

Popular Mechanics

MARCH 1980 \$1.00

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7 places to look



35-PAGE SPECIAL

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On the cover

Submersibles of a variety of shapes and sizes are now a familiar part of the oil production effort in the often treacherous North Sea. To date, the safety record of free-roaming minisubs is considerably better than that of tethered diving bells.
—PM painting by Ed Valigursky

Popular[®] Mechanics

MARCH 1980

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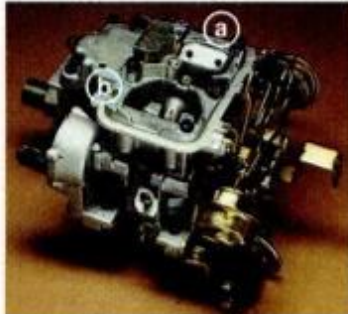
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DOUBLE-BARRELED POWER & ECONOMY.

The **4.1 Liter (250 Cu. In.) Six engine** has a staged, two-barrel carburetor to help it give impressive horsepower and fuel economy. A plus this year is the new 1980 Chevrolet Three-Year Perforation-From-Corrosion Limited Warranty. See your Chevrolet dealer for details. And ask him about leasing a tough Chevy truck.



STAGED, TWO-BARREL CARBURETOR uses one barrel (a) for normal operation and a second, larger barrel (b) for more power.

DUAL TAKEDOWN EXHAUST MANIFOLD reduces exhaust back pressure. The emissions control system uses engine exhaust manifold vacuum pulses that eliminate an air pump, pulley, belt, and about 15 pounds.



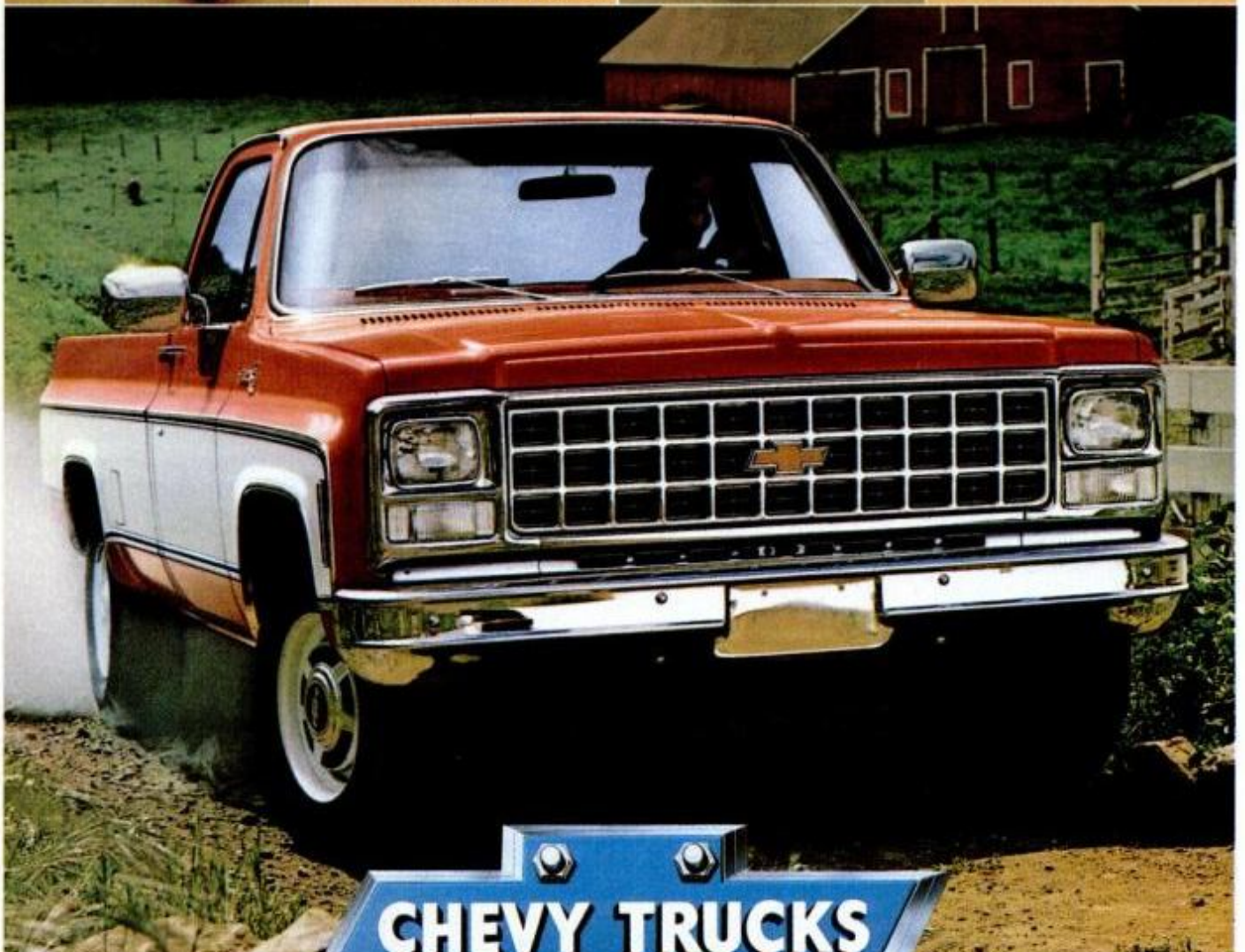
EPA EST. MPG

EST. HWY.

18

24

Remember: Compare the "estimated MPG" to the "estimated MPG" of other vehicles. You may get different mileage, depending on how fast you drive, weather conditions and trip length. Actual highway mileage will probably be less than the estimated highway fuel economy. Lower in California.



Chevy C10 Fleetside pickup

CHEVY TRUCKS

Chevy pickups are equipped with GM-built engines produced by various divisions. See your dealer for details.

BUILT TO STAY TOUGH

LETTERS TO THE EDITOR

Lights, camera. . .

In the article *Make a Photographic Inventory of Your Home* (page 118, Dec. '79) it is suggested that this be done using snapshots or slides. We used our 8-mm movie camera, which can record a single frame at a time. Even on movie cameras without single-frame capability, short bursts on an object will suffice. This has the advantage of being less expensive and requiring less storage space than snapshots or slides.

WILLIAM T. DUBOSE
ROCKINGHAM, N.C.

It's an interesting idea, but there are some disadvantages. Movie frames can't be examined without a projector or viewer, for example. Best bet is to find out which format your insurance agent prefers.

Desk jockey

I built an oak rolltop desk using your plans (see *For Nostalgia Buffs . . . A Rolltop Desk You Can Build*, page



Reader Auger's rolltop desk.

80, Jan. '76). It took me over a year and a half, but it was well worth the effort. I made several modifications, but the basic construction methods and overall dimensions came from your well-written and illustrated article.

JOHN AUGER
ORTONVILLE, MICH.

Careful making paint remover

Your article *How to Make Your Own Paint Remover* (page 187, Nov. '79) is generally correct technically, but totally misleading in terms of personal safety. I offer the following as a concerned professional chemist.

Hot 15 percent lye in the eye can destroy the cornea instantly. The absolute minimum protection for work with such solutions is a

brimmed or billed hat, chemical-worker's goggles (see your local college-supply store), heavy cotton coveralls worn over boots and rubber or plastic gloves with gauntlets which are turned back two inches. A face shield is strongly recommended. Don't forget the standby hose within arm's reach.

Caustic contaminated articles in the garbage may burn the garbage man. Wash down all contaminated articles before disposal. Most sewage plants welcome small amounts of alkali, but you should check for local problems, such as bans on alkaline drain cleaners.

In the event of contact with lye solutions, wash the affected area for at least 15 minutes. If the material gets in the eye it is a major emergency. Contact emergency medical help immediately while continuing to wash the eye.

D.C. MACWILLIAMS, PH.D.
ALAMO, CALIF.

How to Make Your Own Paint Remover understates the hazards in handling caustic soda solutions. It is true that dry caustic soda is not particularly dangerous, but if some happens to get in an eye and mix with tears, or in a sweaty palm, painful burns can occur.

Following a caustic bath with chlorine bleach can produce chlorine gas, unless the piece which has been stripped is rinsed thoroughly. A vinegar rinse is recommended.

Never bring a strong caustic solution to a full boil. Minute particles of caustic soda may be entrained with the steam and irritate the eyes and respiratory passages of anyone nearby.

TED EHERNBERGER
WEST LINN, ORE.

Point of VU

The article "How To Use VU Meters" (*PM Electronics Monitor*, page 26, Nov. '79) was very informative, but it would be more accurate if it stated that an increase in sound of 6 decibels doubles in volume, not 3 decibels.

GERALD KORNBLUTH
A & J RECORDING STUDIOS INC.
NEW YORK.

Yes, when we said volume we really should have used the word power. Doubling the power increases the

output 3 decibels. However, doubling the volume increases VU reading 10 decibels. It is doubling the voltage that results in a 6 decibels increase. Decibels are tricky little beasts!

Woodmobile

In *Burning the Barrel at Both Ends* (page 156, Sept. '79), you mention that the Swedes used wood to run their trucks, motorboats, etc. at the end of World War II. How can I obtain more details about this process?

LEON PARISH
CLERMONT, FLA.

The Coming Age of Wood, by Egon Glesinger, was our source, but the book is out of print and probably lacks enough detail to enable you to operate an engine. We suggest you contact Tekniska Hogskolan, FACK, 10044 Stockholm, Sweden, or the ECON Co., Box 828, Alexander City, Ala. 35010.

Well trained

In "There's A Long, Long Train A-Winding . . ." (*PM Briefs*, page 49, Dec. '79), there is a small error. You say the record-length train was 501 cars including engines, but it was 501 cars *plus* engines. That brings me to something else—the record for the longest *real* train. In 1967, the Norfolk & Western ran a 500-hopper train, with coal, from Iaeger, W. Va., to Portsmouth, Ohio. The six locomotives, 500 hoppers and one caboose weighed about 48,000 tons and covered four miles, 395 feet of track. One engineer controlled all six engines.

ROBERT COLTRANE
SOPHIA, N.C.

The fix is in

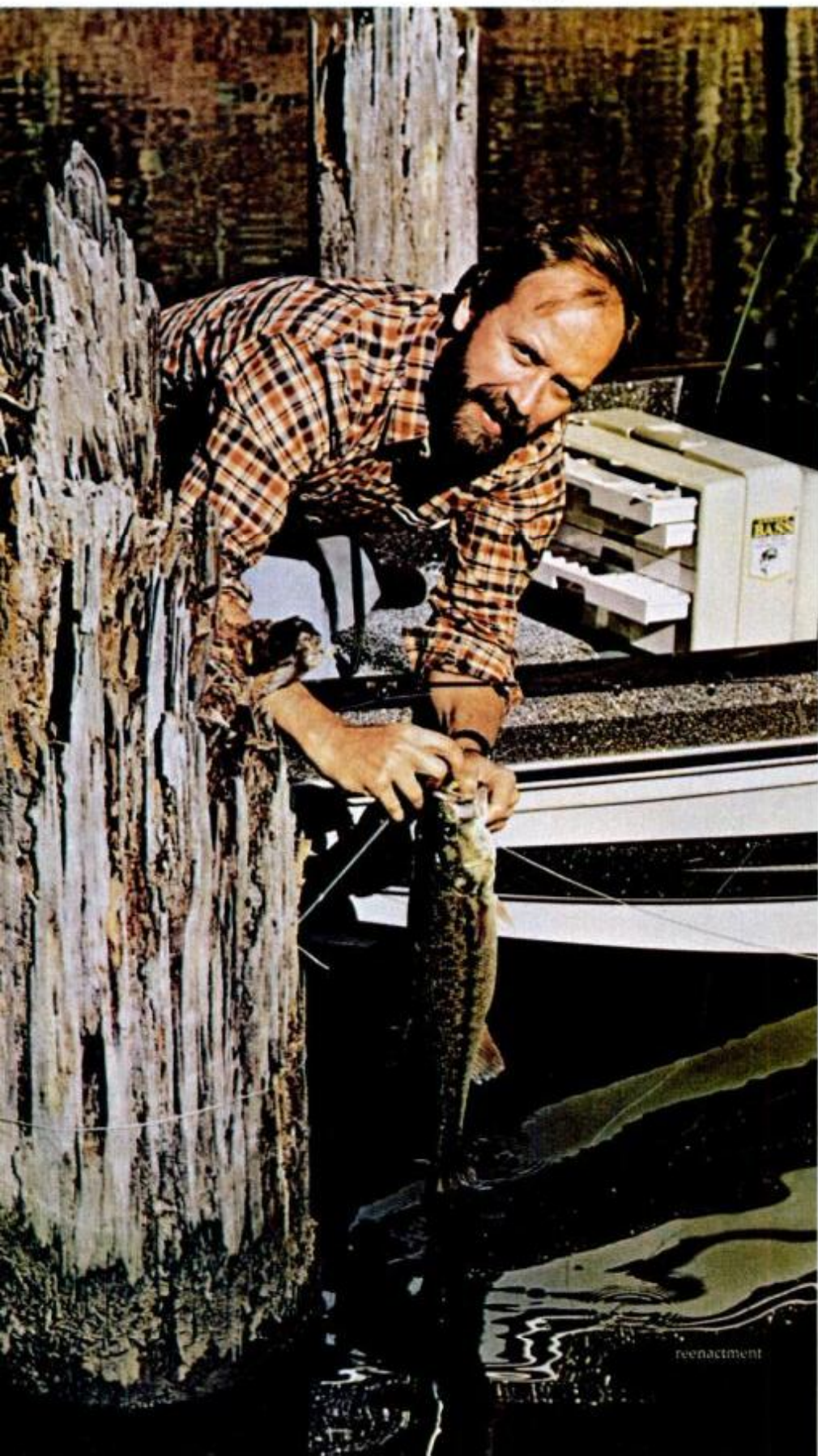
Thanks to your great magazine, I have fixed my dryer twice and my washing machine once and saved a lot of repair costs. Thank you.

BARBARA OLSEN
SUMNER, WASH.

Special note

The ready-made portable saw tables mentioned in the November issue (*Build This Bench for Your Portable Circular Saw*, page 136) are available by mail order from SKS Enterprises, 11207 Bos St., Cerritos, Calif. 90701. Model 666 is \$64.95 and model 665-B is \$62.95.

"He had me around a stump, but tough Stren® held."



Bass fisherman Bob Melvin found out how tough Du Pont Stren® fishing line is.

"I was fishing a tournament when I got a strike," says Bob. "That fish wrapped my line around a stump which had a trot line tied to it.

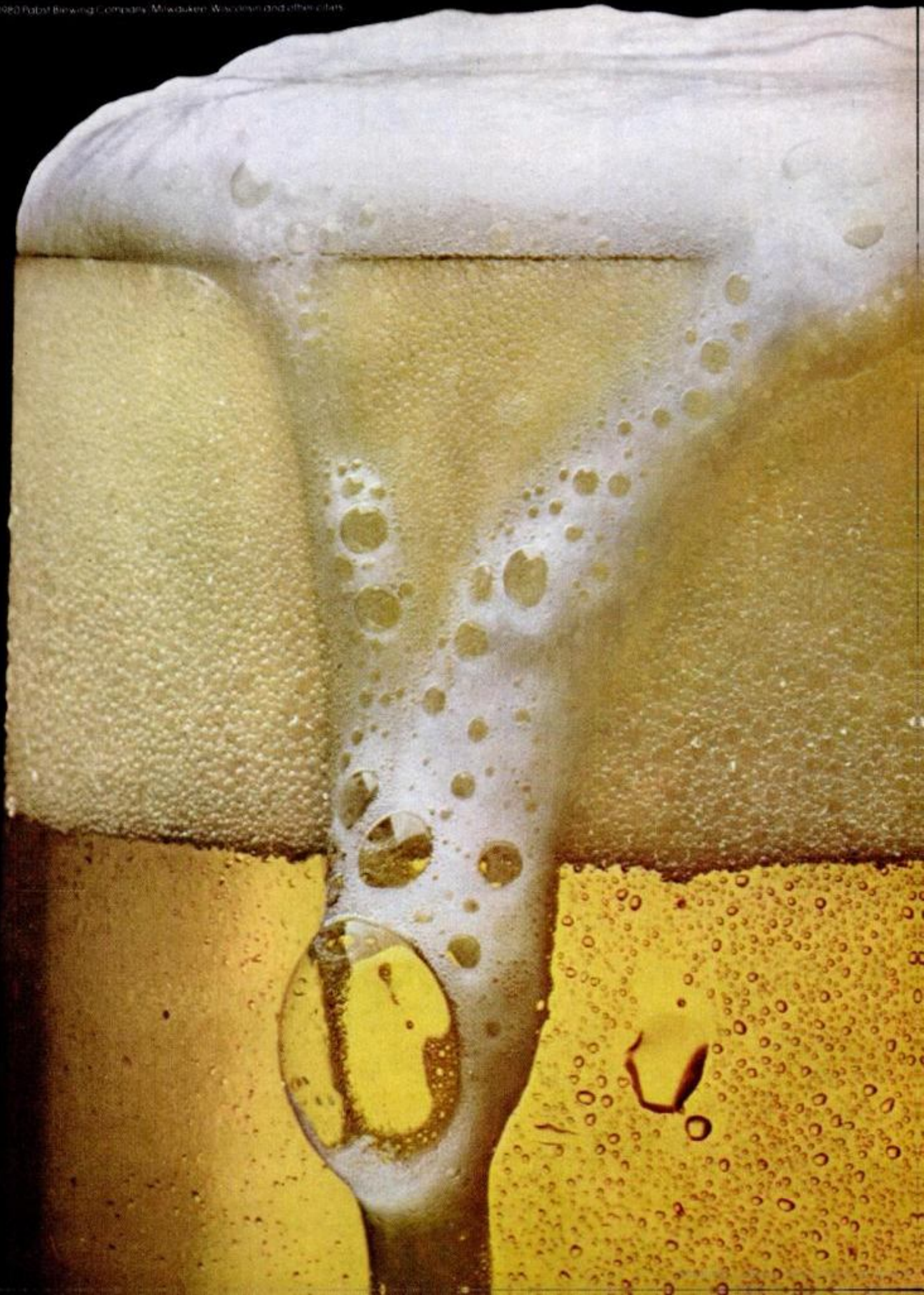
"Now a trot line will cut fishing line like a razor blade. But my Stren held. I worked the fish around the stump and pulled in the trot line and a 5 lb. 13 oz. spotted bass. That's what sold me on Stren... my actual experience."

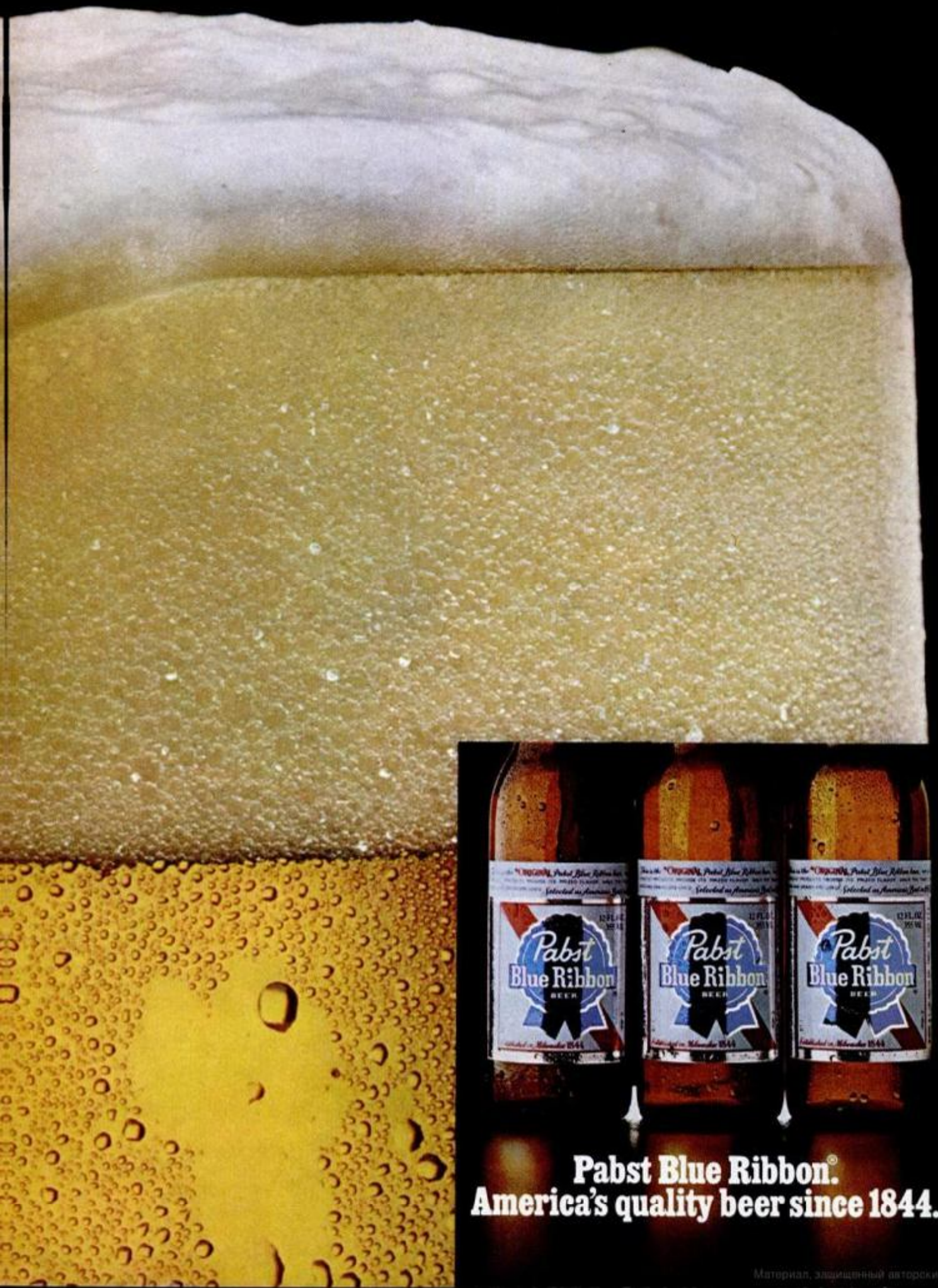
Prove it to yourself. Fill your reels with Stren. And go get tough with a fish. Any fish.



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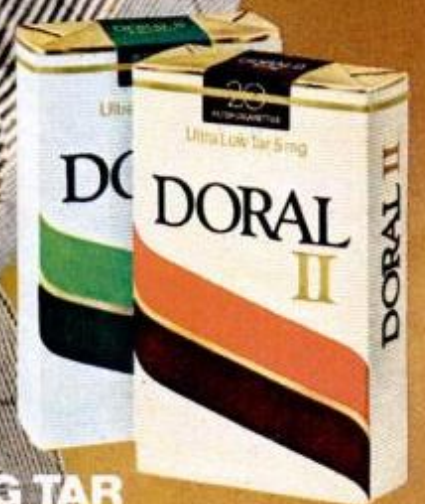
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APPLIANCE CLINIC

QUESTIONS ANSWERED

Cool Cal

Why does a Calrod unit of my GE P7 electric range spark, cut off and go cold when I switch it on?—Peter J. Verdi, Center Moriches, N.Y.

The connector that attaches the Calrod has either developed a short or has a carbon buildup, which creates high resistance between the circuit and Calrod unit.

Carbon forms when the Calrod isn't inserted fully into the connector. This can happen after the Calrod has been temporarily removed so that the range can be cleaned. A loose Calrod produces electric arcing, which leads to carbon formation in the connector.

Whether the connector is shorted out or carbonized, it probably has to be replaced.

Stained synthetics

A number of colored, synthetic fabric shirts and blouses are emerging from our 9-year-old Speed Queen washer and dryer with oily-looking, opaque stains. They appear in unlikely places—shirt tails, button folds, upper sleeves, etc. They're not food stains. Any chance of an oil leak in the washer or dryer?—Mrs. Donald Hunting, East Hampton, N.Y.

We doubt it. A leaky transmission would deposit oil on all areas of fabric. It sounds more like a case of "invisible stains." These stains, which are caused by food, body oils and cooking oils, attach themselves to synthetic fabrics and aren't visible until after the wash cycle. The reduction of phosphates in detergents and the lowering of wash water temperatures have greatly increased this problem.

Use the following steps to correct this problem:

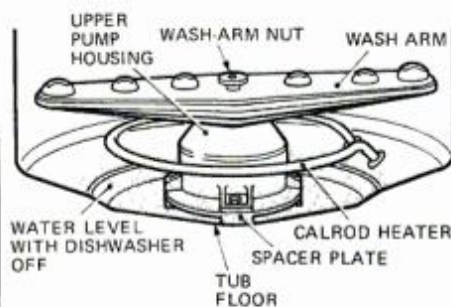
1. Rub the spots and stains with undiluted liquid detergent and leave them for about 30 minutes.
2. Wash the fabrics in warm water (100-120° F.), using 50 percent more detergent than normal. Use a phosphate detergent if available.
3. Use bleach where it is allowed.
4. If you have hard water and no mechanical softener, add a nonprecipitating water softener with phosphate (such as Calgon) to the wash water.

To prevent further problems, wash synthetics as soon as possible after wearing them. Remember to use warm water and extra detergent.

Bailing out

I own a Sears Kenmore dishwasher in which I recently installed a new motor and pump. At the end of a complete cycle, there is still some water left in the bottom of the tub. Is this normal?—Bob Griffin, Lantana, Fla.

Water in your dishwasher sump is normal and necessary to keep your lower impeller and motor shaft seals moist. However, the water level



When a dishwasher isn't operating, water level should be below the Calrod heater.

should never be as high as your Calrod heating coil. If it is, check the drain line for possible kinks or blockage. Also, make sure the lower impeller is properly keyed on the motor shaft and not missing any of its fins. A dry sump, on the other hand, could indicate possible seal failure.

Noisy clothes washer

We have a 2-year-old Sears washer. While it was running, I noticed a burning smell and called a Sears technician. He told me that bleach and detergent had ruined all the wires and shorted the motor along with everything else. The repair bill came to about \$169. Is it possible for bleach and detergent to do this?—John Tartaro, Ridgefield, N.J.

Bleach and detergent, improperly handled or used in excess, are two of the major factors in shortening the life of a washer. Combined with moisture, they can eventually corrode all unprotected surfaces of a washer, including electrical contacts, connections, controls and unfinished surfaces. A shorted motor usually isn't reason enough to condemn a washer, but coupled with extensive further corrosion, that decision might have to be made. A good rule of thumb to use in determining whether to repair or replace a washer: The repair shouldn't exceed 60 percent of the washer's original price.

Water to spare

My handicapped neighbor owns a Maytag combination washer, model No. CA50. Everything seems to be working all right, except that at the end of the wash cycle, the wash water goes into the spin dry cylinder. I want to repair it for her, but I don't know what to look for.—W.J. Kerns, Brooklyn, N.Y.

Sounds like the flapper inside the diverter valve is broken. Carefully lay the washer on its back. The diverter valve is located on the left-hand side of the washer and is black. Then you should remove the three hoses on the valve. Next, remove the six screws holding the valve to the bracket. The valve itself is held together with three screws. Open it up carefully and you will see a flapper about the size of a half dollar and a spring. Replace both the flapper and spring. Cost should be around \$4.50. Carefully install the new parts and reassemble the entire unit.

Regassing refrigerator

I own an antique and used furniture business and have two refrigerators from which all the gas has leaked. It seems a shame to destroy them. Can they be repaired?—Mickey Hessian, Cairo, Ill.

The only way refrigerators can lose all their gas is through a hole or crack in their sealed systems. The procedure for repair is to pressurize the system to find the leak, repair the leak if possible, replace the drier (desiccant-filled component), evacuate the system, and recharge the unit with the proper amount of refrigerant.

You didn't mention how old the refrigerators are or how long they have been unused. If moisture has gotten into the sealed systems, it could have contaminated the oil in the compressors. This would mean that, along with the procedure just described, the compressors would have to be removed, their oil changed and all the remaining tubing in the systems flushed with a cleaning agent such as R-11. If this is the case and the refrigerators are old, it may be more economical to scrap them. **FM**

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 discussed in this column.

IMPORTS & MOTORSPORTS

1980 Saab 900 models



Sporty, light-alloy, "soccer-ball" wheels identify 900 as the three-door EMS model.

At the wheel, you feel like a racecar driver; at the hatchback, like you're loading a moving van; sitting in the plush back seat, like you should hire a chauffeur. No other sedan on the road today offers what Saab does in its front-wheel-drive 900 series: Performance, utility and the most satisfying, ergonomical driver's environment is wrapped up in a package of perfect proportions.

The 900 was introduced in 1979, the culmination of a decade of design evolution that began with the model 99. I knew that Saab had, at last, integrated all the elements I consider important in a car, so I bought a new EMS model late last year. I had a preview of what would be changed for '80, but couldn't wait. Here's what I missed:

- Improved fuel economy from the Lambda emissions control with three-way catalyst, and, on turbo models, a five-speed transmission (which also cuts interior noise).

- Power steering with the four-speed gearbox (previously only with automatic transmission).

PM photo: Daniel Kennedy



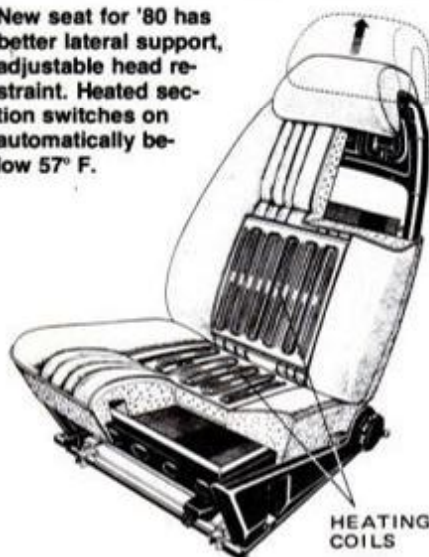
Six-foot rule stretches from folded-up back seat to tailgate in author's 900 EMS. Additional storage space is under floor.

- New seats with adjustable head restraints, better lateral support.

- New taillight cluster, which increases light output for safety, especially in fog.

- Space-saving spare wheel and tire, which increases the huge cave under the rear hatch to 53 cu.ft. when

New seat for '80 has better lateral support, adjustable head restraint. Heated section switches on automatically below 57° F.



you have the back seat folded down.

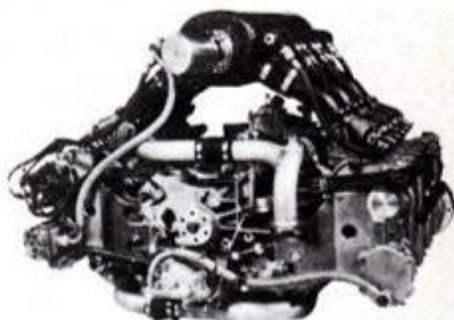
All 900s now have the grille that was used only on turbo models last year, but minor changes like this are hardly worth mentioning when so many impressive features continue to be standard, depending on model: heated seats, tinted glass, steel sun-roof (designed to slide back and forth with a pull instead of having to be cranked to open and close), vent system with dust and pollen filter and side-guidance back-up lights. Beautifully built, fun to drive. I don't know how Saab will improve it for '81.



Bigger taillights are safer in fog.

Blitz at the brickyard?

Look who's coming to Indy! You guessed who if you spotted the engine below. It's not a V8 certainly, and hardly an Offy. A horizontally opposed mill can only mean ... Porsche. Yes, look out A.J., the black stallion of Stuttgart is after the Borg-Warner stein with its turbo Six. The 2649-cc, 630-hp powerplant will slip into a chassis still on the drawing boards, will be entered by



Porsche Six will burn methanol this May.

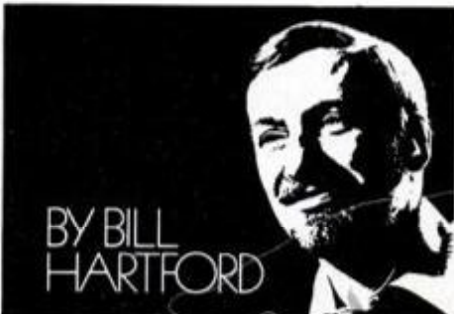
the Interscope racing team and be driven by the Flyin' Hawaiian, Danny Ongais. There will be more on this invasion of Unser country in PM's May issue.

C'mon Fiat!

It's lousy not having a choice. If you want a four-seat convertible—and you've got \$10,000 for a new car—you're forced into a VW Rabbit. But look at this Fiat Strada cabriolet. If it were only available now! Alas, it's only a prototype from the Bertone studios. Only *Fabbrica Italiana Automobili Torino* can make the production decision. C'mon Fiat, give us the cabrio! **PM**



Folding top disappears in Strada convert.



INTRODUCING A SPORTS CAR FOR THE 80's. FORD MUSTANG.



Mustang 3-door

Certified by the U.S. Auto Club as a sports car.



USAC put Mustang through a series of tests against a number of popular sports cars. Mustang's performance earned it official USAC certification.

Sports car performance. Impressive fuel economy.

Every standard Mustang offers the advantages of a sports car. Yet delivers the high mileage of a 4-cylinder engine. For comparison, Your mpg may differ depending on speed, distance and weather. Actual hwy mpg will probably be lower. Calif. mpg is lower.

23 EPA EST. MPG. **38** EST. HWY MPG.

Design your own Mustang.

Besides impressive standard features like modified McPherson front suspension and rack & pinion steering, Mustang can be personalized with options like Michelin TRX radial tires, forged aluminum wheels or the elegance of a Mustang Ghia.

Mustang. A sports car for the 80's.

Whether you buy or lease a Mustang, ask your Ford Dealer about the Extended Service Plan.



Better Ideas for the 80's. FORD.



Mustang 2-door

\$5,250

Sticker price as shown excluding title, taxes and destination charges.

FORD MUSTANG

FORD DIVISION



Why did Dave Lewis choose the Kawasaki KZ1000 LTD with its exclusive Clean Air System?

Because Dave believes in full power when making a pass.

Dave was impressed with Kawasaki's ability to meet the EPA standards without loss of power. In fact, he appreciated the improved acceleration, the stable idling and the short warm-ups that the unique Clean Air System gave him.

But the real truth is, Dave Lewis bought the KZ1000 LTD because he had no choice. The mean, low-down, both feet on the ground stepped seat; the low, fat rear tire; the teardrop fuel tank; the pullback handlebars; he couldn't resist. Of course, with his friends, Dave was quick



Kawasaki believes in riding safely. Check local laws before you ride. Member of AMA and MSF.
Specifications and prices subject to change without notice. Some model availability may be limited.

to point out how reliable the 1015cc engine was; that it was easy to maintain with its transistorized breakerless ignition. He raved about the way it handled and the excellence of the three drilled disc brakes. He would mention that his was the engine that holds most major drag records and the world land speed record.

Then a lady would pass by and smile. As he smiled back, Dave knew why he bought the KZ1000 LTD.

Come and check out the KZ1000 LTD at your local Kawasaki dealership and while you're there make a pass at the other LTDs. 'Cause they've got the power to keep you out there looking good.



KZ750 LTD (FOUR)



KZ750r LTD (TWIN)



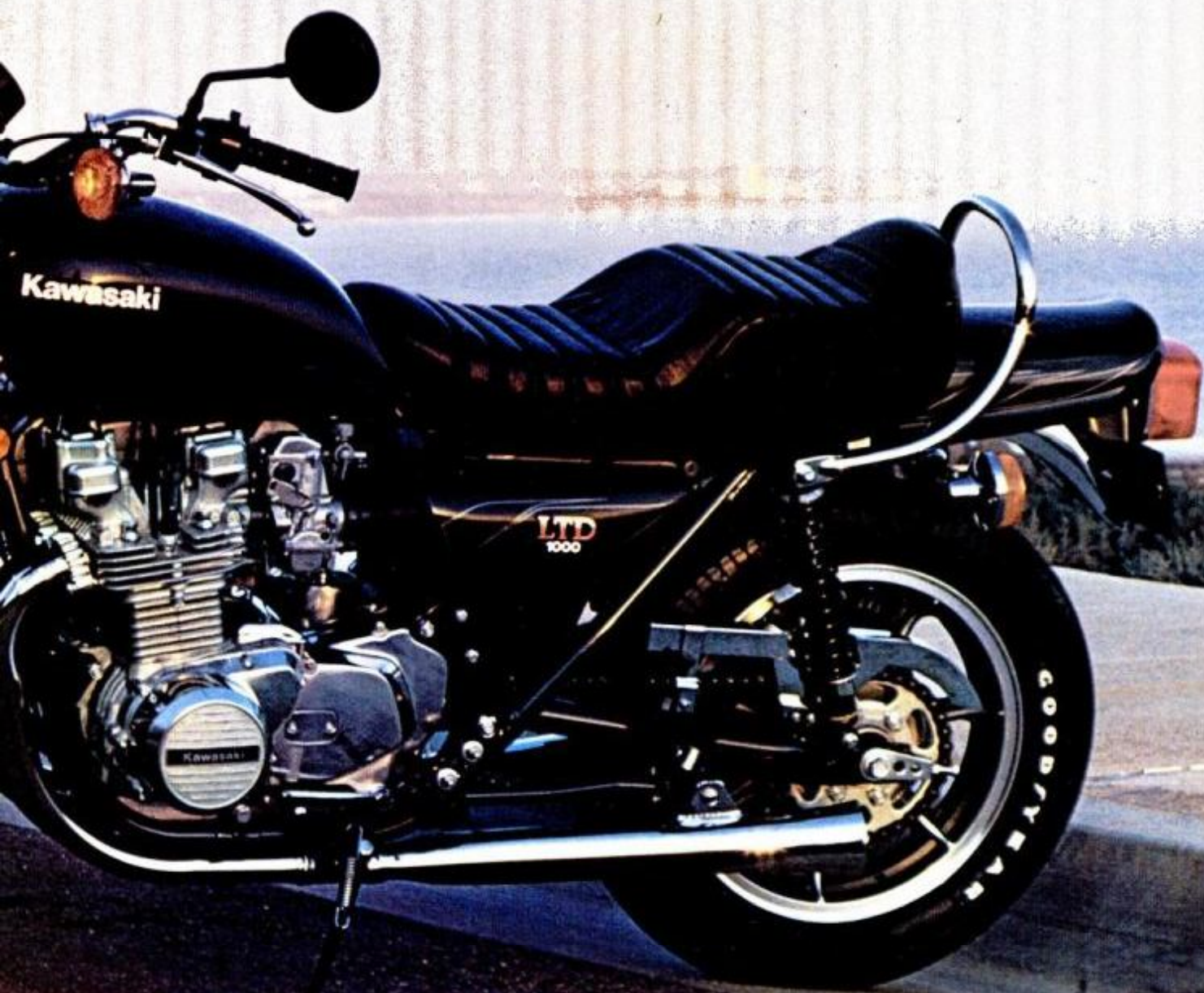
KZ650 LTD



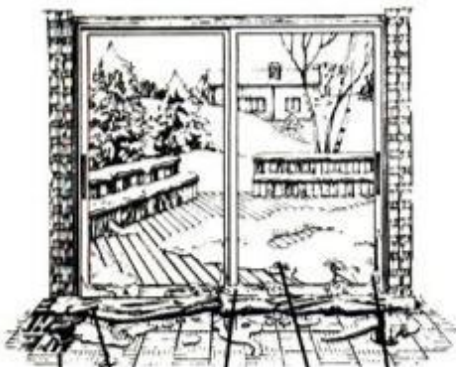
KZ550 LTD

Kawasaki

Don't let the good times pass you by.



Stop winter sliding door problems cold!



Water damage
Ice build-up
Excessive heat loss
Chilling drafts

Andersen introduces a new low-maintenance Perma-Shield® gliding door especially sized to replace most six-foot wide metal sliding doors. In most cases, without structural changes, reframing or resizing your existing door opening. Make the change. And stop winter cold!

The facts are

FREE!



Please send your free booklet "Andersen presents a new gliding door..." Mail to: Andersen Corp., Box 12, Bayport, MN 55003.

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Address _____

City _____ State _____

Zip _____ 026-030

The beautiful way to save fuel®
Andersen Windowalls



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NOTES FROM THE EDITOR

John A. Lillenton

Tony Assenza, PM's new Auto Editor, can be forgiven if he feels that we scheme to keep new staff members feeling a bit modest about themselves. He has his first PM byline in this issue (page 102), and his debut is not a reporting job about high-powered Maseratis . . . or functional Chevies . . . or even about cars, for that matter. It's about mopeds. And Tony had to share the byline to boot!

However, you'll be seeing a lot of reporting under Tony's name, including a description of life with an electric car (photo below).

By way of introduction, Tony was a prolific freelancer as well as a managing editor before joining PM. He also spent a year building and testing racing-boat engines in Italy. A hands-on auto buff from age 13, he has torn down, rebuilt, added to, modified and tested dozens of cars.

Americans are said to have a love affair with automobiles; if so, you'll find that Tony's affection takes a very practical turn. He likes to see how well and how far they'll go on a gallon of gas.



Familiar view for Tony: Under the hood.



Life with an electric car can be good—but then, it may have its moments. Tony's upcoming report will include tips on what to do if batteries die.

When PM staffer Joe Provey wrote our last October cover story on furnaces that burn more than one fuel, he was anxiously looking forward to cold weather (as a minority of one around here, by the way). Earlier, he had installed the HS TARM boiler in his home in Connecticut, and he could hardly wait to see how much he would cut his oil bills by burning wood and coal.

As I write this column, I find Joe bemoaning the unusually warm winter we've had so far. He says he uses wood only when the temperature falls below 35° F., so he hasn't really been able to measure the full potential savings. He reports, however, that his oil consumption was down by about 50 gallons through October and November.

Joe promises full disclosure about his entire year's heating in an issue this fall. Meanwhile, he's found that if you use a little ingenuity, you can keep your woodpile stacked high at little or no cost (see page 126).

PM

Everybody's making money selling microcomputers. Somebody's going to make money servicing them.

**New NRI Home Study Course Shows You How to Make Money Servicing, Repairing,
and Programming Personal and Small Business Computers**

Seems like every time you turn around, somebody comes along with a new computer for home or business use. And they're being gobbled up to handle things like payrolls, billing, inventory, and other jobs for businesses of every size...to perform household functions like budgeting, environmental systems control, indexing recipes, even playing games.

Growing Demand for Computer Technicians... Learn in Your Spare Time

Even before the microprocessor burst upon the scene, the U.S. Department of Labor forecast over a 100% increase in job openings for the decade through 1985. Most of them *new* jobs created by the expanding world of the computer. NRI can train you at home to service both microcomputers and their big brothers. Train you at your convenience, with clearly written "bite-size" lessons that you do evenings or weekends without quitting your present job.

No Experience Needed

You don't need prior training in electronics or computers to take this exciting new course. NRI starts you with the basics, gives you a firm foundation to build on. And your personal counselor is always available, ready to help whenever you have questions.

Assemble Your Own Microcomputer

NRI training also includes plenty of practical experience. You perform



meaningful experiments building and studying circuits on the NRI Discovery Lab.[®] Then you build your own test instruments like a transistorized volt-ohm meter, CMOS digital frequency counter... equipment you learn on, use later in your work.

And you build your own microcomputer, the only one designed for learning. It looks and operates like the finest of its kind, actually does more than many commercial units. But NRI engineers have designed components and planned assembly so it demonstrates important principles, gives you working experience in detecting and correcting problems. It's the kind of "hands-on" training you need to repair and service units now on the market.



Rush Card for Free Catalog... No Salesman Will Call

Send the postage-paid card today for our 100-page, full-color catalog. It describes NRI's new Microcomputer Technology Course in detail, shows all equipment, kits, and lesson plans. And it also tells about other NRI courses... Complete Communications with 2-meter transceiver... TV/Audio/Video Systems Servicing with training on the only designed-for-learning 25" diagonal color TV with state-of-the-art computer programming. With more than a million students since 1914, NRI knows how to give you the most in home training for new opportunity. If card has been removed, write to:



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Washington, D.C. 20016

THE TIGER THAT THRIVES IN TALL, TOUGH GRASS.



Hahn 30" Riding Mower
Optional CatchMaster available.

Even lawns that look like tiny jungles are easy prey for the Tiger.

It maneuvers easily, with automotive-type steering. There's a rear engine for better traction. A floating front axle for mowing on uneven terrain.

All-gear, 3-speed transaxle has a 2-year limited warranty.

Let a riding Tiger or lawnmower turn your tall grass into a beautiful lawn.



HAHN TIGERS
Tough Mowers For Tall Grass

Hahn Outdoor Products, P.O. Box 5004, Clemmons, NC 27012

PM LOOKS AT ANOTHER RUST PRIMER



Primer comes in 8-oz., 1-gal. sizes.

A newly developed formula based on the rust-to-magnetite conversion principle, Corro-seal is both a rust treatment and base-coat primer. It is a synthetic resin latex containing rust-converting agents that combine with rust to transform it into a nonactive substance. The coating protects metals from recurring subsurface rust and new rust.

Applied by brush, the liquid forms a thermoplastic rust-inhibiting seal. The end result is similar to heat-treated, nonrusting gun barrels. Due to its high heat resistance, Corro-seal can be used on tailpipes, mufflers, barbecues and other rust-prone objects.

Applied Coatings Technology Inc., 1735 Austin Ave., Los Altos, Calif. 94022, prices Corro-seal at \$6.50 postpaid per 8-oz. size. One-gal. size is \$40.—*R. Capotosto*



Rusted washing-machine motor housing was revived; coating is good primer for all types of topcoats.

If you rebuild automobile engines, LUBRIPLATE is for you!

LUBRIPLATE No. 105 Motor Assembly Grease is a smooth, high quality, water repellent grease. It provides instant lubrication to the engine before the motor oil has circulated. Apply it to the engine bearings, cylinder walls, pistons and rings.

In fact, if you want full protection for your car, these are all for you!



LUBRIPLATE LUBRICANTS
A Form of Performance in Every Ounce!

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MANUFACTURING PLANTS IN NEWARK, N.J. 07105 AND TOLEDO, OHIO 43605 / DISTRIBUTORS NATIONWIDE

NEW TECHNOLOGY

Cordless Wonder

For \$89.95 the Mura cordless telephone sounds like a bargain. But wait until you hear about its many disadvantages.



The Mura cordless telephone represents a major breakthrough in telephone technology.

It's about time. For years you've seen ads for cordless telephones selling for between three and four hundred dollars.

Now through some very clever planning and a sprinkle of new technology, Mura Corporation has come up with a cordless telephone that sells for \$89.95. However, it has major disadvantages that could totally discourage you from buying the system—but more on that later.

ONLY IN AMERICA

The Mura weighs only 12 ounces and measures 1½" x 2¾" x 6½". The system includes a base unit that plugs into your telephone jack. You carry your cordless telephone with you and when your phone rings, you press a button and answer. And you can talk to anyone as long as you remain within 400 feet of the base unit.

But wait. We mentioned that the phone had major disadvantages. And it does. But first, let's outline some of its major advantages.

Convenience You don't need an extension telephone. With the Pocket Phone you have an extension phone that you can take with you—in the bath, in the den, in the garden, or to your neighbors.

Intercom You can use the base unit to page the person holding the cordless telephone. For example, if you're in your office and someone outside has the unit, you can press a button on the base unit and buzz the portable phone—just like on an intercom. Simply by talking on the phone plugged into your base unit, you can talk with someone on the remote phone. It's ideal for home or factory use.

Price The cost of the Mura remote telephone is only \$89.95. Compare this price not only with the cost of other \$300 remote telephones but with conventional phones as well, and you can appreciate what a major breakthrough the Mura system represents. But there's more.

You can plug any conventional phone into the base unit and carry on a three-way conversation. You can answer a call at the base unit and signal the remote unit to pick up the line. You can cut out the remote phone from the base unit if you want to keep a conversation private.

TALK OF VALUE

You can carry the cordless telephone with you with its antenna collapsed and the battery on standby. When a call beeps your unit, you simply extend the antenna, turn the power on, and start to talk.

The unit is FCC approved for connection directly into your telephone line. If you don't

have a four-pronged jack or a modular connector, simply call your telephone company. They'll promptly install a jack for you and the cost will be around \$15 or less depending on your location.

NOW THE CATCH

We mentioned that there was a catch—a few major disadvantages that you, as the consumer, should know about before you consider purchasing this product. Here they are:

Forget About Dialing The new Mura Pocket Phone can't dial out. It only receives calls. To many people, this doesn't matter because 90% of remote phones are used to receive calls and not to place them. By eliminating the dial, Mura has cleverly saved consumers hundreds of dollars.

Forget About Steel Walls The Mura unit won't penetrate them. This means that if you want to use your phone in a factory with metal walls, your unit won't work. But for most factories and practically all homes, the unit is ideal.

Forget About Snooping The unit has only a 400 foot range. At first this might seem awfully short, but nobody can snoop in on your conversations if that person is beyond this range, and 400 feet is more than enough for most applications. Most cordless telephones operate in the 27 megahertz range—the same frequency area used for citizen band radios.



The base unit for the Mura can also be used as a personal paging system or intercom.

The Mura uses the 49 megahertz range. This frequency has clearer reception with practically no interference.

The above are the disadvantages. For 90% of you, they don't mean a thing. For those 10% of you who need a dial, we would recommend the more expensive cordless telephones.

But for those of you who will accept its disadvantages, you'll be in store for the greatest idea in telephone convenience since the

cordless telephone was first introduced. In fact, rather than install an extension phone, why not consider the Mura instead?

TRY IT FIRST

We suggest you try the Mura Cordless telephone system in your own home, office or factory. Use it for 30 days. Take the phone to your next door neighbor's house or with you to the bathroom while you take a shower or bath. Take it with you on your patio or balcony, or bring it in your garden as you work. Use it in your factory as an intercom or in your office as a remote telephone.

After you've given it a thorough test, then decide if you want to keep it. If not, no problem. Simply return your system for a prompt and courteous refund including your \$3.50 postage and handling. You can't lose.

HERE'S THE WAY

To order your unit for a 30-day test, simply send your check for \$89.95 plus \$3.50 postage and handling to JS&A Group, Inc., One JS&A Plaza, Northbrook, Illinois 60062. (Illinois residents please add 5% sales tax.) Credit card buyers, call our toll-free number below. We'll send your base unit, cordless telephone, rechargeable batteries, recharger, complete instructions, our 90-day limited warranty, and the address of the closest Mura Service Center or service-by-mail station.

Your unit is backed by Mura Corporation, a 17-year old company famous for their microphones, headsets, and other audio products. JS&A is America's largest single source of space-age products—further assurance that your modest investment is well-protected.

Very often when a product's disadvantages aren't made clear to the consumer, that product ends up being a disappointment. By explaining the major disadvantages of the Mura cordless telephone, not only are we avoiding a possible disappointment, we're proving just how great a product it really is. Order a Mura cordless telephone at no obligation today.

JS&A PRODUCTS
THAT
THINK

Dept. PM One JS&A Plaza
Northbrook, Ill. 60062 (312) 564-7000
Call TOLL-FREE 800 323-6400
In Illinois Call (312) 564-7000

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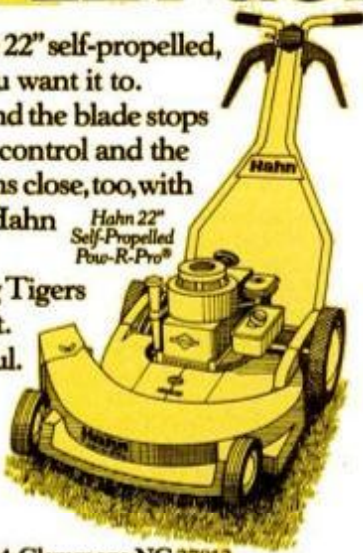
THE TIGER THAT STANDS STILL WHEN YOU LET GO.

Hahn designed this maneuverable 22" self-propelled, dual-control mower to stop when you want it to.

Release the BladeMaster control and the blade stops in seconds. Release the DriveMaster control and the wheel drive disengages. This Tiger trims close, too, with a low profile front and the exclusive Hahn trimmer notch on the left side.

If you have tall grass, Hahn riding Tigers and lawnmowers can really go after it. And leave your lawn looking beautiful.

HAHN TIGERS
Tough Mowers For Tall Grass



Hahn 22" Self-Propelled Pow-R-Pro®

Hahn Outdoor Products, P.O. Box 5004, Clemmons, NC 27012

A FULL 900% PROFIT FOR YOU... EACH AND EVERY TIME!

Make up to \$100.00 or more in just one hour ... even if you've never sold a thing ever before in your life! Simply "show" the entire Cameo collection of over 300 unique and unusual selections to friends, neighbors, relatives, co-workers, etc. Let them browse through page after page of the most expensive looking, high fashion rings imaginable ... all shown in glorious full-color and true-to-life detail.

JUST SHOW ... AND SELL!

Men, women, young folks ... they're all prospects! And when you make those sales, take a 100% deposit from these "sure-to-buy" customers - and use it to order and pay for their selections. YES - your customer's money - NOT your own - buys stock ... and you make a full

Simply put, before taxes, inflation, more taxes, recession, take your last spare dollar, we'll prove how you can MAKE \$100, \$200, \$300 or more EXTRA dollars every week! And - NO "SELLING" ... NO INVESTMENT ... NO EXPERIENCE NEEDED!



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SEND TODAY FOR YOUR FREE - DYNAMIC - POWER PACKED CAMEO COLLECTION SELLING KIT ... AND WITHIN MINUTES ... YOU'RE "IN BUSINESS" - RAISING IN BIG, FAT 900% PROFITS ON FAST AND EASY SALES!

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TO: Edgar Farrington - Dept. C-42
CAMEO COLLECTION
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Dear Mr. Farrington:

Please RUSH me via 1st CLASS MAIL - the complete Cameo Collection Selling Kit - including colorful Catalog, Ring-Sizer, Customer Order Forms, Order Envelopes, etc. all FREE. It is thoroughly understood that I am not under any cost or obligation whatsoever - and that everything you send me is absolutely free - and does not have to be returned ever, under any circumstances.

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SPECIAL FREE OFFER!

New products you should know about



The MacPenny Plantminder has a 4-pint reservoir in its 8x20-in. tray with a capillary mat that stores the water. Plants on the mat draw the water through the holes in the bottom of their pots to water themselves for as long as three weeks. Plantminder is priced at \$10 from Bramen Co. Inc., Salem, Mass. 01970.



Grow vegetables and flowers indoors in the 10½x15x19-in. Home-Grown Hydroponic Greenhouse. It's \$40 postpaid, with planting bed, feeding system, nutrient reservoir, mix, greenhouse, root-support medium, guide. Uncle Milton Industries Inc., Box 246, Culver City, Calif. 90230.



The Grill and Garage Scrubber (\$2.62) helps ease the chore of cleaning garden tools, barbecue grills, cement floors and boat bottoms. Its handle gives you scrubbing leverage. The tough scrubbing pad has no bristles to fall out or flatten. Available in houseware, hardware stores, from 3M Co., 3M Center, St. Paul, Minn. 55101.

FIRST OF A SERIES

FTC Revolt

You've heard of the tax revolt. It's about time for an FTC revolt. Here's my story and why we've got to stop federal bureaucratic regulation.

By Joseph Sugarman,
President, JS&A Group, Inc.

My story is only one example of how the FTC is harassing small businesses but I'm not going to sit back and take it.



I'm pretty lucky. When I started my business in my basement eight years ago, I had little more than an idea and a product.

The product was the pocket calculator. The idea was to sell it through advertisements in national magazines and newspapers.

Those first years in the basement weren't easy. But, we worked hard and through imaginative advertising and a dedicated staff, JS&A grew rapidly to become well recognized as an innovator in electronics and marketing.

THREE BLIZZARDS

In January of 1979, three major blizzards struck the Chicago area. The heaviest snowfall hit Northbrook, our village—just 20 miles north of Chicago.

Many of our employees were stranded—unable to get to our office where huge drifts made travel impossible. Not only were we unable to reach our office, but our computer totally broke down leaving us in even deeper trouble.

But we fought back. Our staff worked around the clock and on weekends. First, we processed orders manually. We also hired a group of computer specialists, rented outside computer time, employed a computer service bureau, and hired temporary help to feed this new computer network. We never gave up. Our totally dedicated staff and the patience of many of our customers helped us through the worst few months in our history. Although there were many customers who had to wait over 30 days for their parcels, every package was eventually shipped.

WE OPENED OUR DOORS

During this period, some of our customers called the FTC (Federal Trade Commission) to complain. We couldn't blame them. Despite our efforts to manually notify our customers of our delays, our computer was not functioning making the task extremely difficult.

The FTC advised JS&A of these complaints. To assure the FTC that we were a responsible company, we invited them to visit us. During their visit we showed them our computerized microfilm system which we use to back up every transaction. We showed them our new dual computer system (our main system and a backup system in case our main system ever failed again). And, we demonstrated how we were able to locate and trace every order. We were very cooperative, allowing them to look at every document they requested.

The FTC left. About one week later, they

called and told us that they wanted us to pay a \$100,000 penalty for not shipping our products within their 30-day rule. (The FTC rule states that anyone paying by check is entitled to have their purchase shipped within 30 days or they must be notified and given the option to cancel.)

NOT BY CONGRESS

The FTC rule is not a law nor a statute passed by Congress, but rather a rule created by the FTC to strengthen their enforcement powers. I always felt that the rule was intended to be used against companies that purposely took advantage of the consumer. Instead, it appears that the real violators, who often are too difficult to prosecute, get away while JS&A, a visible and highly respected company that pays taxes and has contributed to our free enterprise system, is singled out. I don't think that was the intent of the rule.

And when the FTC goes to court, they have the full resources of the US Government. Small, legitimate businesses haven't got a chance.

We're not perfect. We do make mistakes. But if we do make a mistake, we admit it, accept the responsibility, and then take whatever measures necessary to correct it. That's how we've built our reputation.

BLOW YOUR KNEE CAPS OFF

Our attorneys advised us to settle. As one attorney said, "It's like a bully pulling out a gun and saying, 'If you don't give me a nickel, I'll blow your knee caps off.'" They advised us that the government will subpoena thousands of documents to harass us and cause us great inconvenience. They warned us that even if we went to court and won, we would end up spending more in legal fees than if we settled.

To settle would mean to negotiate a fine and sign a consent decree. The FTC would then issue a press release publicizing their victory.

At first we tried to settle. We met with two young FTC attorneys and agreed in principle to pay consumers for any damages caused them. But there were practically no damages, just a temporary computer problem, some late shipments, and some bad weather. The FTC then issued a massive subpoena requesting documents that will take us months to gather and which we feel was designed to harass or force us to accept their original \$100,000 settlement request.

Remember, the FTC publicizes their actions. And the higher the fine, the more the

publicity and the more stature these two attorneys will have at the FTC.

If this all sounds like blackmail—that's just what it appeared to be to us.

We did ship our products late—something we've admitted to them and which we publicly admit here, but we refuse to be blackmailed into paying a huge fine at the expense of our company's reputation—something we've worked hard eight years to build.

We're not a big company and we realize it would be easier to settle now at any cost. But we're not. If this advertisement can attract the attention of Congressmen and Senators who have the power to stop the harassment of Americans by the FTC, then our efforts will be well spent.

ALL AMERICANS AFFECTED

Federal regulation and the whims of a few career-building bureaucrats is costing taxpayers millions, destroying our free enterprise system, affecting our productivity as a nation and as a result is lowering everybody's standard of living.

I urge Congressmen, Senators, businessmen and above all, the consumer to support legislation to take the powers of the FTC from the hands of a few unelected officials and bring them back to Congress and the people.

I will be running this advertisement in hundreds of magazines and newspapers during the coming months. I'm not asking for contributions to support my effort as this is my battle, but I do urge you to send this advertisement to your Congressmen and Senators. That's how you can help.

America was built on the free enterprise system. Today, the FTC is undermining this system. Freedom is not something that can be taken for granted and you often must fight for what you believe. I'm prepared to lead that fight. Please help me.

Note: To find out the complete story and for a guide on what action you can take, write me personally for my free booklet, "Blow your knee caps off."

JS&A PRODUCTS
THAT
THINK

One JS&A Plaza, Northbrook, Ill. 60062

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SLEEP LIKE YOU'VE ALWAYS DREAMED OF...

On a Siesta Air Bed!

The new improved air bed

Inflates in minutes for luxurious comfort anywhere!

- Camping
- In your Car or Van
- On the Boat
- By the Pool
- In the Guest Room

The sensuous way to sleep

Siesta Air Beds provide you with the relaxing, sensuous sleep of a water bed without the fuss and weight! Their revolutionary Tubular Air Coil System automatically equalizes body weight so you don't "sink" and sides won't pop up. Your whole body gets the firm yet gentle support it needs to wake up feeling alert, rested, restored!

Improved! Lush, denim-like finish

Unlike other air mattresses you may have seen, the Siesta Air Bed is luxuriously covered with a soothing denim-like Rayon that never feels cold or slick. You'll enjoy complete "at-home" comfort even when you camp out on vacation!

Outstanding durability, too

The Siesta Air Bed is unbelievably strong—kids can jump and play on it without wear and tear. It's double-sealed by the manufacturer for long, leak-proof life... Siesta's are really built to take it. So, you can take your Siesta along wherever you go and get the sleep you need.

Like having a guest room on a shelf

No place to put up guests? No problem when you own a Siesta Air Bed! Just inflate it in minutes and provide guests with a luxurious "guest room" anywhere. When they're gone, just deflate it and store it easily on a small shelf! But you may well decide to make your Siesta Air Bed your permanent mattress. No frame or box spring is required—the Siesta is the all-in-one luxury bed for comfort and unprecedented convenience at home or on the road.



Store your Siesta "Guest room" on a shelf when not in use! Inflate it in minutes when guests arrive—or use it every night for a deep, restful sleep.



Sleep FREE for 30 nights!

We invite you to sleep-test a Siesta Air Bed for a full 30 nights before you decide a thing. If not convinced that it gives you the most restful, supportive sleep ever, simply return it for a prompt, complete refund.

Available in a variety of sizes

Whether you order Full, Twin, Queen or King, you'll enjoy the sleep of a lifetime! And don't forget to order the Custom Air Pump specially designed for use with the revolutionary new Siesta Air Bed.

Order Now at these low prices!

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HINTS FROM READERS

Light bulb replacement tool



When attached to the end of a broomstick or rod, the spring bulb clip from a table lamp can replace light bulbs in hard-to-reach places. Pad the clip with electrician's tape.—*Ken Patterson*

Square becomes scriber



Since I often use my combination square as a marker scriber, I filed a notch in one end of the ruler for the pencil.—*H.E. Moody*

How to raise a horse



Add height to sawhorses and avoid stooping by clamping a pair of rectangular frames to the top crosspiece. The frame sides should be made the same width as the sawhorse top.—*John F. Dinges* (Editor's Note: Skin one side of each frame with 1/4-in. plywood for rigidity.)

