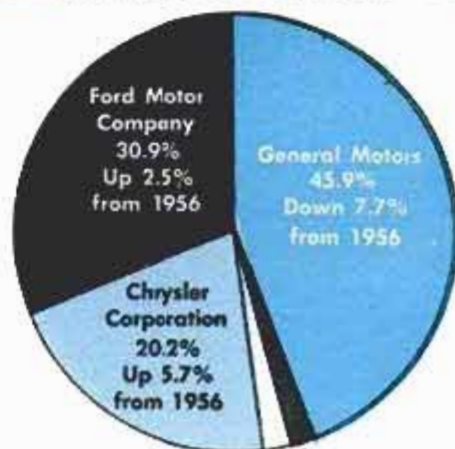
(Continued to page 284)

PRODUCTION OF PASSENGER CARS DURING 1957



TOTAL FOR INDUSTRY: 6,005,655 passenger cars—Up 5.3% from 1956

PERCENTAGE OF THE INDUSTRY



Production period covered is from January 1 to December 31, 1957. Total production for 1957 is expected to be about 6,100,000 cars. Estimates by courtesy of Automotive News

HOW WELL DO YOU KNOW THE '58 CARS?

STYLISTS TRY to make cars attractive—and tempting, too. But they also must provide easy identification so each car on the street becomes an advertisement. Usually this identification is worked into the front or rear. It's more visible there.

How many of these identification devices do you recognize? Name over 15 and you're expert, 8 to 15 you're average, 0 to 7 you're below average and need to study the following pages.

For photos of the cars
turn the page:



1



2



3



4



5



6



7



8



9



10



11



12



13



14



15



16



17



18



19

To find out how many you identified correctly turn to page 160.

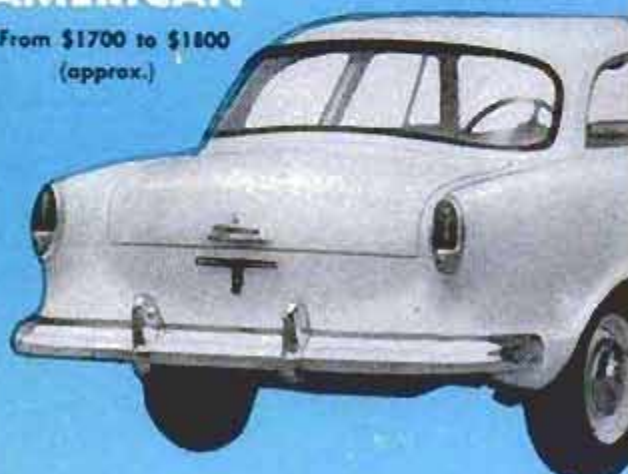


From \$2587 to \$3116



AMERICAN

From \$1700 to \$1800
(approx.)



BUICK

From \$2636 to \$5125



CADILLAC

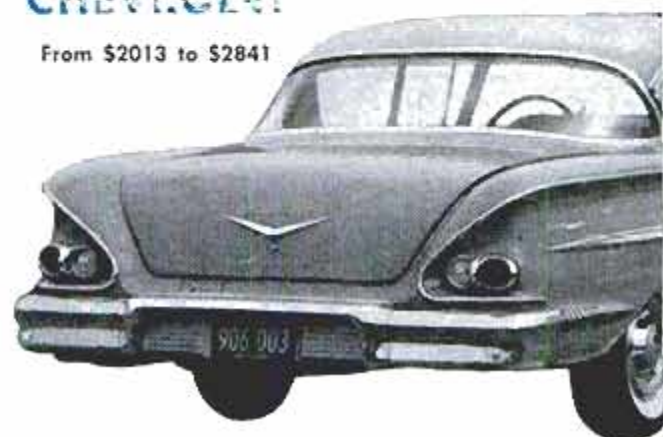
From \$4784 to \$13,074





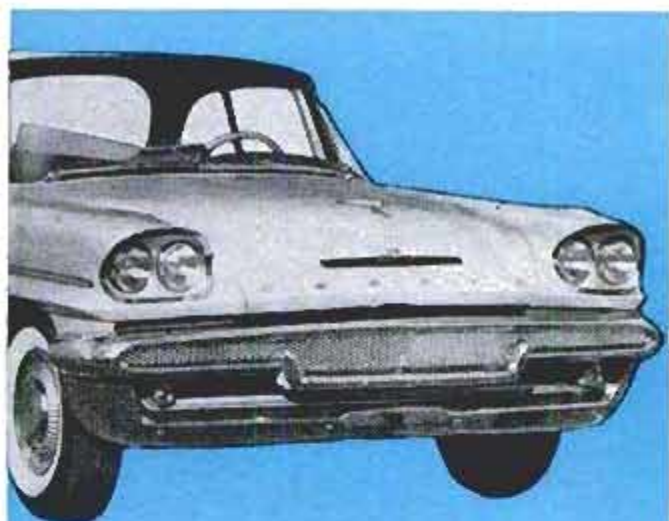
CHEVROLET

From \$2013 to \$2841



CHRYSLER

From \$3129 to \$5083



DE SOTO

From \$2819 to \$4369



DODGE

From \$2449 to \$3354





EDSEL

From \$2519 to \$3801



FORD

From \$1977 to \$3173



IMPERIAL

From \$4839 to \$5969



LINCOLN

From \$4803 to \$6283





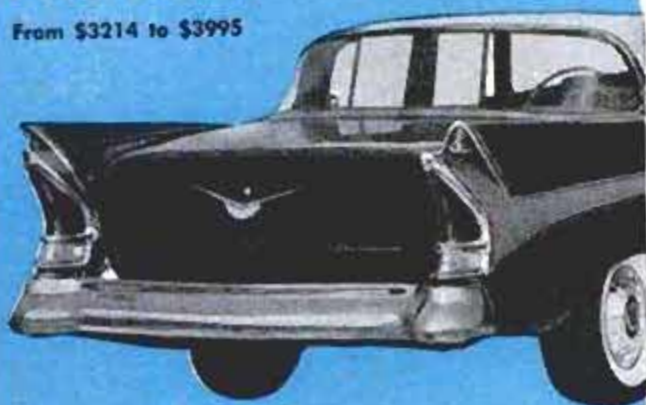
Oldsmobile
From \$2652 to \$4118



OLDSMOBILE
From \$2772 to \$4300

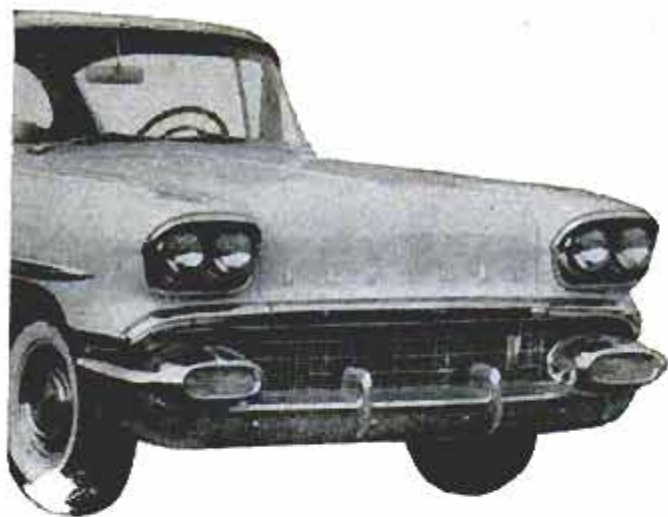


PACKARD
From \$3214 to \$3995



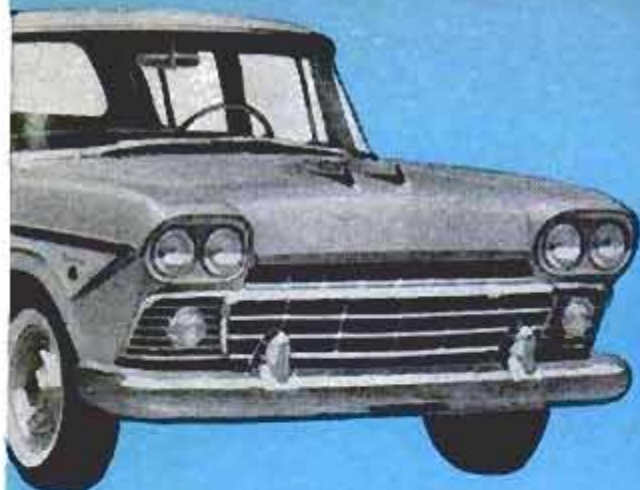
Packard
From \$2028 to \$3067





PONTIAC

From \$2573 to \$3586



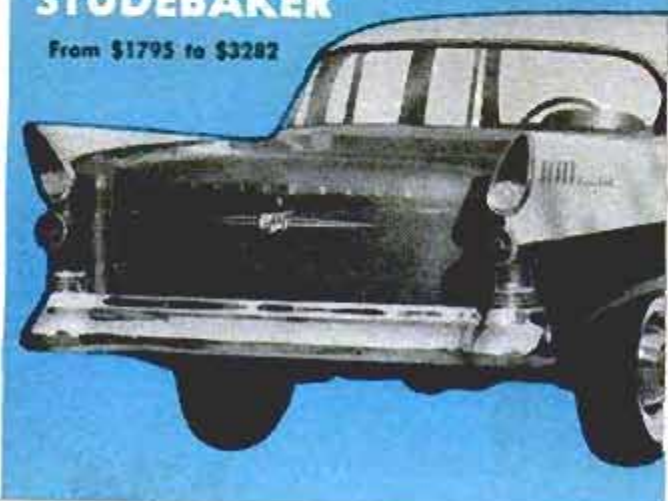
RAMBLER

From \$2047 to \$2751



STUDEBAKER

From \$1795 to \$3282



Recognition-Test Answers

If you haven't taken the test, turn back to page 155 before looking at the answers



1. OLDSMOBILE



2. MERCURY



3. PACKARD



4. BUICK



5. DODGE



6. LINCOLN



7. IMPERIAL



8. DE SOTO



9. PLYMOUTH



10. CHRYSLER



11. AMERICAN



12. STUDEBAKER



13. RAMBLER



14. CADILLAC



15. EDSSEL



16. FORD



17. PONTIAC



18. AMBASSADOR



19. CHEVROLET

porty Type—These Are for You

About two feet longer (it is 205.4 inches over-all), the new Thunderbird is a four-seater. Its V8 engine puts out 300 horsepower. Displacement is 352 inches, compression 10.2 to 1. For more about the car and specifications, see page 178. Here is the new hardtop model. Not announced yet, but rumored to be coming out early in the spring is a soft-top convertible body style



THUNDERBIRD

Few changes have been made in the new Chrysler 300D, except in horsepower. This model develops 380 horsepower in the standard engine, 390 with optional fuel injection. Displacement is 392 cubic inches in the hemispheric-head V8. It continues to be a fast, heavy road car that will cover miles quickly and willingly. Highly tuned, it is no car for inching along in city traffic



CHRYSLER 300-D

Still the only American entry in the sports-car category, the new Corvette remains a cozy two-seater. Weighing just 2800 pounds (thanks to lightweight plastic), it is an uncontradictable bomb when powered by a 290-horsepower V8 and four-speed transmission (both optional). Inside are changes also: Instrument panel has all dials where driver can read them, for example



CORVETTE

PACKARD HAWK

Not stampeded by the industry's big switch to four of a kind, Packard retains single headlights in its Hawk series. Also retained is the classic nonwrap windshield. Again this year, horsepower is 275 and displacement 289 cubic inches. Standard is the supercharger that cuts in on demand to ram pressurized air through the two-barrel carburetor for power surges

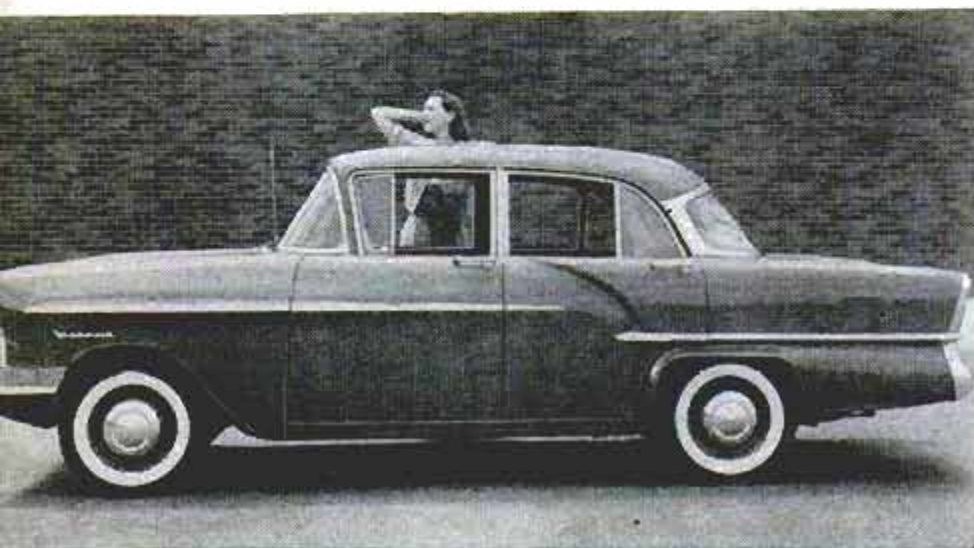


THE IMPORTS:



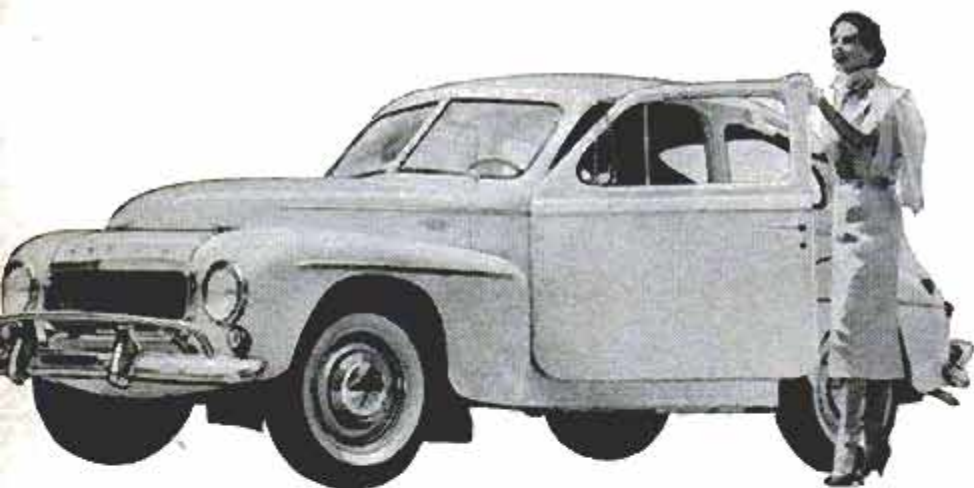
◊ FIAT from Italy

It comes in three sizes: A "big" 92-inch-wheelbase sedan (left); a smaller 600, featuring the roomy Multipla design; and an even smaller 500. Prices from \$1000 to \$2500



◊ VAUXHALL from England

General Motors now admits that a few in America will buy small cars. To satisfy them, it imports this trim sedan and sells it through Pontiac dealers. Price is \$1850



◊ VOLVO from Sweden

Favorite with performance lovers, the Volvo is a comparatively high-power family car. Fast and solid, it corners like a racer. Comes as a two-door only. Price is \$2200



◊ MERCEDES-BENZ 190SL from Germany

Like a micrometer, the 190SL is a joy to handle. Despite its modest engine (four cylinders), it's alert, responsive under a good driver. Expensive, though. Price is \$5200

VOLKSWAGEN from Germany



Not beautiful like the VW Ghia shown here, the standard VW sedan outsells all other imports because of reliability. Air-cooled, rear-engined, it's truly a workhorse. Prices: \$1545 up to \$2450



FORD from England



Styled in America, made in England, British Fords come in several sizes. This one is a big Consul four-door. All look more American than most imports. Prices: \$1539 to \$2900



RENAULT from France



Pleasant to drive and economical to own, the Renault Dauphine is a roomy (for its size, that is) four-door sedan. It has a water-cooled rear engine and a reasonable trunk space under the hood. Price: \$1645



METROPOLITAN from England



Part of the American Motors family, this car is a British-American hybrid. Actually just a two-seater, it is smaller than other cars on these pages. Peppy. Price is \$1567



(Continued on next page)



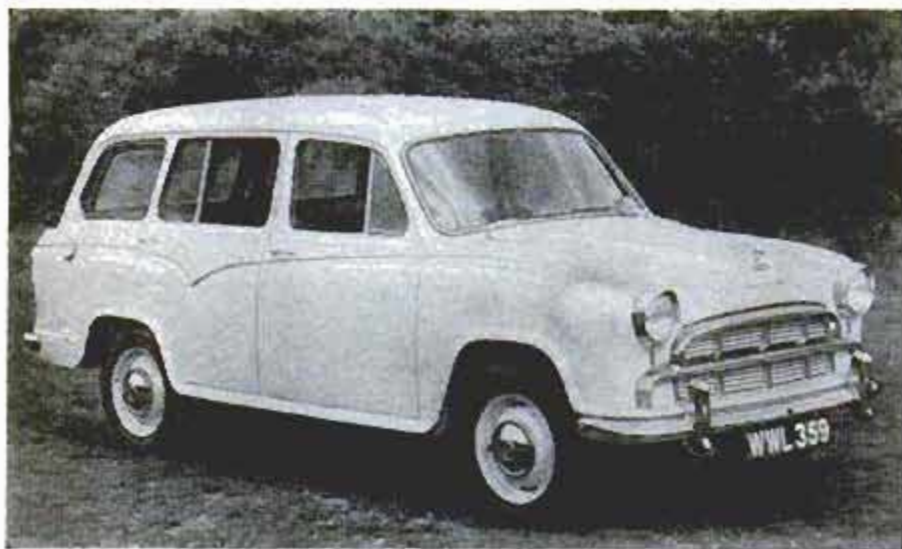
◇ OPEL from Germany

GM also sells its German Opel over here through Buick dealers. This wagon has a six-foot-long cargo space. Sedan model is also available. Price: About \$2000



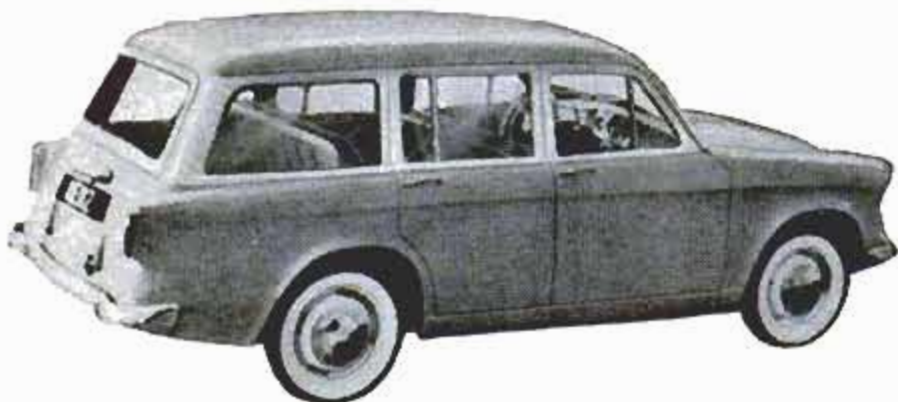
◇ AUSTIN from England

Although this A95 station wagon is not available yet over here, Austin has two smaller sedans that are. Both are good economy cars. Price is \$1545 to \$2100



◇ MORRIS from England

Another neat wagon is the Morris Oxford Traveller, too new to be available here yet. Other Morris cars include the excellent Morris 1000. Prices: From \$1629 to \$1900



◇ HILLMAN from England

Also new and now being sold here is the four-door Hillman wagon. Other models are sedans, a sleek convertible, an austerity wagon. Prices: \$1535 to \$2299

1958 SPECIFICATIONS

CONTINUED ON NEXT PAGE

	Lowest-price 4-door Model	Lowest-price Heater	Automatic Transmission	Power Steering	Lowest-price Radio	Shipping Weight	Wheelbase	Over-all Length	Displacement	Horsepower	Compression Ratio	Bore and Stroke
AMERICAN Two-door Six	\$1789	\$72	\$179	None	\$60	2495	100.0	178.3	195.6	90	8.0	3.13x4.25
STUDEBAKER Scotsman Six	\$1874	Standard	None	None	\$61	2735	116.5	202.4	185.6	101	7.8	3.00x4.38
Champion Six	\$2253	\$71	\$203	\$74	\$61	2810	116.5	202.4	185.6	101	7.8	3.00x4.38
Commander V8	\$2378	\$71	\$203	\$74	\$61	3155	116.5	202.4	259.2	180	8.3	3.56x3.25
President V8	\$2639	\$71	\$203	\$74	\$61	3325	120.5	206.4	289.0	225	8.3	3.56x3.63
RAMBLER Deluxe Six	\$2047	\$76	\$200	\$80	\$82	2947	108.0	191.2	195.6	127	8.7	3.13x4.25
Rebel Custom V8	\$2457	\$76	\$200	\$85	\$82	3300	108.0	191.2	250.0	215	8.7	3.50x3.25
FORD Custom 300 Six	\$2119	\$46	\$180	\$69	\$70	3258	116.0	202.0	223.0	145	8.6	3.62x3.60
Fairlane V8	\$2409	\$46	\$180	\$69	\$70	3508	118.0	207.0	292.0	205	9.1	3.75x3.30
Fairlane 500 V8	\$2562	\$46	\$180	\$69	\$70	3523	118.0	207.0	332.0	240	9.5	4.00x3.30
								optional →	352.0	300	10.2	4.00x3.50
CHEVROLET Delray Six	\$2155	\$49	\$188	\$70	\$61	3439	117.5	209.1	235.5	145	8.25	3.56x3.94
Biscayne V8	\$2397	\$49	\$188	\$70	\$61	3450	117.5	209.1	283.0	185	8.5	3.88x3.00
Bel Air V8	\$2547	\$49	\$188	\$70	\$61	3470	117.5	209.1	283.0	185	8.5	3.88x3.00
								optional →	348.0	250	9.5	4.13x3.25
PLYMOUTH Plaza Six	\$2169	\$69	\$180	\$77	\$73	3255	118.0	206.0	230.0	132	8.0	3.25x4.63
Savoy V8	\$2413	\$69	\$180	\$77	\$73	3400	118.0	206.0	318.0	225	9.0	3.91x3.31
Belvedere V8	\$2548	\$69	\$180	\$77	\$73	3430	118.0	206.0	318.0	225	9.0	3.91x3.31
								optional →	350.0	305	10.0	4.06x3.38
DODGE Coronet Six	\$2530	\$84	\$180	None	\$87	3410	122.0	213.8	230.0	138	8.0	3.25x4.63
Coronet V8	\$2637	\$84	\$180	\$92	\$87	3555	122.0	213.8	325.0	252	9.0	3.69x3.80
Royal V8	\$2797	\$84	\$220	\$92	\$87	3570	122.0	213.8	325.0	252	9.0	3.69x3.80
Custom Royal V8	\$3030	\$84	\$220	\$92	\$87	3640	122.0	213.8	350.0	295	10.0	4.06x3.38
								optional →	361.0	305	10.0	4.12x3.38
AMBASSADOR Super V8	\$2587	\$83	\$230	\$90	\$99	3456	117.0	200.2	327.0	270	9.7	4.00x3.25
Custom V8	\$2732	\$83	\$230	\$90	\$99	3462	117.0	200.2	327.0	270	9.7	4.00x3.25
EDSEL Ranger V8	\$2592	\$87	\$231	\$85	\$80	3805	118.0	213.2	361.0	303	10.5	4.05x3.50
Pacer V8	\$2735	\$87	\$231	\$85	\$80	3826	118.0	213.2	361.0	303	10.5	4.05x3.50
Corsair V8	\$3425	\$87	Standard	\$85	\$80	4235	124.1	218.9	410.0	345	10.5	4.20x3.70
Citation V8	\$3615	\$87	Standard	\$85	\$80	4230	124.1	218.9	410.0	345	10.5	4.20x3.70
MERCURY Monterey V8	\$2721	\$94	\$226	\$108	\$102	4277	122.0	213.2	383.0	312	10.5	4.30x3.30
Montclair V8	\$3236	\$94	Standard	\$108	\$102	4329	122.0	213.2	383.0	330	10.5	4.30x3.30
Park Lane V8	\$3944	\$94	Standard	Standard	\$102	4418	125.0	220.2	430.0	360	10.5	4.30x3.70
PONTIAC Chieftain V8	\$2638	\$96	\$231	\$108	\$102	3735	122.0	210.5	370.0	240	8.6	4.06x3.56
Super Chief V8	\$2834	\$96	\$231	\$108	\$102	3770	124.0	215.5	370.0	240	8.6	4.06x3.56
Star Chief V8	\$3071	\$96	\$231	\$108	\$102	3825	124.0	215.5	370.0	255	8.6	4.06x3.56
BUICK Special V8	\$2700	\$102	\$220	\$108	\$102	4115	122.0	211.8	364.0	210	8.0	4.13x3.40
Century V8	\$3316	\$102	Standard	\$108	\$102	4241	122.0	211.8	364.0	300	10.0	4.13x3.40
Super V8	\$3789	\$102	Standard	Standard	\$102	4500	127.5	219.1	364.0	300	10.0	4.13x3.40
Roadmaster V8	\$4667	\$102	Standard	Standard	\$102	4646	127.5	219.1	364.0	300	10.0	4.13x3.40
Limited V8	\$5112	\$102	Standard	Standard	\$102	4700	127.5	227.1	364.0	300	10.0	4.13x3.40
DE SOTO Firesweep V8	\$2819	\$89	\$180	\$106	\$94	3660	122.0	216.5	350.0	280	10.0	4.06x3.38
Firedome V8	\$3085	\$89	\$220	\$106	\$94	3965	126.0	218.6	361.0	295	10.0	4.12x3.38
Fireflite V8	\$3583	\$89	Standard	\$106	\$94	3990	126.0	218.6	361.0	305	10.0	4.12x3.38
OLDSMOBILE Series 88 V8	\$2837	\$97	\$231	\$108	\$102	3985	122.5	208.2	371.0	265	10.0	4.00x3.69
Super 88 V8	\$3112	\$97	\$231	\$108	\$102	4008	122.5	208.2	371.0	305	10.0	4.00x3.69
Series 98 V8	\$3824	\$97	Standard	Standard	\$102	4316	126.5	216.7	371.0	305	10.0	4.00x3.69
CHRYSLER Windsor V8	\$3129	\$93	\$220	\$108	\$100	3895	122.0	218.1	354.0	290	10.0	3.94x3.83
Saratoga V8	\$3818	\$93	Standard	Standard	\$100	4120	126.0	220.2	354.0	310	10.0	3.94x3.83
New Yorker V8	\$4295	\$93	Standard	Standard	\$100	4195	126.0	220.2	392.0	345	10.0	4.00x3.90
PACKARD Sedan V8	\$3214	\$71	Standard	\$69	\$80	3575	120.5	213.2	289.0	225	8.3	3.56x3.63
CADILLAC Series 62	\$4891	\$129	Standard	Standard	\$164	4675	129.5	216.8	365.0	310	10.25	4.00x3.63
Sixty Special	\$6232	\$129	Standard	Standard	\$164	4930	133.0	225.3	365.0	310	10.25	4.00x3.63
Series 75	\$8460	\$129	Standard	Standard	\$164	5360	149.8	237.1	365.0	310	10.25	4.00x3.63
IMPERIAL Imperial	\$4945	\$141	Standard	Standard	\$176	4590	129.0	225.8	392.0	345	10.0	4.00x3.90
Crown	\$5632	\$141	Standard	Standard	\$176	4755	129.0	225.8	392.0	345	10.0	4.00x3.90
LeBaron	\$5969	\$141	Standard	Standard	\$176	4780	129.0	225.8	392.0	345	10.0	4.00x3.90
LINCOLN Capri	\$4951	\$142	Standard	Standard	\$183	4754	131.0	229.0	430.0	375	10.5	4.30x3.70
Premiere	\$5565	\$142	Standard	Standard	\$183	4802	131.0	229.0	430.0	375	10.5	4.30x3.70
Continental	\$6072	\$142	Standard	Standard	\$183	4888	131.0	229.0	430.0	375	10.5	4.30x3.70

* estimated

	HEADROOM		SEAT HEIGHT		LEGROOM		SHOULDER ROOM		HIPROOM		TURN-CIRCLE DIAMETER
	Front	Rear	Front	Rear	Front	Rear	Front	Rear	Front	Rear	
AMERICAN	34.2	33.0	10.8	13.2	44.0	37.5	51.5	49.8	58.0	45.3	36.0 ft.
STUDEBAKER											
All except President V8	36.0	35.0	12.6	12.3	43.0	39.0	55.5	54.5	59.5	59.0	39.0 ft.
President V8	36.0	35.0	12.4	11.8	43.0	41.0	55.5	54.5	59.5	59.0	41.5 ft.
RAMBLER (all series)	36.0	35.0	10.4	14.2	43.0	40.0	57.7	57.6	59.8	60.1	37.3 ft.
FORD											
Custom 300 Six	39.9	37.9	10.7	14.4	45.1	44.7	57.6	57.0	60.3	60.3	40.1 ft.
All Fairlane models	38.9	37.7	10.7	14.0	45.1	42.7	57.3	57.0	60.0	60.1	41.6 ft.
CHEVROLET (all series)	35.0	34.2	10.8	13.0	44.6	42.7	56.4	56.2	62.1	63.1	37.7 ft.
PLYMOUTH (all series)	35.7	34.2	10.8	12.0	45.5	41.5	60.5	60.4	63.0	62.7	42.3 ft.
DODGE (all series)	35.7	34.5	10.8	12.0	45.5	42.5	60.5	60.4	63.0	62.7	43.6 ft.
AMBASSADOR V8	36.0	35.0	10.4	14.2	43.0	40.0	57.7	57.6	59.8	60.1	39.8 ft.
EDSEL											
Ranger	33.9	33.6	10.7	14.0	43.1	40.7	57.3	57.0	60.0	60.1	41.7 ft.
Pacer	33.2	33.6	10.6	14.0	43.1	40.7	57.3	57.0	60.0	60.1	41.7 ft.
Corsair and Citation	33.9	32.8	10.6	14.5	44.2	43.4	59.7	59.7	63.5	63.5	43.2 ft.
MERCURY											
Park Lane	34.0	32.8	10.6	14.5	44.1	43.4	60.2	60.2	61.3	62.9	44.6 ft.
All others	33.9	33.2	10.6	14.5	44.1	43.4	60.2	60.2	61.3	62.9	43.7 ft.
PONTIAC											
Chieftain V8	35.0	34.3	10.4	13.0	44.7	41.6	56.4	56.2	62.0	63.1	41.7 ft.
Super Chief and Star Chief V8	35.0	34.3	10.2	12.8	44.5	41.4	56.4	56.2	62.0	63.1	42.1 ft.
BUICK											
Special V8	34.9	33.5	10.9	12.0	43.0	41.7	56.9	55.7	62.6	62.1	43.2 ft.
Century V8	34.9	33.5	10.8	11.9	43.0	41.6	56.9	55.7	62.6	62.1	43.2 ft.
Super V8	36.4	35.1	10.9	11.0	43.5	44.5	58.5	56.8	65.7	65.0	44.5 ft.
Roadmaster V8	35.8	34.5	11.2	11.7	43.2	44.1	58.5	56.8	65.5	64.8	44.5 ft.
Limited V8	35.8	34.5	11.2	11.7	43.2	44.1	58.5	56.8	65.5	64.8	44.5 ft.
DE SOTO (all series)	35.7	34.5	10.8	12.0	45.5	43.0	60.5	60.4	63.0	62.7	*
OLDSMOBILE											
Series 88 V8	35.1	33.5	11.2	11.8	44.0	41.2	56.9	55.7	62.5	62.1	42.0 ft.
Super 88 V8	34.6	33.5	11.2	11.6	43.8	41.2	56.9	55.7	62.5	62.1	42.0 ft.
Series 98 V8	34.6	33.1	11.2	11.9	43.8	41.6	56.9	55.7	62.5	62.1	43.0 ft.
CHRYSLER (all series)	35.7	34.5	10.8	12.0	45.5	43.0	60.5	60.4	63.0	62.7	†
PACKARD (all series)	36.0	35.0	12.4	11.8	43.0	41.0	55.5	54.5	59.5	59.0	41.5 ft.
CADILLAC											
Series 62	35.0	34.9	13.5	12.7	45.0	45.2	59.0	57.0	65.2	65.0	43.4 ft.
Sixty Special	33.9	34.8	13.9	12.7	45.0	45.3	59.0	57.0	65.0	65.0	45.0 ft.
Series 75	36.6	35.7	12.8	13.6	43.6	N.A.	59.0	56.8	65.5	57.9	51.7 ft.
IMPERIAL	35.4	34.2	‡	12.5	46.0	45.0	64.0	62.0	61.0	60.2	48.1 ft.
LINCOLN											
Capri and Premiere	35.0	33.8	11.5	14.5	44.4	46.6	63.1	63.0	61.0	65.5	44.4 ft.
Continental	35.0	34.1	11.5	14.5	44.4	42.9	63.1	67.0	61.0	65.1	44.4 ft.

* Firesweep—46.5 ft., all others 49.3 ft.

† Windsor—43.6 ft., all others 46.9 ft.

‡ Crown and LeBaron—9.8, all others 10.3

NOTES ON SPECIFICATIONS

N.A.—Data not available at press time.

NONE: No such option available on the car.

STANDARD: This item comes on the car at no added cost.

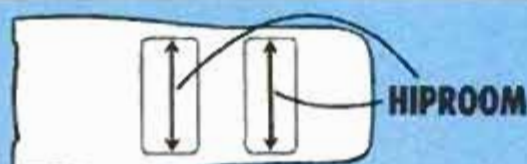
All specifications, except where otherwise noted, are for four-door models. For those cars which do not offer four-door models with centerposts, the specifications are for the equivalent four-door hardtops.

All dimensions are in inches, unless otherwise stated.

Car prices are the suggested advertised-delivered prices. These include federal excise taxes and suggested dealer handling—delivery charges. Not included are such variables as freight from the factory to your city, optional equipment, state and local taxes.

Accessory prices are, as stated, for the lowest-price item available as factory-installed equipment. These prices include federal excise taxes, but not state and local taxes.

All horsepower ratings are for standard-equipment models only, except as noted. This is the horsepower you get for the price listed in the first column. In the case of Buick, for example, almost all Specials are sold with automatic transmissions and have 250 horsepower. But the horsepower on the standard-equipped Special that you can buy for \$2700, as stated, is only 210, as the table shows. To get the 250-horsepower engine you must buy the automatic transmission at extra cost.

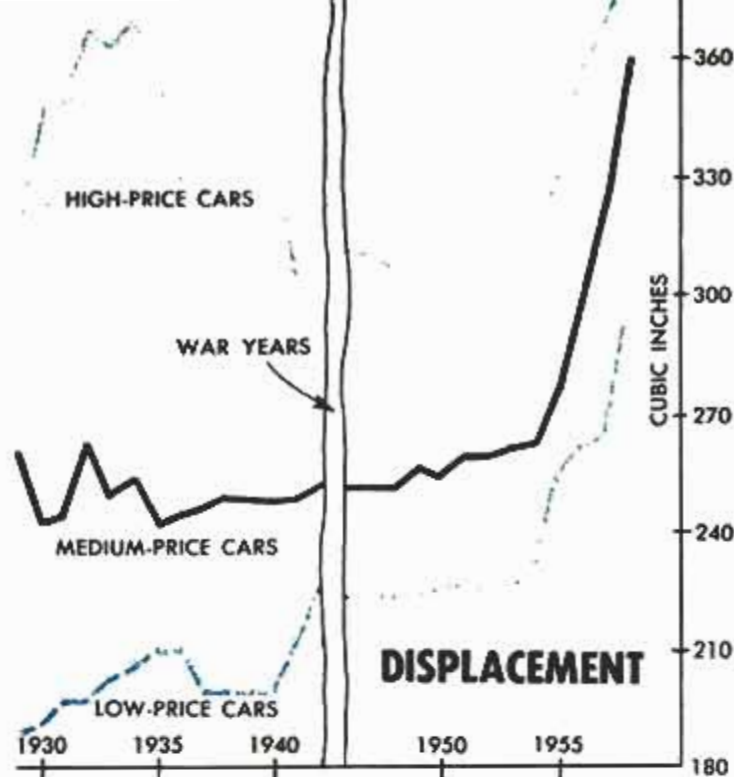


HIPROOM



LEGROOM

HEADROOM



Left, engine displacements are skyrocketing, especially in low-price cars. This is one reason why gas economy is so low in city driving. High-price cars are moving back to their prewar peaks

Bottom, the chart is proof of the horsepower race. The three curves show how engine horsepower has been soaring in the past years

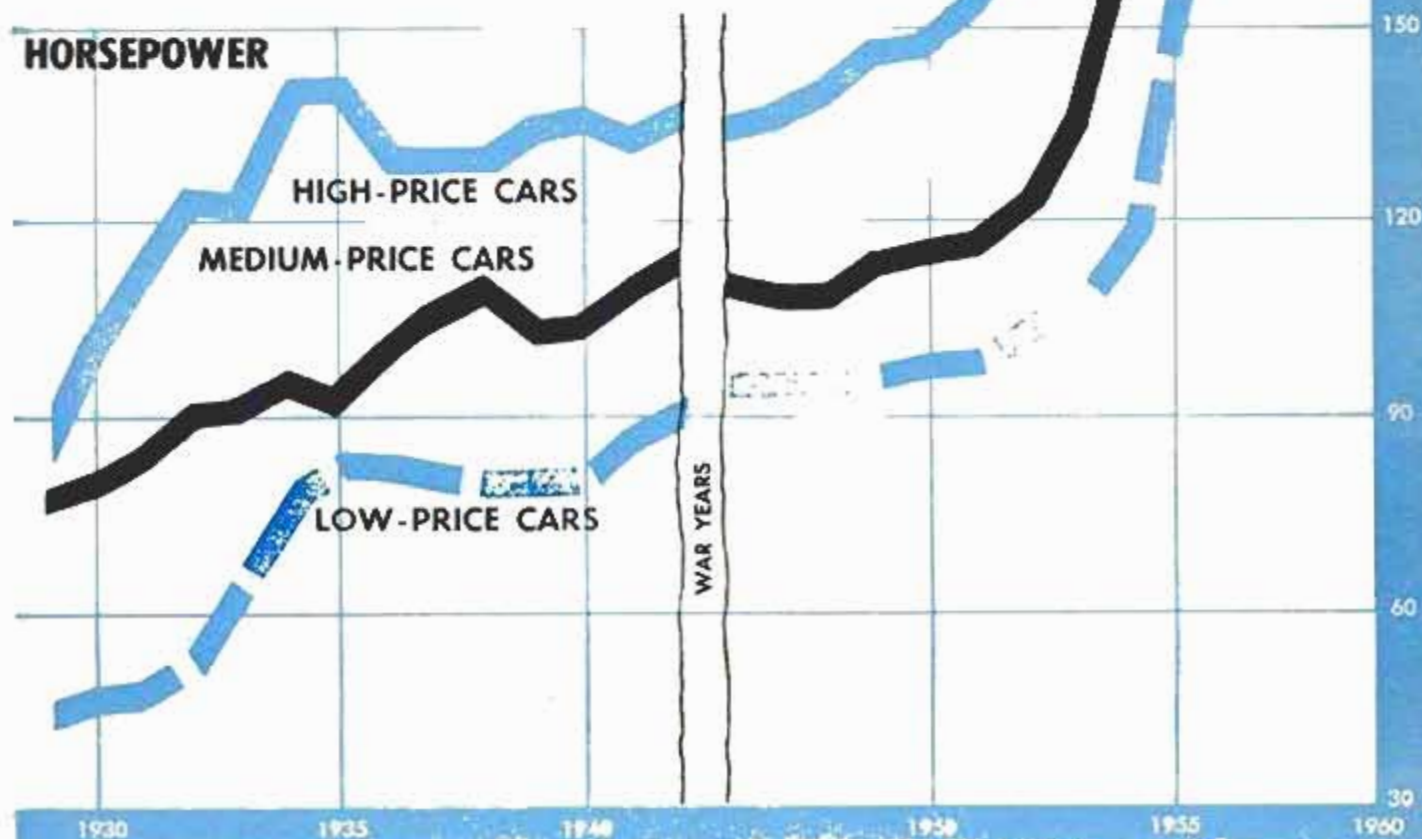
This Year's Crop of Engines

By David Critchlow

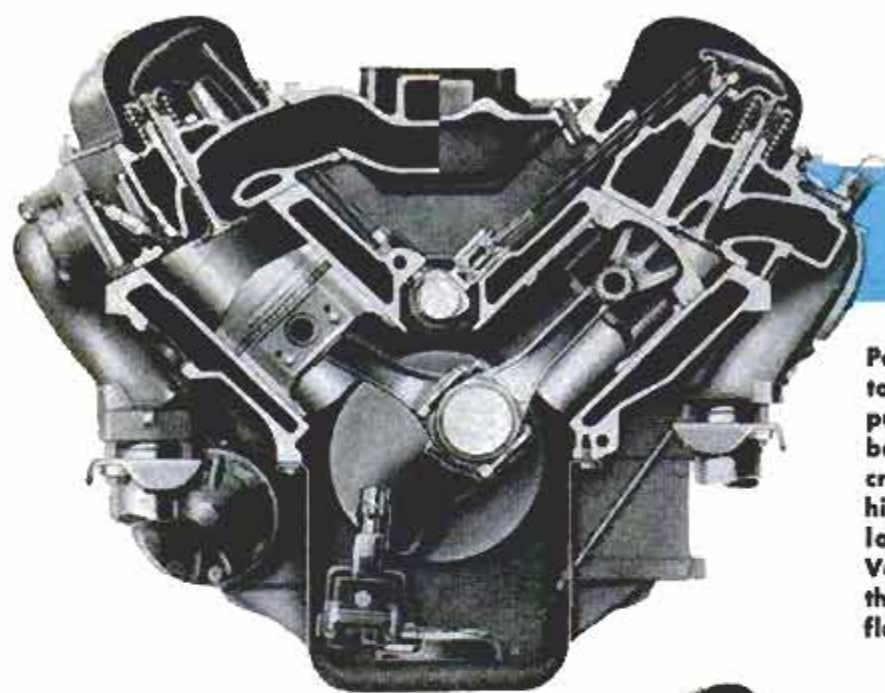
NOWHERE ELSE in the world has the V8 become so refined as in America. It has evolved into a classic pattern.

This refinement resulted from the skyrocketing popularity of the V8 in the low-price cars. Engineers had to come up with an efficient engine suitable for volume production at reasonable cost.

Today, assembly lines of different companies produce cars powered by remarkably similar V8 engines, no



360
330
300
270
240
210
180
150
120
90
60
30

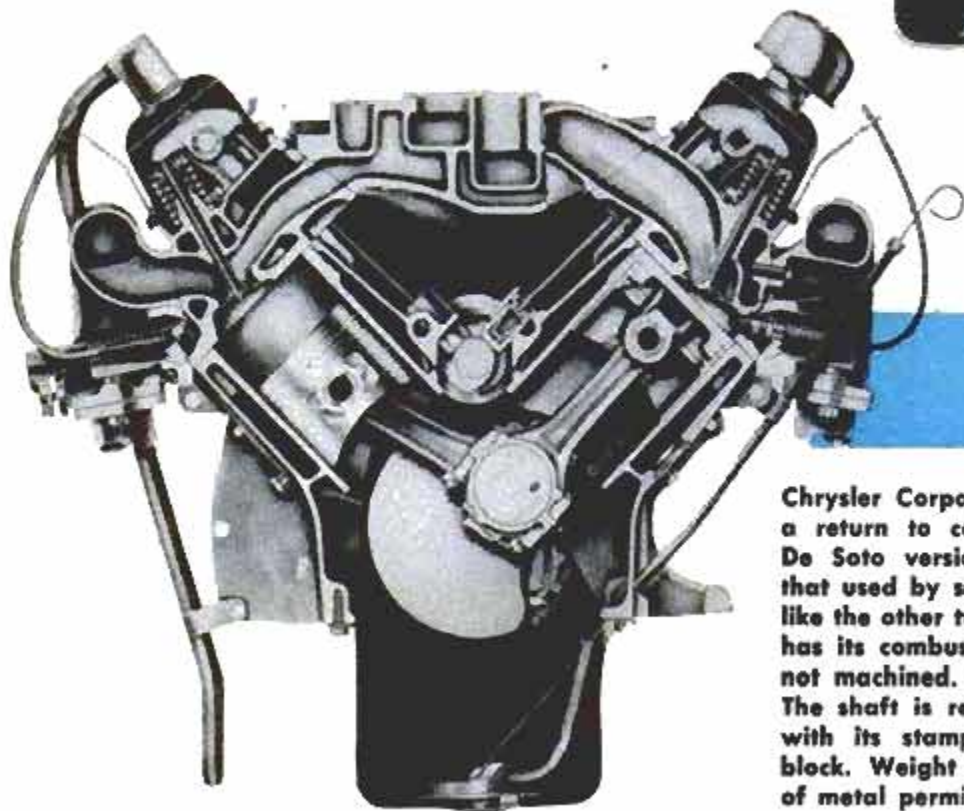
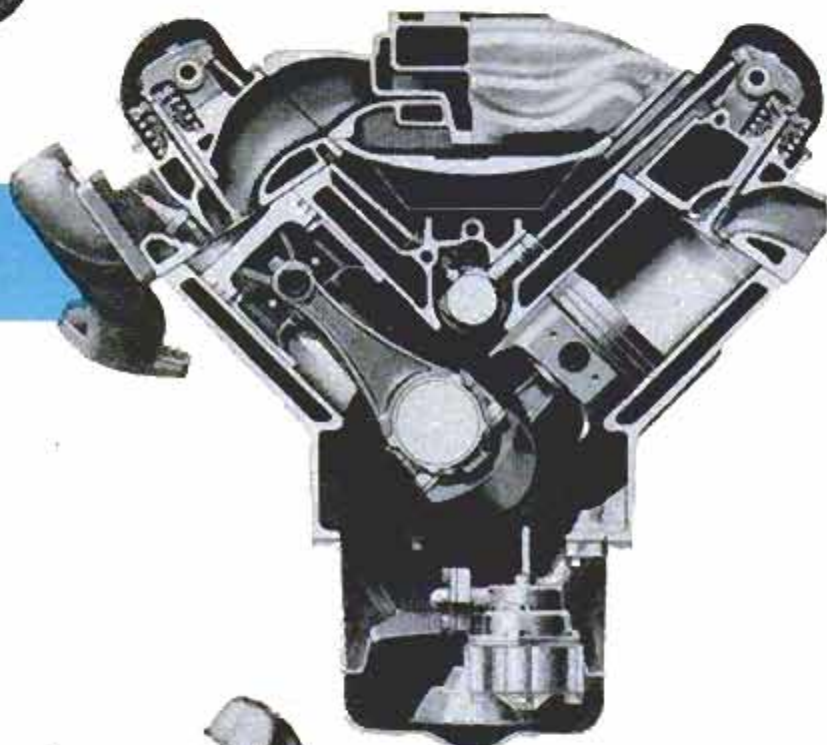


CHEVROLET

Peaking the piston dome and angling the top of the block 16 degrees, Chevrolet puts its fully machined combustion chamber inside the block. This is said to create more turbulence and to produce a higher volumetric efficiency. Spark-plug location gives short flame travel. Valves are located out in the open on the flat face of the head to allow free flow of gas, insuring good breathing

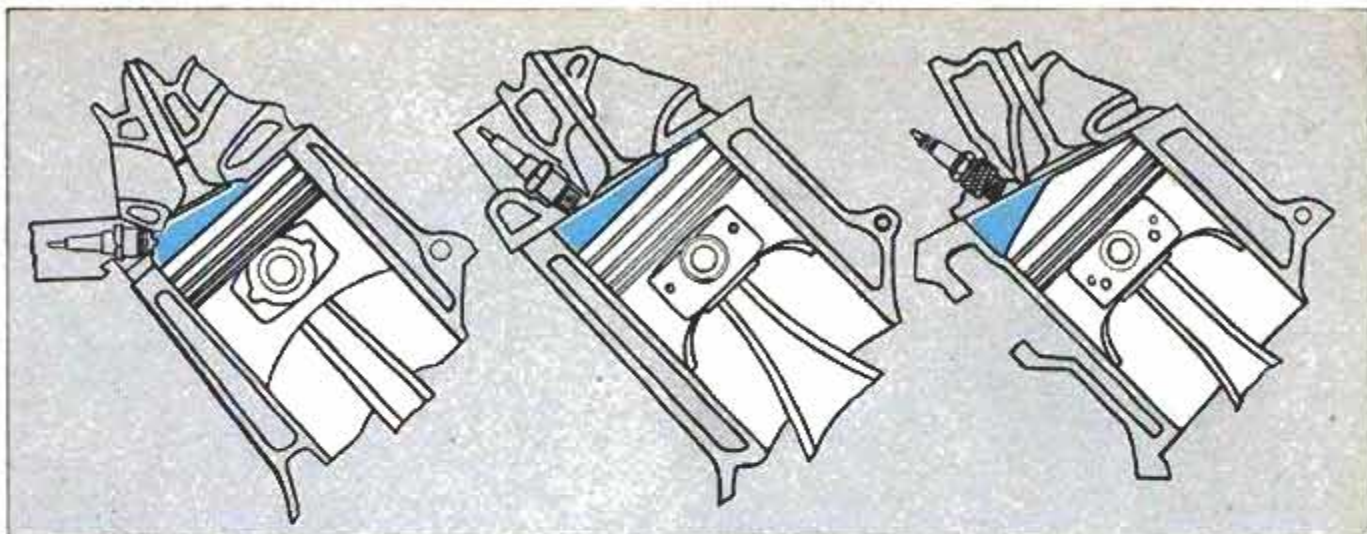
MERCURY

Ford Motor Company offers two all-new engines for 1958. Here is the Mercury version. It is larger than the Ford-Edsel design. Like Chevrolet, it has its fully machined combustion chamber in the block. The intake manifold is water-jacketed to eliminate the need for an exhaust heat-control valve. The deep skirt provides rigidity. Hot spots are eliminated by the alternate location of the exhaust valves



DE SOTO

Chrysler Corporation's new engine for 1958 is a return to conventional design. Here is the De Soto version, differing only in size from that used by some Dodges and Plymouths. Unlike the other two engines on the page, this one has its combustion chamber in the head. It is not machined. Stamped rocker arms are used. The shaft is retained (Chevrolet uses no shaft with its stamped arms). It has a deep-skirt block. Weight is kept low. The smaller mass of metal permits the engine to warm up faster



Left to right, De Soto, Mercury and Chevrolet combustion chambers, three solutions to the problem of shape

surprise since the aims of all are similar: Good performance, low cost, suitability for full or semiautomated tooling.

The standard American V8 is a large-displacement, short-stroke engine with overhead valves and a high compression ratio. Its crankshaft has five main bearings and it turns in a cast-iron block beneath two banks of four cylinders arranged in a 90-degree vee. Power output is high and torque characteristics provide exceptional performance at low and medium speeds in heavy vehicles equipped with automatic transmissions.

Similar though these engines are, there are numerous details that demonstrate original and ingenious solutions to design problems. The highly efficient (but costly) hemispheric combustion chamber Chrysler brought out six years ago is one example. Another is the Chevrolet-Pontiac stamped rocker-arm design which first appeared three years ago to startle the industry by pointing the way to a significant cost reduction in eliminating the expense of a rocker-arm shaft.

For 1958, each of the Big Three has a new V8. These engines are built in a variety

of sizes, but it is convenient to group them by parent company rather than by car make or displacement size. Except for General Motors, all makers extend the basic engine into more than one line of cars. In this way, at a reasonable investment in tooling, the companies can offer a wide range of engine sizes to each brand, opening the market to a wide variety of buyers.

Let's look at the three major companies and their new V8 engines for 1958.

FORD MOTOR COMPANY

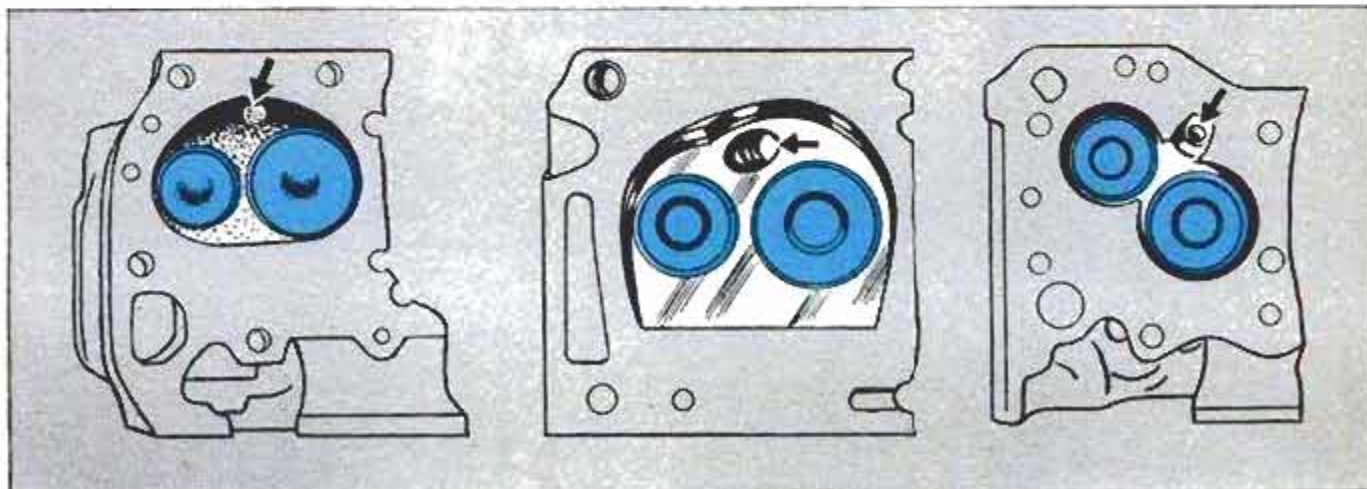
Ford engineers developed two entirely new groups of V8 engines for 1958. Size is the principal distinction. One has a medium displacement, the other an extremely large displacement.

The smaller of the two (used in Ford, some Edsels and Ford trucks) comes in three displacements: 332, 352 and 361 cubic inches.

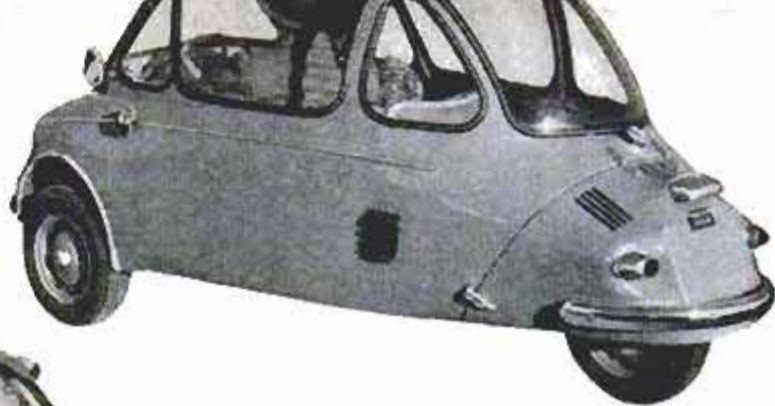
The first two (332 and 352) have a common bore of 4 inches; strokes are 3.3 inches and 3.5 inches respectively. These two V8s are used in the 1958 Ford cars, rated at 265

(Continued to page 290)

Left to right, De Soto, Ford, Chevrolet heads. Arrows point to spark-plug holes. De Soto's combustion chamber is not machined; Ford's is fully machined; Chevy's is not in the head at all, being in the block



A 1½-CAR FAMILY



A USE TEST OF BUBBLE CARS

HEINKEL

Weighing 535 pounds, the Heinkel has three wheels, an air-cooled one-cylinder engine in the rear. Visibility is unlimited. The four-stroke engine has a 10.4-cubic-inch displacement and takes about a quart of oil for an oil change

It's harder to get out of the Heinkel because the wheel does not swing out with the door. But the Heinkel has enough room behind the seat for two children or for carrying large bundles



HALF A LOAF is better than none—we all know that. But what about half a car? Is it better than none? Or perhaps in some cases better than a whole car?

Bubble cars, like the Isetta and the Heinkel, may be the answer to the problem of the American suburban housewife. Perhaps the 1½-car family is a practical solution in a car-dependent society in which the husband needs a car to drive to work and the wife needs one to get to town.

To put bubble cars to a use test, *Popular Mechanics* made available two of them (Heinkel and Isetta) to four typical suburban housewives for a week at a time. These women, all with small children, were told to use the cars as if they were their own. And they did.

They finished the test with mixed feelings.

All agreed that the cars (and perhaps any car so small) have serious limitations. These limitations are, unfortunately, tied in with their advantages. It is the smallness of these bubble cars which makes them desirable, yet at the same time makes them of limited usefulness.



Left, the Isetta 300 test car. It has four wheels, a one-cylinder air-cooled engine. Weight is 770 pounds. Displacement is 18 cubic inches and oil capacity 3.6 pints

Below, the Isetta 600, a new and enlarged version not yet available in this country. It has a rear seat with a side door and it should answer most of the complaints of the housewives who tested the two cars for PM

ISETTA



For example, high on the best-liked list is ease of parking, a product of small size. These cars are driven head-on into parallel parking space. No backing is required. In jammed traffic lanes, backing against the current into a small parking space can be nervewracking. If done clumsily, this can be embarrassing. The bubble car ends this worry.

Economy is a very big plus feature, of course. In the test, during which all mileage was stop-and-go city-traffic driving, the Isetta averaged 42 miles per gallon, the Heinkel averaged 52 miles per gallon.

But gasoline mileage is not the only economy. Both cars have one-cylinder air-cooled engines. This is about as simple as a car can get and it virtually eliminates all expense-creating complications.

It is doubtful if the out-of-pocket cost of operating either of these cars would cut seriously into any household's budget, although

(Continued to page 296)

You open the Isetta's door with the steering wheel, which swings forward so you exit more easily. Even so, entry and exit are awkward, especially in a tight skirt



STYLISTS, the men who create the shapes that eventually become your automobile, are basically artists. It is their job to give a practical device like the motorcar a look of beauty that is pleasing.

In their work (which, incidentally, is

always behind locked doors because they work on the day after tomorrow), they use a language of their own.

Here, thanks to the styling departments of Chrysler Corporation and the Ford Motor Company, is some of the stylists' lingo.

A

Ace. An exceptional design.

A-post. Pillar connecting roof to body at windshield. Also known as A-pillar



Applique. Something added to the basic form: chrome moldings, crests, trim

B

Backlight. Rear window

B-post. Pillar connecting roof to body at rear of front door. Also known as B-pillar

BBC. Bumper to back of cab

Bead. Indentation running along or across sheet metal. Also known as ripple

Beehive. Backup light located in center of disk. Also known as bull's-eye

Beltline. Break between lower body and upper structure.



Bezel. Rim surrounding and supporting the headlight.

Biscuit. Shape formed on many door panels and seats.

Blind quarter. Windowless area at rear of greenhouse.

Blisters. Bumps over wheels for clearance

Blurps. Bumps of any kind.

Body roll. Convex sheet-metal form

Bomb. Projectilelike object used as a bumper guard. Also known as Dagmar



Buck. Wooden framework that supports clay model.

Bulbous. Fat section. Well-rounded.

Cant. Angle of departure or angle of lowest point behind rear wheel. Angle of approach or angle of lowest point of bumper

Catwalks. Area between fenders and hood, also known as valley

Clean. Absence of moldings.

Cluster. Grouping of instruments on dashboard

C-post. Rear pillar connecting roof and body. Also known as C-pillar

Crazy. Nice.

Creaseline. Leading edge of hood. Also known as wing section, windsplit or prow

CV. Controlled ventilation. Small vent windows front and rear

D

Dagmar. Rounded sphere on bumper guard. Also known as bomb

DLO. Daylight opening

Deck lid. Metal covering for trunk and spare tire

Doghouse. Rectangle housing gas-filler cap



Drip molding. Chrome strip above doors

Drip line. Forward edge of rear quarter of roof

E

Egg crate. Grille characterized by horizontal blades supported by vertical struts

Eyebrow. Forward extension of front-fender crown over headlight. Also known as shroud hood, shade visor



Fast back. Greenhouse flows into rear deck with no break in surface

Fence. Representing the section above the belt and below the window

Fillet. Radius between two intersecting surfaces.

Fins. Upper sections of quarter panels, also known as blades.

Fleet. Fast-looking, indicative of motion.

Flipper. Door-lock cover

Fireplace. Grille opening, also known as mouth

Frying pan. Circular ending of jet tube.

Garnish molding. Painted sheet-metal strip just below side windows on interior of car.

Gasarooney. Terrific, overpowering, weird

Goo-goo. Overdone.

Gorky. Looks awkward, out of shape.

Gorped-up. Overdone, too many embellishments.

Greenhouse. Upper structure, passenger compartment.



Gutty. Powerful appearance, has race-car look

Hairy. Has too powerful an appearance, overdone.

Hardware. Metal parts of door interior

Header. Top of windshield, inside or out.

Highlight. Light reflection on body surface

Hot. Advanced design.

Ipsipipsi. Correct proportions. Right on the nose.

Ivory towers. Styling studios.

Jazzy. Flashy

Jet tube. Cylindrical form extending through quarter panel.



Jounce. Clearance for up-and-down movement of wheel

L

Lowlight. Secondary light, such as ground reflection on body.

Louver. Air intake.

M

Mouth. Grille Opening. Also known as fireplace.

N

Notchback. Greenhouse flows into rear deck with a break

O

OD. Outside diameter, as of a tire.

Overhang, front or rear. Distance from wheel center to front or rear extremity of car.

Pizazz. Give it everything.

Pork chop. Section joining end of dashboard and door panel, so called because of its shape.

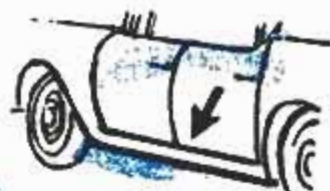


Prendelo. Automatic transmission quadrant, suggested by the letters P - R - N - Dr - Lo.

Q

Quarter panel. Sheet metal between the doors and each of the four corners of the body.

Rocker panel. Bottom edge of body below doors between front and rear wheel-houses.



S

Sassy. Has appearance of high performance.

Scallop. Concave indentation in sheet metal.

Sings. Meaning it glitters.

Spaghetti. Too many moldings, overdone.

Spooky. Embodying futuristic styling concepts.

Squealy. A rendering or drawing making broad use of black.

Stacks. Tail pipes.

Stinkle. Glitter or shine.

Sweep spear. Molding running along the body.

Sweeten. Make refinements in a design.

Taut. Sprightly

Telephone pole. Molded upright form directly below taillight.

Thrust. Feeling of direction.

Tumblehome.

Amount of lean towards the center or degree of slant from the vertical of the upper portion of body.



Tuned in. Well qualified, knows what he's doing.

Turn-under. Turning under of lower body sections

V

Valley. Low area between fender and hood. Same as catwalk

W

Wheelhouse. Opening for wheel.

Windlace. Stripping attached to door openings to prevent wind noises



What's Best a... for Your Car?

By Dale Kelly, SAE, Registered Professional Engineer

HIGH COMPRESSION — what does it mean? Unlike some loudly shouted phrases, high compression is worthwhile.

In fact, increased compressions are probably the most important single improvement in automobile engines during the past 50 years. A given amount of gasoline does almost twice as much work at a compression ratio of 10 to 1 as at 3 to 1.

With the poor gasolines of years ago, any attempt to raise compression resulted in abnormal, uncontrolled combustion causing what was then called "spark knock" (now known as detonation).

Probably no harm is done by a momen-

tary trace of knock during acceleration, but continued severe knocking can ruin an engine in a few hours.

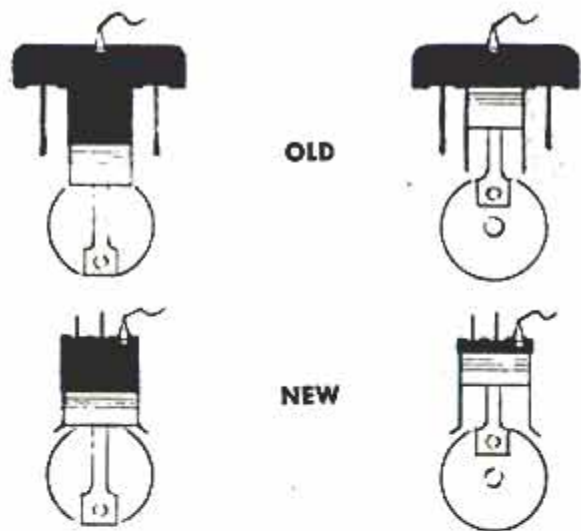
As gasolines have been progressively improved in knock resistance (both by improved refining and by the addition of tetraethyl lead), the limitations on compression ratios have been raised.

Twenty-five years ago, the best premium gasoline had a Research octane number (the measure of knock resistance) of about 74. Today, regular gasoline has an average octane number of 91, premium is about 99 and the superpremium fuels are about 102.

But, as you can see from the map on page 175, gasoline in the central Atlantic states averages five octane numbers higher than gasoline in the Rocky Mountains. Oil companies do this deliberately, partly because an engine is less likely to knock in the lower atmospheric pressure at high altitudes.

For years, most oil companies have marketed two grades of gasoline—regular and premium. Originally, premium differed from regular primarily in that it contained tetraethyl lead (a half teaspoonful of which in a gallon of gasoline gives a tremendous improvement in knock resistance). For this reason, premium gas was commonly called Ethyl gasoline. Today nearly all regular gasolines are leaded just about as much as premium gasoline.

Back in 1956, the highest standard compression ratio in the new cars jumped to 10



Years ago, ratio between cylinder volumes with the piston at bottom and top of stroke was only 3 to 1. New V8 engines are more efficient with 10 to 1 ratio

Below, here is how knock looks in slow motion. The flame "explodes" in the last two frames, causing knock

General Motors Research photos



Below, high-octane gas burns slowly without knocking. Movies of a combustion chamber show even burning



to 1. The compression spread between these new cars and the old cars was too great to be accommodated by the two existing grades of gasoline. So several companies brought out super-premium, a fuel useful primarily in those few late-model cars with very high compression ratios. (One company, Sun Oil Company, has developed a mixing pump which dispenses as many as six grades of gasoline from one hose.)

So today, when you drive into a service station, you have to decide which of these several grades you should buy. There is an important difference in price per gallon. Is there a major difference in what you get?

Actually, there is a big spread between the highest octane number your engine can use effectively and the lowest on which it can run reasonably well, if (and this is important) the ignition is timed to match the particular grade of gas being used.

In other words, you have a choice. Your engine may be adjusted to run satisfactorily on any two and sometimes all three of them. Your choice depends on how much you, as a buyer, are willing to spend for the extra acceleration your car may be able to give on the more expensive gasoline.

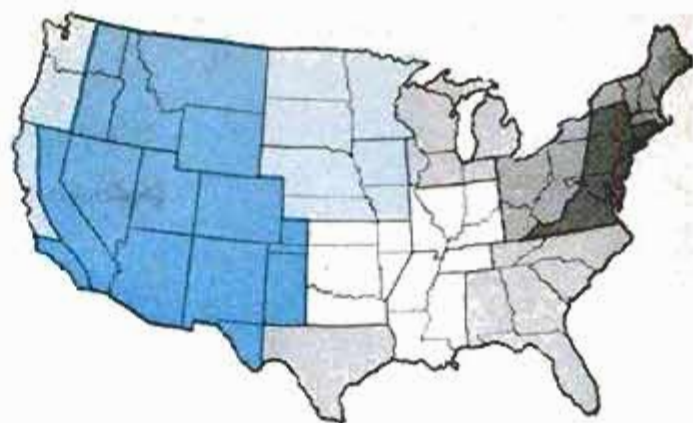
This extra amount of acceleration depends on your engine's compression ratio and, to a lesser extent, on the number of miles it has been accumulating carbon and other deposits.

Timing the engine for regular gas instead of premium may decrease or it may increase gasoline mileage. But usually there is no important change either way. However, mileage per dollar will almost always be better on regular gasoline.

All cars now have a vacuum-advance to give, at light load, the additional spark advance necessary for best gasoline mileage. If an ignition system is engineered for regular and the owner advances the spark to obtain the small improvement in acceleration that may be possible with premium, he could get too much advance at light load. This will reduce his gasoline mileage. The 1958 Plymouth reported on in last month's *PM* is an example of this. In this case, he will pay more and get fewer miles per gallon.

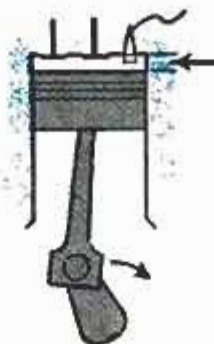
Just because it costs more does not necessarily mean that premium gasoline is better. The semiannual survey by the Bureau of Mines shows that, except for the lower octane number, regular gasoline is substantially equal in quality to premium. Therefore, there is no reason for using premium gasoline except for antiknock.

Much of the improved performance of today's gasoline, regular and premium alike, is due to additives other than tetraethyl lead. Almost all gasoline today contain a



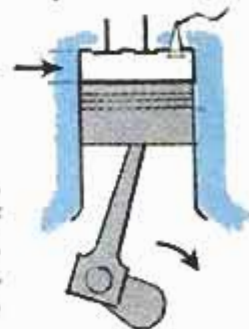
OCTANE RATINGS BY SECTIONS OF THE COUNTRY

Areas in white sell gasolines with average octane rating. Other sections sell gasoline of one or more octain points above or below the national average



Left, "retarded" spark occurs when the piston has almost completed its upstroke. The engine will run on low-octane gas with a possible loss of power and economy

Right, "advanced" spark occurs well before top of stroke. This takes full advantage of high-octane fuel. Engine would knock on regular

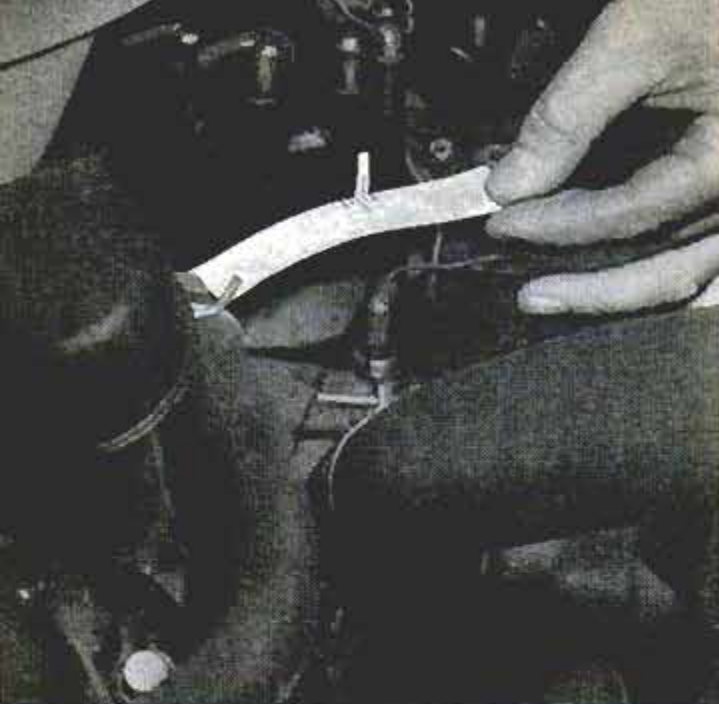


phosphorus compound, such as TCP (tri-cresyl-phosphate) to retard the formation of deposits in the combustion chambers.

Today's engines are so large that they operate most of the time at a small fraction of full power. Part-throttle operation subjects the engine to more accumulation of deposits. Unless additives such as TCP are used, spark plugs are apt to be short-circuited by these deposits and white-hot particles in the combustion chambers are likely to ignite the fuel mixture prematurely (which also causes detonation).

Other additives used in some of today's gasoline prevent the formation of gum in storage, gum that would later collect in carburetors and inlet manifolds. Additives also remove such accumulations if they occur. They also prevent corrosion of tanks and fuel systems (and of the oil companies' pipelines and tanks). Additives discourage carburetor icing, which is troublesome when the temperature is at freezing or a few degrees above with high humidity.

As far as octane requirements are concerned, cars fall into three categories. At



one extreme, certain late models with high compression ratios will run on regular only with an appreciable loss in acceleration. At the other extreme, most older cars with low compression ratios will run as well on regular as on premium. For these two groups the choice is easy to make.

