

Popular Mechanics

PM'S DOCKSIDE GUIDE TO IMPORTED CARS

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Planes for pilots of any age

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New VW Dasher

Road test:
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- How to sharpen skates
- How to silence plumbing noise
- How to work with copper tubing

JUST OUT!
The Flying Needle —
hot new kit-built
sport plane

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Come to Marlboro Country.



18 mg. "tar," 1.2 mg. nicotine av. per cigarette, FTC Report Sept. '73

Warning: The Surgeon General Has Determined That Cigarette Smoking Is Dangerous to Your Health.

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THE TEST RESULTS ARE IN...



The Firestone Steel Radial 500 can give you up to 30 extra miles* from every tankful of gas you buy.

*Based on a car with a fuel capacity of 20 gallons and currently averaging 15 miles per gallon. Naturally, your savings will depend on how much stop and start driving you do.

You've probably read that radial tires roll more easily than other types of tires, and since the Firestone Steel Radial 500 tires are now available across the country and are original equipment on many new cars, we thought you'd like to know how much more gas mileage they might give you now that fuel is in short supply.

For months the Firestone Engineering and Development Division has been conducting tests, both in the laboratory and on the test track, so we could tell you what to expect from these tires. And now, the results are in.

Laboratory Rolling Resistance Test:

In laboratory tests conducted in the Firestone Indoor Test Center, our engineers studied the differences in rolling resistance — that's the amount of energy and power needed to move one tire—between our original equipment Steel Radial 500 and our original equipment belted bias tire. When their tests showed an amazing 27 percent difference—that's 27 percent less energy needed to move the Steel Radial 500 than the belted bias tire—they immediately set up a series of tests at our outdoor proving ground at Ft. Stockton, Texas, to determine what kind of fuel savings our Steel Radial 500 might give you in actual on-the-road conditions at different speeds.

Fuel Economy Test:

These tests were run on a standard four-door U.S.A. sedan. All fuel, speeds, and mileage were scientifically measured in a series of twenty-four carefully controlled and measured runs. Two complete tests were made, with two runs in each test.

Test No. 1†	30 MPH	50 MPH	70 MPH
Firestone Belted Bias Tire	18.12 mpg	18.62 mpg	14.90 mpg
Firestone Steel Radial 500	19.87 mpg	20.46 mpg	16.15 mpg
Percent improvement in Fuel Economy of Steel Radial 500	10%	10%	8%

†All figures are an average of two runs each, at speeds of 30, 50, and 70 miles per hour.

Test No. 2†	30 MPH	50 MPH	70 MPH
Firestone Belted Bias Tire	19.07 mpg	19.23 mpg	14.86 mpg
Firestone Steel Radial 500	20.72 mpg	20.60 mpg	15.86 mpg
Percent improvement in Fuel Economy of Steel Radial 500	9%	7%	7%

†All figures are an average of two runs each, at speeds of 30, 50, and 70 miles per hour.

What all this means to you:

You may have been considering radial tires to get their better steering, road holding, and a 40,000 mile guarantee. Now the Firestone Steel Radial 500 gives you a still stronger reason, for as gas becomes both harder to get and more expensive, the more miles per gallon we can give you will mean both dollars saved and extra gasoline you can use for little errands or long trips.

And think about this: even if radial tires only gave people fuel savings of 2% instead of 7% to 10%, the effect of putting all the nation's hundred million cars on radial tires would result in a tremendous savings of fuel each year, a significant factor with our current fuel shortage.

So think hard about radial tires. And ask your Firestone Dealer or Store for a free copy of the fuel savings test data on the tire you now know can put some extra trips into every tankful you buy...

The 40,000 mile Steel Radial 500 another people tire from

Firestone
This One



L7CN-WHX-8NHB

OUR 40,000 MILE GUARANTEE

The Steel Radial 500 by Firestone is guaranteed to give you 40,000 miles of treadwear in normal passenger use on the same car. If it doesn't, take your guarantee to any Firestone Store or participating Dealer. He'll replace the tire with a new one and give you credit for the mileage not received based on the then current adjustment price (approximate national average selling price) plus Federal Excise Tax. A small service charge may be added.

Sub-compact. Full size.

Which demands more from its motor oil?

At today's expressway speeds, little car engines strain to keep up with the big guys. That raises the oil temperature. Today's big cars are usually loaded with power options that also raise the oil temperature. And heat is the main reason oil deteriorates. Today you have to name your oil. By type. By S.A.E. grade. By brand.



Ten years ago, you rarely had to think about oil temperatures. Today you do. Thinking about it may help prevent an unnecessary repair bill.

It doesn't matter what size car you're driving. Even with a modest number of power extras, your new little car can generate some severe crankcase temperatures. Emission controls are one reason. Also the strain of high speeds on little engines, especially on a hill. The harder an engine works, the hotter the oil gets.

Full-size cars run hotter, too. They're loaded with heat-raising options. Some examples: Automatic transmission ups oil temperatures by 10-15° F. Air conditioning adds about 10° F. Power steering, about 10° F. Plus, in new cars, a 15-20° F. boost from emissions systems. And if you're hauling a trailer, change the oil even more often.

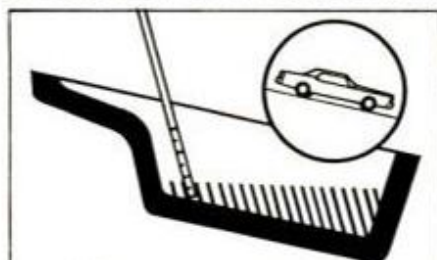
What all this means is that your engine oil temperature may be running close to or over 300° F., compared to about 180° F. 10 years ago.

In short, heat is now an oil's worst enemy. So what should you do?

First, read your owner's manual. And change oil just as

frequently as it says to. Also note the cautions about severe operating conditions such as dusty areas and short trips in extreme cold.

Second, have your oil level checked more often. Every time you fill up with gas, in fact. Some oil burn-off is normal—but the amount



When you check and add oil yourself:

1. Choose a level spot—not a sloping driveway.
2. Turn the engine off. Wait a few minutes.
3. Fill to the full dipstick mark, but not beyond.

varies from car to car, even when they're the same size and the same year. And keeping the crankcase full helps keep the oil cool.

Quaker State your car to keep it running young.

Third, watch your oil warning light. At start-up, it flickers on for a moment or so, until the oil flow is normal throughout the engine. If the light stays on, switch your ignition off immediately and get help. If the light goes on when you're driving, pull over as soon as it's safe. Maybe it's just your oil that's low. Or there may be a more serious problem. Answer: Wait for a professional to get you going again.

Fourth, be sure to use a premium oil. An oil that's fortified to handle this severe heat. For your peace of mind, ask for Quaker State Motor Oil. Quaker State is refined only from 100% Pure Pennsylvania Grade Crude Oil, the world's choicest. And Quaker State is fortified with a blend of additives, scientifically selected to retard oxidation, clean and disperse harmful deposits and to neutralize harmful acids.

Just ask for Quaker State Motor Oil by name. For your peace of mind.



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It's a durable saw, too. And reliable. With a sturdy, extra-wide wraparound steel shoe, to maintain balance and keep your cuts true and level. (The shoe tilts to 45° for bevel and compound-mitre cuts.)

It's also a comfortable saw. Because of its balanced handle placement and lightweight construc-

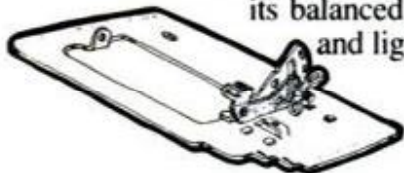


tion, it moves almost effortlessly through the work. In fact, it cuts through 2" stock at any angle, with ease.

The Saw Horse comes with a 7¼" combination blade.

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INTERNATIONAL EDITIONS

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ON THE COVER: VW's new Dasher—"the future shape for the family car"—arrives at an East Coast port.
Photo: Fred L. Wolff

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Subaru^{Front Drive}'74

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*U.S. Labor Department

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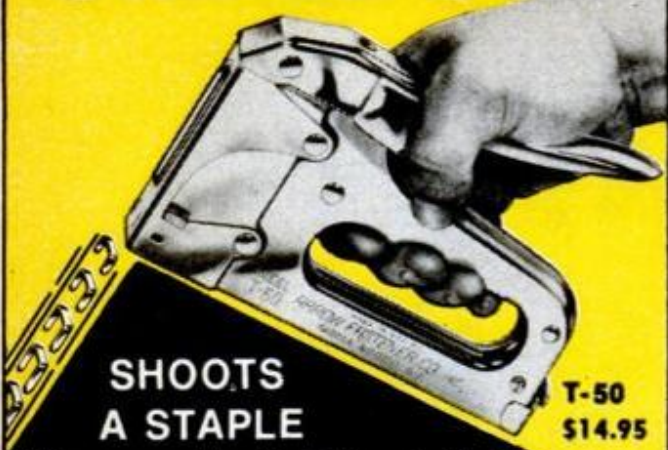
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LETTERS

TO THE EDITOR

It's an elk . . . it's a moose

In December you show a picture of what you refer to as elk (*Science Worldwide*, page 55). Are you sure those are not moose? If they are not moose, they are the funniest looking elk I've ever seen.

PLEASANT VIEW, COLO. D.H. LIVINGSTON

These elk sure don't resemble the elk we raise in Montana. We do have animals exactly like the ones in the picture, but they are called moose.

GREAT FALLS, MONT. ROBERT A. MAJERUS

The reference books we checked indicate that our news source is correct in calling those beasts elk. There are two very different members of the deer family that bear the name elk. One is the familiar animal of North America. The second lives in Europe and looks like the American moose. The European elk exists in several countries, including the Soviet Union, where the picture was taken.

Antique tool collection

I enjoyed reading your article on Frank Sahlmann's collection (*One Man's Incredible Antique Tool Collection*, page 168, Oct. PM). It was very well done, and I would like to see more of that type of article in your magazine. Your reference to the Early American Industries Assn. particularly caught my attention. Would you please give me the address of that organization.

VIRGINIA BEACH, VA. A.B. REYNOLDS

Inquiries can be addressed to: Early American Industries Assn.; Office of State History, Bldg. No. 8; Rotterdam Industrial Park; Schenectady, N.Y. 12306.

Pro Soloist is now smallest

In reference to *Low-Cost Synthesizers: Switched-On Home Music Fun* (page 126, (Please turn to page 10)

TOM McCAHILL SAYS:

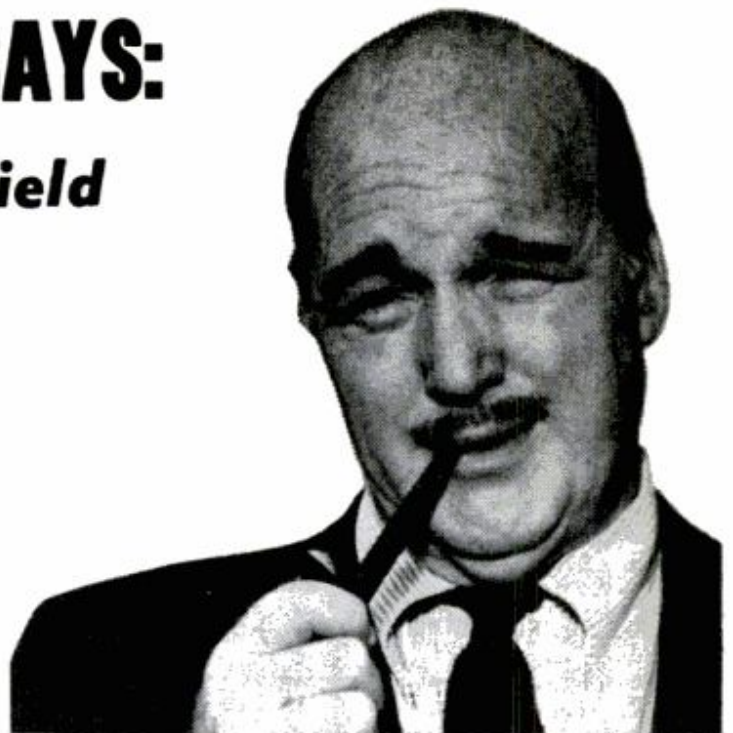
"The appliance repair field is so uncrowded it's almost lonely!"

Someone once said that if you build a better mousetrap, the world will beat a path to your door. In the home appliance business, a lot of enterprising companies have gotten rich peddling a list of handy electrical gadgets for the home longer than Wilt Chamberlain's arm. The trouble is, the dozen or more appliances in the average American home can go on the fritz, and men with the proper training to do repairs are as scarce as knee-length skirts on teen-agers.

Good Appliance Repairmen are a rare breed these days. Those with a little ambition are booked so solidly you can wait days to get somebody to fix a balky refrigerator or cantankerous toaster. Sometimes, you have to settle for a bum job from a guy who had no business calling himself an Appliance Repairman in the first place.

This brings me to my point. If you want to make money in a field that's begging for trained technicians, there's a fine, low-cost home-study plan available that teaches you how to handle every type of Appliance repair in detail—including refrigeration, air conditioners, and even small gas engines. The course was prepared by the instructors at National Radio Institute. This is the oldest and largest home-study school in the Electronics/Electrical fields with more than fifty years' experience training men like yourself for new careers or spare-time or full-time businesses of their own.

A few years ago, NRI recognized the increasing demand for trained Appliance Repairmen. They set about preparing well-illustrated, easy-to-understand lessons that teach you how to repair home, commercial and farm Appliances. NRI even added a professional Appliance Tester that's included in their low tuition. With the Tester and a few basic tools you probably already have,



you're equipped to service most Electrical Appliances. If you aren't making as much as \$4 to \$6 an hour in spare time fixing Appliances for friends and neighbors within a few months after enrolling, my name isn't McCahill.

The reason I'm no doubting Thomas, is because the staff at NRI is composed of experienced instructors who guide you through the course with more personal attention than you'd get in many classrooms. With the kind of help they give a student and the kind of course they have, you can be the man in demand in this field—even if you've never tried to rewire a plug, or got fed up with school at the 9th grade.

The best advice I can give you is to clip the coupon below and send for the NRI Appliance Training Catalog. It's free, and there's no obligation. NRI doesn't employ salesmen, so nobody will be knocking at your door. All it will cost you is a postage stamp. Take it from Uncle Tom, the Appliance Repair field needs good men. Now.

Tom McCahill

TOM McCAHILL

APPLIANCE DIVISION, NATIONAL RADIO INSTITUTE
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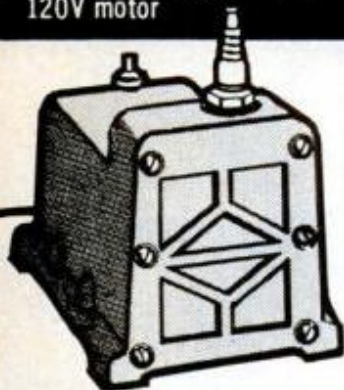
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IRWIN every bit as good
as the name

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LETTERS

(Continued from page 8)



Jan. PM), the "smallest ARP" synthesizer is no longer the Soloist model shown on page 127. Smallest is now the Pro Soloist (photo), which sells for \$1395.

ARP INSTRUMENTS, INC.

DAVID FRIEND

NEWTON, MASS.

One more bottle

I have had many compliments on the barrel bar I made following your plans in *Roll Out the Barrel* (page 130, Jan. '72 PM). I altered the lazy Susan bottle rack slightly by adding one more bottle and putting an



ice bucket in the middle. I paid \$20 for this barrel, but since have found a place where I can buy them for \$5.50 in South San Francisco.

PINOLE, CALIF.

JOHN F. BROWN JR.

Angle cutting

In "Cutting $22\frac{1}{2}$ ° angles" (*Hints From Readers*, page 173, Oct. PM), it seems there is a printing error somewhere as it would be necessary to set the gauge at $22\frac{1}{2}$ ° and not 45° as stated.

MIAMI LAKES, FLA.

ANTHONY H. LIPPERT

It is a printing error. To cut a $22\frac{1}{2}$ ° miter on a table saw would require a miter gauge that could be set at $67\frac{1}{2}$ ° ($67\frac{1}{2}$ from 90 equals $22\frac{1}{2}$). Most miter gauges can be set only to 60°, therefore a little trickery is required. Cut a 45° miter into a 12-inch scrap of 2x6 lumber, and screw it to the

miter gauge. Reset the miter gauge to read $22\frac{1}{2}^\circ$. The two angles— $22\frac{1}{2}^\circ$ and 45° —total $67\frac{1}{2}^\circ$ and will result in the finished workpiece having a $22\frac{1}{2}^\circ$ miter. A few pointed brads in the 2x6 will keep the work from sliding.

How long is Danny?

Your article *Christmas Gifts You Can Make* (page 166, Nov. PM) was a honey. My husband wants to make Danny Dachshund (page 168). But he says you forgot to tell how long Danny should be.

CHICAGO

MRS. PENNY NICHOLS

We did forget. Danny's body should be $7\frac{1}{4}$ inches long.

Slightly larger mini barn

My *Dutch Mini Barn* (page 64, Aug. '72 PM) was the first major project I have undertaken and I am quite pleased with it.

I did increase the dimensions to 12 by 16



feet to accommodate a utility trailer, and in place of plywood siding I used Masonite Woodsman siding.

Construction costs were kept within your estimate of \$397, including concrete slab.
WASHINGTON, MO. WILLIAM H. VERDINE

Complete plans are available for \$3.95 from Popular Mechanics, Dept DM-JL, Box 1014, Radio City, New York, N.Y. 10019. Two sets of plans are \$5.95.

'Man and his machines'

My pleasure with your magazine's contin-

(Please turn to page 12)

HERMAN RAWHIDES

Herman Rawhides take naturally to the outdoors. From the first day you own them, the supple, full grain rawhide uppers conform to your feet. The oil-resistant Neoprene® soles and heels provide long wear and sure footing. On just about any surface. And fit? Herman Rawhides come in over 90 sizes: 9 A to 14 EEE. Cushion insoles are covered in full grain leather for even greater comfort. And Rawhides come in three styles: 8" boot (Style #7130); 6" shoe (Style #7630); and, oxford (Style #7430). Looking for real quality in outdoor shoes? Look up a pair of Hermans.



FREE CATALOG

J. M. HERMAN SHOE COMPANY
DEPT. 34, MILLIS, MASS. 02054
I'd like to try a pair of Herman Rawhides. Send me your catalog and the name of my nearest Herman Dealer.
PM-RH-4-2

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unique tools,
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And that knowledge (along with your magical fingers and a reliable sewing machine) can save you up to 50% over the cost of ready-made bags, jackets and tents.

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frostline kits

LETTERS

(Continued from page 11)

uing coverage of what I call the world of "man and his machines" grows with each issue. Your latest on the Pitts Special (*World's Hottest Homebuilt*, page 122, Nov. PM) had more of the excellent photographs and clear descriptions which I think are earning you a strong and growing following. WASHINGTON, D.C. R. G. SUMMERS

Teacup builder

Here are pictures of the *Teacup* (page 146, Jan. '66 PM) I built from your plans. Everything was built in our home shop, including the sails, for under \$200. I went



one step further and made a carrier and jack for car transporting. (I've also built an iceboat to which the *Teacup's* mast and sail can be adapted.

O'FALLON, ILL.

GEORGE H. KREY

Most explicit ever

How to Fell, Buck and Limb a Tree (page 90, Sept. PM) has got to be the most explicit and well-pictured article I have ever seen. Here at the rental store we have several chain saws, axes and other tree-trimming and cutting implements. Most users are first-timers or at least not very knowledgeable about tree work. I'd like to make sure our customers see this article when they rent this type of equipment.

MICHIGAN CITY, IND.

CHARLIE MARKS

Touch of realism for play appliances

I was very interested in *Kitchen Play Appliances* (page 172, Nov. PM). I have made a couple of "electric stoves" for my grand-

(Please turn to page 14)



CARPET DETERGER



UPHOLSTERY DETERGER



WALL DETERGER

PART TIME or FULL TIME

*have your own
money-making
business*

You offer a service everybody needs . . . work part time or full time . . . own your equipment . . . keep all you earn . . . start with just a small investment . . . and we help you every step of the way!

Have your own money-making business and make the kind of income you probably thought impossible. You can when you clean carpeting or upholstery or walls with Von Schrader professional cleaning equipment. Every home, every building, are potential customers. And every customer represents repeat business.

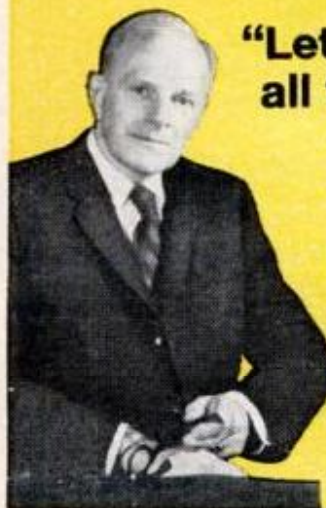
Moreover, we help you every step of the way . . . just as we have helped thousands of other Von Schrader Associates build money-making businesses for almost 40 years. Here are some comments. Carpet: "You people sure helped me and I'll never forget it. I'm averaging about \$18,000 a year."—*H. Kendall*. "During first 2 months made \$2500 net."—*R. Pilong*. Upholstery: "One day I did a \$135 job. Best week was \$500."—*C. Lambert*. "We passed over the

\$450 mark in five days."—*T. E. Baylor*. Wall: "I work just 2 or 3 days a week. Best month was \$1200."—*J. R. Johnson*.

There are three easy-to-operate Von Schrader Detergers. You need no special skills. Each offers a proven way to a growing income. (1) Von Schrader Carpet Deterger gives deep-level cleaning to carpeting. (2) Von Schrader Upholstery Deterger cleans fabrics and synthetics beautifully. (3) Von Schrader Wall Deterger cleans walls (and ceilings) five times faster than by hand.

You can start with just one Deterger. Then, as your business keeps growing, you may want to add the other two and thus offer a complete cleaning service.

There are no fees, royalties, or contracts. There's no franchise involved to shackle you with giving up part of your income. Instead, you own your equipment, keep all you earn. Cost of the equipment is so small you may find it hard to believe. What's more, we help you get started and continue to help afterwards. For complete information—without any obligation—send for the interesting free booklet.



"Let me send you our free booklet that gives all the facts"

—Francis von Schrader, President

Read about the big demand for on-location cleaning, see why Von Schrader Detergers are the finest of their kind, how easy they are to operate. Learn how other men have become financially independent, how Von Schrader helps you every step of the way. Fill in the coupon and send for free booklet.

Extra! Special Recorded Message included with booklet. Listen as Francis von Schrader talks to you personally about your growing future with Von Schrader Detergers.



Three proven ways to your own profitable business with Von Schrader Detergers.

39 years of helping people earn good money

VON SCHRADER company

1024 Place, Racine, Wisconsin 53403

Please send complete information on Von Schrader Detergers.

Name _____

Address _____

City _____

State _____ Zip _____

LETTERS

(Continued from page 12)

children. I used real knobs and switches from junked stoves. The burners, cut out by sabre saw to resemble real burners, have a piece of heavy red plastic underneath, with a Christmas-tree bulb under the plastic. When the switch is turned on, a red glow appears. I used a door switch from a junked car to make the oven light come on when the door is opened.

SAUK CENTRE, MINN. JOHN A. NEUMANN

Test lamp polarity

The "Test Lamp From Ballpoint Pens" (*Hints From Readers*, page 26A, Sept. PM) could be dangerous if not used right. One should use a polarized plug with the light bulb connected in series with the "hot" line. If the bulb were in series with the neutral line, the other probe would be a dangerous live wire.

TUCSON, ARIZ

FRANK L. RICHEY

The probe shown is a homemade version

of commercially made test lamps. We must agree, however, that there is a shock hazard if correct polarity is not observed.

Prize-winning pool table



Here is a picture of my son, Bill, at age 13 when he won first prize at the Portola Junior High Industrial Arts Fair with a bumper pool table he constructed from PM plans (*A Bumper-Pool Table You Can Build*, page 146, Jan. '70 PM). His wood shop teacher is Mr. Milton Argue.

TARZANA, CALIF.

MRS. MARY ANN SCHATZ

Specialties to Do Each Job Better for HOME - AUTO - SPORTS

BELT-EASE For better traction on all drive belts.

LOCK-EASE Makes locks work easier, protects against freezing—rust.

SIL-GLYDE High-film strength, clear lubricant for door and window tracks, bike chains, snowmobiles, etc.

DRIPLESS OIL All-purpose . . . stays put, won't run out. Penetrates, rust-proofs.

DOOR-EASE Stick Lubricant Clean—for all exposed surfaces—windows, doors, drawers, saw blades, zippers, etc.

LITH-EASE White lithium grease for cables, trailer rollers, brake parts, bearings, etc.

AGS LINE Since 1931
AMERICAN GREASE STICK COMPANY
Muskegon, Michigan 49443 U.S.A.

The Lazy Man's Way to Riches

'Most People Are Too Busy Earning a Living to Make Any Money'

I used to work hard. The 18-hour days. The 7-day weeks.

But I didn't start making big money until I did less — a *lot* less.

For example, this ad took about 2 hours to write. With a little luck, it should earn me 50, maybe a hundred thousand dollars.

What's more, I'm going to ask you to send me 10 dollars for something that'll cost me no more than 50 cents. And I'll try to make it so irresistible that you'd be a darned fool not to do it.

After all, why should you care if I make \$9.50 profit if I can show you how to make a *lot* more?

What if I'm so sure that you *will* make money my Lazy Man's Way that I'll make you the world's most unusual guarantee?

And here it is: I won't even cash your check or money order for 31 days *after* I've sent you my material.

That'll give you plenty of time to get it, look it over, try it out.

If you don't agree that it's worth *at least a hundred times* what you invested, send it back. Your *uncashed* check or money order will be put in the return mail.

The only reason I won't send it to you and bill you or send it C.O.D. is because both these methods involve more time and money.

And I'm already going to give you the biggest bargain of your life.

Because I'm going to tell you what it took me 11 years to perfect: How to make money the Lazy Man's Way.

O.K. — now I have to brag a little. I don't mind it. And it's necessary — to prove that sending me the 10 dollars... which I'll keep "in escrow" until you're satisfied... is the smartest thing you ever did.

I live in a home that's worth \$100,000. I know it is, because I turned down an offer for that much. My mortgage is less than half that, and the only reason I haven't paid it off is because my Tax Accountant says I'd be an idiot.

My "office," about a mile and a half from my home, is right on the beach. My view is so breathtaking that most people

comment that they don't see how I get any work done. But I do enough. About 6 hours a day, 8 or 9 months a year.

The rest of the time we spend at our mountain "cabin." I paid \$30,000 for it — cash.

I have 2 boats and a Cadillac. All paid for.

We have stocks, bonds, investments, cash in the bank. But the most important thing I have is priceless: time with my family.

And I'll show you just how I did it — the Lazy Man's Way — a secret that I've shared with just a few friends til now.

It doesn't require "education." I'm a high school graduate.

It doesn't require "capital." When I started out, I was so deep in debt that a lawyer friend advised bankruptcy as the only way out. He was wrong. We paid off our debts and, outside of the mortgage, don't owe a cent to any man.

It doesn't require "luck." I've had more than my share, but I'm not promising you that you'll make as much money as I have. And you may do better; I personally know one man who used these principles, worked hard, and made 11 million dollars in 8 years. But money isn't everything.

It doesn't require "talent." Just enough brains to know

what to look for. And I'll tell you that.

It doesn't require "youth." One woman I worked with is over 70. She's travelled the world over, making all the money she needs, doing only what I taught her.

It doesn't require "experience." A widow in Chicago has been averaging \$25,000 a year for the past 5 years, using my methods.

What *does* it require? Belief. Enough to take a chance. Enough to absorb what I'll send you. Enough to put the principles into *action*. If you do just that — nothing more, nothing less — the results *will* be hard to believe. Remember — I guarantee it.

You don't have to give up your job. But you may soon be making so much money that you'll be able to. Once again — I guarantee it.

The wisest man I ever knew told me something I never forgot: "Most people are too busy earning a living to make any money."

Don't take as long as I did to find out he was right.

I'll prove it to you, if you'll send in the coupon now. I'm not asking you to "believe" me. Just try it. If I'm wrong, all you've lost is a couple of minutes and an 8-cent stamp. But what if I'm right?

Sworn Statement:

"I have examined this advertisement. On the basis of personal acquaintance with Mr. Joe Karbo for 18 years and my professional relationship as his accountant, I certify that every statement is true." [Accountant's name available upon request.]

Bank Reference:

American State Bank
675 South Main Street, Orange, California 92668

Joe Karbo
17105 South Pacific, Dept. 551-B
Sunset Beach, California 90742.

Joe, you may be full of beans, but what have I got to lose? Send me the Lazy Man's Way to Riches. *But don't deposit my check or money order for 31 days after it's in the mail.*

If I return your material — for any reason — within that time, return my *uncashed* check or money order to me. On that basis, here's my ten dollars.

Please send Air Mail. I'm enclosing an extra dollar.

Name _____

Address _____

City _____

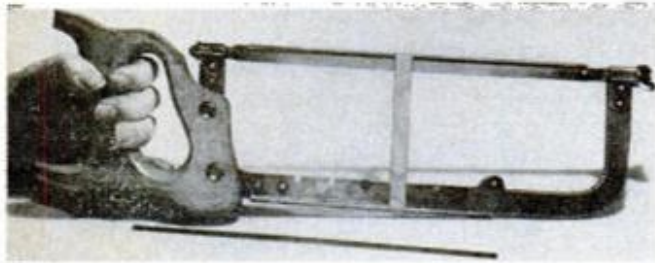
State _____

Zip _____

© 1973 Joe Karbo

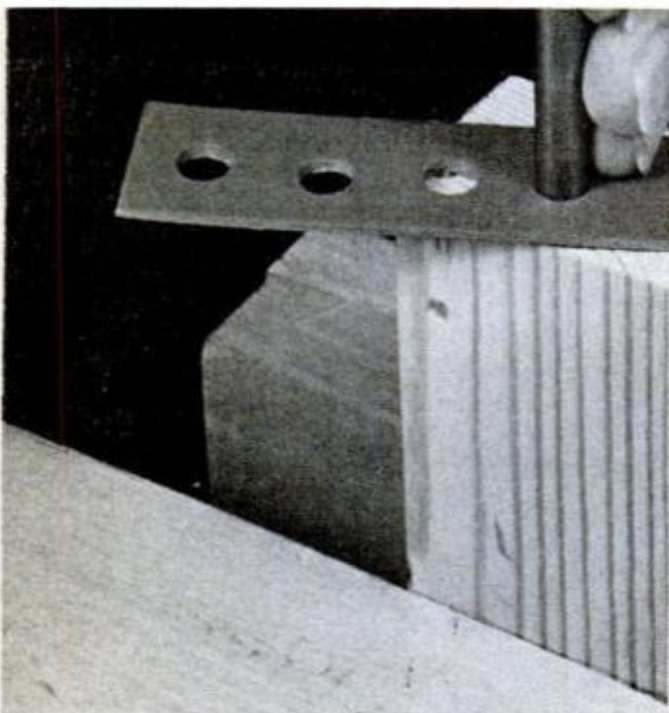
HINTS

FROM READERS



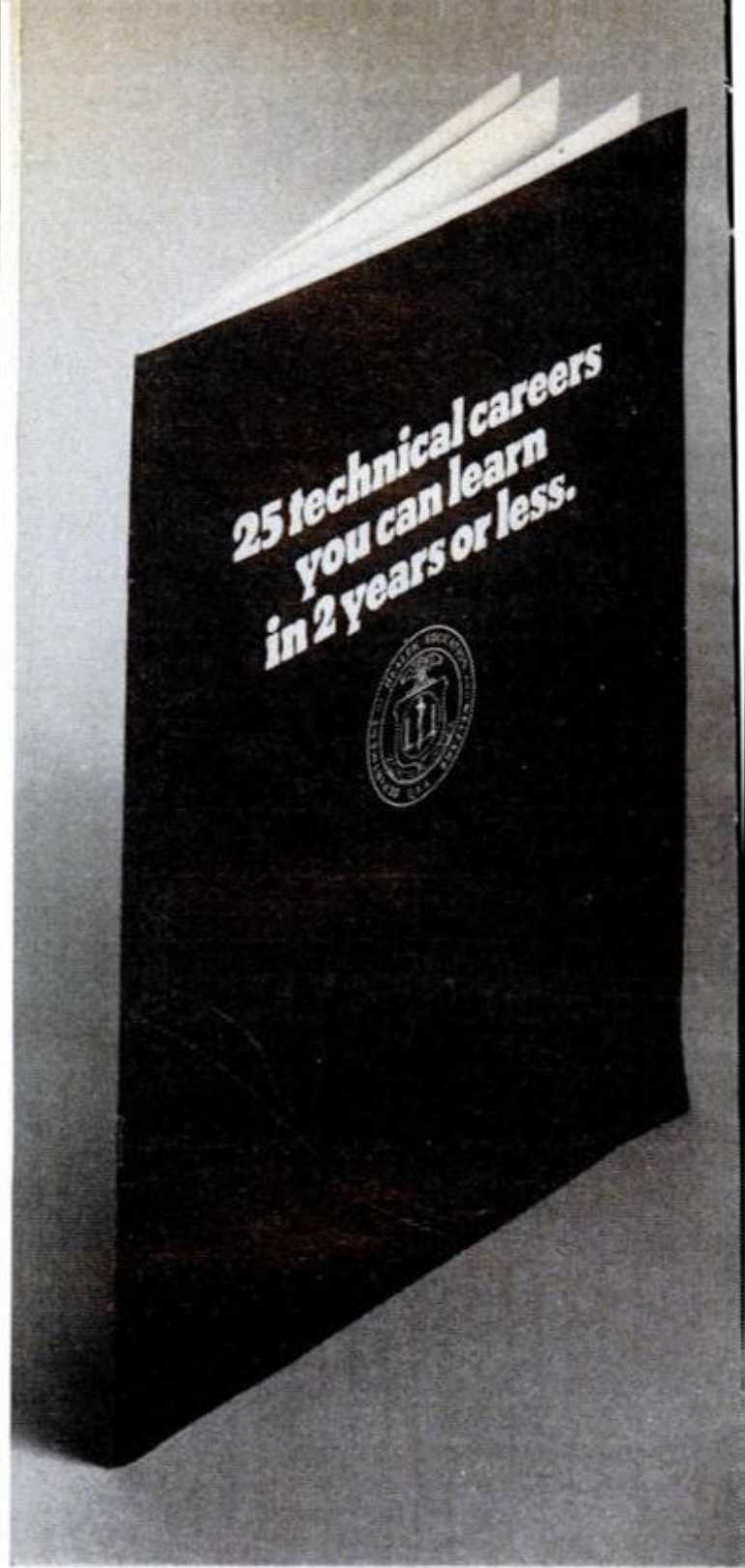
Blade guard for hacksaw

To prevent accidental cuts and protect the teeth of your hacksaw blade, cover the blade with a grooved rib from a discarded umbrella. To cut rib to length, file a notch in the back of the rib and break with fingers; a rubber band holds the rib in place over the teeth.—*Allen Wilks, Matawan, N.J.*



Method for punching holes

Neat, clean holes can be made in leather, vinyl, fiber and thin metals by punching with a steel rod of the diameter required over a block of scrap wood. Punching is done over the end grain of the wood and a new spot selected on the wood for each hole.—*Kenneth Wells, Portsmouth, England*



"...you no longer need four years of college to start out on a scientific or technical career.

"You can break into any field—from medicine to computers to engineering to the space program—with only a year or two of education. Just become a technician."

—U.S. Office of Education

Take advantage of these U.S. Government facts and get started in a big income career.

How far can you go without four years of college? Here's what the U.S. Government says about it in a booklet shown at left:

"A lot of people think that careers are meant for college graduates — jobs are for everybody else.

"Ten years ago, they may have had a point. But something's happened recently to change all that. A revolution in science and technology...

"You can break into any field — from medicine to computers to engineering to the space program — with only a year or two of education.

"Just become a technician."

You don't need to read the government booklet. (Its main message is printed above.)

But you do need some guidance to pick a field you'd enjoy working in.

Free Guidance Materials

To help you select the technical career field that's right for you, we've listed opportunities in the special coupon, at right. And you can find out what you should know about the field you like best by simply checking off your choice and mailing the card or coupon today.

Free Guidance Booklet

By return mail, you will receive a free ICS Career Guidance Booklet that describes the opportunities, income and job security you might expect in your newly chosen field. It will also explain how ICS can help you get the training you need to break into this new career field...right in your home...during your spare time...without losing a single day's pay from your present job...and without ever setting foot in a classroom.

Free "Demonstration Lesson"

In addition, you'll receive a free "Demonstration Lesson" that lets you see for yourself why picking up the job skills you need — the ICS way — may be easier than you think.

More than 8,500,000 men and women have turned to ICS for career training since 1890. Some 2,000 American firms and government

agencies are using ICS training programs to upgrade their employees. (Among these firms are such names as Ford, U.S. Steel, Chrysler, Mobil, 3M Company, Alcoa, Pan Am, GE, Motorola, RCA.)

ICS career training is approved for veterans training, and is Accredited by the Accrediting Commission of the National Home Study Council. Just mail the card or coupon for your free guidance materials. (Gov't booklet is not included.)

If card is missing, use coupon and mail to: ICS, Scranton, Pa. 18515.



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ICS International Correspondence Schools
Scranton, Pennsylvania 18515

Please send me free ICS Career Guidance Booklet and a free "Demonstration Lesson" for the field I have checked below. I understand I am under no obligation.

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| <input type="checkbox"/> Automotive Mechanics | <input type="checkbox"/> Computer Servicing | <input type="checkbox"/> Engineering Technician |
| <input type="checkbox"/> Electronics Technician | <input type="checkbox"/> Diesel/Truck Mechanic | <input type="checkbox"/> FCC Licensing |
| <input type="checkbox"/> Auto Body Rebuilding Specialist | <input type="checkbox"/> Surveying & Mapping | <input type="checkbox"/> Transmission Specialist |
| | <input type="checkbox"/> Drafting (Mechanical) | <input type="checkbox"/> CATV Tech. |
| | | <input type="checkbox"/> Engineering (Civil, Electrical, Mechanical, Chemical) |

Check here for special information, if age 16 or under

NAME _____ AGE _____

ADDRESS _____ APT. _____

CITY _____ STATE _____ ZIP _____

THE BICYCLE SHOP

BY EUGENE A. SLOANE

If you're under 80, reasonably healthy and have a fairly good bicycle, it is very practical to commute to work by bike—even as far as 12 miles.

Benefits of bicycle commuting are many and real. Daily exercise of an hour or two on a bike will keep you sparkling healthy, fit and trim. Savings in gas, wear on a car, parking fees, or daily train fare, can pay for a good new bike in under a year.

Natly attired in plus fours and helmet, Gene breezes along a Chicago street in his daily commute to the Loop. He picks streets on which cars are parked; otherwise moving traffic often forces a bicyclist to the curb.



There'll also be fewer medical bills as you become more fit and so able to throw off disabling colds and the aches and pains you pay for inactivity.

The growing fuel shortages, with rising fuel prices, may make cycling to work the best way to get there—as Europeans have long since discovered. In fact, I was in Holland a few months ago, the day the country posted a total ban on Sunday pleasure driving. On that first day I interviewed dozens of cyclists who commute daily to work over one-way distances of up to 18 miles.

I have been commuting to work 12 miles each way, every day, winter and summer, for years through rush-hour city traffic, and have never even come close to a mishap. My home-to-office time is almost exactly the same by bicycle as by car or train! The only time I don't bike is right after a snowfall of over three inches, or when streets are icy. So far it hasn't got cold enough so that

I can't ride, and this includes temperatures down to minus 30° F. (I'm no spring chicken, either.) As it gets colder, I simply pile on more layers of clothing.

The idea of wheeling your bike out into rush-hour traffic may seem frightening at first, but, believe me, you soon get used to the roar of traffic around you and learn to ignore it as you concentrate on the cycling situation of the moment. I have, within the past few months, cycled through the rush of traffic in Paris and Amsterdam with no problems. If you think big-city traffic in America is rough, you haven't seen traffic until you've biked in Paris, where it seems a point of honor on the part of motorists to drive full tilt and never give way to anything. By way of comparison, motorists in America are the very soul of courtesy and consideration.

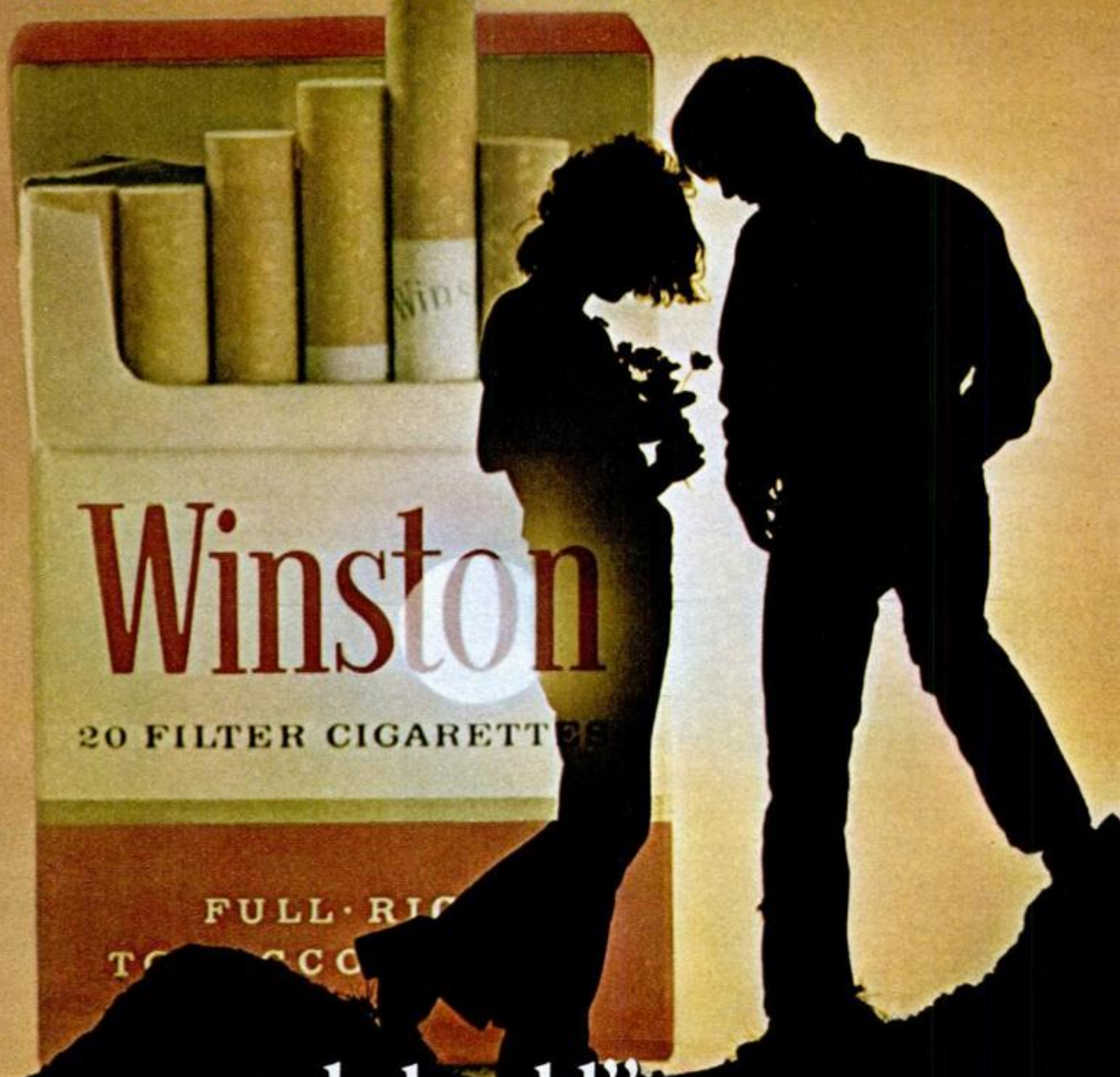
To commute safely, follow a few simple rules:



Plan your route carefully. Go over it first by car. Avoid heavily traveled streets, but use streets where stop signs are in your favor. In big cities, avoid one-way streets where cars tend to leave you little room; use major thoroughfares for cross-town cycling instead. In Chicago, I take side streets from my suburban Evanston home about four miles and then pick up the scenic, trafficless bike trail (shown) along Lake Michigan to the Loop. Always use streets on which cars are parked. Distance between them and moving traffic is at least three feet, which gives you plenty of room. When there are no parked cars, traffic forces you right up to the curb.

(Please turn to page 22)

There's a lot of good
between "Winston..."



and should."

Winston tastes good GOOD, like a cigarette should.

Warning: The Surgeon General Has Determined
That Cigarette Smoking Is Dangerous to Your Health.

© 1973 R. J. REYNOLDS TOBACCO CO.

20 mg. "tar", 1.4 mg. nicotine av. per cigarette. FTC Report SEPT. '73.

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THE BICYCLE SHOP

(Continued from page 20)

Watch for car doors opening. Keep an eye out for people in parked cars ahead who might suddenly open a door in your face. Watch through rear windows and for the reflection of a driver in the side-view mirror of parked cars.

Be ready to stop instantly. Ride with your hands on or just on top of the brake levers so you can stop in time to avoid hitting a suddenly opened car door or a jaywalking pedestrian who steps out in the middle of the block from between parked cars.

Let cars run interference at intersections. When the light turns green, let the traffic start up first and move with it. That way there will be a car between you and anybody who may try to run the light from the left. Never run a red light or cut across an intersection at an angle. To turn left in rush-hour traffic, keep to the right side, cross the intersection with traffic, then either wait till traffic clears and turn left, or cross and wait till the light turns in your favor. I prefer to wait at the curb till traffic clears, then turn left before the light changes to red.

Obey all traffic laws. Traffic rules were made for moving traffic, and that includes bikes. Never run a red light (I repeat), don't bike on streets where cycling is not allowed (even if you disagree) and try to keep more or less to traffic speed, even though you may be able to go faster in traffic-clogged streets. Motorists don't expect cyclists to be going faster than they are, so be doubly careful at intersections. Never fight a car for the right-of-way even if you have it. You may lose.

trated. Use a strap-on leg light that moves as you pedal, with red to the rear and white to the front. Generator lights are okay but they don't work when the bike is stopped at a traffic light and they are heavy and drag on the wheels. Wear bright yellow or red jacket.



Wear a rear-view mirror. You must be aware of what's coming up behind you so you know whether you can swerve out into traffic to avoid a car door opening or pedestrian. Safest way to keep track of upcoming traffic is a small mirror (above) you can clip to glasses or to the visor of your cap. It's available at bike stores.



Watch out for sewer gratings. Many cities have storm-sewer gratings in the street with openings wide enough for bike wheels to fall through. People have been killed this way. I separated a shoulder just last May by falling in a similar opening, but in a bridge over Puget Sound where bridge sections join. Watch out for bridge expansion joints, too, which have similarly dangerous openings. In the Puget Sound incident, my front wheel hit the bridge joint, and the sudden stop not only broke the bike in half, but threw me over the handlebars 15 feet.

Wear head protection. Even a simple fall, from a standstill, off a bike can cause fatal injury if your head hits a curb or something as solid. I use a good helmet that I bought in a motorcycle shop. In warmer weather, I use a Cooper or Nestor Johnson hockey helmet. These offer fair protection, tend to be hot over 70° F., but are better than nothing and could save your life.

(Please turn to page 24)

Make yourself visible. Most city and suburban streets are well lighted so you can see well enough at night, even without lights. What's more important is that motorists see you. Use reflectors, amber on sides, red on the rear and white on the front. Install pedal reflectors. Use reflective cloth tapes as a belt or to hold pants cuffs from tangling in the chain, as illus-

"If you can find a better saw at a better price, buy it."

J. V. "Jim" Ezell
President, Power Tool Division
Rockwell International



What moved our president to make that bold statement is our Homecraft® 9" bench saw priced at \$129.99, motor included.

This tool has all the features you'd find on saws costing \$50 to \$100 more.

A see-thru blade guard, for instance, with splitter

and antikick-back fingers added for safety and efficiency.

One-hundred percent ball-bearing construction. Self-aligning fence. Thermal overload protection. Miter gauge. Up-front controls. Safety switch to prevent accidental starts.

Plus a rugged power unit that develops a full 1.5 hp.

It's complete and ready to run for the remarkable price of \$129.99.

"As I said, if you can find a better saw at a better price, buy it."



Rockwell International

For your local Rockwell dealer, phone toll free: 800 243-6000 (Conn.: 1-800 822-6500). Excluding Hawaii and Alaska. Or write: Power Tool Division, Rockwell International, Memphis, Tenn. 38131.

NEW FREE BOOK DISCUSSES

HOW TO SELL YOUR INVENTION

If you have an invention (whether patented or unpatented) that you believe has commercial value, our Free Booklet entitled "How to Go About Selling Your Invention" may help you save time and money.

We are specialists in representing inventors and submitting their inventions to manufacturers. We work with scores of manufacturers who are seeking new products or new product ideas, and we therefore know which firms may be interested in your particular invention. Our service is designed to do all those things the average inventor lacks the knowledge or facilities for doing, or does not have time to do. We prepare your sales letters, folios, duplicate drawings, handle correspondence, select the firms.

We charge the standard commission (on sales) and a modest fee for the submitting service. This fee is refunded if a manufacturer buys your invention through our efforts. We are a nationally known concern with an impeccable reputation for ethics and integrity.

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You can obtain this booklet "How to Go About Selling Your Invention" by mailing the coupon below. And if you wish to write us for comments on your invention, please do so. We make no charge for consultation. But please do NOT send drawings or models. Just describe the purpose and nature of your invention. Mail the coupon to K. O. Kessler, Pres., Kessler Sales Corporation, Dept. D-52, Fremont, Ohio 43420.

You are welcome to ask your lawyer, local Bank, Chamber of Commerce to carefully check on our reputation for honesty and fair-dealing.

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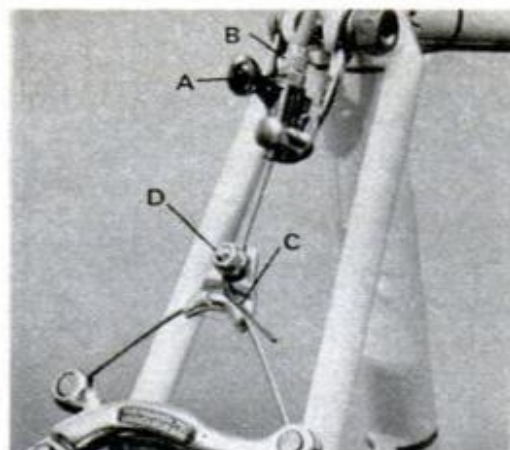
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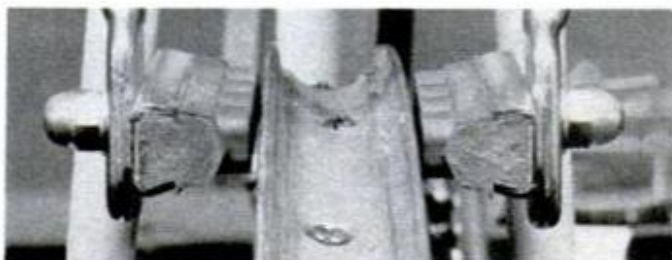
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THE BICYCLE SHOP

(Continued from page 22)



Check brakes. Brakes should be in good working order. Caliper brake levers should cause the brakes to grip when depressed no more than one inch. If necessary, readjust the brakes to take out shoe wear or cable stretch. You can take up cable stretch two ways—either by loosening barrel nut A and turning barrel nut B counterclockwise until the brake shoes are about 1/8 inch from the rim, or by loosening cable locknut D and pulling excess cable C through until the brake shoes are adjusted as noted above (and shown below) and then retightening the cable locknut.



When brakes are properly adjusted, the brake shoes should be about 1/8 inch from the wheel rim.



A "third hand," which applies spring tension on the brake shoes, makes their adjustment easier. Remember when riding in the rain or snow that wet brakes don't stop as well as dry. Be prepared to apply brakes a lot sooner or allow more room to stop.

When you get there. At work, secure your bike by using a 1/2 or 5/8-inch stranded-steel cable, at least five feet long, passing the cable through both wheels and the frame, fastening the cable to a cement-embedded bike stand or some other theftproof object. Ideally, bring your bike inside and lock it. In summer, you breeze along so fast you seldom work up a sweat; in winter, don extra layers of clothing, then peel down to work clothes or a business suit or a dress when you arrive. ★★

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FEBRUARY 1974 25

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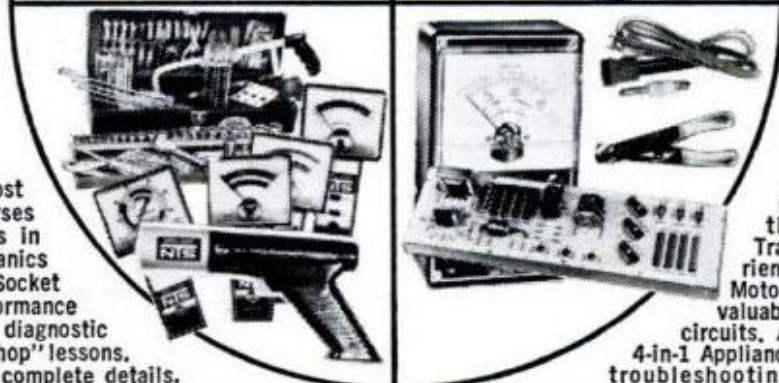
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DETROIT LISTENING POST

Get in line for small cars

The rush to buy small cars has accelerated so quickly that it has become more difficult to write about current developments (mid-November 1973) which will still be valid for PM's February issue. General Motors, after having suspended its production of big cars for the holidays, and Ford are looking at every small and medium-size car they make to see if additional small cars can be pulled off the same tooling. Both companies are also seeking ways to increase production of existing small cars. Ford has already given the go-ahead for a slicked-up Pinto to be sold through Lincoln-Mercury dealers, following the same approach the company is using in Canada, where a reworked Pinto—dubbed the Bobcat—is marketed by L-M dealers.

The big cars, the heavy gas users, are in serious trouble, and the auto companies know it. That's the way three of the four companies read the signals. The only disbeliever is Chrysler.

AMC mini to be late entry

American Motors is working up production plans for the mini commuter car it will



Still experimental, but—Chrysler's new turbine car is a lot closer to meeting passenger-car requirements and going into production than the company's original experimental turbine of the early '60s.

bring out late this year. The new job will come out a couple months after the company introduces its other '75 products—probably not before November. This doesn't mean the car is behind schedule or that AMC is running into problems. The lag between the regular line and the new number had been planned that way.

Pontiac Vega nearing production

Pontiac has wrapped up design and engineering work on its version of Vega. GM apparently hasn't cleared a start-up date for the car, but this is just a matter of time. Pontiac wouldn't have gone through the preliminaries without corporate approval. There's still time to get the car on the line as a '75, but it's more likely to come out in the spring of '75 as a half-year model.

New bodies for Nova & Co.

Chevrolet's Nova and its derivatives—Buick's Apollo, Oldsmobile's Omega and Pontiac's Ventura—are due to get new bodies in late summer. GM plans these things years in advance and once a project gets rolling, it takes time to apply the brakes. But some people at GM wonder if it's really necessary to give Nova and family the new skin treatment. Try to find a Nova on a used-car lot. If you do and it's in fair shape, the asking price will be about the same as the wholesale price the dealer paid for the car when it was new. With that kind of acceptance, why bother changing the body? "For competitive reasons, because you have to look beyond right now, because it's time to change," GM replies.

Speaking of Nova, GM staffers like to point out that if you take the first letter from Nova, Omega, Ventura and Apollo in that order, they spell NOVA. This revelation is accompanied by a mysterious smile. Yeah,

(Please turn to page 32)

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DETROIT LISTENING POST

(Continued from page 30)

and if you spell it backwards it comes out AVON, as in the bard of or the lady who sells lipstick door-to-door.

Plastic bumpers for all cars

If the government sticks with the beefed-up front bumper standard it has proposed for 1976-77, auto engineers say all cars will have to go to plastic bumpers. The rule requires that the bumper be able to take a five-mph hit without leaving so much as a smudge on the surface. No dings, dents or scratches. Detroit says there's no metal made that can meet that kind of test, and the only way of complying with the requirement will be to go to elastomeric front ends.

More dashboard warning lights

The '76 cars will carry at least one new warning light and possibly two or three. A new standard that becomes effective when the '76s go into production requires all cars to be equipped with a dashboard light to alert the driver if there's a loss of brake fluid.

The auto companies anticipate a series of standards covering other safety-related parts—lights, steering and tires. Rather than tack the lights on piecemeal as the government writes the rules, engineers would prefer a systems approach where all lights would be contained in a single package and added to the car simultaneously.

GM has an idea for adding an advisory light feature to the warning lights on the dash. The indicator lights would still flash red, as they do now, when a part isn't functioning properly. But before the red light goes on, an amber light would appear, indicating that while it's safe to drive the car the flagged item should be checked.

Prize package from Dodge?

If you're thinking about buying a big Dodge and don't need it right away, stall the deal until the company starts running its spring special ads. You'll get the automatic transmission free. ★★★

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APPLIANCE CLINIC

BY PAUL MANN

Disposing of odor

After several years of use, our food-waste disposer is still going strong, but so is the odor that it started giving off recently. Is there any way to get rid of it?—Mrs. Ray Foran, Syracuse, N.Y.

Try filling the hopper with ice cubes and adding a small amount of chlorinated cleanser—never a caustic cleanser, which could damage the unit. Run the disposer with the water off for about 15 seconds. Then, while it's still running, turn on the cold water and let the disposer flush itself out.

Next, cut a lemon in half and drop both halves into the hopper. Allow grinding to take place for about 30 seconds without running water; then with the disposer still operating, turn on the water for 15 seconds. Shut off the unit and fill the sink with water. Turn the unit on, force-purging the sink. If you have a continuous-feed model, be sure to remove the stopper. If the odor persists, repeat the procedure.

Nonfilling clothes washer

When my Westinghouse automatic clothes washer is turned on and begins to fill, the pump also switches on and water flows right out. The tub never fills. I have replaced the water-level switch and the timer. What now?—Andrew Van Deras Jr., Highland, Ind.

I assume you are correct in your diagnosis—that the pump is turning on when the motor starts, since water will drain from a washing machine if the drain hose doesn't come up above the water level. If the hose is positioned properly, the pump's friction-wheel solenoid spring may be improperly adjusted. In Westinghouse front-loaders, a solenoid allows the pump's friction wheel to come into contact with a motor drive wheel during the drain cycle; thus the pump is driven by the motor. If the solenoid spring is set too high, the two wheels will be in contact all the time and the motor will

operate the pump when the tub should be filling.

The solution is to find the solenoid (consult the wiring diagram on the machine), take off the spring and bring it down one notch on the shift-lever arm. This should be sufficient to keep pump and motor wheels apart until the tub is to be drained. Another possibility is that the solenoid itself is sticking, preventing disengagement of pump and motor. In this case, replace the solenoid.

Nonautomatic automatic

My wife complains that the oven temperature control of our Westinghouse electric range advances about 25° F. over the setting during the cooking cycle when the unit is on automatic. Is this possible?—Wyn Freeman, Huntsville, Ala.

I think there's some confusion regarding the automatic feature. The oven can be set to turn itself on and off automatically. It doesn't raise or lower itself, but is preset. The automatic feature has nothing to do with the temperature. If the oven is 25° above the setting when the oven is on automatic, it is also 25° above the setting when your wife operates it manually.

You can check the temperature with an accurate oven thermometer. If thermometer reading and dial setting don't jibe, remove the temperature-control knob. If there is an adjustment screw, you can set the temperature yourself. One notch ticked off by the screw equals about 10° F. If there is a hole in the stem instead of a screw, the adjustment will require a special tool and should be left to a serviceman.

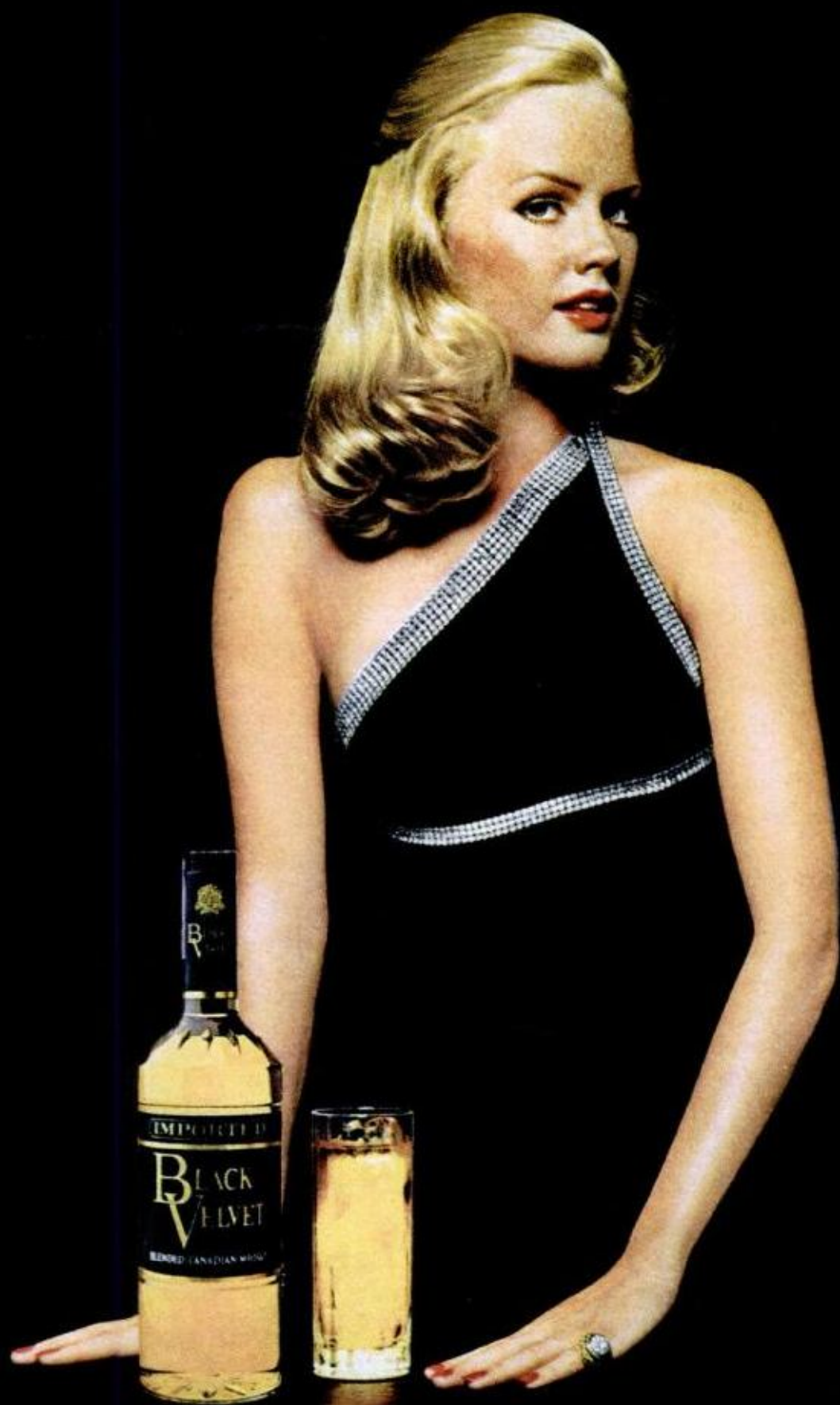
Problem center

In the fall of 1956 we purchased a General Electric kitchen center consisting of range,

(Please turn to page 36)

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APPLIANCE CLINIC

(Continued from page 34)

dishwasher and washer-dryer combination. The center has these appliances integrated into a framework. When we bought it, we were told that each appliance could be replaced just by slipping it from the frame and sliding a new one into the same position. Well, things have changed, or so I've been told. I now want to replace some appliances, but local dealers tell me I can't replace them with units of the same kind. Are they right, and if they are, what do I do now?—Albert F. Tyson, Kinston, N.C.

Your local dealers are correct—things do change in 17 years. For example, GE no longer makes a combination washer-dryer. According to a GE spokesman, you can replace your appliances, but major modification of the framework will be required. Possibly it would cost you less money and trouble to have your old appliances repaired. In any event, I have been advised to suggest you contact A. C. Ward, manager of product service, General Electric, 3300 Bush Ave., Raleigh, N.C. 27611. He will make a survey of the situation and suggest your best action.

Refrigerators that kill

A story in my hometown newspaper the other day shocked the devil out of me. A 6-year-old had crawled into an unused refrigerator that his family had stored "safely" in the basement and had closed the door. When his mother found him, he was dead.

Please—to keep this tragedy from striking your home, take a few minutes to make sure that a refrigerator or freezer doesn't turn into a death trap for some youngster. Remove the door by unscrewing the hinges. Or wrap a chain around the door and secure it with a padlock. Or fasten a thick block of wood to the door or door frame with epoxy so the door can't close.

Take precautions even if you think you are putting the unit in a "safe" place. Kids have a knack for getting into trouble. But this kind can kill in 10 minutes and cause brain damage in four minutes. ★★

If you have a question about any appliance, send it to Appliance Clinic, Popular Mechanics, 224 West 57th St., New York, N.Y. 10019. Sorry, but letters cannot be answered individually. Problems of wide interest will be answered in this column.

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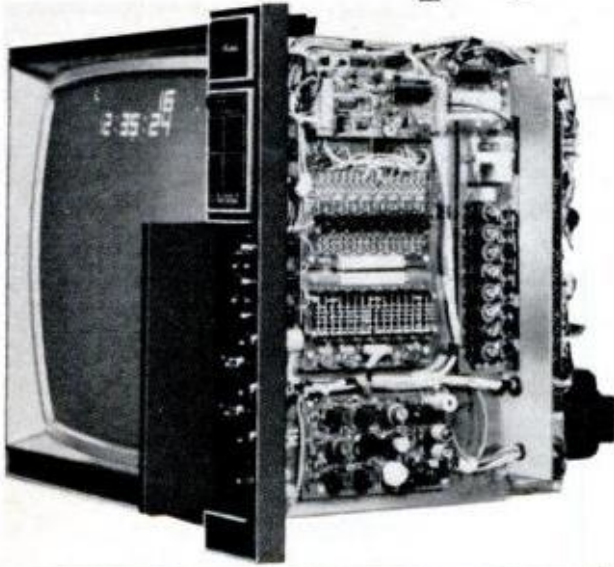
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build this unique, all-new Heathkit Super Set



Three years ago, Heath began its most extensive engineering project — the development of a truly different color TV using digital and other design techniques unusual to the industry. The result is spectacular.

It features: ■ Programmable Digital Counter Channel Selector ■ On-Screen Digital Channel Identification ■ On-Screen Digital Clock Read-out (optional) ■ Silent touch-tune electronic tuning ■ Combination VHF/UHF Varactor Tuner — DC voltage controlled ■ Exclusive Fixed-Filter IF—ideal bandpass shape for cleaner pictures and no instrument alignment ■ Digital True-Dot Generator — easier color convergence ■ 11-Function Remote Control (optional) ■ 100% Solid-State — the only tube is the picture ■ 19 integrated circuits (32 with remote) ■ 71 discrete transistors with sockets ■ Solid-State Tripler High Voltage Supply ■ Solid-State Low Voltage Supply — short-proof IC regulators ■ Solid-State Transformerless Vertical Sweep — better picture detail ■ Latest 25V Black (negative) Matrix picture tube — fully illuminated "black-surround" dots for brighter pictures — new etched face plate reduces glare and reflections ■ Front access slide-out Self-Service Drawer ■ 20 glass-epoxy circuit modules plus 12 prefabricated wiring harnesses with connectors for easier assembly.

The Heathkit Super Set is unlike any other color TV you've ever seen... it silently selects channels with digital-logic accuracy... it displays the channel numbers on the screen... it displays the time digits on the screen... it uses a fixed filter that never needs instrument alignment... it uses more integrated circuitry than any other set... it is easy to use... it is easy to look at... it is easier to build than any we've ever offered.

Pre-program any 16 channels into the digital counter. Touch a button (there isn't any tuning knob), and the counter silently sweeps up or down the stations, then locks in the Varactor Tuner to the station you choose. No mechanical contacts to clean, no turrets to make noise, no motors to hum.

The channel numbers are 1½" white digits on the screen — easy to see across the room, positionable anywhere on the screen. Add the clock module and time is displayed below the channel numbers — in 4 or 6 digits, 12 or 24 hour format. Digits remain on for any pre-set period up to 1½ minutes. Change channels or touch the "recall" button to make them re-appear.

Expanded self-service devices include a separate test meter, new vertical and horizontal centering, new top-bottom-sides pincushioning corrections, purity adjustments... and in the new slide-out service drawer are computer-like programming boards for channel selection, channel readout, clock readout, plus convergence circuit module.

Technically, the Heathkit Super Set is the most sophisticated TV we've ever offered. In addition to all the above features, it also has DC controlled contrast for less interference; an IC color amplifier for truer colors; an IC color oscillator and automatic phase control for more precise, reliable tints; an IC automatic gain control for improved sensitivity, stability, and noise immunity. In total, this digital Heathkit color TV sets new standards for state-of-the-art.

Heathkit Super Set... designed to change your mind about color TV.

Kit GR-2000, basic chassis and tube, 147 lbs. **\$649.95***



Eleven-Function Touch-Tune Remote Control for the GR-2000... \$79.95*

This all solid-state ultrasonic system utilizes 13 integrated circuits, 28 transistors to give you wireless armchair control of on and off, volume, VHF/UHF channel selection, up or down color intensity, and tint. Plus, a touch of the volume button automatically recalls the digital readout to the screen. Kit includes receiver for in-chassis mounting and hand-held transmitter.

Kit GRA-2000-6, 4 lbs. **\$79.95***



Optional Digital Clock for your GR-2000... \$29.95*

In just a couple hours' time you can build the GRA-2000-1 Digital Clock Accessory. Everything mounts on one small board that plugs into the readout board in the GR-2000 service drawer. That's all there is to it. Clock circuit board has slow, fast and hold push-buttons for setting time, jumper wire for selecting 12 or 24-hour format. Order with your GR-2000, or add it on later, if you prefer.

Kit GRA-2000-1, Digital Clock Accy., 1 lb. **\$29.95***

Custom install or use one of four new cabinets.



Like all Heathkit TV's the GR-2000 can be wall-mounted, or choose one of the striking new cabinet designs. The sophisticated Contemporary model GRA-2000-2 shown here, at \$139.95; the Mediterranean GRA-2000-4, \$139.95; the Mediterranean with doors, GRA-2000-5, \$179.95; or the Early American model GRA-200-3, \$139.95.

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Units of Schlumberger Products Corporation

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CAR CLINIC

BY MORT SCHULTZ

Balky Bug

We have a 1966 Volkswagen. At times when you turn on the key absolutely nothing happens. We replaced the starter solenoid. All was fine until hot weather when the trouble returned. We also replaced the battery, wiring harness and ignition switch. What have we missed?—Mrs. N.F. Thompson, Tustin, Calif.

Hit-and-miss starting may be caused by an inadequate ground. In addition to a battery ground, a ground between the transmission and frame should be checked. However, I think the problem is more likely being caused by starter-gear or ring-gear wear. I suggest that the starter be taken from the car, disassembled and cleaned, and worn parts replaced. Also inspect the ring gear. If it is worn, the flywheel will have to be replaced.

Finds humus humorless

How can I remove leaves that have gotten into the vent of my 1968 Thunderbird? When the heater is on, the smell is awful.—C.F. Leeper, Charlotte, N.C.

Lift the hood, then unscrew and remove the grillwork on the cowl below the windshield. Try to fish out leaves this way. If this fails, you will have to remove the heater and purge leaves from the ductwork beneath the dashboard. It's possible that leaves may have been sucked into the blower motor. The motor may have to be disassembled and leaves cleaned out.

Rapping about recall

Because I just bought a used car, I've been wondering how to find out whether the model had ever been involved in a recall campaign to have a safety problem corrected.—Richard N. Cechvala, Hatfield, Mass.

You bring up an important point. According to the National Safety Council,

many of the 36.8-million cars involved in recall campaigns over the past seven years have not been inspected and repaired. People who are second and third owners are therefore not aware that laxity on the part of original owners has resulted in their driving vehicles which are potentially dangerous. As far as I'm concerned, you should go directly to the source. Write the customer service department of the particular manufacturer and ask if the model has been subject to recall. If possible, include the car's vehicle identification number. This way the manufacturer will be able to tell you if your particular car was returned for repair by the original owner if, indeed, it was recalled.

Strike out at streaks

Since the day I bought my 1970 Cadillac Sedan DeVille, the windshield wipers have smeared the windshield as though they had grease on them. The condition occurs no matter in what part of the country I drive, so the problem is not environmental. I have replaced blades with those of any brand you can name. Please help.—Robert Ausbrook Sr., Cleveland

First wash the windshield thoroughly with ammonia and then water. Have spring tension of windshield-wiper arms checked. If spring tension is not strong enough, wipers will skim the windshield, streaking the glass. Finally, replace your present wipers with others from the parts department of a Cadillac dealer. New wipers have been designed to solve this problem.