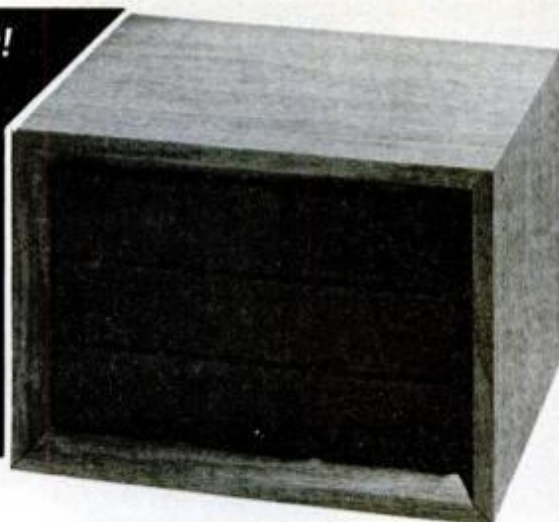
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Low Cost Computerized Burglar Alarm System Home - Office - Business

The Guardex 8000 Alarm System is walnut grained and disguised to look like a small stereo speaker (6 3/4" x 9 3/4" x 8") and weighs less than 6 1/2 pounds.

NO INSTALLATION

Just plug the Guardex 8000 alarm system in, make several simple control adjustments to suit your particular building and it works! There are no other wires to run. This totally self-contained burglar alarm can completely seal off every square inch of the surface of your building. It protects doors, windows, and what most alarms miss... your roof, walls and floors.

HOW CAN ONE SMALL COMPUTER PROTECT MY WHOLE BUILDING?

Guardex 8000 Alarm System works on the principle of audio discrimination. This, put simply, is the process of electronically separating normal everyday sounds, such as voices, telephones, etc. from break-in type noises such as breaking glass, prying metal, or forcing a door open. The Guardex 8000 protects one story homes and offices up to 2000 square feet and open commercial buildings up to 10,000 square feet. The Guardex 9300 with wireless remote sensor capability is available for multi-story homes and offices or single story with more than 2000 square feet. Call the factory for more detailed information.

TURNS ON LIGHTS AUTOMATICALLY

When the first break-in type sound is detected, the system will instantly turn on lights, radio, or other electronic equipment that you have plugged into the back of the alarm. These lights or other equipment will remain on for a period of five minutes, then automatically turn off.

POWERFUL ELECTRONIC SIREN

The Guardex 8000 alarm is equipped with a loud built-in siren. If during the five minute period the lights or other electronic equipment has been activated, a second break-in sound is detected, (it can be only a second or two after the first break-in sound) the built-in siren will start blasting for 90 seconds. At the end of approximately 90 seconds the siren will shut off and the alarm listens again. If another break-in sound is heard, the siren will come on for another 90 seconds. If no other break-in sound is detected, the siren will stay off and at the end of the five minute period the lights will shut off and the alarm instantly resets.



The rear control panel contains two standard AC plug receptacles for a table lamp, spot lights, radio, etc.; terminals for connecting optional outside siren and back-up battery (not included); entry delay time control and sensitivity control.

EXIT AND ENTRY DELAY

The Guardex 8000 alarm has a built-in exit delay allowing you approximately one minute to lock up and leave the building before the alarm is armed. When you enter your building you may find that just your normal entering sounds activate the siren. You may delay it from starting for up to 30 seconds by turning up the siren entry delay control.

BATTERY BACK-UP

Burglars rarely cut power. However, to give you total protection from a burglar and possible power failure, our alarm has provisions for a battery back-up. (Batteries not included). 12 volt lantern batteries are available at most hardware stores.

THE BURGLARY PROBLEM

The F.B.I. statistics show that at the present rate, one out of every four Americans are going to be burglarized. That is not a very pleasant fact, but it is true. You have a greater chance of being burglarized than being a victim of a fire or automobile accident. The time is now to help protect yourself and your valuables with a Guardex 8000 alarm system.

OUTSIDE SIREN

The Guardex 8000 alarm is equipped with a loud, built-in siren, but if you desire an additional siren to mount outside or in an area away from the main alarm, they are available with 50 feet of wire for \$24.95. (Connecting terminals are provided on the back of the alarm).

30 DAY NO RISK TRIAL

This is your opportunity to purchase an alarm system directly from the factory for only \$199.95. Try it in your home or business for thirty days without risking one cent. Put our Guardex 8000 alarm to your own test. See for yourself! It will protect every window and door from break-in. If you are not completely satisfied, return the alarm within 30 days for a complete refund. To order your Guardex 8000 alarm, CALL TOLL FREE to charge your credit card or send your check to Guardian Electronics, Inc. in the amount of \$199.95. If you want the optional outside siren, add \$24.94. (California residents add 6% sales tax.)

(If you require more information, call during California business hours, Monday - Friday)



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- Owners report on AMC's 4wd Eagle.
- PM's secrets for installing hardwood floors.

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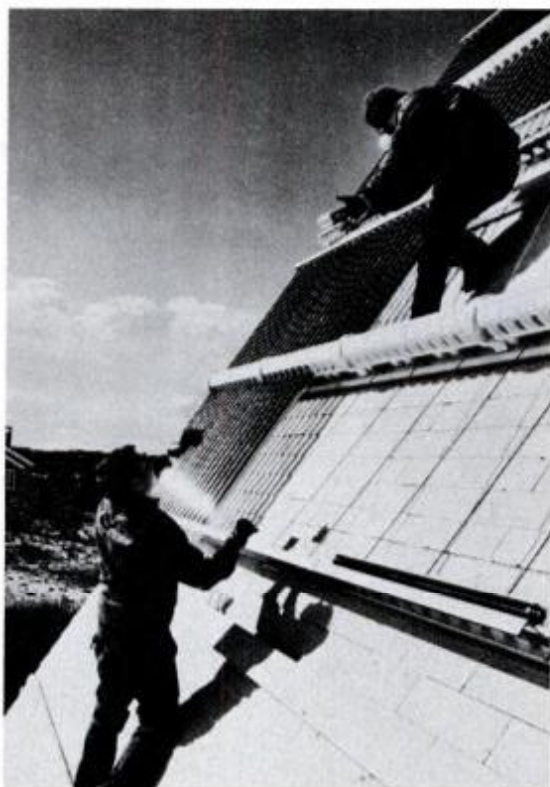
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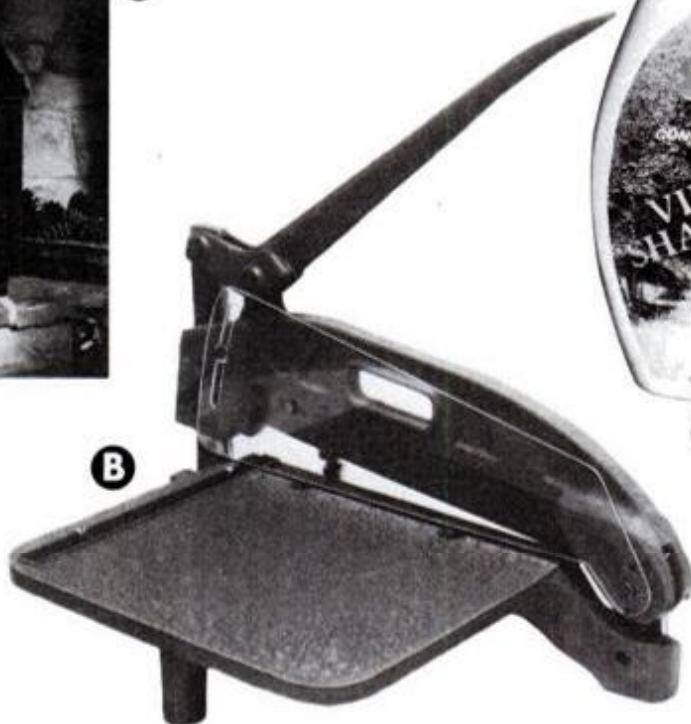
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A

A Hearthstone Contemporary woodstove from Sierra is a 1980 front-opening version of that company's best-selling, airtight model of 1979. It features Vycor glass windows by Corning, which are claimed to be safer, to transmit more heat and to allow you to watch the fire with doors closed. Or, you can open the doors, insert a heavy-duty firescreen and enjoy the firelight. Created to fit a standard 16-in. fireplace hearth or to be used as a freestanding unit, it can heat up to 2000 sq. ft. and is priced under \$600. Free brochure from Sierra, Box 346, Dept. PM, Harrisonburg, Va. 22801.



B

B A safety guard for its line of table shears had been introduced by New Hermes Inc., 20 Cooper Square, New York, N.Y. 10003. All new shears from the firm will be equipped with the guard and current owners of New Hermes shears can install the guard for \$25. An installation kit is also available for \$15, but it requires the drilling and tapping of a hole. For more information, write the manufacturer.

C



C Star Brite Vinyl Shampoo is a concentrated solution that is diluted with 10 parts of water for cleaning a variety of vinyl surfaces including auto tops, furniture, appliances, clothing and shoes. It's available at most department and auto-supply stores for \$2.15. Star Brite Distributing Inc., Box 300, Coral Gables, Fla. 33134.

D Claimed to cost less than half the price of similar, ready-made fixtures, these elegant lighting fixtures come in kit form for assembly by the buyer. They are easy to assemble, no tools are needed, and illustrated assembly instructions are included in the kit. Made of hand-beveled, smoke-glass panels that are joined by gleaming brass collars on flexible bands, the finished fixtures give a jewel-like look when the lamp is lit. The Ultraflex Light Kits are available in 12 classic patterns in sizes from small lights for a foyer, to bath, den and chandelier proportions. They are sold at lighting, department and hardware stores and at gift and bath boutiques. Kits are priced from \$24.95 to \$89.95. Shemsafe Inc., 1501 Boston Post Rd., Milford, Conn. 06460.

D





No compromise

Winston Lights didn't compromise on great taste to get low tar. Why should I?

Winston Lights taste good like a light cigarette should.

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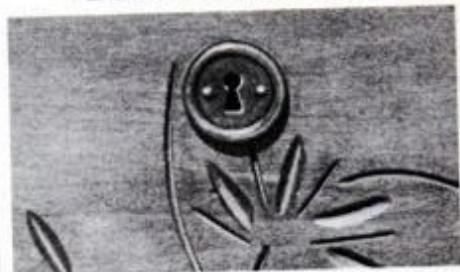
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Wooden escutcheon plates you can make



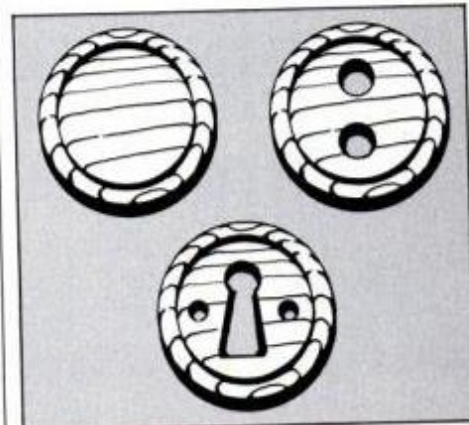
The escutcheon plates around keyholes of antique furniture are often missing. Replace them with your own escutcheons made of cherry, oak, walnut or other wood.

Center and glue round stock to a scrap of wood attached to a 3-in. faceplate. A 1-in.-thick piece makes at least four escutcheons. Grain should run across the plate.

Turn the piece to diameter wanted; then shape a design and sand it on the lathe. Saw a plate 1/8- to 3/16-in. thick before turning face for next plate. Bore two holes to start keyhole. To avoid splitting, make it at a right angle to grain. Shape keyhole with a coping saw. Stain and varnish, glue or nail it to furniture.—*Ralph S. Wilkes*



With the lathe running, carefully saw off the first escutcheon with a hacksaw.



Bore two holes in a blank escutcheon; then shape a keyhole with a coping saw.

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We came to bury a case of C.C.® near the site of the Winter Olympics...and almost got buried ourselves.

We headed to Lake Placid to cross-country ski and to hide a case of C.C. near the Winter Olympics. But skiing deep into the forest, we forgot to watch the sky.

A serious mistake among the unforgiving Adirondack Mountains.

By noon the wind was howling and, faster than we could believe, the ski tracks we hoped to follow were under new snow. We were lost in an Adirondack blizzard! But intent on hiding our case of Canadian Club, we blindly followed our sixth sense. Finally, cresting a steep hill, we found ourselves in an open field. Driving winds were more intense here, but we followed a fence row until we could make out the silhouette of towering Whiteface Mountain. With our bearings restored, we hid our treasure in a place where those who seek gold will miss by a quarter of a mile.

Toasting our luck with C.C. before a roaring fire.

Soon we were regaling friends with our chilling adventure as we enjoyed drinks of Canadian Club before a warming fire. We knew the case wouldn't be easy to find. Those who seek it may have to brave the same bitter conditions that challenge the Olympians. But if you prefer to confine your search for "The Best In The House" to the warm fireside, simply tell your host, "C.C., please."



6 YEARS OLD. IMPORTED IN BOTTLE FROM CANADA BY HIRAM WALKER IMPORTERS INC. DETROIT, MICH. 86.8 PROOF. BLENDED CANADIAN WHISKY. © 1980

Canadian Club
"The Best In The House"® in 87 lands.

HOMEOWNERS' CLINIC

QUESTIONS ANSWERED

White stains on block walls

In 1952 my house foundation was treated with oil-base paint. Periodically (every five or six years), I've repainted it. Ten years ago I buffed it, filled in the more porous areas and holes with nonshrinking filler and repainted, using a latex paint. Shortly after this I noticed an area having alkali stains. This area wouldn't accept any paints. Whatever I put on lasted three months, then fell off.

The area, about 12 ft. long and near the top of the wall, gets weather only when it rains. No one else in the neighborhood has this problem. What can be the trouble? How can I correct it?—Burl Miner, Havre, Mont.

Your wall is suffering from a severe case of efflorescence—the effect of moisture on the water-soluble salts in the concrete and masonry. It usually shows up as white, but green or brown stains are not uncommon. This chemical reaction will not take place unless moisture is present. Stop it and you cure the problem.

My neighbor's basement suddenly developed efflorescence after 15 years. We tracked the cause to a moved splash block under his shrubs, allowing water from the downspout to run down and wet the foundation wall. The salt stains will brush off, but the source of moisture must be removed to keep them from reappearing.

To vent or not to vent

The guy who installed my 30-gallon gas-fired water heater said I didn't have to vent the gas to the exterior, and that if I put tin over my floor joists above to keep them from drying out, I'd have a much more energy-efficient burner, because I'd be warming my basement from the burned gases.—J.C., Fall River, Mass.

In this order, I:

1. Received your letter.
2. Tried calling you immediately, but information couldn't locate "J.C."
3. Hope that by the time you receive this you only have an enormous headache.
4. Can't believe you'd joke about anything so serious, so I asked the editors to print this. By all means, get that heater vented immediately—your life may depend on it.

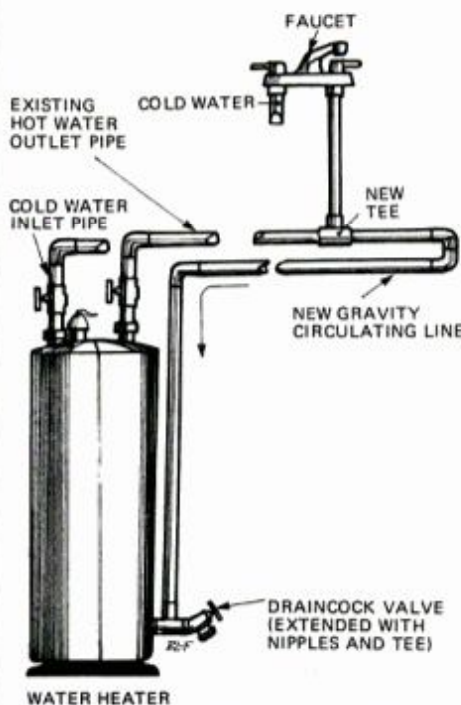
Recirculating hot water

My kitchen faucet is quite a distance from my water heater. Consequently,

I waste a lot of cold water before the hot water flows from the tap. An article in an old issue of PM shows a simple gravity recirculating system. However, I'm concerned about the principle.

When I opened the drain valve on my heater, the water came out with a great pressure. Wouldn't the two water pressures meet at the tee fitting at the bottom of the tank and create an impasse? Does the system actually work?—O.W. Jensen, Novato, Calif.

A gravity recirculating system can work. Continuous circulation of hot water is maintained by the dif-



Hot water recirculates in gravity system.

ference in weight of the warmer supply water and the slightly cooler water in the return line (see drawing, above).

To set up the system, turn off the heat source and the water to the heater, then drain the tank. Unscrew the draincock from the tank, put it on the end of a tee, then screw the extended cock back into the tank as shown.

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. Letters cannot be answered individually, but problems of wide interest will be discussed in this column. For more home repair and maintenance help, get PM's Home Care Guide, \$4.95 postpaid. Send order(s) to PM, Dept. HCG, Box 1014, New York, N.Y. 10019.

Use appropriate fittings to run piping parallel to the supply line from the top of the tee. Connect the existing branch from the faucet to the new gravity recirculating line with a tee.

For maximum efficiency and energy conservation, insulate both hot-water and recirculating lines. For distances over 100 ft. to the last fixture, a recirculating pump that is controlled by an aquastat is very helpful.

Built-up roofing repair

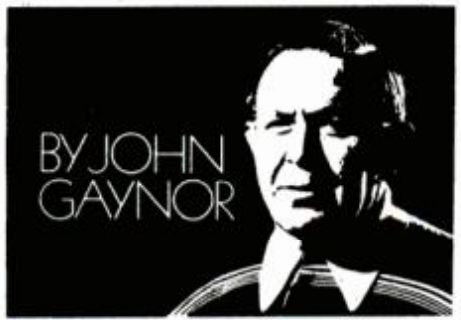
I have a 21-year-old Florida home that has a built-up flat roof topped with white gravel. The roof was coated about four years ago. It needs coating again. Although I've patched it twice in the last three months, I've been told that the life of this type of roof is about 20 years. Should I keep patching, or replace it?—Quentin Wood, Venice, Fla.

Quentin, I imagine you'd like me to tell you to "keep on patchin'." Unfortunately, even the "20 years" has changed since your home was new. Now, most makers of built-up roofs talk of a 10-year warranty. This should indicate how lucky you are with the roof you have.

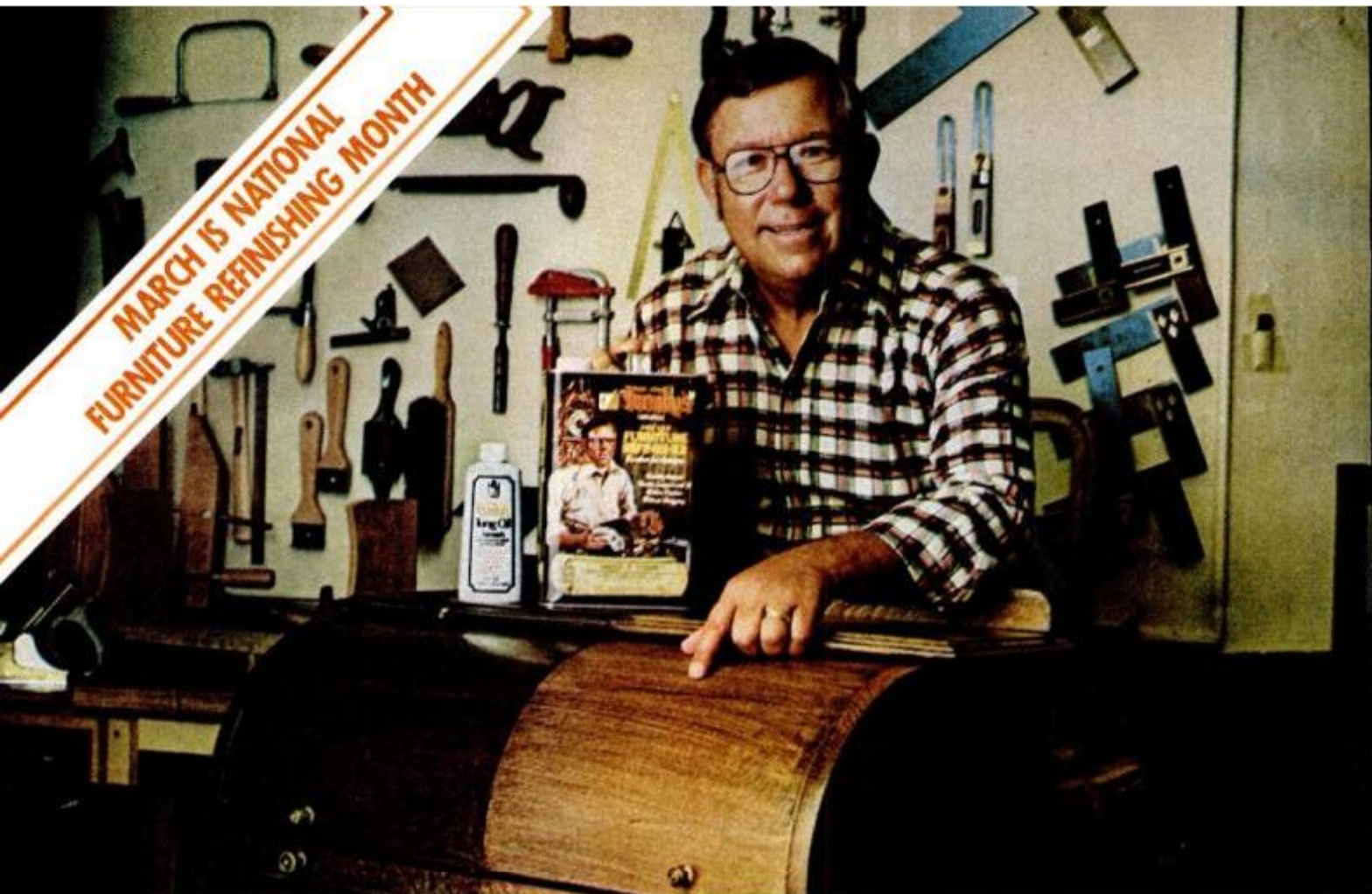
You have to weigh patching and repainting the water-damaged rooms under the leaks against the cost of a new roof. When you've finally had it with patching, the new roof can be applied over the old one. First, the gravel must be removed (spudded).

I strongly suggest gravel be installed over a conventional built-up roof, as it helps to protect a breakdown of the roof materials by the sun's ultraviolet rays. Single-sheet roof applications are available now. They have a mop-on coating to protect against deterioration caused by ultraviolet rays (see "Leaky Tar Roof," *Homeowners' Clinic*, page 40, Oct. '78).

PM



MARCH IS NATIONAL
FURNITURE REFINISHING MONTH



“You won't believe you did it. But you did!”

—Homer Formby
3rd generation antique refinisher

Refinishing furniture by stripping used to be a messy, time-consuming job that nobody wanted to tackle.

Homer Formby has changed all that.

With Homer Formby's products, because you don't need to strip, refinishing is nowhere near the drudgery it used to be.

Imagine a system so simple you actually won't mind refinishing.

Imagine a system so foolproof even your very first project looks professionally refinished in half a day.

Refinishing. From start to finish.

Pour some of the Furniture Refinisher into a metal tin. Dip your steel wool in. (Use Homer Formby's steel wool, because it's low in abrasion and oil content.) Now rub your steel wool over a small portion of the piece. You don't have to rub hard! Very quickly you will see the old discolored varnish, shellac and lacquer melt away.

And the Furniture Refinisher does not remove the wood's patina or raise the grain the way strippers and paint removers do. Raising the grain ruins the patina and the patina is what gives fine old furniture that rich glow and warmth.

If you strip your furniture, you strip away the patina and this destroys your furniture's value.

After you've refinished the piece, go over one more time with

clean Refinisher. Rub with the grain, to remove any streaks.

Then, go over the piece with dry steel wool, to prepare the surface for Tung Oil.

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And now is a great time to get started, because it's National Furniture Refinishing Month. To celebrate, many of our dealers have a sale on Formby's Refinisher and Formby's Tung Oil. For the name of a dealer in your area, call (800) 647-9352 or in Mississippi call (800) 222-8216. So get started right away. Remember you've got a prize right under your eyes.



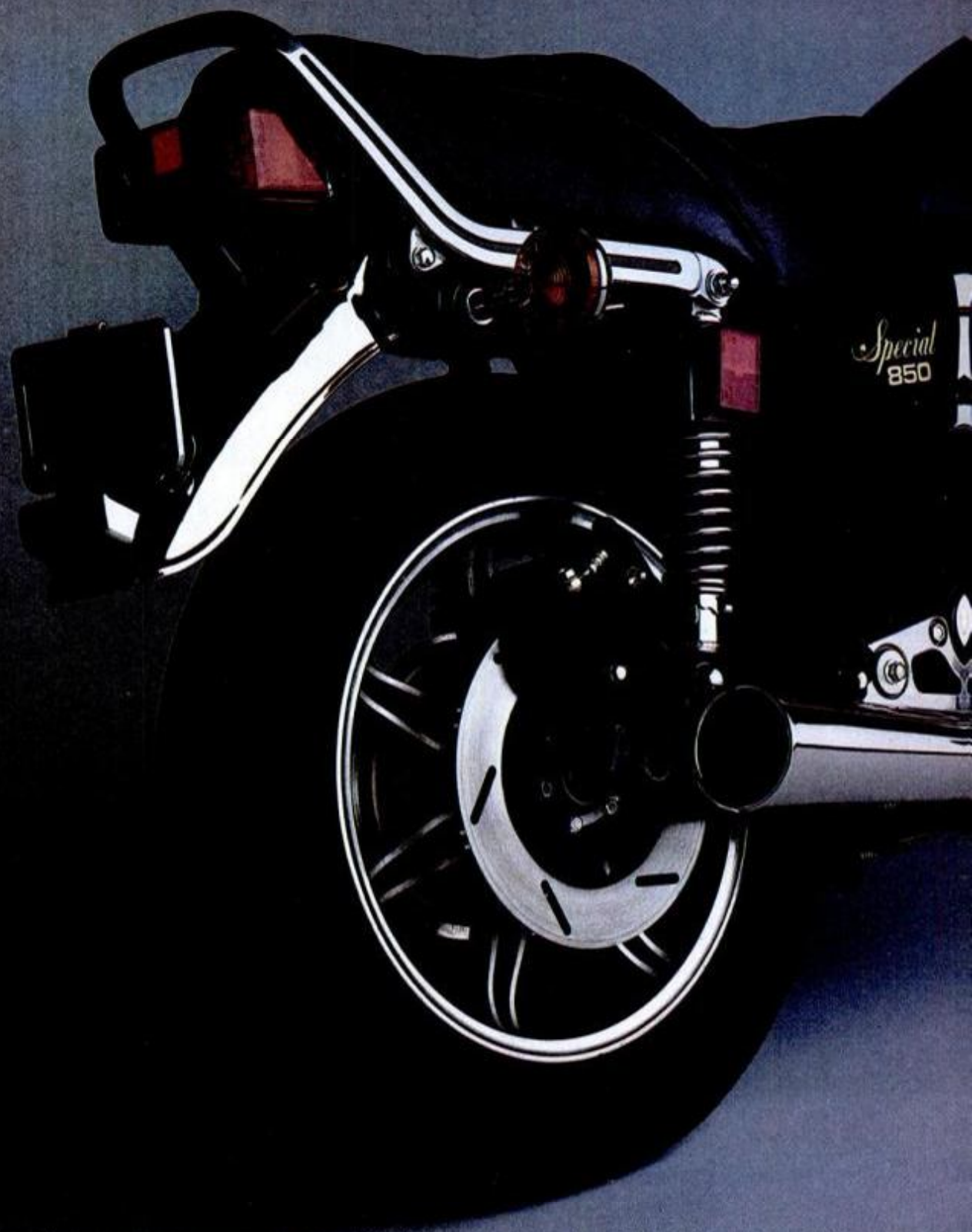
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The clean, fluid downlines formed by the classic teardrop tank and side covers reflect the years we've spent refining our original design.

This year, by cleverly restructuring the frame geometry and

seat mounting system, we not only integrated the seat with the frame but lowered the seat height significantly. So at the stoplights, you get feet-on-the-ground stability, and on the road, a feeling of sitting "in" the seat instead of "on" it.

And that new cast alloy grab rail is not only an attractive accent, but allows the taillight to become an integral part of the tail configuration — with

DETROIT LISTENING POST

Ford front-wheel drives

Ford is beginning to get its future front-wheel-drives in line, as it now appears the upcoming "Erika" program will spawn a wide variety of new products, ranging from compacts to two-seaters.

First will be the badly needed Pinto/Bobcat replacement, which will bow this fall in two-door hatchback and two-door wagon versions. Engines will be 1.3- and 1.6-liter Fours, and possibly a 2.0-liter diesel that Ford may purchase from its Japanese partner, Toyo Kogyo. The Ford models will be called "Escort" and the Mercurys will be dubbed "Lynx." Wheelbase is set at 95 inches, with overall lengths in the 160-inch range.

Next will be sportier versions, in notchback and fastback form, with sloping, soft-plastic noses not unlike those on Chrysler's Omni/Horizon sport coupes. Fuel-injection will be optional on the 1.6-liter engine, and possibly a turbocharger as well.

By mid-1982, Ford should have front-drive, Erika-derived replacements ready for the compact Fairmont and Zephyr lines, with two-door, four-door and wagon models on a wheelbase that is to be approximately 98 inches.

Other spinoffs could include a tiny, two-seat commuter vehicle by 1984-85 and perhaps a two-seat sports model, as well. A new 1.8-liter Four is being developed for the larger cars, while the super-economical microcar would likely be powered by engines that displace less than 1.0 liter.

Also for 1981 there will be redesigned Granada/Monarch models, while the German-built Fiesta subcompact will be scrubbed from Ford's U.S. lineup. A new 3.8-liter V6 engine will make its debut in 1982 for use in mid-size and larger Ford and Lincoln-Mercury cars, all of which are going to remain rear-drive vehicles for the foreseeable future.

Microcars and minivans

If Ford does go ahead with its Erika-based micro-mini plans, it will not be alone.

GM already has running prototypes of such tiny fuel-savers, at least one of which is electric-powered; Chrysler is looking at teaming with its Japanese affiliate, Mitsubishi, to design and develop a mi-

cro; and the AMC/Renault partnership could come up with a U.S. version of a new Renault design currently being groomed for the European market.

Several Japanese and European makers already have micro models for their home markets and could be counted on to send them here as soon as U.S. demand is deemed sizable enough. The way the gas situation is going, that shouldn't take very long.

Another badly needed new vehicle concept for the fuel-short '80s is the minivan. VW has a nicely updated version of its air-cooled, rear-drive Vanagon (with a diesel version coming soon) for 1980 that's certainly the most economical van around, and the domestics will surely go to optional diesel engines as fuel gets more expensive. But the question of who will be first to come up with a smaller and *really* economical minivan for the U.S. market remains very much open.

A GM X-car variation that was half-van, half-wagon was scrubbed for tooling and development cost reasons, but could be revived if enough demand materializes. The Big Three are all looking at minivans for the mid 1980s, and Chrysler recently unveiled a nice prototype that is currently planned for the '86 model year.

AMC is good at filling market holes the others leave open and could surprise us with a small fwd or 4wd van in the next few years. However, my guess is that the ever-clever Japanese will get there first in this country. They already have VW Vanagon-size vans in Japan, and look what they've done with minipickups in the last 10 years.

Bench seats mandatory?

In our "Glad he's not king" department, a reader (who shall remain nameless) writes to solicit help in his campaign to make front bench seats, column-mounted shift levers and other interior features of his preference *mandatory* in all U.S. cars—citing safety, comfort and cost-savings as reasons.

His biggest complaint is that floor- and console-mounted shifters and parking brake handles cause injuries in accidents, which is probably true *if front-seat occupants aren't properly belted in.*

I suggest that this fellow should

buckle up (if he's really concerned about safety) and get used to two-place front seating, since the federal passive restraint requirement (beginning in 1982) will eliminate front bench seats in all but the largest (air-bag-equipped) cars.

Personally, I wouldn't have a car without well-designed, multiadjustable, supportive front buckets that help the belts hold me in place *and* a good, floor-mounted manual shifter. (Don't you feel glad that *I'm* not king?)

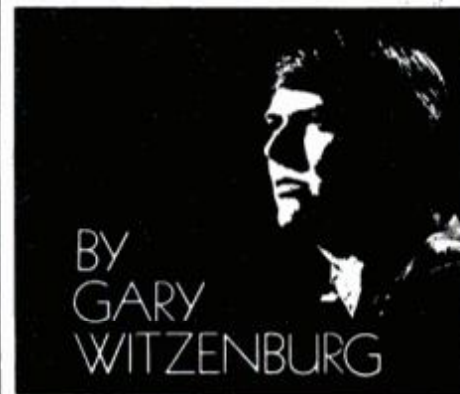
Bench seats do provide three-abreast seating, but they're the absolute *worst* for safety because they let you slip and slide all over the car in emergency maneuvers . . . and *crash* around inside the passenger compartment if you're unbelted and do hit something.

AMC/Renault front-drives for '83

About 2½ years from now, American Motors should be ready to introduce its first all-new car line since the ill-fated Pacer. Designed in conjunction with Renault, it will consist of small, front-drive coupes, sedans and wagons sized between Renault's current LeCar and the 18 sedan that is due for U.S. importation soon.

French-built engine, power train and suspension components are likely to include both diesel and turbocharged engines, and 4wd variations are a good possibility . . . presuming continued success of the Eagle and future smaller (Spirit based) 4wd cars.

The best guess is that the rear-drive Spirit will be replaced by these new models, but the larger Concord/Eagle (in its redesigned and down-weighted form) will stay around just as long as the market demand and CAFE mileage standards permit. **PM**



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Make your own camera harness

A custom-made harness takes the worry out of bringing camera equipment along for activities like skiing or motorcycling. This one is made with 8-ounce pack cloth, nylon webbing and elastic straps.

Sewn in between two layers of cloth are a piece of 1/4-inch, closed-cell foam for each camera and two 2-inch webbing strips running top to bottom. Ultraheavy-duty, 1-inch elastic straps are sewn to the outside to hold cameras in place. Two-inch, 9000-pound-test webbing is used for the back straps; buckles and 1-inch webbing for the adjustable side straps. Another 1-inch strip may be used as a stiffener along collar front.

A standard fanny pack can be modified to carry lenses and other photo gear. With a hand-stitching awl, sew in a layer of 1/2-inch, closed-cell foam all around. Lenses are held in place by Velcro-closed nylon or elastic straps. The opening straps have large loops for handling ease in the cold.

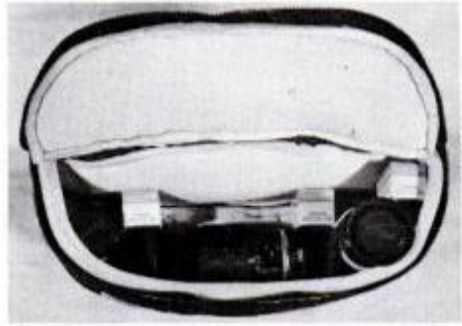
All materials, including awl, are available from camping or mountaineering supply companies. The vest costs about \$14; fanny pack about \$15. If you don't need all this equipment, the design is easy to adapt to your needs.—Ken Gallard.



Cameras rest on 1/4-inch foam sewn between cloth layers. Elastic holds securely.



Skier wears no vest or jacket to show harness in action; normally he would wear one to keep cameras warm and protected.



All sides of fanny pack are lined with sewn-in foam. Lens straps have Velcro closing.



9000-pound-test webbing provides support, distributes load. Side straps adjust.

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PHOTO HINTS

Off the wall



Slow shutter speeds require use of a tripod, but often a tripod takes too long to set up or isn't tall enough. Try bracing it unextended against a wall; the camera will be supported as rigidly as if the tripod were on the floor.—*Bob Berger*

All mixed up



A 2½-gallon plastic bucket is useful for mixing large amounts of photographic chemicals. Its size allows vigorous stirring without spills, and its pour spout makes bottle filling easier.—*Rudy and Marcia Schulze*

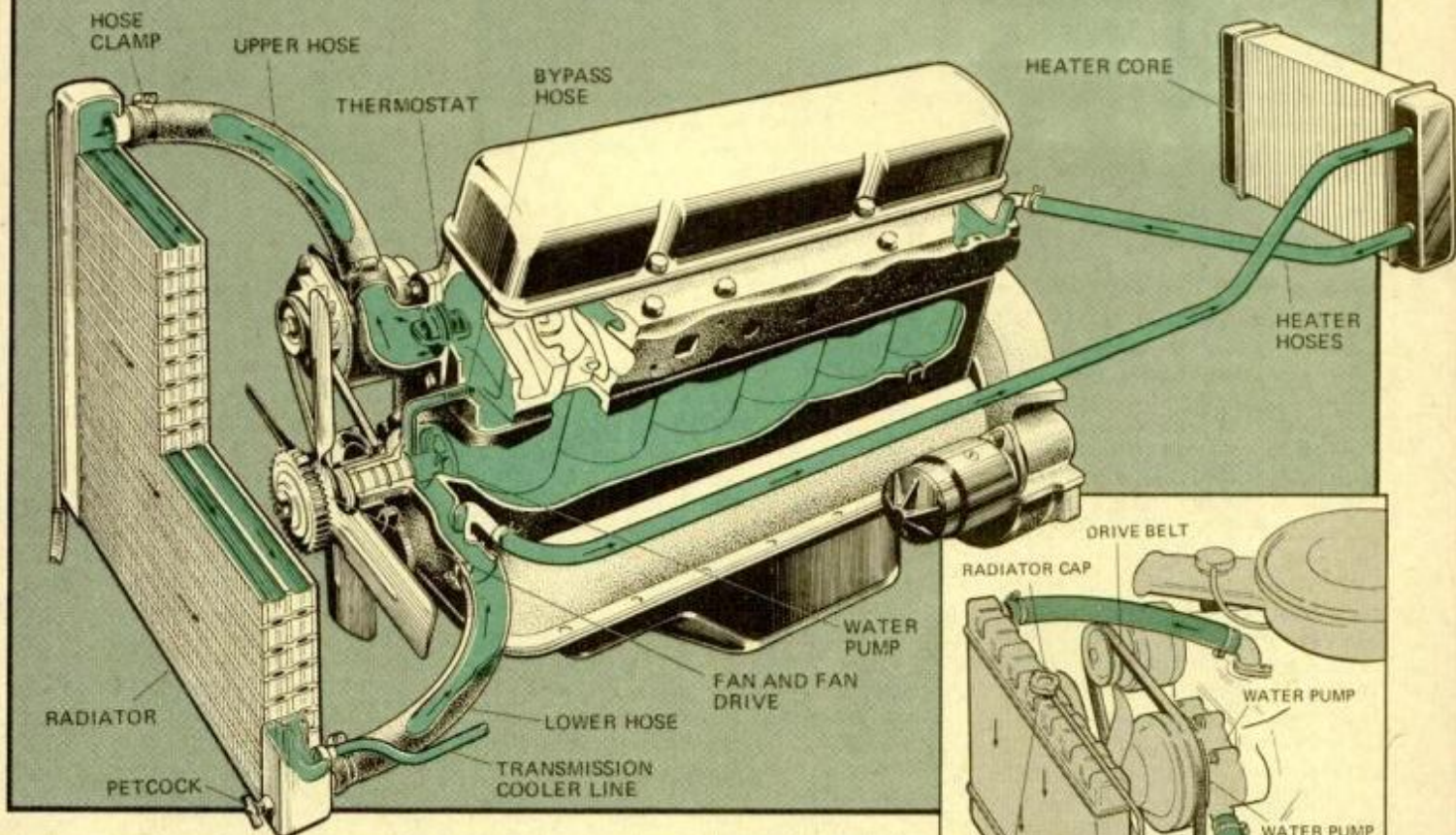
Meter keeper



Instead of hanging a hand-held light meter from your neck, fasten the meter to the chain of a Key Keeper and clip the keeper to your belt.—*Ken Patterson*

COOLING SYSTEM tune-up for troublefree summer driving

by Mort Schultz



Failure-proof service from your cooling system calls for more than a simple flush and fill. The major components, indicated above, should be checked out and serviced to prepare for the warm months ahead. Eyeballing the coolant level just won't do.

Last April, two days after he had drained and flushed the cooling system of his Dodge, but had done nothing else to it, a friend of mine entered the Lincoln Tunnel headed for New York City when, *pfift*, a hose let go. This left him stranded midway under the Hudson River.

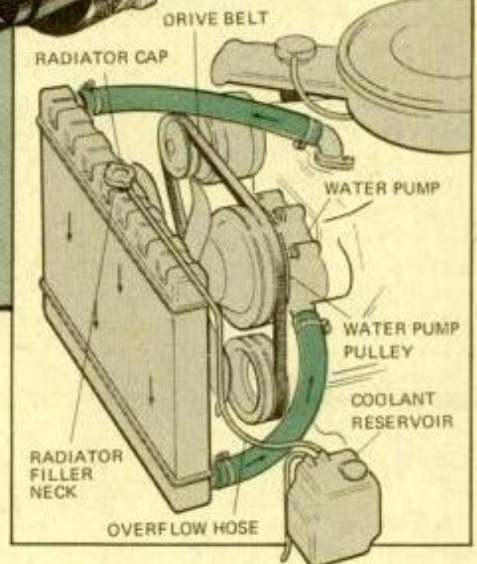
Normally, at 9:00 a.m., the entrance to the tunnel is the world's longest parking lot. You can imagine the chaos that the breakdown caused.

Cleaning, as he learned, is important, but it is not a cure-all. It does not even have to be done every year. However, the cooling system inspection described here, if adopted by ev-

ery driver as an annual springtime event, will make such aggravating cooling-system breakdowns virtually nonexistent.

This inspection involves examining every accessible part of the cooling system. You can use the following as a checklist as you inspect your system:

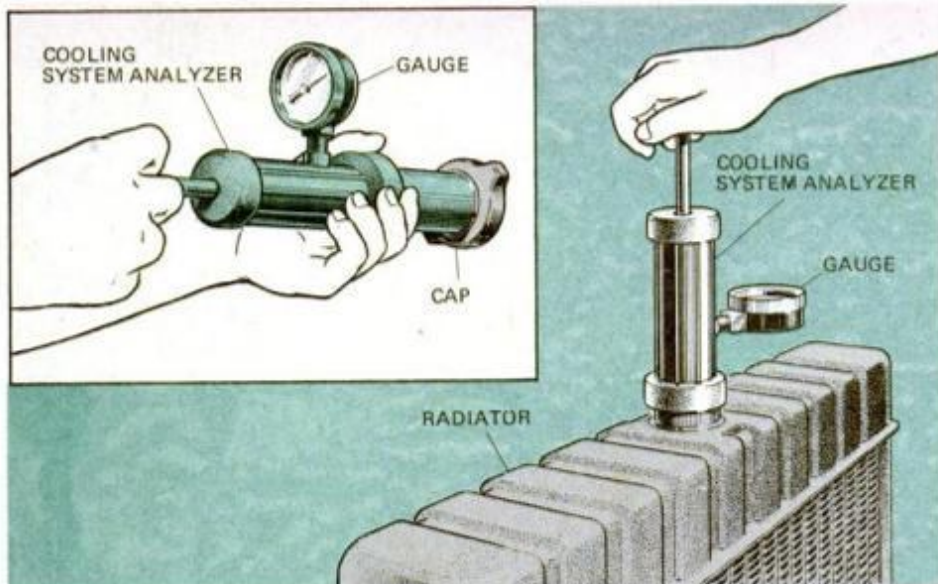
- Radiator pressure cap and filler neck.
- Radiator overflow tube.
- Upper and lower radiator hoses and clamps.
- Radiator and drain (petcock).
- Coolant reservoir and connecting hose.*
- Bypass hose and clamps.*



- Transmission oil cooler and lines.*
- Thermostat.
- Water pump.
- Engine drain plug(s).*
- Heater core.
- Heater hoses and clamps.
- Fan and fan drive.
- Drive belt and pulleys.

The asterisk (*) indicates that the part in question is not necessarily found on all cars.

You should use a cooling system analyzer (pressure tester) to detect



Cooling system analyzer is used to check radiator cap (inset) by pumping gauge up to specified pressure and seeing if the cap can hold the pressure for 30 seconds. The analyzer can also be used to pressurize the cooling system to 15 p.s.i. If the pressure is not maintained, there is a leak somewhere in the system.

tiny coolant leaks and to test the radiator pressure cap.

Testing parts that can leak

If you are going to clean the cooling system and install fresh coolant, make the inspection before draining old coolant. With the engine off and cold, remove radiator cap.

Wipe the filler neck clean and inspect it for bent parts and cracks. A damaged filler neck, which can cause overheating by keeping the radiator pressure cap from seating, can usually be replaced by a radiator shop. The old filler neck is cut off the radiator; a new one is welded on.

Disconnect and examine the overflow tube for rot and cracks. Replace a deteriorated tube. Push a wire through tube to clear obstructions, but be careful not to puncture it.

Following instructions that come with the cooling system analyzer, attach the analyzer to the radiator filler neck. Pump the handle until the analyzer dial shows a pressure of 15 pounds per square inch (p.s.i.). Check the upper and lower radiator

hoses as pressure is applied. If either hose bulges, it is weak and should be replaced.

If the analyzer dial begins dropping slowly, there is a small leak somewhere in the system. Keeping the pressure applied, use a flashlight to examine all coolant-carrying parts. Even a slight seepage suggests a leak.

In spots you can't see, use your hand to check for dampness.

If you don't have a cooling system analyzer, examine each part mentioned above for dampness. Greenish-white corrosion on the part is another sign that a leak is present.

Tiny leaks can often be sealed by adding a cooling system sealer-lubricant to the coolant. However, after driving the car several miles, reexamine the suspicious area.

Pinpointing internal leaks

If the cooling system analyzer dial drops quickly after it has been pumped to 15 p.s.i., there is probably a major external leak, which you can see easily. However, if a visible leak

is not uncovered, suspect that an internal leak exists. To verify this serious turn of events, use the following procedure:

1. Disconnect the cooling system analyzer, install the radiator pressure cap and let the engine run for a couple of minutes. Then turn it off and remove the oil dipstick. If there are water globules mixed in with the oil on the dipstick, or the oil looks white, the engine may have an internal crack.

2. Next, check the automatic transmission fluid dipstick. Water globules in the fluid, or a low fluid level, suggests a coolant leak into the transmission through the transmission oil cooler. This can be verified by disconnecting both oil cooler lines at the lower radiator tank. Plug one of the oil cooler line fittings on the radiator. Remove the radiator pressure cap and add water to fill the radiator, if necessary. Then apply compressed air to the other oil cooler line fitting. If bubbles appear in the coolant, the oil cooler has a hole.

3. Warm up the engine until the thermostat opens. You can determine when the thermostat has opened by squeezing the upper radiator hose. When you feel coolant surging through the hose, turn off the engine and carefully remove the radiator pressure cap.

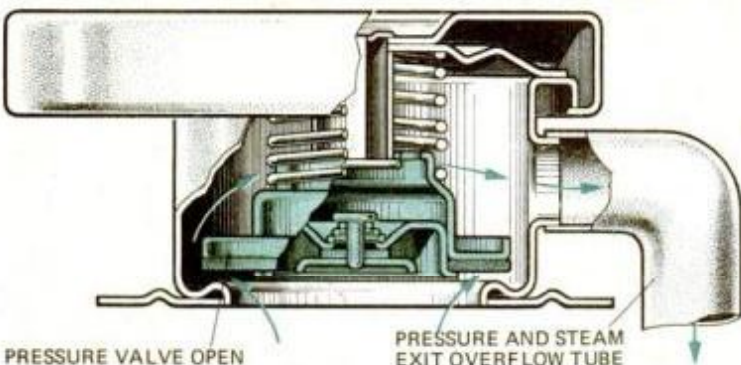
Attach the cooling system analyzer and pump it to about 7 p.s.i. Start and race the engine. If the dial needle of the analyzer fluctuates, the head gasket is blown and should be replaced.

Don't let pressure build up too much. Race the engine only as long as necessary to determine whether or not the analyzer needle fluctuates. Then shut off the engine and carefully disconnect the cooling system analyzer.

If you don't have a cooling system analyzer, test for a bad head gasket by unhooking the overflow tube from the side of the radiator or the coolant reservoir connecting hose

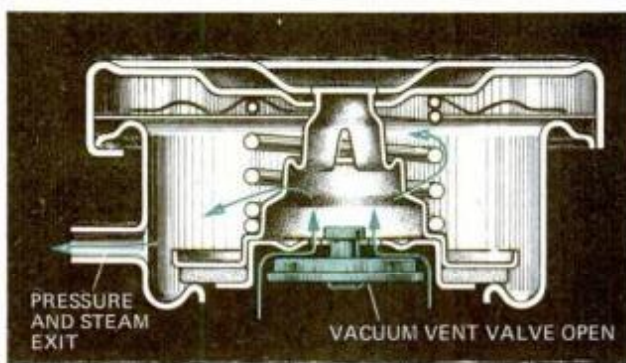
Pressure-vent radiator cap (left) is used by AMC and Chrysler; constant-pressure radiator cap (right) is used by GM and Ford. Caps differ in the method used to release excess pressure: Pres-

sure-vent type releases it through a vacuum valve in the cap's center, while the constant-pressure type releases pressure through a rubber washer which normally seals top of radiator.



PRESSURE VALVE OPEN

PRESSURE AND STEAM EXIT OVERFLOW TUBE



PRESSURE AND STEAM EXIT

VACUUM VENT VALVE OPEN



Thermostat is tested by placing it in a pan of water with a .003-inch feeler gauge inserted beneath the valve. If the valve does not begin to open when water temperature rises to within 5° of the temperature marked on the thermostat body, the thermostat is defective.

from the reservoir. With the engine running (radiator pressure cap in place), put the end of the hose in a beaker of water. If the water bubbles, it verifies that the head gasket has blown.

Pressure cap test

A defective radiator pressure cap is one of the main reasons that engines overheat. There are two kinds of radiator pressure caps. AMC and Chrysler cars generally use a pressure-vent cap, while Ford and GM use a constant-pressure cap. They function differently until pressure in the cooling system exceeds a pre-

set level. Then both open a relief valve to allow pressure to escape.

You test both caps in the same way. However, they are not interchangeable. If you need a new cap, you must get the one designed for the radiator.

Begin your examination of the radiator pressure cap by inspecting for bent tangs and the gasket for cracks and brittleness. Press down on the spring. If there is less than the strongest resistance, replace the cap.

To determine if the cap is leaking pressure, wash it in water and attach it to the cooling system analyzer. Pump up pressure until the dial needle records the p.s.i. stamped on the body of the cap. If this pressure is not maintained for at least 30 seconds, replace the cap.

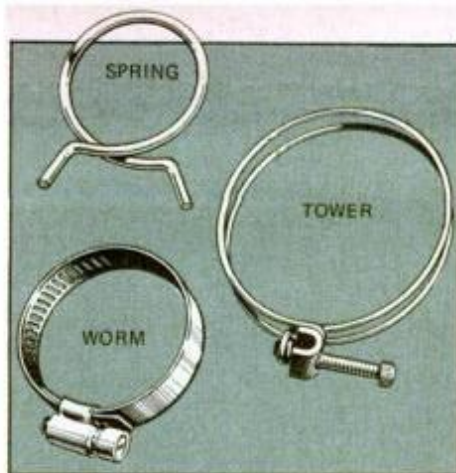
Hose job

The most fragile parts of a cooling system are the rubber hoses. A weak hose can rupture at any time, without warning, leaving a driver stranded. The life expectancy of hoses is two years or 25,000 miles.

Feel each hose. None should be cracked, soft, hard or brittle. They should feel firm and should flex back into shape as soon as you let go of them.

Replace hoses by following this procedure:

1. With the engine cold, drain the coolant. If the upper radiator hose or thermostat bypass hose is to be replaced, drain coolant by removing the radiator cap and opening the drain until the level falls below the thermostat housing (about two



Spring, worm and tower hose clamps are shown above. Of the three, the worm type is the most convenient to use, as well as being the most durable.

quarts). If the lower radiator hose or a heater hose is to be replaced, remove the cap and drain the system completely.

Note: Radiators used on some General Motors cars don't have drains (petcocks). You have to remove the radiator cap and disconnect the lower radiator hose for proper draining.

2. Loosen clamps of the damaged hose and slide them toward the center of the hose. One of three types of clamps is used: spring clamps, which are removed by squeezing them with pliers; worm-drive clamps, which are loosened with a screwdriver; and tower clamps, which are loosened with a wrench.

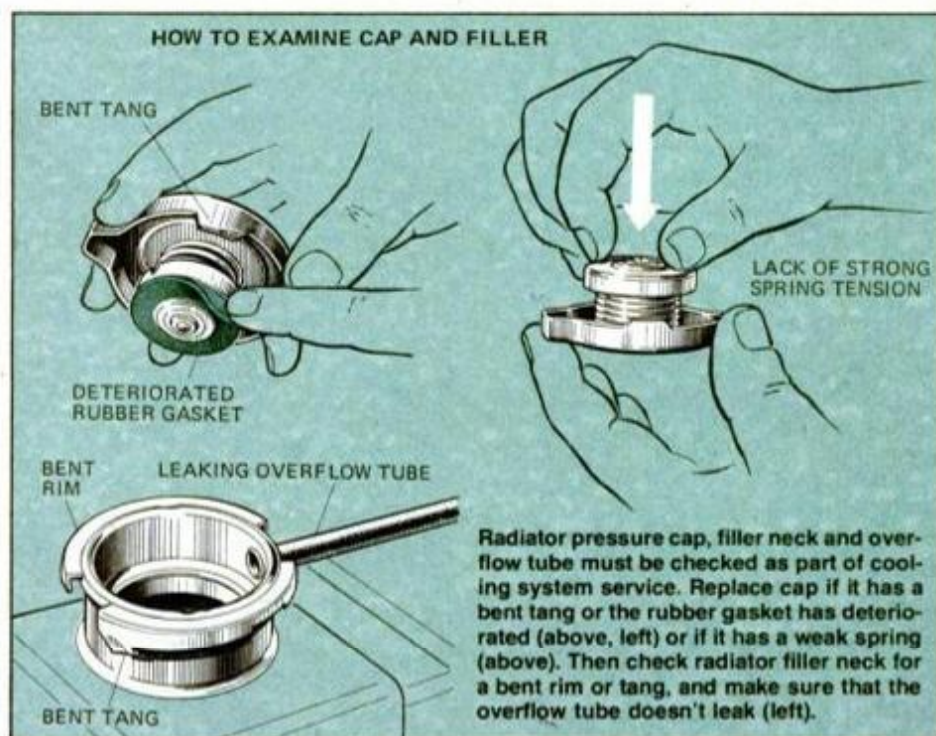
Of the three, the worm-drive clamp is the most convenient to use. The other two are frequently damaged when removed and they have to be replaced. If you switch to worm-drive clamps, keep in mind that vibration, in time, may cause clamps to loosen and coolant to leak. Make it a practice at every oil change to tighten the clamps to avoid coolant loss.

3. Twist the hose off the connectors. If the hose is fused to a connector, don't force it. You may damage the connector. Instead, use a knife, such as a gypsum wallboard knife, to slit the hose. Then pry the hose off by sliding a screwdriver beneath it.

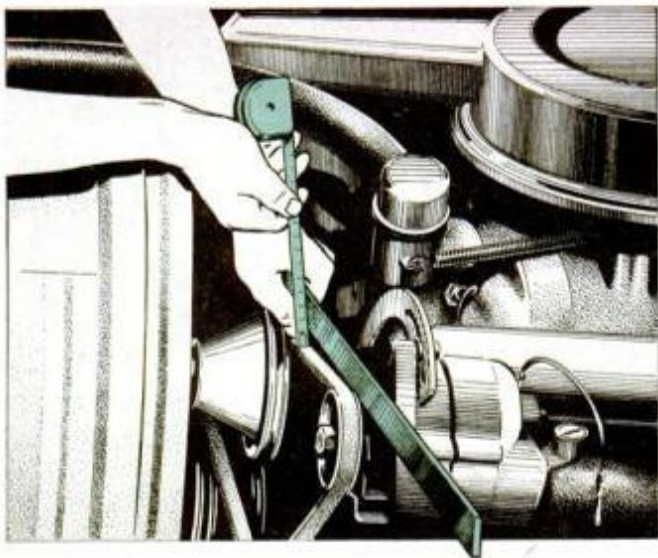
4. Clean connectors with sandpaper and coat them with a waterproof sealer. Do not put sealer on the inside of the new hose. It may flake and clog the radiator or heater core.

5. Place hose clamps on the new hose and install the hose. Position clamps about 1/4 inch from the ends of the hose. Tighten the clamps securely.

6. Drive the car for about 20 minutes or put the cooling system



Radiator pressure cap, filler neck and overflow tube must be checked as part of cooling system service. Replace cap if it has a bent tang or the rubber gasket has deteriorated (above, left) or if it has a weak spring (above). Then check radiator filler neck for a bent rim or tang, and make sure that the overflow tube doesn't leak (left).



Ruler-and-straightedge method is an alternate way to check belt tension. Place a straight-edge between belt pulleys. Then press down with a ruler at a point midway between the pulleys. If free span of belt is less than 12 inches, deflection of belt should be $\frac{1}{8}$ to $\frac{1}{4}$ inch. If free span is greater than 12 inches, specs are $\frac{1}{4}$ to $\frac{1}{2}$ inch.

under pressure with the cooling system analyzer. Check around clamps for leaks.

Testing the thermostat

A thermostat that is starting to fail usually gives warning. If it is sticking in the closed position, the engine will run hotter and hotter on successive trips, until it finally overheats.

A thermostat that is sticking in the open position will keep the engine from warming up quickly, which is a problem in cold weather, especially when you need heat from the heater. You don't have to test the thermostat unless one of these conditions occurs.

If the thermostat seems to be acting up, drain coolant below the level of the thermostat housing, remove the bolts and take off the housing. If the housing sticks in place, tap it with a hammer. Do not pry under the thermostat housing. You may damage castings.

Remove the thermostat and note the temperature at which the thermostat valve is supposed to start opening. This is stamped on the body of the thermostat. Also stamped on the body will be the temperature at which the valve is supposed to be wide open.

Hang the thermostat in a pan of cold water using a hook made from a piece of wire. Place a .003-inch feeler gauge beneath the valve and body of the thermostat and then attach a piece of wire or string to the feeler gauge.

Place a thermometer in the water and heat the water on a stove. You should be able to pull the feeler gauge free from the thermostat when the thermometer is within 5° of the temperature stamped on the thermostat body. The valve should be wide open when the temperature of the water reaches the "full open"

temperature stamped on the thermostat body.

To install a thermostat, use a putty knife to remove foreign material from the engine and thermostat-housing surfaces. Place the thermostat in the housing, making sure the thermostat faces in the correct position. Markings stamped on the thermostat body tell you which direction this is.

Use a new gasket between the housing of the thermostat and your car's engine.

Drive belt inspection

You should inspect drive belts for damage and tightness. A loose belt can reduce cooling-system efficiency, as well as the efficiency of the alternator, power-steering pump and airconditioner compressor. A damaged belt can fail suddenly, presenting you with an immediate roadside emergency.

Most damage occurs on the underside of belts, so twist belts and look for small cracks, splits, frayed edges and grease.

If the belt and/or pulley is glazed (shiny), noise, slippage and overheating may result.

The preferred way of testing belt tension is with a tension gauge. This tool can be purchased at auto-supply stores for about \$20.

To use the gauge, you need to know the manufacturer's drive-belt tension specifications. These are given in the service manual, but note that there are usually two sets of specs—one set to be used for adjusting new belts and one set to be used for adjusting used belts.

If a gauge is not available or cannot be used because of cramped quarters, check tension by placing a straightedge between the belt pulleys. Press down on the belt with a ruler positioned midway between the pulleys.

If the free span of the belt is less than 12 inches, belt deflection should be $\frac{1}{8}$ to $\frac{1}{4}$ inch. If the free span of the belt is more than 12 inches, belt deflection should be $\frac{1}{4}$ to $\frac{1}{2}$ inch. A belt that doesn't meet this requirement should be tightened until it does or replaced if it has stretched too far to achieve proper tension.

Caution: Do not overtighten belts. Too much tension places stress on the alternator and the water pump bearings.

Fans and fan drives

A damaged fan—one that has bent blades—normally is a noisy fan. Since it causes an imbalance that puts abnormal wear on water pump bearings, replace a damaged fan.

Many cars use a fluid fan drive that limits top fan speed to periods when top speed is needed for cooling. The fan drive is controlled by a temperature-sensing device.

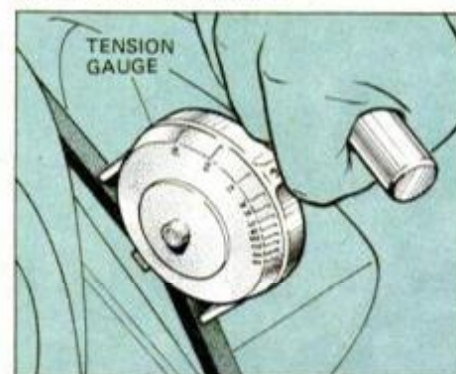
Make a quick inspection of this unit. With the engine turned off, determine if any fluid is leaking from the assembly by drawing your hand around it. Turn the fan by hand. There should not be noise or roughness, and the unit should revolve. Shake the leading edge of the fan from front to rear. It should not move more than $\frac{1}{4}$ inch. If the fan drive fails any of these tests, replace it.

The finishing touch

After you have done all the cooling system checks mentioned above, make sure the coolant itself is up to snuff.

If coolant looks rusty, or if you haven't changed it in several years, it should be replaced. The best way to do this is to use one of the many flush and fill kits currently on the market.

Belt tension gauge is the fastest and most accurate way to determine proper belt tension. To use it, simply hook the gauge beneath the belt and pull up on the handle. Take the reading from the dial on the side of the gauge. Make sure it matches factory specs in owner's manual.





Golden Lights® ends every-which-way search for taste.

With 75 low tar products to choose from, over 1 million smokers switched to Golden Lights... often after just one pack.



Golden Lights.
The taste you'll swear by...
not at.

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

Source comparative 'tar' and nicotine figures: Either FTC Report May 1978, or FTC Method.
Of All Brands Sold: Lowest tar: 0.5 mg. 'tar,' 0.05 mg. nicotine av. per cigarette.
Golden Lights: 8 mg. 'tar,' 0.7 mg. nicotine av. per cigarette by FTC Method.

GE introduces 100 watts of light for only 44 watts of electricity.

GE's new Circlite™

Imagine, some good news about energy. GE's new Circlite is as bright as an ordinary 100-watt bulb, but uses only 44 watts of electricity.