In the middle, however, are many cars for which the choice is not so simple. These cars will accelerate better on premium, but it is difficult to say how much better without running a test. It is difficult to tell whether an owner can detect the improved performance and, even when he can detect it, whether he will consider it worth the extra cost of premium.

For these cars in the middle, the best solution is a simple road test by the owner to show how far the spark can be advanced without knock on each grade and how far it must be advanced for good accelerating.

If you have a reasonably new car, the first thing you do is make a scale (older cars usually have a marked scale attached to the distributor) so you can advance or retard the spark a precise amount conveniently. You make such a scale from a piece of cardboard or wood. It should be long enough so that one end butts against some immobile, well-defined part of the engine while the other end extends past the side of the distributor.

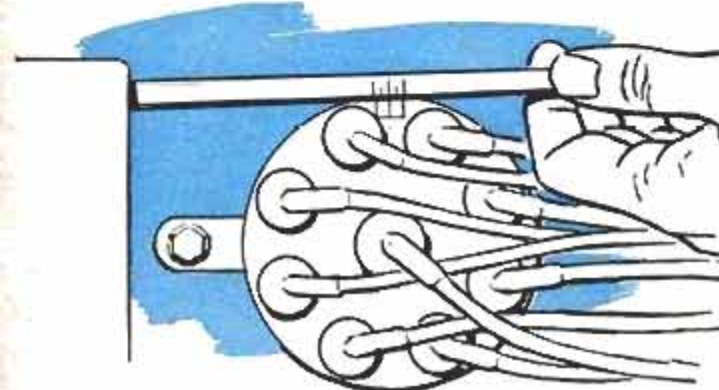
Stick an adhesive-tape patch on the side of the distributor cap and mark a reference line in it. Lay the scale against the immobile part so it runs alongside the reference point and mark it accordingly. Then on each side of this center mark which shows the spark setting as it is now, place additional marks at $\frac{1}{8}$ and $\frac{1}{16}$ -inch intervals. With this scale you will be able to advance or retard the spark precisely.

Find a stretch of road about $\frac{1}{4}$ to $\frac{1}{2}$ mile long on which your car can be driven wide open for 10 second or longer without exceeding safe and legal speeds. The course should be wide, straight and lightly traveled. If possible, it should have a gradual uphill grade.

Select a stationary marker, such as a certain telephone pole or road sign, for your starting line and another such marker as the finish line at about the point your car will be at after 10 or 15 seconds' acceleration.

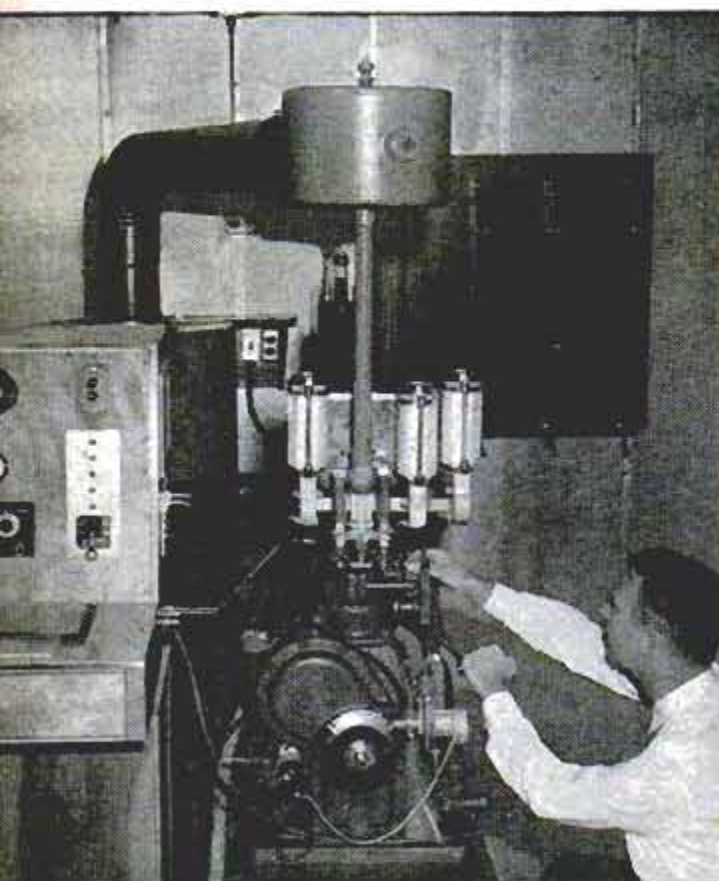
Make up a chart on a pad like those shown on page 177. Put a few gallons of regular gasoline in the tank. (If you have been using premium, the tank should be almost empty when the regular is added. Then run the engine until the regular gasoline has had time to work through into the carburetor.)

If your car has an automatic transmis-



You can retune your engine for the test with this homemade cardboard or wood scale that you match up against a bit of tape stuck to the distributor cap

Below, the author adjusts a variable-compression test engine used to measure the octane rating of gasolines





PICK STRAIGHT COURSE WITHOUT TRAFFIC HAZARDS

STARTING MARKER

You will find out which grade of gasoline is best for your car by simple tests on a course like this one

sion, stop beside the first marker and accelerate until you pass the finish line. If you have a handshift transmission, approach the starting line in high gear at exactly 20 miles per hour and floor the accelerator just as you pass the marker, keeping it floored until you pass the finish line.

Read the speedometer carefully as you cross the finish line. Write this figure on the chart. Also note on the chart the amount of engine knock, if any, during the run, describing it as trace, light, medium or heavy. It may be wise in the first test, at least, to make several runs to get an average to allow for minor errors.

Now advance the spark $\frac{1}{8}$ inch (being careful to retighten the lock screw) and repeat the test. Turning the distributor in the direction the rotor spins retards the spark, the opposite way advances it. Then advance it again to the $\frac{1}{8}$ -inch marker and repeat. If necessary, advance the spark farther to find the point beyond which

there is no appreciable increase in acceleration or the point at which the engine knocks. In no event should you advance the spark beyond this point.

If the engine knocks at its original setting, turn the distributor the opposite direction to retard the spark $\frac{1}{16}$ inch and run the test. If it still knocks, retard another $\frac{1}{16}$ inch and repeat. Do this until you have retarded the spark enough so the engine does not knock on regular.

If the spark cannot be advanced to the maximum power point without knocking on regular, you now can fill the gas tank (it should be nearly empty by this time) with premium and drive around until the extra-cost fuel is in the carburetor.

Return to the course and test the car with premium at the distributor settings which, because of knock, could not be used with regular.

When you have finished, your note pad

(Continued to page 298)

Typical test data on a late-model high-compression car. On regular gas, it has to have spark set for acceleration loss of 2 to 4 miles per hour. This would probably be unacceptable to most drivers. It would probably go fewer miles per gallon on regular gasoline. With the spark advanced slightly, the car accelerates best and runs on premium gasoline without knocking

Spark setting	$\frac{1}{8}$ " Ret.	$\frac{1}{16}$ " Ret.	As found	$\frac{1}{16}$ " Adv.	$\frac{1}{8}$ " Adv.
Speed at end of acceleration run-m.p.h.	51	53	54	55	55
Knock {	on regular	None	Trace	Light	Did not try
	on premium	None	None	None	Trace

Typical test data on an older, low-compression car. Here the use of a premium gas would be money thrown away. With the spark set "as found" it develops maximum acceleration without knocking. If owner bought most expensive gas for this car and advanced the spark he would get less acceleration

Spark setting	$\frac{1}{8}$ " Ret.	$\frac{1}{16}$ " Ret.	As found	$\frac{1}{16}$ " Adv.	$\frac{1}{8}$ " Adv.
Speed at end of acceleration run-m.p.h.	50	51	52	52	51
Knock {	Reg.	None	None	Trace	Light
	Prem.	Did not try	Did not try	None	None

The T's A BIG BIRD NOW

To paraphrase a popular song: The grille is gone. It's now part of the big bumper. Sculptured metal is used instead of trim



THERE WILL be plenty of screaming over the new Thunderbird. Some will scream with delight about the roominess of the low-slung four-seater, about its big trunk space for vacation trips. Others will scream that Ford has destroyed their baby, the "cute" little T-Bird of yesterday.

Much larger than the original model (in fact, it is longer than some 1958 Ford sedans), the 1958 Thunderbird resembles the late-departed Continental Mark II.

Perhaps Ford is hoping to combine these two markets to create one that is big enough to be profitable. This may be an important factor in the design change.

The Thunderbird is now more closely related to the Lincoln than to the Ford. It is

produced at the same plant as the Lincoln. Actually, the unfinished bodies are built by the Budd Company and shipped to the Lincoln assembly plant for addition of running gear and interiors.

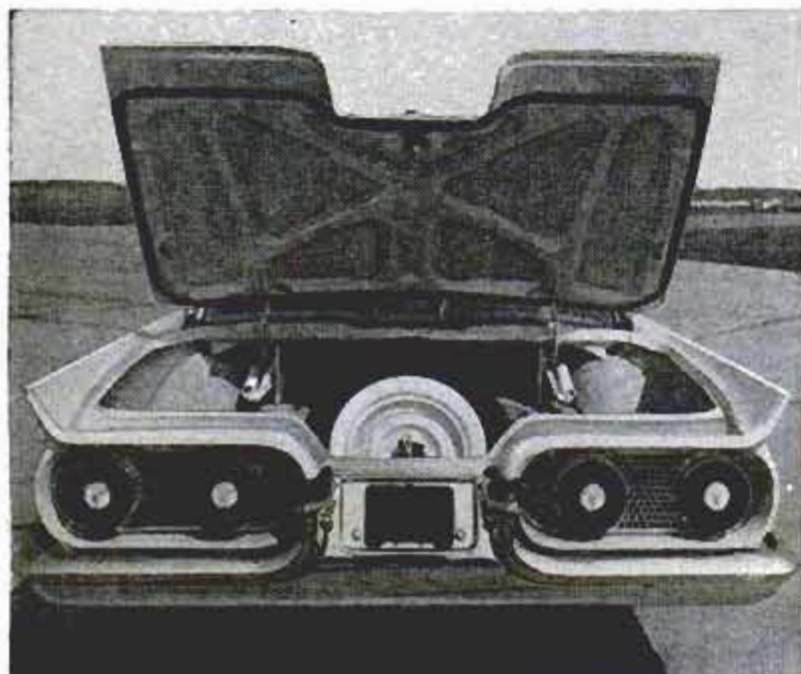
Unit construction is used throughout (as in the Lincoln), providing an all-welded, rattlefree package.

Four separate seats of the bucket type are used and the cushion contouring holds riders securely during fast cornering.

Standard is the 300-horsepower Ford V8 engine. Overdrive is optional with the three-speed handshift transmission. Dual-range automatic transmission is optional.

The hardtop is not interchangeable with the softtop — it's a permanent roof.

Luggage space is almost 50 percent larger in the new Thunderbird. The four round taillights have concentric backup lights



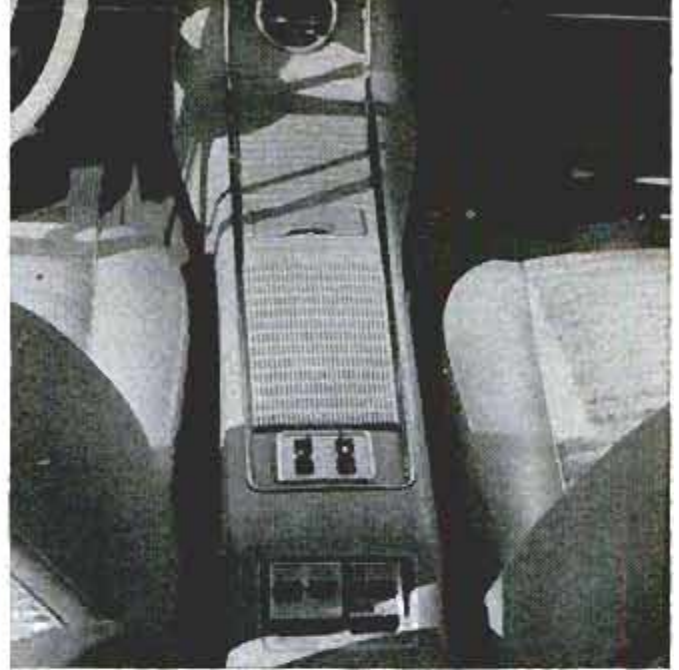
1958 SPECIFICATIONS

(1957 specs in parentheses)

Wheelbase	113.0 (102.0)
Over-all length	205.4 (181.4)
Over-all width	77.0 (72.8)
Over-all height	52.5 (51.6)
Rear-axle ratio	3.7 (3.56)
Bore and stroke	4.00 x 3.50
Displacement	352 (312 and 292)
Horsepower	300 (292 and 312)
Compression	10.2 (9.1 and 9.7)
Shipping weight	3708 (3299)
Headroom, front	34.5 (33.6)
rear	33.3 (none)
Seat height, front.....	11.0 (7.0)
rear	13.1 (none)
Legroom, front	43.4 (44.9)
rear	38.1 (none)
Luggage capacity.....	20.5 cu. ft. (14.0)
Turn-circle diameter	39.3 (35.0)
Wheel turns, lock-to-lock	4.1 (3.5)
Steering ratio	25 to 1 (23 to 1)



You can take along company now that the car has a back seat. All seats are higher, more comfortable



Right through the center runs this console on which are various controls. It's no car for young lovers

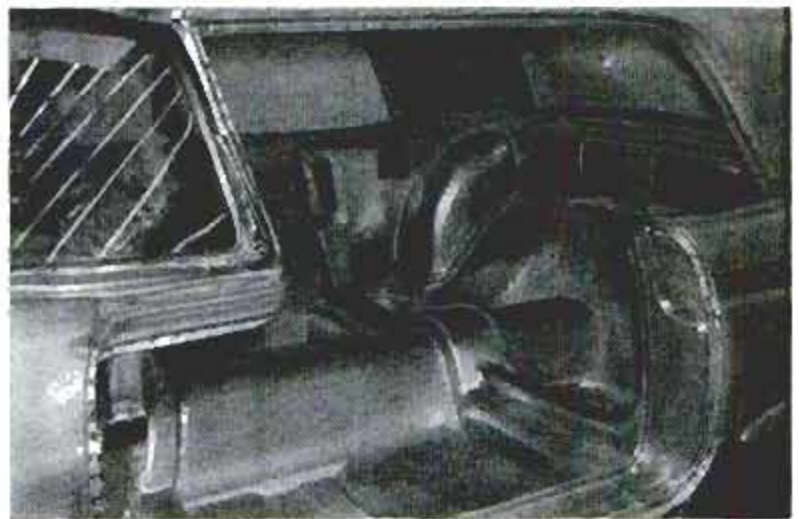
Not announced yet, but expected later is a soft-top convertible.

Suspension is by coil springs all around with air bags as optional.

Ford continues to describe it as a personal car, although the word prestige has been added. However, those who have driven prototype models feel that some of its personal character has been lost.

Being bigger and heavier, it has become more unwieldy, something that contradicts the personal tag. On first acquaintance, at least, it is not a car you feel intimate with.

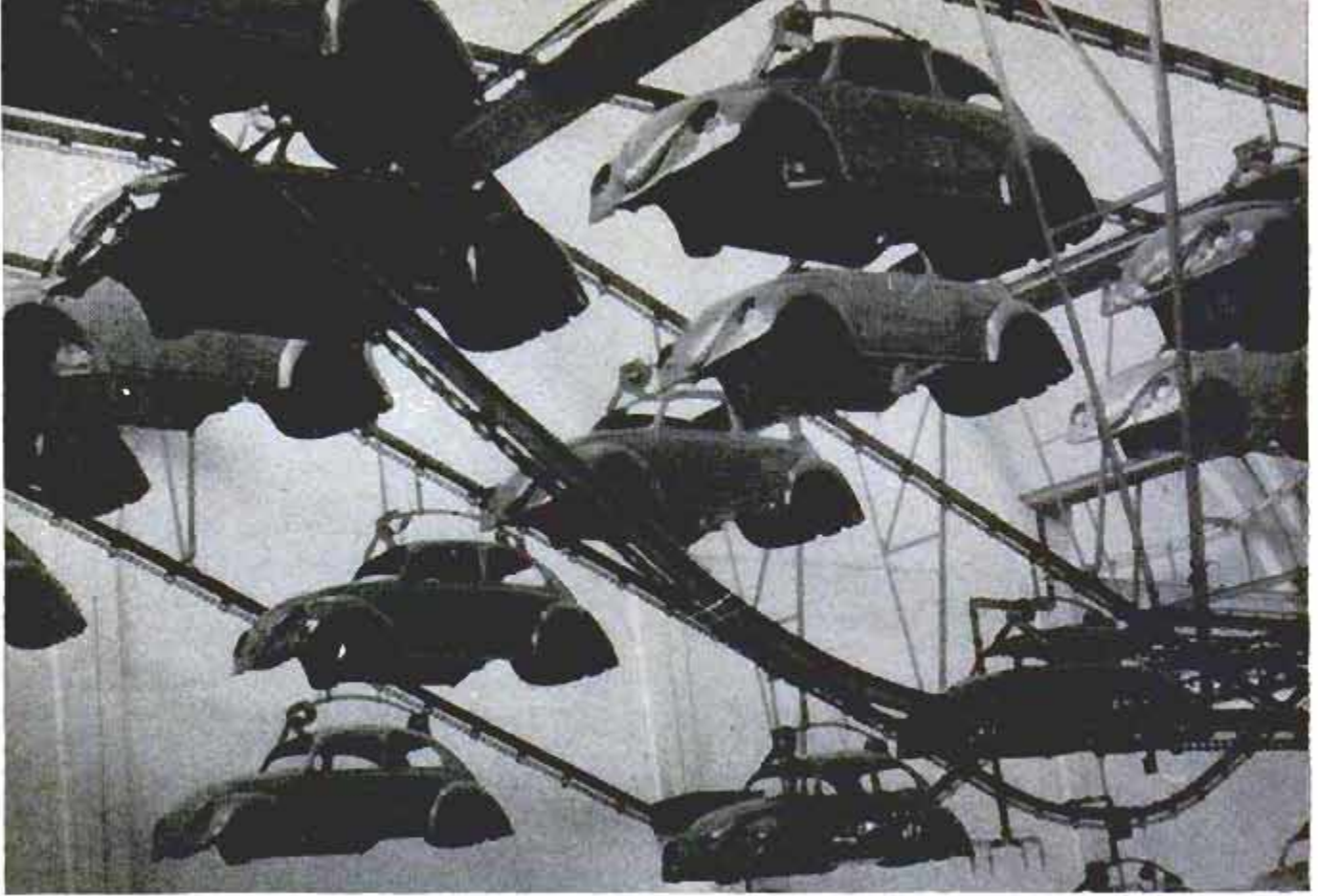
The new Thunderbird is a fine car by its own standards, but it is not the pert, old "Bird." ★ ★ ★



All-welded unit construction is used. Here you see the big driveshaft hump that makes the central console necessary

With its squared-off roof line and blind rear quarters, the new body is reminiscent of the Mark II Continental





Like ornaments on a Christmas tree, VW bodies inch along toward the five final assembly lines at Wolfsburg

By *Arthur R. Railton*

You might expect this many trunk lids to last weeks, but it's just enough for a day's production of VWs





The author, second from left, watches a worker operate a power wrench on one of the three VW engine lines

RARELY HAS what at first glance seemed like so little, accomplished so much.

That, in a sentence, is the Volkswagen story.

Defying most of the rules, a maverick all the way, the Volkswagen has become the world's first international car—a machine "at home" in 100 countries with customers in most of them waiting months for delivery.

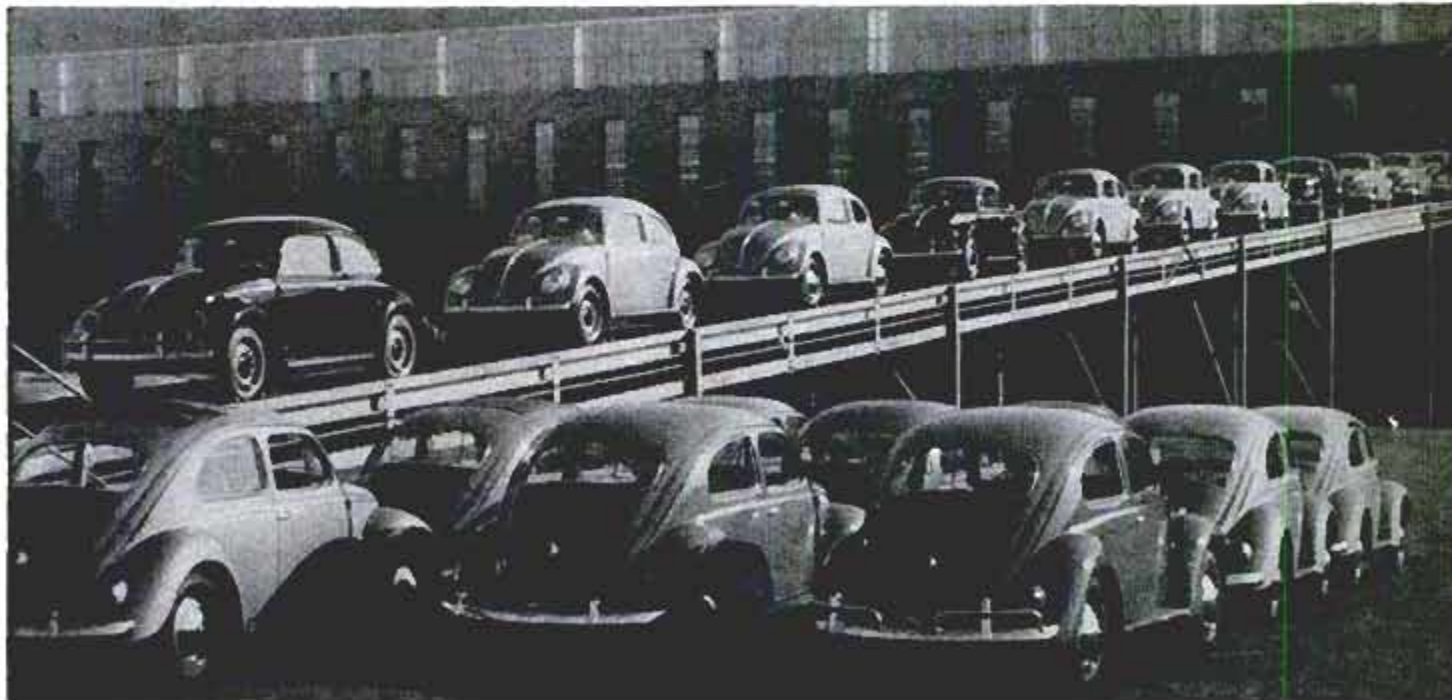
An empire is being created. Millions and millions of dollars are involved. Hundreds of thousands of persons are affected. In fact, some believe the economy of Western Germany (and perhaps of Western Europe and the Free World) is wedded to this enterprise.

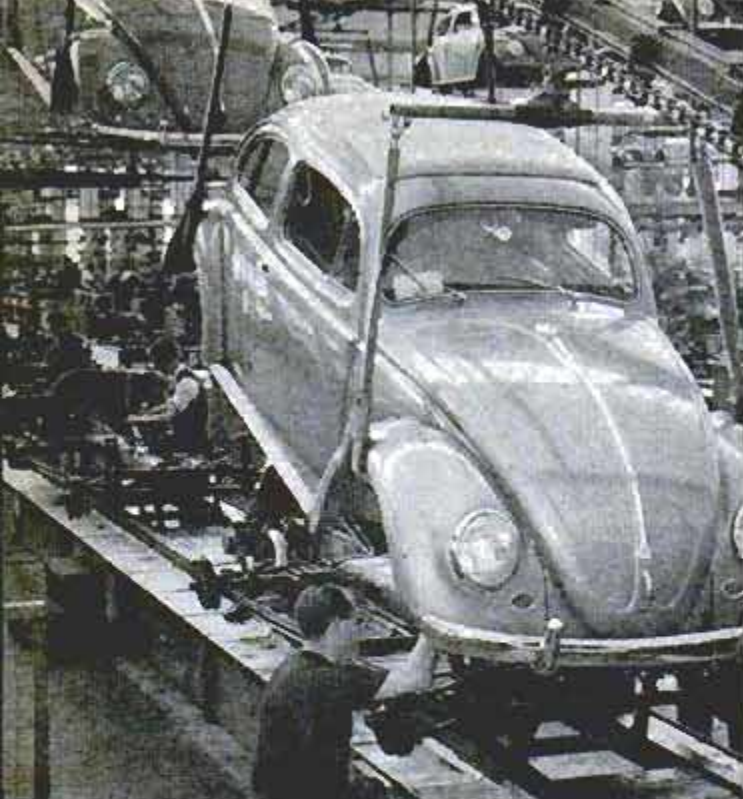
Yet the whole structure rests on an elemental, almost-too-simple machine designed and developed 20 years ago. It is a machine so unpretentious that the American auto industry laughed when it first began to sell in this country and even today some still laugh



Dr. Nordhoff: "The 4,000,000th VW will still look the same"

More than 2000 VWs a day stream down this conveyor belt off the five final assembly lines at Wolfsburg





Body drop on one of the lines. Production is simplified by having just one body: Two-door sedans

Fresh off the assembly line, VWs are hauled on long double-deck trains to Hamburg for shipment overseas

(although their numbers are decreasing).

Yet it sells in greater numbers each year with no evidence of slackening.

How long can this continue? Success like the VW's is easy to take, but is it easy to hold?

Millions Without Change

Millions of VW engines have been built without major change in the past 20 years—a longer period of production than the Ford Model-T engine (VW officials are keenly aware of the parallel and ask uneasily "Will it happen to us?").

Yet this 20-year-old engine supports the empire. Will it support it for another 20 years?

The writer went to Wolfsburg, Germany, the city of Volkswagen, to study the VW miracle. I wanted to learn what makes this car, which looks so ordinary, so successful. I wanted some guesses about its future.

I wanted to find out if success will spoil Volkswagen.

One hazard of success is that you tend to stick with the formula—you resist change. By standing still (as Ford did with the Model T) you let the world rush past.

Will Volkswagen make this mistake?

Dr. Heinz Nordhoff, top man at Volkswagen, told this reporter that "the only decision I am really proud of is that I have refused to change Porsche's design. It's hard to remain the same. You can always sell cars by being new. But we chose a different course."

There is plenty of pressure on Nordhoff

to change. There always has been—even in the beginning before Nordhoff took over.

Right after the war, when VW was first resuming production, the so-called experts demanded changes. You can't sell that car without changing it, they said.

In the first place, they warned, it is associated with Hitler. Nobody is going to buy a car so closely linked to Hitler and the Nazis.

"It Needs a New Name"

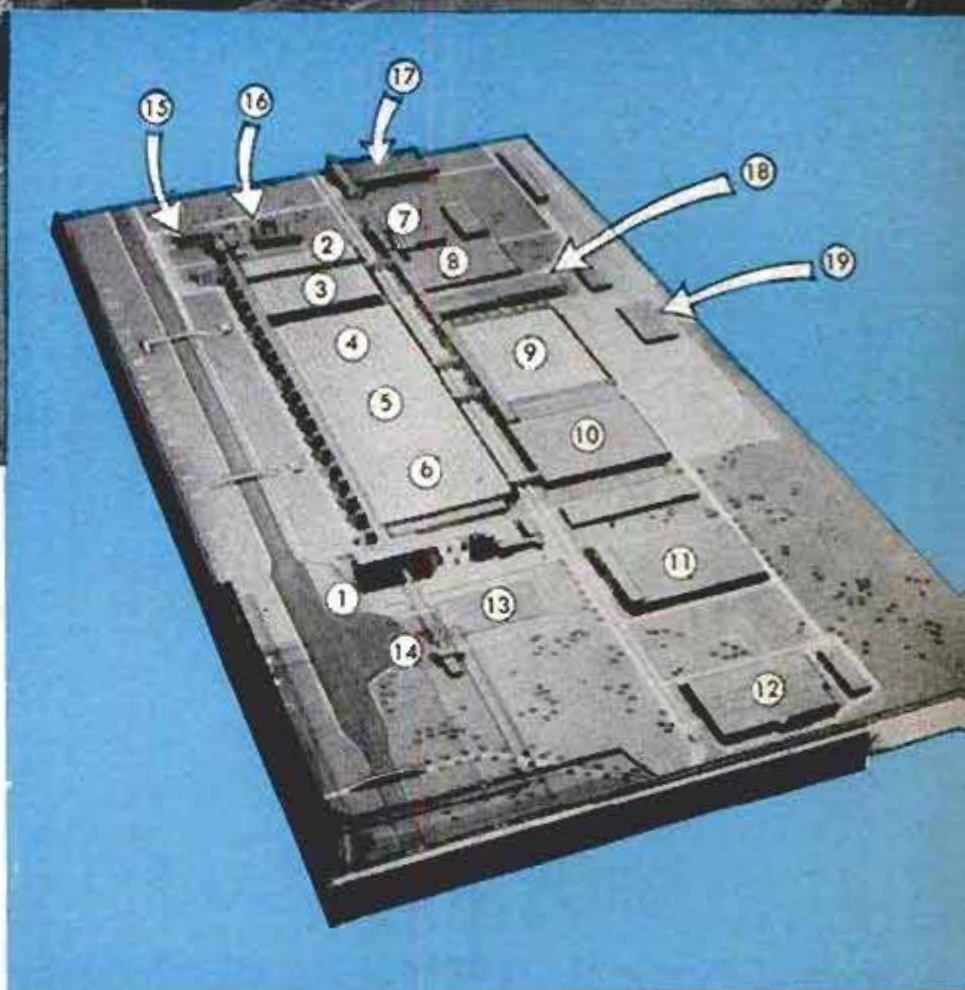
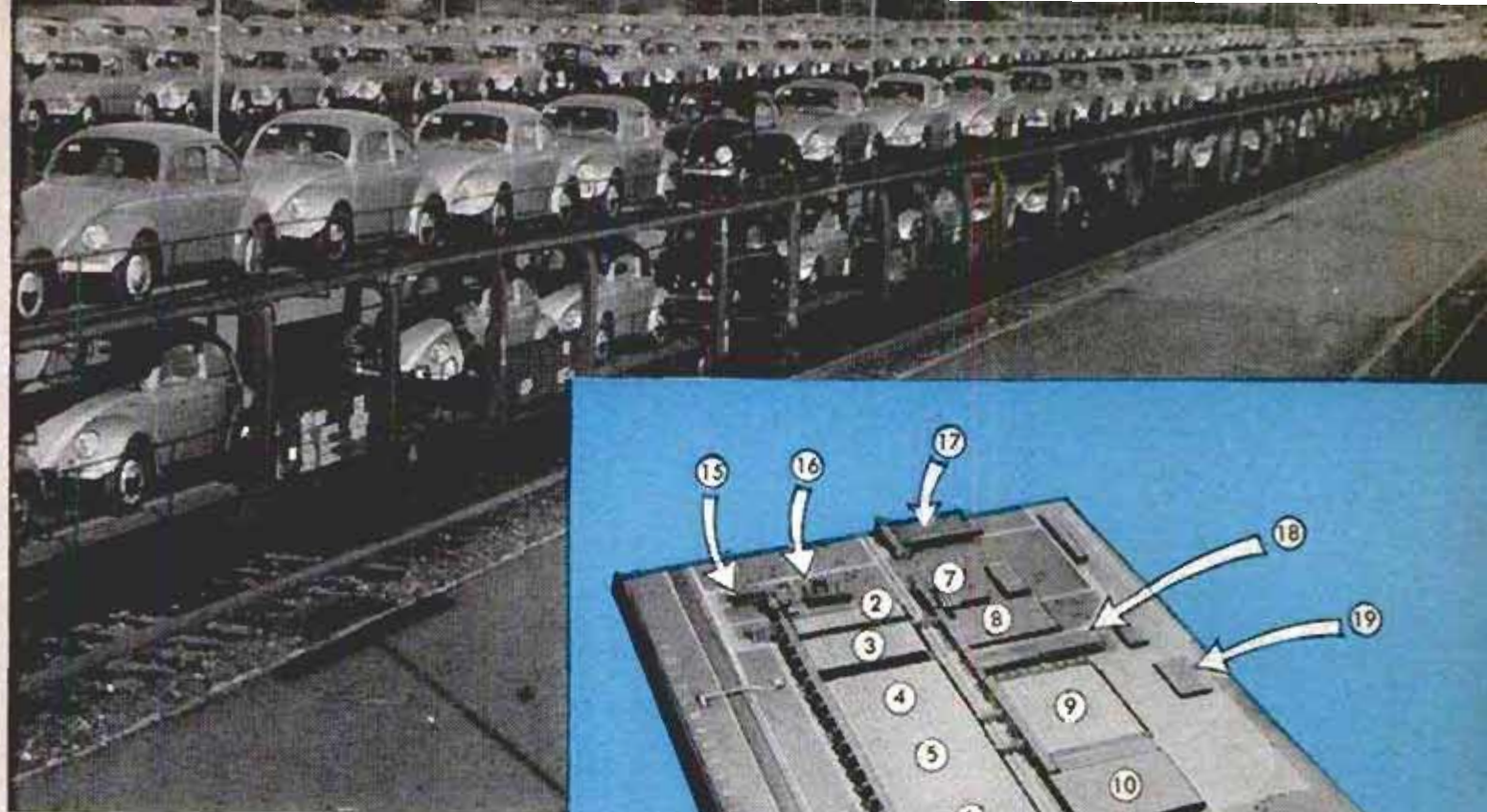
In the second place, it has a name that the rest of Europe won't buy: Volkswagen. That's too German, too soon after the war. You must give it a new name to show it's the new Germany.

And anyway, these experts continued, the design is wrong. It has a rear engine and a rear engine will never sell. It has an air-cooled engine and the Franklin Company long ago discovered that air-cooling won't sell. It's too noisy. And those headlights in the fenders! Pierce Arrow went broke with that design.

These were the arguments for change back in 1946 and 1947.

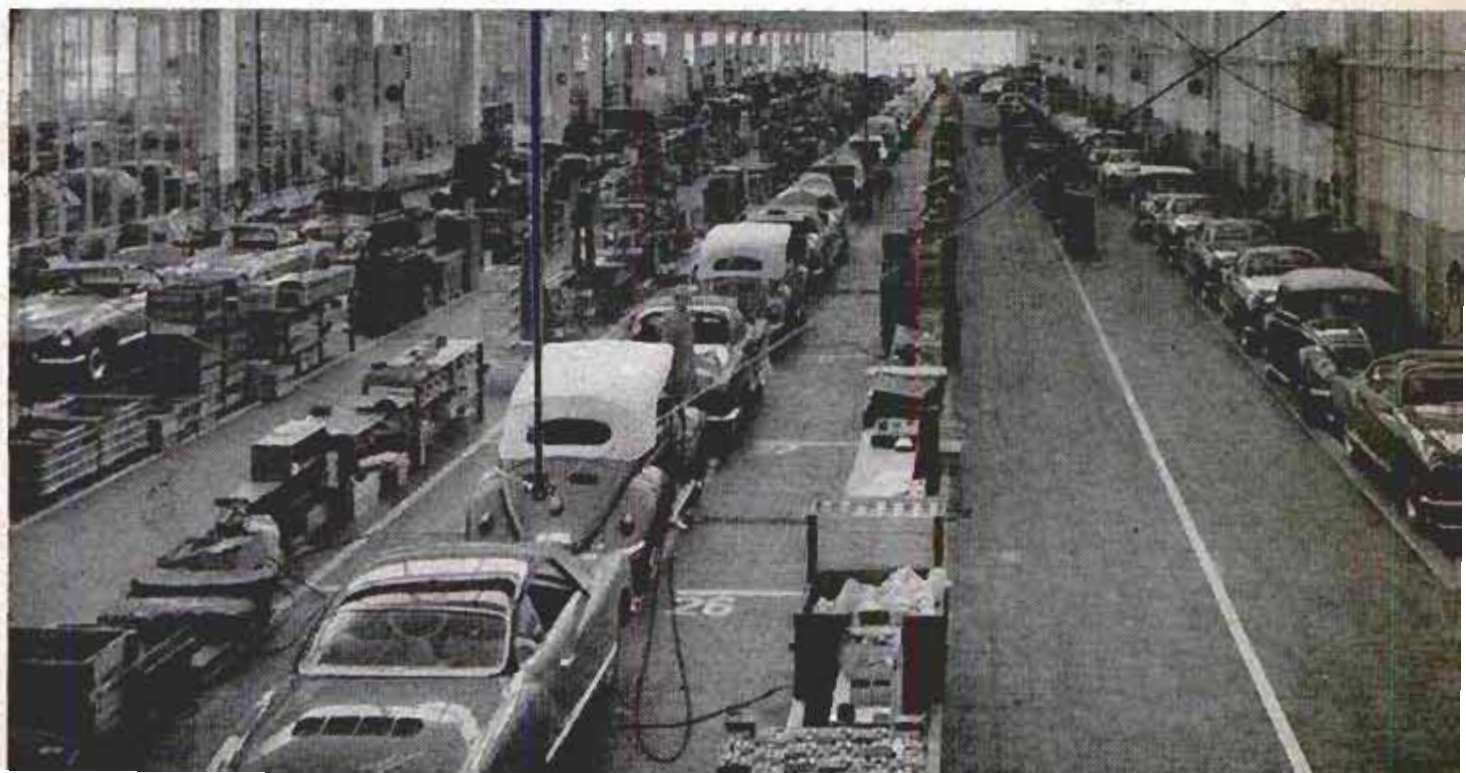
But at the start (this was before Nordhoff took over), the car couldn't be changed. It either had to be built as it was or not built at all. There was no money, no material, no machinery for changes.

But there were many workers in Wolfsburg, most of them refugees. They were happy to work, mostly to have something to do, to feel some security in an uncertain, demoralized war-torn country. They had



1. Power plant; 2. New stamping mill; 3. Old stamping mill; 4. Body assembly in white; 5. Frame, chrome, upholstery; 6. Engine-transmissions; 7. Research and Development; 8. Knocked-down-car shipping; 9. Final assembly and painting; 10. Wheel shop; 11. New engine-transmission plant; 12. Foundry; 13. Harbor for Midland Canal; 14. Conveyor belt to boilers; 15. New office building; 16. Service department; 17. Spare-parts warehouse; 18. Shipping office; 19. Train loading. Originally, the plant included only 1, 3, 4, 5, 6, 7, 12, 18

At Osnabrück, the Karmann Company takes VW chassis and builds sleek Ghias and Volkswagen convertibles





Air view of original plant after bombed areas (blue lines) were repaired. It's much larger today, see page 183

barracks in which to live, electricity from the factory's power plant to light their homes and potatoes to eat—but not much more at first.

Most of the cars they built were taken over by the Allied military authorities. Nobody in Germany could buy cars anyway. And the car wouldn't sell elsewhere because of its reputation and design—at least, so the British occupation forces thought.

Dutch Importer Turns the Tide

The first real break came when a Dutch importer visited Wolfsburg and said he could sell 10,000 of the cars if he could get them to Holland. That man was Ben Pon (still the VW distributor in Holland—a

rich man today). Some VW veterans say he's the man to whom they owe everything. He proved the car would sell outside Germany. The great success story had begun.

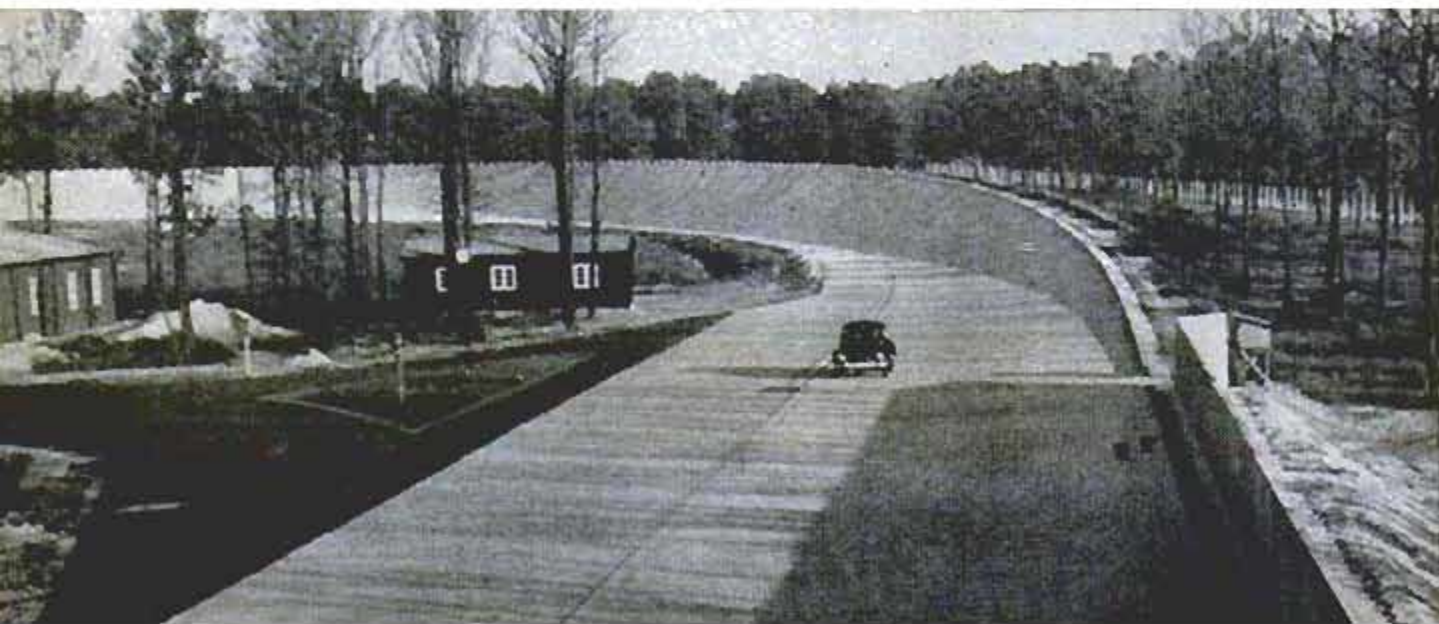
But will this success story continue? You don't stay ahead by standing still. Nordhoff knows that. And, contrary to what most people think, Volkswagen has not stood still.

Changes Have Been Minor

Not one part of the VW is the same as the original version, Nordhoff told me. Most changes have been minor. But there have been big changes (by VW standards at least): Synchronesh transmission; completely redesigned oil cooler (the result of

(Continued to page 254)

Built for speeds up to 100 miles per hour, this one-mile engineering test track seems to be rarely used



HERMAN ESARGUE
EXPERT RADIATOR SERVICE
BROOKFIELD, ILL.



How a Professional Recores an Auto Radiator

By Henry J. Kandl

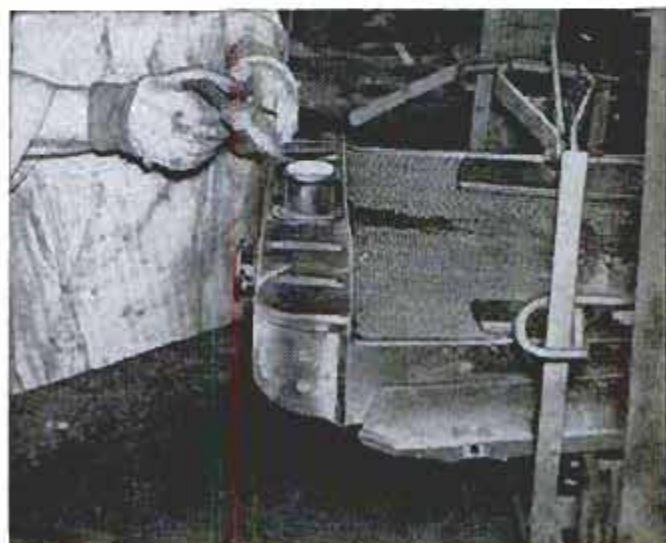
1130 ROBINHODD LANE
LAGRANGE PARK, ILL.

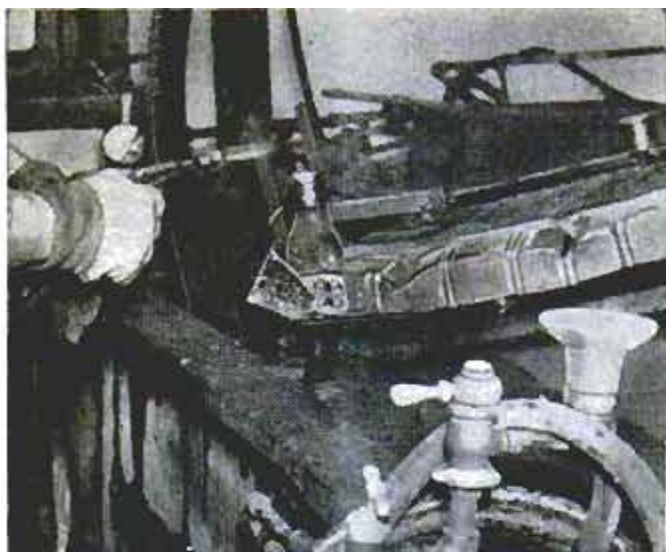
IF YOU HAVE EVER had to replace the radiator of your car because it had been damaged or was badly plugged and caused overheating, your mechanic probably recommended that the radiator be recored. This repair is just as effective as a com-

pletely new radiator, but is considerably less expensive. You were pleased at being able to save money, but have you ever wondered just what recoring is? The step-by-step photos on these pages show how a professional replaces a core. ★ ★ ★

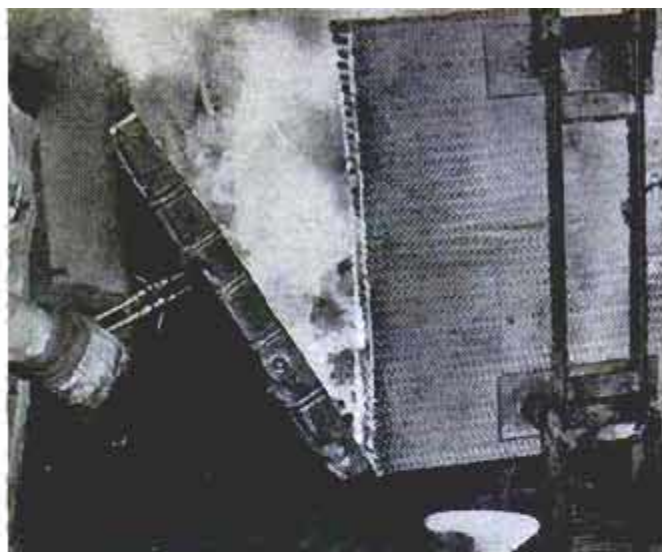
This radiator has been damaged by the engine fan and crankshaft pulley during front-end collision

First step in disassembly of damaged radiator is to unsolder upper ends of side brackets from upper tank

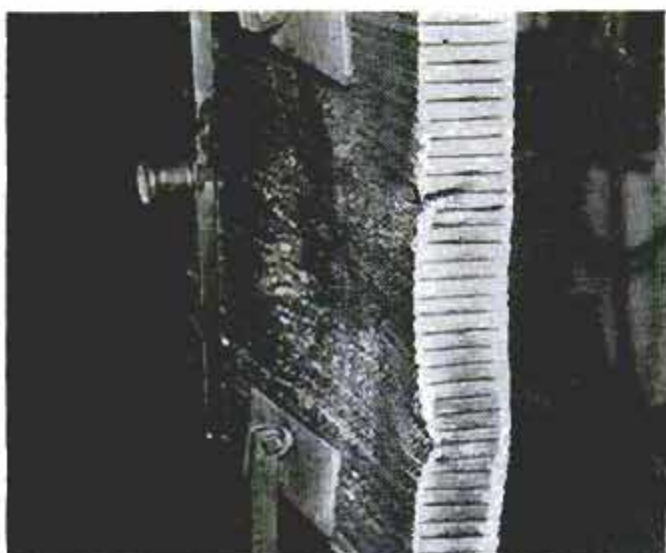




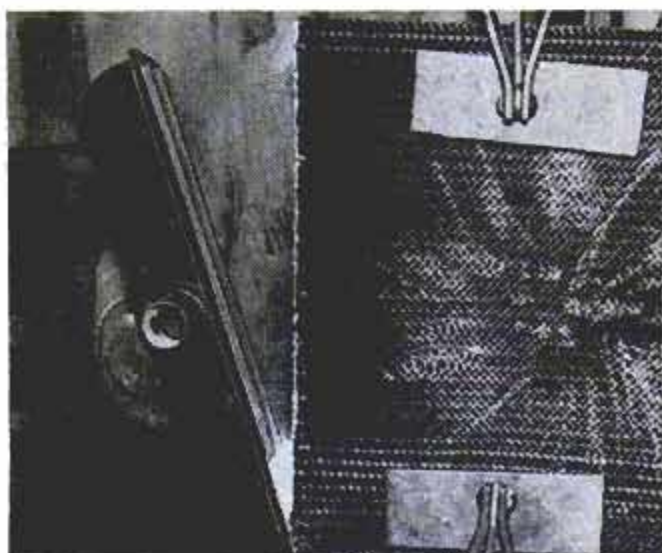
Lower ends of side brackets that hold radiator in car are removed from bottom tank. Note that tank also has been damaged in collision and needs repair



After side brackets are removed, the bottom tank is unsoldered. After it is removed from old core, tank is repaired easily and reshaped to fit new core



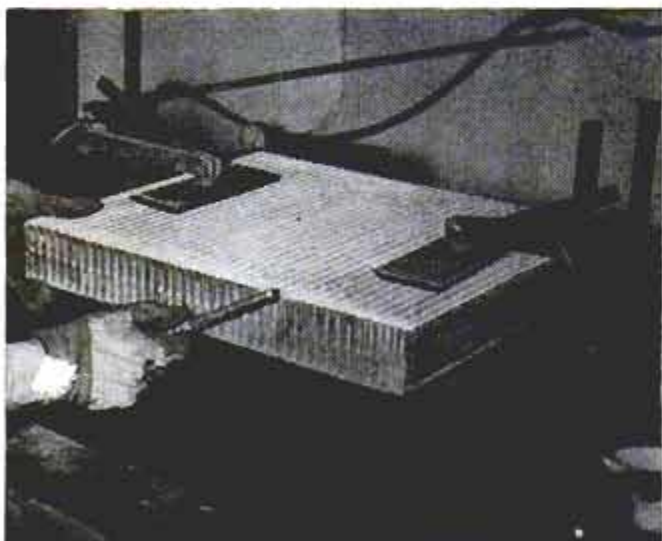
View of lower end of radiator core shows extent of damage. Deep cuts on end of core extend into water tubes, which appear to be long, thin slits in core

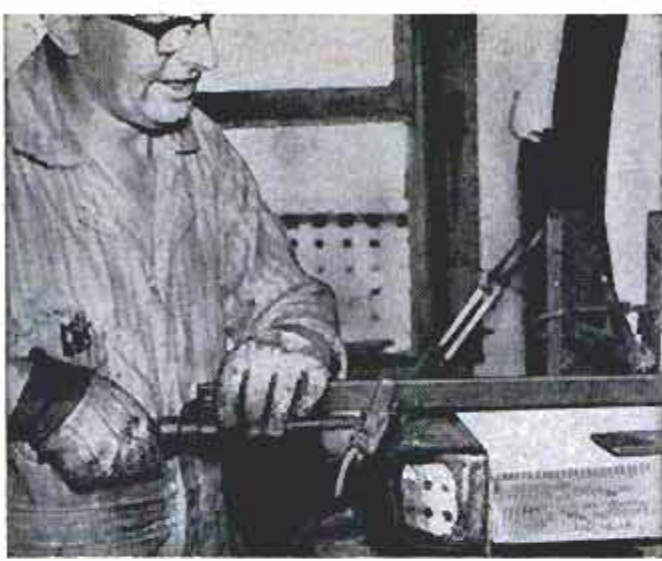


Last step in disassembly of damaged radiator is removal of upper tank. Air-acetylene torch is used for all operations, as it has lower temperature flame

Edges of upper and lower tanks are wire-brushed to remove rust, dirt and scale to assure complete tinning in preparation for soldering them to new core

Edges of new core now are cleaned with a wire brush to remove any residue that may have been formed during manufacture, to assure watertight soldering

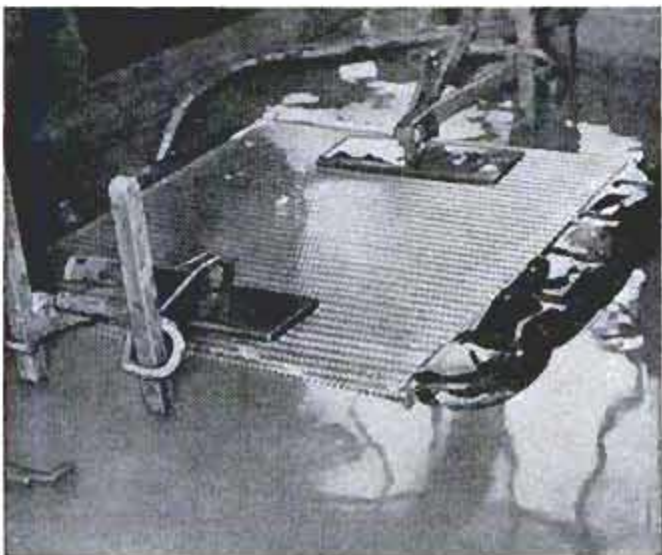




Upper tank now is clamped to new core and soldered in place. Lower tank is attached in the same manner. Special jig keeps core in proper working position



Bottom tank is already soldered in place. Here upper tank is receiving final touches. Skill is required for soldering, as radiator metal is extremely thin



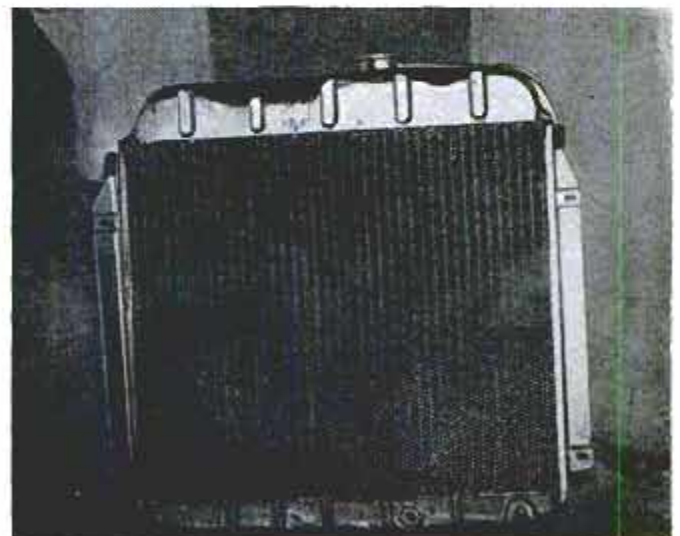
Core-and-tank assembly now is tested under air pressure in water tank. Test is made both before and after side brackets are attached to assembly



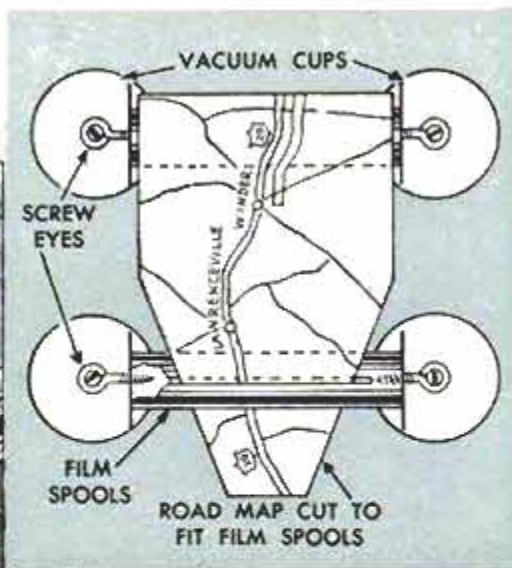
Side brackets are set in place and ends are soldered to upper and lower tanks of radiator. This is the final step in reassembling reconditioned radiator

Strictly for the sake of appearance, a coat of special black paint is sprayed on finished job. Paint is of a type that does not insulate against heat

Here is recond radiator, shining in its new paint. It looks like a brand-new radiator, will operate just as efficiently as original radiator on the car



"Roll Off" Map Holder Mounts on Car Instrument Panel



Four vacuum cups, of the type fitted with a screw, are mounted on top of the instrument panel to hold four screw eyes that provide "axles" for two film spools as shown in the detail. Cut a strip from a road map to include your route, making the strip just wide enough to fit on the spools. Taper the ends of the map strip so that it can easily be threaded onto the spools. The threads on the screw eyes, binding against the inside of the spools,

will prevent the latter from rolling too freely when the map is being unwound.—Bruce D. Stewart, Winder, Ga.

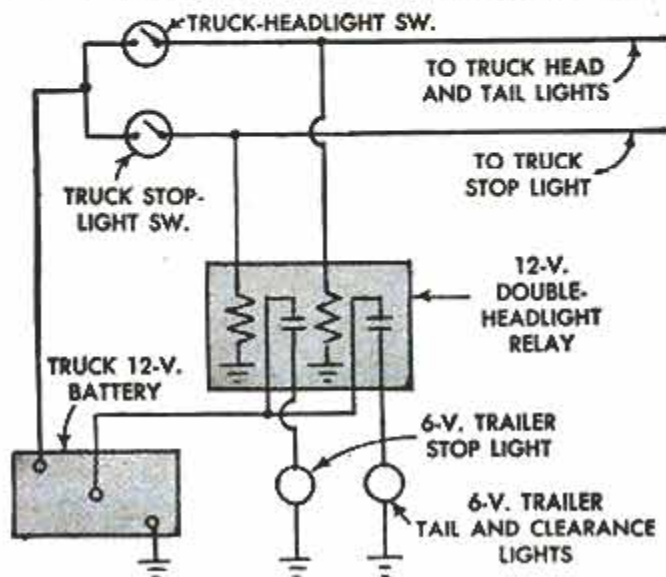
There will be no need for fumbling with a folded road map while driving if you make this convenient "roll off" map holder.

Causes and Cures for Cool-Weather Engine Stalling

During late fall and early spring, when the weather is cool and humidity high, many motorists are troubled by having their car engines die every time speed is dropped to idle. After a few miles of driving, when the engine is thoroughly warmed, the problem disappears. "Carburetor icing" is the term generally used to describe the condition that causes the trouble. When gasoline is sprayed into the carburetor throat it tends to vaporize, and in so doing requires heat. It absorbs heat from whatever is around it, in this case the carburetor. The temperature of the metal is reduced to the freezing point, and air, drawn in with the gasoline, contains a large percentage of water vapor on a humid day. The water vapor condenses

and freezes on the cold metal, and can build up a sufficient volume of ice to restrict the carburetor throat. When the car is driven at moderate speed, the throttle plate is open far enough so that gasoline and air can be drawn into the manifold. However, when the throttle plate is closed to the idle position, the opening is so small that the ice completely restricts it. Some gasolines now have additives that prevent icing conditions. However, if you have this problem with your car, there are a couple of things that can be done. One is to set the idle adjustment for a slightly faster idle during the weather periods in which icing occurs. A second method is to shift to neutral when stopping, with left foot on the brake, right foot on the gas pedal.

Tractor-Trailer Fleet Equipped With Two-Voltage Lighting

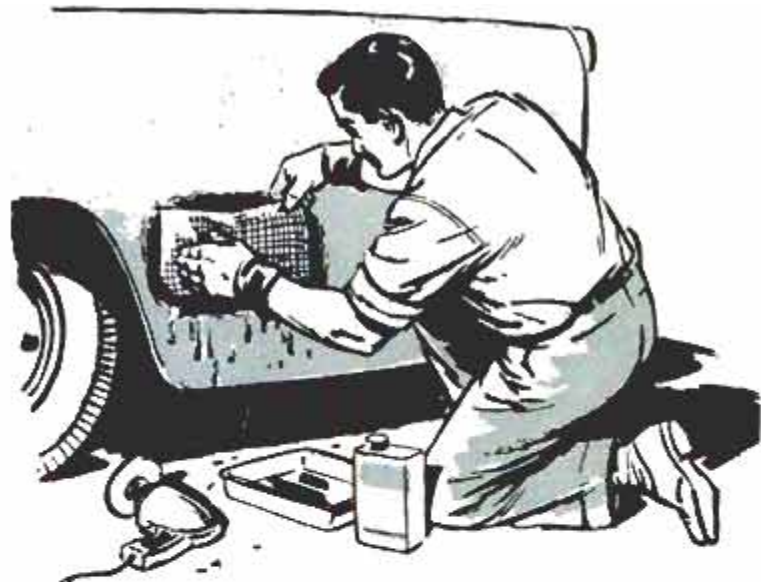


When one truck-fleet owner purchased a number of new tractors that had 12-volt lighting systems, he was faced with the problem of using them with trailers equipped with 6-volt lights. Also, because some of the older tractors still had 6-volt systems, it was impractical to convert the trailers to 12 volts. His solution was to have a battery post soldered to the center post of each 12-volt battery, and a lead run from this post through a circuit, including a headlight relay, as shown in the detail. Another method of achieving this result would be to hook up a resistor to a separate wiring system, which would reduce battery current from 12 to 6 volts.

Albert W. McDermid, Sacramento, Calif.

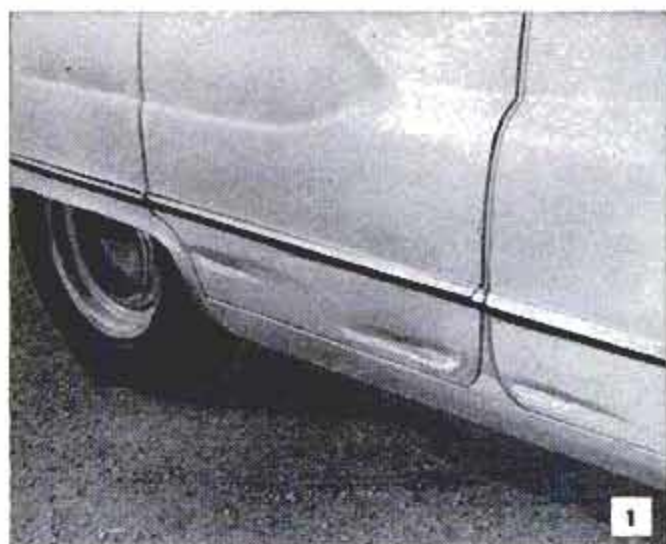
Do-It-Yourself Auto-Body Repair

Photos courtesy
Taylor and Art Plastics, Inc.

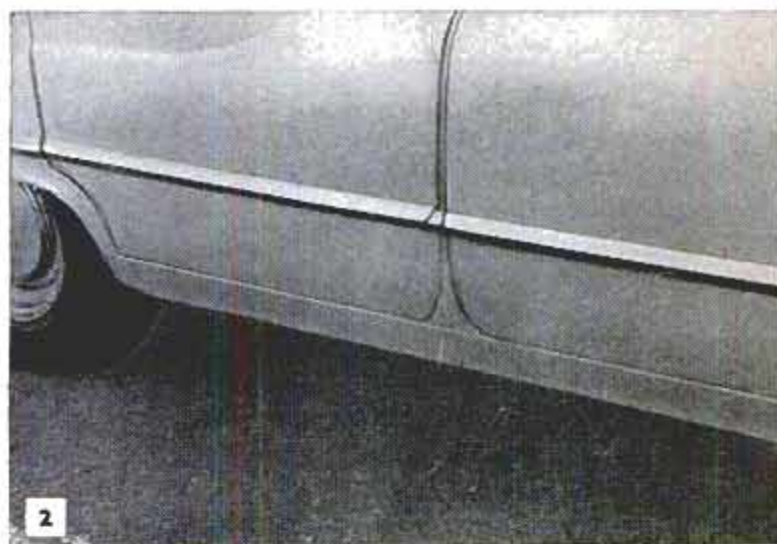


LIKE MANY ANOTHER skill, automobile-body repairing now has become a job that can be handled easily by the handy man. Glass-fiber materials and epoxy resins have made this possible. Most glass-fiber products, such as auto bodies and awnings, consist of glass fiber and polyester resins. This latter resin produces a strong, lightweight material, but does not adhere to other substances. Epoxy resin adheres tenaciously to metals and other materials. When buying a repair kit for auto-body work, be sure it contains epoxy resin. Because no heat is required when making repairs with glass fiber,

warping and distortion of the sheet metal do not occur. Also, since no acids or fluxes are required, as when lead is used to make a sheet-metal repair on a car body, glass-fiber does not present a painting problem. If fluxes and acids are not completely removed or neutralized, they will



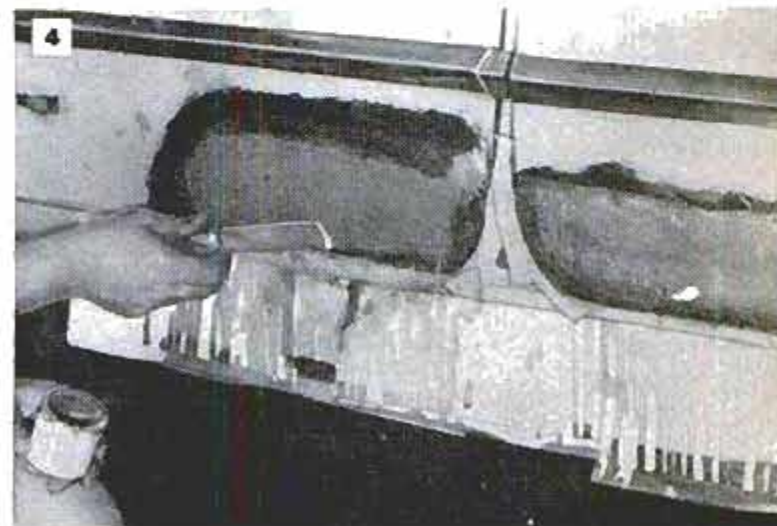
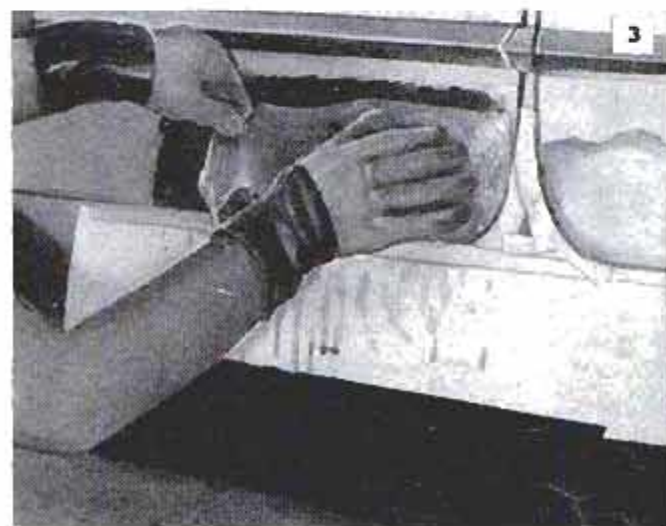
This type of damage, not extensive, but unsightly and value-reducing, is repaired easily by the handy motorist with kit containing glass fiber and resin



Repair with glass fiber restores original appearance to car body. Repair is as permanent as one made with metal, has added advantage of being rustproof

Because excess resin will run onto paint and damage it, paper towels are taped to body around area to be repaired, so they absorb resin, protect the paint

After glass-fiber cloth has set and been sanded, small pits and imperfections are filled with glass-fiber "putty," applied with regular putty knife





Heat lamps are used to warm metal before glass-fiber patch is applied and, as here, to speed drying of patch after it has been applied to body metal

Disk sander is used first to prepare surface for repair, then to smooth glass-fiber patch after it is applied. Use coarse or medium-grit sanding disks

react with the paint and cause it to peel off down to bare metal.

Whether damage to an auto body is due to something denting the sheet metal, as in Fig. 1, or is due to rust, Fig. 7, it can be repaired to like-new condition as shown in Figs. 2 and 9. The first step in making a glass-fiber repair is to sand down the damaged area, Figs. 6 and 7, removing the paint several inches beyond the actual damage.

Next, wipe the sanded metal with a solvent to remove all traces of oil and wax. If there are holes torn or rusted through the metal, tap the edges inward. Now, drill a series of small holes just outside the perimeter of the damage. Resin will be forced through these holes and help anchor the glass-fiber patch to the sheet metal. To assure maximum adhesion of the glass-fiber material, the damaged area of the car body should be warmed by using heat lamps. Pieces of glass-fiber cloth now are cut to fit over the damaged areas. The resin and hardening chemical now are mixed together in a shallow pan in the proportions given by the manufacturer. Rubber gloves must be worn when dipping the glass-fiber cloth in the resin and applying it to the sheet metal, Figs. 3 and 8. Heat lamps are used again, this time to speed drying. When dry, the glass-fiber patches are sanded down to the contour of the body. If any air bubbles or low spots appear, glass-fiber "putty," a mixture of chopped glass fibers and resin, is spread on the patch, Fig. 4. After the putty has set firmly it is sanded flush, the area is cleaned and a prime coat of paint is sprayed on the repair. As shown in Figs. 3, 4 and 5, paper towels should be attached to the sheet metal around the damaged area to prevent the resin from harming the paint. ★ ★ ★

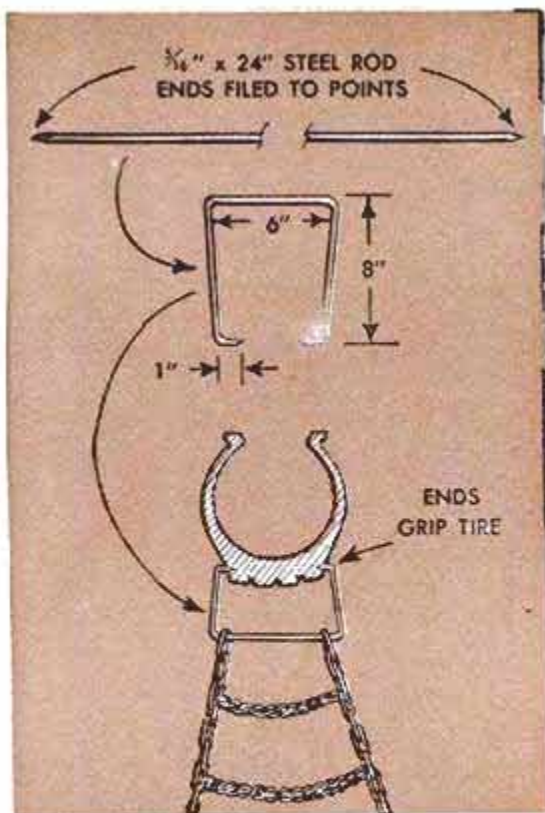


Rusted-out areas of body sheet metal are repaired as easily as dents. If holes are quite large, wadded newspapers are used to support patch until it sets

When applying glass-fiber cloth that has been dipped in epoxy resin, rubber gloves are worn to protect hands. Cloth is pressed smooth to remove air bubbles

Trunk lid has been restored to like-new condition without need for welding or use of lead. Repair is strong, light, rustproof and as permanent as metal





U-Shaped "Clamps" Simplify Installing Tire Chains

Because installing tire chains is necessary only when the weather is at its worst, the job never can be considered pleasant. Also, due to the slight clearance between the wheels and fenders on some late-model cars, it is necessary to raise each side of the car with a bumper jack to permit fitting a chain on the wheel on that side. However, with the aid of two U-shaped "clamps," bent from $\frac{1}{16}$ -in. steel rod as indicated in the detail, the need for jacking is eliminated and the job of installing the chains is made easy. The ends of the arms of the U-shaped clamps are ground to points and bent inward, as shown, to

provide a gripping action on the edges of the tire treads. In use, the clamps are "threaded" through the end links of the tire chains and are clamped to the tire treads. The chains then are stretched out behind each wheel and the car is backed slowly until the clamps come around close to the opposite ends of the chains. Someone standing beside the car can signal the driver when to stop. Or, as illustrated, a block of wood placed at the end of each chain will contact the wheels and let the driver know that he has backed far enough. The clamps and blocks then are removed.

Andy Vena, Philadelphia, Pa.

Improving Windshield-Defroster Efficiency for Driver

On many cars, the defroster clears the passenger side of the windshield before it does the driver's side, where it actually is needed first. Generally, this is due to the fact that the defroster hose is shorter on the passenger side. On new cars, the difference in clearing time is only a matter of moments. However, on older cars, where the heater and defroster fans work with reduced efficiency, this time difference is noticeable and potentially hazardous. To

remedy this situation, remove the hose from the passenger side of the defroster-fan housing, and stretch a 1-in.-wide strip of tape across the outlet. This usually will balance the air flow so that the driver's side of the windshield will clear first. In some cases it may be necessary to reduce or increase the width of the tape strip in order to produce the desired defrosting effect on either side of the windshield.