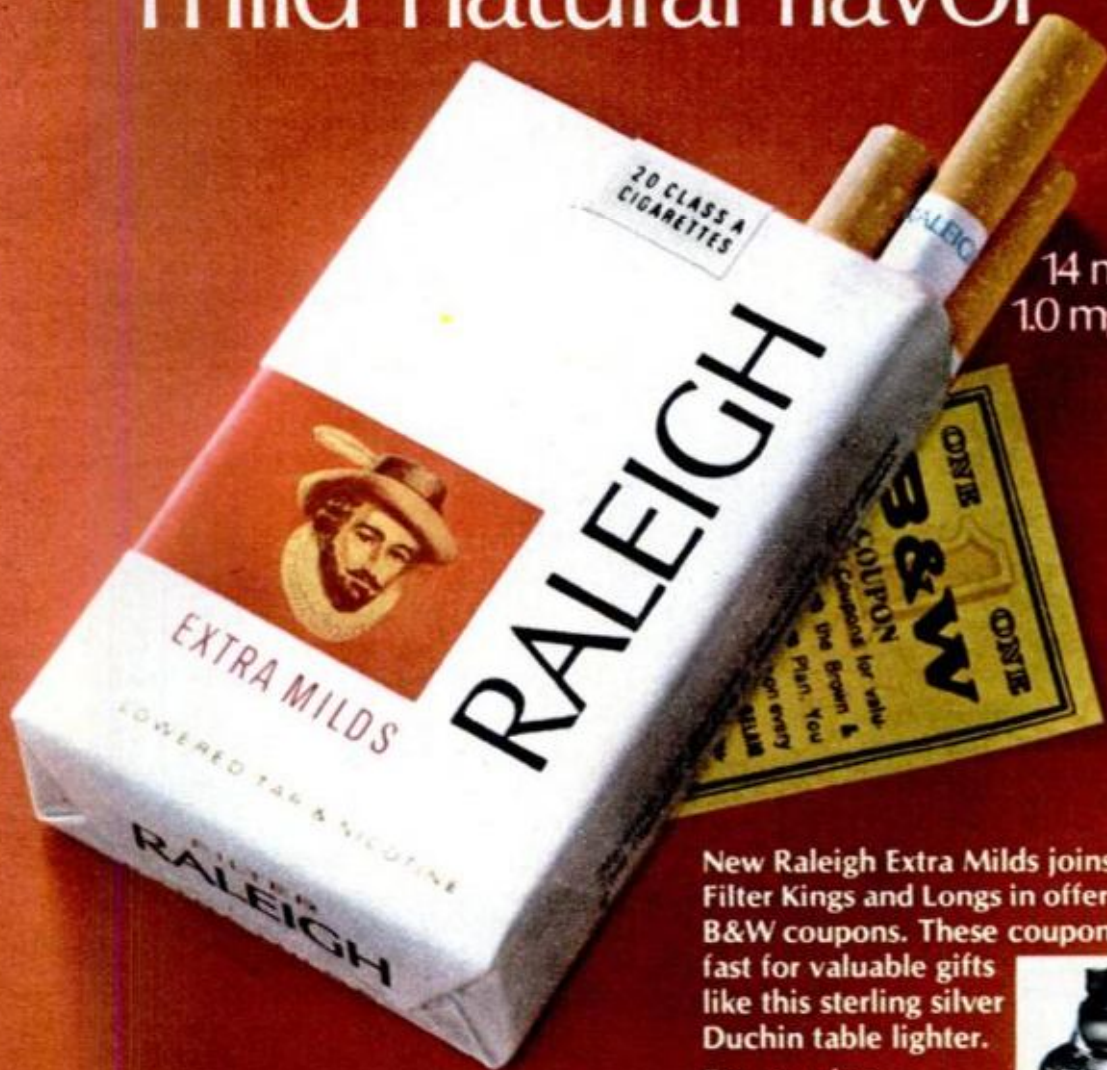
Drops of trouble

My 1972 Dodge Polara 400 is very hard to start after it has been parked overnight. The car has a Holley 2210 two-barrel carburetor that ejects drops of gasoline if manually operated when the engine is cold

(Please turn to page 42)

Introducing Raleigh Extra Milds

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New Raleigh Extra Milds joins Raleigh Filter Kings and Longs in offering free B&W coupons. These coupons add up fast for valuable gifts like this sterling silver Duchin table lighter.

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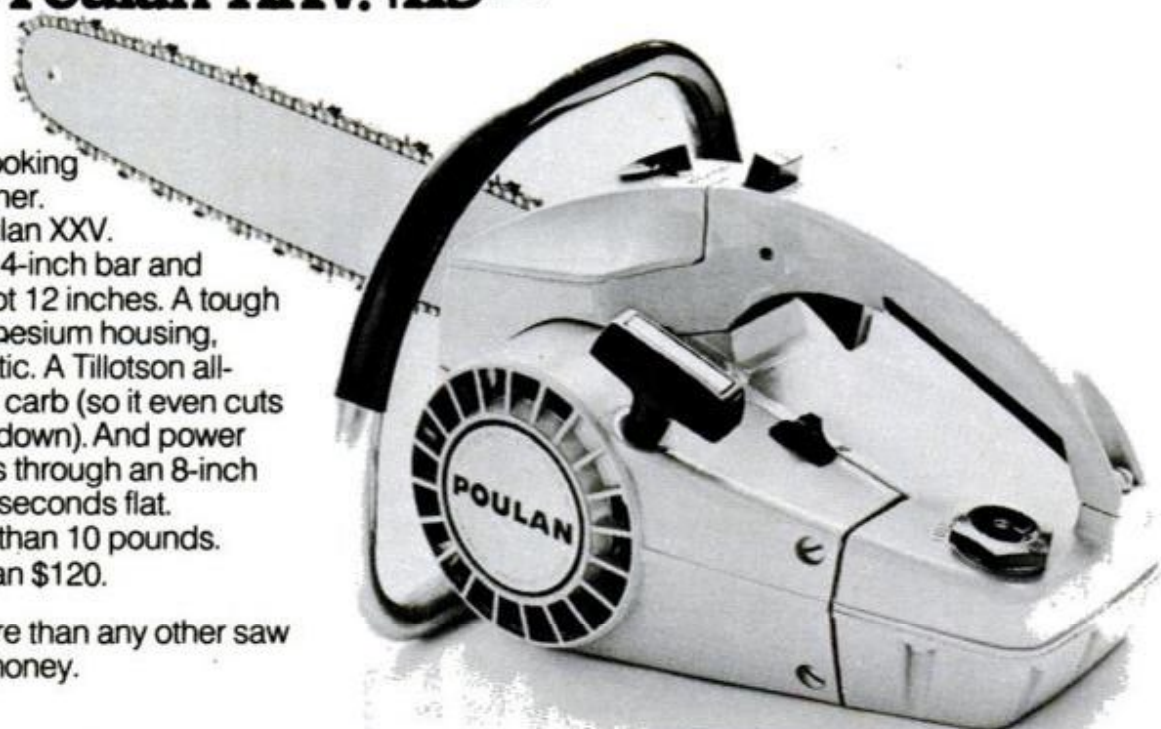
Warning: The Surgeon General Has Determined That Cigarette Smoking Is Dangerous to Your Health.

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Extra Milds, 14 mg. "tar," 1.0 mg. nicotine, av. per cigarette, by FTC method; Filter Kings, 16 mg. "tar," 1.2 mg. nicotine; Longs, 18 mg. "tar," 1.3 mg. nicotine, av. per cigarette, FTC Report Sept. '73

Last year's hottest selling lightweight: The Poulan XXV. \$119⁹⁵

You're looking at a winner. The Poulan XXV. With a 14-inch bar and chain, not 12 inches. A tough all-magnesium housing, not plastic. A Tillotson all-position carb (so it even cuts upside-down). And power that cuts through an 8-inch log in 4 seconds flat. It's less than 10 pounds. Less than \$120.

And more than any other saw for the money.



CAR CLINIC

(Continued from page 40)

rather than the fine mist it should eject. However, once the engine starts and warms up, and I operate the throttle manually, I get a fine mist. What do you think is wrong?—Nate Almond, Torrance, Calif.

The following, in the order presented:

1. Check the carburetor accelerating-pump plunger cup for sticking.
2. Check the carburetor throttle body-to-main body screws for looseness. Tighten if necessary.

The stalling by itself doesn't really upset me, but it's the fact that I can't get the engine restarted for hours afterward, and neither can Pontiac mechanics, that is dismaying. On every occasion I have had the car towed to a Pontiac dealer, mechanics have taken one to three hours to restart it. Everyone just replaces points and condenser. Please help.—Mrs. David M. MacGregor, Morristown, N.J.

I would judge that mechanics have seen that the engine isn't starving for fuel, so there's no reason to suspect a filter. My money is, therefore, on the ignition coil. A weak coil is unpredictable—that is why the engine stalls and won't restart at times, and will function okay other times. It's worth a shot to have the coil replaced.

Cockeyed coil

I'm having a terrible problem with my 1973 Pontiac LeMans, driven only 1100 miles. The car has a 350-cu.-in. engine and automatic transmission. Every so often (about once a week) the engine stalls anywhere from 100 feet to its first full stop for traffic following starting. I allow the car to warm up at least two minutes after I first start the engine; more recently, five minutes.

Losing its coolant

I own a 1972 Oldsmobile 98 Luxury Sedan with a 455-cu.-in. engine, four-barrel carburetor, airconditioner and all power options. The cooling system has been giving me a headache. When I shut off the engine after it has warmed up, there is enough

internal pressure to force coolant out of the overflow. My mechanic has checked the system several times, and has removed and boiled out the radiator. He tells me he's had the same difficulty with three other Oldsmobiles and doesn't know what to do to rectify it. Do you have any ideas?—Arnold R. Schultz, Stamford, Conn.

Be certain that you're not overfilling the radiator. When the engine is cold, the coolant level must be at the fill mark on the radiator—about three inches below the top of the filler neck. Second, make sure that the pressure cap fits the filler neck tightly. Finally, see that the cooling system has the correct thermostat—it has a flapper valve and is marked Dole Valve Co., Morton Grove, Ill. A wrong thermostat will create high internal pressure.

SERVICE TIPS

□ **1974 Torino and Montego owners:** Don't be aggravated if you're having a hard time moving the transmission shift lever on your car. Return the car to your Ford or Lincoln-Mercury dealer and have him install a new transmission shift cable bearing part No. D20Z-7E395-F.

□ **Chevrolet** recommends an easy way of cleaning the EGR valve on its models. Remove the assembly from the vehicle. Grasp it firmly in hand (do not clamp it in a vise), and tap lightly on the sides and end of the valve with a small plastic hammer to remove deposits from the valve seat. With a wire wheel, buff deposits from the mounting surface and from around the valve. Depress the valve diaphragm and look at the valve outlet, checking for cleanliness. If valve or seat isn't completely clean, repeat the procedure. Check for deposits in the valve outlet and remove any you find with a screwdriver. Clean the mounting surfaces of the valve assembly and intake manifold. Using a new gasket, install the valve assembly back on the intake manifold.

□ **AMC 1967-73 six-cylinder engines** have had carburetor problems traced frequently to a build-up of carbon inside the carburetor choke housing caused by a burned-out choke-heating tube. AMC is distributing a newly designed tube. It carries part No. 3219774. ★★★

GOT A PROBLEM WITH YOUR CAR? Just ask Mort about it. Send your question to the Car Clinic, Popular Mechanics, 224 West 57th St., New York, N.Y. 10019. While letters cannot be answered individually, problems that are of general interest will be published in the column.

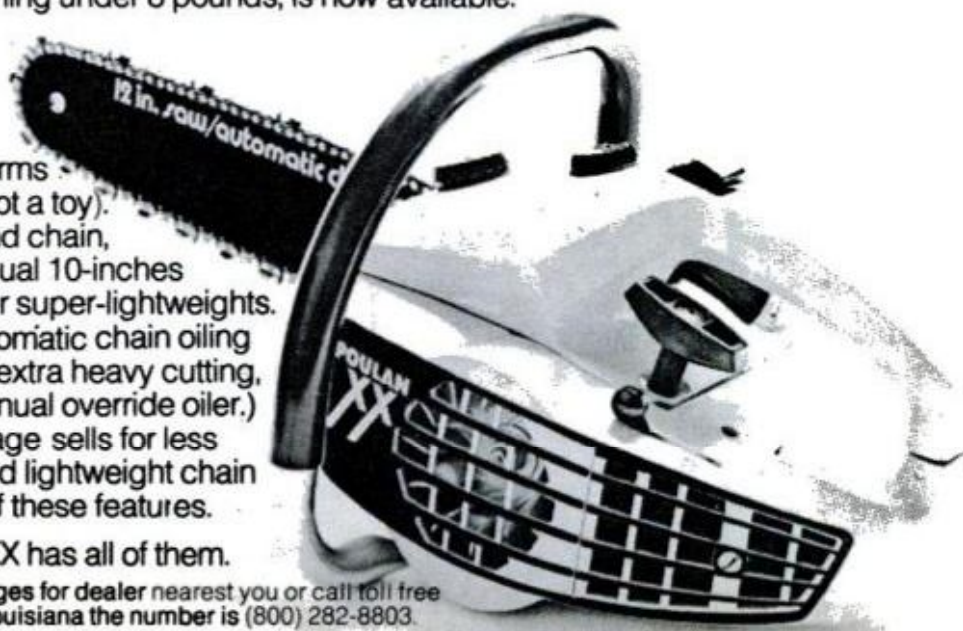
Next year's hottest selling super-lightweight: The new Poulan XX. \$99⁸⁸

Introducing another sure winner. The brand new Poulan XX, weighing under 8 pounds, is now available.

With the same tough all-magnesium body (so it performs like a machine, not a toy). A 12-inch bar and chain, instead of the usual 10-inches you find on other super-lightweights. And get this: automatic chain oiling is standard. (For extra heavy cutting, the XX has a manual override oiler.) The whole package sells for less than \$100. A good lightweight chain saw has many of these features.

But the Poulan XX has all of them.

Check the yellow pages for dealer nearest you or call toll free (800) 551-8989. In Louisiana the number is (800) 282-8803.



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Yes, you can take your 8 hits for 99¢ on records or cassettes instead of cartridges! (Sorry, no mixing.) Check box in coupon. You still enjoy all benefits described here, and take future selections (usually \$5.98 for records, \$6.98 for cassettes) in your preferred type of music.

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CAT STEVENS 10383 Catch Bull At Four A&M	ELVIS BLUE HAWAII 24044 RCA VICTOR
ELVIS COUNTRY 14026 RCA VICTOR	THE MANCINI GENERATION 13713 RCA VICTOR
JOHN DENVER 33364 Farewell Andromeda RCA VICTOR	The Best Of Charley Pride, Vol. 2 13385 RCA VICTOR
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JOHNNY CASH 04024 Original Golden Hits VOL. 1 SUN	ELVIS For Everyone! 14015 RCA VICTOR
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• Sonny & Chér: Live00237	TOM JONES 13257 Close Up PARROT
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NEIL DIAMOND 20138 Hot August Night MCA	
* THIS IS THE BIG BAND ERA 22514 RCA VICTOR	

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- Coeway Twitty 24005
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Please accept my trial membership in the RCA Music Service and send me the 8 hits I have chosen for 99¢. I agree to buy as few as eight more at regular Music Service prices in the next two years, after which I may cancel my membership. I understand I may refuse the automatic shipment of each "Selection of the Month," order other selections, or none, by returning the dated card always provided. (Small shipping-service charge added to each shipment.)

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I'd like to give this to my fellow men... while I am still able to help!

I was young once, as you may be—today I am older. Not too old to enjoy the fruits of my work, but older in the sense of being wiser. And once I was poor, desperately poor. Today almost any man can stretch his income to make ends meet. Today, there are few who hunger for bread and shelter. But in my youth I knew the pinch of poverty; the emptiness of hunger; the cold stare of the creditor who would not take excuses for money. Today, all that is past. And behind my city house, my

summer home, my Cadillacs, my winter-long vacations and my sense of independence—behind all the wealth of cash and deep inner satisfaction that I enjoy—there is one simple secret. It is this secret that I would like to impart to you. If you are satisfied with a humdrum life of service to another master, turn this page now—read no more. If you are interested in a fuller life, free from bosses, free from worries, free from fears, read further. This message may be meant for you.

By Victor B. Mason

I am printing my message in a magazine. It may come to the attention of thousands of eyes. But of all those thousands, only a few will have the vision to understand. Many may read; but of a thousand only you may have the intuition, the sensitivity, to understand that what I am writing may be intended for you—may be the tide that shapes your destiny, which, taken at the crest, carries you to levels of independence beyond the dreams of avarice.

Don't misunderstand me. There is no mysticism in this. I am not speaking of occult things, of innumerable laws of nature that will sweep you to success without effort on your part. That sort of talk is *rubbish!* And anyone who tries to tell you that you can *think* your way to riches without effort is a false friend. I am too much of a realist for that. And I hope you are.

I hope you are the kind of man—if you have read this far—who knows that anything worthwhile has to be *earned!* I hope you have learned that there is no reward without effort. If you have learned this, then you may be ready to take the next step in the development of your karma—you may be ready to learn and use the secret I have to impart.

I Have All The Money I Need

In my own life I have gone beyond the need of money. I have it. I have gone beyond the need of gain. I have two businesses that pay me an income well above any amount I have need for. And, in addition, I have the satisfaction—the deep satisfaction—of knowing that I have put more than three hundred other men in businesses of their own. Since I have no need for money, the greatest satisfaction I get from life is sharing my secret of personal independence with others—seeing them achieve the same heights of happiness that have come into my own life.

Please don't misunderstand this statement. I am not a philanthropist. I believe that charity is something that no proud man will accept. I have never seen a man who was worth his salt who would accept something for nothing. I have never met a highly successful man whom the world respected who did not sacrifice something to

gain his position. And, unless you are willing to make at least half the effort, I'm not interested in giving you a "leg up" to the achievement of your goal. Frankly, I'm going to charge you something for the secret I give you. Not a lot—but enough to make me believe that you are a little above the fellows who merely "wish" for success and are not willing to sacrifice something to get it.

A Fascinating and Peculiar Business

I have a business that is peculiar—one of my businesses. The unusual thing about it is that it is needed in every little community throughout this country. But it is a business that will never be invaded by the "big fellows." It has to be handled on a local basis. No giant octopus can ever gobble up the whole thing. No big combine is ever going to destroy it. It is essentially a "one man" business that can be operated without outside help. It is a business that is good summer and winter. It is a business that is growing each year. And, it is a business that can be started on an investment so small that it is within the reach of anyone who has a television set. But it has nothing to do with television.

This business has another peculiarity. It can be started at home in spare time. No risk to present job. No risk to present income. And no need to let anyone else know you are "on your own." It can be run as a spare time business for extra money. Or, as it grows to the point where it is paying more than your present salary, it can be expanded into a full time business—overnight. It can give you a sense of personal independence that will free you forever from the fear of lay-off, loss of job, depressions, or economic reverses.

Are You Mechanically Inclined?

While the operation of this business is partly automatic, it won't run itself. If you are to use it as a stepping stone to independence, you must be able to work with your hands, use such tools as hammer and screw driver, and enjoy getting into a pair of blue jeans and rolling up your sleeves. But two hours a day of manual work will keep your "factory" running 24 hours turning out a product that has a steady and

ready sale in every community. A half dollar spent for raw materials can bring you six dollars in cash—six times a day.

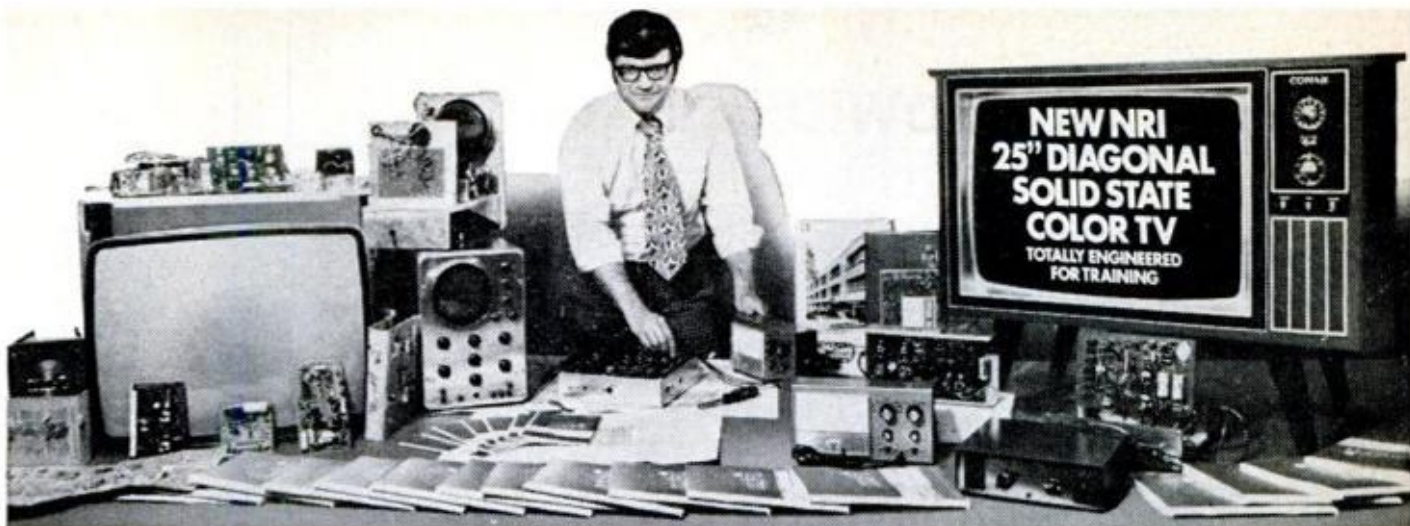
In this message I'm not going to try to tell you the entire story. There is not enough space on this page. And, I am not going to ask you to spend a penny now to learn the secret. I'll send you all the information, free. If you are interested in becoming independent, in becoming your own boss, in knowing the sweet fruits of success as I know them, send me your name. That's all. Just your name. I won't ask you for a penny. I'll send you all the information about one of the most fascinating businesses you can imagine. With these facts, you will make your own investigation. You will check up on conditions in your neighborhood. You will weigh and analyze the whole proposition. Then, and then only, if you decide to take the next step, I'll allow you to invest \$15.00. And even then, if you decide that your fifteen dollars has been badly invested I'll return it to you. Don't hesitate to send your name. I have no salesmen. I will merely write you a long letter and send you complete facts about the business I have found to be so successful. After that, you make the decisions.

Does Happiness Hang on Your Decision?

Don't put this off. It may be a coincidence that you are reading these words right now. Or, it may be a matter that is more deeply connected with your destiny than either of us can say. There is only one thing certain: If you have read this far you are interested in the kind of independence I enjoy. And if that is true, then you must take the next step. No coupon on this advertisement. If you don't think enough of your future happiness and prosperity to write your name on a postcard and mail it to me, forget the whole thing. But if you think there is a destiny that shapes men's lives, send your name now. What I send you may convince you of the truth of this proverb. And what I send you will not cost a penny, now or at any other time.

VICTOR B. MASON
1512 Jarvis Ave., Suite M-2-DB
CHICAGO, ILLINOIS 60626

You get more for your money from NRI



SOLID STATE TRAINING—Learn-by-doing with NRI equipment. TV-Radio Servicing course includes 25" diagonal color TV, with handsome woodgrained cabinet at no extra cost; wideband service type oscilloscope, color bar crosshatch generator, transistorized volt-Ohm meter, and solid-state radio kit. Other courses equally complete.

NRI Programmed Equipment Gives You Priceless Confidence, Makes Learning TV-Radio, Electronics Fast and Fascinating

NRI pioneered the idea of supplying home-study students with custom designed training kits to give practical on-the-job experience as you learn. Today, NRI's "3-Dimensional" training can't be equalled. You get more value—from the exclusive Achievement Kit sent the day you enroll, to "bite-size" texts and custom training equipment. Learning TV-Radio, Electronics or Communications at home is easy, exciting, the NRI simplified, dramatized way.

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openings or have a business of your own. And if you choose one of five NRI courses that include FCC License preparation, you must earn your FCC License or NRI refunds your tuition!

MAKE \$5 TO \$7 AN HOUR EXTRA IN SPARE TIME STARTING SOON

Tens of thousands of NRI graduates are proof it is practical to train at home in your spare time. Keep your present job while preparing for a better one, and earn \$5 to \$7 an hour extra in spare time while you train, fixing sets for friends and neighbors. NRI shows you how. Equipment you build and keep becomes useful in your work.

STEP UP TO BETTER PAY, A BRIGHTER FUTURE

NRI can help you, but the decision to act must come from you. Decide now to move ahead . . . mail the postage-free card today for your FREE NRI color catalog. No obligation. No salesman will call. NATIONAL RADIO INSTITUTE, Electronics Division, Washington, D.C. 20016.

APPROVED UNDER GI BILL

If you served since January 31, 1955, or are in service, check GI line on postage-free card or in coupon.

CASH IN ON THE BOOM IN COLOR TELEVISION



The NRI TV-Radio Servicing course includes your choice of black and white or color TV training equipment. Color TV needs thousands of trained men to keep pace with millions of sets being sold every year. NRI prepares you quickly. Cash in on the boom.

Mail insert card for your **FREE NRI color CATALOG**

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SCIENCE WORLDWIDE



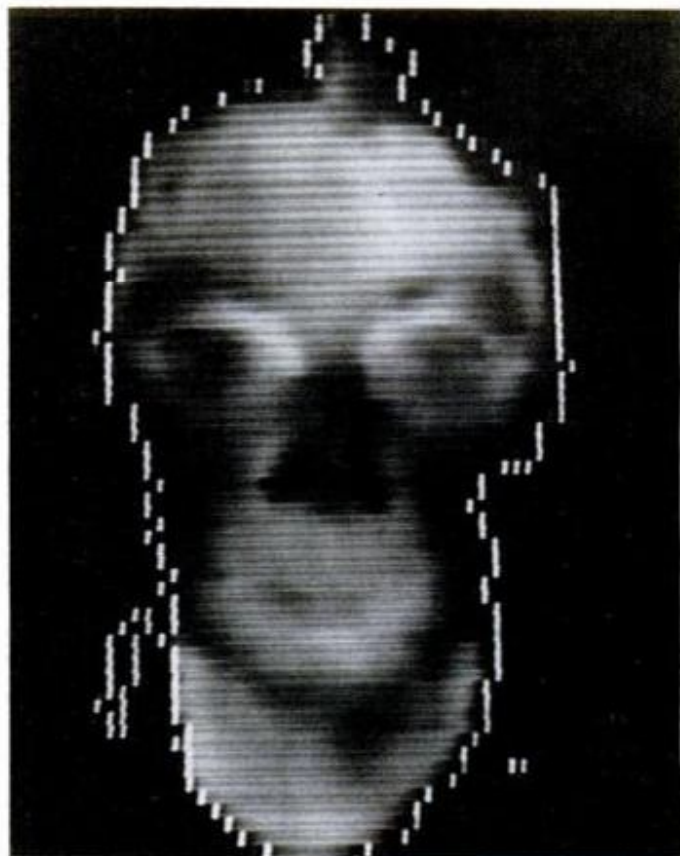
Heading down for 'spacewalk'

Though he's never blasted off atop a rocket, Charles Cooper has spent more time "spacewalking"—over 2000 hours—than all of our astronauts put together. As chief of the Space Simulation Engineering Section at the Marshall Space Flight Center in Alabama, he does his walking 40 feet down in the Center's 1.5-million-gallon simulation tank. Cooper tests tools and makes repairs on mock-up spacecraft to work out bugs in equipment and procedures. He wears a \$100,000 pressure suit that's the same as those used in space. By carrying about 120 pounds of extra weight, he achieves neutral buoyancy, enabling him to function just as he would in space. He trains astronauts in the simulator, and is the key man in solving problems such as those that cropped up during the first Skylab mission.

Canadian glacier threatens floods

Serious floods could hit areas of Alaska and Canada next summer if the "galloping" Tweedsmuir Glacier advances far enough to block the Alsek River. Recent air and satellite photos indicate that the 44-mile-long glacier, possibly the largest in Canada, is

advancing in "spectacular fashion," according to the U.S. Geological Survey. If the glacier dams the river, melting ice next summer could release surges of water that would flood downstream channels.



Heat photo for predicting stroke

A new use for infrared thermography—spotting potential stroke victims—is under investigation at a hospital in Bath, England. A scanner is focused on the patient's face. Infrared emissions are picked up by an optical system, which directs them to a thermocouple. Signals are then amplified and displayed on a cathode tube. Dark areas on the picture represent a cool reading; light areas, a hot reading. The warning sign of a potential stroke is coolness over one, or both, eyebrows. Coolness indicates blockage in a major blood vessel, which is a cause of

(Please turn to page 52)

The "typical" American camper:

We can help him and her pack more comfort into camping.

SHOULDERS: Carry less driving burden. Adjust for comfort as you adjust the wheel.

MIND: It's easier keeping it on vacation fun when the driving's more comfortable. That's what Power Steering and Tilt-Wheel Steering are all about.

ARMS: Have less work to do, with Power Steering.

TUMMY: Tilt-Wheel Steering gives you plenty of room for it.

FEET: Should be pointed in the direction of a GM dealer for a demonstration.

KNEES: Same thing for them.

Power Steering and Tilt-Wheel Steering are two things you should take camping. Power Steering helps make handling easier, even on rough back roads. And parking easier, even in tight places. Tilt-Wheel lets you adjust the wheel to your most comfortable driving position while you drive. Also moves out of the way to make entry and exit easy. See your Chevrolet or GMC Truck

dealer for a demonstration of Power Steering and Tilt-Wheel Steering. Saginaw Steering Gear Division, General Motors Corporation.



SAGINAW
POWER STEERING
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UNUSUAL BARGAINS

NEW PRODUCTS • NEW MATERIALS • NEW IDEAS

3-CHANNEL COLOR ORGAN KIT



Easy to build low-cost kit needs no technical knowledge. Completed unit has 3 bands of audio frequencies to modulate 3 independent strings of colored lamps (i.e. "lows"—reds, "middles"—greens, "highs"—blues). Just connect hi-fi, radio, power amp etc. & plug ea. lamp string into own channel (max. 300w ea.). Kit features 3 neon indicators, color intensity controls, controlled individual SCR circuits; isolation transformer; custom plastic housing; instr.

Stock No. 41.831 \$17.50 Ppd.

"FISH" WITH A MAGNET



Go treasure hunting on the bottom! Fascinating fun & sometimes profitable! Tie a line to our 31½ lb. Magnet—drop it overboard in bay, river, lake or ocean. Trawl it along bottom—your "treasured" haul can be outboard motors, anchors, other metal valuables. 31½ lb. Magnet is war surplus—Alnico V Type—Govt. cost twice our price. Lifts over 40 lbs. on land—much greater weights under water.

Stock No. 70.570H 31½ lb. \$11.50 Ppd.
Stock No. 60.215H 11½ lb. \$6.50 Ppd.

SUPER GLUE! DROP HOLDS TON



Clear Permapond obsoletes other adhesives! No mixing; sets in seconds—no solvents, catalysts, heat. Tensile strength to 5000 lb. in. 7 Joins, welds, seals, mounts; bands rubber, plastic, wood, etc. Use for assembly repair, O.E.M. wk. Mend china; bond silicone chips to ceramics; metal to glass; fix parts to rivet. Impervious to most chemicals (enters cracks others can't); non-water soluble; non-toxic.

No. 41.509 1-OZ. BOTTLE \$8.75 Ppd.
No. P-42.107 (5-PAK 2 GM. TUBES) \$7.95 Ppd.

GIANT WEATHER BALLOONS—8' or 25' DIAMETER



"Balls of fun" for kids, traffic stoppers for stores, terrife for amateur meteorologists. Create a neighborhood sensation. Great for decorations, launching radio controlled airplanes, scuba diving markers, etc. Amateur meteorologists use to measure cloud heights, wind speed and temperature. Made of thin neoprene designed to burst at high altitudes. Inflate carefully with vacuum cleaner or auto air hose, or locally available helium for high rise.

Stock No. 60.568H (8' size) \$2.50 Ppd.
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4 1/4" ASTRONOMICAL TELESCOPE



See craters on moon, rings of Saturn, double stars. Up to 270X. New vibration-free equatorial mount. f/10 mirror corrected to better than 1/4 wave length. Gives theoretical limited resolution. Back and pinion focusing. Aluminum tube, 6X finder telescope, 2 standard eyepieces and Barlow lens gives power up to 270X. Free: Star Chart, 272-page "Handbook of the Heavens" plus "How to Use Your Telescope".

Stock No. 85.105H (Shipping Wt. 42 lbs.) \$115.00 F.O.B.

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SCIENCE WORLDWIDE

(Continued from page 50)

strokes. The thermograph shown on page 50 contains no signs of impending stroke.

CO₂ for fast-curing cement

If you expose portland cement to carbon dioxide, it will become just as strong in 10 minutes as it would with seven days of normal curing. That was determined by researchers at the University of Illinois, Urbana, in experiments designed to discover the mechanism of the hardening process. Portland cement reacts with water to form an alkaline solution of calcium, according to the researchers. The carbon dioxide speeds things up by promoting a vigorous reaction between calcium silicates in the cement and the water. The reaction occurs several hundred times faster than usual.

New investigation clears coffee

Coffee drinking does not cause heart attacks, according to a research report in a recent issue of the *Journal of the American Medical Assn.* In a study conducted among patients at a California medical center, researchers found "no independent association between coffee drinking and a subsequent first myocardial infarction (heart attack) in 464 patients." Heavy coffee drinkers tended to be cigaret smokers. It's likely, the researchers concluded, that cigaret smoking and other risk factors—not coffee—brought on the attacks. The study refuted a report in a British medical journal linking coffee drinking and heart attacks.

Push urged for solar homes

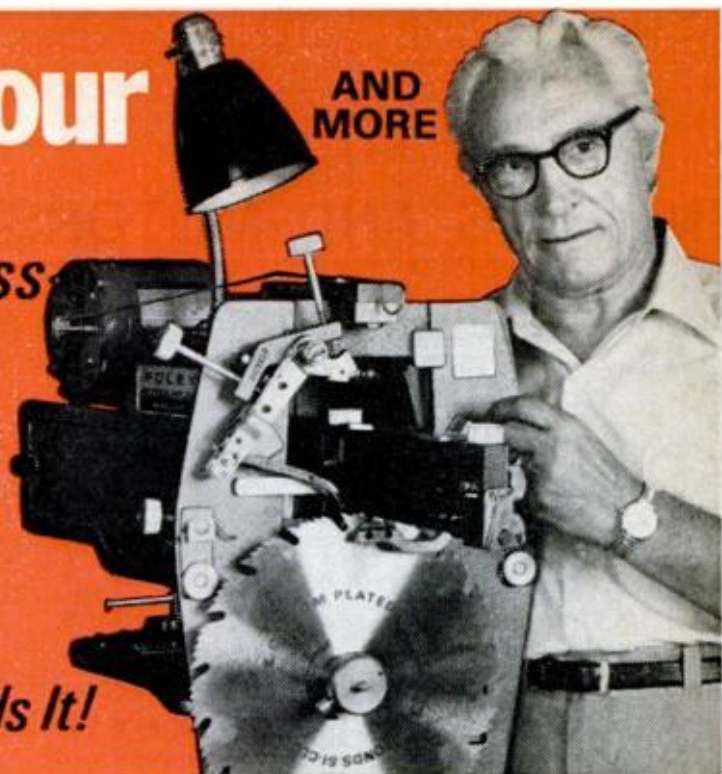
Mass-produced solar energy systems to heat, cool and generate electricity for homes and other buildings could be available within five years if a development program were given federal assistance, believes John P. Bologna, an executive of PPG Industries, Pittsburgh. He says the technology and manufacturing capability already exist, but what's needed now is the kind of federal funding that advanced aerospace research in the '60s and made possible the Manhattan project to develop the atomic bomb. ★★

Earn \$8 an Hour

In The Evening or on Weekends in a Business of your own!

Sharpening Saws & Tools

For Industry and Homes! Every Neighborhood Needs It!



No Experience needed.

Here's a business of your own that lets you start earning *right now*. You need no experience or training. Your precision-made Foley equipment does the job for you. Simple, easy-to-understand instructions tell you how.



Sharpening is Big Business ... and Profitable Too!

All over the country, in small towns and big cities, people just like yourself are earning big money in the saw sharpening business. Industry, home handymen, professional carpenters all need their equipment sharpened. It's a business that's growing every day.

Sharpen Carbide and High Speed Tools



The tremendous growth of the use of Carbide Tipped Saw Blades and other extra hard metal tools is an extra bonus for saw sharpening shops using Foley's Carbide Grinding Equipment. It takes just 15 minutes to renovate a carbide blade... 15 minutes that pays you \$8—practically all profit, too! Customers are limitless because Carbide tipped saws are being used almost exclusively to cut metals, plastics, laminated woods, hard woods and giant logs.

Part Time Shop Now Makes \$30,000 A Year in Profits

Floyd B. of New York started his saw sharpening business in his spare time. But before long, his business made it necessary to quit his regular job and devote full time to his new business of his own. Today he has a fully-equipped saw sharpening shop. In his first year, he did over \$30,000 in business.

Foley will finance you.

There's no need to make a huge investment or carry big inventories when you're in "business for yourself" with Foley Sharpening Equipment. All you need is the equipment and pennies worth of electricity. Foley will finance your equipment to help get you started with minimum investment. When you charge \$8 for sharpening a carbide tipped saw blade, \$7.50 is profit.

No Franchise Fees! No Obligation

Find out today how you can earn big money in the saw sharpening business. Write today for more information. There is no obligation.

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Please send information on the potential profits in a Sharpening business of my own and how Foley will help finance me.

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City _____

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IMPORTS AND MOTORSPORTS

Fuel for thought

The energy crisis is going to be a blow to motorsports—and a boon to imports. Already canceled (as of Dec. 1) are *all* motorsports in South Africa, and what was to have been next month's Mint 400 Desert Race in Nevada. Too bad: The fuel used by the race cars themselves is not that great, but the consumption is just too conspicuous. In other sports, great gobs of power are used, but more subtly: Spectator travel burns up the greatest amount. Compare the following figures for annual fuel consumption:

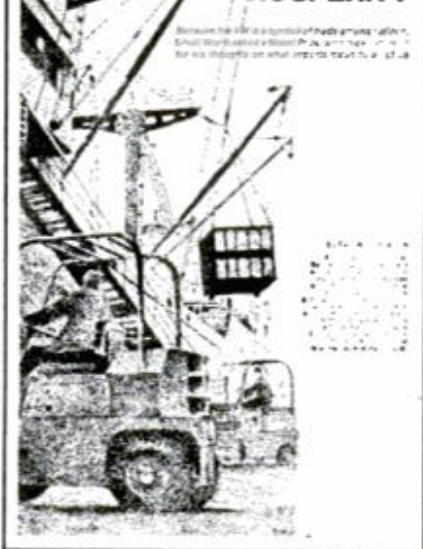
	Gallons
Vacation travel	5,416,140,827
Nonscheduled aviation	835,000,000
Motion picture theaters	749,578,653
Football	564,043,166
Basketball	238,394,571
Horse racing	97,522,973
Auto racing	93,639,696
Rodeos	88,000,000
Bowling	40,000,000
Major-league baseball	33,657,289
Wrestling	27,108,185
Golf	14,560,000

The figures were compiled by the National Motorsports Committee of the Automobile Competition Committee for the United States (ACCUS), at 330 Vanderbilt Motor Pkwy., Hauppauge, N.Y. 11787. It totaled all forms of energy use including lighting, heating and airconditioning. Fuel consumption by all mass entertainment sports is a drop in the bucket compared to leisure-time use. Keep the faith—and car pool.



Four cylinders is all you ever need—even to win the prestigious Press On Regardless International Rally. The Corolla 1600 did the job for Walt Boyce and Doug Wood who did the 1700 hard miles way ahead of the second place Volvo 142S and third place Datsun 240Z.

IMPORTS AND AMERICA'S PROSPERITY



International trade is rational trade

Of all the people looking to buy a new car in the United States every year, more than 15 percent don't find what they want—among the models made in Detroit. They buy an import. More every year. In many cases, a lot of the parts used in these imported cars were made right here in the United States or a country other than that where the car started down the line. Similarly, thousands of jobs are created at home by the importation of cars from abroad.

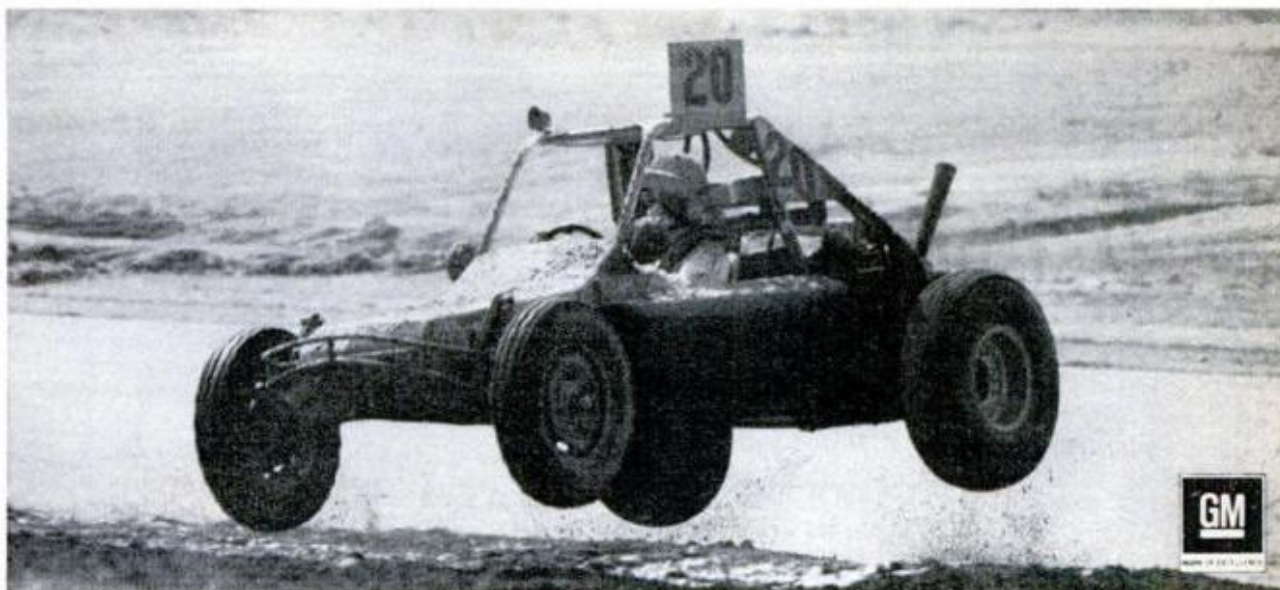
The complex subject of international trade is discussed in a recent article by Nobel-prize winning economist, Paul A. Samuelson. The piece, a page of which is shown above, originally appeared in *Small World*, the Volkswagen owners' magazine. As he says: "If, shortsightedly, we build walls against imports and indulge widely in protective quotas, this will not add to our rate of progress. Instead, it will *slow down* the pace at which we acquire longer and healthier lives." If you'd like to read his complete analysis, write Volkswagen of America, Inc., Englewood Cliffs, N.J. 07632.

A new tune

Mazda's new top-of-the-line car is the RX-4. It's the most luxuriously appointed Mazda to date and uses the company's biggest two-rotor for a little more hum in the engine compartment. In addition to the coupe and

(Please turn to page 56)

AC-EQUIPPED VEHICLES SWEEP ALL 4-WHEEL CLASSES IN FIRST RUNNING OF MICKEY THOMPSON'S SCORE INTERNATIONAL



AC SPARK PLUG DIVISION

SCORE, or Short Course Off-Road Event, is a totally new form of off-road competition. SCORE brings the excitement of a lengthy off-road event to a 7.5 mile short course track, fully visible to spectators.

At this year's inaugural running of SCORE, AC-equipped vehicles swept every 4-wheel class. AC Spark Plugs, Oil Filters and Air Filters were on six out of the eight winning vehicles, including the one driven by the overall 4-wheel vehicle winner, Rick Mears. The vehicles driven by the two other 4-wheel class winners were protected by AC Filters.

If AC products can deliver winning performance under the extreme driving conditions of SCORE, think how they will perform for your kind of driving.

Go with the winners—reliable AC Fire-Ring Spark Plugs, AC Oil Filters and AC Air Filters.

AC WINNERS AT MICKEY THOMPSON'S SCORE INTERNATIONAL*

(AC-equipped vehicles win eight out of eight 4-wheel classes)

CLASS	1st PLACE	AC PRODUCTS
Single-Seat 4-Wheel Vehicle	Rick Mears (Overall 4-Wheel Vehicle Winner)	AC Spark Plugs AC Oil Filter AC Air Filter
2-Seat 4-Wheel Vehicle	Dr. William Kemp	AC Spark Plugs AC Oil Filter AC Air Filter
4-Wheel Drive Stock Production	Rodney Hall Jim Fricker	AC Spark Plugs AC Oil Filter AC Air Filter
4-Wheel Drive Modified Production	Jerry Colton Robert Gellenback	AC Spark Plugs AC Oil Filter AC Air Filter
Baja Bug	Lee Evans Douglas Ellsworth	AC Oil Filter
2-Wheel Drive Production	Dick Lee	AC Spark Plugs AC Oil Filter AC Air Filter
Mini-Pickup	Dr. Don M. Bare Raymond Lynch	AC Oil Filter AC Air Filter
2-Wheel Drive Utility Vehicle	Walker Evans	AC Spark Plugs AC Oil Filter AC Air Filter

*"Score International," an off-road event sponsored by the National Off-Road Riding Association, 7.5 mile short course track run at Rivers to Raceway, Riverside, California, October 6 and 7, 1973.



Back-yard storage

These appealing back-yard houses can also serve as playhouses or place for a guest. Extra plans are for obtaining permit.



Above: Playhouse and storage with covered walkway. Two-story house 8 ft. wide by 12 ft. long. 2nd floor 2 ft. 4 in. wider.

B1277 Single set \$3.95
B1277A Two sets \$5.49



Left: Featuring a pillared porch with a dutch door. Shake roof topped with a birdhouse-cupola. 8 ft. wide by 8 ft. deep.

B1301 Single set \$3.95
B1301A Two sets \$5.49

Right: Dutch mini-barn with country charm. Looks small but is 10 ft. by 13½ ft. Roof design gives 8 ft. overhead room.

B1279 Single set \$3.95
B1279A Two sets \$5.49



Left: Delightful A-frame. Outside stairway to attic crawl space. 8 ft. by 12 ft. and almost 13 ft. high.

B1302 Single set \$3.95
B1302A Two sets \$5.49



Right: A little beauty for tools and kids. Looks more like a storybook cottage. 10 ft. square with 6 ft. porch.

B1300 Single set \$3.95
B1300A Two sets \$5.49



Popular Mechanics, Box 1014, Dept. AD, Radio City, N. Y. 10019

I am enclosing \$_____ for _____ sets of plans of buildings indicated below. (Please write numeral 1 or 2 in box.)

B1277 B1302 B1301 B1300 B1279

Name _____

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City _____ State _____ Zip _____

IMPORTS AND MOTORSPORTS

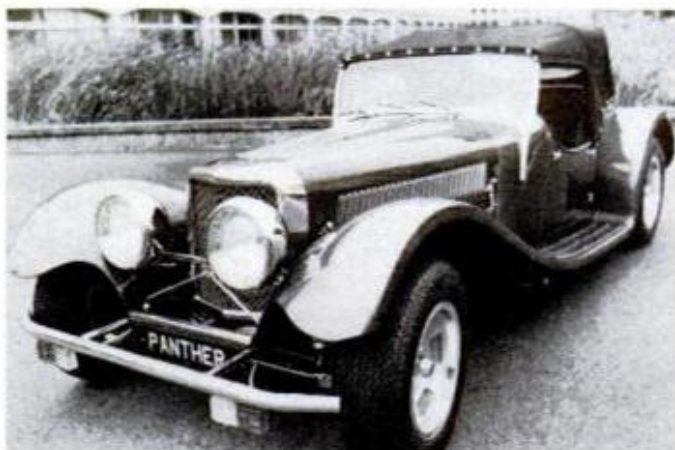
(Continued from page 54)

the station wagon models shown below, there's a four-door sedan. The first cars just started arriving and all models should be available nationwide in the spring.



A bit of the good old days

If it looks just like the prewar (WW II, that is) Jaguar SS 100, it's meant to. The Panther J72 is a new car being built by Panther Westwinds, Ltd. in England. It should be called the 19G. That's the price. The body is hand-formed aluminum, under-carriage is treated with vinyl to be abso-



lutely corrosion-resistant and drivetrain is Jaguar. Interior is hand-upholstered in leather, carpet is English wool. Dash? Hand-tooled burred walnut. For more information write the U.S. distributor, Edward Gaylord, 1918 Prairie Ave., Chicago, Ill. 60616. ★★

Edelbrock introduces a new, improved MILEAGE/PERFORMANCE MANIFOLD.

Performance equipment that *improves* rather than reduces gas mileage. Unheard of? Meet Edelbrock's new STREETMASTER! First performance intake manifold designed to increase mileage, improve vehicle responsiveness and reduce emissions.

Streetmaster's secret? Velocity and efficiency. The fuel gets from carburetor to combustion chambers faster. Better fuel atomization. More uniform distribution. Better cylinder filling.

The Streetmaster design is available for most popular make family



cars, pick-up trucks, motor homes, vans, station wagons and campers.

The Streetmaster has met or exceeded latest federal emission standards. Using stock carburetion, Streetmaster easily replaces your stock manifold, providing increased vehicle performance from off-idle to cruise. Up to a 9-14% mileage improvement can be yours using economy driving habits.

See your local Edelbrock Performance Dealer, JC Penney Auto Center, or send \$1 for complete catalog and special Edelbrock pen.

The small-block Chevy "STREETMASTER" received "BEST NEW PRODUCT" award at '73 SEMA Trade Show.

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ALL OUTDOORS

Camping's energy aids

For ways that *PM's* several million outdoorsmen can stretch the family fuel supply, we asked Sheldon Coleman, chairman of the Coleman Co., for his thoughts.

"Basic camping products which are lightweight and versatile," he notes, "are ideally suited for standby or emergency use in time of fuel shortage, just as they have been during storms and power failures. Stoves, lanterns, catalytic heaters and other products such as those manufactured by our company have already been proved virtual 'lifesavers' thousands of times. They can be stored conveniently in any home, and with proper care and a minimum of maintenance, can be pressed into service at any time. Fuels for safe and convenient operation of appliances—whether powered by gasoline, propane or kerosene—can be safely stored in small quantities which will see the user through most emergency situations.

"With a common sense approach, campstoves can be used inside the home for cooking, catalytic heaters for warmth, and lanterns for both light and heat. Care must be taken, of course, to provide proper ventilation (as it must with any household appliance) and for the safe handling of fuels while filling or refilling.

"During power failures or 'brownouts,' modern sleeping bags that are now both warm and washable are versatile aids for sleeping comfort. Products such as coolers and jugs can also be pressed into service for low-cost refrigeration.

"There are, in fact, hundreds of fine products on the market today, initially designed for the use of outdoorsmen, which are excellent for indoor use, if and when the need arises." So says the man whose name has come to suggest convenient light and heat outdoors.

Motormaker motor homes

Car manufacturers, the builders of the trucks and chassis that mount so many recreational vehicles, are easing into the RV business themselves. GM has its big motor home, Ford offers the American Road Pickup truck camper body at Ford dealers. And now Ford has announced it may market its own motor home the same way in 1975. Initial plans call for the Sheller-Globe Corp. to build the bodies at its Kosciusko, Miss., plant.

International Truck dealers this spring

(Please turn to page 60)



Swinger's newest motor home has Generac all-electric total-energy system supplying power for airconditioning, heat, lights, stove, refrigerator, hot water.



Plymouth Trail Duster is four-wheel-drive addition to famous line. Dodge will also have a Ramcharger. Options will include soft, hardtops, 313 or 440 V8.

START YOUR NEW CAREER NOW! WITHOUT OVERHEAD! ANY PLACE! ANY AGE!

UPHOLSTERING JUST ONE

you don't even have to quit your present job!!!

CHAIR can pay you as much as your present weekly paycheck!

Start learning now. At home, or in the garage, in your spare time — no outside classes to attend. If you can tie a knot and drive a tack, you can learn this business, quickly, easily. You start learning the basics **right away** through the proven MUI Home Training Plan. And before you're barely into it, you can start doing the simple upholstery jobs that are all around you waiting to be done. Chairs, cushions, seats, footstools. Even before MUI students finish their training, people start bringing upholstery jobs to them, and remember—the world is full of furniture that needs fixing and re-upholstering and more is wearing out all the time!



"What started as a hobby, now pays me \$10 an hour"

Yes, many MUI graduates make better than \$10 an hour turning old wornout furniture into bright new decorator pieces! Stack it up against what you're doing now! Are you making \$150 a week? \$200? \$250? Do you put in long hours of dull work, with small raises? Is that the way you want to spend the rest of your life? Just imagine, you can make \$150, \$200, \$250 upholstery just one chair or sofa these days! And if you're the kind of person who likes to work and earn, you can sometimes finish a job like this in a day. That's pay, ... and it beats what most college graduates make!

AS YOU LEARN, YOU JUST SLIP INTO THE IMMENSE FLOW OF UPHOLSTERY WORK! Think of all there is! . . . Sofas, lounging chairs finished in beautiful fabrics, which MUI tells you how to get at the right price — even leather and all the new vinyls. And then you have built-ins and breakfast nooks, boats, trailers and all the millions of automobiles in America. Yes, you learn all this and more! When we finish teaching you, (in your own home in your spare time) and when you get our California state approved diploma, you know this business . . . as a real professional! You will then have one of the most fantastic moneymaking skills in America built into your head and hands! No one can ever take this skill away from you . . . and no one can ever fire you, because you're the boss of a business that you can take with you . . . You can make big money from then on . . . any time, anyplace you want to put out your shingle!

When you read the papers you see there's a strike here, a lockout there, Detroit lays off 150,000 men. A plant is shut down and moved out of state. A new automated machine eliminates 5,000 jobs. They talk about dislocated workers and try to do something about it. What pays the bills if you get caught up in one of these situations? When you know upholstery, life gets very simple and lots of fun. It's simple because where there are people, there are upholstery jobs and lots of them. It's fun because life is fun when the bills are paid and there's money in the bank, even enough to buy those things you've always wanted for yourself.

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ALL OUTDOORS

(Continued from page 58)

will have 8, 9½ and 10½-foot camper bodies plus standard and deluxe cap covers, all specially designed for the International 8-foot Bonus-Load pickup.

Snow-go with less gas

Late-season suggestions from Mercury for snowmobile fuel conservation include cleaning plugs and checking timing, tightening fuel-line fittings, carburetor adjustment by a trained mechanic, avoiding excessive idling, slower speeds that can save up to 50 percent on consumption, more careful refueling, replacement of a slipping drive belt, drive chain and track adjustment, and proper fuel-oil mix. The results are likely to save both gas and money.

Recycling tale

Squirrel hunters should remember that tails aren't edible but are salable to tempt hungry fish. Sheldons' of Antigo, Wis., 54409, maker of the famous Mepps fishing lures, has found no plastic substitutes for the fur dressing on its spinners. Fish seem to prefer fox or black squirrel tails the most, with gray and red next, although they'll also strike at buck tails from Virginia white-tailed deer. Sheldons' pays 8 to 10 cents a tail for top quality. The company spent more than \$20,000 last year for tails but couldn't get enough of them. Squirrel-stew fanciers should write Sheldons' for shipping instructions.

Free firewood

If you have a National Forest nearby and gas to get there, you can apply for a permit to collect and cut dead timber for personal use. Previously, only "bona fide settlers, miners, prospectors and residents" were allowed the privilege. The Department of Agriculture reports relaxation of rules, due to the energy shortage. Permits are obtained from the supervisor of ranger district offices at any of the 155 National Forests in 44 states and Puerto Rico.

(More photos on page 60B)

Theft protection for hunting or sport rifles, shotguns or carbines carried in your car is aided with new locks from Smith & Wesson. Electric or key locking units are offered.



Rawhide 125, newest from Crosman, is an easy-pump single-stroke air rifle with fully adjustable sight, 35 .177-cal. BB capacity. Saddle strap included.



Winnebago now has Kap covers for Ranchero, El Camino or any other pickup truck. Covers are \$200 to \$375; some models include cabinets, bunks.



Wilderness model 114 from Bowen Knives, Atlanta, Ga., is stainless-steel survival-camp-throwing knife with 60-inch sheath lanyard for lashing as spear. \$30.

Jock itch (or chafing, rash, itching, sweating) shouldn't be treated lightly.

If your groin, thighs, or buttocks suffer from redness, rash, chafing, soreness, excessive perspiration, or Jock Itch (*Tinea cruris*), then you need medicated Cruex®.

Cruex soothes itchy, inflamed skin. Absorbs perspiration. Helps cushion against further irritation. And medicated Cruex helps prevent fungous infections that can develop.

Cruex spray-on powder reaches hard-to-get-at



places so you avoid the sting and burn of rubbing or smearing on ointments, creams or powders.

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While our houses aren't cheap, a precut Lindal can save a whole lot of assembly time and cost—no matter who puts it together. And you get a tougher, more enduring home.

Components in our insulated, 5-3/4" walls interlock for weather-tight fit; floor and roof beams are reinforced with *steel*; decking is 2" thick! All that, plus the natural warmth and beauty of kiln-dried cedar, inside and out.



With a Lindal, *what you get* is even more impressive than what you save.

For more proof (73 plans, prices), send \$1 for our 44-page Planbook.

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FEBRUARY 1974 60A

ALL OUTDOORS

(Continued from page 60)



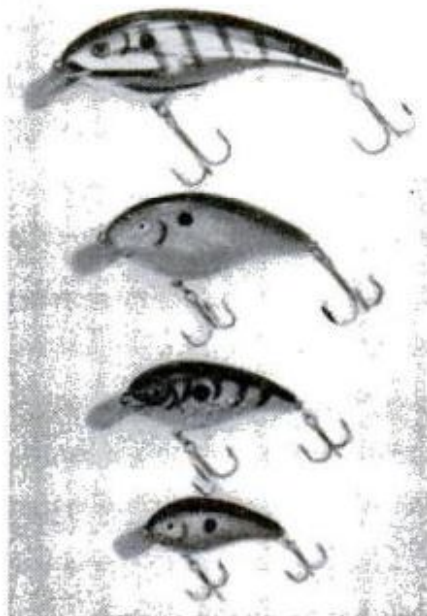
Ski-Doo's new single-seater experimental Blizzard is now on trial touring the racing circuit in 340, 440 and 650-cc events but is not yet available for sale.



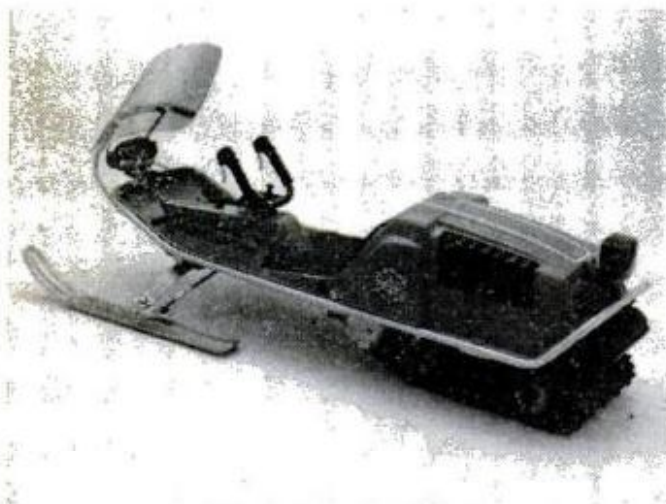
Columbia Kyotee, special nonproduction model for five-mile Sno-Pro races, was developed by Kalamazoo Engineering with Wiseco Pistons, Klotz Oil, NGK plugs.



John Deere 295/S is high-performance limited-production model just introduced mid-winter. Rated at 40-plus hp, unit has dual carbs, tuned exhaust, CD spark.



Big-O, famous Fred Young bass lure made by the Cordell Tackle Co., now comes in four sizes—two larger and one smaller than the original—for salt or fresh water.



Honda White Fox by American Honda Motors brings new snowmobile look. For young or lightweight drivers up to 150 lbs., narrow-track unit has 178-cc power.

Castamatic I, a new Berkley spinning reel, has a trigger control reported to eliminate all need to handle line or touch bail while you're casting the line or reeling it in.



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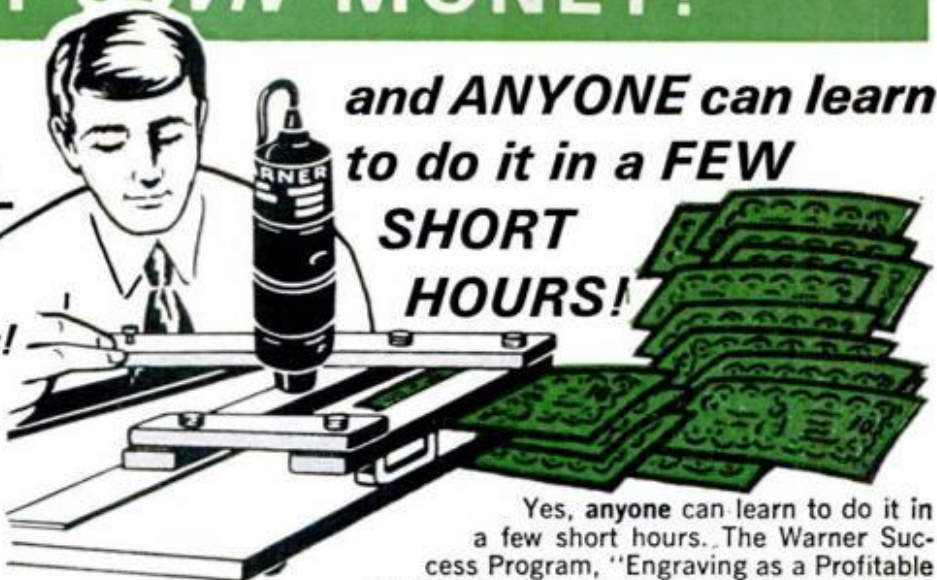
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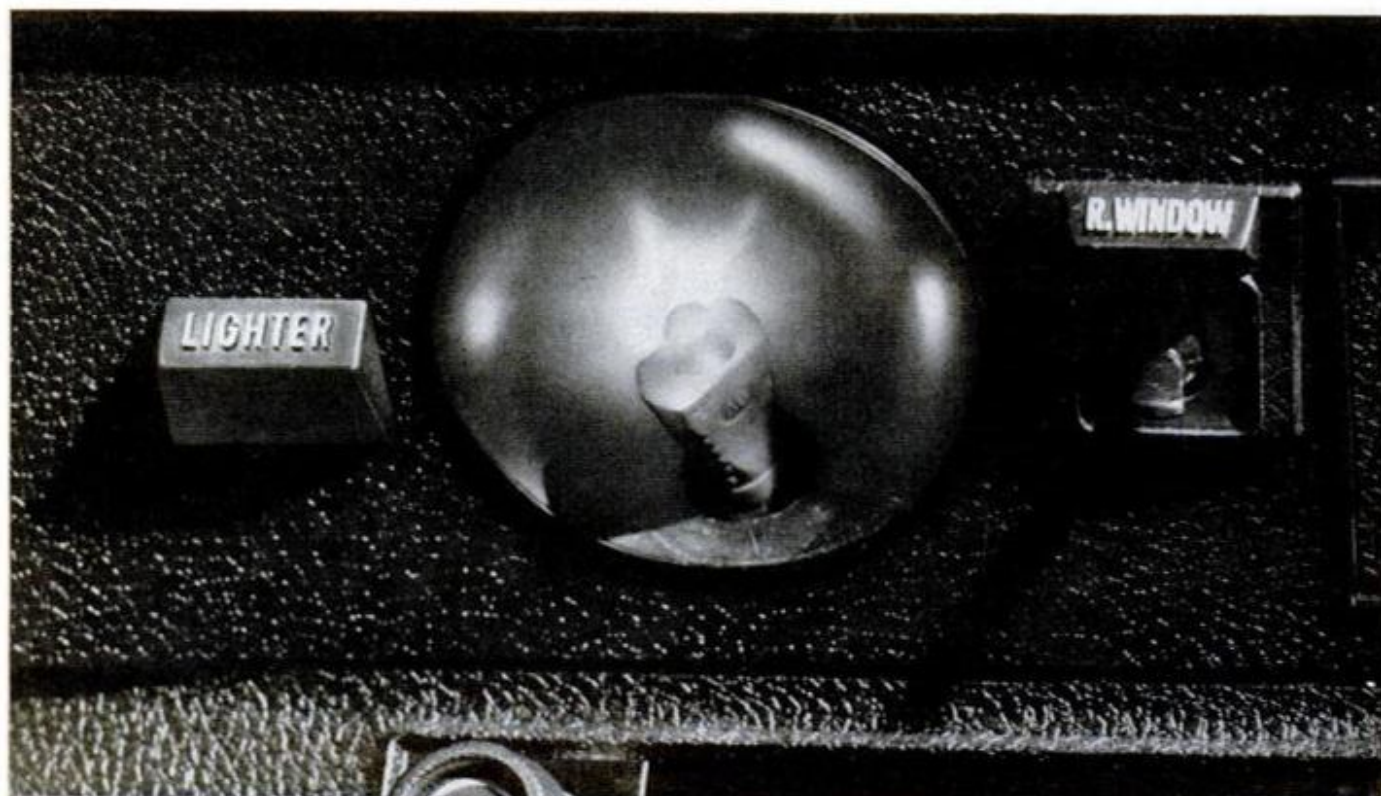
Please rush full particulars about your new Success Program, "Engraving as a Profitable Business." Tell me about your less-than-bank-rate credit plan that will help me get started in this profitable business in my spare time, at home. Everything you send me is FREE . . . no salesman will call.

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Check your battery with a light in your lighter

by Rudolf F. Graf
and George J. Whalen

If the light blinks when you're starting your car, the battery's headed for trouble—a steady glow indicates that all is okay. This precise go/no go indicator plugs into car's cigaret-lighter socket.



Photos: Robert D. Borst

Your car battery faces its moment of truth every morning, when you turn the key in the ignition. If the battery passes this trial, you start; if not, you sit and listen to the lonely, disheartening click of the starter solenoid.

There are clues that alert you to a slowly dying battery—a slowdown in your turn-signal blinkers, headlights that dim or brighten noticeably with changes in engine speed—but only if you *are* alert. Neither your ammeter nor charging light will tell you anything directly about your battery's condition. But this \$2 plug-in checker can.

Engineers agree that the best way to test a battery is under load, and that the terminal voltage of a 12-volt auto battery

should not fall below 9.2 volts when initially loaded by the starter motor. The light in the checker is designed to turn off whenever voltage dips below that figure. All you do is plug it into your lighter socket before starting—if the lamp flickers or goes out as the starter cranks, your battery needs checking. It's easy enough to do daily, but a weekly check should be often enough.

Here's how the circuit works: Silicon diode D1 has an approximate (but virtually constant) turn-on voltage of 0.6 volt, while zener diode D2 immediately following it has a constant avalanche voltage of 7.5 volts.

Thus, current has no path through these series diodes until the potential difference

(Please turn to page 60F)

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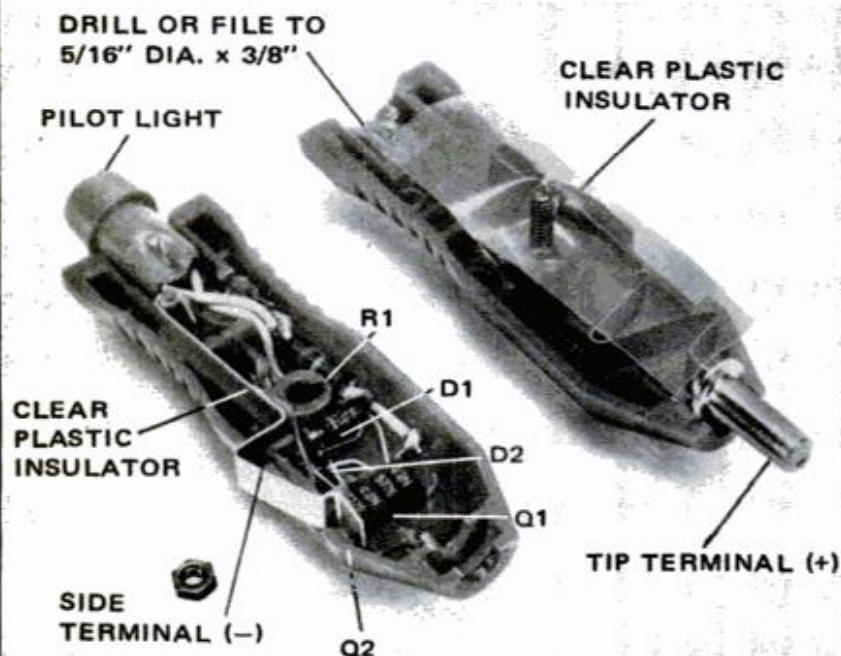
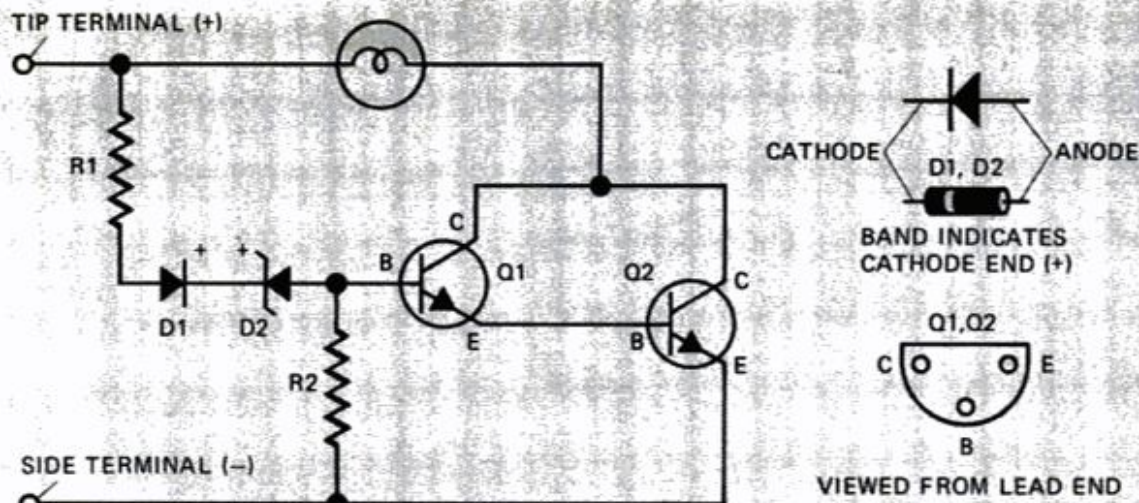
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Check here for special information, if 16 or under.

Battery-checker schematic



PARTS LIST

- D1**—General-purpose silicon rectifier diode, 200 PIV, 1-amp. rating (HEP 156 or equivalent; Lafayette Radio 19 P 54775)
- D2**—Zener diode, 7.5-v. (Mallory ZB7.5B)
- Q1, Q2**—NPN silicon transistor 2N5376 or equivalent (HEP736; GE-10 Lafayette 19 P 27359; SK-3020 Lafayette 19 P 43307; Radio Shack 276-2009)
- R1**—120-ohm, 1/4-w. composition resistor $\pm 20\%$ (Lafayette 52 P 2051)
- R2**—4700-ohm, 1/4-w. composition resistor, $\pm 20\%$ (Lafayette 52 P 2089)
- Pilot light**—12-v. incandescent bulb (Lafayette 34 P 52620 red; 34 P 52638 amber; 34 P 52646 green)
- Case**—Cigarette-lighter plug (Lafayette 99P 85136).

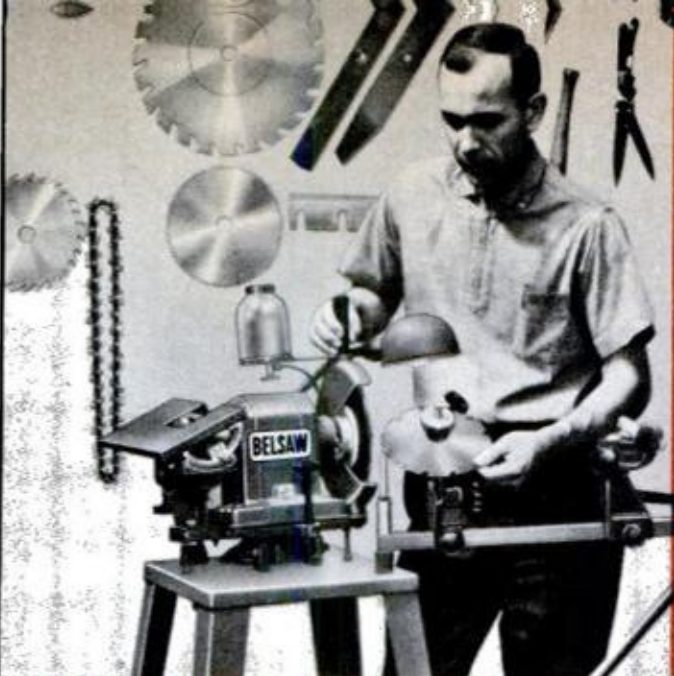
Cigarette-lighter plug holds all of this battery checker's simple circuitry. The layout will vary slightly with the plug you buy; just be sure to use insulation where necessary.

across them is greater than 8.1 volts. The output of the diodes (at the junction of D2 and R2) is applied to Q1 and Q2, which are wired as a Darlington transistor switch. This switch circuit does not conduct until the potential difference between its base (Q1B) and emitter (Q2E) exceeds 1.2 volts. Only then does the transistor combination act as a closed switch, allowing current through the indicator lamp. In other words, the lamp will light only when the voltage across the input terminals is high enough

to pass through both diodes and switch, or $0.6 + 7.5 + 1.2 = 9.3$ volts. If voltage falls below 9.3 during cranking, it will go out, indicating potential battery failure under load.