Here's some more good news. GE's Circlite lighting system fits the

majority of table lamps and some ceiling sockets. There are only two parts. One is the light, which is a unique circular fluorescent with a pleasing soft quality that'll blend in

well with the kind of light you're now using. The other part is the adapter, which screws into your present fixtures.

That's all there is to it. No rewiring, no other parts. Just switch on Circlite

and you get 100 watts of light on only 44 watts of electricity.

Hang in there—just a little more good news. Circlite has the life of 10 ordinary light bulbs. So you won't have to

change bulbs for years—with normal use. By the way, the adapter is designed to last for 20 years.

The new Circlite lighting system is only from GE, so be sure to see your GE lighting dealer. He'll show you how it can start saving energy for you in your own home tonight. Now that's what you call good news.



We bring good things to life.

GENERAL  ELECTRIC

IPM BRIEFS

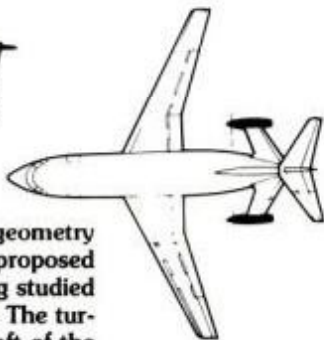
PM's Whatsit

For PM readers who have been complaining that our Whatsits are impossible to guess, here's an easy one.

Remember, though, that part of the problem of looking at a photo of something is that you have no idea—in the absence of a reference object for scale—how big or small it is. Answer on next page.



Clean wings



A fairly radical new look in aircraft geometry surfaced recently from NASA. It's a proposed small propfan transport design being studied by Lockheed under NASA contract. The turbine-driven propellers are situated aft of the wing on pylons and actually lie slightly behind the lower leading edge of the vertical stabilizers. The plane would carry up to 50 passengers at Mach 0.7 for a range of 600 nautical miles.



Don't bite on worm deals

One of the most prevalent get-rich-quick frauds in the United States, notes the General Services Administration, involves earthworms. The GSA says promoters offer the investor a starter supply of worms, and a bin or bed to grow them in, for prices ranging from \$400 to \$800 a bin. The same amount of worms can often be purchased wholesale for \$50, government investigators have found. Worm promoters sometimes offer to buy back a customer's entire worm crop, hoping to raise the necessary cash by selling more new investors on the idea of raising more worms. Their plans almost always come up short, says the GSA, in addition to which they misrepresent the types of worms they sell, play down the time and care necessary to raise more and overstate the reproduction rate.

Mower power to you

In case someone ever bets you that there is no such thing, you're looking at a steam-powered lawn mower (the larger one). It was fabricated as a one-of-a-kind in Britain around 1930 and actually turned up recently cutting grass—which it still does very well—on the estate called Beaulieu, a well-known stop on England's "stately homes" tour circuit. The Lord of the manor, one Montague, says he borrowed it, however. The moral may be that if your lawn mower weighs 3000 pounds, don't lend it to neighbors.

We don't know exactly why, but this reminds us of the old "weather" joke that is usually told on the city of Rochester, N.Y. It's the only place where you have to put antifreeze in your power mower.



Dynamite in your pocket

Because of two recent accidents involving disposable butane lighters, you're going to be hearing them discussed often in terms of safety in the months ahead. Though separate incidents, both of the accidents were ultimately fatal, and both victims were employees of the Union Pacific Railroad, engaged in welding operations. In the first, a welding spark melted through the casing of a disposable butane lighter in a man's shirt pocket, causing it to explode, killing him instantly. In the second, the lighter was in a hip pocket and was also contacted by a welding spark that caused it to explode. The victim's leg was amputated as a result, and he later died.

One estimate puts the explosive power of some butane lighters at the equivalent of several sticks of dynamite. In any case, they belong nowhere near open flames or welding apparatus.



Whatsit revealed

Of course it's a chair, made of two rolls of foam and a piece of canvas over a steel tube frame. The chair, designed by Dutch art student Albert Haas of Utrecht, was commissioned as a prototype by a London firm and may be on the market soon.



Maybe next year we'll build a gambling casino

Local girl Suzanne Kerr was one of many who failed to claim a prize for covering 50 meters (165 feet) in the annual jump off the pier at the resort town of Bognor Regis on the south coast of England. The pier is about 30 feet high, and Suzanne did manage a glide of close to 100 feet before splashing down—as every contestant must. The longest flight was 40 meters. The shortest was by a man on a broomstick who plummeted straight into the sea.



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FREE estimate.*



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CAR CLINIC

SOLUTIONS FOR MECHANICAL HEADACHES

BY MORT SCHULTZ



Three problems, three cures

Do you know what will cure hot-start and cold-start problems with a 1978 Ford Fiesta? The car, which has a Weber 740 carburetor, also idles too fast. Two Ford dealers have worked on the car and now one of them, saying he can't figure it out, wants to replace the carburetor. The car has been driven 17,000 miles. Please help.—Al McCollough, New York.

For the hot-start problem, have your dealer apply the modification in service bulletin 161, article 3268, entitled "Carburetor hot soak surge, stumble and hesitation." The repair calls for installing a fuel-enrichment vacuum restrictor (part No. D8RZ-9L460-A) in the vacuum channel next to the secondary barrel of the carburetor.

The solution to the cold-start problem is discussed in service bulletin 176, article 3532. In addition to installation of the fuel-enrichment vacuum restrictor, it calls for reversing the positions of the primary and secondary main jets, installing a different choke bi-metal cap (part No. D9RZ-9848-A) and setting fast idle speed to 2000 rpm.

The erratic idling problem is discussed in service bulletin 161, article 3271. The article was mistakenly entitled "Door weatherseal cut caused by quarter trim panel interference." It should have been entitled "Engine idle speeds high/erratic—warm engine." The repair calls for checking the position of the fast-idle-cam operating spring, installing a different choke housing-to-carburetor retaining screw (part No. E603531-S72) and installing a fast-idle-cam stop (part No. D8RZ-9L459-A).

Imported from Mass.

You've told owners of cars built in the United States how to get service manuals. Can you tell owners of imported cars how to get manuals, too? I own a 1977 Triumph TR7, and am having trouble obtaining service information.—Ronald Eberhard, Hazelton, Pa.

The task of obtaining service man-

uals for imported cars is more difficult than getting manuals for domestic cars. U.S. manufacturers sell manuals to those who want them. But owners of imported cars aren't as lucky, except for those who have Volkswagen, certain model Toyota, Capri and, lucky you, British Leyland automobiles.

A company that is located in Massachusetts—Robert Bentley Inc. 872 Massachusetts Ave., Cambridge, 02139—publishes manuals, which are, to say the least, classy presentations, for the following:

VWs from 1966 to the present, including Beetle, Karmann Ghia, station wagon, Type 3, Rabbit, Scirocco and Dasher; Audi Fox; Toyota Corolla 1600; MGB, MG Midget, MG, Sprite, Triumph TR 2, TR 3, TR 4, TR 6, TR 7 and Spitfire, Austin-Healey and Jaguar E; and Capri.

Prices vary between \$12.95 and \$25, with \$16 the norm. There is an additional charge of \$1.95 for postage. Prepayment is required, so you should write the company for a stock list and order form.

Soggy shoes

When balancing of tire-wheel assemblies failed to stop an erratic vibration in my car, a friend in the tire business dismantled all four radials, dumped about a pint of foamy

water from each and rebalanced all assemblies. Problem cured. Thought you'd like to know.—Dave Foster, Newark, Del.

I like, I like. Thanks for a valuable tip, Dave. I'll keep it in mind. So should everyone else.

Belly dancer

As far as I'm concerned, my 1979 Plymouth Horizon vibrates too much at idle and low speed. The dealer and factory field representative have checked the carburetor, timing and all other relevant areas. They have failed to come up with any kind of a solution.

Now they say that the vibration is normal and inherent to a Horizon with four-cylinder engine and automatic transmission. Is this so much bellywash? Is there a solution?—Charles R. Bowers, Milwaukee.

Some people who have switched to smaller cars from big cars are finding it difficult to become accustomed to the characteristics of the smaller vehicle. The vibration, therefore, may be a normal characteristic that you aren't used to. But, then again, maybe it isn't.

We've uncovered two problems that affect idling and help produce excessive vibration in both Horizon and Omni.

In some cases, the wrong type of PCV valve was installed. The PCV valve for Horizon and Omni is identical in appearance with the PCV valve used in other Chrysler Corp. engines, except for one thing. The valve for Horizon and Omni is black—the others are either white or a neutral color. If the wrong valve is in your Horizon, engine rpm is being reduced by 150 revolutions, which will cause engine oscillation.

Another part which causes vibration problems is the fan belt installed during the early production run. The belt was redesigned, but

(Please turn to page 56)



PM CAR CARE
TIP

Bagging your spare

We recently received a maintenance tip from Clarence DeGraff of Essex Junction, Vt., who has figured out

a way of keeping his spare tire clean and the rim rust-free. In most cars that's not a problem. But if you own a car that stores the spare underneath the back end, you could benefit from this advice. You simply wrap the spare in a big plastic garbage bag and seal it up with wire ties. This method of storage will keep the tire and rim looking new for years.

FORD'S EXCLUSIVE CLUB ROOM



1980 Ford Captain's Club Wagon. Best EPA gas mileage rating of any van. Station wagon luxury — much more room.

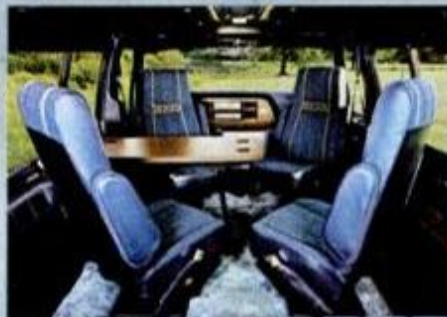
Here's one exclusive Club everyone can easily enter! Ford's advanced Club design means more move-around room for driver and plenty of inside passenger comfort. Built tough: Separate body-on-frame construction, rugged Twin-I-Beam suspension. See your Ford Dealer. And ask about Ford's Extended Service Plan.

BEST VAN GAS MILEAGE

18 EPA EST.* **26** Hwy. EST.*



*300 Six, optional 4-spd. manual transmission. Compare these estimates with others. Your mileage may differ, depending on speed, distance and weather. Actual highway mileage will probably be less than estimated. California estimates lower.



Welcome inside the Club. Ford's Captain's Club Wagon comes with fold-out snack/game table, four recline/swivel chairs, and seat/bed.



Combination seat/bed. Folding rear seat turns Ford's Captain's Club Wagon into a mini camper.



Super wagon size, too! Ford wagons offer seating plans for four to 15 passengers. And Ford Club Wagons offer light- and heavy-duty Trailer Towing Package options.

FORD

FORD DIVISION



CAR CLINIC

(Continued from page 54)

not before hundreds of Horizons and Omnis were delivered. Ask your dealer to install a new Mopar belt and see what happens.

There are other causes contributing to poor idle quality of the Horizon and Omni: incorrect carburetor idle and ignition timing settings, vacuum leaks, incorrect vacuum hose routing and loose or corroded electrical connections.

Setting carburetor idle is particularly important and is the subject of service bulletin 14-13-79, which you should call to your dealer's attention.

Incidentally, the final sentence of this service bulletin says, "Due to the inherent characteristics of four-cylinder in-line engines, it may not be possible to eliminate a certain amount of 'bumpiness' at idle."

Cablegram

I had occasion recently to jumpstart my son's 1973 AMC Javelin, which had a dead battery. I noticed that the negative battery cable of the Javelin became very warm as starting began, while the battery cables of my car remained cool. No one here seems to

know why this should happen. Can you explain it?—John A. Cutrone, Staten Island, N.Y.

Easily, John. Usually, a hot cable means that the cable is damaged internally, or it's loose or dirty at connections. This creates high resistance and that causes cables to overheat. The bad cable could have caused the rundown battery.

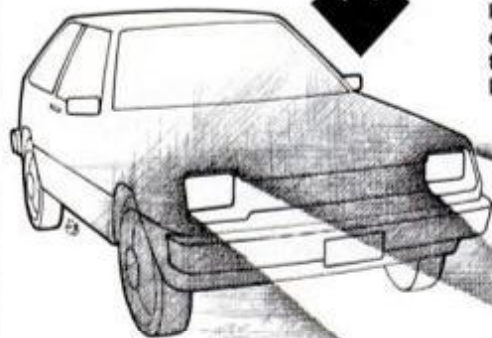
However, there may be another reason for the hot cable. A defective starter motor may be drawing excessive amperage when the engine

is being cranked. This causes the negative battery cable to overheat. So, if servicing or replacing battery cables doesn't cool things down, you should suspect a starter motor malfunction.

Tanks for the memory

My 1955 Ford (yes, 1955), which has been driven only 70,000 miles, was contaminated with dirty fuel—so much so that the sediment bowl became filled with dirt and the in-line fuel pump-to-carburetor filter then

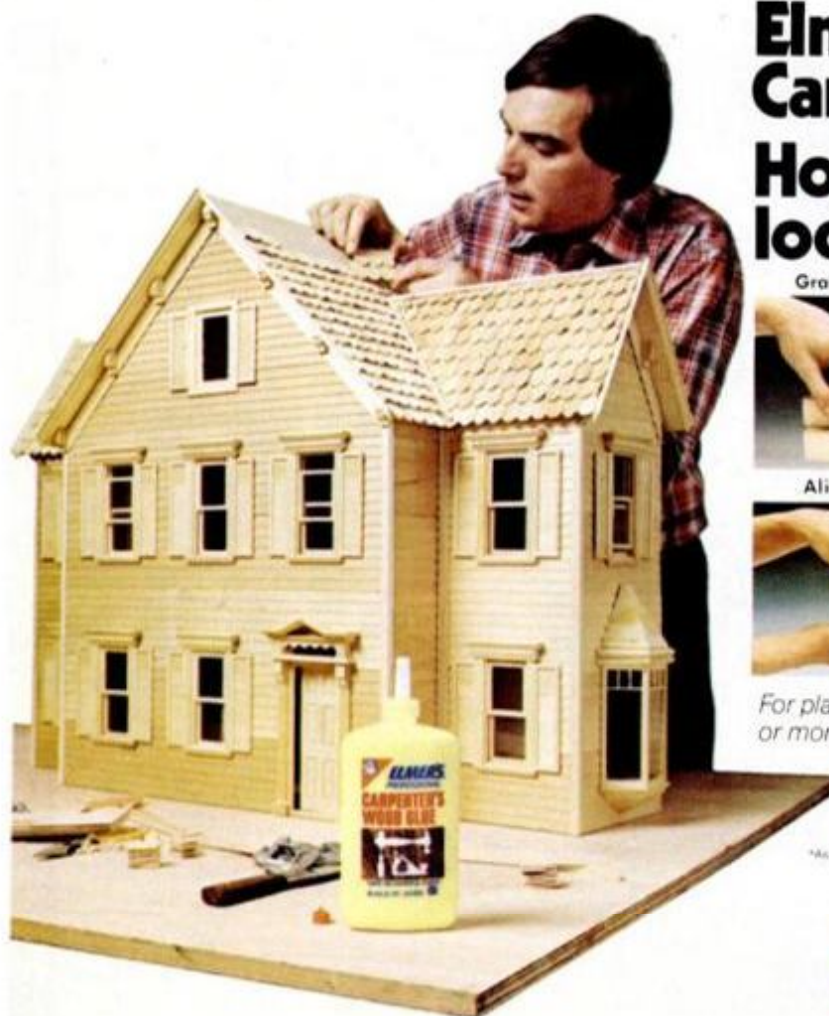
PM CAR CARE
TIP



Quick check of starting system

Watching headlight performance can often tip you off to an electrical problem. Turn your lights on. If they are dim, the battery is probably undercharged or a battery cable connection is loose or corroded. If lights are bright, crank the engine. If lights then dim, as the engine cranks, the battery or cable may be at fault, or a problem may be developing in the starter circuit.

Finally, if lights are bright and remain so, but the engine doesn't turn over, there is definitely a problem in the starter circuit. This circuit contains some or all of these parts (depending on the vehicle): starter relay, starter solenoid, starter motor and cables.



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Aligns easily.



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Available in pump or aerosol.

jammed up. This, of course, caused the engine to quit. We cleaned out the bowl, filter and carburetor. The engine starts and runs, but keeps stalling. A fuel pump test shows normal flow-rate and pressure, but the car is unreliable on the road.

My question, therefore, is this: Is there a fuel filter in the gas tank that may be clogged? I want to know before I commit myself to going through the trouble and expense of dropping the tank.—Henry M. Hume, Brooklyn, N.Y.

All Ford models since 1949 have had a filter on the gas sender in the tank. It's reasonable to suspect that this filter may be causing the engine to stall.

Resisting change

I've always been led to believe that sparkplugs can be cleaned and re-used for as long as the porcelain is not cracked and electrodes aren't excessively worn or damaged. I've used some sparkplugs for 50,000 miles.

Now a local mechanic tells me that after 10,000 or 12,000 miles, the resistance changes and the sparkplugs don't operate properly. Is this true?—Eugene Vasilew, Binghamton, N.Y.

I spoke to an engineer at a leading

sparkplug company about this. He says there is a slight change in resistance after 10,000 to 12,000 miles—which is so slight that instruments in the laboratory of his company can't measure it. The change in resistance is not enough to affect performance.

Independence day

The telescoping power antenna of my 1973 Buick sticks and needs help when raising and lowering itself. What can I do to make it independent again?—Carl N. Martens, Calumet City, Ill.

Use a solvent, such as trichloroethylene, to clean off the grease. Then lubricate the antenna with a few drops of a light machine oil, such as 3-In-1 Light Household Lubricant. Now you should work the antenna up and down several times. Also, make certain that any dirt which may have accumulated on the nylon bushing of the housing is removed.

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.

Service and safety tips

■ If you bought a used Capri, you may not get the word from Ford that most Capris are being recalled. The '71, '72 and '73 models need to have front seats modified—they may collapse backward without warning; the stick shift lever in '71, '72, '73, '74, '76, '77 and '78 models may possibly separate from the transmission; the '71 and '72 models are in need of a new headlight switch.

■ According to Goodyear Tire and Rubber Co., you shouldn't rotate the tires of a car having front-wheel drive. By not rotating, you can stretch the life of tires on rear wheels to perhaps the life of the car, assuming that tires are radials.

"Rear tires, because of their lighter load and free-rolling function, simply loaf along and tend to wear much longer" than front tires, says Goodyear. To get maximum life from the rear tires, new tires you buy to replace worn-out front tires should be placed on the front wheels of your car. Leave rear tires on rear wheels.

■ VWs use one of two types of fuses—ceramic or plastic. Interchanging them can cause deformation and overheating of the fuse holder or the fuse relay panel. If you have to replace a fuse, use the plastic type in the Beetle, station wagon, Karmann Ghia, Type 3 and Type 4—that is, in all air-cooled vehicles; be certain that you use the ceramic fuse in Rabbit, Dasher and Scirocco—that is, in all of the water-cooled cars.

FM

George Wendt, rapids-shooting philatelist.




George Wendt, white water expedition guide, has found something exciting to do on dry land. He collects stamps.

George finds that collecting U.S. Commemoratives lets him explore the thrilling panorama of America. He discovers new places and things, meets fascinating people and relives exciting events in our history.

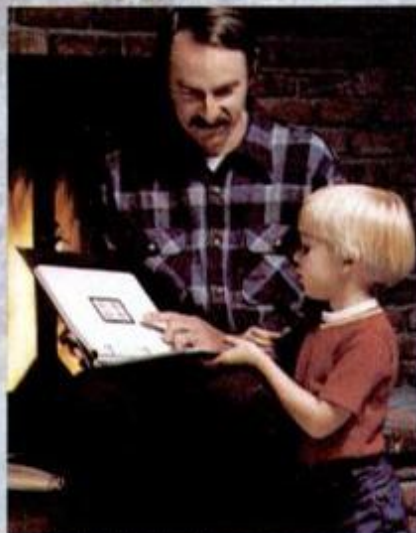
You can start the adventure of stamp collecting with U.S. Commemoratives. It's easy and affordable. Every few weeks,

there are new, beautifully designed issues at your local Post Office. You'll also find an informative, colorful guidebook called *Stamps & Stories* to help you get your feet wet. And the new 1980 Olympic Stamps are an exciting place to begin.

"Collecting U.S. Commemoratives is a special kind of thrill," says George. "And it's one adventure I can share with my family."

U.S. Postal Service 

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Olympic Winter Events (Available now.)

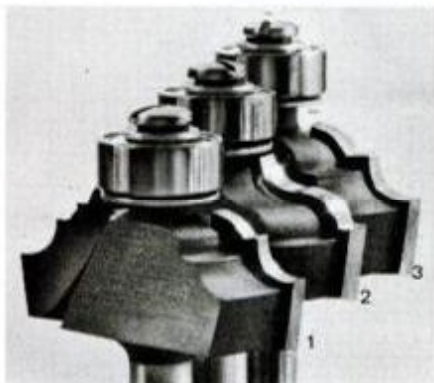
Start the adventure of stamp collecting with U.S. Commemoratives.

PM LOOKS AT CARBIDE-TIPPED ROUTER BITS

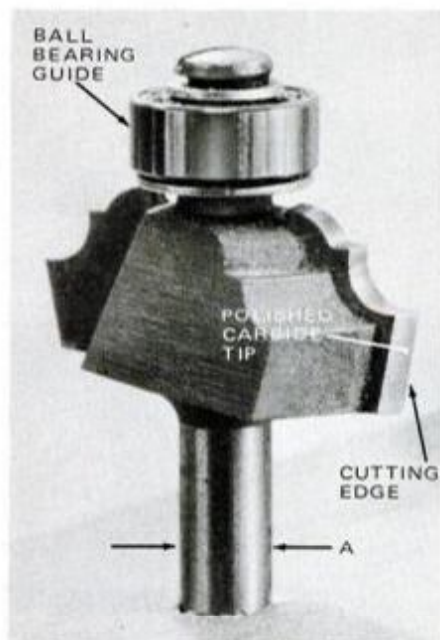
A completely new line of edge-forming production bits has been introduced by Stanley Power Tools, Box 2217, New Bern, N.C. 28560. The cutters fall into three distinct families (profiles): raised panel, classical and ogee. The ogee with fillet will produce three different cuts, depending upon depth of cut and the size of the ball-bearing pilot. Most of the bits are available in both 1/4- and 1/2-in. shanks.

The bits—intended primarily for professionals rather than do-it-yourselfers—feature extra thick carbide inserts which are diamond-

(Please turn to page 60)



New industrial router bits from Stanley Tools feature profiles not previously available in off-the-shelf router bits. The designs fall into three basic shapes—classical (1 and 3), ogee with fillet (2) and raised panel (which is not shown).



Super cutting bits with either 1/4- or 1/2-in. shank diameter (A) can be purchased at tool specialty houses.

Don't be a Drifter!

Level road can be hard to find. And when it's time to go, the last thing you need is to drift back into the car behind you. That's where Hurst's Roll Control comes in. This handy fingertip control mounts on your shifter. To lock the wheels, just apply the brakes while pressing the button. Your feet are now free to operate the gas and clutch. Release the button, your brakes are free! With Hurst's Roll Control, you won't be a drifter!

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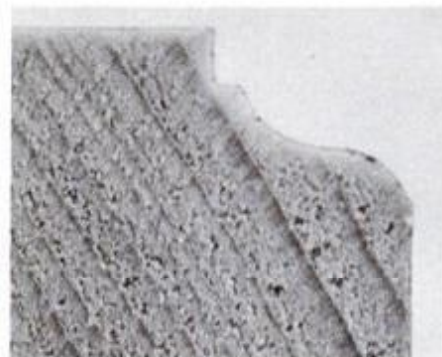
CARBIDE-TIPPED ROUTER BITS

(Continued from page 59)

honed with micro-fine abrasives to create the sharpest router bit edge I have ever cut with.

I pushed the three bits shown through a variety of materials, including clear pine, plywood, particleboard and (DuPont's) Corian with unbelievable results. The cutters whirred through all materials effortlessly and produced clean, very fine, shaped edges. Since the cutters are produced for the industrial market, they are priced accordingly. The least costly ogee, for example, is \$37.90.

To obtain information about bit availability and prices, write the manufacturer directly.—Harry Wicks



Ogee with single fillet on wood edge.



This profile was cut in wood with bit No. 3, shown on the preceding page.



A shallower classic profile was made with the No. 1 cutter on page 59.

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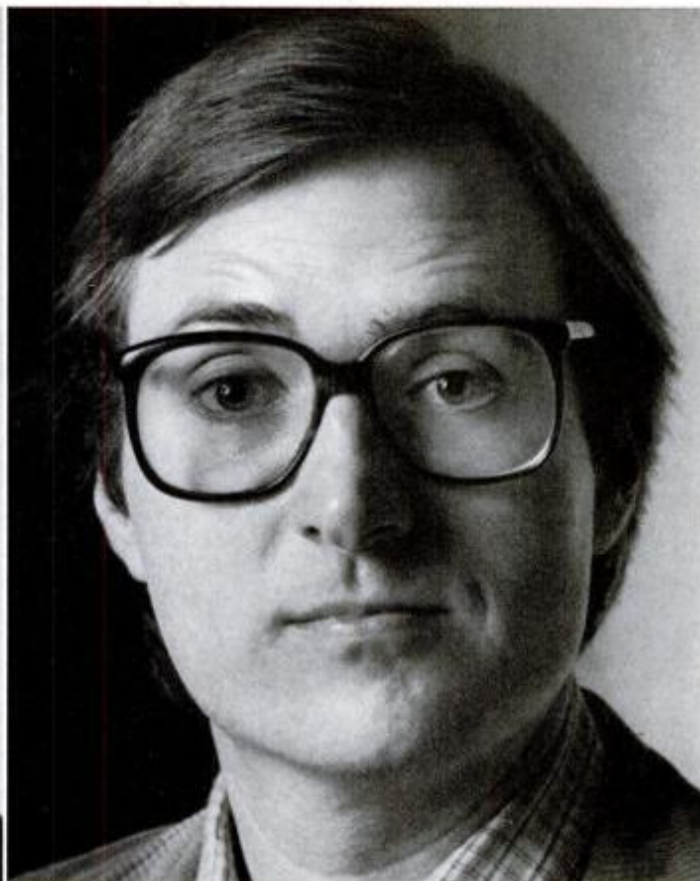
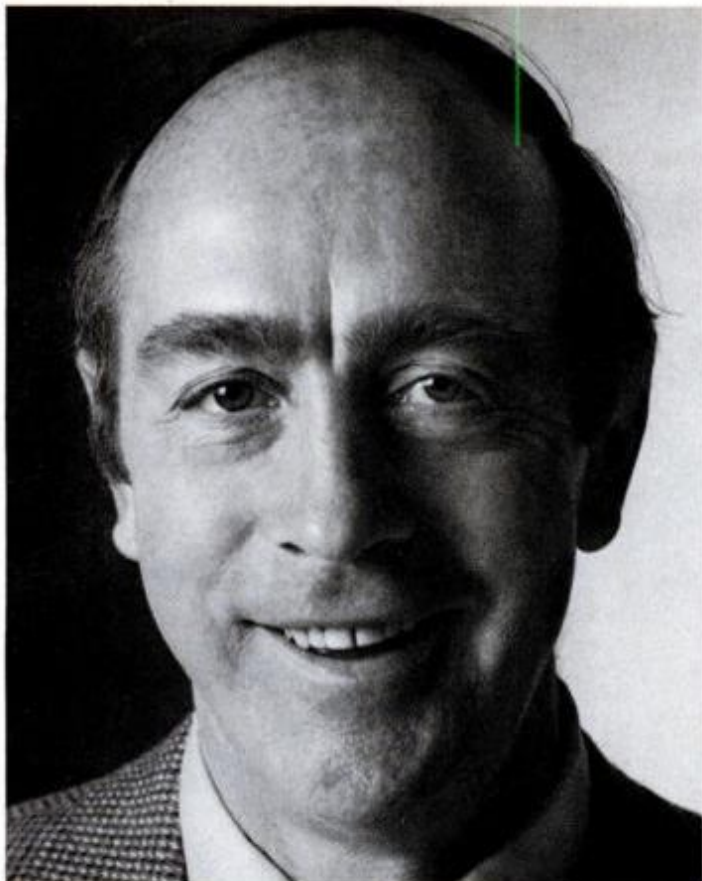
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One of these men just bought a car that's specially ordered, newly painted, but belongs to someone else.

He got a "really great deal" from "somebody who knew somebody in the business." What the man on the left didn't know was that "the business" was car theft—a \$1.7 billion business—one of the most lucrative and costly crimes in the country today. Lucrative for thieves, costly for the rest of us.

Organized car theft rings have found that stealing automobiles is profitable in several ways. Some people arrange to have their cars stolen to collect on the insurance. Then the car is broken up into valuable parts for re-sale. Other people seek to buy used cars at a lower price than offered on the legitimate market, even though they may know something isn't right with the deal.

As a major group of property and casualty insurance companies, we want to stop this crime. And so should you, because your auto insurance premiums have to go up to pay for these theft claims.

In several states, concerned citizens are working with law enforcement and insurance personnel to check the spread of auto theft. We applaud and support these efforts and urge you to do the same. Working together, we believe we *can* make a difference and keep automobile insurance affordable.

Here's what we're doing:

- Supporting the National Automobile Theft Bureau, a non-profit organization created by insurance companies to help law enforcement agencies combat auto theft.
- Investigating theft claims more thoroughly.
- Encouraging manufacturers to install improved locking devices.
- Utilizing a system that checks for incorrect or forged vehicle identification numbers.
- Encouraging improvement of state automobile certificate of title laws.
- Informing people what they can do to prevent auto theft.

Here's what you can do:

- Check the title before you buy a used car.
- Support anti-car theft campaigns sponsored by the National Automobile Theft Bureau and by other organizations.
- Take your key and lock your doors. Don't invite trouble.
- Install an anti-theft alarm. You may receive a premium discount.
- Avoid the temptation to make that "really great deal"—you may lose the vehicle and your money.

This message is presented by the American Insurance Association, 85 John Street, New York, N.Y. 10038.

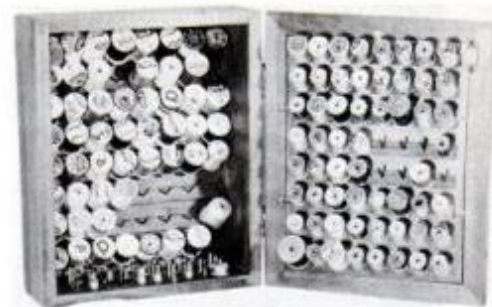
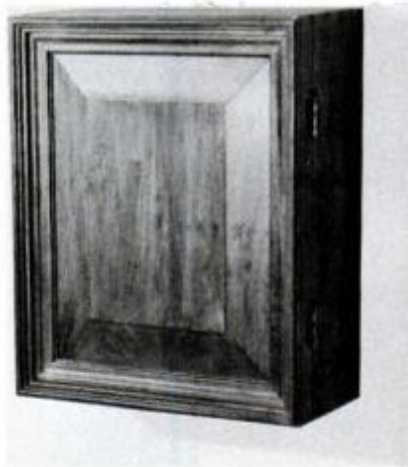
Affordable insurance is our business...and yours.

© 1979 American Insurance Association.

Make this decorative cabinet for spools of thread

The seamstress in your family will appreciate this wall cabinet for storing an easy-to-reach lineup of spools and bobbins. An 11×14-in. wooden picture frame, either purchased or made of molding, gives the project an attractive custom-cabinet look.

Edge-glue pieces for the front panel and cut bevels to create the raised cabinet panel. Cut spool holders and bore holes for dowel pegs using jig in photo. Cut parts (A, B, C), bore bobbin peg holes and assemble. Stain and finish with varnish.—*R.C. Barnes*



Cabinet holds 60 bobbins and 128 spools of thread. Smallest spools are kept on the cabinet door. Bobbins are stored two to a peg along the cabinet bottom.



Jig helps you bore holes perpendicular to face of spool bar accurately and safely.

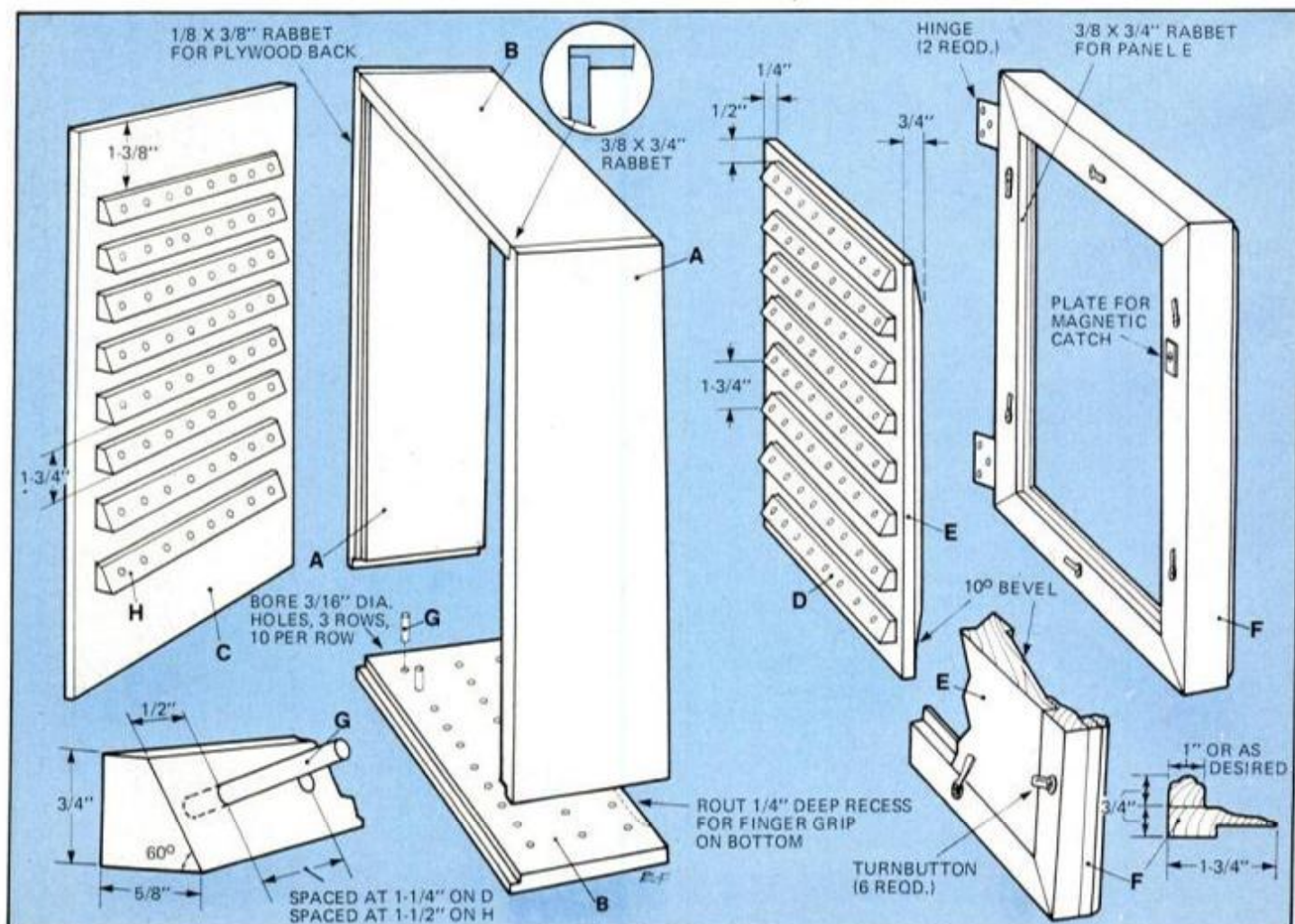
MATERIALS LIST—SEWING CABINET

Key	Pcs.	Size and description (use)
A	2	3/4 × 5 × 16 1/2" basswood (side)
B	2	3/4 × 5 × 12 1/8" basswood (top/bottom)
C	1	1/8 × 12 1/8 × 15 3/4" plywood (back)
D	8	3/4 × 5/8 × 9 3/4" basswood (front spool bar)
E	1	3/4 × 11 × 14" basswood, two pieces edge-glued (front)
F	1	1 1/2 × 11 × 14" i.d. basswood (frame) with 1 3/4"-wide members
G	158	3/16"-dia. × 1 1/4" dowel (pegs)
H	8	3/4 × 5/8 × 11 1/4" basswood (back spool bar)

Misc.: 6, 1 1/4" turn buttons; pr. 1 1/2" brass-plated cabinet hinges; 2 sawtooth picture hangers; magnetic door catch; 2d finishing nails; glue; light walnut or other stain; varnish.



This handsome, wall-hung spool cabinet is built around an 11×14-in. picture frame.



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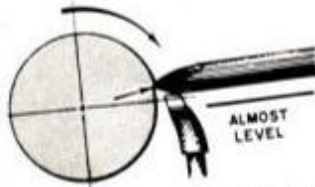
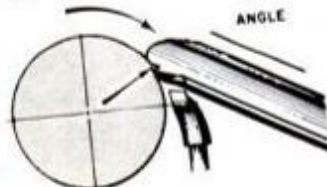
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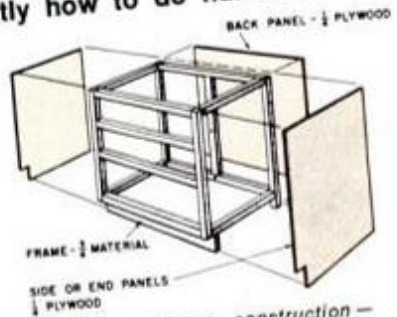
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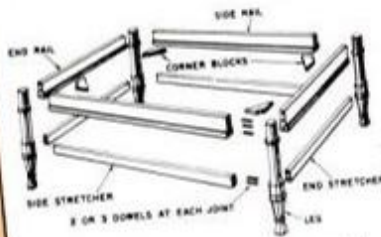
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The two basic methods of turning on a lathe: cutting (top) and scraping.



This is frame construction—often used in kitchen cabinets.



Exploded view of coffee table showing leg-and-nail construction using dowels and corner blocks.



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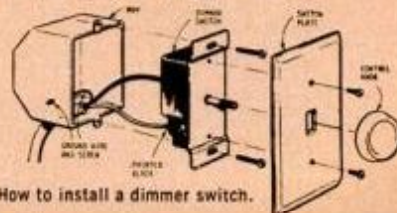
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Cling-Grip gloves help you do heavy gardening, cleaning and lifting chores. Their textured, nonslip surface of rubber polymer prevents rake and other handles from slipping and causing blisters. Ticketed at \$1.70 per pair, they're made by the Advance Glove Manufacturing Co., 901 West Lafayette Blvd., Detroit, Mich. 48226.

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"This machine pays for itself making money out of scrap boards. It is a very well built machine and I confess it is more than I really expected for the price. It does everything you say it will."

Stephen Schultz - Orangeville, Penna.

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R. S. Clark - Springfield, Ohio

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W. W. Robinson - Flat Rock, Illinois

...and from this well known authority -

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Jay Hedden, Editor
Workbench Magazine



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The 1980 Mercury Zephyr wagon from Lincoln-Mercury.

Now that you know the 1980 Zephyr wagon from Lincoln-Mercury delivers the best gasoline mileage ratings of any wagon built in America, you should also know how good it really is.

STATION WAGON	EPA EST. MPG	EST. HWY. MPG
MERCURY ZEPHYR	23	38
BUICK CENTURY	20	27
OLDS CUTLASS	20	27
CHEVY MALIBU	20	26
PONTIAC LeMANS	19	26
PLYMOUTH VOLARE	16	24
DODGE ASPEN	16	24
DODGE DIPLOMAT	16	23
CHRYSLER LeBARON	16	23



You should also know that the 1980 Zephyr wagon is estimated at more miles per gallon than a total of 8 different Datsun and Toyota models, including wagons and sedans.

Of course your mileage can vary, depending on how fast you drive, weather conditions and trip length. Your actual highway mileage will probably be less than estimated, as will California ratings. And these figures

exclude other Ford Motor Company products, and should be used for comparison. But compare these official Government EPA mileage ratings to those of any other maker's wagons of the same size, and you'll see that

none of them compare to Zephyr. Compare Zephyr's low sticker price to any wagon from Buick, Oldsmobile or Pontiac, and you'll see there's no comparison. Compare Zephyr's generous cargo space with any other wagon in its class, from any other maker, and you'll see there's no comparison. Compare Zephyr's excellent

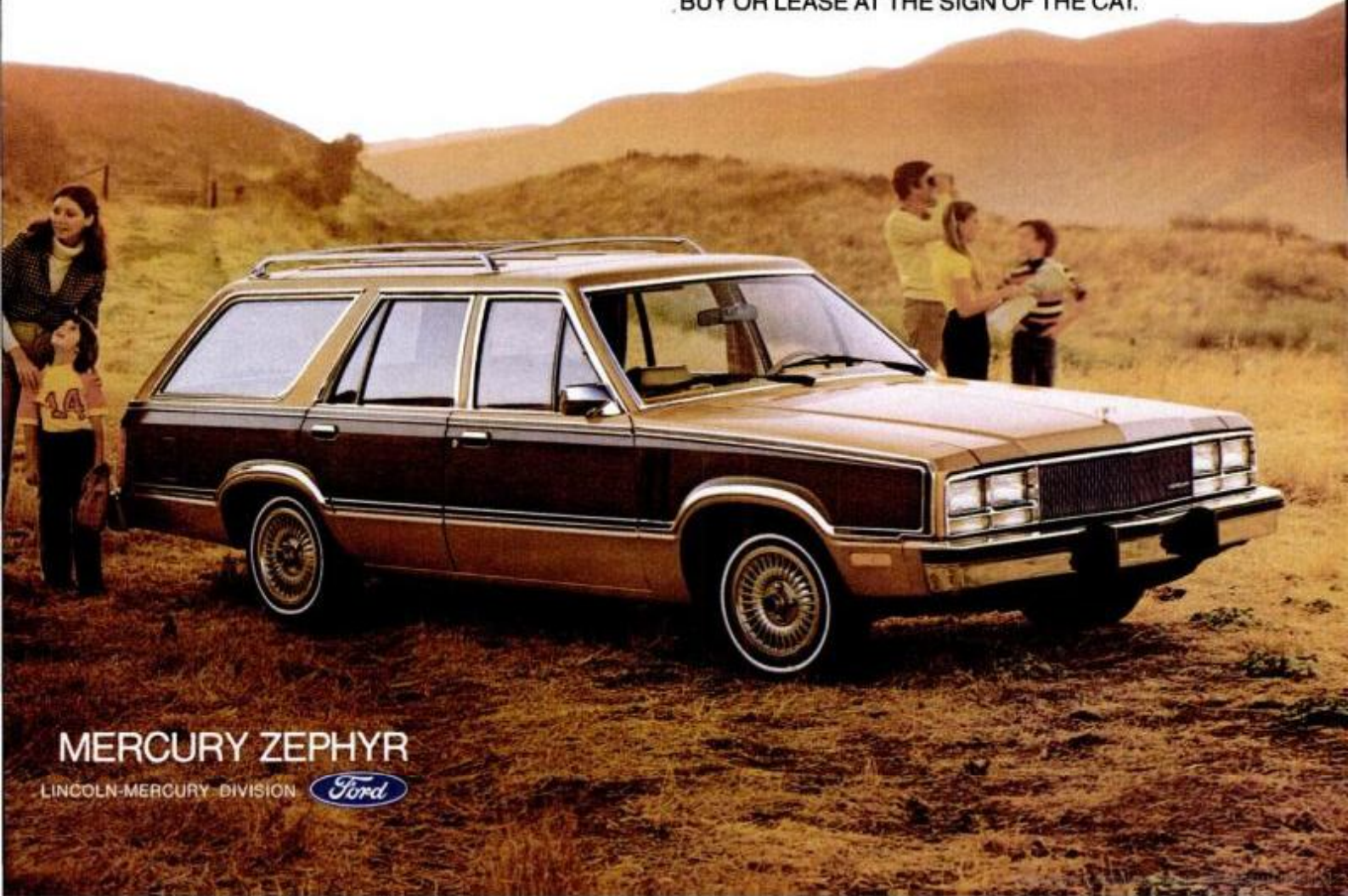


combination of fuel efficiency, comfort and quality and you'll see the Lincoln-Mercury difference. There's just no comparison.



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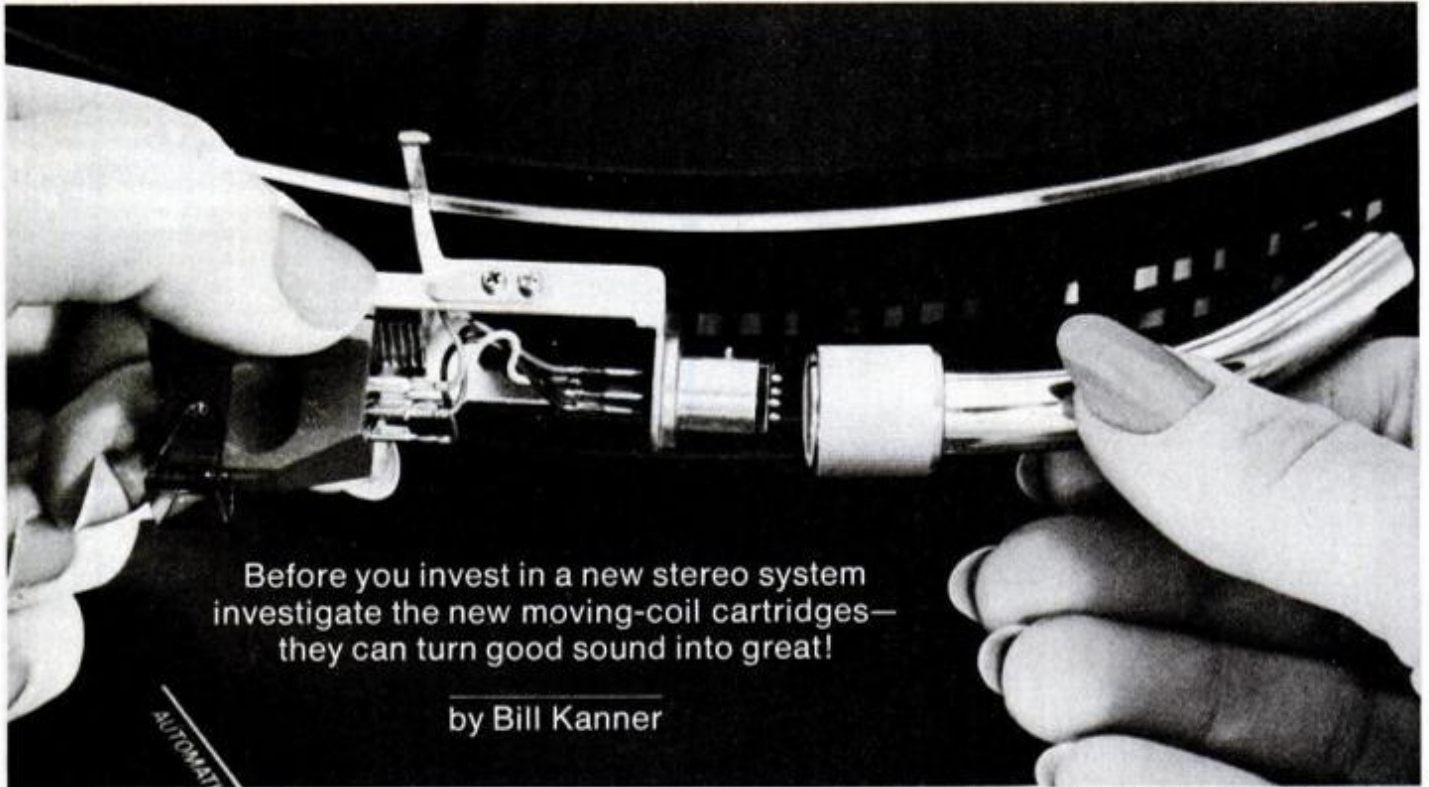


MERCURY ZEPHYR

LINCOLN-MERCURY DIVISION



Move up to a moving-coil cartridge



Before you invest in a new stereo system investigate the new moving-coil cartridges—they can turn good sound into great!

by Bill Kanner

Turntable courtesy of Rabson's Stereo Warehouse, New York.

Planning to upgrade your stereo system? If it's reasonably up-to-date and costs around \$500, be careful. You could spend a lot of cash on this or that new component without getting appreciably better sound. Consider, instead, replacing your old phono cartridge with a moving-coil cartridge.

At one time, such cartridges were strictly for the money-is-no-object audiophile, but recently they have come down in price. List prices for the best moving-coils can still run about \$300, but others are now under \$200—some well under \$200 with discounts.

The difference in sound between a moving-coil cartridge and a conventional moving-magnet type is like the difference between sound from a conventional cone speaker and that from an electrostatic. It's just better. It is, in fact, beautiful, with a crisp, transparent, almost ethereal quality.

In a moving-magnet design (and most well known cartridges are of this type), the stylus is attached to a bar or cantilever that has a magnet at the other end. As the stylus negotiates the record's grooves, it moves the cantilever, and the magnet thus moves between the stationary iron-core coils, producing an electrical signal which is translated into sound. In a moving-coil cartridge, the coil itself is wound around the

cantilever. Being lighter than a magnet, the coil moves more responsively, producing truer sound.

The high cost of quality

A number of factors kept moving-coil units expensive. For one thing, each one had to be hand-crafted. Also, most moving-coils required a step-up transformer—or a preamp—which boosted not only output, but cost, as well. To make matters even worse—or costlier still—the delicacy of the coil winding meant the user could not replace the stylus when the tip wore out. The entire cartridge had to be sent back to the manufacturer. The total package did give extraordinary sound, but at a high price.

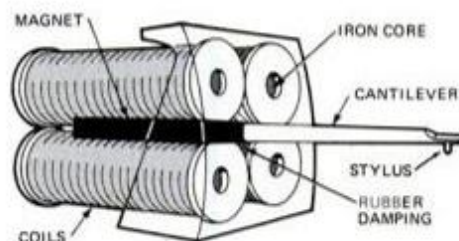
In the last few years, manufacture has been streamlined. Also, several moving-coil designs have ap-

peared that will work with many hi-fi systems without the pre-preamp stage. Meanwhile, some companies now offer user-replaceable styluses. So a moving-coil cartridge is now a lot more accessible to the music lover who wants really good sound, but at reasonable cost.

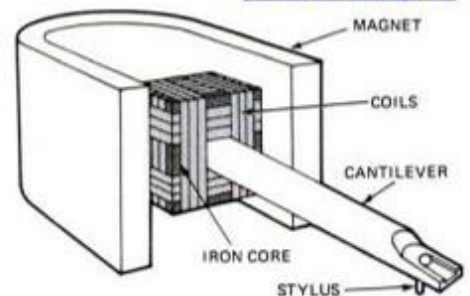
What's available

Ortofon's MC-10 requires a transformer and has no user-replaceable stylus. However, its list price of \$125 for the cartridge alone, or \$185 for the cartridge plus step-up transformer, makes it comparable in price to top-flight moving-magnet cartridges which do not, however, measure up to the MC-10's performance. The MC-10 has a frequency response of about 20 to 20,000 Hz and a suggested tracking force of 1.7 to 2.3

(Please turn to page 74)



A moving-magnet cartridge has a magnet whose moving lines of force cause varying voltage levels. Voltage varies as the stylus follows the record grooves.

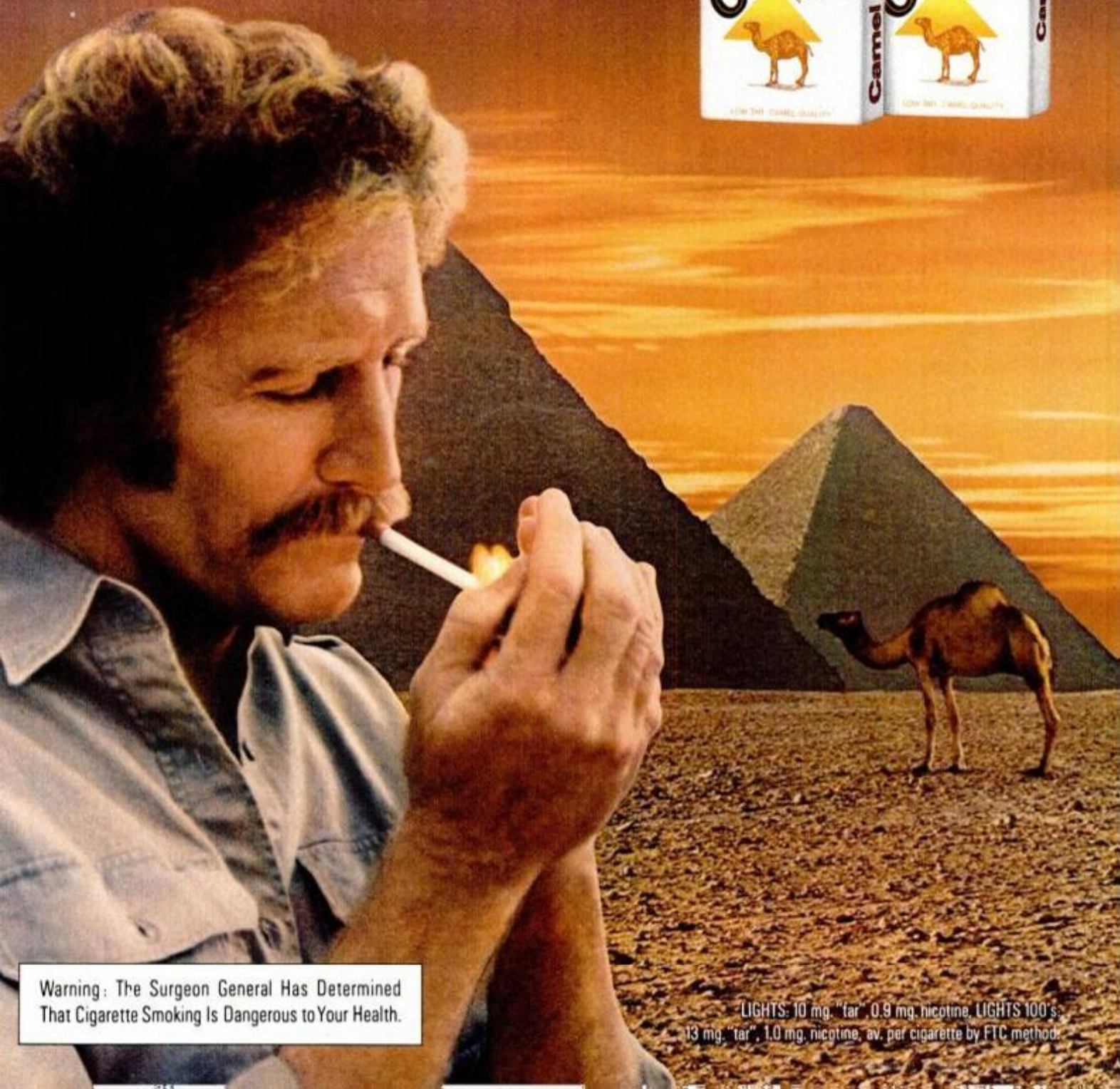


A moving-coil's magnet is stationary. The coil movement causes the voltage fluctuations. Again, the movement is caused by the stylus following the record grooves.

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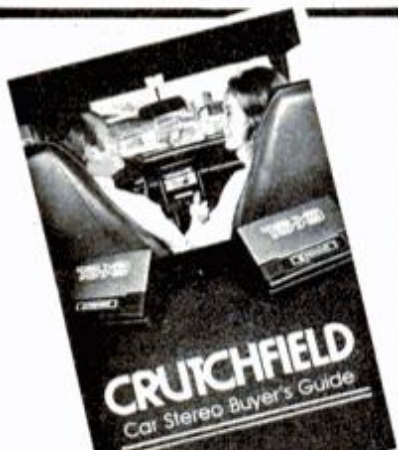
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MOVING-COIL CARTRIDGE

(Continued from page 70)

grams. It weighs 7 grams, has an elliptical stylus.

The Denon also needs a transformer. It was designed for NHK (the Japanese national broadcasting company), comes with a conical stylus and has a suggested tracking force of a rather heavy 2.5 grams. I ran it quite successfully at 2 grams, though.

The stylus has to be replaced at the factory and the total price for the cartridge plus transformer is \$195. Cartridge alone is \$140.

Audio-Technica has entered the moving-coil sweepstakes with its AT-30E. While it uses a step-up transformer costing \$95, the cartridge itself sells for only \$100. It has a user-replaceable elliptical stylus, requires a tracking force of 1.4 to 2 grams and has a frequency range of 15 to 25,000 Hz.

If your amplifier will not handle the low output from a moving-coil and you find the price of \$200 a little steep, even when discounted, you might do well to listen to two cartridges that can be used without step-up transformers; they produce voltages comparable to moving-magnet designs. They are Dynavector's 10X and Satin's 117Z.

The Dynavector 10X is priced at \$120, but unfortunately won't fit either Dual or Technics turntables. However, if you have one of the many other brands of turntables that can handle the 10X, it is well worth listening to. It gains its higher output by using more turns of thinner wire to make the coil. Its suggested tracking force is 1 1/2 grams and it has a listed frequency response of 20 to 20,000 Hz. The stylus is an elliptical diamond.

While the 10X does not have a user-replaceable stylus, Dynavector does have an excellent policy on replacement. If and when you need a new stylus, an over-the-counter exchange of the entire cartridge is \$66 (55 percent of original cost).

The newly designed Satin 117Z does have a user-replaceable stylus, which is conical rather than elliptical. The higher output which allows Satin to do away with the step-up stage is obtained via a special flat-ribbon wire winding. Tracking force is 1 to 2.2 grams and the frequency range around 20 to 20,000 Hz. The Satin 117Z is \$125. The 117G has an elliptical stylus for \$25 extra.

Those very expensive new components you've been eyeing may not seem quite the necessity they once were. Before you upgrade, it's a good idea to listen to moving-coil cartridges first.

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THE PM GARAGE

CAPSULE REPORTS ON NEW AUTO PRODUCTS

Digital test meters

The microprocessor revolution that is so evident under the hood and in the sophisticated test equipment of the big shops is coming to the hand-held testers the Saturday mechanic buys.

Three new testers from K-D Tools, all using microprocessors (minidigital computers), show how the change-over has filtered down to even the basic levels.



K-D Tools' digital dwell-tachometer has bright LED readout, 10-rpm resolution

One tester (No. 2634) is a dwell-tachometer, a second (No. 2635) is a volt-ohm-ammeter, and a third (No. 2610) is a multipurpose volt-ammeter. Nos. 2634 and 2635 list for \$100; the multimeter is \$140. They're not cheap, but they're surely in the Saturday mechanic's league.

I tried all three and was impressed with their ease of operation. The ohmmeter worked off the car battery rather than a separate flashlight battery, as would a simple, multiscale ohmmeter of conventional design.

To connect any of the testers, you simply hook up two leads to the car battery, then one or two more, depending on what you want to measure. If you want voltage, move a switch to VOLT, then touch one of the additional wire leads (the red one) to the battery positive post, and you get the number (to two decimal places, yet).

If you run the engine and turn on the parking lights, the tester also will check alternator diodes and a light will flicker if a diode is bad.

If you want amps., attach a coil shunt in series with the battery ground strap and post. The shunt is a push-fit onto the post, and one of its hook ends is a force-fit into the cable end. On side-terminal batteries, you use nuts and bolts through the hook ends to lock the shunt to the terminal and cable. This is more convenient than shunts I've used.

For resistance tests, you just hook up both the red and a green lead, in addition to the battery leads, and you'll get a reading to one decimal.

Accuracy of the testers is excellent. I compared an ohmmeter reading between the multimeter and the volt-ohm-ammeter and got identical numbers (1.2 ohms for an ignition resistor). I next hooked up my trusty old Fox Valley ohmmeter, and got a confirming reading of 1.3 ohms.

I put the dwell-tach through similar testing. Dwell is not something to consider on electronic ignition, but if you still have breaker points, it is. Further, some of the computer controls coming on 1980 cars (and more in 1981) require a dwellmeter for testing. So it can't hurt to have one. The digital dwell-tach is, however, primarily a tachometer, and it does this job well on electronic ignition systems.

I compared engine-speed readings with those obtained simultaneously on the Chrysler TDC (Timing Diagnostic Computer), another computer-controlled tester covered in *PM Garage* (page 52, May '79). There was a deviation between the two testers of 0.3 percent—5 rpm at about 1500 rpm—which is really nothing.

Dwell between the two varied by 1° (51° versus 52°). These testers are accurate to 0.5°. Apparently the numbers hit the computers on each side of 51.5° and were rounded off in different directions.

This K-D tester comes with a warning light that goes on if the dwell reading varies by 4° or more, to tip you off to a worn cam on the breaker-points system. I also hooked up both the K-D dwell-tach and multimeter simultaneously and compared the readings. They were the same for both dwell and rpm.

Which K-D tester you should consider depends, of course, on what you already have. Do you have a TDC, for example? Then you don't need dwell-tach. So forget the multimeter. The volt-ohm-ammeter is enough.

K-D doesn't accept mail orders, but their products are at most auto-parts stores. K-D, Lancaster, Pa. 17604.—Paul Weissler

Unique folding socket

One of the trickiest and toughest unscrewing jobs anyone runs into is trying to uncouple metal-tubing fittings. Most of these are made from relatively soft brass so that they'll seal effectively when tightened. After they've been in place for a few years, undoing them is never easy. In some cases, it seems impossible without butchering the fittings.

For years there have been special flare-nut wrenches that look like box wrenches with a cut in one side to fit over the tube. They work better than open ends, but not that much better.

Now there is a unique folding socket that fits over the tubing and then closes around the hex nut, fitting to grip it on all six flats. Aircraft and automotive mechanics are en-



Hex Tube Nut Wrenches grip nut on all six flat surfaces to prevent damage.

thusiastic about these folding sockets that can be turned with any combination of standard 3/8-inch square drive ratchets and extensions.

The hex drives for Hex Tube Nut Wrenches now come in sizes of 1/2-, 9/16-, 5/8-, 11/16-, and 3/4-inch. Smaller inch and metric sizes will be available soon.

The complete set of five wrenches is \$26.75 postpaid (item No. BT 7912A). Individual sizes are \$5.95 each (item No. BT 7912, specify size desired). Order from: Burroughs Tool and Equipment Corp., 2429 North Burdick St., Kalamazoo, Mich. 49007.—Angus Laidlaw

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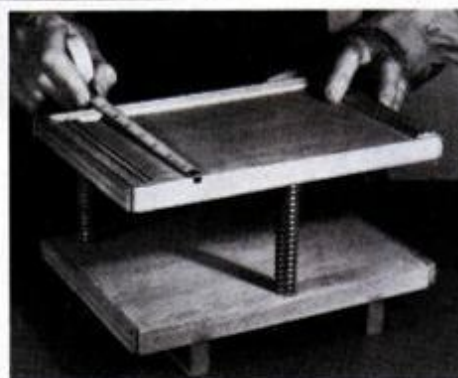
When carefully disassembled, a piece of "junk" can yield surprising quantities of hardware, including brass screws, nuts and bolts—and sometimes well-seasoned hardwood boards. At today's prices, examine articles before resigning them to the trash bin.