Donald G. Daus, Indianapolis, Ind.

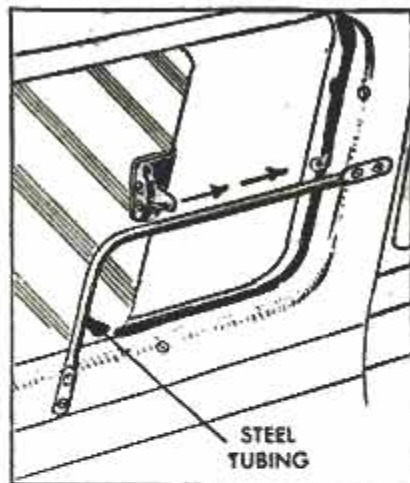
Turn Signal Indicates Emergency

With the indicator set for a left-turn, the directional lights on your car can be used as emergency caution lights when changing a tire or making other repairs at the side of a road at night.

Oil Prevents Frozen Trunk Lid

You can prevent the lid of your car trunk from being frozen shut this year by wiping the rubber gasket with a heavy coating of olive oil. The oil, which helps seal out water, will not harm the rubber gasket.

Guard Rails Protect Children in Rear of Station Wagon



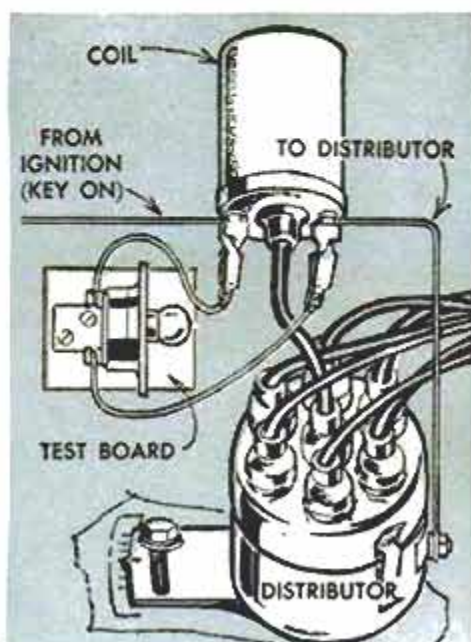
Restless youngsters riding in the back of a station wagon sometimes are tempted to slide open the windows and lean out to view the passing scenery. You can protect against this potentially hazardous situation by fitting guard rails, bent from steel tubing, inside the windows as shown. They are attached with sheet-metal screws.

Auxiliary Ignition Battery for Cold-Weather Starting

For every degree drop in temperature, an automobile storage battery loses some of its efficiency, and down around zero degrees F. the usable energy in even a fully charged battery may be only 60 percent of normal. This often is the reason that the starter sometimes seems barely able to turn over the engine on a bitter-cold day. And because cold oil in the engine causes increased resistance to the engine turning, the starter motor must consume more electrical energy than usual. The result is that little or no electricity is left to be sent through the coil, distributor and to the spark plugs. The engine simply will not start. However, with the aid of a 6-volt lantern battery—two in series for a 12-volt ignition system—plus a single-pole, double-throw, momentary-contact switch and a few feet of 16-ga. stranded copper wire, you can hook up a sure-starting auxiliary-battery system that will start your engine during even extremely cold weather. The

lantern batteries are held on the fire wall in a clamp bent from sheet metal and attached with sheet-metal screws. Note which pole of the car battery is grounded and ground the corresponding poles of the lantern batteries. Next, remove the coil end of the wire leading from the ignition switch to the coil and connect a wire in its place to run to the momentary-contact switch that is located on the instrument panel. Connect the wire from the coil to the common pole of the switch. Now, connect the wire from the ignition switch to the normally closed pole of the switch. A length of wire then is run from the lantern batteries to the momentary-contact pole of the switch. For starting the engine, push the switch to the momentary-contact side and use the starter in the usual way. Current from the lantern batteries goes through the coil and distributor and fires the plugs. When the engine starts, release the switch so ignition returns to normal.

Improved Timing Light Aids Home Auto Mechanic



Here is a timing light for the home mechanic. A 6 or 12-volt bulb, such as from a taillight, is fitted in a socket mounted on a wooden base. A wire on each contact of the socket has a battery clip at the end. One clip is snapped on each low-voltage terminal of the coil and the engine rotated until the timing mark aligns with the arrow. With the ignition on, rotate the distributor until the light just goes out, which indicates that the points are opening to produce a spark.



A PLACE FOR EVERYTHING

FOLD-AWAY SEWING CENTER

By W. G. Waggoner

FEW HOMES CAN SPARE a separate room for sewing. More are apt to have 12 in. of wall space which is all the depth this fold-away sewing center requires. When closed, it looks like just another wall storage cabinet, but when open, it reveals a most complete and compact sewing workshop that is sure to please any family seamstress. Here in one floor-to-ceiling cabinet are stored all the essentials that go to make sewing really convenient. Featuring drop leaves which let down to provide a padded cutting and pinning table and a legless sewing-machine stand, the cabinet has a separate compartment for a dress form, shelves for dress material and patterns, thread racks and three button trays.

Where you can install it is an individual problem. Perhaps the most practical locations are in a bedroom, if large enough, or

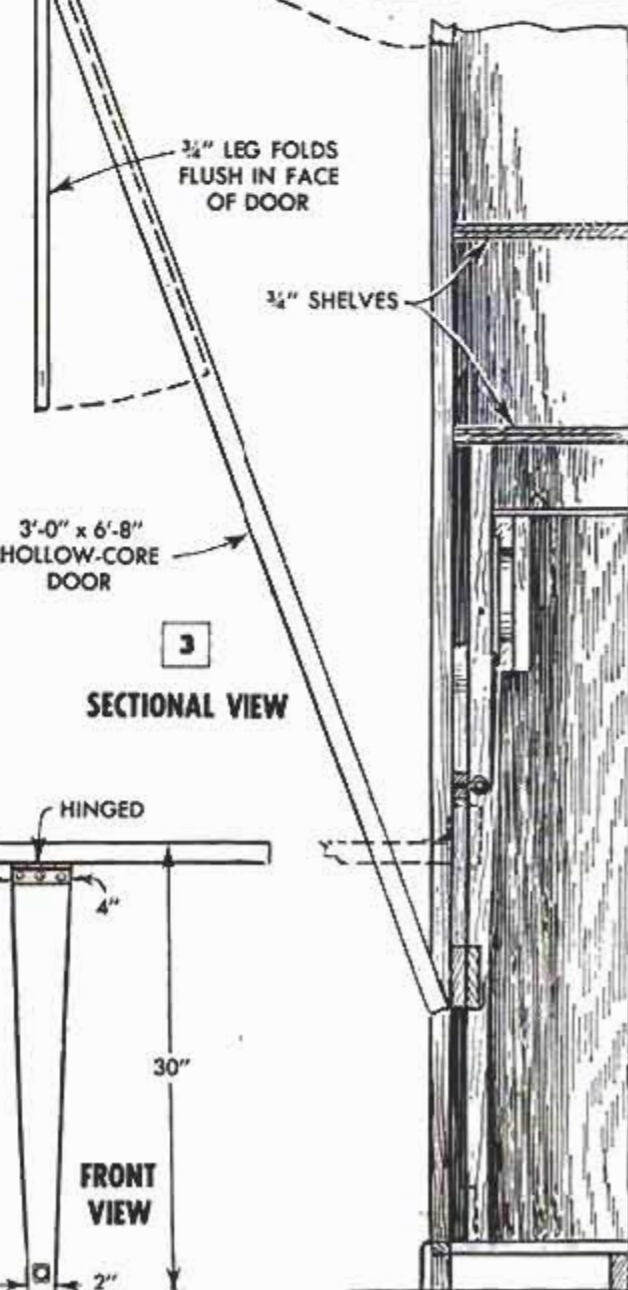
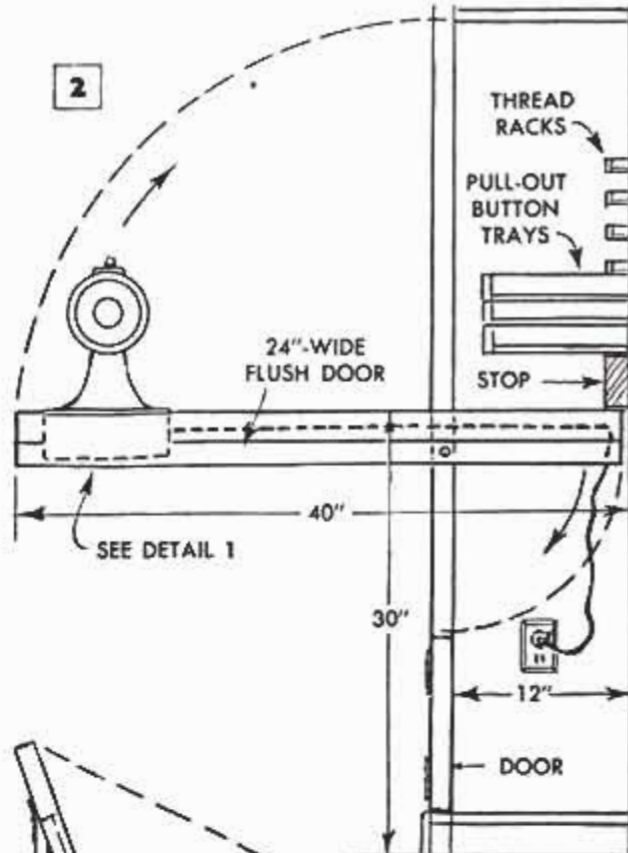
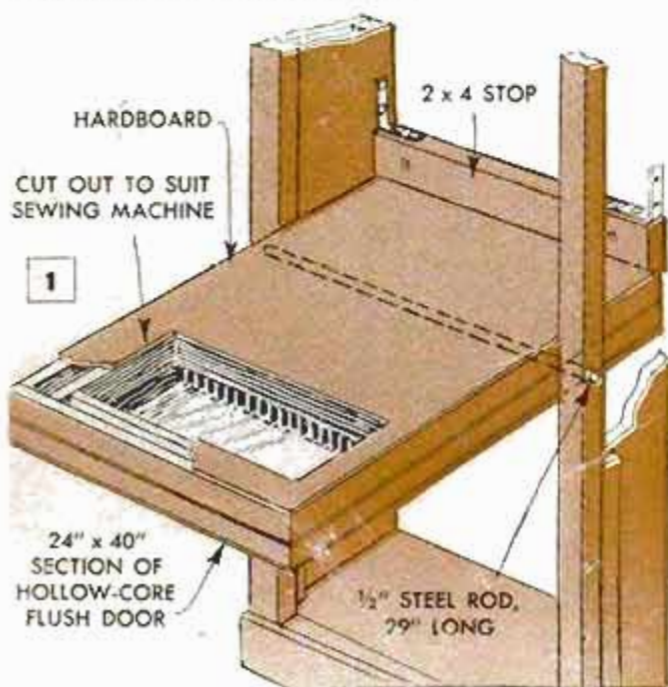
in a corner of a basement recreation room. Figs. 4 and 6 show how the basic cabinet goes together. The depth is determined by the height of the sewing machine since it swings in over the button trays. Plywood is used for the ends, bottom and partitions, as well as the overhead storage doors. Shelves and bottom are set in dadoes in the upright members and then the front edges are faced with 2 x 4s. Strips across the back at top and bottom serve as anchor cleats for screwing the cabinet to the wall. Three standard flush-type doors, two measuring 24 x 80 in. and one 36 x 80 in., are used for the drop leaves and for the door for the dress-form compartment. The 36-in. door provides the cutting table, while one of the others is cut in three pieces to make the sewing-machine table and the doors above and below it, Fig. 2. Note how

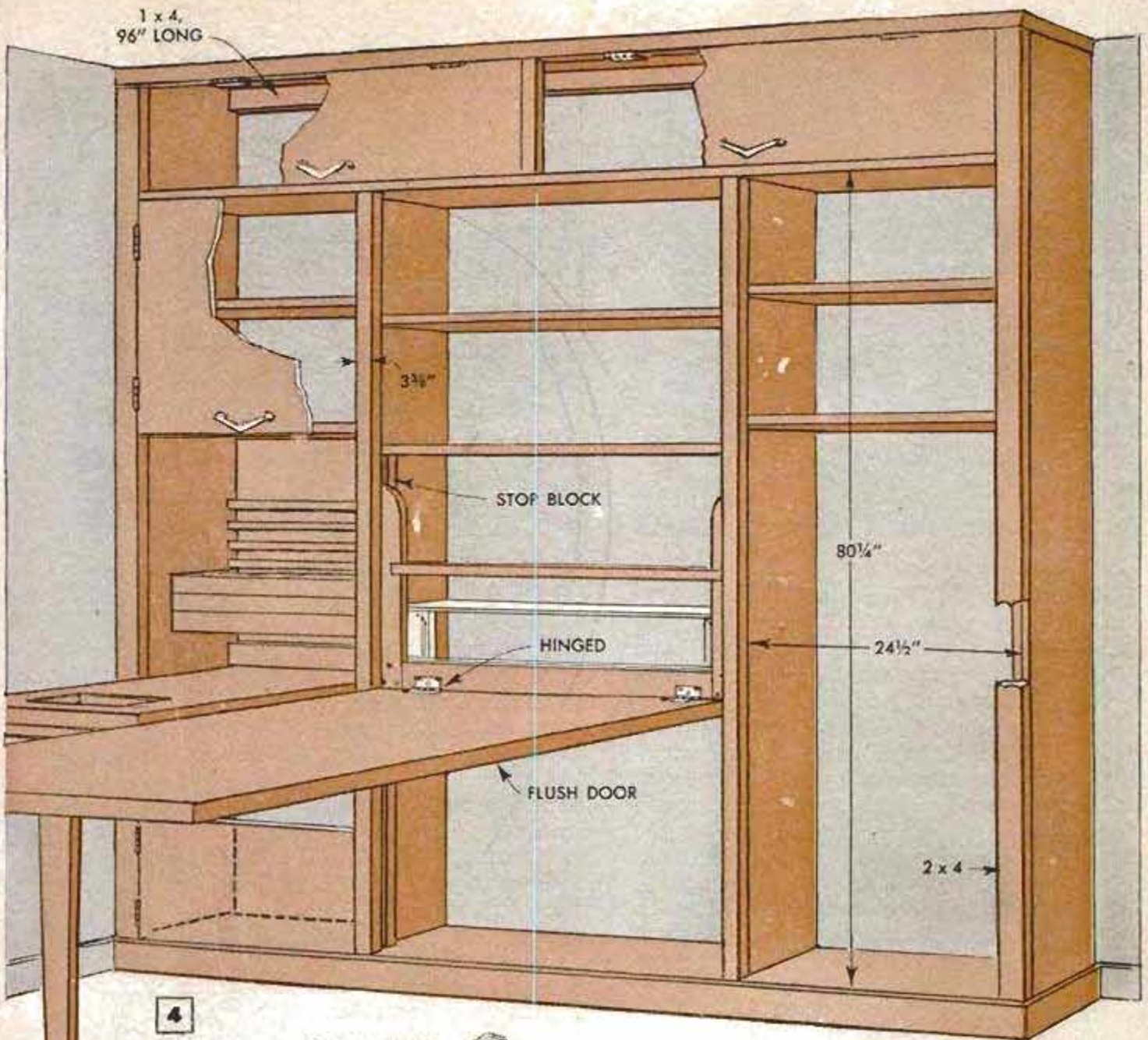


Racks and pull-out trays located over sewing machine keep thread, buttons and needles within easy reach

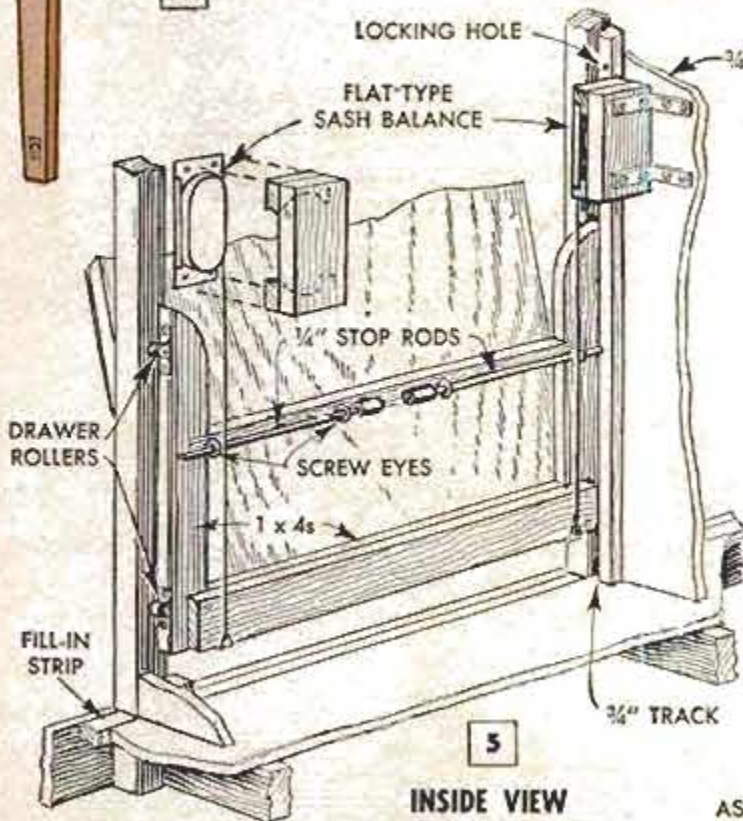
the rear edge of the table rests against a 2 x 4 stop when open, and how it is built up to double thickness with strips of wood and hardboard, Fig. 1, to suit the sewing machine. The surface of this, as well as the cutting table, is padded and covered.

Fig. 5 shows the method employed to counterbalance the cutting table. Here flat-type window-sash balances are mounted on wooden blocks and attached to a U-shaped assembly to which the rear edge of the door is hinged. Drawer rollers fitted to the edges of the assembly make it roll easily in a track formed with cleats. Stop rods sliding in screw eyes engage holes in the top of the track to lock the table at the proper height. A single leg folds flush and supports the outboard end. ★ ★ ★



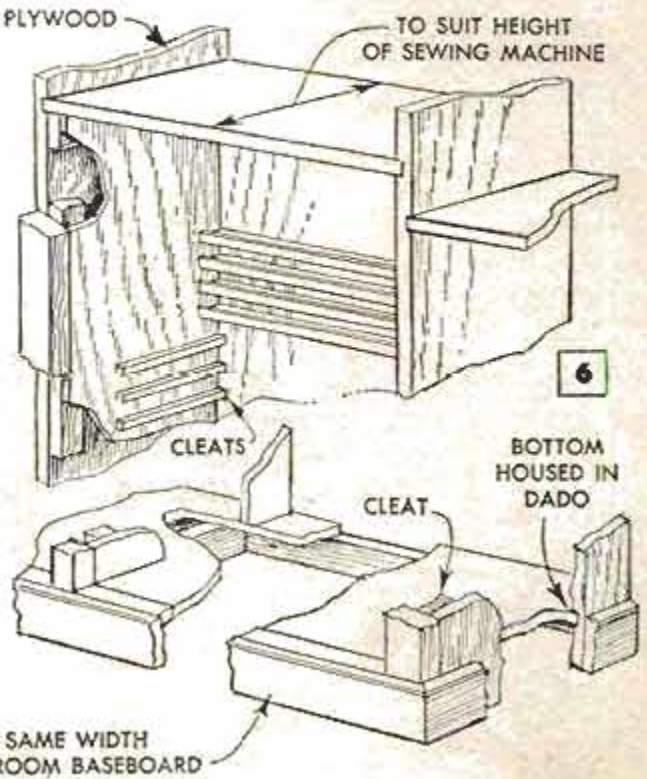


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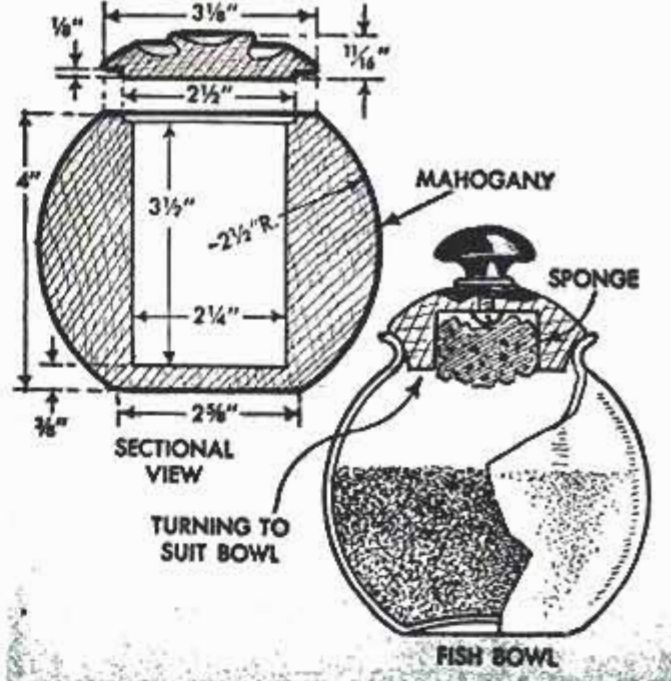


5

INSIDE VIEW



6



Two Simple Lathe Projects for the Smoker

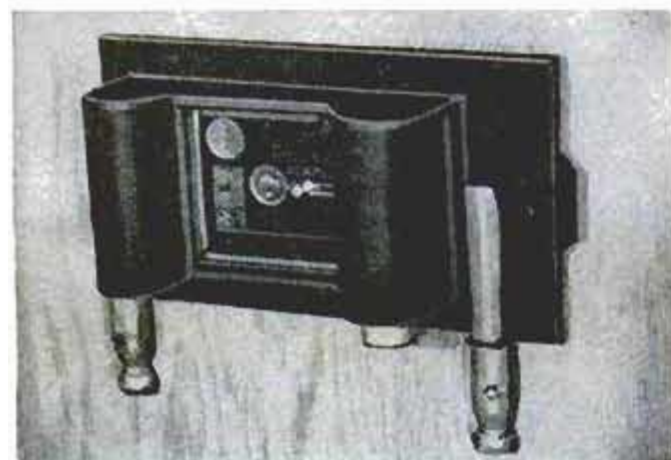
If you have a wood-turning lathe, and smoke either a pipe or cigarettes, one of these two projects will let you combine hobby and habit. The "cannon ball" cigarette box will hold a full pack of king-size cigarettes; the capacity of the fish-bowl humidor depends on the size of the bowl used which, in turn, is determined by the amount of tobacco a smoker keeps on hand. Hardwood, such as Philippine mahogany, is suggested for the cannon ball, although any hardwood can be used. Softwoods with interesting grains also would make an attractive sphere. A block consisting of alternate laminations of dark and light woods, when turned, will present a strik-

ingly attractive pattern. If you have a friend who is a bowler, drill a couple of finger holes in the sphere, finish it with an ebony stain, and present it to him as a useful as well as ornamental memento of his hobby. Fish bowls come in a variety of shapes and sizes. Rose bowls, usually of lighter-weight glass, also could be used as humidors. A wooden lid is turned to fit the mouth of the bowl, then a recess is bored in the underside to accommodate a sponge that is moistened to keep the tobacco fresh. The knob on the lid can be a wooden turning, or a metal one in chrome or antique brass finish.

Hi Sibley, Nuevo, Calif.

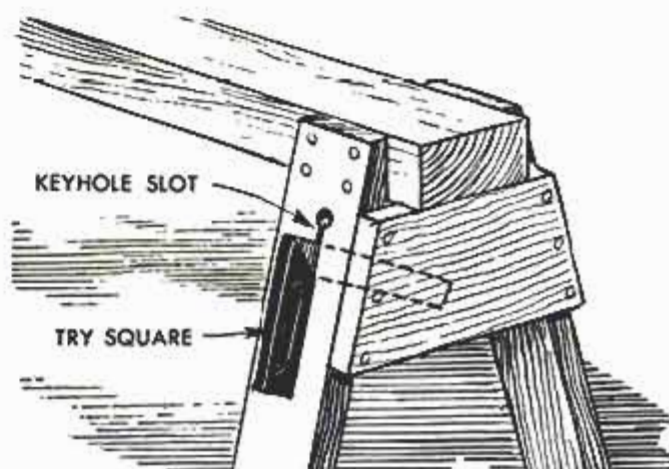
Wall Rack for Roll-Film Adapter

When not in use, a roll-film adapter for a camera may be kept safe from accidental damage by storing it on two wooden clothespins screwed to the darkroom wall. Mount the pins upside down in a vertical position and just far enough apart to take the adapter.—John J. Rea, Urbana, Ill.



Square Held in Sawhorse Leg

On jobs where a try square is used frequently, such as when installing siding, the tool can be kept conveniently at hand by placing it in a slot cut in one leg of a wooden sawhorse. If a sawhorse has metal legs, attach a U-shaped metal bracket to one leg to accommodate the square.

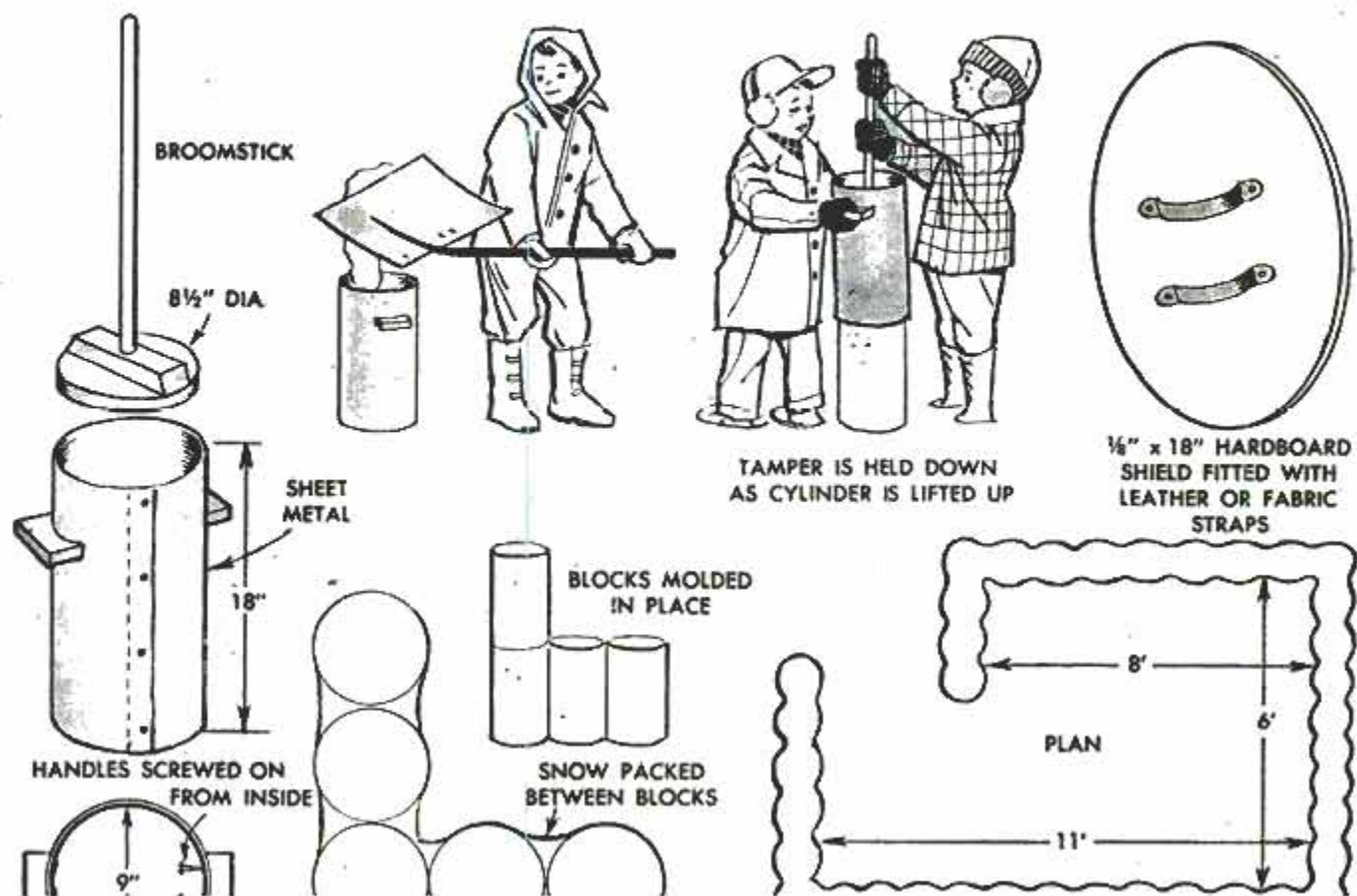




alls of ‘

CONSTRUCTED of “extruded” snow cylinders, “Fort Freezer” will withstand a heavy seige of snowball fighting. Spraying the fort with water on a cold night will give it resistance to thaw so it will last through several above-freezing days. First, mark off the outlines of the fort, then form a row

of snow cylinders along the lines, using the “extrusion machine” detailed below. Walls can be made any desired height, snow being packed between the cylinders as “mortar.” When the Fort Freezer warriors venture forth to storm another fort, hardboard shields will provide protection.





SHOP UNDER BASEMENT STAIR

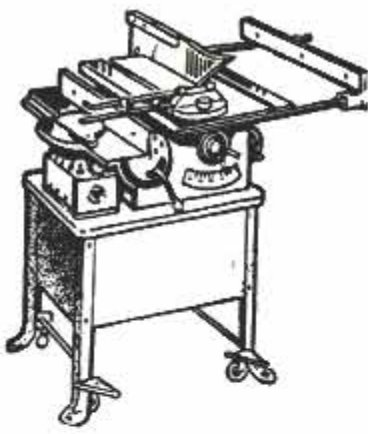
You Will Be Proud Of These Power Tools

THEY ARE MADE BY DELTA and each unit has been designed and built to meet the diversified needs of the home shop and the school shop. To meet satisfactorily the requirements of these two applications the tools must be rugged. A 9-in. circular saw must be capable of handling a cut up to the full capacity of a 9-in. blade. The lathe must stay put, wherever it's placed, whether you're turning down a large square for a table leg, or recessing stock on the faceplate for a decorative wooden bowl. These operations call for heavy cuts and that means strength and stability where it's needed. Yet each unit must be light enough to be easily portable, so that you can move it about to the point where it is to be used, or push it back against the wall out of the way. At the same time, the unit must be attractive. Not pretty, but pleasing to look at, especially in the home workshop.

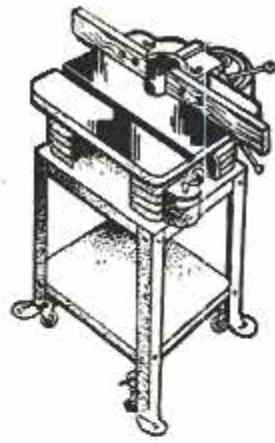
While many experienced craftsmen prefer to work with individual power tools, they will tell you there are advantages in

owning a combination unit, especially if the available shop space is limited, say, to the area under the basement stairway as in the photo above, or to the end of the garage as pictured on the opposite page. With these tools you have a choice of combination or of individual units. As an example, note the saw-jointer unit above. This comes also as a separate saw and jointer, each machine on an individual stand. Or you can buy the combined units as pictured above. Add the folding drill press, disk sander and saber saw (also available but not pictured), and you have very nearly a complete shop. All these machines are driven from one motor—the drill press, saber saw and sander being driven from a V-pulley, which is easily and quickly attached to the circular-saw arbor.

If your home-shop space is limited to the garage, the photo on the opposite page shows what can be done with attractive shop built-ins and a radial saw and dust collector. It's really a one-machine shop, but the radial saw is not a one-operation



COMBINATION
SAW-JOINTER
UNIT



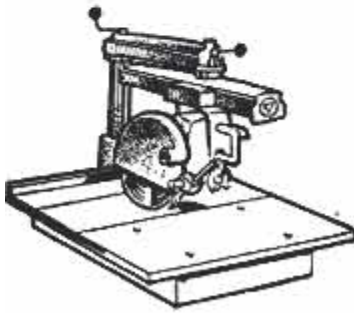
VERTICAL-
SPINDLE
SHAPER



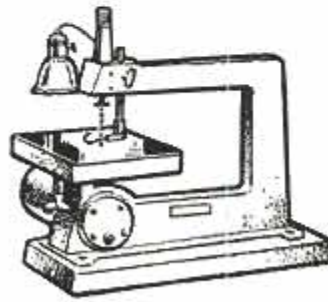
11-IN.
DRILL PRESS



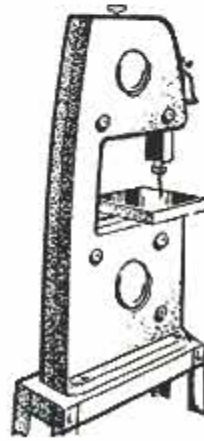
VACUUM
DUST
COLLECTOR



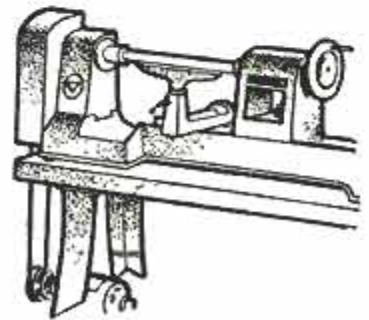
9-IN.
RADIAL
SAW



16-IN.
JIGSAW

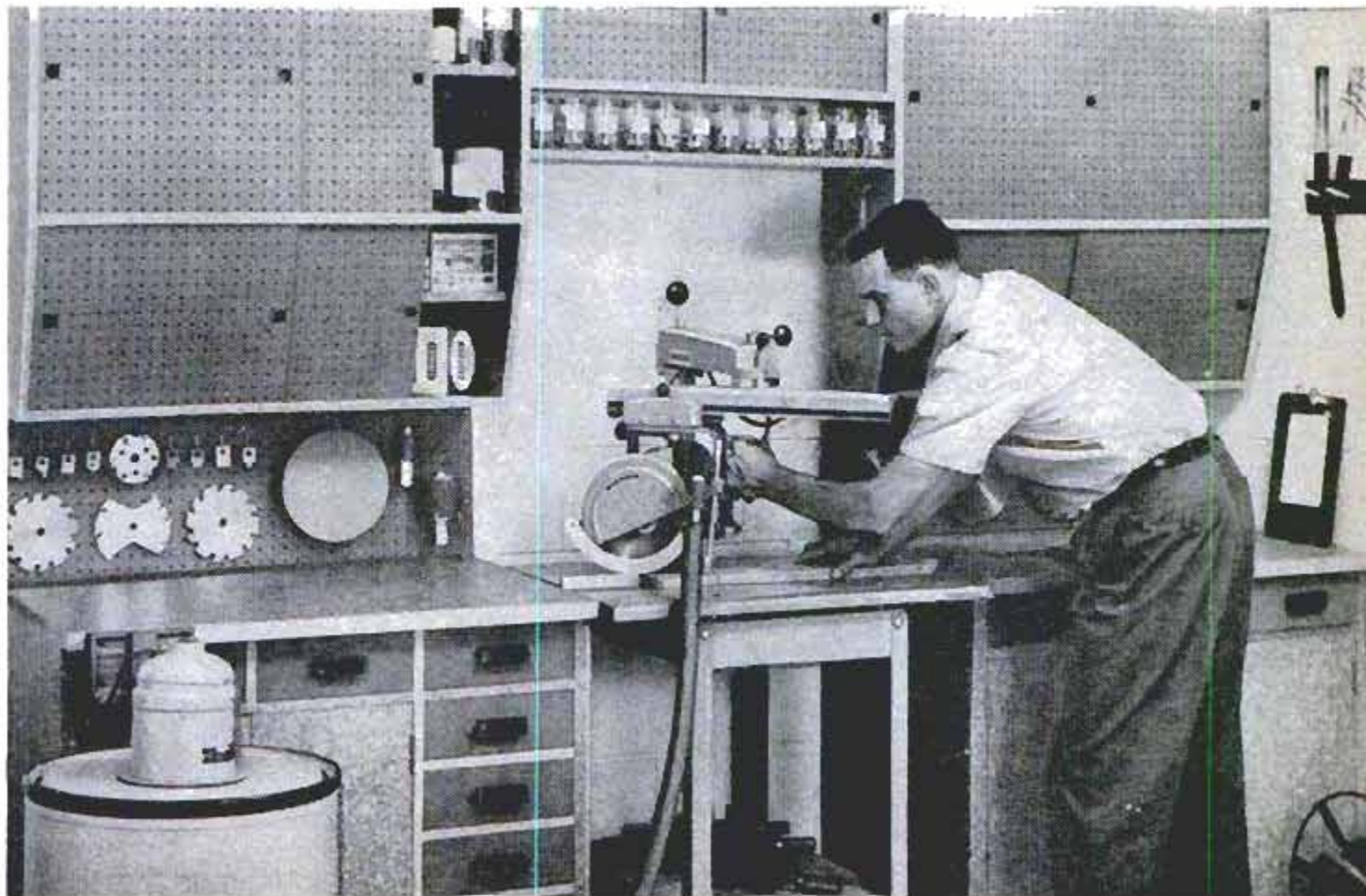


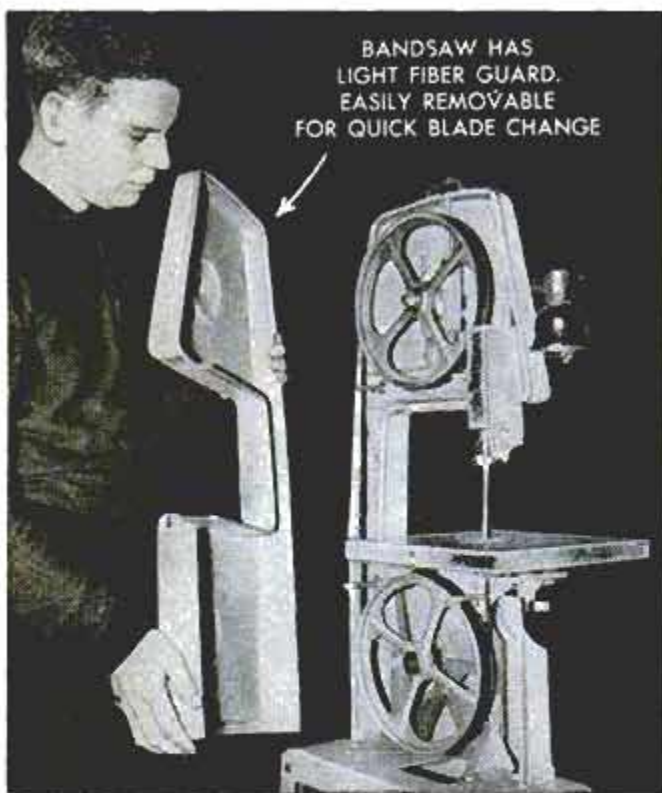
10-IN.
BANDSAW



12-IN.
LATHE

SHOP IN THE GARAGE



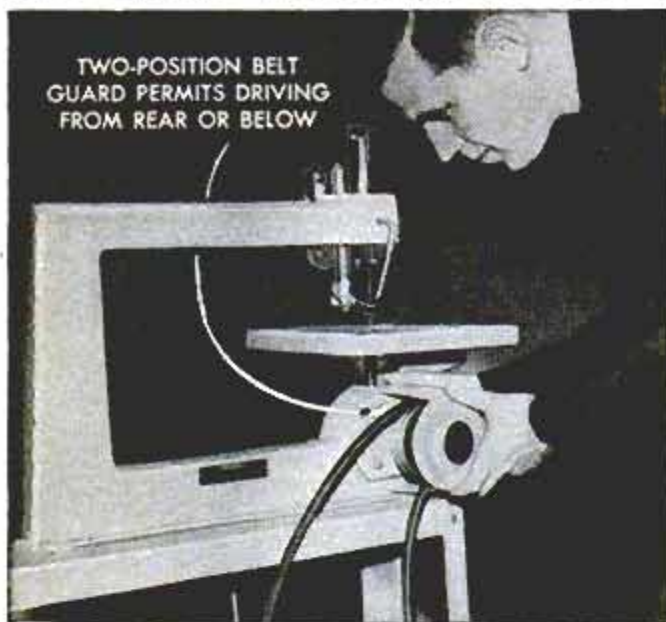


BANDSAW HAS
LIGHT FIBER GUARD.
EASILY REMOVABLE
FOR QUICK BLADE CHANGE

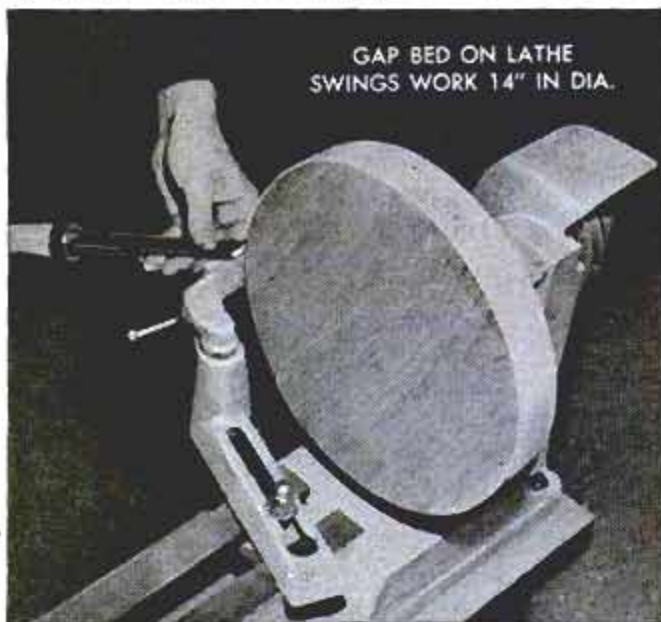
machine. It's a fast, accurate rip and cross-cut saw; it will cut grooves, dadoes, compound angles, bevels and, with accessories available, it becomes a router, drill, shaper, sander and grinder. Special retractable-caster sets are available for nearly all of the individual power-tool stands pictured. The caster sets are operated by a foot treadle and raise or lower the entire machine as desired. When the casters are in the down position the unit is raised clear of the floor and can be rolled easily to the desired position. Retracting the casters by a simple movement of the treadles lowers the stand to the floor. The combination unit (also the individual machines of which this unit is made up), the shaper, drill press, radial saw, jigsaw and bandsaw are available with steel stands to which the caster sets can be fitted. The dust collector is fitted with a special set of three casters which are regular equipment.

Now note some of the special features of the new machines. First of all, guards are

SPECIAL FEATURES OF DELTA MACHINES WHICH



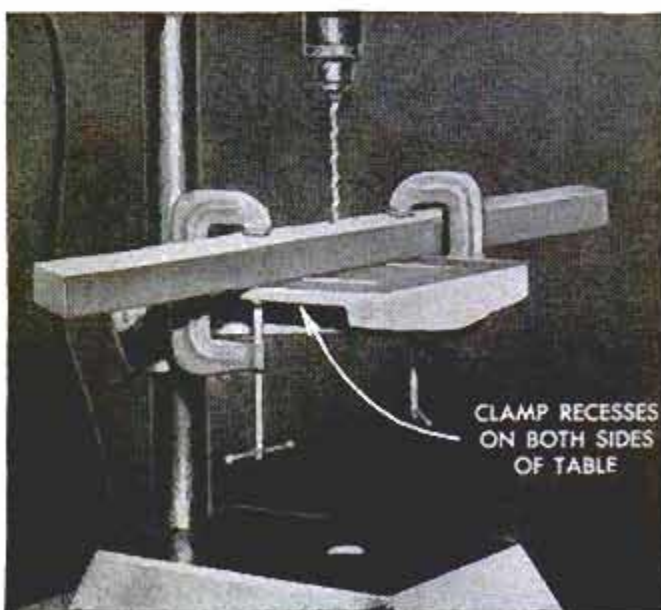
TWO-POSITION BELT
GUARD PERMITS DRIVING
FROM REAR OR BELOW



GAP BED ON LATHE
SWINGS WORK 14" IN DIA.



WRENCH CAN BE
INSERTED FROM FRONT
OR BACK OF TAILSTOCK



CLAMP RECESSES
ON BOTH SIDES
OF TABLE

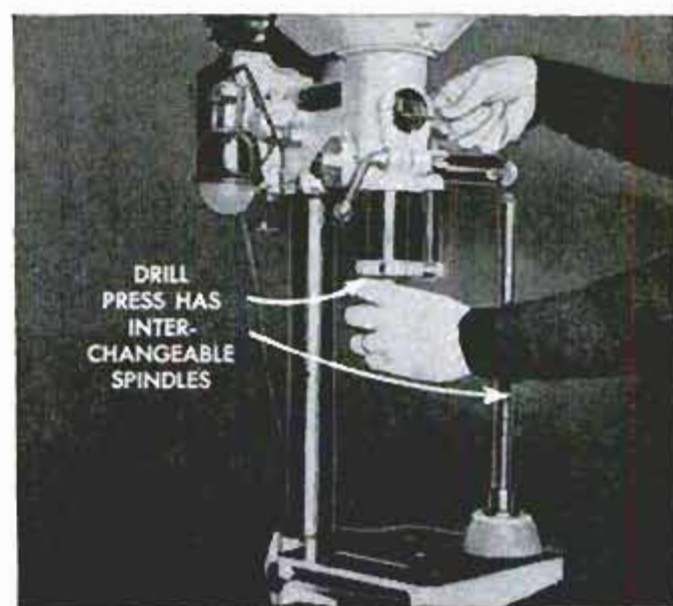
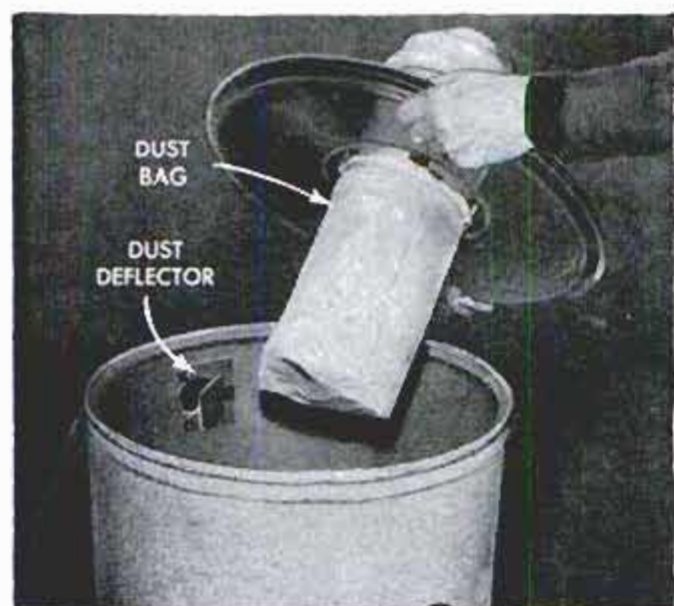
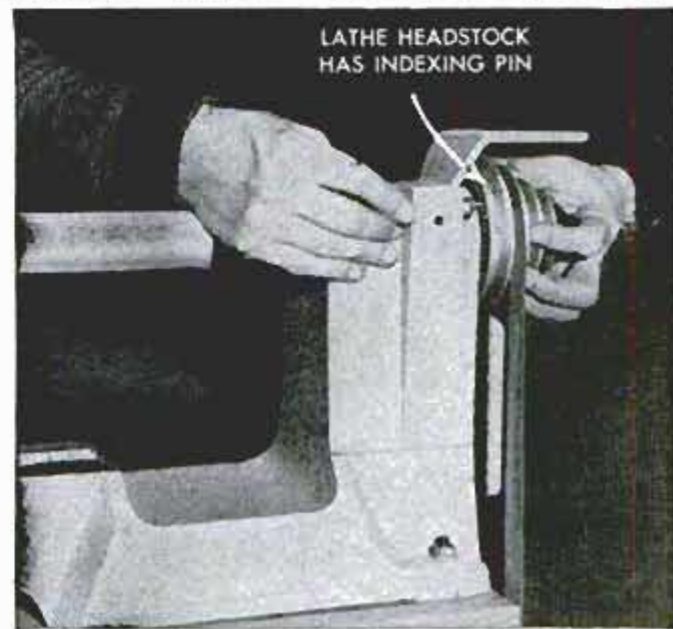
fitted at all points where moving parts might cause injury in a moment of inattention on the part of the operator. A good example is the manner of guarding the radial-saw blade. The guard covers the top half of the blade and also the cutting edge as shown in the photo on page 199. The bandsaw is fitted with a special light-fiber guard which covers wheels and blade as in the photo at the top left on the opposite page. The lathe, jigsaw and drill press have belt guards designed to prevent fingers from being caught between the belt and pulley. The shaper can be fitted with a special ring guard to prevent any possibility of hand injury when running a molding cut on curved work. An accessory lamp is available for the bandsaw, jigsaw and drill press as work on these machines usually requires concentrated light.

Notes on the photos below and on the opposite page point out several new features of the 12-in. lathe. It swings work 12 in. in diameter over the bed, but the gap

in the bed adjacent to the headstock permits you to turn disks 14 in. in diameter. Note also the open tailstock which permits inserting the wrench from either side. The tool-rest clamp will not fall between the bed ways should you find it necessary to remove the tool-rest arm. There's an indexing pin and plate built into the headstock as in the upper right-hand photo below.

Note especially that the belt guard on the jigsaw, center left-hand photo on the opposite page, can be placed in two positions for driving with a V-belt from the rear of the machine or from below. This feature permits mounting the machine either on a bench or stand and still make use of the protective features of the guard. The drill-press table is recessed on both sides so that you can place C-clamps as in the lower right-hand photo, opposite page. The unit also takes interchangeable spindles which are available. The dust collector holds 3 bu. of dust and chips. ★ ★ ★

PROMOTE SAFETY, EFFICIENCY AND VERSATILITY



Improved Vacuum-Cleaner Attachment Permits Cleaning Inside Typewriter



To clean inside the confined spaces of a typewriter, tape a rubber tube to the radiator-cleaning attachment of a vacuum cleaner. The tube should be about 10 in. long, with an inside diameter of about $\frac{1}{4}$ in. After fitting the end of the tube into the attachment, seal the connection with tape. Vacuum cleaning a typewriter is preferable to blowing out the dirt, as air pressure is likely to drive dirt particles between moving parts.

Temporary Gas-Leak Repair

For a temporary repair on a leaking gas line, wipe the spot clean and dry and apply nail polish. The dried polish will seal a minor leak for a few hours, but a permanent repair should be made as soon as possible.

☐ Cardboard that is used in most laundered shirts provides a good guard to protect the floor when painting baseboards. Just hold the cardboard against the baseboard and slide it along on the floor as you paint.

☐ If a spray gun produces a distorted spray, probably the nozzle is partially clogged. Use a clean solvent to wash the nozzle. Never use a metal instrument to clean the nozzle orifice.

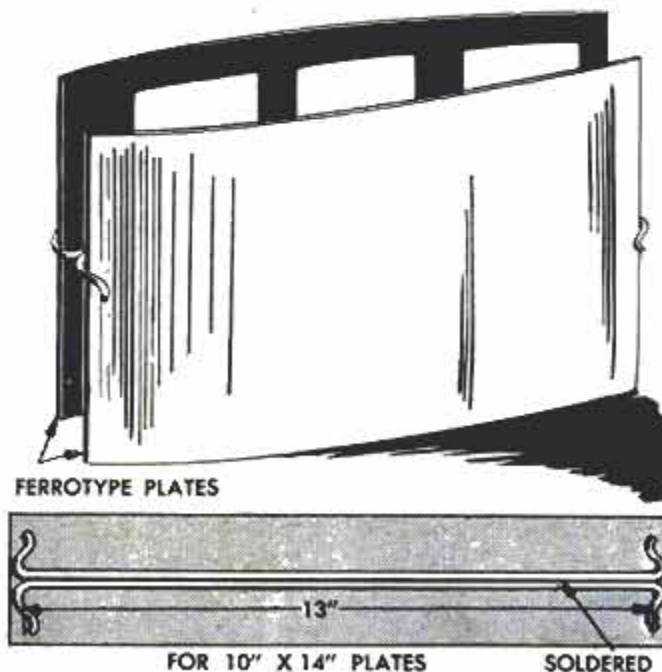
Bandage Repair Salvages Model

Plastic models too badly damaged to be repaired with just cement can be salvaged by reinforcing the damaged area with gauze bandage. Assemble the broken pieces and cement them in the usual way and allow the cement to set. Then apply gauze over the area and saturate it with cement.



"Rack" Supports Ferrotypes Tins

When drying a number of small prints, one photo enthusiast fits two ferrotypes tins in a wire "rack" made by soldering together two lengths of wire bent as indicated. The bowed tins provide a self-supporting unit that can be placed anywhere on a work surface while prints are drying.



HOW TO WORK WITH HARDBOARD

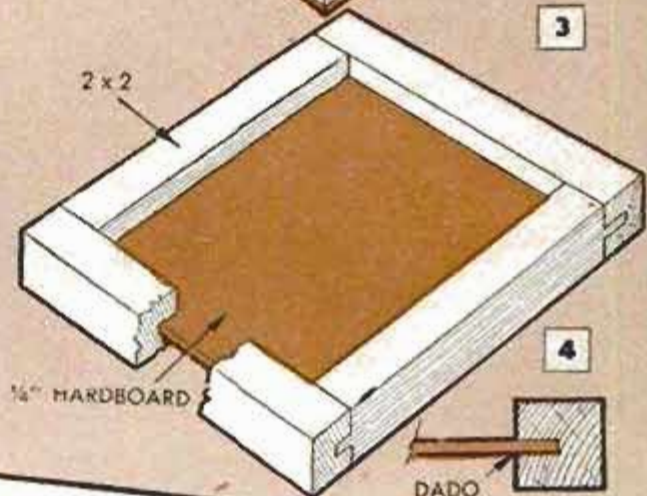
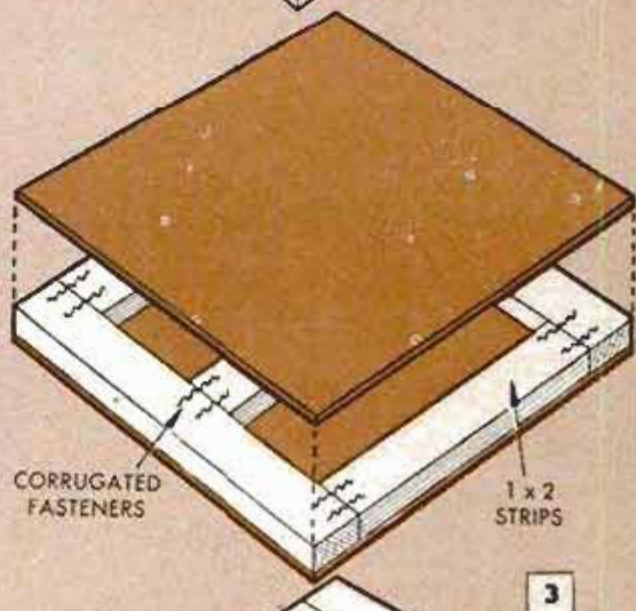
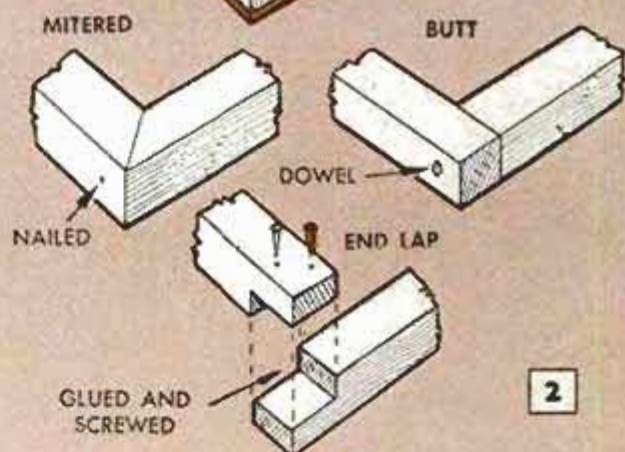
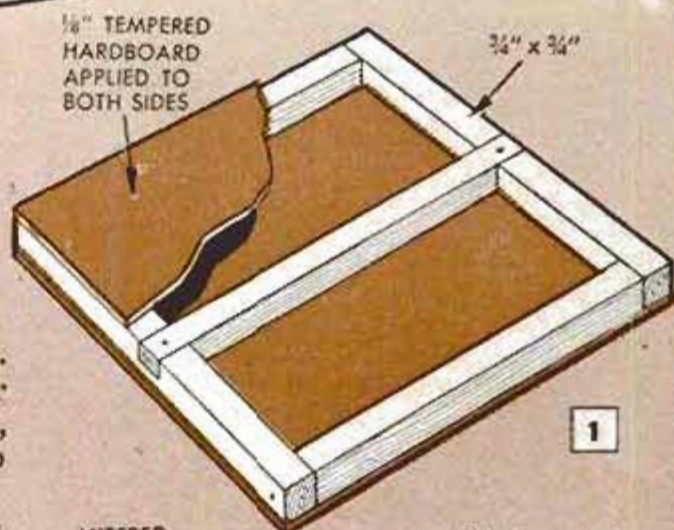
HARDBOARD may not be new to you. You, perhaps, have already used it for drawer bottoms, bypassing cabinet doors, as an underlayment for a tile floor or to surface the top of your workbench.

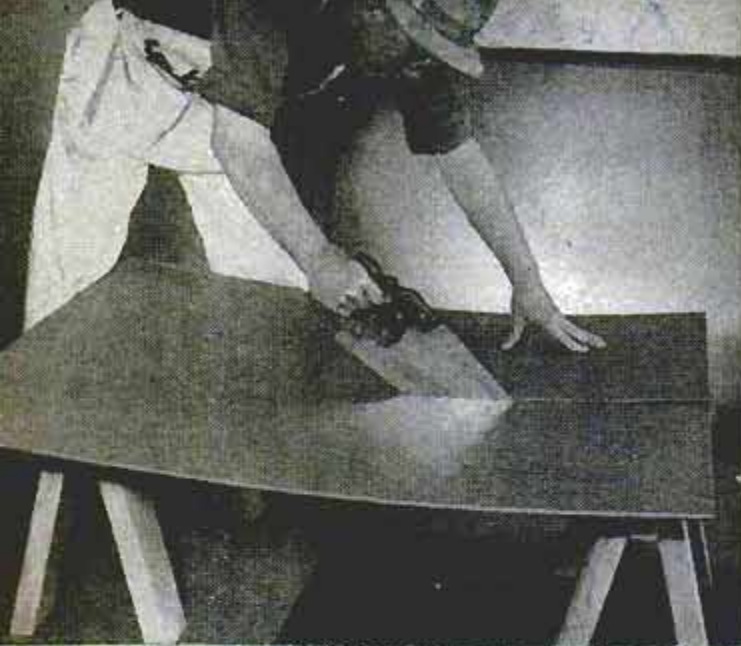
In the material itself, there are a dozen advantages to be considered in using this manmade product. The do-it-yourselfer who works with it for the first time will find its hard, smooth surface ideal for painting. The material is all good since there are no knots or other surface imperfections to bother with. Being without grain, it has equal surface strength in all directions which means it cannot check or split like wood. It offers good and permanent resistance to moisture and can be formed into bends and curves. Best of all, it can be worked almost as easily as wood with hand and power tools, although its hard surface dulls cutting edges more quickly. It can be surface-nailed, screwed, glued and clamped like wood.

Hardboard comes $\frac{1}{8}$, $\frac{3}{16}$ and $\frac{1}{4}$ in. thick and in standard or tempered panels. If you want it for outdoor use, or for indoor use where high-humidity conditions prevail, you ask for tempered since it is harder and is treated to withstand moisture. If you want it for indoor use, you ask for standard. Popular sheet size is 4 x 8 ft., although smaller panels of standard size can be had.

WHAT IS HARDBOARD?

Basically, hardboard is reconstructed wood. It is manufactured by separating wood fibers, leaving each surrounded by its natural adhesive agent, and rearranging them in a "felted" or matted form under heat and pressure. The hardboard panel resulting from the process is a dense, grainless board which has great strength, durability and adaptability.



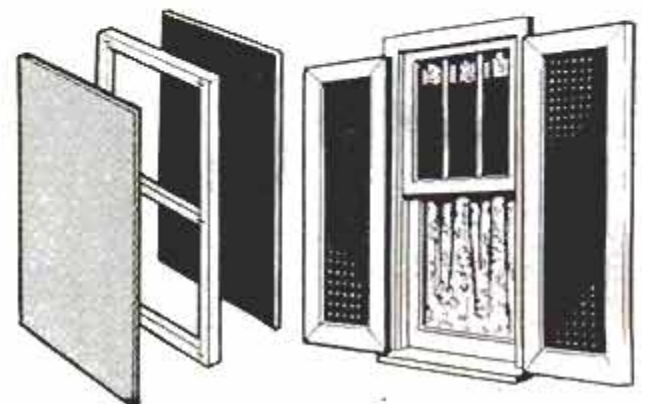
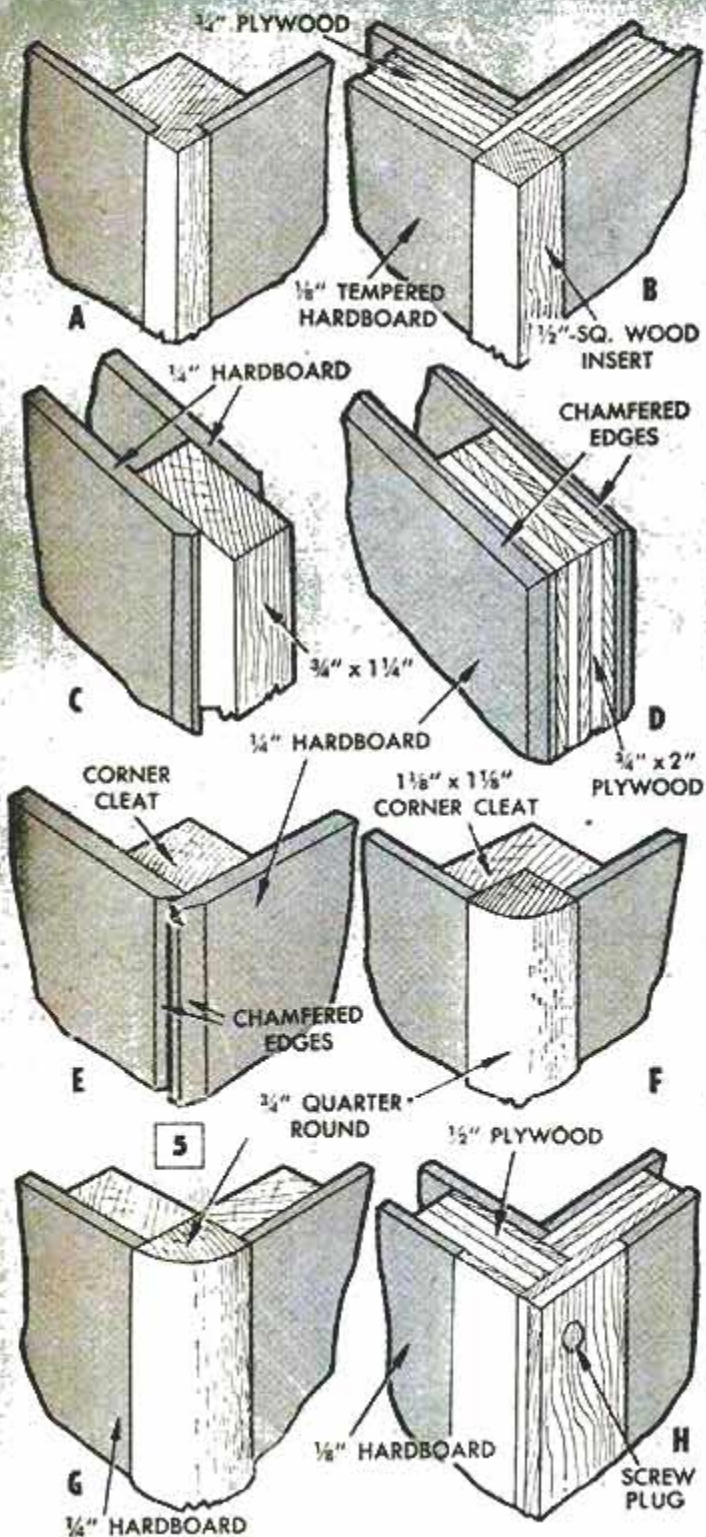


To achieve "balanced construction" when making hollow panels, you must remember this: Hardboard of the same thickness must be used on both sides of the panel. If $\frac{1}{8}$ -in. tempered board is used on one side and $\frac{1}{4}$ -in. standard on the other, the pull will be unequal and the panel will have a tendency to warp. Likewise, when wood veneer is applied to a hardboard core, veneer of the same thickness must be added to both sides to minimize warping.

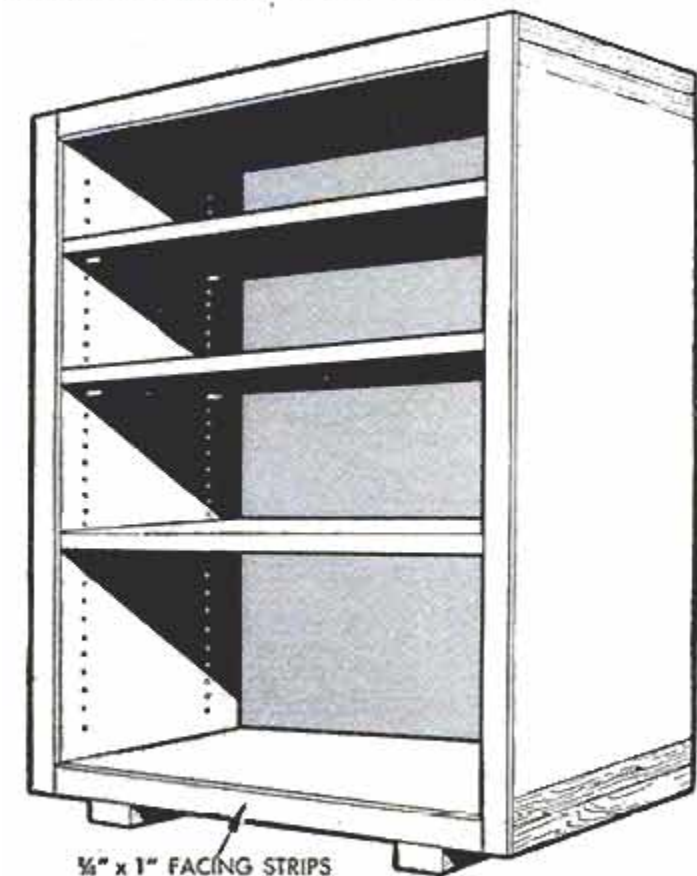
Figs. 1, 3, 4 and 9 show four different ways to construct hardboard panels. With the exception of the panel shown in Fig. 4, both hardboard facings are applied to a perimeter framework of wood strips which are cross-braced for additional rigidity when the panel is more than 12 in. wide. One cross brace is sufficient for panels up to 24 in. wide. Wider panels should be cross-braced at 12-in. intervals, or at equal intervals if the width is less than a multiple of 12. If the panel measures 2 x 4 ft., one cross brace, running parallel with the 4-ft. perimeter strips, is sufficient. Crisscross bracing is not necessary. In all panels of balanced construction it is best to provide vent slots so the panel can "breathe." These are shallow saw kerfs made in the perimeter strips on two sides of the panel where they will not be noticed. Fig 2 shows three ways of joining the $\frac{3}{4}$ -in.-sq. perimeter strips. Cross braces are either half-lapped or butted. Where wider perimeter strips are used, such as 1 x 2s, the strips can be joined with corrugated fasteners as shown in Fig. 3. The hardboard facing may be attached to the wood strips with nails or screws, nails and glue, or glue alone when clamps are available. Nails and screws can be countersunk and covered with wood putty. Glue is preferred to other type fasteners, particularly if the panel is to be machined later for fit.

The lightweight panels, made as shown in Fig. 1 are recommended for swinging and bypassing cabinet doors, for the walls of built-in storage cabinets and as shelves for bookcases and closets. When a more substantial panel is required, heavier perimeter strips are recommended, Fig. 3.

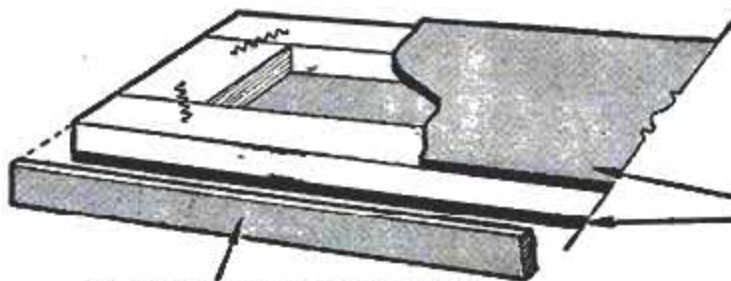
Fig. 4 shows how a panel can be made



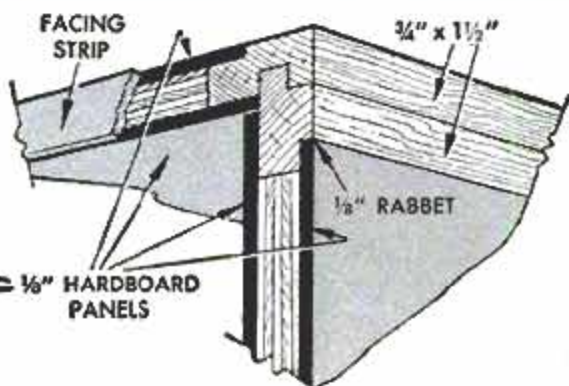
HARDBOARD BOOKCASE



1/4" x 1" FACING STRIPS



1/4" x 3/8" FACING STRIP ON SHELVES



FACING STRIP

3/4" x 1 1/2"

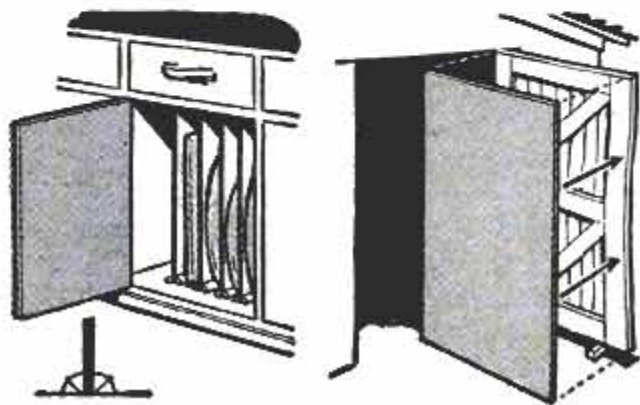
1/2" RABBET

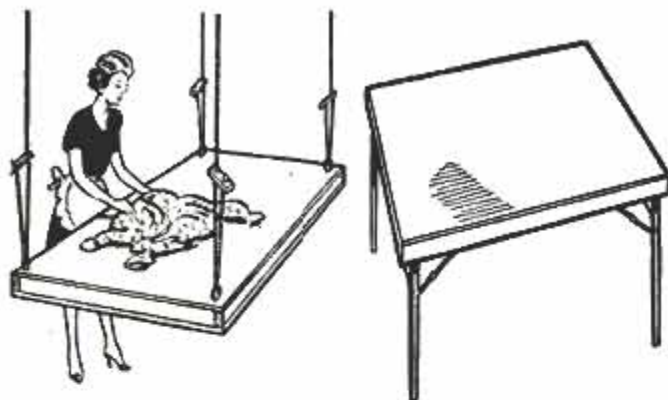
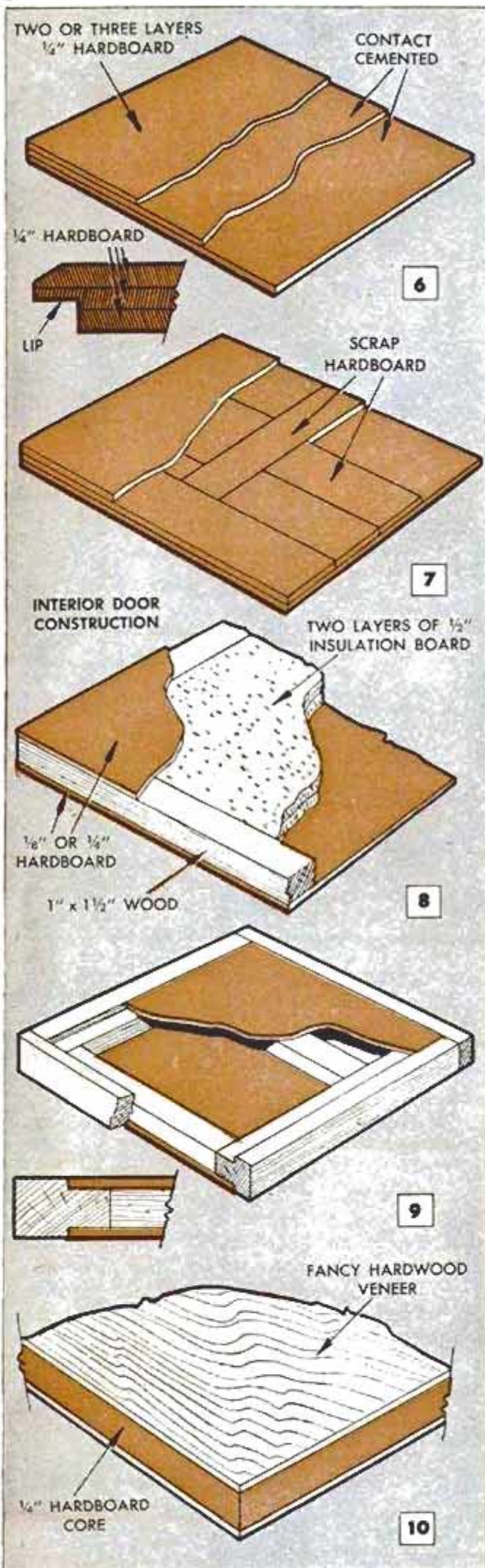
1/4" HARDBOARD PANELS

from a single sheet of 1/4-in. hardboard. Here the wooden frame members are grooved, or dadoed, to fit over the edges of the hardboard. It is standard practice to cut the insert a scant smaller than the depth of the grooves to provide clearance should the hardboard expand. Cross bracing is not necessary unless the hardboard spans an area of more than 16 in. Cross bracing, when necessary, consists of battens equal in thickness to the lip of the perimeter strips which are applied to both

sides of the hardboard, 16 in. apart. The same sunken-panel effect can be achieved in another way which eliminates grooving. This is done by gluing 1/2 x 1-in. or 3/4 x 1-in. wood strips to both sides of the hardboard at the edges.