Construction is simple, with all components fitting snugly inside a standard cigarette-lighter accessory plug. First, remove the screw or drill out the rivet that holds the two halves of the plug together and remove the small, molded-in separating struts at the rear of the plug. Holding the halves

(Please turn to page 179)



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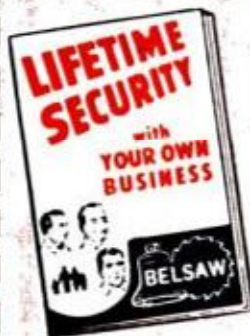
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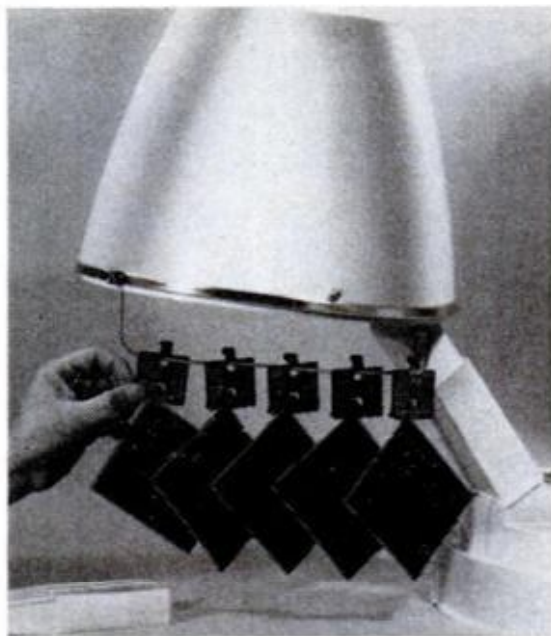
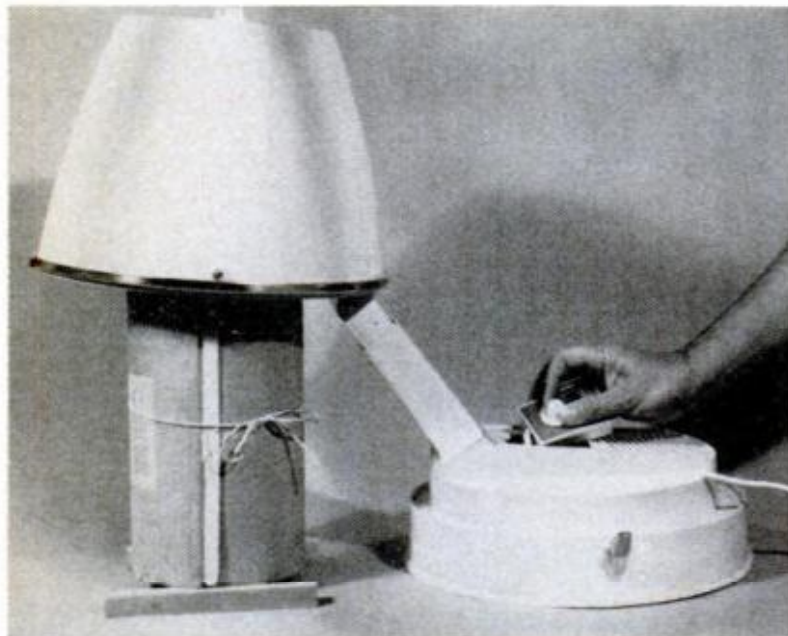
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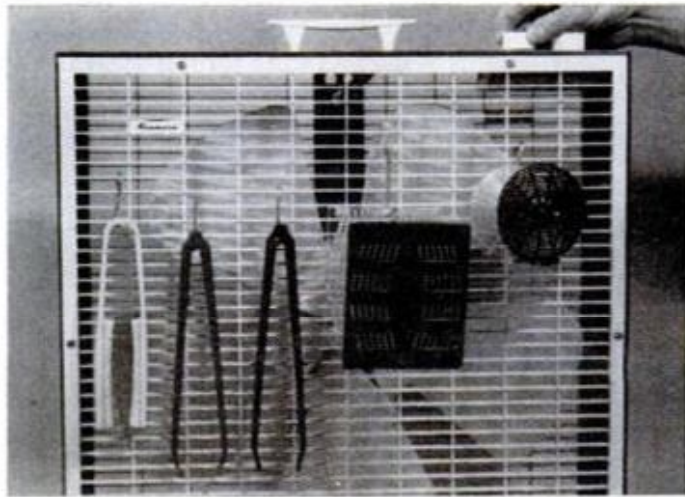
FROM READERS



Hair driers, fans ease darkroom drying

My wife's hair driers have a lot of uses in my darkroom. The hard-hood type is the best device I've found yet for quickly drying prints in a blotter roll (above, left); just be sure you prop up the roll as shown so air can circulate beneath it. With a coat-hanger wire beneath the hood, it also dries my 4x5-inch sheet film. For roll film, I place the dryer at the edge of my counter, and let the film hang down. [You could also dry film on metal developing tank reels, if you first wind the film emulsion-out to reverse

its curl.—*Ed.*] If your film curls, use a lower heat. A soft-hooded dryer (below, left) dries my plastic developing tank reels quickly after one reel's developed, so I can load the next roll of film without its sticking. And the modern square type of household fan (below, right) makes an ideal dryer for reels, print tongs and other paraphernalia. Just make hanger clips from light wire to hold everything to the grille, and place a damp towel over the back of the fan to filter out dust.—*Ken Patterson, Regina, Sask.*





Telephoto flash beamer

For distant night shots, sports photography, or flash fill-in of subjects 100 feet or more from your camera-mounted flashgun, you can rig this simple, beamed flash unit. The parabolic reflector is available from Edmund Scientific Co. (No. 71,224; \$2.95). Enlarge the reflector neck hole with a pipe reamer till it will just engage the threads of a standard lamp-socket shell. Screw the socket into the disc firmly. The unit may be hand-held, or clamp-mounted with conventional floodlight reflector clamps. Solder the bayonet base from a discarded flashbulb to one end of a lamp cord to make the connection. Use a one-inch bayonet-bulb adapter and Press 25 flashbulbs, or M3 bulbs with an M3 adapter in the bayonet socket; the bulb's center will be near the parabolic reflector's focal point. The flash beam spreads so little that I get well-exposed telephoto night shots on Tri-X up to 200 feet away.

—George Daniels, Danbury, Conn.

Minolta helps you spend more time with the baby and less time with the camera.



If you think babies are fun to photograph, but more fun to play with, try an electronic Minolta Hi-matic F.

With this 35mm camera, you never have to spend time making adjustments. Because the Hi-matic F sets itself automatically for one perfect picture after another. Indoors or out, with or without flash, all you do with a Hi-matic F is point, focus and shoot. Even time exposures are automatic.

Besides being easy to use, the Hi-matic F is easy to take. Just slip it in a pocket and you're ready whenever the baby is.

Try a Minolta Hi-matic F and start taking pictures for the fun of it. For more information, ask your dealer or write to Minolta Corp., 200 Park Ave. So., N.Y., N.Y. 10003. In Canada: Anglophoto Ltd., P.Q.



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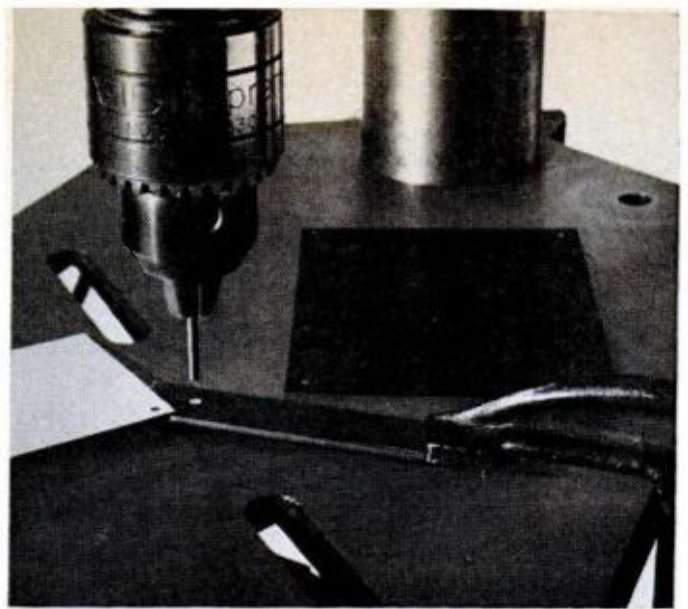
FROM READERS



Windproof gate latch

A metal strip with a hole drilled in it and bent 90° can be loosely screwed above a hook eye on a gate to prevent the hook from becoming unlatched in strong winds. Bracket swings away for unlatching hook.

—Clarence Breitenfeldt, Marathon, Wis.



Punching holes with drill press

A drill press can be used to punch neat, clean holes in paper, soft plastics or thin metal. Clamp piece of scrap steel to press table and drill hole through it using a drill bit the size of the hole to be punched. Remove bit; grind shank end flat and square. Replace drill in chuck with ground end aligned over hole in steel for punching.

—R.S. Hedin, Minneapolis

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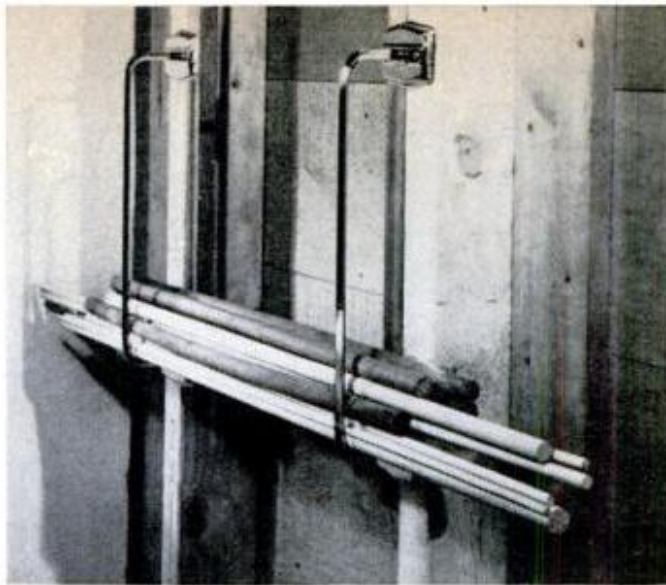
HINTS

FROM READERS



I.D. tags for stereo cables

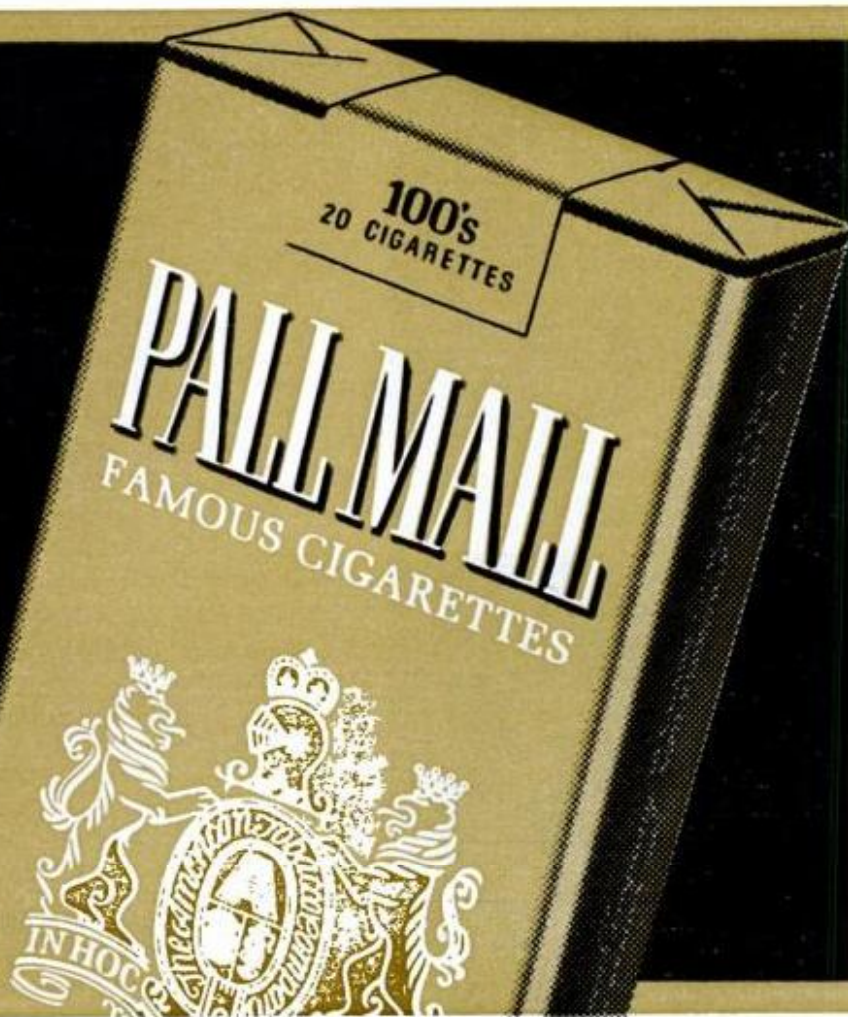
Plastic bag fasteners commonly attached to bread wrappers can be used to identify immediately the right cable for different input sources for your hi-fi or stereo. Simply number each fastener and slip it around the cable.—*Ken Patterson, Regina, Sask.*



Storage rack

Two inexpensive metal towel racks—perhaps salvaged during a remodeling—can be fastened vertically to open studding in a garage or workshop to provide an easy-to-get-at storage rack for such miscellaneous shop “clutter” as dowels, molding, pipe and thin strips of stock. The racks also provide good storage for such nonworkshop items as mailing tubes and garden stakes.—*Victor Lamoy, Saranac Lake, N.Y.*

100's



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"I lost 5³/₄ inches off my waist, 25 pounds of excess weight... and shaped up... in just 14 days!"

One 5-Minute exercise, twice daily, lying on my back, without giving up the foods I love... Did It!"



Gordon as he looked the day he started.

After 7 Days — A remarkable transformation — pot almost gone — revitalized.

After 14 Incredible Days — Slimmed, reshaped, looking 15 years younger, feeling 25 years younger

SEE AND FEEL AMAZING RESULTS IN JUST 3 DAYS!!

WHAT IS THIS INGENIOUS PLAN?

The Weider "5" Minute Body Shaper plan is based on doing ONE CONTINUOUS RHYTHMIC CO-ORDINATED EXERCISE while still eating the foods you like. That's all you do! This one five-minute exercise is designed to attack the Waist and Hips (where fat accumulates quickest, giving your body a flabby, weak and distorted look) — as well as burn off excess body fat fast by speeding up your metabolism, burning up stored calories and releasing excess water—while reshaping your chest, abdomen, firming up your legs and arms — your total body!

It's safer than strenuous workouts, beats the time consumption and dangers of gym workouts... or any other vigorous sport.

The unit weighs about 16 oz. and fits any wallet-sized case. You can carry it and use it wherever there's floor space — anytime. Even while watching television.

WHAT COMES OFF IN 14 DAYS?

Individual results vary, but during an average 14 day period, you can expect to lose up to four inches from your waistline and up to ten pounds off your present weight. It strengthens your heart and lungs, increases stamina and endurance, improves your digestive function and general health. IT TOUGHENS YOU UP. For a "5-Minute Exerciser" — it sure does a lot!

WHAT SATISFIED CUSTOMERS SAY:

Results vary depending on how much overweight each of our students is. Nevertheless, this is a sampling from the impressive letters we receive: Willie Ellis — "I lost 3 inches off my waist and 9 pounds in 7 days." Kent Christensen — "I lost 5¹/₂ inches off my waist and 20 pounds in 10 days." Marino Zoller, M.D. — "I lost 2 inches off my waist in 14 days." Michael Benedict — "I lost 6 inches off my waist and 22 pounds in 21 days." Ken Waller — "I lost 3 inches off my waist in 5 days."

WHAT THE EXPERTS SAY:

Medical Doctors, Chiropractors, Osteopaths, Athletic Coaches...agree its the most successful Waistline-Weight Reducer and Shaping Up Plan ever invented!

Patent Pending. Copyright Joe Weider, 1973

"Doctors have always known, exercise done while lying on the back virtually eliminates strains while slimming and reshaping the body. Yours is the finest Body Shaper Program on the market."

RICHARD TYLER, D.C.

"Beats jogging and working out in gyms — and much safer. I lost 4¹/₂ inches off my waist in 14 days." — JIM HANLEY, famous athletic coach.

"Based on sound physiological and medical knowledge, it burns fat and shapes the body without strain to the heart or other organs. I lost 12 lbs. of excess weight using it."

DR. ANITA D. SANTANGELO, Chiropractic Orthopedics

EXPOSING EFFORTLESS EXERCISERS

Reader's Digest (Sept. 1971), New York Times and Good Housekeeping, among others, exposed sauna wraps, inflated belts, weighted belts and effortless exercisers as frauds. Scientific researchers, medical and fitness experts all agree...there is only one way to firm, shape and trim up your body... you must work the inches off!

NO GIMMICKS, NO CATCHES MONEY BACK GUARANTEE OFFER

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FREE TRIAL OFFER!!

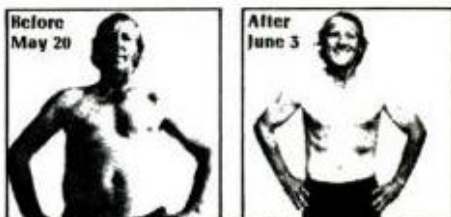
See your exciting new body begin to take shape in 3 days or every penny back!

SEND TODAY

Weight just 16 oz.



IN CANADA: "5" Minute Body Shaper Plan, 2875 Bates Road, Montreal, Quebec.



14 days shaped me up in the privacy of my home!

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We Care About The Shape You're In — DON'T YOU?

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HOMEOWNERS' CLINIC

BY W. CLYDE LAMMEY

Paint peeling after insulation

New latex primer and paint were applied to my home recently, and after a few months the paint is peeling. I've learned that peeling paint was no problem before insulation was blown into the walls by a previous owner. What does one do to correct this tendency?—John Worley, Wheaton, Ill.

You may have applied the first coat of primer and latex over an oil paint that was chalking. The primer is designed to seal the surface, but in some instances the chalking may be so far advanced that the primer is only partially effective. I'm inclined to think this may be the basic cause of the trouble you are experiencing. Insulation can be only indirectly at fault, if at all, as moisture (water vapor) will pass through insulation as well as through other building materials, unless, of course, there is a vapor barrier on the room side of the insulation.

There can be other factors: too much moisture in the air indoors owing to a too-high setting of a furnace humidifier, daily showering by several persons, boiling kettles, an unvented clothes dryer and a range used without a venting hood. Each factor can be the reason for a large amount of water vapor in indoor air and may be a contributing cause of exterior peeling, especially when trapped inside by tightly weatherstripped doors and windows. Anything you do to reduce indoor moisture will help to correct the trouble. Exhaust fans in bathrooms and over ranges help. Some homeowners beset with this problem use an automatic dehumidifier to reduce moisture.

Broken garbage cover

I have a sunken garbage container with a cast-iron cover. The latter has been broken into two pieces accidentally. Where and how can I get a replacement?—Mrs. Jay Sears, Akron, Ohio.

I don't know. You did not give the name of the manufacturer, which must appear somewhere on the unit, possibly on top or

bottom of the cover. If so, write to the maker, giving all information that may appear with the name. Or take the pieces to a local welding shop, which should be able to handle such a job and return the cover to you almost as good as new.

Sweating basement windows

My basement windows are steel sash and the glass sweats in cold weather. I have a power saw and can easily make wood storm-sash frames, but how can I attach these to the metal frames?—Bernard Wells, Aurora, Ill.

Most steel frames have a flange or lip against which the sash frame closes, the sash frame overlapping it at the bottom. Remove the sash and drill and countersink holes for 1/4-in. stovebolts at each side of the frame. One hole through each side should do. Then make the wood sash frames with a bottom rabbet for the overlap of the metal sash frame. Glaze the storms, preferably with double-strength glass, and apply felt strips all around. Drill the wood sash to take the stovebolts and secure them with wingnuts.

Winter plant feeding

How can I best feed ordinary house plants in winter, especially those brought in from outside?—Mrs. Leroy Thompson, Peoria, Ill.

Liquid, water-soluble solutions are the handiest. Mix with water according to instructions on the container, and give plants a thorough watering at least once a week—twice if the house air is dry. ★★★

Do you have a home maintenance or repair problem? Send it to Homeowners' Clinic, Popular Mechanics, 224 West 57th St., New York, N.Y. 10019. While letters cannot be answered individually, problems of wide interest will be discussed in this column.



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Kings, 15 mg. "tar," 1.2 mg. nicotine; Longs, 18 mg. "tar," 1.4 mg. nicotine, av. per cigarette, FTC Report Sept. 73

Warning: The Surgeon General Has Determined That Cigarette Smoking Is Dangerous to Your Health.

Photographed near Margaree Forks, Nova Scotia.



Canada at its best.

Try the light, smooth whisky that's becoming America's favorite Canadian.
Imported Canadian Mist.

A sleek Spitfire ready for take-off in the Battle of Britain? No, it's a scale model flown by control line. Below, plane is launched to engage in combat at national meet.



Photos by the author

The exciting world of miniature aviation

Today's radio-controlled models fly exactly like full-sized planes. The jets race at speeds of 190 mph. No longer is this a sport strictly for kids.

by Fred L. Wolff



A Long Island, N.Y., lawyer admits that it has become a mania with him. The president of a scientific instrument firm in Reading, Pa., says he spends most weekends at it, usually accompanied by his sons. Physicists and engineers at Bell Laboratories in Murray Hill, N.J., spend many a lunch hour engaged in it.

What has them hooked? Flying

Radio control



R/C aerobatic planes are sleek, follow full-scale configurations. With no "fragile" pilot aboard, they can outperform any manned plane built.



Here's a scale model of a full-scale Volksplane, a popular craft among homebuilt enthusiasts. The miniature Volks picked up a trophy at Oshkosh.

Free flight



Here's a stagger-wing Beech. Model is built in "old-fashioned" way—light balsa frame and tissue covering—and is powered with rubber-strand motor.



This plane has typical free-flight configuration. The contestants are readying "dethermalizer," a fuse that causes tail surfaces to change attitude.

Control line



Aircraft lined up for carrier event. Planes must take off and land from simulated carrier deck. Like full-scale jobs, planes are equipped with landing hooks.



Size alone differentiates scale-model Zero from Japanese fighter of World War II. Paint is weathered and chipped, and oil streaks are along belly.



Beautifully detailed R/C copter sits on "pad." Choppers are latest wrinkle in miniature aviation and call for vastly different piloting skills.



Contestants ready rubber-strand motor. Ordinary hand drill is used to get powerful strands as tightly wound as possible. This plane was a winner.



Every one in this family is involved in racing these small speed aircraft. Planes are clocked for top speeds at level flight, fly four feet off ground.

—flying miniature airplanes. Their avid interest helps to explain why some 2000 people from 50 states and abroad gathered at Oshkosh, Wis., several months ago to participate in the National Model Airplane Championships, the Superbowl or Olympics of miniature aviation.

For a week, Wittman Field buzzed like a giant hornets' nest as the small planes zoomed and dived or raced with engines flat out. In all, there were 49 separate events in three major aircraft categories: free flight, control line and radio control (R/C).

Free-flight planes fly free of any control by the modeler. He can make preflight trim adjustments, but otherwise he must rely solely on the flight characteristics of his plane. The object is to obtain the greatest duration of flight for a given amount of power. Power is limited in relation to the size of the field used.

The most spectacular performers in this category are the gas-engine jobs. They are hand-launched nearly vertically and climb almost out of sight in 11 seconds or less of powered flight. They then soar.

Since some of them might stay up almost indefinitely, they are equipped with "de-thermalizers." These are fuses, ignited upon launch, that burn for a specified time. After, say, three minutes, they burn down and cause a rubber band to part. This in turn, causes the plane's tail surfaces to snap into an upright position. Then the plane stalls and drifts back to earth.

Control line is a category of models flown in a circle by means of steel wires or ca-

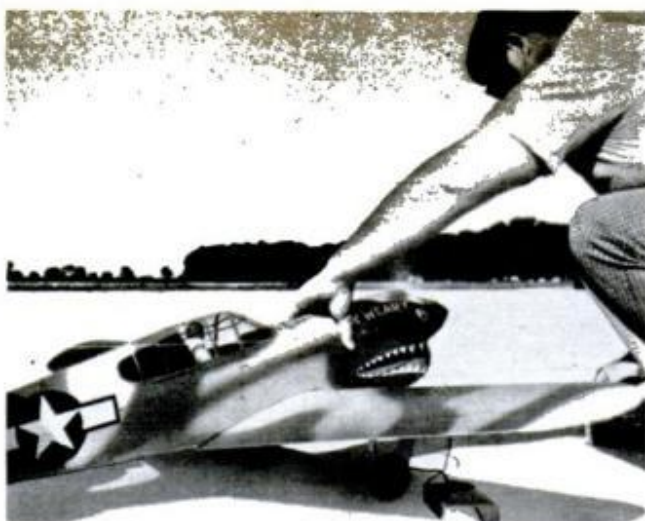


Control-line aerobatic planes are specially designed for this event. Many are original designs. Plane shown was patterned after full-scale craft.

Radio control



In World War I the DH-2 gained the upper hand over early Fokkers. Scale models such as this one are judged on workmanship and stability in flight.



Scale model of P-40, a great American fighter of the past, is typical of the good-looking aircraft available in kit form. The P-40 flies well.

Free flight



This rubber-powered entry in free-flight category has dummy piston engine. Despite light weight, planes like this flew well at windy Oshkosh field.



And away she goes! Object is to attain flight of from three to five minutes. Flight is not official if it does not last at least 40 seconds.

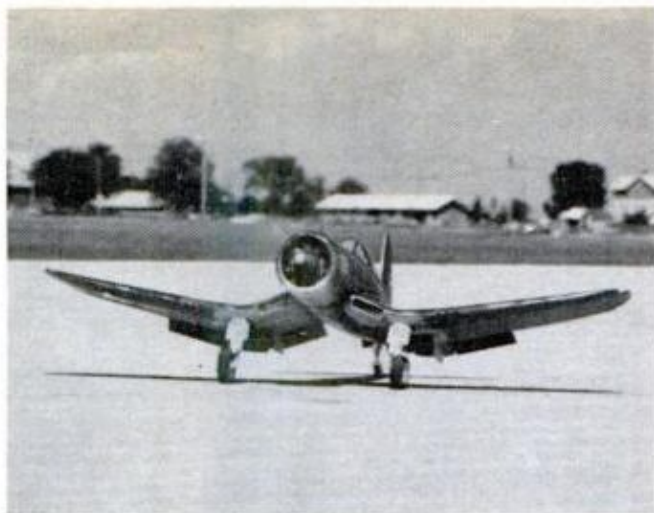
Control line



Model of twin-engine B-25 is flown by means of three cables: one for "up" elevator, one for "down" elevator, and a third for throttle control.



Imaginative Chicago contestant produced this exotic scale model of a French steam-powered plane dating back to 1890. Model has 45-inch wingspan.



Another winner was this Corsair, modeled after plane that saw duty in Korea. Like full-scale craft, model has landing flaps and retractable wheels.



Only thing missing from this version of the Lockheed Winnie Mae is Wiley Post, first pilot to make a round-the-world flight. Model is rubber-powered.



In flight, B-52 model looks like the real thing. Fast-spinning props aren't noticeable, giving plane jet look. Engines must be synchronized for proper flight.

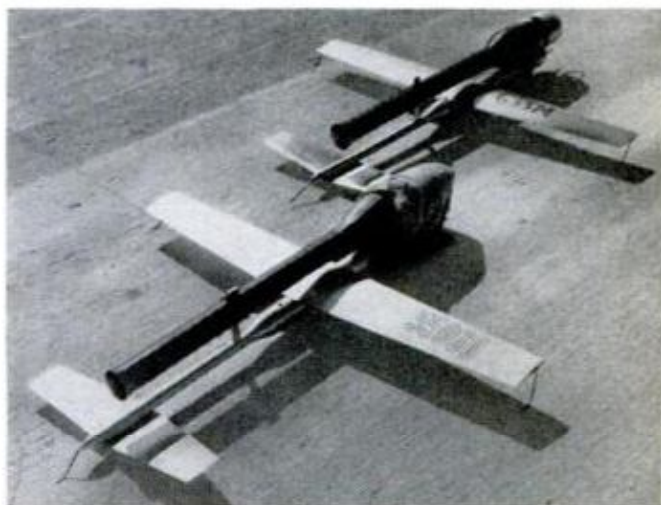
bles. In spite of line restrictions, they are extremely maneuverable (see flight patterns on page 70). Control is obtained by means of a U-shaped handle that's attached to the cables actuating the plane's elevators and linked to the throttle. The "pilot" stands in the center of the flight circle as his model zooms around overhead.

There are a number of events, each requiring planes with special characteristics, in this category. One of the most exciting events is "combat," in which two planes engage in a dogfight. These planes are relatively simple in construction, highly maneuverable, and fly with a long streamer attached to the tail. The object is to score a "kill" by maneuvering your plane so that its prop cuts the streamer away from your opponent's plane.

The radio-controlled models are the most sophisticated and most expensive. Total cost for a plane and control gear may run from about \$200 to \$500. But they can do everything a full-sized plane can do—and more. No human pilot could withstand the forces generated by some of their maneuvers.

The pilot controls his plane with a hand-held transmitter that can send from 1 to 12 channels of information to the model's receiver. Signals are channeled from the receiver to actuators, called "servos," connected to ailerons, rudder, throttle, flaps, retractable landing gear and other mechanisms.

There are three R/C events: aerobatics, pylon and scale. Pylon racing has all the excitement of the full-scale events and de-



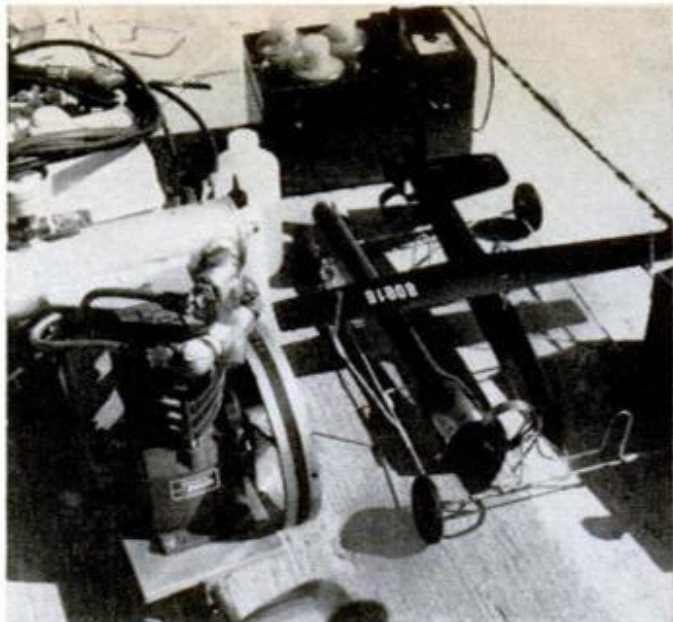
Jet speed planes produce a deep-throated roar with engines that develop thrust of 4½ pounds. They hit actual speeds of about 190 mph.

mands real piloting skill. The aircraft are miniature copies of Formula 1 racing planes.

In scale flying, the planes follow a flight plan and execute maneuvers that would be appropriate for the full-scale aircraft they represent.

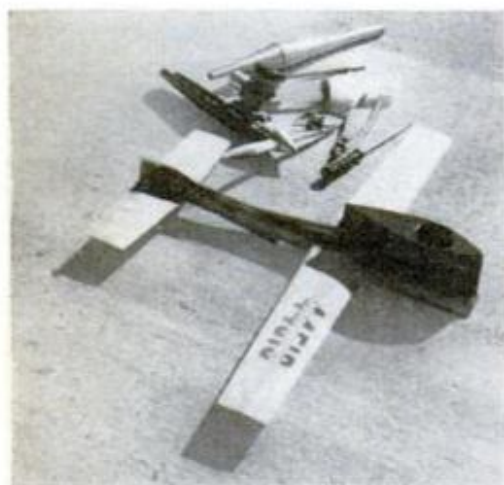
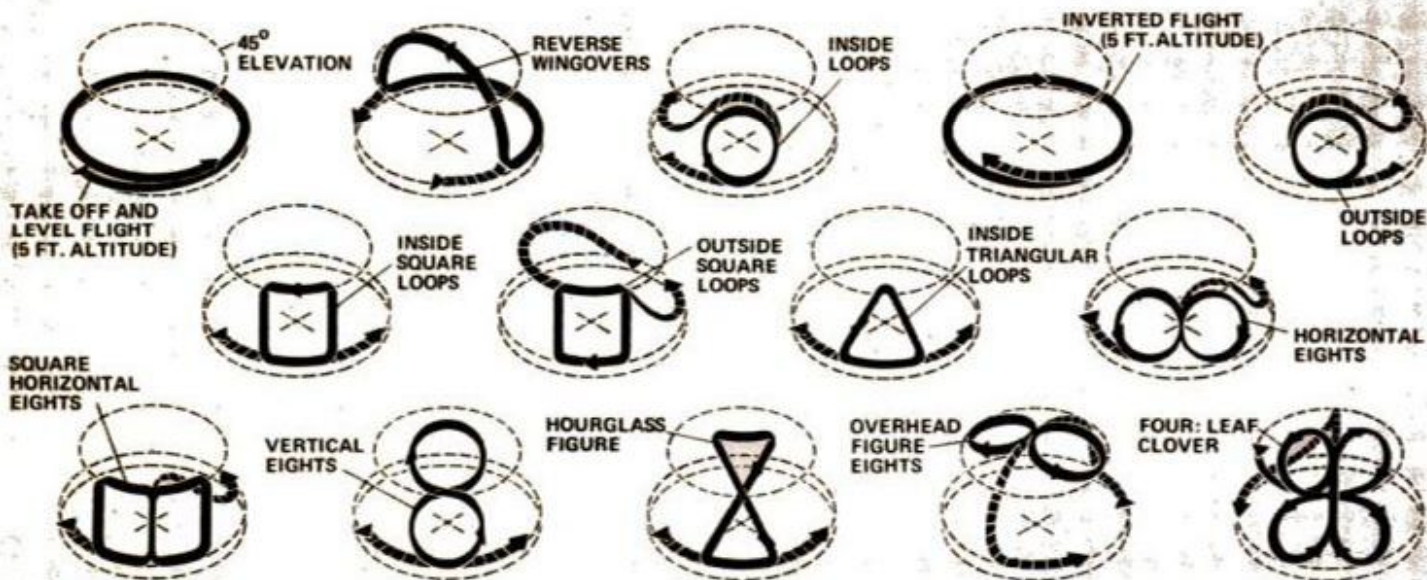
Miniature aviation has mushroomed in recent years. It has an official organization—the Academy of Model Aeronautics—which maintains its headquarters in Washington, D.C., with a membership of more than 50,000.

It's a sport (enthusiasts refer to it as a sport rather than a hobby) with no age limitations, and whole families become involved in it. The owner of the scientific instrument company in Pennsylvania puts it this way: "There's no generation gap on the flying field." ★ ★ ★



Here's a typical pit area for jet. Compressor, seen at lower left, is used to force air through engine to start it. The fuel is white gasoline.

Control-line flight patterns



This type of speed plane is powered by a piston engine and has fuselage just large enough to accommodate power-plant. There are no frills on these jobs.



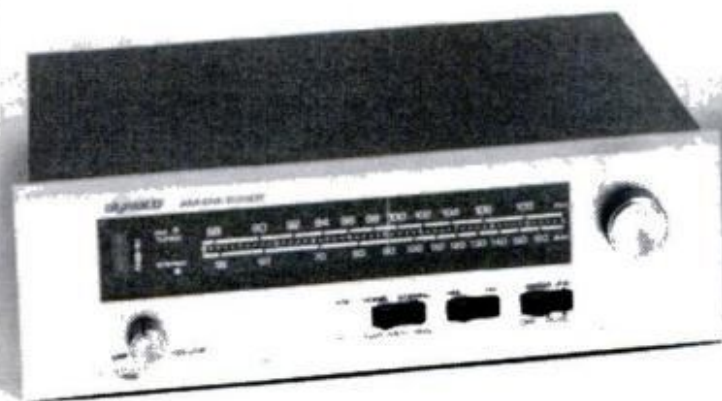
Lower half of speed plane's fuselage is magnesium pan that contains engine. Plane uses dolly for takeoff, lands on its belly.

When photo (right) was taken, wary contestant used a bit of cloth to hide special device used to control fuel flow to engine.

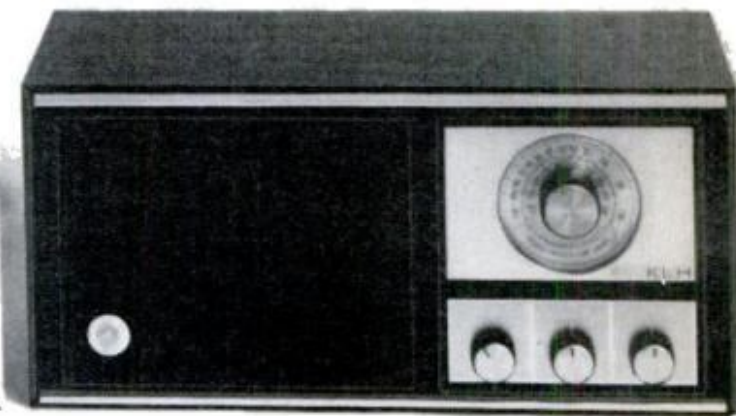


Two FM favorites add AM

by Ivan Berger
ELECTRONICS EDITOR



Dynakit AF-6 AM/FM tuner

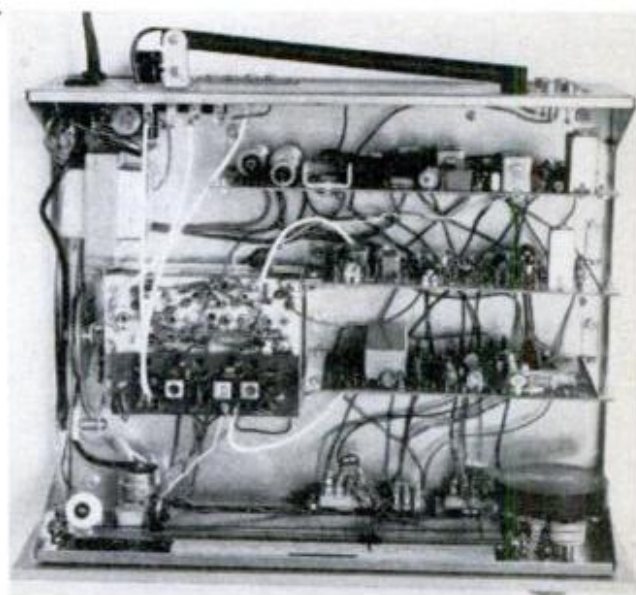


KLH Twenty-One AM/FM radio

Now that AM has been added to FM radio products we've already praised—the KLH 21 radio (*Can a Lowly Table Radio be Real Hi-Fi? You Bet It Can!*, page 124, Sept. '72 *PM*) and the Dynakit tuner (*FM Kits: One . . . Super Value*, page 166, Jan. '73 *PM*)—we've retested them.

AM reception on both was reasonably clear and clean, though no match for FM. But the current KLH 21 models now sound even more impressive for their size than the last one we tested. The KLH's amplifier sections now deliver 4.5 continuous watts at 1 percent or less distortion, with an extra boost to match the bass roll-off of the built-in, acoustic-suspension speaker, so sound output is flat within ± 4 db from 60 to 15,000 Hz. The FM section now has sensitivity and capture ratio specs comparable to those of many component tuners, and the FM-only version now has a muting switch for easier reception of weak stations. The AM/FM version is \$119.95, the FM-only model is still \$99.95, and a new, stereo model (with phono inputs and tape inputs and outputs) is expected soon under \$200.

Dyna's new AM/FM tuner, the AF-6, looks at first glance just like its FM-5 (and uses the same FM circuits). But a closer look will show the addition of AM frequencies to the tuning dial, AM audio band-



Dynakit's interior

width indications added to the stereo/mono switch (narrowing the band width cuts frequency response, but cleans up noisy signals), and the substitution of an AM/FM selector for the FM version's FM/Aux input switch. The additional AM circuit board (near tuner's front panel in photo above) adds about two hours to the FM-5's six-hour construction time, and raises the kit price from the FM-5's \$159.95 (\$249.95, assembled) to \$225 (\$325, assembled). ★ ★ ★

How to remove and reset a toilet

If you've noticed water seeping out under your toilet bowl or collecting under and around it, chances are the wax seal between bowl and waste stack (sewer connection) needs to be replaced. Wax seals sometimes leak because they have been partially melted away by heat generated by chemicals poured into the bowl to help clear sewer lines.

There are reasons besides a faulty wax seal for having to lift a toilet: replacing wall finish behind the tank, removing an obstruction that can't be cleared with force cup or auger, or replacing a cracked bowl.

Whatever the reason, each time the toilet is lifted the wax seal must be replaced with a new one.

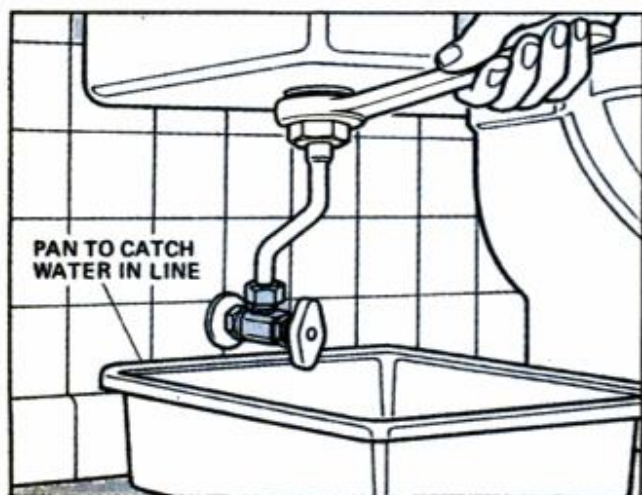
Although replacing the seal is a job you can do in a couple of hours, you should plan it for a day when the hardware store is open; parts that haven't been disturbed for years often break when finally worked on, and you'll want the toilet back in service the same day. Cost? Usually 50 cents for the wax seal, \$1 for bolts (if needed), \$1 for compound, 40 cents for caps. A plumber would charge about \$20 for the job.

Tools needed

Jab saw or hacksaw blade (one end covered with tape for a handle)
Putty knife or scraper
Adjustable wrench
Rags
Newspaper
Plastic pan

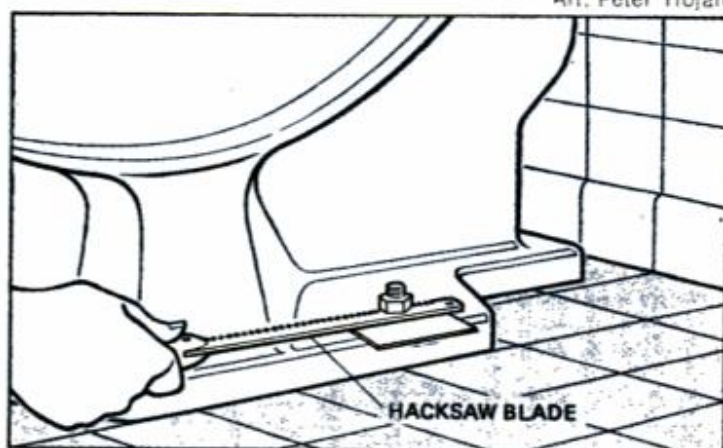
Materials and parts needed

Wax seal (ring)
New hold-down bolts, nuts and washers
Toilet-bowl setting compound
Ceramic caps
Plaster of paris, 1/3-cup
New flange (optional)



Disconnecting supply line

First, the water supply to the toilet tank must be turned off, either at the shutoff valve below the tank, or, if none, at the water supply main. With water turned off, flush the toilet to remove as much water as possible from bowl and tank. Next, lay newspaper on the floor to catch water that will remain in the trap of the toilet bowl. Remove the nut fastening the flexible copper supply line to the tank, being sure to position the pan below it first, as more water will flow from the opened line. Then remove the line from the wall or valve fitting, or bend it out of the way to prevent damage.



Art: Peter Trojan

Loosening bowl

A toilet is most commonly fastened to a flange in the floor with two bolts. (Some older toilets may have four fasteners at the base; the two nearest the front are usually screws used as an extra hold-down.) The nuts on these bolts are covered by ceramic caps. Filled with plaster of paris, the caps are easily cracked off with the tap of a mallet or screwdriver handle. After removing the caps, clean the nuts and remove them. If bolts turn as you turn the nuts, pull up on them to lock flats on bolt heads into flange slots. If nuts will not turn at all, saw them off with the jab saw or hacksaw blade. To protect the bowl's surface from scratching, slip a piece of cardboard between blade and bowl.

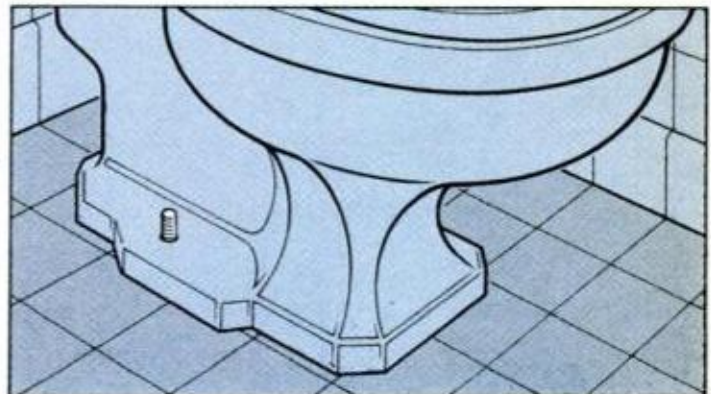
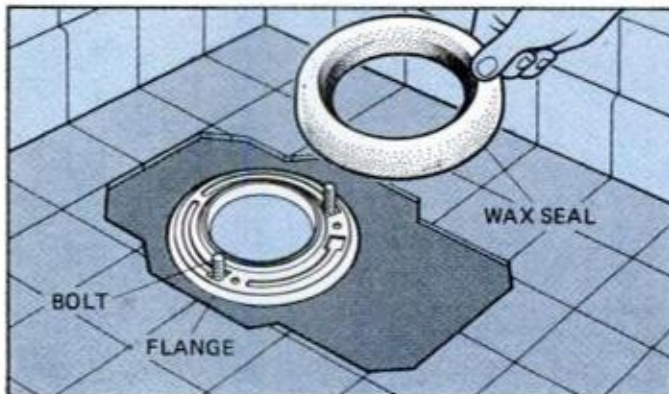
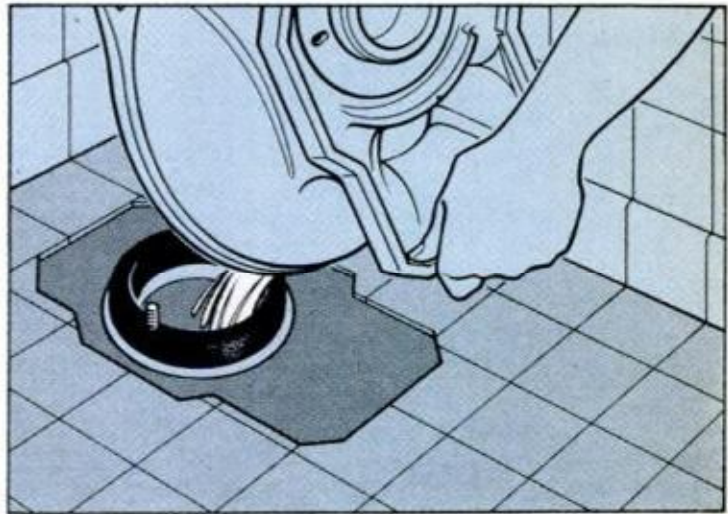
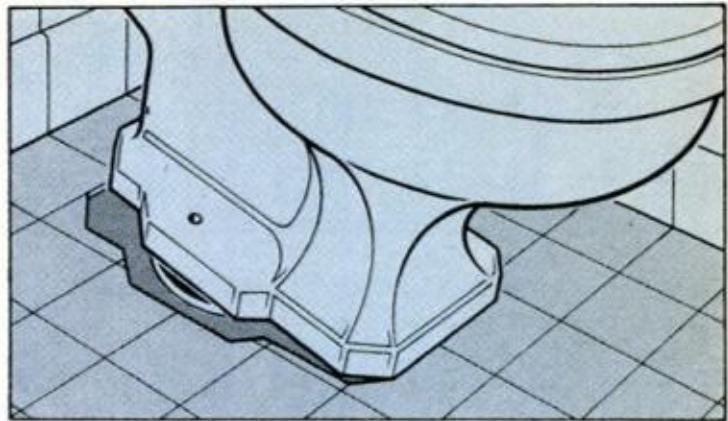
Removing bowl and seal

It is not necessary to open the connection between tank and bowl. Instead, after the nuts at toilet base have been removed, carefully lift both parts together, tipping them forward to drain water remaining in tank and bowl trap into the waste stack.

Lay the unit on its front edge carefully, on rags to protect it from possible damage. (If the undersides of bowl and tank could use a good cleaning, take the unit outdoors and use a garden hose.)

Now, remove the existing wax seal, bolts and mounting compound from the flange and scrape it clean. Thoroughly clean off the old compound from the base of the bowl. Then dry and sweep or vacuum the floor.

Caution: A wall-hung toilet must be blocked up adequately to support its considerable weight before it is unbolted from the wall. You should know that this type of toilet is much more difficult to lift and reset than the floor-mounted type. If you have any doubts about your skills, you should not attempt the job. A plumber's fee, although it may seem high, will still be less than the cost of replacing a wall-hung toilet broken by mishandling.

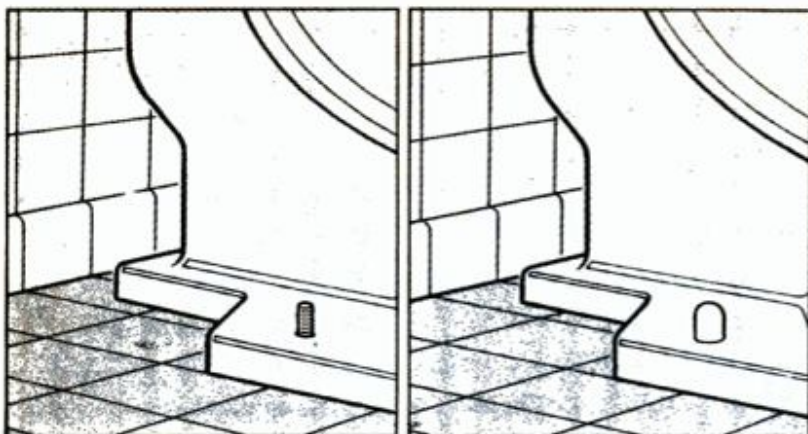


Placing the seal

Place the new wax seal on the mounting flange. (Note: The wax seal will melt at a relatively low temperature—keep it away from heat and out of direct sunlight before using.) Slip the mounting bolts into the holes in the flange, sliding them around to their approximate positions at the sides of the waste line. Apply enough setting compound to assure a solid connection to the waste stack. Then place the toilet over the flange and carefully lower it into place. If you have a helper, he can line up and steady the bolts.

Retightening bowl

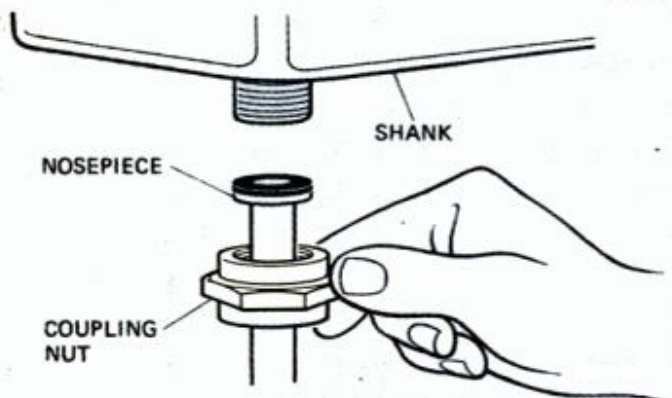
The toilet should now be resting on the wax seal with the bolts protruding through the holes in the bowl's base. Pressing downward on the sides of the bowl, rotate or wobble it until its base is resting firmly on the floor and it no longer can be rocked. The toilet is now seated and washers and nuts may be installed. Alternately tighten the nuts, making a few turns on either side; hold bolts up to keep them from turning with the nuts. *Do not overtighten.* Overtightening the nuts could crack the base of the bowl.



Capping bolts and nuts

Bowl at far left has been set and rests firmly on the floor. After washers and nuts are installed, they are covered for looks and protected from exposure to rust-producing moisture with ceramic caps. Test-fit the caps dry over nuts; if a bolt is too long for the cap to fit over it, saw it off at top of nut. Fill caps with plaster of paris and press into place; remove excess plaster. (Snap-on plastic caps are also available.) Then reconnect water supply line to tank.

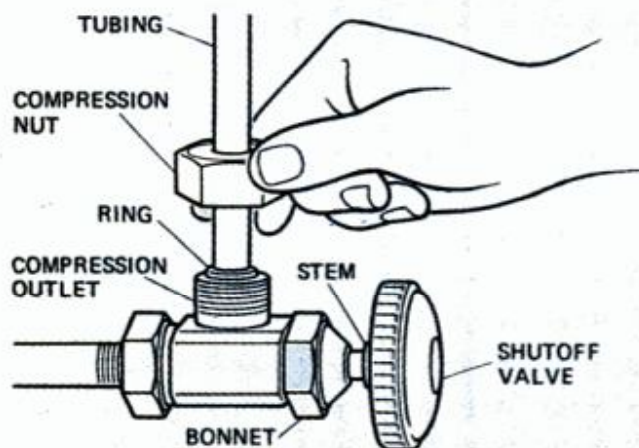
Installing a shutoff valve in the water supply line



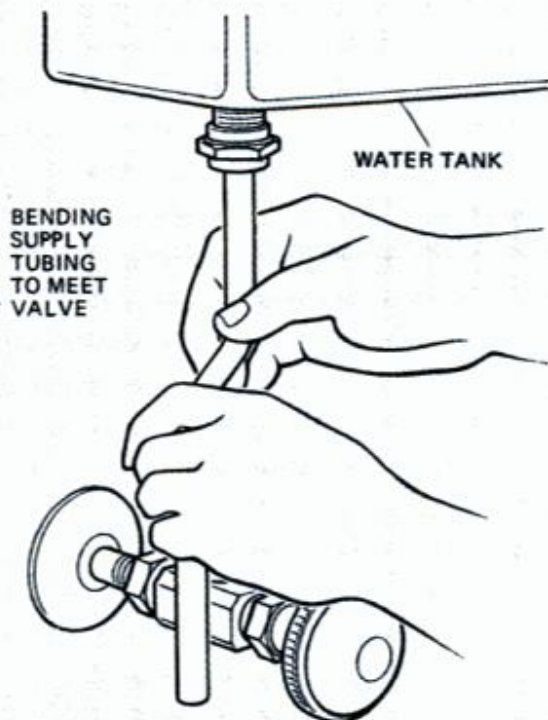
There should be a chrome or galvanized $\frac{1}{2}$ -in. nipple coming from the wall to an L (90°) fitting, with the L in turn connected to the flexible line. Remove the L fitting from the $\frac{1}{2}$ -in. nipple with an adjustable wrench. You may need a pipe wrench to keep the nipple from turning at the same time. The L fitting is replaced by an L valve, which should have an internal thread to receive the $\frac{1}{2}$ -in. nipple and, at a right angle, a threaded fitting to receive the $\frac{3}{8}$ -in. flexible tubing. Ferrule and nut normally come with the valve.

Apply pipe-joint compound to the nipple and tighten the valve onto it, making certain that the $\frac{3}{8}$ -in. fitting is in the 12:00 o'clock position when the valve is in place.

Carefully measure and bend the flexible tubing to meet the $\frac{3}{8}$ -in. opening at the top of the L valve, then cut it to length, allowing it to project into the fitting.



The final step in resetting a toilet is reconnecting the water supply line to the tank. But if there is no shutoff valve in the line, this is the ideal time to install one, while water is still turned off at the main. You'll find it worthwhile—especially in the event of any future trouble with the toilet or tank mechanism. Begin by reinserting the flexible supply line into the fitting on the tank and finger-tightening the coupling nut.



Slip the nut and ferrule over the cut end of the flexible tubing, push the tubing into the valve fitting and slide the ferrule and nut down. Finger-tighten the nut to make certain that the tubing is going into the fitting straight and not binding on the side of the nut. When everything is lined up, finish tightening the line at both ends. Care must be taken with both of these compression fittings to make sure the tubing goes in squarely. ★★★

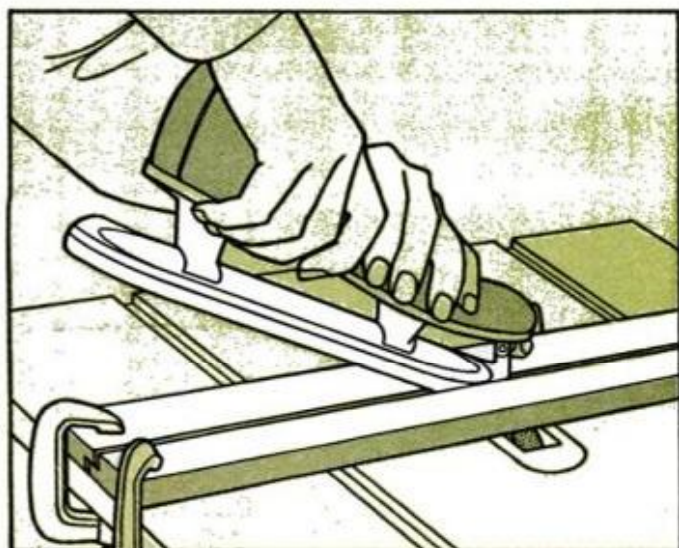
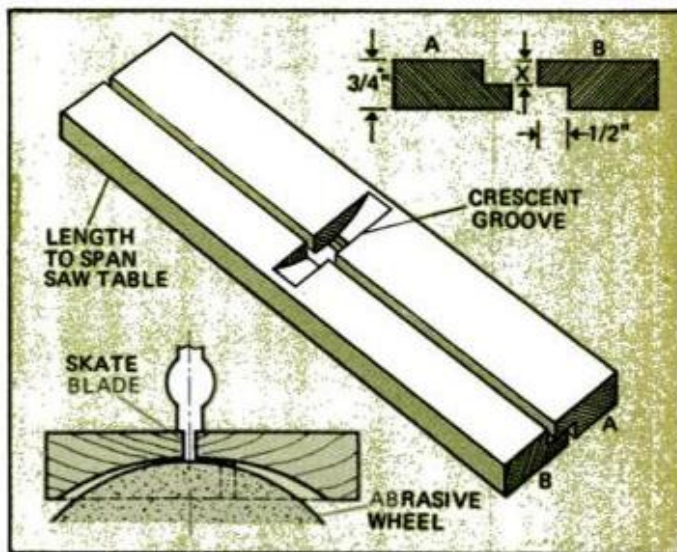
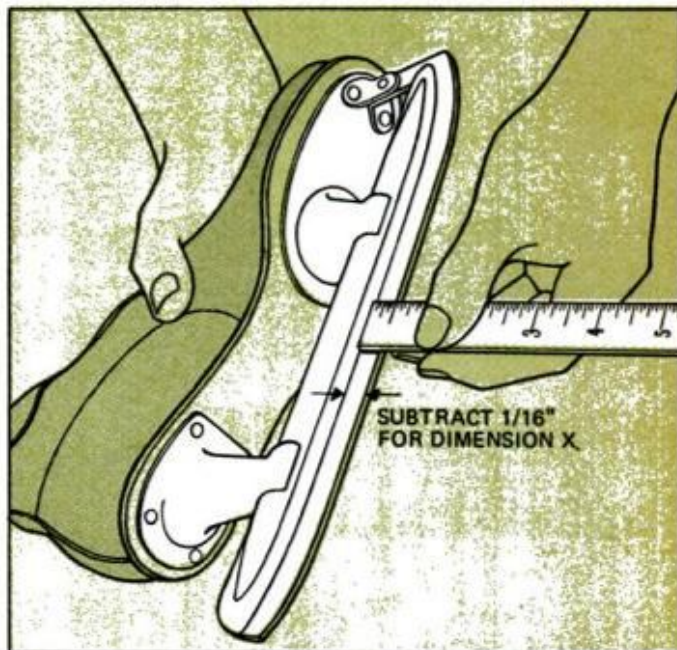
How to keep your ice skates sharp

Make a sharpening jig

Now's the time of year when the kids—and maybe even you—are getting in a lot of ice-skating. And nothing's more frustrating than trying a graceful figure eight with dull blades. By making the simple jig (lower right) and clamping it to your bench saw, you'll be able to touch up blades with perfect hollow-ground edges as often as needed.

To make a jig, use two scrap pieces of $\frac{3}{4}$ -in.-thick lumber, long enough to span width of your saw table. After measuring depth of skate blade and subtracting $\frac{1}{16}$ in. to get dimension X (right), cut mating rabbeted edges on pieces A and B (lower right) with a dado head or make two cuts at 90° with an ordinary saw blade. Temporarily secure A and B together with two small scrap wooden strips tacked across top of jig. With saw blade or dado head lowered, center jig over cutting area across width of table, clamp work securely, and raise spinning saw blade or dado head to make $\frac{7}{16}$ -in.-deep, $\frac{5}{8}$ -in.-wide crescent groove on underside of jig.

Replace saw blade or dado head with a $\frac{1}{2}$ x 5-in., 80-grit abrasive wheel on the saw arbor. With saw off, check jig with grinding wheel to make certain there is clearance. Determine the exact center of the wheel and mark clearly across top edge of the wheel. Place piece A across width of table, with crescent groove fitting over abrasive wheel and vertical face of the rabbet offset from marked center-line on wheel by a distance equal to half the thickness of the skate blade. Make sure piece A is exactly at right angle to grinding wheel by using the saw's miter gauge before clamping A in place. Position skate in the rabbet, slide piece B in place, and clamp to form a slot for the skate blade to ride over the abrasive wheel (right).



Using the jig

With jig clamped in place, raise grinding wheel until it just touches skate blade. Turn saw on and slide skate back and forth over wheel. If needed, wax or silicone spray can be applied to slot to facilitate movement of the skate to and fro. After every few passes, check edge of skate with your thumb as you would when sharpening a knife. Grinding marks should show along full edge of blade. Skates are sharp when, held like a pair of scissors, they cut strips of newspaper easily.

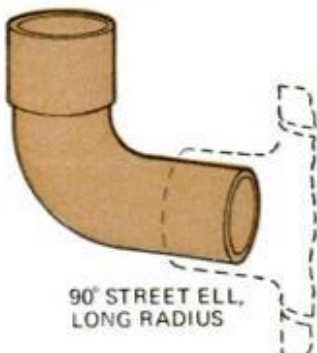
If the blade has a rough edge to it before you begin sharpening, you may have to raise the wheel a bit and grind off slightly more than usual. Don't forget to give the curved tip of the blade a good sharp edge. To do it, lift the back of the skate as shown in the drawing at left. ★★★

How to work with copper piping

TYPICAL PRESSURE FITTINGS



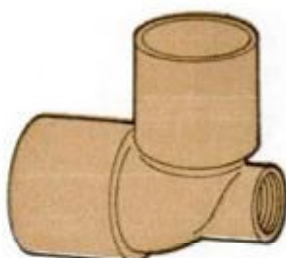
90° ELL, CLOSE-ROUGH



90° STREET ELL, LONG RADIUS



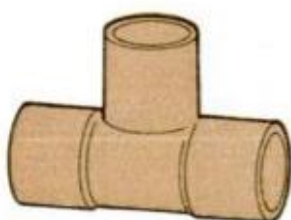
RETURN BEND



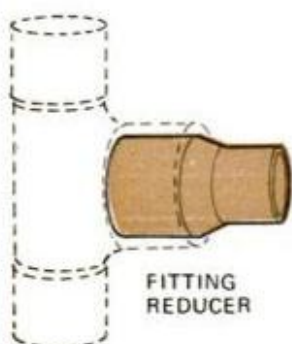
BASEBOARD TEE



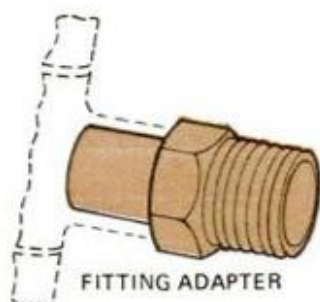
45° ELL



TEE



FITTING REDUCER



FITTING ADAPTER



COMPANION FLANGE NO. 125 STANDARD

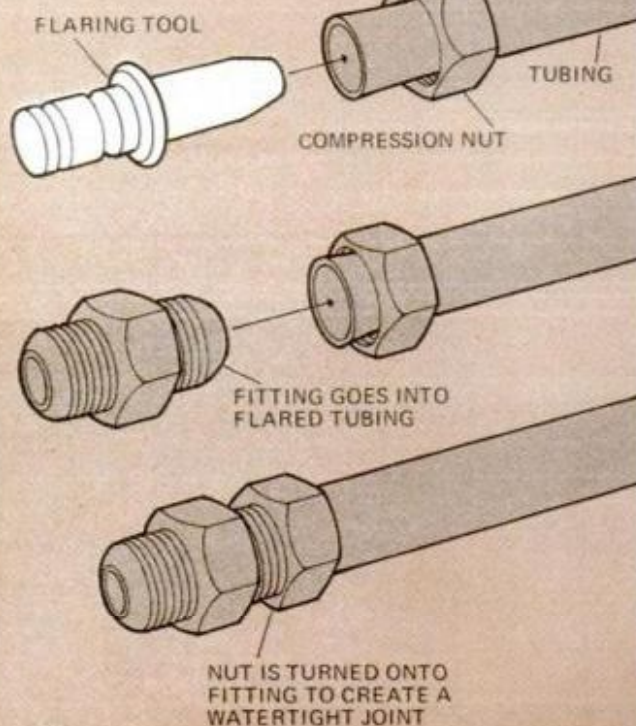


CROSS

Copper piping is light and extremely durable, requires no threading of the ends to join it, comes in varying diameters, wall thicknesses and degrees of hardness, and is suitable for both hot and cold-water systems. To join copper piping, there are many types of fittings to cover every part of the plumbing layout. A number of common fittings are shown at the left.

Copper pipe can be joined using either soldered (also called capillary or "sweat" joints) or screwed (compression fitting) joints. Compression joints are of two types. With the first, called a "bead" fitting, the tubing is pushed into the fitting, a bead of jointing paste is applied around the tubing in front of a compression nut, and the compression nut is tightened onto the fitting. The result is a watertight fit. The second type is called a "flare" fitting because the end of the tubing is funnel-shaped with a special flaring tool (below). This shaped end receives the male end of the fitting; the compression nut is then tightened to finish the connection.

FLARED JOINTS



Types of copper piping

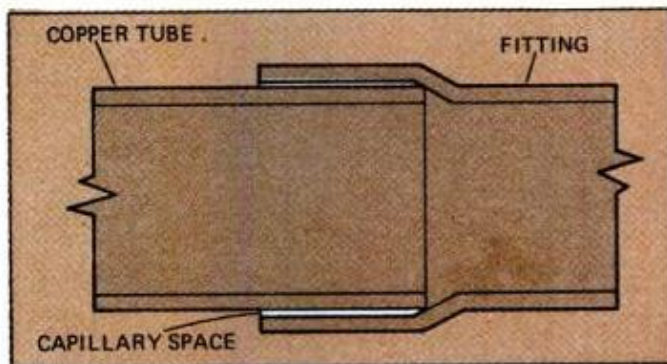
Type	Temper
K	Hard (rigid) or soft (flexible)
L	Hard or soft
M	Hard only

To be sure the type of copper piping that you use for a specific application complies with local plumbing code, always check with your local building department. In general, Type L can be used below ground, Type M above ground. For a superior installation, use Type K below ground and Type L above ground.

Equipment needed

Propane torch	Tubing cutter
Hacksaw	with reamer
Smooth file	Sandpaper or fine
Tubing bender	steel wool
(also known as	Solder
a "hickey")	Flux

Capillary or 'sweat' joints

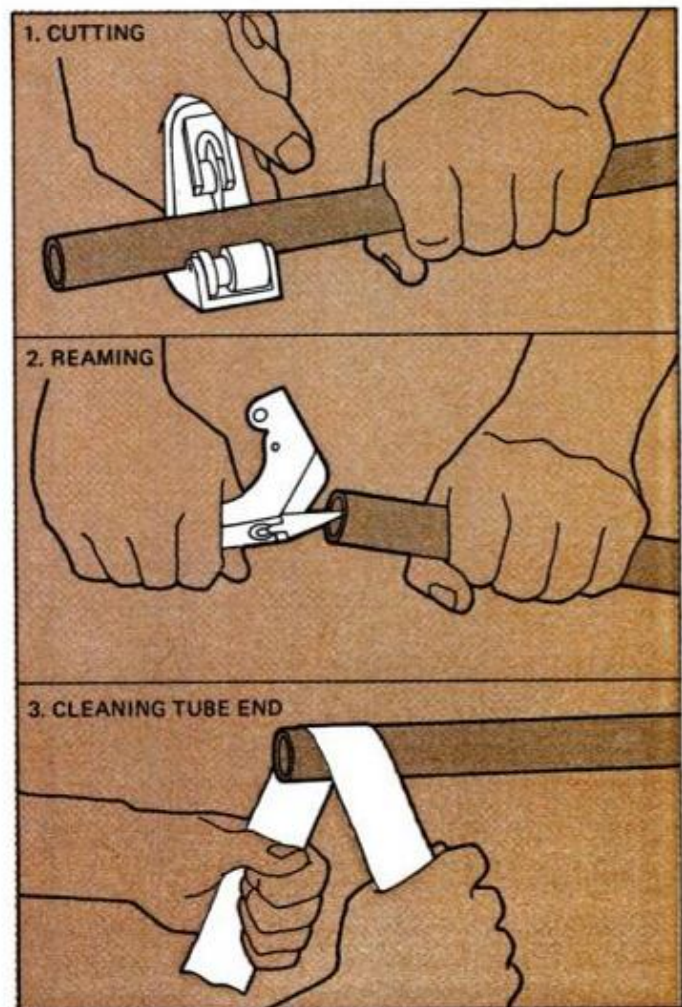


Properly prepared, a sweated joint will provide many years of troublefree (nonleaking) service. Although your joint may leak the first couple of times you attempt to sweat pipe, you'll soon be sweating copper pipe just like a pro by getting a little practice under your belt and by following the rules outlined on these pages.

To understand the principles of sweating pipe, you should understand how capillary action works. When the end of a copper pipe is inserted as far as possible into a fitting, a small amount of space will remain between the inside wall of the fitting and the outside wall of the pipe. When the fitting is heated with a propane torch and solder is applied around the pipe at the outer edges of the fitting, the solder will be drawn into this space by capillary action, bonding the pipe and fitting together securely. Such action will be the result regardless of whether the piping will be running horizontally or vertically.

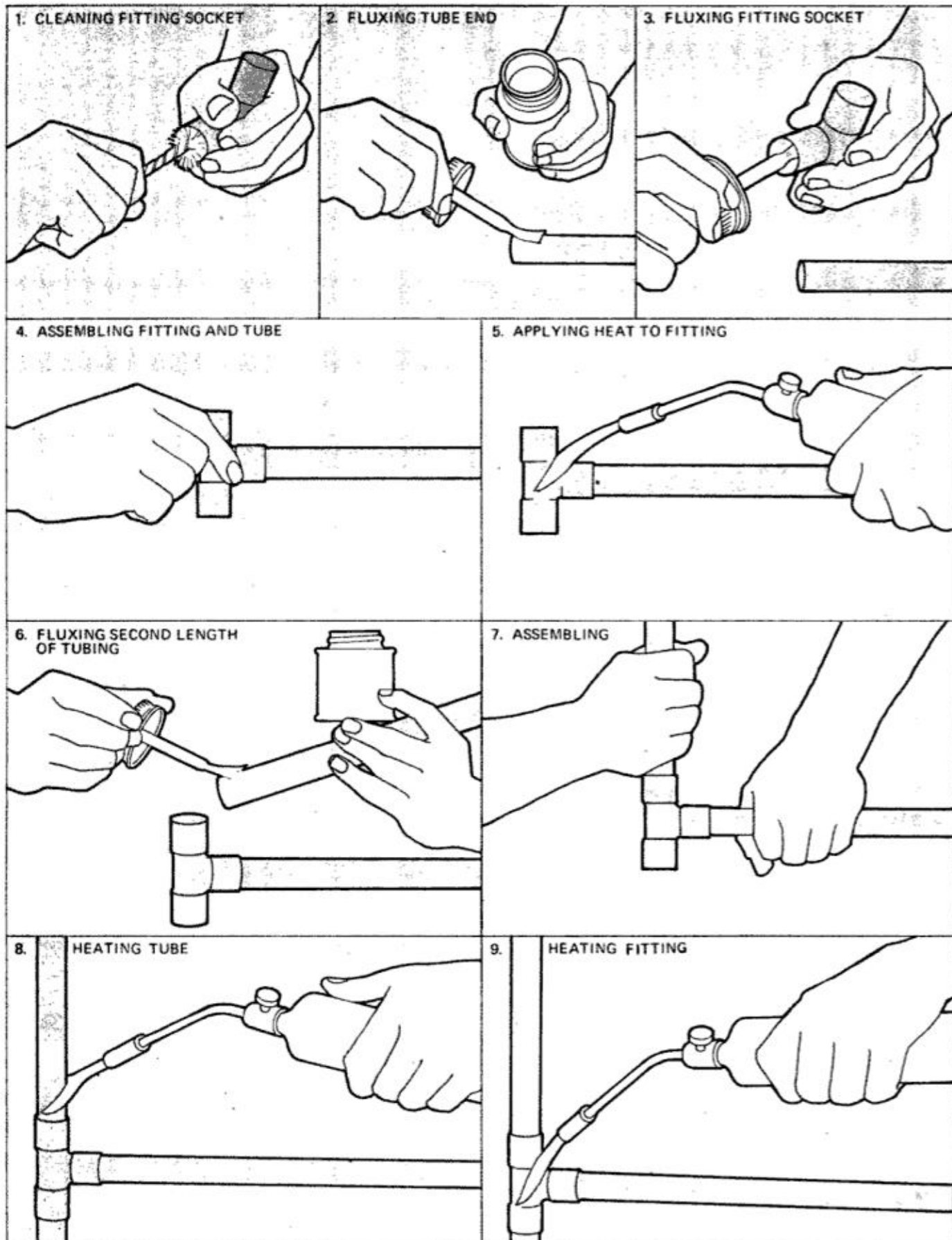
If you're repairing or adding to an existing copper piping system, remember that all parts to be joined first must be completely dry. After the soldering is done and the joint cooled to room temperature, test the work for possible leaks.

Cutting and cleaning

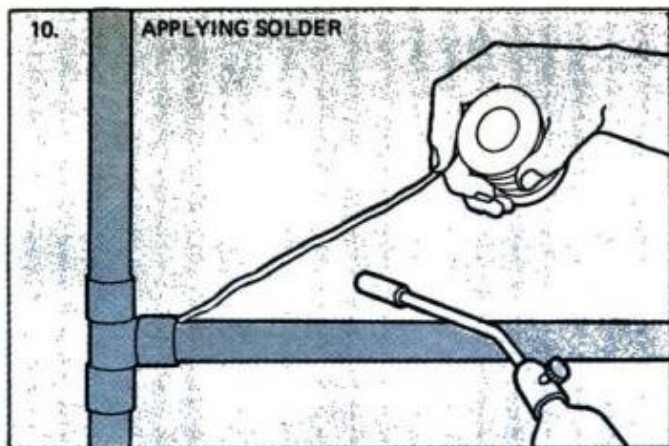


Cut pipe to length using a tubing-cutter (1) or a fine hacksaw blade. Make sure the cut is square and the pipe remains round and true. Cutting with a hacksaw blade leaves rough edges on the inside and outside of the pipe, while a tubing cutter leaves rough edges on the inside of the pipe. Remove burrs on the outside of the pipe with a smooth file or sandpaper and on inside with a reamer (2) or rattail file. Clean the end of pipe with steel wool or a strip of sandpaper (3).

Ten steps for assembling copper piping



Clean the inside of the fitting with a wire brush. A thorough cleaning is absolutely necessary because a "sweat" joint relies on capillary action and *any* dirt, grease, or surface oxidation on the pipe or the fitting will hinder the joining action. Because the pipe should fit tightly into the fitting, do not remove too much metal when sanding or the capillary space will be enlarged and the joint weakened.