Used furniture can yield a treasure-trove of fine hardwood boards, hardware and interesting building techniques. At tag sales and used-merchandise outlets, many items can be had for just a few dollars.

Wooden parts often require a little cleaning and hole-filling, but the wood is likely to be sound and well seasoned. Various fittings, as well as screws and other fasteners, can be cleaned with steel wool and polished before re-using.

To disassemble the shelf-like article shown here, a knife was used to separate the joints. The glue which remained was very hard and resisted scraping. Water wouldn't remove it, and neither would lacquer thinner. But a paint remover (Zip-Strip) softened the glue so that it could be scraped off with a putty knife. The wood was then wiped clean with lacquer thinner (outdoors, for safety).

Before attempting to cut salvaged wood, use a magnetic stud finder to check for buried nails so they can be removed.—Walter E. Burton

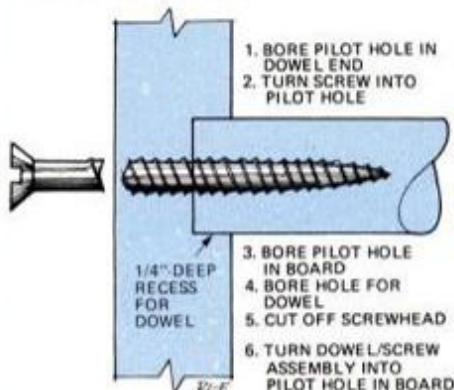


Unidentified wooden object, purchased at a used-merchandise store for 47 cents, contains several dollars' worth of materials.



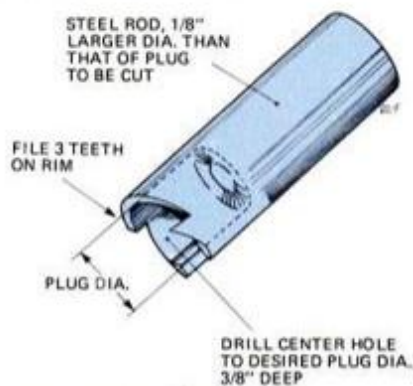
Screw hole can be filled by driving in splinter and sawing flush, or by using dowel plug and glue or plastic wood to fill.

DOWEL-JOINT DETAIL



Upon disassembling shelf-like article shown in photos, author noted ingenious technique for joining dowel to board.

SHOP-MADE PLUG CUTTER



To use, clamp cutter in drill chuck, bore ¼-in. deep and withdraw drill. Pop (break) plug from the wood with a screwdriver.

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Frank Sartin
Grandview, Washington 98920

100% Disabled

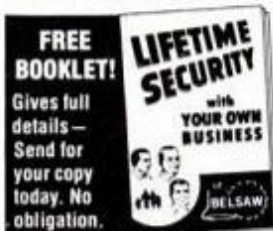
"I was disabled by an accident while employed as an iron worker. They declared me 100% disabled and said I'd never work again. I don't think I could work for anyone else but I started my sharpening business part-time and now it's turned into a full-time job with more work than I can do."

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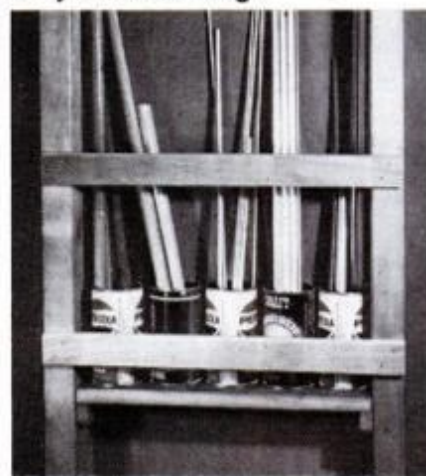
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HINTS FROM READERS

Nifty dowel storage



Since the wall studs in my shop are exposed, I use the space between for storing dowels and welding rods. Using toenails, I installed a shelf and added two wooden strips above, across the face of the studs. So you can blow out sawdust periodically, leave space between bottom strip and shelf.—Charles Hardy

Bit selection

When boring for a bolt through wood or metal, use the nut to aid in selecting the proper size bit for the job. The bit that barely fails to pass through the nut should produce the right size hole.

—Lane Olinghouse

Accenting raised letters



Use typewriter correction paper to make the unpainted, raised lettering on electronic units (such as camera flash attachments) readable. Place the correction paper on the lettering and draw the side of a knife blade over it. Remove excess particles with tape. When the correction material wears off, repeat the process to renew the image.—Walter E. Burton

Velvet Sippin'

Premium. Imported.



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Відомо також, зазначений навіс для торгівельного підприємства

PM ELECTRONICS MONITOR

But what if it's preempted?

When video cassette recorders, or VCRs, first came out, they were touted as a means to escape having to plan your life around TV. So what if there was a program you wanted to view during Aunt Minnie's untimely visit? With a VCR, you could enjoy both—or at least suffer through one and enjoy the other.

Then came the programmable VCR. Now you could automatically record a TV show up to a week in advance.

Zenith, with its brand-new Video Director model VCR, has put the icing on the video cake. It is programmable over a two-week period—and accepts five-hour tapes.

You can set this VCR to record any number of shows (up to the five-hour tape limit) during the entire two-week programming period. It can even do things such as automatically turn on and tape a weekly show once every week—for even longer than a two-week period.

No one can disagree that the VCR is indeed a most convenient tool. But, you'll have to learn to program.

Football—a light sport

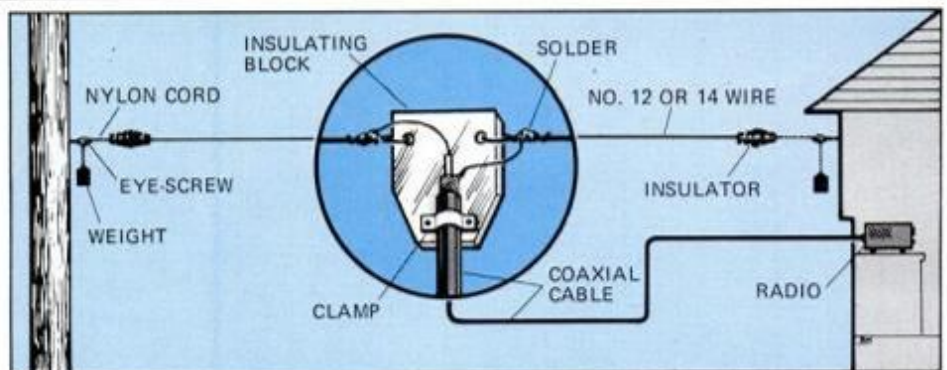
If you watched the Nov. 18, 1979, game between the Tampa Bay Buccaneers and the New York Giants broadcast over CBS, you were part of a TV first. You tuned in a game—sound and pictures—that was transmitted on a beam of light from the stadium to the CBS studios.

Signals from cameras and microphones were first converted into light waves by a tiny (grain-of-sand-sized) laser. The laser light was then routed along a 5.6-mile long glass fiber, only .005-inch in diameter, in an underground conduit to the main studio. At the studio, the light was converted back into electrical energy and transmitted normally to the network's stations.

The system, developed by GTE Laboratories Inc., offers noise-free transmission. The test seems to confirm expert opinion that such optical links will indeed work well.

Tampa is pleased and future games will be sent on the same system. Soccer games will also be telecast using the system. Unofficially, CBS is thinking of using it with more affiliated stations.

By the way, in that game, the Bucs scored the world's first optically transmitted pro football victory. Try that for your next barroom bet!



An easy way to make a shortwave antenna

Need a shortwave antenna? We show an old favorite—the half-wavelength dipole. First, you must calculate the length. Length in feet is equal to 468 divided by the frequency in megahertz that you wish to receive:

$$L = \frac{468}{f(\text{MHz})}$$

Wire should be copper of sufficient gauge to stand up to the elements and strain. The center connector should be made from thick

plexiglass, porcelain, or other nonconductive material—or you can buy an inexpensive insulating block.

We recommend 50- or 75-ohm coaxial cable for your lead-in as this eliminates most signal losses. Don't forget the end insulators and the weights and eyebolts that will keep the antenna taut even when trees shake in the wind.

Orient the antenna broadside to the direction you wish to receive and then you're in business.

Canada's our good buddy

Up until recently, it was illegal to exchange Citizens Band communications with *any* foreign nation. No longer!

The FCC has decided that it's okay to talk across the border to Canada. The rule against no foreign contacts was originally intended to prevent "skip" communications of distances over 150 miles. Working skip is *still* illegal—if you talk to Canada, you had best be within 150 miles of the other station.

Still, bearing in mind the fact that Canada and the United States share a 5500-mile open border, the new ruling should result in many new friendships on the CB frequencies.

... and the rest of the world?

While CBers have just received permission to talk to Canada, ham operators have been talking to the whole darn world for decades.

The American Radio Relay League (ARRL) represents this country's hams. The 26th National ARRL Convention is to be held in Seattle July 25 through 27, 1980.

The theme will be "World Friendship Through Amateur Radio" and more information can be obtained by writing: 1980 ARRL National Convention Committee, Box 68534, Seattle, Wash. 98168.

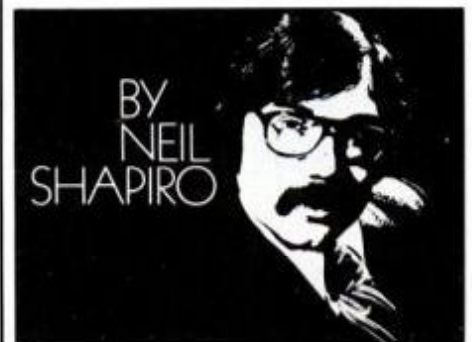
Be a scanning superman!

If you own a scanner, you are probably aware of the frequencies for

your local fire department and police. But how about the CIA?

A book titled *Registry of U.S. Government Radio Frequencies* is available to tell you where to tune to hear not only the CIA but military operations, forest services, Civil Air Patrol and everything from the Treasury Department to the Bureau of Indian Affairs. All these government services, and many others, use radio communications and, because they need not be licensed by the FCC, there are no official frequency lists.

You can also learn about scramblers, satellites, and even the receiving equipment you need in this comprehensive guide. Offered by the same publisher is another book, *Air Scan*, which gives frequencies of most airports in the United States. The books are priced at \$4.95 each and are available from CRB Research, Box 56, Commack, N.Y. 11725. Happy eavesdropping! **PM**





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It took Datsun to come up with the biggest small pickup news in 20 years: the new Datsun King Cab® GL. With more space, legroom and luxury than you may experience in any small truck—including two reclining bucket seats up front and two jump seats behind that fold up to create more inside storage space than ever. That's "Grand Luxury" as only the King Cab GL can deliver it. With everything from cut-pile carpeting to a road-smoothing new ride.



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DATSUN MILEAGE. MONEY IN THE BANK.

There isn't a bigger rig that can match Datsun pickups for economy. Yet Datsun trucks, with their gutsy 2-liter overhead cam engines, can haul 1400 lbs. of cargo and some bigger pickups. Now that's a truck you can drive all the way to the bank.

25 EPA ESTIMATED MPG **32** EPA ESTIMATED HIGHWAY

EPA estimates for comparisons. Actual mileage may differ, depending on speed, trip length and weather. Actual highway mpg will probably be less than est. California mileage lower.

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Li'l Hustler to the luxurious King Cab GL. We're dedicated to building you the right truck for your trucking needs.

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Fight Back with STP Gas Treatment. Add STP Gas Treatment to your gas tank regularly. It helps prevent the formation of gum and varnish deposits in your carburetor while it helps keep your intake valves and manifold clean. It contains a highly effective active ingredient that inhibits rust from forming in your fuel system and also helps remove water from your gas tank.

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SCIENCE WORLDWIDE

Saved—by a simulated dive

A 42-year-old English teacher from Arkansas passed out during a medical test investigating a spot on her lung. And after a night in intensive care, Jane Benton remained unconscious.

The diagnosis was alarming: Dr. James S. Adamson Jr., who had been conducting the biopsy on her lung, concluded that a bubble of air had entered an artery of her brain, blocking circulation, threatening her life.

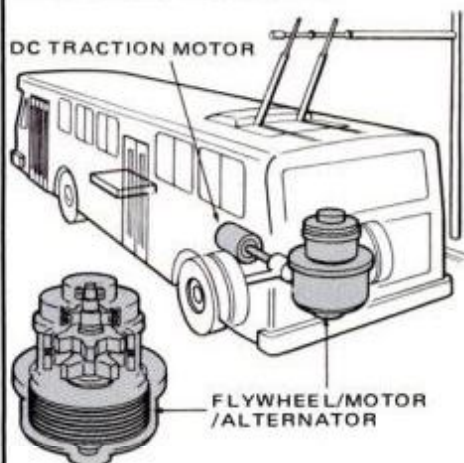
Adamson quickly made arrangements for a long-shot treatment: a simulated dive in a high-pressure chamber.

Dr. Adamson flew his still unconscious patient 525 miles to Brooks Air Force Base in Texas. There, as she lay in a 25-foot-long, air-tight chamber, technicians increased pressure around her until she was at the equivalent of 165 feet below sea-water surface. The high pressure compressed the bubble in her brain until her system could absorb it. Then the chamber was decompressed slowly. Some 14 hours after the "dive" began, Mrs. Benton awoke abruptly and asked the results of her biopsy. The test had been negative, she was told. And the high pressure had wiped out the bubble, saving her life.

The 26-hour delay between Mrs. Benton's collapse and the start of her "dive" set a record, her doctors said, and raised hope for other patients with a similar arterial blockage.

Taking a spin with a flywheel

A new full-sized bus under design by General Electric will draw its power from a spinning flywheel.



Recharging revs flywheel to 10,000 rpm.



Arkansas teacher spent 72 hours in this chamber as pressure reduced embolism.

San Francisco, Philadelphia and Seattle have shown interest in trying the prototype of the bus, the company says, although it'll be several years before the first model hits city streets.

Heart of the propulsion system is a 1½-ton flywheel, made of steel discs and connected to a combination motor/alternator. During charging at curbside stations, external power will run the motor, revving up the flywheel to 10,000 rpm. After disconnection, the flywheel/alternator will provide enough power to run the vehicle's electric motor for up to 3½ miles in normal stop-and-go traffic.

The flywheel will then be re-energized at curbside, in approximately 90 seconds.

The bus will produce no pollution, and conserve oil. Its initial cost is higher than diesel or trolley buses, but low operating costs make it competitive, GE says.

Bouncing off the meteor trail

A California scientist proposes bouncing radio signals off the wakes of meteors to send messages cheaply as far as 1200 miles.

Charles P. Mason, a consultant at the nonprofit research institute SRI International, suggests using meteor trails as communications satellites.

To collect the data, a central station transmits a continuous radio signal toward space. When meteors

enter the atmosphere, they leave a trail of ionized particles in their wake. In the few seconds before these charged trails fade away, they bounce the continuous signal to remote stations, triggering the transmission of stored data—on local weather conditions, for instance—back along the trail.

There are enough meteor showers to allow for up to 100 message bursts an hour, Mason says, at far lower cost than systems using man-made satellites.

Meteor-shower transmission is already employed in some western states, providing farmers with data on snowfall at remote locations so they can forecast water supply. Use of the natural system saves the farmers up to \$6.6 million annually, SRI reports.

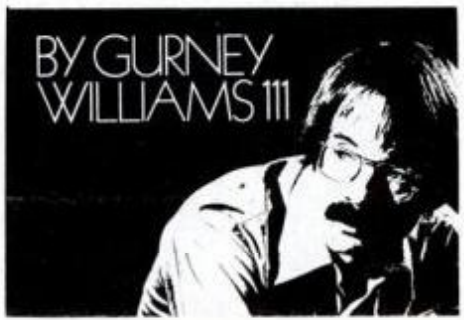
Wanted: Light-pollution trackers

Night skies over cities will get brighter during the 1980s, and that prospect is making astronomers gloomy.

Some projections suggest the use of outdoor lighting will triple in the next 10 years, washing stars from the sky, capping important telescope work near cities.

To track the growth of light pollution, Wesleyan University astronomer Arthur Uppgren plans to teach some 50 volunteers this summer to build and use portable light-measuring instruments. After five days of training on the Connecticut campus, they will return home and send data on light pollution to Uppgren. In addition to mapping major areas of glare, he plans to correlate light-pollution data with the 1980 census figures to see if brightness can be used to estimate population of an area.

Volunteers should apply to Earthwatch, a private, nonprofit, research-support group (10 Juniper Rd., Belmont, Mass. 02178). The course and accommodations cost a stiff \$450, but it's all tax-deductible, and scholarships are available. **PM**



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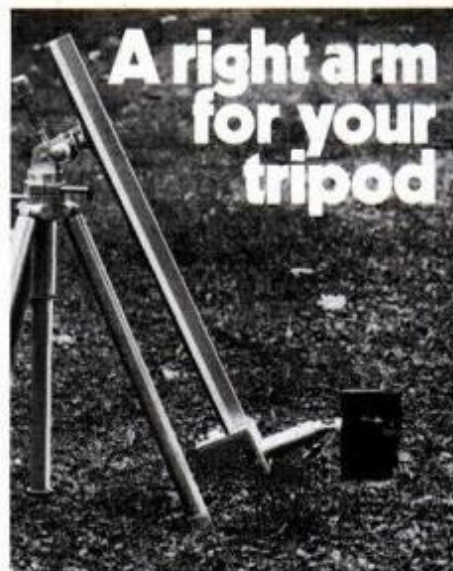


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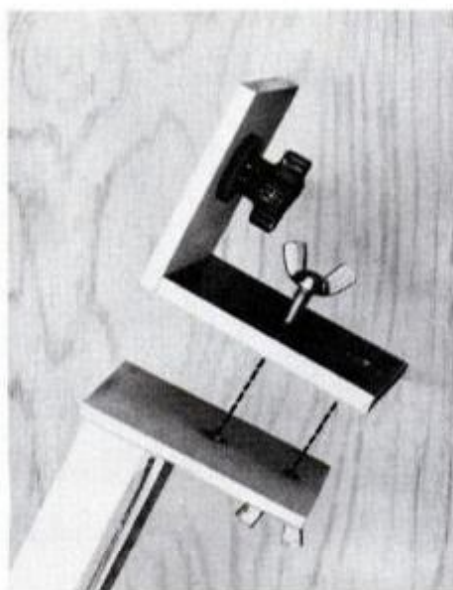
Remember, the safety of any tire depends on wear, load, proper inflation and driving conditions.



One of many uses of tripod extension arm. Ball-and-socket head adds to versatility.

An extension arm can multiply the versatility of a sturdy tripod manifold. And sturdy the tripod must be, if camera shake is to be minimized at long extensions. A stiff metal beam forms the main part of the arm. Here, an aluminum T-beam, 26 inches long and $\frac{5}{16}$ -inch thick, is used. Four 0.201-inch holes are drilled and tapped for $\frac{1}{4}$ -20 threads along base so extension length can vary. A $3\frac{1}{2} \times 2\frac{1}{2}$ -inch plate of $\frac{3}{16}$ -inch aluminum is welded to beam end (flathead machine screws can also be used to attach plate).

A right-angle bracket screws to the end plate via two $\frac{1}{4}$ -20 wing bolts, and a $\frac{1}{4}$ -20 knob holds the camera. The camera can also be affixed directly to the end plate. With arm at maximum extension, it's usually necessary to weight the tripod to keep it from tipping.—Irv Swope



Bracket screws to arm via wing bolts. Camera attaches to bracket or end plate.



Gear breakthrough replaces ratchet catches.

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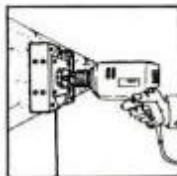
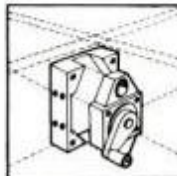
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to use it as an emergency tow cable. Our **Load Handling Handbook**, included **free** with each Easy Tugger™, will make you a pro at pulling and lifting. You save more money with an Easy Tugger™ because you only need one winch to do all your pulling and lifting. The Easy Tugger™ mounts vertically or horizontally almost anywhere with bolts, a chain, a hook, a rope, a stake, or a trailer hitch. The Universal Mount, available separately, allows one Easy Tugger™ to be moved easily and quickly from one job to another; it can be used as a utility winch, a chain hoist, a ratchet hoist, and a load binder. You can take the motor out of your car with the same Easy Tugger™ you use on your boat trailer.



instead of straining your back. Ordinary old-fashioned winches can be dangerous and are in a class with the dinosaur—clumsy, unsafe, and out-of-date. The Easy Tugger™ case protects your fingers and knuckles. A replaceable shear ring prevents accidental lifting of oversized loads that might break the cable. The body is designed to take an 8,000-pound load and our cable has a safety rating four times its advertised strength. We have designed this tool to take abuse so you won't have to replace it. It will last longer and the body won't rust. The Easy Tugger™ is a quality American-made product.

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PM-3

ALL OUTDOORS

Conquering the cold

In a number of articles, *Popular Mechanics* has been a leader in reporting on hypothermia and new studies of the special perils of getting too chilled. This time of year, it's particularly easy for an outdoorsman to get in trouble, though it can happen almost anywhere, any month of the year.

Temperatures *do not* need to be below freezing. All it takes is a breeze that drops the wind-chill factor, and skin that is wet enough so heat is drawn away from the body through evaporation. That lowers the core temperature by a few degrees. The moisture may come from rain or snow, or from sweat that doesn't have a chance to evaporate while you're exercising and leaves your clothes cold and soggy when you stop for a rest.

Synthetic insulation materials have proved to be better than down for keeping you warm when they get wet. New, insulated, foul-weather gear and rain jackets are on the market. Survival immersion suits are available for offshore fishermen and boatmen. Snowmobile clothing has become popular for ice fishermen and anyone else whose sport or work requires extended exposure outdoors.

Recently, a number of fatalities that once would have been called drownings have been recognized as deaths from hypothermia instead. Water below 70° F. is cold enough to cause eventual loss of life. Fortunately, precautions, proper gear and recognition of the symptoms (extended shivering, slurred speech and fatigue), plus a knowledge of proper re-warming techniques, can help prevent a tragedy. Right now is a good time to check with the Red Cross and the Coast Guard for ways to avoid or treat hypothermia.

For boatmen

With winter weather finishing its annual damage to waterfront slips and property, it's good to report that there is now a source for much of the dockside pleasure-craft equipment that you admire at other people's lakes or tidal cottages, but is often hard to find.

The Waterfront Equipment and Hardware Store, 104 Annapolis St., Annapolis, Md. 21401, is issuing a \$5 catalog and gives you full credit for that price on your first purchase. Listed are items like boat lifts, float-

ing docks, mooring whips, davits, boat houses, marine railways, de-icing systems, swim floats, ramps, even a Lakeside Lift elevator to carry you up a steep slope from dock to cabin. It's unusual to find such equipment available from one source.

With the introduction of elaborate and highly accurate new Loran C sets to tell us where we are, how fast we're going and how to steer to a destination, it was inevitable that a Loran would be developed that could steer the boat as well, as we predicted here some time ago. Now Western Marine Electronics in Seattle has one. Its new Wesmar LC10 Loran C Navigator can be connected to its autopilot to steer you home and give you checkpoint signals along the way.

It's a daisy

One of our most popular mechanical classics finally retired at the beginning of this year. Over 20,000,000 of us learned to shoot with this famous Model 25 BB gun. For 65 years it has



First Model 25 Daisy BB gun of 1914, 1936 model and current model look similar.

been a standard. The original design was so successful that only the looks, sights and minor materials have been modernized since the first of these elbow-cocking pumps was produced.

In 1912, a young inventor sent a blunt letter to the Daisy Manufacturing Co. in Plymouth, Mich. "I have designed and built a model of a pump-action air rifle which I would like to have you see with a view toward its manufacture," wrote Charles Lefever. "My credentials include the fact that I am a gunsmith and a grandson of the founder of Lefever Arms Company. If you're interested and can come to St. Louis to see me, I'll show you the gun."

The head of Daisy was intrigued, visited Lefever, and bought the design. Then he talked the independent inventor into coming to the Michigan plant for six months to supervise initial production. Lefever

was soon put in charge of all production, demanded and got a personal machine shop and working hours. When he retired from Daisy 42 years later, he had obtained over 60 patents for air guns. The twenty millionth—and last—of the Daisy Model 25 pumps will be on display in the National Rifle Assn. museum in Washington, D.C.

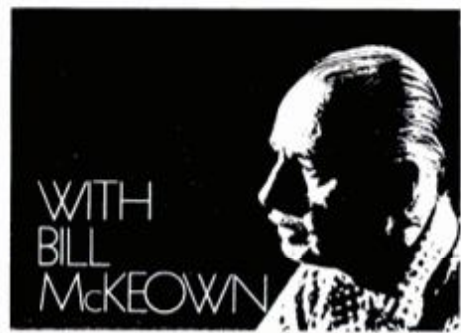
How to fish

More books have been published about fishing than about sex, author Norman Strung points out, which should prove something. Norm's latest, *To Catch a Trout*, from Stein and Day for \$10.95, proves that an all-around fisherman who is a fine writer can produce a sensible how-to book that is a delight to read.

Strung realizes that most of us fish because we want to catch 'em. We may keep them to eat or release them alive, but we want action of some kind. As a result, he doesn't scoff at using worms, if that's what a trout wants, and doesn't insist we use only a fly rod if we're much more comfortable when spinning. He doesn't skimp on the techniques a purist will insist on, but he never forgets that what we really want to know is what works best. The answers are here in a volume that's due to become a standard.

It's not sport and it's no fun to haul in a small fish on a large rope. The true pleasure comes in proving you can land a large one on light tackle and give any fish a fighting chance. More and more fishermen enjoy the challenge of taking on a fighter with minimum-weight gear, as the recent record books show.

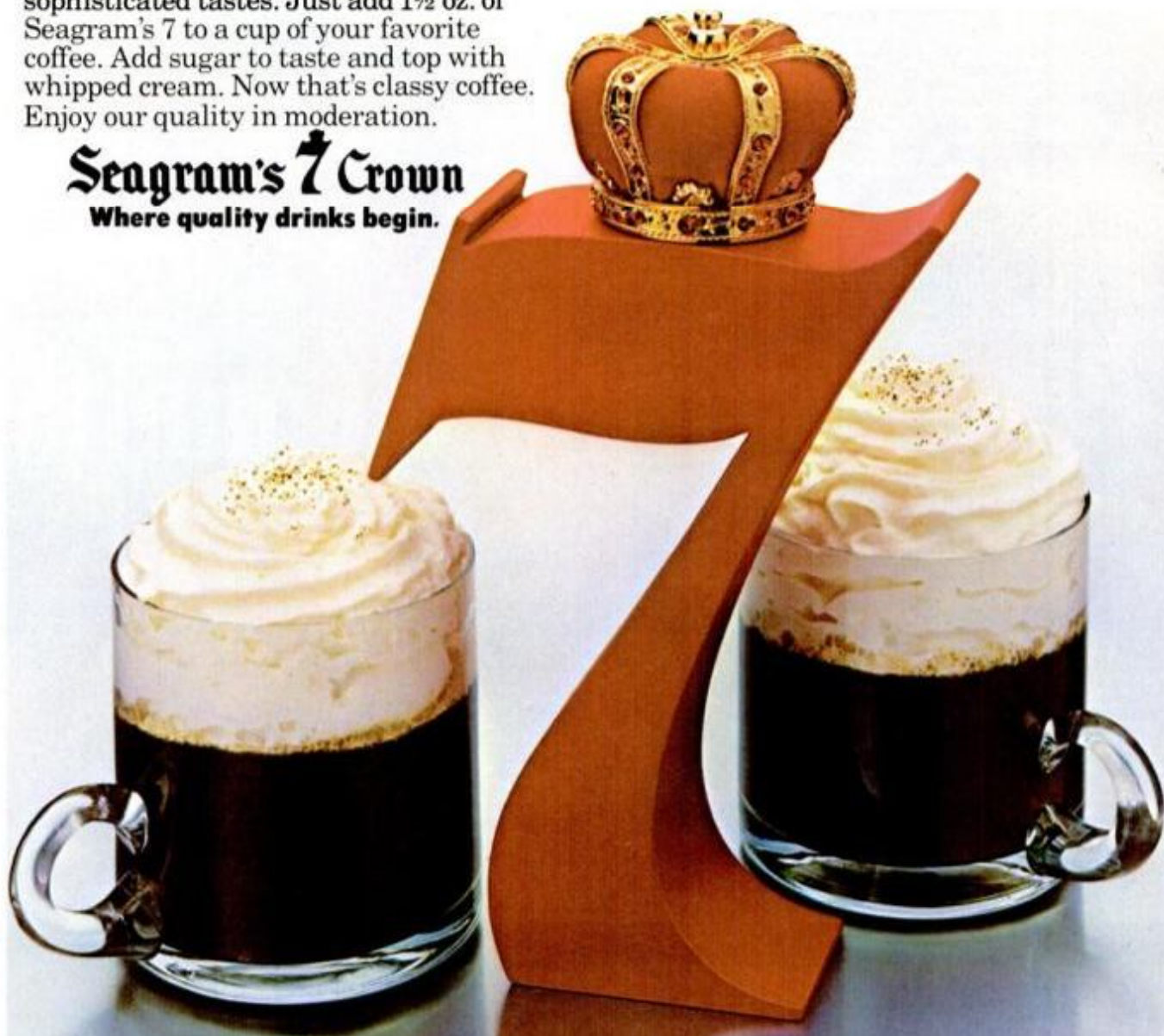
Mark Sosin, well-known fishing writer whose work has appeared in *PM*, describes best how anyone can learn to do it in his latest, *Practical Light-Tackle Fishing*, \$14.95 from Nick Lyons/Doubleday Books. Here are the ultimate in instructions for the ultimate in fishing. **PM**



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Patrolling the pipeline at the bottom of the North Sea

Hundreds of feet deep, divers trust their lives to high technology

by Jack Carroll

Ungainly looking yellow submersibles like this one ferry crews back and forth from the oil-rich sandy sea bed. Subs can track buried pipeline and "fly" courses with military precision.

Buchen Field, North Sea, 58° N. Latitude, 0° Longitude.—Aboard *Intersub Two*, a support vessel, mechanics prepare the ungainly looking, 22-foot-long yellow submarine for the day's first dive. *My first dive.*

The sea has relented from the previous day's Force 7 condition—near-gale winds with waves up to 14 feet—to a benign, almost unnatural smoothness. To the hum of electric motors, the submersible moves in a cradle from the security of the *Intersub Two* hangar to the afterdeck. There, the crew hooks on





main hawser and secondary lines from the giant A-frame launching crane.

I climb the oil-slippery ladder to the tiny conning tower. And with a passing thought about claustrophobia, in we go. Tony Miller, a 2000-hour sub pilot commanding this mission, advises me to crawl back into the rear compartment; in other words, stay out of the way. It's a chin-on-knees situation, made even more cramped by the black boxes and electronic gear that crowd the 41-inch width of the vessel's pressure hull.

This rear compartment is normally occupied by two divers and sealed off from the front compartment. But today's mission will not involve divers, so I have the small space to myself.

All set to go

With a slight lurch, the submersible is lifted up and away from the stern of *Intersub Two* and deposited gently into the sea. Now the swimmer from an attending Zodiac inflatable detaches all connecting lines. We're powered up, in communication and ready to go. Miller floods the tanks and we begin the descent,

PM photos by the author

From cramped quarters aboard a North Sea submersible (above), a diving supervisor monitors the work of men outside. After 3- to 4-hour shifts at 500 feet, divers return to pressurized compartment aboard the sub.



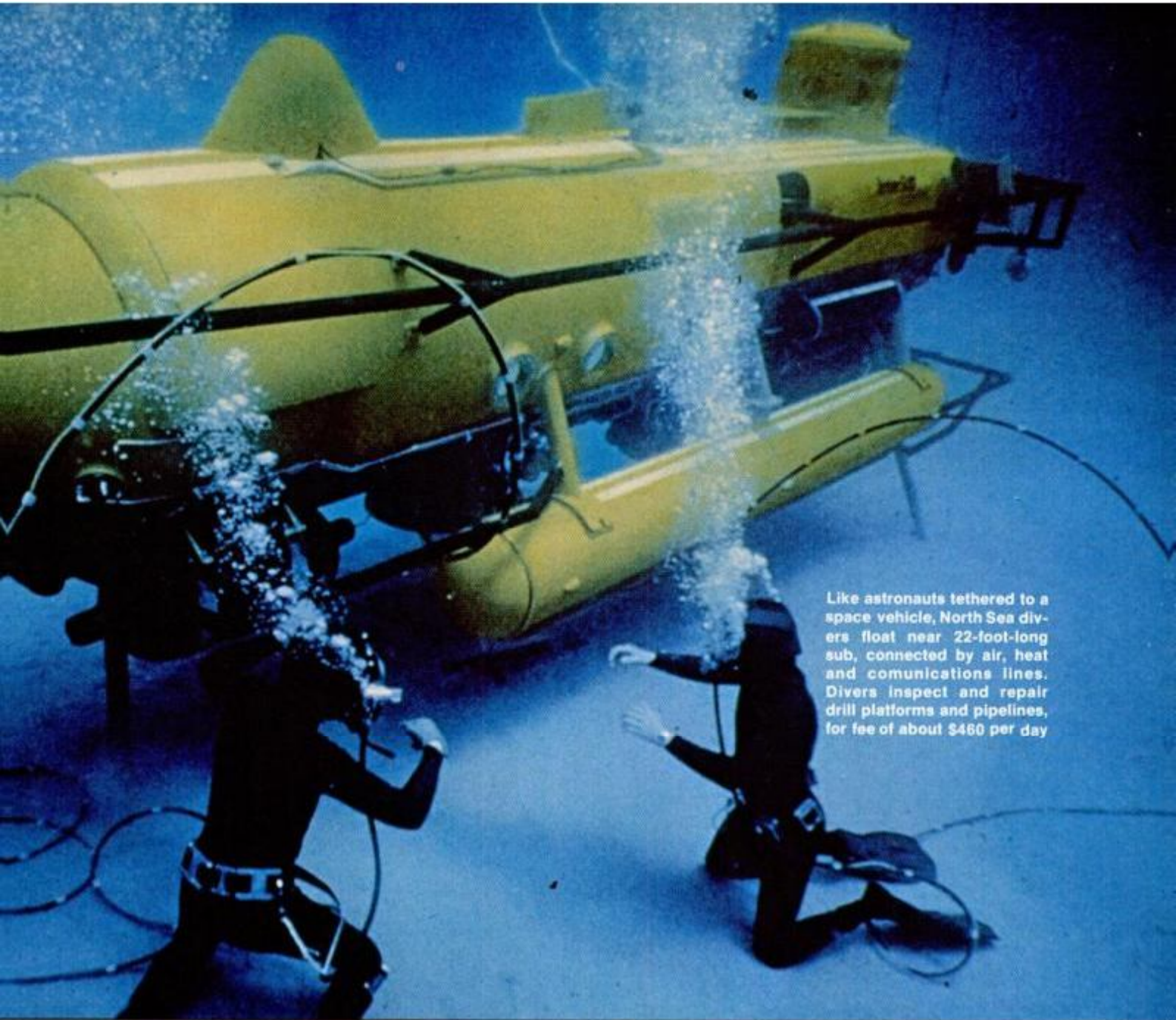
as I get a fleeting, final look at the mother ship through the bomber-like plastic bubble in the sub's nose.

The vessel I'm riding has become an essential tool for offshore engineering tasks, working successfully in the most demanding proving ground of all: the oil-rich North Sea

fields. So rich, in fact, that from the Buchen Field alone, which is considered marginal, BP expects to extract more than 50 million barrels of oil in the next four years.

The submersibles work hard to keep this oil flowing, cruising over pipelines or around drill platforms on inspection missions, aiding deep-





Like astronauts tethered to a space vehicle, North Sea divers float near 22-foot-long sub, connected by air, heat and communications lines. Divers inspect and repair drill platforms and pipelines, for fee of about \$460 per day

sea surveys, ferrying divers. The small subs perform these tasks with the help of technology you'd expect to find only on much larger vessels. For example, Intersub has developed an inertial navigation system based on military aircraft technology to provide highly accurate, rapid distance and angle measurements.

The Marseilles-based company has also developed a patented pipe tracker allowing the submersible to follow a pipeline buried up to three meters deep.

Intersub's gamble on developing new technology for the oil industry has apparently paid off. The company, which was founded in 1973, has grown from one sub and support vessel in 1974 to a fleet comprising one remotely piloted and 14 manned submersibles, including the one I'm riding now.

"Passing five zero feet," reports T.J. Jaynes, the observer, who is stationed forward with the video monitor and controls for the craft's two

mechanical arms, or manipulators. The sea changes color rapidly, darkening to a sediment-laden green, captured in the glare of the sub's quartz-iodide lamps.

It is 10:21 and all the old late-night television submarine movies never prepared me for this: Calm prevails and there are no sharp commands or anxiety. Just the reassuring whirs, rasps and hums of electric motors and servos. One motor, somewhere, keeps cutting out. Miller instructs me to "Give that box there a good rap when it happens." It works, and it seems I now have a job for the duration of the voyage.

There is little sense of motion as we reach 150 feet at 10:26, 350 feet at 10:29, and our working depth of 376 feet shortly thereafter. The bed of the North Sea—as I had been advised earlier—is unspectacularly



At the end of a dive, swimmer from Intersub support vessel attaches lines (far left), then leaps for safety as swells shove sub perilously close to mother ship.

flat and sandy. But that's where the oil is, and that's why Intersub vessels are here—complemented by some of the best divers in the world.

Saturation divers—the elite

As versatile and useful as the submersibles may be, they're still only machines and lack the dexterity and mobility of humans. So Intersub teams saturation divers with the submersibles, especially for close-in detail work and inspections of drilling platforms.

Divers "in saturation" breathe a mixture high in helium and low in oxygen and, when not out working in the ocean's depths, are "stored" at that same pressure level in a chamber aboard the support vessel. When it's time for work, the two divers on duty (the mother ship's chamber usually holds four divers) suit up and pass through a transfer trunk and lock system. They enter the rear compartment of the submersible—my compartment.

When divers are aboard, the after

section of the sub is "blown down" to a pressure level precisely matching that of the chamber on the support vessel. The sub's pilot, observer and diving supervisor remain in a one-atmosphere environment (the same as you're in as you read this) in the front compartment. From there, they observe, direct and control the divers' activities throughout the mission.

Once the sub reaches the work site, the diver steps out through an airlock with tools, testing probe or camera. Supplied with heat, breathing mixture and communications link through an umbilical cord, he goes to work.

At the end of a shift lasting three to four hours at 500 feet, the procedure is reversed. The divers pass from their compartment in the sub, through the support vessel's airlock and into the confines of the chamber. There, they'll eat, sleep and try to avoid boredom, usually for about 21 days plus 6 days for decompression; sometimes for as long as 48 days.

According to Laurie Duffin, a saturation supervisor with Wharton-Williams Ltd., an Intersub diving subcontractor, "There's really not too much of a problem with boredom as long as you're working.

"But when the weather is too bad for operations and all your time is spent in the saturation chamber, it can be difficult, no matter how many books and magazines you have to read." Like any other job, said Duffin, "You get used to it." And, presumably, to the pay, which can amount to approximately 215 pounds or about \$460 per day.

Life in a pressure chamber

While in the chamber, the divers' lives are controlled completely from the outside by life-support technicians who continually monitor the pressure and breathing mixture, control the lock through which meals are passed, and even operate the divers' toilets. Communication between the divers and their operators is made possible by a voice "scrambler" that brings the divers'

THE HIGH-PRESSURE WORLD OF THE PIPELINE PATROL

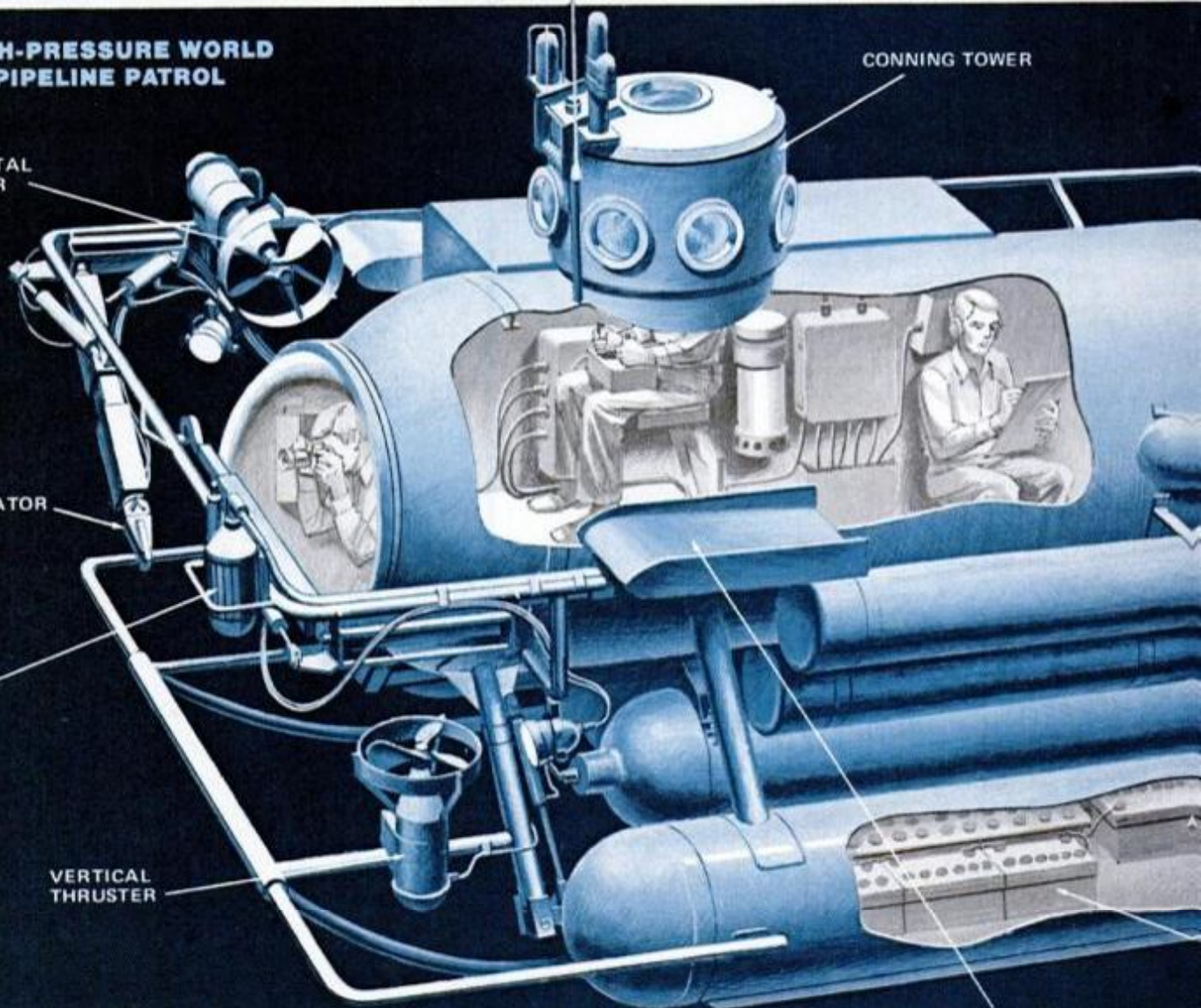
HORIZONTAL THRUSTER

MANIPULATOR

SONAR

VERTICAL THRUSTER

CONNING TOWER



Material: BOW PLANE Авторским правом

voices from a helium-induced, Donald Duckish squawk to a more human level. And they'd better get along in their steel prison, said Hartmut Winterberg, a diver with more than 3000 hours in saturation.

"You observe the divers closely in those tight quarters—their personal cleanliness and how they get along with the other divers—so you can stop trouble before it starts. If the friction gets to be too much, we get them out of there as fast as we can." Fortunately, though, divers are a tight little fraternity and most get along accordingly.

Locating a template

After long confinement in a chamber, the high-pressure underwater work is comparatively pleasant. Far below hostile weather, the emerald-colored waters are calm and quiet. And—I'm finding on my North Sea dive—easing through these waters is as smooth and quiet as a glider flight on a clear day.

Our first task is to locate a tem-

plate, a square piece of metal on the seafloor used to mark a drilling site. The sub "flies" just above the bottom and, using its sophisticated inertial navigation system, finds the plate easily—but not before an unexplained communication lapse occurs with the mother vessel. At 10:44, as we're positioned precisely at the template, communications are restored with a matter-of-fact query from the surface: "Where've you been?" An inquisitive cod swims casually into the halo of light in front of the transparent nose blister, pauses momentarily and moves on, perhaps used to these little yellow submarines by now.

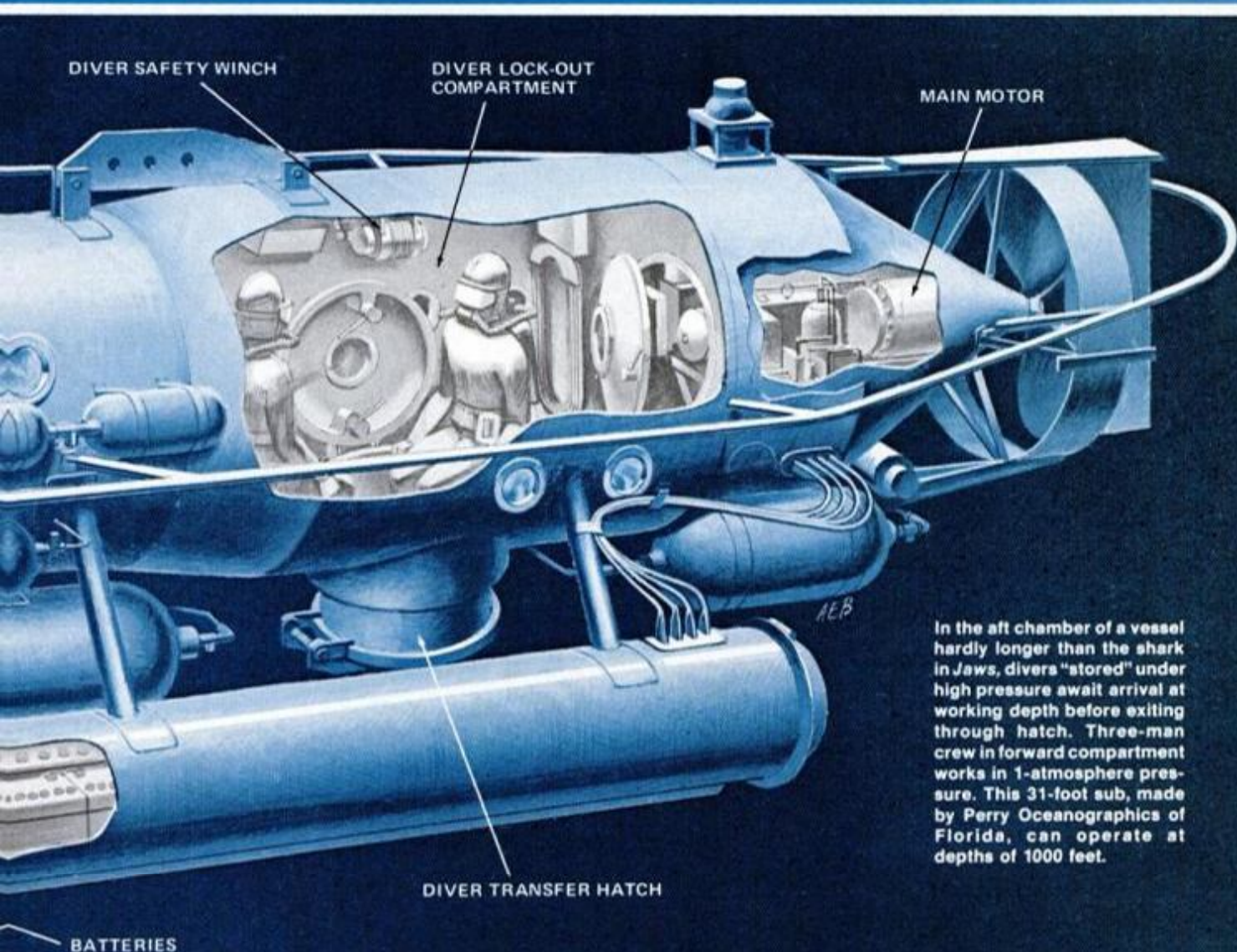
We inspect the template and the pilot begins to fly the sub along a nearly two-kilometer length of 12-inch pipe that leads to a connection with a hose to a surface buoy. As the sub flies over the pipeline, seemingly faster than the stated cruising speed of just one knot, a videotape unit continually covers all objects in the sub's path. Meanwhile, the observer supplements the visual

record with his own running commentary for the benefit of British Petroleum Oil, which is paying for this trip. The picture on the TV monitor flip-flops intermittently, and mission control in the mother ship advises there may be too much light. The problem is never fully resolved on this flight.

An odd-job request now crackles over the radio speaker: A transponder buoy that should have been released by radio signal, allowing it to rise to the surface for recovery, is hung up. Do we see it, and can we release it? Suddenly, as if on cue, there it is, looking like a bright yellow pencil sticking straight up out of the greenish haze.

The sub hovers efficiently, as observer Jaynes flexes his "muscles"—the sub's manipulator arms. One arm has a clawlike grip. The other holds a mean-looking rotary disc cutter. Jaynes adroitly maneuvers the sub's right arm to grip the transponder's restraining line. But before the disc can go into action,

(Please turn to page 194)

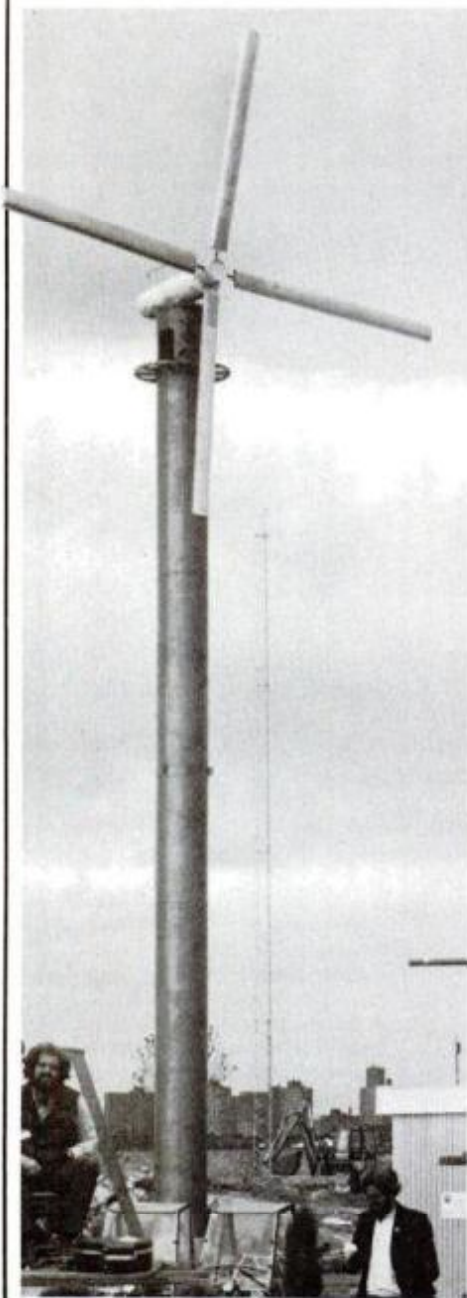


In the aft chamber of a vessel hardly longer than the shark in *Jaws*, divers "stored" under high pressure await arrival at working depth before exiting through hatch. Three-man crew in forward compartment works in 1-atmosphere pressure. This 31-foot sub, made by Perry Oceanographics of Florida, can operate at depths of 1000 feet.

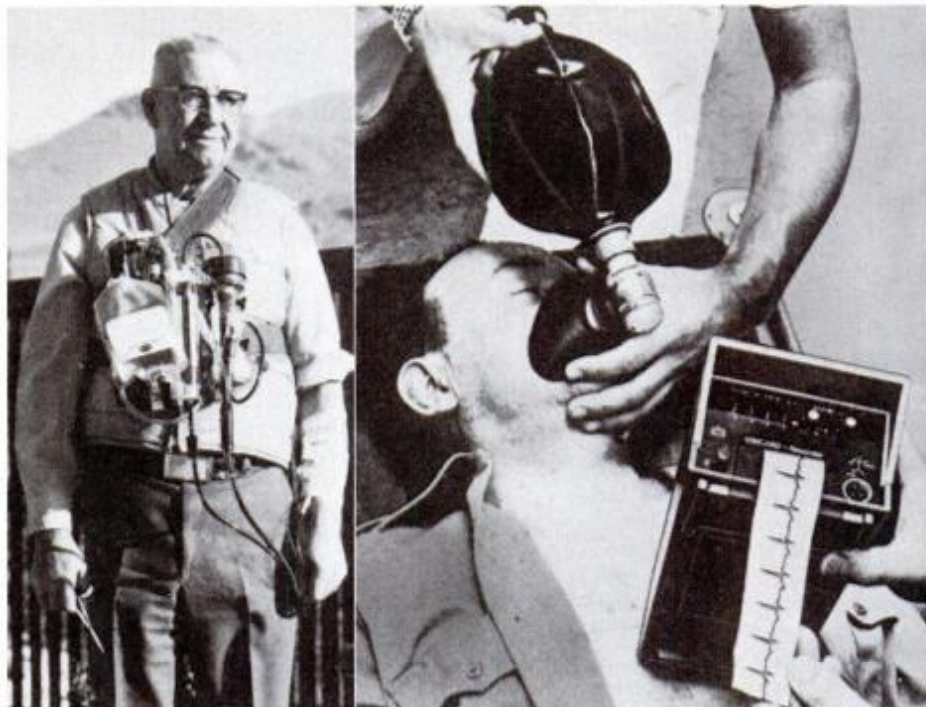
IT'S NEW
NOW

Windy City

Not Chicago, but New York; specifically, the Bronx. A free-standing windmill with a rated generating capacity of 40 kilowatts was recently erected at Bronx Frontier, a community development group. The unit's fixed-pitch blades are 38 feet in diameter and perch atop a 64-foot tower. The a.c. electrical output is rectified and everything over 20 kilowatts is fed into storage batteries. Power for lights and an experimental composting operation is sent through a three-phase synchronous inverter parallel to the utility grid. Future plans would eliminate batteries. Extra power would be sold to the utility.



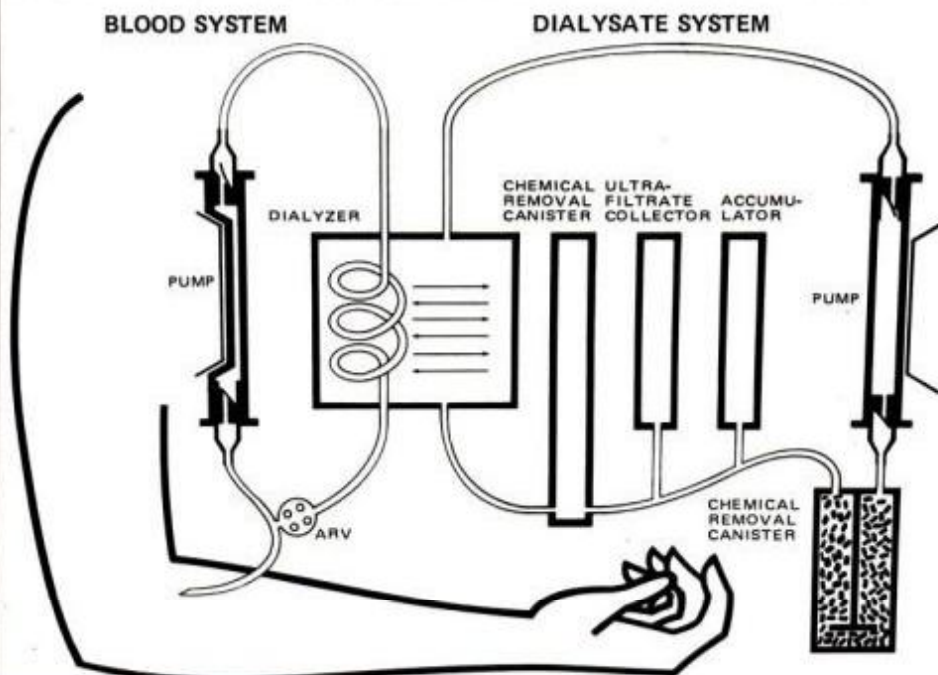
Portable medical equipment



Recent advances in the miniaturization of kidney dialysis machines (see *It's New Now*, page 65, Aug. '79) have enabled patients to travel, but the patients still needed to be tied to the machine during dialysis. Researchers at the Bioengineering Institute of the University of Utah have developed a wearable artificial kidney (WAK) that allows patients to move about (see photo, above left, and diagram below). The WAK can be disconnected from

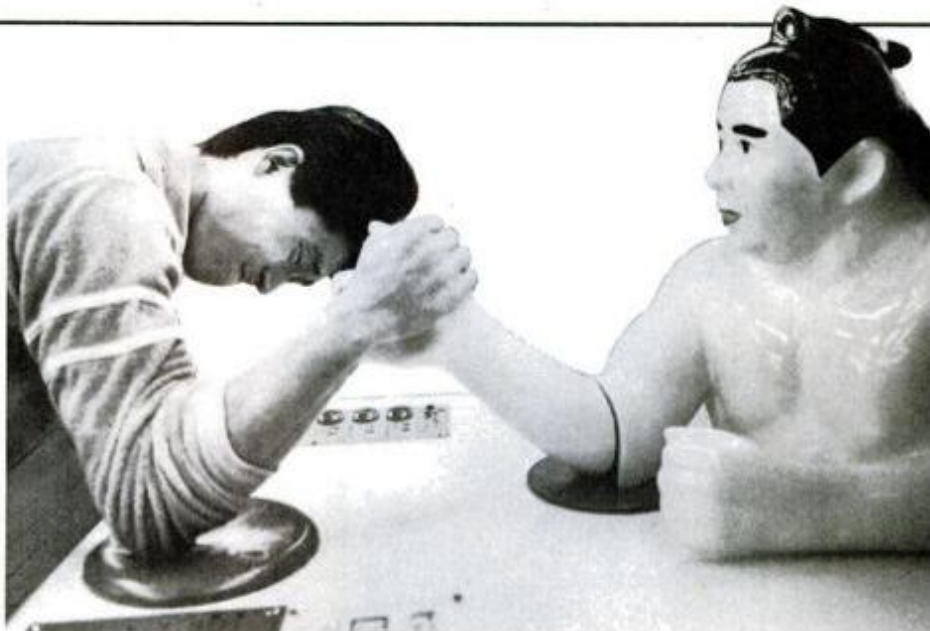
its 20-liter dialysate tank for up to 15 minutes without penalty of longer dialysis. It weighs about 6 pounds and should be available soon on a limited basis.

Also miniaturized is the Visicard-recorder (above), a battery-powered cardioscope-recorder made by Resuscitation Laboratories of Bridgeport, Conn. It produces a graphic display of heart rate so that cardiac irregularities can be monitored at the scene of an accident.

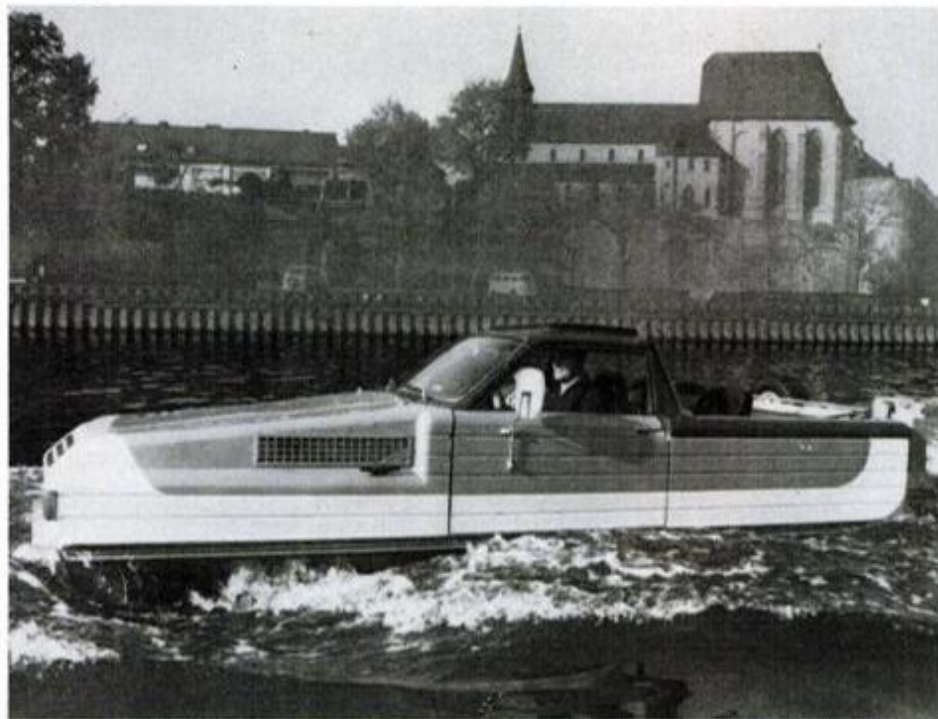


Forewarned is forearmed

That's not a real sumo wrestler testing the strength of the young man on the left. He's a hydraulic machine in a Tokyo version of an electronic games parlor. The strength of the machine can be set in six steps, each named for a rank in sumo wrestling. Rumor has it that people attempting too high a level have suffered minor injuries as a result.



If you can't walk on water . . .



If you run out of road, you can drive on water with the Conte amphibious vehicle. Reminiscent of the famous Amphicar, it shares many similar design features with its predecessor. This amphibian is powered by either a 2.3- or 2.8-liter, six-cylinder Ford engine. A hydraulic double-screw system (see lower left photo) pro-

vides waterborne push, and steering is accomplished as it is on land—with the front wheels. The removable hardtop and the upper parts of the body are made of aluminum; the rest of the body is galvanized steel. At 2.4 tons, Conte is no lightweight, and neither is the price: about \$35,000. Airconditioning is optional.