Fig. 6 shows how laminated-hardboard panels can be built up by bonding together two or three layers of 1/4-in. material, using either contact cement or regular glue. Such panels, which are relatively warp-free, are ideal for cabinet doors, both hinged and sliding types, counter tops and bread and meat carving boards. If such doors are to be hinged, a lip can be formed by running a rabbet around the edges and then chamfering the corner as shown in the detail. This can be done either with a bench saw or a jointer. In the case of a two-layer door, the rabbet can be formed by simply cutting the bottom piece 1/2 in. smaller all around than the top one. If glue is used instead of contact cement, the work should be clamped to assure a good bond. If hardboard is used which is smooth





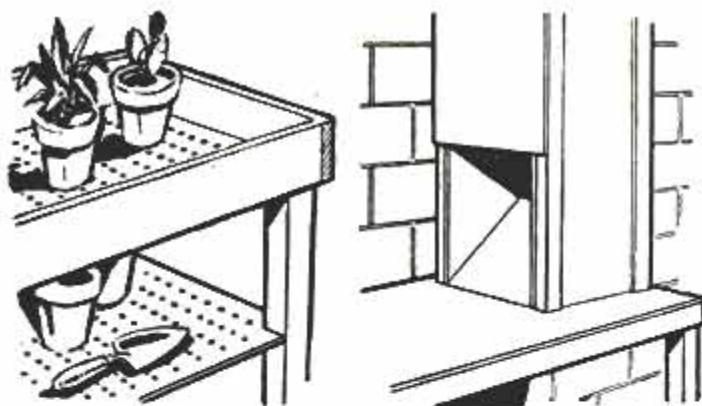
on one side only, the rough, "screened" side should first be sanded somewhat to assure a better bond.

Fig. 7 shows how hardboard scraps can be utilized in laminated panels. Here the core, or center layer, is made up piecemeal from random-size scraps which are assembled and glued to one face piece and then the opposite facing is added. Scrap pieces of hardwood of uniform thickness can be used for the core.

Fig. 8 shows how flush-type interior doors can be made of hardboard. Here the center is filled with layers of 1/2-in. insulation board to produce a door that has both thermal and sound-deadening values. The side perimeter strips are ripped about 2 in. wide from 1-in. stock, the bottom one 3 in. wide. A cross brace at least 4 in. wide to accept a lock is located in the frame at doorknob height. Corrugated-metal fasteners can be used at the corners of the wooden frame but the cross brace should just be glued. Spots of glue are applied here and there on the back of the hardboard panels to bond them to the insulation-board core. This type of door is most easily assembled by gluing the frame to one sheet of hardboard, installing the sections of insulation board and finally attaching the second hardboard panel.

Hardboard also may be used as the core of fine-wood panels, Fig. 10. For example, when a press is available, mahogany veneer can be applied to both sides of 1/4-in. hardboard. Such panels are sturdier and more warp-free than natural-wood panels of the same thickness.

Fig. 5 shows eight methods of making corner joints. You'll notice here that strips of plywood can be used as well as solid wood. Details C and D show two ways that panels can be assembled where both surfaces are exposed. All of these methods afford protection to the edges which are subject to chipping. Details F and G show how common quarter-round molding can be used to both conceal the hardboard edges and provide a neat rounded corner. Chamfering is another good way to overcome chipping of the exposed edges and at the same time take away the plain square

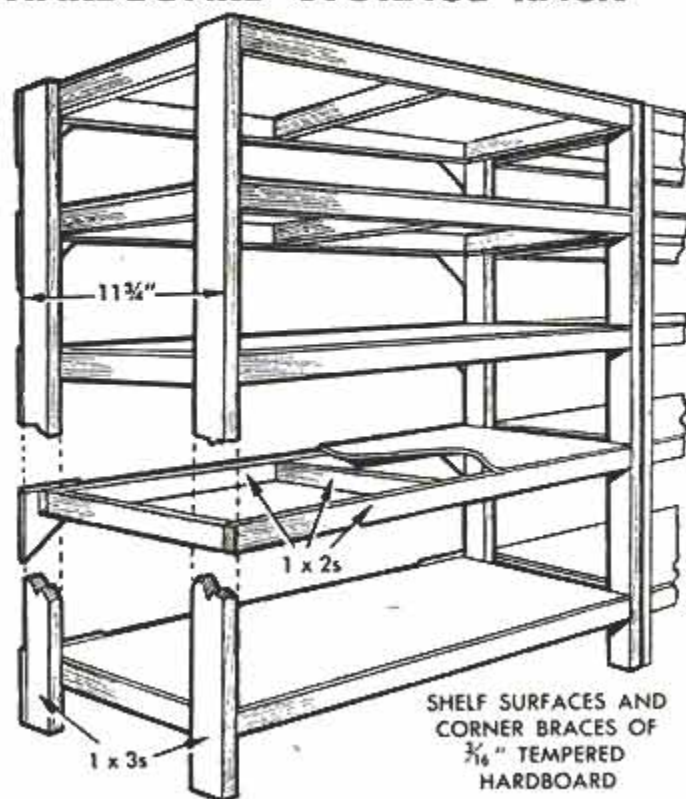


edge. Details C and E show two examples.

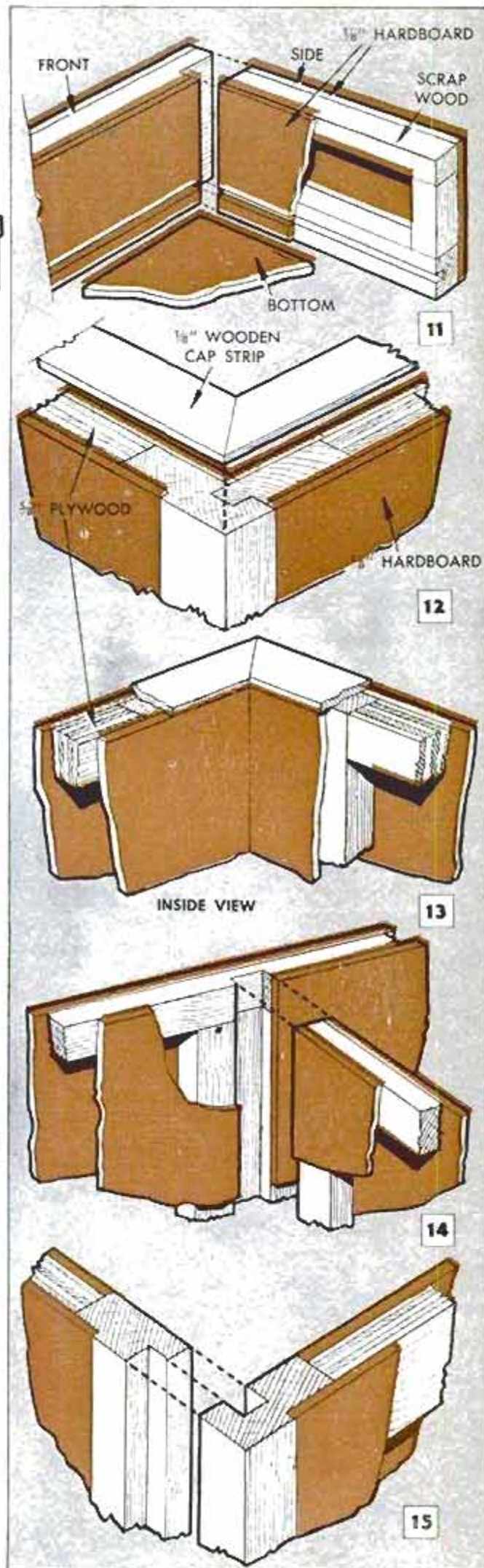
Hardboard leftovers can be put to good use in making drawers. Fig. 11 shows how the sides and backs can be built-up by applying $\frac{1}{8}$ -in. hardboard to scrap-wood frames and then grooving to receive the hardboard bottom. A solid-wood core is used for the drawer front and faced both sides with hardboard. Figs. 12 and 13 show how facing strips of $\frac{1}{8}$ or $\frac{1}{4}$ -in. wood can be used to cap the exposed edges of hollow built-up panels so that when painted they give the appearance of solid-wood construction. Note the corner joint.

Where it is desired to glue shelves or partitions in dados in hollow, hardboard panels, cross bracing is installed at the proper points, Fig. 14, so that the grooves can be made to receive them. As a rule, you'll find in joining two panels together at a corner, Fig. 15, that a more accurate job can be done if the edge members are cut first. Trying to do this after the panels are assembled can be an awkward job and lead to an ill-fitting joint. ★ ★ ★

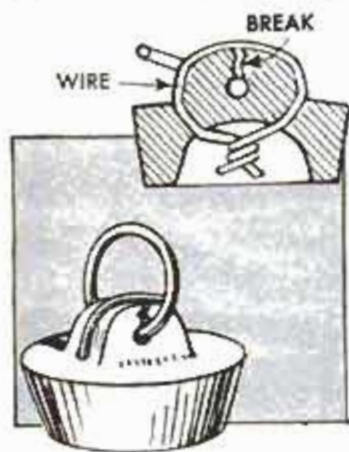
HARDBOARD STORAGE RACK



SHELF SURFACES AND CORNER BRACES OF $\frac{3}{16}$ " TEMPERED HARDBOARD

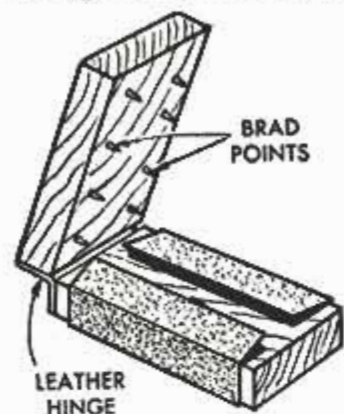


How to Mend a Sink Stopper



When the ring pulls out of that sink stopper you can make an emergency repair with a loop of wire as in the sectional view. Punch two holes through the stopper, force the ends of the wire through and twist tightly on the underside.

Hinged Blocks Hold Sandpaper



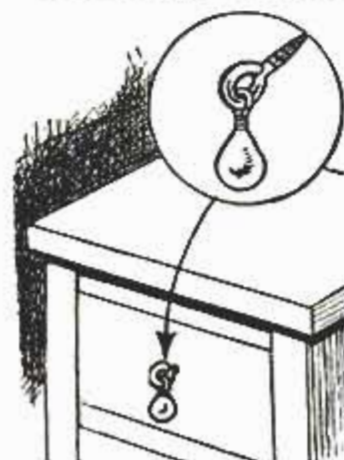
Here's a handy sanding block you can make in a few minutes. Hinge two blocks with leather and drive brads through the upper block so that the points project $\frac{1}{8}$ in. to hold the sandpaper securely.

Rubber Band Holds Pail Handle



Often it's handy to hold the handle, or bail, of a paint pail upright. A rubber band snapped around the handle will do the trick nicely. It holds the bail upright where it's easily grasped and at the same time it serves as a brush rest or wiper.

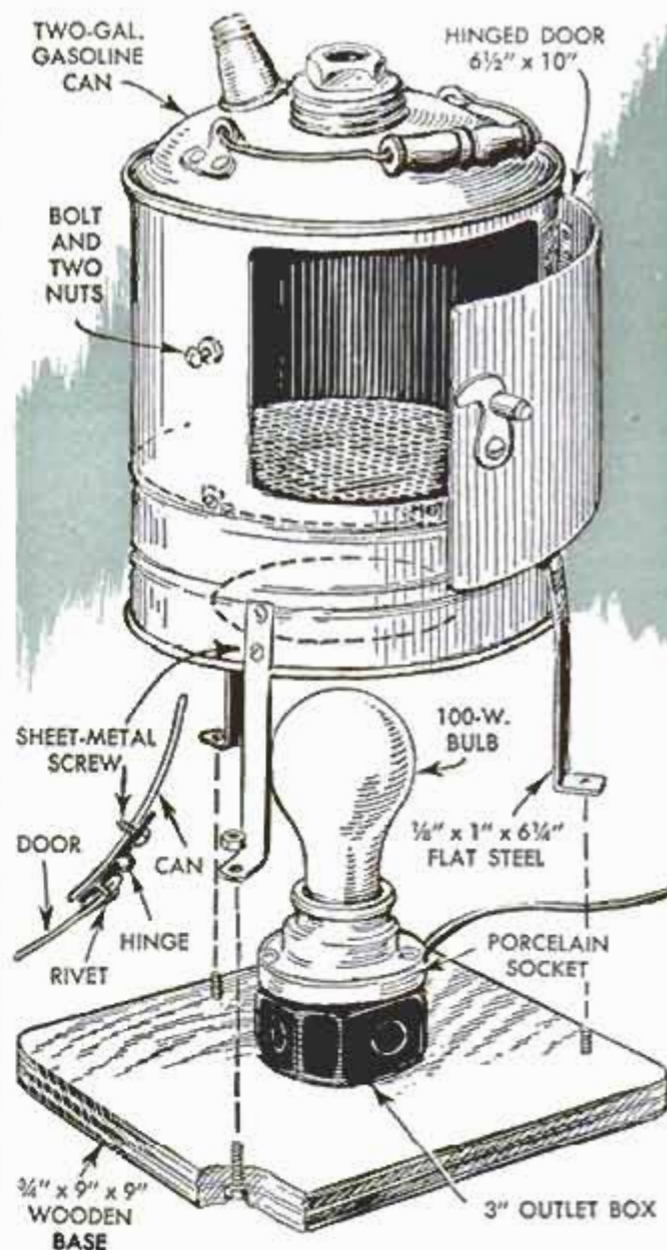
"Teardrop" Drawer Pulls



Casting sinkers of the type that are teardrop-shaped can be made into attractive and durable drawer pulls for a shop cabinet. Just open a small screw eye, attach the sinker and then turn the screw eye into the drawer front.

DRYING OVEN FOR

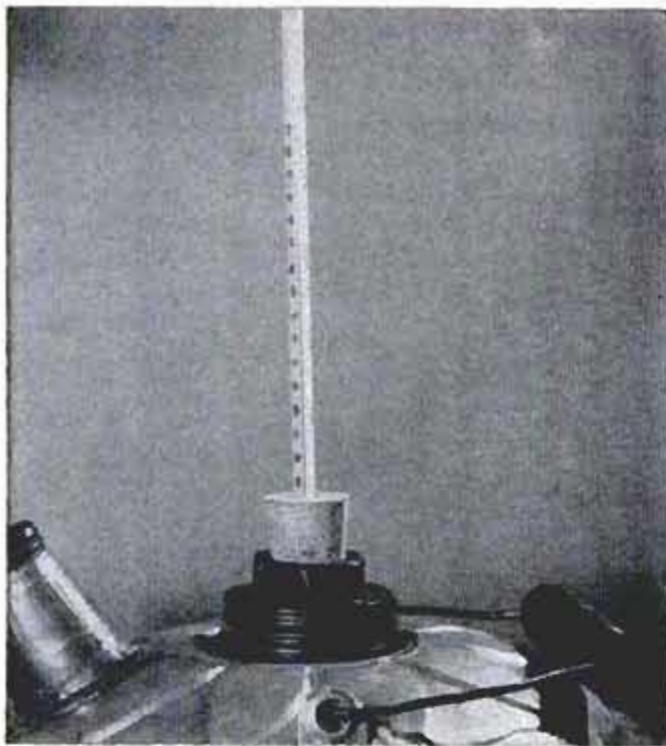
By Walter E. Burton



Legs of flat steel are attached with sheet-metal screws. Note the 2 3/4-in. opening in bottom of can



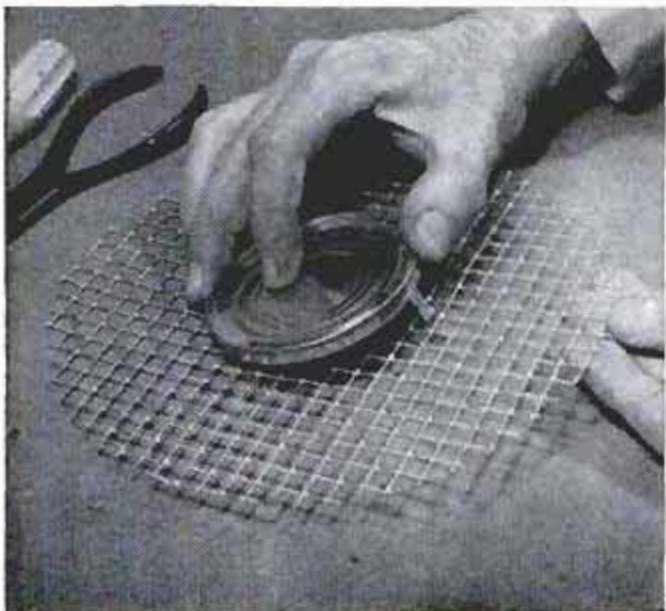
HOBBYWORK



Temperature of the oven can be checked by inserting thermometer in cork and sticking in filler hole

DOZENS OF USES will be found for a drying oven in the workshop and hobby room. Not only will it prove handy during humid weather in speeding the drying of spray enamels, but its gentle warm-air circulation will hasten the drying of plaster casts, clay models, cemented bric-a-brac and small glued objects. Air entering through an opening in the bottom of the can is heated by a 100-watt lamp, rises and escapes through the uncapped spout and filler openings. With a 100-watt bulb, the oven maintains a temperature between 140 and 160 deg. F. Of course, less heat

Bottom from food can is hooked to hardware-cloth shelf to provide heat deflector and drip cup over lamp



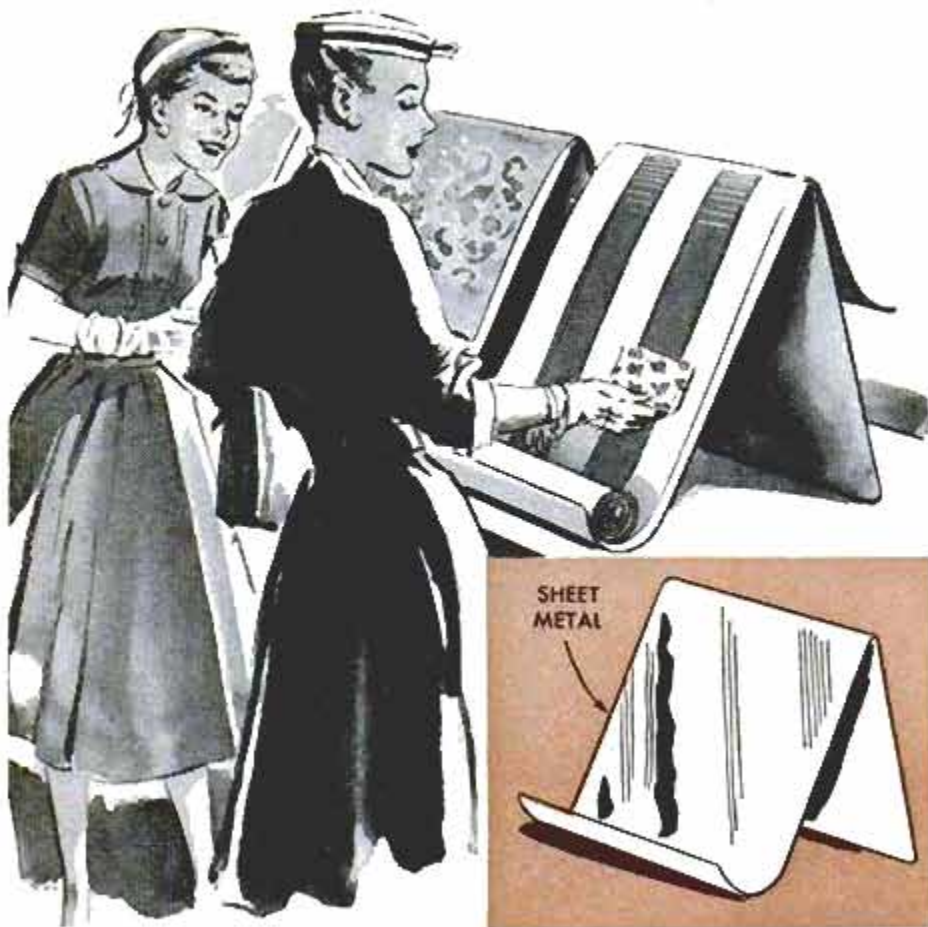
can be had by using a smaller watt lamp.

As you can see, it is made primarily from a two-gal. gasoline or oil can which is provided with a hinged door, a hardware-cloth shelf and legs to support it over the lamp. A deflector cut from the bottom of a tin can is hung $\frac{1}{4}$ in. below the shelf and directly over the bulb to avoid a hot spot and to catch drips. The shelf rests on sheet-metal screws which are turned in through the side of the can a little below the door opening. When using the oven to dry lacquer or other finishes containing highly volatile solvents, leave the oven door open the first few moments to permit the solvent fumes to escape. Of course, there should be adequate room ventilation, too. ★ ★ ★

Heat from 100-watt lamp bulb provides warm circulating air to speed drying of this cemented doll head



Sheet-Metal Easels for Displaying Wallpaper Rolls



Showing wallpaper patterns from rolls for customer viewing is easily and conveniently accomplished by one store owner who uses easels made from lengths of sheet metal to display selected rolls as shown in the illustration. After a customer selects preferred patterns from sample books, the appropriate rolls are removed from stock and placed on the easels for better examination, especially where large patterns are concerned. To make an easel, simply shape a curved trough at one end of a length of heavy-gauge sheet aluminum or steel and make a right-angle bend in it as shown. Since it is easy to make an easel of this type, you can turn out as many as are needed in a hurry.

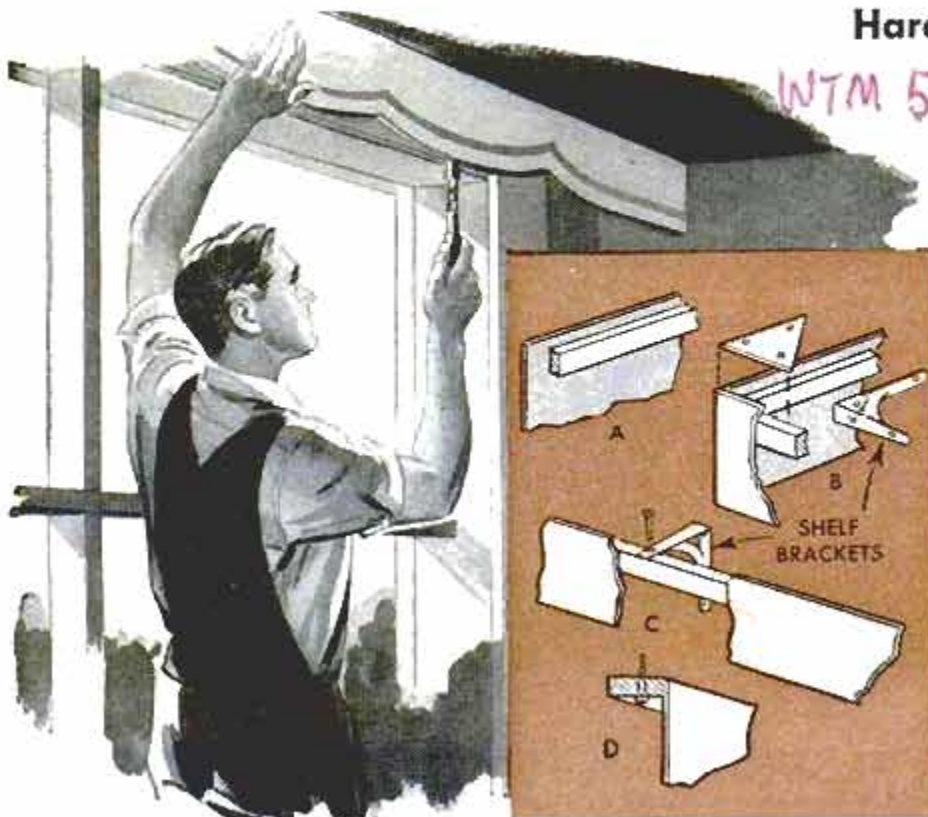
Household Glue Made From Starch

For a handy household glue try the following formula: To one cup of granulated laundry starch add enough water to produce a liquid of whipping-cream consistency. Then, bring the mixture to a boil and allow it to cool.

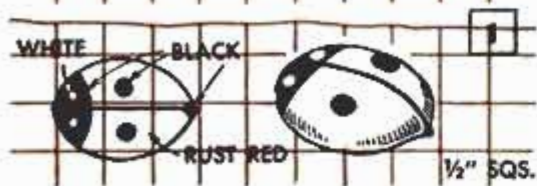
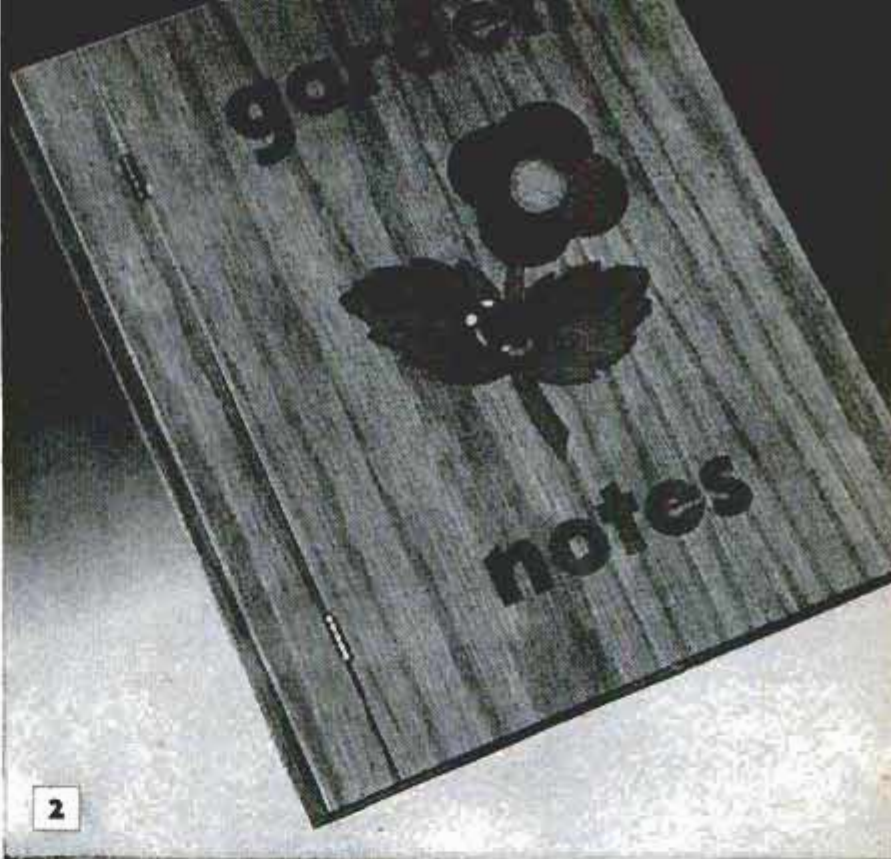
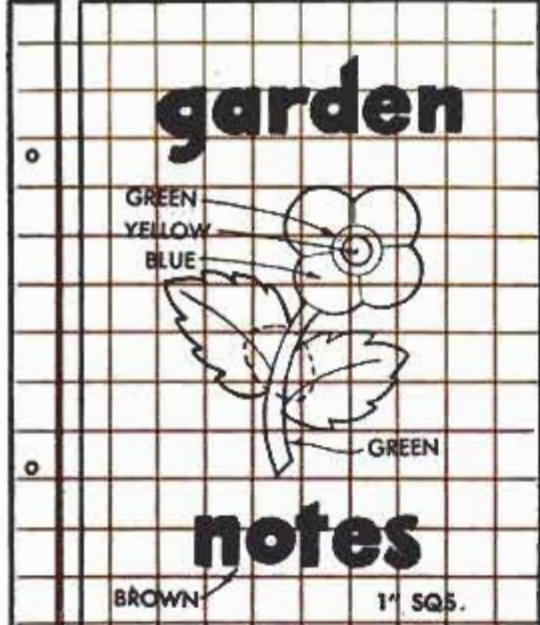
Putty Used as Pipe-Joint Seal

If pipe-joint compound is unavailable the next time you repair a water-pipe line, try using linseed-oil putty. When applied to the threads of a joint the same as compound, the putty provides an effective seal. Eugene E. Snell, Lynn, Mass.

Hardboard Window Cornice



WTM 59 Here is an attractive window cornice that you can make out of inexpensive materials consisting of a hardboard facing nailed on a frame of furring-strip stock. If the cornice is to be attached to the window frame, the hardboard is nailed to 1 x 2s and mounted on the frame by means of shelf brackets as in details A, B and C. For a cornice that is attached to the ceiling, the facing material is nailed to a 1 x 3 and screwed to ceiling joists as in detail D. A scallop design can be cut on the cornice as shown, or it can be left plain and painted as desired.



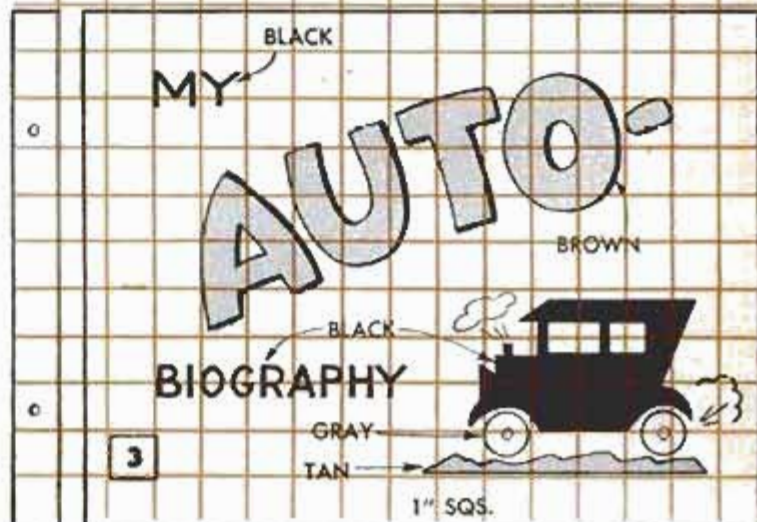
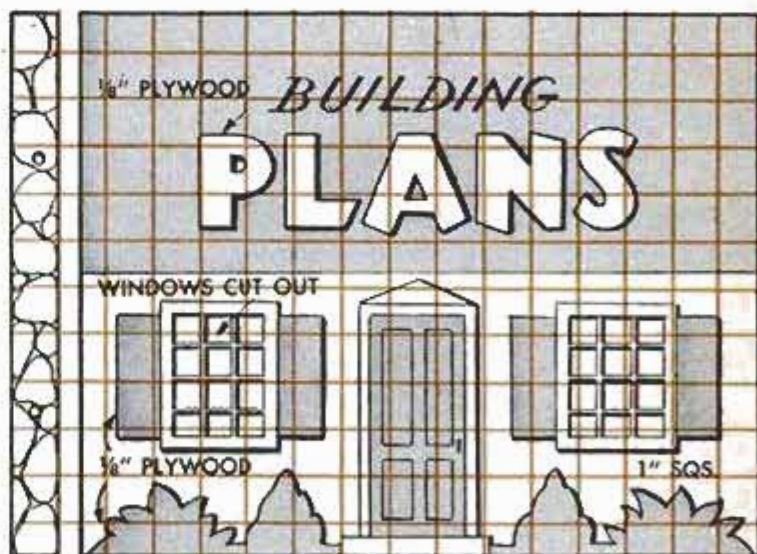
ONE FOR YOUR SCRAPBOOK

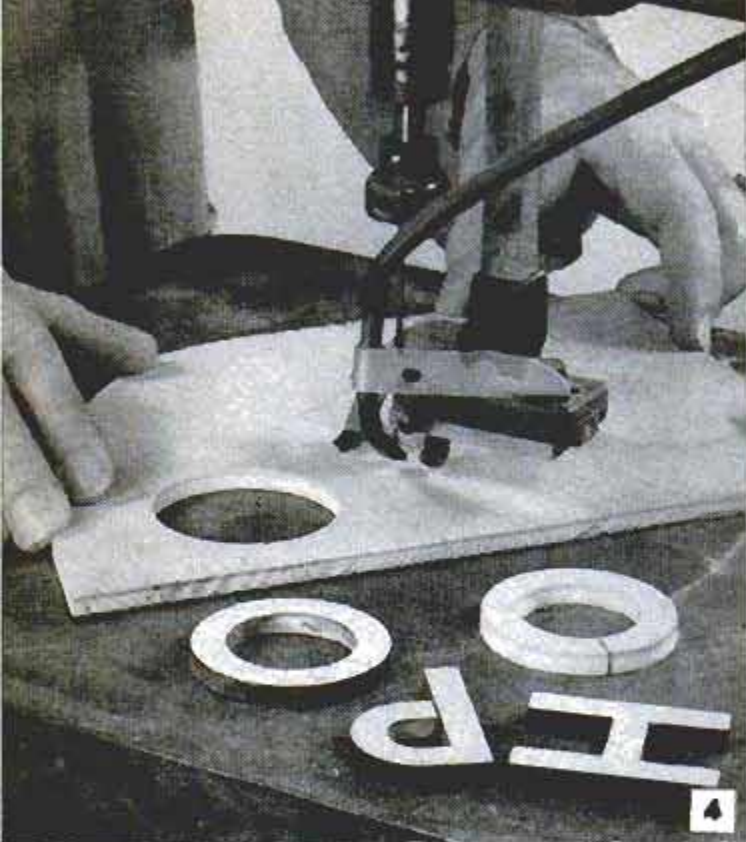
By Bess A. Lee

WIM 59

GOOD BOOKS deserve good covers and this is especially true when it comes to scrapbooks which can become dog-eared in no time at all if not provided with stiff, durable covers. Such covers need not be plain pieces of wood. As these examples show, they can be dolled up with novel overlays depicting the particular subject.

The covers themselves are simple enough, being nothing more than three pieces of 1/4-in. plywood. One piece provides the back and the others the front which is hinged together with tiny brass hinges. Front and back covers are then tied together with a leather thong which also holds the paper filler. The overlay designs can be cut from 1/8-in. plywood, sheet plastic or flexible veneer tape which comes in rolls like ribbon and can be easily cut with a knife or single-edge razor blade. Art stores sell ready-cut letters, but if you have a jigsaw, you can cut these out yourself, Fig. 4. Some of the small letters can be burned in the wood if you have a wood-burning tool. A coat or two of shellac makes a good finish for the covers. Boiled linseed oil applied with a cloth will give a less glossy finish.





In duplicating any of the covers, you first have to enlarge the patterns by ruling off on paper an equal number of squares of the size indicated. The Garden Notes cover, Figs. 1 and 2, features a flower complete with a ladybug. Here each section of the leaves and flower is cut out separately from thin veneer. Birch is good for this since color stains or water colors, applied after gluing, will let the grain show through. The carved ladybug is simply glued in place on top of the flower.

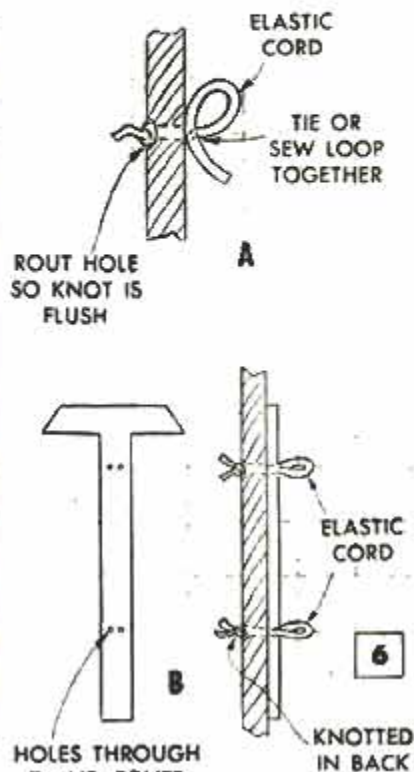
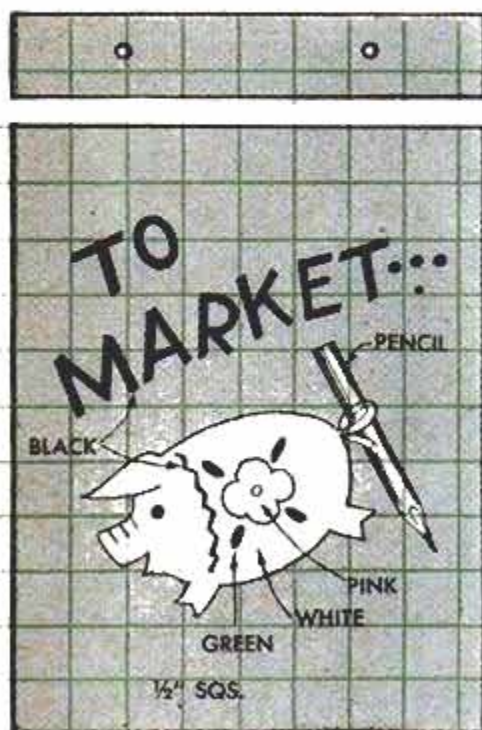
An appropriate cover for a scrapbook for new home ideas, plans and clippings is shown below Fig. 2. Representing the front of a house, it makes a book large enough to hold pages from even the larger mag-

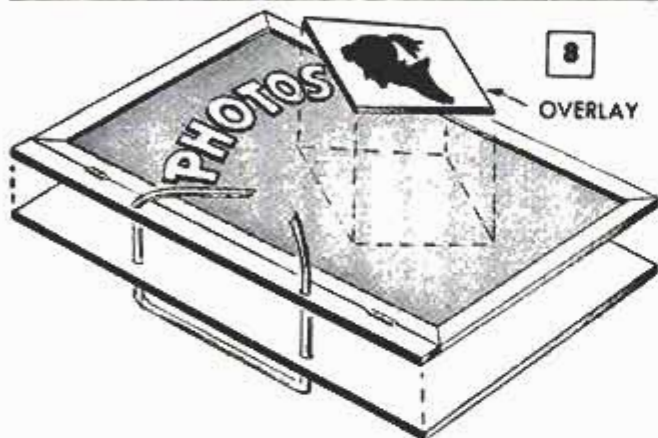
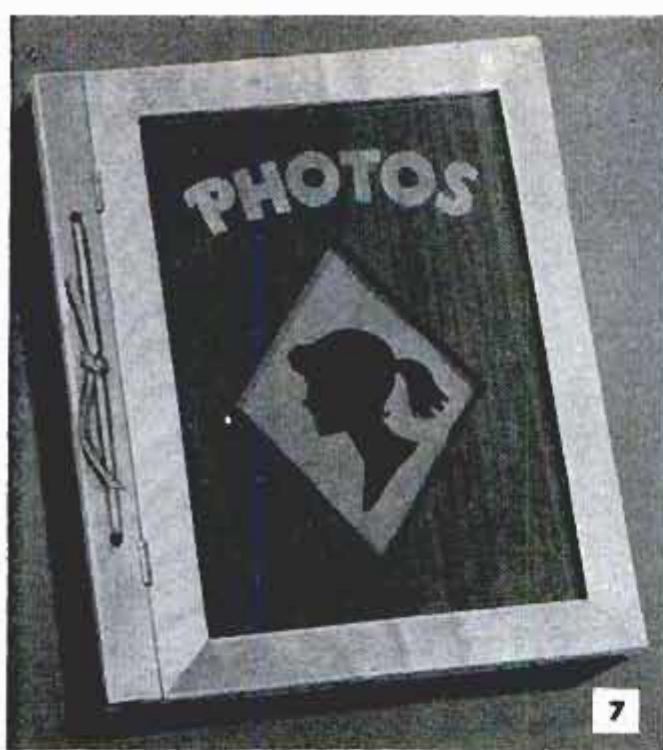


azines. The shutters, shrubs and doorstep are jigsawed separately from thin plywood, while the rest of the house design is simply painted on. The word "plans," which is also jigsawed, should be left natural or finished light to contrast against a dark roof. The part to which the cover is hinged is made to look like a stone fireplace by painting it gray or terra cotta and then outlining the stones in black.

The cover shown in Fig. 3 is designed for a vacation motor-trip scrapbook. Letters of the word "auto," as well as the antique car and bumpy road, are jigsawed and glued on. The rest of the design is merely painted on. A few strokes of white paint indicate steam and exhaust from the car.

Designed as a cover for a diary, the one shown in Fig. 5 makes use of a sun and

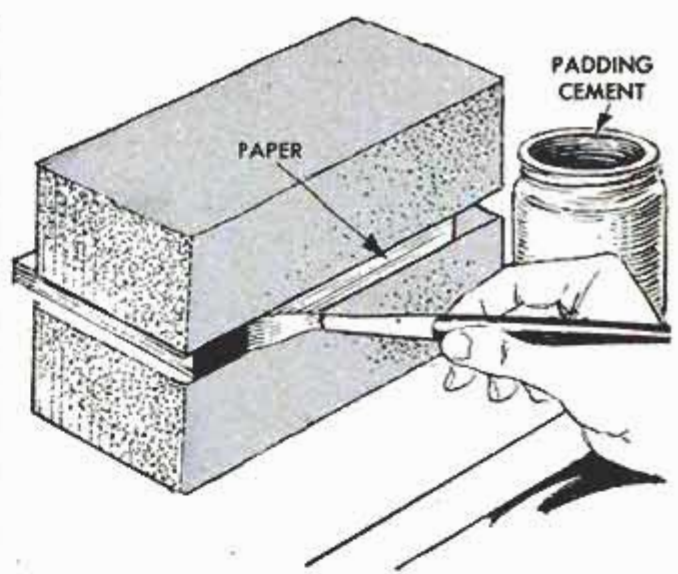




moon cutout to carry out the title, Days to Remember. A school notebook or pad of paper punched at the top to match the holes in the coverpiece makes a good filler since it can be kept as a pad when filled and removed from the scrapbook.

Elastic cord inserted through holes in the covers and looped and knotted on the back keeps a pencil handy in the two covers shown in Fig. 6. A bright thumbtack is used in one to simulate the chrome hub cap on the auto wheel. The large T and L letters are sawed out and glued on. The rest of the lettering of both covers, as well as the birds and pig, is painted on.

The photo-scrapbook cover, Fig. 7, is made to look like a framed picture. Starting with a dark-plywood back, in which a diamond is cut, a light-colored frame is glued to the surface around the edges and mitered at the corners. An insert of light wood is fitted in the diamond opening and a silhouette pasted in the center. A variation of this is shown in Fig. 8 in which the diamond is an overlay which is merely glued in place. The letters of the word "photos" should be jigsawed from 1/4-in. plywood and glued on to stand out in relief. ★ ★ ★



Simple Way to Make Scratch-Pads

Discarded letterheads and other printed matter can be converted to scratch-pads by purchasing a little padding cement from a printer. This is the adhesive used for binding the edges of such pads. After cutting the paper to size, stand all the original edges together and place the stack between heavy weights, such as a couple of bricks. This will keep the edges aligned while coating with the padding cement.

Ink Bottles Won't Tip

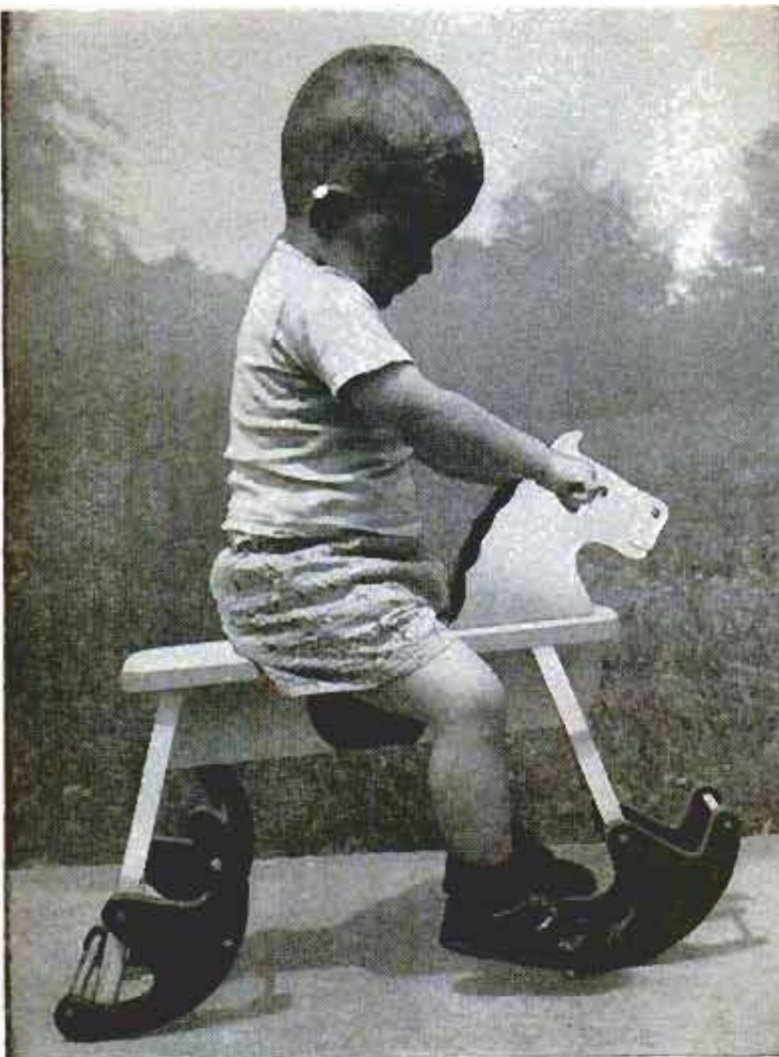
Three bottles of drawing ink are less apt to tip than one when they are bound together with a strip of masking tape. You'll find them less awkward to handle, too, when kept in groups of three. Be sure to draw the tape tightly.



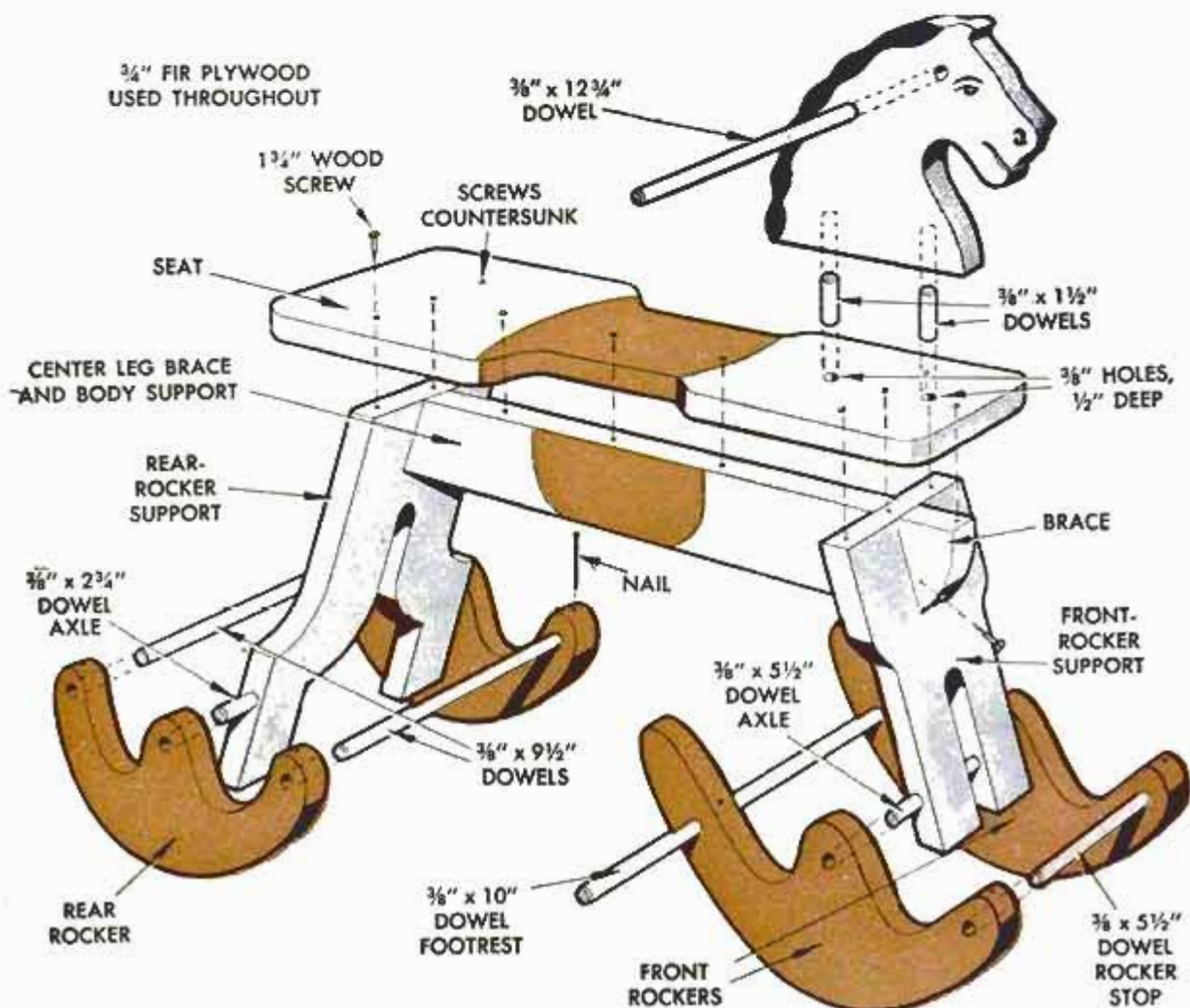
☛ Sew little magnets into the corner of a pot holder and it will always be at hand as it can then be attached to the stove.

STAY-LEVEL

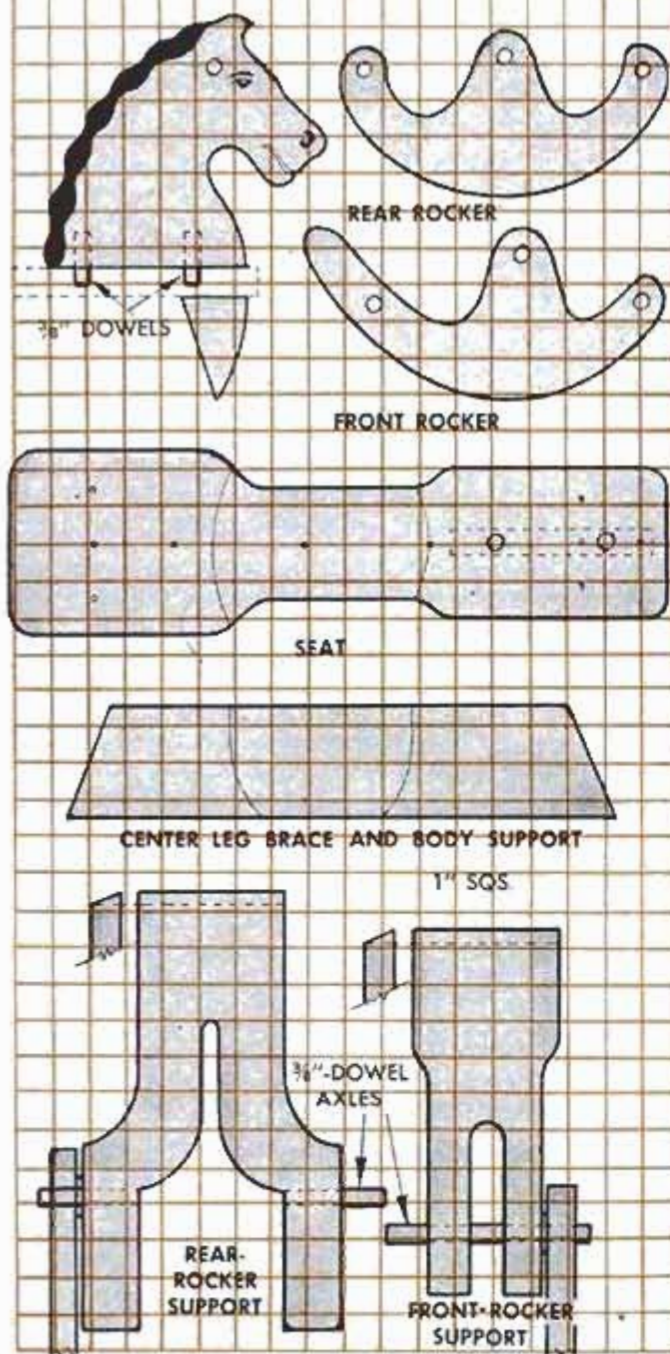
By G. E. Hendrickson



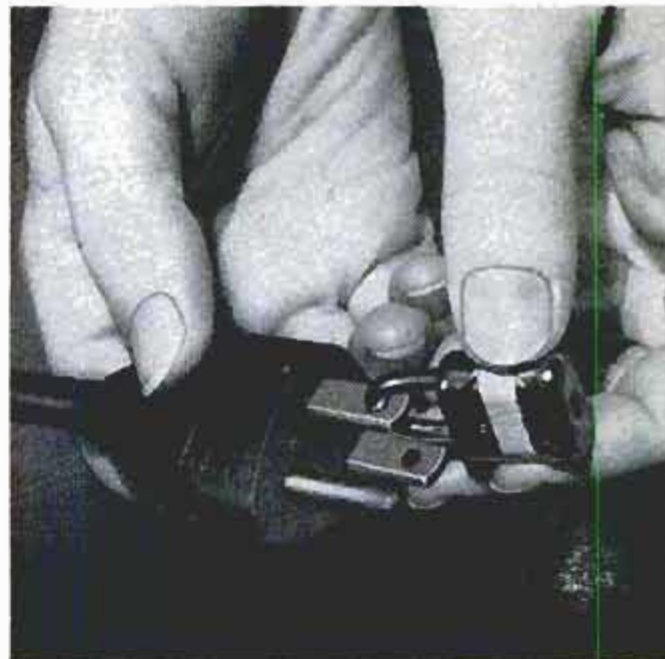
EVEN THE YOUNGEST rider is in no danger of having this rocking horse throw him. The reason is that the two sets of rockers are so positioned that the body of the horse remains level at full gallop. Note how they are pivoted in much the same manner as a porch glider. All parts for the horse, including the rockers, can be cut from $\frac{3}{4}$ -in. plywood, following the squared patterns on the facing page. Axles and rocker stops are lengths of $\frac{3}{8}$ -in. dowel. The stops are an added feature that limits the length of swing of the rockers, and also prevents the rockers from being inverted when the horse is dragged about by its youthful owners. On the front set of rockers, the rear stop is allowed to project about 3 in. outside each rocker to provide footrests for the rider, and also as a means of "driving" the horse. ★ ★ ★



ROCKING HORSE



FEBRUARY 1958



Power-Tool Cord Padlocked

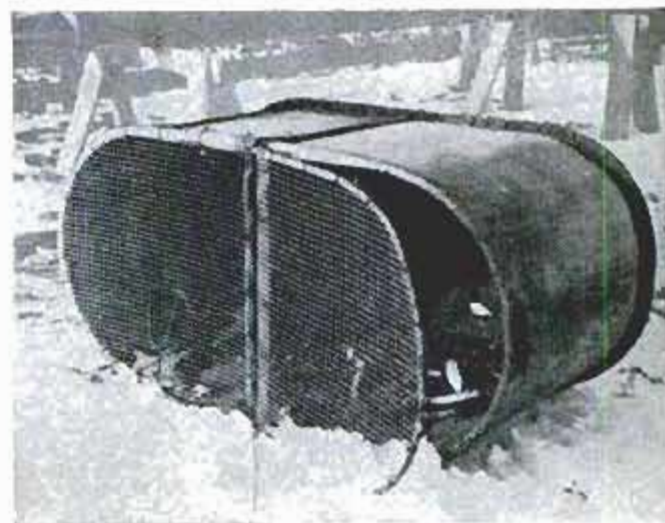
To prevent children or unauthorized persons from using power tools left out on your workbench, slip a small padlock through the hole in one of the plug prongs as indicated. It will prevent the plug from being inserted in a receptacle.

"Noiseproofing" Leather Seats

When annoying creaks develop in the leather seats of an automobile they can be eliminated by rubbing saddle soap between the seat cushions and side panels, and between the cushions and seat backs. Also, rub soap on adjacent edges of the pivoting backs of the front seats of two-door cars.

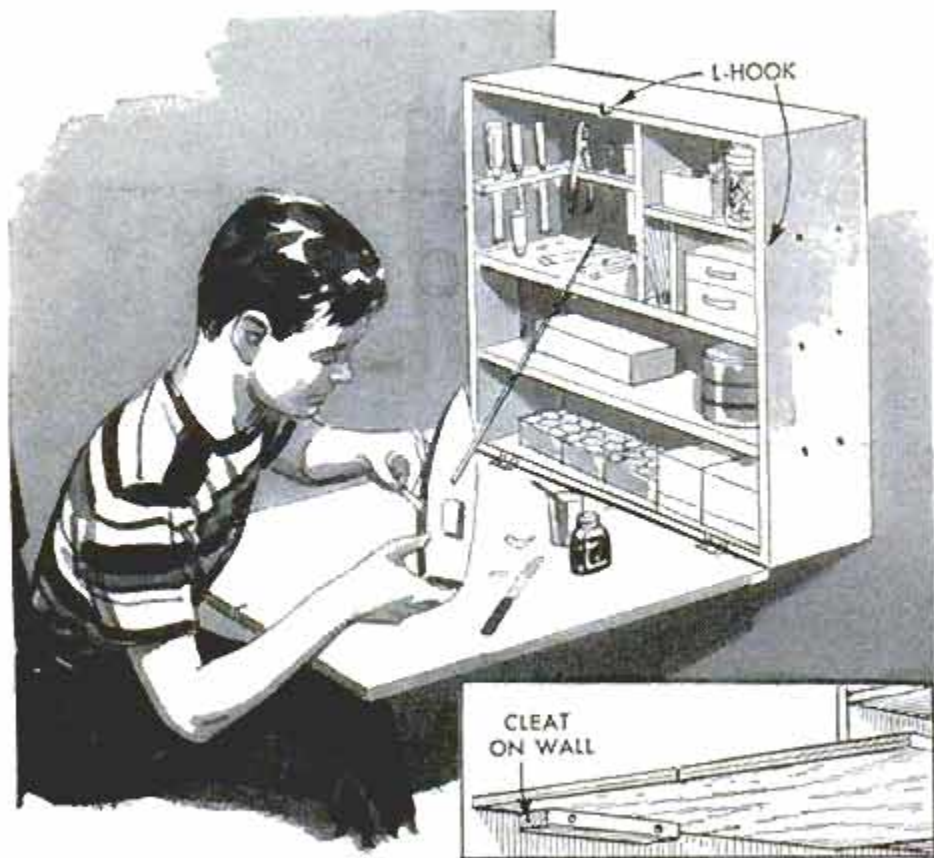
Watering Tank Used as Cage

Placed on its side and fitted with doors covered with hardware cloth, this steel watering tank is used as a utility shelter on one farm. Poultry, small pigs and pets are kept in it. The doorframes are tubing and steel angle.



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Hobby Cabinet Provides Both Storage and Work Surface



Fastened to the wall in a corner of a room, this small wall cabinet serves both as a storage place for hobby supplies and as a workbench. Depending on the hobby concerned, the cabinet can have two or three shelves, and whatever vertical partitions prove necessary. The door, which can be $\frac{3}{8}$ or $\frac{1}{2}$ -in. plywood, is hinged to the bottom shelf. When the door is dropped to a horizontal position to be used as a workbench, it rests on a cleat attached to the adjacent wall. If the cabinet is located on a wall not adjacent to another, chains or brackets can be used to support it. For a latch, a L-hook is used at side or top, fitting a notch in the door.

Layout Blue Container

Instead of using a large pot or bottle of layout blue when doing a small job, clean out an empty nail-polish bottle and fill it with the blue. The polish bottle is small and handy, and contains its own brush in the screw cap.

Tape-Spool Reel Stores Line

Instead of having a chalk line a tangled mess when you want to use it, wind it on a reel made from an adhesive-tape spool. A small knob screwed to the flange of the spool permits quick winding, and your forefinger is used as the "axle" of the reel.

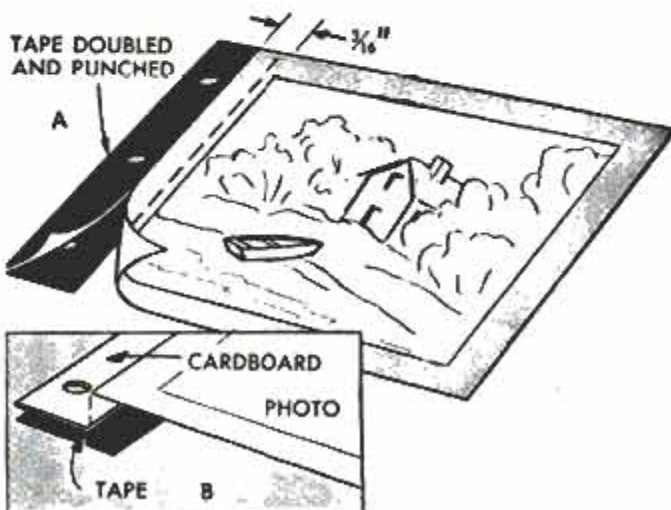


Tape Protects File-Card Edges

Small file cards (3 x 5 in.) that become frayed and torn around the edges from frequent handling may be protected by binding the edges with cellulose tape. The narrow tape strips will not interfere with any notations made on the cards.

Ring-Binder Photo "Album"

Small, easily handled photo "albums" can be made by taping a strip of cardboard to one edge of each photo as indicated, and punching holes in the cardboard. Notebook rings then are used to make a ring binder for the photos. This idea is especially good for pictures in a sequence, such as those taken on a vacation trip. Details A and B show two methods of applying the tape.





First Aid For Your Trophies

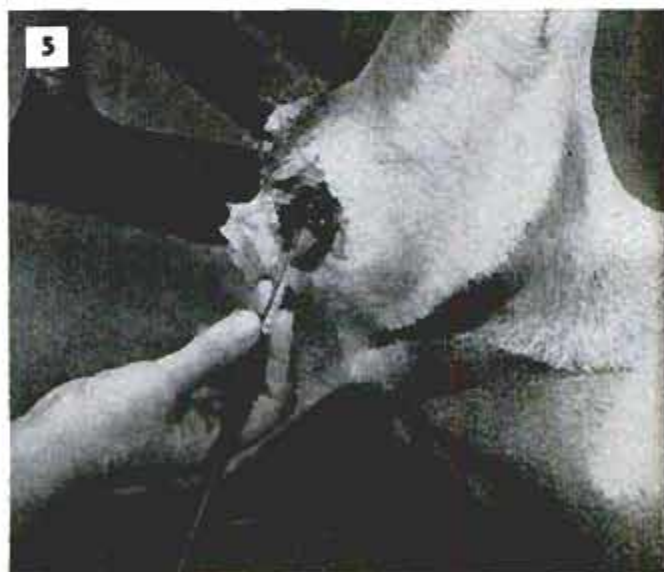
SINCE MOUNTED FISH and birds, as well as animal heads, collect dust just as does household furniture, they, too, need an annual spring-cleaning. So that your favorite trophies look their best, here are taxidermist-approved methods that will enable you to restore safely their original lifelike appearance.

For proper cleaning of mounted fish, dust all surfaces with a soft cloth, wiping with the lay of the scales. Then, touch up faded parts with oil colors as in Fig. 1, and apply a coat of clear lacquer. Soft bread makes a good "dusting cloth" for cleaning feathers on mounted birds, Fig. 3. Cleaning fluid may be used for removing grime, but do not use soap and water. The best way of removing dust from fur is to vacuum it



with a small unit, working with the "grain" of the hair as in Fig. 2. For horns, wipe off the dust and then wash them with mild soapsuds, being careful not to wet the fur. Then, dry the horns and polish them with liquid floor wax, Fig. 4.

Eyelashes are made to glisten when coated with clear shellac as in Fig. 5. White corn meal is best for cleaning a bearskin rug. After vacuuming the pelt, pure corn meal is hand-rubbed into the fur and then removed by vigorously beating the pelt on a clothesline, using a carpetbeater.



CARDBOARD STEREO VIEWER

By Allan Carpenter

THE NEXT TIME you entertain a group of friends with stereo slides, it won't be necessary for each person to wait until the viewer is passed to him. All that you need do to eliminate this inconvenience, is make several cardboard viewers like the one shown in the drawings so that at least one viewer is provided for every two people present.

To make a viewer, first outline the various parts in full size on medium-weight cardboard. Draw dotted lines for folds as indicated in each of the drawings. Then, cut the parts from the cardboard stock and make the indicated cutouts in the slide carrier and focus component, detail A, and in the lens housing, detail B. After gluing a strip of household wax paper over two of the square cutouts as shown in detail A, the slide carrier and focus component is folded as indicated by the dotted lines. Cellulose tape is used for joining the edges that form corners. The free end of the slide carrier is then folded inward and glued to the bottom as shown. A cardboard tab for pulling the carrier when focusing a slide, is taped to the bottom at the front to complete this component.

Before folding and taping the edges of the lens housing, the lenses are centered on the $\frac{3}{4}$ -in.-dia. holes and taped in place as indicated in detail B. The diameters of the lenses used is not important except that the lenses be of the same size and focal length for any one viewer and have a diameter of less than $1\frac{1}{2}$ in. but greater than



Cut Sheet Metal With Hacksaw

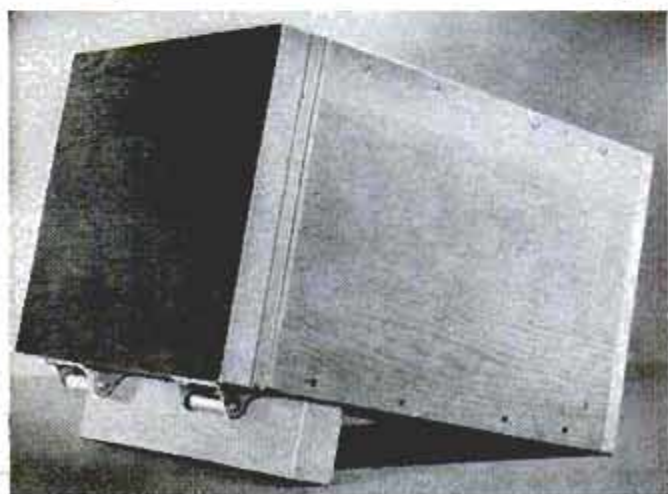
When no suitable tin snips is available, use a hacksaw to cut sheet metal. To do this, reverse the blade so that the teeth point toward the handle and clamp the sheet to be cut to a bench top as shown. Then, mark the sheet for cutting, draw a second parallel line 1 in. from the first and saw alternately along both lines, rolling the metal as the cutting proceeds.

S. Clark, East Bradenton, Fla.

Picture Framing the Easy Way

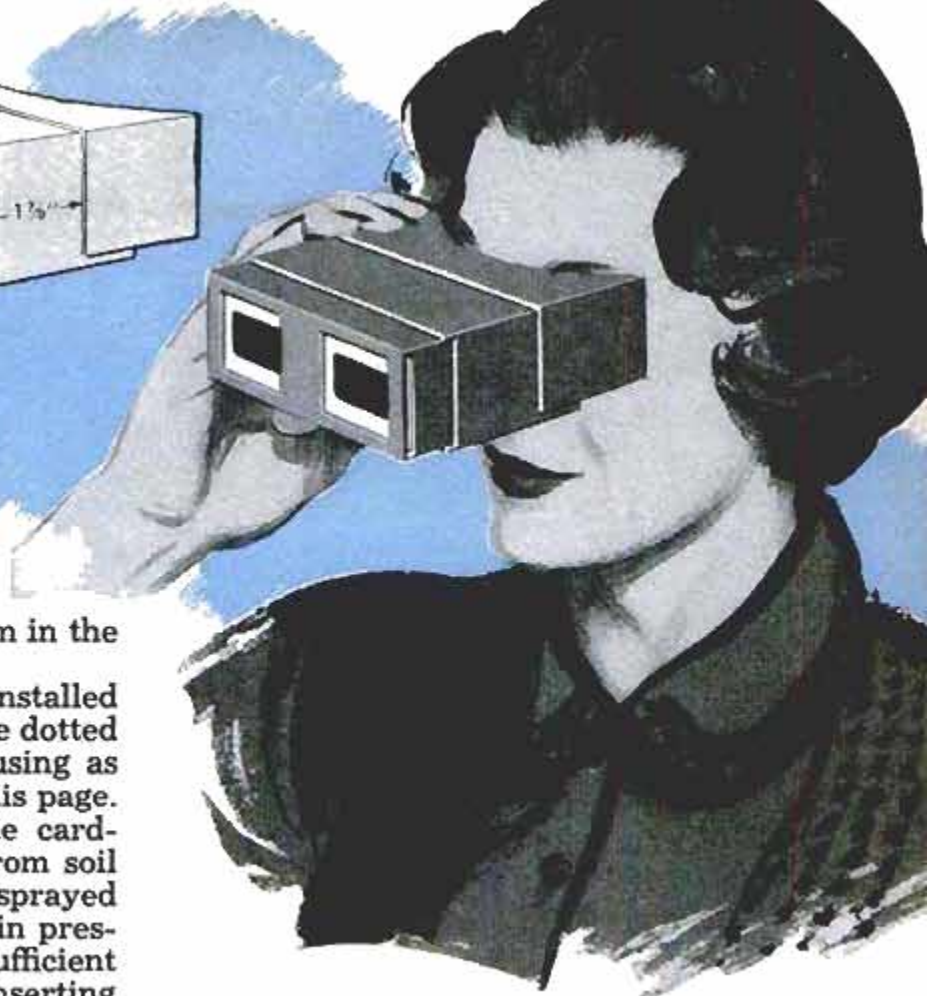
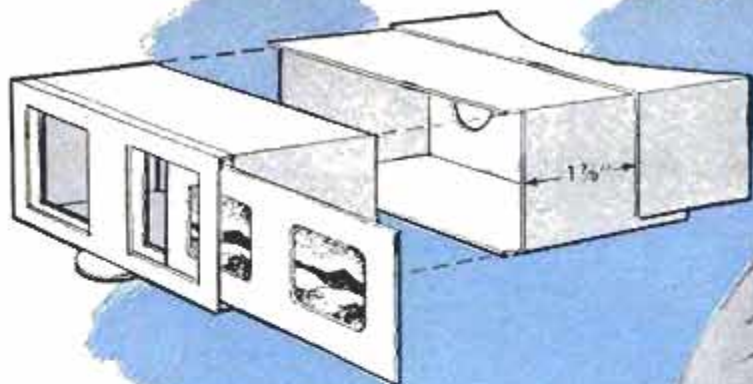
Proper positioning of a picture in a frame is assured if first the glass is removed and the picture is placed under it for trimming. Pictures that are smaller than the glass but larger than the opening in the frame, are positioned on the glass as desired and secured with cellulose tape.