10. APPLYING SOLDER

Assembling copper system

After you have thoroughly cleaned the inside of the fitting socket (Step 1, left), apply a thin coat of flux to the end of the pipe (Step 2) and the inside of the fitting (Step 3) with a small, clean brush. Then push the tubing tightly into the fitting (Step 4) and twist the pieces slightly in order to distribute the flux evenly. Wipe off any excess flux that remains and apply heat with a propane torch to the fitting (Step 5).

In the same manner, apply flux to the second length of tubing (Step 6), insert in the fitting (Step 7) and apply a flame to both the tubing (Step 8) and fitting (Step 9). Melt the solder from a spool of soldering wire around the tubing-fitting joint (Step 10, above).

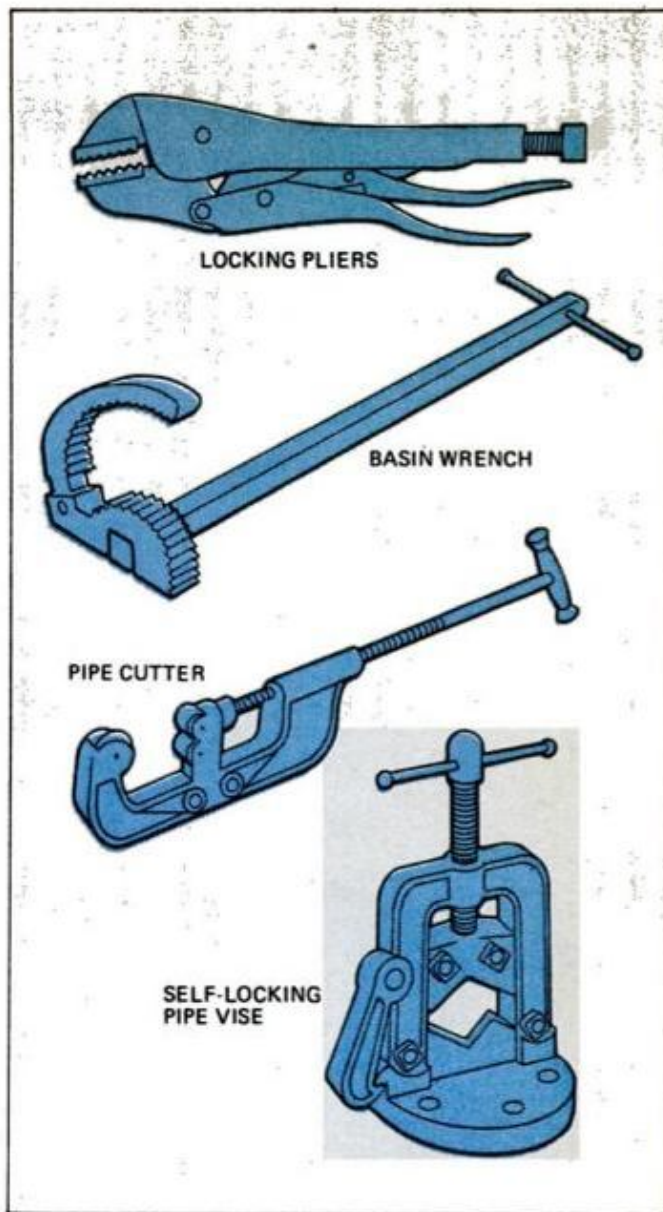
Flux for soldering is mildly corrosive. It contains zinc and ammonium chlorides in a petroleum base, and is used as a protective coating on the metal and as an agent to help the solder flow. Always stir flux before you use it.

The cardinal rule in choosing a solder is to buy a quality solder. Most solders for household plumbing jobs are composed of 50 percent tin and 50 percent lead. If the joint requires a solder of greater strength, use one comprising 95 percent tin and 5 percent antimony.

Do not clean, flux and assemble more copper piping than you can solder in about two hours.

Soldering tips

Remember to align joints with adequate support before soldering, and to place no strain on them. When soldering, use torch with sweeping motion—tubing and fitting should be at same temperature for best flow of solder into joint. If solder forms lumps, joint is not hot enough. If there is no question that the joint is hot enough but solder still does not flow freely, overheating resulting in burned flux is likely, and the joint must be started again from Step 1. As soon as solder has set, use a wet brush or rag to crack and remove flux (remove it from inside of pipes by flushing with water); remove all flux before pressure-testing the joint—if necessary use a wire brush. If you have to redo a joint, reflux the entire joint area before applying heat to unsolder.



LOCKING PLIERS

BASIN WRENCH

PIPE CUTTER

SELF-LOCKING PIPE VISE

Toolbox additions

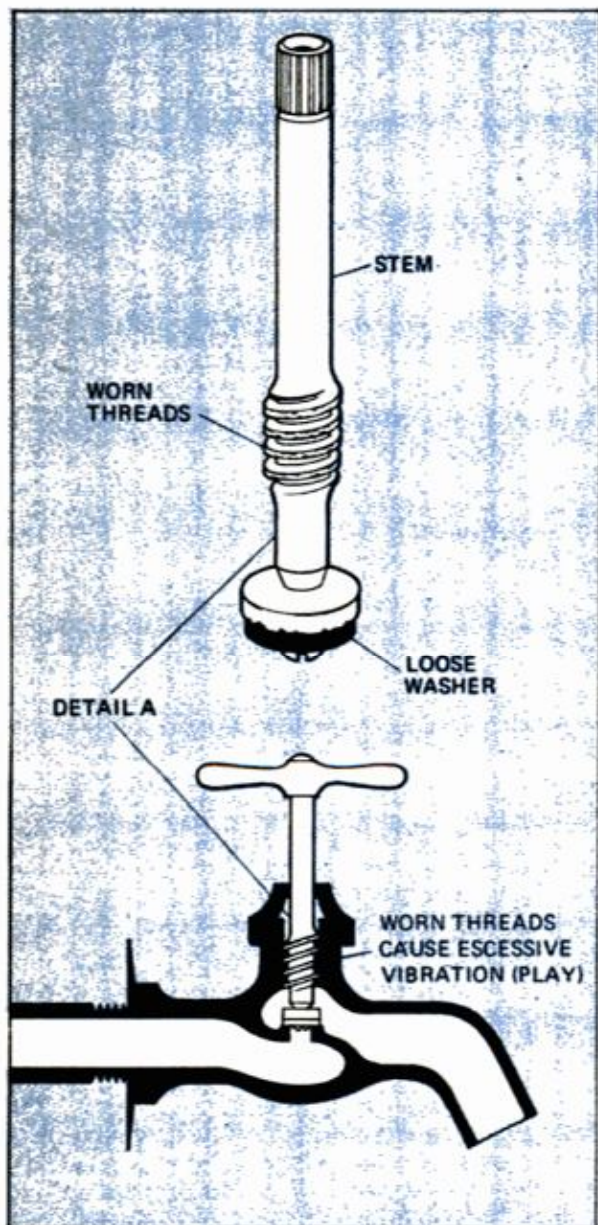
If you plan on doing most of your own plumbing jobs, the four tools shown above can be valuable additions to your toolbox. The two pictured at the top are available at most hardware stores, while you may have to visit a plumbers' supply house to find the lower two.

Vise-grip pliers, with serrated jaws and locking nut, are especially useful when working with small-diameter pipes. A basin wrench, whose gripping head is adjustable, will save you many bumps and knocks on head and hands when you are installing a basin where there is little room for swinging ordinary wrenches.

A pipe cutter, which is faster and more accurate than a hacksaw when cutting iron or galvanized pipe, is operated simply by starting the cutter over the pipe, and, as it is revolved, tightening the handle gradually to deepen the cut. Thread-cutting oil should be applied to both the cutter and the pipe.

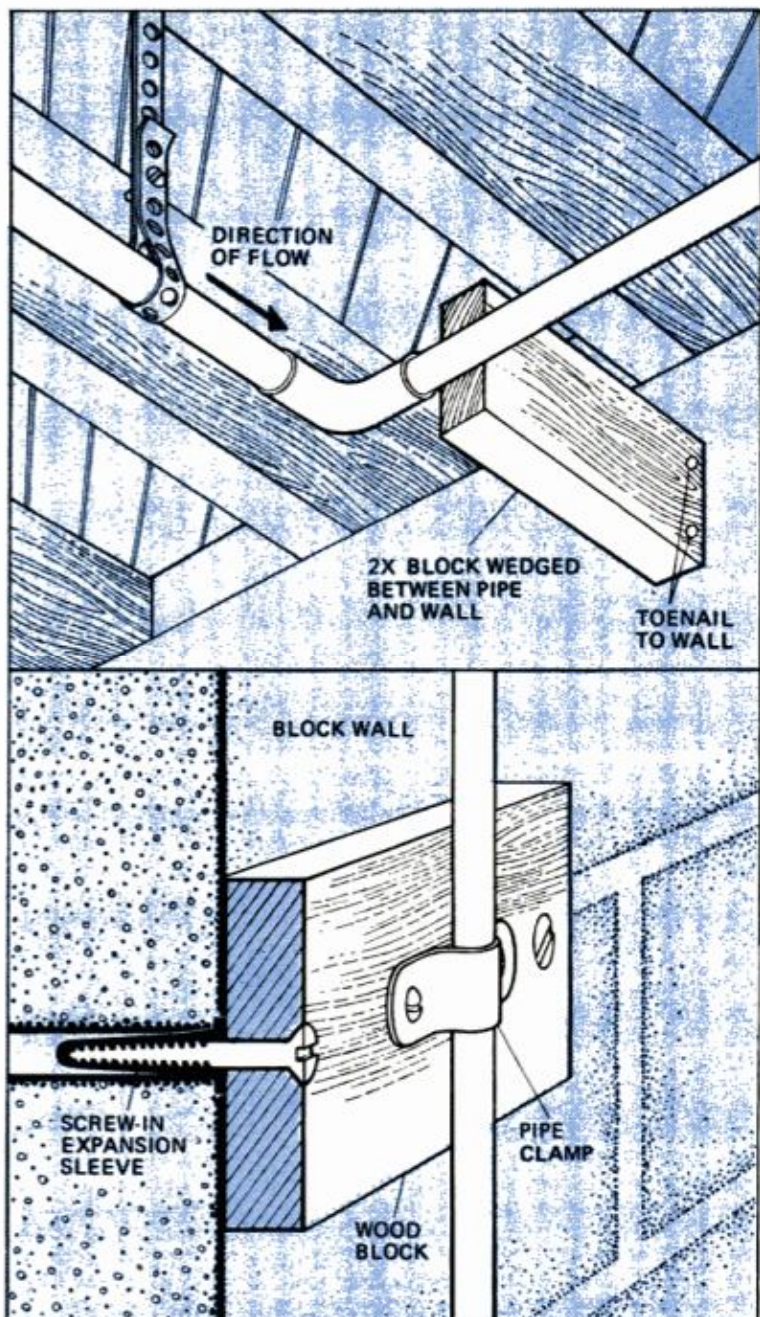
A self-locking pipe vise has V-shaped jaws that grip the pipe from both top and bottom. It eliminates the need for a helper to hold the pipe while you do the cutting. ★★★

How to silence plumbing noises



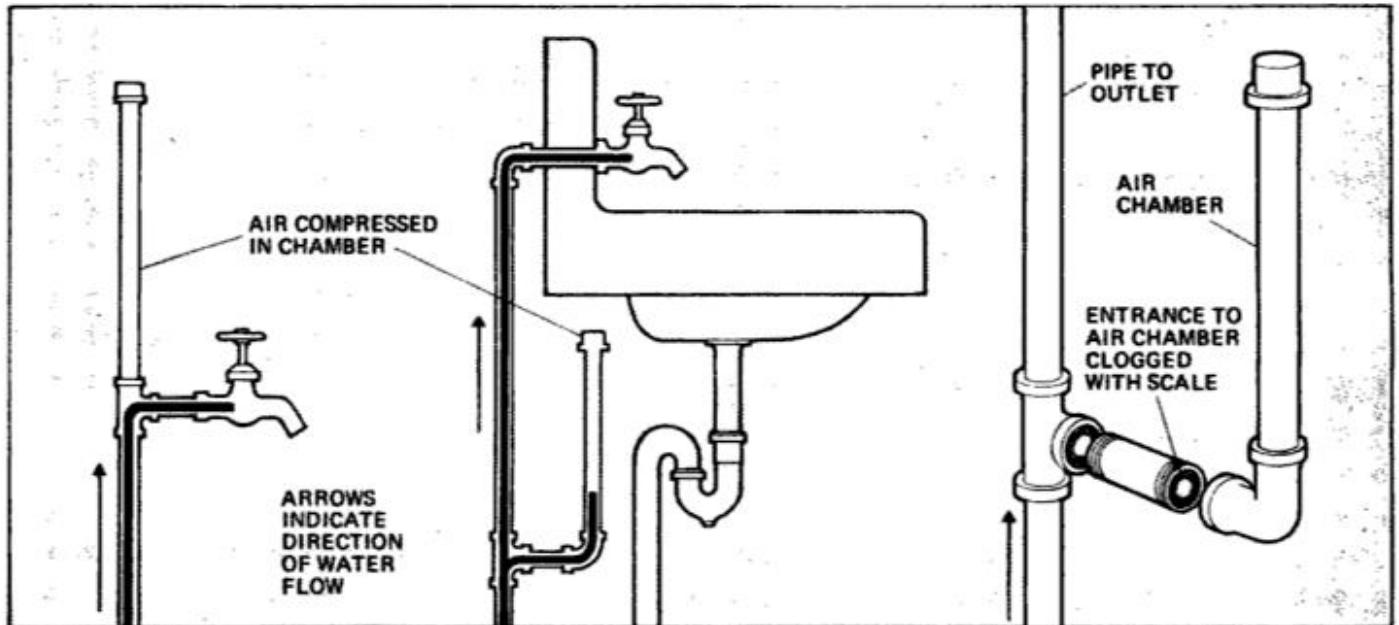
Noisy faucet

Chattering and whistling are the most common faucet noises. When this happens in a compression-type faucet (above), the usual cause is either a loose or worn (corroded) internal assembly. To remove faucet stem, turn off water supply, loosen cap nut and unscrew spindle (stem) assembly. First check small screw at end of stem; if loose, tighten to seat washer firmly. If washer is worn, replace it. When screwing stem assembly back in place, check whether it has any "play" (movement up and down) caused by worn threads. If assembly is loose, replace it with a new one. Occasionally, faucet noises are caused by a defective faucet design. In this case, replace the entire faucet.



Water hammer (knocking, banging) in pipes

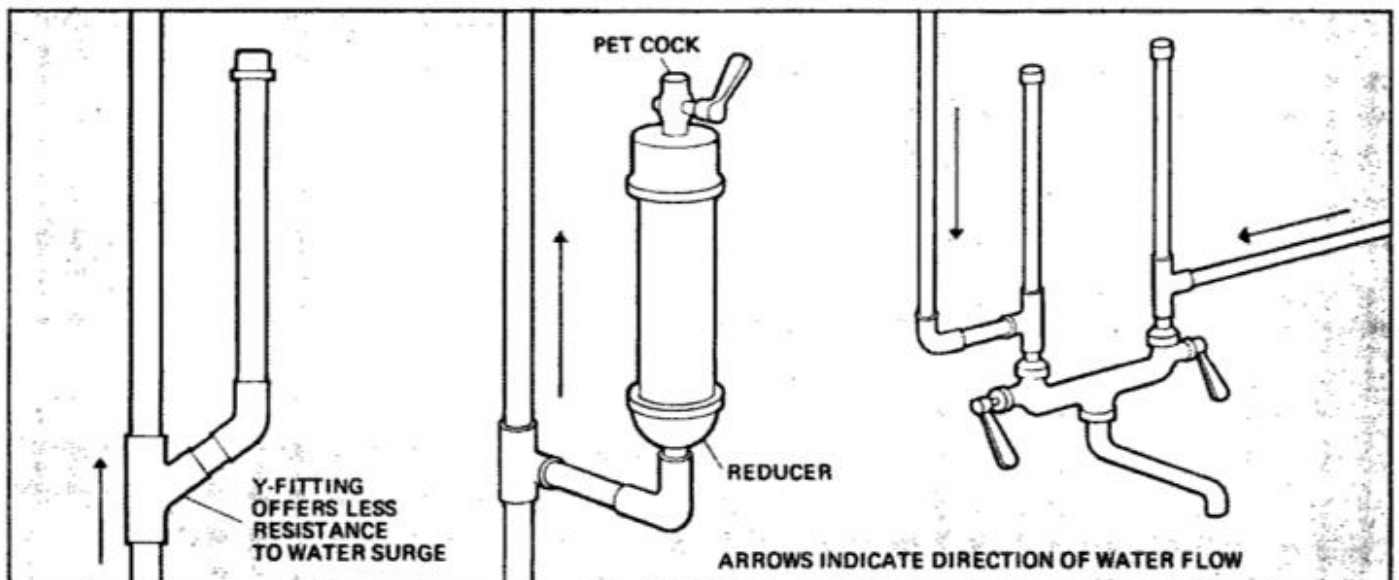
When fast-moving water, especially in a long horizontal pipe, is suddenly turned off, a shock wave often occurs between faucet and where the pipe changes direction. The result is hammering due to severe vibrations. To lessen such noise and rattling, anchor the pipe firmly along its run. One method of further securing long horizontal piping hung by strap-type pipe hangers is to wedge a scrap piece of 2x4 between pipe and wall, toenailing block to wall with masonry nails. (Caution: Avoid oversized wedge that creates pressure on the pipe and may cause a nearby joint to leak.) Pipe clamp and wood block, fastened to concrete wall as shown above, will secure the riser and also reduce vibration.



Noise-reducing air chambers

Air chambers also help minimize water hammer. When a faucet is closed quickly, water rushes into the chamber and the compressed air cushions thrust of the water (above, left and center). Since the air cushion is gradually absorbed by water under pressure, water must occasionally be drained

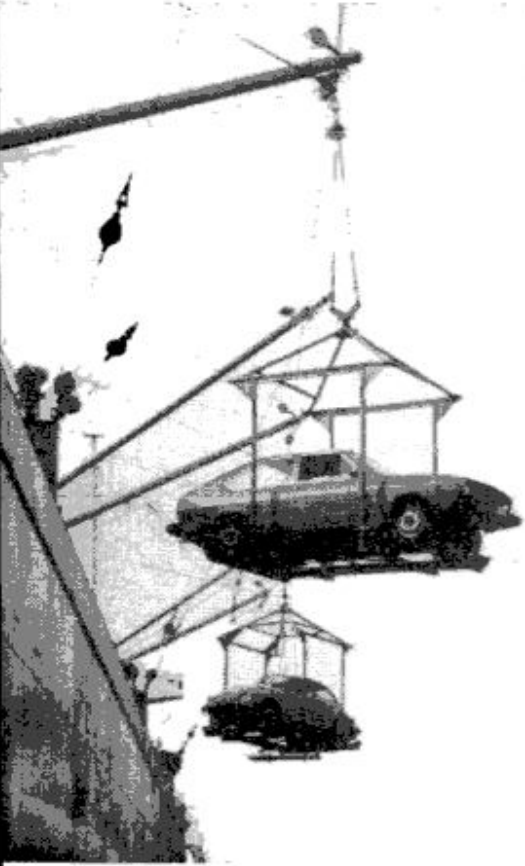
from the chamber and air replaced. To drain, turn off water, open drain valve below the level of the air chamber and remove cap at upper end of chamber. Short, horizontal pipe leading to chamber (above, right), which often becomes clogged with scale, should be periodically checked and cleaned.



Air chamber positions

An air chamber that is a direct continuation of a pipe (positioned as shown at top, left of page) is best because it then receives the full thrust of rapid-moving water. A "Y" (45°) fitting (above, left) offers less resistance to water surge than a 90° fitting. An air chamber that needs draining fre-

quently can be made more convenient by addition of a pet cock on cap of chamber (above, center). Effectiveness of a chamber is increased if inlet opening at bottom is about half size of connecting pipe (note reducer shown). Faucet, below level of chambers (above, right), acts as a drain valve.



PM's dockside guide to imported cars '74

by Bill Hartford
AUTO EDITOR

Suddenly, big cars are rusting at the curb—or in the remote lots where dealers have stashed them. Without fuel, they're dinosaurs. The cars that will survive are, with few exceptions, imported.

Big cars have become a bad trip—a short one! They don't go far on a gallon. If you want to extend your range, you had best be behind the wheel of a car that is sensibly scaled for the job it was intended



Audi Fox must now compete with the new VW Dasher. Both share many components, including engine, fwd.



Datsun B-210 Hatchback is the style leader of the new B-210 Series that replaces the 1200 Series for '74.

to do—the kinds of cars innovative auto-makers in Europe and Japan have been building for years. We can't get all the different cars they make, but all those that are available in the United States are listed here.

There's no better example of how a car

can be designed to weigh in at 2100 pounds and still have all the performance, comfort and economy that the average 4.2-person family would need than VW's new Dasher (see test, page 168). The so-called "sacrifices" to be made when switching from big-outside/small-inside cars to a sensibly sized, intelligently designed import are nil. Such cars have, in fact, better space utilization than most of Detroit's "big" cars, and the same, if not more, comfort.

True, among the imports there are the exotica—the fuel-hungry Ferraris—and a few heavyweights and some models that are skimpily put together, but this dockside guide abounds with well-built, economical cars—cars that go far on a gallon of gas, or on a ration stamp, if it comes to that.

Alfa Romeo models have been changed only enough to meet federal safety and emissions standards. The Berlina is the fun-to-drive *practical* family car; the GT and Spider are the *impractical* family cars (tight 2+2 configuration), but even more fun to drive! All use the same double-overhead-cam (dohc), fuel-injected, two-liter engine.

Audi Fox introduced the front-engine, front-wheel-drive (fwd) setup that's identical to that now available in the VW line in the Dasher. It's an ohc design with excellent performance and fantastic economy. Slight sheet-metal change at front fenders makes



Fiat X1/9, now in dealer showrooms, is the lowest priced mid-engine sports car on the American market.

car slightly wider for '74. The Audi 100, also fwd, is wider, too, and has power steering available this year—a feature you'd expect in a luxury car like the 100. (For reference to more complete PM road tests, stories and Owners Reports, see page 174).

Austin Marina is British Leyland Motors' easily serviced sedan that borrows many existing drive-line components from other models. The engine, for example, is same as MGB's. Introduced here last year, the Marina is unchanged for the '74 model year. It's still less than \$3000 and still not a very exciting car.

Bentley automobiles are Rolls-Royces with less ostentatious front grilles. Don't bother



Dodge Colt is restyled for the first time since introduction in 1971. Among the models is this two-liter GT.

looking unless you'd consider trading in your house for one. It would provide a fair degree of comfort for a small family.

BMW cars from the Bavarian Motor Works are for the enthusiast. Still, the 2002 sedans would make excellent family cars—where the family automobile got a big place in the budget. Gone are the days of the marvelous 1600 which was less than \$3000. The top-of-the-line BMWs compete with Mercedes. They're high-performance, luxury cars, capable of more than 120 mph. Of course, high-performance European-style, includes fuel economy of 20 mpg from a 3-liter (182-cu.-in.) ohc Six. A superb new BMW sedan was recently introduced in Europe as the 520 and is expected here as the 530i before the end of the year.

Capri is Lincoln-Mercury's ace-in-the-hole. It was a winner when Ford first designed it for the European market and it's still going strong. The 2000-cc engine is standard (remember when it was the hot option?) and the hot setup is now a V6 dis-



Honda Civic will pioneer CVCC engine, a stratified-charge design with good fuel economy, low emissions.

placing 2800 cc—up 200 from last year. Rallye instrumentation is standard and the standard radials are now the steel-belted type. It's a reasonably priced 2+2 for a small family, but already it's starting to look antiquated next to the modern, more angular, sporty sedans with their lower beltlines and larger greenhouses.

Citroen has a nice range of cars for the European market—from the odd, two-cylinder 2CV to the racy GS—but here, alas, there is only the SM: Of course that's all you could ever want if, alas, you had the megabucks to buy one. It's a most sophisticated automobile in a *special*, aerodynamic 2+2 coupe layout with dohc, fuel-injected, *Maserati* V6 engine (hence the designation,

Specifications and comparisons of all imported 1974 cars

Car— Series: Models, Options	Body Style	Wheel- base (in.)	Overall Length (in.)	Overall Width (in.)	Curb Weight (lbs.)	Engine* (cubic centi- meters, in-line Four except as noted)	1974 Changes (Not federally regulated)
ALFA ROMEO							
2000 Berlina	4-dr.	101.1	167.9	61.6	2400	2000	Refinements
2000 GT Veloce	2-dr. coupe	92.5	167.9	64.2	2300	2000	Refinements
2000 Spider Veloce	2-dr. roadster	88.6	167.9	64.2	2300	2000	Refinements
AUDI							
Fox	2-dr., 4-dr. sedan	97.2	172.0	64.7	1984	1471 fwd†	Refinements
100LS	2-dr., 4-dr. sedan	105.3	187.2	69.0	2400	1871 fwd†	Refinements, power steering
AUSTIN							
Marina	2-dr., 2-dr. GT, 4-dr.	96.0	169.0	64.8	2200	1798	Unchanged
BENTLEY							
Bentley T, Corniche	2-dr., 4-dr. sedan, convert.	119.0	203.5	71.0	4800	6750-V8	Refinements
BMW							
2002, 2002tii	2-dr. sedan	98.5	172.0	59.5	2300	1990	Refinements
Bavaria, 3.0S	4-dr. sedan	106.0	192.0	68.3	3100	3000-6	Refinements
3.0CS	2-dr. coupe	103.3	186.5	65.7	3100	3000-6	Refinements
CAPRI							
2000, 2800	2-dr. coupe	100.8	174.8	64.8	2400	2000, 2800-V6	Refinements, larger engine
CITROEN							
SM	2-dr. coupe	116.1	192.6	75.0	3200	2965-V6-fwd†	Refinements
DATSUN							
B-210	2-dr., 4-dr. sedan, hatchback	92.1	160.6	60.8	1950	1288	New series replaces 1200 series
PL-710	2-dr., 4-dr. sedan, 2-dr. hdtp.	96.5	170.9	62.2	2300	1770	New series replaces 510 series
PL-610	2-dr. hdtp., 4-dr. sedan, wagon	98.4	174.0	63.0	2400	1952	Refinements, larger engine
260Z	2-dr. hatchback sports car	90.7	169.1	64.1	2499	2565-6	Refinements, larger engine, new emission controls
DODGE							
Colt	2-dr. coupe, 2-dr. hdtp., GT, 4-dr. sedan, wagon	95.3	172.2	63.6	2100	1597, 1995	Restyled, new 2-liter engine
FERRARI							
Dino 246 GTS	Mid-engine coupe and spider	92.2	167.0	66.9	2500	2418-V6	Unchanged
Daytona 365 GTB/4	2+2 coupe and spider	94.4	171.2	68.0	3100	4308-V12	Unchanged
365 GTC/4	2+2 coupe	98.4	179.9	70.1	3200	4390-V12	Unchanged
FIAT							
128	2-dr. sport coupe, 4-dr. sedan, wagon	87.5	154.4	61.4	1800	1290-fwd†	Refinements, larger engine
124	2-dr. & 4-dr. sedans, wagon, sport coupe and spider roadster	96.4	151.0	63.9	2100	1592, 1756	Refinements, larger engine
X1/9	Mid-engine roadster	89.9	160.4	63.5	1940	1290	All-new car
HONDA							
Civic	2-dr. sedan, hatchback	87.5	151.0	62.0	1940	1290	All-new car
JAGUAR							
XJ6, XJ12C, XJ12L	2-dr. hdtp. coupe, 4-dr. sedan	108.8	194.8	69.7	3900	4000-6, 5343-V12	New coupe and long-wheelbase sedan
E-Type V12	2+2 roadster	112.8	198.8	66.1	3200	5343-V12	Refinements
JENSEN							
Jensen-Healey	2-dr. roadster	92.0	161.9	63.2	2100	1973	Refinements
Interceptor Mark III	2-dr. coupe	105.0	186.0	69.0	4000	7200-V8 (Chrysler 440)	Refinements
LOTUS							
Europa Special	Mid-engine sports car	92.0	157.3	64.5	1600	1600	Refinements
MASERATI							
Bora	Mid-engine sports car	102.2	170.4	68.1	3600	5000-V8	Unchanged
MAZDA							
808	2-dr. coupe	91.0	162.0	63.0	2000	1600	Unchanged
RX-3	2-dr. coupe, 4-dr. wagon	91.0	168.0	63.0	2350	1146-2-rotor	Refinements
RX-2	2-dr. coupe, 4-dr. sedan	97.0	173.0	62.0	2500	1146-2-rotor	Refinements
RX-4	2-dr. hdtp. coupe, 4-dr. sedan, wagon	99.0	177.0	66.0	2630	1308-2-rotor	New series

*Not all engines available in all models

†Front-wheel drive

Car— Series: Models, Options	Body Style	Wheel- base (in.)	Overall Length (in.)	Overall Width (in.)	Curb Weight (lbs.)	Engine* (cubic centi- meters, in-line Four except as noted)	1974 Changes (Not federally regulated)
MERCEDES-BENZ							
230, 240D	4-dr. sedan	108.3	195.5	69.7	3200	2300-gasoline 2400-diesel	Larger engines, new transmission refinements
280, 280C	4-dr. sedan, coupe	108.3	195.5	69.7	3400	2746-6	Refinements
450SE, SEL	4-dr. sedan	112.8	205.7	73.6	4000	4520-V8	Refinements
450SL, SLC	2-dr. coupe/roadster, 2+2 coupe	116.7 96.9	209.4 182.5	70.5	3700	4500-V8	Refinements
MG							
Midget	2-dr. roadster	80.0	144.5	54.9	1750	1278	Unchanged
MGB, MGB/GT	2-dr. roadster, hatchback	91.0	159.5	59.9	2400	1798	Unchanged
OPEL							
Manta, Luxus, Rallye, 1900	2-dr. coupe, wagon	95.7	176.1	64.3	2200	1900	Refinements
PANTERA							
Pantera L	Mid-engine sports car	98.4	176.0	71.3	3200	5751-V8 (Ford 351)	Refinements
PEUGEOT							
504	4-dr. sedan, wagon	108.0 114.0	177.0 189.0	66.0 67.0	2800 3000	2000-gasoline 2112-diesel	New diesel-engine sedan and wagon
PORSCHE							
914	Mid-engine roadster	96.8	161.2	65.0	2100	1795, 1971 flat 4	Refinements, larger engine
911	2+2 coupe, Targa	89.4	168.9	63.4	2400	2653-flat 6	Refinements, larger engine
911S, Carrera	2+2 coupe, Targa	89.4	168.9	65.0	2400	2653-flat 6	Refinements, larger engine, Carrera model
RENAULT							
12, 12L, 12TL	4-dr. sedan, wagon	96.0	174.0	64.5	2100	1647-fwd†	Refinements
15TL	2-dr. coupe	96.0	172.0	64.0	2300	1647-fwd†	Refinements
17TL, Gordini	2-dr. coupe, coupe convertible	96.0	172.0	64.0	2500	1565, 1647-fwd†	Refinements, new "Coupe convertible" configuration
ROLLS-ROYCE							
Silver Shadow, Corniche	4-dr. sedan, 2-dr. sedan, convertible	119.0	203.5	71.0	5000	6750-V8	Refinements
SAAB							
99LE, EMS	2-dr., 4-dr. sedan, hatchback	97.4	174.0	66.5	2500	1985-fwd†	Refinements, hatchback model, fuel injection for all models, power steering
Sonnett III	2-dr. hatchback sports car	84.6	160.0	59.1	1900	1698-V4-fwd†	Refinements
SUBARU							
DL, GL	4-dr. sedan, wagon, coupe	96.6	164.4	59.2	2000	1360-flat 4-fwd†	Refinements
TOYOTA							
Corolla 1200	2-dr. sedan	91.9	159.4	59.3	1800	1200	Refinements
1600, SR-5	2 & 4-dr. sedans, wagon, coupe	91.9	159.4	59.3	1900	1600	Refinements
Corona RT, SR	2 & 4-dr. sedans, 2-dr. hdtp., wagon	98.4	170.7	63.6	2300	2000	Restyled, on board fault- detection system
Celica ST, GT	2-dr. hdtp. coupe	95.5	169.2	63.0	2300	2000	Refinements, 5-speed GT
Mark II	2-dr. hdtp., 4-dr. sedan, wagon	101.8	175.4	64.0	2700	2600-6	Refinements
TRIUMPH							
Spitfire 1500	2-dr. roadster	83.0	155.3	58.5	1700	1500	Refinements
TR-6	2-dr. roadster	91.0	162.0	58.0	2400	2500-6	Unchanged
TVR							
2500M	2-dr. coupe	90.0	164.0	64.0	2000	2500-6	Unchanged
VOLKSWAGEN							
Beetle	2-dr. sedan	94.5	163.4	61.0	1800	1584-flat 4	Refinements
Super Beetle	2-dr. sedan, convert.	95.3	164.8	62.4	2000	1584-flat 4	Refinements, new front- suspension geometry
Karmann Ghia	2-dr. coupe, convert.	94.5	165.7	64.3	2000	1584-flat 4	Refinements
The Thing	4-dr. utility vehicle	94.5	148.8	64.6	2000	1584-flat 4	Unchanged
412	2-dr., 4-dr. sedan, wagon	98.4	183.7	65.9	2500	1679, 1795-flat 4	Refinements, larger engine
Dasher	2-dr., 4-dr. sedan, wagon	97.2	172.8	63.0	2100	1471-fwd†	All-new car
VOLVO							
142, 142GL, 144, 144GL, 145	2-dr., 4-dr. sedan, station wagon	103.0	188.0	67.1	2800	2000	Refinements, new Grand Luxe series, new fuel injection
164E	4-dr. sedan	107.0	191.7	67.1	3200	3000-6	Refinements

SM). Suspension is independent all around, hydropneumatic and automatically leveling. Datsun models now start with the new B-210 lineup. The restyled little ones replace the 1200 series. Best looking is the hatchback. Engine is up to a huge 1288 cc. The 510 models, Datsun's intermediates, have been replaced by the 710 models which boast less angular sheet metal than the



Mercedes-Benz 240D is a luxury car with extraordinary fuel economy: up to 30 mpg using No. 2 diesel fuel.

510s. Too bad: The 510 had a great enthusiast following, who'll miss, too, the independent rear suspension which has been replaced with a live axle in the 710. I'd guess that Datsun won't leave us without a small wagon for too long, and one'll be along soon in the 710 series. The 610 is too new to be changed much, but it also gets 200 cc more muscle. Add the same 200 to 2400 cc and you get a 2600-cc "Z" car for '74. Ergo, 260Z. Under-the-hood changes make it a smoother performer this year.

Ferraris are a hobby. If enough aficionados put in orders for the new flat-12, mid-engine Boxer Berlinetta, the car will be imported. Otherwise, they'll only be seen on the *autostrade*—if pleasure driving isn't banned. Most recent additions to the Dino and Daytona series are the spider models.

Fiats are for transportation—even though there are many collectors of the marque, and even though the sports models are among the most exciting cars you can drive anywhere. They never run out of revs. The best thing for '74 is that the 124 Special TC four-door sedan and wagon now have the 1600-cc twin-cam engine—and that'll make for very exciting grocery shopping. The front-wheel-drive 128 line has another 100 cc which is fine, but what the U.S. needs is another 100 cars a week from Italy to meet

the demand. The 124 Coupe and Spider have a new 1756-cc engine and the new X1/9 sports car is finally here. Price is slightly higher than originally forecast in *PM's* road test, page 26B, Sept. '73.

Honda has a car with what sounded like a very dumb name for a car when it was first introduced, but now with it the duty of every citizen to save gasoline, "Civic" has a different ring. It even has sprightly performance. This year Civics will start arriving here with Honda's compound vortex controlled combustion (CVCC) engine. (The one they're selling to Detroit.)

Jaguar news this year is a Series II on the XJ sedan. The new, C-Type XJ coupe is a striking two-door hardtop. The XJ12 sedan gets a four-inch-longer wheelbase and therefore gets an "L" tagged on the end of its designation. The revised instruments and controls improve the interior of the Series II cars, but there's no improvement on Jaguar delivery time: There's still a waiting list.

Jensen is helping to keep the traditional (read British) sports car alive here (you can't get a Morgan anymore and Austin-Healey is defunct) with the Jensen-Healey. It owes its snappy performance *and* its fuel economy (25 mpg) to its two-liter, twin-overhead-cam Lotus engine. It's a roadster that saves gas and keeps the fun in driving. The Interceptor is a grand (\$20,000) touring car still practical on American roads since it uses an all-Chrysler drive train.

Lotus now has only the Europa Special for sale here. No more Elans. The fiberglass two-seater is incredible for its fuel economy and cornering power—pulling close to one G in skid-pad tests. If you're nimble enough to work yourself into one, you're probably healthy enough to pull a G.

Maserati hobbyists have a new car to play



Porsche 911 has many changes including larger, 2.7-liter engine, new seats, neatly redesigned bumpers.

with—new by European standards. The \$30,000 Bora is a mid-engine sports car with a big V8 that puts out 300 hp. Still, it gets between 10 and 15 mpg.

Mazda is still the only rotary-engine car sold in the United States. In 1974 the line of vehicles will become all-rotary: This is the last year for the piston-engine 808 coupe, and the pickup truck will be available with rotary engine perhaps as early as next month. Engine will be the big one from the RX-4. The new RX-4 adds a touch of luxury to Mazda's lineup of sporty sedans (see *Imports and Motorsports*, page 54, for pictures of the RX-4). Now, if rotary-engine fuel economy could be improved . . .

overhead-cam design with a single four-barrel carburetor: Fuel is distributed equally to all cylinders with same precision as a fuel-injection system. Mileage is between 15 and 20 mpg. Mercedes is still *the* car worth investing in—not for status, but for technical excellence.

MG lives! The sports cars named at Morris Garages, Ltd., continue to work their magic on people who love cars and driving. The current models are essentially unchanged again for '74 as they've been unchanged for countless years. So what!

Opel has its finest line of cars here—ever. Or, rather, Buick has them. The lineup is simple: the 1900 wagon and three versions of the popular Manta coupe. The two and four-door sedans are discontinued as is the GT. The mini-Corvette-styled GT had its fans, but the Manta proved so much more car, who needed it?

Pantera L really is one "L" of a car, but it has to overcome the reputation of the original model. Just be sure to maintain the cooling system by the book and it won't overheat. There's no other car like it in its price class. Lincoln-Mercury dealers have it.

Peugeot has a marvelous range of models and its petite, new 104 is a natural for urban U.S.A. But federal safety and emissions complexities and the economics of sending cars to our ports of entry affect Peugeot and all foreign car manufacturers big and small. Only Peugeot's luxury model, the 504, is available here, as a four-door sedan and a wagon. The wagon is the most stylish such vehicle of all the imports. For '74 there's a diesel-power option in both models. That makes the diesel station wagon the only such vehicle you can buy

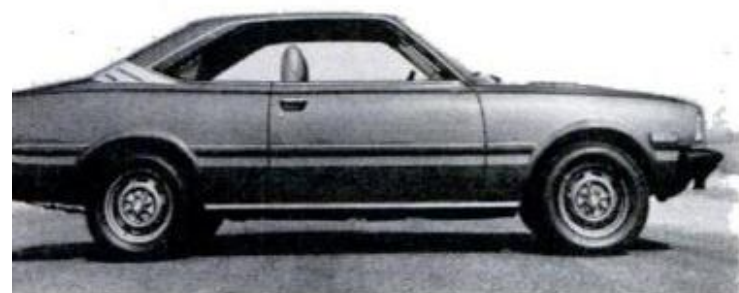
(Please turn to page 172)



Renault 17 TL Coupe Convertible: Fiberglass hard top is removed; soft top underneath can be opened, closed.



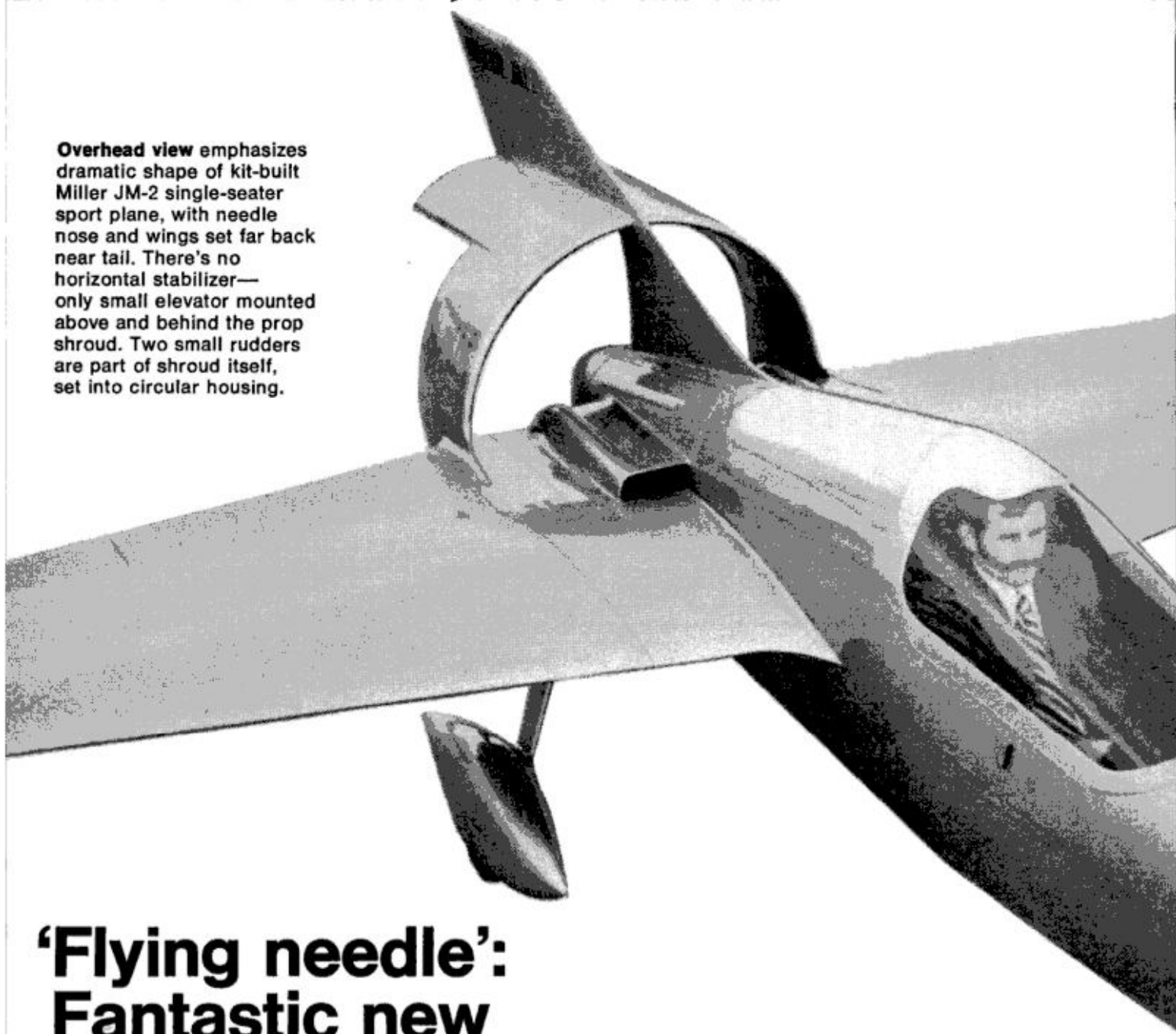
Saab 99 EMS is top of the line. All 99s, including the new hatchback, have anatomically redesigned seats.



Toyota Corona SR Coupe has standard: 5-speed, AM-FM, radials, tach, styled wheels, Electro Sensor Panel.

Mercedes-Benz has one of the hottest cars for the American market at the moment: Called, variously, "the lifetime car" and "the world's most expensive economy car," the 240D diesel combines workmanship, luxury, reliability and comfort with terrific economy. The 240D and its gasoline-engine equivalent, the 230, have larger-displacement engines plus many of the safety features originally introduced on the incomparable 450SL, SLC and SE, SEL models. In between the Mercedes Fours and the V8s is the 280 series with the 280 four-door and 280C coupe. Power is produced by the smoothest Six on the market, a twin-

Overhead view emphasizes dramatic shape of kit-built Miller JM-2 single-seater sport plane, with needle nose and wings set far back near tail. There's no horizontal stabilizer—only small elevator mounted above and behind the prop shroud. Two small rudders are part of shroud itself, set into circular housing.



'Flying needle': Fantastic new fun plane

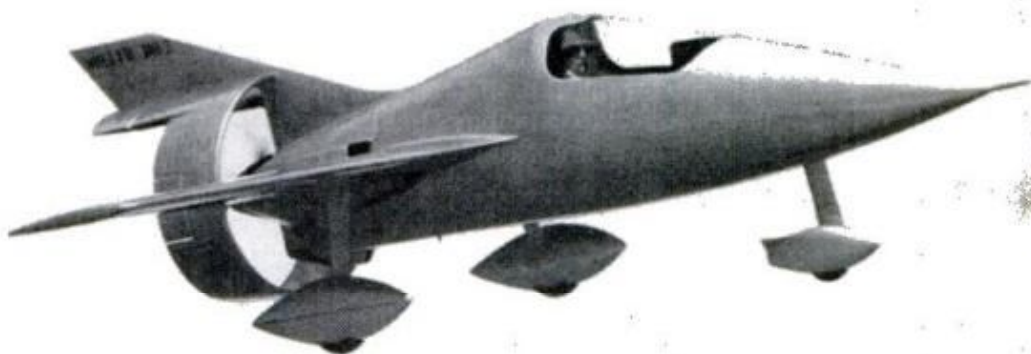
It started out as a test project and ended up a sleek, aerobatic beauty you can build from a kit.

by Sheldon M. Gallager
and Howard Levy

At a recent exhibition of business aircraft in Texas, a racy little gold-colored monoplane stood out like a glittering jewel. It wasn't supposed to be a sport plane, but it looked so incredibly appealing and unusual that it stole the show. Actually, it was

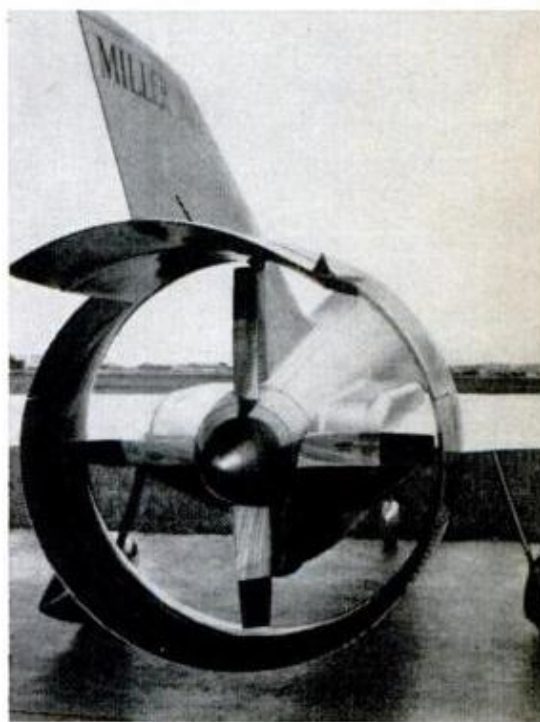
a half-scale prototype for what its designer, Jim Miller, expected would eventually become a four-place plane for corporate use. But the businessmen weren't interested in it for business—they wanted it for fun. The sleek, needle-nosed single-seater attracted so much attention that Miller immediately decided to change his plans and produce the baby-scale beauty as a build-it-yourself kit plane for personal use.

Thus was born the JM-2 shown above and on the cover of this month's *PM*—a plane as unconventional in design as it is eye-catching in appearance. Its wings are set so far back they're where the tail would normally be. The engine and propeller are also in the rear, and the prop is shrouded



Basic specifications

Overall length	19 feet
Wingspan	15 feet
Engine	100-hp Continental
Top speed	235 mph
Rate of climb	1600 f.p.m.
Range	400 miles
Stall speed	70 mph
Empty weight	630 lbs.
Gross weight	1100 lbs.



Photos: Howard Levy

Shrouded prop is one of most distinguishing features of Miller JM-2, giving it somewhat the appearance of a jet. Shroud helps to provide "ducted-fan" effect, enclosing airstream for increased thrust with less turbulence. Prop is small, but has four blades, producing tremendous power for its size. Pusher arrangement has added advantage of putting prop behind wings so wings work in "clean" air undisturbed by prop wash. Vertical stabilizer above prop shroud is fixed.

A 235-mph streak of glittering gold

in a circular casing like a squirrel-cage blower. There are no ordinary tail surfaces.

The elevator is a small hinged plate attached directly to the propeller shroud, extending above and beyond the prop. The rudders are two tiny curved tabs set right into the rim of the shroud itself. The nose tapers to a sharp point with just enough room inside for a pilot to snuggle in, and the whole ship—no longer than many cars—squats on the ground barely waist-high. It looks daring, dashing, jaunty and rakish all in one—no wonder the businessmen were goggle-eyed.

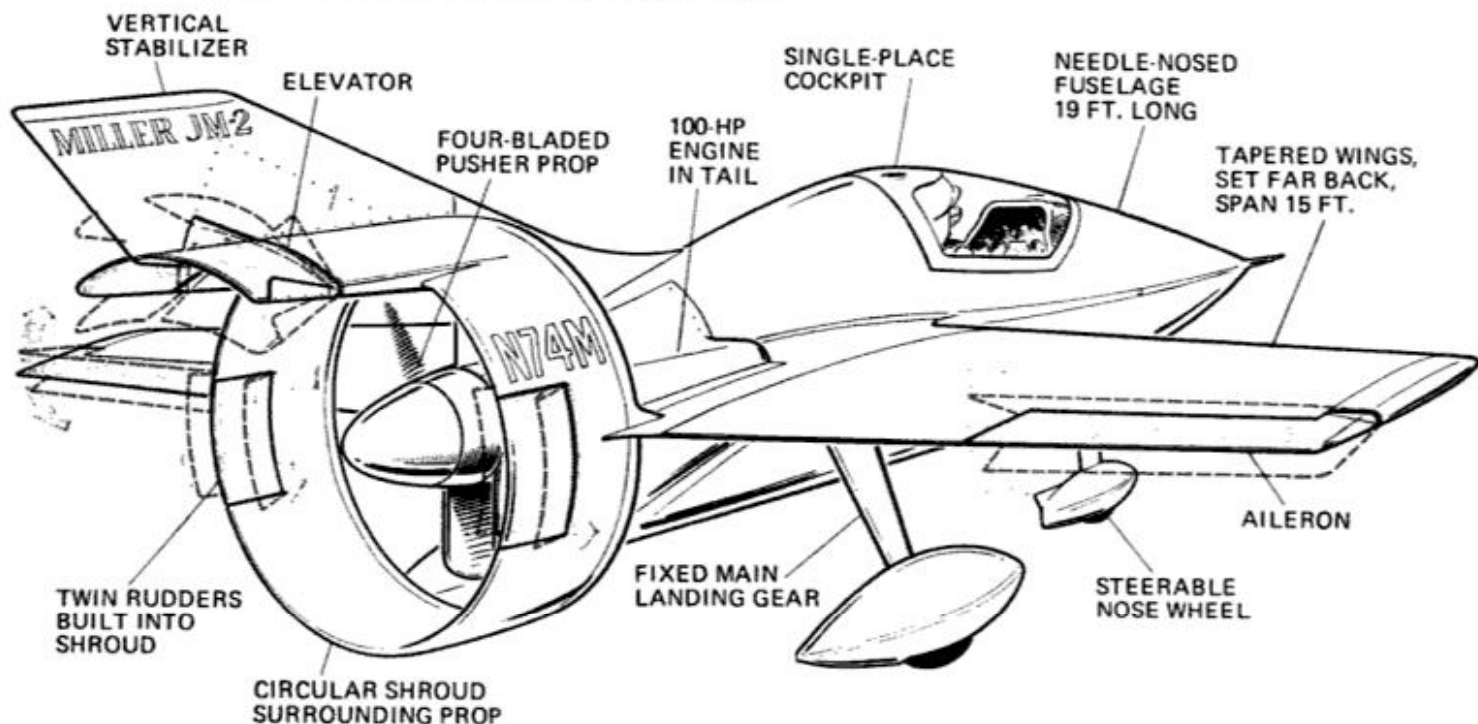
The shrouded propeller—the JM-2's most distinguishing feature—works on the "ducted-fan" principle. The circular casing tends to contain the air around the prop and channel it rearward with tremendous force, something like the blast of a jet. Proof that the principle works is the fact that out of the ship's relatively low-powered 100-hp Continental engine Miller manages to squeeze an astonishing top speed of 235 mph—extremely "hot" by small-plane standards. Cruising speed is better than 180 mph, and rate of climb is an impressive 1600 feet per minute. That's a lot of performance on 100 horses.

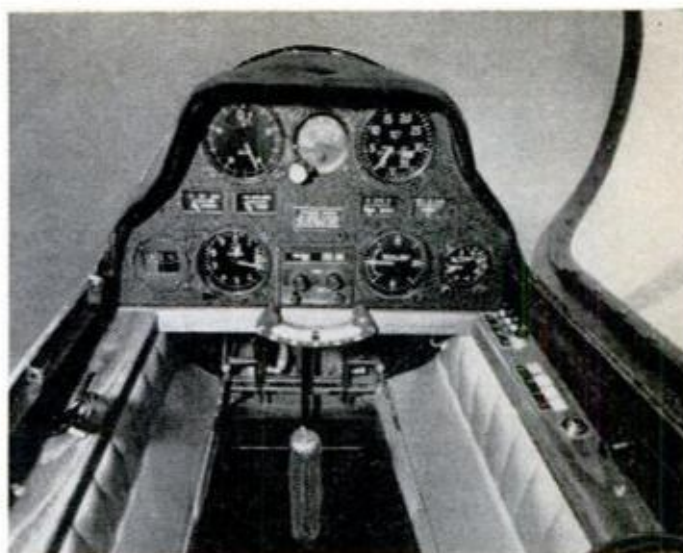
Despite their small size, the elevator and twin rudders provide highly sensitive, quick

response because they work right off the full force of the prop blast, requiring little pressure on the controls for fast maneuvering. Locating the propeller in the rear offers the additional advantage of keeping wings and ailerons clear of prop-wash turbulence for good stability and control. The combination of the two effects makes the tiny gold-end speedster easy to handle, exceptionally maneuverable and an agile aerobatic performer. The ship is still undergoing stress tests, but has already withstood up to 8 Gs in static trials and 6 Gs in actual flight—bound to please the advanced pilot looking for thrills, as well as assuring high structural strength and safe handling for the less experienced.

Overall length is 19 feet; wingspan, 15 feet. The wings, modified from a 6400-series airfoil, taper from a wide chord of 72 inches at the fuselage root to a narrow 36 inches at the tips. Thus the wings have the appearance of being swept back at the leading edges even though they extend straight out from the fuselage. There are no wing flaps in the current prototype, but even without them stall speed is a comparatively tame 70 mph with power, 74 mph with power off. Landing speed is 80 mph—not slow, but surprisingly mild for a ship as hot as JM-2.

How the unconventional control surfaces work





Cockpit interior (above) shows instrument panel, control stick and additional control consoles along sides to save space and put flight switches within easy reach of pilot's fingertips. Pilot has excellent visibility in all directions, especially to sides and downward because wings are set so far back there's nothing to obscure his view—a help in making unobstructed landing approaches. Photos at left show elevator in down position (top), up position (bottom). Note how twin rudders are incorporated right in prop shroud. Though small, they give maximum control effect because of location directly in line with prop.

Still, Miller is considering adding flaps in the production kit version, as well as leading-edge slats, to bring landing speed down to a more docile 60 mph as an aid to low-time pilots. At present, the JM-2 requires an approach speed of 100 mph, a minimum landing roll of 2000 feet and a takeoff run of 1500 feet. All of these would be substantially reduced if Miller modifies the wings as proposed.

Another plan is for a "stretched" version of the JM-2 providing two-place tandem seating for the pilot who likes instruction and/or companionship in his flying. This would have the same 100-hp Continental engine and be otherwise similar to the single-place model except slightly slower. Miller expects to market it as a fully certificated, ready-to-fly aircraft instead of a kit. He also hopes eventually to expand the design still further into his original concept for a four to six-place corporate plane. For the moment, though, the kit-built version of the JM-2 will have first priority.

Construction of the JM-2 is welded steel for the fuselage with aluminum I-beam spars for the wings. All parts are covered with premolded fiberglass skins ready to apply. This eliminates fussing with tricky bends, produces a slick, smoothly contoured finish and makes assembly simple. Landing gear is of the modern tricycle type with fixed main wheels and a steerable nose wheel linked to the rudder pedals for easy ground maneuvering. The prop is a small 39-inch-diameter four-blader turning in a 40-inch-diameter casing—that's how snugly prop and shroud mate to form a tightly enclosed duct.

The price of the JM-2 kit has not yet been firmly established, but is expected to be around \$7000. Miller hopes to have packaged parts ready for sale toward the end of this summer. Further information about specifications and availability of the kit can be obtained from J. W. Miller Aviation, Inc., Horseshoe Bay Airport, Route 3, Box 757, Marble Falls, Tex. 78654. ★★★

New afloat for '74



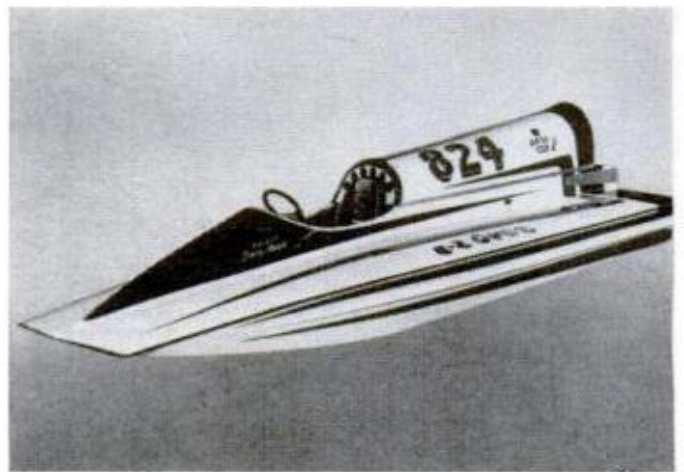
More performance and posh, seakindliness and style, are promised from the latest in pleasure craft.

by Bill McKeown
BOATING EDITOR

This year's boats and motors are better—and they need to be. Fuel restrictions for marine engines, and for the tow cars that could trail them, are likely to limit radius of action. A skipper may need to do his cruising nearer home, and to take advantage of his boat with more hours afloat at anchor. The dreamboat of 1974 should provide added relaxation—as well as action.

Performance this year will mean more miles per gallon rather than just miles per hour. But the big new outboard, I/O or inboard still has its place. Throttled back, the higher horsepower mills can equal gas consumption of smaller kickers run full bore for the same speed. Yet a big muscle machine may be opened up in an emergency to get you home before a storm.

More craft are coming with water-jet power this spring. Safety (no underwater prop blades to threaten swimmers and water skiers) plus minimum draft are advantages. But the jet pump may provide less efficient operation (fewer miles per hour per horsepower). And a skipper should check out any boat on the water before buying. Several jet jobs we have



Sprint speeds from tunnel hull of Baja CT-150 Unlimited outboard (above), ultimate offshore racing (below), with bigger 40-foot *Cigarette* from Don Aronow's line of 100 marathon winners, or relaxation with Viking's V239—you pick.





Bass boats have taken over big-boat power. This 18-foot Advancer from Ouachita's glass line has a 140-hp MerCruiser I/O that could pull skiers.



Starcraft Stinger 19 (top) wraps windshield around cockpit of this ski-boat 19-foot line leader. It's available as an outboard for up to 190 hp, or with I/O or water-jet-power push of as much as 350 hp.

Tunneflite (above) uses aerodynamics to lift hull for added speed, less resistance.



Larson LX-5 is high-styled sport runabout addition to Larson's 20-boat fleet. Rated for up to 95-hp outboards, 1150 lbs. capacity, this ski-boat has modified V-hull, metal-flake finish, optional stereo.

Don Aronow, ace of offshore racing drivers, designed Glasspar's new Don Twenty, first production runabout to incorporate lines of big *Cigarettes*. Classic deep-V hull holds Chrysler 275 for power.

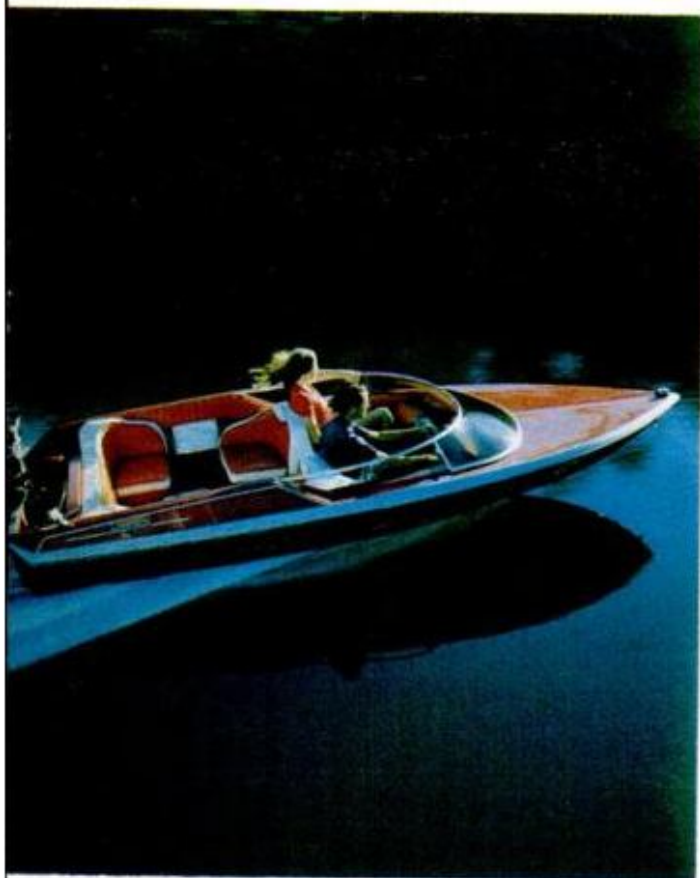


Chrysler's crew tops line with these high-performance runabouts from Conqueror Sport Boat Fleet, including new jet.





Sporty CV-18 S/S Glastron/Carlson offers stern-drive or water-jet powering. Built-in steps in transom are desirable safety and convenience aid. Handrail circles cockpit; finish is metal flake.



Mark VII from Marquis Boats, a high-performance 17-footer, has upright flotation, mounts outboards or can take inboard, hydro-jet or stern-drive power up to 390 hp. Speedometer and tach included.



Duo 16-foot bass boat is Chris Schenkel Signature model. Fittings include vinyl carpet, rod racks, upholstered fishing chairs and helm seat, live well, locked storage under foredeck, side rails.



Steury adds the convenience of a safely mounted LP-gas bottle to the transom of new 18-foot V518 cabin cruiser. Deep-V two-bunk model can take 155-hp outboards or stern drive, as at right.

tested recently offered bad steering control.

Hulls for larger craft up to cabin size will be of fiberglass, while smaller boats may be plastic or aluminum, plus a growing number of good inflatables. Bass boats are the fastest growing design. Tri-hulls are stable and suitable inshore while deep-Vs are the seaworthy choice for offshore going. The outstanding craft here are a good cross section of the best for '74. ★★



Jetcraft X180 modified V-bottom 18-footer by Steury is rated for seven passengers and 455-cu.-in. water-jet engine. For skiing or speeding, it comes in all white or blue metal-flake gel finish.

Chris-Craft's new 25-foot Tournament Fisherman (right) can sleep two forward, powers from pair of 130-hp C-C engines, comes fully fitted out. Among options are Bimini top, berth pads, windscreen.

Tempest II, (below) by Lund is result when a well-known fishing-boat builder produces a sleek one. The GT 118 can take a 245 OMC stern drive or up to 160 outboard hp. Water jet is option.



Gran Bateau (above) from Cruisers is 25-foot deep-V cruiser with six feet of standing headroom and two bunks in cabin, power to 225-hp I/O or twins of 165 hp. Trailerable, craft offers 30 options.





Catamaran action from a compact craft is delivered by this newest Hobie Alter creation from Coast Catamaran. Mono-Cat's 12-foot one-piece hull lifts a keel as helmsman hikes (above) with lee rail under. Cockpit is self-bailing; rudder kicks up automatically.

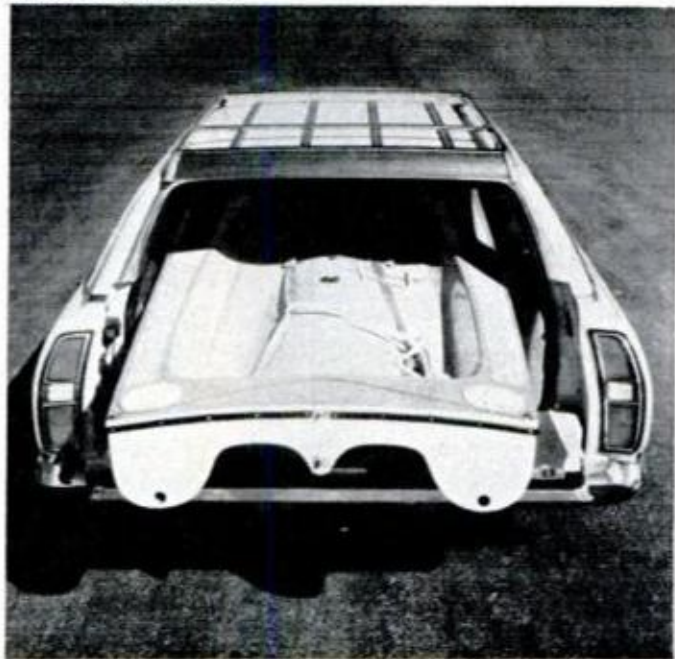
New cat that scats at sea

Hobie 12 Mono-Cat joins famous Hobie Cat 14 and 16 in great planing action. All three feature zero fuel consumption!

First came Hobie Alter's Hobie Cat 14, the sailboat that could make like a surfboard and even be sailed off the beach into the waves. Then came Hobie 16. Now there's a mini-sailing machine, a planing skimmer of only about 12 feet overall—the Hobie 12 Mono-Cat.

Rounded asymmetrical hulls provide buoyancy and stability even while heeled; controllable automatic kick-up rudder and centerboard handled from the cockpit allow sailing right up on the beach. But it's the performance of this \$795 scooter that's most impressive.—*Bill McKeown*

Photos: David Gooley



Mono-Cat beam of only four feet fits inside a station wagon with little overhang. Two-piece aircraft alloy mast disassembles. Rigging takes only minutes.

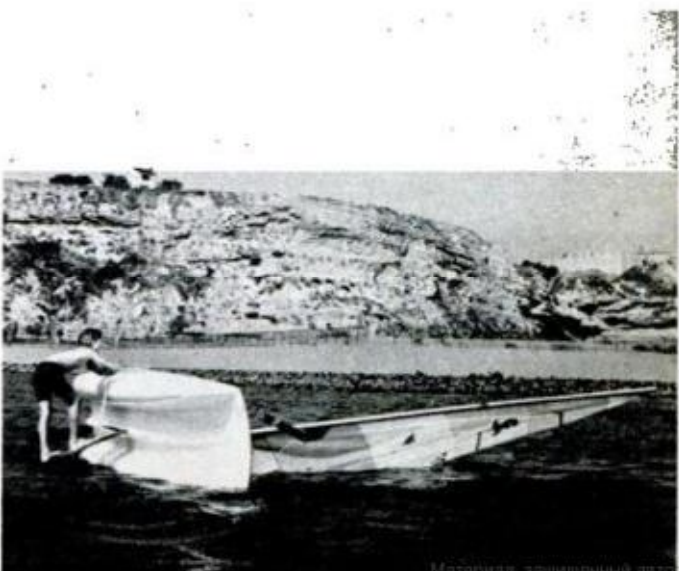
Capsized Hobie 12 Mono-Cat is righted by 50-pound child, builder claims. Skipper stands on centerboard, leans back, and hull and spar swing back upright.



Light 150-pound hull is easy to cartop but will carry reported 300 lbs. of passenger weight. Sail area is big 90 sq. ft. for small 11-foot 9-inch hull.



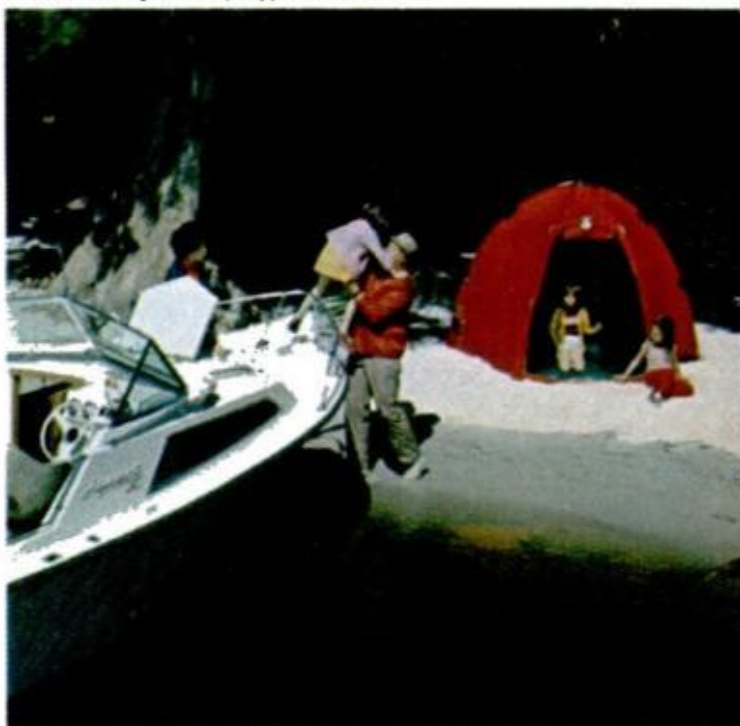
Storage compartments, one in each hull section, can keep small gear dry with watertight covers in place.





Large-craft performance and outboard-motor convenience combine in this seakindly craft. Speeds of 40 and up give boat extended cruising range; generous freeboard keeps passengers in and waves out. Roomy cuddy cabin and cockpit fit within trailerable eight-foot beam to fit either family or fishermen.

Photos: Jerry Imber, Cypress Gardens



Big new outboard cruiser has rugged offshore hull . . .



. . . plus plenty of performance from two compact kickers.

by Bill McKeown
BOATING EDITOR

We had cruised and tested smaller Aquasports before. For years, these sturdy little open utilities have been seen eating their way through tumbled big-water conditions to gain a special popularity with fishermen. Now this well-known Hialeah, Fla., builder is moving up into a new league.

Cruisers powered with outboard motors were getting bigger and bigger a few years ago. Then along came stern drives to fill that gap between overweight inboards and underpowered kickers. Now each kind of engine has developed its own place afloat. But the outboard that can be removed for servicing, tilts up completely clear of the water, and has an impressive herd of horses under the cowl, rates new attention and husky hulls to match. That's where Aquasport's new 240 Cuddy Cabin comes in.

This interesting 24-footer is a direct seakindly descendant of the 170, 19-6, 22-2 and the Sea Hunter 240, the open-cockpit model with center or side-control console plus an optional mini tuna tower mounting a second set of controls above a Bimini top. Fiberglass construction, with teak trim, is of the top quality that has been earning Aquasports their reputation since the company was founded in 1964.

The model we used for our cruise had no





Cabin or open, outboard or I/O

speedometer, but with our two new 135-hp Johnson Sea-Horse outboards we had no trouble pacing a 40-mph photo boat. The hull is rated for 270 outboard horsepower. An OMC 225 stern drive is reported to give similar speeds, with the 188 or 165 Mercruisers only a few mph less. Handling was sure and responsive. The modified deep-V bottom which designer and racing driver Walt Walters has given her has smooth ride through a chop and stability at anchor.

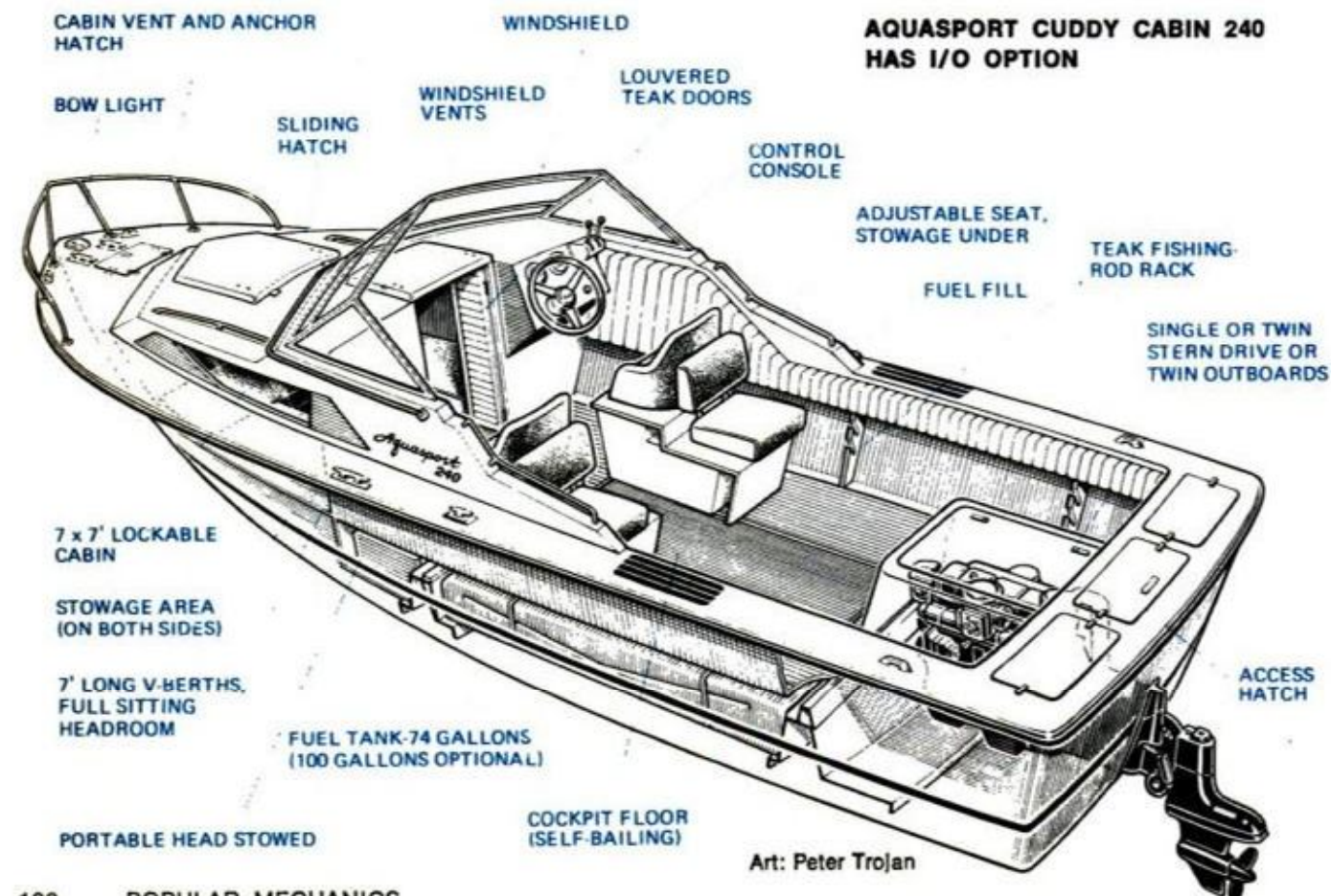
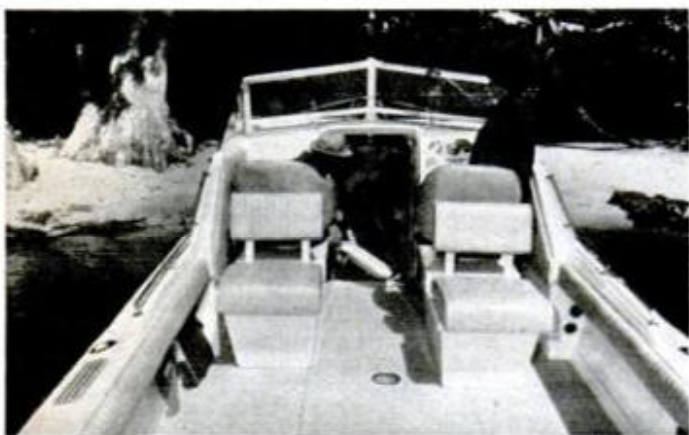
I admired a cockpit deck high enough to drain its scuppers overboard and be self-

bailing. Also the teak trim, fine workmanship, easy handling. My wife approved of the forward hatch that allowed climbing down onto the beach to set up camp ashore without getting wet, plus high cockpit sides that kept the children safely aboard. They like the room to romp in both cockpit and cabin, the stern teak seat that folds down to become a casting platform, the speed and easy ride.