Still and all

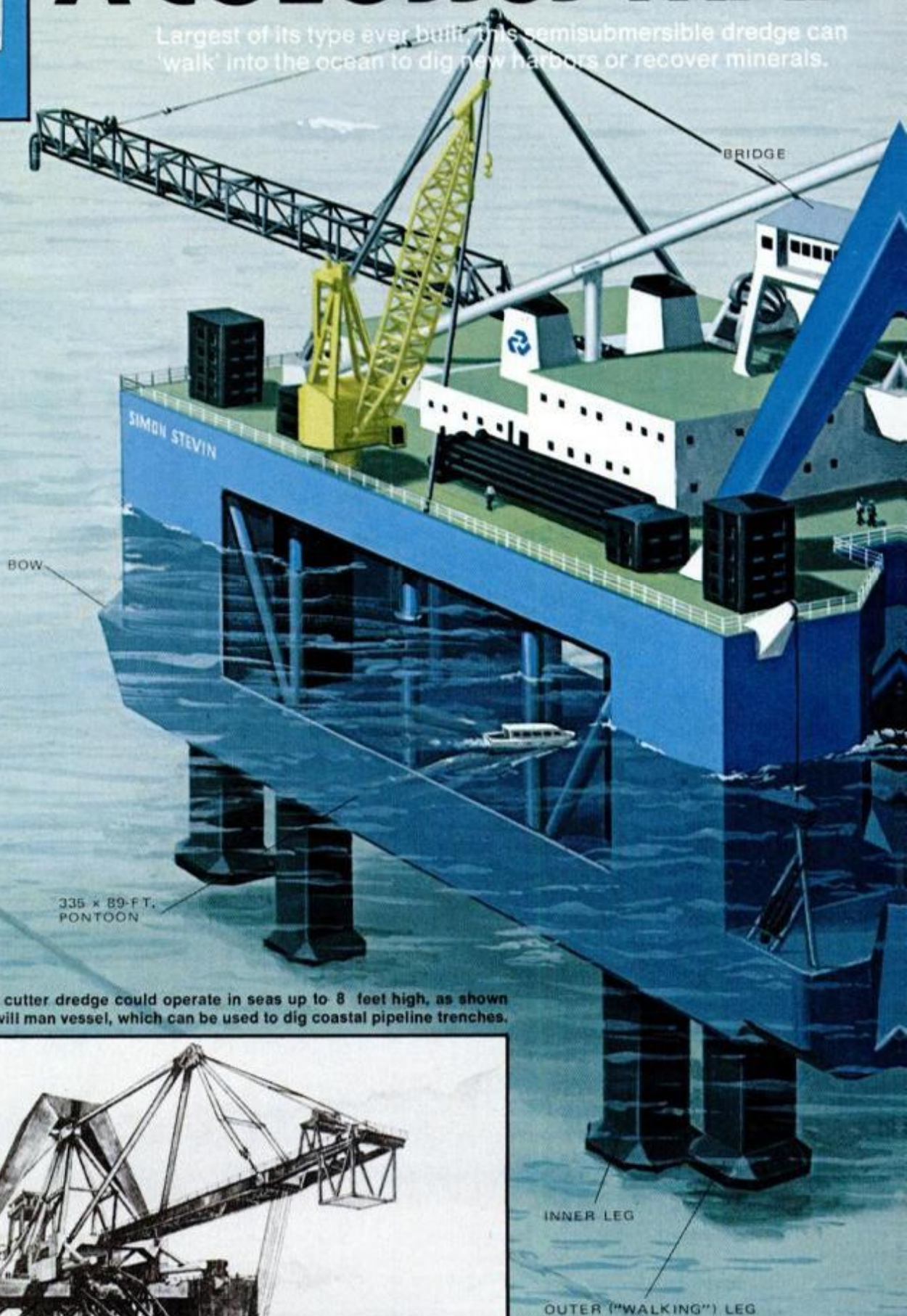
What was once the province of moonshiners and underworld characters may have achieved a patina of respectability. A company called Victory Still of Norfolk, Va., is marketing a home still for the purpose of brewing alcohol—but not the drinking kind. The unit is intended to produce ethanol, the “-ohol” part of gasohol. The company claims the still will put out about a gallon of the stuff in 1½ hours, at a cost of about 25 to 50 cents. It says there's no worry about revenuers, but that it's a good idea to have the necessary permit before brewing.



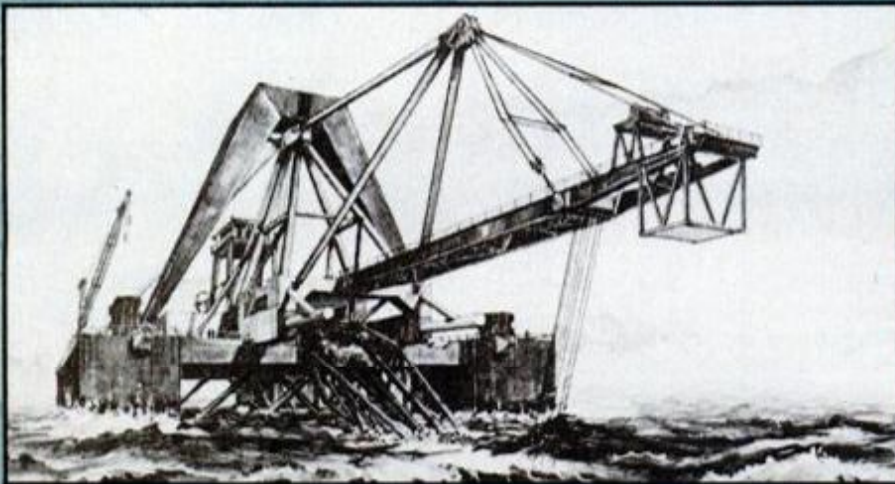


A COLOSSUS THAT

Largest of its type ever built, this semisubmersible dredge can 'walk' into the ocean to dig new harbors or recover minerals.



Recently launched cutter dredge could operate in seas up to 8 feet high, as shown below. Crew of 65 will man vessel, which can be used to dig coastal pipeline trenches.



STANDS UP TO THE SEA

Built in Holland for the Volker Stevin Dredging firm, the 620-foot (boom tip to boom tip) *Simon Stevin* is classified as a semisubmersible cutter dredge and is the largest ever conceived. A 5000-hp engine powers its cutting head, which can handle almost any hard soil or rock

except basalt or granite. Its retractable-leg system enables the vessel to stand firmly on the sea bottom and maintain dredging operations in ocean swells up to 8 feet high or more. This means that new harbors—up to 105 feet in depth—can be dredged in areas where wave action previously rendered such facilities unthinkable. A ram-and-hinge system enables the vessel to “walk,” taking 10-foot steps on its outer legs, at up to 80 feet per hour. Ballast pumps regulate its buoyancy and the pressure exerted on the sea bottom; floating free with legs retracted, it can make over 5 knots on its own power—four screws each driven by a 2500-hp engine. **PM**



What you should know before you start ... commuting by moped

by Moss Miller and Tony Assenza

Europeans have been commuting by moped for years. With their gasoline prices, which average \$2.25 per gallon, and the relatively short distances they need to travel, it's no mystery why mopeds are so popular on the other side of the Atlantic.

Until recently Americans had shown a marked lack of interest in this mode of transport. Small displacement two-wheeled vehicles have never been popular here. If you recall the fifties you'll remember that Vespas in Europe were so popular they seemed to outnumber the human population. While in America the only people who



New-for-'80 General has motorcycle styling, standard turn signals.

Puch's Sport MK II is light enough for anyone to maneuver.

Motobecane's 1980 models retain proven engineering features.

- 1 Variator-type belt-drive transmission is for smoothness.
- 2 Locking bar secures baggage while moped is parked.
- 3 Engine is on flexible mount to reduce vibration.
- 4 Two chain drives—the smaller of which enables the moped to be pedaled if it runs out of fuel—are standard.
- 5 Kill switch sets off horn if a thief starts moped.



Two-speed MK II cruises at 28 mph.



would be caught dead on a Vespa were the types who haunted coffee houses, sported goatees and were called beatniks.

In recent years, that attitude seems to have changed. Due to the incredible traffic congestion in big cities, the price of gas and the parking situation, the typical American sedan no longer has the attraction it once had, especially for everyday commuting to and from work.

There are, of course, alternatives: You can take public transportation. In many areas, however, this is either not available or even less attractive than traffic jams and high gas bills. Then there's the problem of arranging your schedule to fit a bus or train line. In addition, you can't get door-to-door service on a bus.

You can walk if you're close enough to your job, or ride a bike if you don't mind the exercise.

Then there's the motorcycle. But this represents a sizable investment which may not be worthwhile if you're only using it for a few miles a day. Ultimately, for short-haul commuting, motorcycles will cost you more money than they save.

For a particular type of short-distance commuting, then, mopeds seem to fill the bill perfectly.

The initial attraction of a moped is the low investment. For a few hundred dollars you could be rolling. In most states, you won't even need to register the moped or purchase any insurance.

Get there for pennies a day

The prime attraction is the amazing fuel economy. You can keep them in gas for literally pennies a day. Maintenance is minimal and, if you've been faithfully reading PM, you probably know how to fix them.

If you're considering commuting by moped, the critical factors you should consider are distance, climate, parking and your location.

The question to ask yourself is how far can you comfortably travel by moped and stay within your usual travel time. A 20-mile run by moped, under ideal conditions, will take about an hour. If you will encounter hills, add more time.

If your normal mode of transport takes only 20 minutes as opposed to an hour for the moped, it might not be a good idea to use the moped. But, ultimately, the bottom line on the question of distance is really determined by how far you can travel comfortably.

The ideal distance for moped commuting is probably around 5 miles. At that span, the moped is quicker than a bicycle, more efficient than a

STATE MOPED LAWS—1979-80

State	Min. Age	License Rules	Registration	Speed Limit	Maximum Engine Limits	Legal Definition	Mandatory Insurance
Ariz.	16	Any driver's license	\$8 year	25 mph	1.5 hp, 50 cc	Pedal bicycle with helper motor	No (financial responsibility)
Ark.	No	None required	None	30 mph	2 hp, 50 cc	Motorized bicycle	No
Calif.	15	Any driver's license or learner's permit	None	30 mph	2 hp	Motorized bicycle	No (financial responsibility)
Colo.	16	Any driver's license	\$5/3 yrs.	30 mph	2 hp, 50 cc	Motorized bicycle	No
Conn.	16	Any driver's license	None	30 mph	2 hp, 50 cc	Bicycle with helper motor	No
Del.	16	Any driver's license	\$5/3 yrs.	25 mph	1.5 hp, 55 cc	Moped	No
D.C.	16	Any driver's license or motorized bicycle permit	\$6 yr.	25 mph	1.5 hp, 50 cc	Motorized bicycle	No (financial responsibility)
Fla.	15	Any driver's license or learner's permit	\$5 one time	25 mph	1.5 hp	Moped	No
Ga.	15	Any driver's license, learner's permit or limited permit	None	30 mph	2 hp, 50 cc	Moped	No
Hawaii	15	Any driver's license or learner's permit	\$3 yr.	35 mph	1.5 hp, 50 cc	Moped	No
Ill.	16	Any driver's license	\$12 yr.	30 mph	2 hp, 50 cc	Motorized pedalcycle	No (financial responsibility)
Ind.	15	None required	None	25 mph	1.5 hp, 50 cc	Motorized bicycle	No
Iowa	14	Any driver's license or motorized bicycle license	\$5 yr.	25 mph	50 cc	Motorized bicycle	No (financial responsibility)
Kans.	14	Any driver's license or motorized bicycle license	\$5 yr.	30 mph	2 hp, 50 cc	Motorized bicycle	No
Ky.	16	Any driver's license or moped license	None	30 mph	2 hp, 50 cc	Moped	No
La.	15	Any driver's license	None	25 mph	1.5 hp, 50 cc	Motorized bicycle	No
Me.	16	Any driver's license	\$5 yr.	30 mph	2 hp, 50 cc	Moped	No (financial responsibility)
Md.	16	Any driver's license or moped permit	None	None stated	1.5 hp, 50 cc	Moped	No
Mass.	16	Any driver's license or learner's permit	\$3/2 yrs.	25 mph	1.5 hp, 50 cc	Motorized bicycle	No
Mich.	15	Any driver's license or moped license	\$5 yr.	25 mph	1.5 hp, 50 cc	Moped	No
Minn.	15	Any driver's license or motorized bicycle permit	\$3 yr.	30 mph	2 hp, 50 cc	Motorized bicycle	No
Mont.	16	Any driver's license	None	30 mph	2 hp, 50 cc	Bicycle	No
Neb.	14	Any driver's license, learner permit or school permit	None	30 mph	2 hp, 50 cc	Moped	No
Nev.	16	Any driver's license	None	30 mph	None stated	Moped	No (financial responsibility)
N.H.	16	Any driver's license	\$3 yr.	30 mph	2 hp, 50 cc	Moped	No (financial responsibility)
N.J.	15	Any driver's license or motorized bicycle license	None	25 mph	1.5 hp, 50 cc	Motorized bicycle	Yes
N.M.	13	Any driver's or restricted license	None	25 mph	50 cc	Motorized bicycle	No
N.Y.	16	Any driver's license or special license	\$5 yr.	20 mph	None stated	Limited use class C motorcycle	No (financial responsibility)
Class C							
Class B	16	Any driver's license or special license	\$5 yr.	30 mph	None stated	Limited use class B motorcycle	Yes
N.C.	16	None required	None	20 mph	50 cc	Moped	No
N.D.	14	None required	None	30 mph	2 hp, 50 cc	Motorized bicycle	No
Ohio	14	Any driver's license or motorized bicycle license	None	20 mph	1 hp, 50 cc	Motorized bicycle	No
Okla.	No	None required	\$6 yr.	30 mph	2 hp, 50 cc	Motorized bicycle	Yes
Ore.	16	Any driver's license or moped license	\$6/2 yrs.	30 mph	50 cc	Moped	Yes
Pa.	16	Any driver's license	\$6 yr.	25 mph	1.5 hp, 50 cc	Motorized pedalcycle	Yes
R.I.	16	Any driver's license	\$10 yr.	25 mph	1.5 hp	Motorized bicycle	No
S.C.	12	None required	None	20 mph	1 hp	Bicycle with helper motor	No
S.D.	14	Any driver's license, instruction permit or restricted permit	None	30 mph	2 hp, 50 cc	Moped	No
Tenn.	14	Any driver's license or motorized bicycle permit	\$10.50 yr.	30 mph	2 hp, 50 cc	Motorized bicycle	No
Tex.	15	Motor-assisted bicycle license (written test)	\$6 yr.	20 mph	60 cc	Motor-assisted bicycle	No
Vt.	16	Any driver's license	\$10 yr.	30 mph	2 hp, 50 cc	Moped	No (financial responsibility)
Va.	16	None required	None	20 mph	1 hp	Bicycle with helper motor	No
Wash.	16	Any driver's license	\$3 yr.	30 mph	2 hp, 50 cc	Moped	No (financial responsibility)
W. Va.	16	Any driver's license	\$8 yr.	30 mph	2 hp, 50 cc	Moped	No (financial responsibility)
Wis.	16	Any driver's license	\$5 yr.	30 mph	50 cc	Moped	No (financial responsibility)
Wyo.	16	Any driver's license	None	30 mph	2 hp, 50 cc	Moped	No

Helmets are mandatory only in Georgia, New York (class B), Oklahoma (under 18 years old) and Tennessee.

Chart: Moped Association of America, 1001 Connecticut Ave. N.W., Washington, D.C. 20036



Commuting by moped liberates you from bus or train schedules. It's also fun.

motorcycle and, door to door, much faster than a bus or train that must make many stops.

Climate may be a critical consideration. In the sun belt, the question is irrelevant. Anywhere else you must consider how far into the winter you can ride.

These days, really low temperatures are not a big problem. Motorcyclists have been using cold-weather riding gear for years and you could follow their lead. High-quality biker suits are good for temperatures to 25° below zero.

Snow and rain main enemies

The real enemies to safe travel by moped are snow and rain. As long as the weather is dry, no matter how cold, you can stay comfortable. But rain and snow are probably too much for a moped to handle. Under those conditions, a moped becomes dangerous.

The next area of consideration is parking. If your job provides free parking, you're in business. But if you have to pay for parking, the question becomes complicated.

Our own mopedalist, Moss Miller, discovered that it cost him \$2 to park his moped in a public garage. A round-trip bus ride in New York is only a dollar. By riding the moped to work, Moss was spending a dollar more than he would normally. For anyone having to spend more for parking than for mass transit, mopeds would seem not to be a practical alternative.

In heavy urban areas, however, the parking situation might change this. If some enlightened city administrator could be convinced to build special moped racks, similar to but more secure than bike racks, commuting by moped would become ex-

tremely economical for many working people.

Your location, regardless of distance, is the last area of concern. If, let's say, you live only a few miles from your job, but have to travel over an interstate highway or cross a bridge or go through a tunnel, you won't be able to use your moped. The law just won't allow it. Your only alternative in this case is to find a less direct route to your destination, if possible.

Of all of us on the PM staff, Miller was ideally situated for our hands-on commuting test. He lives 24 blocks north of the office, which works out to a little over a mile. For him, it would be a straight shot downtown and, except for the potholes which have been known to swallow taxis whole, would involve no changes in elevation.

City streets tough test

In the world of high-performance motoring, off-road racers test their skills and equipment at Baja. Endurance racers have Daytona and LeMans. For the mopedalist, there is probably no tougher challenge than that experienced on the streets of New York City.

Aside from the potholes, Miller

had to contend with taxis and buses piloted by individuals who are not known for their courtesy or grace under pressure. In short, he would be up against it.

Fully aware of his task, Miller armed himself with the most sophisticated moped he knew of, the General 5-Star model manufactured by the General Moped Corp. It seemed fitting that he should choose to do battle in the New York streets with a "5-star general" as an ally—this moped was really living up to its name.

First, it has an authentic hydraulic, twin-cylinder suspension, front and rear. This is an absolute requirement for both rider comfort and safety. You can't concentrate on where you're going if the moped is pitching like a seesaw on every bump.

The General also has turn signals on both ends to insure that everyone on the road knows where you're going. Turn-signal indicators are fitted into the speedo face, but, as on early motorcycles, they are not self-canceling.

To make life easier, the General has a battery that gives the starting system a boost. After depressing the choke and squeezing the starter



Many aftermarket items are now available for mopeds. This is a lighting pack.



For a customized look, you can swap stock wheels for mags or chromed spokes.



Motobecane offers comfort and safety items like fairings, locks and carriers.



These padded motorcycle-style seats give more comfort and style than stock ones.

handle, you need only turn the pedals to bring the engine to life.

Beat downtown buses

The motive drive is provided by a two-stroke Minarelli engine that displaces 49.6 cc and yields 1.5 hp. With the 1.8-gallon fuel capacity, Miller was an infrequent visitor at the local gas station.

In the demanding environment of New York, the engine proved flexible and adequately powerful; he was able to keep pace with traffic and, in many cases, outrun it. He made better time on his moped than that scheduled for the downtown buses. He was able to ride between lines of stopped cars and stay well in front of the traffic.

Although you can make tremendous time splitting lanes like Miller did, he cautions that you should be very careful. You never know if one of those stopped cars will suddenly swing open a door, causing you to crash into it. If you're going to split lanes, do it very slowly and carefully and always be ready to brake.

Hill climbing tough

On level ground, the moped had more than enough power to scoot around any obstacle in its way. But on the auto roads that wind through Central Park, it was a different story. The little Minarelli engine couldn't quite make the hills. Unless there was a long approach to help develop a full head of steam, the little two-stroke would slow down to a snail's pace. Speed would go down to about 7 mph, and that with the throttle cracked wide open and a liberal use of body english by the mopedist.

Another problem Miller found annoying was severe vibration at wide throttle openings. At around the redline, 4800 rpm, his eyeballs would almost shake out of their sockets. The entire frame and handlebars would shake so badly he had to cut back his speed. Since this moped is relatively heavy at 152 pounds, it is a mystery why it should vibrate so much.

The heavy frame should absorb most of the vibrations, but it doesn't. Our only conclusion is that the engine mounting system could use some modification to isolate the engine from the rest of the chassis. The most comfortable speed for the General is 15 mph. Vibrations are tolerable at that velocity.

Road courtesy extended

To his surprise, Miller discovered that cabbies and bus drivers were more courteous than he had anticipated. On several occasions he was

VITAL STATISTICS: THE MOST POPULAR MOPEDS

MANUFACTURERS AND MODELS	SAFETY			EASE OF RIDING			LOCKS	COMFORT			EXTRA FEATURES			MISC.							
	TURN SIGNALS	BATTERY	HORN	SPEEDOMETER	SINGLE-SPEED	TWO-SPEED		VARIATOR	SEPARATE PEDAL GEARING	STEERING-COLUMN LOCK	FUEL-TANK LOCK	STEP-THROUGH FRAME	CROSS TANK	LONG (MOTORCYCLE) SEAT	SADDLE (BICYCLE) SEAT	MAG-TYPE WHEELS	PACKAGE CARRIER	TOOLKIT	COUNTRY OF ORIGIN	FUEL CAPACITY (Gal.)	SUGGESTED RETAIL (\$)
Sachs																					
Suburban		•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	G	1.3	625
Prima		•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	G	2.1	675
Seville		•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	G	2.1	749
G-3		•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	G	2.3	799
Puch																					
Maxi		•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	G	0.8	609
Maxi Luxe		•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	G	0.8	659
Newport II		•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	G	0.8	748
Sport Mk II		•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	G	0.8	829
Magnum II		•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	G	1.85	899
Magnum Mk II		•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	G	1.85	949
Motobecane																					
Solex		•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	F	0.3	449
Traveler		•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	F	1.0	599
Moby		•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	F	1.0	699
Le Moped		•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	F	1.0	799
Sebring		•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	F	2.7	849
AMF																					
Roadmaster B120		•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	US	0.37	420
General																					
5-Star	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	T	1.8	NA
5-Star ST	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	T	1.2	NA
5-Star Presidential Edition	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	T	1.8	NA
Honda																					
PA-50	•										•	•	•	•	•	•	•	J		NA	
Sparta																					
Buddy		•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	H	1.0	599*
Buddy Deluxe		•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	H	1.0	625*
Easy	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	H	1.3	NA
Tomos																					
Bullet		•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	Y	1.25	499
Silver Bullet	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	Y	1.25	559
Columbia																					
2250		•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	US	0.5	550
2240		•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	US	0.5	600
2220		•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	US	0.5	650
Garelli																					
Sport		•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	I	0.84	459
Rally Sport		•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	I	0.84	599
Rally Sport LTD		•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	I	0.84	659
Super Sport XL		•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	I	0.84	679
Super Sport XL LTD		•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	I	0.84	739
VIP		•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	I	0.84	759
Vespa																					
SI		•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	I	1.12	NA
Special		•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	I	0.75	459
Supreme		•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	I	0.75	499
Deluxe		•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	I	0.90	549
Super Deluxe		•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	I	0.90	599
Grande Deluxe		•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	I	0.75	729
Grande Super Deluxe		•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	I	0.75	779

Note: All models have front and rear shock absorbers except AMF Roadmaster B120 and Columbia 2250 (front shocks only); Motobecane Solex, Honda PA-50 and Vespa Special (no shocks), and Vespa SI (central cantilever suspension).

Footnotes: * 1979 price; NA, not available at press time; F, France; G, Germany; H, Holland; I, Italy; J, Japan; T, Taiwan; US, United States; Y, Yugoslavia.

even given the right of way by those good people and actually got a nod of approval as he scurried between ranks of yellow Checkers. By their very nature, moped commuters seem to elicit a certain amount of admiration from other motorists. The feeling seems to be that if you're brave enough to be riding a moped in this town, you need all the cooperation you can get.

One final problem Miller noted was the kill switch. He found himself

accidentally hitting the kill button and stalling in the middle of traffic. He would like to see the switch positioned somewhere else on the handlebars where it wouldn't be so easily hit.

Moss Miller's final verdict on commuting by moped is that it's an eminently sensible way of getting around. For short-haul commuting, he says that the moped has to be the cheapest and fastest mode of transportation.

PM



PM photos: Claudius Stevenson

Miniatures that shoot

Gems of the gunmaker's art, these prized collectors' items are produced today by a handful of uniquely skilled craftsmen.

by Paul Wahl



Karl Furr fires his 1/2-scale replica of 10-barrel Model 1874 Gatling gun. Miniature shoots .22 shorts at 800 rounds per minute—five shots at each turn of the crank. Feed drum holds 222 cartridges.

How small is "miniature"? By the classic definition, a miniature gun is one that is too small to be held in a normal firing position in even a baby's hand. But most collectors now accept anything half-scale or smaller as miniature.

Master craftsmen

Ever since the 1500s when the first miniature guns were made, each generation has produced a few artisans with the skills and patience it takes to make these tiny firearms. A fine miniature requires hundreds of hours of meticulous work to complete. Over the years, only a small number have been made and thus, old or new, these are scarce collectors' items. Demand for the products of today's makers is such that some craftsmen have waiting lists several years long. And people who can't wait often will pay dealers or other collectors as much as twice the maker's price.



PM photo: Ursula Thom

Shown actual size (half that of the original), Leon Crottet's working model of Colt Model 1911 .45 automatic is authentic in every detail. Cartridges are full and half scale.

Pictured here are examples of current work by several outstanding firearms miniaturists. All except Switzerland's Leon Crottet are Americans.

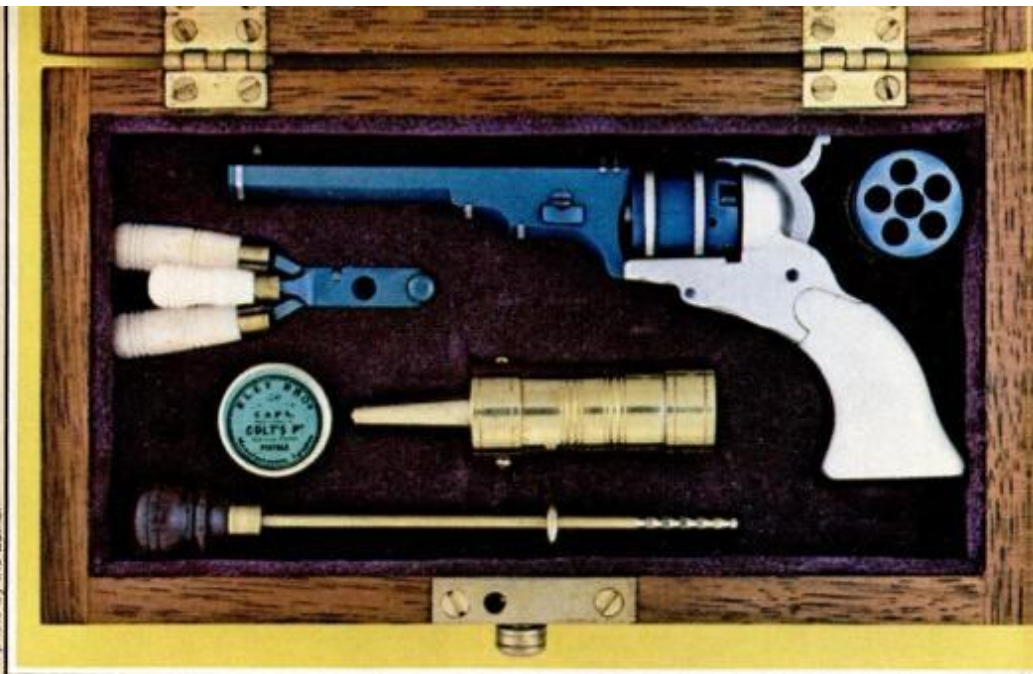
Rare guns miniaturized

Herschel Kopp, president of the Miniature Arms Society, has built 52 miniatures—faithful small-scale replicas of rare original arms that range from handcannon to cartridge pistols.

His masterpiece, which took some 450 hours to construct, is a beautiful one-third-scale working model of a 16th-century wheel-lock pistol with matching powder flask and spanner. Another of his miniatures is an Apache pistol, also in one-third scale. It unfolds from a knuckle-duster into a six-shot double-action revolver with a bayonet-like dagger. This triple-threat weapon is said to have been favored by turn-of-the-century Paris gangsters known as "Apaches," hence its name. The original fired 7-mm pinfire cartridges and Kopp's one-third-scale version shoots 2-mm pinfire blanks.

Superbly detailed 5/16-scale models of Kentucky rifles and pistols by famous 18th-century gunsmiths are the specialty of Dan Osterman. Although fully functional, these miniatures do not shoot because flintlocks in this scale are too small to produce ignition. However, the one-of-a-kind flintlock pistol, representing his work in this article, does shoot. Although it is traditionally styled, this handsome 3/8-scale handgun is of Osterman's own design, not a replica. It was made as a gift for his father, gunsmith Albert Oster-

PM photo by the author

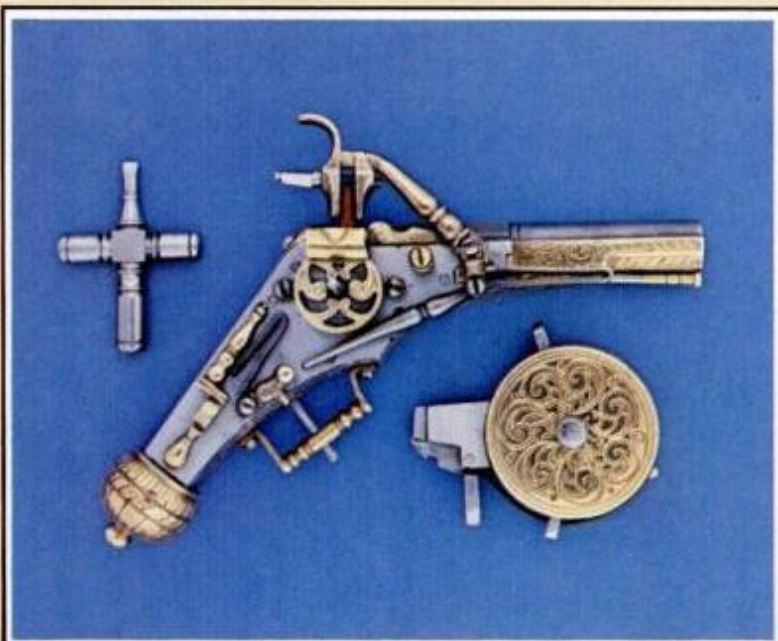


Handsome Colt Paterson pistol set by Larry Smith is 1/3-scale, shown actual size.

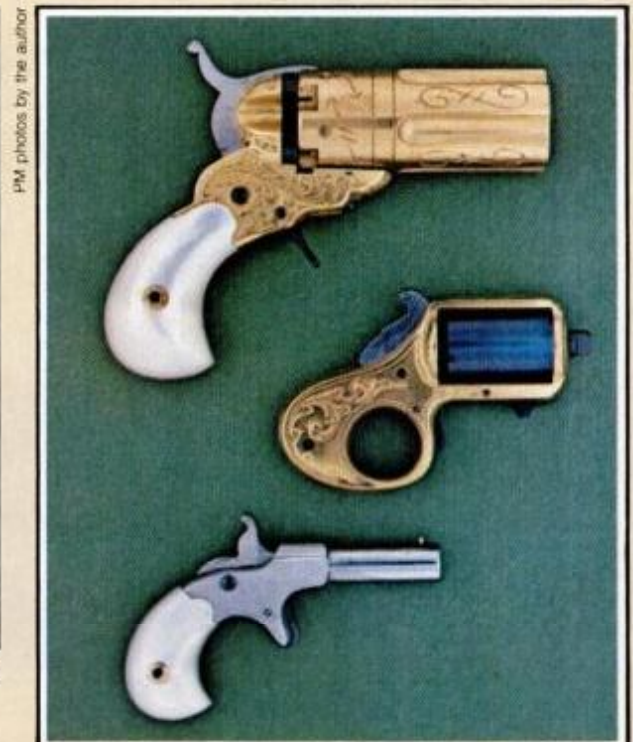


PM photo: Ursula Thomi

Less than a foot long, this tiny fully functioning Tommy gun by Crottet is half-scale.



Kopp's wheel-lock pistol (above), and Smith Pepperbox, Reid, Remington derringer by Smith (right) are 1/3-scale, shown actual size.



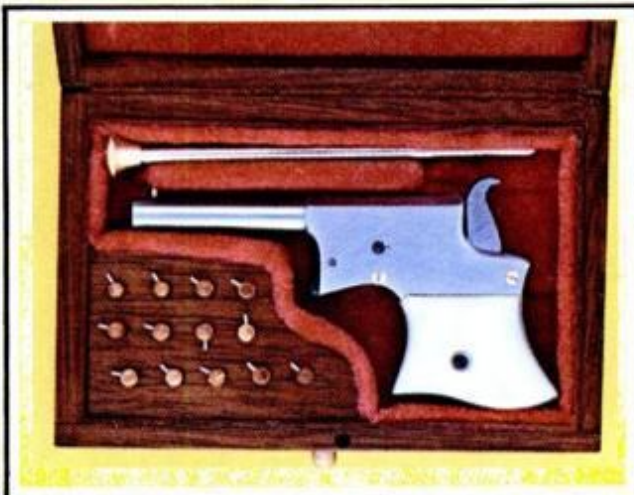
PM photos by the author



Folded for use as knuckle-duster, the triple-threat firearm had dagger, brass knuckles. Shown actual size.

Paris underworld favorite, Apache pistol is 1/2-scale by H. Kopp.

PM photos by the author



Larry Smith's half-scale cased Remington Vest Pocket model pistol is shown actual size with its 2-mm pinfire cartridge blanks for this and other Smith miniatures and Apache.

man, from whom Dan learned his craft.

.22-caliber Gatlings

Invented by a physician, Richard Jordan Gatling, during the American Civil War, the rapid-firing Gatling gun, with its hand-cranked revolving cluster of barrels, is a truly historic weapon and of great inter-

est to nearly all gun enthusiasts. The marvelous .22-cal. Gatling guns made by Karl Furr and Paul Kuhni are so popular with collectors that a gun ordered now will be delivered in two to three years. It takes over 200 hours to complete one of these miniature Gatlings and only a few dozen are produced annually. In

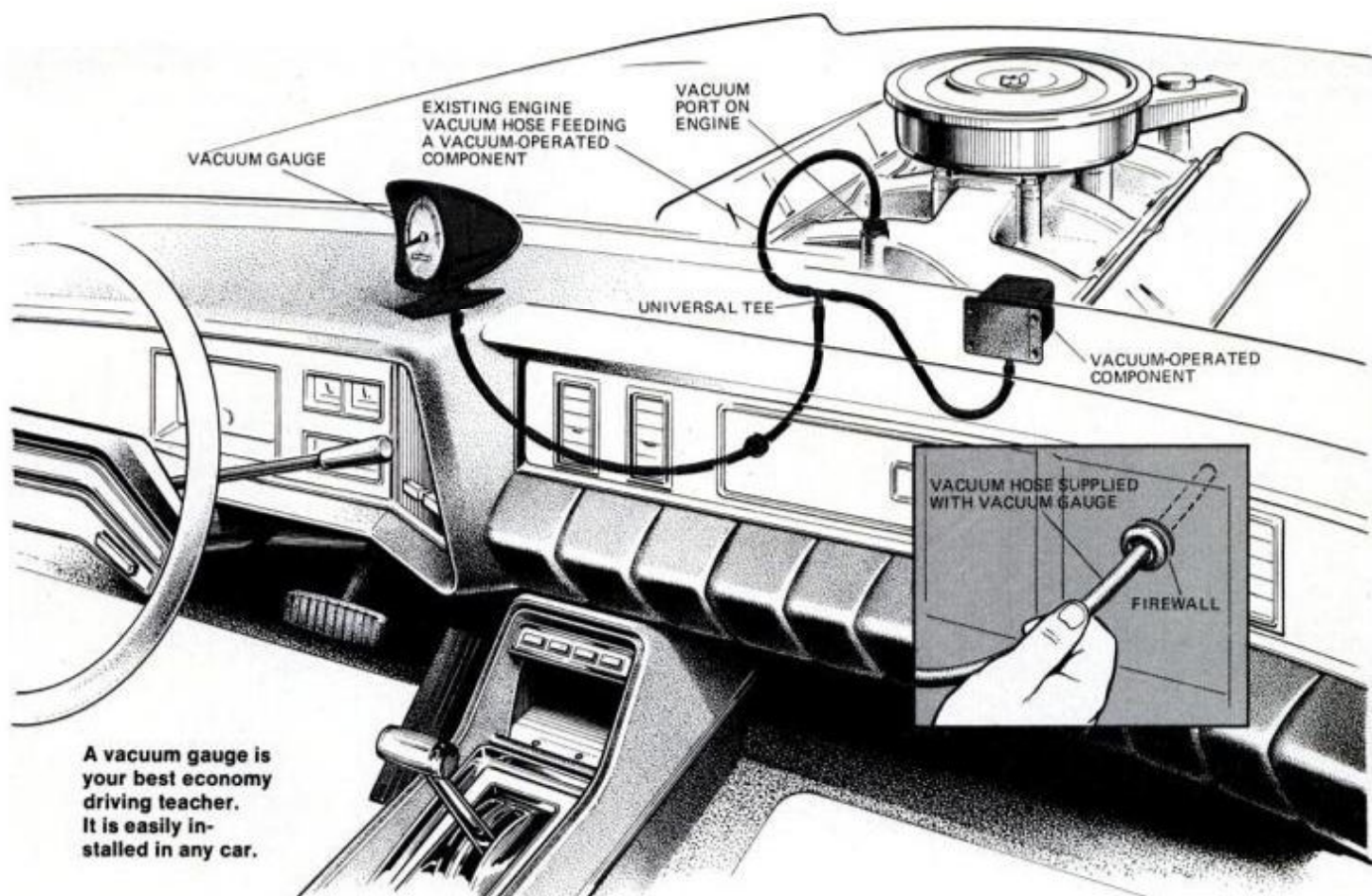
(Please turn to page 198)



Flintlock pistol and bullet mold by Dan Osterman are 3/8-scale, shown actual size. Target attests to firearm's accuracy.



DRIVING FOR ECONOMY: HOW YOU CAN ACHIEVE MAXIMUM MPG



A vacuum gauge is your best economy driving teacher. It is easily installed in any car.

So you think you know all you need to know about getting the best gas mileage your car can give. Take this test and learn the truth:

1. When does your car get its worst mileage?

- a) After many hours on the highway.
- b) Climbing hills.
- c) In city traffic.
- d) The first few miles in the morning.

2. When should you check your tire pressure?

- a) When your tires are cold.

- b) At each fill-up.
- c) After you've driven 10 miles.
- d) After you've taken a long trip.

3. How much energy loss is caused by one fouled sparkplug (V8)?

- a) No appreciable loss.
- b) 3- to 5-percent loss.
- c) 7- to 10-percent loss.
- d) 25-percent loss.

4. To save gas when leaving a stop sign, you should:

- a) Accelerate as fast as the car will go.
- b) Accelerate very slowly.

- c) Get to cruising speed smoothly, but as quickly as possible.
- d) Motion speedier motorists to pass.

5. You'll increase fuel efficiency 20 percent by:

- a) Slowing from 55 mph to 50.
- b) Slowing from 70 mph to 55.
- c) Driving normally at 20 mph.
- d) Coasting down inclines.

6. How much gasoline does an average American driver use per year?

- a) 200 gallons.
- b) 800 gallons.

- c) 1500 gallons.
- d) 2000 gallons.

7. Which of the following costs you gas mileage?

- a) Permanent roof racks.
- b) Underinflated tires.
- c) Accelerating slowly and gradually.
- d) All of the above.

8. Which practice is likely to save the most gas?

- a) Keeping engine filters clean.
- b) Using gasoline of the recommended octane.
- c) Doing a regular tune-up.
- d) Removing excess weight from car.

9. Which of these saves the most gas?

- a) Installing radial tires.
- b) Maintaining correct tire pressure.
- c) Driving on underinflated tires.
- d) Driving on overinflated tires.

10. Which of these conditions uses the most gasoline when driving at highway speeds?

- a) Driving with windows open and air conditioner off.
- b) Driving with windows closed and air conditioner on.
- c) Driving with vents open, windows closed and air conditioner off.
- d) All conditions use the same amount of gas.

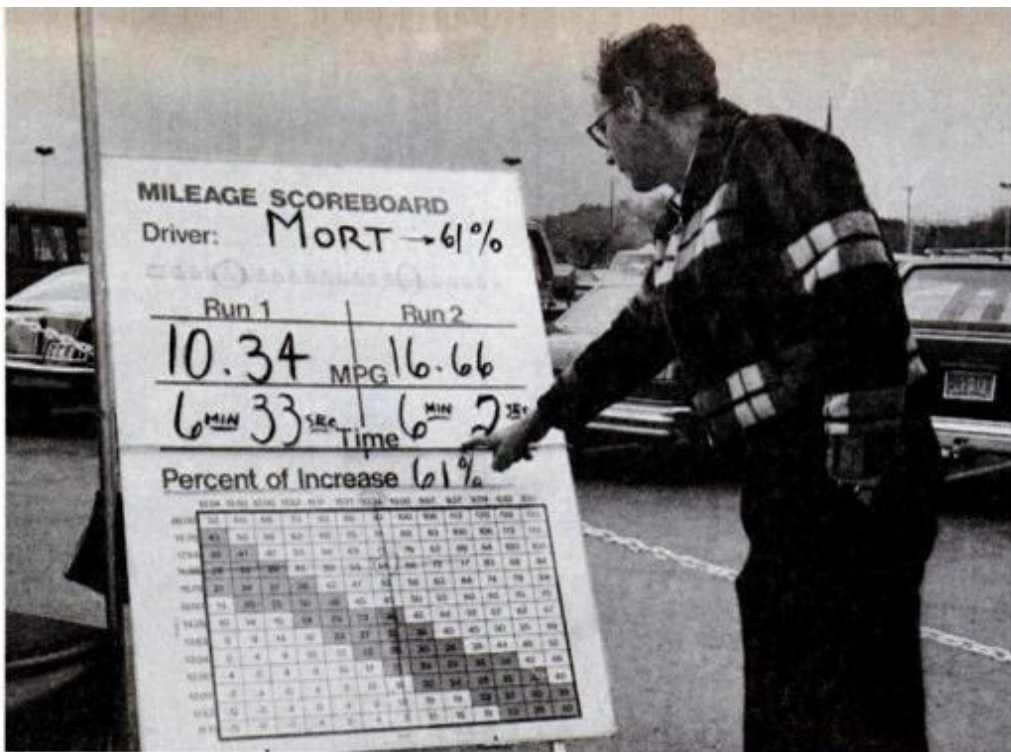
Answers: 1, d; 2, a; 3, c; 4, c; 5, b; 6, b; 7, d; 8, c; 9, a; 10, a.

Tens of thousands of Americans have been asked these questions by driving experts of the Department of Energy (DOE) and Atlantic Richfield Co. (Arco). DOE and Arco, acting independently, are conducting seminars to help drivers get the most mileage from a gallon of gasoline.

Mileage up 30 percent

The purpose of the DOE and Arco quizzes and seminars is to demonstrate how little most of us know about driving economically. According to John W. Gendron, Arco senior vice-president, "A typical driver can improve his or her car's gasoline mileage by as much as 30 percent," using fuel-efficient driving and maintenance techniques taught by Arco and DOE, and using a vacuum gauge as a reinforcement tool to make your newly learned techniques become a habit.

The DOE program is designed primarily to retrain company and fleet vehicle drivers. The Arco seminar is aimed at private individuals. Frank Miller, who was a senior driver-training instructor with the DOE in Ne-



Author (above and at wheel, left) checks scores of runs. First time around he averaged 10.34 mpg in 6 minutes, 33 seconds. Using vacuum gauge, second run averaged 16.66 mpg in 6 minutes, 21 seconds. Mileage improved 61 percent, yet elapsed time dropped.

Cockpit of Arco test car (above, right) comes with vacuum gauge, FloScan mpg gauge and odometer. Vacuum gauge (right) is stock Pontiac unit in shift quadrant.

vada, is the chief instructor for the Arco program.

Four Arco teams are traveling the country—two in the West, one in the Midwest and South, and one in the East. They set up exhibits, often in shopping centers, to bring the message of fuel conservation to the man and woman on the street. It was at a shopping center in DeWitt, N.Y., that I ran into the East Coast team.

If you remember, on my recent coast-to-coast trip in connection with PM's *Fuel for the Future* series, I looked for fuel-conservation devices. When I came across an engine add-on that promised a 5- to 10-percent improvement in mileage, I considered it suitable for testing. When a device offering 15- to 20-percent improvement crossed my path, I jumped at the chance to test it.

Here, Arco is offering a 30-percent improvement, and no purchase is necessary except for a vacuum gauge, if your car isn't equipped with one.

Save 160 gallons a year

Suppose the 30-percent estimate is ambitious—suppose the average saving is only 20 percent. Do you realize what this means? Approximately 250,-

000 people are expected to witness the Arco exhibits by December 1980. If each driver who witnesses the exhibit improves his or her gas mileage by "only" 20 percent, they will save 160 gallons a year each, or 40 million gallons altogether.

You can understand why I got interested. A saving of 160 gallons a year means a saving of more than 160 bucks. That's why I had to find out if the Arco Drive for Conservation, as it's called, is effective. So I took the test.

The test at the exhibit is a driving test. The car (in this case, a 1979 Chevrolet Caprice) sits on a Clayton dynamometer. It's equipped with a FloScan 660 miles-per-gallon gauge, a Halda Tripmaster that ticks off mileage traveled and a Stewart-Warner vacuum gauge.

Wasteful vs. sensible driving

The results of my test were startling. Within 15 minutes, I had attained a 61-percent improvement in fuel economy. As impressive as this sounds, something else was proven that struck me just as hard.

This improvement in gasoline mileage was attained with a decrease by 12 seconds in the length of time it



took me to get from point A to point B. In other words, driving hell-bent-for-leather to get somewhere wastes both fuel *and* time.

Yes, there's a catch. The test doesn't allow the driver to handle a car the way he or she normally drives. Part A incorporates practically every bad driving sin in the book, except speeding, while Part B substitutes sensible driving.

A volunteer driver from the audience is given instructions by a taped voice piped into the car through the loudspeakers. The program allows for combination highway and city driving.

The first part of the program, taking six to seven minutes, engages the driver in a series of erratic, gas-wasting maneuvers such as jack-rabbit starts and abrupt changes in speed.

It took me 6 minutes, 33 seconds to complete the first part of the program. The car averaged 10.34 miles per gallon of gasoline.

The same course of travel is then followed for the second part. This time, instructions call for smooth but rapid acceleration to reach the specified rate of speed; cruising up to a red traffic light hoping it will change and you won't have to stop the car; and,

instead of lane jumping, maintaining a smooth driving rate in traffic.

This part of the test took me 6 minutes, 21 seconds to complete—12 seconds less than the time required in Part A. The car's mpg jumped to 16.66.

Although the 61-percent improvement in my case is not a realistic figure, because it doesn't take into account my usual way of driving, several of the gas-consuming habits experienced in Part A of the test are things I'm guilty of doing. Therefore, by changing these, I can realize a definite increase in fuel economy.

Economy depends on driver

But how much of an increase can you actually expect? McDonnell Douglas Corp. uses the same system as Arco to train people who drive for the company. It reports an overall 22-percent improvement in fuel economy.

Some drivers consistently achieve better automotive fuel economy than others, even when all other factors (vehicle size and type, driving cycle, weather) are equal. These differences can only be ascribed to the way in which the individual driver operates the vehicle. Such factors as acceleration rate, average speed, and braking

and stopping techniques are known to produce significant effects on fuel economy. According to the DOE, "By practicing known fuel-efficient driving techniques, a driver can improve vehicle fuel economy by up to 20 percent."

How can you learn the driving techniques that will help you attain this significant improvement in fuel economy? One way is to practice the techniques described at the end of this article. Another is to visit the Arco exhibit if it comes to your area. The event is publicized in local newspapers and over local radio and TV stations.

Four ways to save gas

However, driving techniques alone won't allow you to attain maximum fuel economy. According to Arco, the optimum savings are realized by paying attention to four areas, as follows:

1. Driving: An improvement of 8 to 12 percent can be anticipated by following the practices outlined at the end of this article.

2. Speed reduction: DOE reports that driving at 50 to 55 mph instead of 65 to 70 mph uses 15 to 18 percent less fuel.

3. Maintenance: An improvement of 9 percent can be expected by keeping aware of some simple practices. They include inflating tires to correct pressure, keeping the air filter clean and keeping fan belts tightened to specification. The greatest improvement in gas mileage is attained by tuning the engine regularly (see PM, Dec. '79 and Jan. '80), switching to radial tires, changing oil regularly and having the front end aligned.

4. Trip planning: DOE says that by planning trips you can improve mileage by 5 percent. This involves planning to do all the tasks you have to do at a particular location during one trip, so you don't have to drive back again.

Manifold vacuum gauge helps

Another way to help your gasoline budget is to equip your car with a manifold vacuum gauge. The gauge, mounted on the dash, allows you to determine when the engine is operating at its greatest efficiency.

Manifold vacuum has a direct correlation to fuel consumption. When manifold vacuum is high, fuel consumption is lowest. Conversely, when manifold vacuum is low, as it is during rapid acceleration, fuel consumption is highest.

Basically, there are three types of in-car vacuum gauges: dial, indicator light and piston. The dial-type gauge indicates intake manifold by a pointer on a dial face. Many dial-type gauges show the amount of vacuum in relative terms, such as poor, fair and good. Others use numerals (zero to 30)

(Please turn to page 196)



A down-sized travel trailer, this new 16-foot 1395-pound Ultra is from Shasta Div. of Coachmen.

Chopped vans offer motor-home convenience without length. Itasca Sundancer has picture windows.



NEW RV LIGHTWEIGHTS that go light on fuel

Mini rigs are coupling up with the compacts for economy camping that saves on gas and cost.

by Bill McKeown
RV EDITOR

STEEP GRADE - 10%
NEXT 5 1/2 MILES
USE LOW GEAR



A fold-down camping trailer can follow a Citation up the hills (above) or set up to sleep a family (left). The Rebel from Coleman has beds for five, and larger models like its Saratoga LTD can sleep up to nine. Curb weight of the Rebel without optional accessories is 870 pounds, and its hitch weight is only 100. The fold-down campers have less wind resistance, offer better rear visibility, and are lower priced.



Popular stretched vans have sitting headroom forward, space to stand at rear galley. Winnebago's is the Winnie Wagon II.

Less weight, less bulk and less wind resistance are features that are finally making it possible for recreational vehicles to use less gas. Chrysler, Ford and General Motors—the big car companies that supply the chassis for most chopped vans and motor homes—are building lighter frames, installing smaller engines and sharing their streamlining know-how with the RV companies willing to learn.

No longer is the recreational vehicle industry telling about all the energy we're supposed to save



Aerodynamic-angled front is one feature of new light and compact 15- and 17-foot Starlette five-sleeper trailers.

when we turn off the lights to leave home and go camping. Instead, a number of fringe companies have dropped out and most of those left seem willing to face gas consumption problems and trim down in small but useful ways.

Alternate fuels are one possibility, and some motor homes are going to diesel or offering engines that can switch from gasoline to cheaper propane and back, though installation still requires special tuning. Aluminum framing and foam structural siding and insulation are cutting the weight of



Even the compact import pickup trucks can slide in a camper. Coleman's Country Squire (above right) folds down to sleep four, folds up and drops roof for minimum windage. Low and light-weight LLT 16- and 18-foot models (right) bring trailers back to the Winnebago line.



trailers and motor homes, while helping to conserve warm air inside in the winter, cool air in the summer. Even add-on turbocharging is being considered by some well-off owners who have sold their home, retired and are determined to do the traveling they've planned for many years, in spite of escalating gasoline costs.

Smaller refinements are also being studied. Radial tires are a favored option since they add an estimated 2.8 percent to gasoline mile-



Santana vans from Fleetwood are offered in Chuckwagon (shown), Station Wagon, Surfer and Vancamper, and in 12 models.



This Prowler LT, plus Wilderness II and Taurus 2000, all 19- and 22-foot Fleetwood models, weigh 1650 and 1800 pounds.



For sub-compact towing to sleep four in 13½ feet, Sunline's self-contained trailer has a hitch weight of only 125 pounds.



Champion's TranStar is the latest model of its TransVan, the RV with rear-standing headroom that spawned a host of copies.

age. Small and imported chassis are favored for some chopped vans, with the hope of moving the average gas consumption of RVs from 10 miles per gallon up to nearer 20. Travel trailer sizes and weights are being reduced up to a reported 50 percent. Fleetwood Enterprises now has several new small models that weigh as little as 1650 pounds for a 19-footer that can sleep up to six, with a tongue weight of only 115 pounds. Winnebago is reintroducing light travel trailers to its extensive line. Coleman and Starcraft both feature new models of extra-light, fold-down campers.

Energy savers

Solar heating has been experimented with already on some models for heating and trickle charging. The Energy Recycling Co. of Lansing, Mich., is developing a heat exchanger for recreational vehicles that stores engine heat, plus an optional solar attachment to provide hot water for galley use and warm air to keep the vehicle comfortable as required.

Engine monitors are another add-on that RV owners are testing to squeeze out additional efficiency. Two-speed axles, overdrives and more sophisticated streamlining are all being tested to improve efficiency. Gone are the days when a shoe-box design seemed to be the industry standard, with the reasoning that maximum inside space was the only factor that counted.



Fifth-wheel trailers are still the way to get extra space in a live-aboard recreational vehicle. This Holiday Rambler Imperial 5th Estate measures 34 feet long.



Double-duty Sunline Micro-Cruiser built on Datsun or Toyota has optional twin-rear doors for business use, can get 20 mpg.



A Ford courier, Datsun or Toyota body can sit under Chinook's 17-foot Eagle to give low gas use for RV vacation travel.

New styling

Aerodynamic exteriors are being matched with inside planning, as well. A preview of late models shows Champion's TransVan, with its standing headroom behind the rear axle at the aft galley, is the model to copy. Eight manufacturers have already jumped on this low-profile bandwagon with look-alikes.

Picture windows, the wide models

popular on jazzed-up surfer vans and the more sedate park-model trailers, are appearing on intermediate size minihomes. Smaller trailers are getting bigger windows, as well, and the best of the "van look" is showing up across the field.

This year the RV makers are running scared. The gas crunch may inspire a number of quick, worthwhile improvements as a result. **PM**



There's a hitch in towing with compacts

So you tow a boat or cargo box, a travel or fold-down camping trailer behind your car. Now you're thinking of replacing your big rig with a compact to save on gas, or you already have made the move. Does that mean you have to give up trailer towing and the runs to campgrounds and launching ramps by family car?

Not if you are careful, and fit out with some new hitch gear. Of course, if you own a heavy, 25-foot boat, or a 35-foot trailer, you may have already been overloading your full-size family station wagon, despite its heavy-duty springs, oil and transmission coolers and tow package. For a fifth-wheel trailer, cabin cruiser or park-model rig that you constantly haul over mountain passes, a pickup truck as tow vehicle is still the answer.

For lighter loads, however, over shorter distances and modest slopes, your compact can do the job. First, check your warranty; it may

Now even front-wheel-drive minis can pull small trailers.

by Joe Gill

specify the maximum tongue load and gross trailer weight that your small car is designed to handle. Your car dealer may not be a trailering expert, but he should be able to get you one of the excellent trailering guides that several automotive companies put out.

Rear-end loads

When the trailer tongue is lifted and dropped on the ball mount, a percentage of the trailer weight pushes down on the rear of your car, particularly a small one. This load is referred to as the tongue weight and it may range up to 200 pounds for a 1000-pound trailer, to 350 pounds for a 4000-pounder. Tongue weight should approximate—but not ex-

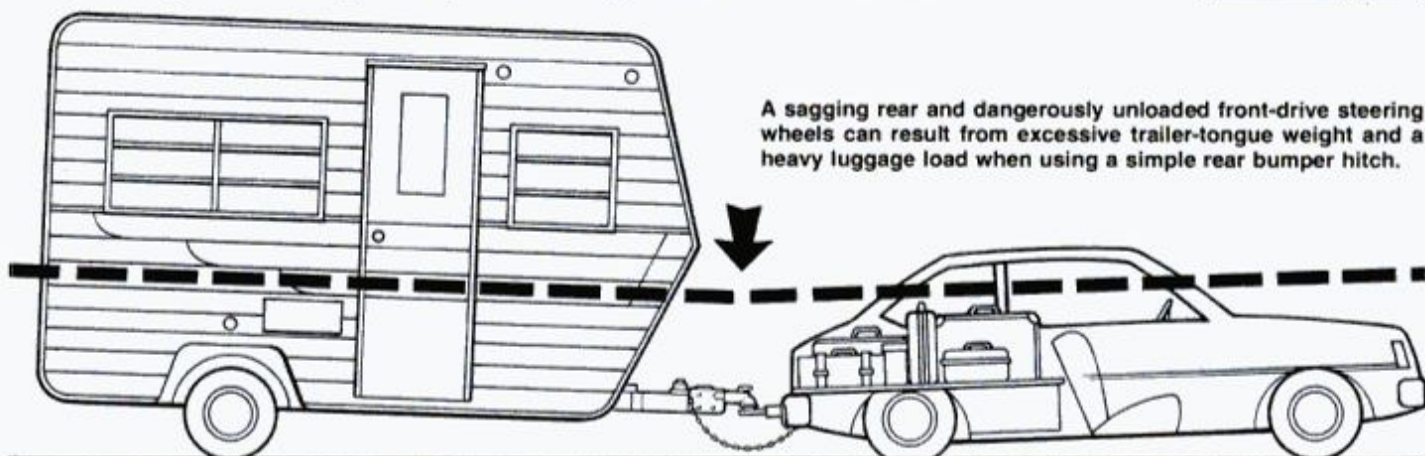
ceed—15 percent of the trailer's fully loaded weight.

If the tongue weight is 200 pounds, road motion and weight shift when stopping may add 50 percent, or 100 pounds more, to the total weight on the car's rear axle. These 300 total pounds can weigh down the back of your car so that it sags several inches. When the rear of your car drops, the front will "unweigh" and rise an inch or more. This means you will have reduced towing power because of less traction and poorer steering control. With so many small cars coming on the market now with front-wheel drive, the problem is magnified.

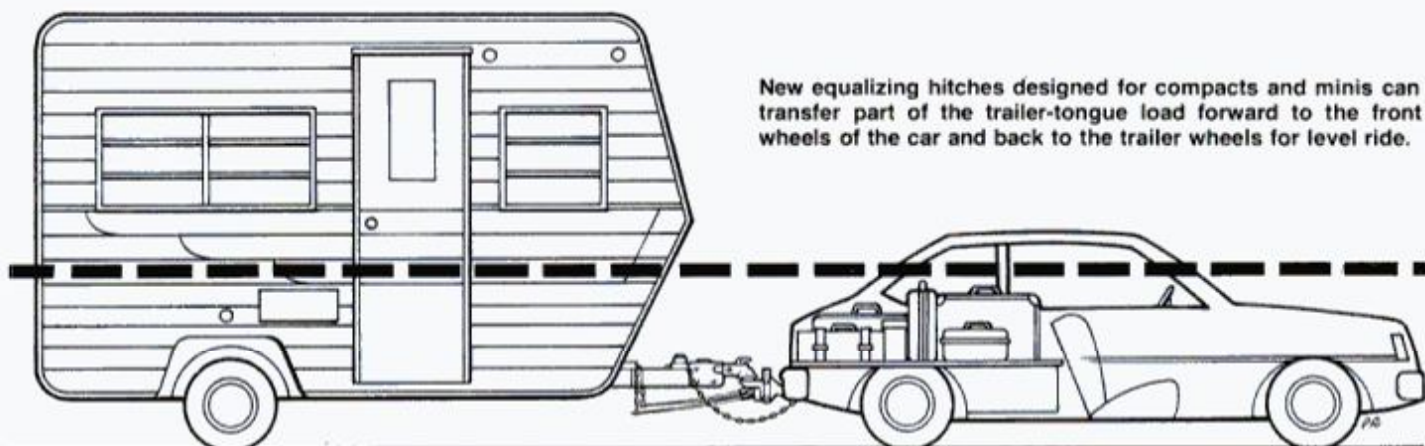
Small-car solutions

Though it's true that large cars can haul larger loads, compact owners don't have to give up on the sport. Many manufacturers provide heavy-duty shocks and springs for their small cars. Other heavy-duty

(Please turn to page 178)



A sagging rear and dangerously unloaded front-drive steering wheels can result from excessive trailer-tongue weight and a heavy luggage load when using a simple rear bumper hitch.



New equalizing hitches designed for compacts and minis can transfer part of the trailer-tongue load forward to the front wheels of the car and back to the trailer wheels for level ride.



Kit gear for low-cost camping



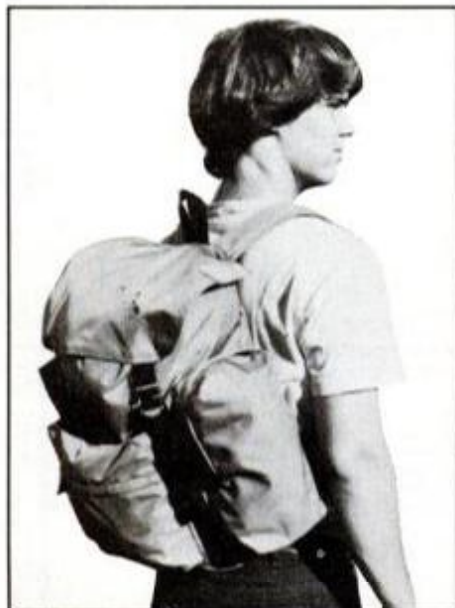
Two-man, lightweight tent with fiberglass poles, stakes, stuff sack and vestibule fly is about \$135 from dealers of Altra, 5541 Central Ave., Boulder, Colo. 90301.



Carry-alls and carry-ons of assorted sizes and prices up to \$35 make easier projects to learn on, all from Altra Sewing Kits.



Cordura nylon with Super K-Kote finish is used by Sun Down Kits, 14850 Northeast 31st Circle, Redmond, Wash., for luggage.



A general-purpose, frameless rucksack of Cordura with foam-padded shoulder straps, is about \$17 from Sun Down Kits.



Backpacker jacket is from extensive line of Frostline Kits, Frostline Circle, Denver, Colo. 80241, largest mail-order supplier.

New pre-cut projects offer savings of up to 50 percent on quality equipment that you can complete at home.

by Bill McKeown
OUTDOORS EDITOR

Nothing beats the satisfaction of playing pioneer and building outdoor gear from scratch. Since most of us don't have the deer hides, the tanning facilities or the time to make a leather frontier jacket, or the birch bark or skills or patience to fashion a canoe, working from a kit is the next best choice. It can also save up to 50 percent on the cost.

Kit suppliers today provide new materials and fabrics, as well, that are not locally available. An outdoor outfit made from the latest space-age synthetics can be warmer, stronger and more durable than any of the homespun and cabin-tanned items that Daniel Boone wore. Fabrics that let sweat get out without letting rain get in, insulation that doesn't become matted and soggy, and stitching that won't rot or mildew are a few of the supplies a kit sewer can select. Your results may turn out better than any garment you can buy.