Handy Darkroom Safe for Enlarging Paper Has Self-Closing Door



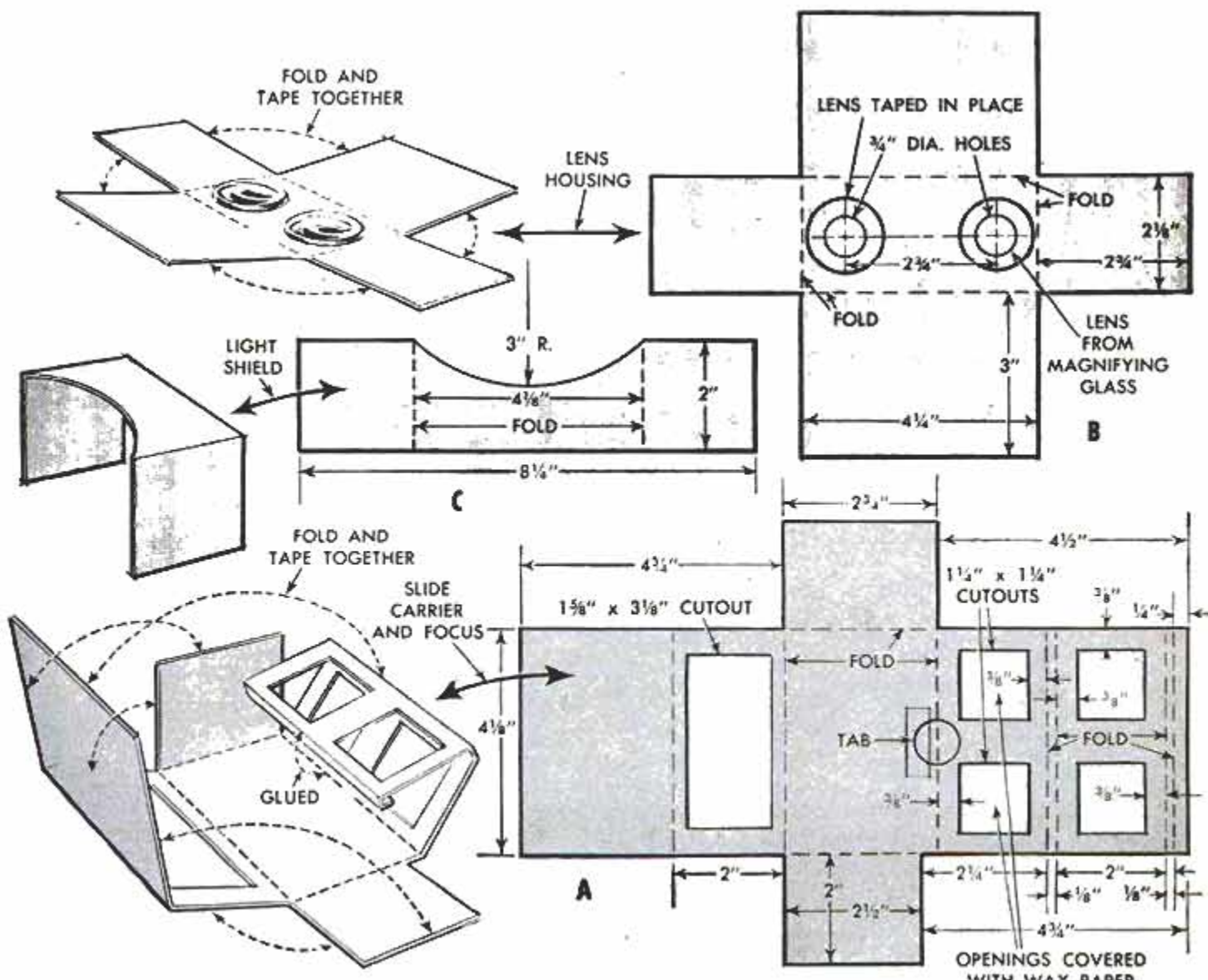
This light-tight paper safe was made by one amateur photographer for storing enlarging and print paper. Plywood strips glued in $\frac{1}{4}$ -in. rabbets cut in the inside edges of the door and open end of the box overlap when the cover is closed. All corners of the box are rabbeted to prevent light leaks. The door is mounted on spring-loaded hinges that automatically close it when released. A block of wood supports the front end of the safe so that it is on a slight incline to prevent paper from falling to the floor if other sheets should cling to the one being withdrawn.

B. Brownold, Cedarhurst, N. Y.



$\frac{7}{8}$ in. for proper positioning of them in the space allotted.

The light shield, detail C, is installed simply by folding the ends along the dotted lines and gluing it to the lens housing as shown in the detail at the top of this page. To improve the appearance of the cardboard viewers and protect them from soil and wear, all outer surfaces are sprayed with paint of the type that is sold in pressurized cans. Be sure to allow sufficient time for the paint to dry before inserting the slide carrier into the lens housing. ★ ★ ★





Rocks Gripped by Tire Chain

Using a car or truck to pull a large rock from the ground and drag it away takes the hard work out of the job, but produces the problem of how to wrap a chain on the rock so that it does not slip. Tire chains are ideal for this; the cross links and side chains form loops that grip projections on the rock.—R. P. Dunlop, B. C., Can.

Driving Screws in Plaster Wall

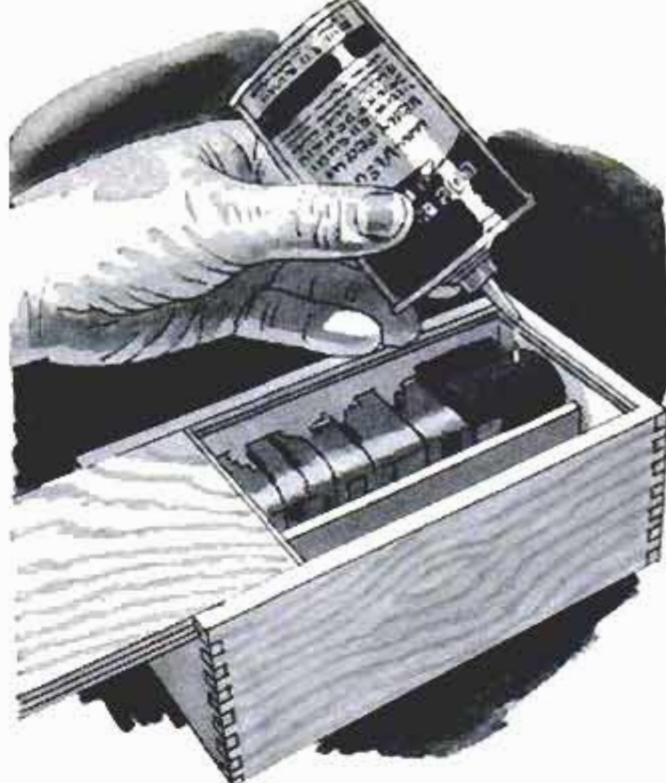
Wood screws driven into a plaster wall have little holding power, and usually chip the surface and pull free. To improve holding power, first drill a hole in the plaster and pack it with steel wool. Then drive the screw into the steel wool.

"Taped" Waterproof Labels



Waterproof labels for jars, cans and other objects are easy to make when the desired information is typed or written on a clean sheet of paper and stripped off with transparent tape. The tape then is applied to a smooth surface of the object receiving the label.

Use a soft-lead pencil, or strike the keys hard if a typewriter is used to write the label. In the latter case, the use of a new ribbon is recommended.



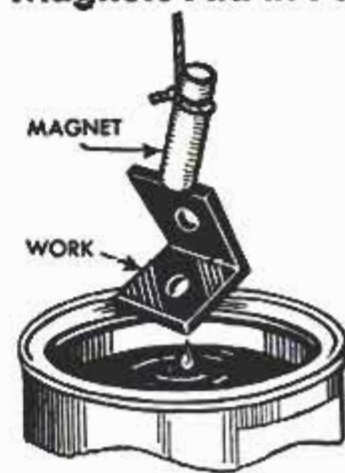
Oiled Felt Rustproofs Cutters

In damp locations expensive shaper cutters may rust even though stored in a wooden box. Keep the cutters rust-free by storing a piece of rolled felt in the box, and soaking it with a good quality gun oil. Fumes from the slowly evaporating oil will condense on the cutters and keep away damage-causing moisture.

Cleaning Small Brass Articles

Small brass articles that have become tarnished can be cleaned by immersing them in a solution consisting of: ammonia, $\frac{1}{2}$ cup; detergent, $\frac{1}{2}$ cup, and water, 2 qt. After the brass has soaked for an hour, remove and polish it with fine steel wool.

Magnets Aid in Paint-Dipping



Iron or steel parts can be dipped in paint with a minimum of contact by the supporting device if small magnets are used as indicated. Dipped parts can be kept on the magnets until the paint dries. A touch-up with paint may be required on the small

areas contacted by the magnets, and the magnets themselves should be scraped free of paint each time they are used to prevent an undue accumulation.



Motorized Wheelbarrow Converts to Sprayer

By Ronald L. James

HERE IS A WHEELBARROW that will enable you to move heavy loads over rough terrain or soft ground with almost no effort. When the removable tray is unbolted and a water pump and spray tank installed on the platforms provided for them, the unit can be used for spraying insecticide on fruit trees, shrubs and home-garden crops.

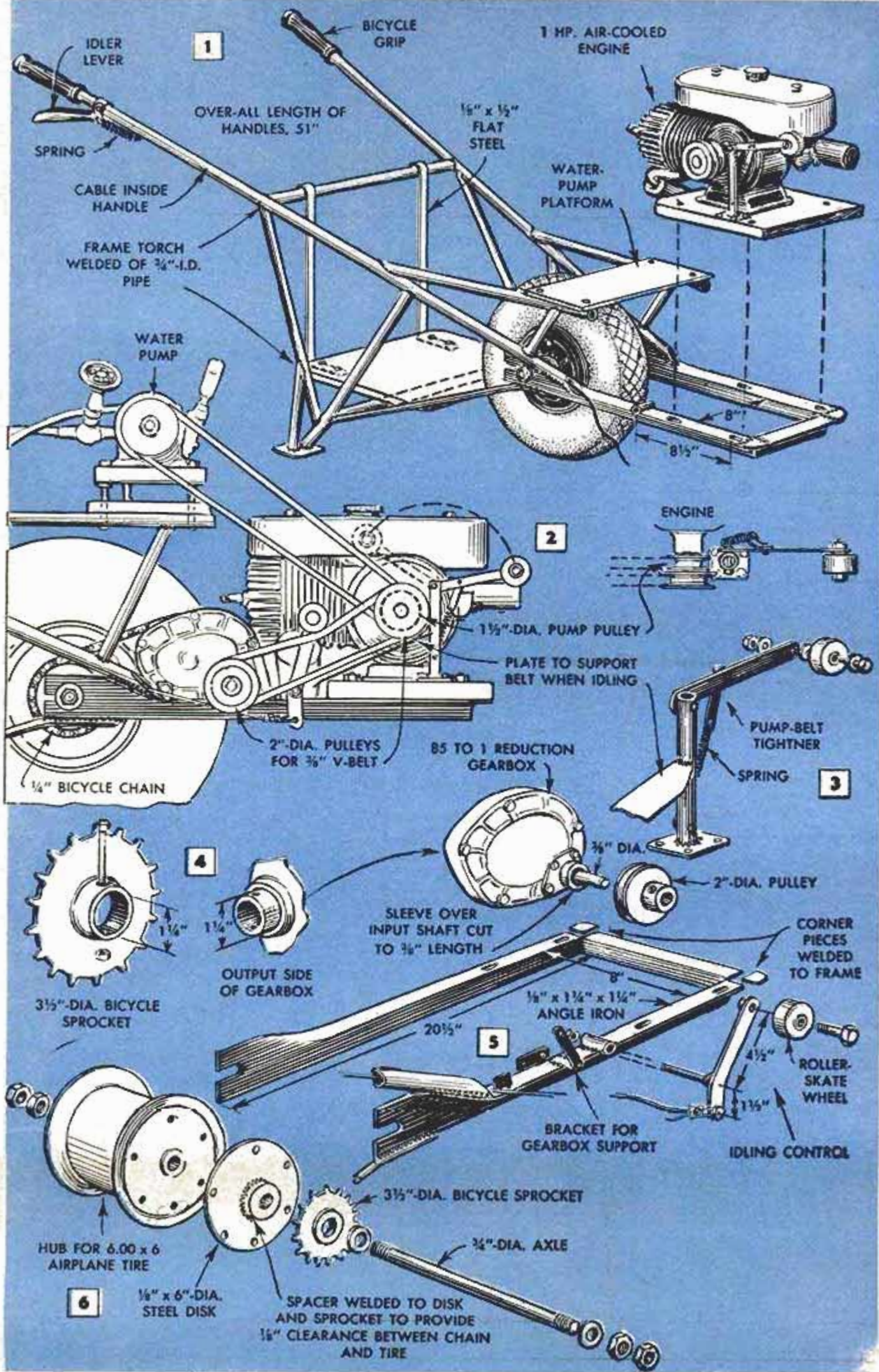
A 1-hp. air-cooled engine from an old lawn mower provides ample power to move the loaded unit at about 2 m.p.h. over any surface. When the V-belt from engine to gearbox is disconnected and the power is used to run the water pump by means of another V-belt-and-pulley assembly, about 150 lb. of pressure is available with the high-pressure geared pump shown for spraying. A high-speed engine and reduction gear are necessary for this dual-purpose unit to turn the pump at high speed and drive the wheelbarrow at slow speed.

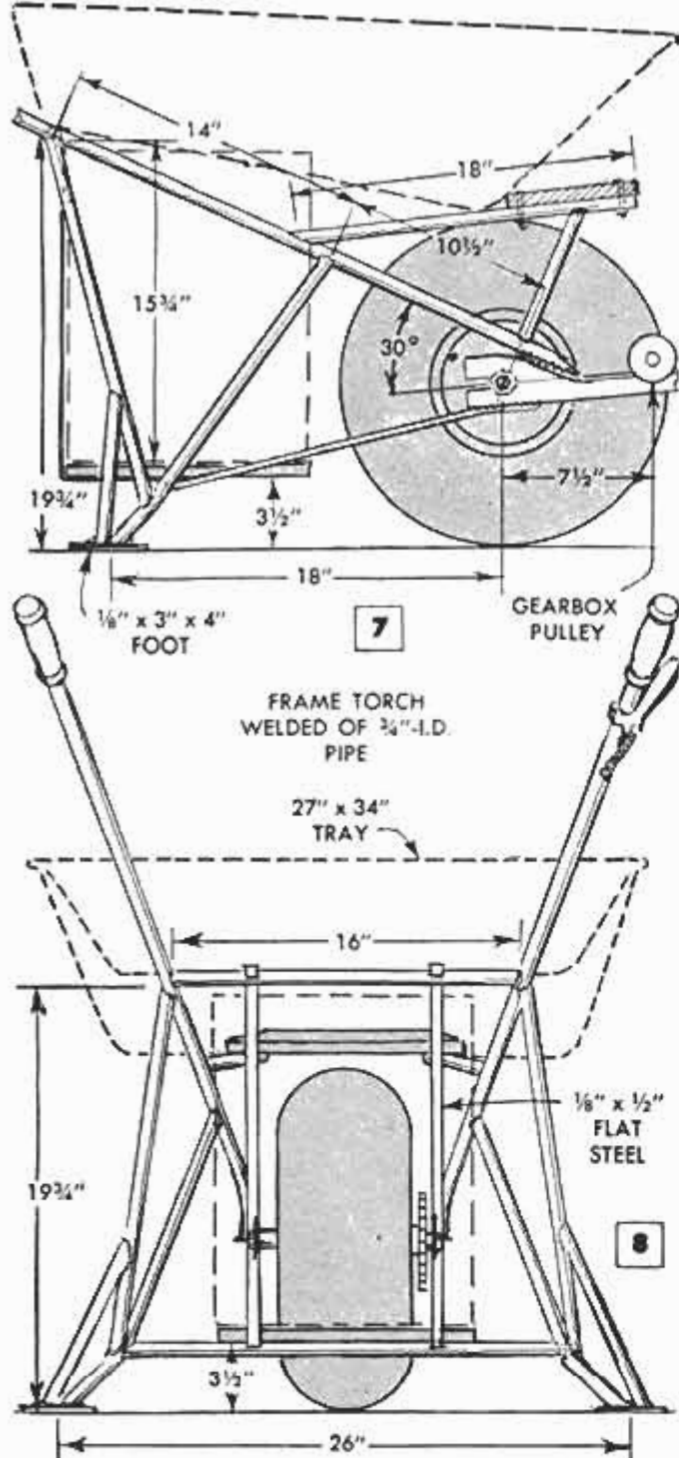
The frame of the wheelbarrow is torch-welded from $\frac{3}{4}$ -in. black steel pipe and $\frac{1}{8} \times 1\frac{1}{4}$ -in. angle iron as shown in Figs. 1, 5, 7 and 8. Lugs welded to the right side of the angle-iron section of the frame, as in Fig. 5, provide a means of bolting the gearbox in the required position. The gearbox used for the unit shown is a war-surplus J-H No. 1045 having an 85 to 1



When wheelbarrow tray is removed and spray assembly installed in its place, idler control automatically relieves tension on V-belt running from engine to gearbox which places latter in "neutral" position







reduction. To permit mounting a 2-in.-dia. pulley for the drive belt on the $\frac{3}{8}$ -in.-dia. input shaft, the sleeve on the latter is cut to a length of $\frac{3}{8}$ in.

The sprockets are 3½-in.-dia. bicycle sprockets, one of which is mounted on the 1¼-in.-dia. output shaft on the gearbox and the other on the wheel hub as shown in

Figs. 4 and 6. The output sprocket has a 1¼-in. inside-dia. sleeve welded to one side of it. Holes drilled through the sprocket and output-shaft sleeves accept a $\frac{1}{4}$ x 1½-in. carriage bolt for easy connecting or removing of the sprocket.

The tire is a discarded airplane tire mounted on a war-surplus wheel or hub. If unobtainable, the hub also can be made by cutting the necessary parts from hardwood plywood and assembling them with waterproof glue.

The sprocket for the wheel is spot-welded to a steel spacer that is then welded to a $\frac{1}{8}$ x 6-in. steel disk. After slipping the wheel on the hub, this assembly is bolted to the hub as in Fig. 6. The purpose of the spacer is to provide $\frac{1}{8}$ -in. clearance between the drive chain and sidewall of the tire. If a narrower tire or a wheel with a wider hub is used, it may not be necessary to provide a spacer.

Tension on the drive chain can be adjusted by loosening the outer nuts on the wheel axle and sliding the latter forward or backward in the slots provided for it as required. Lateral adjustment of the wheel is made by turning the inner nuts on the axle in the direction that the wheel is to be moved, in the same manner as the wheels on a bicycle are adjusted to prevent them from rubbing against the frame members.

The idling control, Fig. 5, is simply a belt tightener which applies pressure to the V-belt running from engine to gearbox when the idler lever is pressed against the handle, Figs. 1 and 2. When the lever is held in this position, power is supplied to the drive wheel through the gearbox. When the lever is released, a small spring attached to it relieves tension on the cable connecting the lever to the control so that the gears are automatically placed in "neutral." This improvised clutch is necessary for starting the engine, stopping briefly to unload or load the wheelbarrow, or when pushing the unit with the engine turned off. Also, it serves as a safety precaution. A plate that is welded to the pump-belt tightener supports the idler belt when it is inoperative to reduce drag on the drive-shaft pulley, Figs. 2 and 3. ★ ★ ★

Moistureproof Paper-Tape Roll

Gummed paper tape of the type used in roll dispensers can be prevented from sticking at the edges if both sides of the roll are given a thin coat of rubber cement or paraffin. This prevents moisture from penetrating the exposed sides of the roll. The coatings offer only slight resistance when a strip of tape is removed.

Polish Renews Weathered Rubber

Black liquid shoe polish, applied on a weathered windshield gasket, fills the tiny cracks in the exposed rubber and coats it with a thin film of wax for protection against further oxidation. This treatment also can be used to freshen the appearance of rubber floor mats, accelerator and brake-pedal covers and other rubber items.

Party Game Tests Eye and Hand Coordination



Introduce this interesting device at your next party and let your guests challenge each other as to who has the better coordination between hands and eyes. A small metal eye must be guided over a metal rod without touching it, the eye being just twice the diameter of the rod. The eye is bent on the end of a wire "wand" that is covered with rubber tubing to insulate it. A flexible wire is soldered to the end of the wand and run through a flashlight bulb, a dry cell and a switch to the horizontal rod over which the eye is passed. With this circuit, the bulb will light whenever the eye contacts the rod, which is bolted to a bracket that is screwed to a plywood base. If a doorbell or buzzer is used instead of a bulb, three dry cells will be required instead of just one.—E. R. Haan, Evanston, Ill.

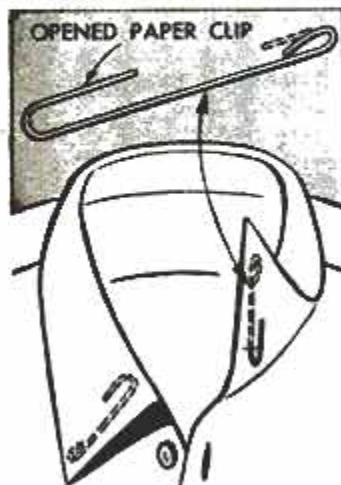
Shockproof Grip for Star Drill

To provide a firm, shock-resistant grip on a star drill, cut a hole through a solid rubber ball and force the drill through it. Hammer shocks are absorbed by the ball so hand fatigue is reduced considerably.

Glue Helps Hang Heavy Doors

When hanging a heavy door in a soft-wood frame, prevent the hinge screws from pulling loose quickly by first drilling a pilot hole and filling it with glue. Then drive the screw into the glue-filled hole.

Emergency Shirt-Collar Stays



When collar stays have been mislaid, satisfactory substitutes can be improvised from ordinary paper clips. Each clip is rebent so there is a closed loop in one end, and an open loop in the other. The loops are bent at right angles to each other.

Piston Ring Is "Storage Rack"



Fitted over a nail in the workshop wall, a piston ring provides an ideal holder for large nuts and washers. Spring tension keeps the ends closed to permit the parts to be slipped around for easy selection. Twisting the ring ends slightly permits quick removal of the items.

☞ To clean a slender vase, fasten a piece of old sponge on a stick and push it down into the vase.

☞ Use an empty spray-deodorant bottle to rinse the leaves of delicate house plants and to give them extra moisture.

On the MARKET

for Do-It-Yourselfers

1. PROTECTIVE COATING is compounded for application to smooth metal surfaces where only perfect adhesion will prevent chipping or peeling. It comes in three colors: White, light gray and red; can be sprayed, brushed or rolled on. Can be applied to galvanized gutters and downspouts without any aging or preparation of surface other than cleaning

Master Bronze Co., Inc., 538-548 W. State St.,
Calumet City, Ill.

2. GRAINED FINISH comes in blond, maple tone, blond mahogany and walnut. Base, intermediate and finish coats can be applied over the original finish on old pieces of furniture. Works equally well on new projects. Second application is the graining coat and is worked with the graining tool 2 to 3 min. after application. Comes with full instructions

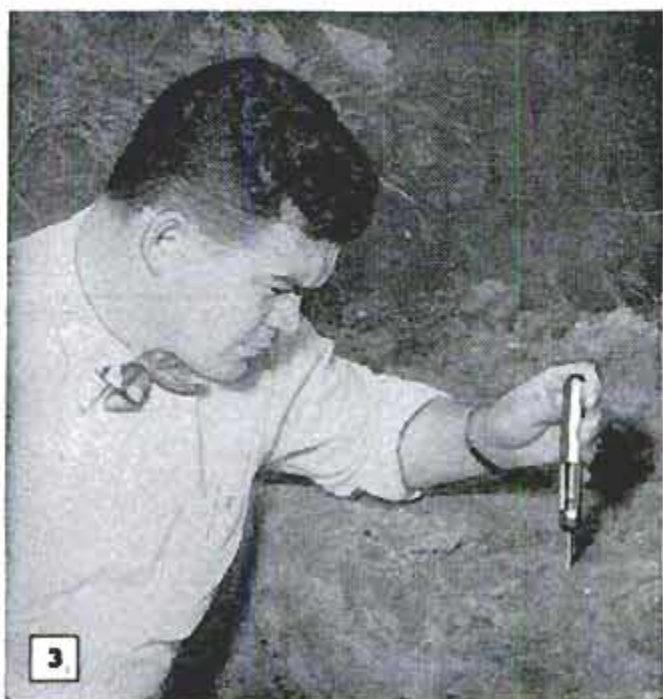
North Star Paint & Varnish Co., 612 Vandalia St.,
St. Paul 14, Minn.

3. POCKET-SIZE SOIL TESTER gives a reasonably accurate check on safe foundation loads for different types of soils. Useful to contractors and homeowners for checking soil conditions before laying driveways, patios and slab floors. Calibrated for direct readings in tons per sq. ft. Pointed plunger of instrument is forced into soil to give the desired reading

Soiltest, Inc., 4711 W. North Ave., Chicago 39

4. DECORATIVE acoustical tile absorb up to 20 times more sound than common ceiling materials, can be installed by any home handyman. Tile are 12 x 12 in. and come with a special joint that conceals nails or staples used in fastening to furring strips. Fine for soundproofing first and second-floor ceilings in homes and apartments, also basement rumpus rooms

The Celotex Corp., 120 S. LaSalle St., Chicago



Brace for Clothes Pole Adds Storage Space in Closet



Heavily laden clothes-closet poles that sag can be leveled by means of a plywood brace that adds storage space as well. The brace consists of a sheet of plywood, cut to form a partition as indicated. A notch is cut in the upper end to receive the pole. Tie and shoe racks, as well as hooks for smaller articles can be attached to the plywood.—L. W. Smith, Portland, Ore.

Aluminum-Foil Screw Anchors

Masonry-screw anchors may be improvised from ordinary household aluminum foil. First, roll the foil into a tight cylinder and tap it into the drilled hole. Next, drive an ice pick or small-diameter punch into the end of the foil to form a shallow starting hole for the screw. Finally, drive the screw into the foil.

Screw-Eye Cabinet Latch



Where appearance is not a prime factor, as in workshop cabinets, simple latches can be improvised from screw eyes. One is driven into the cabinet frame and aligned with a slot cut in the edge of the door. Rotating the screw eye to a vertical position, latches the door, and moving it to the horizontal position permits the door to be opened. On metal cabinets, a small pad eye can be used in the same manner.

On metal cabinets, a small pad eye can be used in the same manner.

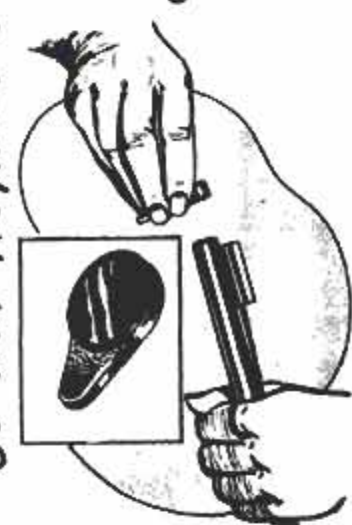
Scoop Measures Dry Chemicals

Ideal for use in the darkroom for measuring out small quantities of dry chemicals is a miniature plastic scoop with graduated marks. Scoops of this type may be purchased at cosmetic counters and in the household section of department stores.

Drawing-Board Surface Renewed

If your drawing board has become pitted with thumbtack holes, here is one method of renewing the surface. Dip round wooden toothpicks in glue and force them into the tack holes. When the glue has set, break off the toothpicks and sand flush with the surface of the board. An over-all sanding will remove minor irregularities in the wood as well as smooth the picks.

Dust Plugs for Rifle Barrels

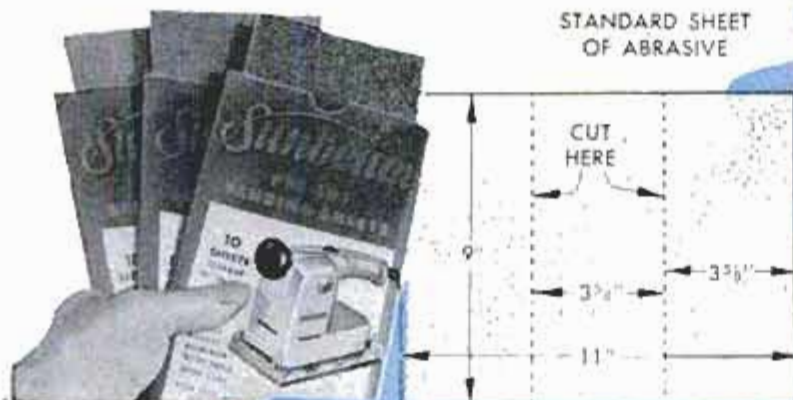


Rifles that are stored with the muzzle upward in a vertical rack can be protected against dust by sealing the muzzle with a rubber lens cap. Fitted with a tab for easy removal, the caps are available in a variety of sizes at most photo-supply shops. Another method of protecting a rifle is to use

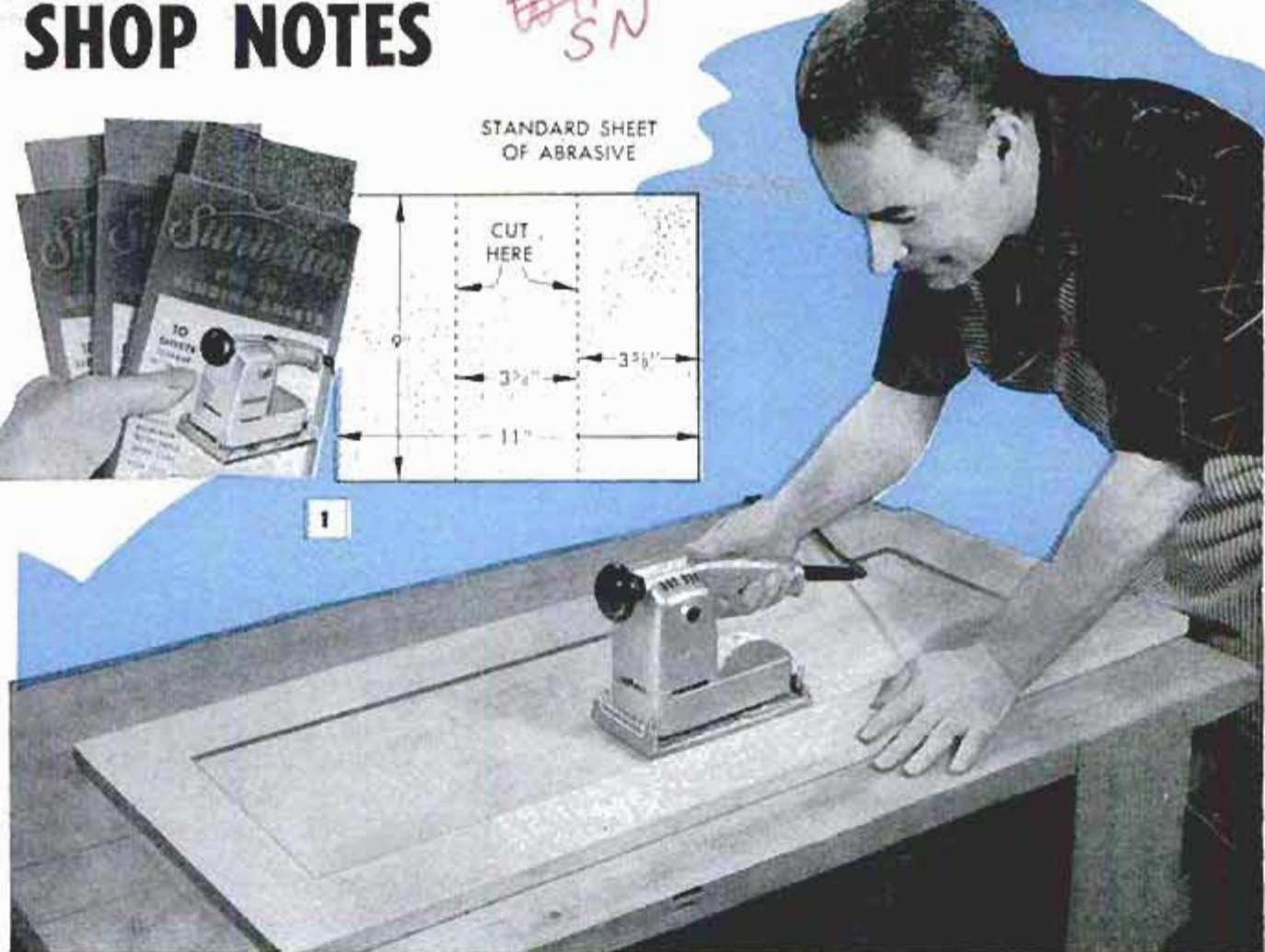
an adjustable cap of the type used to reseal opened bottles of beverages. Some of the latter type can be reshaped for this use.



STANDARD SHEET OF ABRASIVE



1

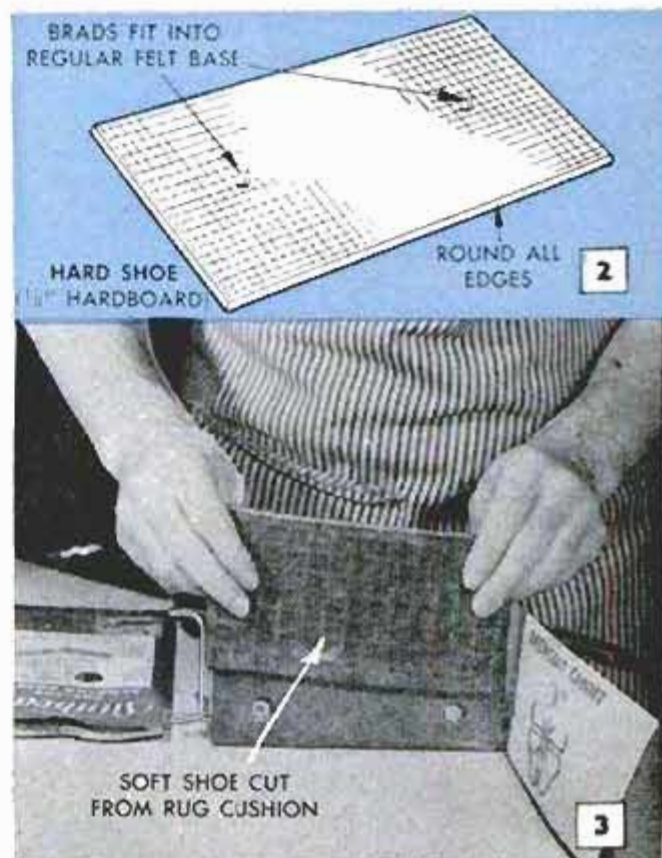


Finish That Shop Project With a PAD SANDER

By Sam Brown

YOUR PAD SANDER is a sanding block, a speedy polisher and a rubbing pad, all in one motor-driven unit. Like other portable power tools, it's designed to be held with one or both hands when in operation. On nearly all types the pad, or shoe, is driven at a fairly high speed in an orbital, or circular, motion. The length of the stroke averages about $\frac{3}{16}$ in. However, some machines are available which feature a straight stroke, rather than a curved, or orbital, stroke. Pad sanders having a straight stroke of the pad permit the use of somewhat coarser abrasives than do the orbital types. All these machines are fitted with conventional motors having rotating armatures. Another type of pad sander uses a magnetic-coil drive and operates at very high speed.

All pad sanders are finishing sanders and do their best work with comparatively fine abrasives, 2/0 to 6/0 grades on both hardwood and softwood. Most pad sanders come with a pad taking a sheet of abrasive





Above, pad sander works just as effectively on a vertical surface as on horizontal table top. Below, while not all-inclusive, the table lists and describes abrasives suited to pad sanders

ABRASIVE PAPER GRADES			
GRIT	EQUIV. "O" SERIES	GENERAL DESCRIPTION	REMARKS
600	—	SUPER-FINE	USED FOR WET SANDING PRODUCES HIGH SATIN FINISH
500	—		
400	10/0		
360	—		
320	9/0		
280	8/0	VERY FINE	USED FOR DRY SANDING ALL FINISHING UNDERCOATS. THESE GRADES WILL NOT SHOW SANDING MARKS
240	7/0		
220	6/0*		
180	5/0	FINE	FOR FINAL SANDING OF BARE WOOD. GOOD FOR SMOOTHING OLD PAINT
150	4/0*		
120	3/0	MEDIUM	USE FOR GENERAL WOOD SANDING. GOOD FOR FIRST SMOOTHING OF OLD PAINT, PLASTER PATCHES
100	2/0*		
80	1/0		
60	1½*	COARSE	USE No. 1½ FOR ROUGH-WOOD SANDING. No. 1 IS COARSEST PAPER WHICH CAN BE USED TO ADVANTAGE WITH PAD SANDER.
50	1		
40	1½		
36	2	VERY COARSE	ALL TOO COARSE FOR PAD SANDERS. THESE GRADES REQUIRE HEAVY MACHINES AND HIGH SPEED TO CUT WELL
30	2½		
24	3		

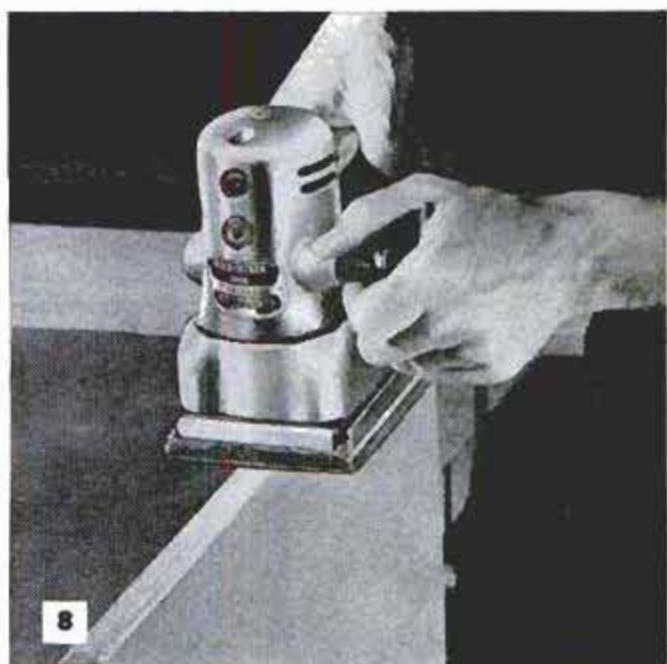
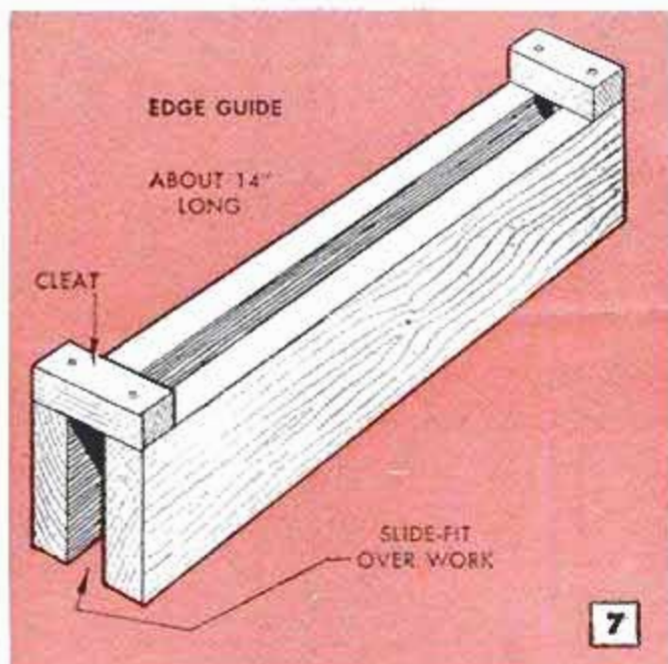
*Grades generally supplied as Very Fine, Fine, Medium and Coarse

measuring $3\frac{5}{8} \times 9$ in. which means you can cut three strips to fit the pad from a standard 9 x 11-in. sheet of abrasive, Fig. 1. Special packs containing 6 to 10 ready-cut sheets also are available. Either way, you have a wide range of abrasive grades readily available. The table, Fig. 5, lists and describes applications of abrasive grades suitable for use on pad sanders when working either metal or wood. The sander pad usually comes with a felt facing about $\frac{3}{16}$ in. thick. This gives about the right flexibility for all average work, but for some types of sanding on bare wood a hard shoe is desirable. This is especially true when sanding fir and similar woods having a pronounced grain of alternating hard and soft-grain structure. A hard shoe made as in Fig. 2 will give the abrasive the necessary rigid backing.

On the other hand, a softer shoe is an advantage when smoothing an old finish with a fine abrasive. A rectangular section cut from a discarded rug pad, or cushion, is just the thing. Cut and fit as in Fig. 3, making sure that the auxiliary pad is exactly the same size as the original. Lacking a section of rug pad, a piece of sponge rubber usually will serve the purpose.

One special feature you'll notice right away when using a pad sander is that you can work right up to a vertical surface or into a corner. And you'll see that it does equally good work on both horizontal and vertical surfaces, Fig. 4. Its use saves a lot of time when smoothing plasterboard joints and





cleaning up old woodworking that is to be re-finished. Don't attempt to sand off an old finish with a pad sander. It just isn't designed for the job. Remove the old finish with a paint and varnish remover, clean the surface and allow to dry. Then use a medium to fine-grade abrasive on the pad sander and you'll end up with a fine finish-sanding job.

There's one thing to make sure of before you begin sanding or when you replace the worn sheet of abrasive. Be sure that the abrasive sheet is drawn taut with the locking device, Fig. 6. If it is slack, even slightly, it will not travel with the pad and sanding efficiency will be greatly reduced. Some locking devices, or paper locks, are operated with a screwdriver as in Fig. 6. Others are lever-operated. All types are designed to hold the ends of the abrasive sheet securely across the full width and to keep the sheet under the correct tension.

All pad sanders are equipped with a handle, or knob, for two-handed operation.

This is for the purpose of guiding the machine rather than applying pressure. The knob is, of course, necessary when working on a vertical surface as in Fig. 4. On all regular work on a flat, horizontal surface the weight of the machine is sufficient to make the abrasive "bite" uniformly on hardwood or softwood. Pressure in excess of the weight of the machine may cause the abrasive to leave semicircular scratches, or marks, on the surface of the work, especially when using the coarser grades. Another two-handed job with the pad sander is smoothing the edge of plywood, Fig. 8. This can be done with reasonable accuracy freehand as pictured, but if you must have a job that compares with jointer accuracy, then take time to make the edge guide detailed in Fig. 7. Use the same kind of wood for both lengthwise members so that the cutting action will be at approximately the same rate. This will tend to hold the sander square with the edge of the work and you'll get a clean job with sharp corners. In this





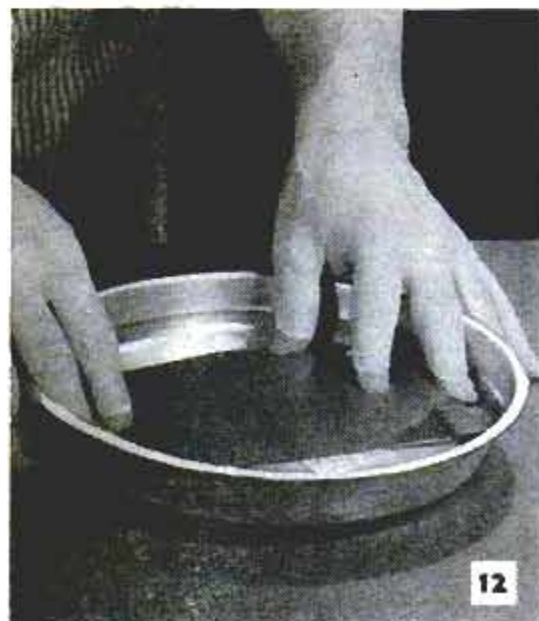
job as in all others, keep the sander moving. A straight stroke, back and forth just as you do in hand sanding, works very well. The pad will cut equally well in both directions.

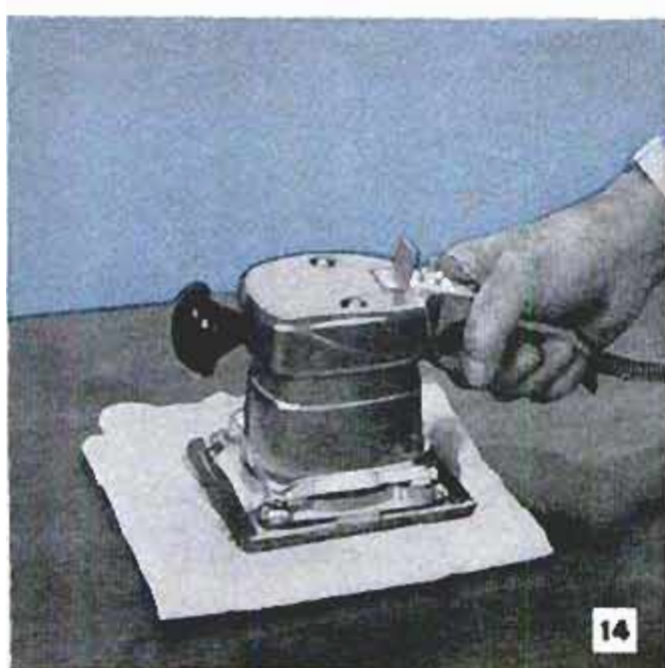
When sanding resinous woods and when finish-sanding old paint or varnish in preparation for polishing, the abrasive will tend to clog, become coated with resin or paint pigment. When this happens, apply a few drops of turpentine to the abrasive and then hold a steel-bristle brush on the pad while the sander is running. This treatment generally will remove the coating quite effectively.

Your pad sander really shines when it comes to fine sanding of finishing coats in either clear finishing materials or pigment finishes, such as colored lacquers and enamels. This can be done either by the wet or dry process. Sanding of the top coat depends on the type of finish and the degree of gloss desired. A simplification of these processes is use of a ready-mixed

rubbing compound which is applied to the surface and then rubbed down with a pad of coarse burlap or a piece of pile carpeting attached to the sander pad in place of the abrasive. However, the ultimate in fine furniture finishing is wet sanding with a waterproof silicon-carbide abrasive paper attached to the sander pad. The advantage of wet sanding, Fig. 11, is that it builds a perfectly level surface. In order to sand down to a level surface you'll need at least three finishing coats, one sealer and two top coats, as otherwise there is always the possibility of cutting through the finish to the bare wood. Use a 500-grit paper.

Many lubricants are used for wet sanding but clean, soft water with a little soap added is quite satisfactory. The best way to add the soap is to apply it to the pad as in Fig. 13. When applying a new sheet of abrasive to the sander pad when wet sanding, always dip in water first as in Fig. 12, before clamping in place on the sander pad. *Caution:* When sanding apply the

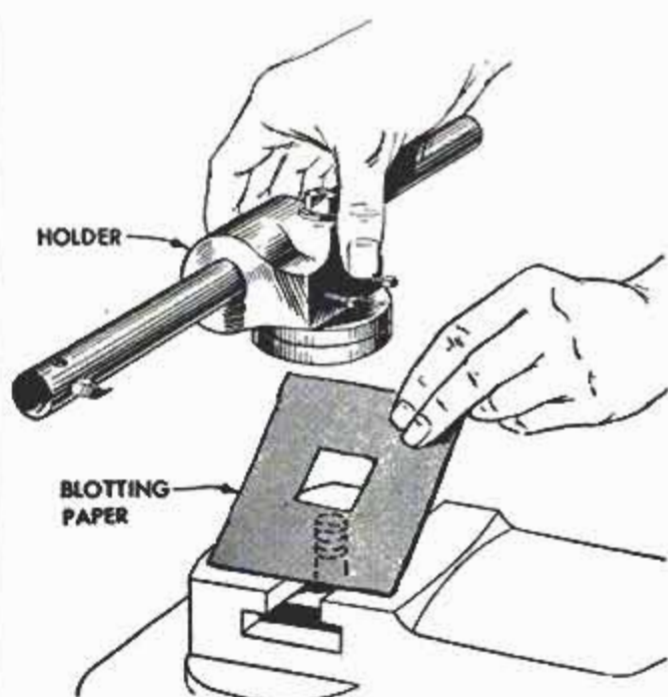




water to the surface with a sponge, being careful not to get the surface sloppily wet. Wipe off any excess water. Never dip the sander pad in the water. Take extra precautions to prevent water, even a small drop, from reaching the motor. Do not use a magnetic-type sander for wet finishing.

If you finish with wax, polish with a cloth pad as in Fig. 14. Just fold the cloth several times and place the sander at the center of the cloth pad.

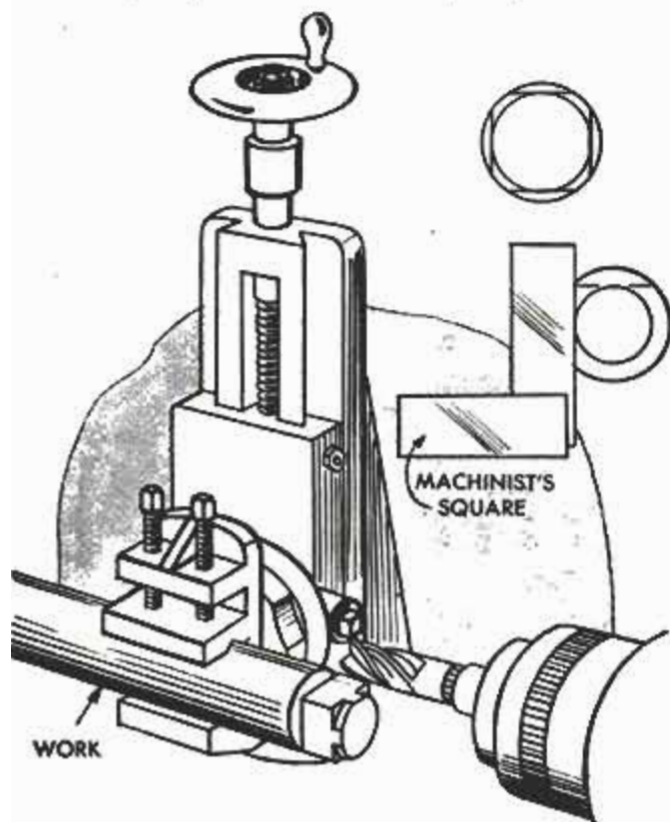
One more application of the pad sander is sharpening chisels and plane irons, Fig. 10. You'll be pleased at the excellent job it does. ★ ★ ★



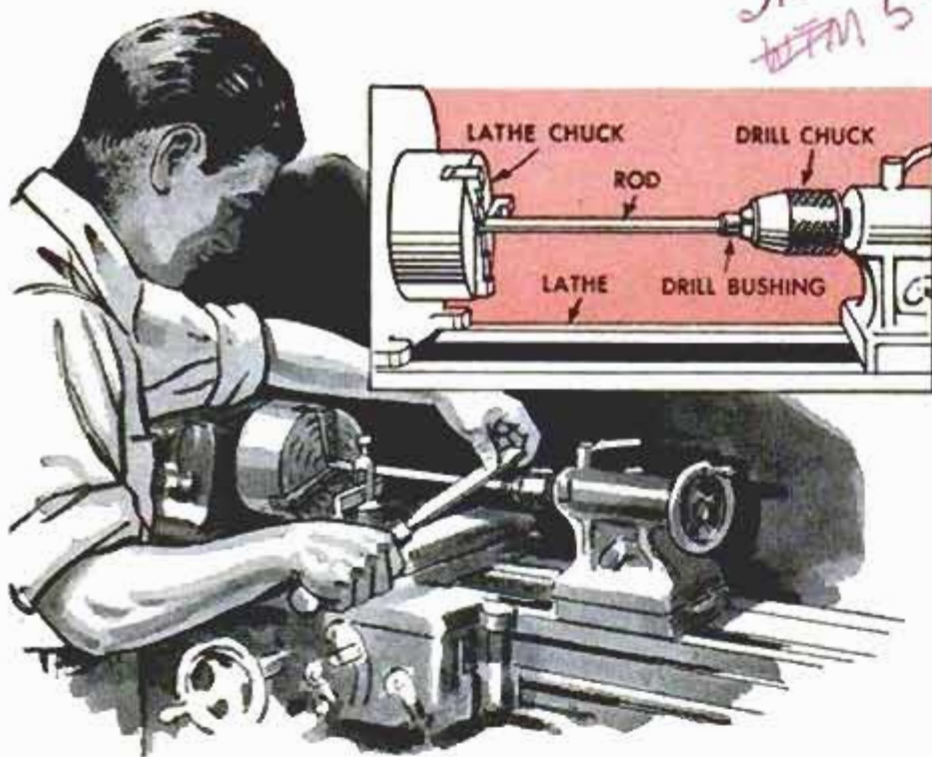
Prevent Chatter in Deep Bore

When deep-boring in roughcastings it generally is necessary to take a fairly deep cut on the first pass in order to get under the scale. This often causes chatter marks near the end of the bore due to the overhang of the cutting tool. Usually this tendency can be offset by placing a soft pad of blotting paper, several thicknesses of wrapping paper or leather under the boring-bar holder. Varying the tension on the T-bolt and reducing the feed also may help to eliminate the trouble.

Milling Squares of Varying Size on End of Round Work



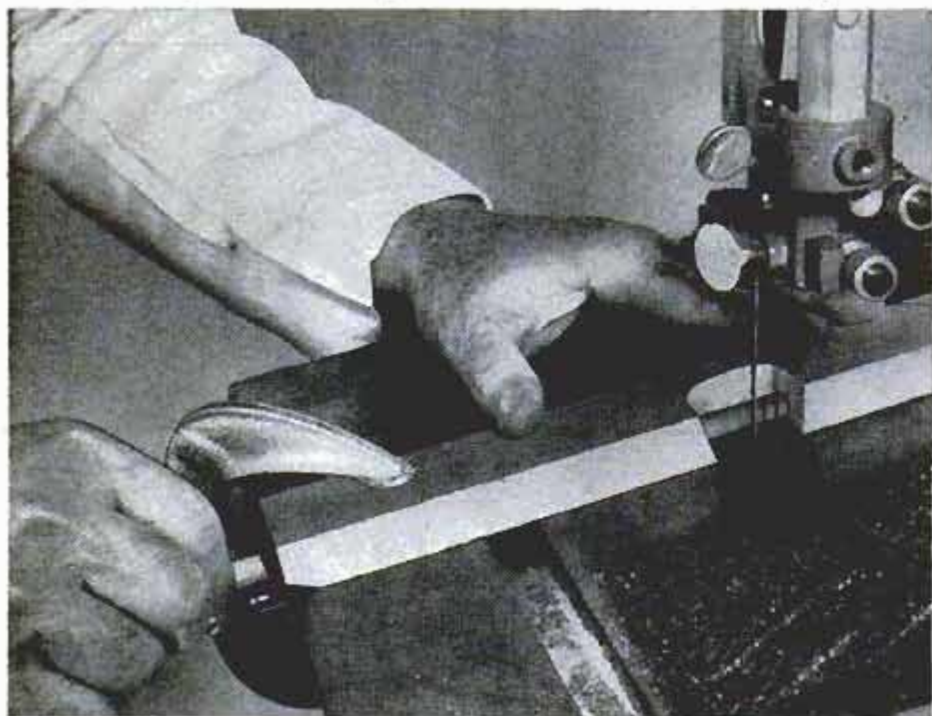
Milling squares of varying size on the ends of round workpieces can be accomplished at a fairly fast rate by this method. The first step is to chuck the shaft and turn a shoulder $\frac{1}{16}$ in. wide, running the cut in until the diameter equals the desired size of the square. Then chuck a milling cutter in the collet chuck and set up the work in the lathe milling attachment. Run the first cut in several passes and check to be sure of the setting. The final cut should just touch the top of the round turned on the end of the shaft, or cut into it slightly if a slight allowance has been made and the measurement is not too critical. Next, loosen the milling-attachment clamp and give the work a quarter turn so that the milled face bears against a machinist's square placed vertically on the lathe ways. Tighten the clamp and recheck the setting before running the second cut. Proceed in the same manner when running the third and fourth cuts. On work of small to medium diameter all cuts except the first usually can be run in one pass.



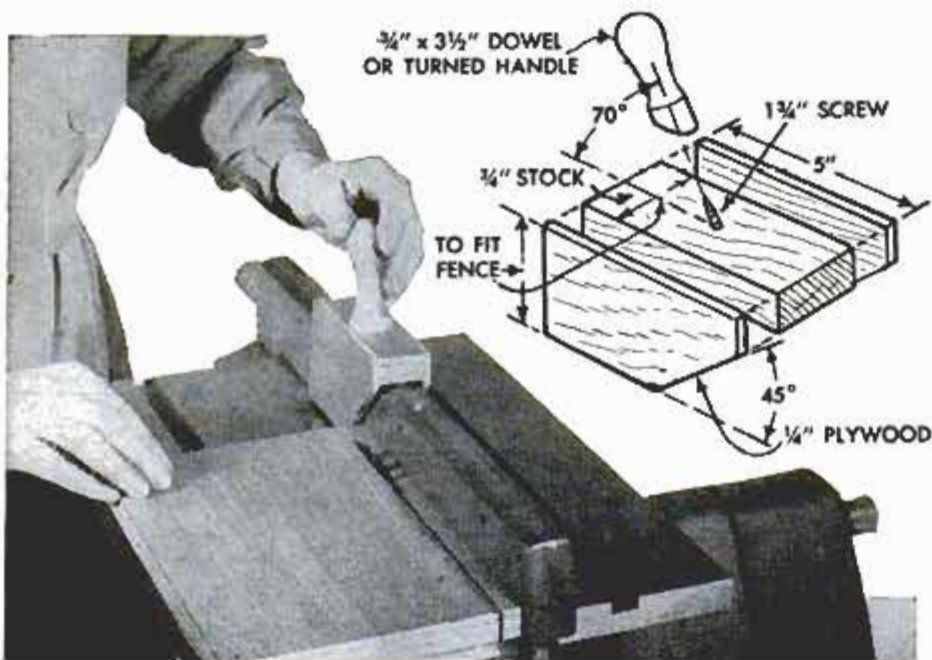
Bushing Is Bearing When Filing in Lathe

When filing work of small diameter between centers in the lathe, the pressure of filing may cause deflection. This tends to enlarge the center hole in the outer end of the work. To offset this tendency, the outer end of the work can be carried in a drill bushing (or any standard bushing) held in the tailstock. When necessary, turn the end of the work to an easy, running fit in the bushing. Lubricate occasionally with a drop or two of light oil.—Frank LaSarcina, New York City.

Simple Jig Makes Spiral Dowels Accurately on Your Bandsaw

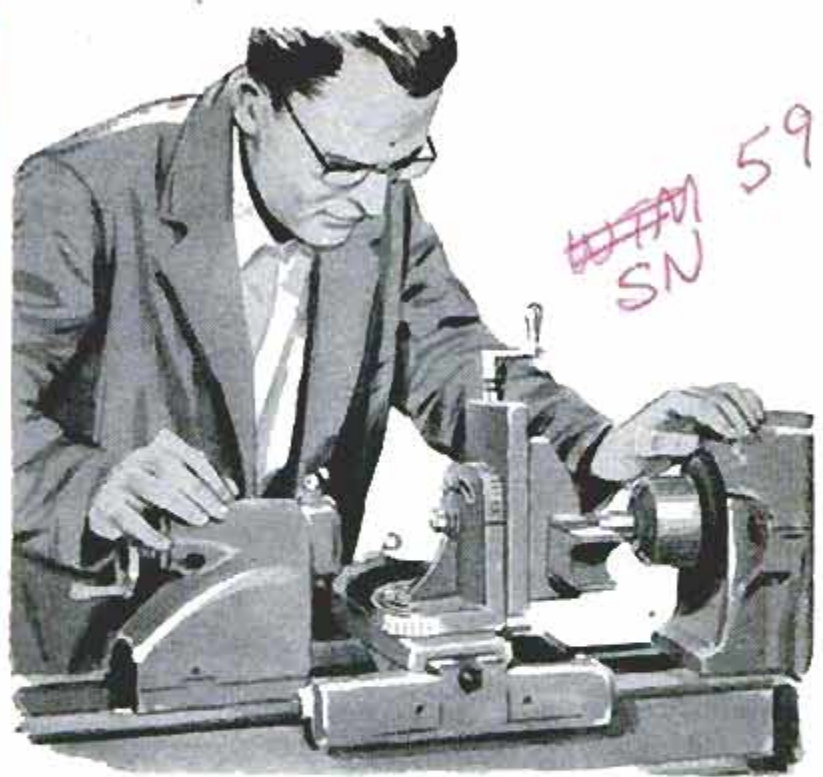
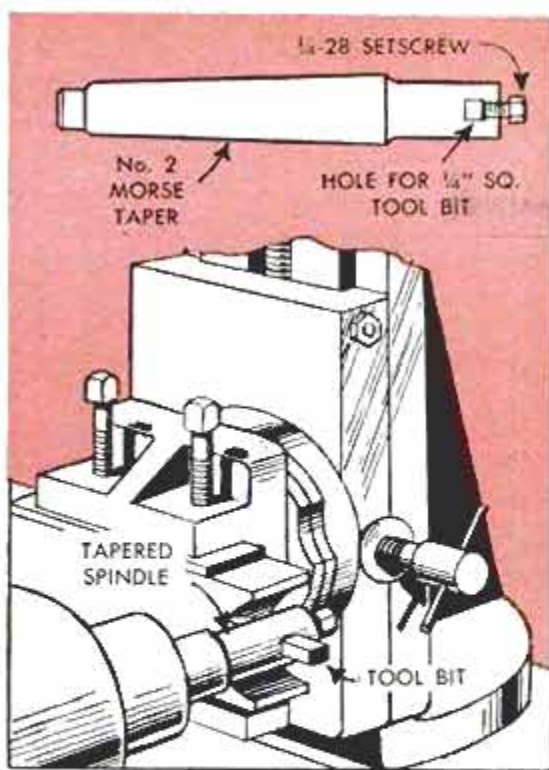


Spiral dowels of the type used by cabinet-makers are easily made on your bandsaw with this special jig. Groove a length of 1 x 2-in. stock to take the dowel in an easy, sliding fit. Then cut the strip to a length only slightly less than the width of the machine table. Tilt the table to about 10 deg. and cut a notch at the center of the jig. Set the jig so that the blade will cut into the dowel about $\frac{1}{16}$ in. and clamp in place as pictured. Insert the dowel in the groove, bring it up to the blade and feed slowly.



Push Stick for Saw

Here's a push stick that does a better job of keeping your fingers a safe distance from the blade on a tricky ripping cut. As you will note from the photo, it rides the ripping fence and not only holds the work down but carries it safely past the blade. Parts that fit over the fence are cut from plywood; handle is turned from solid stock.—Tom Riley, Atherton, Calif.



Fly Cutter Handles Those Special Milling Jobs

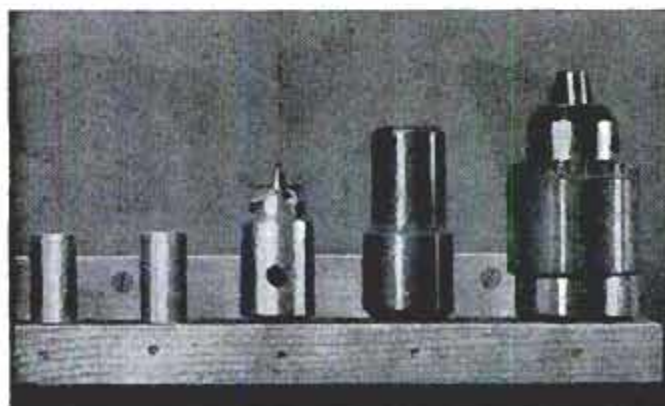
Some jobs that come into the shop require improvised setups on either the lathe or milling machine. Where the parts are small and preformed or semifinished and only a finishing operation is required, it often is possible to make an efficient setup on the lathe using the milling attachment. The detail shows a typical job of this type. A simple holder for a fly cutter was machined from the shank of a discarded drill bit having a No. 2 Morse taper. The broken drill was cut off, leaving about 1 in. of the straight portion of the shank projecting. This was drilled transversely and the hole squared to take a 1/4-in. tool bit, the latter

held in place with a setscrew turning into a tapped hole in the end of the shank, or spindle. This arrangement permits the tool to be adjusted to cut the required radius. Care should be taken in squaring the hole for the tool bit to obtain a close sliding fit, as otherwise the bit may tend to loosen under the setscrew when making an interrupted cut, such as that shown in the detail. Square the hole with a broach, or file carefully by hand to size. When fly-cutting on duplicate parts to the same radius, improvise a stop which will assure successive pieces being placed in the same position.—C. W. Woodson, Chicago.

Accessories Kept in Order

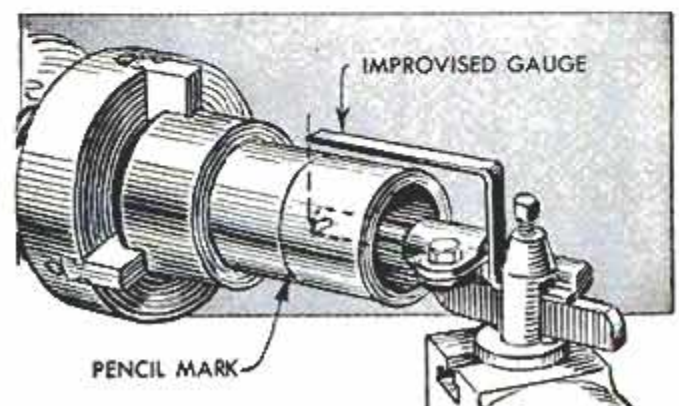
Power-tool accessories are always within easy reach when stored on a rack like that pictured. Select dowels that will fit easily into the spindle holes. Cut off short lengths and fit into holes drilled in a narrow shelf. Attach to wall or tool panel.

R. J. DeCristoforo, Los Altos, Calif.



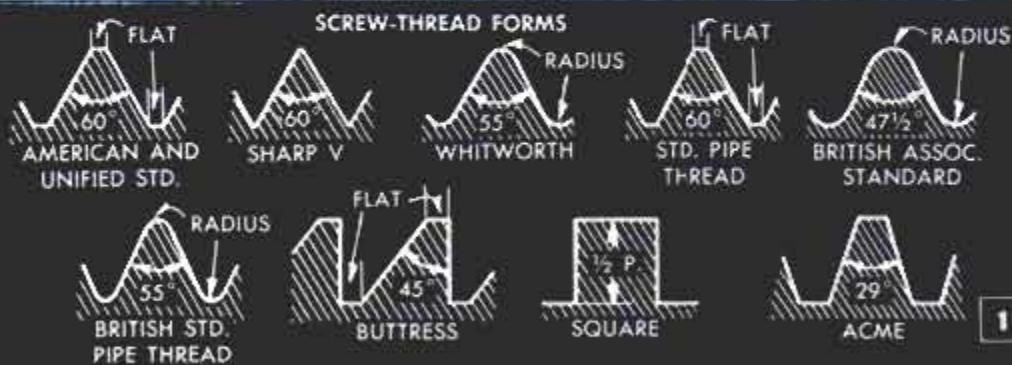
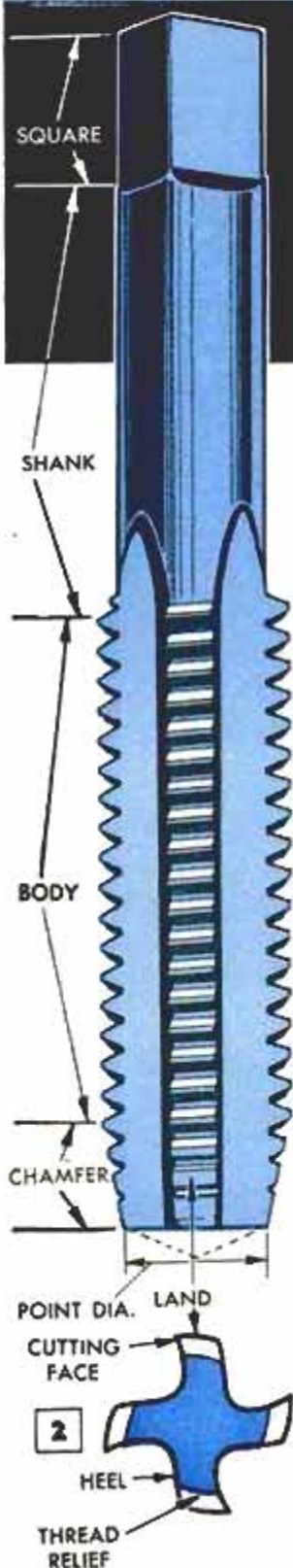
Indicator Shows Tool Position

An indicator, or gauge, which shows the position of a threading tool in an internal bore is helpful on duplicate work. It consists of a length of flat steel bent to an S-shape and carried in the toolholder. Pencil-mark the desired depth of the thread on the outside surface of the work.



HAND TAPS ARE PRECISION TOOLS

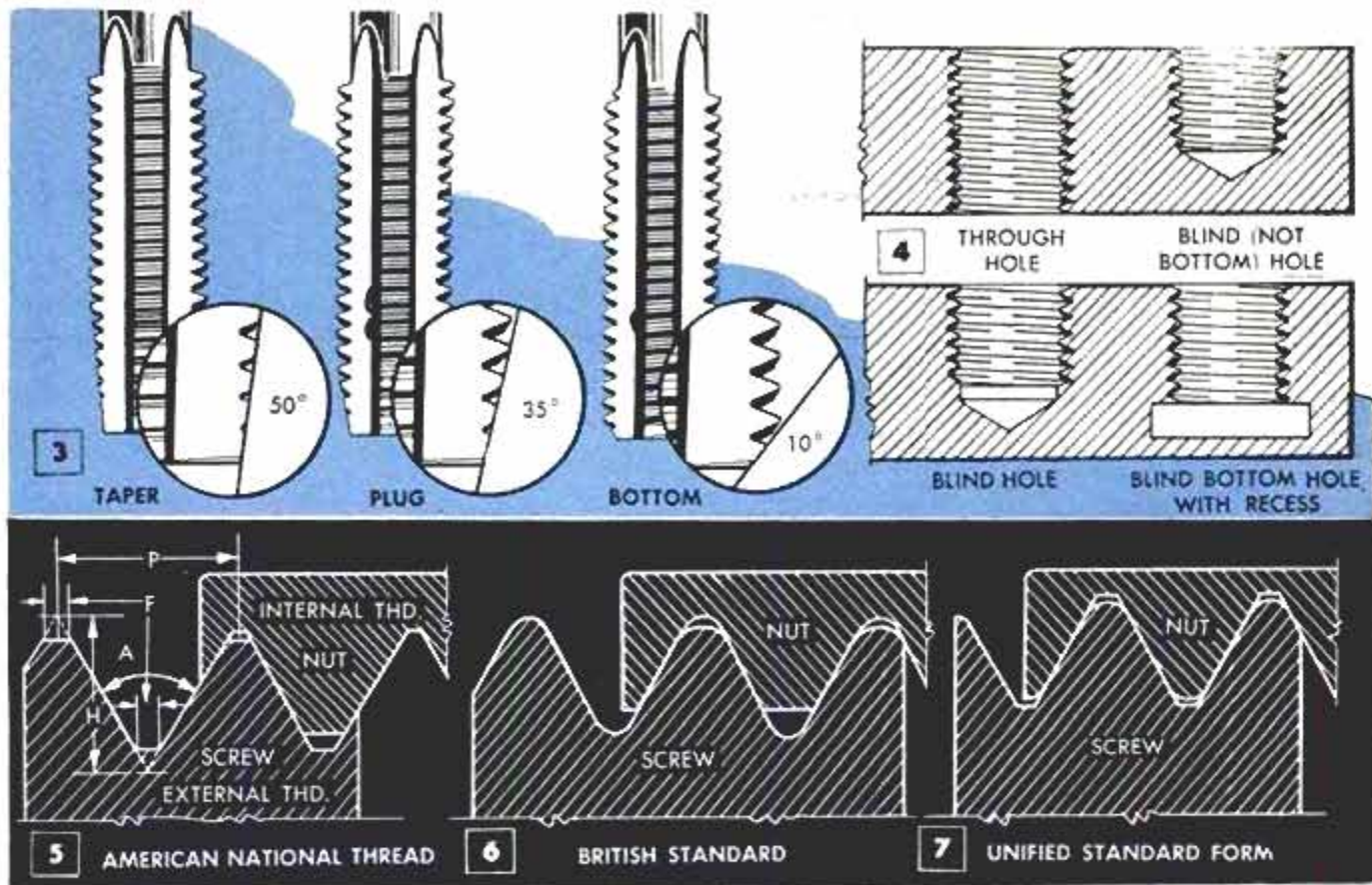
By C. W. Woodson



NO ONE REALLY KNOWS when a tap was first used to cut an internal thread in a hole drilled in metal, but it is certain that taps have been in use for centuries. Probably the initial development of the tap began with the first attempt to join metal to metal in an assembly consisting of several parts, one or more of which had to be removable and replaceable without damage. Such an assembly would call for the use of screw threads and screw fasteners much like those in use at the present time.