Without engines, the well-equipped outboard model is \$6500—a good price for a craft of fine performance and finish. ★★★

Cruising with kids is real test of adequate living space aboard. Cabin, cockpit, stowage is generous.

Open cockpit models of same hull are offered with side or center console controls, optional mini-tower, helm.



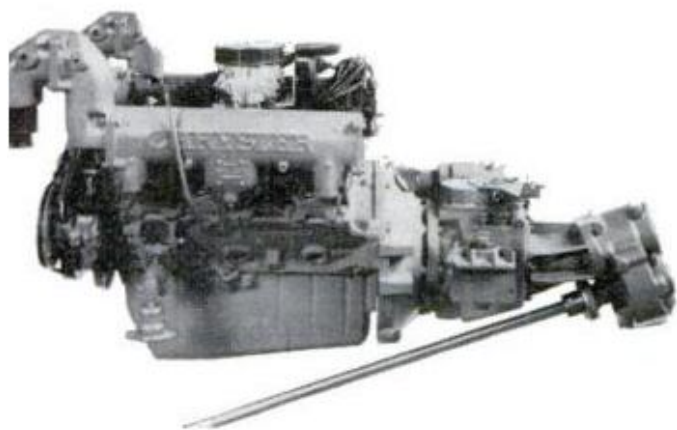
Inboards— big and new

Hulls that can handle bigger seas and speeds now have stronger powerplants available. This year's muscle motors claim up to 90 mph aboard big offshore racing hulls. Jets, which offer added water-ski safety (no prop blades) plus thin-water capabilities, often need more horsepower to equal the speeds of conventional craft. Now they can hook up more horses than they can sometimes steer.

Leading open-ocean marathon winner this year has been Kiekhaefer Aeromarine with engines that hang together for hours of nonstop pounding—the true test of offshore performance. Rivals are appearing in the high-horsepower league, and all are passing race-tested refinements down to more conventional rigs. Like outboards, inboards are growing in popularity; I/O pioneer, Volvo-Penta of Sweden, is opening a U.S. plant for marine engines.

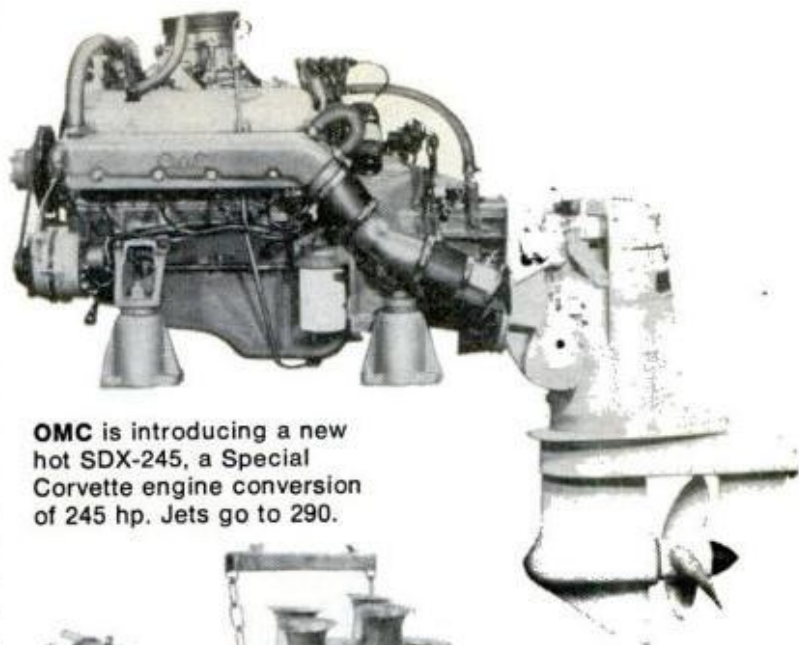
A vee-drive trend positions conventional inboards back where hulls have been designed to carry I/Os and outboards. All owners of bigger craft will benefit.

—Bill McKeown

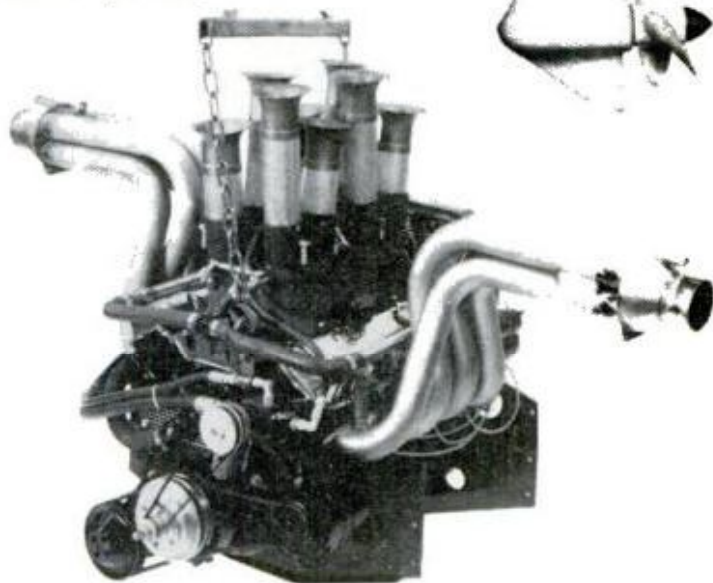


Chrysler's high-performance Super Bee engines will now be offered in vee-drive to keep weight balance aft. Electronic ignition and speed limiters are included.

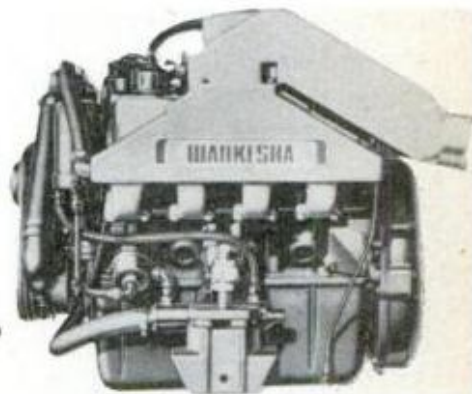
Holman-Moody has built up a 429 NASCAR sports-car engine into its marine CP-494 (right), a special order 700-hp mill with 494 cu. in. for \$14,000.



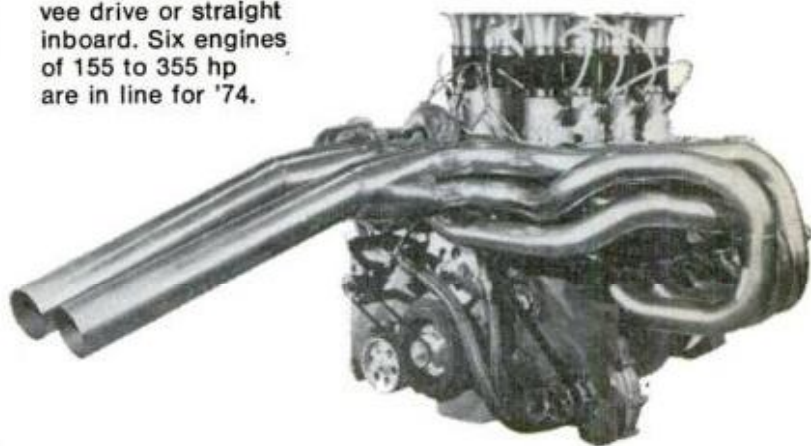
OMC is introducing a new hot SDX-245, a Special Corvette engine conversion of 245 hp. Jets go to 290.



Mercury predicts speeds to 90 mph with 36-foot hulls from new 550-hp 482-cu.-in. V8 fuel-injected Mercruiser with ram tubes and exhaust headers.



Waukesha hooks up its new 460-cu.-in. Model 460/4 V8 to Jacuzzi jet drives, vee drive or straight inboard. Six engines of 155 to 355 hp are in line for '74.



Mini motors— maxi push



Small outboards are earning big new popularity for fishing, auxiliary use and second-motor safety.

by Robert Stearns

While high-horsepower outboards get bigger, stronger and heavier each year, the muscular little midget mills continue to fit all their compact convenience into packages that seem smaller and sleeker, lighter and more efficient. Their growing popularity proves there's a big market between the powerhouse models and the mini-electrics. Without breaking your budget, a small modern fishing kicker can provide dependable push for your small boat, trolling speeds for a variety of pleasure craft, and the safety of a spare "get home" engine along without big cost and consumption of scarce fuel. For canoes, dinghies, skiffs and sailboats on up to workboats and houseboats, the small outboard motor is likely to be the choice for primary or auxiliary power.

How compact can they get? Now you can buy a "vest-pocket" kicker that delivers 1.2 hp from an 8½-pound package (Aquabug). Another one provides that hp from only 11 pounds (TAS Mini), and from only 17 pounds you can get 1.7 hp (Mighty Mite).

This year there's also more sophistication being built into some of the smaller ones. Using design principles that have radically improved the performance of the large outboards, some little kickers have come out with these same features. Several manufacturers have incorporated the gas-saving and power-increasing features of loop-charging and loop-scavenging. By reducing exhaust back pressure, improving combustion and aiding discharge of burned gases from cylinders, more horsepower can be delivered from the same size engine.

Breakerless solid-state ignition systems are also appearing in some smaller engines. These have no breaker points to wear out;



Eska 14-hp, top of '74 line of these popular fishing motors, has solid-state ignition, quiet underwater exhaust, 50:1 gas-oil mix, power-loop design with antipolluting drainless crankcase. Five other models range from 3.5 up to 9.5 hp ratings.

sparkplugs foul less, last much longer and fire more effectively. Drainless crankcase recycling of fuel mix is helping prevent water pollution.

Not all fishing outboards will be using a gas-oil mix. From Japan comes the Honda with standard configuration but a four-cycle powerhead. It has a 7.5-hp motor with separate crankcase sump that uses the same 10W30 motor oil that lubricates cars.

Otterbine's four-cycle air-cooled Briggs & Stratton engines power jet drives that require little more water than the boat itself. Otterbine water jets are available as both clamp-on outboards and permanent-mount inboards, with from 3.5 up to 10 hp. The first production rotary combustion outboard, powered by a German-built Wankel engine and assembled in Italy, offers 10 hp in a 77-pound package that claims only two moving parts in the powerhead.

Largest exclusive producer of fishing-size motors is probably Eska Co. of Dubuque, Iowa, with six models from 3.5 to 14 hp. Chrysler, Evinrude, Johnson and Mercury have always made a number of power options for this market as well. Disadvantages? Small air-cooled models can burn a careless hand, and full swivel may be offered in place of a reverse shift. But these neat little mills are easy to carry and economical. ★★★

MAKERS OF SMALL OUTBOARDS

Honda—American Honda Motor Co., 100 West Alondra Blvd., Gardena, Calif. 90247. A 4-cycle, 7.5-hp model with gearshift, magneto ignition; 67 lbs.

Clinton and Chief—Clinton Engine Corp., Maquoketa, Iowa 52060. Air-cooled models, 3.5, 7, 7.5, 9.9 hp.; water-cooled, 9.9, 14, 25 hp.

Chrysler—Chrysler Marine, Box 2641, Detroit, Mich. 48231. Models, 3.6, 5, 6, 8, 10, 15, 20, 25, 30 hp (more models to 150 hp).

Eska and Seaco—Eska Co., 2400 Kerper Blvd., Dubuque, Iowa 52001. Magneto-ignition models, 3.5, 5 hp.; solid-state, 7, 7.5, 9.5, 14 hp.

Evinrude—Evinrude Motors, Box 663, Milwaukee, Wis. 53201. Models, 2, 4, 6, 9.9, 15, 25 hp (more models to 135 hp).

Johnson—Johnson Motors, 200 Sea-Horse Dr., Waukegan, Ill. 60085. Models, 2, 4, 6, 9.9, 15, 25 hp (more models to 135 hp).

Tomos—Lika Enterprises Co., 1210 Matheson Blvd. West, Mississauga, Ont. A 5-hp, 33-lb. air and water-cooled motor made in Yugoslavia.

Sea King—Montgomery Ward, 619 West Chicago Ave., Chicago, Ill. 60607. Models, 2, 4, 5, 6, 7, 9.6, 20 hp (more models to 55 hp in 1973).

Mercury—Mercury Marine, 1939 Pioneer Rd., Fond du Lac, Wis. 54935. Models, 4, 7.5, 9.8, 20 hp, all with gearshift (more models to 150 hp).

Otterbine Jets—Otterbine Industries Inc., Fourth and Madison, Malta, Ill. 60150. Water-jet drives with 4-cycle B&S power, 3.5, 5, 8, 10 hp.

Sachs-Wankel Mac 10—Recreational Motor Sports, Box 1340, Minnetonka, Minn. 55343. A 10-hp rotary-combustion assembled in Italy. About \$550.

Aquabug—Seaborne Systems, 100 Merrick Rd., Rockville Centre, N.Y. 11570. A 1.2-hp, 8½-lb. gas midget; electric, generator conversion options.

British Seagull—Seagull Marine Sales, 1851 McGraw Ave., Irvine, Calif. 92705. English-built workhorse of 2, 3, 5, 6 hp.

Ted Williams—Sears, Roebuck & Co., 303 East Ohio, Chicago, Ill. 60611. Models, 3, 4, 5, 5.5, 7.5, 9.9, 10.5, 15 hp (top three with shift).

Tas Mini—Sportspal Inc., Emlenton, Pa. 16373. Japanese-made 1.7-hp, 11-lb. air-cooled motor.

Mighty Mite—TerMar, Inc., 2300 Eighth St. S.W., Lehigh Acres, Fla. 33936. A 1.7-hp, 17-lb. mill.

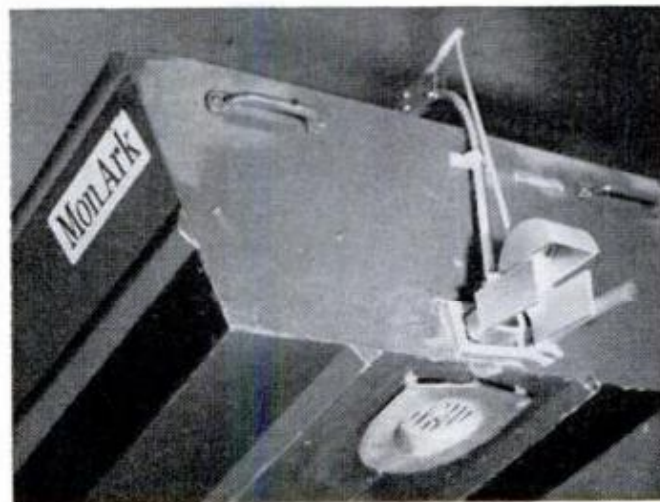
Triton and Arro—Triton Industries Inc., Box 3553, Portland, Me. 04104. Models, 4, 5.5, 7.5 hp.

Archimedes-Penta—Wait Mfg. & Marine Sales, 406-410 South Peoria, Tulsa, Okla. 74120. Swedish motors, 4, 4.5, 5.5, 8, 10, 14, 15, 25 (to 60) hp. (Private-brand motors are frequently made by these well-established manufacturers.)

Otterbine jets are made in through-the-bottom and conventional clamp-on-the-transom models that provide their push with water-jet power. Four-cycle air-cooled Briggs & Stratton engines of 3.5, 8, or 10 hp drive the units. Shallow-water operation is possible with no propeller blade or shear-pin problems. Inboard kits and outboard models are \$100 up.



Sears Roebuck Ted Williams outboards this year range from 3 hp up to 15, with models of 4.5, 5.5, 7.5, 9.9, and 10.5 hp in between. New 15, shown under test on Sears boat by Ted Williams (above) has loop-charged design, gearshift, remote tank, is under \$500. **Mighty Mite** (below) from TerMar Inc., still has 1/10th hp per pound. This 17-lb., 1.7-hp portable pivots for reverse steering, has integral one-quart fuel system, magneto ignition, sells for about \$110.



Pump tilt to trim your outboard

You can make your own power-tilt mechanism for about \$50.



by Walter B. Chandler Jr.

Most outboard engines have pin holes to allow adjustments that fix the angle between your lower unit and the transom. Now the larger motors have standard or optional power-tilt arrangements to permit tilting up your prop when you're beaching your boat or running in shallow water, trimming your lower unit for the best angle when getting up on plane and trying for the most speed or running on an even keel with various loads aboard. But if your older outboard doesn't have a power-trim kit available, you can make your own as I did for about \$50.

Basic parts required are a hydraulic power pump, hydraulic cylinder, lower tilt bracket and upper tilt bracket. I bought a pump and cylinder from Surplus Center, Box 82209, Lincoln, Neb. 68501, for about \$30. The power pump's specifications are 1500 pounds per square inch (p.s.i.), with a volume of one inch per stroke and a reservoir capacity of one pint. The hydraulic cylinder has a 15/16-inch bore and a stroke of 4⁵/₈ inches. Its two-way cylinder operates from 1500 to 2000 p.s.i.

Your power pump can be located in a position convenient for the boat driver. Positioning the cylinder that lifts the engine, plus the design of the upper and lower tilt brackets, will require imagination by the builder so that they fit his particular make of outboard. Studying tilt devices on other boats and motors will supply ideas.

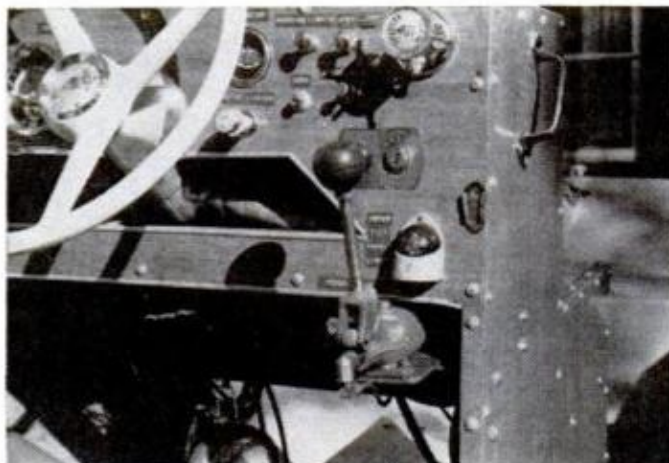
The lower tilt bracket that anchors the hydraulic cylinder can be secured to a tilt-pin hole in the engine's bracket or bolted to the boat transom. Using a tilt-pin hole

avoids through-hull holes, but requires a cylinder with a shorter stroke and your motor cannot be tilted as high. I used a tilt-pin hole in my 1964 motor. A ³/₈-inch steel rod nine inches long with cotter holes drilled at each end was welded to a two-inch angle iron transom brace.

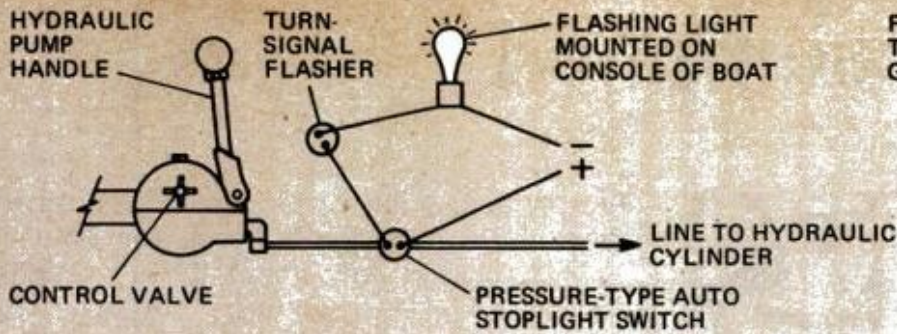
I attached the upper tilt bracket to the cylindrical upper swivel bracket of my engine. Two auto connecting-rod caps of about the same diameter were bought at a junkyard, fitted, and grooves filed in the caps to prevent slippage. A local machine shop supplied a short length of 1/2-inch square metal and a piece of 1/4-inch flat metal for \$1. A 3/4-inch length of the square metal rod was filed down to ³/₈ inch and a flat washer fitted to the round surface, welded, and a cotter-pin hole drilled beyond it as shown in the diagram. Then the square rod was cut to 4¹/₂ inches in length, welded to the center of a connecting-rod cap, and bent into a shallow figure "S" shape to allow a straight-line operation of the hydraulic cylinder.

To allow the outboard to tilt past the extension of the hydraulic cylinder, a piece of flat 1/4-inch metal was cut four inches long and one inch wide. A 1/2-inch wide slot was cut up the middle, and it was welded to the action arm of the hydraulic cylinder. For full tilt-up when launching, hauling or beaching, the outboard's regular full-tilt latch is used, and the motor hinged up manually.

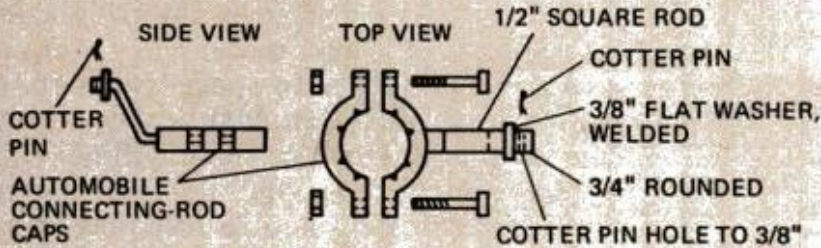
From the hydraulic pump mounted at the helm position, a 1/4-inch copper tube line is run aft to the transom. Here a flexible hydraulic brake line connects the copper line from the pump to the tilt cylinder. Since mine is a two-way cylinder, a flexible rubber hose was attached to the upper



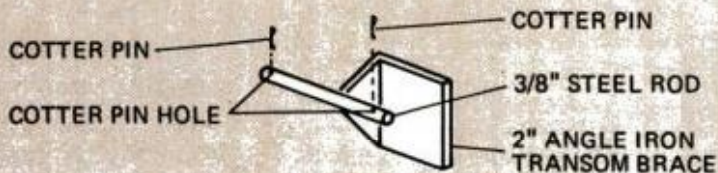
Hydraulic pump to actuate motor tilt is mounted on steering console dash. Flasher blinks when motor is up.



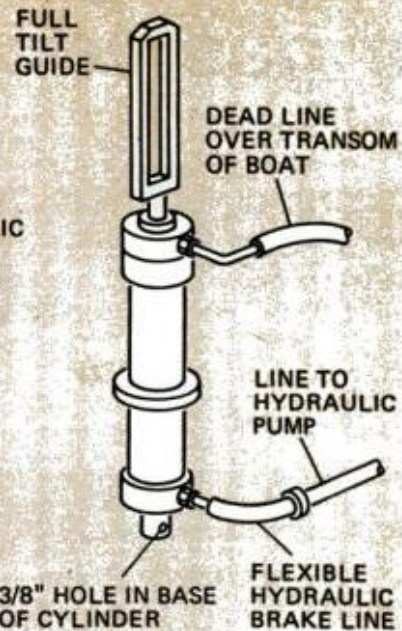
HYDRAULIC PUMP



UPPER TILT BRACKET



LOWER TILT BRACKET



HYDRAULIC CYLINDER

Parts for motor tilt include surplus hydraulic hand pump, hydraulic cylinder, old brake pressure switch, flasher switch; light, 1/4-inch copper tubing, flexible tube as required, 3/8-inch steel rod, 1/2-inch square rod, automobile connecting-rod caps, angle iron, 1/4-inch flat sheet steel, cotter pins. About \$50, including welding.

Art: Bob Michaels

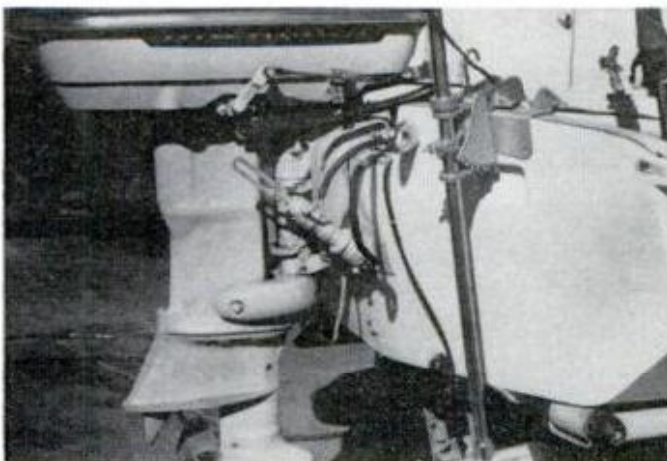
cylinder port and run over the transom into the boat to prevent water from entering the upper part of the cylinder.

I also installed a tilt warning light near the pump position on the console panel, to show when the outboard is in tilt position. A pressure-type stop switch from an old Ford was placed in the hydraulic line and a car's signal flasher wired in the circuit to provide a blinking light and a click until the release valve is open on the pump and

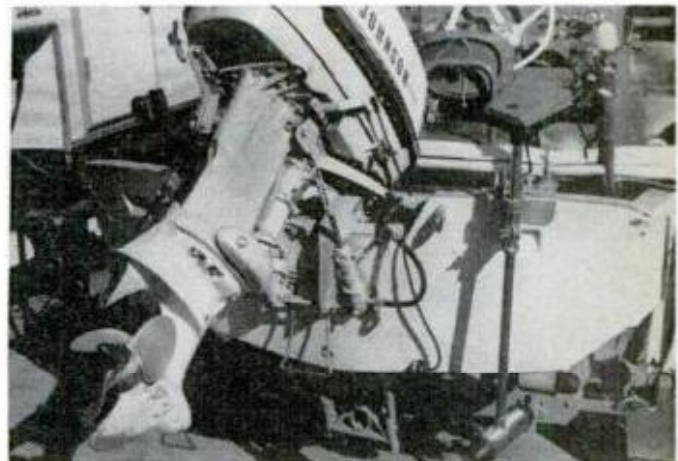
the engine returns to running position.

Files, hacksaw and other hand tools, plus an electric drill, were the only tools required. Metal welding and bending was done at a local welding shop. A wooden pattern was constructed with a jigsaw to give the welder dimensions for bending the square rod for the upper tilt bracket.

Building the power tilt makes an interesting project and, pays off in improved performance from your outboard motor. ★★



Cylinder to lift motor can be fastened to tilt-pin hole or bolted to transom with bottom bracket of angle iron.



Tilted up, engine is raised by cylinder for shallow-water running. Top bracket allows manual full tilting.

Bargain gauge for gas consumption

Ease your outboard's offshore energy crisis with this \$3 jug test.

by Robert D. Stearns



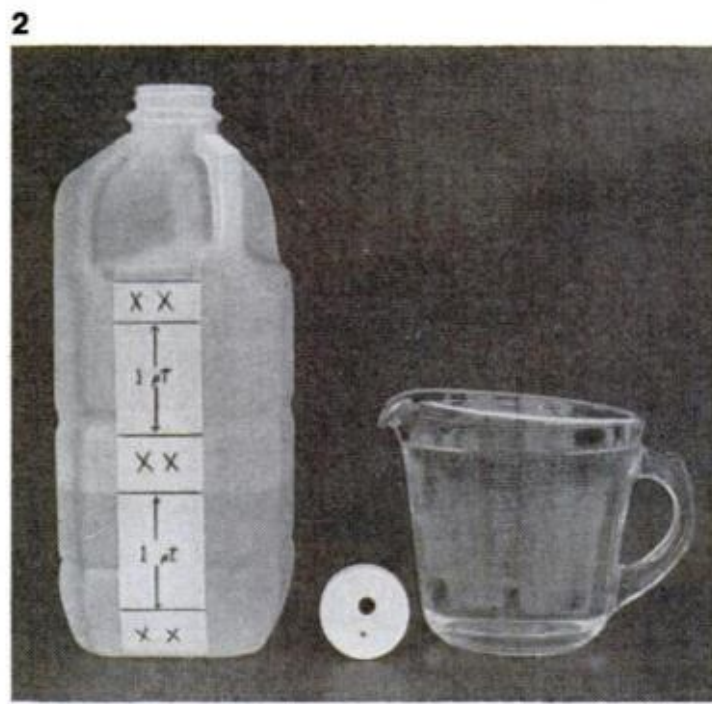
Fuel shortages make knowing the gas-line consumption of your outboard more important than ever. If you can figure out in advance your most efficient cruising speed, miles per gallon and range of action on a tank of gas, you're sure to increase your boating safety and enjoyment.

Most large outboards burn about one gallon per 10 hp per hour at full throttle. A 100-hp mill uses up approximately 10 gph wide open, but a 10 percent reduction in rpm can cut gas consumption by 20 percent, while an 80 percent drop in rpm may mean a 35 percent gas saving. These averages apply generally to planing hulls riding over, rather than through, the water, but they can vary greatly from boat to boat with different-size motors and loads. It's certainly worth the small amount of time and expense, using the method shown here, to determine what your fuel requirements really are. Almost any outboard with separate

fuel tank can be tested; with adaptations the system should also work for inboards.

Total cost is only about \$3 in parts. Assemble a fuel-line connector for your make of engine, a small stainless-steel hose clamp, three feet of $\frac{3}{16}$ -inch i.d. clear vinyl tubing and enough $\frac{3}{16}$ o.d. copper tubing to reach the bottom of your measuring container with a couple inches to spare. For our use, vinyl tubing is better than rubber (other than neoprene) since gasoline will not cause vinyl to deteriorate, and its transparency allows monitoring a bubble-free flow of gas. An ideal fuel container is a discarded semi-transparent plastic quart or half-gallon milk jug. Glass would work, but there is the hazard of breakage in a bouncing boat.

First, apply a strip of masking tape vertically on your jug. You will make your calibration marks on it. Marking directly on the jug with a felt-tip pen didn't work well when I tried it; gasoline made the markings run. To calibrate the jug, first pour in an inch of water and draw a line on the tape at that level. Next add one pint of water using a kitchen measuring cup (two eight-ounce cups equal one pint), and draw another line. With a half-gallon jug you can add and mark another inch of water, measure in another pint, and top it off with one more one-inch marking.



The inch separations between pints are important since they allow getting the boat up on plane and running steadily before timing starts. The bottom inch makes it unnecessary to run the engine dry, and avoids the chance of getting extra miles from fuel in your lines and carburetor. Once your jug is calibrated, dump your measuring water, rinse with gas and then fill with your fuel mix on the dock to avoid the chance of spilled gas and vapor aboard.

Test runs are easy. Find a calm water area for easier reading of your jug markings and, preferably, with buoys or markers spaced a known distance apart, if you don't have a boat speedometer. Use up your extra inch of gas, once you're plugged into your engine, to get settled on a smooth run and then time your run while burning one pint.

The arithmetic is simple. A pint is $\frac{1}{8}$ th of a gallon so by multiplying your pint time by eight you have your time for burning one gallon. Divide that figure into 60 for gallons per hour. Let's say you use one pint in two minutes. Two times eight is 16, and 60 divided by 16 is 3.75. Your engine is burning 3.75 gallons per hour at that throttle setting. For an even easier way, divide your time for one pint into 7.5 (which is 60 divided by eight) and you get the results in one step. Using our two minutes per

pint: 7.5 divided by 2 is 3.75 gph. It's easier to work with time using minutes and tenths instead of seconds; six seconds equals $\frac{1}{10}$ th of a minute and you can do some rounding off. If your boat has a tachometer you can record runs at 500-rpm intervals, or mark settings on your throttle. With speedometer or measured courses, you can also determine what throttle setting will give the longest distance or radius of action with the gas you carry. With twin engines running, double your measurement.

Wind, currents and sea conditions make your distance covered per unit fuel consumed less accurate than ashore in your car. But your calculations can result in much less worry and more safety afloat. ★★

1. Inexpensive jug and tubing rig, plus wristwatch, are only requirements for this simple fuel-consumption test for outboards. Bottle-reading assistant helps driver.

2. Plastic quart or half-gallon milk bottle, top and kitchen measuring cup are often already available. Strip of tape is pasted on jug to make marking easier.

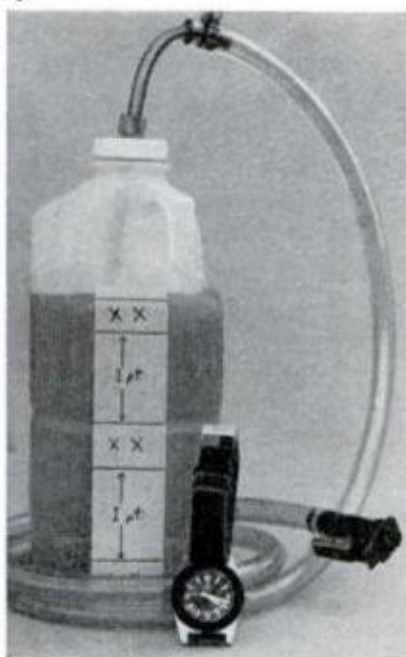
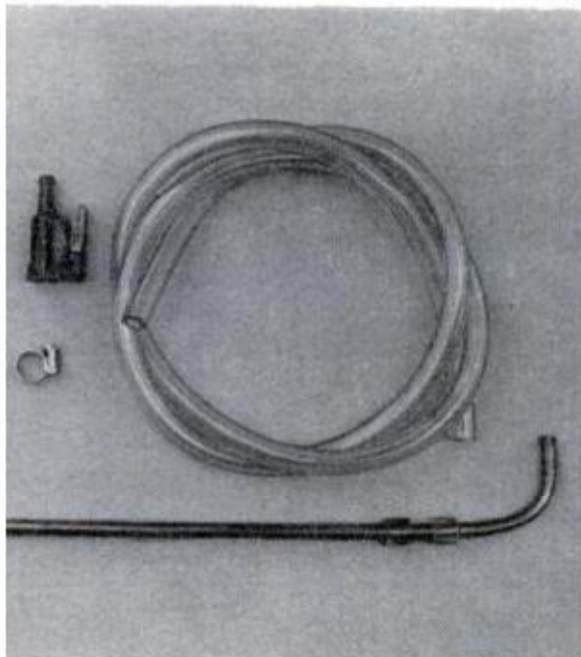
3. Buy a length of 5/16-inch outside-diameter (o.d.) copper tube, three feet of 5/16-inch i.d. vinyl tube, stainless-steel hose clamp, fuel-line outboard connector.

4. Copper tube to bottom of jug fits through large hole in top. Add small hole for air vent. Before boarding, fill jug at dock from approved carrying tank.

5. Burn gas from one-inch separation marks between pints to get boat on plane and running smoothly on a straight course. Then take time for pint consumption.

3 4

5



Latest gear and gadgets



Extras for '74 from Cosom of Lakeville, Minn., include boat loaders for one-man cartopping, folding chairs, boarding ladders, boat and motor dollies, paddle boat-hooks, telescoping outriggers, loungers.

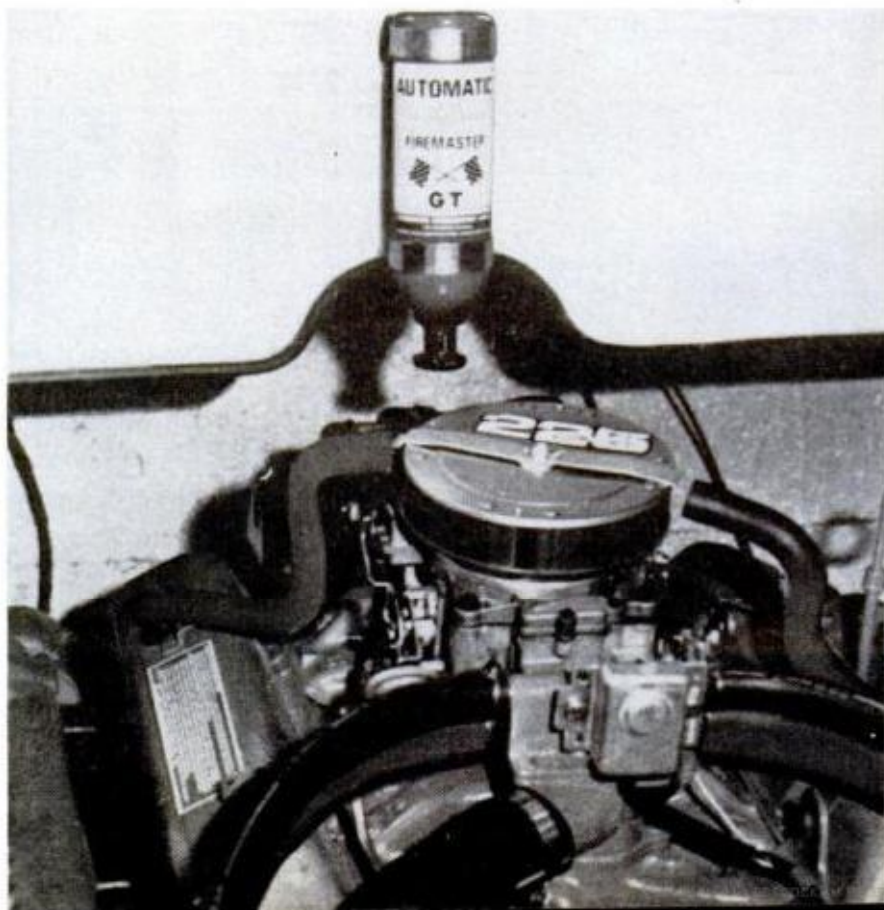


Self-contained submersible Pump Pak holds 12-v. battery, pumps 3.5 gallons per minute.

Up-Down Thrust Adjust Nozzle (left) trims water thrust of Jacuzzi 12WJ pump jet nozzle with hand or foot control for better plane. Hardin Marine, Anaheim, Calif.



Fire extinguisher (right) mounted in engine compartment of boat or car, is reported to discharge automatically 1 lb. of firefighting vapor at 230°F. With mounting brackets, it's \$20 from J. E. Martin Sales, Spring House, Pa.

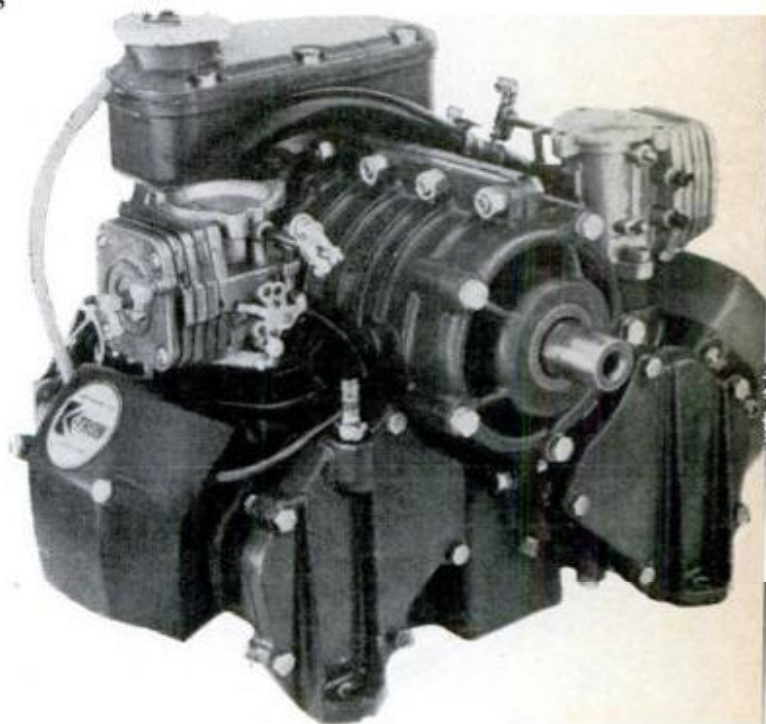


Adding accessories has always been a big part of boating. But now that the gas shortage threatens to make hours and miles on the water even more valuable, a skipper needs to look for more performance and less weight from his add-ons. Fewer pounds and more power inside a hull will increase speed; an even keel, clean bottom and proper trim will make for smoother as well as swifter ride with less wave resistance. But not at the price of safety—it still comes

KAM I/V marine engines are claimed to be a new concept in inboard power for smaller boats. Using inverted-V design and inclosed "freshwater" cooling, these compact two-cycle powerplants are reported to provide quieter and smoother performance. Suitable as auxiliary power for sailboats or in light sportcraft, small hydrojets, airboats, and probably snowmobiles, the engines will first be available in 250-cc, 20-hp; 330-cc, 30-hp, and 436-cc, 40-hp models. Kiekhaefer Aeromarine Motors, Fond du Lac, Wis.



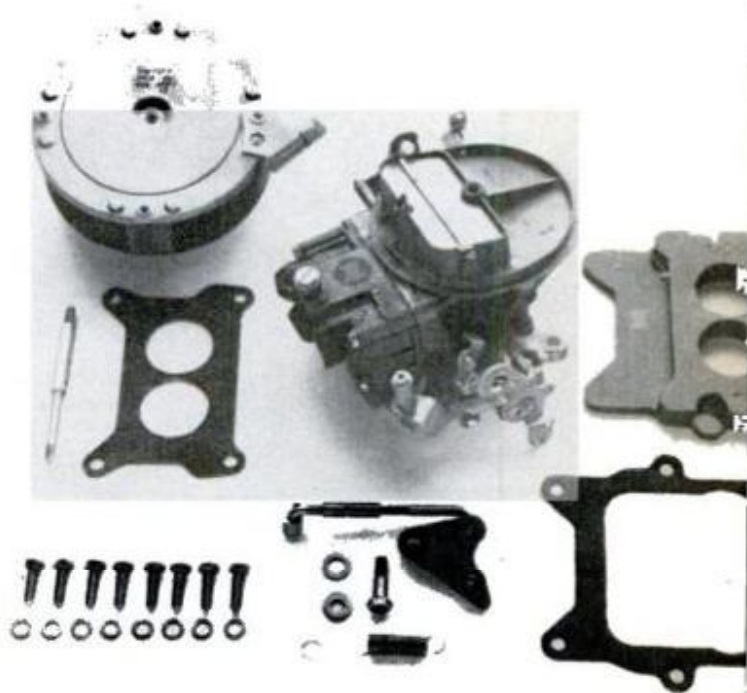
Two-way scrubber from 3M Co., the new Brushlon Marine Brush, \$1.29 at boat stores, has rough synthetic fiber on one side and soft sponge on back, a combination suggested for cleaning hull bottoms.



Performance boost of up to 30 hp is claimed for Black Widow kits on a 165 Mercruiser. Developed by Janisch/Sirois Marine of Fort Lauderdale, Fla., the kits adapt new carbs, cams and lifter assemblies for added power.



Sighting ring on Aqua Meter's Sailor compass aids taking fixes while tacking. Model 120, mount, \$24.

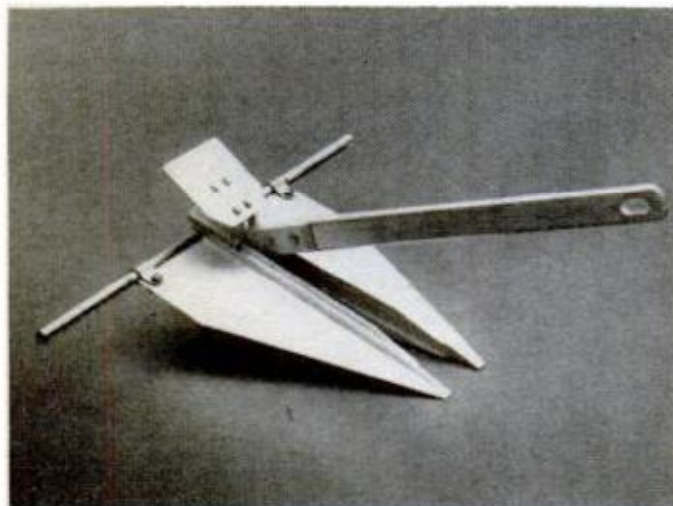




first. Fishermen out for bass have led the way recently in fitting out with extras that can add more comfort. Protection from sun and rain from above, wind and spray from every side, and a hard seat and bone-bouncing ride below can be corrected with many new aids available. Padded seats that convert to sunloungers, hulls that cleave, life jackets comfortable enough to wear full time are among worthwhile new items. ★★★

Fishing Boat Seatop lets bass fishermen or any other boatmen come in out of the sun. Pivoting on brackets mounted to back of fishing chair, demountable shade is \$23 from N. A. Taylor Co.

Skimmer 45, portable and fast-rigging iceboat (right), has 45 sq. ft. of sail on 15-ft. mast, is 106 inches long with 72-inch beam. Boat is \$250 f.o.b. from Lockley Mfg., New Castle, Pa.

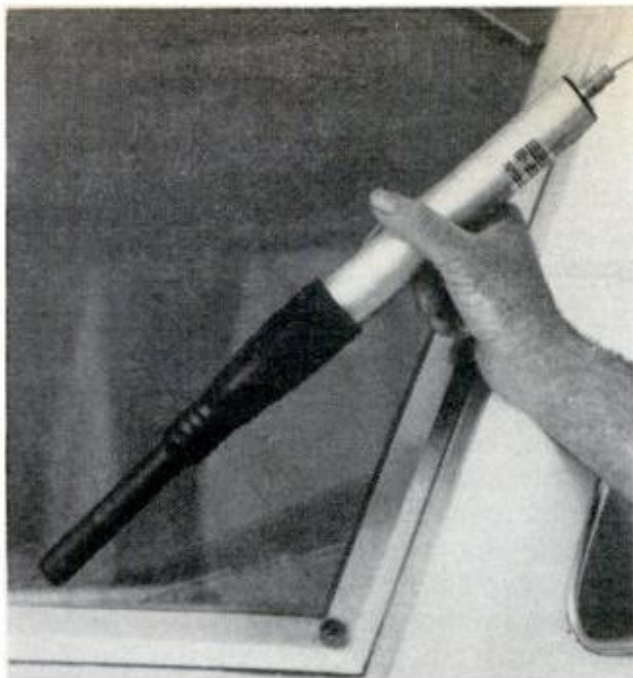


More anchoring strength with less weight that can do the work of lunch hook, working anchor and storm anchor in one model is claim by Viking Div. of Mercury.



Jet-Pak (above) from Mid America Engineering, Osseo, Minn., includes marine engine, imported single or multistage Hamilton jet pump, drive and exhaust.

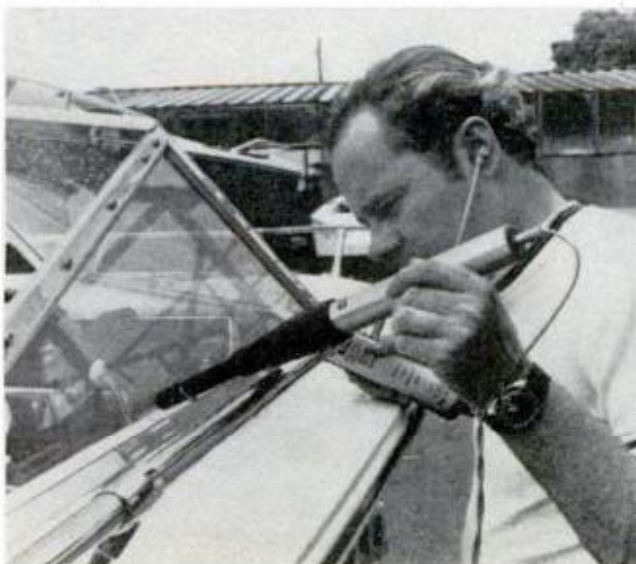
Pooch preserver (left) is called Doggie Vest by Texas Water Crafters, Wichita Falls, Tex., and comes in four chest-size models at \$7 for this family member.



Sonic Leak Locator is big name for little gadget from Boatlife, Inc., that can pinpoint pinhole leaks which let in air or water. Rubber focusing extension tip is an accessory to reduce field of detection, generator tone.



Complete kit includes leak locator, tone generator to transmit from far side of any solid material, earphones and focusing extension slip-on to localize voids.



Listener that locates leaks



Is \$250 a lot for a gadget that just gives you a buzzing in your ears? Not if it can keep your boat from sinking, skippers claim. Not if it stops water from dripping on your bunk all night, wind or rain from driving through hidden seams of your trailer or motor home. Not if it points where the gas is seeping out of your tank. And not if your boating or RV friends can team up to make the purchase and then rent out Boatlife's Sonic Leak Locator. The invention uses a tone generator and locator probe.

The manufacturer is Boatlife, maker of sealants, dry-rot cures and adhesives, 65 Bloomingdale Rd., Hicksville, N.Y. 11801.

—Bill McKeown



Through-hull-fitting leaks can be found or traced to spot where water enters at one place, travels between laminate layers and seeps out at another. Tires, air brakes, transmissions can be checked.

Joints, seams or seals, as well as solid sections of wood, metal or plastic hull will test out for invisible leaks. Ultrasonic sound coming from the small tone generator is not heard through solids.

When gas mains become blockbusters

Deteriorating gas pipelines buried beneath America's towns and cities take a deadly toll. In 1972, gas explosions claimed the lives of 54 persons and injured 434.

by Mort Schultz

On the morning of Aug. 31, 1972, a secretary was one of the first arrivals at the annex of the Henry W. Grady High School in Atlanta. As she approached the building, she heard a hissing sound and smelled gas.

She alerted school authorities, who barred the 200 students and staff from the building. The principal notified the Atlanta Gas Light Co., and soon a repair crew was digging a hole in front of the annex. They had determined that gas was leaking from a fractured cast-iron main and seeping into the building.

Assistant Principal Clifford M. Ashmore, checking the halls for any students who might have missed the repeated warnings over the intercom, noted a heavy smell of gas in the front part of the building. When he emerged, the repair crew was attempting to throw a collar around the leaking joint.

"It happened so suddenly that I didn't



have time to be frightened," Ashmore recalls. "I heard an explosion and saw a ball of fire come toward me. After that I don't remember a thing."

Ashmore suffered burns and broken limbs. He was one of seven persons, including the three-man repair crew, injured in the explosion. A female school employee, delivering interschool mail to the annex and apparently unaware of the emergency, was killed by flying brick and glass.

This unfortunate woman was one of 54 persons killed by gas explosions in the United States in 1972. A total of 434 were injured. Through Sept. 1973, 56 persons were killed and 345 injured in nearly 500 explosions.

Barry Sweedler of the National Transportation Safety Board, a government agency, points out that the incidence of explosions is greatest in cold weather.

"During the last three months of 1972,

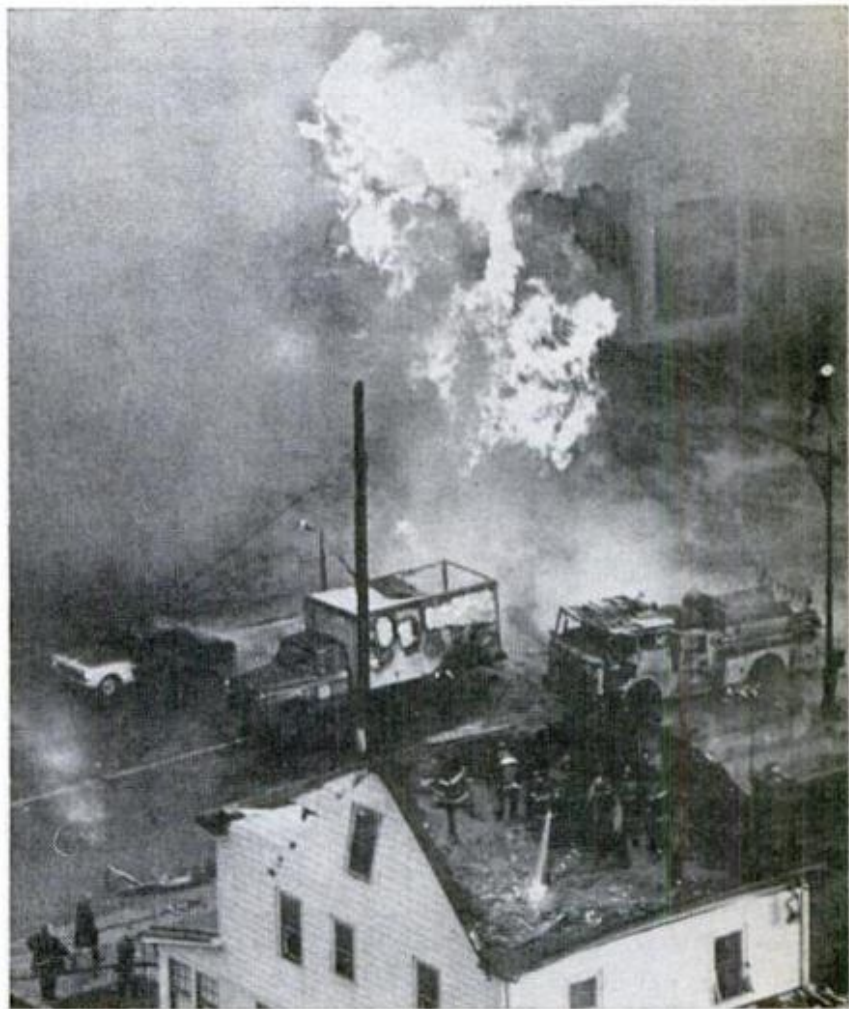
some 25 people lost their lives in gas explosions," he states. "We have to go through the last three months of this year, so I fear that 1973 will show a dramatic increase in the accident rate." (The interview took place in Oct. 1973, when this article was in preparation.)

The bomb beneath America's towns and cities is the more than 1 million miles of pipe that carries natural gas to homes, factories, and public and commercial buildings. Much of this pipe is old or weak and subject to failure. But it's more than weak pipe that's involved in many explosions.

"Catastrophic accidents in which several people die occur when pipes are damaged by construction equipment," says Sweedler.

A study made by his division reveals that 41 percent of all gas pipeline accidents in 1972 was caused by construction crews.

"Some construction outfits gamble," charges John Allen of Public Service Elec-



Two homes were leveled and three persons killed (left) when gas exploded on a street in Annandale, Va., in March, 1972. The cause was a fractured gas main at nearby construction site. Above: Flames roar from a gas-fed fire in New York City. Blaze consumed houses and automobiles.



This portable flame-ionization unit (left) has proved to be a supersensitive detector of natural gas. Street



surveys are carried out with mobile leak plotter (right), capable of covering 400 feet per minute.

tric and Gas Co. in New Jersey. "They guess where pipelines are, or if they know, they don't exercise enough caution."

Evidence supports this contention. In Lake City, Minn., on Oct. 30, 1972, a gas explosion demolished a small department store, killing six. The blast occurred after a gas service line had been snagged and broken by a bulldozer in an adjoining construction area.

On March 24, 1972, a blast leveled two homes in Annandale, Va., killing two children and their mother. A gas main had been fractured at a nearby construction site shortly before the blast.

In Coopersburg, Pa., on Jan. 21, 1973, five people were killed and 16 others injured in an explosion that demolished a six-family apartment building. Apparently a contractor, blasting a sewer trench a few feet from a gas service line, had inadvertently cracked the line.

"Unfortunately, we do not have the authority to regulate anybody but pipeline operators, and they are not the cause of the problem. Contractors are." So says Joseph C. Caldwell, director of the Office of Pipeline Safety, Department of Transportation.

On the other hand, contractors claim that pipelines are frequently not marked and that municipal maps showing pipe locations are often not accurate.

But some utility companies and construction outfits are now working together to reduce accidents. In Detroit, for example, construction foremen call a telephone number (the letters on the dial spell out the program's code name—MISS DIG) and give locations of upcoming construction sites.

Within 24 hours, every utility company

and municipal agency with underground lines in a given area—gas, electric, water, telephone, sewer—dispatches a representative to mark off line locations.

In 1972, some 61,000 "alerts" were phoned into MISS DIG. A total of 1900 accidents (not all of them affecting gas pipes) occurred anyway, most of them attributed to inaccurate pipe-location maps or contractor carelessness. However, an estimated 5000 accidents would have occurred without MISS DIG. Programs such as this are in operation in other areas, too, including Houston, Cleveland and Rochester, N.Y.

Excavation damage isn't the only cause of

Pipes are tested by sealing off section, introducing fluid under pressure. This pipe burst at weak spot.





An electronic "pig," shown being introduced into a pipe, detects flaws as it moves along.



Data from the pig's sensors are relayed by cable to mobile unit, where readouts are recorded.

gas explosions. Failure of equipment is to blame, too. In Lambertville, N.J., eight people were killed three years ago when a row of homes blew up. Investigation disclosed that gas had seeped into the houses from a cracked valve in a main.

Much equipment is antiquated. More than 70,000 miles of cast-iron main, for example, were installed at about the turn of the century. Jute packing used to seal joints is drying out, giving gas an avenue of escape.

Hundreds of thousands of miles of steel service lines branching from mains and carrying gas into our homes was buried in the '40s and '50s. These lines aren't protected by electrochemical corrosion proofing, a process that wasn't perfected until the '60s, so this pipe is rusting.

External forces act to break weak pipe. In the Atlanta school explosion, for example, soil shifted—perhaps because of alternate thawing and freezing of the ground, or because of heavy traffic—and the main bent and parted at a joint. (The explosion occurred, authorities said, when gas inside the building ignited.)

Pipeline experts of the Department of Transportation advocate installation of automatic shutoff valves that would seal off a pipe when there is a rise in gas pressure. Pressure increases when a pipe begins leaking as more gas is pumped through the system to compensate for losses.

Utility companies have resisted this proposal. Although Barry Sweedler told me that effective automatic valves exist, utility companies claim they are ineffective and that installation cost would be prohibitive.

Be that as it may, deteriorating equipment is keeping utility companies hopping.

Daily mobile and foot patrols seek to uncover leaks while they are small and not explosive. A small amount of natural gas (methane) won't explode. Surprisingly, neither will a great concentration.

Gas has upper and lower explosive limits. Just as your car's engine won't run if the gas-air mixture is too lean or too rich, natural gas won't explode if there is less than 4.5 or more than 15 percent present.

To find leaks, most utility companies now use flame ionization detectors, supersensitive instruments able to detect 10 parts per million of gas seeping through the earth.

The heart of the ionization detector is a tiny hydrogen flame under an accumulator plate. Air is scooped in through a pickup. If it contains hydrocarbons (methane is a hydrocarbon), it ionizes when it meets the flame. Ions—charged atomic particles—collect on the accumulator plate and are electronically measured to indicate the percentage of gas present.

Ionization detectors are mounted in trucks for street surveys. Foot patrols use backpack versions around buildings.

Inspectors also may survey vegetation around a house—a method the homeowner should be aware of. Natural gas venting up through the ground removes oxygen from the soil, causing plant-killing bacteria to thrive. If your lawn starts looking stunted and patches of grass begin turning yellow or purple at the base, call the gas company. There may be a leak.

Other testing methods used by gas companies seek to discover weak pipes before leaks start. One method is to introduce fluid under great pressure into a section

(Please turn to page 174)

IT'S NEW NOW



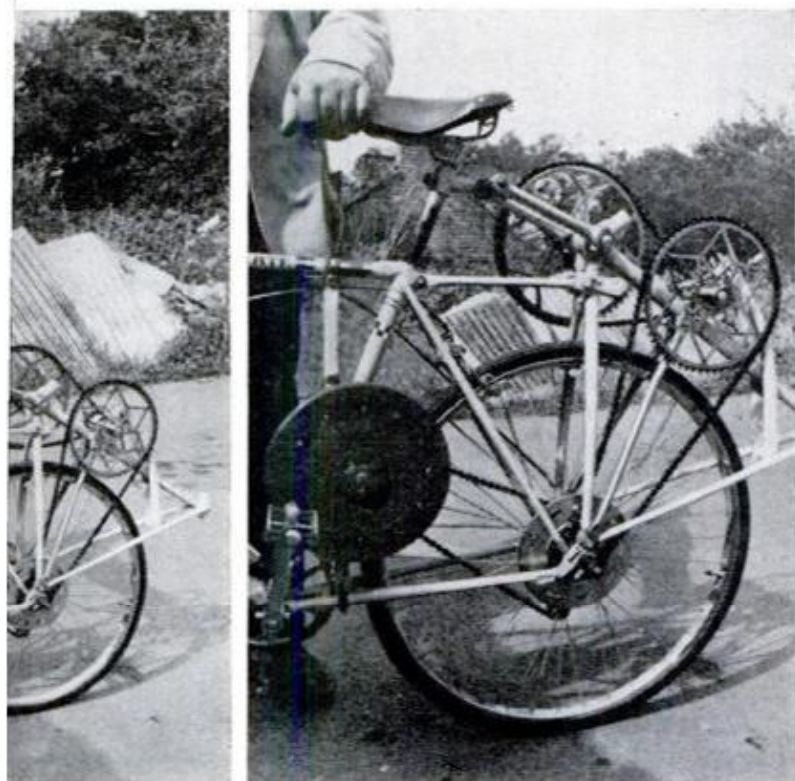
Blade dispenser for utility knife

Replacement blades for Stanley's utility shop knife are available at the flick of a finger from the handy self-feeding wall-mount dispenser below. The spring-loaded plastic container holds 100 blades in a choice of three types—regular, heavy-duty and hook. Prices are \$9.39 for 100 regular blades, \$10.45 for heavy-duty and \$31.98 for the hook kind. Stanley Tools, 195 Lake St., New Britain, Conn. 06050.



Soldering aluminum made easy

Repairing broken aluminum household articles is easy with this new low-melt aluminum alloy soldering rod. It can be used with any ordinary propane torch and melts at 400°F. below melting point of aluminum so there's no danger of softening or distorting the parent metal in the process. Four Quantalloy rods sell for \$5.60 ppd. from Quantum Systems Industries, Inc., 4550 S.W. Hall Blvd., Beaverton, Ore. 97005.

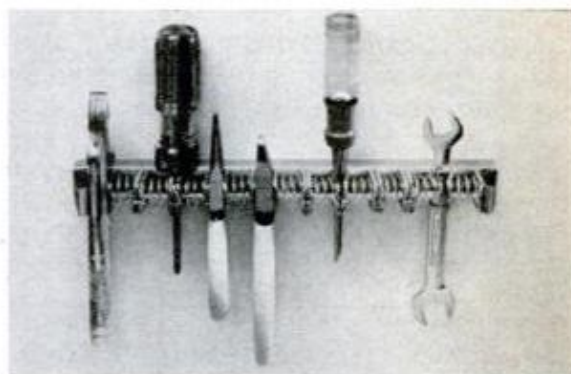


Far-out bikes for faster pedaling

The popularity of bicycles is bringing with it some strange new shapes. Vertical-action bike (two photos at far left on facing page) has no pedal crank. Instead, the pedals are connected to two long arms that alternately drive sprockets on the rear wheel through a chain-and-cable arrangement. A rocker arm mounted above the rear wheel returns one pedal to the up position as the other pedal is pressed down. Because pedaling action is straight up and down instead of circular, system is said to produce more force with less effort. It's the invention of Trevor Harris, 1945 Placentia Unit F, Costa Mesa, Calif. 92267. Odd-looking contraption at near left gets an assist from a flywheel turned by pumping up and down on the seat—like posting on a horse. Once spinning, flywheel drives bike through series of chains and sprockets without need for pedaling. Harold Bate of Blackawton, England, devised the novel self-propulsion system.

More moisture for warm-air furnaces

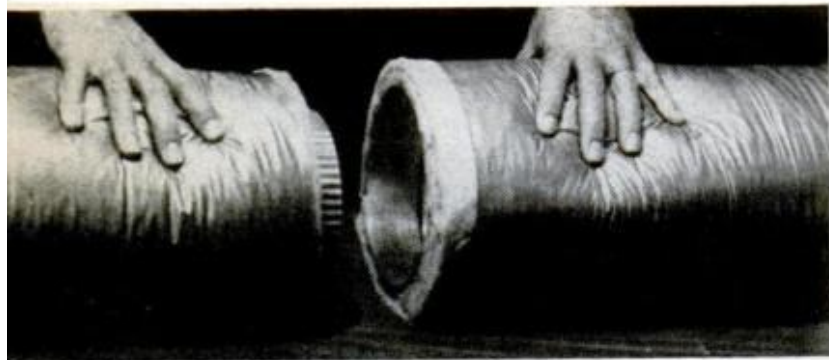
Said to have 50 percent more capacity than earlier models, this new Carrier furnace humidifier puts out 15.6 gallons of moisture a day to condition dry winter house air. Designed to fit any central warm-air heating system, the unit has spinning discs that pick up water from a pan and disperse it through heating ducts. Can be operated manually or by humidistat. Carrier Corp., Box 1000, Syracuse, N.Y. 13201.



Low-cost toolholder

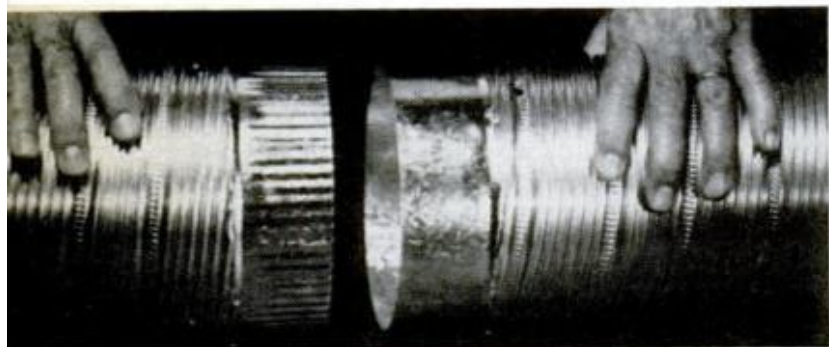
Up to 11 shop tools, kitchen utensils, rubber stamps or other small household items can be stored neatly in this self-adjusting spring-clip wall-mount holder. Called Grasp-all, the rack will take objects up to 1/2 inch in width and support a total of three pounds. Several can be mounted end-to-end to form a long strip or arranged vertically in pairs for horizontal storage of long, thin items like fishing poles. Price is \$1.99 each postpaid from Jayray Sales, Box 283, Beaverton, Ore. 97005.

NOW



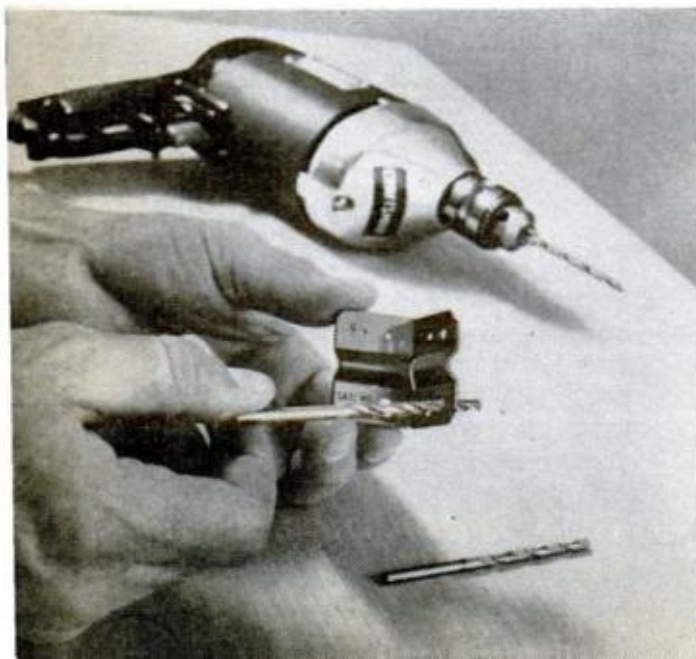
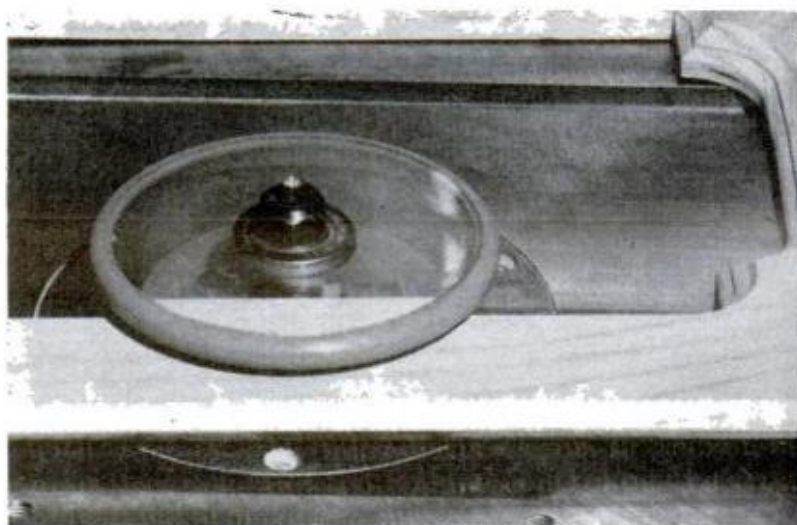
Easy-to-install ductwork bends around corners

You can bend this flexible circular ductwork around corners without the fuss of cutting lengths and installing elbow fittings. Made for heating and airconditioning use, the spiral-wound aluminum tubes come in two types—plain (lower photo at left) and wrapped with an outer covering of fiberglass insulation (upper photo). Sections are joined simply by pressing the telescoping ends together. Called Flex-Met, the ductwork is available in diameters from 3 to 22 inches. For prices and specifications, contact Johns-Manville dealers or write Johns-Manville, Fiber Glass Insulations Div., Box 5705G, Denver, Colo., 80217.



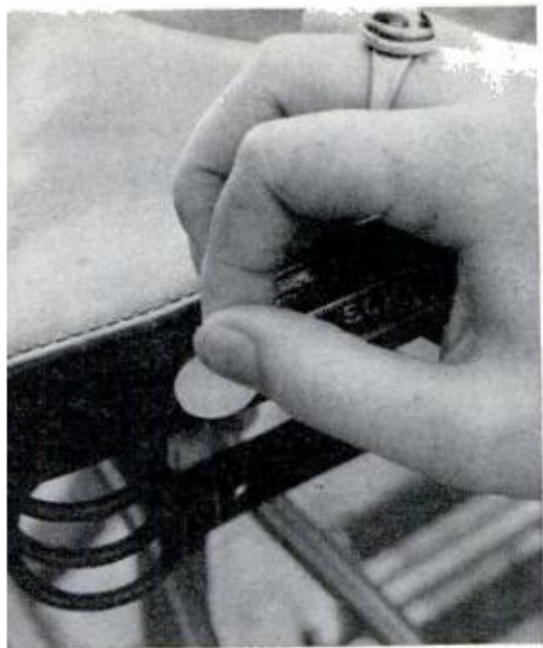
Shaper guard protects eyes and hands without blocking your view

New-type clear-plastic shaper guard at right lets you see the work while at the same time protecting your eyes from flying chips and your hands from accidental contact with the cutters. The disc mounts directly on the shaper spindle and adjusts to suit work thickness. In 3½ to 6½-inch diameters to fit ½, ¾ and 1-inch spindles, it's priced at \$67.20 to \$68.90. Homewood Enterprises, Inc., Box 2083, Nashville, Tenn. 37214.



Drilling aid doubles as alignment guide and bit-sizing gauge

This handy drill guide not only helps you make absolutely straight holes, but also serves as a sizing gauge for checking bit diameters from 1/16 inch to ¼. In use, two U-shaped slots—one at the base and one at the top—align the bit vertically to assure accurate drilling at 90° to a surface. Marked holes along edges let you quickly determine bit diameters being used. Craftsman gauge is 49 cents at Sears, Roebuck stores or can be ordered from the catalog.



Colorful 'Hot Dots' light you up on the road at night

Brilliantly colored reflectorized "Hot Dots" can be used to outline bicycles, car and truck bumpers, trailers and hiking gear for greater safety on the highway. The self-adhering stick-on circles, visible up to 600 feet, come in 1/2 and 3/4-inch-diameter sizes and in four colors—red, orange, yellow and white. Sample kit of 200 in assorted colors and sizes is \$3; 1000 and 2000-dot packs up to \$20. Applied Products, 41 Richmondville Ave., Westport, Conn. 06880.

Pickup tent converts truck to camper

If you own a pickup truck, you can turn it into an inexpensive camper with this tent designed to slip over the truck bed. Made of colorful nylon, the Quik Shell covering is available in sizes to fit both standard and compact pickups, can be attached and removed in minutes without special fasteners. For information on sizes and prices, write General Recreation Products, Inc., 543 North Lamb Blvd., Las Vegas, Nev. 89110.



The time is what? 'Space clock' tells it like it really is

Conventional clocks are confusing, thinks William Hayter of Villefranche du Perigord, France, because a time like 10 minutes past 10 can be misread as 10 minutes to two from a distance. To solve the problem, his "Astro clock" (far left) uses a rotating rocket-ship pointer to indicate the hour and a miniature revolving Earth to designate minutes. This way, there's no doubt about the time, says Hayter.