Many sportsmen learned to appreciate good outdoor gear when cheap war surplus equipment was flooding the market years ago. But much of it was designed primarily for function and durability, rather than attractiveness, light weight and comfort. Today's colorful, ready-made products supply the same rugged dura-

(Please turn to page 180)



Deluxe rain jacket from Sun Down has 10-inch under-arm ventilation zippers to open during strenuous, wet-weather activity.



A geodesic dome of a tent, the new free-standing Earth Station of Gore-Tex from Early Winters is 10 pounds, \$500.

For a year when many campers will be adding accessories to save fuel and make outdoor vacations fun with shorter trips, many improved gadgets are appearing.

Backpackers and tenters can choose clothing and fabrics that are waterproof and yet "breathe," letting the sweat of a hike evaporate. Compact cooking and sleeping equipment that will stow in a compact-car trunk are on the market—expensive, but available. Recreational vehicle owners and renters can add new heaters, airconditioners, dual-purpose slide-in utilities that let a rig serve as business office van or work truck during the week, and family pleasure transporter on weekends.

Lighter weight is designed into many new items. They take less energy to pack up a hill, less gas to drive.—*Bill McKeown*



Solar heat is reported to warm the water in new unfoldable \$75 Solar Shower from L&R Distributing. A reservoir holds six gallons of sun-warmed water, enough for two showers, and the 1x3-foot package opens into a cabana for dressing or bathing.



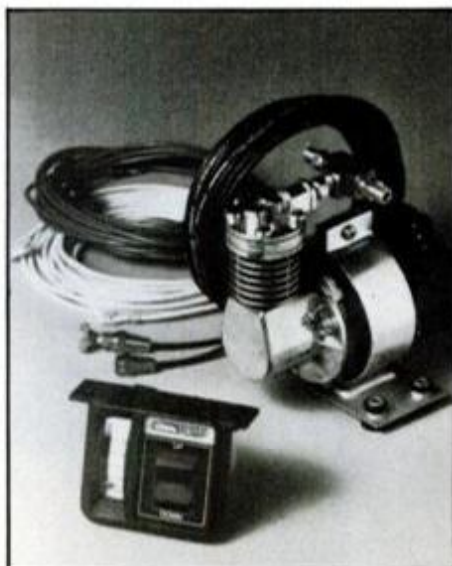
Mark V alarm, \$42, senses dangerous levels of propane, butane, methane or natural gas. Lopat Industries, Anaheim, Calif.

A pickup bed guard from L&R Distributing, Wood River, Neb., comes in sizes to fit standard, compact imported trucks.



Unfolded from narrow two-foot width, the Fold'N Fun trailer can open to a 4x8-foot platform for cargo, a pair of motorcycles or snowmobiles, or a camping tent or boat. It's available in three models from Innovative Products, Appleton, Wis. 54913.

For adjustable shock absorbers, Coleman's new Shock Pump works with a dash switch and gauge, has 24-foot hose.



NEW DIGITAL SOUND



A full-size audio disc (above, right) is just over 4 inches in diameter, but it can reproduce better sound than any other medium. Its shiny surface is immune to fingerprints since the music is encoded in digital "pits" that are read by a scanning laser beam. An audio displaying deck from Philips (right) is much smaller than a conventional turntable. Sound gets ever truer to life, while the equipment continues to shrink, as shown in photo above comparing the old and new.



BREAKS ALL RECORDS!

Digital sound, both on the new digital disc and on specially prepared grooved records, is on its way to your home. It sounds great and audio will never be the same again!

by Hans Fantel

As audio swings into the '80s, the sound of the future can already be heard. By now it's for certain—stereo is going digital.

You can walk into any of the fancier record shops and, for anywhere from \$8 to 15, buy a disc made with digital studio equipment. Granted, so far only a handful have been issued by such companies as London Records, Telarc, Denon and RCA. But more are on the way, setting new standards of fidelity and ushering in a new era of stereo. And soon even these may be outmoded by an audio disc played by a laser beam.

For a stunning demonstration of what available digital recordings can do, try Telarc's version (DG-10039) of the Polovtsian Dances by Borodin or maybe London Records' "New Year's in Vienna" (LDR-1001/2), which mostly features the music of Johann Strauss. I know there's room for argument, but to my ears these discs are just about the most spectacular recordings ever made.

Every facet of the sound stands out as clearly as if it were etched in crystal, giving the music an emotional immediacy not normally experienced from recordings. The highs sparkle and the lows come through with an ear-boggling force that puts the bass drum right in the pit of your stomach. Add to this an almost silent background and the rock-steady pitch resulting from minimal flutter and wow on the record itself, and you get a notion why these new digital discs sound like nothing before.

Revolution in the studio

And all that is just the first step in what has been called the digital revolution. For the present, digital technology is still confined to the studio. That's where analog-to-digital converters break down the audio signal from the microphone into digital bits to be recorded on a master studio tape. The digital process—ex-

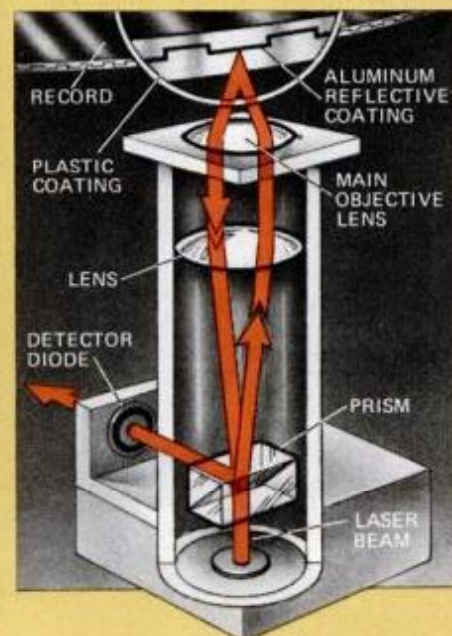


Companies such as Sony have also shown audio disc prototypes like that above. Sony's system is also planned to work on principle of optically scanning laser.

plained in detail later—provides far better sound definition at high- and low-frequency extremes, along with better signal-to-noise ratio.

This studio technique accounts for the superior sound of the discs now available under the name of "digital" records. But these discs in themselves are not fully digital—although such discs are on their way. In order to be played on existing

Digitally encoded aluminum coating reflects beam of laser light. Diode detects changes to produce an audio signal.



turntables, digital studio recordings still have to be transferred to regular LP platters—and that's a bottleneck. The hitch is that not all the sound captured on the digital master recording can be squeezed into the narrow record grooves or tracked by conventional phono cartridges. The loud passages must be scaled down about 30 decibels to be tracked by present home equipment.

That's where the second step of the digital revolution comes in—a radically new kind of disc and turntable to make the most of all the possibilities inherent in digital sound.

Riding on a laser beam

Such devices are already on the way: They bring digital technology right into the home with a special record player, using a laser beam for a "needle." Two versions of the laser phonograph are now in the works—one by Philips and one by Sony. I listened to both. My reaction? Let's just say that outside of flesh-and-blood musicians I've heard nothing comparable.

Developers of these gadgets know they've got a winner, and they sound cocky: "This is a more significant advance than the change from tinhorn to electric recording back in the 1920s," proclaimed a Philips exec when their new laser phono-

(Please turn to page 191)

Economy goes beyond miles per gallon. A North Carolina real estate agent explained his view of the Audi 4000's economy this way:

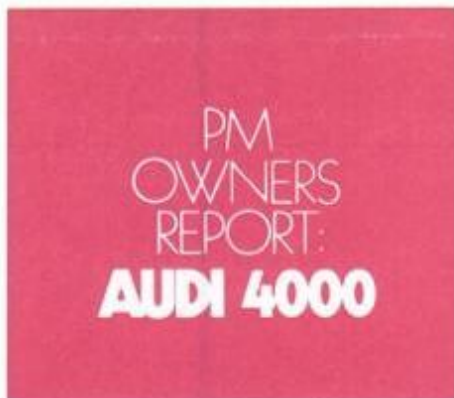
"After checking out the workmanship of most American cars, I test-drove the Fiat Brava, Saab 900, Pontiac Phoenix and Audi 4000. Although the Audi's purchase price was higher than the Brava's or Phoenix's, I know I'll make up the difference in resale value."

And he goes on to comment, "The 4000 is not only a pleasure to drive, it corners like a slot car, takes potholes like a Lincoln, and accelerates much faster than the ads claim; all this with the styling of a little Mercedes and 30 mpg in town to boot!"

Now that's economy! Not all the Audi



Audi 4000 shares the 5000 styling. Now the 5000 has rectangular lights, too.



4000 owners in our survey managed to get 30 mpg in town, but the average came out to a very respectable 25.5 mpg city and 31.6 mpg on the highway.

Other views of economy involved troublefree operation and overall quality. Nearly 60 percent of our respondents said they'd had no mechanical problems at all, and among those who did, the most persistent complaint centered on loose windshield-wiper nuts.

Quality came in for rave reviews, with 96.1 percent rating it *good to excellent*. That's right up there with Mercedes, BMW, Honda, Mazda and Volkswagen—and 25 percentage points above such cars as the Continental Mark V, Dodge Charger and Pontiac Firebird. Nor does the 4000 take a back seat to the Audi 5000 in workmanship. The 4000, in fact,

scored half a percentage point higher than its five-cylinder cousin.

Complaints tended to be mild and few. The biggest Audi 4000 gripe: too much fan noise.

"I was parked in a parking lot," reports a Michigan housewife, "and my mother-in-law and I got out of the car to go into the supermarket. As she walked around in front of the car, the automatic radiator fan suddenly came on with a roar. My mother-in-law nearly jumped out of her skin. She thought the car had started up again and was about to run over her."



Rocker switches on sides of instrument cluster let driver keep hands on wheel.

In all, nine percent of the owners we interviewed agreed that the 4000's thermostatic fan makes too much noise. In Audis with airconditioning, the fan often runs constantly. While it's normal for the

BY MICHAEL LAMM WEST COAST EDITOR

Excellent economy and handling, but that noisy cooling fan must go!

Some owners would prefer conventional spare to high-pressure space saver.

Beam rear axle integrates sway bar, uses trailing arms and coil springs.



Porsche-Audi imports both two- and four-door versions of the 4000.

PM photos by the author

fan to kick in around town or while waiting at stops, normal airflow through the radiator at highway speeds is supposed to give adequate engine cooling. Sometimes it doesn't, though, and the fan comes on even during sustained cruising.

A similar but less common complaint accused the engine itself of being noisy. With a final axle ratio of 4.11:1 and an 0.90:1 top gear, the Audi's 1588-cc Four tends to rev fairly high even at 55 mph (3125 rpm). Several owners reported drumming and resonance at 4150 rpm in second and third gears.

Fully 23.3 percent suggested adding a five-speed manual gearbox to the 4000's option list. Audi shares the VW Rabbit's four-speed and could share its five-speed just as easily. Porsche-Audi spokesmen tell us that the 4000 will likely get a five-speed in late 1980 or for '81. The Rabbit's five-speed would reduce engine noise and increase fuel mileage since it has an 0.76:1 overdrive high.

Styling proved to be another praiseworthy feature. The 4000's styling clinched quite a few purchases and remains a factor in owner satisfaction. A California college student told us, "I bought the Audi because it's a very sporty and classy car. It has the European styling I was looking for."

"Looks sharp and stylish," comments a California policeman. A New Mexico

chemist calls the 4000 "a good combination of functionality and sportiness."

Handling brought another set of smiles to most owners' faces. "Front-wheel drive makes for great handling in snowstorms and inclement weather," notes an Illinois legal secretary. A California farmer opines, "Handles very nicely and a lot of fun to drive."

A Colorado service rep: "I drive 82 miles a day to work and back, and the Audi's road handling in both snow and under normal conditions is unbeatable."

On the other hand, a minority of Audi 4000 owners found a little fault with the car's handling. A professional race-car driver from Illinois felt that "the steering could be quicker, with stronger springs

(Please turn to page 218)



Four-cylinder engine tilts 20°, has 1588 cc, fuel injection and delivers 78 hp.

The Foxy 4000

Audi introduced the 4000's precursor, the Fox, in May 1973. In early 1979, after a year's consumer testing on the *autobahns* of West Germany, the factory brought over the Fox's replacement, the Audi 4000.

The 4000 uses the same engine and drive train as the Fox (and the present VW Dasher and Scirocco), with north-south placement ahead of the axle centerline. All these cars, of course, have (had) front-wheel drive.

The 4000's wheelbase, though, stretches 2.3 inches longer than the Fox's—to 99.5 inches. And the 4000's new unitized body is totally re-engineered. It's wider and about 60 pounds heavier than the Fox's—or 2305 pounds at the curb. Much of the additional spaciousness shows up as desirable rear legroom.

With the 15.8-gallon fuel tank underneath the rear seat, the 4000's trunk is impressively large for this size car—11.7 cu. ft. with spare and tools in place.

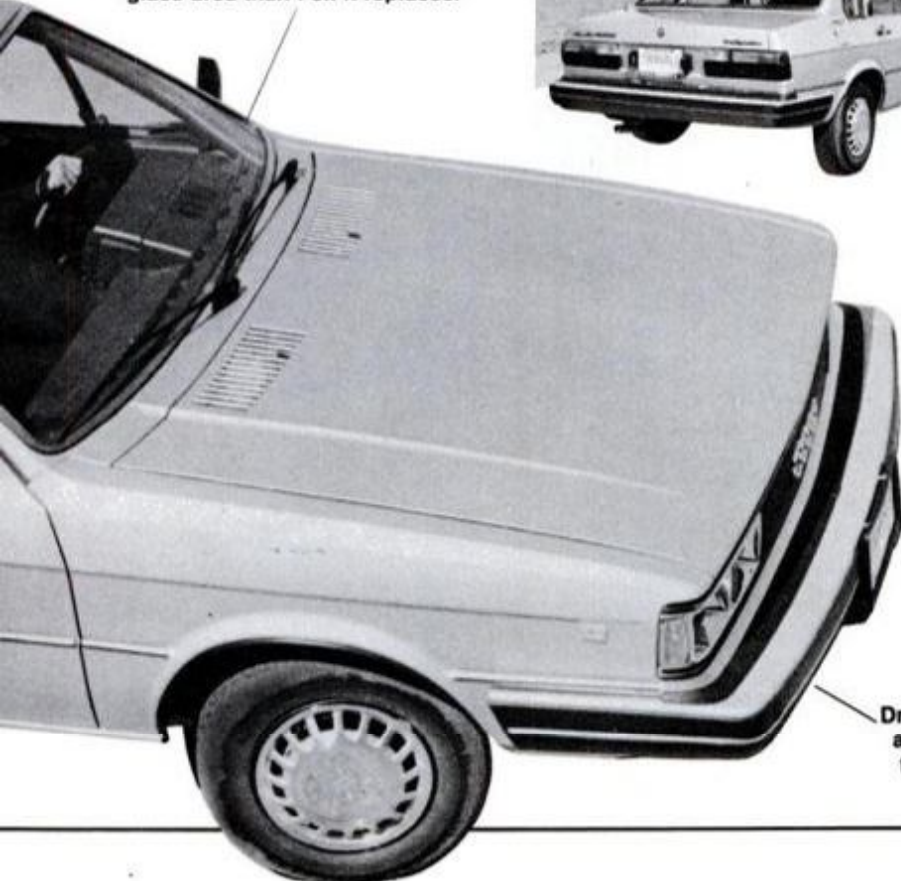
The 4000 borrows its overall styling flavor from its larger cousin, the five-cylinder Audi 5000. Both cars were sculpted by Italian designer Giorgetto Giugiaro.

The 4000's front suspension consists of MacPherson struts with lower A-arms, coil springs, an antisway bar, and tube shocks. Around back, there's a trailing-arm-located beam axle with an integral sway bar on coil springs. Disc front brakes, rack-and-pinion steering and radial tires complete the mechanical package.

Instrumentation includes a tach, clock, oil-temp. gauge and voltmeter.

A NATIONWIDE SURVEY BASED ON 1,034,311 OWNER-DRIVEN MILES

The 4000 boasts 11 percent more glass area than Fox it replaces.



Deep, boxy trunk has a 12-cu.-ft. capacity and very few intrusions, since the gas tank is situated beneath the rear seats. It has a high liftover sill which is a minor inconvenience.

Despite boxiness, Audi 4000's drag coefficient is a respectable 0.40.

Drivers praise front-drive handling and traction, pine for five-speed trans (available later this year).

Now ham operators have

Radio amateurs (hams) send each other slow-scan TV pictures of everything from family portraits to radio equipment.

by Neil Shapiro, WB2KQI
ELECTRONICS EDITOR

I've been a radio amateur, or "ham" for 19 years, since the tender age of 13. In that time I have talked with a reigning monarch, who was operating from his Asian palace, helped coordinate various relief and rescue missions internationally and, generally, have had a lot of fun.

But the first time I sent and received television—*slow-scan* television—was a thrill as big as the one when I made my first radio contact! I remember when the idea of a long-distance conversation, complete with video pictures at both ends, would have been considered wild science fiction.

Now, here I was exchanging "live" pictures with another radio amateur who was in Florida, about 1000 miles away. As he talked a bit about his family—illustrating his comments with pictures of his wife and

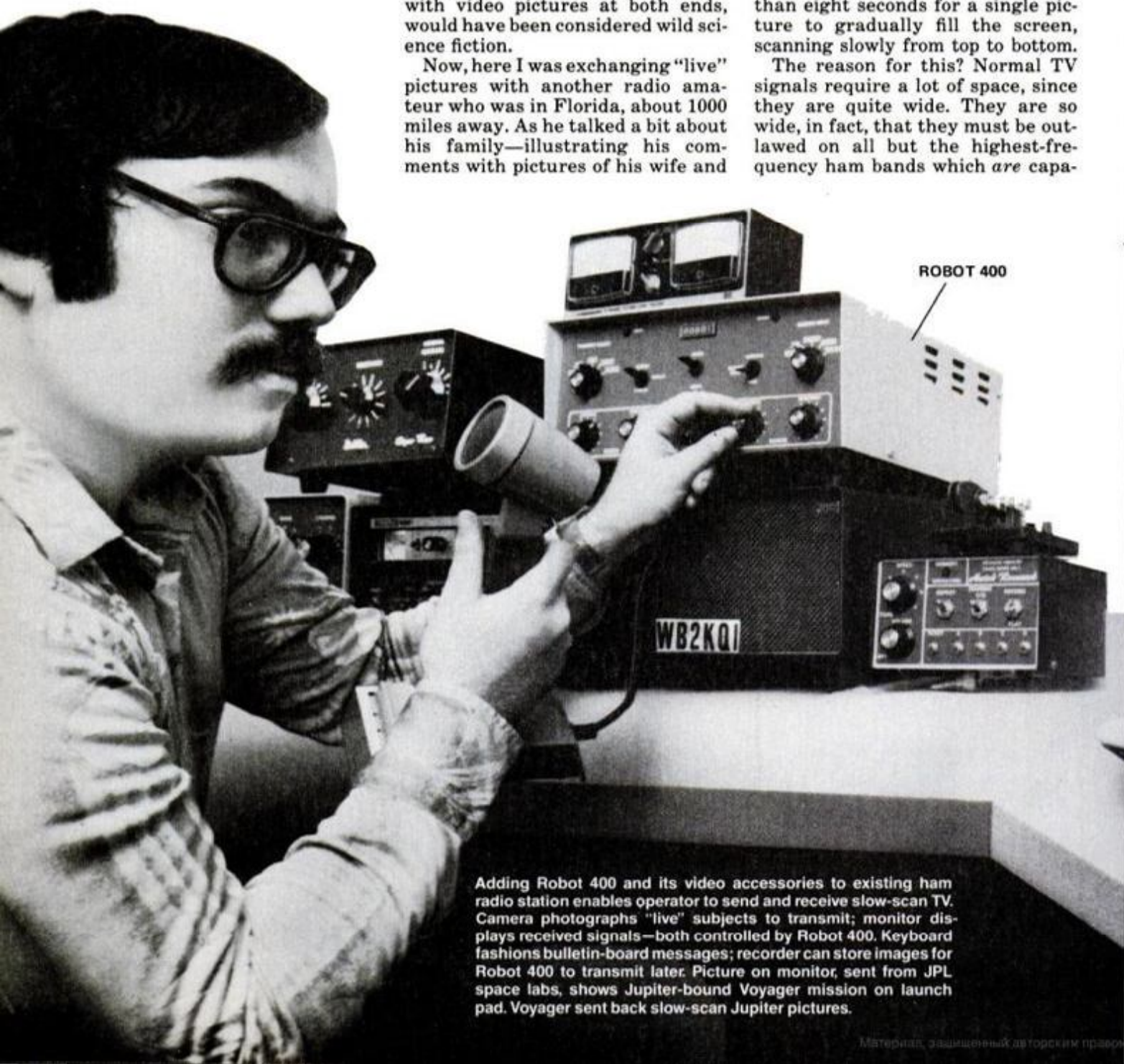
two kids—I couldn't help reflecting that the ham radio art is still ahead of its time.

Someday such video conversations will be as common as normal telephone fare is now. But I—and a few thousand other hams worldwide—have been first.

Like mad canaries

Slow-scan ham TV is only remotely similar to everyday broadcast TV. For one thing, it is *not* a moving picture. The reason it is called slow-scan is that it takes a touch more than eight seconds for a single picture to gradually fill the screen, scanning slowly from top to bottom.

The reason for this? Normal TV signals require a lot of space, since they are quite wide. They are so wide, in fact, that they must be outlawed on all but the highest-frequency ham bands which are capa-



Adding Robot 400 and its video accessories to existing ham radio station enables operator to send and receive slow-scan TV. Camera photographs "live" subjects to transmit; monitor displays received signals—both controlled by Robot 400. Keyboard fashions bulletin-board messages; recorder can store images for Robot 400 to transmit later. Picture on monitor, sent from JPL space labs, shows Jupiter-bound Voyager mission on launch pad. Voyager sent back slow-scan Jupiter pictures.

got the picture

ble of accommodating regular TV, although only over short transmission distances.

Slow-scan requires only the same space as normal single-sideband (SSB) voice communications. It does this by tone-encoding.

You tune for a slow-scan TV signal by first listening. If you hear a noise like a thousand mad canaries, you probably have found slow-scan.

There are 16 possible shades of gray from white to black considered standard in slow-scan TV. Each has its own "musical" tone.

The transmitting station encodes a picture into this cacophony of quick sounds. The receiving station decodes the sounds back into a viewable picture.

Musical computers

The technological idea of such encoding/decoding is straightforward,

(Please turn to page 182)

Pictures of friends and family can be sent coast-to-coast or even around the world via ham radio and slow-scan TV. Slow-scan equipment can attach to any ham radio with single-sideband voice capability. The Robot 400 processes signals from the camera and to the monitor. Slow-scan is the hot new thing in ham radio, with thousands of stations already able to send and receive it.



Images from a slow-scan TV monitor aren't as sharp as broadcast TV. Note how image (left) is made from 16 shades, ranging from white to black and divided into small, mosaic-like blocks. Each block's shade of gray is controlled by one of 16 different musical tones.



Build this 'roll-top' desk for your youngster

You'll please your youngster with this desk that looks like Grandpa's. Easy to build, its top is a single, lift-up piece.

by Ralph Wilkes

The roll-top look of this desk is a great attraction for youngsters. Contrary to the real thing, though, this desktop simply swings up as a unit. Your child will be able to open it without difficulty. The work surface slides forward for writing, coloring or other activities.

Built as shown, the desk will accommodate kids from ages 5 to about 10. The design is simple, since it will be used at only one stage in a child's growth.

Materials used to build the desk are readily available. I built this one of 1-in. pine (actually $\frac{3}{4}$ -in. thick). It is easy to work with and produces a neat appearance. Pine is less expensive than birch-veneered plywood and looks nicer than fir plywood.

Building the desk

The $16\frac{1}{2} \times 24\frac{7}{16}$ -in. work surface (E) is made up of four pieces of 1-in. stock (see drawing, page 125). Glue tongues of the short pieces into the grooves on the ends of the center boards. This joinery helps to prevent warping and assures that the board will slide between the guides. Keep the assembly clamped until the glue dries (at least overnight).

Cut the sides (C) and clamp them together and sand the edges smooth. If you use a belt sander, work cautiously to avoid misshaping the edge caused by dishing. Finish the sanding by hand, using 150-grit garnet paper on a sanding block.

Cut the remaining parts for the desk frame: the top (A), bottom trim (D), guides (F) and (G), braces (H), front (I) and filler (M). Cut the back (B) of $\frac{1}{4}$ -in. plywood; cut the two pieces of $\frac{3}{4}$ -in. half-round for the side trim.

Assemble the back and the sides of the desk frame. Use a temporary brace across the front to hold the assembly rigid while you apply bottom and side trim. Install the work-sur-

Ralph Wilkes, a veteran do-it-yourself writer, is an antiques dealer in upstate New York.



The roll-top pivots back, and the work surface slides forward, ready to be used.

face guides, checking for fit with work surface before applying glue. Add front rail (I). Then install corner braces to hold the unit square. Remove temporary brace.

Building false tambour front

Cut ends (J) to shape and sand smooth. Fashioning the slat assembly is the time-consuming part of this project, unless you use the sim-

plified procedure described later. I made the slats from two, 1-in.-thick, clear pine boards, each about 26 in. long.

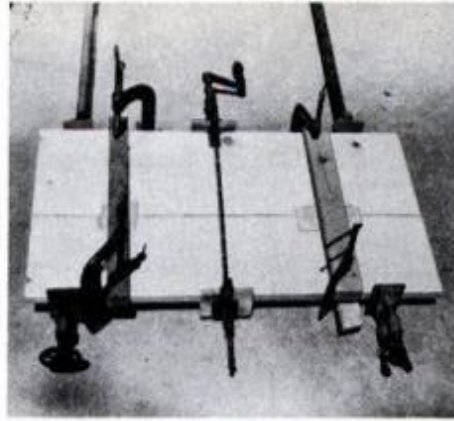
Start by rounding all four edges of both pieces of pine stock. If you don't own a shaper, you can create the moldings using a router and rounding-over bit, or by hand with a block plane, rasp and sandpaper. (*Editor's note:* a Surform tool will do this shaping quickly and in smooth fashion.)

Set the rip fence on your table saw to produce a 3/8-in. wide board and push the four edges through using a push stick. For minimum sanding, cut the moldings with a fine blade and use a slow feed.

You will need about 21 slats (depending on whether your desk sides are built to exact dimensions shown). So cut a couple of extras in case of mishap.

To assemble slats to each other and to ends (J), temporarily tack-nail a scrap piece of plywood to the

(Please turn to page 200)



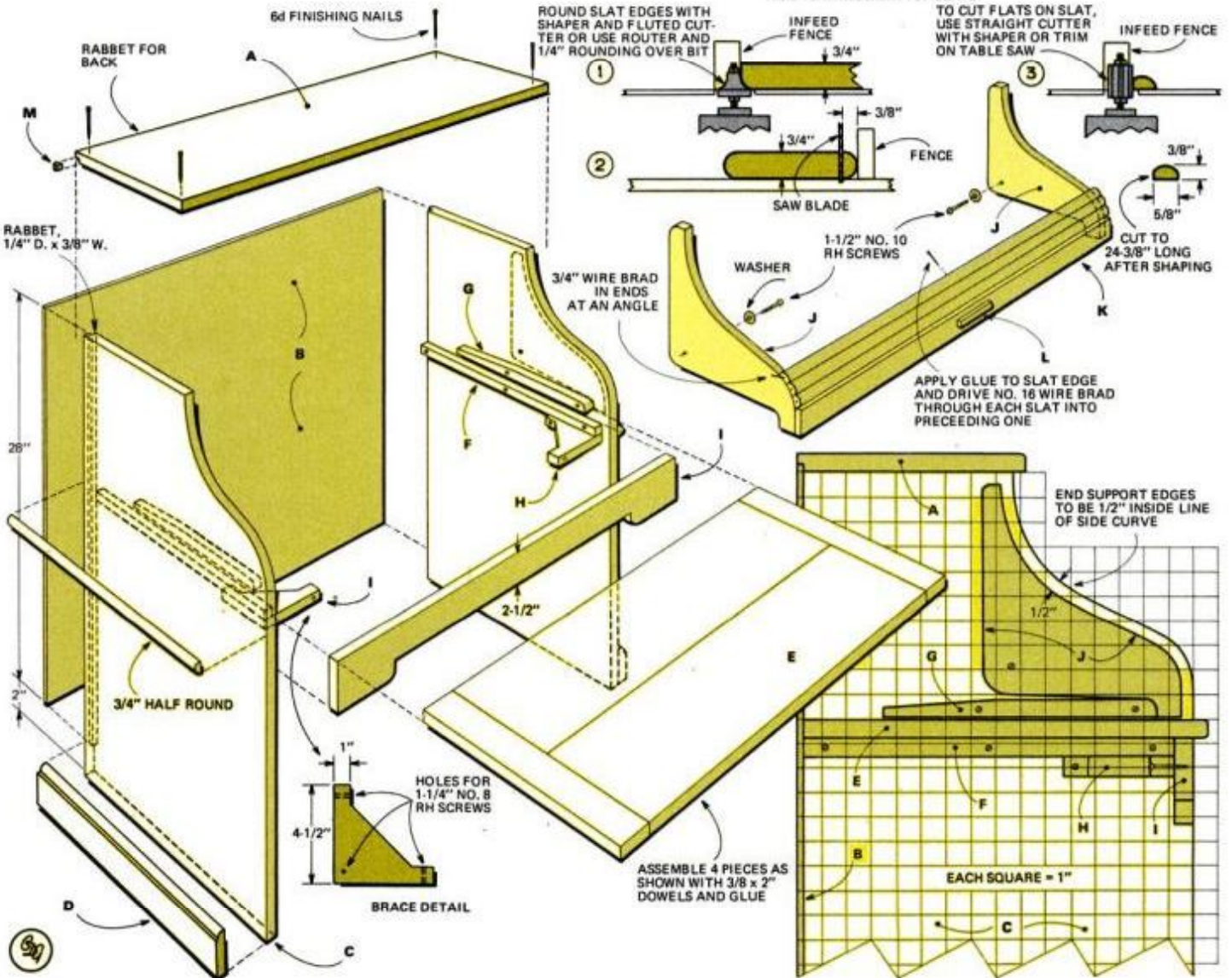
Good clamping technique on wide pieces: C-clamps and boards prevent warping.



Use a 120-grit belt in sander to smooth contours of clamped-together side panels.

MATERIALS LIST—"ROLL-TOP" DESK

Key	No.	Size and description (use)		No.	Size and description (use)
A	1	3/4 x 9 1/4 x 27" pine (top)	I	1	3/4 x 3 1/2 x 24 1/2" pine (front)
B	1	1/4 x 25 1/4 x 28" plywood (back)	J	2	3/4 x 8 x 9 1/2" pine (end support)
C	2	3/4 x 16 x 30" pine (side)	K	1	3/8 x 1 1/2 x 24 3/8" pine (handle backing)
D	2	3/4 x 3 x 16" pine (bottom trim)	L	1	1/4 x 3/4 x 3" pine (handle)
E	1	3/4 x 16 3/4 x 24-7/16" pine (work surface)	M	2	1/4 x 3/4 x 1/2" pine (filler)
F	2	3/4 x 3/4 x 15" pine (bottom guide)	Misc.: 3/4"-dia. dowel, 1" clear pine about 26" long (or 3/4" half-round pine molding) to make slats, 6d finishing nails, No. 16 x 3/4" wire brads, 2 No. 10 x 1 1/2" rh screws, 6 No. 8 x 1 1/4" rh screws, glue, sandpaper, stain, varnish.		
G	2	3/4 x 3/4 x 11" pine (top guide)			
H	2	3/4 x 4 1/2 x 4 1/2" pine (brace)			



7 ways to get cheap firewood



Wood, cleared from land above an underground pipeline, proved easy pickings for author. Town dump (top) may not be picturesque, but can be good source.



of dead and downed wood. Call your parks and recreation department to find out if it issues permits.

3. Construction sites must often be cleared of trees to make way for excavation. After framing is underway, there will also be lots of scrap (cut-offs) that can be good for kindling. Check your local newspaper for planning commission notices and building permits issued to find out where the clearing and excavating will be done. Contact developers listed for their policy of tree disposal.

4. Municipal road-widening and sewer projects, as well as routine trimming along roads, produce plenty of potential firewood. Call your local public works department for information.

5. The town dump may or may not pan out. Small-diameter logs are usually grabbed up quickly. If you're enterprising, however, there is frequently plenty of large-diameter stuff to be had—it just needs to be reduced to more practical sizes.

(Please turn to page 178)

Now is a good time to start replenishing your woodpile. If you're a wood scavenger like me, you should find plenty of downed trees and limbs from winter storms. The added benefit of early firewood gathering is the increased drying time between now and next winter.

Begin your hunt for free or almost free firewood by checking out the following possibilities:

1. State and national forests have programs that allow removal of deadwood and, in some cases, the cutting of specified trees. To learn about the opportunities in your state's forests, call the nearest office of the state forestry department. For information about national forests, call the Forest Service, listed under U.S. Government in the white pages of your telephone book. If you live in the West, ask about firewood programs administered by the Bureau of Land Management.

2. Town Parks are another source

CONSIDER COAL FOR YOUR FIREPLACE



Cannel coal, a popular parlor fuel in the 19th century, is making a comeback in many modern fireplaces. It burns with a bright, flickering flame and produces far more heat than an equivalent amount of wood.

The easiest way to burn cannel coal is to feed it to an existing wood fire. Take care not to overfill the grate and maintain an adequate draft until all coals have been extinguished. Burning coal in a wood fire is especially help-



Tigerlog (above), made from cannel coal, meets EPA standards. It costs 89 cents to \$1.39 for a 4½-in.-dia. by 14½-in.-long log, is available at hardware outlets. Equipment (left) for burning cannel coal in a fireplace (masonry only) includes cast-iron grate with sides (or a coal basket), ash shovel, scuttle for coal and ashes.

ful when the wood is green, or when you want to extend the fire's burn time.

Cannel coal is currently being marketed in convenient 30- and 40-lb. boxes. However, if you can get it in bulk from a local fuel supplier, you'll save. But, storing large quantities of coal will require a coal bin.

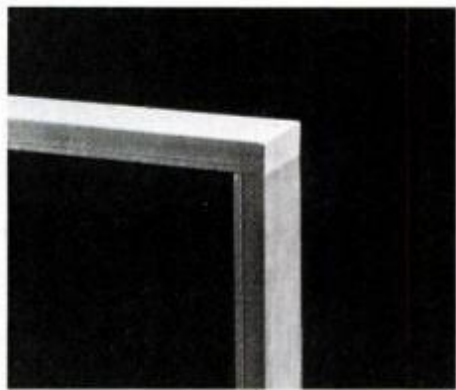
Note that coal produces more ash than wood. Unlike wood ash, it's not advised for gardens; have two ashcans on hand.

WORKSHOP MINICOURSE

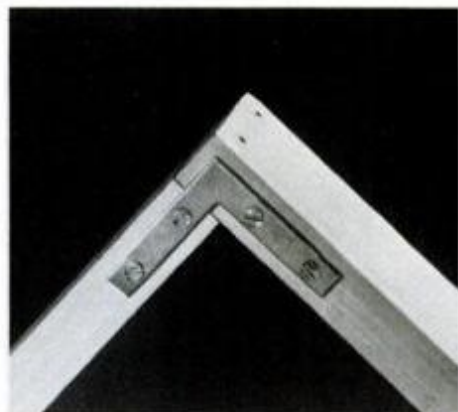
ABOUT JOINTS AND JOINERY

Though just about everyone loves the look of exotic and intricate wood joints, most of us stick to the routine methods of joinery when it comes to the projects in our own shops. The fact is, today's glues, tools and fasteners often make it sensible to join wood parts the easy way. If the master craftsmen of 200 or so years ago were around today, they wouldn't hesitate to use a router and dovetail template, for example, to create a dovetail joint (rather than cutting them tediously by hand).

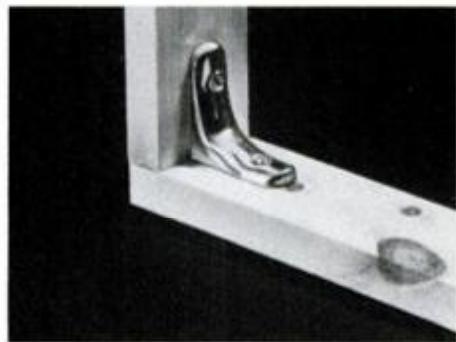
If you are serious about woodworking and intend to pursue furni-



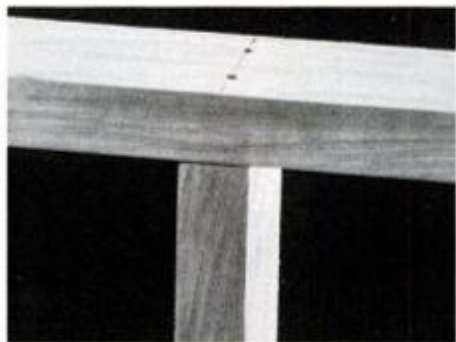
Simple butt joint is the most commonly used type of joint. But even when made with glue and screws, it's a weak one.



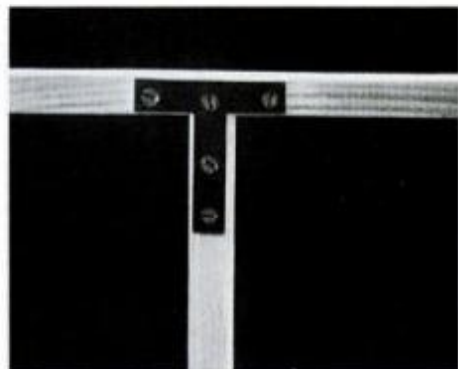
Flat corner iron is an easy way to beef up the joint—when looks don't matter.



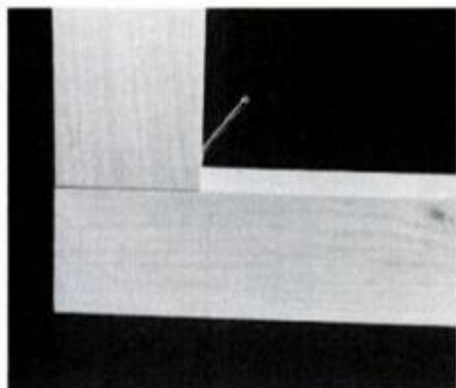
Chair brace strengthens a corner, too. These are often used in woodworking to repair weak joints in old furniture.



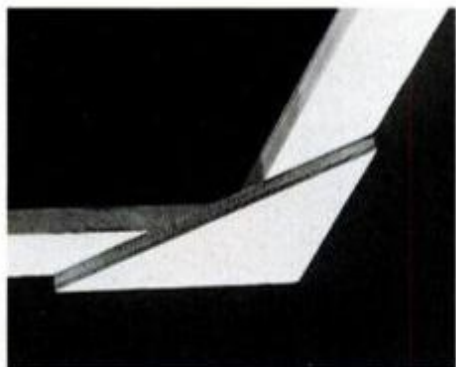
Another type of butt joint—where the pieces meet at the middle of one member—is called a T-joint. It, too, is weak.



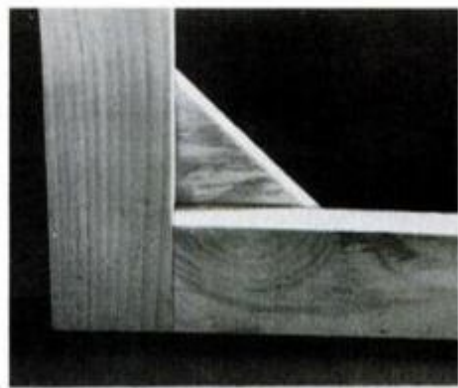
T-iron makes the joint longer lasting. If possible, use an iron on both sides.



When a joint's looks aren't important, such as in structural work, strengthen it with a plywood gusset. Start by toenailing the members, as shown here.



Gussets are used wherever maximum strength is important (in a truss roof, for example). They are also frequently used in the construction of wooden boat hulls, and for some types of wall bracing.



Back view of the joint. In most cases, the plywood triangle is installed on both sides. For maximum holding power, use white glue and ringed nails to fasten.

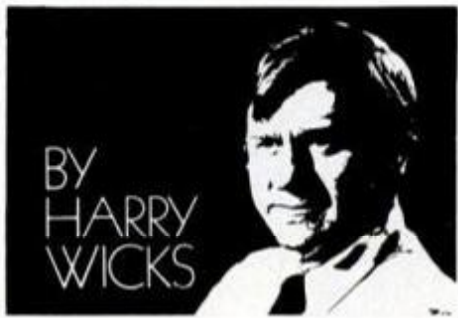
ture-making as a hobby, you should become familiar with various basic joints so that you will know which to use when a particular joinery situation comes up. You don't have to memorize every joint in the book in order to be a competent carpenter. Simply keep a handy reference in your shop so you can turn to it as the need arises.

One good reference is the *Pop-*

ular Mechanics' Master Shop Guide. It covers 28 joints (along with a lot of other shop facts). To get a set, send \$5.45 to Popular Mechanics, Box 1014, Radio City Station, New York, N.Y. 10019.

On this page we show some basic wood joints and good hardware to know about. We will get into some of the more exotic versions in future issues.

PM



Old-time shutters that look great—and save heat



PM photos: Ewell Schirmer, How-to photos: R. Capotosto

Your shop-built shutters will blend with most surroundings and keep out the night chill.

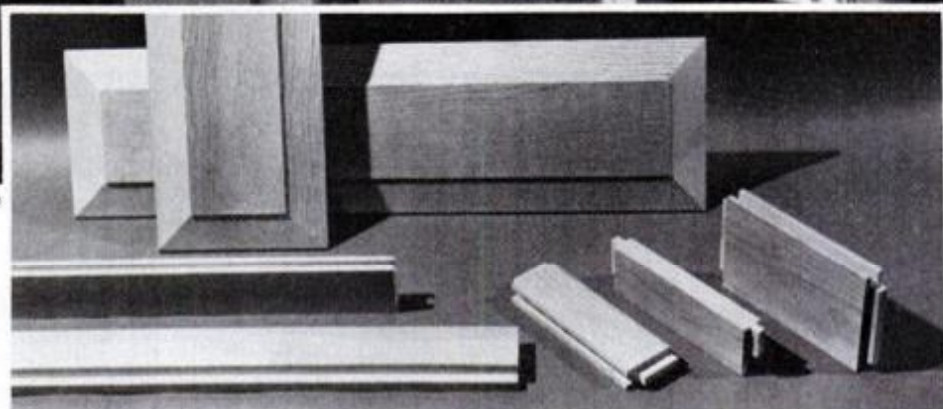
by Roy R. Cottrill

Your workshop efforts making these solid-panel shutters will be repaid in several ways. Besides being decorative, the shutters, when closed, will stabilize airconditioning costs in summer and heating expense in winter. Closed, the shutters give you total privacy. They open partially or fully for varying degrees of visibility and light. Our colonial ancestors used similar shutters to keep out wild animals and hostile Indians.

Use almost any available kiln-dried wood to make the shutters—those shown are made of clear pine. All framing and raised panels (F) are made of $\frac{3}{4}$ -in. stock. The estimated cost per window can be as low as \$7 to \$10. We installed shutters on 12 windows at a cost of slightly more than \$100.

Plans shown are for a standard 30-in.-wide window. Panel heights can be varied to fit the particular window opening.

The secret of easy-operating shutters is to build them with exact 90° corners and straight, parallel sides. (Editor's note: Do take time to select only warp-free lumber to build shut-

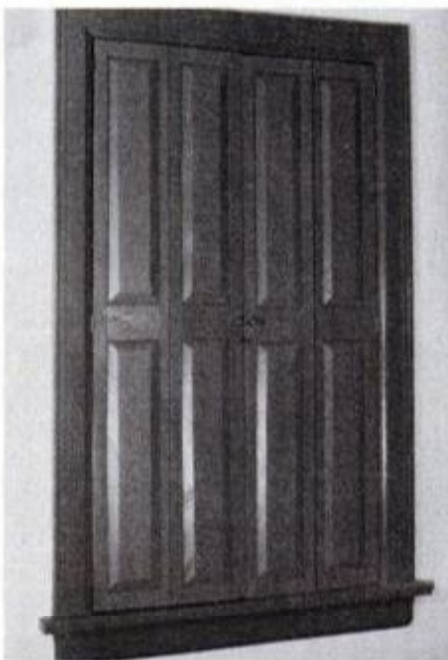


Solid panel shutters replace window blinds, can be used with or without draperies.

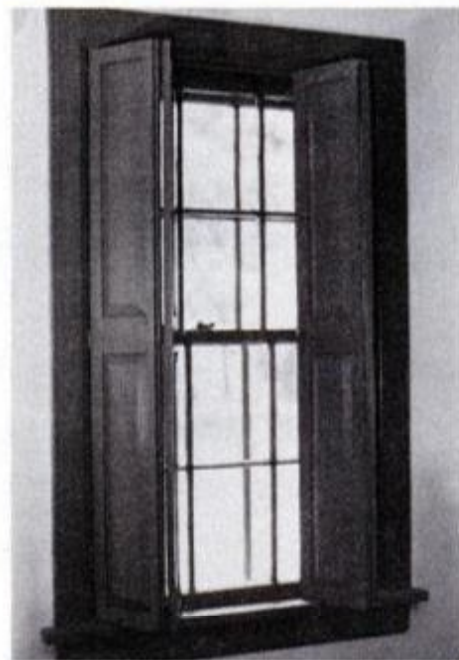
ters; warping will ruin your work.)

Cut panels from 1×6 stock to proper length (see materials list, page 130). Set the saw blade to make a

beveled face $1\frac{3}{8}$ -in. wide around the entire panel, and the fence to leave an outside edge $\frac{3}{16}$ -in. thick (see drawing, page 129). To be safe, make



Closed shutters give total privacy, keep out sunlight and add old-world charm.



Partly opened shutters direct sunlight and its warmth, allow an outdoor view.

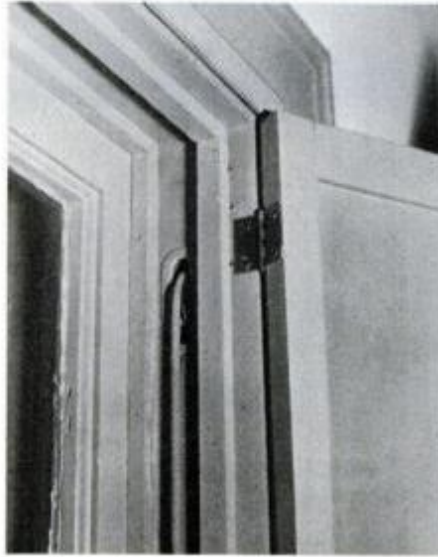
Two good stunts you should know

Stop molding is a must on all windows, including those with shutters. It is nailed to the inside of the window jamb at both sides and top to serve as molding for both jamb and shutter (near right).

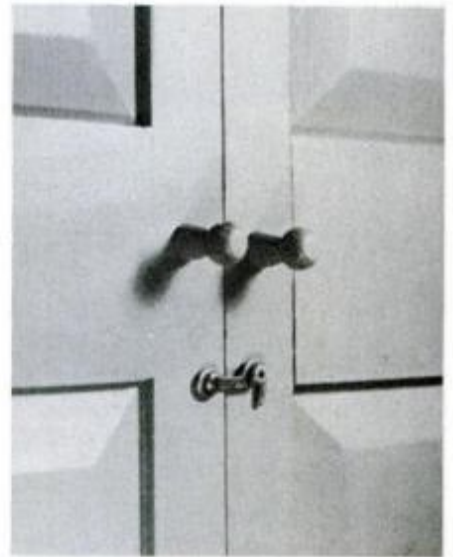
Remove the existing molding from the window. Pull out the nails from the back. Then measure and rip the moldings to the new width. Re-install with 4d finishing nails; set and fill the nail holes with wood filler.

Make pulls from clothespins

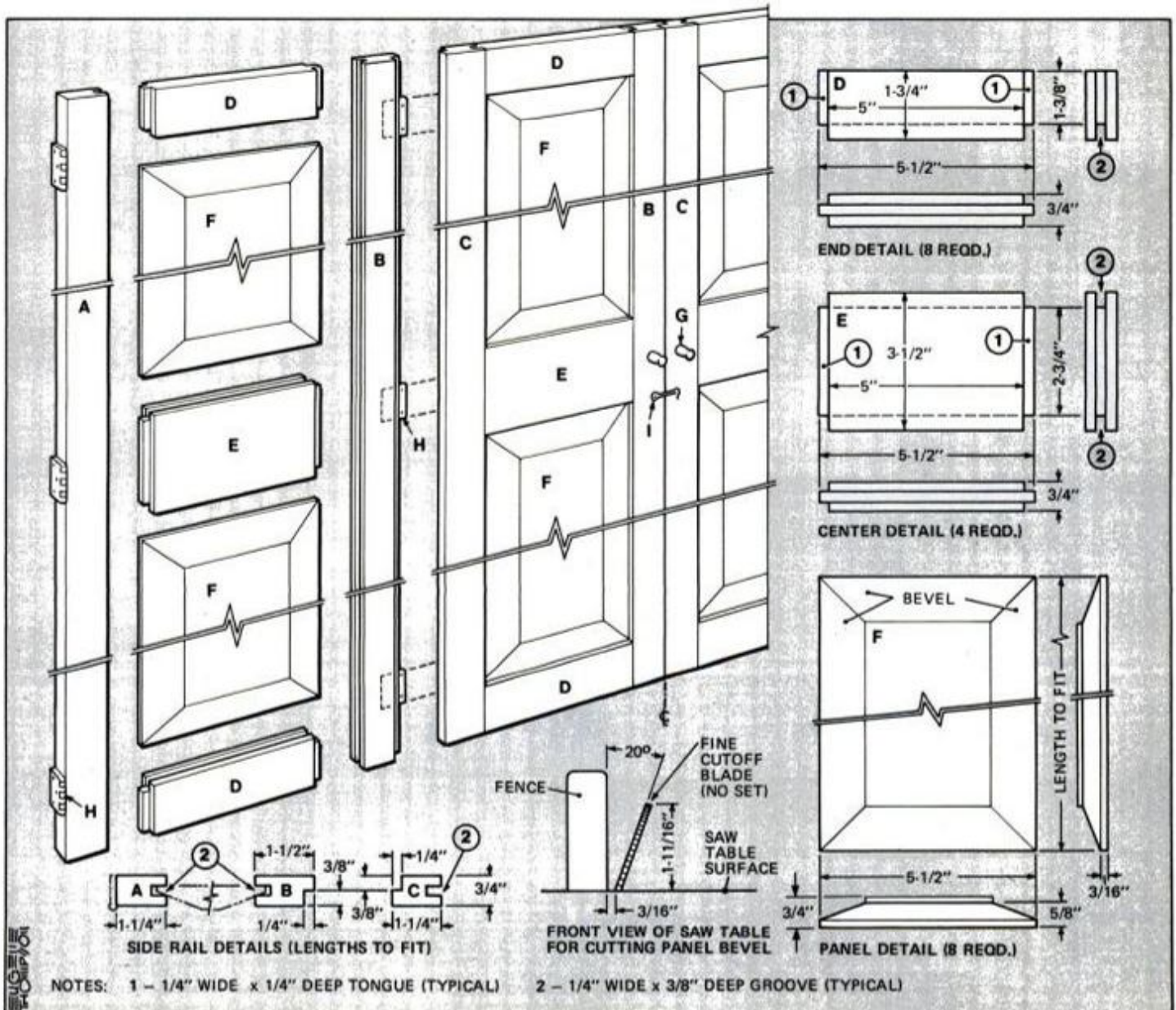
Although shutter hinges and other hardware are found at hardware and building supply stores, you can make wooden pulls like those shown (far right) by cutting the tops off of old-style wood clothespins. They are installed using 1¼-in., No. 8 flathead screws in countersunk holes from the back side of shutters.



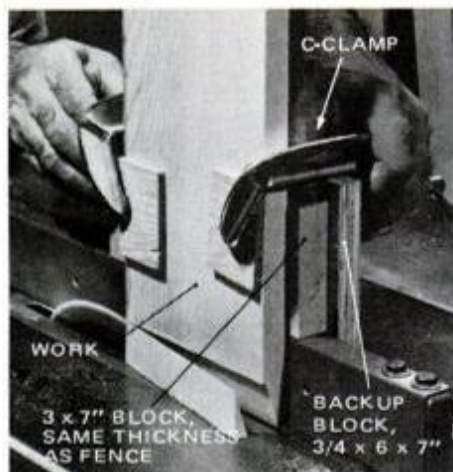
Re-use stop molding; pull nails through back, cut to suit, install with 4d nails.



Detail view of a panel assembly shows wooden pulls cut from clothespins.



Building the shutters



Tilt the saw blade and use wood blocks to cut bevels on the ends of panels (F).



You can cut side bevels without blocks. Stand behind the fence for good control.



Adjust fence and blade to square off panel shoulders. First make test cuts on scrap.



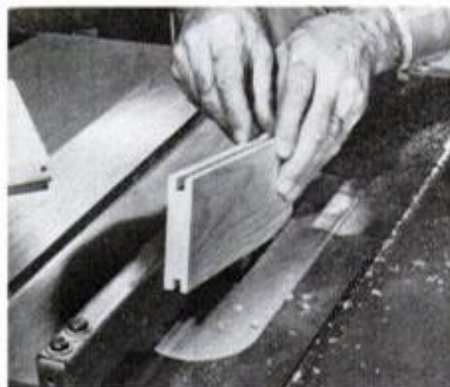
For precision, set dado to groove width wanted, test on scrap, mark cut on insert.



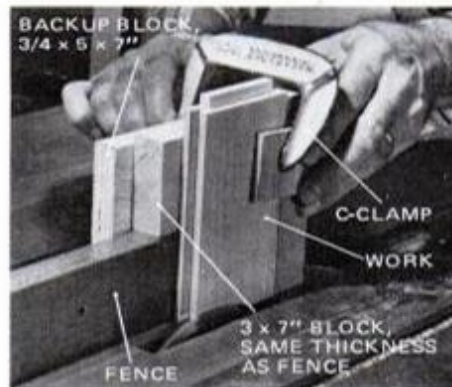
When grooving rabbeted stiles (B, C), have push stick ready for use near end of cut.



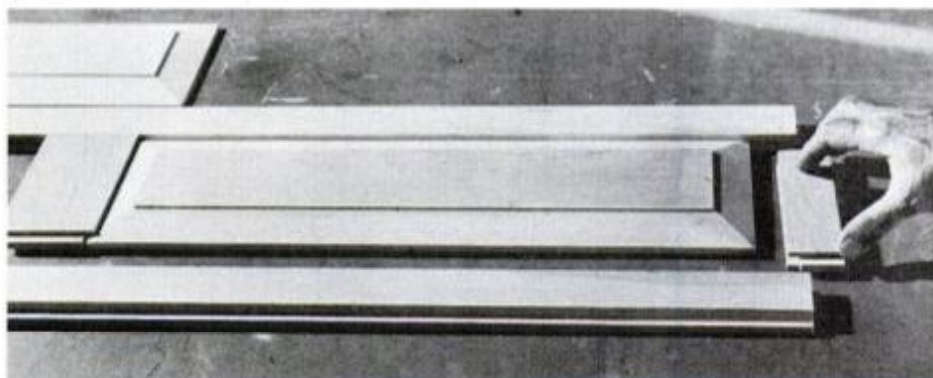
When grooving short pieces (D, E), apply pressure at front and back . . .



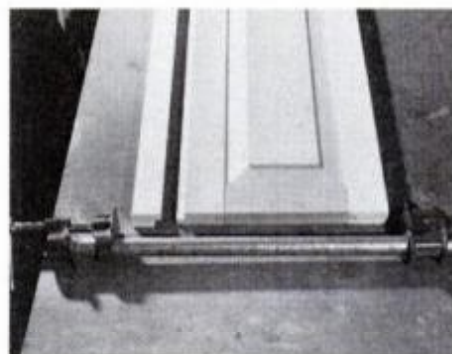
If you don't, the groove won't be uniform. You may damage the work or your hand.



Use two blocks as aids in cutting tongues in D and E. Rear block stops splintering.



Test-fit all parts and sand them smooth before you finally assemble the sections.



Wood scrap with a rabbet cut on one edge serves as a clamp cushion after gluing.

a test bevel on a scrap of wood first.

Bevel the ends (across the end grain) first; then the sides. A jig of scrap-wood blocks (see first photo on this page), is helpful. You can bevel along the panel length without the blocks, but hold the work firmly and use a slow feed. Keep the panel firm-

(Please turn to page 189)

MATERIALS LIST—SHUTTERS

(for 1 set, 4 sections)

Key	Pcs.	Size and description (use)
A	2	3/4 x 1 3/4" x to fit (side stile)
B	3	3/4 x 1 3/4" x to fit (center stile)
C	3	3/4 x 1 3/4" x to fit (center stile)
D	6	3/4 x 1 3/4 x 5 1/2" (top, bottom rail)
E	4	3/4 x 3 1/2 x 5 1/2" (center rail)
F	8	3/4 x 5 1/2" to fit (panel)
G	2	shaped or purchased (pulls)
H	12	1 1/2 x 1 1/4" butt hinges, brass finish
I	1	shutter hook and catch

Misc.: carpenter's glue; pigmented shellac such as Bin or Enamelac; satin-finish enamel paint; sandpaper.

This cleverly designed calendar can be reused year after year.

The dating system of this calendar is designed so it can be used forever. The calendar front is 1/8-in. lauan plywood surfaced with zebra-wood veneer, while the ends are solid cherry.

You can make the front and the number slider of any plywood or hardwood to match your decor. You'll need about one sq. ft. of this wood. Make the ends of hardwood (1/2 x 2 1/2 x 7-in. piece) and the other parts of any solid wood.

Begin by carefully cutting the calendar from the magazine. Cut the front (A) and rough cut the window opening slightly undersize with a jigsaw or sabre saw. Use a jig to cut a bevel edge, front to back, on the window. First, center A in the jig, using the marked guidelines, and tack its corners with brads. Use a 45° bevel router bit with bearing guide. Adjust the bit for a 3/16-in. depth of cut. Insert the router bit into the opening and allow the pilot to follow the opening in the jig. Test on scrap wood first. After making the cut, remove the piece and sand the edges.

Cutting support pieces

Next, cut stock to a 5/32-in. thickness for the upper (C), lower (D) and end (E) spacers. Use rubber cement on both surfaces to mount the narrow paper strip (with the days of the week) on C. Cover the paper with clear adhesive film. Use white glue to secure C, so the print is properly aligned at the top of the window.

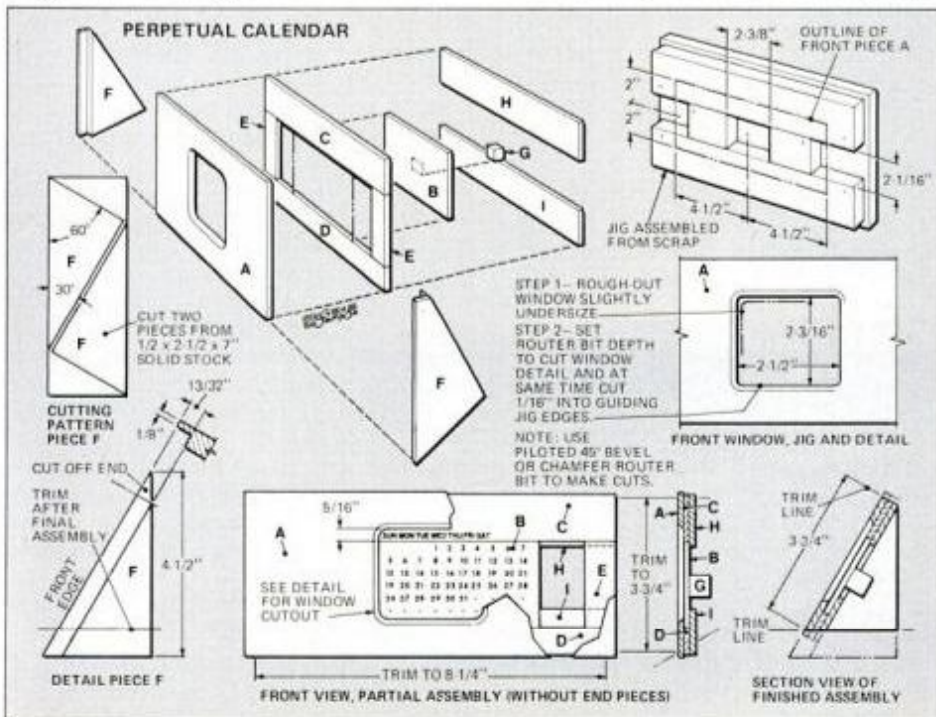


Build PM's perpetual desk calendar

Desk calendar, above, never needs replacing. Carefully cut the calendar face below from the magazine. Separate upper and lower sections with single, straight cut.

----- Cut along dotted lines -----

		SUN	MON	TUE	WED	THU	FRI	SAT
			1	2	3	4	5	6
2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19
20	21	22	23	24	25	26	27	28
29	30	31	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—



Cut the slider (B). Then cement the numeral sheet to B and cover with clear adhesive. Position the slider; then glue in the lower spacer (D), so slider can move freely.

Glue in the end spacers (E). To position them, place B behind the window, with No. 1 at the left edge of the window. This is the slider's left limit of travel. Repeat with No. 1 at the right-hand window edge.

Cut the remaining parts. Clamp back strips (H and I) on the assembly.

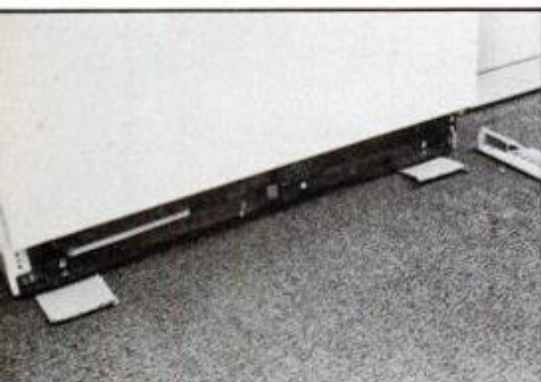
(Please turn to page 199)

MATERIALS LIST—DESK CALENDAR

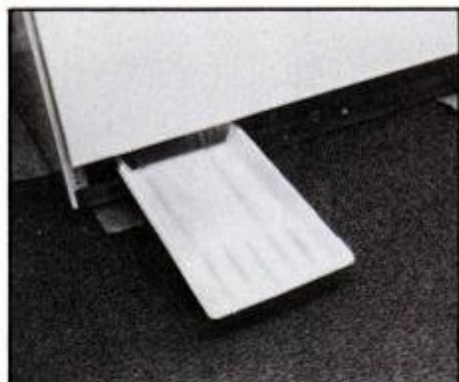
Key	No.	Size and description (use)
A	1	1/8 x 4 x 9" plywood or hardwood (front)
B	1	1/8 x 2 1/4 x 5 1/4" plywood or hardwood (slider)
C	1	5/32 x 1 1/2 x 9" solid wood (upper spacer)
D	1	5/32 x 1/2 x 9" solid wood (lower spacer)
E	2	5/32 x 3/4 x 2 1/4" solid wood (end spacer)
F	2	1/2 x 2 1/2 x 7" solid wood makes both pieces (end blocks)
G	1	1/2 x 1/2 x 1/2" solid wood (knob)
H	1	1/4 x 1 1/4 x 9" solid wood (top runner)
I	1	1/4 x 1 1/4 x 9" solid wood (bottom runner)

Misc.: Brads; white glue; sandpaper; clear film, such as Contact; rubber cement; Danish oil and wax or other finish.