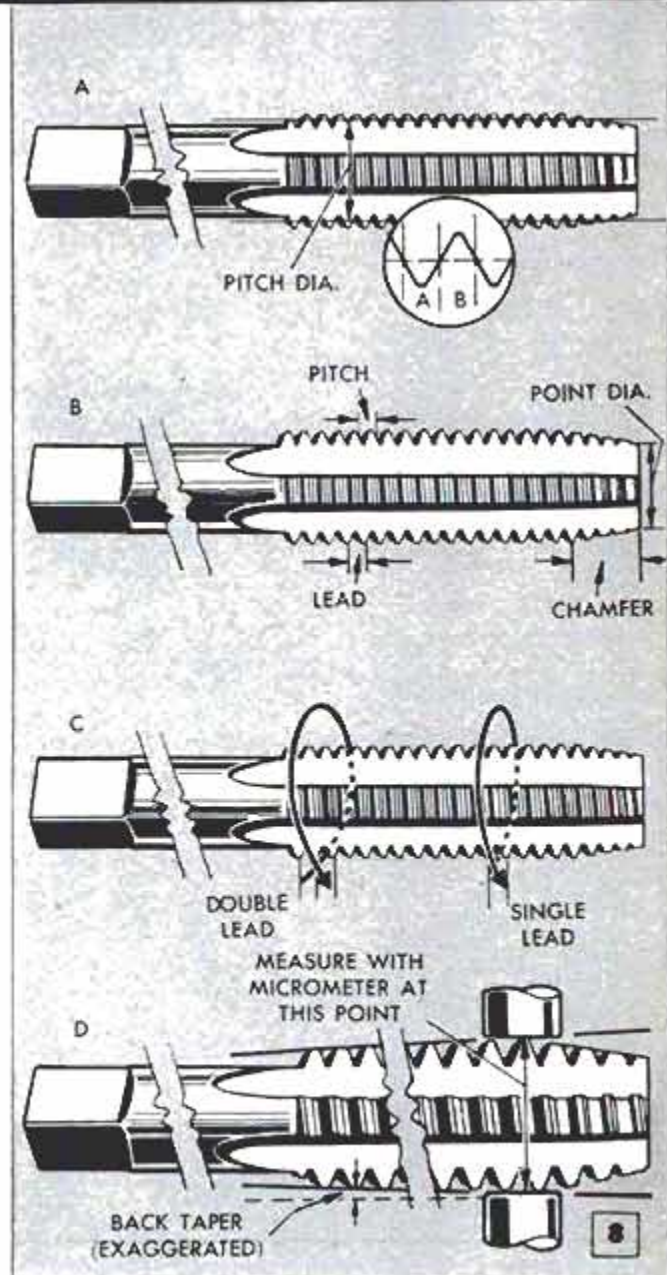
Modern hand taps have been developed to high standards of precision and long-wear life. Generating of threads on the fluted body of a tap is done by grinding rather than cutting, a process which holds the shape and contour of the thread within very close limits. The general shape and proportions of a common hand tap of the taper type is shown in Fig. 2. The body of the tap is generally taken to mean that portion of the fluted section on which the full threads are cut. The chamfered portion at the lower end of the body is that section on which the threads are chamfered, or tapered, down to the root diameter. The upper end of the round shank is always squared to take a tap wrench or other type of driver. The taper tap is generally used for tapping open, or through, holes, that is, holes which are drilled entirely through the stock. The plug tap, Fig. 3, is identical in general measurements except that the chamfered portion at the end of the body is shorter, only about 3 to 5 threads being chamfered. The bottom, or bottoming, tap is chamfered at an angle of about 10 deg., Fig. 3, the chamfer involving only 1 or 1½ threads. In handwork the taper tap is perhaps the most commonly used as it is easier to start accurately by hand methods and cuts more freely in such harder metals as can be hand-tapped. When tapping deep, blind holes by hand, Fig. 4, it is a fairly common practice to use the taper, plug and bottom taps in the same hole, beginning with the taper tap, making a second cut with the plug tap and finishing with the bottom tap. Although it takes more time, this procedure prevents wedging and possible tap breakage.

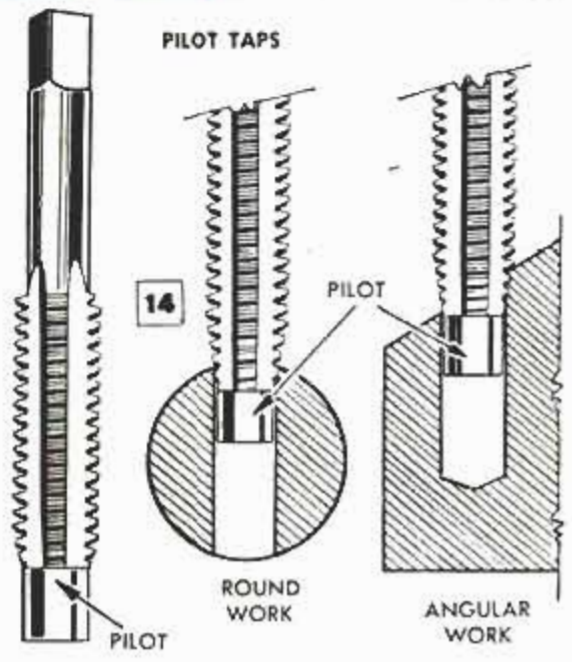
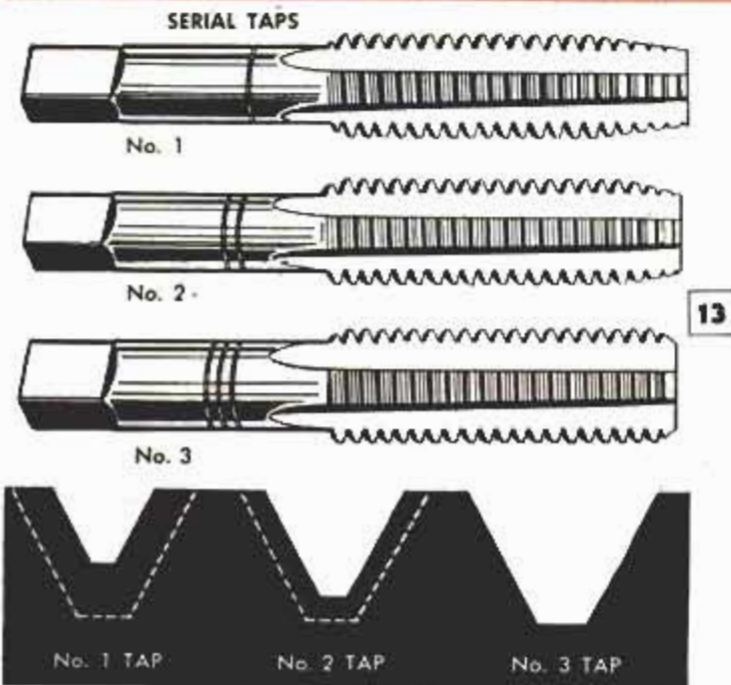
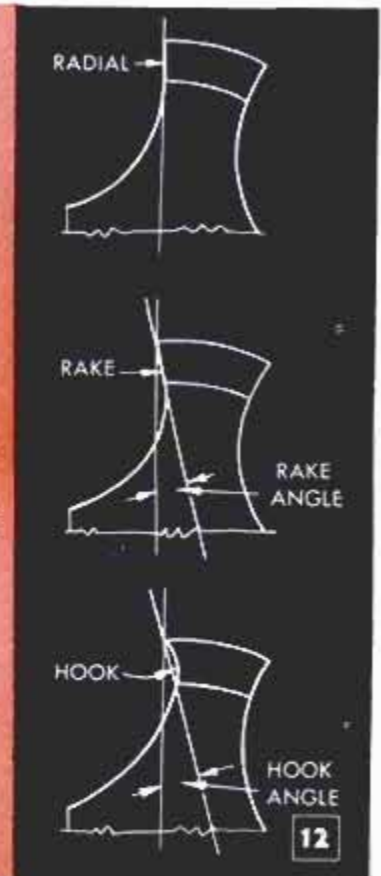
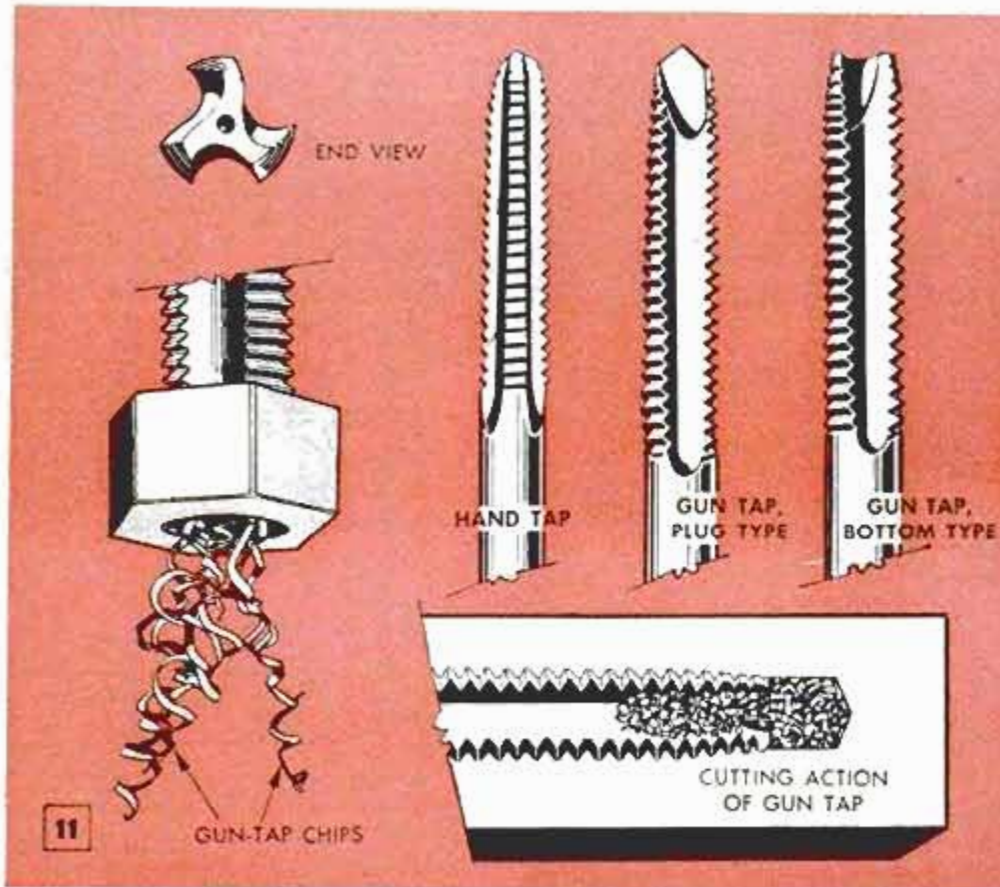
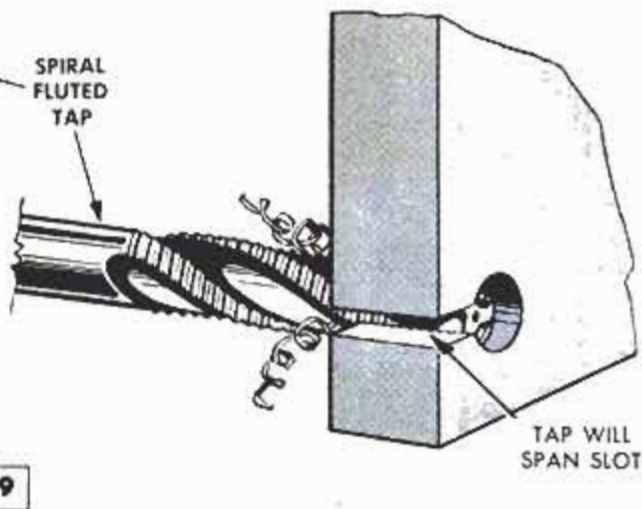
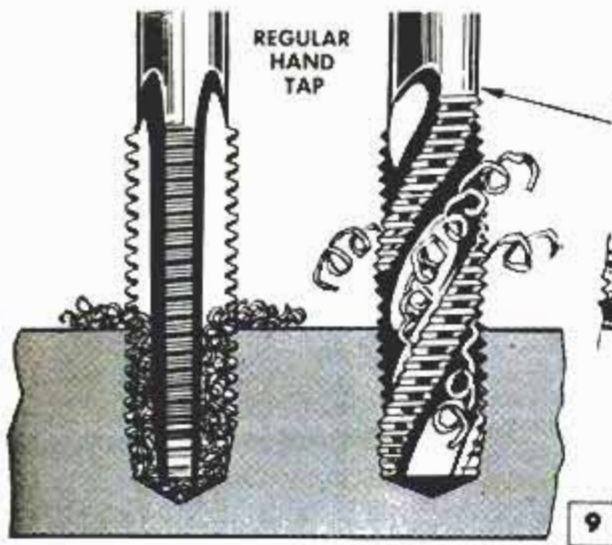
General characteristics of the American National Thread are detailed in Fig. 5. The letter P indicates the pitch, letter A the thread angle, letter F the width of the flats at the root and crest, and letter



H the depth. In this instance, the latter indicates full depth of the sharp-V thread. Ordinarily it would indicate the depth as measured between the flats at the root and crest. Now compare the American with the British Standard and the Unified Standard Form, Figs. 6 and 7 and also Fig. 1. Recent international agreements between the two countries have resulted in establishing new manufacturing limits which permit nearly all sizes of the two types of threads to interchange as in the Unified Standard Form, Fig. 7.

In Fig. 8, details A, B, C and D have been somewhat exaggerated in an effort to show some characteristics of taps which are rather difficult to visualize. Pitch diameter is an example. It's defined as an imaginary cylinder, the lines indicating its surface passing through the threads at a point midway between the root and crest, detail A, Fig. 8. Pitch usually is defined as the distance from a given point on one thread to a corresponding point on the adjacent thread, the measurement being taken parallel to the axis, detail B, Fig. 8. Lead generally is taken to mean the axial advance of a thread in one complete turn of a single-thread screw. On a single-thread screw, lead and pitch are the same, detail B, Fig. 8. However, on a double-thread screw the lead is twice the pitch, detail C, Fig. 8. All common taps have a back taper, usually running from a point just above the chamfer. Any measurements taken for the purpose of checking wear should be made at the point indicated in detail D, Fig. 8.





Figs. 9 and 19 compare the standard tap with a spiral-fluted tap designed for special purposes. The spiral-fluted tap will span a slot or bridge a keyway which is run into the hole as in Fig. 10. It has been specially designed to work in such hard-to-tap metals as aluminum, copper alloys, magnesium and in certain die-cast parts. The spiral flutes lift chips in much the same manner as the flutes of a twist drill, tending to clear the hole and to prevent jamming and breakage.

The gun tap, Fig. 11, is designed only for machine tapping and differs from the conventional hand tap in that it has a two-stage, or two-section, flute which cuts with a shearing action. This forces the chips to pass out of the hole ahead of the tap, rather than lifting them in the opposite direction as does the spiral tap. The flutes are shallower and narrower than those in the standard tap. This gives a greater cross-sectional area in any given size and results in greater strength and resistance to breakage.

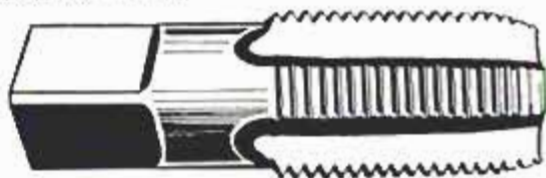
Machining characteristics of the metal to be tapped determine tap selection for the job. As an example, brass and certain fibers call for a negative rake or a radial face like that in the top view, Fig. 12. Hard brass, bronze, malleable iron and cast steel generally tap best with a rake angle such as that in the center detail, Fig. 12. Die-cast aluminum, cast iron, magnesium and machinery steels are usually worked with a tap having a hook angle like that in the lower view, Fig. 12. These views detail only what is considered average practice. They are not all-inclusive, of course.

Serial taps come in sets of three, Fig. 13. The first, or No. 1, tap starts the thread. No. 2 tap cuts to about three fourths of full depth while the No. 3 tap finishes the thread to full depth. Pilot taps are designed for tapping round work transversely or starting a thread angularly, Fig. 14.

Fig. 15 shows a standard pipe tap and thread and a variation known as the self-sealing thread. Note the hand-tight and wrench-tight positions. Pipe taps are made in both the straight and tapered types. Interrupted-thread pipe taps, Fig. 17, detail A, are often used in place of the conventional tap, detail B, in machine tapping of pipe fittings. The interrupted thread gives somewhat greater chip clearance, produces a cleaner thread in fittings. In Fig. 16 comparisons are drawn between the 100, 75 and 50-percent thread. As noted, the 100-percent thread is rarely used. ★ ★ ★

☞ Empty window-spray bottles are good dispensers for turpentine or other solvent to spray your hands to remove paint.

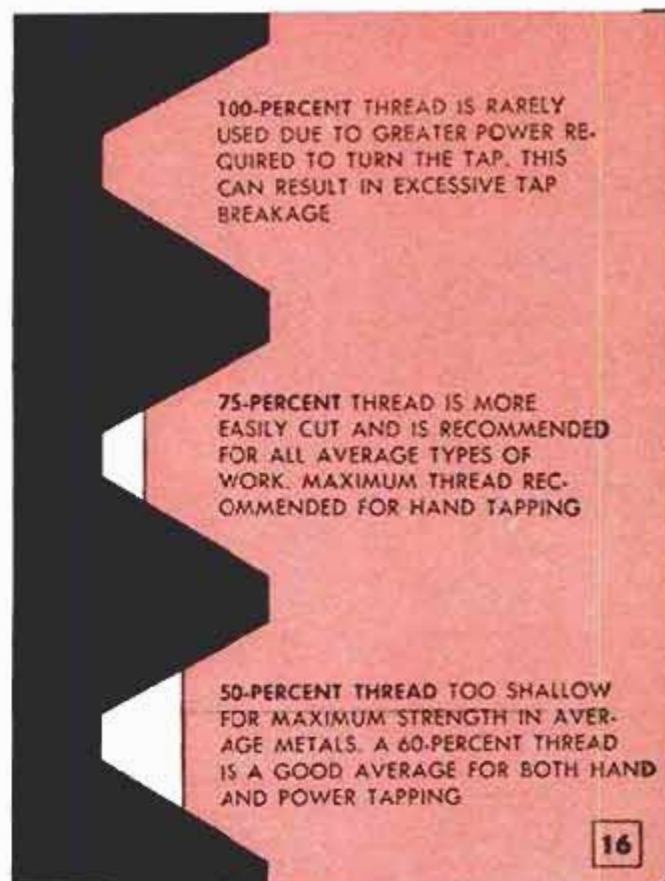
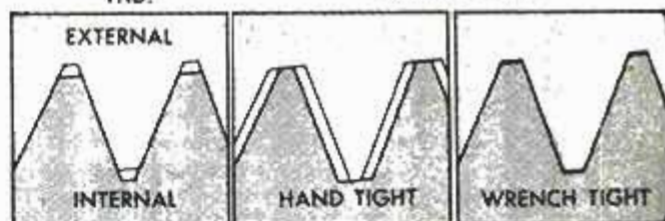
REGULAR PIPE TAP



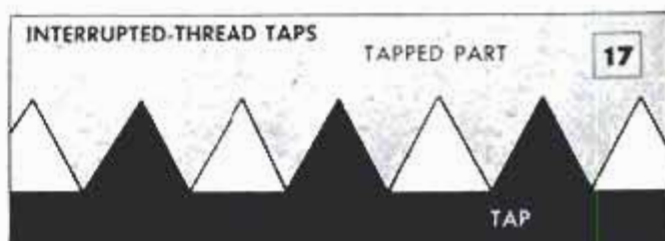
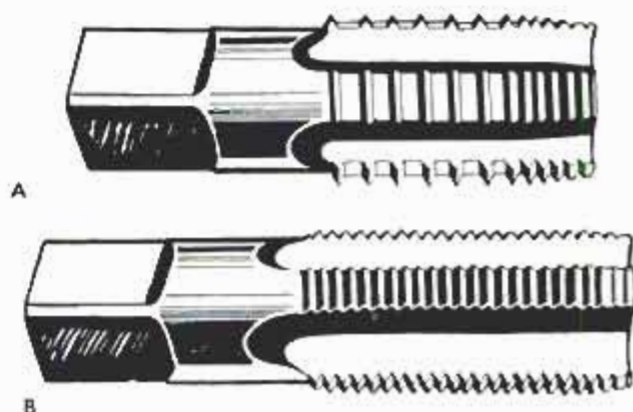
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REGULAR PIPE THD.

DRY-SEAL THD.

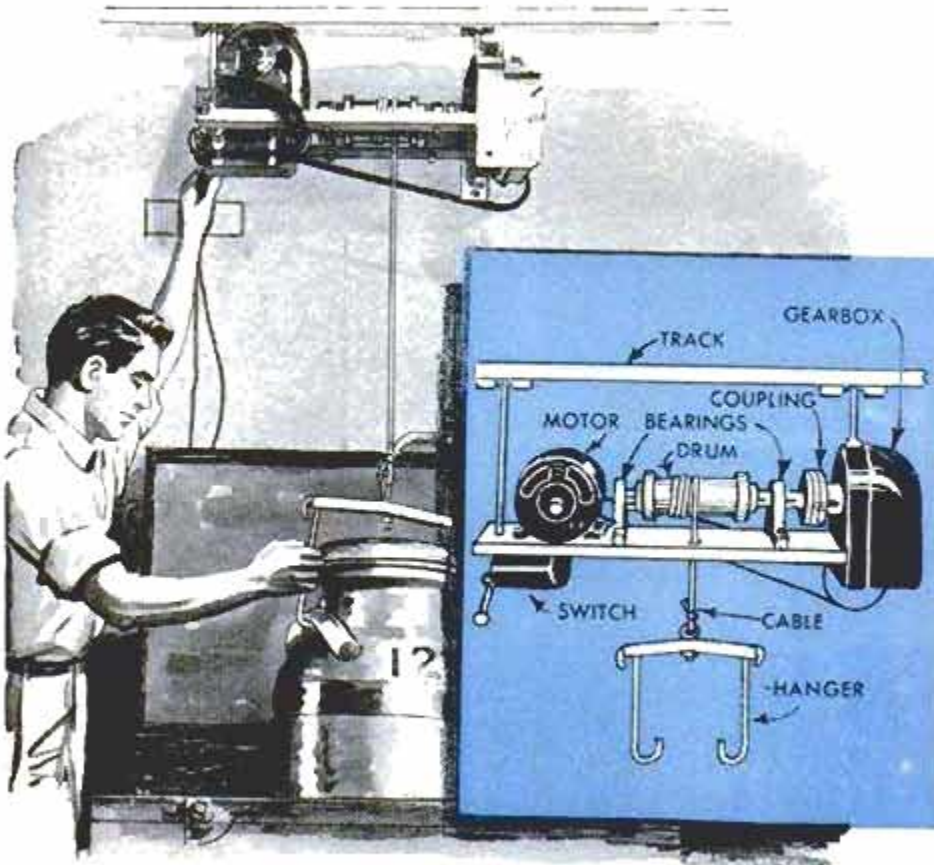


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Hoist Uses Washing-Machine Motor, Gearbox



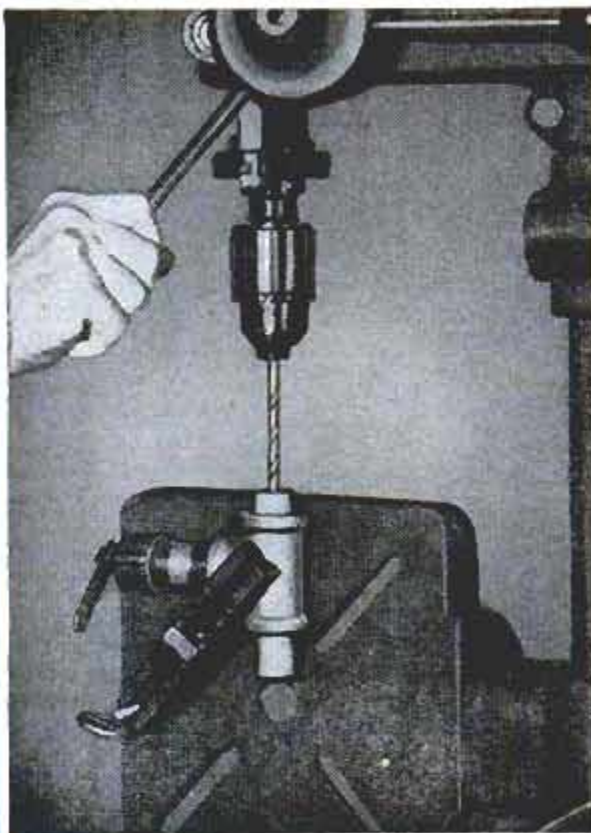
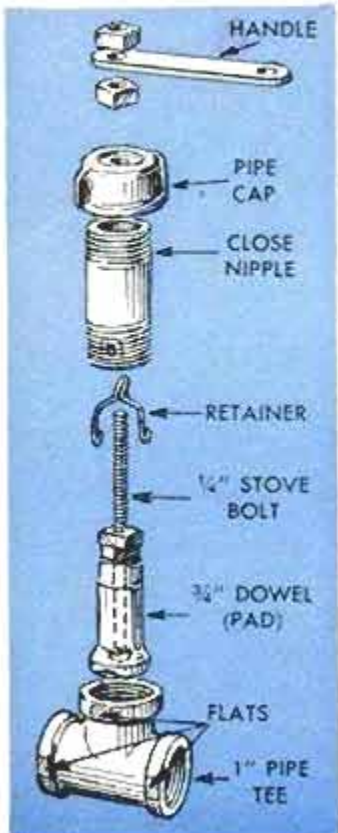
To reduce any stress on the gearbox, a flexible coupling is used between it and the cable drum. A flexible coupling can be improvised by cutting a V-belt pulley in half along the center of the V-groove, then reassembling it with nuts and bolts, rubber washers being installed between the pulley halves. If a lathe is not available, the cable drum can be made by welding large washers to the ends of a length of steel pipe. The washers should prevent cable from sliding off the ends. It also may be necessary to weld still smaller washers to the large ones to reduce the hole to a size small enough to receive the drum shaft. It then is welded solidly to the

Although originally designed for lifting loaded milk cans from a cooler to a truck, this traveling hoist will prove handy wherever loads of a similar weight must be handled. A gearbox and electric motor from a washing machine are mounted on an angle-steel frame as shown in the detail.

drum ends. A switch is mounted on the angle frame below the motor, and the wire used to connect the motor to an outlet is long enough to allow the hoist to travel the full length of the overhead track. Trolley assemblies and track were purchased new. Hobart Brothers Co., Troy, Ohio.

Timesaving Jig for End-Drilling Round Work in Quantity

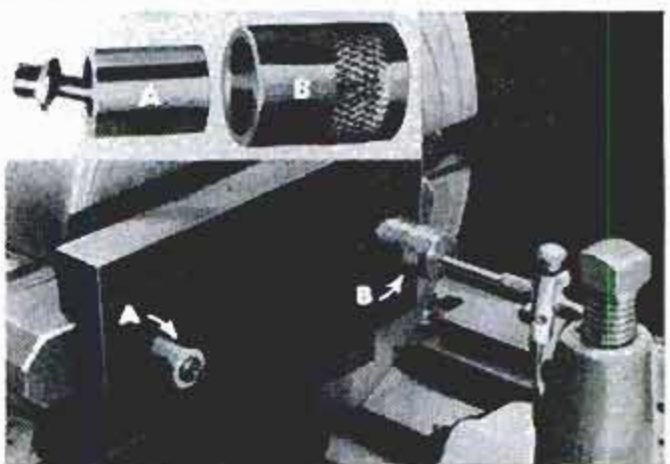
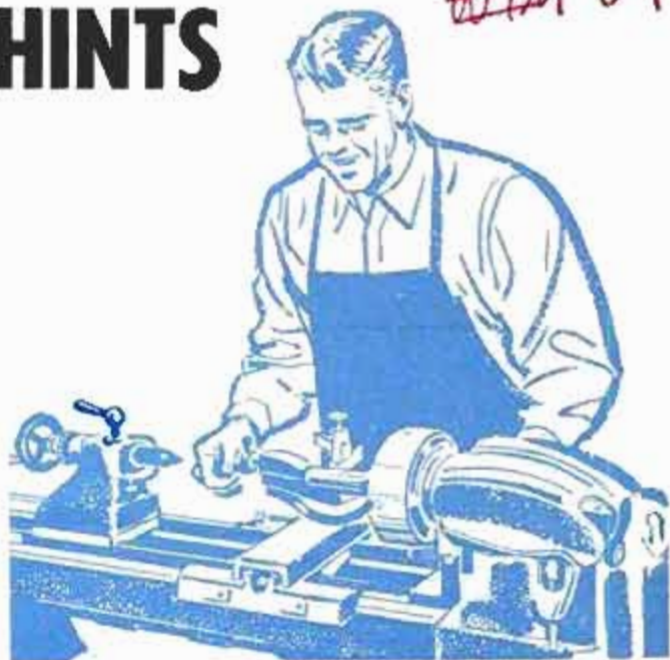
SN 59



One craftsman improvised this simple jig to speed up the job of end-drilling a number of short lengths cut from $\frac{3}{4}$ -in. dowel stock. It consists of a 1-in. pipe tee, a short nipple, a pipe cap and a clamping assembly which fits inside the nipple and cap. The clamp pad is formed by shouldering a $\frac{3}{4}$ -in. dowel in the wood lathe and drilling it lengthwise to take a $\frac{1}{4}$ -in. stovebolt. The bolt head is countersunk flush and the pipe cap is drilled and tapped to take the threaded end of the bolt. When assembled, the unit is positioned and clamped to the drill-press table with a strap clamp. — Hugh Botts, New York City.

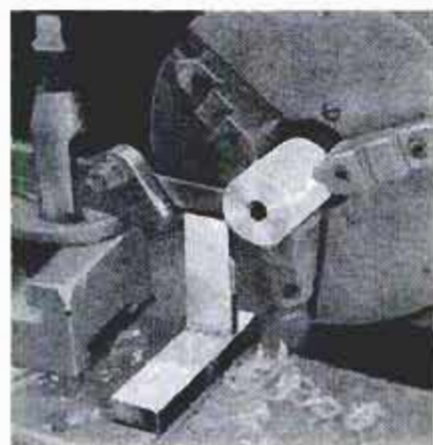
4 HANDY SHOP HINTS

Locating holes with toolmaker's buttons can be speeded up by using the special sleeve pictured in the photo at the right. The sleeve, B, is centered, turned, knurled and bored to a smooth, wringing fit over the button, A. Then the center finder, or wiggler, is brought up to the work, its center point engaging the center hole in the end of the sleeve. Although very close settings can be made with the center finder alone, a dial indicator should be used for the final setting when greater precision is required. The left-hand photo below pictures a useful support for a cutoff tool which will reduce chatter to the minimum in deep cuts. As will be noted, the support travels with the carriage. The upright is a length of tool steel of a thickness slightly less than the cutoff tool. This is welded to a base of $\frac{1}{4}$ -in. stock. Another handy kink to know about when it is necessary to drill a pattern of holes in flat stock is supporting the work on steel balls as in the center photo below. The balls hold the work in perfect alignment, yet permit it to be shifted easily. By drilling and tapping a hole in the tailstock base and turning in a capscrew to engage the carriage lock screw you can improvise a power feed for large taper-shank drills. Note the setup in the lower right-hand photo. The tailstock lock screw is loosened just enough to permit the tailstock to move with the carriage.

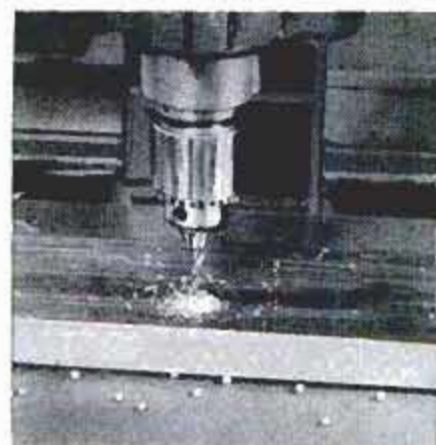


A special sleeve and center finder speed up the job of locating holes with toolmaker's buttons

A vertical support under the cut-off tool will eliminate tool vibration and chatter in deep cuts



When drilling pattern of holes in flat stock support work on steel balls to permit easy shifting



In this setup tailstock is powered. Capscrew in tailstock base engages the carriage lock screw



Use Pipe Cleaner to Open Drain Holes in Bottom of Car Door

It's always a good idea to check the drain holes in the bottom of car doors occasionally to make sure that none of them is clogged. This is best done while the car is on the hoist, as you can readily see the bottom of the opened door to make a close examination. An ordinary pipe cleaner

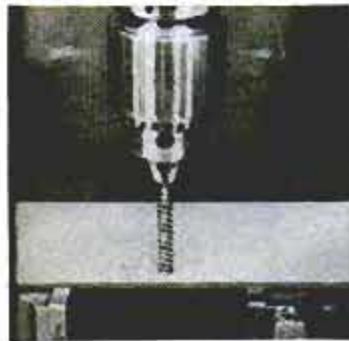
looped back on itself is just the thing to clean debris out of the holes. While you're at it make sure the weather stripping is firmly in place. Otherwise it may seal the holes when the door is closed. If it's covering the holes, use a sheet-metal screw to hold the weather stripping away from them.



Hand Tap Used to Make Edge-Knurling Wheel

A concave knurl, or edge-knurling wheel, is easily made in the lathe, using an ordinary hand tap as a cutter. First, the knurl blank is turned to the diameter desired and the concave cut to the same radius as that of the tap. It is then center-drilled and mounted on a special holder as pictured. This must be made to fit the lathe tool post, of course. Then chuck the fine-thread tap with the outboard end supported in the tailstock center. Mount the blank and holder in the tool post and set the lathe for back-geared drive at its lowest speed. As the blank is fed against the rotating tap the lead on the thread of the tap will rotate the blank. After the teeth of the knurl have been cut to the desired depth, harden the wheel and draw the temper to give a good cutting edge.

Spring Prevents Drill Breakage



In drilling small-diameter holes through material less than $\frac{1}{4}$ in. thick, you may experience trouble with frequent drill breakage. This tendency usually can be overcome by slipping a fairly

stiff compression spring over the drill bit before lowering it to the work. The spring should be cut to a length which equals the projection of the drill bit beyond the chuck. Inner diameter of the spring coils should be only slightly greater than that of the drill.—H. J. Gerber, Stillwater, Okla.

Portable Feed Rack

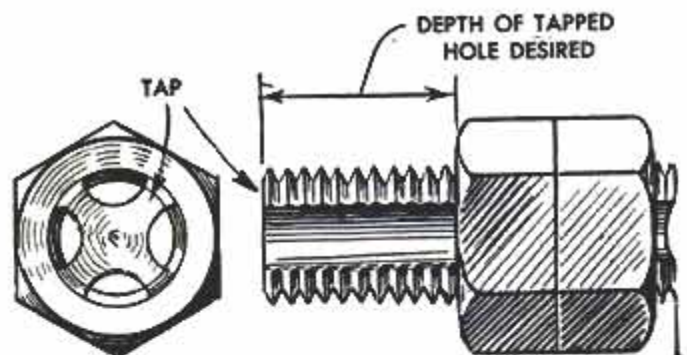
A portable feed rack which takes ground feeds or supplements and roughage, such as hay or corn fodder, can save a lot of time in morning and evening feeding schedules. Here's one built on the farm trailer. A pipe framework supports the rack.

Martin Duffy, Livingston, Ill.

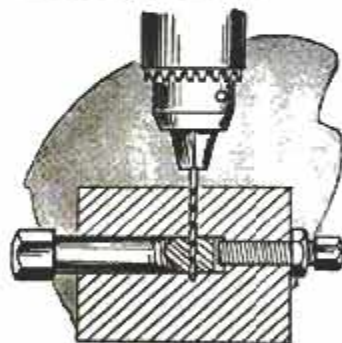


Stop on Bottoming Tap

On certain types of work it may be necessary to cut a thread in a blind hole to a measured depth. To do this simply run two hex nuts onto the tap and tighten at the desired distance above the end of the tap. When you near the final depth, back the tap to clear it before finishing the cut.



Drilling Cotter-Pin Holes



Drilling holes for cotter pins is an easy trick if you use the simple jig detailed. Counterbore a square of cold-rolled steel, the large diameter of the counterbore taking the screw or shaft in an easy fit. Then tap the small-diameter hole to take a setscrew and locknut. Now locate and drill the transverse hole in the block, the hole centering through the large diameter of the counterbore. The setscrew and locknut provide the necessary adjustment in positioning the work.

SHOPPING FOR TOOLS

1. ENGINE STAND of universal type enables serviceman to tilt engine to almost any position desired. Locks firmly in place. Takes any air-cooled reel or rotary-mower engine, also garden-tractor engines of average size, either horizontal or vertical type

The Pate-Root-Heath Co., Plymouth, Ohio

2. LAYOUT FLUID for machinists, tool and diemakers, dries almost instantly and gives a sharply contrasting scribed line that relieves eyestrain and promotes fine accuracy. Comes in bright purple for use on finished surfaces and in layout white for cast iron

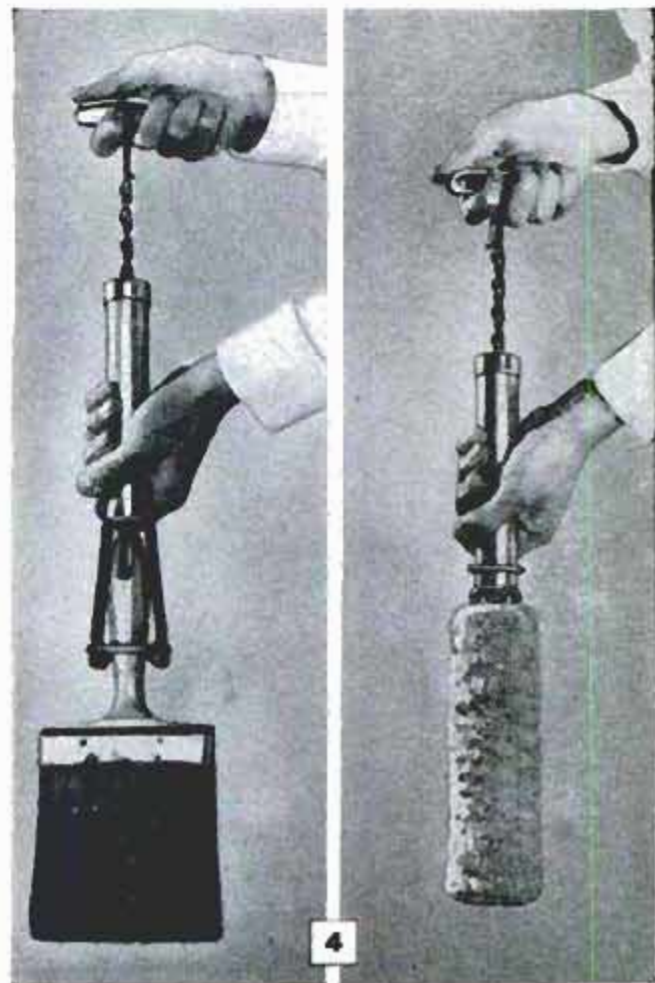
Dayton Rogers Mfg. Co., Minneapolis 7, Minn.

3. PARTS CLEANER comes in a pressurized can, is nonflammable and noncorrosive and can be sprayed on painted and lacquered surfaces. Handy for cleaning oil-burner parts, auto engines and parts, removing oil stains from concrete floors, machine tools

Edward Milton, 4703 25th St., Mount Rainier, Md.

4. HAND-OPERATED SPINNER for cleaning paintbrushes and paint-roller covers works in a manner similar to a push drill. Just attach brush or roller cover to special clips, or jaws, lower into cleaning solution and press handle. Takes brushes up to 6 in.

Kruger Products, Fenkell P. O. Box 5582, Detroit 38, Mich.



SHOPPING FOR TOOLS

Continued from preceding page



5. LIGHTWEIGHT MASONRY DRILL is diamond-faced and water-cooled for high-speed work, up to 3 in. per minute in solid concrete. Drive is by electric motor through a flexible shaft. Drills holes from 3/16 to 2 in. in diameter. Water tank is regular equipment
Powder Tool Fasteners, Inc., 5349 W. Madison St., Chicago

6. SPECIAL HAMMER comes with detachable accessories, making it both a hammer and a handled metal punch for center-punching in layout, or piercing sheet metals for self-threading screws or nails. Especially useful for punching holes for nails in metal roofing

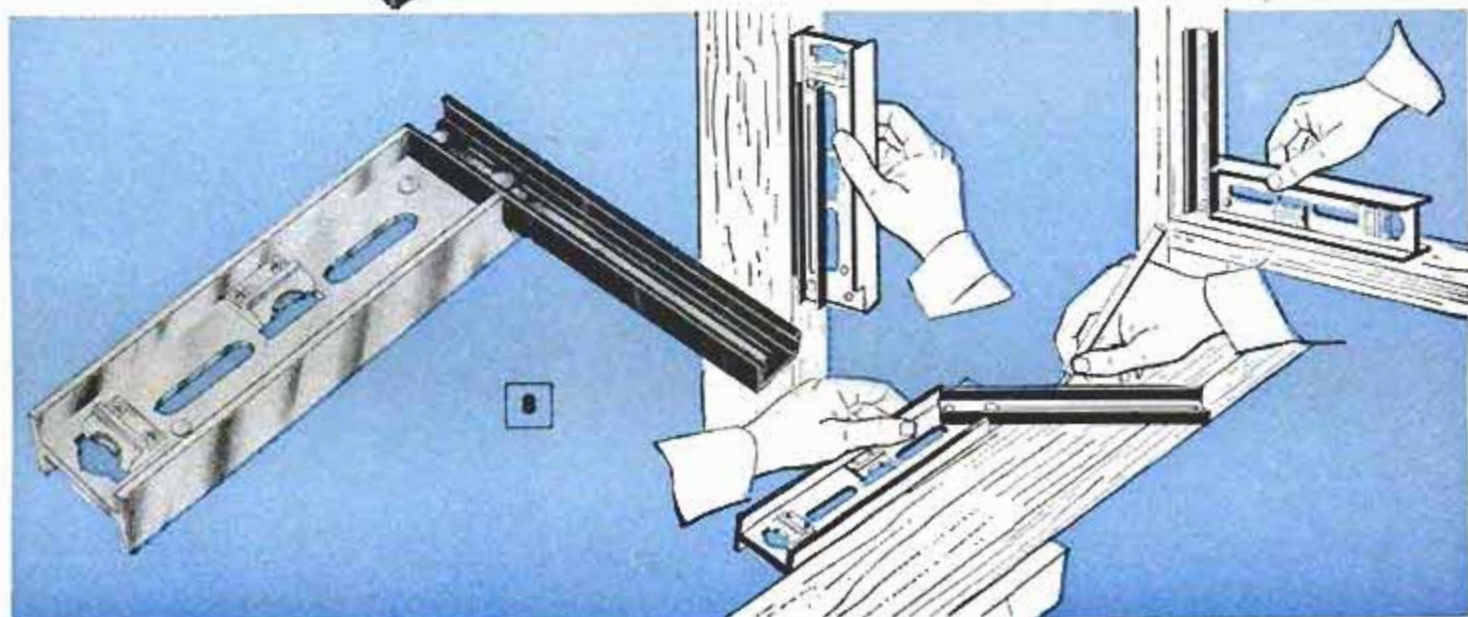
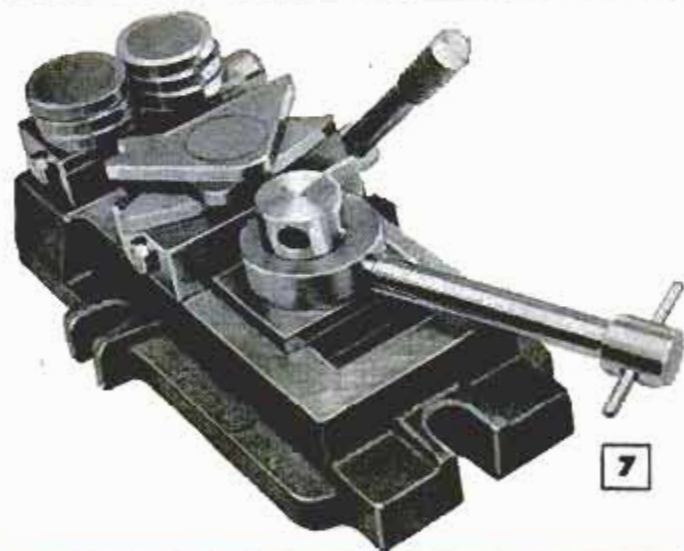
Nelson & Timmons Tool Co., 6102 Orinoco Ave., Indianapolis 27, Ind.

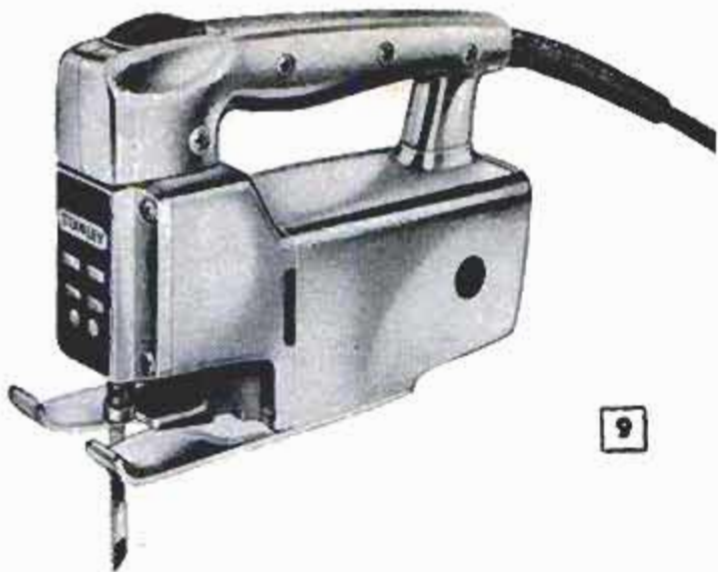
7. MULTIPURPOSE MACHINE VISE is designed to grip work of almost any shape: Flat, round, angular or irregular. Locks with camming action, not conventional screw and movable jaw. Open frame permits through-drilling. Jaws open 2 1/2 in. Weighs 14 lb.

The Custanite Corp., Larchmont, N. Y.

8. COMBINATION TOOL is designed to serve as level, square and modified T-bevel all in one unit only 10 in. long. Sliding blade can be locked at 90 and 45-deg. positions to serve as a square or bevel. Can be used as a horizontal or plumb level as pictured

Mackinburg-Duncan Co., Box 1197, Oklahoma City, Okla.





9

9. PORTABLE SABER SAW has a vibration-dampening mechanism which reduces vibration to a minimum. A feature is the sliding base which enables user to cut to a wall by using shear blade

Stanley Electric Tools, Div. of Stanley Works,
111 Elm St., New Britain, Conn.

10. PORTABLE SCAFFOLD folds up so that it can be carried like a stepladder. Mounted on casters it is especially useful for inside work. Highest level of scaffold board is 55 in. from the floor

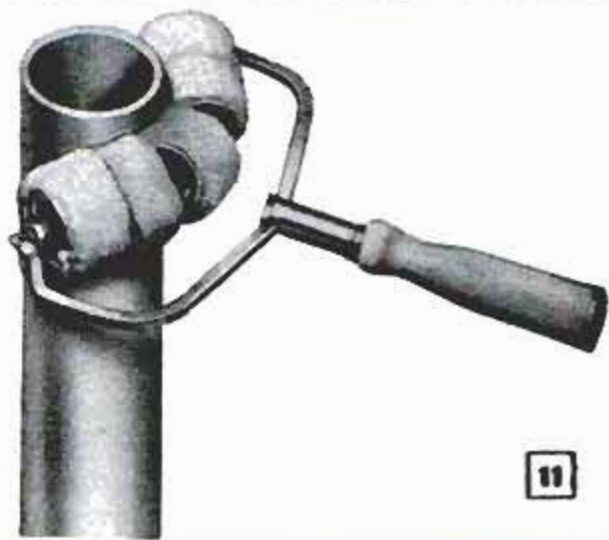
Roll-A-Fold Scaffold Co., 3536 Stoneway, Seattle 3, Wash.



10

11. NOVEL PAINT ROLLER is designed to coat curved surfaces in one stroke. Just the thing for painting long runs of pipe, utility poles, downspouts. Two sizes for large, medium, small pipe

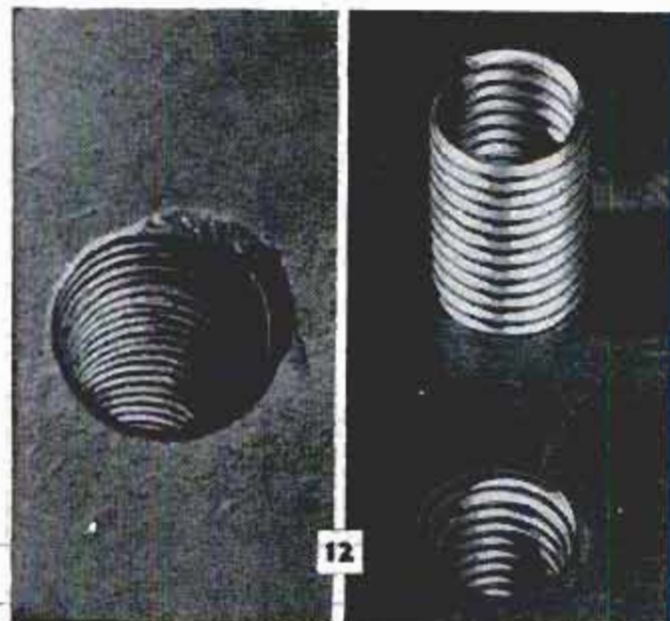
EZ Paintr Corp., Milwaukee, Wis.



11

12-13. THREAD INSERTS are precision-formed thread liners made from stainless-steel wire. They eliminate welding, plugging or going to oversize screws in an attempt to repair stripped threads. To make the repair, Fig. 12, hole is drilled to remove damaged thread. Then it is retapped with a special tap supplied with the kit, Fig. 13. Finally insert is installed with the aid of special tool

Heli-Coil Corp., Danbury, Conn.



12



13

V-Block Serves as Center-Punch Guide on Simple Layout



When center-punching metal it's an advantage to use a guide that holds the punch perpendicular with the surface of the work as it is struck with the hammer. An ordinary V-block serves this purpose very well. Simply stand it on end, place the punch in the vee and move into position with the center point of the punch directly over the layout mark. A light blow of the hammer will indent the work sufficiently for all practical purposes. Of course, the punch must be correctly ground at the proper angle and with the point, or tip, located precisely in the center.

Frank L. Rush, Columbus, Ohio.

Floor Mat Catches Dust

When you sand small parts with a sanding block, place the pieces on a rubber floor mat. The mat cushions the workpiece, provides a nonslip surface and equally important, it catches the dust.

John Comstock, Wellsboro, Pa.

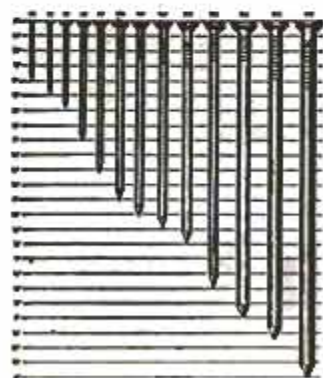
☐ A nut will serve as an emergency gauge when selecting a small tap drill. Locate a nut of a size that will turn onto the screw to be used. Then select a drill bit slightly larger than the inside diameter of the nut.

☐ When a stock and die are not at hand for rethreading a pipe, bolt or other fitting on which the threads have been damaged, the thread usually can be filed or ground down so that the part is again usable.

Do-It-Yourself MATERIALS GUIDE for the Homeowner and Handyman

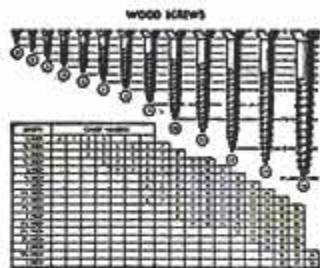
Cross Indexed for Easy Use

If you've ever walked into a hardware store without knowing exactly what you need (and walked out without being sure of what you'd bought), you'll want a copy of this new guide that lists *all* the specifications for *all* Do-It-Yourself materials. With this book, you'll know exactly what to look for, and how to save money when you buy.



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The chart at the right, of common wood-screw sizes and gauges, is typical of the dozens of illustrations (all much larger) in the book. Now you'll know how to choose and where to use building and hobby materials.



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Servicing Engine Ignition Systems Electronically

By Ed Brinker and Bjorn Heyning

THE IGNITION SYSTEM could very well be described as the heart of the modern gasoline engine. It produces the spark that ignites the gas which drives pistons that rotate the crankshaft which, ultimately, makes the wheels go 'round. And chances are that if your automobile, boat or airplane engine misses or otherwise fails to act just right, some component in the ignition system is at fault.

Locating ignition troubles with commonly used gauges and meters is often a time-consuming and frustrating process involving a part-by-part check of all components. This process can be greatly simplified with the electronic ignition analyzer—better known as the oscilloscope.

The oscilloscope is primarily an instrument which converts rapidly varying electrical voltages into a visual "trace" which then appears on a TV-like screen. It is ideally suited for pinpointing troubles in the ignition system whose entire operation depends upon rapidly varying voltages and currents. Because the oscilloscope clearly portrays the sequence of events occurring during the entire ignition cycle, it reveals at a glance many of the faults which could otherwise be located only after tedious step-by-step test procedures.

¹Manufactured by the Heath Co., Benton Harbor, Mich.

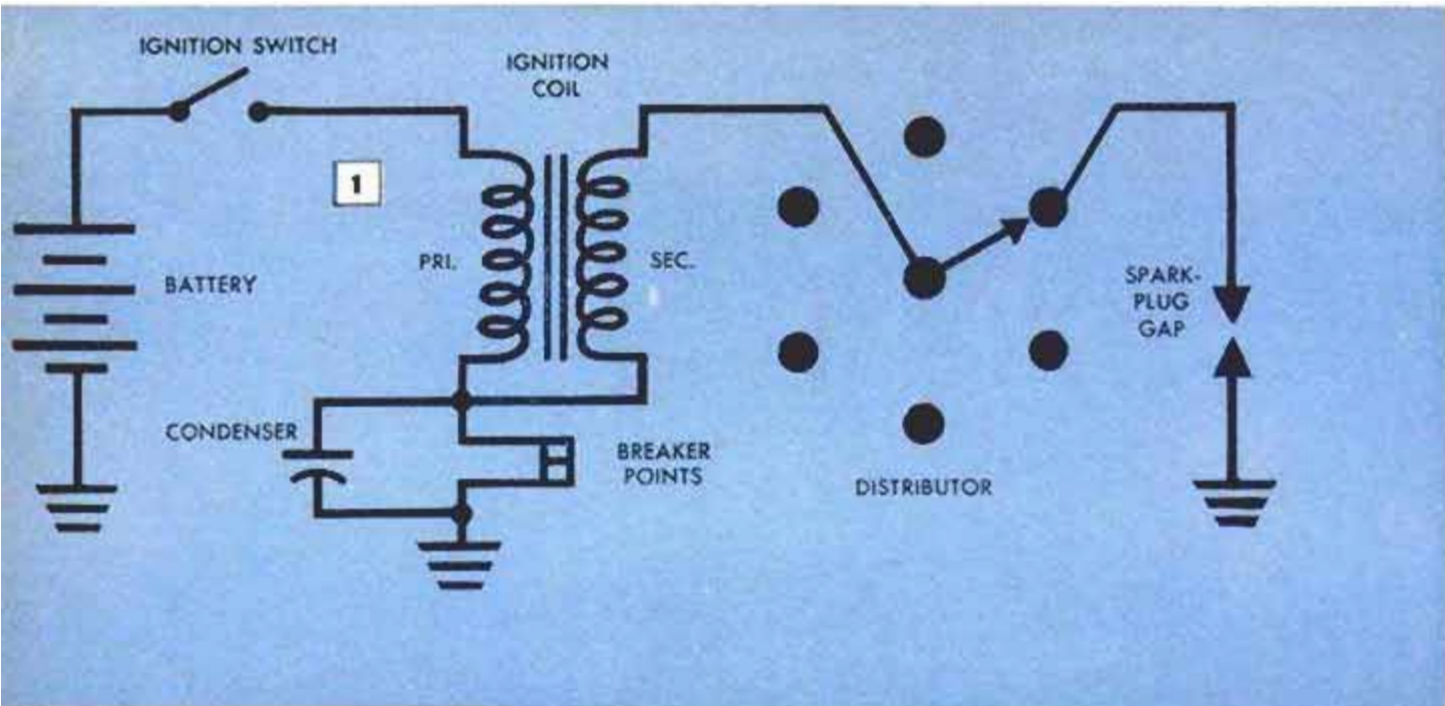
The oscilloscope has been used for some time as a laboratory instrument for engine analysis. In the past three or four years, some professional units have become available commercially. The relatively high cost of these, however, has prevented them from coming into general use. Now, such a unit can be purchased in kit form¹ at a price which is within reach of any mechanic or hobbyist.

Assembly of the ignition-analyzer kit requires no electronic experience. The instructions supplied with each unit are so thorough that anyone who can handle a soldering iron and follow simple directions can complete the job in a couple of spare evenings. But, in order to use the instrument to maximum advantage, the technician should be familiar with the electrical operation of the ignition system, so that he can properly interpret the pattern that appears on the oscilloscope screen.

Basic Electrical Theory

Fig. 2 shows a simple electrical circuit consisting of a battery, a coil and a switch. Below the diagram is a graph of the voltage that would appear across the switch at any instant of the cycle to be discussed.

When, at time A in the graph, the switch is suddenly closed, current from the battery begins to flow through the coil. This



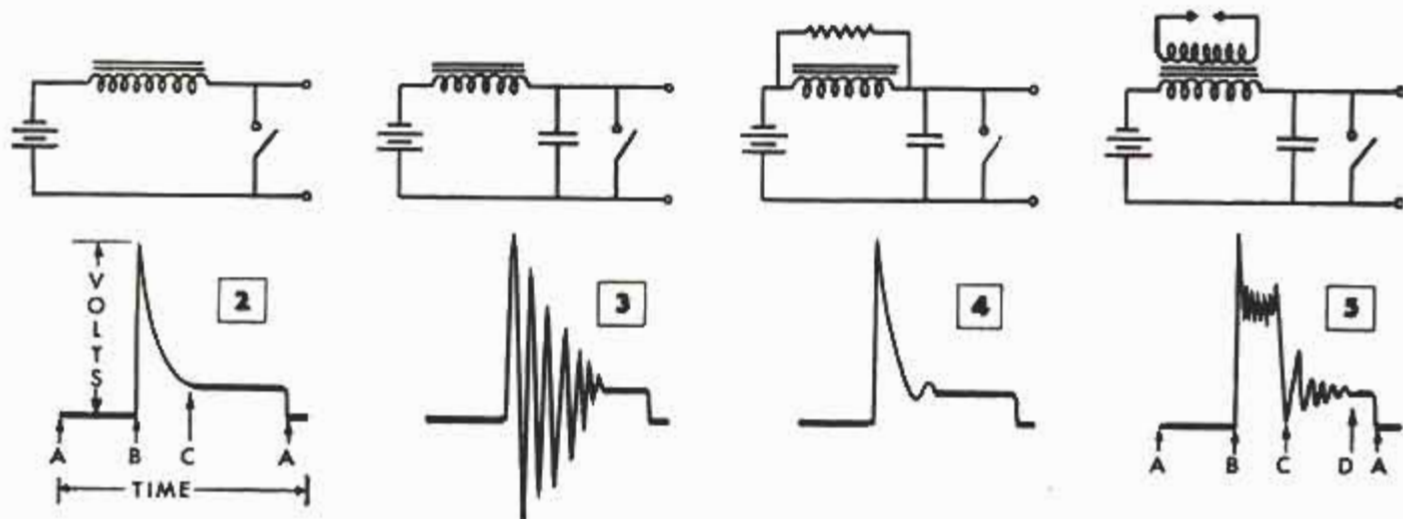
same current also flows through the switch, but since the closed switch represents a short circuit, the voltage across the switch contacts will be zero. Not so in the coil, however. As current begins to flow, a magnetic field is developed about the coil. This magnetic field starts at the center of the coil and spreads outward in all directions. In so doing, it induces a countervoltage in the coil which tends to oppose the flow of battery current. The battery, of course, quickly overcomes this opposing voltage and, in a fraction of a second, the maximum amount of current, limited only by the resistance of the wiring, will flow in the circuit. At the same time, a strong magnetic field will envelop the coil.

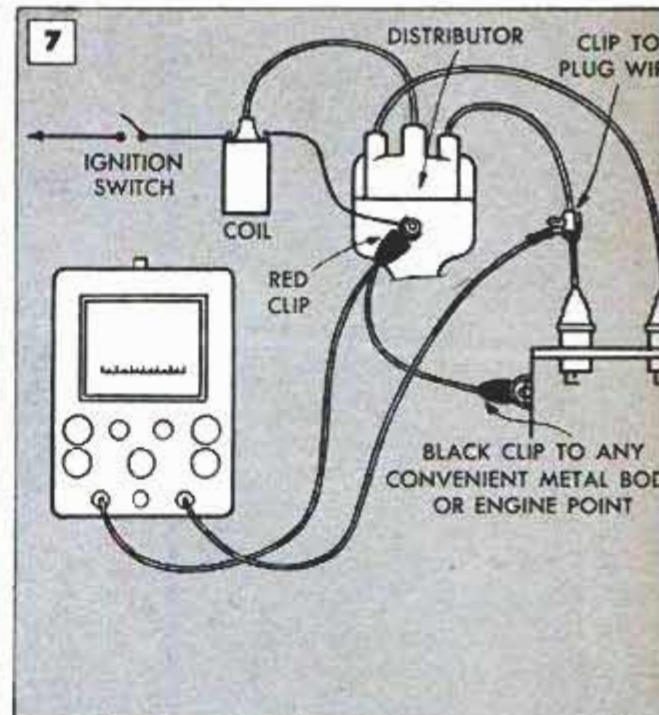
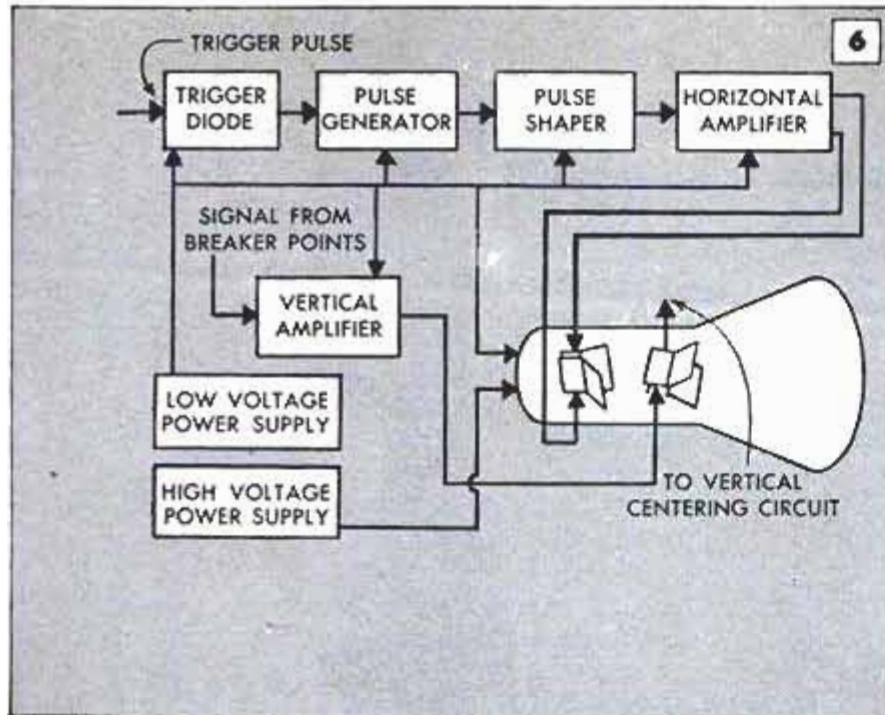
At time B in the graph, the switch is opened and current in the circuit is cut off immediately. When this occurs, the magnetic field about the coil abruptly collapses and induces into the coil a voltage which tries to help the battery push current through the now-open switch. Because the magnetic field collapses almost instantaneously, the induced voltage is very high (up

to several hundred volts) and this voltage appears across the switch contacts. If it were possible to open the switch instantaneously, even this high induced voltage could not force a continued current flow through the open circuit. It would gradually disappear until, at point C, only the battery voltage would remain across the open switch contacts.

In practice, the opening of contacts is a gradual rather than an instantaneous action. The high induced voltage, therefore, is actually successful in maintaining a current flow across the slowly widening gap. This appears in the form of an electrical arc which can quickly ruin the switch contacts. To prevent this arc, a condenser is connected across the switch contacts as shown in the diagram of Fig. 3.

The addition of the condenser has a pronounced effect on the voltage across the switch contacts. During time A-B, the voltage is still zero and, when the switch is opened, the collapsing magnetic field again induces a high voltage in the coil. But now, rather than jumping across an open circuit,





the current produced by the induced voltage rushes into the condenser. As a result, the condenser immediately charges to the full value of the induced voltage.

Of course, the condenser cannot remain in a charged state and, as soon as the magnetic field has completely collapsed, the charged condenser will discharge by sending a current through the coil in the opposite direction. This current builds up a new magnetic field about the coil. Once the condenser is discharged, this new field collapses and produces a continued current flow. The condenser, therefore, charges up in the opposite direction.

This is a continuing and repetitive process. The energy produced in the coil by the original magnetic field alternates back and forth between coil and condenser until, finally, it is completely dissipated by the resistance of the circuit. Accordingly, the voltage across the condenser and the switch contacts builds up first in one direction and then the other, as shown in the voltage graph of Fig. 3.

Fig. 4 shows what happens when a resistor is connected across the coil. Here, much of the current produced by the collapse of the initial magnetic field flows through the resistor, and very little remains to charge the condenser. As a result, the number and amplitude of the oscillations is small and the voltage graph is very similar to that of Fig. 2.

In Fig. 5, a secondary winding and a small air gap have been added to the coil of Fig. 3. The coil, therefore, becomes a transformer and, as with all transformers, any voltage built up in the primary by the expanding and collapsing magnetic field also appears in the secondary. But, because the secondary winding has a much larger

number of turns, the voltage in the secondary is correspondingly higher. Unless and until a current flows in the secondary, however, the secondary voltage does not affect the primary circuit.

The voltage graph of Fig. 5 indicates that during time A-B the voltage across the switch is zero, as in the previous examples. When, at time B, the switch is opened, the collapsing magnetic field charges the capacitor to a high voltage peak and, at the same time, induces a voltage of several thousand volts into the secondary transformer winding. When this occurs, the air in the spark gap is ionized and a spark appears across the gap terminals. We now have a current flow in the secondary winding which definitely affects the action in the primary circuit.

At the instant the spark is struck, the current in the secondary sets up a magnetic field of its own which induces a voltage back into the primary. The polarity of this voltage is such that it tries to keep current flowing into the condenser at a time when the condenser itself is trying to discharge. As a result of these two opposing forces, all action in the primary circuit stops for the duration of the spark. The condenser voltage remains fixed at the value it had attained when the spark began, except for some low amplitude oscillations reflected back from the secondary.

At point C, much of the energy in the circuit has been expended in the spark, which now can no longer sustain itself. As the spark is extinguished, secondary current stops and the condenser will resume its discharge. The remainder of the energy is then used up in primary oscillations, time C-D, as though the secondary winding were not present.

In comparing the circuit of Fig. 5 with the simplified diagram of a typical ignition system, Fig. 1, it is evident that the two circuits are identical. In the latter, the switch has been replaced with breaker points and the secondary transformer winding is connected to the gap (spark plugs) through a distributor which directs the spark to each of the plugs in the required sequence. It might be assumed, therefore, that the voltage across the condenser in the ignition system is identical to that just described. This assumption is confirmed by actual tests made with the oscilloscope.

Oscilloscope Operation and Use

Figs. 6 and 7 show a simplified block diagram of the Heath ignition analyzer and the manner in which this instrument is connected to the engine. One test lead from the analyzer is clipped to a spark-plug wire. Each time the plug fires, a triggering pulse is obtained which is applied through a trigger diode to a pulse generator. For every trigger pulse the generator produces a rectangular voltage pulse which is then "formed" by a pulse shaper, amplified, and applied to the horizontal deflection plates of a cathode-ray tube. As a

result, a bright horizontal line appears on the face of the tube. At the same time, another set of test leads is connected across the breaker points and a voltage appearing there is applied to the vertical deflection plates through the vertical amplifier. The combined action of the horizontal and vertical deflection voltages produces a pattern on the screen which is an exact replica of the voltages across the breaker points at any instant during the entire ignition cycle.²

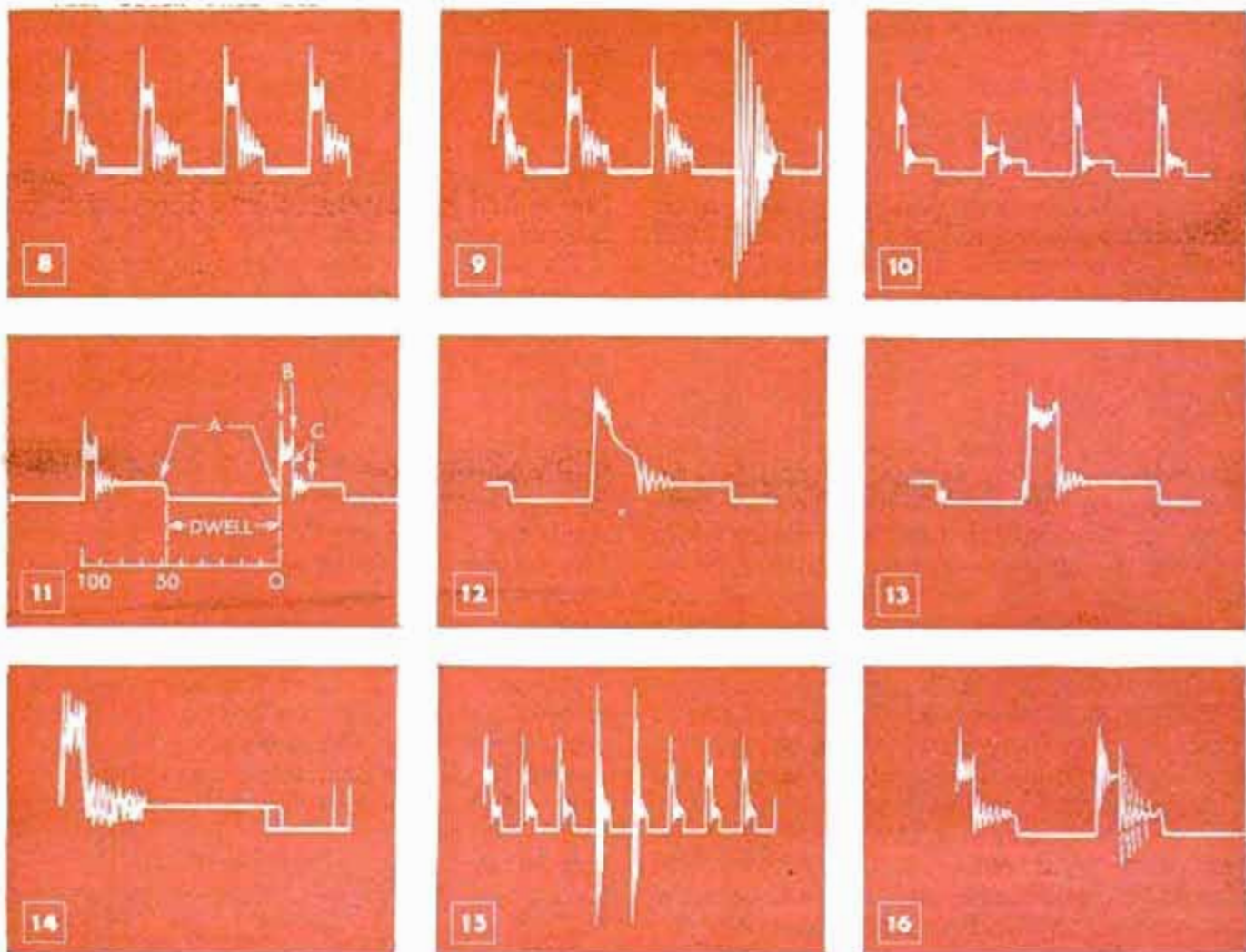
The complete pattern of a smoothly running four-cylinder engine is shown in Fig. 8. Each pulse represents the firing of one cylinder in the regular engine firing order, beginning with the plug to which the trigger lead is connected. Any major defect in the ignition system becomes immediately apparent by viewing the entire ignition cycle. Fig. 9, for example, shows that No. 4 spark plug is not firing. Note the similarity between this pattern and that of Fig. 3.