'Third hand' rod holder

Changing fishing lures is difficult when you're wading hip-deep in water because there's no place to put the rod down while working on the line. With this handy rod holder clipped to your waist, your hands are left free to make adjustments easily. The holder hooks over your belt and has a leg tie to keep it in place. The rod handle slips into a pocket and is held firmly in a spring clip. Third Hand holder is \$1.49 from Pacific Diversified Products, 732 S.E. Powell Blvd., Portland, Ore. 97202.



Watch out! The ground you walk on may be 'bugged'

Putting his ear to the ground—electronically—is just what the Westinghouse engineer above is doing in testing out a new underground alarm system for detecting intruders. The device is basically a long tubular microphone that can be buried in the earth around a house or building for distances up to 1000 feet. Operating on the same current-generating "electret" principle used in studio recording mikes, it's sensitive enough to pick up the sound of footsteps, setting off alarm. Westinghouse expects to market system within a few years.



Gas-powered ram tamps down loose soil fast

Tamping down loose soil in back-filling, trench-digging, terracing and other land-grading operations is quick and easy with this gasoline-driven impact hammer. Powered by a 4.2-hp, two-cycle engine, reciprocating ram can be fitted with a variety of shoes from 4½ inches wide for narrow trench filling to 12-inch width for compacting larger areas. The Wacker Rammer has an exhaust silencer, can get a spark-arrester attachment to eliminate fire hazards in wooded regions. For prices, write Wacker Corp., 3808 West Elm St., Milwaukee, Wis. 53209.

Turntable has one moving part

Make the turntable platter a direct extension of the motor, and you have a turntable with, effectively, just one moving part. That's the latest trend, as exemplified by Technics SL-1200 by Panasonic (below) and similar units from Sony, Dual, and Pioneer. The secret is a motor that turns at the record's speed, with electronic circuitry keeping that speed accurate. Motors turning faster need gearing down, are more subject to variations in turntable speed.



Stopwatch doubles as desk clock

Accurate to 1/100th second, this quartz-crystal-controlled electronic stopwatch can time single or sequential events or laps. Used as a hand-held stopwatch, it runs on a built-in rechargeable nickel-cadmium battery. Mounted on its base, it serves as a 24-hour clock while recharging. Charger is in the base and operates on 117-volt a.c. Cronus costs \$195, is made by Intersil, Inc., 10900 North Tantau Ave., Cupertino, Calif. 95014.

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Compressor handles many household jobs

All-purpose home compressor from Black & Decker handles a variety of jobs such as spraying paints and garden chemicals (top photo below) and pumping up tires, air mattresses, rafts and other inflatable objects (center). It even drives an air-powered caulking gun for fast, smooth caulking jobs (bottom). Basic price for compressor and inflator kit is \$40. Black & Decker Mfg. Co., Towson, Md. 21204.

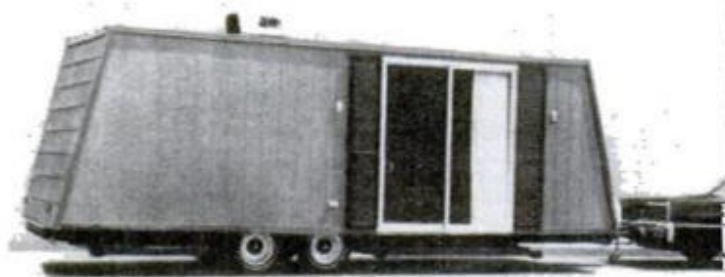


Pop-up for pickups

This streamlined pickup camper is designed to give Mazda, Ford Courier and Chevy LUV models a swank, one-piece, motor-home look. Its molded fiberglass sides fit over the truck bed, instead of inside it, producing a smoothly contoured body that blends with the rest of the vehicle. Its pop-up top gives 76 inches of headroom, with sleeping for four. Base price of the Calico/4 is \$5200. Cal-Am, 1339 West Brooks St., Ontario, Calif. 91761.



NOW



All-in-one hobby toolkit for working in wood, metal and plastic

New Weller Mini-Shop above is a 38-piece kit designed to let the hobbyist or home craftsman do intricate shaping, cutting, drilling or polishing in wood, metal and plastic. Heart of the kit is a 25,000-rpm power head capable of taking many attachments. Included are eight abrasive bits for grinding, sharpening and shaping metal, expanding drum mandrel with three sanding sleeves, four wire and bristle brushes, seven sanding discs, metal cutoff wheel, shaping bit, two buffing wheels, metal and plastic polishing rouge.

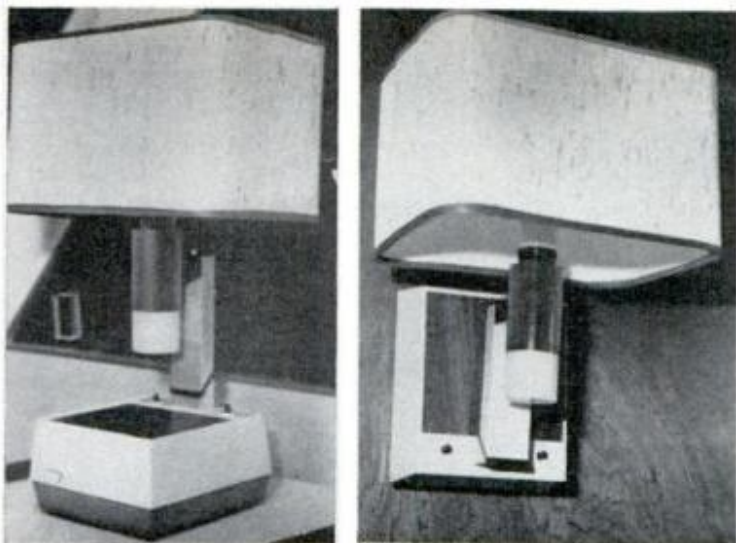
Mobile house trailer disguised to look like a permanent home

Park this travel trailer on a wooded lot and you have a ready-made summer cabin or winter ski lodge you can take with you as you move or the climate changes. The trailer, styled to look like a small, rustic vacation home, features self-storing patio decking and a knock-out panel that accepts an L-shaped extension. Interior includes bath, kitchen, and sleeps four to six. Adventurelodge comes in five models from \$4895 up. Recreational Enterprises, Box 1084, Gainesville, Fla. 32601.



Electronic 'keys' tell the good guys from the bad guys

Watching TV's "Man From U.N.C.L.E.," Eric Hawthorne got the idea for a novel security system to keep unauthorized persons out of his highly secret computer bureau in London. It consists of a tiny pocket-sized radio transmitter that identifies the carrier as an employee. Anyone not carrying one of the transmitters sets off an alarm. When not in use, the electronic "keys" are stored in a rack (far left) where they're recharged overnight. The system will be manufactured by Lewis Security, Leatherhead, England.



Four-way convertible lamp stands or wall-mounts, runs on battery or house current

Convertible lamp for home or travel works four ways. It operates on 117-volt a.c. or on its own built-in 6-volt battery. Ideal for boat, camper or other recreational use, it also has a swivel base that swings up for wall-mounting (near left) or down to form a table lamp (far left). At home, it provides emergency lighting during power failures. Price is \$22.95 with battery, \$19.95 without. Paulin Products, 30520 Lakeland Blvd., Willowick, Ohio 44094.

TV car of the future shows up in real life

If this futuristic sports car looks as if it came straight out of a science fiction TV show, it did. It was built for British actor Jon Pertwee who plays Dr. Who, a time-traveling scientist in a popular BBC TV adventure series. Pertwee uses the car both on screen and off, driving it jauntily around the streets of London. Fully operational, the far-out finned vehicle is powered by an Imp engine, can do 100 mph and has a built-in TV set—so Pertwee can watch himself on TV.



New wrinkles in portable video recorders

Small, shoulder-pack video recorders have been with us for some time, but Sanyo's new VTC7100 model (top photo above) is the first to load as easily as a Super-8 movie camera, using pop-in, 20-minute cartridges of half-inch tape. It's \$1845 alone, under \$2700 with black-and-white camera and battery pack. Akai's new CVT-150 model (bottom photo) costs \$6000—but that's because it shoots color, using a new \$4000, 5¾-pound color camera and reels of quarter-inch tape.

NOW



Alarm shuts up on command

Growl at this alarm clock and it obligingly stops beeping—for two minutes. To silence the two-minute reminders, you must turn it off manually. Large, self-illuminated digital numbers are easy to read through morning-squinted eyes, even across the room. Styling is suitable for offices. Vox-Clock is \$69.95 from Vox, Highway 20 East, Independence, Iowa 50644.



Open wide: Trailer truck takes to the air for first overseas flight

For the first time in history, a complete 13½-ton, 40-foot trailer truck has flown the Atlantic Ocean. The Freuhauf van, equipped as a mobile TV studio for filming a series of sports events in Europe, was recently airlifted from New York to Frankfurt, Germany, and back in a Lufthansa Boeing 747F air freighter, shown being loaded above.



Electric meat tenderizer

You don't have to pound tough cuts of meat by hand with this motorized tenderizer. Reciprocating spikes pummel the meat, breaking down gristle and distributing seasonings through the tissues for tastier eating. \$32.45 postpaid from Harbert, Box 781, Four Corners, Silver Springs, Md. 20901.



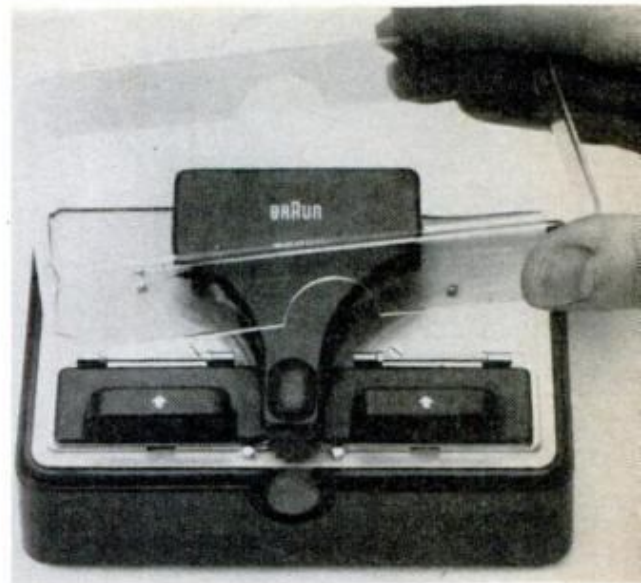
Low-cost oxy-propane welding torch for home use

Increased use of solid oxygen fuel sticks, combined with ordinary propane, is making possible high-temperature welding, cutting and brazing torches inexpensive enough for home use. This 5000°F. Turner outfit has propane tank and oxygen supply in handy carrying stand for about \$40. Turner Co., 821 Park Ave., Sycamore, Ill. 60178.



Have a ball with your music

The music goes round and round—and looks it—with Sanyo's new PhonoSphere AM radio/phonograph. While the turntable plays 7-inch 45 or 33-1/3-rpm records, a light glints off a faceted mirrored ball on the spindle for a glittering "ballroom" effect. PhonoSphere is \$44.95 from Sanyo, 1200 West Artesia Blvd., Compton, Calif. 90220.



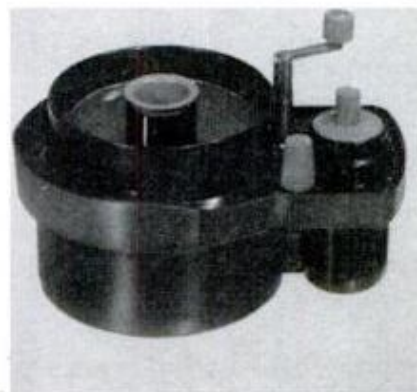
Motor drive zips out good movie splices

Tired of movie splices that fall apart because you didn't scrape them well enough—or scraped right through the film? Braun's new motorized splicer grinds a clean, wedge-shaped splice just deep enough, and its built-in light illuminates the work. List price of FK-1 is \$40. Braun North America, 55 Cambridge Parkway, Cambridge, Mass. 02142.



Clean cutting punches in many sizes

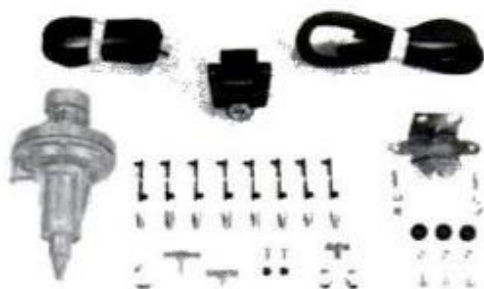
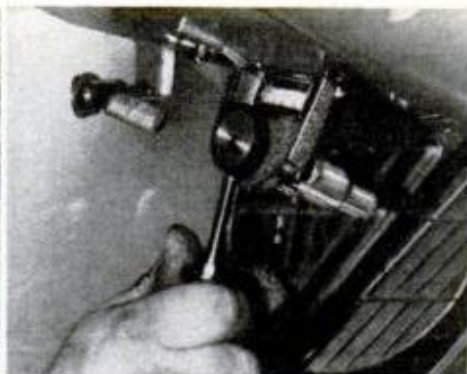
You can cut clean, neat holes in leather, rubber, cloth, thin metals and other soft materials with these arch-style punches. Made of hardened tool steel, they're available in sets of nine from 1/16 to 7/16-inch diameter for \$10.95, from 1/2 to 1-inch diameter for \$20.95. Brookstone Co., 14 Brookstone Bldg., Peterborough, N.H. 03458.



35-mm developing tank has built-in 'darkroom'

Load this tank in full light, just as you'd load a 35-mm camera, and you're ready to develop your film without a darkroom or a changing bag. The crank winds the exposed film onto the developing reel, a built-in knife cuts it from the cassette, and you load and empty chemicals at the top. The Day-load 35-mm tank is \$17.95 from Spiratone, Inc., 135-06 Northern Blvd., Flushing, N.Y. 11354.

NOW



Automatic load leveler for cars

If your car has air shocks, you can add this automatic load-leveling system that lets you adjust rear-end height from the driver's seat. Load-Tamer is designed for use when towing trailers or carrying extra-heavy loads. By simply turning a knob, you can inflate or deflate the shocks to bring the car to proper riding level. Kit (right, above) includes compressor, dash control and connectors. For prices, write Scovill Mfg. Co., Scovill Square, Waterbury, Conn. 06720.



Color printer for home darkrooms

Converting your home darkroom to color could create space problems—cramming in an enlarger with color head, color and exposure analyzers, a voltage stabilizer, and a timer. Honeywell's new Sable 1 Color Printer has them all in one package 16¼ inches wide, 26½ inches deep, and 35½ inches high. Using additive filters, it can make color prints from 35-mm or 126 color negatives or slides, or make black and white prints. It's \$599.50 from Honeywell dealers.

Slip-in boots seal wind, rain and noise out of pickup campers

Slipping these soft, cushiony boots between pickup cab and camper body helps to seal out rain, wind, dust and road noise. Boots fit over the cab roof and behind the rear window, the latter making it possible to keep the window between cab and camper open for a convenient food and conversation passageway. Price is \$29.95 in variety of sizes to suit most cab and camper combinations. For nearest dealer, write Kamp-Kushion, Inc., Box 66495, Seattle, Wash. 98166.





Carryall bag with a trick to it

Stuff this waterproof canvas bag with papers, cameras, shopping or what-have-you, and there's still room for more—a zipper enlarges the 15¼ by 13-inch bag from 4 to 8 inches deep. It costs \$22.50 in gray or warm brown, and wears well—we used the nonexpanding, \$16.50 version nearly two years before the strap began to fray. From The Chocolate Soup, 249 East 77th St., New York, N.Y. 10021.

Two-way kitchen sink with a separate drain for garbage

This unusual new design in kitchen sinks sports a separate drain in one corner for a garbage disposal unit. The handy dual arrangement allows you to dispose of food wastes even when the main basin is being used for soaking or stacking dishes. Called the Urbanite, the self-rimming sink is available in 12 colors. For prices and details, write Kohler Co., Kohler, Wis. 53044.



Bus gets the green light—every time

When this bus nears an intersection, instead of waiting for the light to change, the driver flips a switch, the light turns green and the bus rolls on. The bus-priority system, designed to speed mass transit through crowded city streets, is part of an experimental electronic traffic-control program under federal development near Washington, D.C. Lights can also be controlled from a master console (below) according to traffic density.



PM OWNERS REPORT: VOLKSWAGEN THING

A nationwide survey based on 1 million owner-driven miles.

With its 48-bhp Volkswagen engine overhanging the rear axle, the Thing easily lifts its front wheels. It goes well in mildly rough country.

Top speed and cruising are the same—68 mph. Some say that side curtains lift away from car above 40 mph, let in rain and drafts. Radial tires are standard.

Owners like handling, both on and off the road. Simple, rugged construction, lack of frills, "endearing ugliness" attract buyers.



Photos by the author



"Its ugliness." That's one of his reasons for buying VW's Thing, claims a New York engraver. "It's unique," he explains, adding that he uses it to make business deliveries. "Kids shriek, 'I love your Thing!' as I drive through town." He sees the car's ugliness as a definite commercial asset—free goodwill and advertising.

Other owners are likewise attracted by the Thing's *Wehrmacht* styling. "I wanted an on-road/off-road machine that looks strange," confesses an Ohio machinist. A South Carolina pharmacist: "I was shopping for another Jeep-like vehicle. I saw the Thing and thought it was so ugly it was cute. I do own a 1969 CJ5, but the Thing is a lot uglier and cheaper."

Yet the Thing is more than just another pretty face. "Engineering and design are superb from a human engineering standpoint," comments a New Jersey social re-



Rear bench folds flat for storage. Black seats heat up in summer and while some owners said they had hosed Thing's interior, they also reported this rusted the floor.

Beautiful ugliness in a wheeled breadbox

So what if it does assault the eyes, ears and kidneys?

by Michael Lamm
WEST COAST EDITOR

searcher. "Fantastic space utilization. It's a unit that's merely a series of panels welded together—good ideas with exceedingly cheap interpretation."

"It's a simple car," echoes a West Virginia druggist, "and being an off-road vehicle, it has none of the buzzer or nuisance devices of 1974 cars."

Designed in Germany and assembled in Puebla, Mexico, the Thing sells in the United States for a base price of \$2850. Engine and running gear remain pure VW Beetle. The Thing borrows the VW automatic stickshift's 4.125:1 rear-axle ratio but keeps the manual transmission. The body consists of a series of simple, rib-reinforced flat stampings mounted on the familiar Beetle floorpan. It's frill-free, but among the Thing's many standard extras are a gas-fired heater, removable doors/windows top, plus VW's 24 24 warranty.

Thing owners do seem to enjoy a bit of ritualistic suffering. "Although it *doesn't* ride like a luxury car," notes a New Jersey receptionist, "I find it very well put together." "It's hard to get into the front seat wearing a dress"—South Carolina manageress. "The thing rides hard on bumpy roads, but it is comfortable under the circumstances"—New York hotel clerk.

Now let's take some harder categorical looks at Thing owners' opinions. Here's a composite of comments about workmanship.

"Generally good; could be better but still superior to American standards." "A well-built, solid car." "Very good, but top hold-down clasps should be brass or stainless, not pot metal." "Not anything like a Volkswagen should be." "Way below the VW average, but then it's a utility vehicle." "Typical VW—simple and excellent." "Fair; the spot-welding seems very visible; clamps

holding the top to the windshield fell off twice before I epoxied the pin in place." "It's put together rough, but then you don't have to worry about every little nick and scratch."

In all, 67.1 percent gave the Thing a "good-to-excellent" workmanship rating. That compares with 88 percent for Saab, 82.1 for Fiat, 80.7 for Datsun, and 55.6 percent for the Buick Apollo.

What of economy? The Thing's promotional literature says it averages 21 miles per gallon. Our survey shows it'll do a bit better: 21.2 mpg around town and 24.3 out on the highway. As a Newark educational consultant penned, "My Thing has thus far met all its advertised claims, and in this day and age, that means a lot."

Apparently, though, performance suffers at the expense of good gas mileage—or at least the Thing seems less peppy than many owners would like. "Top speed is 68 mph, as noted in the owners manual," comments an Ohio manufacturing exec, "and it certainly has no acceleration for satisfactory passing, even at lower speeds." Other agree. "No pickup or passing reserve." "Underpowered." "Less weight and more power."

A significant but untabulated number of owners suggested making four-wheel drive optional. And a relatively large number (15.8 percent) would make a rollbar standard equipment—a suggestion also put forward by Ralph Nader and several safety groups. The Thing slips past the federal rollbar requirement claiming to be a utility or off-road vehicle, not a passenger car.

Small consolation to anyone worried about having a Thing land on top of him.

Another grumblesome area involved the Thing's side curtains and ventilation system. A New Jersey rug cutter isn't alone in his observation: "The plastic windows pull away from the top at 40 mph and above." A New York computer programmer continues, "My Thing takes in water driving in the rain. On a trip to Boston, I had an inch of water on the floor." And a schoolteacher from Bangor, Me., asserts, "I find the lift-out windows a real pain (no pun). They scratch easily, are hard to store, and there's no cool air entering with the side curtains up, so there's nothing to blow away the fog that forms inside during a rainstorm or in cold weather." This inadequate ventilation problem came up repeatedly. Many owners suggested more expensive glass windows instead of side-curtains.

There is a defroster of sorts, along with the standard gasoline-fired heater, and while hot air comes instantaneously, the windshield wiper motor deflects the defroster's upward draft. Thus the glass directly in front of the driver is the last place to defrost or defog.

Most owners enjoy the way the Thing handles. "I've gone through road-construction areas where the Thing has negotiated rock piles and bomb craters better than regular cars," states a New York optical receiver. "I've had mine on some Jeep trails and old mountain roads with very good results"—New Jersey salesman. "It handles

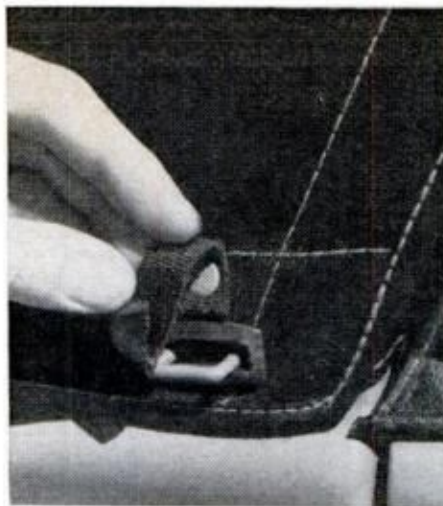


Windshield folds flat, but it's illegal on some highways; if you hit a hard bump, the glass can crack. Wiper motor obstructs defroster, so last spot to defog is right in front of driver. Things come in three dull-finish colors: white, yellow, orange.

Thin, light doors can be removed in a matter of seconds by releasing spring-loaded detent on hinge pins, but putting the doors back is another story. Lining up the pins can be something of a chore. Question: What do you do with doors once they're removed? Not many vehicles of this type have four doors. All-steel body boasts anticorrosive primers plus three coats of semigloss paint.



Side curtain stows in 5.4-cu.-ft. compartment up front. Special case keeps them from scratching. Rib reinforcements stiffen flat steel body panels.



Top hold-downs are hasps instead of snap, are hard to insert. Manipulating top is a two-man operation. Vinyl top can be removed fully.



Side curtains' metal rods poke into holes in doors. With all curtains in place, ventilation suffers and the windshield fogs.

nicely, holds the road well"—Pennsylvania serviceman.

Some owners complained of noises—of all sorts. The engine, for one; all-weather tires for another, plus numerous squeaks and rattles. "Ought to be more insulation between me and the powerplant," suggests a Texan. "There's a squeak in the rear area that sounds like the rusty coils in an old bed"—Virginia newspaperman. "It rattles inside like a tin box of nails"—Illinois letter carrier.

We noted a relatively high incidence of owners making their own repairs: 11.3 percent. Two reasons: 1) It's a simple car to work on; 2) Fairly minor things seem to go wrong. Owners' opinions of dealer service departments weren't particularly high. Parts apparently aren't overly abundant.

Most Thing owners, though, consider their cars more than mere transportation. A New Jersey college student writes, "It not only attracts the girls but has turned the heads of drivers of 240-Zs, Porsches, Mercedes and whole busloads of people."

Another student: "I believe the Thing to be a car of many moods. Whatever mood I'm in, the car changes to fit it. If it's a nice day and I'm in a good mood, I'll put the top down, take off the doors, flip down the windshield, and head out. If it's a lousy day and I'm in a bad mood, I put everything up. The variations are endless."

Finally, a California schoolteacher observes, "There isn't much to go obsolete on this car. Its styling is as ugly and as endearing as any on the road. It's fun and it's distinctive." ★★★

Summary of 1973-74 Volkswagen Thing Owners Reports*

Total miles driven1,031,244

Average miles per gallon

Local driving 21.2

Long trips 24.3

Why did you buy the Thing?

Design 26.8%

For recreation 19.2

Versatility 18.2

Economy 16.2

Roadability 10.6

Specific likes:

Economy 47.3%

Handling 38.9

Styling 28.1

Roadability 14.8

Roominess 13.8

Versatility 12.8

Specific dislikes:

Rattles 27.5%

Lack of power 16.0

Poor ventilation 11.5

Poor materials 9.0

Parts unavailable 7.5

What changes would you like?

Standard rollbar 15.8%

Better ventilation 13.2

More horsepower 11.1

Roll-up windows 10.5

Had any mechanical trouble?

Yes 56.6%

No 43.4

What type of trouble?

Electrical 16.7%

Windshield wipers 11.4

Transmission 10.5

Brakes 8.8

Heater 7.0

Did you repair it yourself?

No 88.7%

Yes 11.3

Dealer repairs satisfactory?

Yes 68.9%

No 31.1

Dealer service opinion:

Good to excellent 55.5%

Average to poor 44.4

Workmanship opinion:

Good to excellent 67.1%

Average to poor 33.0

Is the Thing your only car?

No 72.1%

Yes 27.9

Other cars owned:

Volkswagen 28.0%

Chevrolet 23.3

Ford 16.7

Oldsmobile 10.7

Plymouth 10.0

Age distribution of owners:

15-29 years 50.3%

30-49 years 43.0

50-plus 6.7

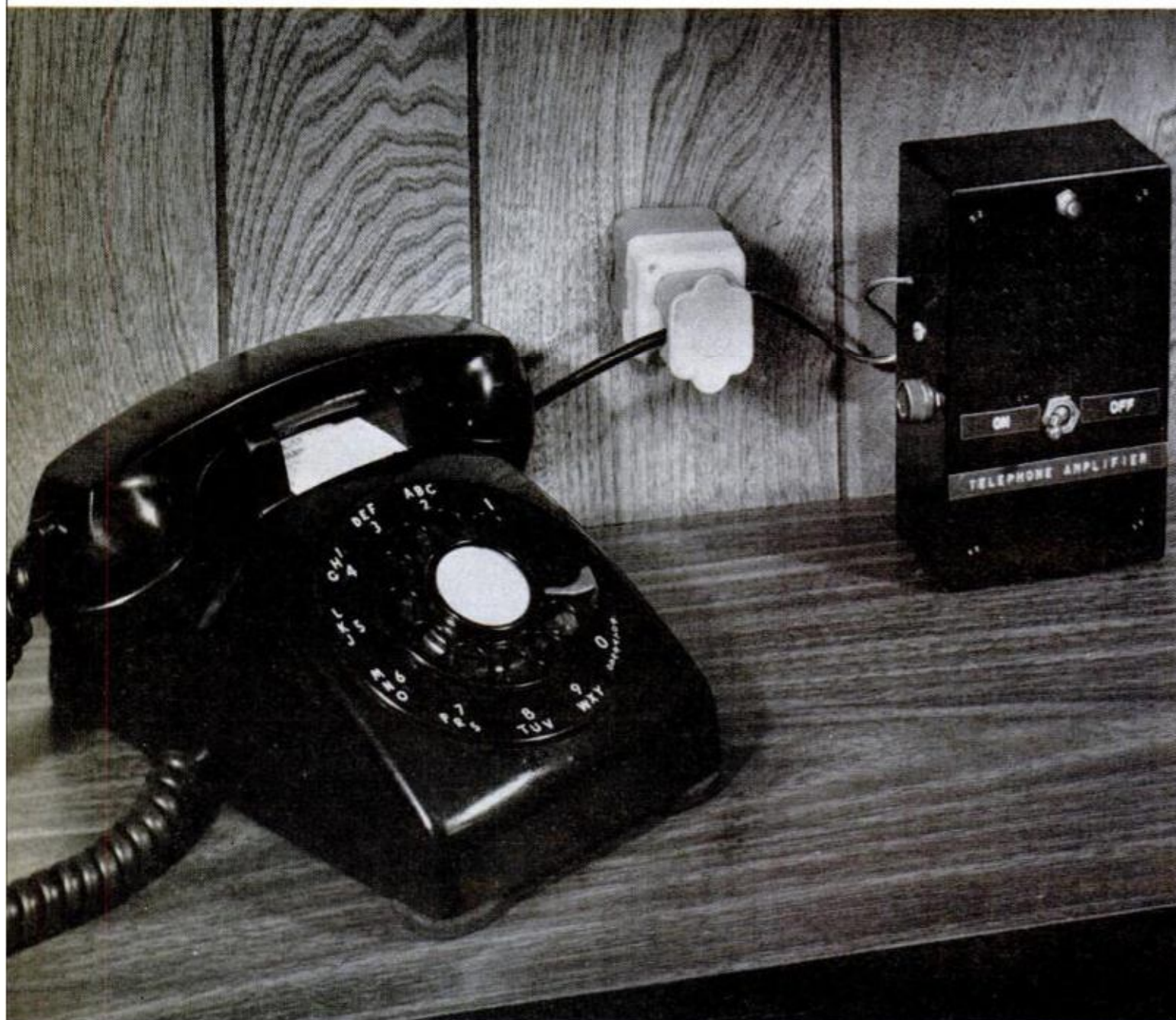
Would you buy another Thing?

Yes 64.2%

*Percentages might not equal 100% due to rounding or insufficient data.

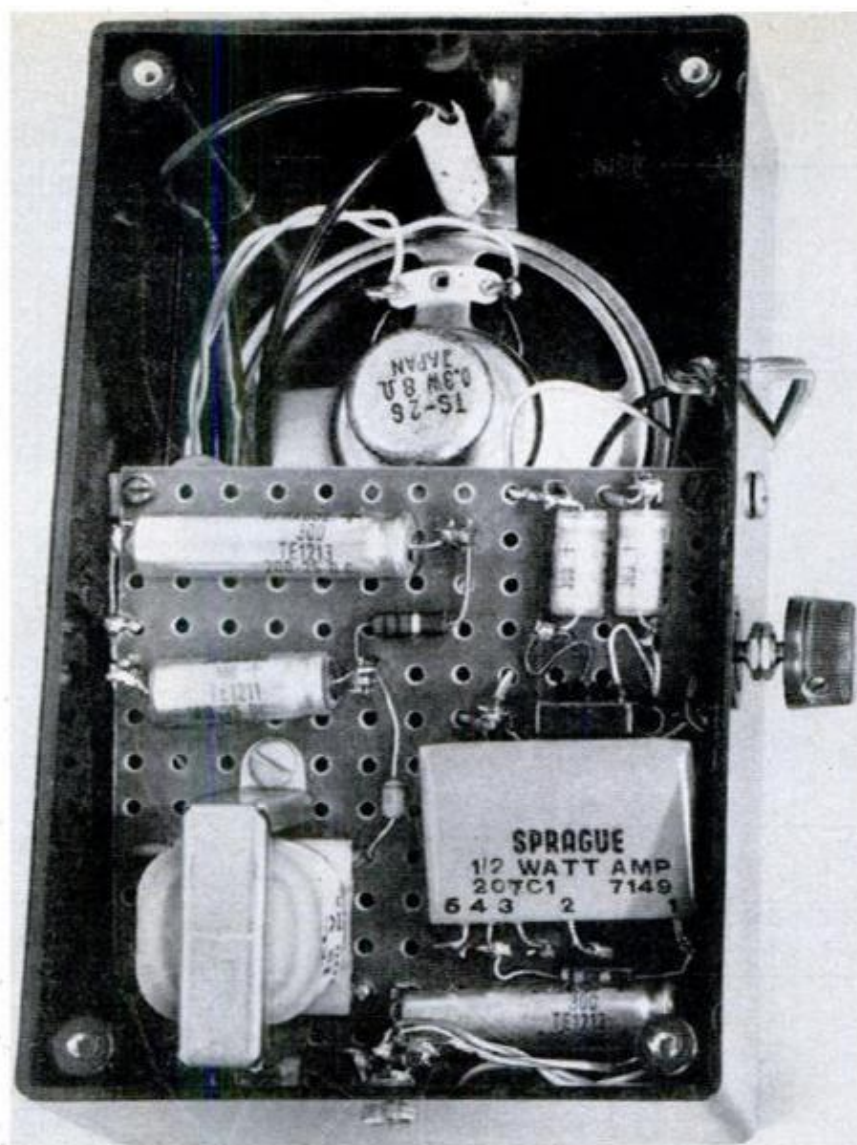
Let your family listen with this easy phone amp

by Rudolf F. Graf and George J. Whalen



This simple telephone amplifier lets your family listen in on long-distance or other important calls. Easy to build, it plugs right into your phone jack.

Want the family to listen in on calls from relatives far away? This simple telephone amplifier plays both sides of a phone conversation clearly, with no need for cumbersome inductive pickups or acoustic couplers. It just plugs into your phone line, with coupling capacitors, a matching



The hard parts are done for you: Radio Shack's Perfbox has predrilled speaker grille and all amplifier circuits are contained in Sprague's six-terminal module. Other components provide power supply and couple amplifier to the phone line. Unit is a.c.-powered.

transformer and a disconnect ganged with the power switch, all ensuring that this amp can't disturb your telephone line. The only precaution: Don't operate it where a phone is close enough to pick up its output—if you do, you'll get a feedback howl.

Construction is simple: The amplifier is snugly housed in a $3\frac{3}{4} \times 6\frac{1}{4} \times 2$ -inch plastic box, with components mounted on a $3\frac{1}{2}$ -inch-square piece of perfboard angled within the case.

The speaker may be glued or screwed in place, and should be mounted first, since the speaker baffle holes in the box determine its location. The switch, pilot light, volume control and optional extension speaker jack may be mounted wherever convenient; the locations shown in the photos proved convenient for the component layout shown, though you might wish to

mount the pilot light closer to the on-off switch, and the volume control on the front panel near the switch.

Notch the perfboard to fit around the box's corner posts and locate positions for the "L" brackets that hold the board before mounting the components.

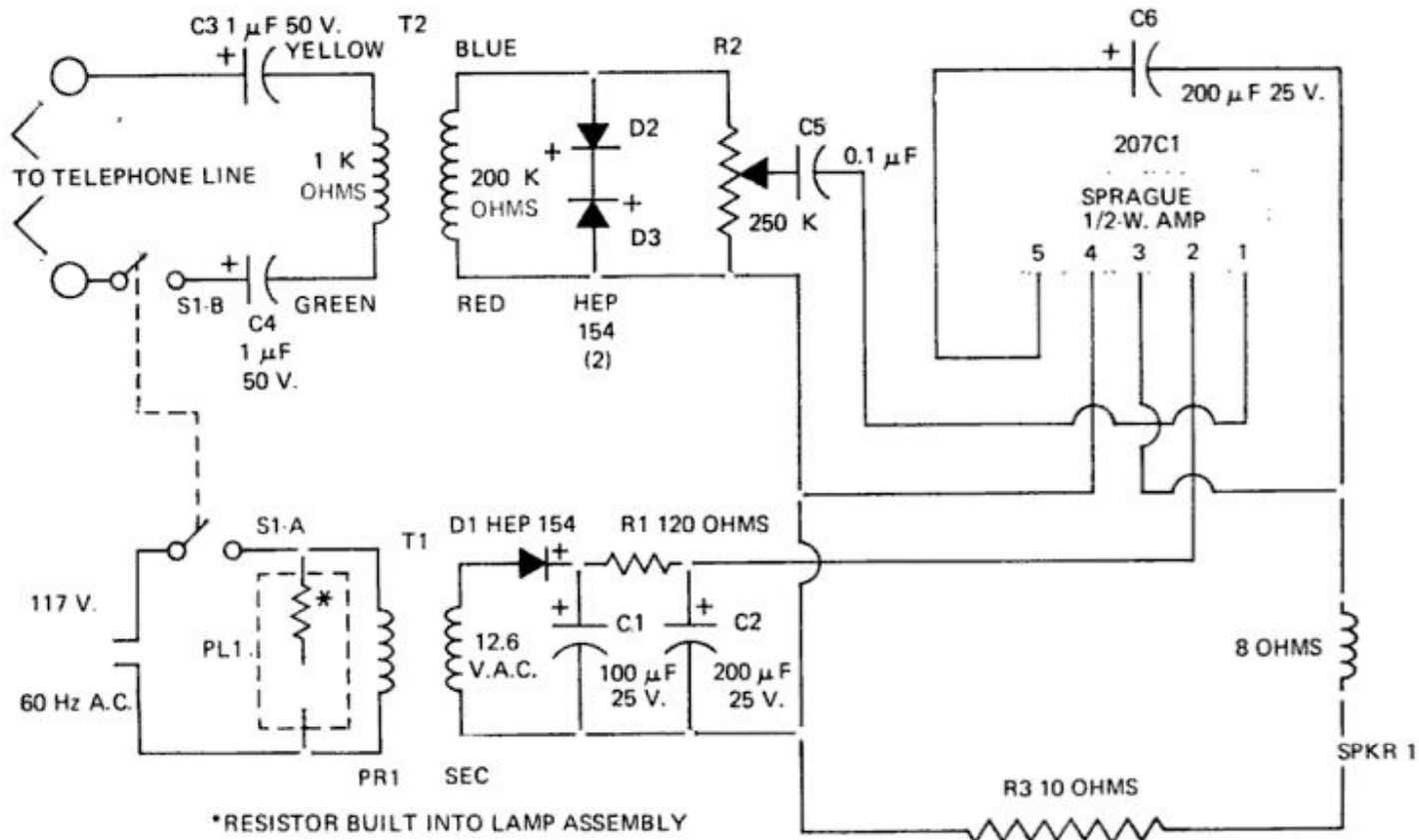
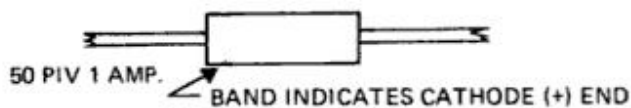
Connection to the telephone line may be made through a standard telephone plug, or through a combination male/female telephone jack plug, such as the one listed.

The case we used comes with no back, so we made one from perfboard, gluing a thin piece of foam rubber to the underside to cover the screwheads and protect the surface of the desk our amplifier sits on. If foam isn't easy or convenient, "moleskin" foot dressing will do.

Here's how it works: Two 1-microfarad capacitors in series with coupling-trans-

Telephone amplifier schematic

D1, D2, D3 HEP 154



*RESISTOR BUILT INTO LAMP ASSEMBLY

Parts list

- C1**—100 mf, 25-v. aluminum electrolytic capacitor (Lafayette 34E83617)
- C2, C6**—200 mf, 25-v. aluminum electrolytic capacitor (Lafayette 34E83633)
- C3, C4**—1 mf, 50-v. aluminum electrolytic capacitor (Lafayette 34E83476)
- C5**—0.1 mf, 200-v. Mylar capacitor (Lafayette 34E82056)
- R1**—120-ohm, ½-w. resistor (Lafayette 52E3051)
- R2**—250k, audio taper, miniature potentiometer (Mallory MCL254L, Lafayette 44E19016)
- R3**—8.2-ohm, ½-w. resistor (Lafayette 52E3023)
- T1**—117:12-v., 300 mA power transformer (Radio Shack 273-1385)
- T2**—200k:1k audio transformer (Lafayette 99E60345, Radio Shack 273-1376)
- Amp**—Sprague 207C1, ½-w. amplifier module (\$4.25 postpaid from J. Cronin, Sprague Products Co., North Adams, Mass. 01247)
- D1, D2, D3**—50-p.i.v., 1A diode (Motorola HEP 154, Lafayette 19E54379)
- TP**—Telephone jack-in-plug (Lafayette 44E19016, Radio Shack 279-370)
- PL1**—Neon pilot-light assembly with internal resistor (Lafayette 34E52166)
- S1**—D.p.s.t. toggle switch (Lafayette 34E33133)
- Spkr 1**—2½-in., 8-10-ohm, permanent magnet speaker (Lafayette 99E60972, Radio Shack 40-247)
- Perfbox**—3¾ x 6¼ x 2" (Radio Shack 270-097)
- Misc.**—A.c. plug, wire, perfboard, perfboard mounting brackets, screws.

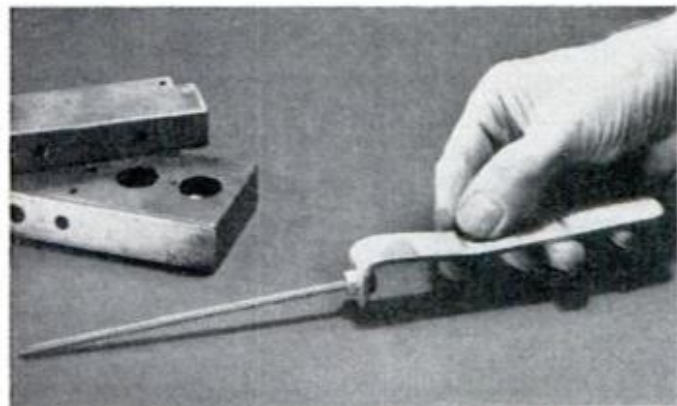
former T2 connect to the telephone line. These capacitors must be wired with the indicated polarity for proper operation. The transformer provides a step-up of the phone line signal, so that even on long-distance calls you'll get enough signal to be heard clearly through the loudspeaker. Diodes D2 and D3 across the transformer's output winding protect the amplifier's input, in case high-voltage surges appear across the line (as they will if the amplifier is connected while the phone is ringing).

The amplifier itself is a ready-made, inexpensive Sprague module, which requires no output transformer, but only a coupling capacitor between itself and the speaker. Terminals are clearly marked as the photo shows, which simplifies wiring.

Power is provided by a miniature 12-volt filament transformer, T1, with its output rectified by diode D1 and filtered by C1, R1 and C2. The power switch S1 is a double-pole, single-throw (d.p.s.t.) type; one section controls the a.c. power, the other connects the unit to the telephone line. When the amplifier is not in use, switching the power off automatically disconnects the amplifier from the telephone line, too. ★★

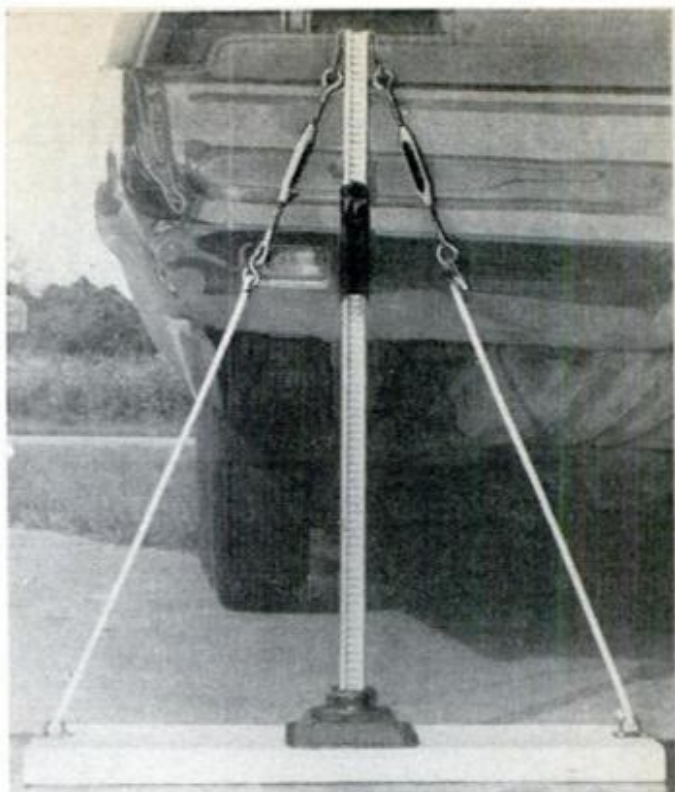
HINTS

FROM READERS



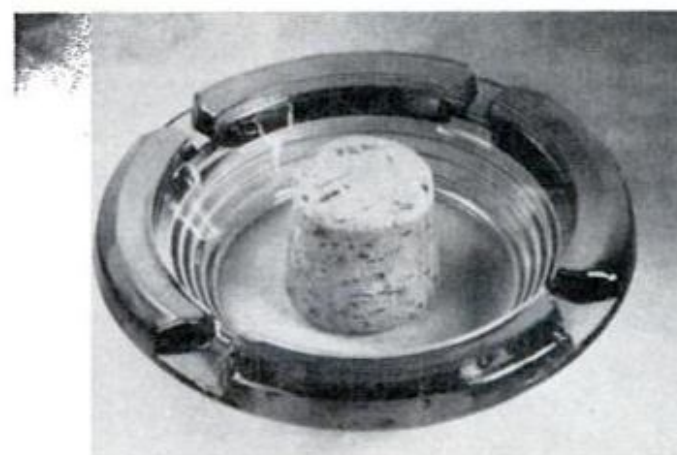
Hole cleaner from rod

A length of threaded rod equipped with a handle is a useful tool for cleaning holes, grooves and slots in metal. Used like a file, its threads loosen grease and scale without damaging the piece being cleaned; 3/16-24 rod shown has a handle bent from aluminum bar, secured with nuts. Handle's grip surfaces were roughened with a vibrating-point tool, could be wrapped with tape instead. A wire brush removes dirt from threads.—*Walter E. Burton, Akron, Ohio*



Jack safety device

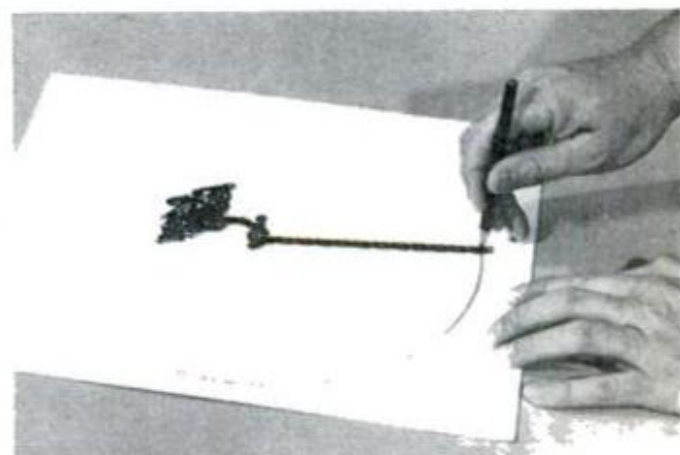
The conventional bumper jack is too likely to tilt over sideways. Stabilize it with a 30-in. length of 2x6, 1/4-in. steel rod (or light chain) and a pair of large turnbuckles. Eyebolts or U-bolts in the 2x6 base hold the rods, their ends bent into hooks; if chain is used, turnbuckles must have hooks, instead of eyes, at both ends. In use, some adjustment of the turnbuckles may be necessary to hold the jack securely.—*Dale F. Underwood, Winter Park, Fla.*



Ashtray silencer

Knocking dottle from a pipe into an ashtray is usually a noisy business. You can make it easier on the ears by epoxying a large cork to the ashtray to rap the pipe on.

—*Phil Tempo, Verdugo City, Calif.*



Compass for large circles

To draw circles too large for a conventional compass to deal with, use a length of light, flexible chain like that shown. Use a pushpin to fasten it at circle's center.

—*Ken Patterson, Regina, Sask.*

How to get more life from your clutch

by Mort Schultz

Clutches and manual transmissions save gas. They are also easier to maintain for the weekend mechanic. For many people, it's also more fun driving with a stick shift. For various reasons, manual transmissions have maintained their popularity over the years.

There are millions of cars in use with four-on-the-floor or three-on-the-tree. Do you or will you own one of them? Then you will want to know how it works, what can happen to it, and how to care for and repair it.

The clutch is a device that allows you to connect and disconnect the engine and transmission. An automobile engine must attain a speed of 300 to 600 revolutions per minute before it will run on its own power. An engine cannot attain this starting speed while connected to the transmission. The load imposed by the transmission is too great.

Once the engine begins running, the clutch is needed to keep engine and transmission apart when the car is stationary. Otherwise, the load of the transmission would cause the engine to stall.

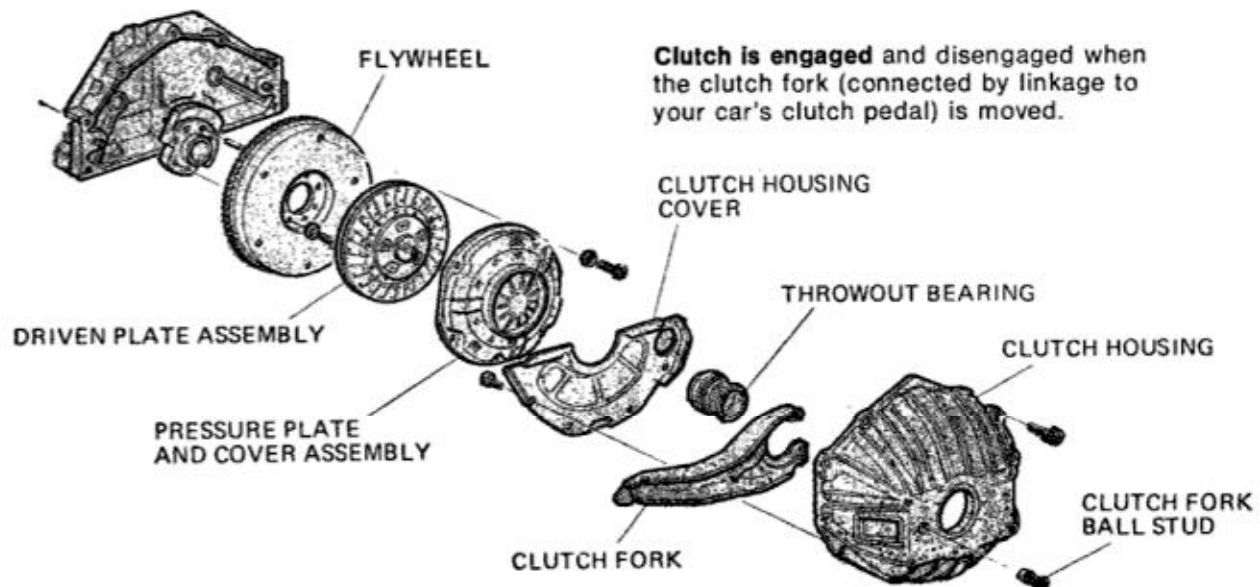
When the car begins moving, the clutch has to gradually raise the speed of the transmission input shaft to the speed of the engine crankshaft. The clutch, then, transmits torque while seeing to it that the slip created by the difference in speed between input shaft and crankshaft steadily decreases. The clutch also disconnects transmission and engine while gear-changing takes place.

A clutch does its work by means of friction. Its main components are a pressure plate and a clutch disc (or plate). The pressure plate is attached to the engine flywheel. The clutch disc, which drives the clutch shaft, is positioned between the flywheel and pressure plate. The clutch shaft forms the output shaft of the clutch to the transmission.

Attached to each side of the clutch disc is a highly frictional material. When the clutch is engaged, coil springs or a diaphragm spring clamp the clutch disc firmly between the flywheel and pressure plate. Friction is created that enables the ensemble to rotate together, thus transmitting engine torque through the clutch to the transmission.

When you disengage the clutch by depressing the clutch pedal, a fork moves to

Typical clutch assembly



Clutch is engaged and disengaged when the clutch fork (connected by linkage to your car's clutch pedal) is moved.

apply pressure to the clutch release (throw-out) bearing. The rotation of the bearing puts pressure on the clutch-release levers, which in turn compress clutch springs and move the pressure plate to the rear. This allows the pressure plate and flywheel to rotate independently, and the clutch disc and clutch shaft to come to rest.

There are several different variations of automotive clutches, although they all work on a similar principle. A single-plate clutch, which we have just described, contains one clutch disc (or driven member) operating between the flywheel and pressure plate. A multiple-plate clutch, on the other hand, uses more than one driven disc.

The difference in performance of single-plate and multiple-plate clutches is largely a difference in the time required to engage the clutch. A clutch with a single plate engages and starts motion faster than a clutch using multiple plates.

Cars and light-duty trucks are most often equipped with single-plate clutches. Medium and heavy-duty trucks generally use multiple-plate clutches.

Clutches may be "wet" or "dry." A wet

clutch has oil supplied to the clutch for lubrication. A dry clutch does not have oil supplied, but the driving members (flywheel and pressure plate) are usually made of cast iron or nodular iron, which possess sufficient graphite to provide lubrication.

A dry clutch is quicker to act than a wet clutch. Thus, dry clutches predominate on cars and light trucks, while wet clutches are usually used on heavier vehicles.

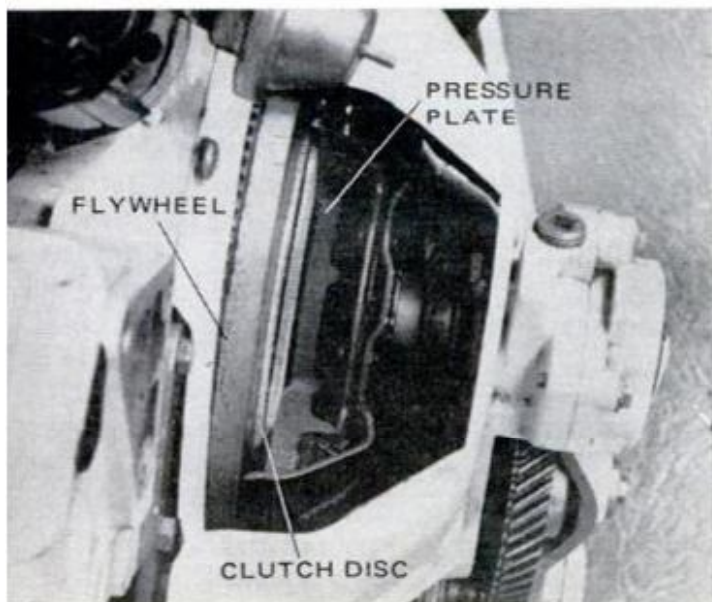
Some clutches use hydraulic pressure to transmit pedal movement to the clutch. This type of system employs master and slave cylinders.

Single-plate or multiple-plate, wet or dry, hydraulically controlled or mechanically controlled—it doesn't matter. Clutches can withstand much abuse, but in time may develop problems. Chief among them are slipping, dragging and chatter. A bad clutch can also cause your car to creep unwantedly.

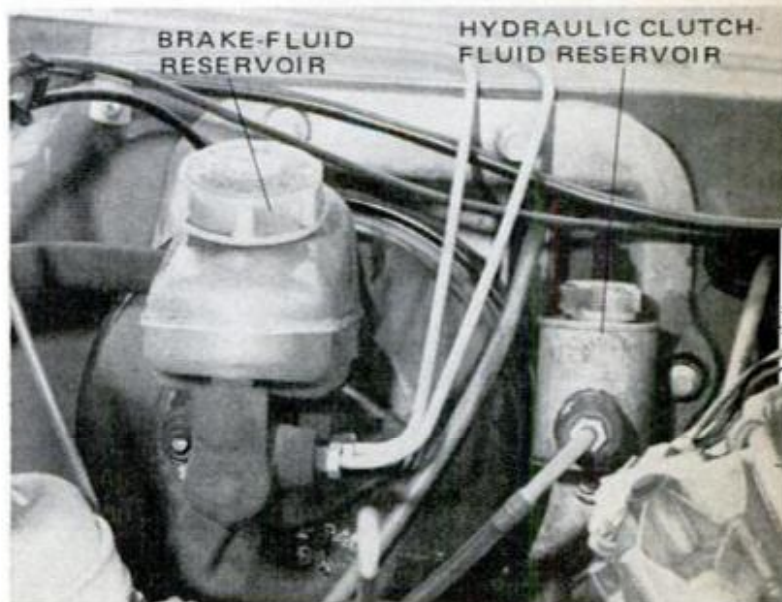
A slipping clutch becomes apparent when the car's speed doesn't increase in response to engine speed and when the car obviously lacks power, especially when climbing.

In its early stage, a slipping clutch may

Actual clutch housing in a Saab 99 is cut away here to show the relationship of the major components.



Hydraulically controlled clutch in Datsun pickup needs its own master cylinder. Check level periodically.



be mistaken for engine trouble. It can cause an engine to lose speed, overheat and use more fuel.

You can get a good idea of whether your car's clutch is slipping by parking on a level surface, applying the parking brake firmly, depressing the clutch pedal and shifting into low gear. Depress the accelerator pedal gradually as you slowly release the clutch pedal. The engine should stall. If it continues to run and remain stationary, the clutch is slipping.

A slipping clutch is usually caused by

lack of free play, oil or grease on the clutch-disc facing or a worn facing, weak clutch springs, or pressure plate or flywheel run-out. Major surgery is required for all malfunctions, except lack of free play.

A dragging clutch causes hard shifting and gear grinding. Does your car have it?

With the engine idling, test for drag by depressing the clutch pedal fully to the floor and shifting into any gear and then into neutral. Hold the clutch disengaged and depress the accelerator pedal part way down. Shift into gear. If shifting is accompanied by a grinding noise, the clutch is dragging.

Causes for a dragging clutch include excessive play that can be corrected by proper adjustment, weak or worn springs, a bad bearing, or a warped clutch disc.

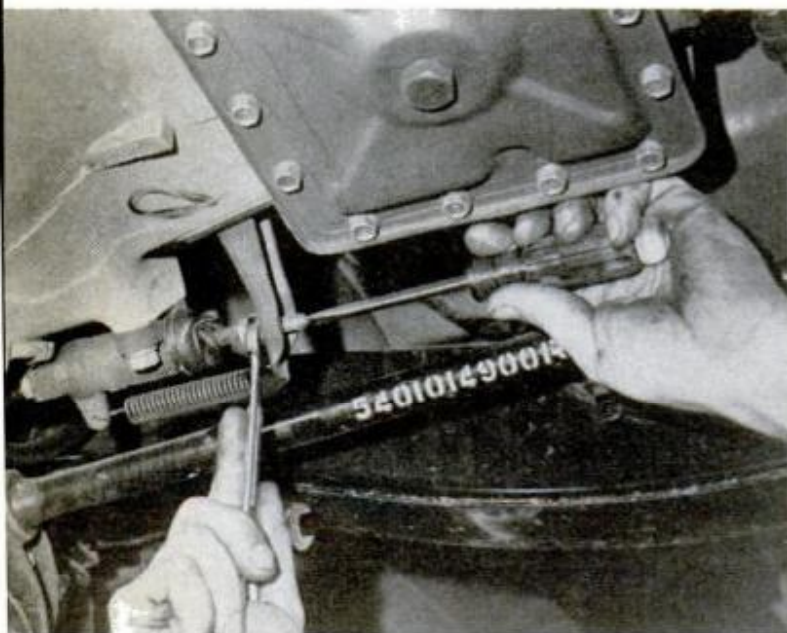
The clutch is said to be chattering when the car vibrates as it begins to move with the clutch partly engaged. There are several things that can cause this, including a defective clutch disc, a warped pressure plate or flywheel, or a loose or worn engine mount.

If the clutch engages suddenly (grabs) and the car moves abruptly as the clutch pedal is brought to a partially engaged position, the vehicle is creeping. The problem almost always lies with a faulty clutch disc.

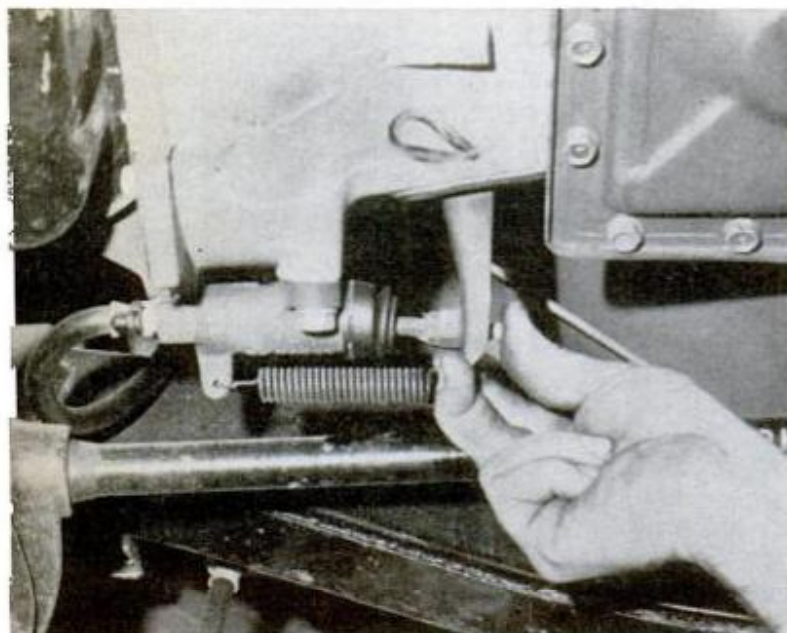
Adjusting play is the only easy service job you have when it comes to a clutch. Practically every other repair involves removing the clutch, and that could be tough.

As a clutch wears normally, the amount of free play is reduced. If free play is not adjusted properly, clutch damage can result. In fact, one of the surest ways of seeing to it that a clutch is ruined is to forget about free play. Clutches that have periodic adjustments made and are treated with some respect when being used can last the life of the vehicle. By treating a clutch with "respect" we mean that you shouldn't rest your foot on the clutch pedal when the clutch is engaged. This is called "riding the clutch." Riding the clutch and not disengaging the clutch fully by depressing the clutch pedal all the way put unusual and unnecessary strain on a clutch that can ruin it.

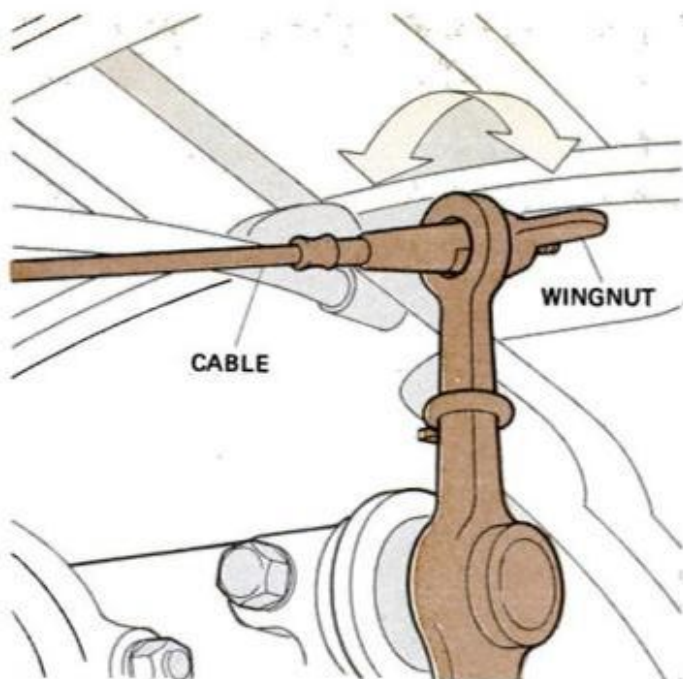
All car manufacturers agree that clutch free play should be checked and, if necessary, adjusted periodically, but they differ as to how often. Volkswagen, Pontiac and Fiat, for example, recommend clutch adjustment every 6000 miles, while Ford rec-



Clutch adjustments vary. On Datsun, locknut is loosened at clutch release fork and pushrod is adjusted for specified free play between fork and locknut.



When clutch fork is able to move a maximum of $\frac{1}{8}$ inch the locknut is retightened.



Clutch in Volkswagen is adjusted by simply turning the wingnut at the end of the clutch cable.

ommends adjustment every 12,000 miles. Check service literature for your car.

The way in which a clutch is adjusted varies from car to car, so you should get a service manual before doing the job. To demonstrate differences, here is how to adjust the clutches of late model VWs and Ford Pintos.

To check free play of the VW, place a ruler above the clutch pedal with the end against the toe board. Note the distance of the pedal from the toe board.

Now, push the pedal until clutch pressure is felt. This movement should be between $\frac{3}{8}$ and $\frac{3}{4}$ inch. If it is more or less, adjust the clutch cable.

Park the car on level ground and jack up the left side. Remove the left rear wheel. Place support stands beneath the vehicle.

Adjust the clutch by holding the end of pliers and turning the wingnut until free play falls within specification. Turning the wingnut counterclockwise shortens pedal travel, while turning it clockwise increases pedal travel.

When the adjustment has been made, the wingnut should be left with the wings horizontal so that lugs on the nut engage recesses in the clutch lever. Operate the clutch pedal several times, and double check to make sure travel falls within specification.

The Ford Pinto clutch is adjusted from beneath the car by loosening the cable locknuts and adjusting nut at the flywheel housing boss. Pull the cable toward the front of the car until free movement of the release lever is eliminated.

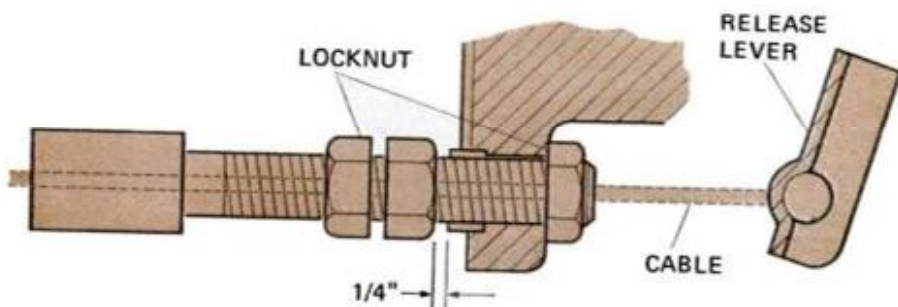
Now, while holding the cable in this position, a $\frac{1}{4}$ -inch spacer is placed against the flywheel housing boss on the engine side. The adjusting nut is tightened finger tight against the spacer.

Taking care not to disturb the spacer, tighten the front locknut against the adjusting nut to a specification of 40-60 ft.-lb. Remove the spacer and tighten the rear locknut against the flywheel housing boss.

Depending upon your degree of technical expertise, tools and availability of literature outlining procedure, you may want to do major clutch work yourself. Replacing any part of a clutch or the entire clutch usually requires dropping the transmission and/or removal of other major parts, such as the propeller shaft, flywheel housing and starter motor.

So, replacing a clutch may not be high on your list of desired tasks. However, there is one other easy job you might consider doing. Some manufacturers (not all) recommend that certain parts of the clutch linkage can be lubricated periodically. For instance, Pontiac recommends that the push rod-to-clutch fork joint be greased with chassis lubricant every four months or 6000 miles. Chrysler suggests that you lubricate the clutch torque shaft bearings every 36 months or 36,000 miles.

Double check the lubrication chart for your car to see if and when parts of the clutch control require service. You can prolong the life of the clutch by seeing that it gets such service. ★★★



The locknut and adjusting nut arrangement for the Ford Pinto is at the flywheel housing boss. Specification for release-lever free play is one-quarter inch.

Fun projects for wintry evenings

Folding basket

An interesting jigsaw project, this handsome little fruit basket is a variation of a South American original. You can duplicate it more easily than you might suspect with a 12x15-in. piece of $\frac{3}{8}$ -in.-thick plywood and a jigsaw. The finished product shown was made of cabinet-grade oak plywood.

Make separate full-size patterns for the handle-frame and the base crosspiece (see facing page). Lay out pattern for the handle-frame piece first, then that for the base crosspiece on the remaining plywood. Notice direction of wood grain. Using an "extra fine" jigsaw blade (32 teeth per in.), cut out each piece. For internal cuts, drill small pilot holes for the jigsaw blade;

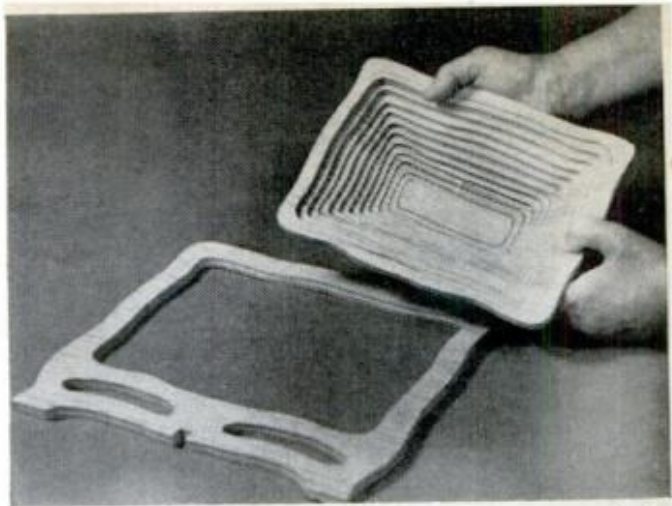
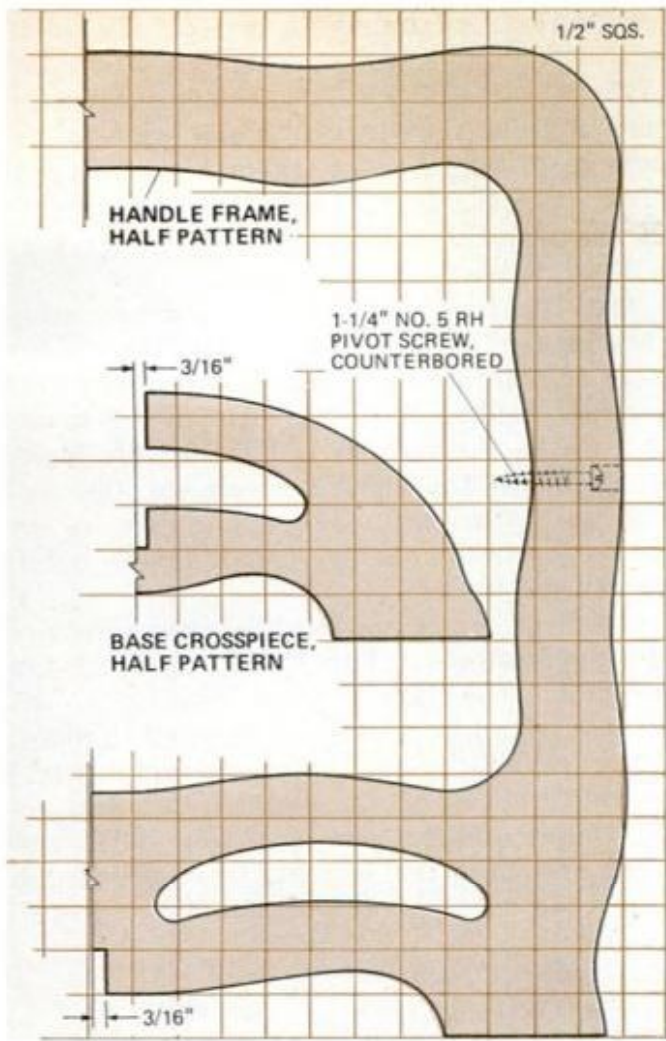
center cutout of handle-frame forms the basket piece.

Lay out guideline for jigsaw spiral cut on the basket piece using pattern and spacing on facing page. Set your jigsaw table at about a 5° angle. In scrap material, make a trial spiral cut to determine if the angle is correct to let the spiral drop in progressive steps, yet not drop through completely. After you have the proper angle, make a continuous spiral cut, turning the workpiece clockwise. Sand any cutting burr on the underside by slipping sandpaper edgewise into the spiral cut. If cut properly when pushed down from the top, the spiral will be tight—if pushed up from the bottom, the spiral will be free. Sand, fill and finish as desired. Assemble pieces as seen in photos on the facing page.

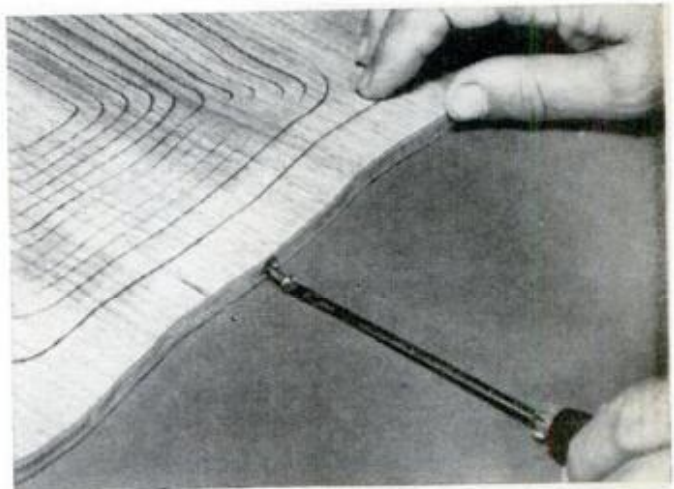
—Willard Waltner



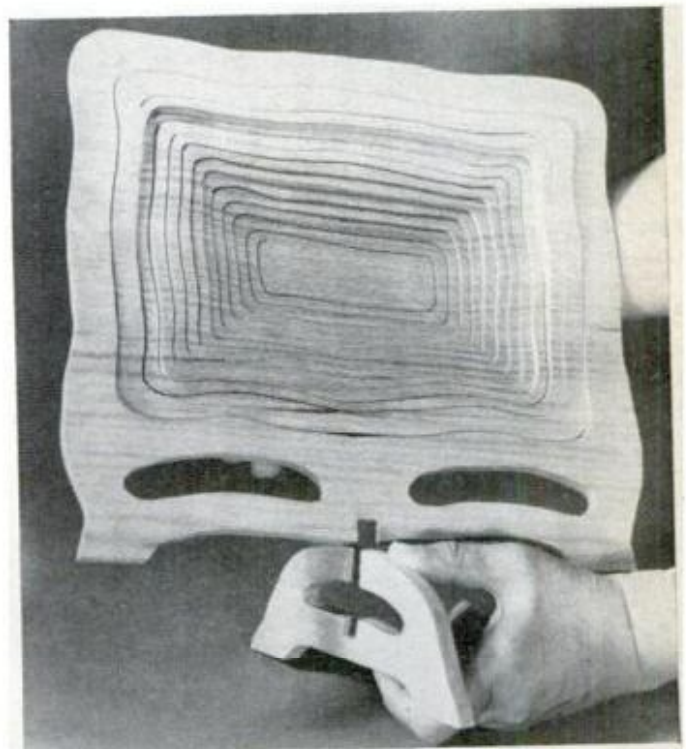
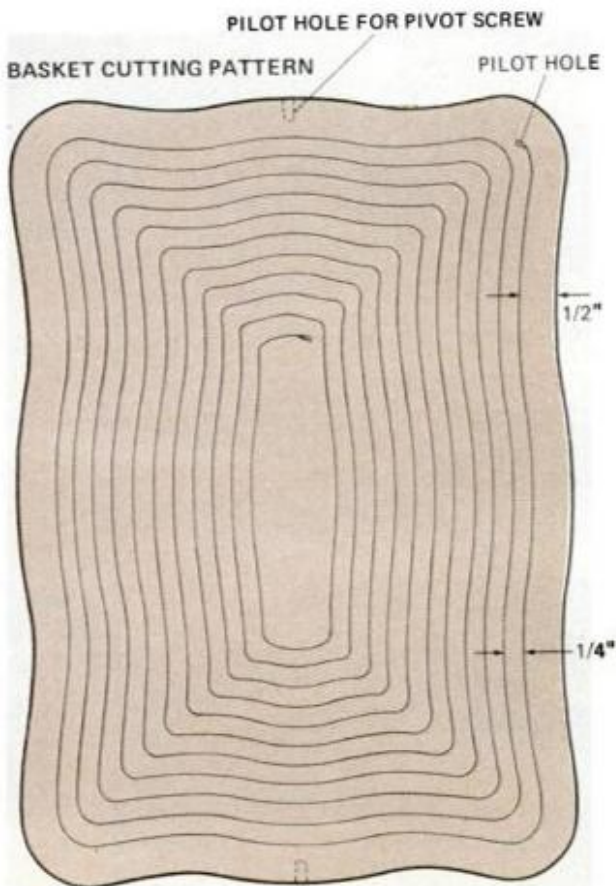
Small basket has two-piece frame for a stand and basket that folds out for display, flat for storage



Handle-frame and basket are cut from one piece of plywood. Jigsawed spiral cut produces collapsible basket.