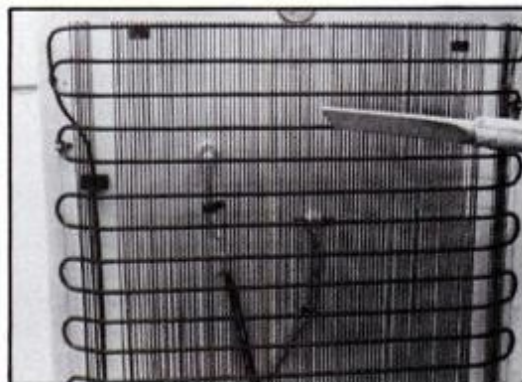
Refrigerator tune-up that



1 Remove the front grille and slide cardboard strips under leveling legs or rollers to move the refrigerator.



2 Remove drain pan; wash, replace. Vacuum the condenser coils under refrigerator in forced-draft system.



3 Vacuum the coils on refrigerator back in natural-draft system. Remove debris under the coils.

A refrigerator in good condition runs less often and saves dollars.

by C.J. Lindo

In my years of servicing major appliances, I've seen case after case of expensive service calls for refrigerator repairs that were either unnecessary or preventable. Preventive maintenance on domestic refrigerators is a safe and simple job. It helps keep the unit in good working order and cuts down on electric costs.

Before you start work, pull the plug. Nothing is more upsetting than shooting off fireworks in the refrigerator, winding a shirt sleeve in a condenser fan blade, or worse.

In most cases you will have to move the refrigerator to get at the plug. First, remove everything from the top of the refrigerator, including any dust or grime. Remove anything inside that could tip over and spill.

Moving the refrigerator

Start the move by grabbing the top front corners and rocking the refrigerator back and forth, then side to side. While rocking, pull it forward until you have enough room to reach behind it and pull out the plug.

If your floor is easily damaged, or the unit is in a tight space, there is another way to pull out the box. Remove the grille at the bottom front. Use a flashlight to note where the front and rear leveling legs or rollers are. Cut two 3-inch-wide strips of cardboard 4 inches longer



7 Use a dollar bill to check proper gasket seal. You should feel tension when you pull out the dollar.



8 Using a hair dryer and a towel, carefully defrost the freezer. A dishpan can collect melting ice.

than the base of the refrigerator.

Use your foot to slide each strip under a rear leg while tilting the refrigerator forward. Tilt the refrigerator back and swivel the front of each strip under a front leg. Look for a metal bar or bracket running across the front of the base. Crouch down in a deep knee-bend position, grab the bracket with both hands, lift and pull forward, *using your leg muscles only*, a few inches at a time.

Cleaning the condenser

After pulling the plug, check to see if you have a natural- or forced-draft condenser. If you see black coils attached to the back, you have a natural-draft system. Forced-draft condensers are tucked away underneath, where a fan forces cooling air over the coils.

Condenser coils give off heat picked up from food in the refrigerator. However, heavy layers of hair and dust act like insulation to keep this heat in the condenser coils, so the refrigerator has to run longer

and work harder to cool the food.

Natural-draft condensers are easy to clean. Use a narrow nozzle on your vacuum and a dust brush. Carefully brush off dust and hair clinging to the condenser and vacuum it up. Remove papers or trash stuck between the condenser and refrigerator wall.

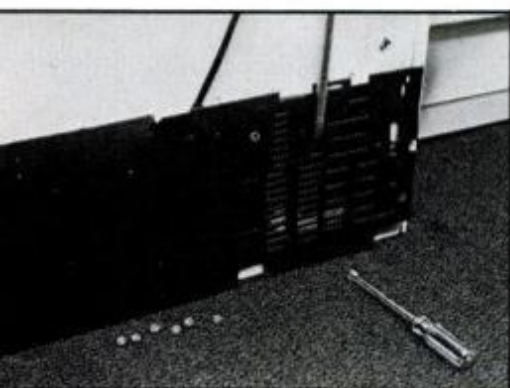
Forced-draft condensers take a little more work to clean. Remove the front grille. With the help of a flashlight and a narrow nozzle, carefully vacuum out the condenser underneath the refrigerator. Take care when cleaning around wires running along the front.

If grime is packed and you don't mind a mess, blow it out by reversing the vacuum when you remove the back cover to clean the condenser fan blade and motor.

The back cover is usually black cardboard with a strip of fiberglass insulation attached inside. Older models may have a black metal cover. Simply remove screws holding the cover. Most are held by slotted hex-head screws, so a ratchet or nut-

The author is a service technician and service manager in the major appliance field.

cuts operating costs



4 Unscrew and remove back cover, clean it with a vacuum. Cover is often cardboard, sometimes metal.

driver will help. But the cover can be removed with a screwdriver or pliers.

Inspecting the condenser fan

Carefully vacuum the condenser fan motor and fan blade. Don't bend or warp the blade, or it will tend to wobble and wear out the fan-motor bearing.

If the fan blade is made of plastic, replace it with a metal one. Plastic fan blades tend to warp or become brittle and fall off due to the temperature in their location. Check your classified directory for the maker's nearest parts center.

Vacuum out the rest of the dirt underneath. You should see clearly from back to front of the refrigerator, through the condenser coils before replacing the back cover. Then replace the refrigerator by reversing the procedure you used to remove it.

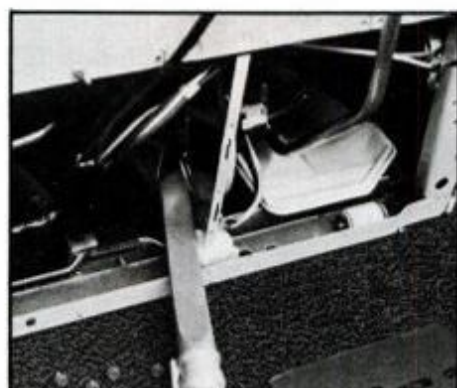
Checking door gaskets

The rubber seal along the inside of the door keeps heat and moisture from seeping into the refrigerator when the door is closed. A faulty seal or torn door gasket have almost the same effect as leaving the door open all day.

Wash accumulated dirt off the gasket with warm soapy water and carefully inspect it for rips. Also wash around the door frame where the gasket closes against it. Sticky spills tend to grab the gasket and tear it in time as the door is opened and shut.

If you must replace the gasket, ask for detailed instructions from the distributor. Procedure varies according to make and model.

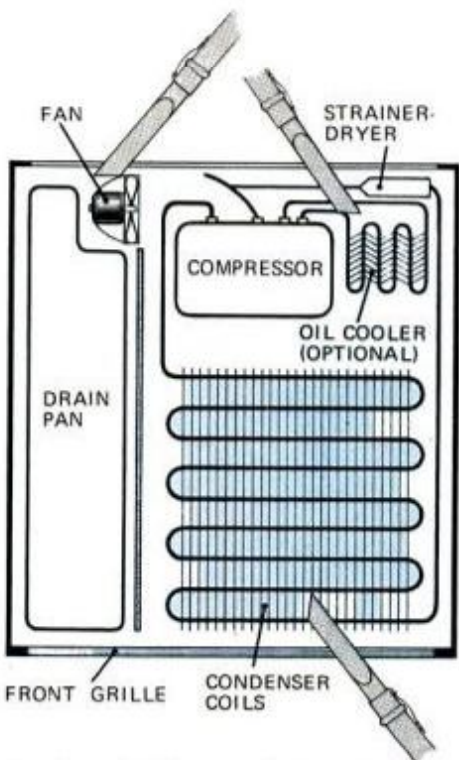
Use a dollar bill to check for proper gasket seal. Close the bill between the door and door frame. Slowly pull



5 Carefully vacuum the condenser fan and the fan blade. Remove all dust and debris from the area.

it out. If you feel tension, the seal is okay. Do this all around the gasket.

There are several ways to correct a seal leak. Fix small leaks by gently heating the gasket with a hair dryer and stretching it to fit. Lift the gas-



Drawing of refrigerator locates condenser coils, fan and motor. Make certain that these parts are thoroughly vacuumed.

ket and check to see that it is screwed in place. Larger leaks can be remedied by adjusting hinges so the door fits evenly.

Filling cracks

Cracks in plastic door liners are among the easiest things to seal. While it is not good in places that must be rigid, an instant rubber



6 Look for worn or torn door gaskets which let heat and moisture enter even when the door is closed.

caulking compound such as GE Silicone Seal adheres well and keeps moisture from soaking into the insulation between the liner and outer door shell.

Squeeze some compound onto the crack and feather it into the surrounding liner with a wet butter knife. The sealant comes in several colors. With care, you can do a professional looking job.

Defrosting the freezer

Frost buildup in the freezer acts as an insulator and reduces the freezer's ability to absorb and disperse the heat of the food inside. Defrosting used to be a messy, time-consuming job. Today you can defrost an inch of ice in 15 minutes using a hair dryer—if you elect to consume the needed electricity.

Move food to the refrigerator section. Place a towel on the freezer bottom to absorb water and put a dishpan on a convenient spot on the floor. Turn on the dryer to its hottest setting and melt a spot of ice on the top of the freezer, holding the dryer at a 45° angle so water won't drip back into it.

Remove ice carefully

As the ice melts, gradually work the hair dryer in widening circles. Don't let hot air hit the plastic directly. Use your fingernails to loosen slabs of ice gently. *Never* use metal or hard plastic to scrape off ice. The freezing coils and shell are made of aluminum. Not only can hard scrapers puncture them, but constant scraping will wear microscopic holes and allow refrigerant gas to escape.

Wash the freezer with warm, soapy water and ammonia, rinse and dry. Plug in the unit, turn it on and the tune-up is complete. **PM**

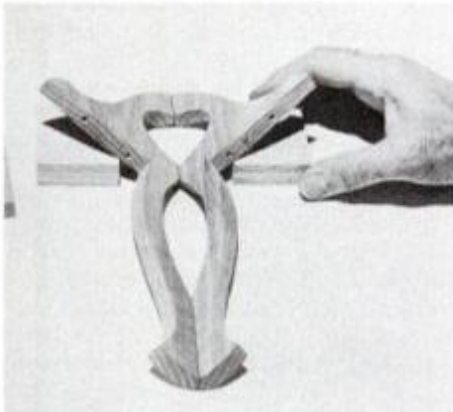
Two handsome hurricane sconces you can make

One requires some lathe work—one doesn't. Both will be cherished family heirlooms.

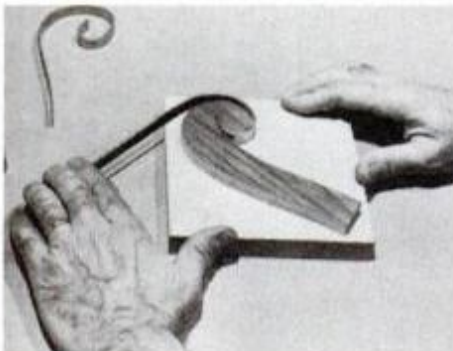
by Rosario Capotosto



Cut curves for scroll sconce after creating bevels on inside edges. Cut both pieces at one time on a band- or other saw.



Since clamping is not feasible, prop pieces with scrap blocks while gluing.



To use the forming jig, insert the bar in the jig slot at curled end of the bar; finish with the bar against curved block.

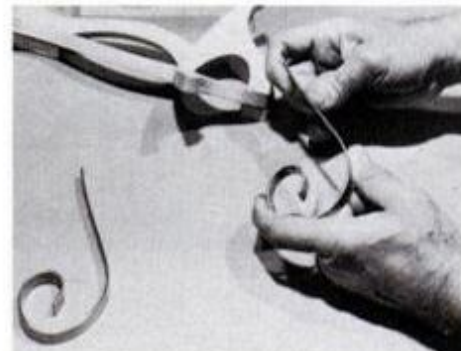
Accent a wall with glowing candlelight with one or two of these graceful fixtures. They would also make great gifts. Your outlay will be about \$15 each.

Appealing to a broad range of home craftsmen, we offer two designs. The spindle sconce requires a lathe; the scroll sconce can be cut with a jigsaw, bandsaw, sabre saw or coping saw. Metalwork is basically the same for each design.

It would be desirable to use solid-brass components, but a complete set of compatible brass parts is unavailable. Therefore, a mixture of brass, brass-plated and plain steel is used. A brass spray-on coating easi-



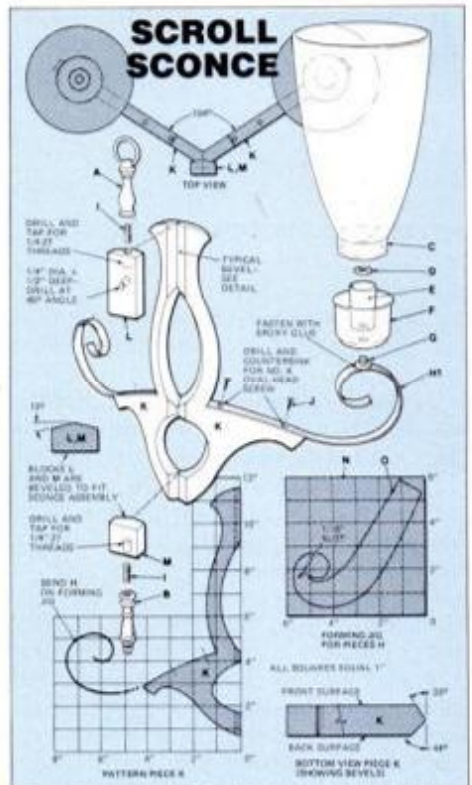
Glue face-beveled reinforcing blocks to back. They also serve as standoffs.



After bending on jig, a slight spring-back of the bar will necessitate freehand pressure in order to obtain the final shape.

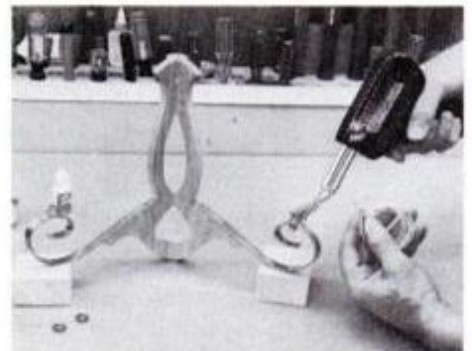


PM photos by the author



MATERIALS LIST—HURRICANE LAMPS

Key	No.	Size and description
A	1 per lamp	1/4" (27) finial ring
B	1 per lamp	1/4" (27) finial
C	2 per lamp	1 1/4" dia. base hurricane glass
D	2 per lamp	1/2"-i.p. hex locknut
E	2 per lamp	3/8" candle cup
F	2 per lamp	1 1/4"-dia. glass holder
G	2 per lamp	1/2"-i.p. cord inlet bushing
H1	2	1/8" x 1/2" x 13" mild steel*



Prop fixture and use clothespin to hold threaded bushing in place for soldering. Clean surface to be joined and apply flux.



ly solves the problem. We used white oak for the prototype lamps, but any hardwood can be substituted.

Making a scroll scence

Make a full-size pattern of the outline by drawing 1/2-in. squares on paper. Plot the design freehand and smooth curves using a French curve. Transfer the outline to two pieces of 1/2-in. stock. Cut the double bevel on one edge of each piece, as indicated in the drawing, using a table saw jointer or hand plane. Be sure to cut a matching left and right bevel in relation to the face side of the stock. Then tack-nail the pieces together and saw both at the same time. Sand edges smooth, then separate the pieces and finish-sand the surfaces.

To join sections, glue and butt the front bevels together using two small blocks to hold the assembly at the required angle. If you use a strong, quick-setting glue (such as Elmer's Carpenter's) and allow the coatings to air-dry a few minutes before joining, the joint will be practically slip-proof. When glue has set, turn over the piece and glue in the two bevel-faced reinforcing blocks. Bore an angled hanging hole into the back of the upper block.

Scrolled arms are made of mild-steel bar stock, easily curved to shape with a simple forming jig. To

make the jig, draw a full-size pattern of the strip-forming block on 1/2-in.-thick hardwood and cut it out with a jigsaw or sabre saw. Note that the metal strip must fit snugly in the starting slot to minimize the chance of its sliding out as you start the bend. Glue the forming block onto a scrap-block base of plywood.

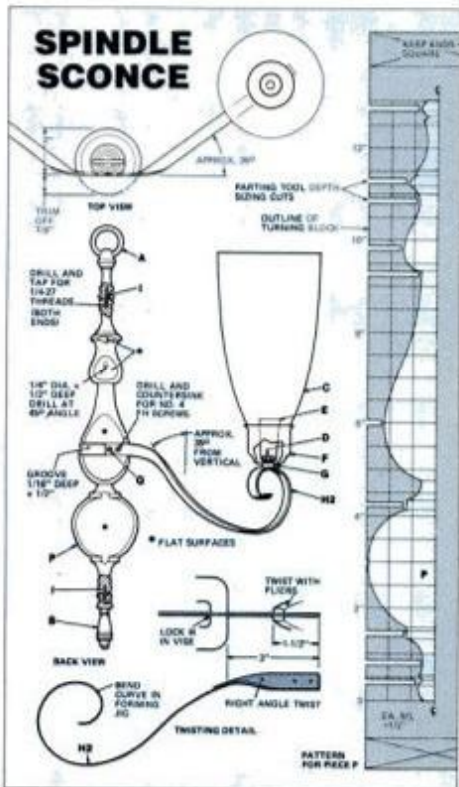
Due to the sweep of the forming block, preform a slight bend at one end of the strip to fit it into the starting slot. To do this, hold about 1/8 in. of the strip end in a vise and make a slight freehand bend. Snug the strip into the slot and bend it against the former. Keep the bottom edge of the strip flush against the backboard.

When you remove the strip, a slight amount of spring-back will occur. Resolve this by further shaping, freehand, with thumbs and index fingers. Check one arm against the other for symmetry.

Drill and countersink two holes in each arm for oval-head screws. Drill pilot holes into the wood and attach the arms temporarily. Prop the fixture vertically, then mark tops of the curls for positioning bushings.

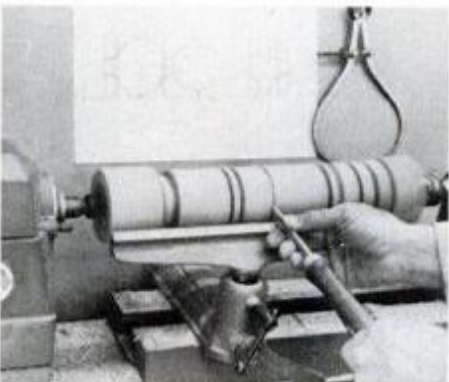
For a good soldered joint between bushing and scroll, file a slight flat at the high point of the curvature. Then apply soldering flux to both surfaces. Hold the bushing in place with a wooden spring clip and apply

(Please turn to page 202)

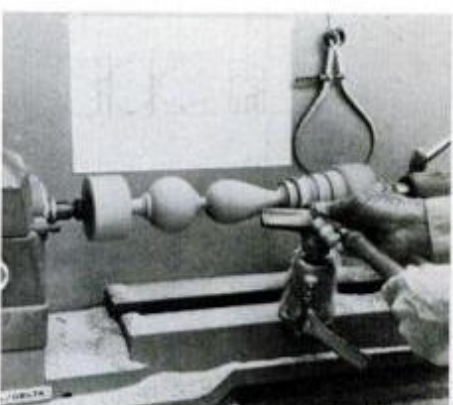


- | | | |
|----|------------|---|
| H2 | 2 | 1/8 x 1/2 x 15" mild steel** |
| I | 2 per lamp | 1/4 (27) 1/2" threaded rod |
| J | 4 | 1/2" No. 4 oval-hd. screw* |
| K | 1 | 1/2 x 6 x 12" oak (scrolled brackets)* |
| L | 1 | 3/4 x 1 x 2 1/4" oak (reinforcing block)* |
| M | 1 | 3/4 x 1 x 1" oak (reinforcing block)* |
| N | 1 | 3/4 x 6 x 6" plywood (jig) |
| O | 1 | 1/2 x 6 x 6" hardwood, cut to shape (jig) |
| P | 1 | 3 x 3 x 16" hardwood** (spindle) |
| Q | 4 | 1/2" No. 4 fl. screws** |

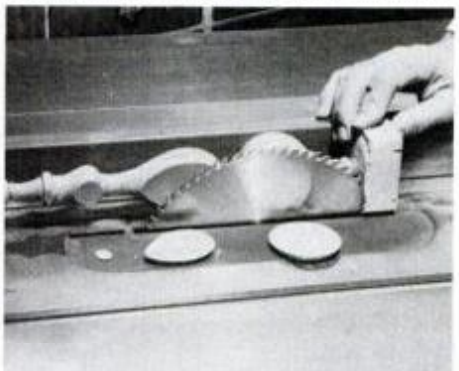
*Required for scroll scence only; **for spindle scence only.



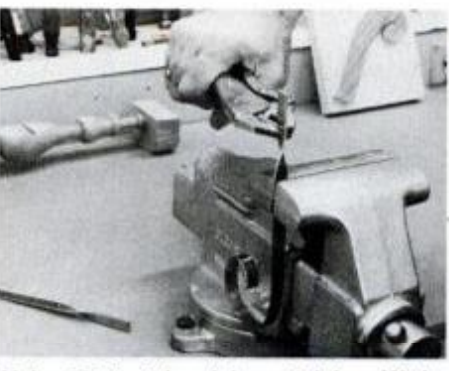
Make parting cut for various diameters on spindle turning; check against full-size drawing with calipers as you proceed.



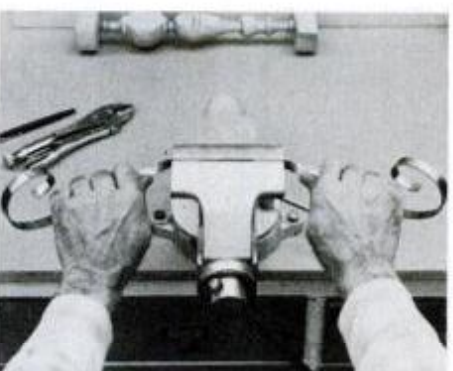
Use gouge to remove a lot of stock quickly; skew to make smooth cuts.



Before removing square waste at ends, cut a flat at spindle back using table saw.



Make 90° test bend in metal bar H2 by clamping in vise and gripping with pliers. See drawing for the gripping location.



To make the final freehand bends, first bend the arms forward, then downward.

PM WORKBENCH

PM EXAMINES PRODUCTS AND SERVICES

Not so hot

If the water in your hydronic heating system is hotter than necessary, it can result in a waste of fuel, advises the Better Heating-Cooling Council. According to the experts, the ratio between the amount of hydronic baseboard in the house, and the amount of heat loss from the house determines the needed temperature of the circulating hot water. Happily, you don't need to make any calculations; you simply observe and adjust.

If your burner cycles on and off frequently in very cold weather, it indicates that the water is hotter than needed. Thus, you should lower the temperature setting to reduce the number of cycles per hour to obtain longer "on" and "off" periods. Be aware that frequent cycling wastes fuel oil.—H.W.

A dandy clamp kit

Using threaded rod, aluminum junction blocks and a unique pressure foot, this clamp kit gives workshop-ers a way to put together custom clamps and work-holding jigs, as needed. The kit contains the parts shown and can be expanded with ad-



All parts shown—plus an instruction booklet—come in the useful clamp kit.



Larger of these two bar clamps is made up by using a length of scrap lumber.

ditional rods available at hardware stores. Instruction book comes with the \$39.85 setup. The flexibility of



The four-corner setup simplifies the assembly of a mitered workpiece.

the kit lets you create clamps to suit otherwise unsolvable clamping problems.

For more information, contact Jamieson Industries Inc., 2556 Royal Lane 2A-167, Dallas, Tex. 75229.—H.W.

New type of plywood

Georgia-Pacific has announced that a new type of plywood—which will double the number of panels obtained from a tree—will start rolling off a new production line any day now. Called Stable-X, the panels will



Rigid core (pencil point) consists of wood flakes, not usual laminated veneers.

have oriented-fiber cores of special wood flakes. Its grain will run in opposite direction of veneer face and back.

For availability and prices of Stable-X, write to Cathy Howard, Georgia-Pacific, 900 Southwest 5th Ave., Portland, Ore. 97204.—H.W.

Wow, wotta punch!

Model 8500 hand punch weighs only 3½ lbs., yet can pierce up to 14-ga. mild steel. The tool develops one ton of power for accurate punching in steel, aluminum, brass, copper and plastic. Its throat depth is 2 in., and the tool sports a side gauge for depth adjustment. It comes in a \$29.95 kit including seven sizes of round holes and dies from 3/32 to 9/32 in. For



Hand punch has the kick of a mule, is comfortable to use. It costs under \$30.

nearest dealer write Lustre Line Products, Richmond and Norris Sts., Philadelphia, Pa. 19125.—H.W.

Good glue for repairs

Boasting a nozzle tip that is non-clogging, Super Wood-Lok has become one of the pet adhesives in my workshop. The industrial-strength adhesive is suitable for many shop tasks, including bonding of leather, high-pressure laminates and paper,



Adhesive's firm, nonrunning consistency makes it good for vertical applications.



All glue squeeze-out is immediately wiped off using a slightly dampened cloth.

in addition to general woodwork chores. A 2½-oz. tube is \$1.29; Permabond International Corp., 480 South Dean St., Englewood, N.J. 07631.—H.W.

If you've come across a new product with some special features, let us know about it. Write to PM Workbench, Popular Mechanics, 224 West 57th St., New York, N.Y. 10019.

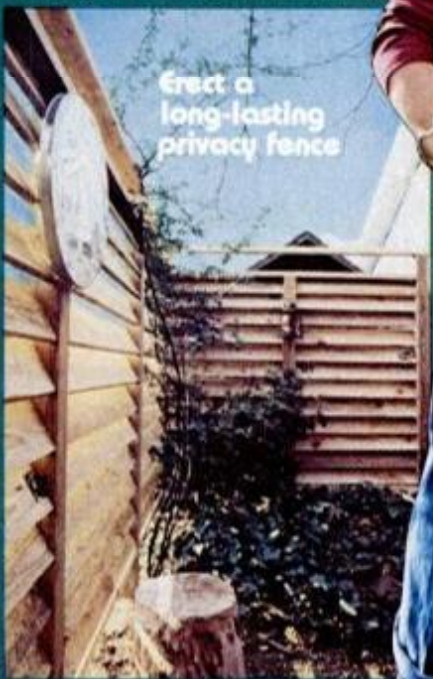
YOU WILL HAVE MORE FUN STAYING HOME THIS SUMMER IF YOU PUT A FEW OF THESE IDEAS TO USE. YOU'LL SAVE GASOLINE, TOO!

PM'S GARDENING AND OUTDOOR LIVING GUIDE

Renovate that old lawnmower



Erect a long-lasting privacy fence



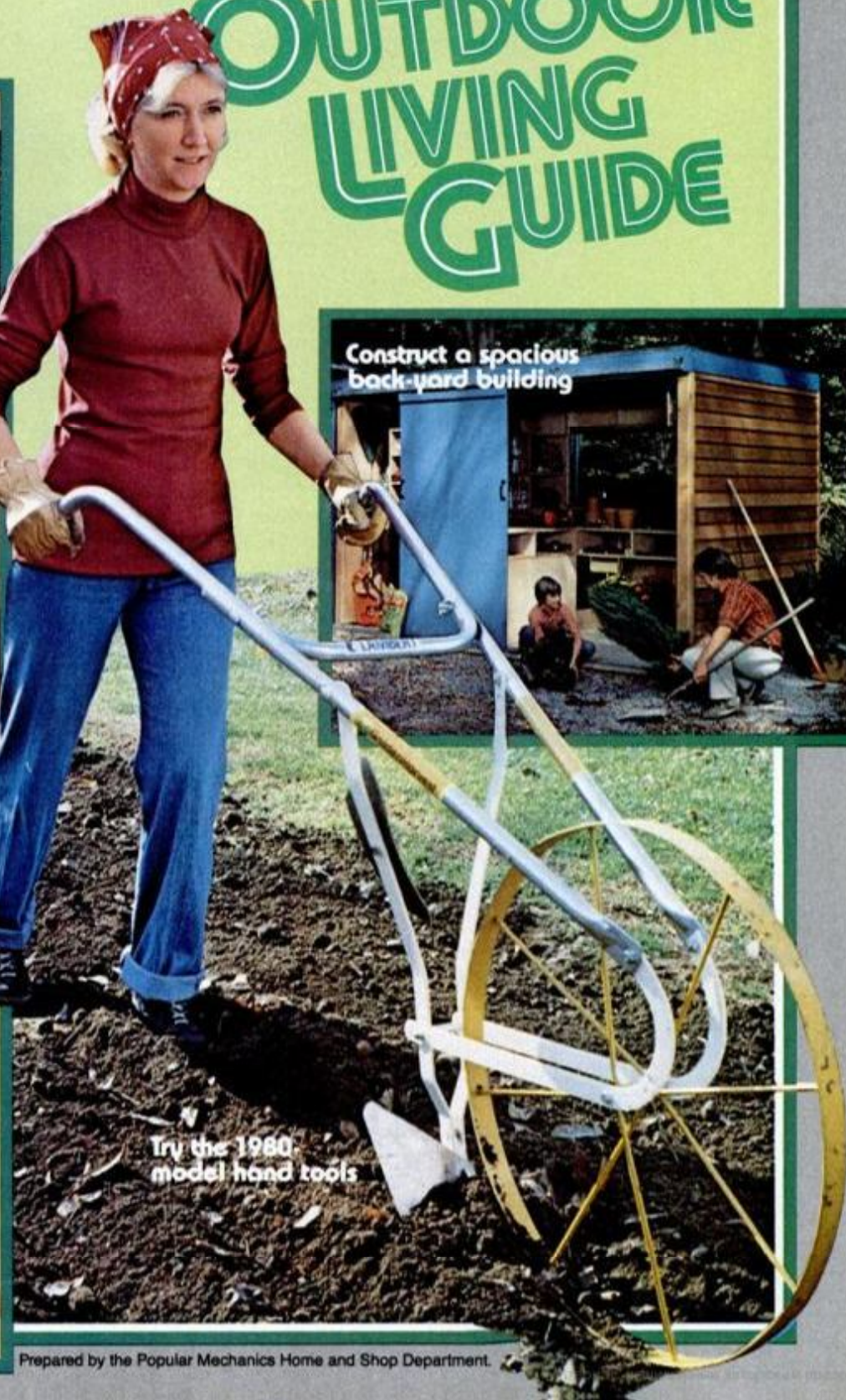
Get a big harvest from a small plot with easy-to-build structures



Construct a spacious back-yard building



Try the 1980 model hand tools





“We learned our lesson with that last tractor we had. This time we got a John Deere.”

Laurence Light, Redfield, Iowa

A few years ago, Laurence Light bought a “bargain” lawn and garden tractor figuring he might save himself a little money.

Unfortunately, it didn't work out that way.

“That cheap tractor never did do the job,” according to Mr. Light. “So last year my son Harry and I bought a John Deere.”

It's a story we hear all the time at John Deere.

People switch to our tractors because they know we build them strong enough to do the jobs you expect a tractor to do. And solid enough to keep on doing them long after others have worn out.

“You can actually feel the difference in a John Deere,” says Light. “We use ours for tilling in spring, mowing in summer and clearing snow in winter. And we love it.”

Test drive one yourself at your nearby John Deere dealer.

Down-to-Earth Value. Save 25%.

By buying a 200 Series tractor before May 31 at a participating dealer, you can save 25% on the following attachments: rotary mower, snow thrower, front blade, rotary tiller or dumpcart.

For more information, write John Deere, Department 50, Moline, Illinois 61265.



Nothing runs like a Deere®



Build PJM's back-yard utility shed

Good design provides storage for yard tools and 3½ cords of firewood, plus 48 sq. ft. of space for a handyman's workshop.

by Harry Wicks HOME AND SHOP EDITOR



Compact shed boasts a work area that every gardener would be happy to have.

Based on the mail we receive from PM readers, functional and attractive back-yard buildings have to be ranked as one of the 10 favorite projects that we can present in the magazine. Lack of space for storage and for pursuing outdoor interests seems to be an ongoing American problem. A back-yard building is one sensible way to solve this problem.

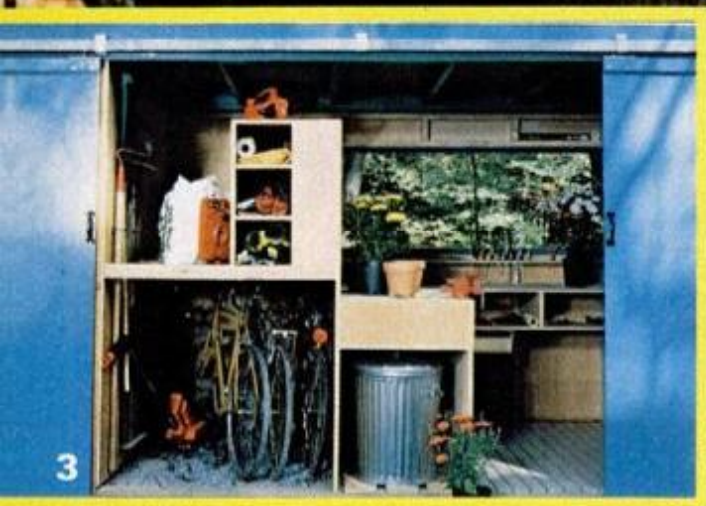
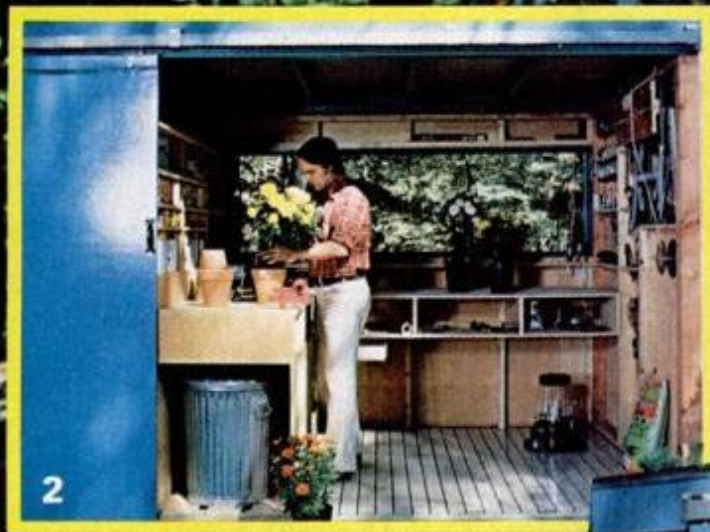
By building your own, rather than

picking a factory-built version, you can design in all sorts of functional features that will make your lawn building efficient and fun to use. The handsome structure shown on these pages was designed by architect Lester Walker, a regular contributor to PM. To keep down the cost, he built his house without a slab and covered it with sheathing-grade plywood. So it would blend with his home, he covered the shed with ce-

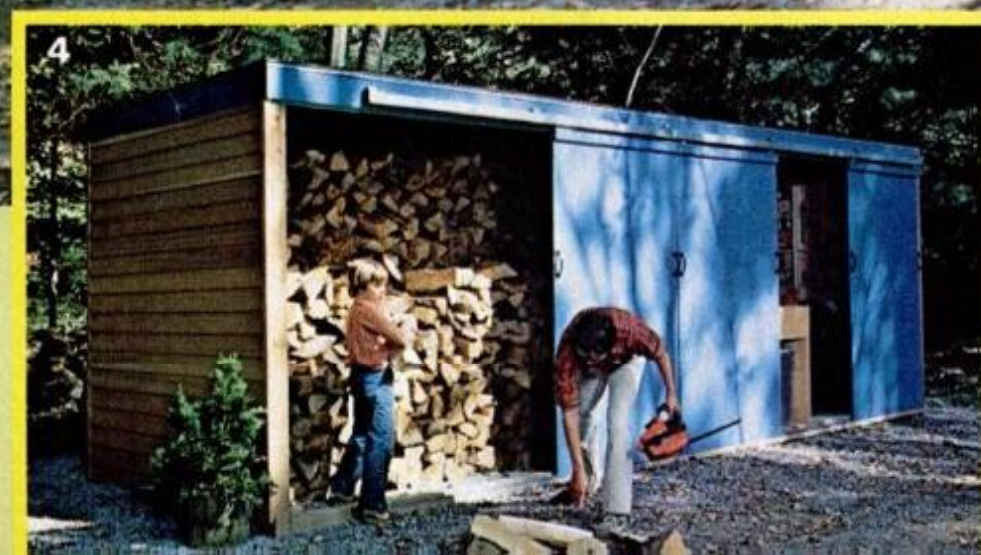
dar clapboard. The building is strong and its "flat" roof is slightly pitched to provide positive water runoff. Complete plans for building the shed are on the following pages.

Getting started

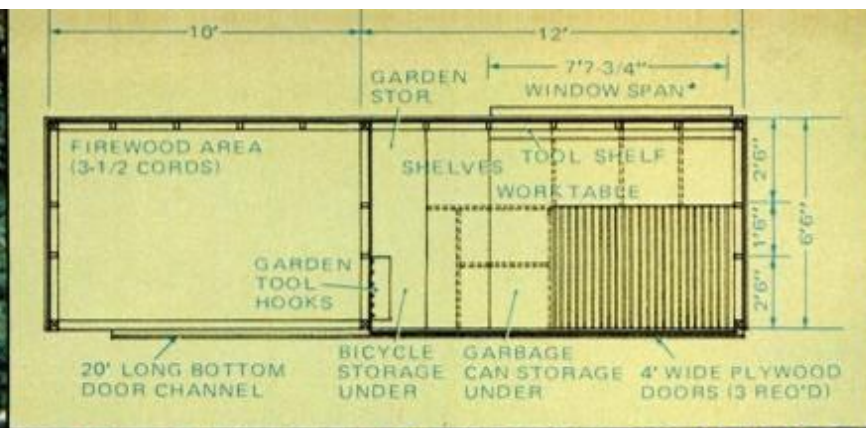
Begin by checking the area where you would like the building located to make certain that you have the space to build the shed as shown. If necessary,



PM's Gardening and Outdoor Living Guide



- 1** Utility shed has uncomplicated, simple lines.
- 2** Designer Les Walker pots plants in airy workshop.
- 3** Behind bench is shelf for garden supplies and bicycle storage.
- 4** End section keeps your firewood dry.



PM color photos: George Ancona
 Black-and-white photos, plans: Lester Walker
 Plants and shrubs: Woodstock Nursery & Garden Center,
 Woodstock, N.Y.

adjust dimensions to suit. Also, check with your local building department to assure that the structure is built in compliance with local codes.

Next, using a mason's line and pointed

1 x 2 stakes, lay out the building's perimeter. Check corners for square, then locate the postholes. Excavate the postholes to a depth below your area's frost line. In most northern climates, a depth of 30 to 36 in. will be necessary. Excavate all postholes using a posthole digger, then pour gravel into each hole to a depth of 4 in.

Framing the building

As you can see in the drawing on page 142, standard framing for an on-grade, flat-roof shed is used throughout. Before you start your framing operation, study the plans carefully—see that you fully understand them. Start by assembling the end and center walls on the ground. This way, the studs can be nailed by spiking

through top and bottom plates. If 4x4 ground beams are used as bottom wall plates throughout (as shown), the studs must be toenailed into position. Use 10d galvanized common nails.

When both end walls and the back wall are framed, enlist the aid of a helper to walk (tilt) the sections upright. Tilt one end wall to vertical and, with your helper holding it, check the frame for plumb in both vertical planes. When you're satisfied, hold the wall rigid using at least two diagonal braces. The lower ends of the braces are fastened to stakes. After securing the wall, recheck with your spirit level to make certain nothing was knocked out of position.

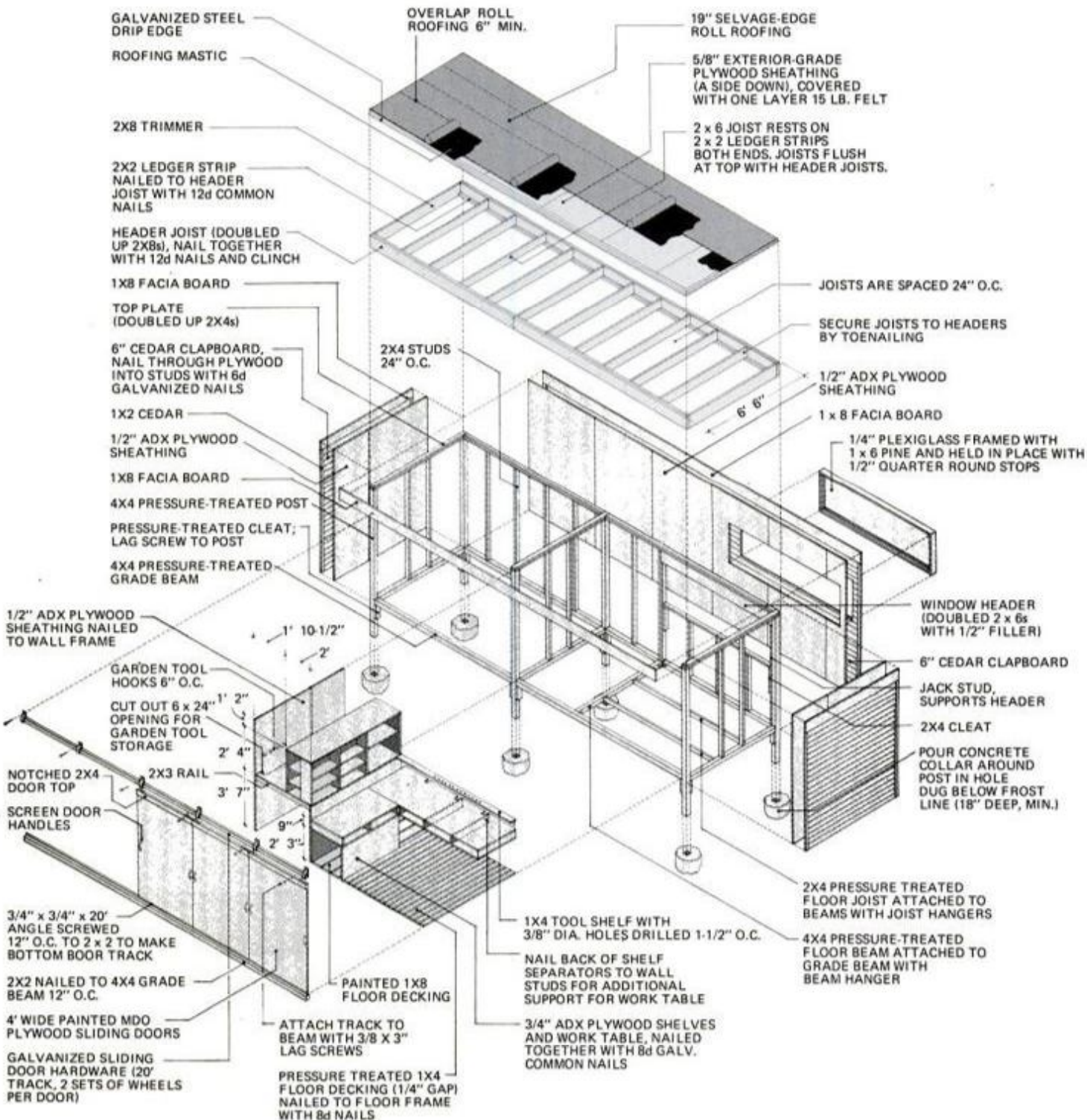
Repeat the procedure for the other end wall, then raise the back wall. The back wall is tied to the end walls by solid nailing at the corners. Use 16d common galvanized nails here.

When all walls are up, you can pour the concrete collars around the posts. These should be at least 18 in. deep and floated level at the top. Leave the wall diagonal bracing in place at least 24 hours while the concrete cures. Next, add the roof joists. These rest on ledger strips, which make installation a snap.

For strength and rigidity, we used exterior-grade plywood sheathing to skin the house. Use 1/2 in. on the walls and, for stability, 5/8 in. on the roof. Install all ply-



1 Side and center walls are framed on ground, then tilted in place and braced, so concrete collars can be poured.





2



3

2 Roof joists are dropped onto ledger strips to complete the framing. 3 Sidewalls are sheathed with exterior-grade plywood that is installed with its good (A) side facing in. The end walls should be checked for square and skinned with plywood first; then you can sheath the back wall.



4



5

4 Roofing consists of 1/2-in. A-D exterior-grade plywood, fastened with 6d galvanized common nails, covered with roll roofing. 5 Steel angle is attached to grade beam and becomes bottom channel for doors.



6

6 The doors are of MDO (medium-density overlaid) plywood, which has good resistance to warpage. Material also provides a good base for a neat paint finish. Door is tilted into the lower channel (above).

wood using galvanized nails to prevent rust stains on the finished building.

Install the 4x4 grade beams as shown and follow by installing the shop floor over the grade beams. You are well advised to use pressure-treated lumber for all structural members that will be in close proximity to the ground. (See *Protect Against Rot and Insects with Pressure-Treated Wood*, page 162.)

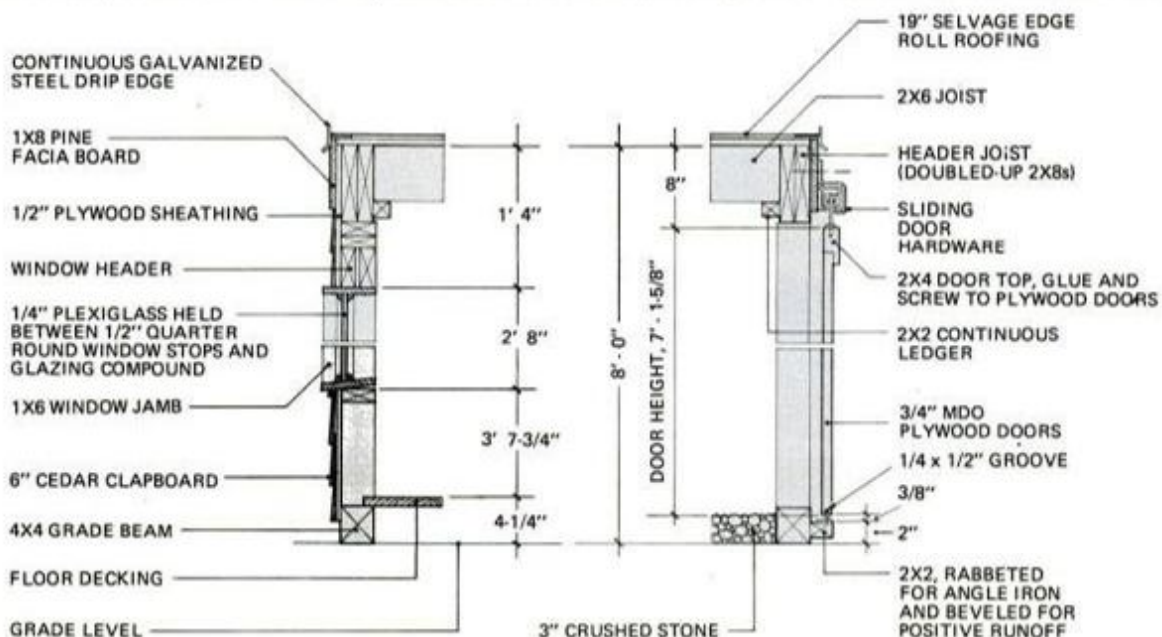
At the least, apply one layer of 15-lb.

felt over the plywood, overlapping the material at least 12 in. Add a layer of mineral roll roofing, overlapping the nongranule portion with each following layer.

For *maximum* roofing protection: First, put down a layer of 15-lb. felt. Overlap each succeeding course at least 12 in. Next, apply a coating of hot tar. Lay down another layer of 15-lb. felt applied at a 90° angle to the first layer. Brush on a second layer of hot tar and finish by putting down

the mineral roll roofing.

The doors are hung barn-door fashion, using conventional hardware, and the interior is divided into sections as desired. On the prototype, designer Walker set aside enough space to hold 3½ cords of firewood. This left more than enough space for some tool storage and a modest-sized handyman's workshop. Wall-board may be used to finish the interior. If you do this, add nailers at corners. **PM**



1980 models: 10 muscle-powered yard tools

Easy-to-use, fuel-saving yard tools are still going strong in the '80s.

The cost of energy these days is reason enough for many of us to have second thoughts before automatically turning on a gasoline- or electric-powered tool for a lawn or garden chore. Though there is little doubt that major manufacturers are making their power tools more efficient than ever, there are many instances when a hand tool—like the kind Grandpa used to use—will do the job as well. There's a bonus, too: You tone up your body as you shape up the yard. **PM**

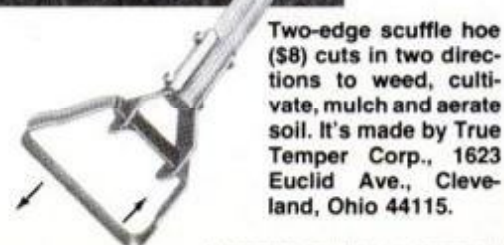
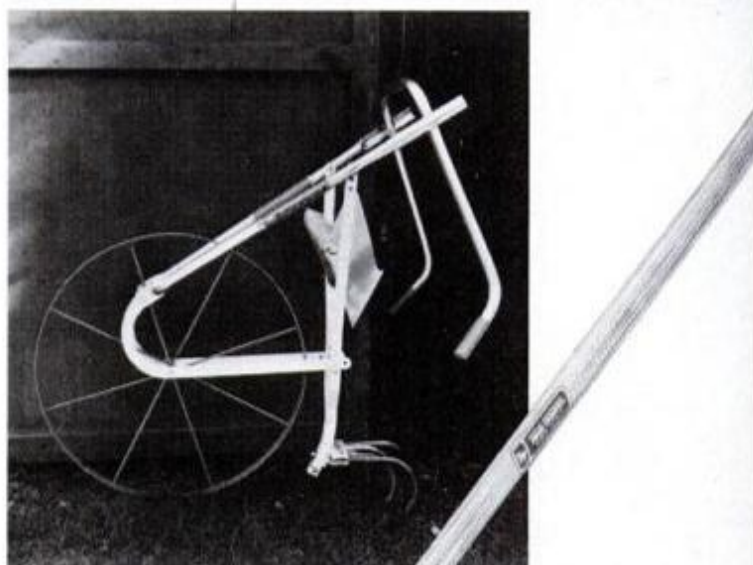


MOLDBOARD
PLOW

FIVE-TINED
CULTIVATOR
AND WEEDER

REVERSIBLE
SHOVEL

For more years than most people want to remember, the high wheel cultivator has helped out in the garden. The updated version of this multi-purpose tool (top, right) comes with three attachments (above, left) so it can furrow, cultivate, weed, cut roots and form hills in tilled soil. A slotted foot for plow attachments lets you adjust the depth and angle of the cut. Its handle folds so that the tool can be stored and transported compactly (above, right). The cultivator, model HWC 243, is priced at \$50 by the Lambert Corp., 519 Hunter Ave., Dayton, Ohio 45404.



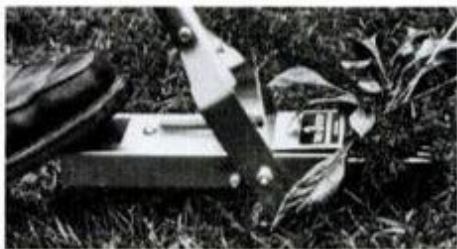
Two-edge scuffle hoe (\$8) cuts in two directions to weed, cultivate, mulch and aerate soil. It's made by True Temper Corp., 1623 Euclid Ave., Cleveland, Ohio 44115.



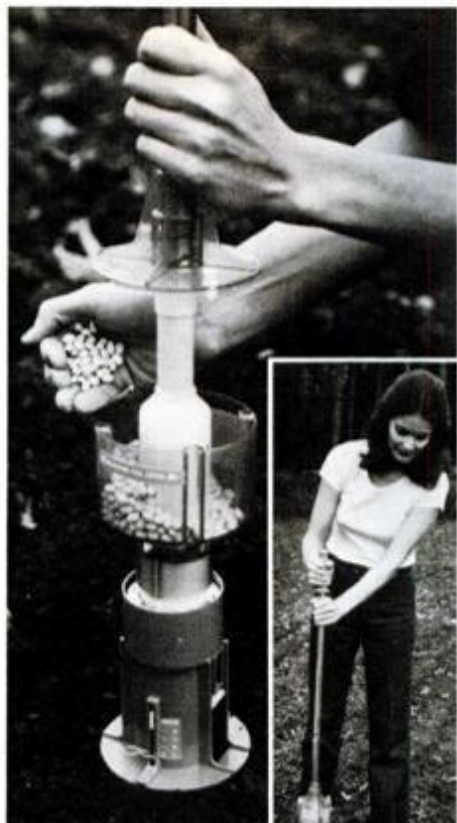
A special control on this fertilizer spreader (\$60) can shut off the flow to its right side. When it's used next to a wall, fertilizer isn't wasted; flowers aren't damaged when you work near a garden. Moving parts are of noncorrosive plastic or stainless steel. F.D. Kees Manufacturing Co., Box 905, Beatrice, Neb. 68310, makes it.



This heavy-duty, 2-gallon sprayer (\$38) is designed to withstand tough chemicals with minimum maintenance. The sprayer has a funnel top to reduce chemical spills and a metal striking plate to stop premature fatigue on the pump cap. Pump action allows tank-pressure buildup for continuous spraying. It's made by Root-Lowell Corp., Lowell, Mich. 49331.



Rid your lawn of weeds with this handy 3-Step weeder: (1) Push the tines into the weed's root system; (2) step down on the back end of the tool to lift out the weed; (3) push the handle forward to remove the weed from the tines. The 3-Step costs \$22 from Wonder Products Manufacturing Co., Box 186, Arlington, Tex. 76010.



When you push down on this seeder in pogo-stick fashion, two planting points enter the ground, opening a hole to your preset depth, and a seed is automatically inserted. When you've withdrawn the tool, it reloads itself for the next planting. In most cases the earth falls in over the seed to cover it. Golden Harvest seeder is available for \$27 from the Lambert Corp., 519 Hunter Ave., Dayton, Ohio 45404.



Maintain a well-manicured lawn with minimal fuss by using the Parkerette lawn sweeper. The sweeper has a 30-in. sweeping width, while the basket holds up to 5 cu. ft. of clippings and debris. The sweeper weighs 42 lbs.; it sweeps with long-lasting polypropylene brushes. The Parkerette Sweeper is the maker's top-of-the-line manual sweeper and is priced at \$118. Parker Sweeper Co., Box 720, Springfield, Ohio 45501, is the manufacturer.



At selected intervals this seeder opens the soil, plants and covers a seed, then marks a new row. It comes with six different plates for spacing corn, bean, pea, radish, carrot and beet seeds. Plates also plant 15 other seeds. Precision Garden Seeder is \$45 postpaid from EarthWay Products Inc., Box 547, Bristol, Ind. 46507.



Give a crisp appearance to the border of your lawn with this duckbill edger. Two cross-ribbed tires provide traction to make straight cuts. Star-wheel points pull in ragged growth and hold it for shearing. Duckbill cutter is tempered steel. Edger DB 2, \$18, made by True Temper, 1623 Euclid Ave., Cleveland, Ohio 44115.



Rake leaves and debris, then pick them up without stooping by using the Grabber rake (\$20). A lever on the handle closes the clamshell plate around the load. It's especially helpful in cleaning up thorny rose clippings. Made in England, it's available in the United States from Encap Products Co., Box 278, Mount Pleasant, Ill. 60056.

Hand mowers: Keep your lawn and yourself in shape

Save energy and tone up your muscles by pushing a lawnmower this summer. Here's how to revivify that old 'monster,' plus pointers for buying a new mower.

Pushing a hand mower hasn't quite achieved the status of jogging when it comes to exercise. But you *can* work up a nice, warm glow behind a mower and at the same time keep up with your neighbors in exhibiting a neat, trim lawn.

If you have an old manual mower out in the garage or if you run across one at a tag sale, you can get it in working shape fairly easily and at very little expense.

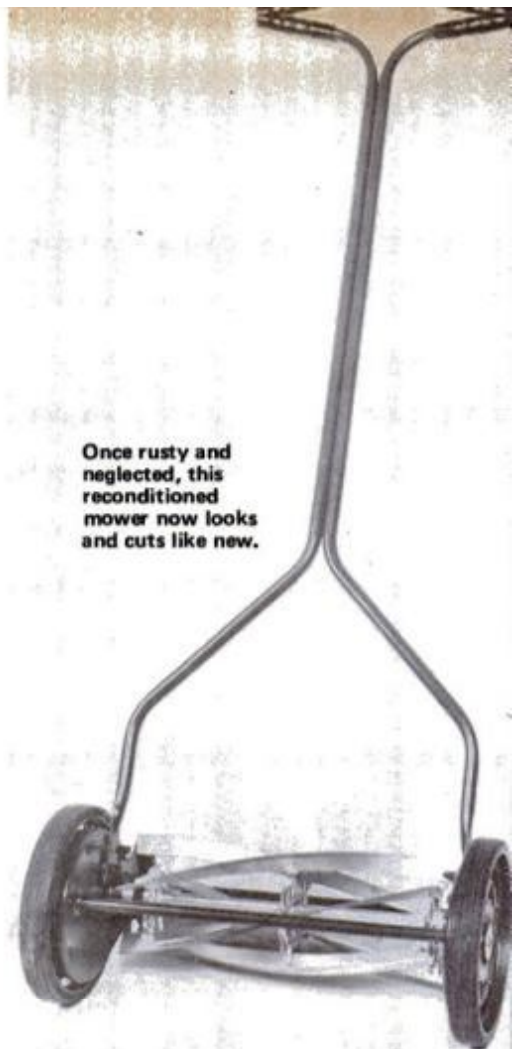
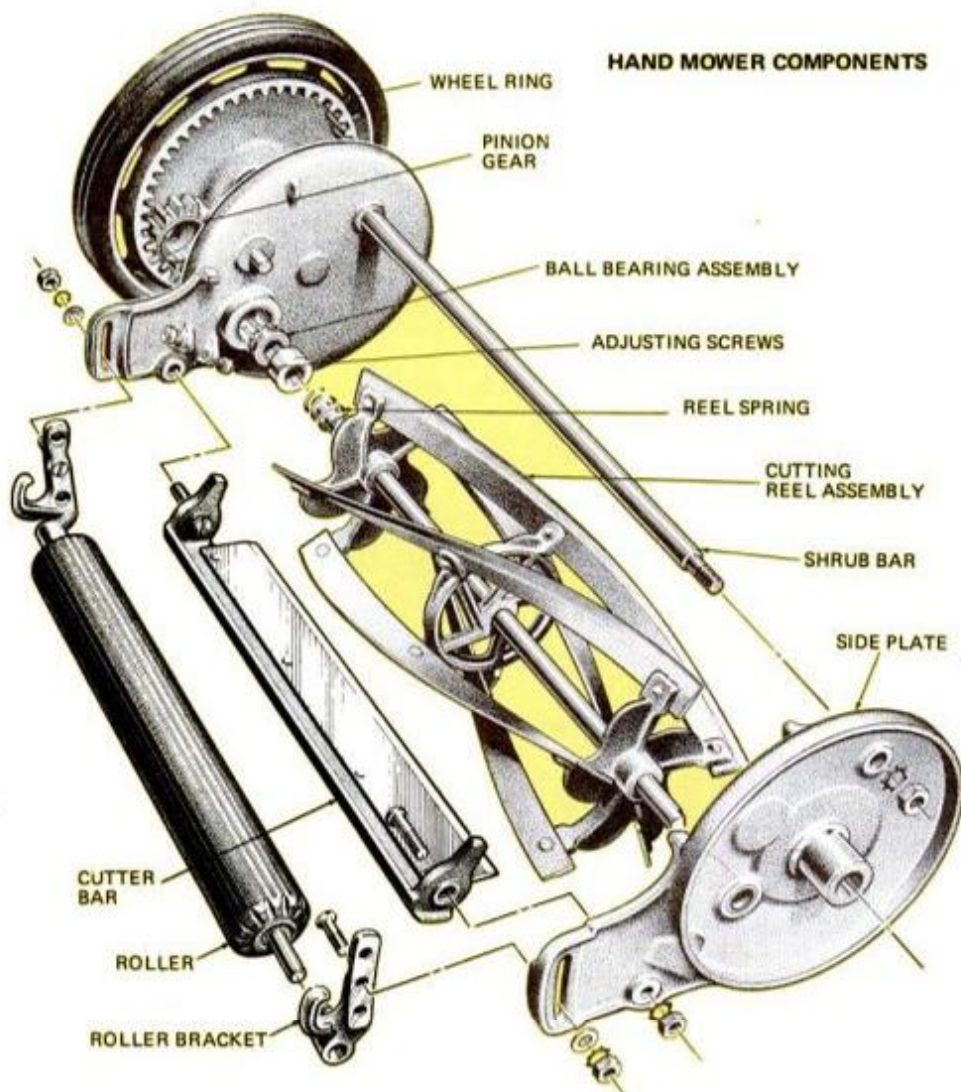
You'll find that a push mower is handy for a small suburban lawn—and it has some benefits other than exercise going for it. There's no engine to maintain, little noise, no exhaust fumes and instant shut-off when you decide to quit pushing it.

Maintaining hand mowers

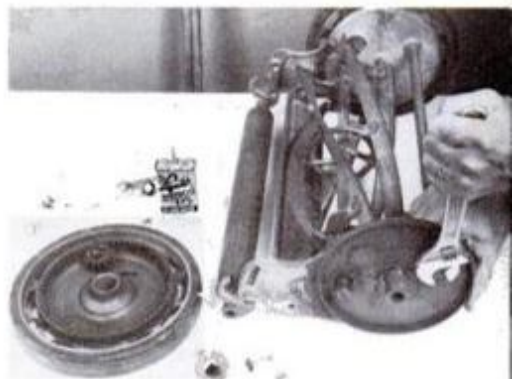
Manual mowers need minimal maintenance. Spend a small amount of your

(Please turn to page 148)

HAND MOWER COMPONENTS



Once rusty and neglected, this reconditioned mower now looks and cuts like new.



1 Strip down the mower completely. If necessary, use penetrating oil to loosen parts that are frozen by rust.



2 Pay particular attention to the reel-shaft bearings. Replace damaged balls or install an entire bearing if needed.

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For your nearest dealer, check your Yellow Pages.