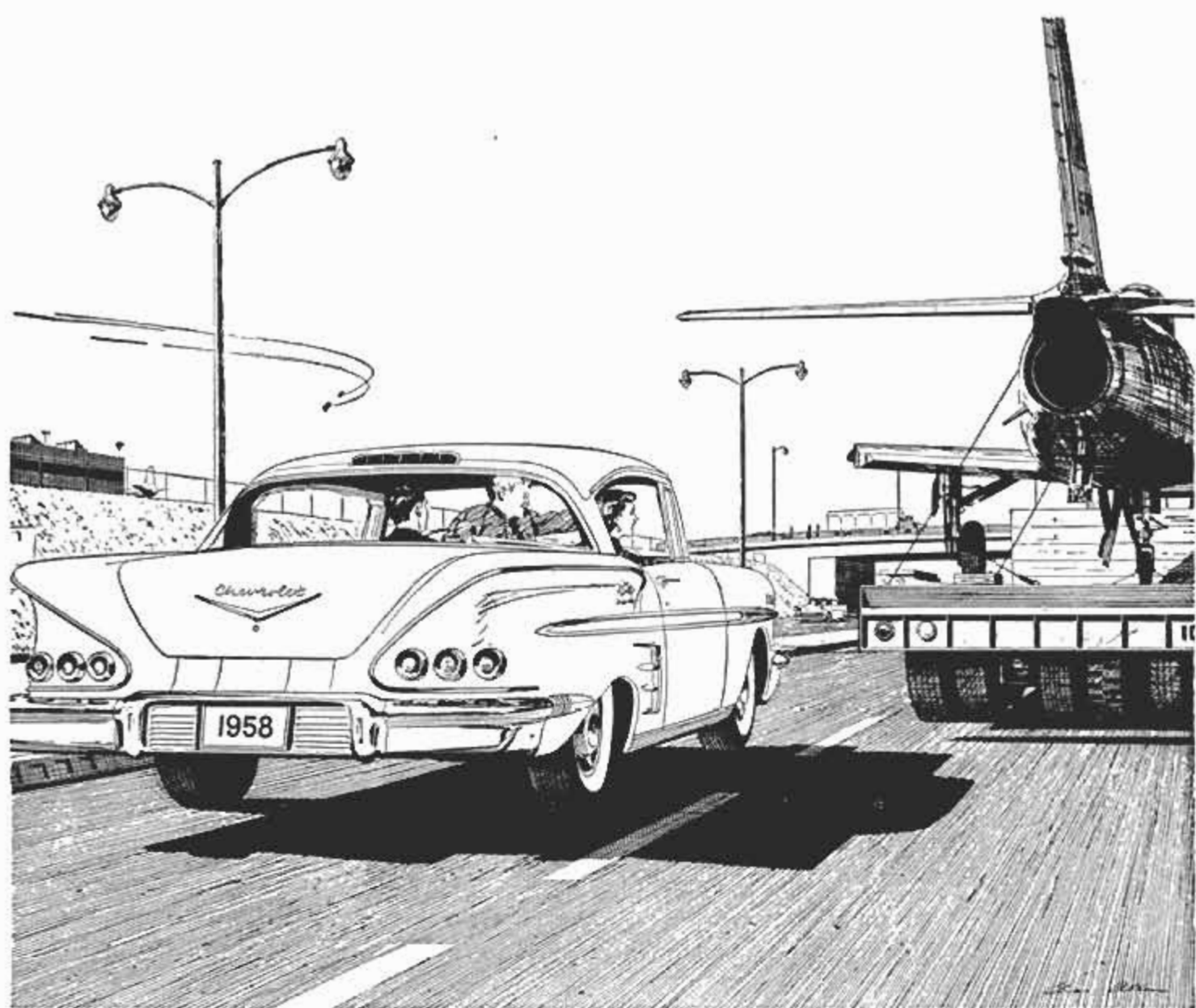
A shorted plug, No. 2 in Fig. 10, shows up as a short, wide pulse in comparison with the others. This pulse is the result of the spark developed across the relatively narrow gap between the distributor rotor and the distributor-cap contact.

One vital feature of the analyzer is its

(Continued to page 266)

²See "Why Buy an Oscilloscope?"
Popular Mechanics, Oct. 1956





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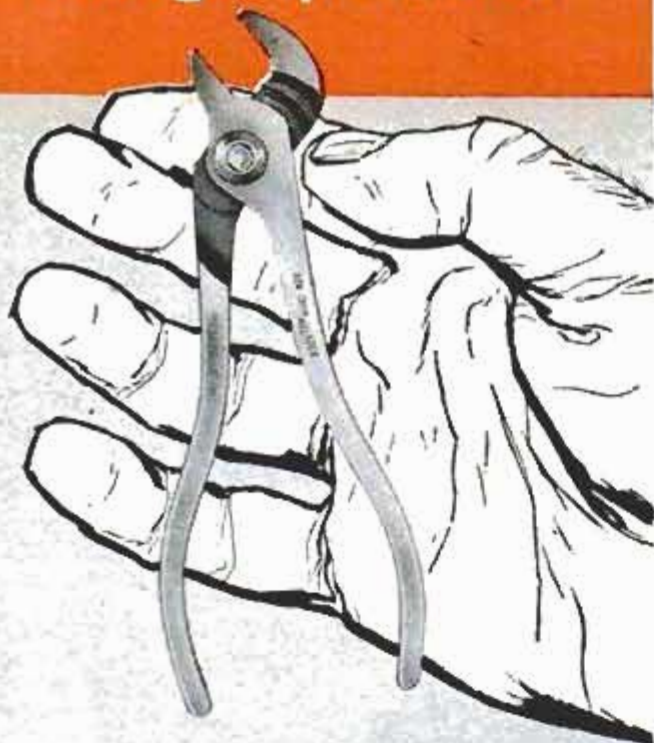
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Sashes Rattle

Q—My home is an older type and when the wind blows from the west several of the window sashes rattle, especially the lower sashes. They seem to be loose in the frames and can be moved back and forth and also from side to side. There must be some way to tighten these sashes without using wedges or tape. How do I go about it?

—G. H., Kans.

A—You can correct this tendency by relocating the stops or by weather stripping. Of course, relocating the stops is perhaps the simplest and least expensive, but we would be inclined to recommend that you consider weather stripping, as this would not only stop the annoying rattle but would prevent the entrance of cold air as well. If you choose to relocate the stops, simply pry them off the frames and re nail so that their edges engage the sash frames sufficiently tight to prevent any movement. This procedure will, of course, stop rattling but may make the sashes rather difficult to open during the warmer months. This is the main reason we would recommend that you consider the installation of weather stripping.



Refinishing Breakfast Set

Q—I have a maple breakfast set of an older type which originally was finished in the natural color. Now it needs refinishing badly, the top of the table especially. It is marred and there are several rather deep scratches. I want to refinish the entire set in the same color as the original, as the graining of the wood is quite attractive. How should I go about it?—O. E., Va.

A—If you are sure that all units of the set are of maple and are not of maple and birch or some other stock such as gumwood, then it is likely that when the old finish is removed the wood will be fairly uniform in color. If, on the other hand, it contains other woods finished as maple (a fairly common practice) then the refinishing job may be somewhat more involved. In any case, it will be necessary to remove the old finish to the bare wood and apply a complete new finish. Reworking an old finish in poor condition rarely produces satisfactory results. After removing all the old finish with

(Continued to page 252)

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a remover the next step is a thorough job of sanding. Removal of the finish and sanding may reveal some sapwood which will show as lighter streaks adjoining wood of the normal heartwood color. Whether or not these lighter areas (generally found only in the table top) are objectionable is a point you will have to decide for yourself. Of course, the lighter wood can be stained to give an over-all uniformity of color. However, sap streaks are sometimes an attractive variation. After sanding, apply a sealer and sand this lightly after it dries. Some refinishers use fine steel, 000 or 0000 grade, rather than fine sandpaper for smoothing finishing coats. Follow the sealer with two coats of water-white lacquer. This can be applied with a brush (use a brushing grade) but you will get a somewhat smoother and more professional job by applying with a spray gun. Usually you can rent a gun from your local paint dealer. When spraying, it's always advisable to do it outdoors. Where it must be done inside during cold weather, be sure to provide adequate ventilation to dissipate the fumes and do the spraying away from any open flame, such as pilot lights.

Refinishing Wall Registers

Q—The wall registers in my home are old style, the type which are installed just at the floor level. The exposed metal grille needs cleaning and refinishing. I would prefer not to paint the parts, but would like to refinish them as near the original color as possible. Can one do this, and what is the procedure?

— O.E., Mass.



A—If the grille has not been varnished then cleaning should be rather simple. If they have been varnished, take off the old finish with a varnish and paint remover. Then go over all the surfaces with very fine steel wool, 000 or finer, using just sufficient pressure to remove any grime and all traces of the paint remover, if this was used. Wipe clean with a cloth dipped in solvent such as alcohol or lacquer thinner. Then finish with a coat of clear metal lacquer applied with spray gun or a fine-bristle brush. When applying metal lacquer with the brush lay it on with one-way strokes. Do not brush back over that which has been applied.

Moisture In Attic

Q—My home was built about 5 years ago and has a low-pitched roof. The rooms are all on one floor and both the attic and walls are insulated. The foundation is poured concrete and there is a basement under part of the house. There is a small louver in each gable. However, I notice that in the colder months the rafters and also the roof boards down near the eaves are damp, that is, there are beads of moisture on the surface. Once I noticed small particles of ice on the floored portion of the attic. What can I do to correct this condition?

— C. N., Mo.

A—Lack of adequate ventilation of the attic is the most probable cause of the condition you describe. It is likely that the louvers in the gables are too small to admit sufficient air to maintain circulation. The louvers also may be partially closed by leaves, cobwebs and dust. This can reduce the free area as much as 10 to 20 percent. If the cornices are of the boxed (closed) type then it may help to cut openings in the cornices to admit fresh, dry air which will tend to promote more adequate circulation. These openings should be screened to prevent entrance of insects. Also, you should check the free area of the louvers and compare with the total area of the attic floor. It's a common rule to provide 12 to 15 sq. in. of free louver area for each 10 sq. ft. of attic floor space. The present louvers in the gables might be supplemented by the installation of several roof louvers, or ventilators. Such louvers can be obtained from your local lumber or building-supply dealer with instructions for mounting.

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Pvt. Robert K. R. Smith
Washington, D.C.
Graduate Woodrow Wilson
High School

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Radar course I
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Army's technical

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Pvt. Max LeBlanc
Lake Charles, Louisiana
Graduate, LeGrange Senior
High School



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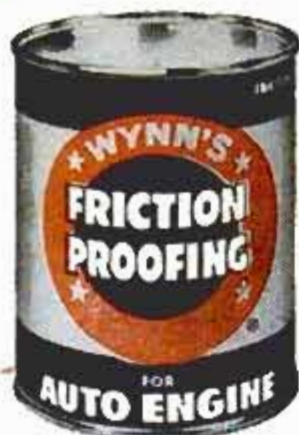


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NUMBER ONE!



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Make your car a Wynner - your service station, garage and new car dealer has Friction Proofing* products especially designed for radiator, upper cylinder, engine and transmission. Get the finest - the can with the red and black bull's eye - and discover for yourself that the proof of Wynn's Friction Proofing is in the performance.

Also available in Canada and everywhere in the free world.

*Friction Proofing is Wynn's Trade Mark for its exclusive metal conditioner which reduces friction between moving metals by chemically smoothing and sealing the surfaces. Manufactured by Wynn Oil Company, 1151 West Fifth Street, Azusa, California, U. S. A.

Will Success Spoil Volkswagen?

(Continued from page 184)

occasional failures under intense heat); rear window enlarged several times; hydraulic brakes with increased lining area. Changes are constantly being made and will continue to be made. (Don't be surprised to see a Volkswagen with no clutch pedal one of these years - an automatic clutch is certainly on the way.)

Biggest changes are in production standards and materials. When Nordhoff took over, cylinder walls were good for about 10,000 miles. Today, he says, they will go 100,000 miles without reboring. VW officials estimate the useful life of a VW at about 125,000 miles.

At the VW Research and Development building, I saw engines tested by running them under full load at wide-open throttle for 100 continuous hours. It's a standard test of production engines. When torn down, they show no appreciable wear.

The Secret of Success

This amazing durability, Nordhoff feels, is the secret of the car's success. It's utterly reliable under all conditions. Sold in 100 countries, it has to be. Dust conditions in the Sahara, extreme cold in northern Sweden, destructive humidity in the jungles, long, hard pulls in the mountains of Switzerland - all these conditions force Volkswagen to improve its product.

"We have chosen the hard course, but the only one we can afford to take," Nordhoff explains. "We are striving for perfection, to make our cars run forever, if possible. The normal course would be to change, to attract customers by new styling, new engines, bigger cars. We will not do that. We have built 2,000,000 Volkswagens. When the 4,000,000th VW is built, it will look the same."

Absorbed With Today's Car

Everything I saw at Wolfsburg reinforced this statement. Perhaps this complete absorption with today's product is VW's weakness.

Nowhere did I see anybody worrying about the day after tomorrow. There was no evidence of long-range research.

I asked Nordhoff if there is anyone in his organization who can match the foresight of Dr. Porsche, the original designer of the car.

"It is impossible to say," was his reply, "that we have a man of the same caliber as Dr. Porsche. But we do have a group of young engineers concerned with the distant future and they have an almost

(Continued to page 282)

* Three wonderful reasons
for **MORE LIGHT**
...**AIMED RIGHT!**



Your family deserves all the safety you can provide . . . deserves the extra safety of new Guide T-3 Headlamps.

With Guide you see farther down the road because this new, industry-approved sealed-beam headlamp, introduced just two years ago, has stepped-up power plus a new light pattern which throws more light on the right—where you need it most.


But, most important of all, these new Guide T-3 Headlamps can be perfectly aimed in minutes—in broad daylight!

Three "Guide Points" on the face of each T-3 lens are ground to tolerances within one ten thousandth of an inch. This precision, and the simplicity of the T-3 aiming method, assure you of **MORE LIGHT—AIMED RIGHT . . .** more safety for both you and your family.

If the headlamps in your car are two years old or more, have them replaced with new Guide T-3s now. And have your headlights aimed at least twice a year.

AC  THE ELECTRONICS DIVISION OF GENERAL MOTORS


Guide



T-3

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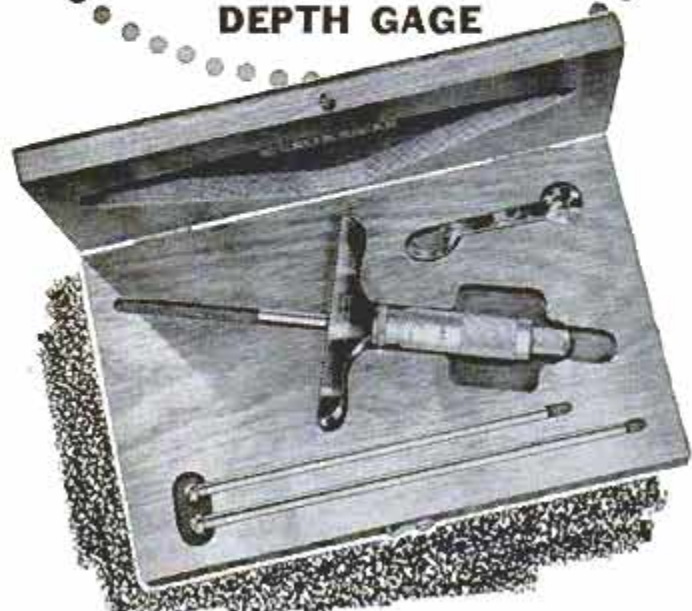
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No. 445 Series

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Available with 3, 4, 5 or 6-inch base in three size ranges; 0 to 3 inches with 3 rods; 0 to 6 inches with 6 rods; 0 to 9 inches with 9 rods. Also available: No. 440 — 3", 6" or 9" with 2½" base; No. 449 — 3", 6" with 2½" or 4" base and non-rotating blade rods.

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**The Weird Things They Do
With Heat!**

(Continued from page 104)

previous method. The flames burn so hotly that not a speck of carbon is left. Yet the cloth itself isn't scorched.

If that sounds like hot precision, Hess can show you even more startling examples. In a vertical furnace, for instance, two huge webs of Kraft paper zip at high speed through a radiant inferno. The intense heat laminates the paper in a continuous operation without searing a fiber.

The same general technique, applied to printing presses, makes it possible for you to get your modern news magazines on time. Before the heat engineers went to work, quality printing on a large-circulation magazine was considered impossible due to the drying time required by inks used on glossy paper. Working with ink-makers and press builders, Hess's men developed gas-fired drying burners that throw more than 2000 degrees of heat at a printed paper web as it flies through the rotary press. Despite the intense heat, the speed of the paper is such that although the ink becomes bone-dry on its flight past the flames, the paper is unaffected. Instead of tediously producing 250 smudgy black-and-white 16-page sections per minute, as they once did, today's rotary presses can turn out 1500 in four or five colors!

Precision Cooking

This kind of precision cooking is due largely to recent developments in radiant, or reflected, heat. Thousands of degrees can be directed on something instantly at full temperature and just as suddenly cut to nothing. Reason: When the flame is killed, there's no heat for the reflector to collect and reflect.

"It's interesting," points out Carl Mann, Selas' drying-division manager, "that this form of energy, probably the first used by primitive man, should have been the latest to give up its secrets to man's research. Primitive man, of course, knew only that when morning came he could crawl out of a damp cave and warm himself in the welcome rays of the sun." The sun's warmth is a perfect example of radiant heat.

In a radiant gas burner the flame's heat is collected and reflected by an incandescent ceramic cup in much the same way light is collected and focused outward from a flash bulb nestled in a polished reflector. The electromagnetic rays of radiant heat that do the job, explains Mann, travel with the speed of light. So, response to control is

(Continued to page 258)

"Sweetest Music This Side of Heaven"



Guy Lombardo drives **MERCURY'S** New Mark 78

"'Sweetest Music This Side of Heaven' has long been associated with my Royal Canadians, but after driving the new Mark 78, I'd say Mercury could claim it for outboards — on every score."

The secret of the sweet, smooth music of this 70 horsepower engine is in its exclusive six-in-line design, proved by experience to be far superior to any other for high horsepower outboards.

Here is the world's supreme expression of outboard dependability and safety. It's the powerful answer to the public's request for better power for bigger, safer, more comfortable boats. The Mark 78 has more exciting new features than ever offered on any outboard — plus the famous compact Mercury look and colorful styling.

Mercury offers the most that's new for '58 — more *all new* engines, more models, more safety features. See your Mercury dealer soon or write for **FREE** catalog.

Guy Lombardo also is famous as a power boating champion. He won the Henry Ford Memorial Trophy, Detroit's Gold Cup Race and set two world records winning the International Gold Cup Regatta.

MERCURY OUTBOARDS
Dependability with a Punch!

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Kiekhaefer Corporation
Fond du Lac, Wisconsin



just as fast as the time it takes to cut in, or cut out, the source of incandescence. On radiant-heat burners it's done in less time than it takes you to blink, either by turning the whole battery of burners away and focusing the heat rays elsewhere, or by moving the work away. "The shorter the distance between burner and workpiece, the more effective the heat transfer," explains Mann.

"Heat," Fred Hess will tell you, "is really just oxidation in a body of matter—a chemical reaction. We simply control the degree of oxidation. In one case—like baking a loaf of bread—you want to distribute the heat throughout the material; in another—such as blowing a hole for electrodes in a radio tube—you aim the heat to get the job done."

By arranging burners in rows, circles, clusters, columns and other formations, Selas engineers can put intense heat exactly where they want it. For a tractor company that needed the teeth hardened on its bogey wheels without hardening the rest of the wheel and making it brittle, the furnace became a circle of burners, blasting only the rim gears under white heat.

For United States Army Ordnance, the furnace is a series of tunnels totaling a mile in length, lined with burners so white with

heat that their dazzling glare will blind you if you look at them without glasses for any time. Through this Hades move 12½-ton, cast-steel tank hulls, heat-hardened to toughness matched only by wrought armor plate. Thousands of radiant burners, aiming their penetrating heat in predetermined patterns on the massive hulks, do the baking job.

Some "ovens" get to be pretty complex. "Glass fiber was originally made by steam," relates Hess. "It came out brittle and was useful in only a few industrial applications. We were asked to do something about it some years ago, and our engineers finally came up with the jet-flame principle that makes today's fine, flexible threads. We concentrated the heat into jet-speed flames. The heat melts the glass and the jet energy disperses it. The roaring hot exhaust gases are used to carry the threads away where they can be gathered up. Out of these threads, today, come your fireproof draperies, refrigerator insulation and glass-wool products."

Problems like this are always being thrown at Hess's heat experts. When Detroit automobile designers drew the first wrap-around windshield on a proposed new model, everyone agreed it was great. But nobody knew how the multiple curves

(Continued to page 260)

new
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H MODEL

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thoroughbred it is!

New bolt from the blue! . . .
Harley-Davidson's Sportster H means
extra smooth and action-packed power.

Get 12% more brake hp. with 9 to 1
compression ratio — a cyclonic
combination of special high dome
pistons, larger intake ports and valves,
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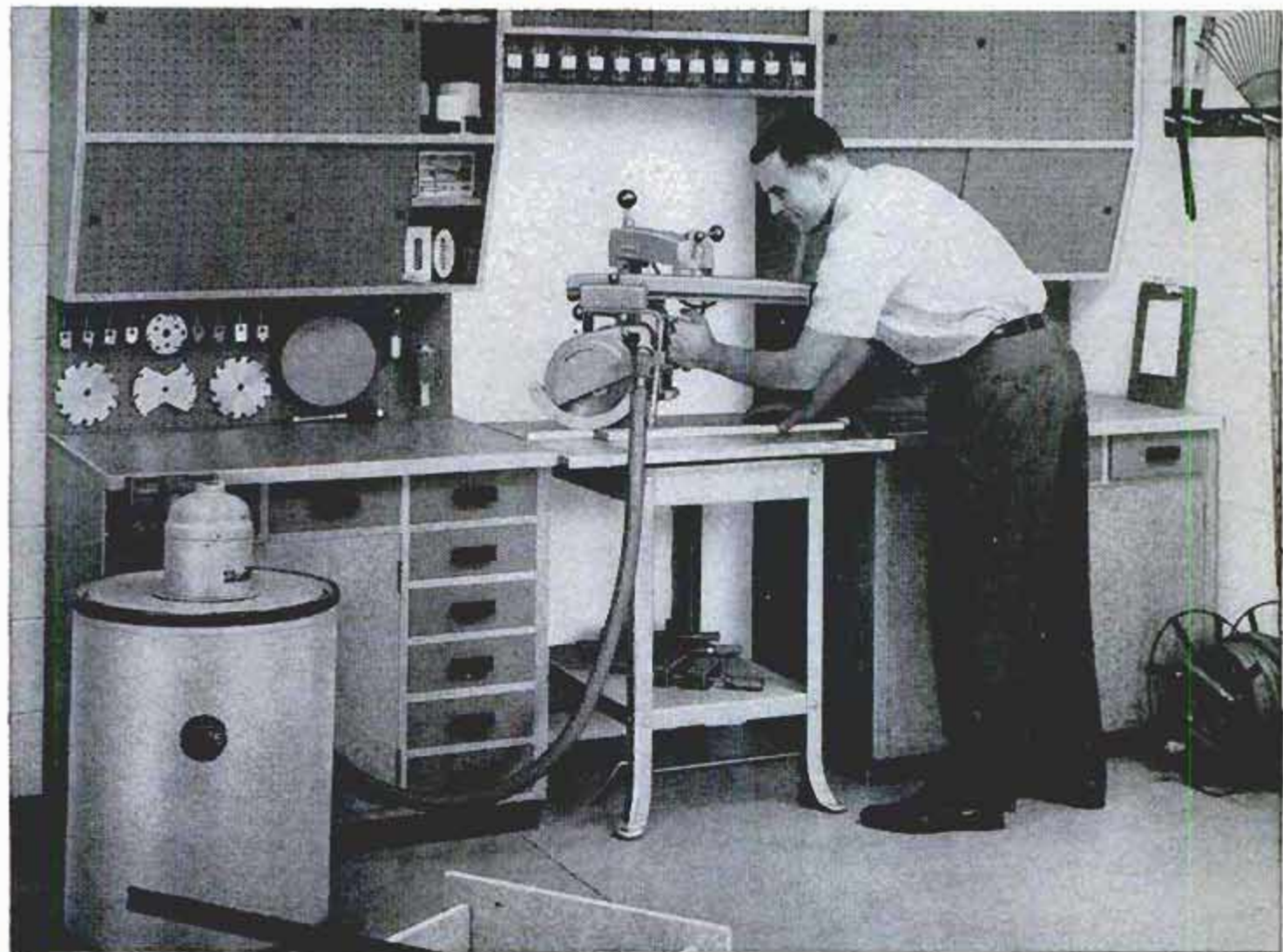
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Rugged as it is good looking, the New Advanced Design "900" Radial Saw is powered by a *full* $\frac{3}{4}$ hp motor. And it's so versatile that actually it's a complete, *all-purpose* workshop! You can rip, cross-cut, drill, sand, shape and do many other jobs fast and accurately. Also shown above is the New Advanced Design Delta Dust Collector. Use it with *any* power tool to keep your shop free of sawdust—even to spray paint. It's powerful enough to pick up a 1" steel ball.

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BUILD THIS ALL-PURPOSE SHOP

Delta experts designed the compact workshop shown above so that you can build it in your

garage or basement. Easy-to-follow plans and the New Delta Reference Guide are yours—for just 10¢—send your remittance with your name and address to Rockwell Manufacturing Co., Delta Power Tool Division, 502B N. Lexington Ave., Pittsburgh 8, Pa.

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MAKE MINE KLEINS



Your skill—the quality of work you do—is controlled in no small measure by the quality of the tools you use.

That's why electricians and good workmen everywhere insist on Klein Pliers—standard of quality by which others are judged "since 1857."

In the complete Klein line you will find pliers exactly suited for every job you do. See your hardware store or Klein distributor for the Klein Pliers you need.



Your hardware store has Kleins in stock or can get them for you quickly. Look for this new display board. It shows the most popular items in the Klein line.

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could possibly be made cheaply and efficiently within the close tolerances needed for mass production. The problem fell in Selas' lap. Hess's men came up with a simple tunnel in which rows of radiant-heat burners line the roof. Flat-glass windshields, precut to proper pattern, enter the tunnel on moving racks. By the time they've reached the other end, radiant heat has softened them just enough so they droop into the bottoms of the racks like strips of soft clay slumping into a curved bowl. The rack bottoms are shaped to the exact mold of the desired wrap-around form, and the softened glass follows every curve.

The plastics people have a few things to thank these industrial cooks for, too. When polyethylene film first came out, packagers wouldn't use it because it was impossible to put printing on the surface. Selas engineers discovered that if the film could be heated to 825 degrees, a chemical change occurred that made the plastic substance ink-receptive. Unfortunately, at 450 degrees polyethylene film is utterly destroyed. Undaunted, the heat wizards fed the film around a chilled drum that kept the bottom of the sheet cold. On the way around, it passed under a single row of radiant burners that threw fierce heat at it for the fraction of a second it took the drum to rotate past it. In that instant the top .0004 inch of the film got a dose of heat equal to 825 degrees; the bottom stayed cool due to the chilly drum and brief heat exposure. Today, packagers print anything they want on that surface.

For the cosmetic industry and insecticide makers, the heat engineers found a way they could use cheap glass containers for their products. For years these people had shied away from putting high or even low-pressure fluids in bottles due to the danger of explosive breakage. By using close-tolerance radiant heat to preheat the glass, molding a plastic covering over it, conditioning the plastic surface for printing, and quick-drying the printing, Hess's cooks did the job. Now glass bottles are used for all kinds of bug killer, toilet water, shaving cream and the like under pressure, with spray caps. If dropped and broken, the plastic envelope contains them. This, Hess proudly points out, is one of the finest examples of heat used as a multiphase processing tool.

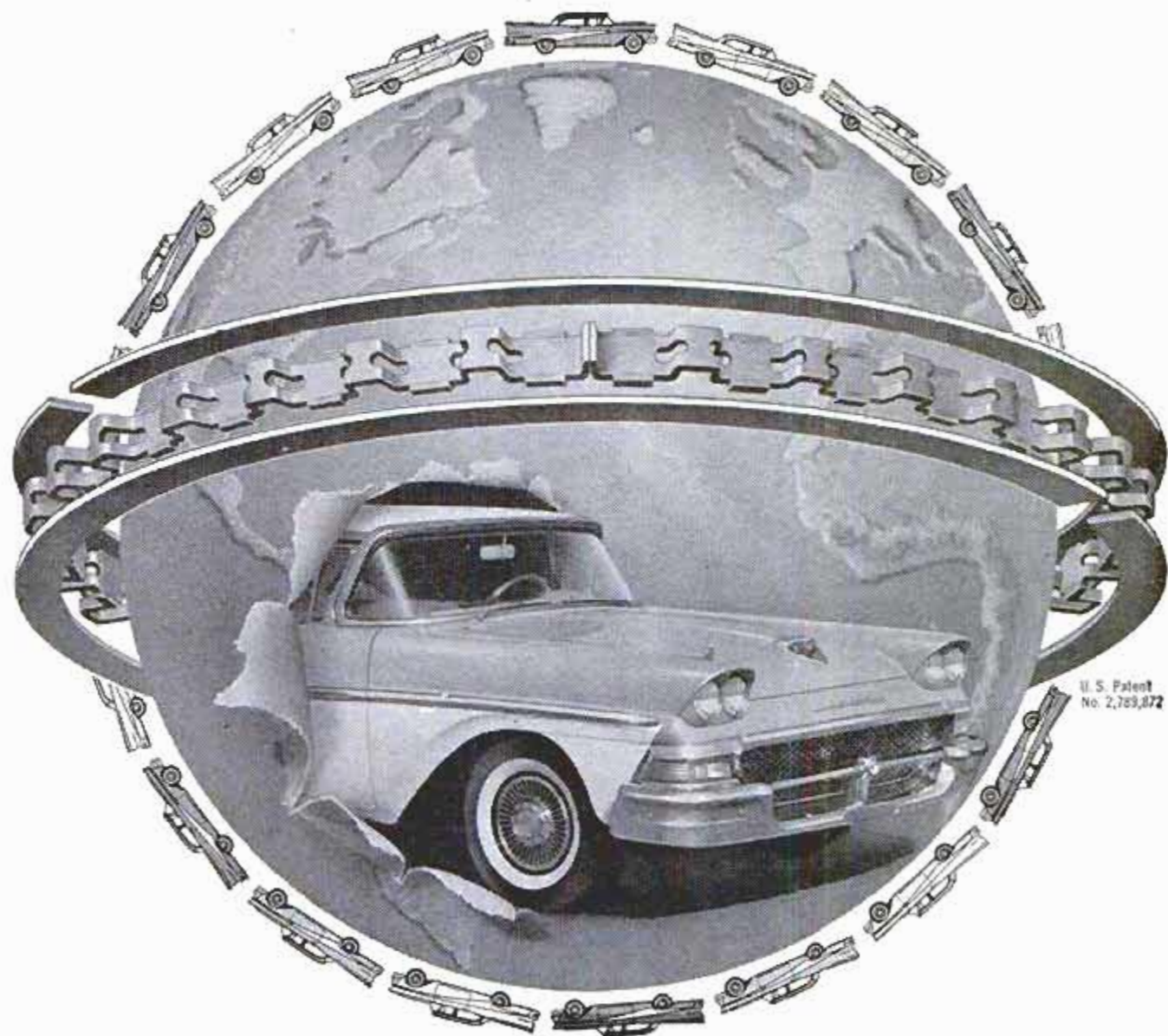
Extremely high temperatures often cause substances to do strange things, which the experts can put to good use. If you heat metals high enough, for instance, they'll vaporize like steam. Make this happen in a sealed chamber, and that metallic

(Continued to page 262)

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THE **Sealed Power**

STAINLESS STEEL OIL RING

FEBRUARY 1958

261

It's Tops...



for quick clean cuts . . .

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Heavy-Duty Pipe Cutter

Powerfully built—guaranteed not to warp or break, always tracks perfectly . . . Famous RIDGID thin-blade or heavy-duty cutter wheels of tool steel roll easily, cleanly through any pipe. Special wheels for stainless steel, cast iron. Every cutter factory-tested. For your work or home, it's most for your money—buy it at your Hardware Store!

Genuine
RIDGID
The World's Most
Popular Pipe Wrench



The Ridge Tool Company, Elyria, Ohio, U. S. A.

vapor will condense on any articles you put in the chamber, giving them a shiny, metallic surface. That's how the silver and gold threads in auto seat covers, draperies and gowns are made. Put a piece of glass in the chamber and a mirror comes out. If the metallic deposit is thin enough, it's a two-purpose mirror: A person on one side can see through it, while a person on the other side sees a reflection.

Fierce heat applied to fine metal or ceramic powders under proper conditions can be made to fuse such particles into a solid mass without melting them. This is called sintering. Solid chunks of metal or ceramic with special characteristics can be made this way out of powders that have extremely high melting points, without having to heat the material to anything like its melting point.

Study of such curiosities accounts for the fact that Selas now sells holes to people. Holes are worth plenty to hospitals, cancer laboratories and even the U.S. Air Force. George Jordan is the man at Selas those job it is to find new uses for holes, and sell them. One big customer is Jackson Cancer Laboratory in Bar Harbor, Me., where cancer cultures are grown and shipped to other laboratories all over the world. The food on which these tissues grow best is a broth made from part of a nine-day-old chicken egg. The broth must be absolutely pure—uncontaminated by any bacteria from the air or the egg itself.

To guarantee such purity, cancer technicians must filter out unwanted bacteria, and that takes *some* filter. But Selas' heat experts discovered a way to cook them up by the dozen. In special ovens they developed a remarkable porous ceramic with 30 million holes to the square inch. The pores are so minute that, although molecules of pure broth can pass through, bacteria cannot.

The white cylindrical filters look like porcelain fillers for Thermos bottles. Hess likes to pick one up and tell you to touch it with the tip of your tongue. If you do, you'll find the moisture sucked away with the pull of a strong vacuum. "Capillary attraction," laughs Hess. "Don't put the surface of your tongue against it or you'll never get it off!" He's right, too. The capillary tug of those 30 million invisible holes has more "cling" than a suction cup.

Today similar filters are used to produce sterile water for hospitals. And you'll find them in floating radar devices used by the Air Force. The filters permit the half-submerged units to "breathe," but at the same time make them absolutely watertight.

These are just a few of the things that heat is making for us today. ★ ★ ★



New "dream walls" offer the warmth of wood...without the work!



Misty Walnut PANELS

How often have you dreamed of the richness, the warmth of wood-grain walls? Only to find they were beyond your budget...too tricky to install...or too much work to keep up.

No more! These new *Misty Walnut* panels bring you all the rich beauty of wood—and without the high cost, either!

Your wall panels go up in handy four-foot widths...no tedious matching or fitting. Attractive vertical grooves set off the grain, give your wall a custom-paneled look. Joints are concealed...no nails mar the surface.

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Is Population Outgrowing The World?

(Continued from page 143)

economist whose name went into the dictionaries for his gloomy doctrine that the world's population was increasing at a rate which, if unchecked by famines, pestilence and wars, would eventually outstrip the earth's ability to supply food.

Modern students are not so alarming. D. H. Killeffer, chemical engineer and writer, said at a luncheon given in his honor by the American Chemical Society that "We must quell the fear of 'Malthusians' who cringe before a rising curve of population. They forget that Malthus lived before the Industrial Revolution. We must show them how productivity now consistently grows faster than consumption, and not in a changing reverse ratio."

A Cambridge University zoologist, also differing with Malthus, avers that the high fecundity rate of the food-scarce nations—such as those of the Far East today—will eventually be counterbalanced by decreasing fecundity when medical science lowers the mortality rate in crowded areas.

Robert C. Cook, director of the Population Reference Bureau at Washington, D. C., says the family of man is growing at a rate of about 1.5 percent annually.

"If such a rate seems trivial," says Cook, "remember that it accounts for the phenomenal 40 million yearly increase. This rate will double a population in about 55 years." Twenty years ago the annual increase was about 25 million persons.

Talk of mushrooming populations, and the average person thinks first of the Far East—India, China, Japan. Not so: By nations, China does have the largest population—close to 600,000,000; India has 377,000,000, the U.S.S.R. 214,000,000, the United States nearly 180,000,000. But Latin America has the highest growth rate and includes several nations whose people are multiplying at a rate higher than 3 percent yearly. Although one in every four babies born in the world these days is Chinese, the Asiatic growth rate is much lower than that of Latin America.

And there are some spots on the earth where human reproduction has declined.

Japan, in recent years, has experienced the most rapid drop in birth rate ever recorded in any land: From 34.3 births per thousand population in 1947 to 19.4 in 1955.

Nearer home, Puerto Rico's birth rate has declined from 42.2 per thousand in 1947 to 34.8 in 1955.

The birth rate for the United States in 1955 was higher than Japan's: 24.6 per thousand. ★ ★ ★

Matches any \$395 saw you can buy!

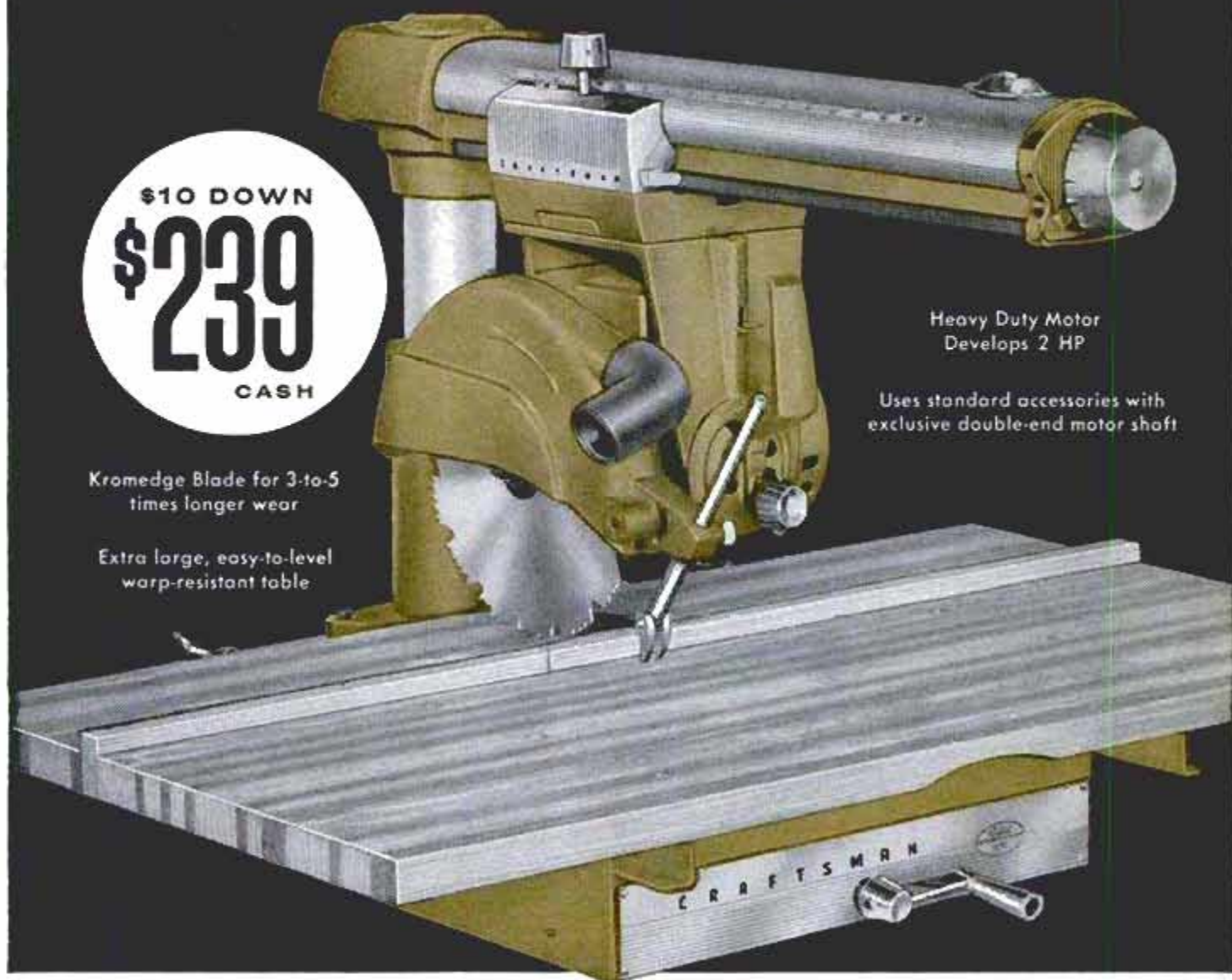
\$10 DOWN
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Kromedge Blade for 3-to-5 times longer wear

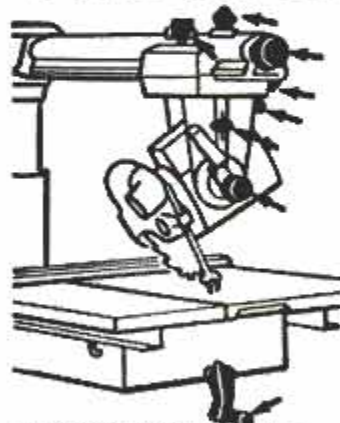
Extra large, easy-to-level warp-resistant table

Heavy Duty Motor Develops 2 HP

Uses standard accessories with exclusive double-end motor shaft



Sears All new Craftsman Accra-Arm 10" Radial Saw



ALL CONTROLS in front for safe, easy access; color-coded for quick identification.

See it demonstrated at Sears! You can cross-cut, rip, dado, miter, compound miter, drill, shape, sand, buff and do dozens of other operations with this most versatile of tools. Here's a precision built, professional dream shop designed to fit small space . . . with maximum accuracy and features unduplicated even at \$395. Only \$10 down, about \$2.90 a week in convenient monthly payments on Sears Easy Payment Plan.

See the Accra-Arm Saw and all other Craftsman Power Tools at Sears Retail Stores . . . or order from Sears Catalog in your home or at Sears Catalog Sales Offices.

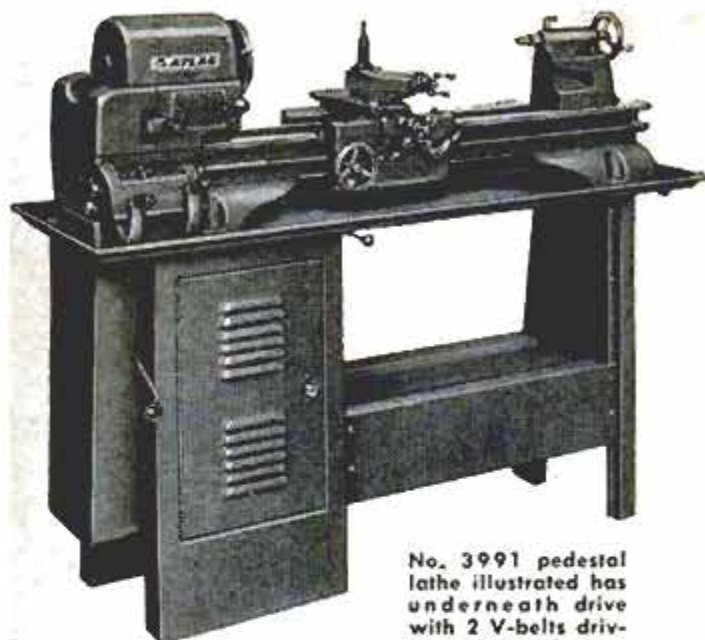
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SATISFACTION GUARANTEED OR YOUR MONEY BACK

FEBRUARY 1958

NEW Atlas 12" LATHES



No. 3991 pedestal lathe illustrated has underneath drive with 2 V-belts driving the spindle.

The new *Atlas* 12" lathes are available in bench models with standard change gears or quick-change gears, and in two underneath drive models with pedestal base as illustrated.

Completely new inside and outside—from the ground up—with greater capacity, performance and value than have ever before been available in lathes at or near their low price.

They have big capacity—12 $\frac{1}{4}$ " swing over bed, 12" swing over saddle wings, 8" over cross slide, up to 36" between centers. And they're ruggedly built throughout to handle bigger jobs, and a wider variety of work with dependable precision.

And the new Atlas back-geared lathes have these important features as standard equipment: Timken tapered roller bearings, 16 spindle speeds, reversible power cross feed and longitudinal feed, wide thread cutting range, V-belt drive. Yet they cost you no more than smaller, less efficient machines.

You'll want to know all about these great new lathes. Write for free literature today.



The famous Atlas precision spindle—an exclusive that assures lifetime accuracy.



New, heavier bed has ground ways—a rigid precision foundation.

Servicing Engine Ignition Systems—Via Electronics

(Continued from page 248)

ability to spread out the pattern so that the various pulses may be seen individually. This permits closer inspection and shows up troubles which may not be visible in the over-all pattern. In Fig. 11, the trace is expanded to permit dwell-angle measurements. A graduated base line is supplied with the analyzer for this purpose. This illustration also shows the portions of the trace depicting specific circuit troubles. In the portion bracketed by A, for example, the breaker points are closed and the voltage should be zero. Defective points or improper spring tension would produce irregularities in this base line, as indicated in Fig. 13, which denotes bouncing points at the time of closing and opening. Improper breaker-point spacing can be determined from the dwell-time measurements.

Part B of the trace shows up troubles in the secondary circuit. A fouled plug will produce the pattern of Fig. 12, while conditions for open and shorted plugs have been discussed earlier. Note the similarity between Figs. 12 and 4. The sloping portion of the pulse is indicative of excessive resistance but, since the oscillations after the spark is extinguished appear to be normal, this resistance is present only during the time that current flows in the secondary winding. This is usually due to a defective plug or faulty plug wiring.

Part C of the trace is associated with the decaying energy in the primary circuit and shows such troubles as condenser defects and excessive primary resistance.

If the trigger lead of the analyzer is clipped to the wire between the coil and distributor cap, the oscilloscope sweep is initiated each time a spark is produced in any of the gaps. The resulting pattern shows all pulses superimposed and permits a quick and easy comparison. The pattern in Fig. 14, for example, shows excessive distributor-shaft wobble, as determined by the fact that the breaker points close at irregular intervals.

Another important advantage of the analyzer is its ability to check an engine under actual operating conditions. (This requires a separate d.c.-to-a.c. converter.) This procedure often reveals engine troubles which escape normal shop tests.

Some Specific Examples

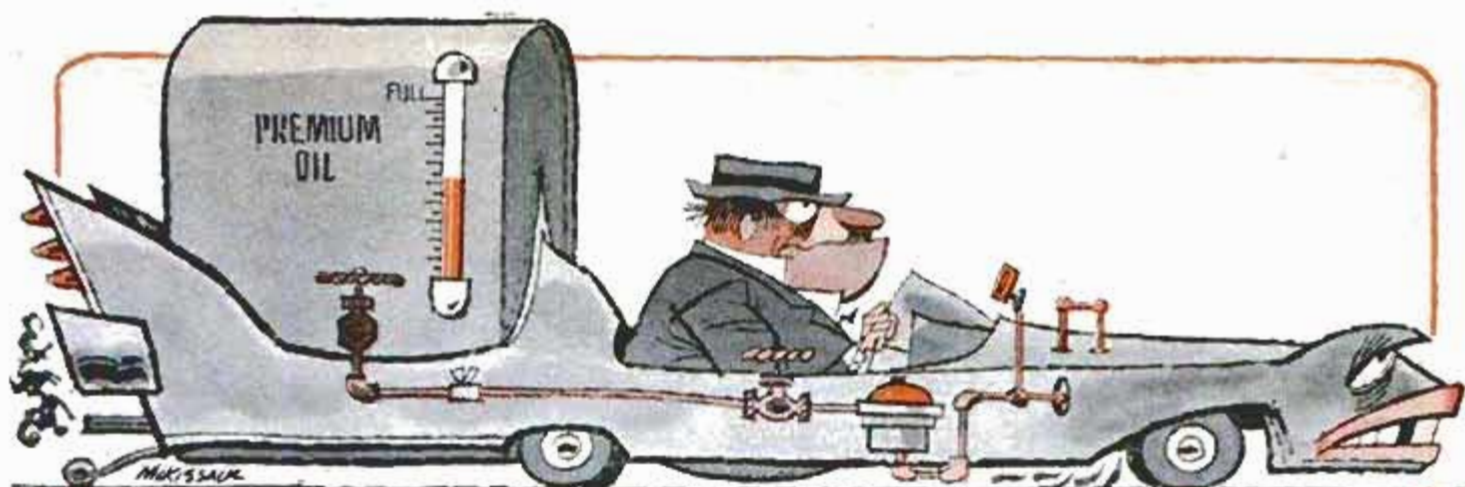
The versatility of the analyzer can best be demonstrated with a few examples.

A motorist complained of an occasional engine miss, particularly on rough roads,

(Continued to page 268)

ATLAS PRESS COMPANY

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even though new plugs, points, distributor cap and wiring had recently been installed. Routine shop tests showed nothing wrong, so the car was given a road test with the ignition analyzer connected to the engine and powered by a small converter. The owner drove the car while the mechanic watched the analyzer. The traces on the screen were perfectly normal until the driver turned onto a gravel road which had given him the worst trouble. At the first bounce, the pattern revealed that two of the cylinders were not being fired, see Fig. 15. As the car was stopped, with the engine idling, the pattern returned to normal.

A visual inspection revealed that the plug wires entered a metal cover over the spark plugs. Removal of the cover showed nothing amiss. Back at the garage, however, a closer inspection showed that the rubber block that keeps the four plug wires from being cut by the cover had been placed too low. Installation of the cover would tilt the block, pulling the plug-wire clips off Nos. 4 and 8 plugs. The rubber spark-plug insulators would keep the clips close enough for idling and running, but the rough road jolted the clips farther away and prevented firing. Moving the rubber grommets to their proper positions corrected the difficulty. A simple fault—yet one that would have been hard to find had not the analyzer provided the tip-off.

Another case involved a 1955 Buick which had been giving a service garage a lot of trouble. The engine was missing so badly that it had to be shifted to low range to get it under way from a stop light. In the shop, it was found that the engine idled smoothly but missed seriously during acceleration. It had all the earmarks of valve trouble but a compression test showed less than 10 lb. difference between cylinders. With the engine running in gear and the brakes on, the plugs were shorted out one by one. The only plug which showed no noticeable change was No. 8 which was promptly replaced. But the trouble was still there.

Now, the ignition analyzer was connected and the pattern was closely observed. It was seen that the trace was normal for all cylinders except for No. 6 in the firing order. The latter changed its shape (see Fig. 16) whenever the engine misfired. Spark plug, wire and distributor were again checked and found to be all right. Now the cylinder head was removed and careful inspection revealed that the exhaust valve was slightly bent. It would seat all right while idling, but under load it would cause the engine to miss. The mechanic found the trouble, but the analyzer showed him where to look. ★ ★ ★



10:05 A.M. The test begins. The B&D Saw will be tested on 2" lumber, making a variety of cuts.



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Test runs through the night. After 24 hours, saw was still going strong. It was then put on laboratory testing machine to continue test* for 6 more days and nights.

*United States Testing Company, Inc., Report No. 37135, Nov. 27, 1957.

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Why Burglars Can't Win

(Continued from page 137)

has ever been broken into by burglars.

Electronic alarms frequently pay off in unexpected ways. In Chicago two burglars tried to bypass an ADT alarm system by cutting a hole through the ceiling of a clothing store. A piece of plaster fell on part of the alarm circuit and flashed a central-station signal. The yeggs were still working on the roof when surprised by police. In Birmingham, Ala., a thief threw his body against a door to force it open. A defective lock gave way and the hoodlum hurled himself onto the floor with such force that he was knocked out. He was still unconscious when ADT guards and police arrived to investigate the cause of the alarm.

Yeggs Chop Hole in Wall

A trick of some professional burglars is to bypass wired windows and doors by forcing a hole in a wall with a hydraulic jack. When yeggs tried this caper at a hosiery mill in Chicago, they fled empty-handed. The building was protected by an ultrasonic device and the sound-wave pattern was upset by the movement of bricks tumbling before the hydraulic jack.

ADT guards also perform feats beyond the routine call of duty to help capture thieves who have tripped alarms. In Houston an ADT guard answering an alarm at a tobacco company heard footsteps on the roof of the building. The guard shinnied up a tree and edged out on a limb. The limb snapped but the guard grabbed at the edge of the roof and made a successful landing. He caught the young burglar and held him until firemen could raise a ladder to the roof top.

ADT engineers have established research laboratories in New York City and neighboring New Jersey to test new and improved alarm systems. They are concerned about a superblowtorch developed at Temple University. The "Temple Torch" can generate heat up to 9000 degrees F.—hot enough to melt a steel and concrete bank vault. ADT believes the Phonetalarm will detect an attack by the supertorch.

Drills and Bits Disappear

Of more immediate concern is another high-powered tool which apparently has fallen into the hands of criminals. It is a 600-pound electric drill used to cut holes in walls for air-conditioning units. With diamond-tipped drills, it can slice an eight-inch hole through a foot of concrete in three minutes. One of the machines, along

(Continued to page 272)



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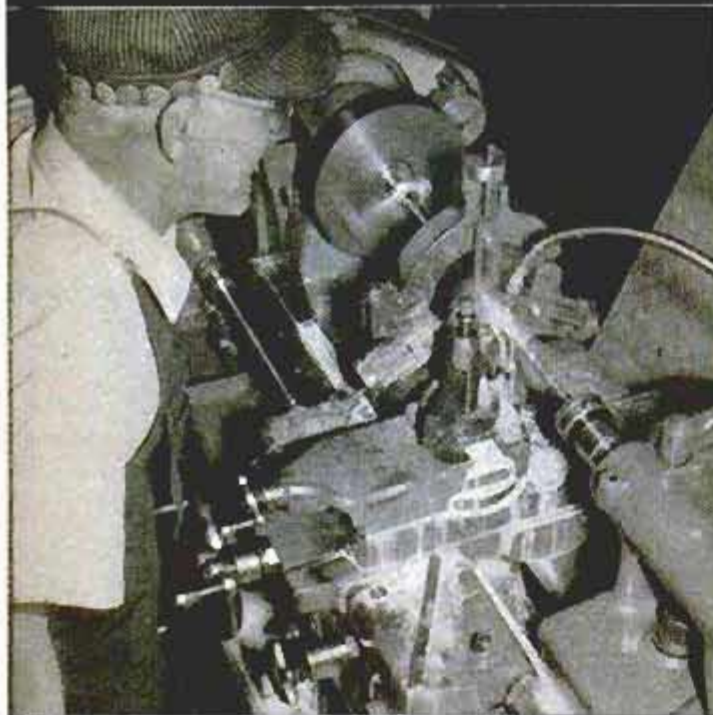
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Spindle speed range.....	20-940	15-875
Shipping weight, 7' bed.....	1760 lbs.	2089 lbs.
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with 180 diamond bits, vanished from a Chicago store several months ago and law-enforcement officials are frankly worried.

Alarms Aid the Watchman

Electronic alarms have not entirely replaced the night watchman, but they have made his job safer. By turning a key in each of a series of transmitting stations, the watchman signals the central station that "all is well." If the signals are not received on schedule, an ADT guard is dispatched to investigate. In the ADT files are numerous cases of watchmen injured, stricken by sudden illness or attacked by criminals but rescued within a few minutes because their signals were not received. In Oklahoma City a watchman was trapped in an elevator between floors and rescued by ADT guards when signals from the transmitting stations were interrupted.

Because of the possibility that hoodlums might force a watchman at gunpoint to continue his tour of transmitting stations, the devices can be rigged to send an alarm signal to the central station without the knowledge of the intruders.

Watchmen have been replaced by alarm systems in some big warehouses and industrial plants. One large soap-company warehouse for example, is completely guarded by electronic alarm systems. The warehouse even has alarm devices to insure that the temperature of detergents doesn't drop below 40 degrees and that a room filled with toothpaste is never cooler than 50 degrees. Other alarms can alert central stations if there's as little as one inch of water on a floor, if the temperature of chemical-processing vats is too high or too low, or if a gate valve in a water-supply system is closed. ADT maintains over 60,000 shutoff-valve alarms throughout the country.

What about the cost of such protection? One firm reports it saves two dollars on insurance premiums for every dollar spent on electronic alarm systems. Another company claims it reduced its plant-protection costs by \$70,000 a year by replacing part of its watchmen with electronic guards. And a food-processing firm says it saves \$32,000 a year in pilferage losses since it had "invisible watchmen" installed at back doors and windows.

Part of the success of modern alarm systems is due to the psychological effect they have on the underworld. Burglars know their chances of cracking the electronic alarm systems are pretty slim. The record shows that for every \$1000 a burglar tries to take from ADT-protected property, he gets only 10 cents. ★ ★ ★

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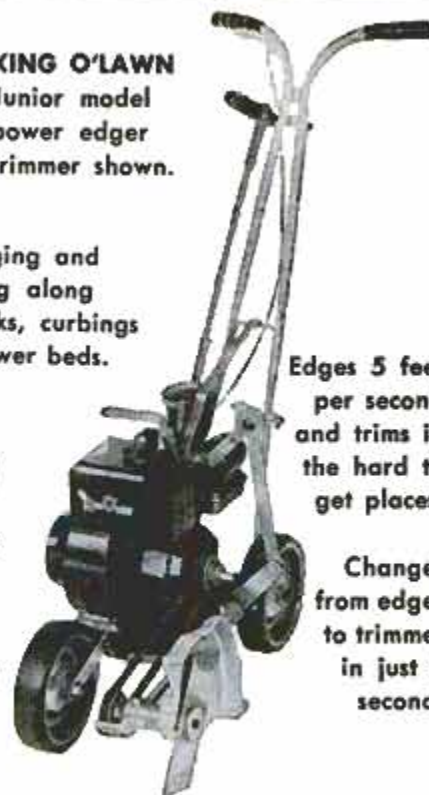
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Edges 5 feet
per second
and trims in
the hard to
get places.

Changes
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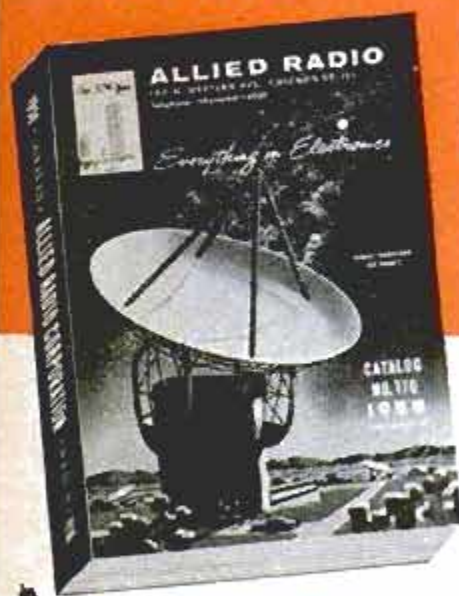
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Atomic Revolution in the Shipyards

(Continued from page 102)

Once in their planes, pilots will be whipped into the air at 30-second intervals on four radically new catapults that actually shoot the planes away with exploding gases—like shells from a cannon. Known as ICCP (Internal Combustion Catapult Powerplant), these mighty engines consist of "combustor cylinders" two feet in diameter and 13 feet long. Fuel, fed into the rear end under pressure, along with compressed air, is exploded by igniters. As the burning mixture roars down the cylinder, water is injected, cooling the mechanism and flashing to steam. This expanding mass roars into the catapult tubes to ram a piston down the long cylinder with tremendous force, capable of flinging the heaviest carrier jets into the air at full flying speed.

Adm. Morgan pointed out that some of the biggest advantages of the new ships are so obvious they are often overlooked. Conventional carriers, for instance, can conduct air operations for only a limited number of days before more aviation fuel is needed. The CVA(N) will be able to operate its aircraft for a considerably longer period, since space formerly used for ship fuel now will be utilized for additional aircraft fuel. Even more important is the fact that this monster ship can cruise at top speed indefinitely! On a conventional ship fuel consumption increases at the cube of the speed. Twelve hours of high-speed run would nearly exhaust the supply of most surface ships. An atomic engine has no such problem. What this will do for fleet operations staggers the imagination. Actually, one prototype nuclear engine for a new Navy ship ran full speed for 1600 hours nonstop, still didn't need refueling.

While the Navy lines up its sights for the atomic era, commercial-fleet owners are watching some fast-moving developments in the offices of the U. S. Maritime Administration, the AEC, the reactor plant of Babcock & Wilcox Company outside Lynchburg, Va., and on the drafting tables of George G. Sharp, naval architects, in New York. This is the team, under Clarence G. Morse, chairman of the Federal Maritime Board and Maritime Administrator of the U. S. Department of Commerce, that is hatching the world's first atom-powered cargo-passenger liner.

Though general design of the ship is already known, nobody wants to say emphatically that details will stay put. However, the Maritime Administration's project director for the ship, Richard P. Godwin, and his project officer, Kemper Sullivan,

(Continued to page 276)

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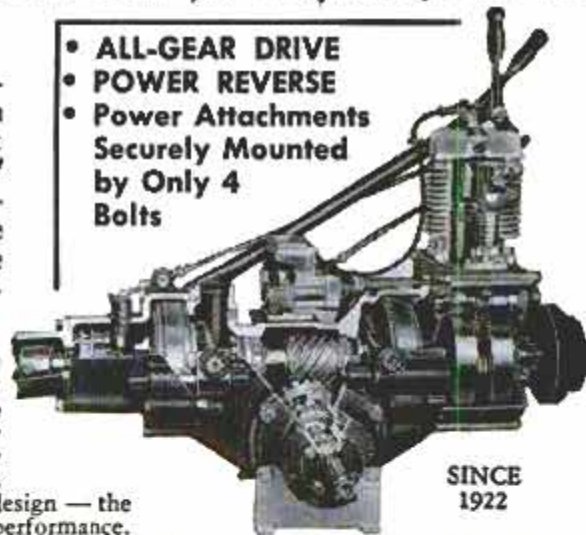
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For the first year or so, the liner will be a "laboratory ship." Her passenger list will comprise nuclear scientists, maritime architects and engineers—all of them listening, with instruments, to the ship's every purr like stethoscope-toting physicians hovering over a medical curiosity.

Passengers will be able to peer through glass walls into the engine room and the enclosed, air-conditioned central-control station. They'll see engineers man the panels of dials and switches that operate, by remote control, the reactor rods, valves and auxiliaries of the ship's propulsion system. The furnace whose atomic fires these men unleash will develop about 22,000 shaft horsepower.

"It is the same type plant that powers the *Nautilus*," Sullivan explains, "— a pressurized water reactor, used to produce steam which powers a turbine. Actually, it is a ship with a conventional steam power plant, but using a nuclear furnace instead of an oil burner."

That furnace makes all the difference, however. First, it's pretty radioactive. To take care of that problem, the designers at George Sharp's have put it and all its primary plumbing into a steel capsule that sits in a concrete nest deep in the ship's hull, forward of the wheelhouse. Measuring 50 feet long and 35 feet in diameter, this gigantic "egg" has a vertical cylinder jutting from its top to accommodate the reactor's long control rods. Inside this containment vessel sits the reactor's core, encased in its own thickly shielded cylindrical

(Continued to page 278)

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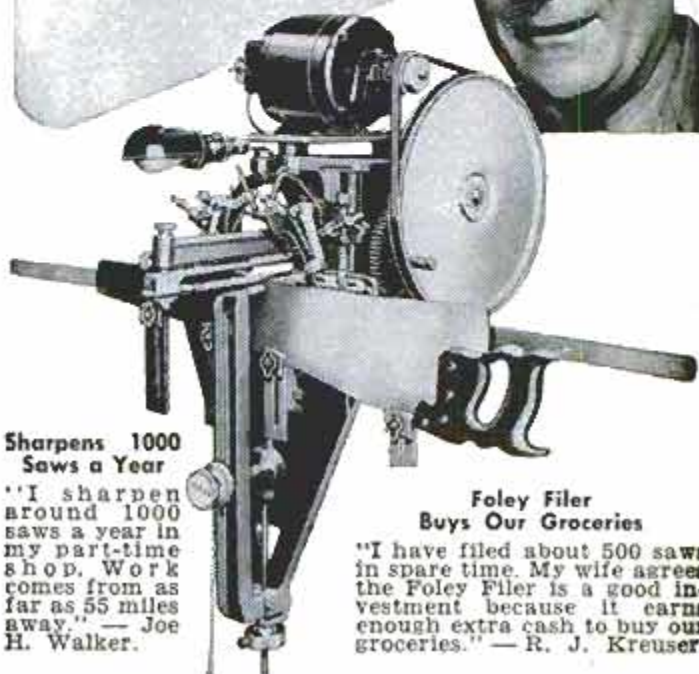
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You can file all hand saws, also band and crosscut circular saws on the Foley Saw Filer. The adjustments are simple—there is no eyestrain—and you can start right away to turn out perfect cutting saws. "The first saw I sharpened with my Foley Saw Filer came out 100%. I think it is a marvel of perfection."—writes Clarence E. Parsons.

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container. While the ship is under way, constantly whirring high-vacuum fans will exhaust air from the voids around the containment vessel, carrying heat losses and any possible stray radiation leakage out a ducting system through the "house" top.

Probably most of these super precautions will never be necessary, however. "If a man sat for a year in the hold right in front of the reactor," says Godwin, "he'd collect about as much radiation as he would from the luminous dial on his wristwatch."

Like any atomic furnace, this one will gradually create burned-out waste that slows down the nuclear reaction and must be removed. This highly radioactive sludge will be stored in the shielded capsule and removed in port every 50 days or so.

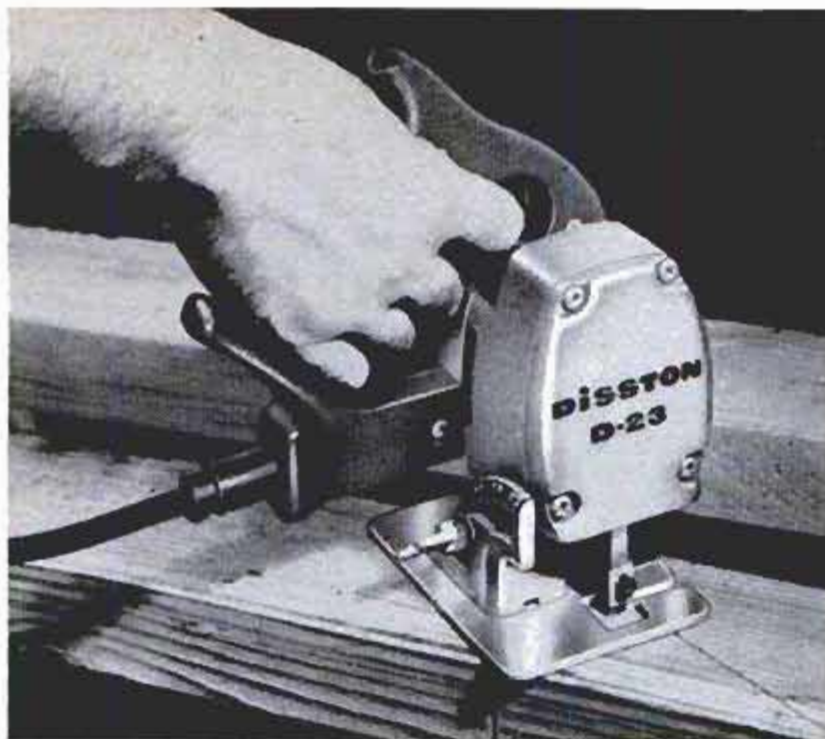
Actually, the big containment capsule is so strong and well-shielded that, if the reactor inside ruptured completely, the outer vessel would contain the whole atomic catastrophe—radiation and all. Dick Godwin and Kemper Sullivan have no patience with gloomy predictions of men who envision oceans made radioactive by atomic shipwrecks.

The containment vessel for the reactor on the new atomic liner is well inside the hull, so a colliding bow would have to shear plenty of steel even to reach it. The big capsule has supports designed to hold it in place even with the ship standing on her beam ends. Besides all this, on the side walls of her thick nest is a "crash pad" made up of layers of three-inch redwood planking interspersed with steel plate to absorb the shock of direct impact. "Even if the sinking caused the primary system to rupture," says Bob Jack, project engineer, "a self-closing flood valve would permit sea water to enter the capsule until pressure was equalized. Then it would close to prevent any further release of fission products. Everything would be trapped in the capsule at the bottom of the sea."

Barring drastic collisions there's almost no way for loose neutrons to escape their prison on the A-liner. Once every three years of normal operation, however, the atomic furnace will need refueling. Though methods and equipment for this delicate job may change right up until the first burned-out slugs are replaced, Godwin provides a pretty clear operational picture.

At a special dockside facility, he explains, men will remove the deck hatch over the capsule's long neck. Carefully, the lead and polyethylene lid covering the control rods will be removed. Prior to this, air from within the capsule area is blown out a vent atop the mast. A bell-shaped housing is lowered by overhead equipment and bolted

(Continued to page 280)



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The Disston D-23 Electric Handsaw cuts every common home workshop material. It cuts wood, plywood, plastics, rubber tile, linoleum tile, asphalt tile, laminated paper and cloth, nylon and Plexiglass. It cuts ¼" steel plate, ½" aluminum plate, angle iron, copper, bronze and brass. It cuts pipe, tubing and sheets.

Features unmatched by other saws have been engineered into the Disston D-23 Electric Handsaw to make it the world's finest—as well as the world's most usable power saw. First, it gives you more cutting power than any other saw because it has the highest output horsepower. A 3-amp motor drives it at 3800 strokes per minute. Second, it cuts faster than any other saw because of remarkable ORBITE

action. The blade slices through material on the upstroke, but backs away on the downstroke. This also reduces fraying, need for sanding, and blade wear. Third, the new Disston D-23 Electric Handsaw cuts more accurately and lasts longer. It is the only reciprocating saw with all needle and ball bearings—9 needle and 3 ball bearings. Check these features against any saw now on the market.

Your most economical buy in power saws. Think of the 1,000-odd uses you have—right now—for this power-packed lightweight! In home repairs and improvements you'll be able to make. In do-it-yourself projects. Think of the times you've wished for just one additional saw for a particular job at hand. Think of the times you've said to yourself that one day you'll have all the saws you need. You can have them all right now in this built-to-last, most usable power saw ever made. With four blades, rip fence and 10-foot detachable cord, the revolutionary Disston D-23 Electric Handsaw sells for just \$98.50.

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down to replace the lid. Working remote-control tools via cables from a gantry inside the bell dome, the head is removed from the reactor vessel, burned-out fuel elements are lifted into a lead coffin which is then hauled up into the bell. The bell housing can then be unbolted, and the whole thing, coffin and all, lifted away by crane to a containment vehicle which moves it off to a storage pool for cooling.

Nobody expects the A-liner to operate economically. She is basically an \$18,000,000 test bed. But it is significant that on a voyage of 13,000 or more miles, she can carry 900 tons of cargo in space which, on a conventional ship of similar capacity, would be required for fuel.

Already, Maritime engineers are mulling over plans for tankers and bulk cargo ships. Due to the long voyages and high speeds demanded of tankers, economists estimate that an atomic supertanker would operate at costs only 14 percent more than conventional tankers.