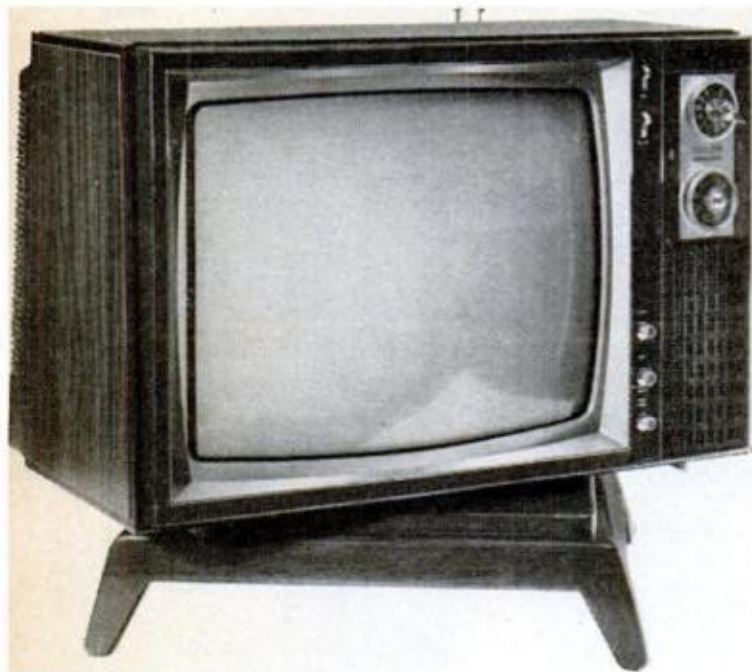


Pilot holes are drilled through handle into edge of basket at each side. Pivot screws are counterbored.



With basket attached, handle-frame fits into slot of base crosspiece to make basket freestanding unit.

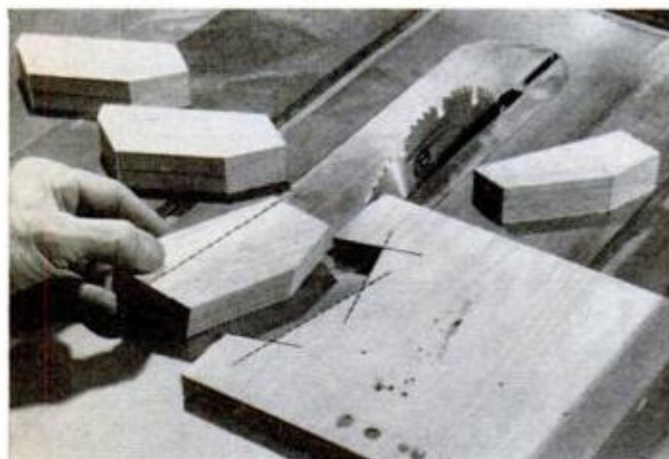
Portable-TV turntable



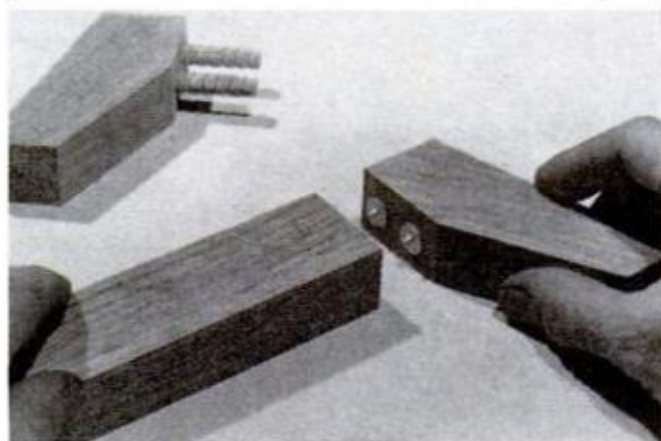
Turning a heavy portable TV set for a better viewing angle can be done with one finger when the set rests on a turntable. With a ball-bearing lazy Susan swivel attached to a four-legged stand and to the bottom of the cabinet, the set easily turns right or left. The stand is dimensioned to fit the set; this one is made for a set with a 23-in. screen.

Cut the legs first. For safety and accuracy, make a jig as shown on the facing page to ride against the rip fence and hold the leg blanks. After the first cut is made, the jig is turned 90° and the leg blank is placed in the second notch for the second cut. You can make one notch in the jig do for both cuts by reshaping the notch (photo, below left).

The legs, ends and middle crossrails are all blind-doweled. The 3/4-in. plywood top to which the lazy Susan bearing is attached, is simply glued and screwed in place. When stand is completed, center swivel bearing on top of the stand, align top access holes and bottom mounting holes and screw-fasten swivel bearing to stand. Match



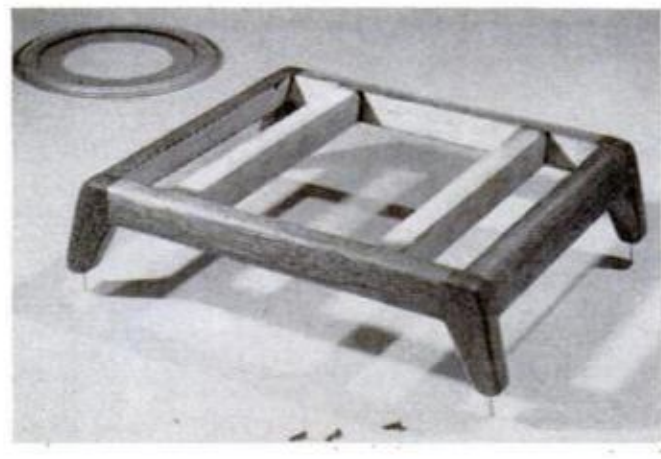
After first leg cuts, jig is reshaped for second pass.



Dowel centers are used to mark rails for drilling.

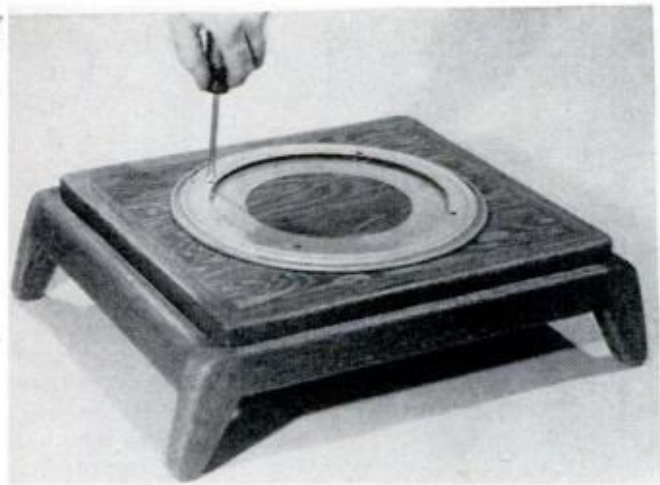


Power sander is used to round frame edges slightly.

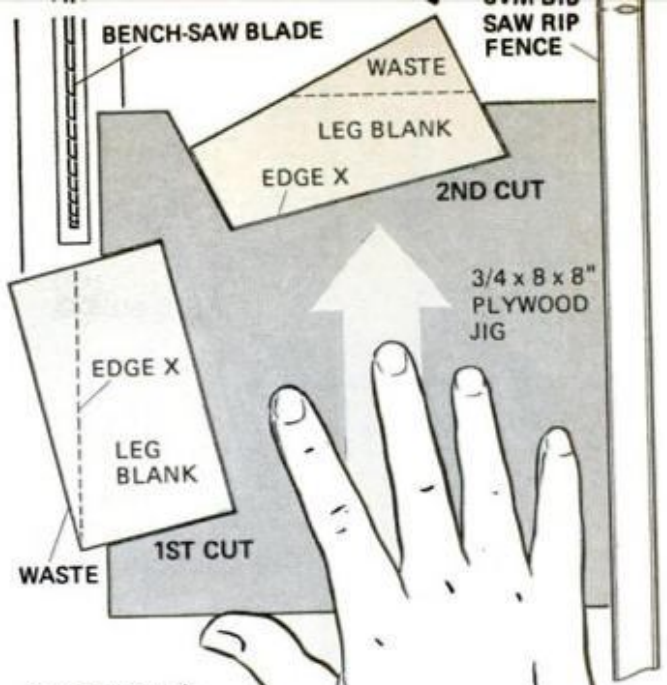


Frame ready for top panel and lazy Susan bearing.

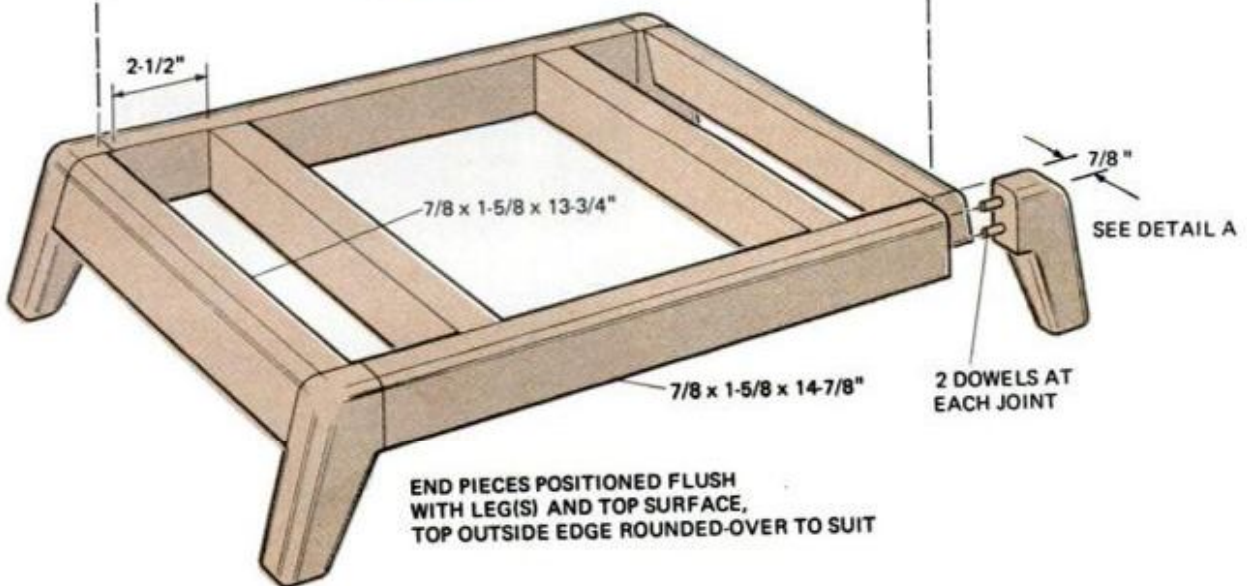
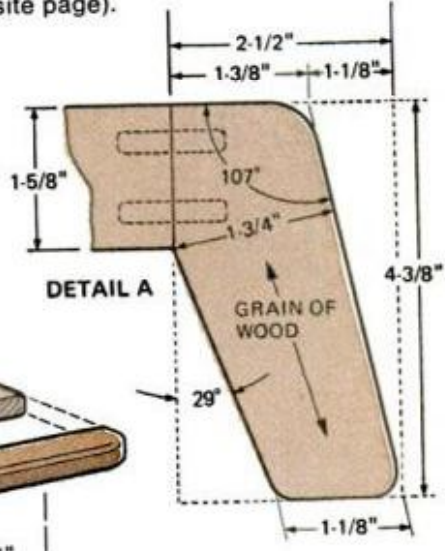
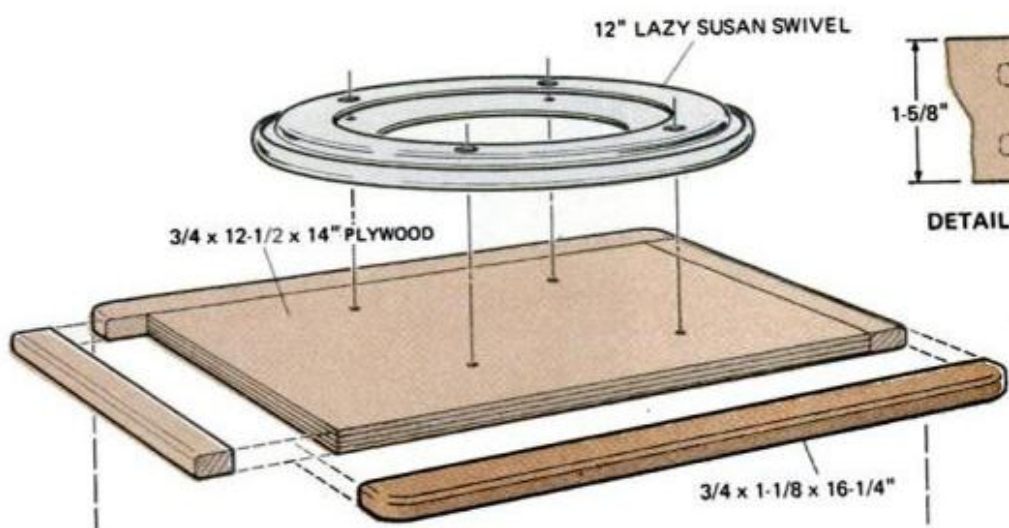
top and bottom access holes and bore four oversize holes through stand. Center stand on inverted TV set and fasten swivel bearing to cabinet through holes in stand, using panhead self-tapping screws if cabinet is metal, round heads if wood. *Caution:* Check inside TV chassis to be sure screws will not touch any parts.—*John Nichols, Chicago*



Access holes allow fastening from each side of bearing.



Jig holds each block for a leg at correct angle for cutting uniformly shaped legs. Use two cutouts (above) or one, reshaping jig after first cut (photo, opposite page).



END PIECES POSITIONED FLUSH WITH LEG(S) AND TOP SURFACE, TOP OUTSIDE EDGE ROUNDED-OVER TO SUIT

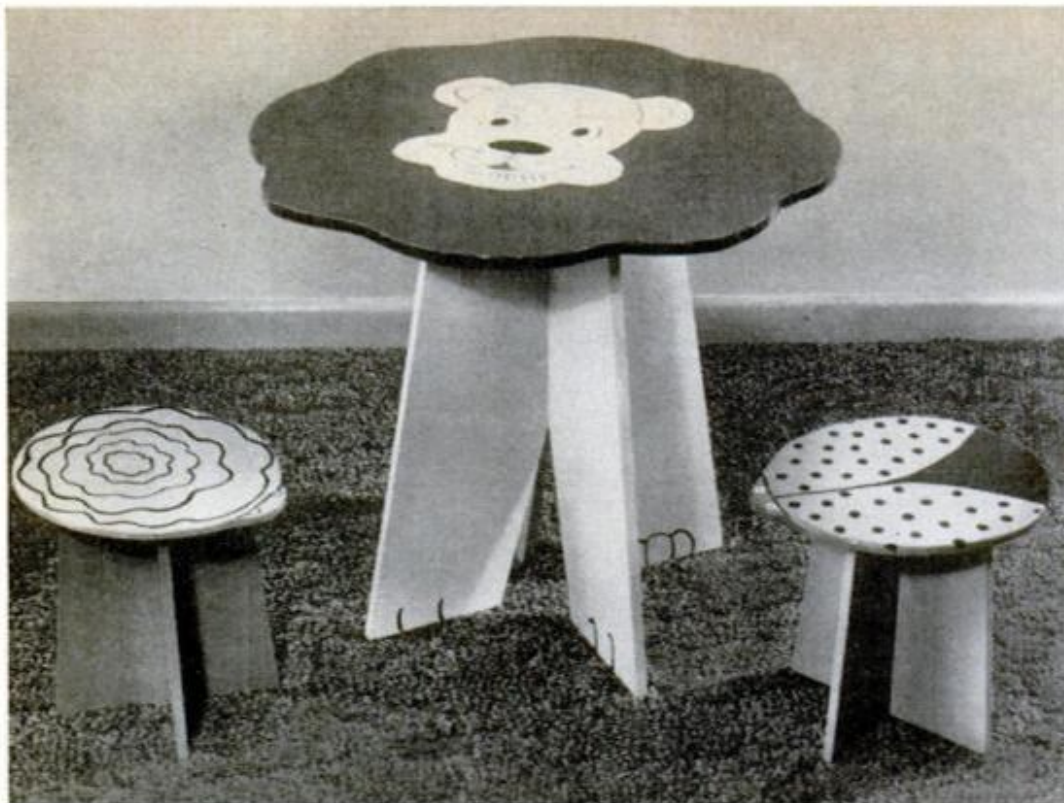


Table and stool set will appeal to young children because of table's "lion" top and stools' "beetle" and "tortoise" seat tops. The legs are two slotted uprights.

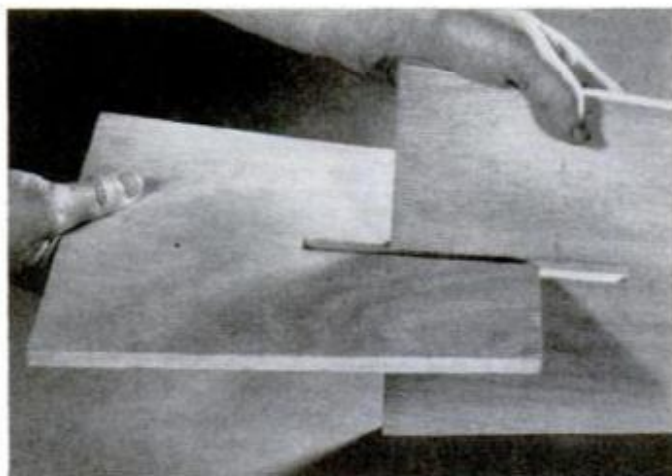
Fun furniture for toddlers

Preschoolers will have hours of fun playing at this "lion" table and "tortoise" and "beetle" stools—a sturdy, almost tip-proof set painted in bright, eye-catching colors. To build the set, you will need a 4x4-ft. sheet of $\frac{1}{2}$ -in. plywood, eight $\frac{3}{4}$ x $\frac{3}{4}$ x 2-in. cleats, four $\frac{3}{4}$ x $\frac{3}{4}$ x 3-in. cleats, 36 1-in. No. 8 fh screws and paint.

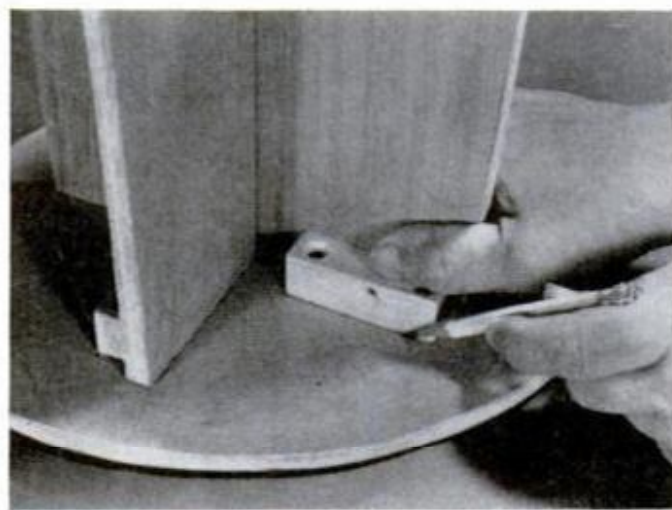
Cut out a 2x2-ft. piece of plywood for the tabletop and two 10x13-in. pieces for the seat tops. Make three patterns (shown on facing page) using 1-in. squares and lay out on the plywood. Cut out tops with a jigsaw. On the remaining plywood, lay out two legs for the table and four legs for the pair of stools. After cutting out, sand all surfaces and edges thoroughly to assure splinter-free furniture.

Assemble the pieces by interlocking lapped legs and fastening to tops as shown in photos at right and on the facing page. Colors for the tops of the furniture, of course, are optional.

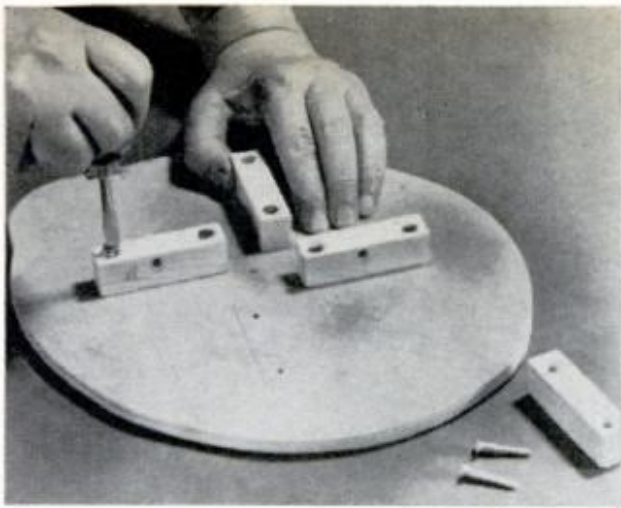
Caution: To protect your children, make sure you paint the furniture with nontoxic, lead-free enamels. If desired, gliders can be fastened to the bottom edges of the legs to protect floor coverings.—*Elma Waltner*



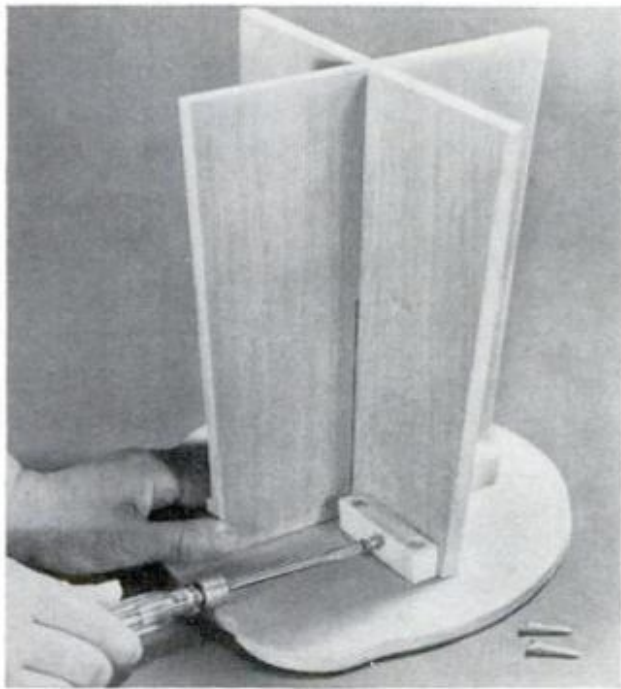
Lapped legs interlock to form solid base for stool (above) and table. Firm fit eliminates using glue.



Legs are positioned on the inverted top so locations of the predrilled cleats can be marked.



Cleats are screw-fastened to underside of top. Use two 1-in. screws through each 3/4-in.-thick cleat.



Legs are positioned and fastened to cleats using one 1-in. screw through each cleat into leg.

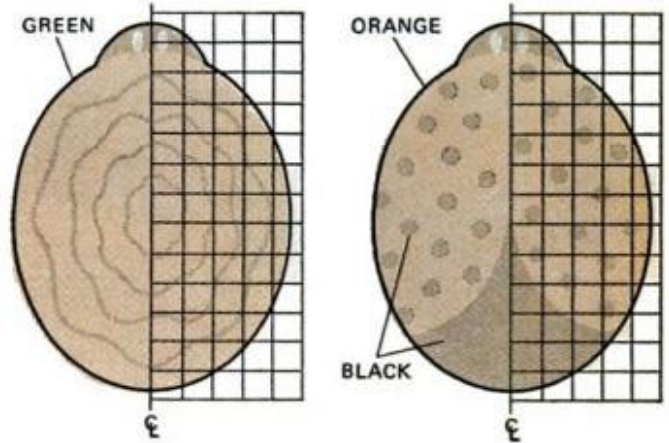
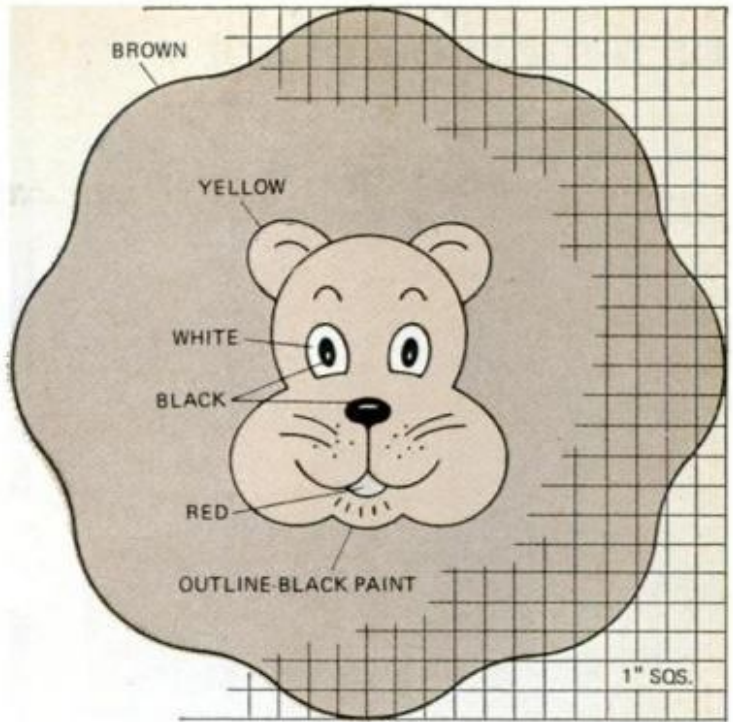
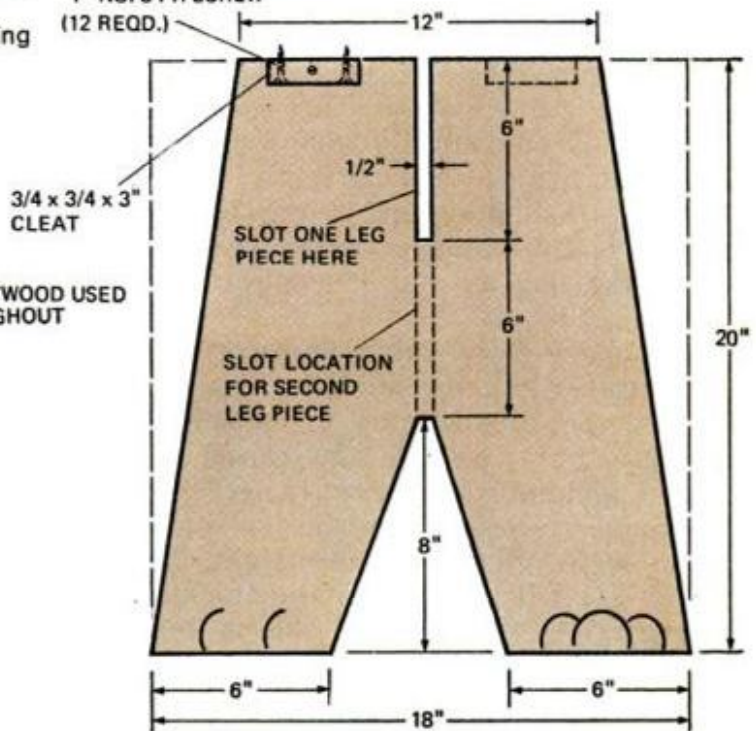
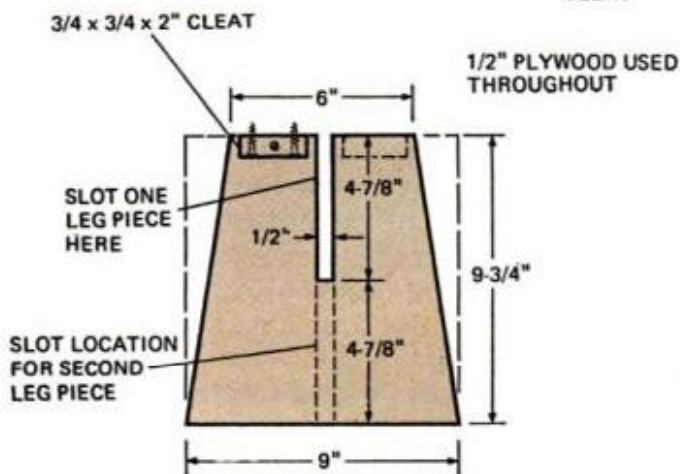


TABLE LEGS (2 reqd.)

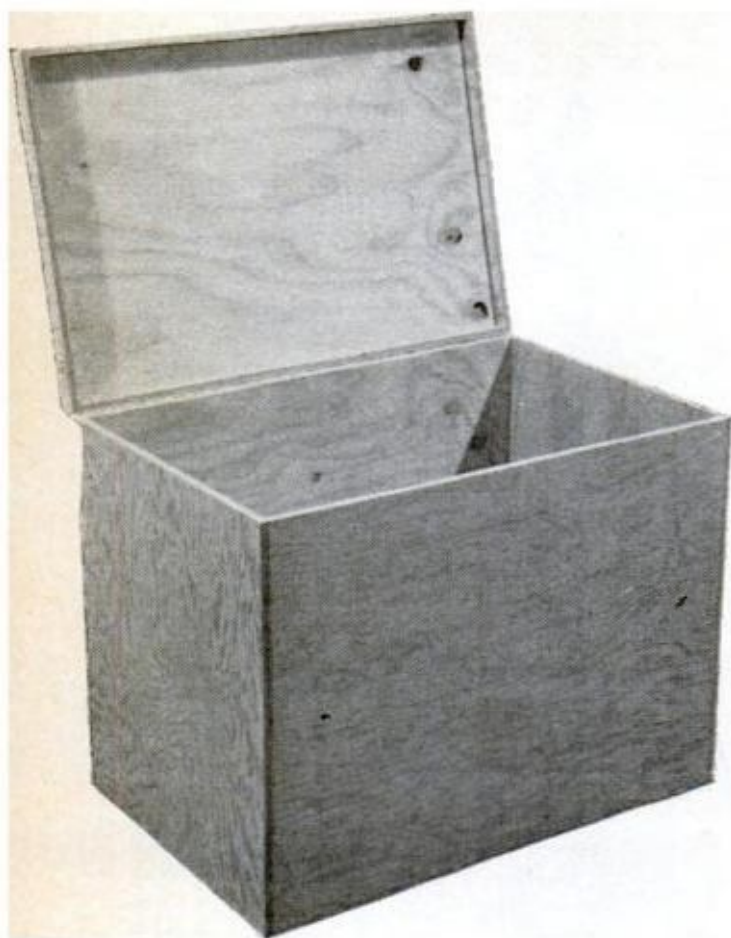
1" NO. 8 FH SCREW
(12 REQD.)



STOOL LEGS (4 reqd.)



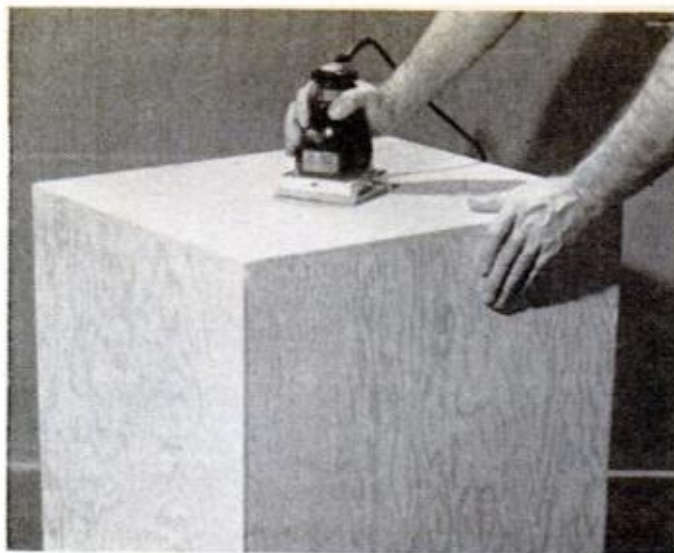
Neat-fitting lid for a storage chest



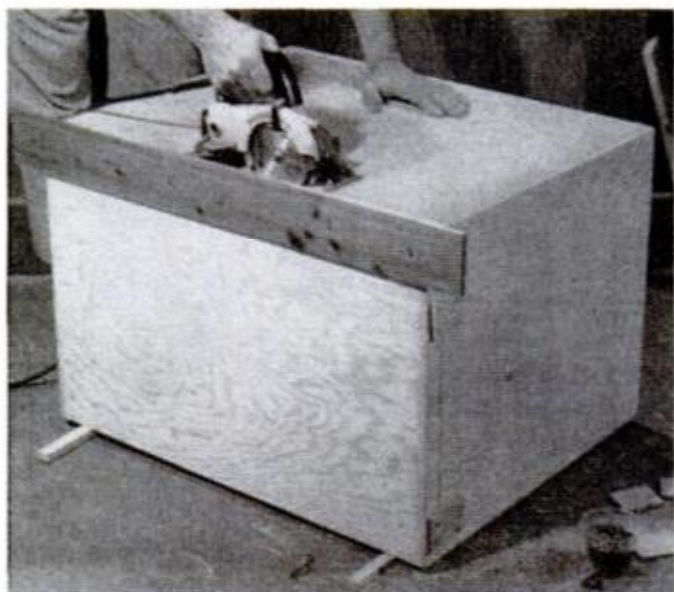
Lid fits box perfectly because—as the pros do—box was built as a fully enclosed unit, then top section was cut off for lid.

There's only one way to make a lid for a box that fits the box perfectly. As experienced workshopers know, any box can have a perfectly mated cover by first constructing the box as a fully enclosed unit and then cutting off the top.

Shown above is a fairly large storage chest. However, no matter what size box you build, the construction principles are the same. First assemble the closed box, using glue and nails or screws. If necessary, use diagonal braces to keep the box square and true while glue dries overnight. Nail or screw size will depend on the thickness of the material. (The general rule is to use a nail or screw three times longer than thickness of the stock being fastened.) *Caution:* Do not nail or screw along the line



After box is constructed, nails are set or screws countersunk, holes filled and all surfaces sanded.



Nailed board acts as rip fence for portable circular saw. Use hollow-ground combination blade to cut lid.

where you will be cutting off the lid. Sand the box thoroughly.

For a small box, the lid can be cut off with four passes on a bench saw. For a larger box, such as that shown, a portable circular saw with a smooth cutting blade (fine-tooth plywood or hollow-ground combination) should be used. For a saw guide, nail a straight board along the edge to be cut, allowing it to project above the edge slightly. With the saw set to a depth of cut that will penetrate the full thickness of the stock, make the first cut. To prevent shifting, nail two small cleats over the kerf using four small brads with each cleat. Relocate the guide strip and make the remaining three cuts, cleating each kerf as before.

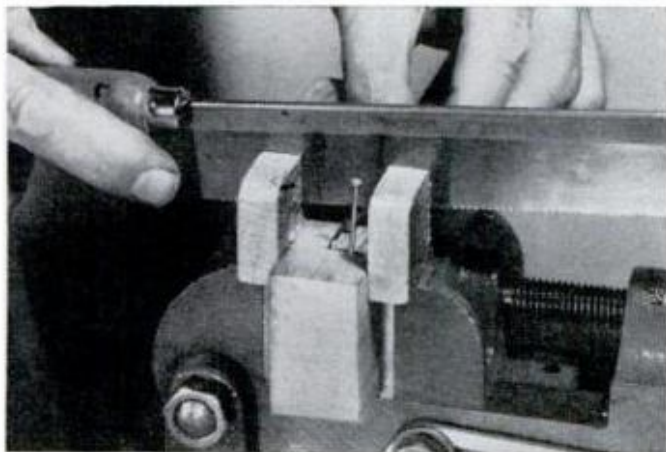
—Johnny Powell

Handsome trivet from scraps of molding

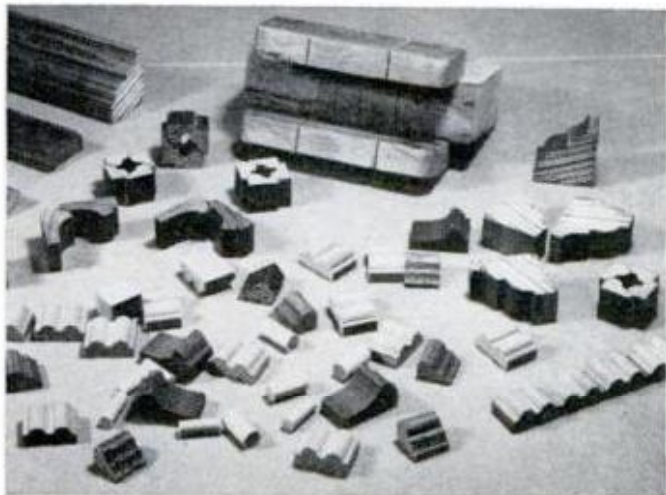
Don't automatically throw away scrap pieces (cutoffs) of wood moldings and dowels. Instead, use them to create highly unusual, attractive, useful objects. Likely, the decorative patterns thus formed will look like delicate, expensive fretwork.

One possibility is a striking trivet (right) of scrap pieces of oak, pine, walnut and maple moldings and dowels. Each piece is cut exactly $\frac{1}{2}$ -in. long using a fine-toothed saw and the simple "miter" box shown below. Parts are assembled in a pattern (see sample design, below, right) and joined with a strong glue. End grains are sanded and a thinned stain applied. (Make sure to remove all glue from ends as it will prevent the stain from penetrating.)

Remember, there are no fixed patterns

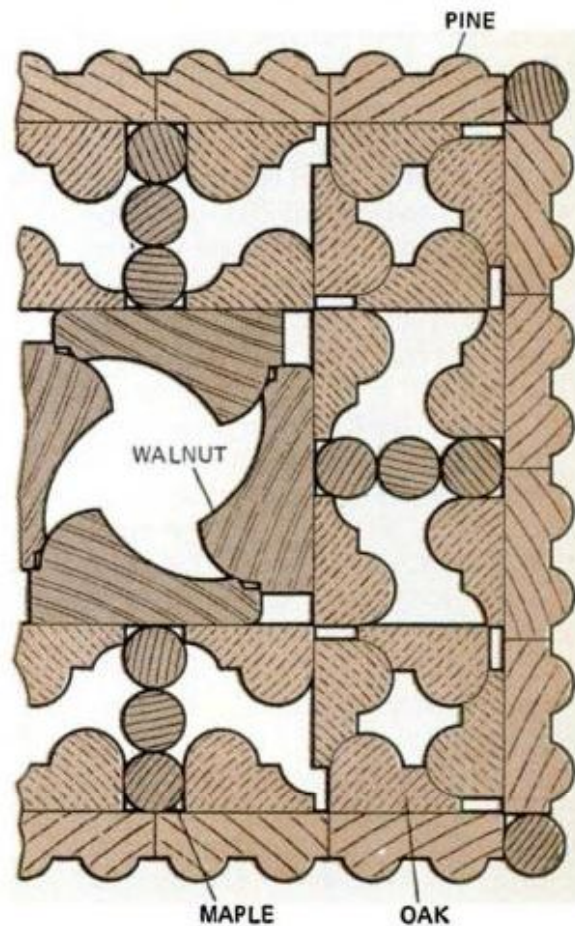


Fine-toothed hacksaw in "miter" box, with nail as a stop, cuts pieces squarely and to exact length.



Typical molding scraps shown can be assembled in any number of ways. The fun is in creating original ideas.

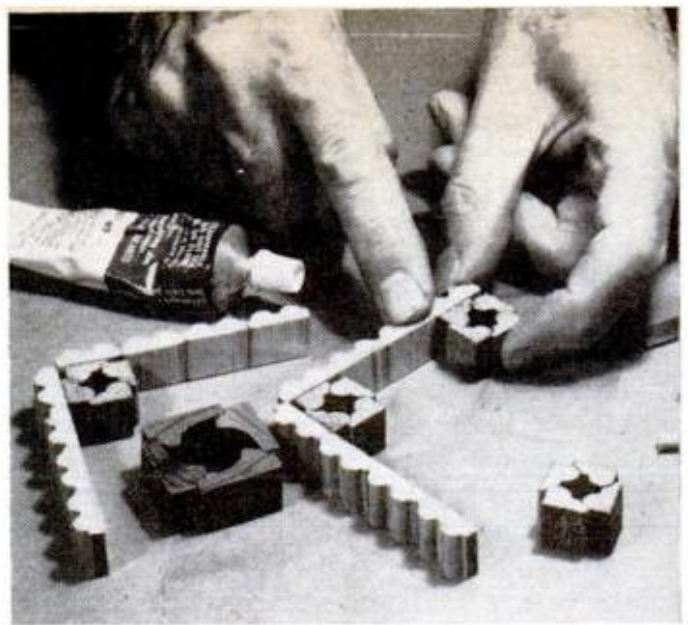
DETAIL OF TRIVET DESIGN



and various objects from serving trays to grillwork for screens can be made by imaginatively assembling and gluing scraps of molding and dowels. (Such objects should not be too large, however, as the small components will lack the strength to hold together under undue pressure.)

General hints: For smaller-sized projects, it is preferable to use pieces not more than $\frac{3}{4}$ -in. long. In assembling the parts, each should have at least two glued contact areas with surrounding pieces. After the basic design of the object is decided, any large opening should be reduced to produce a stronger assembly. (Dowels are good for this as they come in a variety of diameters.) Thinned orange shellac may be used for finishing the trivet if the wood will not be subjected to excessive heat.

—Walter E. Burton



Separate units are glued together; then openings are filled with single pieces to make strong assembly.

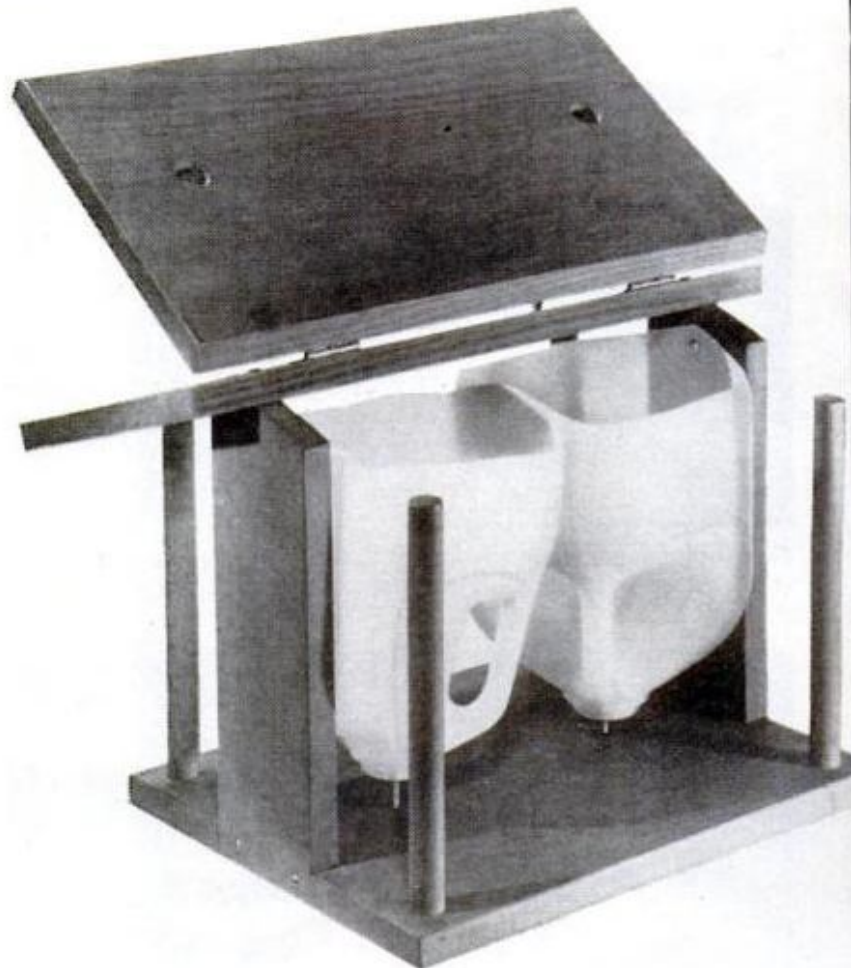
Automatic bird feeder

To delight the bird-watchers in your home, build this year-round, self-dispensing feeder that will attract birds in any season.

The bird feeder, of weatherproof redwood, consists of a notched floor, four dowel posts, two peaked sides and a hinged slanting roof. It gives ample room at front and back to view birds as they eat.

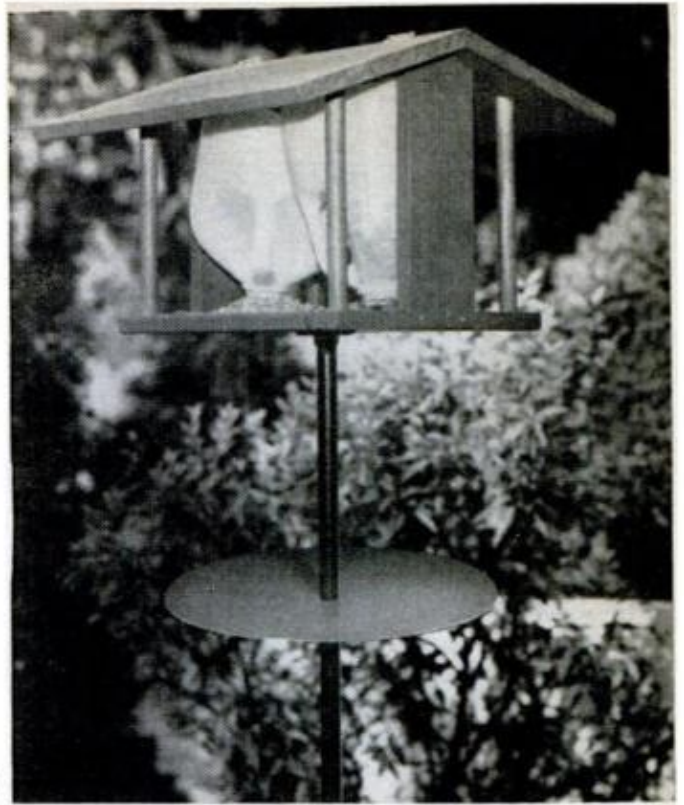
The post is a length of $\frac{1}{2}$ -in. x $8\frac{1}{2}$ -ft. galvanized iron pipe set into the ground 3 ft. The top end of the pipe is threaded to receive the pipe flange that is screwed to the floor of the feeder. A 12-in.-dia. aluminum disc with a 1-in.-dia. center hole slipped over the pipe is loosely secured to the pipe with a $\frac{7}{8}$ -in. machine washer and $\frac{1}{2}$ -in.-wide plastic electrician's tape wound around the pipe beneath the washer. This loose, tilting object can sometimes help prevent squirrels from reaching the feeder. (If desired, more than one disc can be attached.)

The receptacles are two inverted,

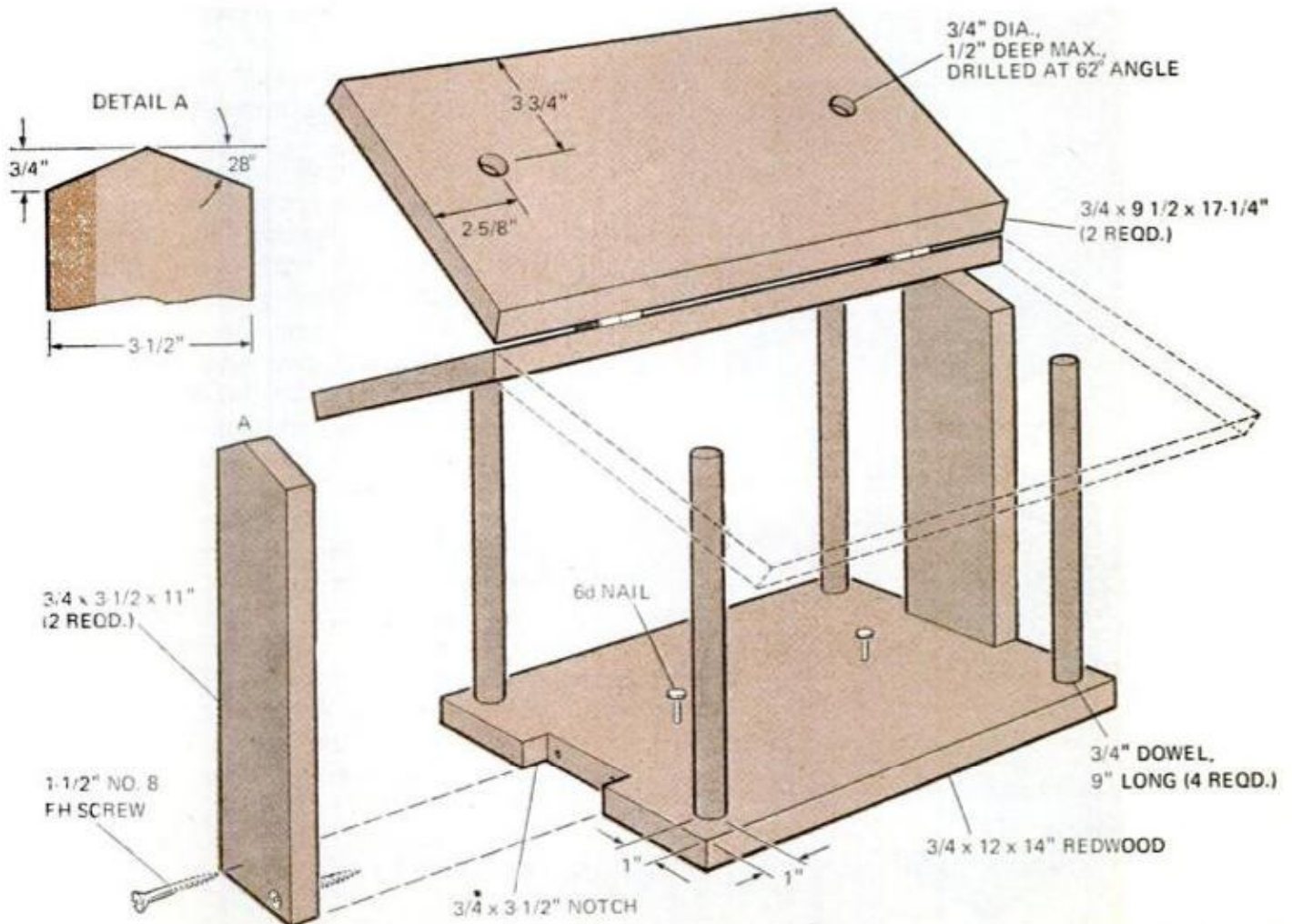
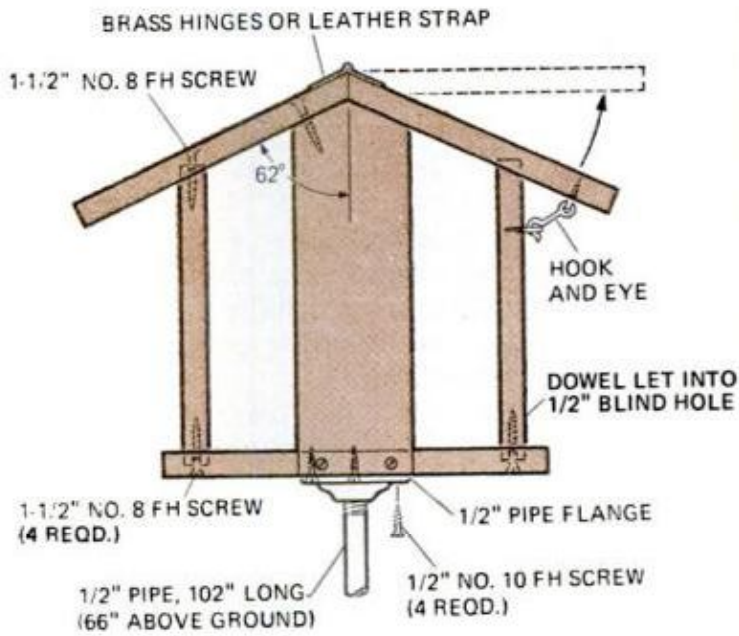


Unfastened half of hinged roof allows access to feed containers—two bottomless plastic gallon jugs.

bottomless plastic gallon jugs, each screwed to a feeder side with a 1/2-in. sheet-metal screw. The necks of these jugs are cut off below the threads of the cap and each straddles a nail in the floor of the feeder to give them stability when empty in strong wind. A discarded leather belt can be used as the roof hinge; simply nail it along each edge with 1/2-in. wire brads spaced 1 in. apart.—*Laurence J. Rasmussen*



Lightly secured disc that will tip easily is meant to discourage squirrels from reaching feeder.



Book-go-round for your desk

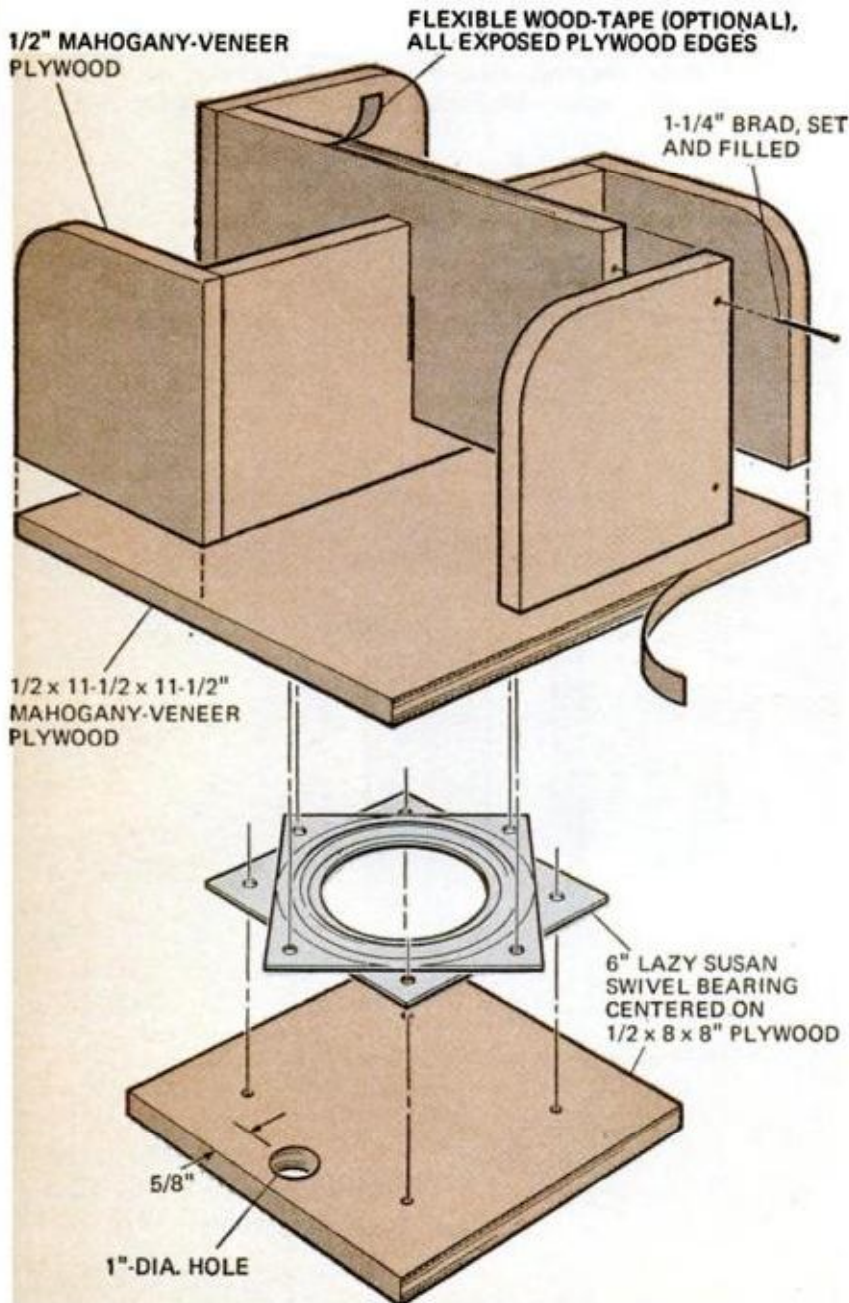
Here's a desk carousel for books that rotates with a flick of the finger for convenient access to any one of four compartments.

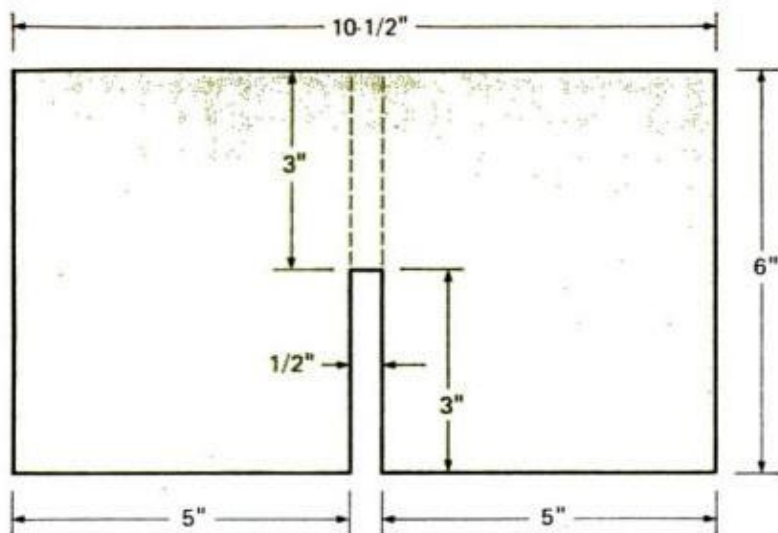
For good looks, cabinet-grade mahogany plywood is used. The unit is dimensioned so that all pieces can be cut from a standard $\frac{1}{2}$ -in. x 2-ft.-sq. sheet of plywood. (Use a scrap piece of plywood without a veneer for the 8-in.-sq. base piece because it does not show; the leftover piece of mahogany-veneered plywood can then be saved for another project.)

First cut the two crosspieces with slots in each piece exactly as wide as the stock is thick so they will fit tightly without using glue. (Because $\frac{1}{2}$ -in. stock is specified, slots should be $\frac{1}{2}$ -in. wide, but sometimes the standard thickness dimension is not exact.) Cut four endpieces, mark and saw a curve on one corner of each as shown in drawing on the opposite page and sand.

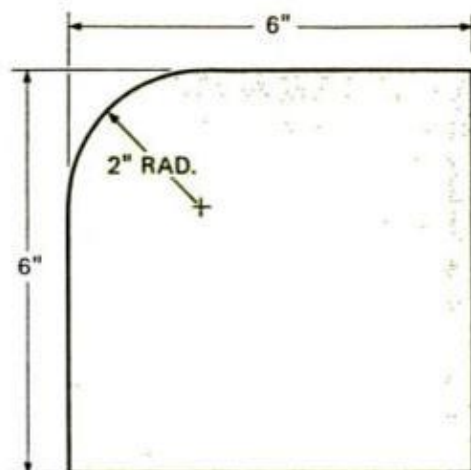
Glue and nail one pair of endpieces to each crosspiece using two $1\frac{1}{4}$ -in. finishing nails per joint. Set nailheads, fill with wood filler to match mahogany veneer and sand. Join notched crosspieces, turn upside down and glue and nail bottom piece in place. Drill 1-in.-dia. hole in base piece, positioned as shown in drawing at left. Screw bearing to base piece and then to bottom piece by rotating base piece with 1-in.-dia. hole to gain access to screw holes in upper plate of bearing as shown in photos at right. (The 6-in. lazy Susan bearing used here is a product of Triangle Mfg. Co., Oshkosh, Wis.)

Apply a clear finish on all surfaces. Edges should also be finished with paint or flexible wood tape that's stained to match the mahogany veneer.—Rosario Capotosto

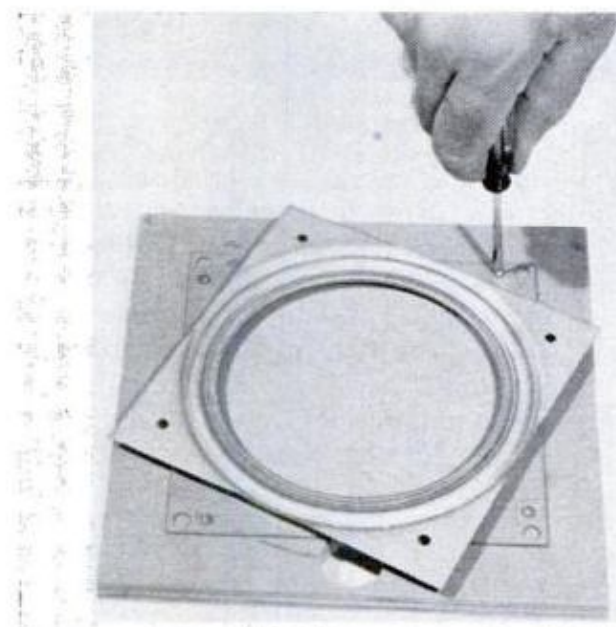




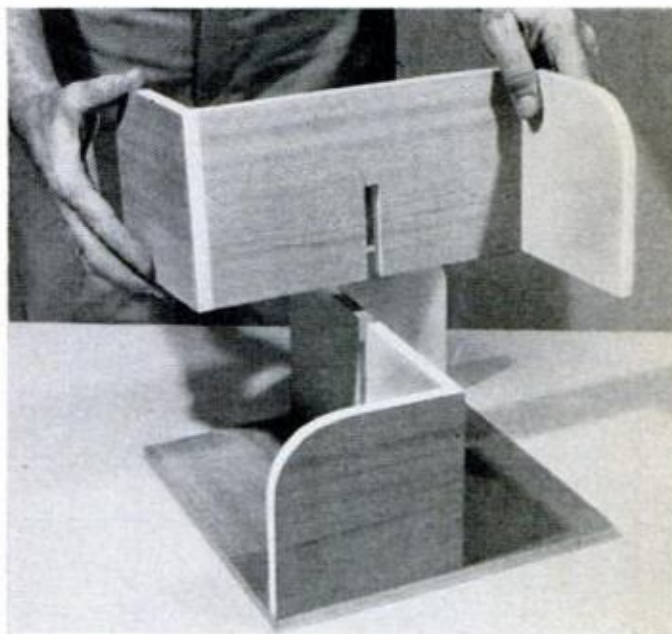
CROSSPIECE (2 reqd.)



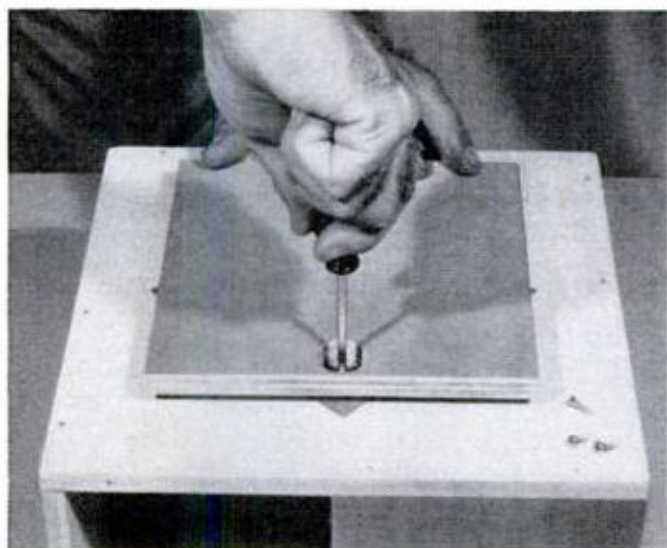
ENDPIECE (4 reqd.)



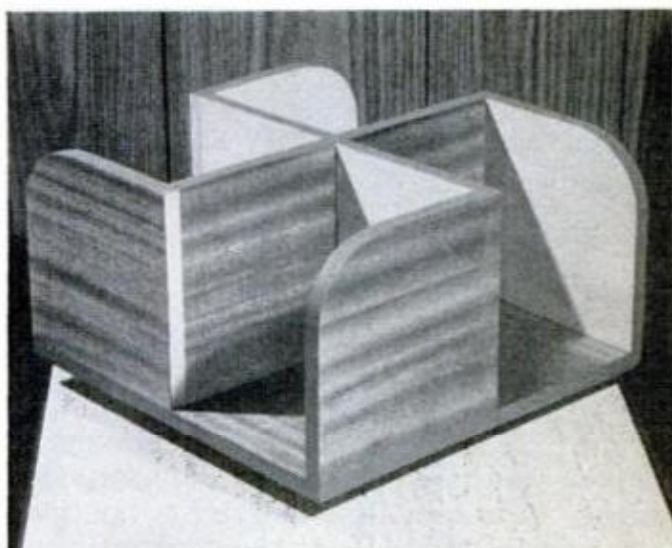
Bottom plate of 6-in.-sq. swivel bearing is centered and screwed to plywood base piece. Note access hole.



Pieces are test fit, endpieces nailed to crosspieces, latter fitted together and the bottom is attached.



Upper plate of bearing is attached to bottom piece of inverted book rack through access hole in base.



Mahogany-veneer plywood is treated with a clear finish, edges with paint or flexible wood tape.

HINTS

FROM READERS



Blocks make drain pipe

Reclaimed cinder blocks can be made into a serviceable drainage pipe. Dig a trench 3 or 4 ft. deep and at least 1 ft. wide, pitched toward a dry well or stream. Hold blocks in position with stones wedged between them and the trench walls. Place plastic or 15-lb. felt over joints to keep dirt out of water passage. Refill the trench and grade.

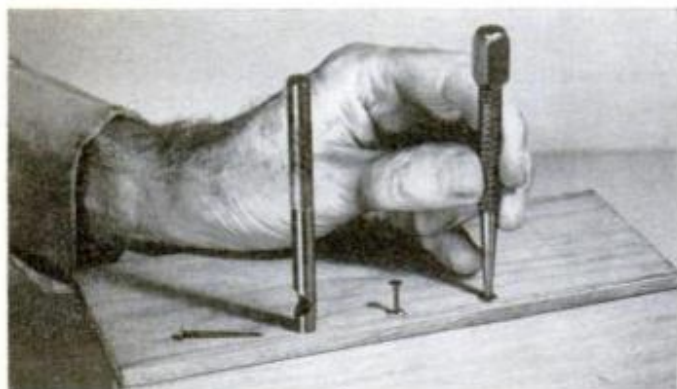
—Tony Sgro, Newburgh, N.Y.



Ice trays for storage

Everyone has a favorite way to store small parts and tools. Mine is in refrigerator ice-cube trays obtained cheaply at a discount store. They are kept in a rack I made from scrap $\frac{3}{4}$ -in. plywood. Rack sides were grooved to take the lips of the trays. With some tray types, dividers can remain in place to make compartments for small parts.

—Arthur L. Ramos, San Anselmo, Calif.



Countersinking common nails

Common nails, superior to finishing nails in holding strength, are difficult to countersink without raising splinters. But not if you first use a hollow leather punch to mark their locations. Use a punch diameter that roughly matches nailhead size. You can then drive and set the nails as though they were the finishing type.

—Harry J. Skelton, Eugene, Ore.



Socket-fit for tap extension

A slip-on extension which seats and "locks" itself over shouldered end of the tap is easily made by cross-drilling the extension at base of its axial hole. The latter is made about $\frac{1}{16}$ in. smaller in diameter than the tap, after which the cross hole is filed, top and bottom, to produce two flats. Finally, all but $\frac{1}{4}$ in. of the axial hole is rebores to accept tap's shank.—E. B. Walters, Chicago

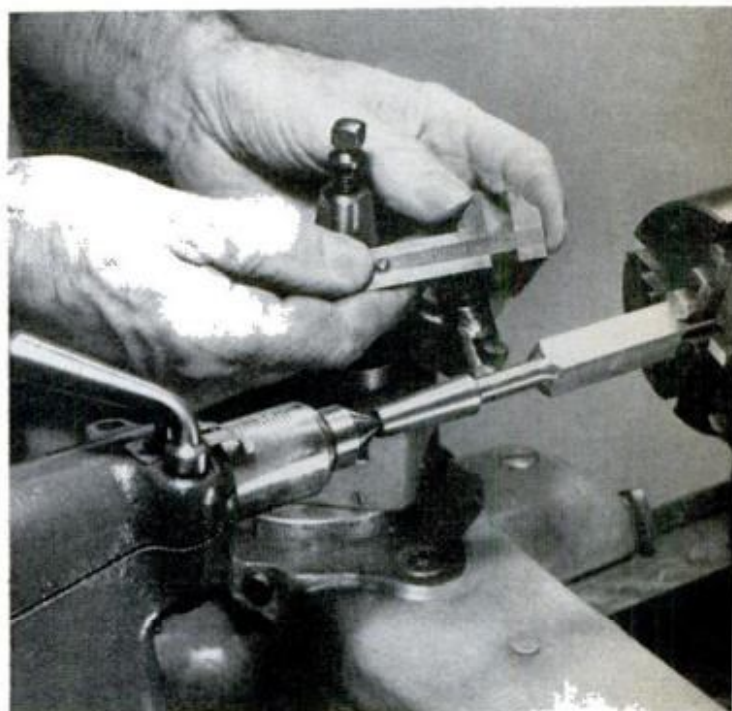
Socket holder for a brace



Adapter couples $\frac{1}{2}$ -in.-sq. drive sockets to carpenter's brace (above) making it a powerful wrench that's easily controlled—and has reversible ratchet.

Socket holder is machined on the lathe (above, right) from $\frac{1}{2}$ -in.-sq. bar stock, could be formed by grinding and filing.

Spring-loaded bearing ball holds sockets on adapter (right). Hole diameter is a bit larger than ball, spring; hole is peened over to hold them.



By means of a simple adapter, a carpenter's brace can be made extra useful as a socket-wrench driver—especially good for tight spots and where maximum torque is needed.

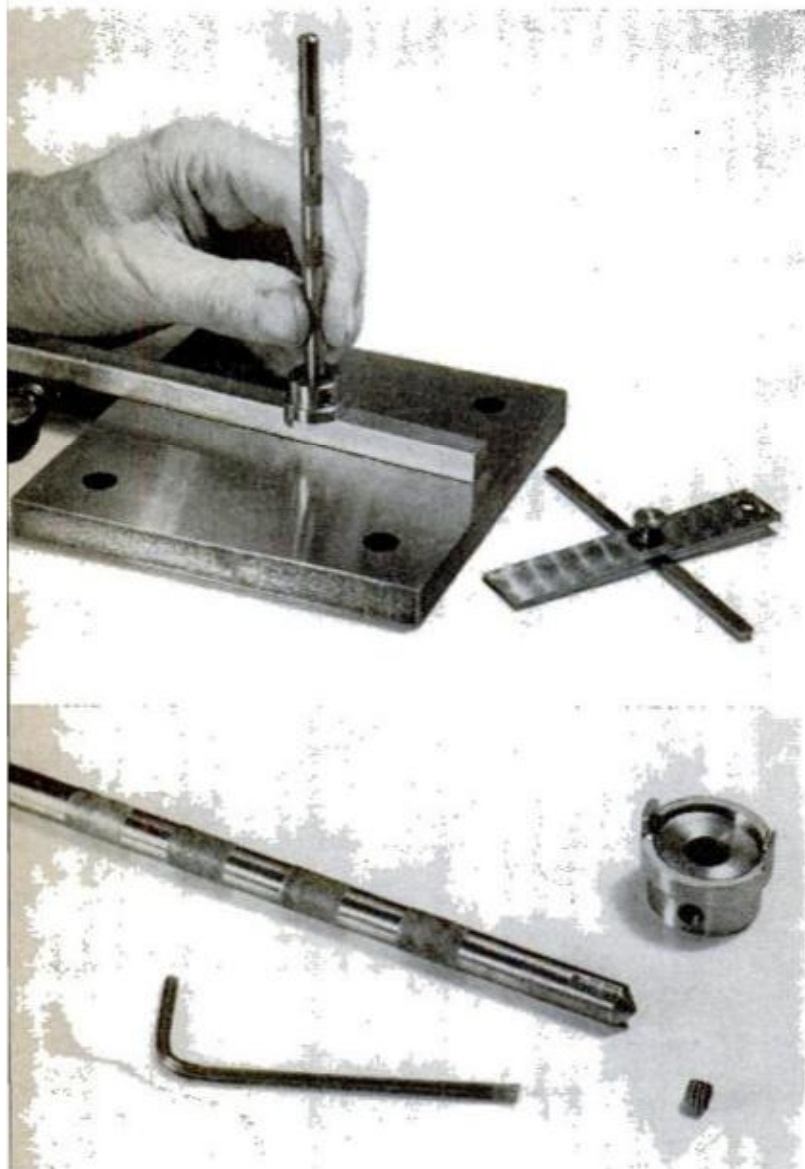
The photos show construction of a square connector for sockets with $\frac{1}{2}$ -in. drive holes. Start with $\frac{1}{2}$ -in.-sq. steel bar stock, turning an initial round taper and a sufficient length of round shank—usually 1 in. by $\frac{1}{4}$ in. in diameter. Milling, grinding or filing squares the taper (using an auger bit as a guide) so that brace jaws will grip it firmly. The bar is cut off to the desired

overall length—5 in. is normal, although several sizes will be found handy.

A $\frac{1}{4}$ -in. retaining ball was used for the unit shown. The ball and its spring were located in a fractionally larger hole drilled about $\frac{5}{16}$ in. from the end of the adapter (check the sockets you plan to use for this dimension). The ball was forced into the hole and held in place in a vise, with jaws covering about half the opening, and the rim of the hole was peened slightly over the ball by light punch marks. The piece was then shifted in the vise and the rest of the rim peened—Walter E. Burton.