Back in a section of the Maritime offices known as the "dreams and schemes department," Col. C. R. Denison already is busy developing ideas for the new breed of A-ship that he feels confident is on the way. Most impressive is a submarine supertanker concept. "It's about 600 feet long," explains Denison, "with an airfoil-shaped superstructure housing crew and control spaces. Besides supplying stability, the odd-looking superstructure would separate ship's personnel from the reactor area—which, of course, would be totally under water in the hull of the ship." In Col. Denison's version of this whale-shaped craft, the reactors would power hydrojet propulsion equipment—"Operating," says the colonel, "on the same basic principle as those little tin putt-putt alcohol boats we sailed in the bathtub as kids. Only these would be king size, and each engine would contain dozens of tubes to provide steady thrust."

Meanwhile, new atomic engines are being developed to propel larger ships at greater speed. Industry plans are in the works for a reactor using gas instead of water as the coolant. The gas, heating and expanding as it circulates through the atomic pile, swings through a single closed loop and spins a turbine en route. Heat exchangers, steam generators and extra plumbing are eliminated, resulting in smaller and lighter power plants with far greater efficiency and economy. "It is a step toward an American nuclear-powered merchant fleet competitive with any kind of fleet in the world," according to William Hepburn, one of the men responsible for the development. ★ ★ ★

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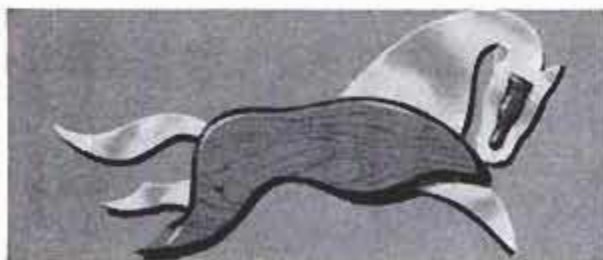
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A modern corner table for your living room that combines the charm of wood and the elegance of aluminum. A project that's beautiful, functional—one you'll be proud to show. Request—PROJECT SHEET NO. 27



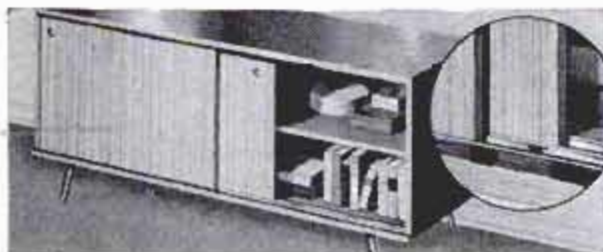
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completely free hand to do what they feel necessary.

"However, I still see quite a while ahead in which to develop the possibilities still in the present design.

"My real problem is to keep the spirit and the productivity of the engineers at a high level despite the fact that their work is almost entirely destined to be put aside, not to be translated into reality at this time."

Here is the real problem—the one that could cause success to spoil Volkswagen.

How can any company hold the truly talented engineer if his work never materializes? How long would the best stylist stay with a company that tossed all his designs into the wastebaskets? You can't keep true talent by letting it spend a year selecting six colors for next year's cars.

Unused Test Track

Behind the VW plant there is a clean new test track. Its high-speed oval is 1.8 kilometers long, just a little over a mile. It is built to handle speeds of over 100 miles per hour. It is a year old, yet is almost as white and clean as when it was built.

There is little or no activity at the track. There were no cars on it except ours during our tour.

I asked if they tested competitive cars. Rarely, was the answer. They didn't have to, seemed to be their feeling.

It could be that VW is the best car built, but it is unhealthy for its engineers to feel that way. A test track that sits idle is perhaps an indication of how success might spoil Volkswagen.

Is there American pressure to change the car? Won't the special demands of this lucrative market force some changes, perhaps spoil it?

Car Shows Feminine Influence

Already some condescensions have been made. The new dashboard has a useless strip of chrome running along it, something Dr. Porsche would probably have ripped off with his own hands. The accelerator pedal has been redesigned to satisfy women drivers. The upholstery now is flashier as well as being two-toned.

All are minor changes, but they could forecast bigger changes that might destroy the Porsche design.

VW is in the position of being condemned if it does, condemned if it doesn't.

It must change to survive, some say, but it might be spoiled by changes. The answer, of course, is to change only to improve—this requires great skill.

"If we make any big change, though,"

THE BRIDGEPORT HARDWARE MFG. CORP., BRIDGEPORT 5, CONN., U. S. A.

said one official, "it will not be a result of pressure from America, but from right here in Germany. Many VW owners in Germany are weary of the same shape, the same car. VWs are as common as lamp-posts. Owners want something different, something distinctive. Here's where the pressure is intense."

The certainty that many have had that the car will never change seems less positive these days. There is a vacancy at the top job in Research and Development—the department that plans for tomorrow. The former chief was relieved, it is rumored, because he was too much against change. Nordhoff is looking for a new Dr. Porsche—for a new genius who is 20 years ahead of his time. He hasn't found him yet. He must find him if the car is to prosper forever.

Walking along the final assembly line at the big Wolfsburg plant (where production is over 2000 cars a day), I noticed a collection of pin-up pictures on a wall.

What girls were in the pictures? No girls at all. The pin-ups were full-color advertisements of the latest American cars. These are pin-ups for VW workers—big, flashy American cars.

But the man at the top feels differently. He knows he would destroy his product if he tried to compete with America's cars.

"We will not get bigger, nor fancier," Nordhoff explains. "We must simply get better."

All changes are up to him. He will think long and hard before approving anything drastic. Nordhoff has guided the company well. Today, he heads a worldwide empire. He intends to keep it that way. ★ ★ ★

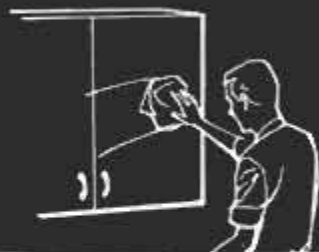
Solid-Propellant Rockets Won't Drop Burned Booster

Two-stage rockets now being built as anti-aircraft missiles will not drop the first stage after it has burned out. In the past the burned-out booster stage was jettisoned to reduce weight. But the process also required complicated separation instruments and a joint between the stages. More efficient solid fuels will reduce the over-all size and weight of the missile and overcome the dead-weight problem of carrying the booster for the remainder of the flight.

Brighter Fluorescent Lamp

With a mixture of rare gases, Westinghouse has developed a standard-sized fluorescent lamp that produces 2½ times more light and yet lasts as long as existing lamps.

FOR GLASS-SMOOTH PAINTING!



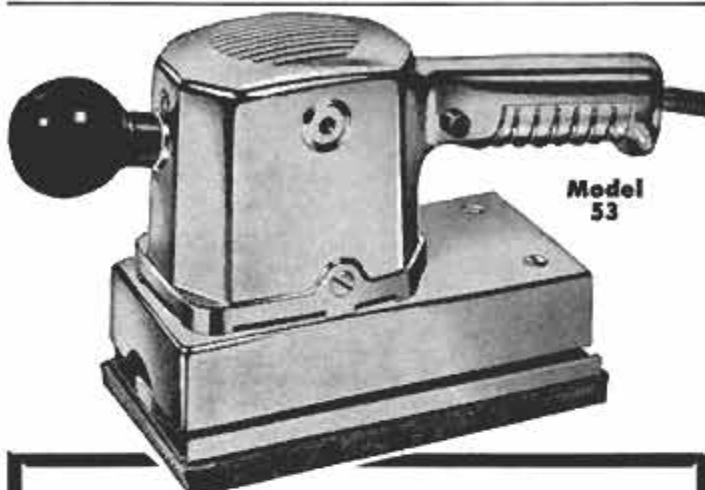
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Simply wipe the Dexall Tack-Rag over sanded surface before enameling or varnishing. It picks up every trace of dirt, dust and sanding particles... assures a professional-looking job!

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Lenk Manufacturing Co., Franklin, Kentucky

The 1958 Cars

(Continued from page 154)

its current advertisements, despite the fact that it dropped its low-price Custom series at the start of the model year.

These are all signs of a change. Two years ago (or even one year ago) you would have been laughed out of the Detroit Athletic Club if you had been so bold as to suggest that these things would happen. But they have happened and they are a symptom.

So 1958 may go on record as the start of the Big Switch, the year the industry discovered it could sell cars by doing something to reduce costs of owning a car.

It is also the year in which General Motors decided to become an importer and sell its small European cars in the American market. Another indication of the changing mood.

What else will 1958 be remembered for? Here are some candidates for the Hall of Fame:

The changeover to four headlights, of course; the industry's (except Chrysler and Studebaker-Packard) adoption of some form of air suspension; the rash of greatly enlarged V8 engines which may be the last such change to be made (although each year the turbine seems further away, not closer).

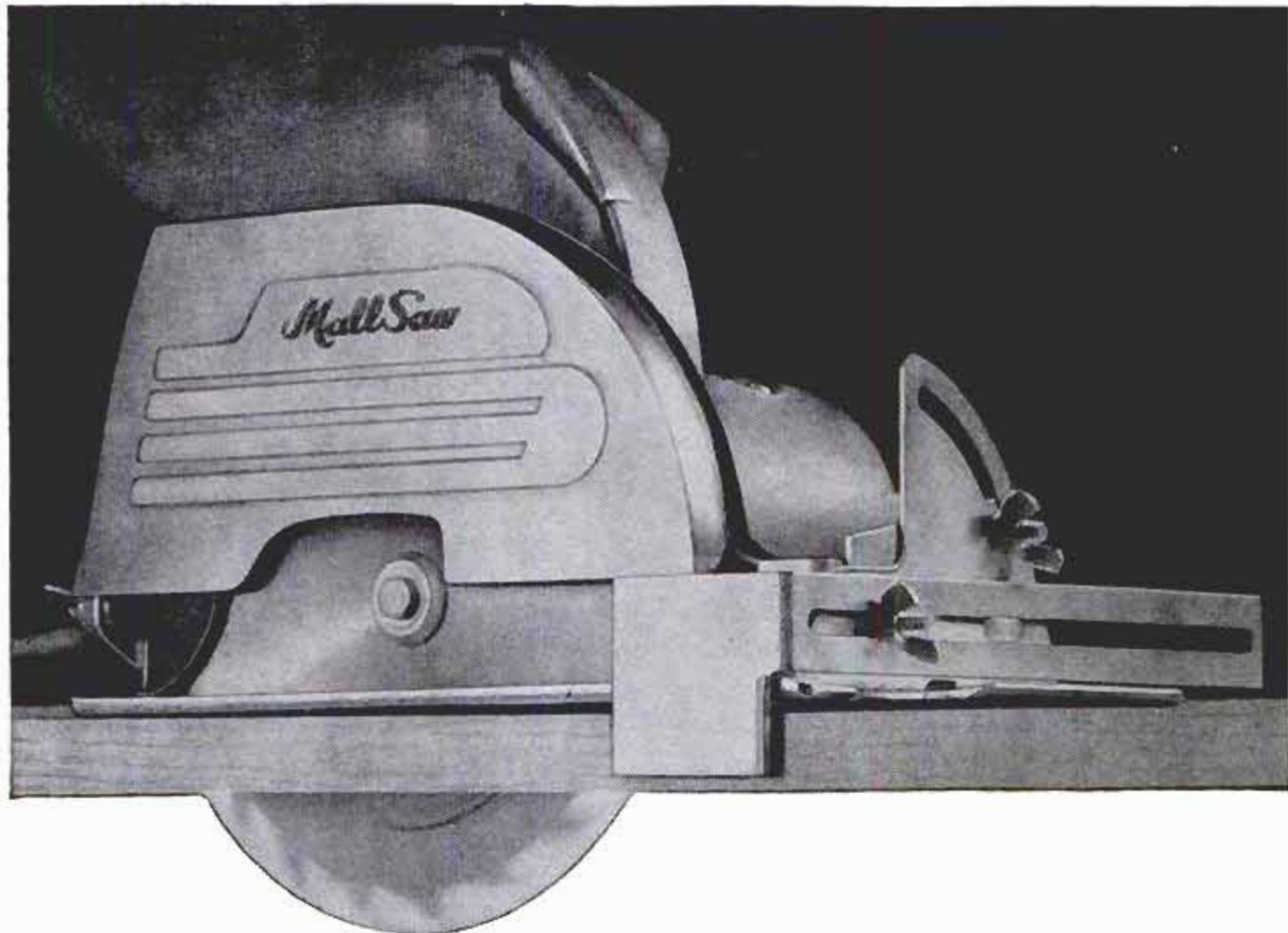
These larger engines may appear to contradict the change mentioned above but they don't really. These new designs were started years ago and are only now being born. Designing a car is like rolling a ball down a bowling alley. After you let go, there are often changes you would like to make in the course of the ball, but it's too late then. The designer lets go years before you see the car. After the design is "locked in," conditions may change and he may wish he had done something different, but it's too late, the ball is going down the alley.

This lead-time handicap may also explain why the bigger, more-powerful trend continues in most cars. The average 1958 car is 213.3 inches long, 1.4 inches longer than the average in 1957. The average 1958 car weighs 3922 pounds, which is 104 pounds more than the average 1957 car. The average horsepower is up from 234.6 in 1957 to 257.0 in 1958, and displacement is up from 306.5 cubic inches in 1957 to 310.3 inches in 1958.

Incidentally, did you notice that the 1958 Chevrolet is longer than the 1958 Oldsmobile Eighty-Eight and Super Eighty-Eight? You can't tell what's what these days.

There are some deaths to report also, deaths which have been recorded quietly

(Continued to page 286)



POWER

Remington 7-inch circular saw gives you an extra deep cut with power to spare!

Ideal for home workshop or maintenance. Model 71 has depth capacity of full 2 $\frac{3}{4}$ " at 90°; will cut through 2" lumber at 45°; speed: 5000 rpm. Powerful 25-60 cycle motor rated at 8.4 amps. Telescoping blade guard; one nut adjusting depth and bevel shoe; ball and self-lubricating bearings; weight: 8 $\frac{3}{4}$ lbs. 10-ft. cord, plug and ground; blade and wrench included. Ask your dealer to show you this powerful saw—it's your biggest saw value!

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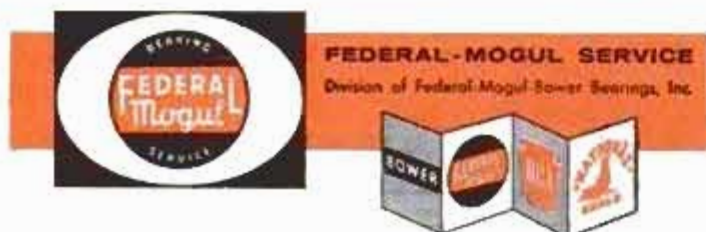
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without fanfare. And, it seems, without much sorrow either.

First, there is the death of Hudson and Nash, two great names in history. The public stopped buying these cars some time ago, but tradition and hope kept them coming out each year (and losing money for their makers). Finally, reality caught up with tradition and the cars were dropped.

Now American Motors builds two Ramblers on one shell: The regular-size Rambler and a stretched-out version called the Ambassador.

Second, there was the silent burial of the most expensive monument to yesterday ever devised: The Continental Mark II. Ford Motor Company's campaign to carry on the car's identity with its 1958 Continental Mark III is understandable, but hardly believable. The Mark II was significant because of its virtually custom-made character. The extreme care with which it was made was its hallmark. It was a car for the person who could afford the finest and was willing to pay a premium for elegant distinctiveness.

The 1958 Continental Mark III is a twin to the Lincoln. It is as much a Lincoln as the Buick Limited is a Buick. When you buy the Mark III you don't get near-custom manufacture, you get another Lincoln (which, it must be added, is a fine car). But the Mark II, the loudly acclaimed revival of the prewar classic, is dead. That's the plain fact.

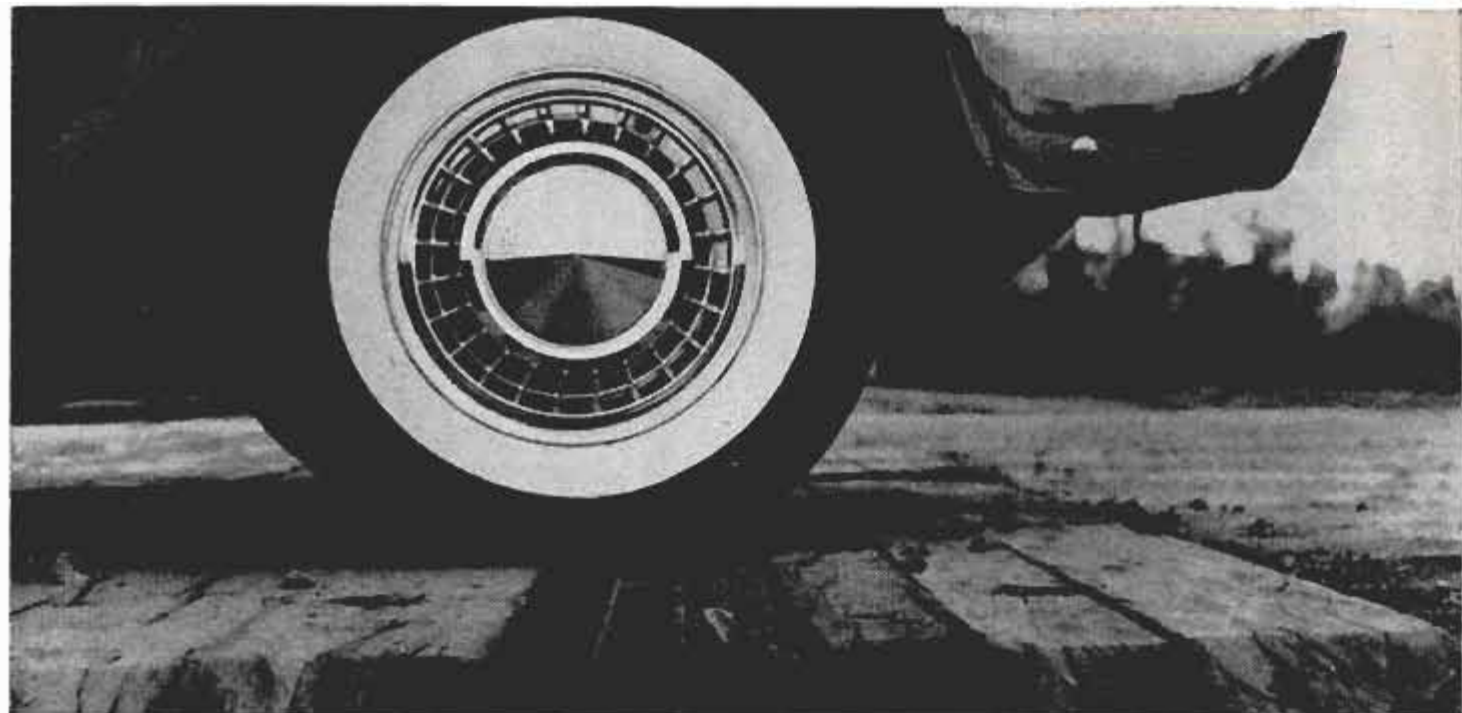
But, to strike a happier note, there has been a birth in the Ford family, too. The Edsel has been brought out for the world to see and, it is hoped, to buy. Thus far, the Edsel has been seen by many, bought by few. Perhaps this will change, but it is no secret that at the moment sales are disappointing. Should Mercury bring out its low-price Medalist again, there may be even more difficulty selling the Edsel.

Ford did unseat Chevrolet as the top car in sales for the model year and Plymouth did the same with Buick for third place. These are significant achievements.

There is significance in the way Buick and Oldsmobile were restyled for 1958. The 1958 Oldsmobile is a complete reversal of its customary clean, uncluttered character. Buick is even flashier than it used to be. Together these are the two most bedecked cars on the road. Such adornment is usually reserved for urgent situations.

But the move is apparently paying off in sales. According to Ward's Automotive Reports, General Motors boosted its sales from 44.5 percent of the industry for the first 10 months of 1957 to 53.7 percent in

(Continued to page 288)



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December (of course, much of this boost is credited to the all-new Chevrolet).

Once again, the public proves that it will buy flash when given the opportunity, despite the fact that it (the public) always says it wants economy and less chrome!

If this sounds mixed up after the earlier discussion of economy cars, it is only because the public is mixed up. This fact is what makes the experts in Detroit mixed up, too. But do not confuse economy with austerity—that perhaps, is where the confusion lies.

It is hard to assess Studebaker-Packard this year. About the kindest thing to be said is that this company will face tough sledding ahead.

That, then, is the way the industry looks to one observer as the year 1958 begins. It is not the most promising picture, but the industry will survive (at least the major part of it; there may be a minor casualty). Perhaps next year at this time, the new cars will again be longer, heavier and more powerful, but it appears less likely than in previous years. It is this reporter's guess that we're now going over the hump and from here on the tendency will be the other way.

In view of the slow sales of most 1958 cars, it is obvious that something is not being done right. The industry, up until now, has refused to admit it could be wrong about its theory that cars must always be bigger and more powerful. It is possible that 1958 will be the year for a major change of philosophy. The steadily increasing sales of foreign economy cars may be the convincing evidence the industry needs. This foreign car "fad," as Detroit likes to call it, refuses to die out.

Also of serious concern to the industry (perhaps of more concern even than the steadily increasing foreign-car sales) is the fear that Congress will pass some limiting laws on horsepower and speed potentials of new cars.

You may hear plenty of screaming if this comes up for debate. But it may be that this is just what the industry wants. It will permit them to change their course sharply without having to admit they have been wrong! ★ ★ ★

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This Year's Crop of Engines

(Continued from page 169)

and 300 horsepower, both having four-barrel carburetion. A detuned two-barrel version (240 horsepower) of the smaller engine (332) powers some other Ford V8 models. In addition, a slightly bored-out version of the larger (352) engine is used in the Edsel Ranger and Pacer. This version (4.05-inch bore) has a 361-cubic-inch displacement and 303 horsepower.

All three of these engines (really three versions of the same engine) are conventional in design, in keeping with Ford's reputation for conservative V8 engineering. Featured are fully machined combustion chambers, until recently confined to high-price cars because of high manufacturing costs.

Full machining accurately controls the volume of each chamber and, even more important, gives surfaces a smooth finish which resists the buildup of deposits. This problem of combustion-chamber deposits becomes very critical as compressions are raised.

Moderately high compression ratios (9.5, 10.2 and 10.5 to 1) are used on these three engines.

Also of interest here is a keystone-shaped intake manifold that eliminates the customary stamped upper cover over the tappet chamber. The manifold nestles in the vee formed by the cylinder banks and adds rigidity to the whole engine.

The second group of new Ford engines is much larger in displacement. It is used in Mercury, some Edsels and all Lincolns. There are three engines in this group also.

First, there is the 383-cubic-inch Mercury Monterey-Montclair engine; second, the 410-cubic-inch Edsel Corsair-Citation engine; third, the 430-cubic-inch Lincoln and Mercury Park Lane engine.

The same 4.3-inch bore is used in the largest and smallest models but with different strokes (3.7 inches and 3.3 inches). The middle-size engine is slightly underbored to 4.2 inches and has the longer 3.7-inch stroke. Thus, three engines are accomplished by juggling two bore diameters and two stroke lengths.

This second group of Ford engines features a cylindrical wedge-shaped combustion chamber entirely in the block. Ford engineered this by inclining the top faces of each cylinder bank 10 degrees from the usual perpendicular to the bore's center line. This provides a fully machined 10.5-to-1-ratio combustion chamber of an elliptical shape that permits advantageous location of valves and spark plugs.

(Continued to page 292)



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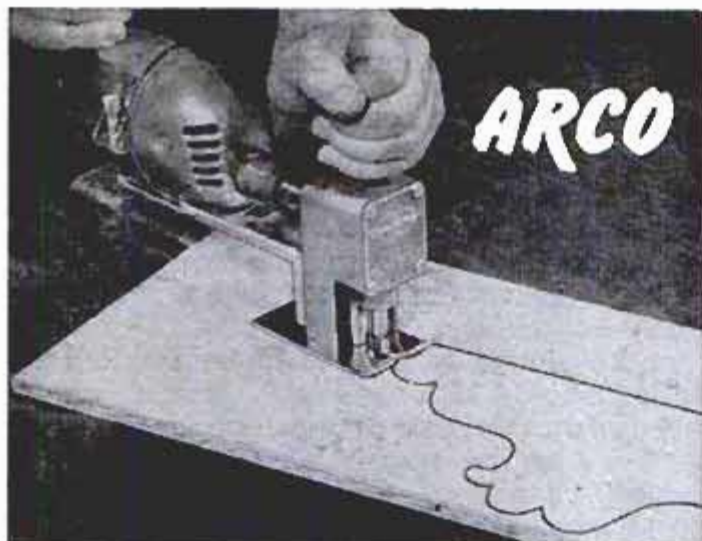
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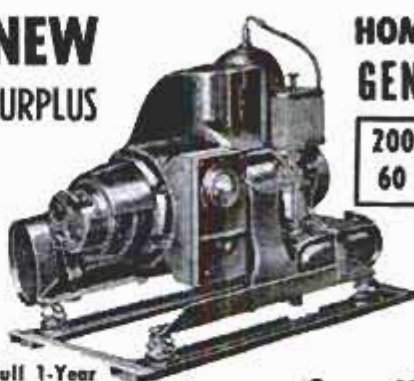
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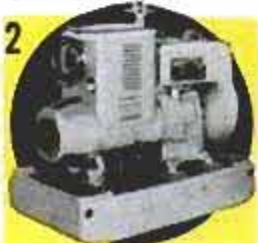
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The step-down dome of the piston determines the quench and squish area as well as establishing turbulence characteristics. The new intake manifold design, as explained above, is used here also.

CHRYSLER CORPORATION

Chrysler engineers have, in the past, produced some advanced V8-engine designs that matched the stylists' current Forward Look in daring and ingenuity. However, the 1958 Chrysler "B" engine marks a return to conventionality.

As mentioned earlier, Chrysler startled the industry in 1951 by mass-producing an unorthodox (by passenger-car standards at least) V8 engine with hemispherical combustion chambers, previously in widespread use only in race cars and aircraft. This design provides excellent volumetric efficiency, but requires a complex valve train with two-rocker-arm shafts for each bank. As a result, it is heavy and expensive.

In 1955 Chrysler engineers introduced a new design for its lower-price lines. This engine had a polyspherical head with a much simpler valve mechanism. Because it has a single rocker-arm shaft, this design is lighter and less expensive. But its performance (compared with the conventional wedge chamber) is not enough better to justify the added cost.

So with the new 1958 engines Chrysler makes the full circle, returning to conventional design and reasonable manufacturing costs.

Chrysler's new engine family has two displacements: 350 and 361 cubic inches.

The smaller size has a bore and stroke of 4.06 and 3.38 inches, the larger size has a 4.12 bore and the same 3.38-inch bore.

A rather bewildering array of carburetor, camshaft and compression-ratio options provides a wide range of rated power outputs.

Although conventional, the new Chrysler engine incorporates features found in the most advanced competitive power plants. It is compact, has no excess weight and is thoughtfully laid out for excellent service accessibility.

Its intake manifold, similar in concept to the Ford design, has a separate sheet-metal cover which acts as the intake-manifold gasket. This is a simple and inexpensive solution to a rather difficult problem of design.

The Bendix electronic fuel-injection system (introduced by American Motors in 1957) is available as an extra-cost option. This system uses electric impulses to open and close solenoid-actuated cylinders for metering fuel.

(Continued to page 294)

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GENERAL MOTORS

Except for Chevrolet, all General Motors divisions are standing pat in 1958 with their existing engines. There have been improvements and refinements, notably the Pontiac adaptation of in-block combustion chambers to their 1957 designs. However, except for Chevrolet, the basic GM engines remain unchanged.

But at Chevrolet the story is different. Here is a brand-new 348-cubic-inch engine bristling with new design features. With it, Chevy maintains its reputation for combining high performance with lightness and ruggedness in its engines. This new design outshines the 283-cubic-inch V8 of 1957 in every department.

Although displacement is increased sharply (348 compared to 283), the new V8 is about the same height, less than two inches longer and wider, and only a little over 100 pounds heavier than the smaller design.

The cast-iron block is conventional. However, the top faces of the block are cut at an angle of 16 degrees to provide a fully machined in-block combustion chamber similar to the one described in the Edsel-Mercury-Lincoln line. Chevrolet is the first low-price car to have this feature, which is certain to become universal.

The stamped rocker arms (pedestal-mounted) are continued. However, an exceptionally high rocker-arm ratio of 1.75 to 1 is used.

The new engine is available in a 250-horsepower version with a single 4-barrel carburetor or a 280-horsepower version with three 2-barrel carburetors.

There's lots of life left in the piston engine. It's hard to imagine another design getting more power for less money than the original, almost-primitive piston inside a cylinder—a piston that goes up and down to make wheels go around. ★ ★ ★

1958's NEW ENGINES

Ford's FET engine:

332 cubic inch—Ford Fairlane 500
352 cubic inch—optional on Fords
361 cubic inch—Edsel Ranger-Pacer

Ford's MEL engine:

383 cubic inch—Mercury Monterey-Montclair
410 cubic inch—Edsel Corsair-Citation
430 cubic inch—Lincoln and Mercury Park Lane

Chrysler's "B" engine:

350 cubic inch—optional on Plymouth and Dodge; standard on De Soto Firesweep
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Chevrolet's new engine:

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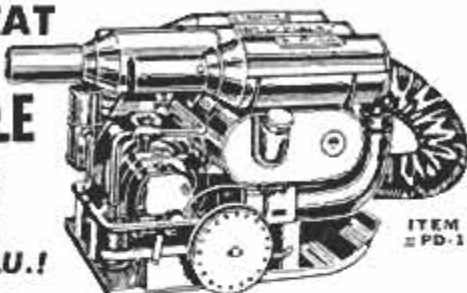
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A 1½-Car Family

(Continued from page 171)

initial cost is high (too high, the women say, being slightly more than \$1000).

The main reason for buying one of these cars rather than a lower-price old second-hand car would be the virtual absence of upkeep. There is no antifreeze to buy, only one spark plug to replace, no complicated parts to act up (the Heinkel doesn't even have a choke—you simply kick the gas pedal a few times to pump gas into the cold engine). Once the hurdles of initial cost and annual insurance are cleared, the car could be operated under the miscellaneous portion of an average food budget (probably for about 75 cents a week).

Serious Limitations

But, the women agree, there are serious limitations to the bubble cars.

The front-opening door is a clever solution to a tough engineering problem, but it is hardly a convenience. You have to lift yourself out with the strength of your arms. The Isetta has the better arrangement. Its steering column is jointed and it swings outward as the door is pushed open. The wheel becomes a huge door handle. The Heinkel wheel stays put and the driver has to slide around it to get out, pulling and pushing himself up with his arms. Heavy and older people are virtually prisoners in the cars until they learn how to exit. In no case, can you get in or out gracefully.

Inconvenient for Shopping

Another shortcoming is the location of the parcel-carrying space. In the Isetta particularly there is no place to put large sacks of groceries if more than one person is in the car. If you put several sacks of groceries on the parcel shelf behind the seat and then make a sudden stop, you are likely to end up with cans and bottles all over. The Heinkel does have space behind the seat so sacks can be put on the floor, but it is awkward to get at. It is apparent that when the cars were designed this grocery-toting activity was not considered.

If the housewife takes two or three children with her, the problem is magnified many times. One of the women who shops at the supermarket once a week was unable to pack all her groceries in either car when she had her three children along—obviously a serious limitation.

Driving the cars is something that takes a little time to master. Steering is extremely fast and there is no wasted wheel turning. You point the car where you want to go and it turns in a hurry. Shifting is

with the left hand and at first it was difficult but soon skill was acquired. Both cars require frequent shifting. The Heinkel was considerably easier to shift than the Isetta, principally because of the design of the shift quadrant.

No Complaints on Ride

Riding qualities are poor by big-car standards, but none of the women complained of being uncomfortable. For an around-town car, this was considered unimportant. Noise levels are high in both.

One serious drawback to the Heinkel is the fact that short persons can't reach the pedals without using a thick cushion behind them. Closing the door on the Heinkel was also difficult for the short driver.

All four women agreed that the car would be better as the car for their husbands to drive to work (all husbands had comparatively short drives to their places of business). Both the Heinkel and Isetta are an ideal solution for the businessman who drives a few miles a day to his office or store or for the commuter who drives to a station.

All agreed that the awkwardness of getting in and out with large packages, of lifting babies in and out, of getting themselves in and out several times during a short trip to several stores, more than offsets the advantages of the small size.

Fits in Garage

An important advantage mentioned by one tester is the fact that the tiny car can be tucked alongside the large family car in the average garage. In effect, this makes a two-car garage out of a 1½-car building.

In summary, the four feminine test drivers felt that the bubble cars did not answer all the problems. It did not do all the things they felt an "errand" car should. However, with a small amount of redesigning, especially in the ease of entry and exit and the location of luggage space, perhaps it could be made to do the job and, as they all admit, a super-economical car could be the answer to a housewife's prayer. ★ ★ ★

B-52 Tail Gunners Get TV Sky Scanners

Tail gunners in jet B-52s will be moved forward near the rest of the crew in the near future and sight their .50-caliber guns by closed-circuit television. Two cameras will continually scan the sky for enemy planes. Electronic controls already on the B-52s track the target and tell the gunner when to squeeze the trigger. The purpose of the TV scanners is to relocate the gunner in a "more favorable environment."

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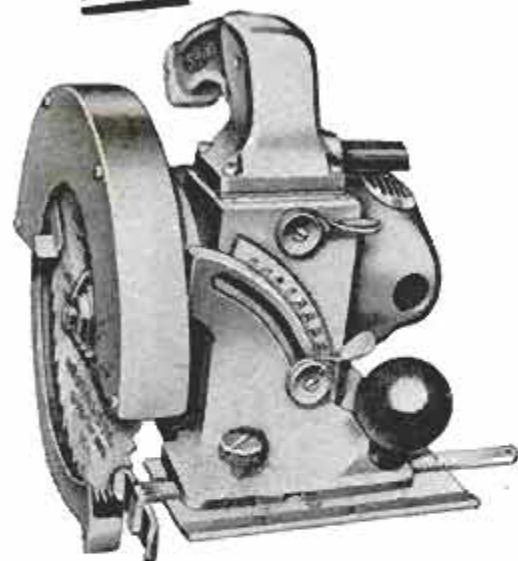
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Which Grade of Gas is Best?

(Continued from page 177)

should look something like one of those on page 177. The top pad shows typical test results on a late model, high-compression car. Its ignition can be advanced with premium gas far enough to improve acceleration on the test run about three miles per hour over regular gas. Many motorists may consider this worth the extra cost.

In such a car, premium might give more miles per gallon, but probably fewer miles per dollar. Premium will be more expensive to use, but will give better performance—enough better to warrant the cost.

With its ignition $\frac{1}{8}$ -inch advanced, this car develops maximum acceleration and runs on premium gas without knocking. There would be absolutely no benefit in using any higher octane number, such as in the new superpremium fuels. You would be wasting money because all the super fuel would do is allow added spark advance which, the table shows, will not improve performance.

The lower pad shows results such as might be obtained from a low-compression engine. Here, obviously, buying premium gasoline would be throwing money away.

Running on regular gasoline with the spark as it was originally, the car develops maximum acceleration and probably gives maximum gasoline mileage. If the owner bought premium or superpremium gas and advanced the spark as far as possible, he would actually lose power and acceleration as well as money.

Your individual tests will tell you what grade of gasoline you need and how timing should be set.

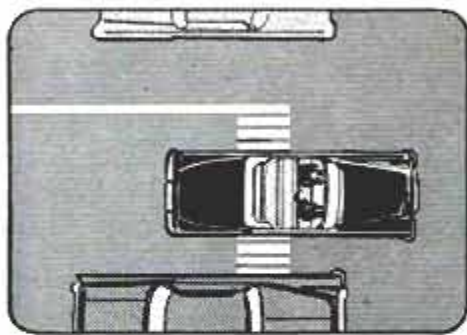
However, when you get a new set of distributor points, the setting may have to be changed. But with some advance planning you won't have to rerun the tests. After you complete the tests outlined above and set the timing as you want it for the gas you want to use, have a mechanic read the marks on the crankshaft pulley at the front of the engine with a stroboscopic timing light. Write down this timing setting as a permanent record. Then whenever you have new points installed, tell the mechanic to set the timing at these same marks. (Of course, when your car gets older, you may have to move up a grade or retard the spark as carbon accumulates.)

If you don't have a permanent record of the setting, mechanics will reset the timing the way the car manufacturer recommends without bothering to check your car by a test. This may be quicker, but it is not likely to produce the best timing for you, your car or your pocketbook. ★ ★ ★

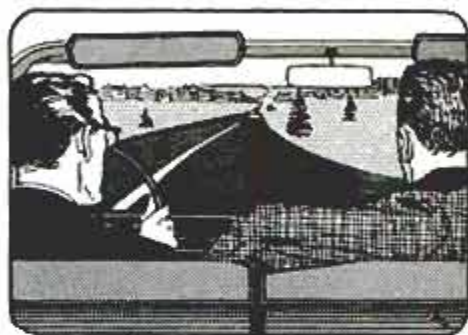
"How to handle your car to get better gas mileage"



"Save gas right from the start. Depress accelerator halfway before starting. Let your engine idle at least 30 seconds before moving. Stay under 30 mph until engine warms up."



"Don't race away from stops. Accelerating hard in low gears wastes gas, and it's not worth the wear on your engine. Take it from me, you'll get there faster by taking it easy."



"A pro always drives with a steady foot. Uneven acceleration—slowing, then speeding up—burns far more fuel than cruising at a steady pace. And it's far safer, more relaxing."



"Keep well back of the car ahead. You can maintain steady, thrifty speeds, avoid sudden stops and gas-consuming starts. And you'll avoid situations that result in accidents."



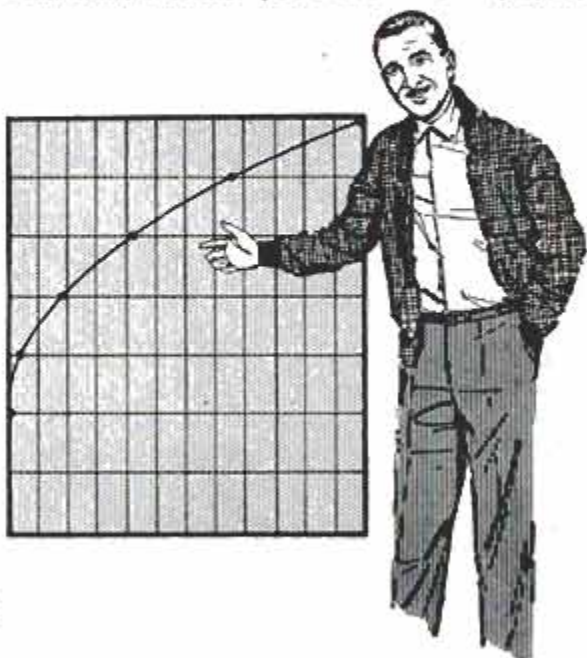
"Take a tip from a pro. Keep your car at peak efficiency. If you drive in traffic, it's a good idea to have your carburetor and other vital engine parts checked every 8,000 miles or so."



"Remember, your carburetor is the heart of your performance. Periodic checks and adjustments by a factory-trained mechanic can save you money in improved gas mileage."

Better gas mileage is usually in your hands. Check your own driving habits. Then, have a Rochester Carburetor specialist diagnose your engine for peak performance. He's factory-trained in the precision maintenance of your carburetor. And he'll help you get top efficiency . . . and extra miles from every gallon of gas. *Rochester Products Division of General Motors, Rochester, New York.*

Maurice Abel top professional driver, points out how your gas consumption goes up sharply with every increase you make in driving speed.

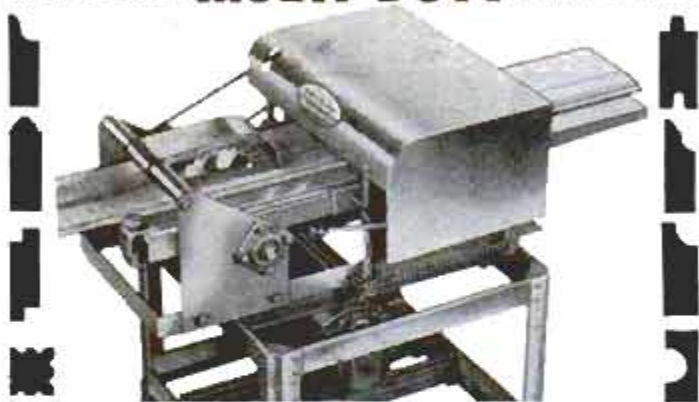


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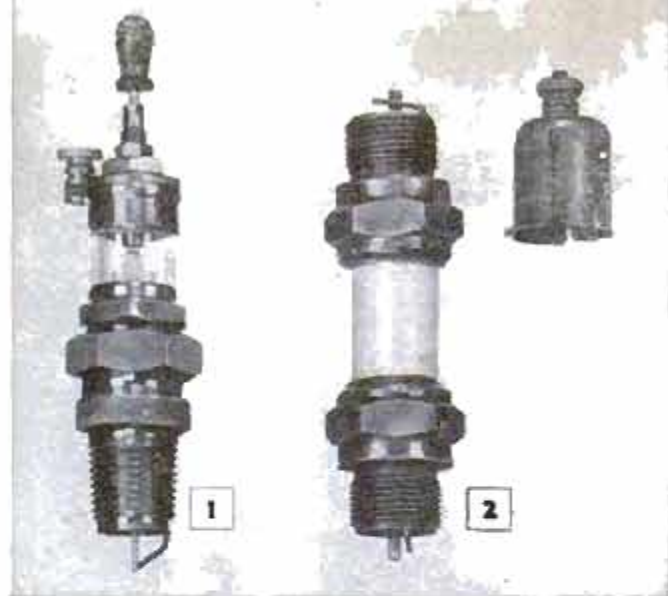
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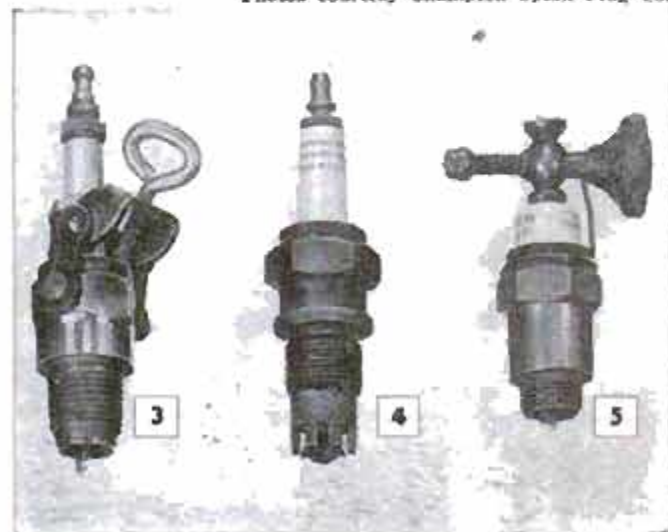
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Evolution of Spark Plug Features Fans and Windows

Ideas for better spark plugs have fired the imagination of inventors since the days of the first horseless carriages. Literally thousands of versions of the spark plug have resulted, a few of which were real "Rube Goldbergs." One plug, produced before World War I, Fig. 1, had an auxiliary gap which could be opened by an insulated handle at the top. It also had a window so you could see whether the jump gap was open or closed. Another bargain of its day, Fig. 2, was a plug which could be turned upside down if one end failed. For early do-it-yourself motorists, a plug, Fig. 3, was built with a device to unfasten the inner-core assembly if it fouled. Another idea, Fig. 4, was a fan-flame design with an electrode that rotated like a propeller. An invention, Fig. 5, for self-priming plugs of 40 years ago ended the flame problem for owners who forgot to close the priming valves before spinning the crank. The plug automatically shorted if the valve was open.

Photos courtesy Champion Spark Plug Co.



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ADJUSTABLE QUADRANGLE Replaces many triangles. Full quadrant 0° to 90°, calibrated to every 30 min. of arc, thus a reading or setting to 15 min. is easily obtained. Set arm to any degree of triangle. Roof Pitch Scale, Percentage Slope Scale, Sine Scale. Every edge a drawing edge. NEW. \$7.50 ppd.

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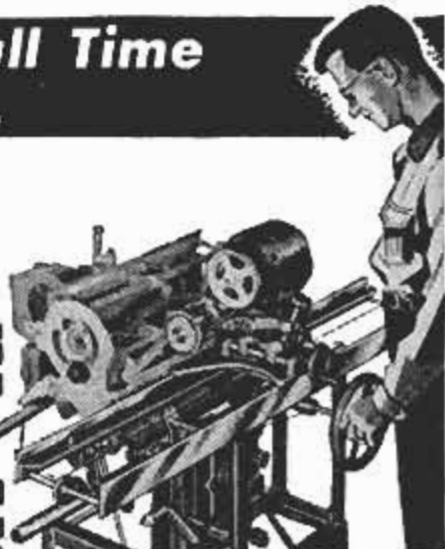
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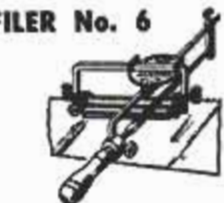
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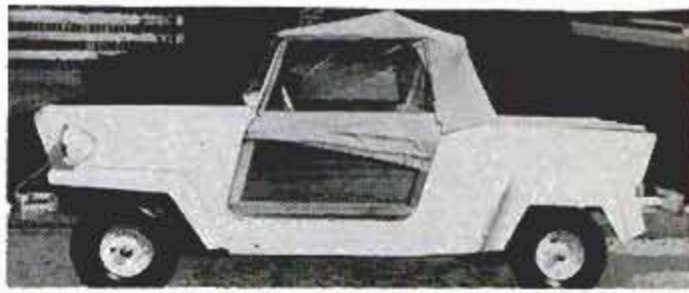
Air or Oil	Bore	Stroke	Shaft	D. Action	Price
#11	1 1/4"	6"	5/8"		\$7.50
#512	2 1/8"	4"	3/4"		\$8.50
#24	3 1/8"	2 3/4"	1 1/4"		\$32.50
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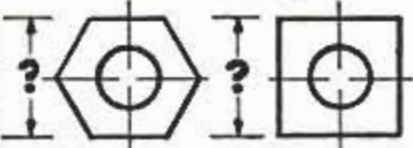
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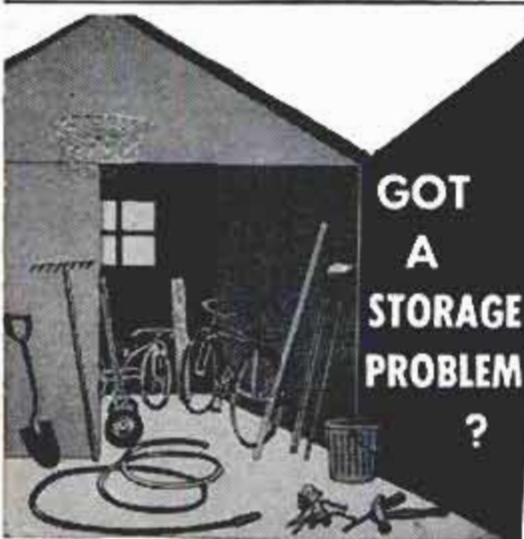
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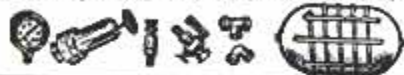
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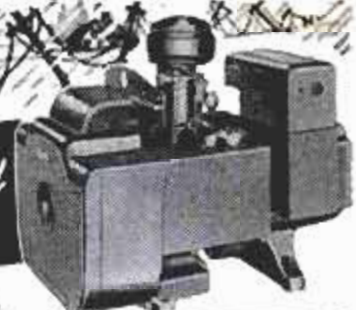
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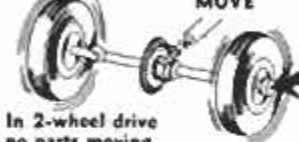
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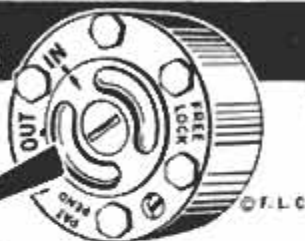
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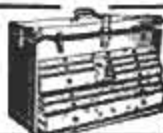
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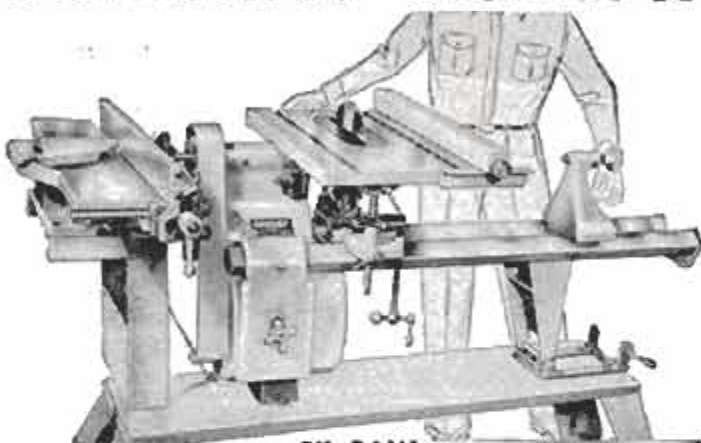


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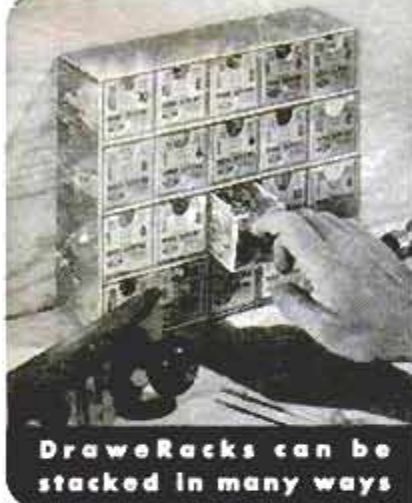


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The all-purpose Plierench comes equipped with Universal gear-jaw. Tool made of chrome molly forged steel in gun metal finish. Form fit handle. Adjustable from 0" - 1 1/2". Thousand pound pressure grip for bench-vice jobs on the spot. For mechanics, home handymen, plumbers, electricians, farmers. Pipe gear-jaw or Wire gear-jaw extra at \$1.50 each. Carrier pouch free with purchase of Plierench and extra jaws. F.O.B. Chicago.

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8 1/2" 20 oz. (with Universal jaw) \$8.50



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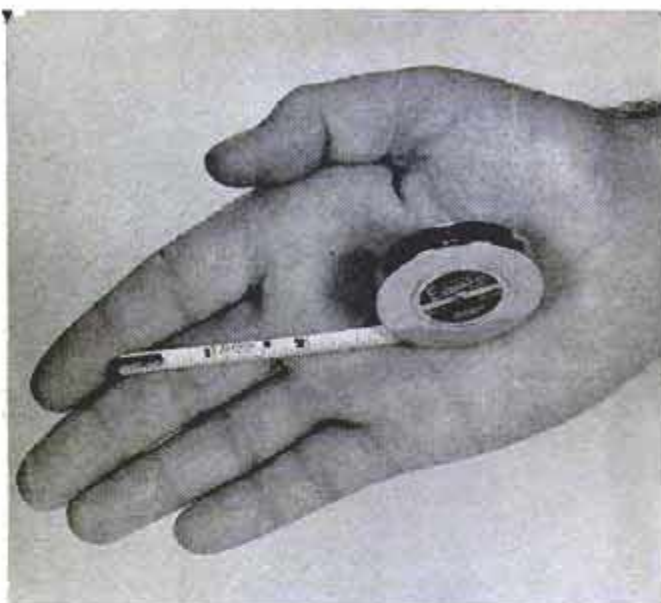
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COMPARES TO
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UP TO \$49.50 **1998** Complete with
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NEW A rugged, professional type, adjustable saw. Will cut any angle from 0 to 45°. Has an adjustable (0 to 6") rip fence. Safety-trigger switch on handle. Full 1/2 HP Universal AC-DC, 110-120 Volt, 60 cycle motor. Weighs only 6 1/2 lbs.

115 VOLT, 60 CYCLE SURPLUS AIR COMPRESSOR



A self-contained motor-compressor. Originally designed for Navy use. Equipped with filter for moisture-free air supply. Ideal for air gun, inflating, spraying, etc. Delivers up to 35 PSI. Motor operates on 115V, 60 cycle AC current and is rated at 1/10 HP. Turns at 1725 RPM.

Complete with built-in pressure gauge and air filter. A Surplus Bargain . . . **NOW 24.95**

AIR STORAGE TANK - Ideal for use with above compressor. Has 280 cu. in. cap. Size 6" x 14-1/2". Tested to 400 PSI. 1/4" ports. **2.95**



2 1/2x - 4x or 6x RIFLESCOPES



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INCLUDING MOUNT
2 1/2x - Overall lgth. 9 3/4"
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Choice of 3 different powers **9.95** WITH
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COMPARE THESE QUALITY SCOPE FEATURES:

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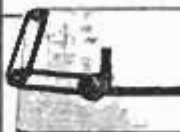
SIDE or TOP MOUNTS available with scope to fit most rifles. When ordering specify type mount, gun model number and brand.

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5.95
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25 POWER x 30 MM SCOPE & TRIPOD

Nowhere but at PALLEY'S can you find a buy like this! Here's a scope, complete with a sturdy metal tripod, that you can have a lot of fun with. Use it to spot hits on the target, for stargazing, interesting views at the beach, etc. Made of aluminum and chrome plated brass. Field: 62 ft. at 1000 yds.



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A professional type, scientifically engineered drawing machine. Ideal for Office, Factory, Workshop, Classroom, Artist, Home, etc. Small enough to FIT IN A BRIEFCASE. Made of black anodized aluminum with white markings. With Coos Bay Hardboard 11" x 17" drawing board. Weight 2-1/2 lbs.

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Designed for use in series.
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4 inch IMPORTED SLIDE RULE
Non-warping bamboo with scales on a
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Contains a wide variety of brand new mounted stones, cutters, felt polishing wheels, rotary files, grinding wheels, mandrels, drum sanders, wire brushes, bristle brushes, rubber wheels, sanding bands and many more accessories too numerous to mention. COMPLETE IN A STURDY WOODEN BOX.

12 MOUNTED WHEELS and points on 1/4" Shank **\$2.95**
36 for **\$7.50 p.p.**
For grinding on plastic, wood, soft & hard metals. Regular Value **\$8.40**. 18 Mounted points on 3/32" shank **\$2.50**; 12 mtd. wheels on 1/4" shank **\$3.60**.

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Assorted sizes cutters on 1/4" or 3/32" shank. Will fit all hand grinders. Ideal for cutting wood, metal, or plastic. **\$13.50 value.**

FLEXIBLE SHAFT—ONLY \$6.50 Post-paid

Fits all electric drills & hand power tools. 35 3/4" long. Oilite bearings. Core of specially wound, high carbon steel wire in flexible steel casing. Will accommodate tool shafts up to 1/4" dia. For lathes, electric drills, etc.

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Fits in the palm of the hand and has an air-cooled motor that runs at 20,000 rpm AC or DC at 110 volts. Comes complete with both 3/32" and 1/4" inch Collets. **\$11.50 P.P. cord and shoe.**

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With 2 interchangeable collets, opening from 3/32" to 1/4" on 1/4" mandrel. **\$1.50 P.P.** Price each only.

KEEP YOUR WORKSHOP TOOLS SAFE AND ORDERLY



This 7-drawer machinist's chest has a place for every tool. Extra durable heavy gauge steel. Felt lined drawers protect delicate edges... operate easily. Size: 8 1/2" x 13 1/2" x 20 1/4". \$27.95 at leading hardware stores. Slightly higher west. Other home workshop models from \$1.25 up.

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GREAT NECK SAW MFRS., Inc.
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Loosens Rusted Bolts, nuts, screws, "frozen" parts!
LIQUID WRENCH

The super-penetrating rust solvent that quickly loosens rust and corrosion.
AT HARDWARE STORES, GARAGES SERVICE STATIONS, EVERYWHERE
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BE YOUR OWN BOSS!
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"I service saws for home owners and carpenters in my community, and all my work is guaranteed. Circular saws range from 90c for 8" blades, on up to \$3.50 each for the larger sizes. I never made a better investment."
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FREE PLAN tells how to boost your income this easy way. Sharpening only 3 saws a day can clear over \$1000 a year net profit. Send coupon today! No obligation. No salesman will call.



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Prepares the toughest soils in one operation. All-purpose tiller-tractor tills to 12" deep — 12" to 40" wide. 3 models; 7 rotor styles including mulchers. 40 attachments include all tractor tools, mowers, snowplow. Tough chain-gear drive. Send for details.



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Sounds like a fairy tale—but it's TRUE. It happened to an advertiser in Popular Mechanics Classified Section. Write for this amazing story NOW. It's free. **F. W. JOHNSON, 202-CM E. Ontario St., Chicago 11, Ill.**

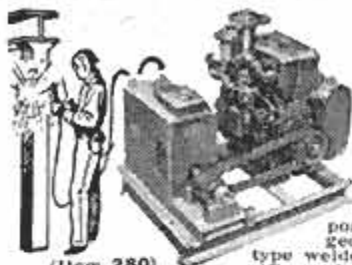
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5 Tools in 1 — 1 ton grip gentle release. One hand adjustment.
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Press—pull it's open. Push—it's closed. Ratchet action adjustment.
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Multiplies grip 10 times.
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Easy To Use

(Item 280) Now a portable rugged industrial type welder with terrific performance, yet at a price hundreds of dollars less than you'd expect. Senior model made for years of trouble-free, continuous service. High capacity DC welding unit enables you to tackle any job with confidence—easily welds anything up to 2" plate using from 1/16" to 1/4" rods. Built-in stabilizer and cooling system makes arc easy to strike and hold. Dual control rheostat provides low heat soldering, brazing and welding from 30 to 300 amps. Complete with instructions, guarantee and triple V-belt or flat pulley. Easy to hook up and easy to operate.

WELDER ONLY — DUAL CONTROL MODEL. Same as above, but drive with your tractor, jeep or gas engine of 14 HP or more. (Item 38a.) Wt. 110 lbs. \$450 value **\$119.50**

WELDER ONLY—INDUSTRIAL MODEL same as above but with ceramic rotary type rheostat providing 74 different heat settings for all types of welding (Item 38b) \$500.00 value **\$139.50**

COMPLETE POWER MASTER (Illustrated above) powered by a 16 hp., air cooled Wisconsin engine. Wt. 480 lbs. (Item 280) Compare with welder costing \$1200. Factory Special **\$449.50**

WELDING KIT. Two 10 ft. leads, welding helmet, electrode holder, ground clamp. Sold only with welder at **\$10.50**

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Now, a super efficient portable steam generator that produces live steam at 100 lbs. pressure in 60 seconds from a cold start! Produces large volume of high pressure steam on 2 pints of fuel oil. Instantly cleans sticky grease, dirt, rust, old paint, etc. off implements and road machinery. Pays for itself in a few weeks. Sterilizes soil. Sterilizes as it cleans—milk equipment, etc. Fully automatic—oil fired with new, built-in lifetime bronze water circulating pump. Draws water from faucet or bucket, simple and safe—anyone can use. Built-in safety valve. Complete with 12 ft. of hi-pressure steam hose and new triple efficiency steam gun that automatically mixes in soap solution if desired. Wt. 250 lbs. Item 463. Special factory price **\$349.50**



MASTER AIR COMPRESSOR

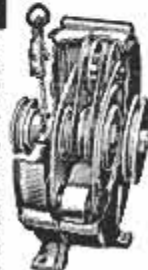
COMPARE! This is the only compressor built with a NO RUST stainless steel tank. Safe up to 500 lbs. (Item 209) High pressure type, 1 1/2 C.F.M. Large volume of air for heavy duty service. For paint spraying, inflating truck & auto tires, greasing, sand blasting, etc. Piston type 2" bore compressor with built-in air filter. Master built with high strength alloys and precision bearings. Tank, 12"x24", 2100 cu. in. cap. Equipped with automatic switch that starts and stops motor to maintain desired pressure (up to 150 lbs.) and check valve, safety valve, gauge, shut-off valve, 20 ft. air hose and tire chuck. Beautifully balanced on ball bearing wheels and rubber tires. Don't take chances with used or surplus equipment. Our compressors are factory new and are guaranteed SAFE. 1/2 H.P. heavy duty model, rep. ind. motor and unloader switch. Item 209A, low factory price **\$129.50**

1 1/2 H.P. model, Cap. 3 c.f.m.—85 psi, item 209 **\$109.50**



Variable Speed Selector

Heavy duty, made by B. F. GOODRICH for industrial use. Provides instant speed changes for any drive. For machine tools, dryers, printing, conveyors, production lines, hoists—any operation requiring variable speed. Employs reliable "trouble free" planetary system. No hydraulic power losses. Infinite range, smooth operation, easy installation. 3 sizes: 1/2-1 hp. 36 lbs.; 1-2 hp. wt. 55 lbs.; 2-3 hp. wt. 105 lbs.; Reg. list \$228, \$252 and \$352. Our prices **\$79.50, \$89.50 and \$114.50**



SAVE middleman profits get MASTER MECHANIC'S direct factory prices

700 WATTS PUSH BUTTON START
115 v. 60 cye. AC Powered by a rugged 2.2 HP easy starting Briggs engine. No wiring necessary; just plug in and operate. Plenty of current for any oil burner, freezer, brooder, emergency lights, etc. which require up to 700 watts. Ideal for television and radios. Complete with Voltmeter and built-in winding to charge 6 v. auto batteries. (Item 24.) Wt. 75 lbs. Easily fits in car trunk. Be prepared if storm knocks out power lines. Reg. \$275 value **\$143.50**

1200 Watt Plant (Item 45) same as item 24 but larger generator and engine with 50% greater output **\$199.50**

LIGHTWEIGHT WATER COOLED DIESEL GENERATOR PLANT
Never before available! Now offered exclusively by Master Mechanic. A low priced, lightweight, continuous duty Diesel Generator set. Powered by a super rugged, exceptionally smooth running, one cylinder Diesel engine. Operates at conservative 1750 r.p.m. and delivers full 1750-2000 watts of power. Operates on low cost fuel oil. Wt. only 240 lbs. representing a triumph of Diesel Engineering. Complete with fuel filter, oil pressure gauge, control box with duplex receptacle and voltmeter. (Item 830) Special factory price **\$399.50**

1500 WATT PLANT
115v. 60 cye. AC Push Button Start. Powered by a 3 1/2 HP. Clinton engine. Combines big output with easy portability. Provides emergency power for operating any oil burner, sump pump, freezer, television, lights, communications systems, etc. which require up to 1500 watts. (Item 22.) Wt. 110 lbs. Reg. \$475 value. Factory price **\$239.50**

1750 Watt Plant Powered by 4.5 HP Briggs engine. Electric starting & battery charging built-in. Factory price **\$279.50**

2500 WATT PLANT—Push Button Start (Item 21) 110/120 v. 60 cye. A.C. A rugged powerful plant. Reg. \$645. Spec. **\$329.50**

3500 Watt Plant Push Button Start (Item 23) 115 v. 60 cye. AC. Similar to above, but larger and 33% more capacity. Wt. 270 lbs. Reg. \$760. Factory Price **\$379.50**

DUAL VOLTAGE 110/220 for Item 21 or 23 **\$30 additional.**

BATTERY CHARGING GENERATOR Push Button Start

A husky, 750 watt plant (designed for battery charging only) that will charge 6 or 12 volt batteries in just minutes! When mounted with two 6 volt batteries it provides a terrific cold weather motor starting unit, as well as a fast charger! Charges all batteries anywhere—no in-line current needed. Ideal for service stations, garages and farms. Comes complete with ammeter and cutout. (Item 821) Wt. 120 lbs. Regularly \$295. Our special, only **\$119.50**

HEATING & VENTILATING FAN

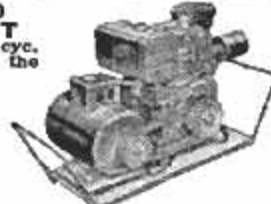
(Item 10) Easily installed in furnace pipes. Forces even heat to all rooms. Over range removes kitchen smoke and odors. Powerful, continuous duty motor, 110-120v. AC. Mount in wall or ceiling to ventilate any area. Quiet, super-efficient fan moves huge volume of air. (400 to 600 CFM.)
8" Pipe, wt. 5 lb. **\$6.85**
9" Pipe, wt. 6 lb. **\$7.85**
10" Pipe, wt. 7 lb. **\$8.85**
12" Pipe, wt. 8 lb. **\$9.85**

GIANT METAL SHEARS

"PEXTO"
Nine inch cutting blade made of special high carbon alloy steel, perfectly aligned and ground. Easily cuts steel plate up to 12 gauge or 1/4" thick. Overall length 40". Wt. 23 lbs. (Item 156) Regular **\$14.95**
\$9.50. While they last.

PORTABLE LIGHT PLANTS

GIANT 2500 WATT PLANT
110-120 v. 60 cye. AC. Absolutely the best made — exclusive dynamicaly balanced armature; heavy windings develop up to 5000 watt overload for motor starting. Skid mounted — portable. Powered by an easy starting Briggs or Wisconsin 6 HP engine—complete with all accessories; engine easily disconnected for other uses. Big outlet box, voltmeter, no wiring necessary. Ample current for all purposes. Factory warranty. (Item 31) Wt. 210 lb. Reg. price \$585. Special at **\$299.50**



Same plant with electric self starter (Item 31a) **\$359.50**

Generator only and control box **\$169.50**

DUAL VOLTAGE 110-220 available on any of above models for \$28.00 additional.

Double Acting Hydraulic Cylinder



A powerful cylinder mfr'd. by Massey Harris which develops both a pushing and a pulling action. Will push 8,100 lbs., with a 1000 PSI pump pressure. Cylinder is 3 3/4" O.D. with 6 1/2" stroke—standard heavy duty clevises on both ends. Has standard 1/2" pipe thread openings. Can be used for tilting buckets or blades, raising or lowering implements, hydraulic presses, etc. Can also be used as an air cylinder. (Item 802) Wt. 17 lbs. Reg. \$68 value. Special **\$14.95**

OTHER DOUBLE ACTING CYLINDERS
8" stroke — 3" bore **\$34.00**
10" stroke — 3" bore **34.80**
16" stroke — 3" bore **43.00**
24" stroke — 3" bore **47.50**

We have all sizes of cylinders available.

HYDRAULIC CONTROL VALVE — 4 way open center valve with built-in adjustable relief. Controls 1 double, or 2 single acting cylinders. Equalizing feature permits easy control even under heavy loads. 3/4" pipe thread on inlet & outlet, 1/2" on cylinder outlets. Easily mounted, finger tip control. Wt. 18 lbs. (Item 822) **\$21.95**



HYDRAULIC KIT
Complete Hydraulic Kit consists of hydraulic hand pump with built-in 2 gal. reservoir and item 802 hydraulic cylinder described above. Pump has a built in relief valve and is rated at 20 tons. Kit is ideal for presses, jacks, snowblows, etc. Pump is 28" long—6" diam. with 1/2" ports. A terrific value! (Item 836), Wt. 50 lbs. **\$39.50**

Pump only (Item 836a) only **\$23.50**

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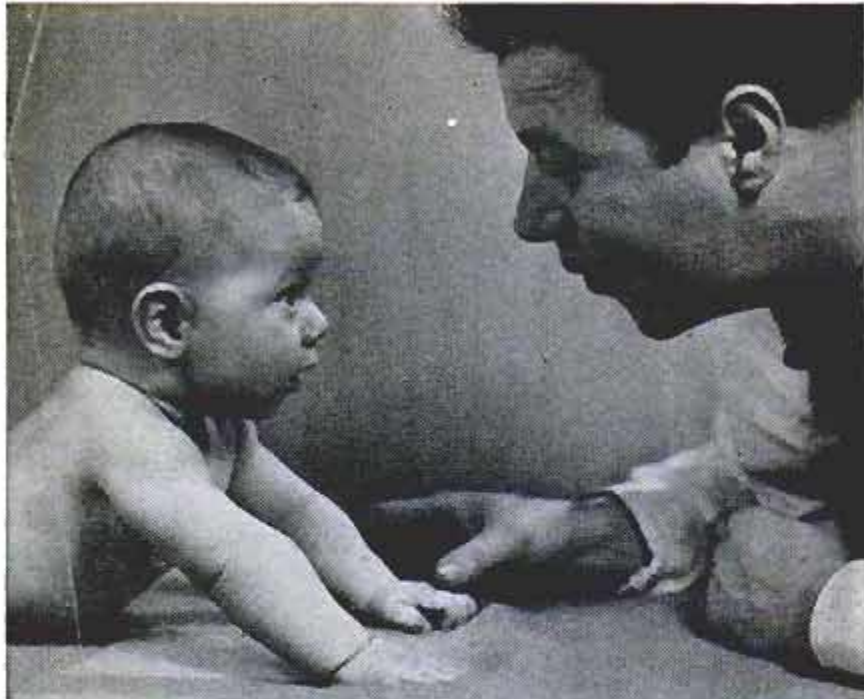
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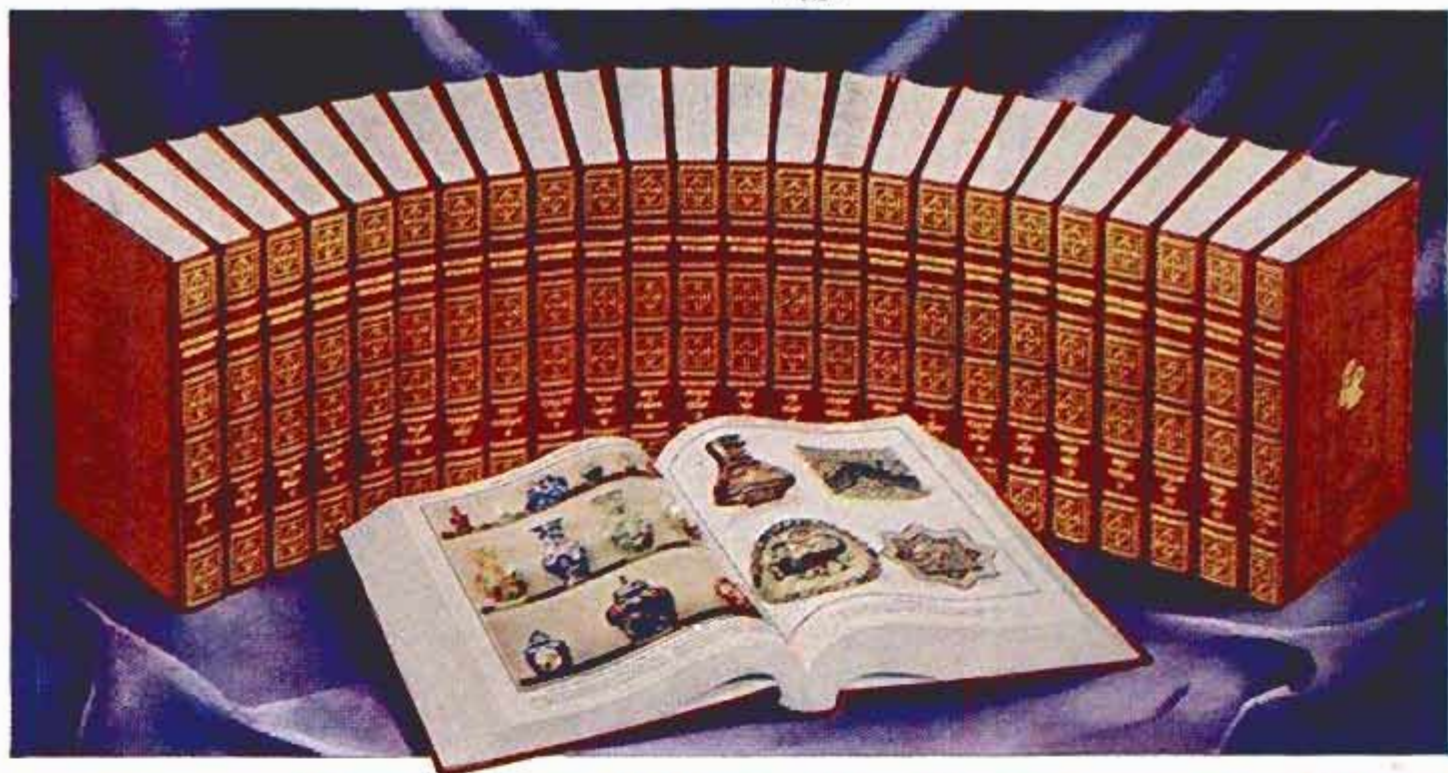
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