Midpoint punch finds the spot

by Walter E. Burton



Punch is positioned (top) to spot-mark the location of a hole to be drilled halfway between the sides of a $\frac{3}{8}$ -in.-square steel bar. The tool is held with a twisting motion that keeps its projecting ears pressed against the sides of the bar, and tapped with hammer. Midpoint punch has just three parts: punch itself, collar with projecting ears and $\frac{1}{8}$ -in. 8-32 Allen-head setscrew to hold collar on punch. Knurled bands on punch shank make punch easier to grip firmly.

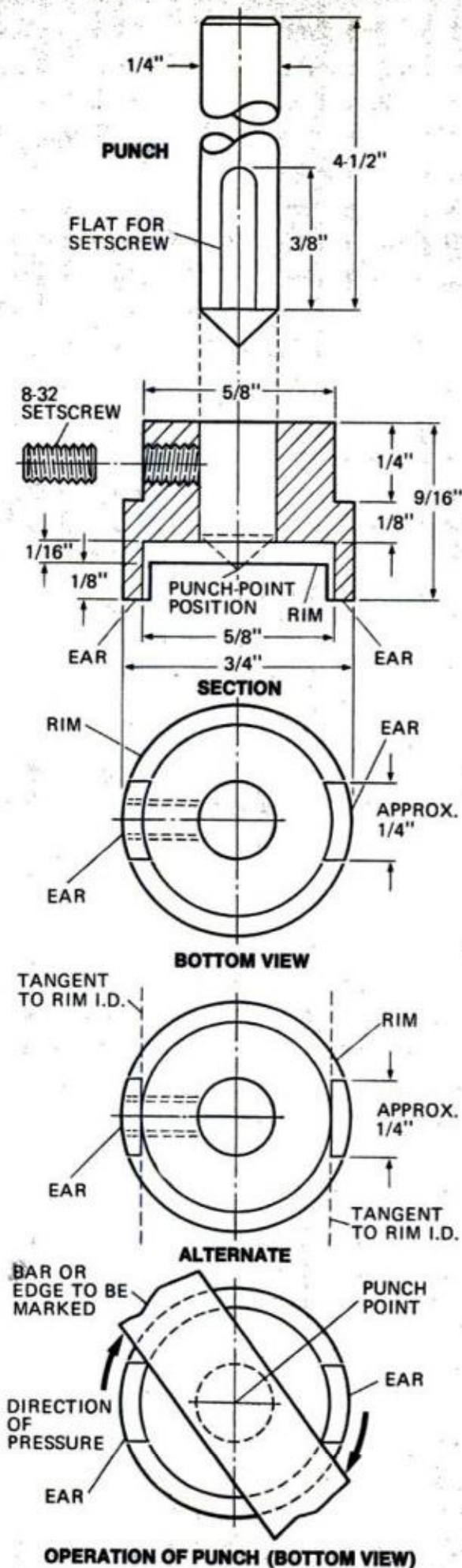
If you have ever tried to make a punch mark accurately located between the sides of a bar or faces of a plate, you know how frustrating the process can be. Working freehand, it's just about impossible, and laying out a centerline first is itself an annoying chore.

The simple "midpoint" punch on these pages was designed to convert that frustration into a kind of automation. All you need do is place the tool across the bar or plate edge, twist it until its two projecting ears press firmly against the surfaces at right angles to the one you want to mark, and tap the punch head with a hammer. Then use a separate, conventional center punch to enlarge the mark so that it can be used to guide a drill-bit point. The punch shown was made to locate and mark midpoints of surfaces up to about $\frac{5}{8}$ in. wide. Larger work would require a greater collar diameter. The tool can, of course, be scaled to any needed size.

The punch proper is a $4\frac{1}{2}$ -in. length of $\frac{1}{4}$ -in. drill rod. One end is turned to a point with an included angle of about 70° , and the other end (the punch head) is chamfered. Knurled bands along the punch body improve grip. A setscrew flat extends back about $\frac{3}{8}$ in. from the base of the hardened tip.

The collar is shaped as shown on the facing page. Its larger outside diameter is an exact $\frac{3}{4}$ in. It is important that this dimension be some standard width and reasonably accurate, because you will make measurements from the collar to position the punch mark.

The collar is machined to an inside diameter of $\frac{5}{8}$ in. for $\frac{3}{16}$ in. of its

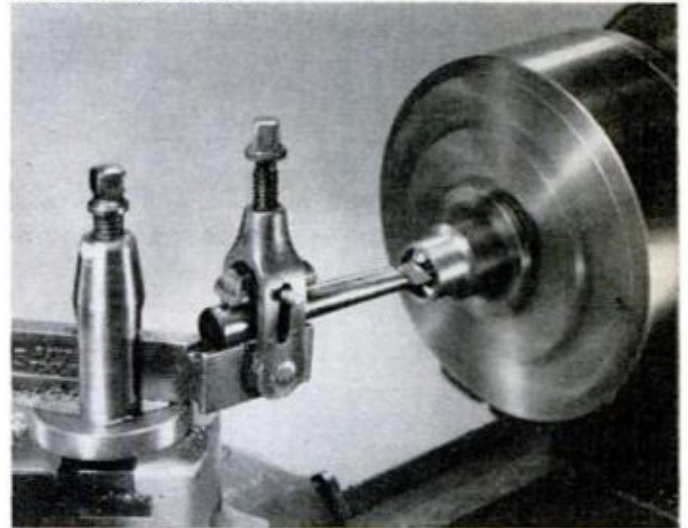


length. To start, a $\frac{1}{4}$ -in.-diameter axial hole is drilled through the piece. A portion of this is enlarged to $\frac{1}{2}$ -in. diameter with progressively larger twist drills. Then the cavity is bored to its final $\frac{5}{8}$ -in. diameter and $\frac{3}{16}$ -in. depth (below). An 8-32 setscrew hole is drilled and tapped in the collar.

Portions of the $\frac{1}{16}$ -in. rim formed by the boring are cut away, for a distance of about $\frac{1}{8}$ in. measured parallel to the axis, to leave two diametrically opposite ears, each about $\frac{1}{16} \times \frac{1}{8} \times \frac{1}{4}$ in. The cutting operation on the tool shown was done by milling, but sawing and filing are acceptable alternatives. Final shaping of the ears with a fine file must be done carefully—location of the ear edges determines accuracy of the finished tool.

With the collar mounted, test marks are punched and their positions measured to determine accuracy of centering. When the ears are properly shaped, the punch marks the same spot whether the collar is turned clockwise or counterclockwise to bring the ears against the workpiece. ★★★

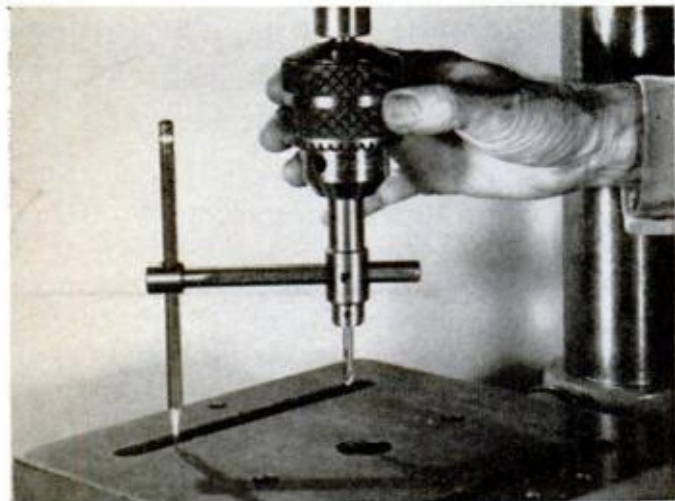
Photos by the author



Collar is bored to give $\frac{5}{8}$ -in.-diameter recess about $\frac{3}{16}$ in. deep (top). Portions of rim are then cut away to form ears, which are brought to final size and shape with a fine file.

HINTS

FROM READERS



Checking level of drill-press table

A quick way to check whether your drill-press table is level or not is to insert a circle cutter in the chuck equipped with a pencil instead of the cutter bit and rotate the cutter. If the marked circle is incomplete, table is not square with the chuck.

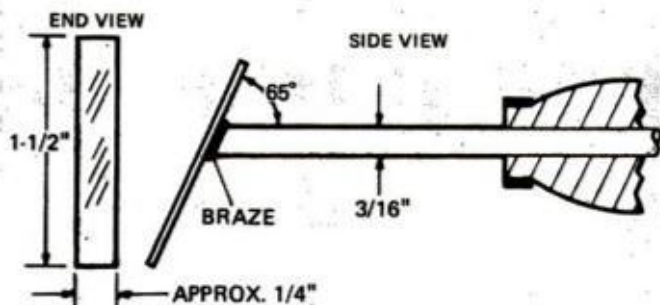
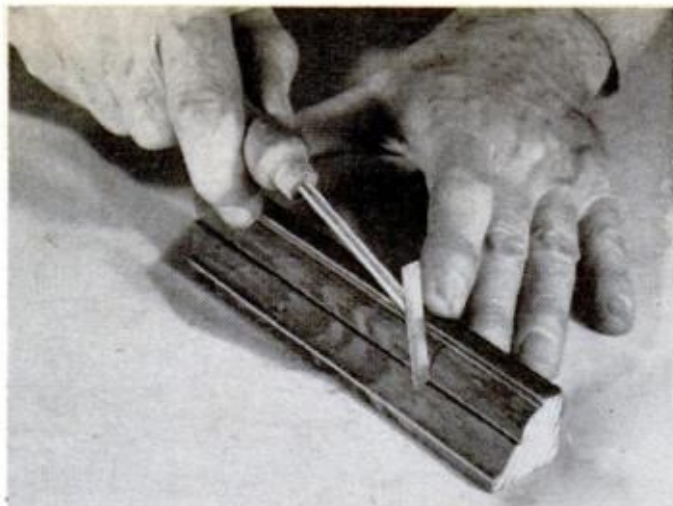
—Bertram Slanhoff, Scarsdale, N.Y.



Gluing clamp makes vise

A standard pipe clamp with pipe bolted to the edge of your workbench provides an excellent vise for holding large workpieces for sanding or routing. The pipe is spaced out from the bench with blocks to allow the movement of the clamp's sliding fixtures.

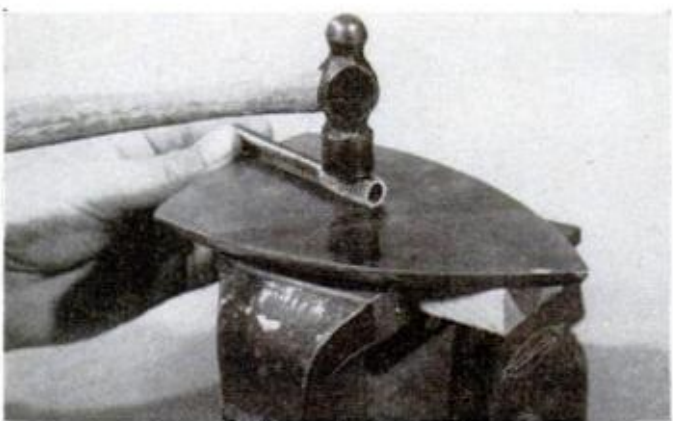
—Walter W. Gunkel, Utica, Mich.



Lawn-rake tine becomes scraper

A section of a steel lawn-rake tine can be used as a small scraper by brazing it to the beveled end of a steel rod fitted to a wood handle. Custom scraper ends can be sharpened like a wood chisel or ground and burnished to get edges like those on a cabinet scraper.

—Walter E. Burton, Akron, Ohio.



From iron to anvil

If possible, salvage the base from an iron about to be discarded and bolt it to a small piece of scrap lumber. When the wood section is clamped in a bench vise, the flat surface of the iron's base makes a convenient, surprisingly rigid shop anvil for light jobs.

—Ken Patterson, Regina, Sask.

You need facts to pick the right pickup. Here are 12 about the '74 Ford.



1 Ford cabs are quiet, car-like, roomy. Inside width of 66 inches lets three big men ride relaxed. Padded dash is standard.

2 Even the standard cab has the comfort of a full-foam seat 7 inches deep.

3 You can choose a Ford Six or, for heavy loads, V-8's up to 460 cu. in.



4 Optional air conditioning is built right into the dash for good air circulation, full legroom.

5 Front disc brakes are standard on all '74 Ford pickups with 2-wheel drive.

6 Ford's optional slide-out tire carrier makes the spare easy to remove.



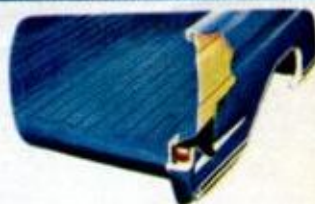
7 Behind the seat is a hidden storage space 5½ feet wide. It's big enough to hold tool boxes or gear.



8 Ford took the gas tank out of the cab and put it in a protected position under the box, inside the frame.



9 Only Ford has Twin-I-Beam suspension for truck strength, carlike ride.



10 Sides of cargo box are double-wall full depth. Over 200 sq. ft. of surface is zinc-coated to resist rust.



11 Ford pickups come big as 10,000 lbs. GVW, like this F-350 Super Camper Special, to meet your needs.

12 Over 92 out of 100 Ford trucks built in the last 12 years are still on the job, based on R. L. Polk & Co. figures. For a durable truck, see your Ford Dealer.

A better idea for safety: Buckle up.

**Works like a truck.
Rides like a car.**

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FORD DIVISION





Classic chandelier you can make for less than \$45

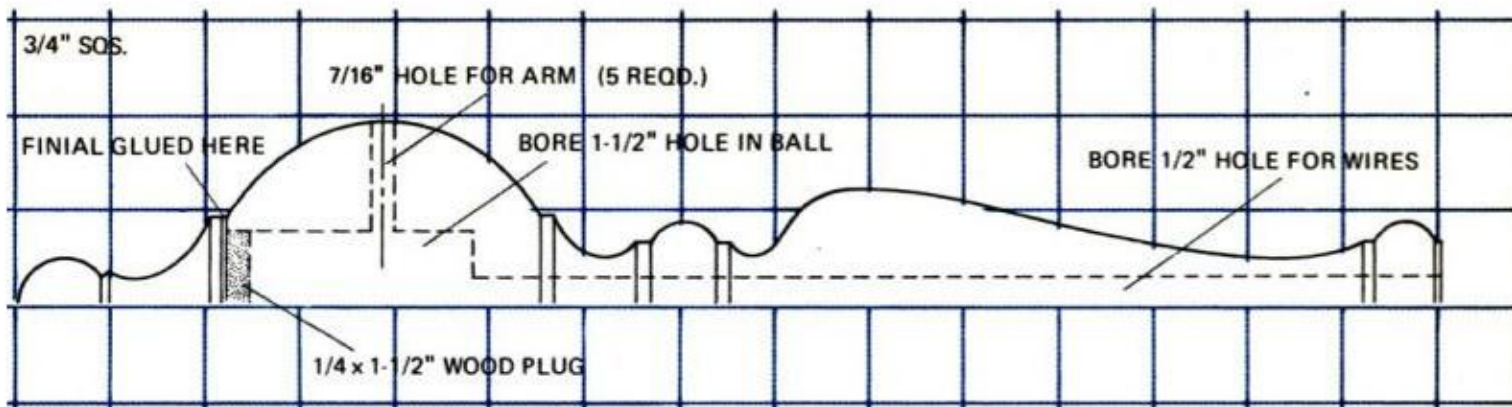
by Rosario Capotosto

Color photo: Robert Borst

A chandelier always adds elegance and warmth to a room. And when you create it yourself, the result is always gratifying and much less expensive than buying a similar item. All parts except the wood spindle come in an easy-to-assemble kit so

most of the work involves turning a 4x4x18-in. mahogany block in a lathe.

Mount the block in your lathe, shave off corners and, using a gouge, roughly shape the block into a cylinder. Make a full-size drawing of the profile and on this drawing



TEMPLATE FOR MAHOGANY SPINDLE OF CHANDELIER

indicate a line through the cross section every $\frac{1}{2}$ in. or so. Now transfer these lines to the cylinder to guide you in making parting-tool cuts.

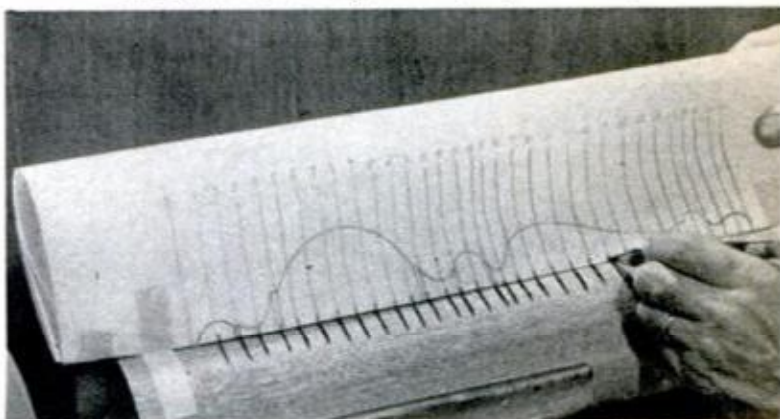
Set your calipers at each "station" to within $\frac{1}{8}$ in. of the actual cross section of the profile pattern and make a parting cut to this depth. The parting cuts leave waste discs of wood which are then removed with round nose, spear point and skew chisels to produce the desired profile. Next, using the lathe's indexing pin, divide the large ball into five equal distances around its center, punch mark, then remove the turning from the lathe. The five holes are drilled with the turning cradled in a jig consisting of two blocks nailed to a base. Two nails driven through the blocks at precisely the same height are partially driven into the center end holes in the turning. Clamp the jig to the drill-press table and bore the five holes to a depth of $1\frac{1}{2}$ in. with a $\frac{7}{16}$ -in. bit. If you have any space between the jig base and the ball, insert a paper wedge so that the turning has solid support.

When it's bored, put the turning back in the lathe and give it a thorough sanding. Now, with the toolrest for support, hold a hacksaw in position over the finial cut line, turn on the lathe and slowly bring the hacksaw down to make contact. Cut about $\frac{1}{2}$ in. deep—not all the way through yet—to permit further sanding.

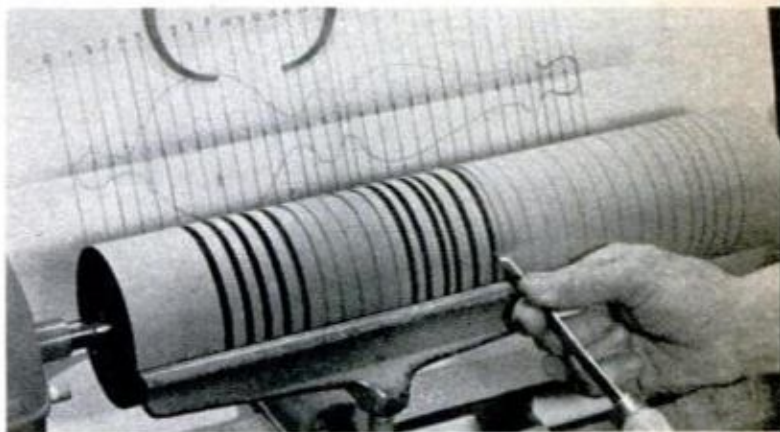
While the piece is stationary, apply mahogany paste wood filler, let it set for 20 minutes and wipe off the excess filler with a piece of burlap while the lathe is running at low speed. Let the filler dry overnight and then brush on two coats of Satinlac, sanding lightly between coats with 600-grit paper.

Cut the finial off completely now by grip-

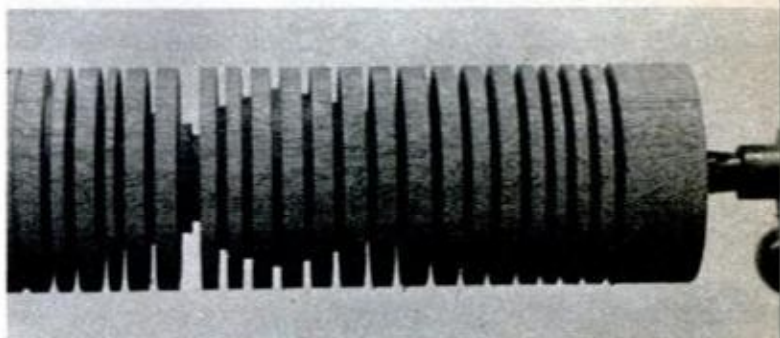
Chandelier from an original design by Bill Ward, AIA



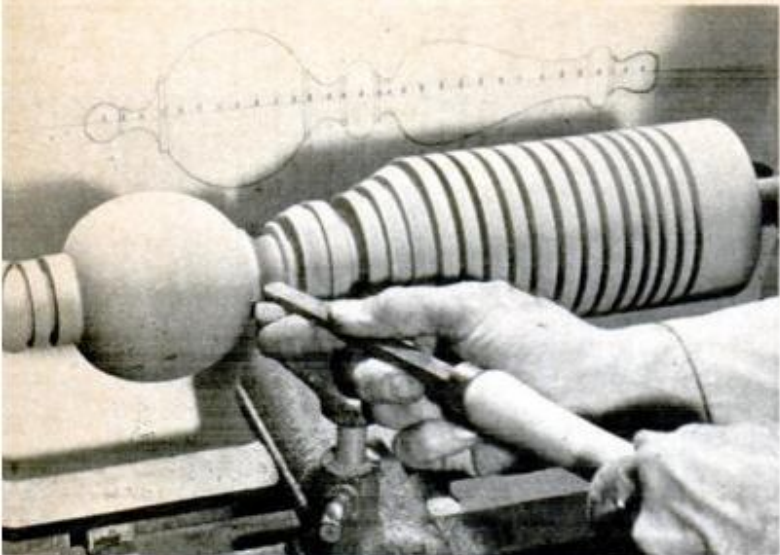
Full drawing of piece is made, folded in half; $\frac{1}{2}$ -inch profile guidelines are marked and transferred to stock.



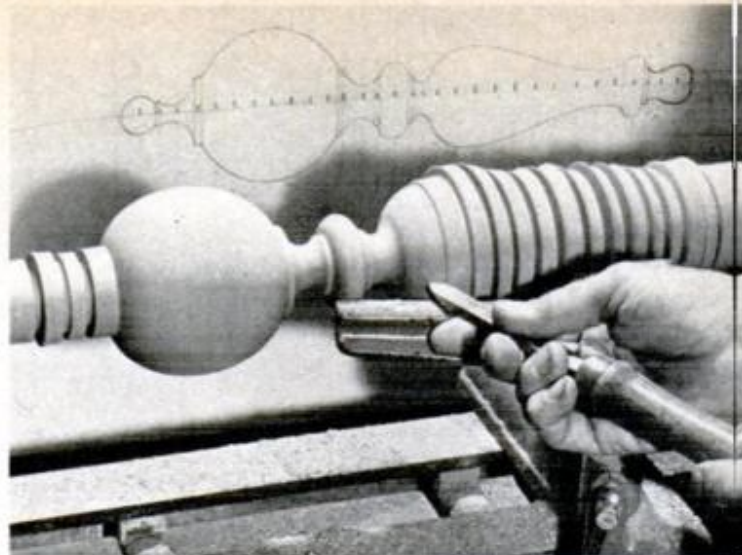
Check diameter of piece at each mark on drawing with calipers; then cut stock at each mark to depth.



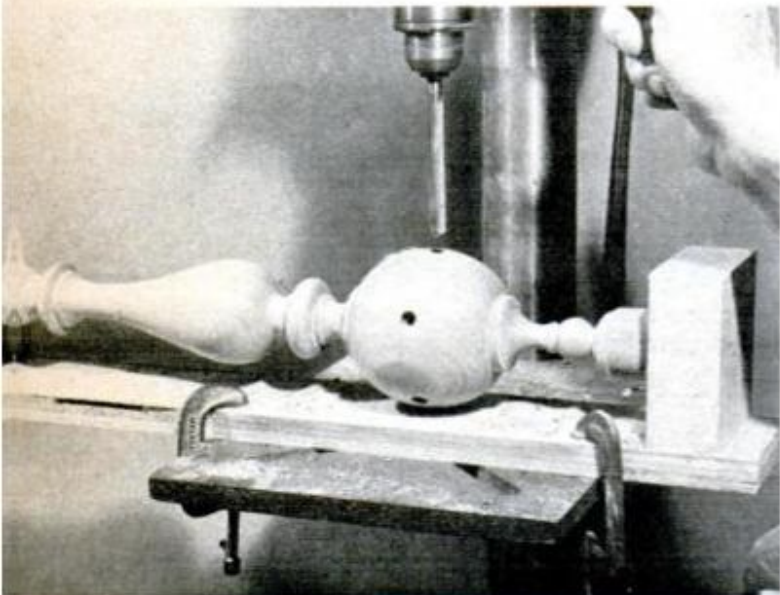
When all of the parting cuts are done, the profile of the turning can be seen through the cuts.



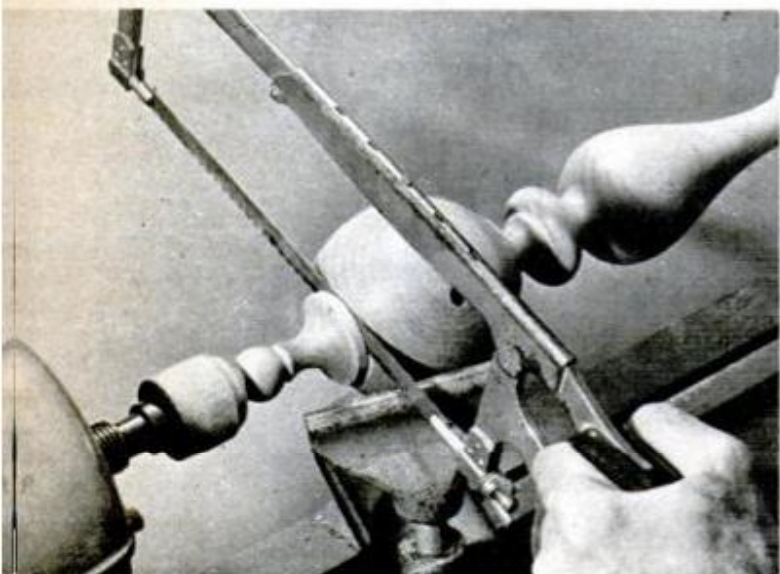
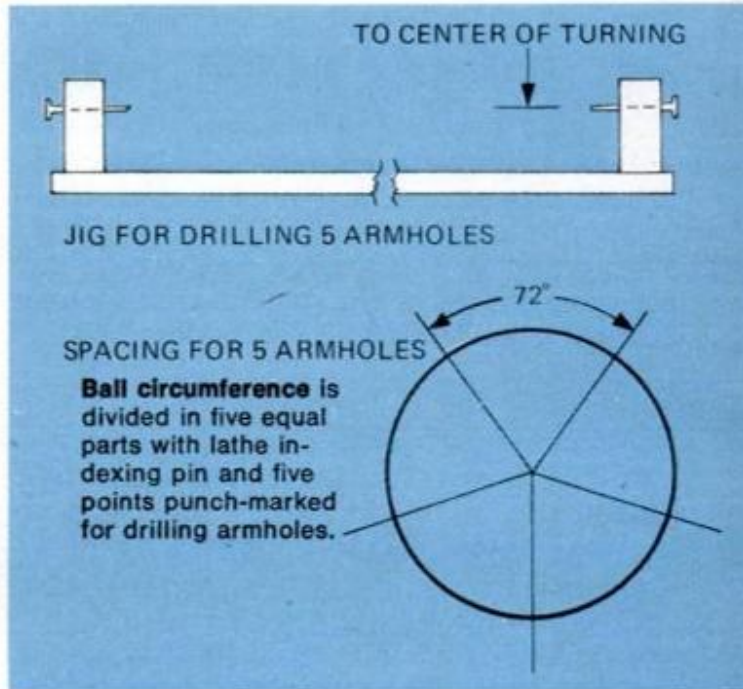
Waste rings of turning are removed with gouge. Hollow areas are shaped with a round-nosed chisel.



Spear-point chisel is used to smooth and form areas where its shape fits the contour of the work.



Simple jig assures accurate drilling of armholes. A nail through each end holds piece exactly horizontal.



Finial of spindle is partially cut off with hacksaw, sanded, full spindle finished and finial cut off.

ping the ball lightly and have a helper handy to catch it. Next, mount the turning vertically on the drill press and bore two holes centrally through it, first a $1\frac{1}{2}$ -in. diameter hole $2\frac{1}{4}$ in. deep with a spade-type bit, then a $\frac{1}{2}$ -in. hole, drilling from both ends. With a nut on the lower end, insert the $\frac{1}{8}$ -in. conduit nipple in the $\frac{1}{2}$ -in. hole through the center of the turning and tighten the chain loop at the top.

The arms are attached to the wood turning with $\frac{1}{8}$ -in. pipe nipples and hex nuts. The nipples are cut about $1\frac{5}{8}$ -in. long from a length of fixture pipe which comes with the kit, and are screwed into ball-shape elbows which are screwed to the lower ends of the arms.

(More illustrations on page 162; text continues on page 164)



**"For an amateur,
he's a whiz.
How'd he get
so good?"**

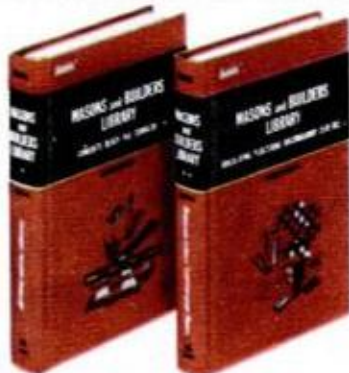
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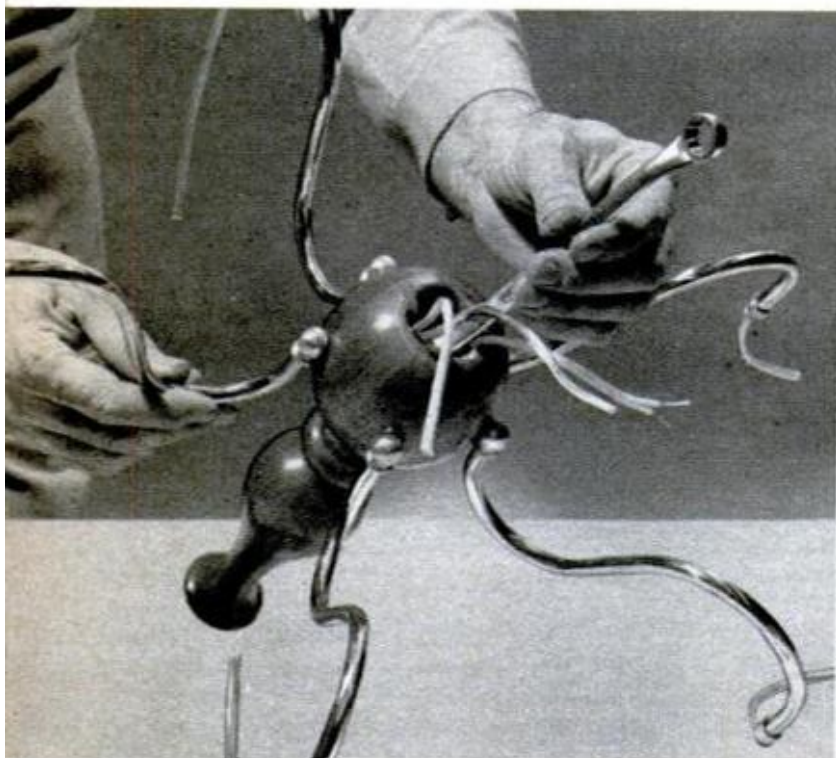
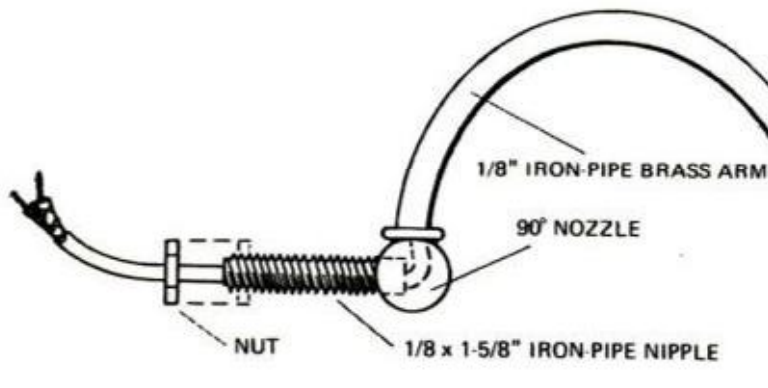
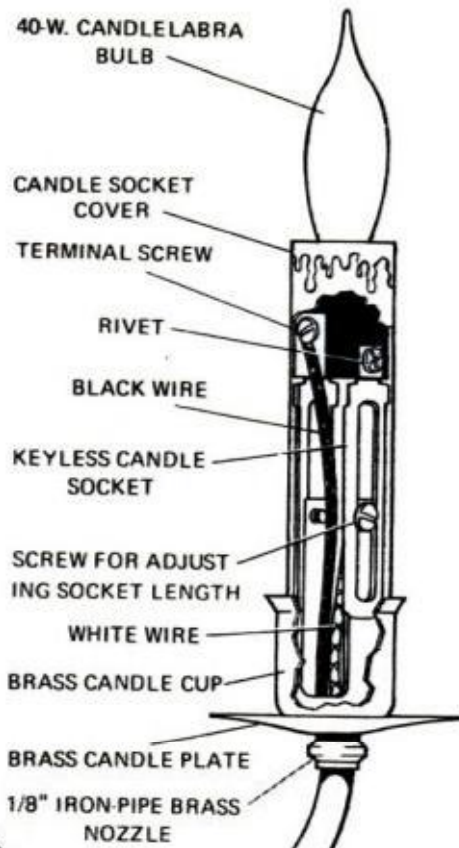
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Lamp wire is first threaded through S-shaped fixture arm and thread-locking sealant applied to help secure brass nozzle and elbow at ends. Nipple screws in 90° elbow.



All five arms are wired and nozzles and nipples attached. Each nipple is inserted in an armhole and hex nuts screwed onto the nipples from inside. Hex wrench is used to tighten nuts.



Chandelier sockets have screw at each side to adjust length. Length is set so socket rests just below the candle cover.

(More photos on page 164)



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Bead of clear epoxy is applied at joint between nipples and spindle to prevent lateral swing of arms.

A lamp cord is poked through each arm and the conduit, then the arms are attached permanently. You'll have a total of six black wires and six white wires inside the ball cavity. All the whites are joined together and all the blacks with wire nuts.

After the wiring is completed, the candle sockets connected and the arm nuts tightened securely, the ball cavity is closed with a wood plug, which is glued in place. Then the rounded end of the finial is completed, hand sanded, touched up with lacquer and finally centered and glued to the plug.

To hang the chandelier, connect the chain to the "hanger" loop at the end of the conduit and thread the wires in and out through the links of the chain. *Now turn off the power* and connect the black wire to the black wire in the ceiling outlet box and the white wire to white. Finally place the canopy over the outlet-box hickey and tighten the ring nut on the hanger to hold it.

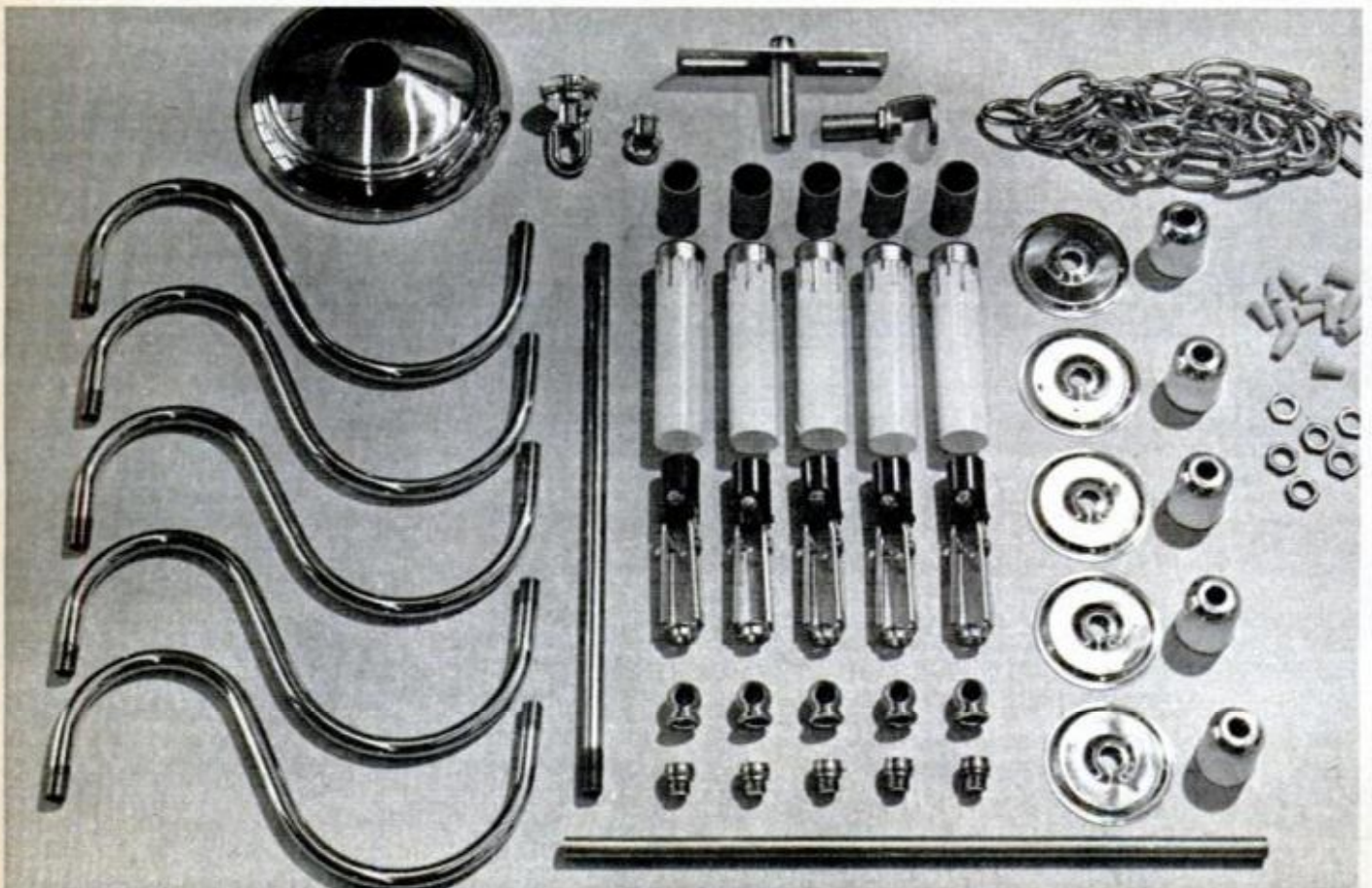
The chandelier kit No. 505 (shown below) can be obtained for \$36 postpaid from J.C. Armor Co., Box 290, Deer Park, N.Y. 11729. ★★★

CLASSIC CHANDELIER

(Continued from page 162)

The nipples should extend into the cavity of the wood ball far enough to take the nuts. Thread sealant, such as Stop-It, is used on the threads of the arms when you're screwing on both the elbows and the nozzles (to which the candle sockets are attached) so they won't come loose.

All chandelier parts, except spindle, are available in a kit (see text). Four feet of lamp wire is also supplied.



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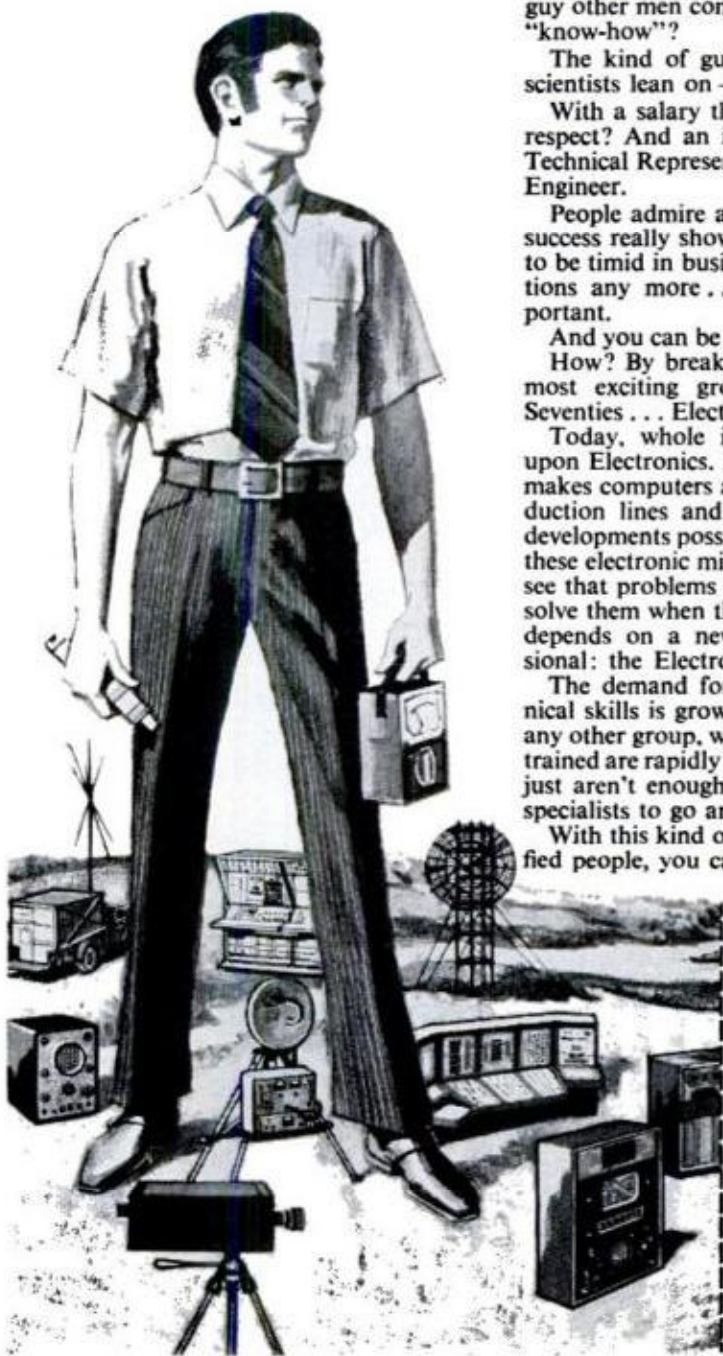
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PM-86



VW Dasher: Future shape for the family car



Twenty-five years after the Beetle sneaked into the United States, VW introduces a car for the next twenty-five!

by Bill Hartford
AUTO EDITOR

In 1949 nobody noticed. Today, the Beetle is the most famous automobile shape in the country, indeed, in the world. The most versatile car, too, being used for dune buggies, kit cars and assuming all manner of mutant shapes. For many, it's also a family car: even for the average American family with 2.2 children (the smallest having the fun of riding in the "well" behind the rear seat). As for economy, why, if it wasn't for the proliferation of the Beetle, we might have had gas rationing years ago! The charisma of the Beetle is alive and well, but, alas, the car itself is just a little obsolete. The next 25 years belong to the Dasher.

The family car of the future is here. And the Dasher's fuel economy is not the only reason—even though, at a time when ration books appear to be on the way, it's a mighty good one. Overall mpg in suburban driving is 25 to 30 (and a steady, featherfoot 50 mph will give more than 30). This kind of fuel economy is only one very nice result of the Dasher's overall design—a design that earns it high marks for every attribute important to a family car.

First, the Dasher is front-engine, front-wheel-drive—the configuration more and more automakers are adopting to better utilize interior space, keep the car's center of gravity low, and improve weight distribution and handling. "Stability" is the word that sums up the Dasher's handling during acceleration, high-speed maneuvering and hard braking. Handling characteristics are hardly distinguishable from those of the Audi Fox, which first introduced this fwd layout for the VW family of cars and impressed us tremendously when we tested it last year (see *Cars the Red Baron would love!* page 138, July '73, *PM*). The Dasher differs from the Fox only in sheet-metal



The Dasher is available in three models: station wagon, four-door sedan and two-door fastback coupe. Beetle is still VW's cornerstone model, but the Squareback and Fastback have been bumped to make room for the Dasher. Flow-through ventilation is featured in all three models. Extractor vents on fastback are located at each side of the back window (visible above and on opposite page), and at door jamb on four-door models.

styling aft of the windshield, small suspension changes and details.

Like the Fox, the Dasher incorporates negative kingpin offset, to prevent a locked-wheel skid from resulting in a spin; and dual-diagonal brakes with left front and right rear wheels on one hydraulic circuit; right front and left rear on the other. Stopping, even in emergencies, is stable. Power-assisted discs are in front, drums in rear.

The Dasher passenger compartment, having no intrusions from drive-line components, takes full advantage of the space. It's spacious and airy (greenhouse or window area is about 27 sq. ft.), with generous front legroom, ample rear legroom and headroom for a six-footer—even in the rear of the two-door fastback coupe. Rear windows in the coupe don't open, however. In accommodation and spaciousness, a similarly scaled car, such as the Mustang II, comes off poorly indeed.

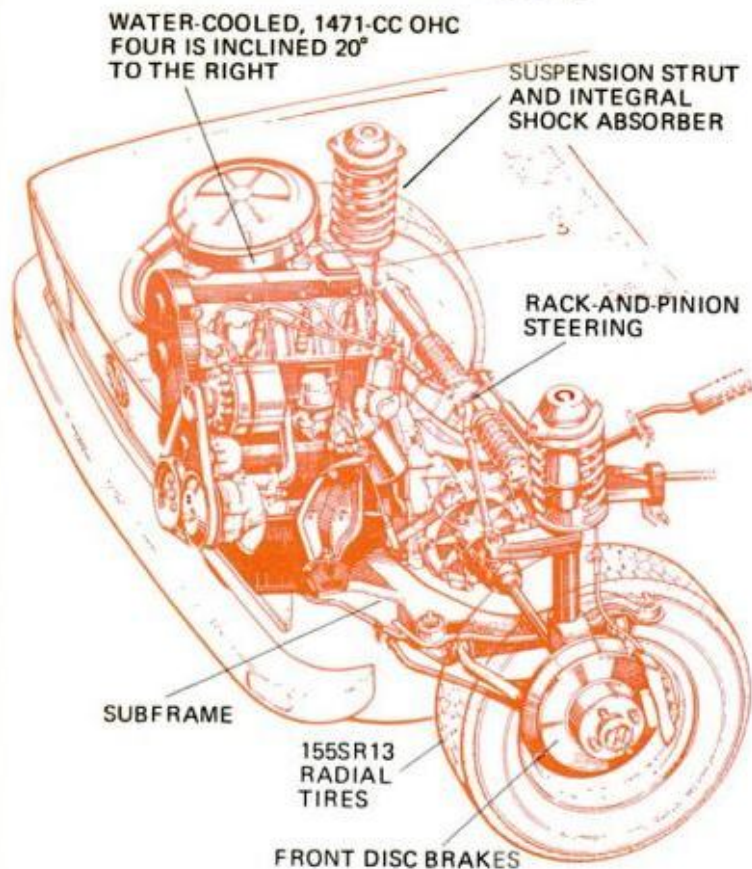
The body, whether two-door, four-door or station wagon, is a perfect combination of styling and engineering. The young, successful Italian designer, Giorgio Giugiaro, put the lines in the sheet metal, while the

computer analyzed stresses to reinforce the body where necessary. The result is a car that doesn't depend on sheer mass for protection. The passenger compartment is designed more solidly than front and rear ends which collapse progressively.

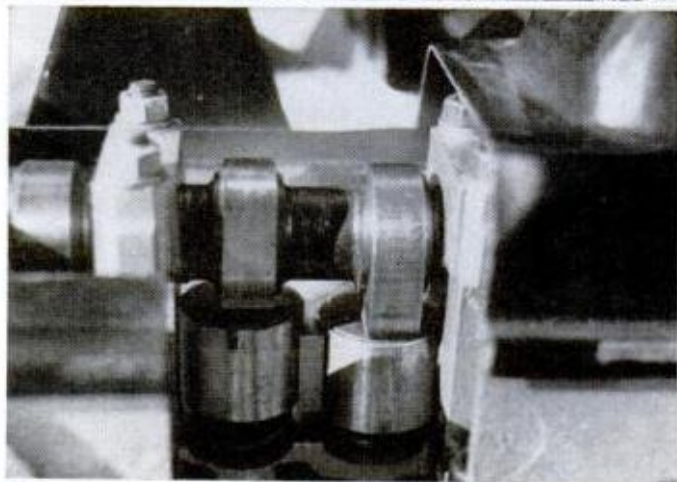
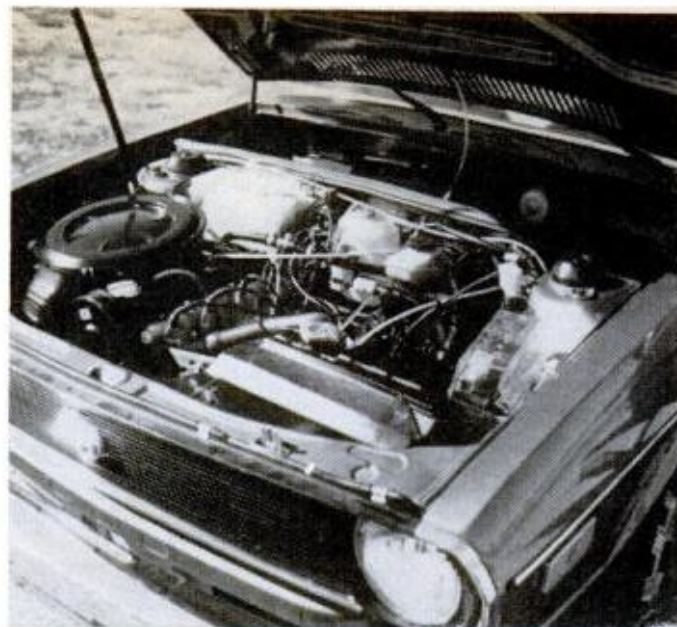
Bumpers are five-mph recoverable, and a lip molding around the back window channels rainwater from the roof around the glass to keep it clear. The three-point belts are easy to use and allow freedom to move but lock up when cornering, braking and when the body pitches forward suddenly. They retract in the B pillar when not in use.

The secret of the Dasher's performance (0 to 60 mph in roughly 12 seconds, and just as fast with the optional automatic transmission) is its power-to-weight ratio. A modest 75 hp at 5800 rpm wouldn't move even a subcompact (2500-pound) Vega that fast, but the Dasher weighs just over 2000 pounds! Because of its light weight the Dasher has excellent performance and fuel economy. Supplying both is a 1.5-liter, overhead-cam, water-cooled Four. Top speed (does it matter anymore?) of 98 mph is also cruising speed. VW's first water-cooled

FRONT-WHEEL-DRIVE VW DASHER



The entire power train is rubber-mounted and supported by a separate subframe which helps to insulate noise and vibration from the body. Engine is placed well forward for 60/40 weight distribution which becomes 50/50 when the car is loaded. Detail at right shows cam lobes and valve adjustment shims.



and ohc engine available here is designed for regular, low-lead or lead-free fuel, of course. It's mounted ahead of the driving wheels and the radiator is at the left of the engine. The thermostatically controlled fan cuts in only when needed—a slick idea, but it's noisy when running.

Engine block is cast iron and cylinder head is aluminum alloy. The camshaft, mounted on top of the cylinder head, is driven by a toothed, rubber, spur belt: no noise, no lubrication. Valve adjustment is easy—even for Saturday Mechanics. The camshaft lobes work directly on cup-shaped followers (see detail above). Shims that fit under the cups come in various thicknesses and are changed to get proper clearance. You'll need a special tool, but there's no need to disturb camshaft or engine timing. Other service features include oil changes every 5000 miles and overall service every 10,000 after an initial 1000-mile lube. The Dasher is equipped, as are all VWs, for plug-in computer analysis service checks,

(Please turn to page 178)

1974 Volkswagen Dasher specifications

Engine: In-line, 4-cylinder, overhead camshaft, water-cooled. Location: Front, slanted 20° to the right. Bore: 3.01 in. stroke: 3.15 in. displacement: 89.75 cu. in. (1471 cc). Compression ratio: 8.5:1. Hp (SAE net): 75 @ 5800 rpm. Torque (SAE net): 79 @ 4000 rpm. Carburetion: 2-stage down-draft Solex.

Electrical: 12-v. with alternator. Battery: 54 amp. hours. Ignition: Coil and distributor.

Drive train: Single, dry-plate clutch. Transmission: 4-speed manual, all synchromesh. Optional three-speed automatic.

Gear ratios:	Manual	Automatic
	1st	3.454:1
2nd	2.055:1	1.59:1
3rd	1.370:1	1.00:1
4th	0.968:1	—
R	3.166:1	1.80:1
Final drive	4.111:1	4.091:1

Body: All steel monocoque (integral body and chassis)

Chassis and suspension: Front: Independent MacPherson struts; coil spring with telescopic shock absorber. Rear: Torsion crank axle with Panhard rod; coil spring with telescopic shock absorber. Rims: 5J x 13 ventilated. Tires: 155SR13 radial. Steering: Rack and pinion. Turns lock to lock: 3.94. Turning radius: 34 ft.

Fuel-tank capacity: 12 U.S. gallons.

Dimensions (inches):

Wheelbase	97.2	Overall length	172.8
Front track	52.7	Overall width	63.0
Rear track	52.6	Overall height	53.9

Curb weight: 2108 pounds.

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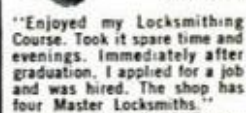
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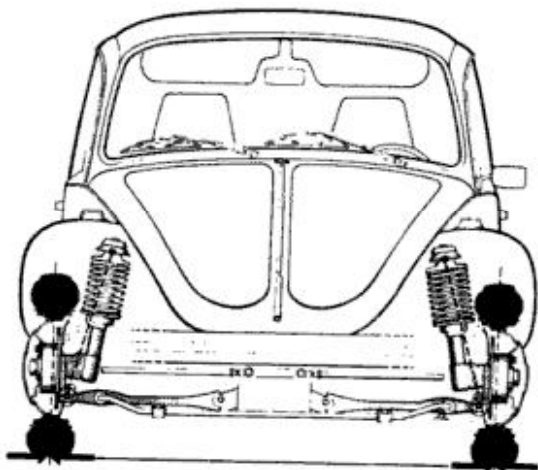
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PM'S GUIDE TO IMPORTED CARS—'74

(Continued from page 87)

here—a good looking and practical one-of-a-kind.

Porsche has put its race car on the road. The Carrera version of the 911 was sold only to race drivers in '73. The Carrera (instantly recognizable by its rear spoiler), 911 and 911S are all available in Targa versions (built-in rollbar and removable top) and improved by a larger, 2.7-liter engine, Bosch CIS fuel-injection system, new seats and additional refinements. Despite their dazzling performance, these cars are not short-range fighters: I got 20 mpg with the Carrera—and with a new 23-gallon fuel tank, that's a 460-mile strike range. The 914 two-liter mid-engine is little changed but the base 914 is up to 1.8 liters.



Volkswagen Super Beetle has new front-end geometry that ensures straight-line stops under hard braking.

Renault's new "Coupe Convertible" is a bit of one-upmanship on the Targa configuration: After you remove the fiberglass hard top, there remains a second soft top which opens and closes electrically. It's obvious the idea popped up because there's no room in the car to store the large hard top, but nevertheless, the result is a real summer convertible and winter coupe. Renault has improved its model line of fwd vehicles since we tested the 12 and 15TL: most practical is the 12 wagon; most exciting is the Gordini with its 107 hp compared to 65 hp for the 15TL and 17TL.

Rolls-Royce automobiles should last forever—that's because they're always parked at the curb—waiting.

Saab's fiberglass Sonnett III is still the only fwd sports car you can buy. It's narrow but nice. Body reinforcements, new headliner and aluminum alloy wheels make it better

this year. The new 99 hatchback was shown in *Imports and Motorsports*, page 57, Dec. '73 *PM*, and some improvements for '74 were listed. The 99 pioneered seats and bumpers that work, aerodynamic design and safe passenger compartments; and with its two-liter fuel-injected, ohc Four and fwd, it's one of the most enjoyable cars to drive. As *PM's* Owners' Report confirms, owning a Saab is never having to say you're sorry.

Subaru has built up a solid reputation in the few short years since its fwd models took on the bigger Japanese importers. The DL and GL go a little heavy on the doodads, but underneath, all parts slide, click and reciprocate as they should. *PM's* question a few years back has been answered: *Subaru: Is it here to stay?* page 24, May '71 *PM*.

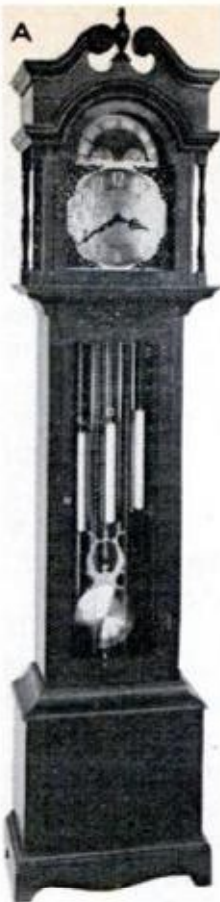
Toyota calls the new Mark II the perfect "phase-out" car—for those drivers who are ready to phase out of Detroit V8s to smaller cars. It's right. The six-cylinder line has received a lot of attention to detail, right down to the intermittent wipers. Restyled and re-engineered, the Corona has five models this year. The SR hardtop is the sportiest with new styling and five-speed gearbox. The Electro Sensor Panel (shown last month in *Imports and Motorsports*) is a big plus on the Corona coupes. Five-speed is new on the Celica and is still at the heart of the Corolla SR-5's terrific small-car performance.

Triumph loses half of its model lineup this year with the GT-6 out of production and the Stag retreating back to England—where it has a waiting line, by the way. But all Triumph needs here is its tried and true winner, the Spitfire 1500 roadster. It got more cc's, radials and wider track in '73. This year a front spoiler is the only noticeable addition. Spitfire's a little brother to the stronger TR-6, cuter (and cheaper) and steals a lot of attention.

TVR's 2500M is as amusing as ever. A funny, short-wheelbase, fiberglass turtle that really scoots.

Volkswagen Beetles: Whoever would have thought they'd be such an incredibly wise investment. They've always had a very high resale value, but, now, who's selling? Devaluation and inflation have blitzed the price of new Bugs, but I always thought the car was underpriced anyway. Front and rear track are wider for '74 and the Super Beetle has new front-end geometry. The award-

(Please turn to page 174)



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PM'S GUIDE TO IMPORTED CARS—'74

(Continued from page 172)

winning Karmann Ghia shape is still in the lineup, squelching again the rumor that a new sports model will replace it . . . What's the "Thing"? See page 128. . . . The 412, VW's luxury line, has a quartz clock and other refinements, still gives 20 mpg plus. All models are covered by VW's new Owner's Security Blanket with Computer Analysis: the best warranty anywhere. . . . For PM's road test of the brand new Dasher, see page 168. . . .

Volvo has a collection of serious sedans—they're made to last and designed to stay contemporary. The 140 Series, including the popular 145 station wagon, is safer: fuel tank's repositioned forward, steering column's further improved and now ventless side windows use steel arches welded to the doors. The 142GL and 144GL are new luxury versions of the 142 two-door and 144 four-door. The same safety improvements and several refinements have been made on the three-liter 164E, the luxurious top-of-the-line car. The discontinued 1800ES sports-wagon is now a collector's item. ★★

Recent PM Road Tests and Owners Reports

Audi Fox: *Cars the Red Baron Would Love!* Page 138, July '73.

100: *PM Owners Report*, Page 120, Aug. '73.

Capri: *PM Owners Report*, Page 82, April '71.

Datsun 240Z: *PM Owners Report*, Page 82, Jan. '73.

Ferrari Dino: *Mid-engine cars story—In the World's Most Exciting Cars . . . The Engine's Breathing Down Your Neck*, Page 112, Oct. '72 (Other mid-engine cars discussed: Lotus Europa, Maserati Bora, Pantera and Porsche 914.)

Fiat X1/9: *Fiat Has a Deal You Can't Refuse*, Page 26B, Sept. '73.

124: *PM Owners Report*, Page 72, Feb. '72.

128: *Biggest Bargain Since the Beetle*, Page 108, Jan. '72.

Jaguar V12 E-type: *Are Eight Cylinders Enough?*, Page 84, Jan. '72.

Jensen FF: *Jensen FF: Safe at Any Speed*, Page 114, June '70.

Mercedes-Benz 450SE, SEL: *Cars the Red Baron Would Love!*, Page 138, July '73.

350SL (450SL): *It Really Is Possible to Design a Car Without Compromise*, Page 58, Oct. '71.

Opel: 1900: *PM Owners Report*, Page 74, July '71.

Renault 15: *It Won't Go Unnoticed . . . And Go It Does!*, Page 142, Sept. '72.

12: *Front-Wheel Drive to the Fore!*, Page 126, Nov. '71.

Saab 99: *PM Owners Report*, Page 106, Aug. '72.

Subaru: *Sabaru: Is It Here to Stay?*, Page 24, May '71.

Toyota Celica: *PM Owners Report*, Page 86, Jan. '73.

Corona: *PM Owners Report*, Page 96, Aug. '71.

Volkswagen Dasher: *Future Shape for the Family Car*, Page 168, Feb. '74.

Thing: *PM Owners Report*, Page 128, Feb. '74.

411: *The 411 Series: Volkswagen's Luxury Line*, Page 92, March '71.

Volvo 140 Series: *PM Owners Report*, Page 94, Feb. '73.

GAS MAINS

(Continued from page 115)

of sealed-off pipe. If the walls of the pipe are weak, it will burst.

Another test, which is designed primarily for long-distance gas and oil transmission pipelines, introduces an instrumented module called a "pig" into a section of pipe. As the pig is pushed along by a constant stream of fluid, a gauging tool attached to it measures the thickness of the pipe wall around its entire circumference, detecting flaws and thin spots. Data are transmitted from sensors to a read-out monitor.

Unfortunately, all gas explosions aren't caused by excavation damage or pipe failure. Ignorance plays a part, too.

On Dec. 11, 1970, in New York City, a devastating explosion blew out the interior of Ryan's Restaurant, killing 12 and injuring 60. Apparently, a new proprietor had become impatient with Con Edison, the local utility, and allegedly attempted to turn on the gas supply himself. The valve he tampered with allowed gas to enter the building through a pipe left uncapped.

There is no substitute for common sense. Here are some tips to help you protect your family and home:

If a contractor has to dig near your home, see to it that he contacts the gas company so that a representative can come to mark the location of gas lines.

If you get a slight whiff of gas that comes and goes, call your gas company. There's no need to vacate your home. (Natural gas is odorless. What you smell is a chemical added to the gas.)

If you get a heavy, constant smell of gas, follow these rules:

□ Do not do anything that would cause a spark—do not turn lights on or off, turn on appliances, use the telephone; above all, do not strike a match.

□ If you're near a window, open it (smash it, if need be) to get ventilation into the house, but do not take time to go through the house and open all windows.

□ Get your family and yourself out of the house at once. Leave the door open to provide more ventilation.

□ Get to a phone and call the fire department first and then the gas company. The fire department is in the neighborhood and is expert at handling natural gas emergencies. Firemen will arrive relatively fast, while a gas company emergency crew may take longer to reach the scene. ★★

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VW DASHER

(Continued from page 170)

and warranty is 12 months/20,000 miles.

In addition to careful workmanship and finish, there are many details that make the Dasher safe, comfortable and generally pleasant to live with—all standard. I liked some especially: *Interior*: fully reclining front seats, full carpeting, windshield-wiper and high-beam controls on steering column. *Safety*: child-proof back door locks, electric rear window defogger. *Trunk*: cavernous with a wide, flat floor; spare lies flat under it, an improvement on the standup position in the Fox. *Do-it-yourself service and repair*: all relays, fuses and electrical connections in one box under the hood; bolt-on front fenders.

The Dasher will be in VW showrooms, and the price announced by PM's newsstand time. I guess it will start at about \$3600. That makes it expensive, but it's the best family car you can get in the \$3500 to \$4000 price range—even if it doesn't have a well behind the rear seat. ★★★



Low hood line is achieved by canting engine 20° to the right. Deep-dish wheels don't use hub caps: removable, black plastic caps are used over lugs and hubs. Crisp lines characterize rear of four-door.



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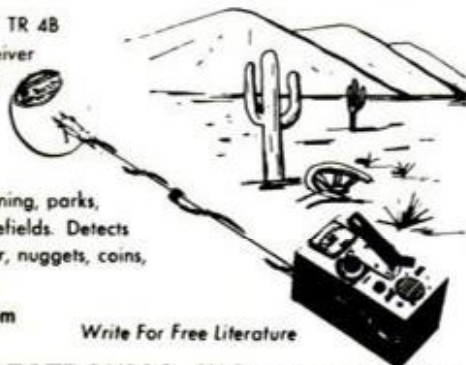
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CHECK BATTERY WITH YOUR LIGHTER

(Continued from page 60F)

of the plug firmly together, drill or file a $\frac{5}{16}$ -inch diameter hole for a depth of $\frac{3}{8}$ inch, to take the pilot light.

The pilot-light assembly is $\frac{15}{16}$ inch long, and must be shortened to fit. Cut away $\frac{3}{16}$ inch, for an overall length of $\frac{3}{4}$ inches. To make room for the pilot-light assembly, the plug's two metal contact strips must be bent around the two plastic parts which support them.

Wire the transistors, diodes and resistors as illustrated. The whole assembly nestles nicely inside the plug after some of the molded-in reinforcements have been removed from one of the plug halves with a pair of long-nosed pliers. To make sure that none of the connections would short together, we cut insulating separators from the clear plastic of the blister package the accessory plug came in. A dab of clear cement holds the pilot-light assembly in place. Make sure that the screw you use to hold the finished plug together doesn't extend beyond the plug body, or the assembly won't fit into the lighter socket. ★★★

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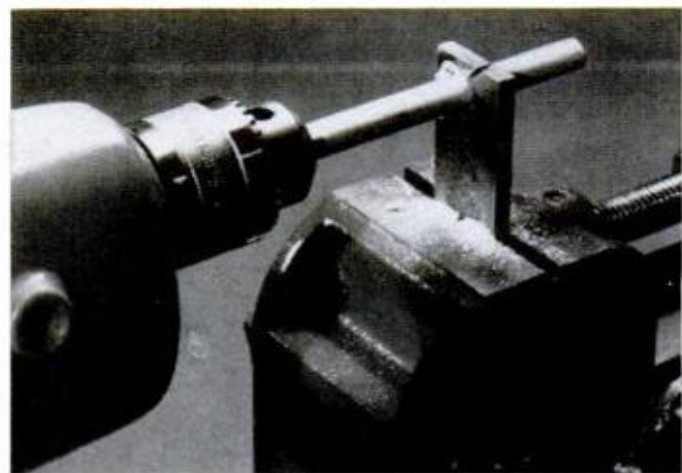
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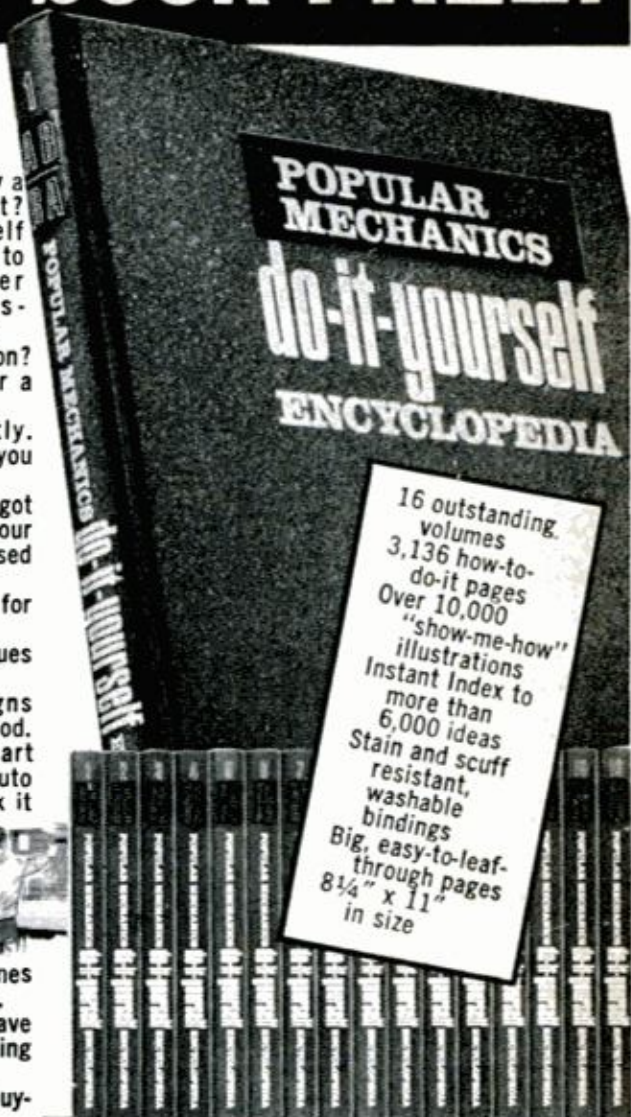
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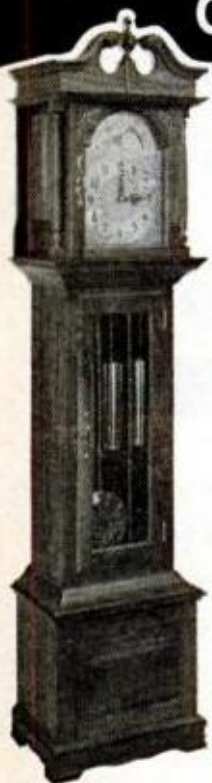


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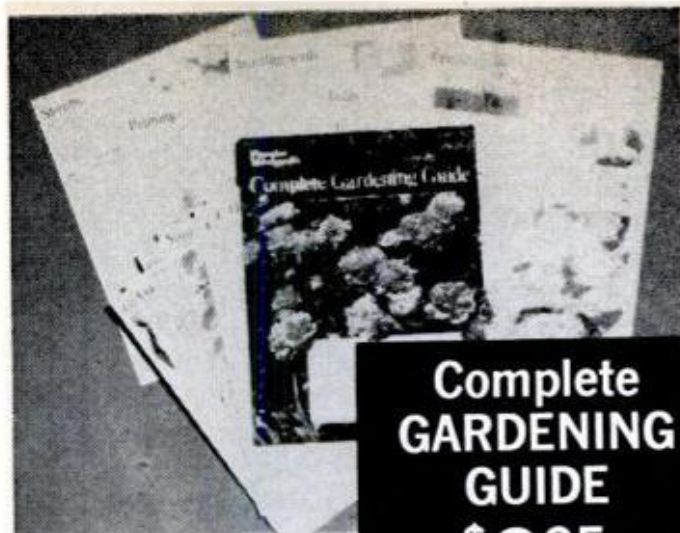
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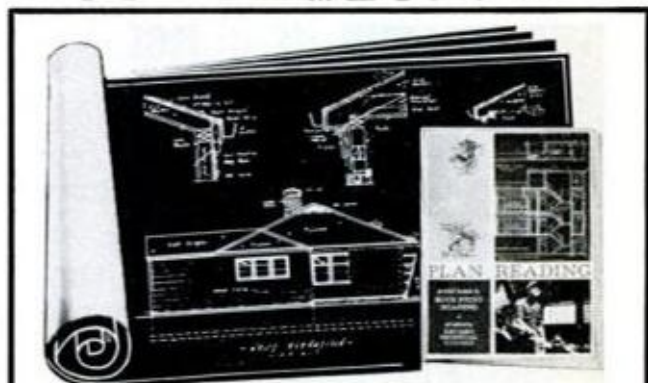
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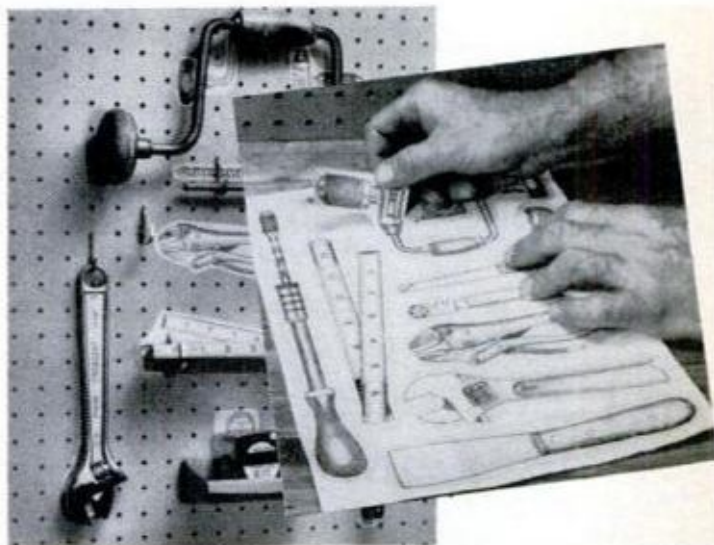
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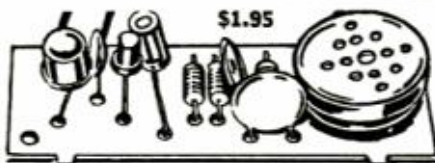
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(Continued on next page)

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(Continued from preceding page)

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(Continued from preceding page)

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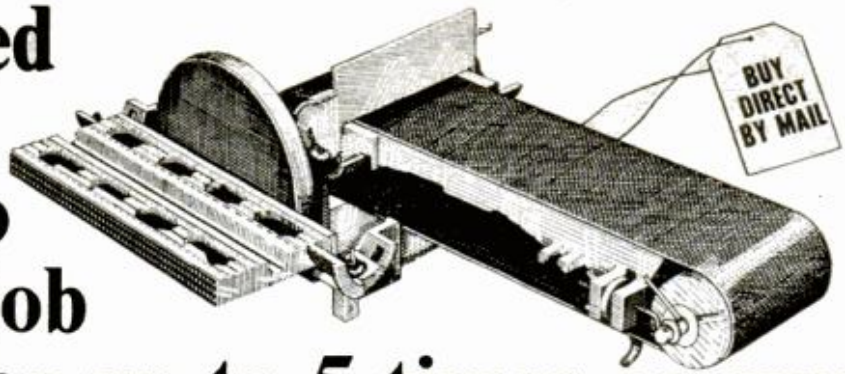
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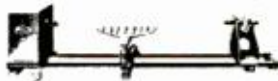


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