For the full story, write to Gravely, 0347 Gravely Lane, Clemmons, N.C. 27012.

 **GRAVELLY**
CLARKE-GRAVELLY CORPORATION
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HAND MOWERS

(Continued from page 146)

time keeping them in shape, and they'll cut grass every time you want them to go to work.

You can make even a long-neglected reel mower work again by performing the simple maintenance procedures shown here. Basically, you'll need to disassemble it and clean its parts, replace worn or damaged parts, apply lubricant, then prime and paint it. After you've sharpened the blades, your mower will be ready for use.

Pay special attention as you disassemble.
(Please turn to page 151)



3 If rust is severe, clean parts with solvent to remove grease and oil. Apply a rust remover such as Naval Jelly. Wear rubber gloves when using the remover.



4 Apply masking tape to parts that won't be painted, including shaft ends, tires, hubs and threads. Peel off excess after carefully cutting with a razor.



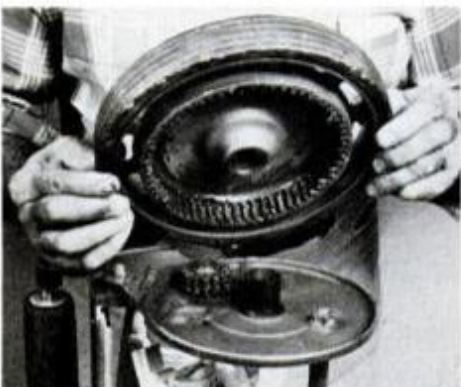
5 Apply oil to the cutting edges of the reel and cutter bar; then spray on red oxide or other primer. Oiled areas won't retain oxide. Later, wipe them clean.



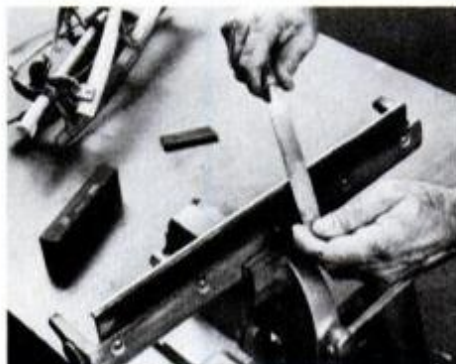
6 Spray several light coats of quality paint that can be used on metal. We used Plast-Kote Aluminum on reel and cutter, Swift Red on other painted parts.



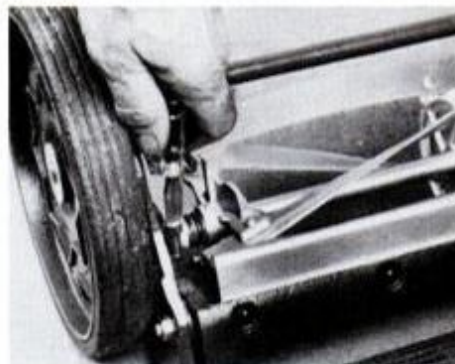
7 Thoroughly grease gears, bearings and hubs. Carefully replace wheel rings and pinion gears in their proper places or reel will turn in reverse direction.



8 Stand the mower on end to facilitate replacing the wheels. Jiggle the wheel after it meets the hub to mesh the gears.



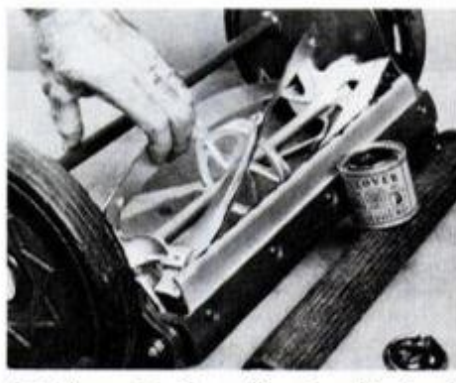
9 Sharpen the cutter bar while it is clamped in a vise. Make flat passes with a smooth, single-cut file on the top edge only. Stroke the edge with a whetstone.



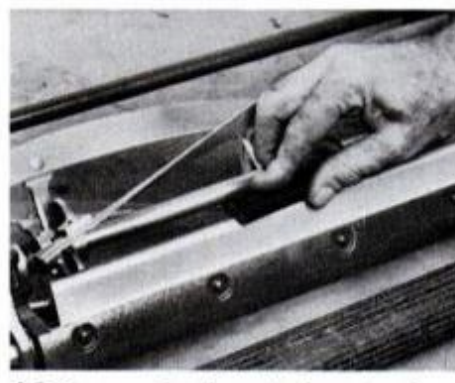
10 To sharpen reel blades, turn mower upside down, if needed, to adjust cutter bar at ends so it lightly contacts reel blades. Then perform steps 11 and 12.



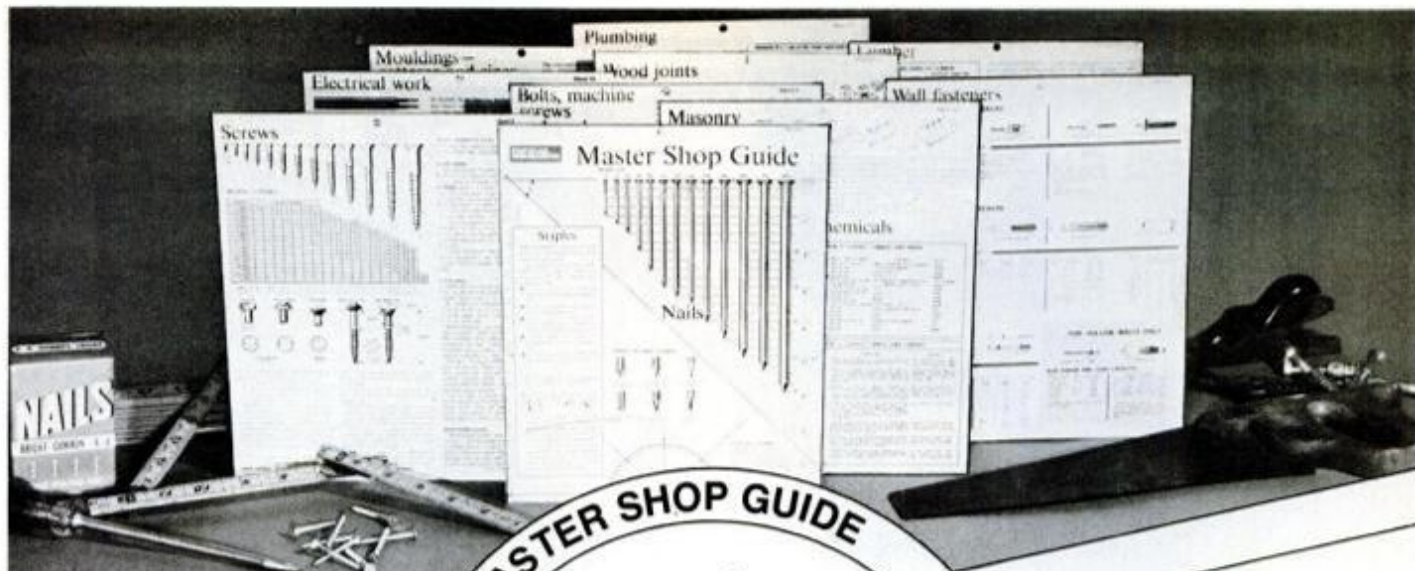
11 Apply fine-grit grinding compound, available at auto-supply stores, along the inside edge of the cutter bar.



12 Then rotate the reel backward by hand so blades make contact with the charged bar about a dozen times, lapping up the abrasive along the leading edge.



13 You can give the cutter bar a touch-up sharpening without removing it. Turn the mower over and firmly slide a whetstone flat across the bar's top edge.



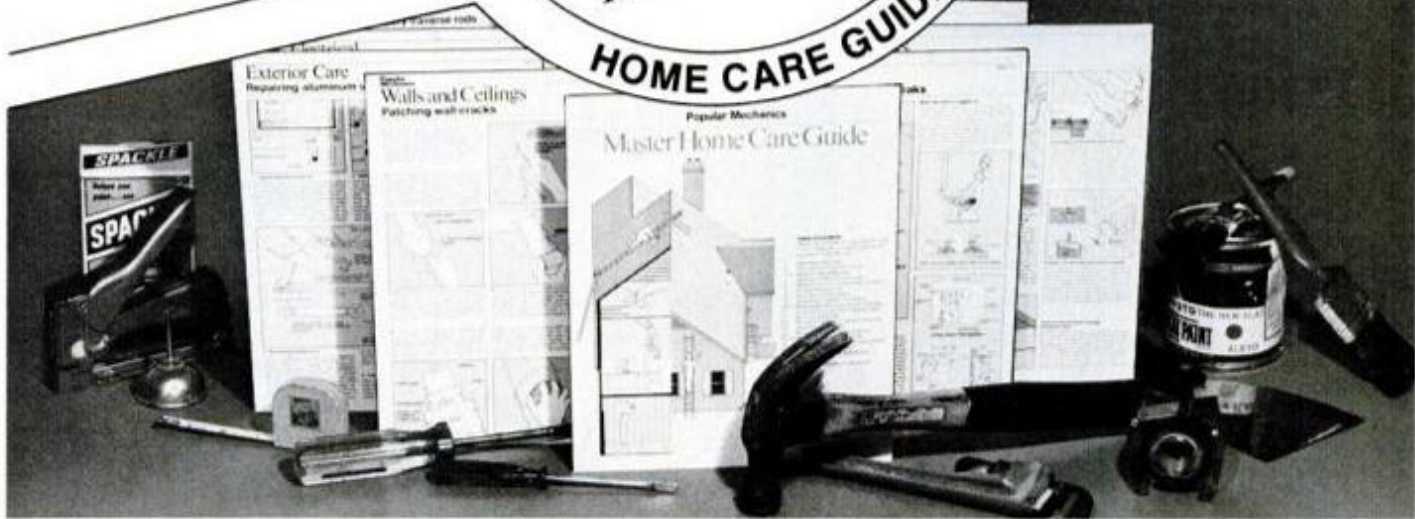
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assembled.
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operation.
Comes completely assembled with a
carrying case worth \$24.95*
\$189.95 manufacturer's suggested list price.
Easy to find in the Yellow Pages under "Saws."
Cannot swim.

*Offer expires June 30, 1980.



Sawing is believing.

HAND MOWERS

(Continued from page 148)

ble the mower, so that you can replace the parts in their original positions. If not replaced properly, some parts, such as the right and left pinion gears, will cause

problems when you try to put your lawnmower to use.

Cleaning mower parts

To get parts thoroughly clean, you may have to apply a rust remover. Wear rubber gloves as you brush the solution onto

the rusty surfaces. Then let it soak. Finally, wire-brush parts, rinse with water.

A last word of caution: Remove sticks and stones from the yard before mowing. When jammed between reel and cutting blade, they can bring the machine, and you, to a very abrupt halt. **PM**

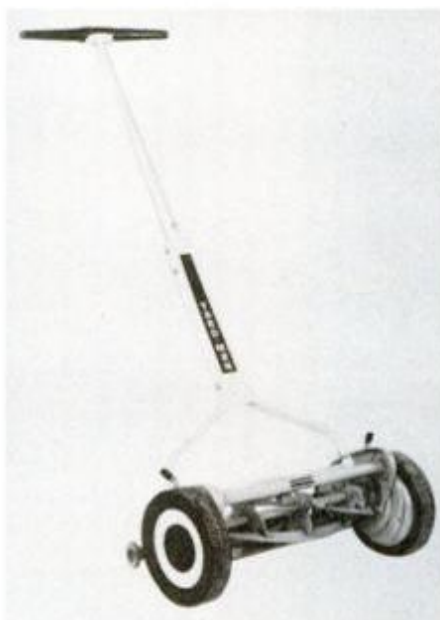
Tips on purchasing a hand mower

If you're one of the old school who remembers hand mowers as being heavy, clanking monsters that you hated to push on Saturday mornings, you'll be pleasantly surprised by today's designs. With their aluminum wheels, rubber tires and ball bearings, the hand mowers of the '80s are a new breed of cutter.

You can probably purchase a manual mower for the price of a power mower's annual maintenance. Prices range from a low of \$50 to over \$100, depending on the width of cut and the number of blades on the reel. Turf experts recommend the purchase of a unit with no fewer than five cutting blades. This eliminates wavy grass patterns that may appear after mowing.

Mower cutting adjustments

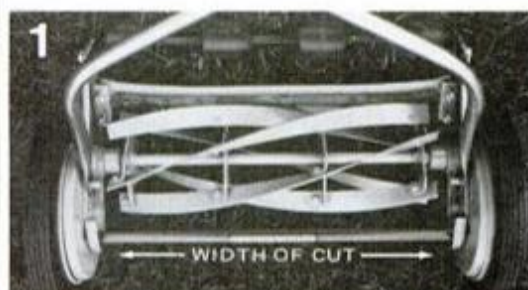
Adjustments on manual mowers are simple. On most machines, you regulate the height of the cut by raising and lowering the rear roller bar. A wrench loosens and tightens



Yard-Man's model 15515 hand mower weighs 42 pounds, cuts an 18-in. swath and has a six-blade cutting reel. You can adjust the cutting height from 1/2 to 1 1/4 in. The mower is ticketed at \$125.



Another lightweight push lawnmower that lets you stretch your muscles while you cut grass is Montgomery Ward's Model 37600, which is priced at \$97. It has six-blade reel, cuts an 18-in. swath.



1

WIDTH OF CUT



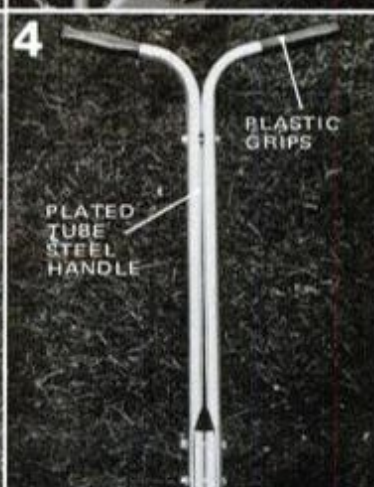
2

REAR ROLLER BAR



3

CUTTER BAR



4

PLATED TUBE STEEL HANDLE

PLASTIC GRIPS

1 American Lawn Mower's Republic model (\$60) cuts an 18-in. swath of grass.
2 The rear roller bar adjusts cutting height (1/2 to 2 1/4-in. on this model).

3 The cutter bar maintains cutting quality. It adjusts with four screws.
4 Check that mower is made of sturdy materials and has a comfortable grip.

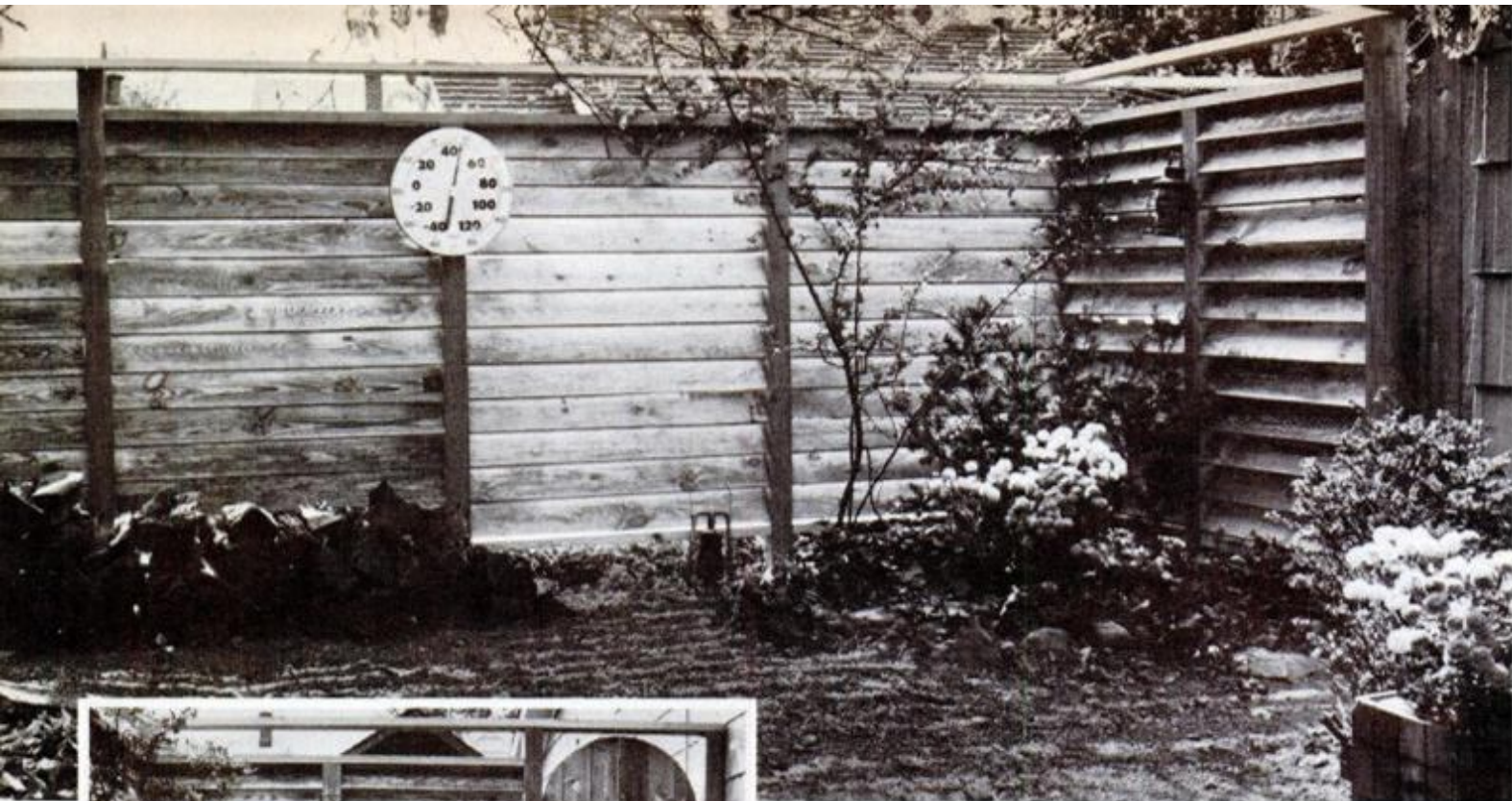
the adjustment nut as you position the roller bar.

You can maintain cutting quality by moving the cutter bar in relation to the cutting reel. The cutter bar is held by four adjusting screws. It is properly adjusted when the blades will shear paper along the entire cutter bar blade, yet the movement of the reel is free and unrestricted.

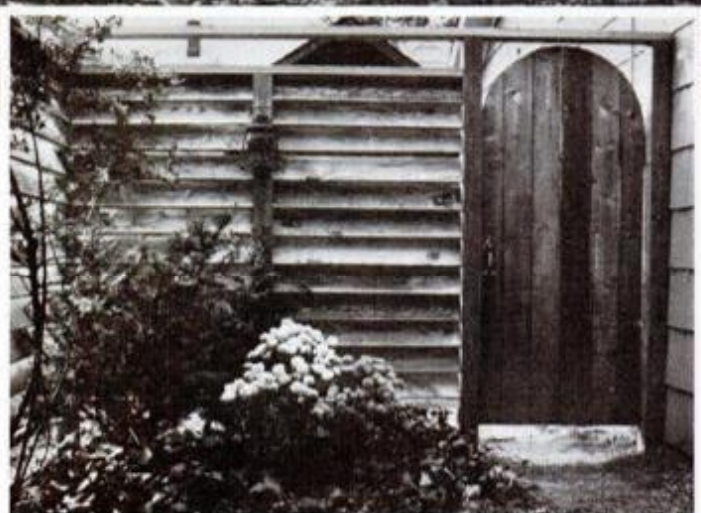
Choosing optional equipment is just a matter of deciding if you want a grass catcher. American Lawn Mower, for example, makes two catcher models for hand mowers. They have wire frames that are covered with canvas and steel bottoms. You can easily hook the catcher onto your mower and remove it when needed. A catcher can cut down on raking and yard cleanup time.

MANUFACTURERS LIST

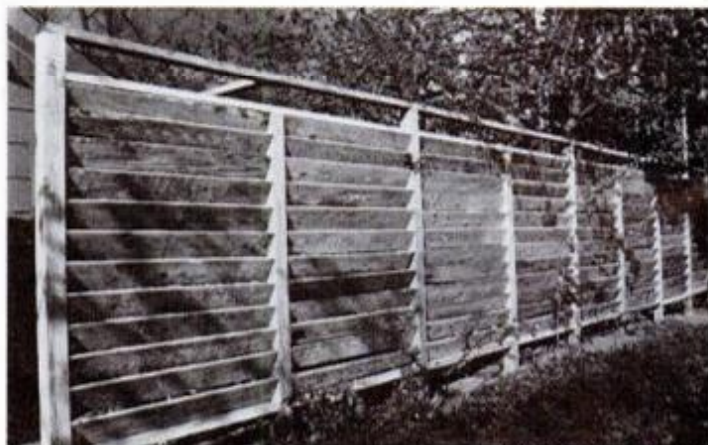
American Lawn Mower Co., 705 East 18th St., Muncie, Ind. 47302.
B&I Mercantile Inc., 8012 South Tacoma Way, Tacoma, Wash. 98499.
Burton Supply Co. Inc., Box 929, Youngstown, Ohio, 44501.
Montgomery Ward & Co., Montgomery Ward Plaza, Chicago, Ill. 60671.
Sears, Roebuck and Co., Sears Tower, Chicago, Ill. 60684.
Yard-Man Co., 5389 West 130th St., Cleveland, Ohio 44111.



Decorative design assures privacy for neighbors on both sides of the fence, yet doesn't stop air flow across property.



Short length of fence (above) at right angle to long run ties into 4x4 in the latter. View of fence from the back (right) shows that the look is good no matter which side the fence is viewed from. The Wolmanized lumber was left unstained.



PM photos: Julius Spedale

PM's Gardening and Outdoor Living Guide

Privacy fence you can build in a weekend or two

Good fences make good neighbors—especially if you build one as nice-looking as this.

by Harry Wicks

HOME AND SHOP EDITOR

There are two reasons for installing a fence along your property line:

- Security—you want to keep youngsters or pets either in or out.
- Privacy—you don't want to be ogled

by neighbors when sunbathing, swimming, entertaining or fiddling about the yard. Also, lack of adequate fencing can often lead to time-consuming conversations at inopportune moments.

If you want a fence for security reasons, chances are you will opt for one of the maximum-security types with links of steel draped between metal poles. These are generally installed by professionals, and in most cases, the owner is more concerned about strength than looks.

But if need for privacy is your motivation, you're sure to like the look of the

fence shown on these pages. Designed to be attractive to residents on both sides, our fence is built of pressure-treated Koppers Outdoor Wood (Wolmanized).

The fence shown replaced one of a similar design which was installed only 11 years ago (see *Protect Against Rot and Insects with Pressure-Treated Wood*, page 162). Though the cedar posts at that time were soaked in creosote, decay and rot actually started within five years. This time around I selected Outdoor Wood because of its resistance to termites and to decay due to moisture. Happily, the salt

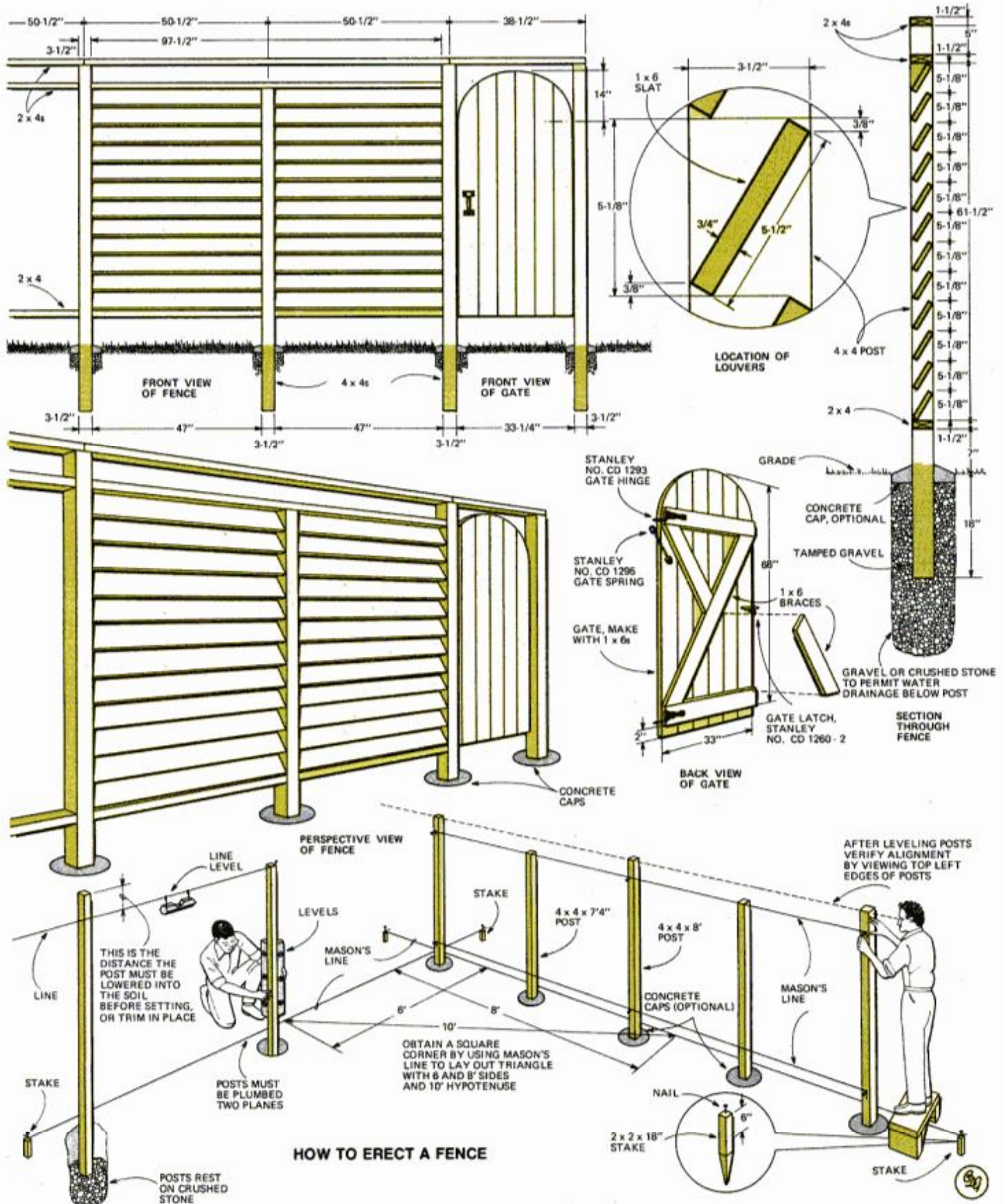
treatment does not alter the wood's characteristics. The chemicals do leave a greenish cast, which is replaced by silver-gray patina as wood weathers.

Though many people who I have talked with thought otherwise, there really is no mystery to installing a fence. Start by studying the drawings of our version so you understand clearly just how it goes

together. Then take measurements so you can work up a materials list. The fence shown consists of 4x4 posts (in two lengths), 2x4 rails at three elevations, and 1x6 lumber for the louvers. Use only galvanized nails (or mechanical fasteners, if preferred) for all connections. Conventional steel nails will rust and produce ugly stains; rusting also dimin-

ishes a nail's holding ability. Use at least 10d common nails to fasten rails to posts, and 8d finishing nails—toed through louver board edges—into the posts.

Begin by checking with your local building department to make certain your fence will comply with local fence codes. Be advised that a noncomplying fence could be ordered removed upon receipt of





Fence route is marked using stakes and mason's line. End postholes are dug first.



Stakes are driven along the line at each point where an intermediate post will go.



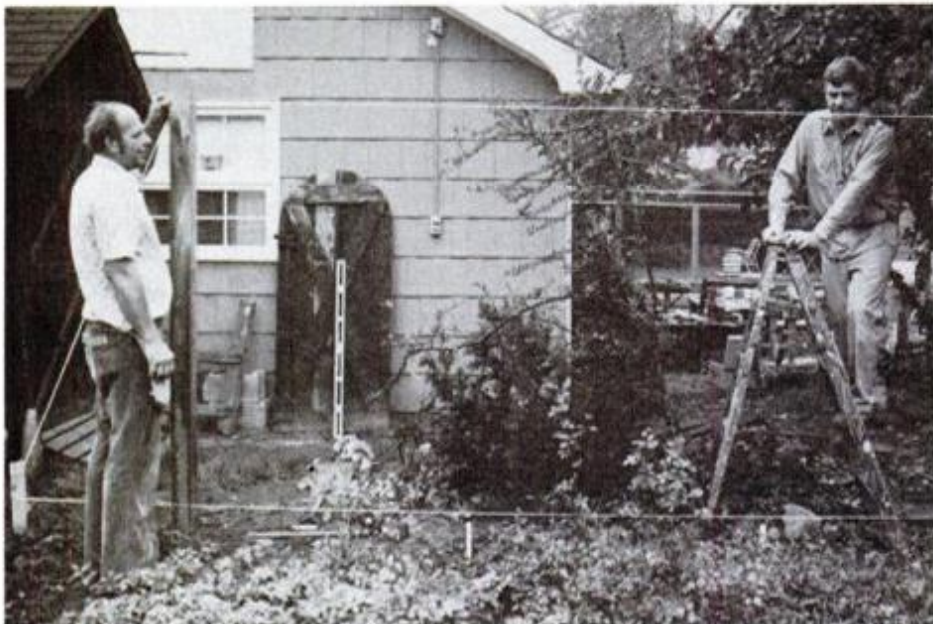
Clamshell posthole digger gives neat holes for more rigid post installation.



Each scoop removes a good amount of soil. Deposit it nearby for easy backfilling.



On the fence shown, holes were dug to about 18-in. depth; note marker stake.



Before planting intermediate posts, use line and line level to determine fence height.

a complaint; that can be a costly oversight. Codes generally spell out height and types of fences permitted as well as distance required from property lines.

Use pointed stakes and a mason's line to lay out the fence run. Dig holes for, and install, the end posts first. Use a taut mason's line stretched between tops of both posts to determine elevation for all intermediate posts. Notice that in the design shown, the post heights alternate every other post. The posts can be cut to length before they are planted by measuring from hole bottom to line. My preference is to install posts and cut them in place. This way, slight height adjustments can be made for ground contour.

The 2x4 rails on the fence are installed by toenailing at both ends. For added rigidity—on the 2x4 rail that is second from the top—do some spike-nailing at its center in short, intermediate 4x4 post.

Tips: Because of the salts impregnated

(Please turn to page 156)



It's easy to set post when one holds it plumb while second backfills and tamps.



Use a spirit level—in both vertical planes—to make certain post is plumb.



Posts can be cut before planting and set to touch elevation line, as here.

LUMBER SCAPING

It's the natural way to deck out your landscaping



So long, Old Paint.
Farewell, Fungus.
Take off, Termites.

America is decking out the out-of-doors with unpainted wood that's beautiful to look at, yet doesn't need looking after.

It's called *lumber-scaping*. And it's done with Outdoor® Wood—real wood deep-treated with Wolman® preservatives to keep it handsome, sturdy and worry-free for decades.

What nature does for

Tidewater Cypress and Heart Redwood, the Wolman process does for Outdoor Wood. Only cheaper. And you don't have to paint it or stain it, unless you *want to*.

Build yourself a beautiful backyard deck with Outdoor Wood. Leave it unpainted. Then, lay back and watch it blend in naturally with the landscaping.

That's *lumber-scaping*.

And that's living.

OUTDOOR WOOD

Wolmanized

Pressure-Treated Lumber

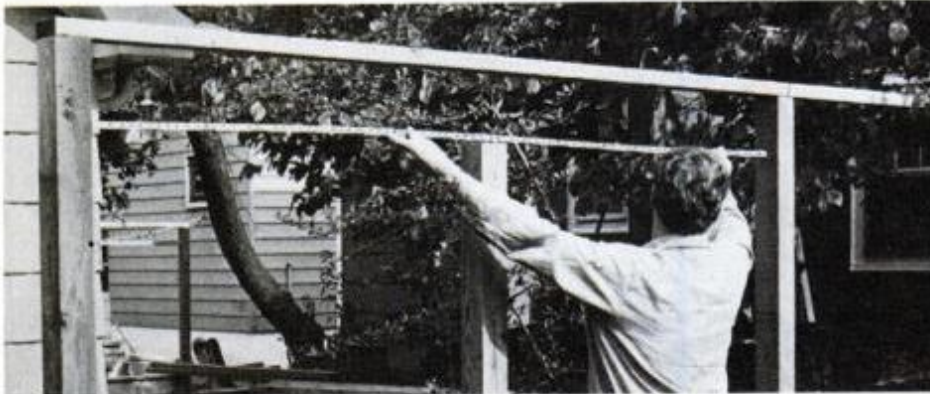
Accept no substitutes. Be sure the lumber you buy is stamped "Outdoor Wood" or "Wolmanized Pressure-Treated Lumber." For more information, call toll free 800-245-2708. In Pennsylvania, call collect 412-227-2441. In Canada, 416-826-9648. ©1978 Koppers Company, Inc.



In some cases, it is easier to install a post, then mark and cut it off in place.



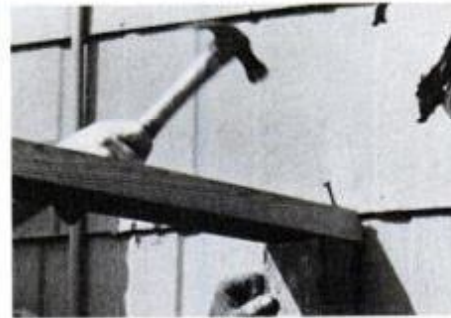
Horizontal rails are fastened using 10d common nails toenailed at joint with post.



Before measuring length of second rail, install the top rail for fence rigidity.



Second rail is toenailed to posts at both ends, and spiked to the center post.



Short length of fence with gate is secured with several nails toed into building.



Louver installation starts at bottom; a square aids placement of next board.



Board's edges are lined up with the pencil mark on post edges as shown.



Cut 1x6s slightly full to gain a force fit; tap board in using a block of scrap wood.



Nails are toed through louver face; dull points first to prevent any splitting.

in pressure-treated lumber, toenailing near an end can cause splitting. To avoid such splits, predrill pilot holes or blunt nail points slightly before driving.

You can leave your fence as is and let it change color as it weathers (my choice), or you can apply a quality outdoor wood stain. If you decide to use a stain, check for areas that may need sanding. Use a 100-grit abrasive paper to stand off any edge splinters and the like. Dust and apply stain according to directions. **PM**

Making a gate

If your fence requires a gate, you must set a 4x4 post on both sides of the opening. After plumbing and setting the first post, cut two lengths of scrap wood to equal the desired door opening. Use these as a jig when digging for and setting the second post. The gate shown was created by butting 1x6 boards edge-to-edge and holding them in that position with horizontal cross braces. An X-brace was also added, to assure a rigid gate. Drive 4d common nails at an angle for maximum holding power. The hardware used is shown on the drawing; all parts are available at well-stocked hardware stores (or can be ordered.) Gate spring makes certain the door stays closed.



Gate is assembled by butting 1x6s; the brace nails are driven at an angle.



X-brace adds strength and a rustic look. Boards can be butted or lap-joined.



After constructing gate, use a sabre saw to cut the top to the desired shape.

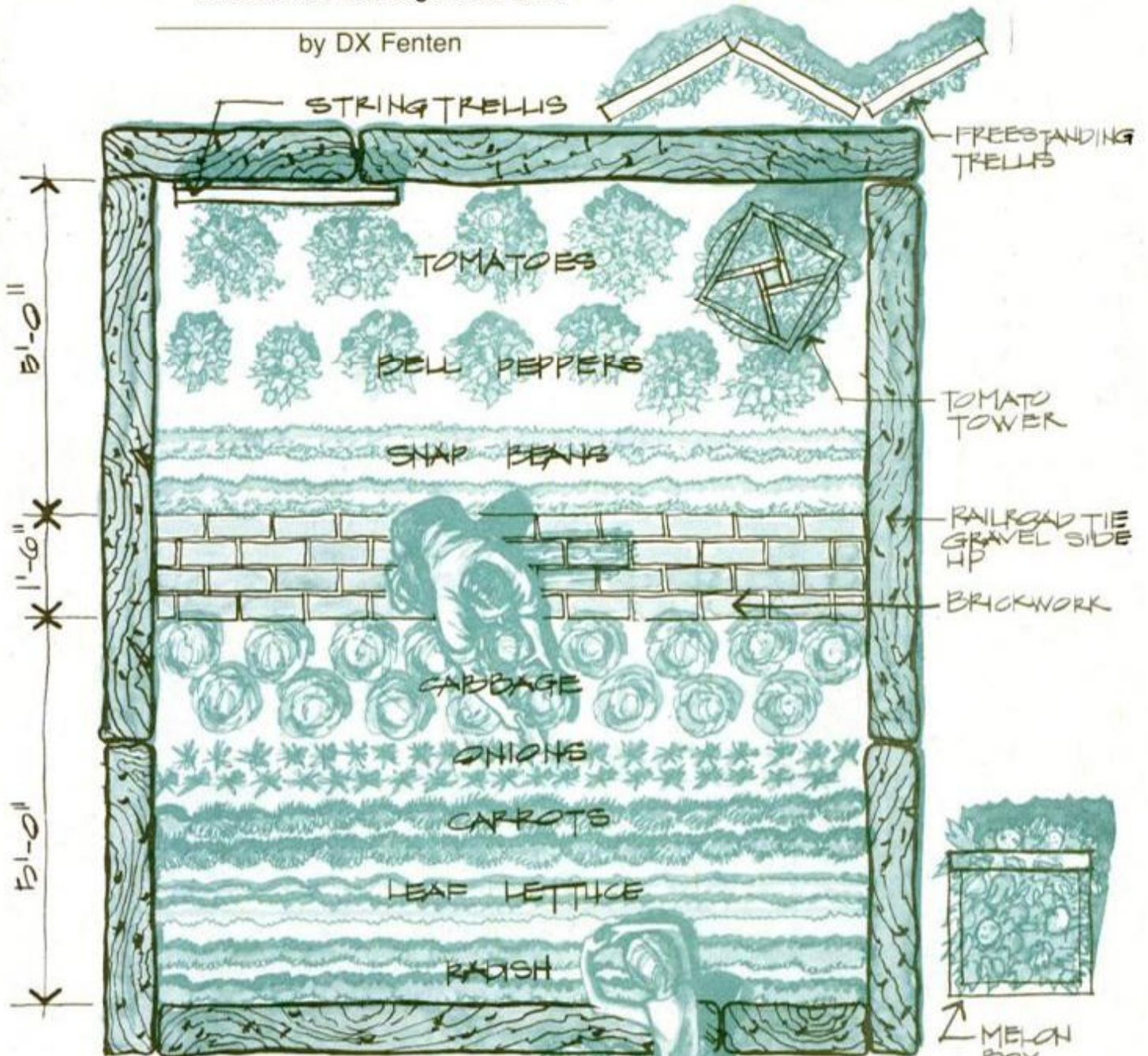
How you can haul a big harvest from a small plot

Simple garden structures can help you beat weeds and high food bills.

by DX Fenten

No more excuses. Now everyone can grow vegetables at home. Until now, the best excuse was limited space. After all, if you only had a tiny piece of land, you certainly couldn't grow much to eat. But that cop-out doesn't work anymore: If you have a spot as small as 10x10 ft., you can grow and harvest luscious vegetables starting in a few weeks and continuing through the first fall frost.

Using a system called intensive gardening, you can produce more in your small, carefully regulated plot than most gardeners tilling much larger plots. First documented by the French late in the



Intensive-gardening system produces an abundant harvest from growing area no larger than 100 sq. ft. Tight spacing blocks weeds, keeps soil moist.

ROLLING PLANTER



19th century, the intensive-gardening system has been known to give several extra crops each year. It has been adapted for American gardeners to allow special vertical-growing techniques and eliminate the huge quantities of fresh manure the French found essential.

Site selection crucial

The first step in successful gardening—intensive and all other kinds—is proper site selection. Choose a spot as close as possible to your kitchen door, one that can get a good water supply and at least six hours of direct sunlight each day. Be sure your site is at least 15 ft. away from any large trees or shrubs whose roots will compete with, and steal, vital moisture and nutrients from your vegetables. Also make sure it is not a low spot where water will collect and rot plant roots.

If you don't have such a site, make one. If the only site available is paved, do your gardening right there—in raised beds.

Wherever you find your perfect spot, carefully measure and mark it. We're using a 10×10-ft. plot because it gives everybody a chance to garden and it's a very workable size. If you have more area to spare, it's a good idea to set it up in 10×10-ft. units. Once the perimeter size has been determined, divide the garden in half and mark it. As soon as the measuring is done, dig up the soil in your gar-

den-to-be to a depth of at least 10 in. It will be better if you can go deeper.

Raising your beds

This part of the job is the true secret of successful intensive gardening. You are about to turn mounds of freshly turned, ordinary garden soil into a super growing medium. To start, use something to act as a border or retainer. If you are gardening over normal ground, the retainer should be about 8 in. tall and strong enough to hold a large quantity of enriched soil. If you garden over concrete, the retainer will have to be about 2 ft. tall. Excellent retainers can be made from railroad ties, stone or concrete, cinder blocks or specially constructed 10×10-ft. frameworks of at least 2-in.-thick boards.

To the ordinary, but thoroughly loosened, garden soil within the retainers, start adding your not-so-secret growing-mixture additives. Put in large quantities of organic matter like compost or leaf mold (if not available, substitute peat moss), sand and well-rotted manure. Add compost and manure in equal amounts.

Mix everything with the garden soil slowly and evenly. Continue to fill the retainers to just about 2 in. below the top. At this point, you will still need a couple of ingredients. Your growing mixture has enough nitrogen from the compost and manure to support plant growth, but requires potassium and phosphates. Add

fireplace (wood) ashes for the potassium and bone meal or rock phosphate for the phosphates.

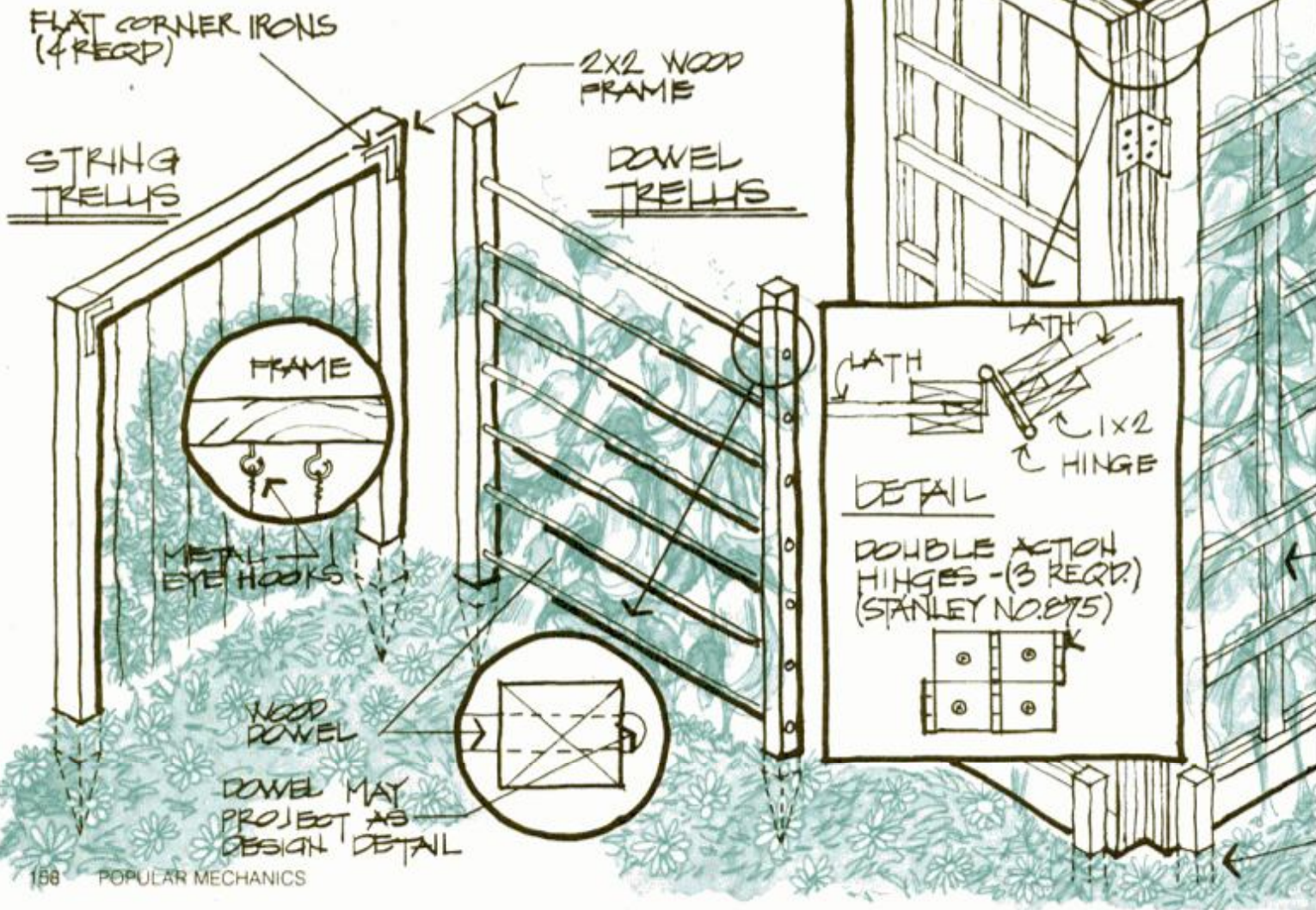
Water thoroughly

With everything added to the planting mix, you are ready to give it one last mixing and blending. Then add water to the mix until it is thoroughly soaked all the way to the bottom. After a day or two, when the uppermost part of the soil has dried a bit and becomes workable, test the soil. Grab a handful and compress it in your hand. If it makes a muddy ball, it's still too wet. If it crumbles a bit, you'll know that it's ready.

Now, put a divider across the bed, right down the middle. Make it just strong enough and just wide enough for you to walk across. Now you have two 10-ft.-long and almost 5-ft.-wide beds. You will be able to reach across from any side or in the middle without walking on and compacting the soil.

Selecting the vegetables

You can grow just about anything that appeals to you in your intensive garden,



but you ought to heed a couple of suggestions. First, select vegetables and vegetable varieties that require little space. For example, if you want to grow squash, don't plant rambling squash; choose, instead, the bush types.

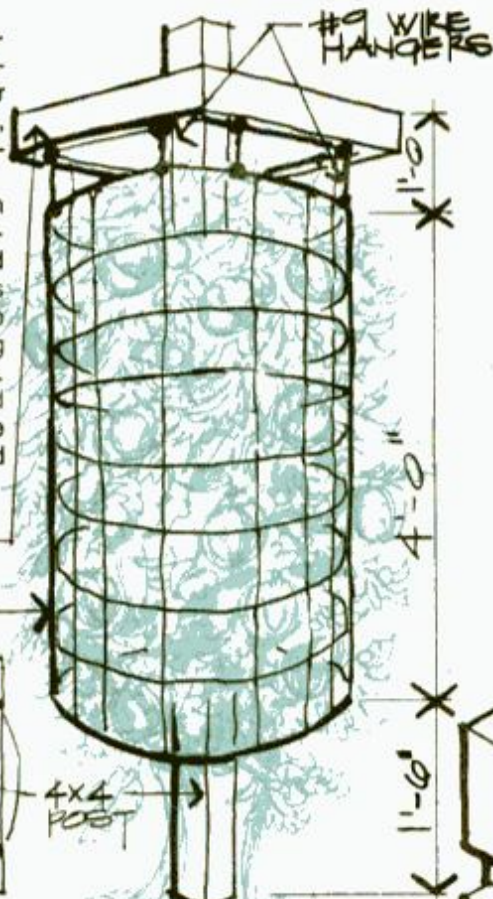
The second suggestion for maximum yield: When you run out of room horizontally, start growing vertically. With the aid of some easily constructed growing aids (illustrated on these pages), your crop can grow up instead of across, adding greatly to the amount of growing space. Tomatoes should be staked, melons and squash should grow on a support. If the fruits become heavy, suspend them in old panty-hose legs.

Some construction tips

As you start planning the building of the structures you'll use to increase the usable space in and around your intensive garden, first consider the building materials. Wood is favored for these structures, but it won't last more than a season or two unless you guard against rot.

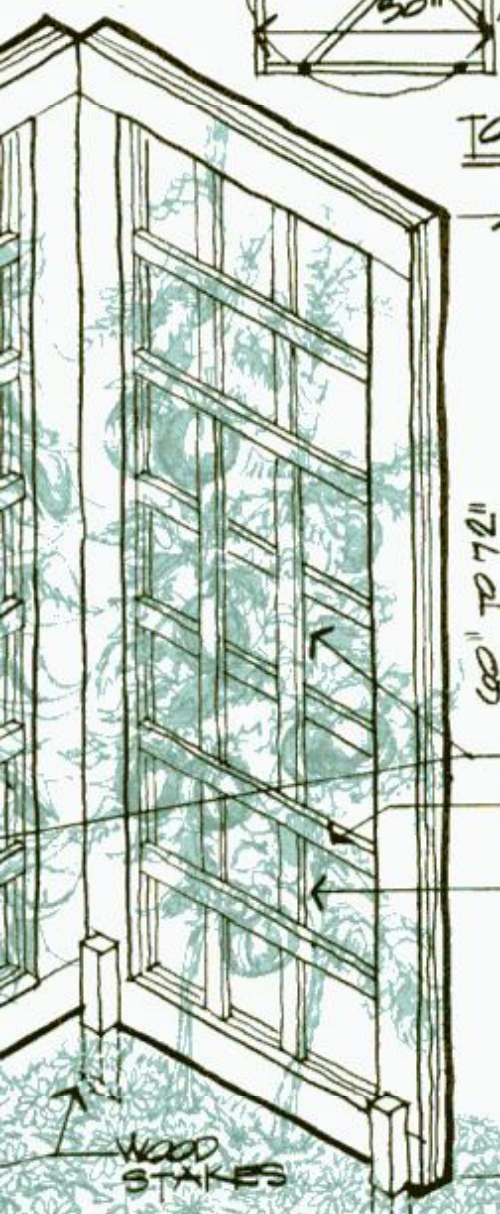
The best woods to use for these structures, because of their resistance to decay and insect infestation, are pressure-treated types. As alternatives, you can also purchase redwood, western cedar or cypress.

If you are going to treat lumber with a wood preservative, do the entire job while

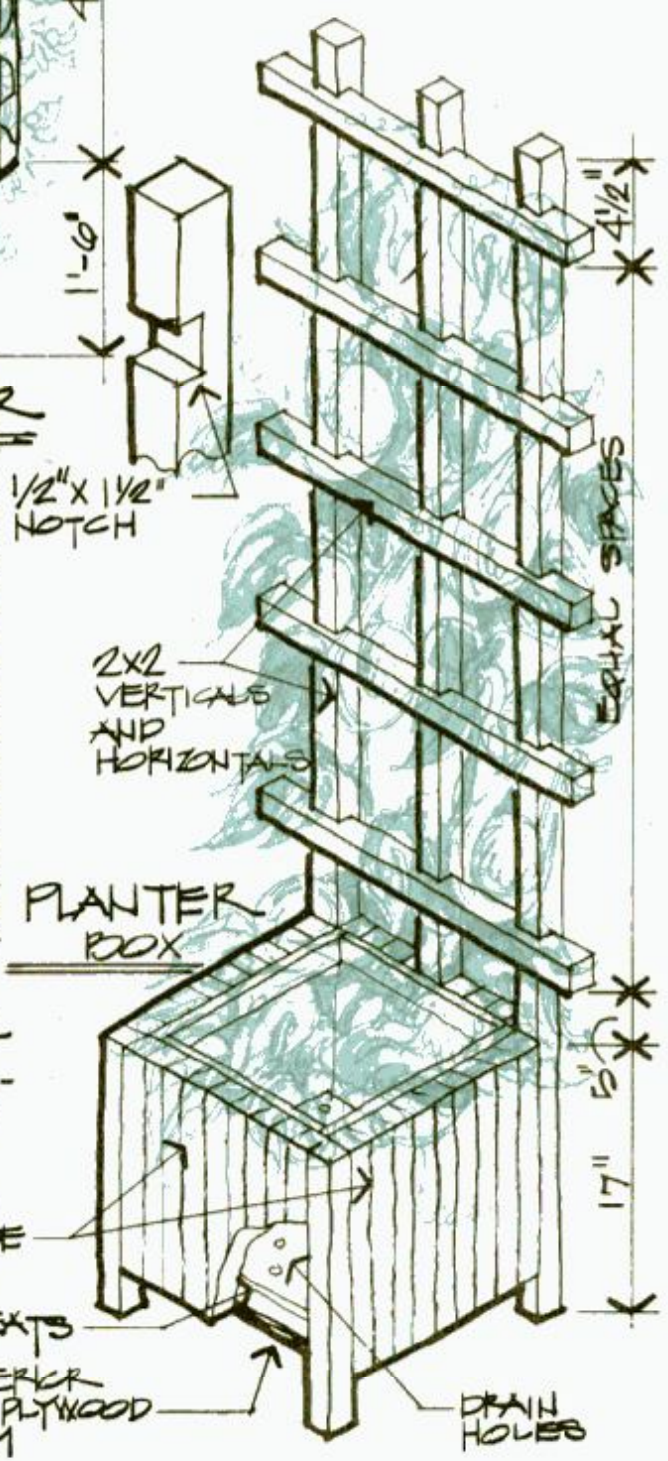


TOMATO TOWER

Easy-to-build trellises increase efficiency in small plots, provide access to ripe vegetables, reduce weeding. String trellis (far left) is ideal for peas, beans, other light vegetables. Dowel and free-standing trellises support tomatoes, cukes, other heavier vegetables. Tomato tower (above) protects crop from dogs and cats, offers solid support around plant. Planter box (right) is easy-to-move conversation piece. Panty hose holds ripening melons.



- LATH MATERIAL
- 6 HORIZONTALS - EQUAL SPACES
- 2 VERTICALS - EQUAL SPACES
- 2x2 SIDE PIECES
- 1x2 CLEATS
- 3/4" EXTERIOR GRADE PLYWOOD BOTTOM



PLANTER BOX

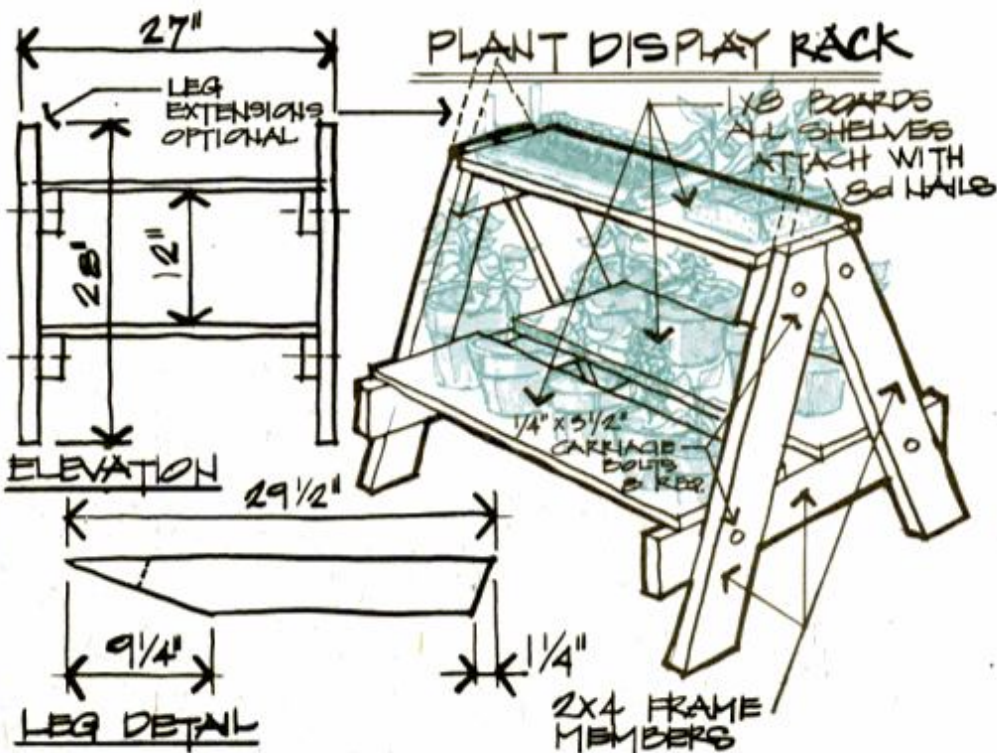
the parts are unassembled. Pay special attention to the spots most susceptible to rot and decay—wherever the wood will touch wet soil and wherever two pieces are held tightly together. Check with your lumber people on the toxicity of the preservative. Use only those preservatives that have no effect on a wide variety of plants.

Almost any good exterior paint also offers some protection against rot. The best choices are the water-based latex paints made from acrylic resins. These last longest, fade or oxidize least and offer the decided advantage of quick, easy clean-up.

On any structure that requires mesh, it's a good idea to stay away from metal. Instead, to avoid burning tender plants, substitute meshes that are made of string or plastic.

Secret's in the spacing

When you have decided on which vegetables to grow, determine the amount of space each will require. Be as accurate as possible. You can get a good idea of the spacing from the seed packet, but be careful. Seed packets usually tell you to plant in rows, with large spaces in between. Your mightily enriched soil eliminates the need for those "wide open" and wasteful spaces—one major way of in-



Plant displayer (above) is ideal for fragrant exhibit of herbs and spices. It's easily moved to keep plants in sun. In winter, cut back herbs, carry displayer inside for continued growth. Ideal locations for it are sunny kitchens or bathrooms.

creasing the yield of your garden. You can still nourish and reach everything without any problem.

For example, if you were planting beans in a "normal" garden, you would plant seeds about 3 in. apart in rows 24 in. apart. In intensive gardens like yours, you'll plant those bean seeds about 3 in. apart, with no rows, over the entire area you reserved for beans. Your richly fortified soil has the capability to support all those beans and assure you of heavy harvests.

Shading helps, too

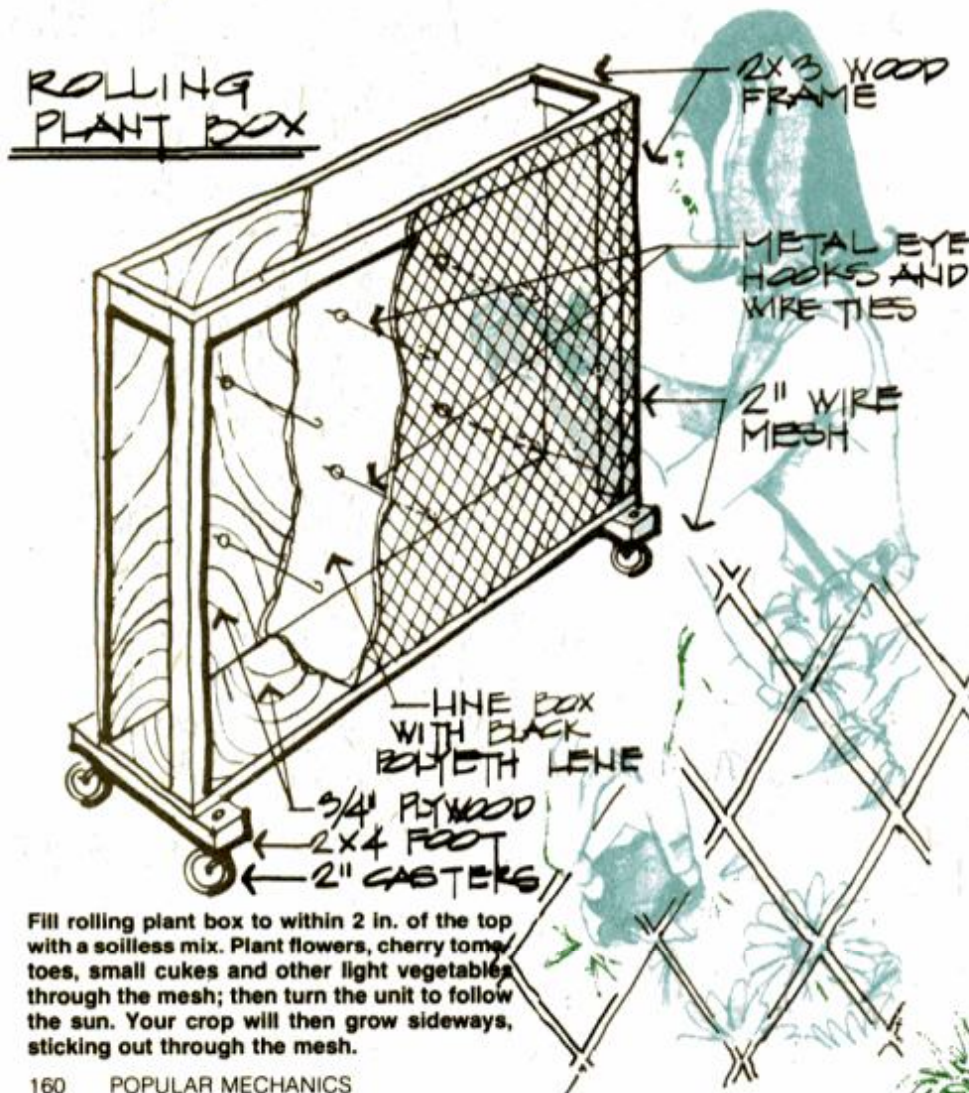
There's still another advantage to this kind of planting. Because the plants grow closely together, the leaves form a kind of canopy over the soil's surface. This keeps some of the sun from hitting the soil, eliminating most of the usual weeding. (Weeds need sun to grow.) It also cuts down considerably on the amount of water that evaporates from the soil, saving you the time, labor and money involved with watering.

But be very careful about the watering. You must never allow the soil to dry out. As soon as it appears that the top several inches of soil have become dry, start watering. Don't trust your eye entirely. Check to see if the soil is dry to the touch.

Keep it working

The last secret of intensive gardening is to keep it working. Just as soon as you harvest one crop, put in another. The soil mixture has been formulated to support many crops over a whole season. Keep it full and you'll have the most delicious, beautiful vegetables you've ever seen or eaten—and all of them from a trim garden that itself eats up very little of your lawn space.

ROLLING PLANT BOX



Fill rolling plant box to within 2 in. of the top with a soilless mix. Plant flowers, cherry tomatoes, small cukes and other light vegetables through the mesh; then turn the unit to follow the sun. Your crop will then grow sideways, sticking out through the mesh.

19 mg. "tar", 1.3 mg. nicotine av. per cigarette, FTC Report MAY '78.

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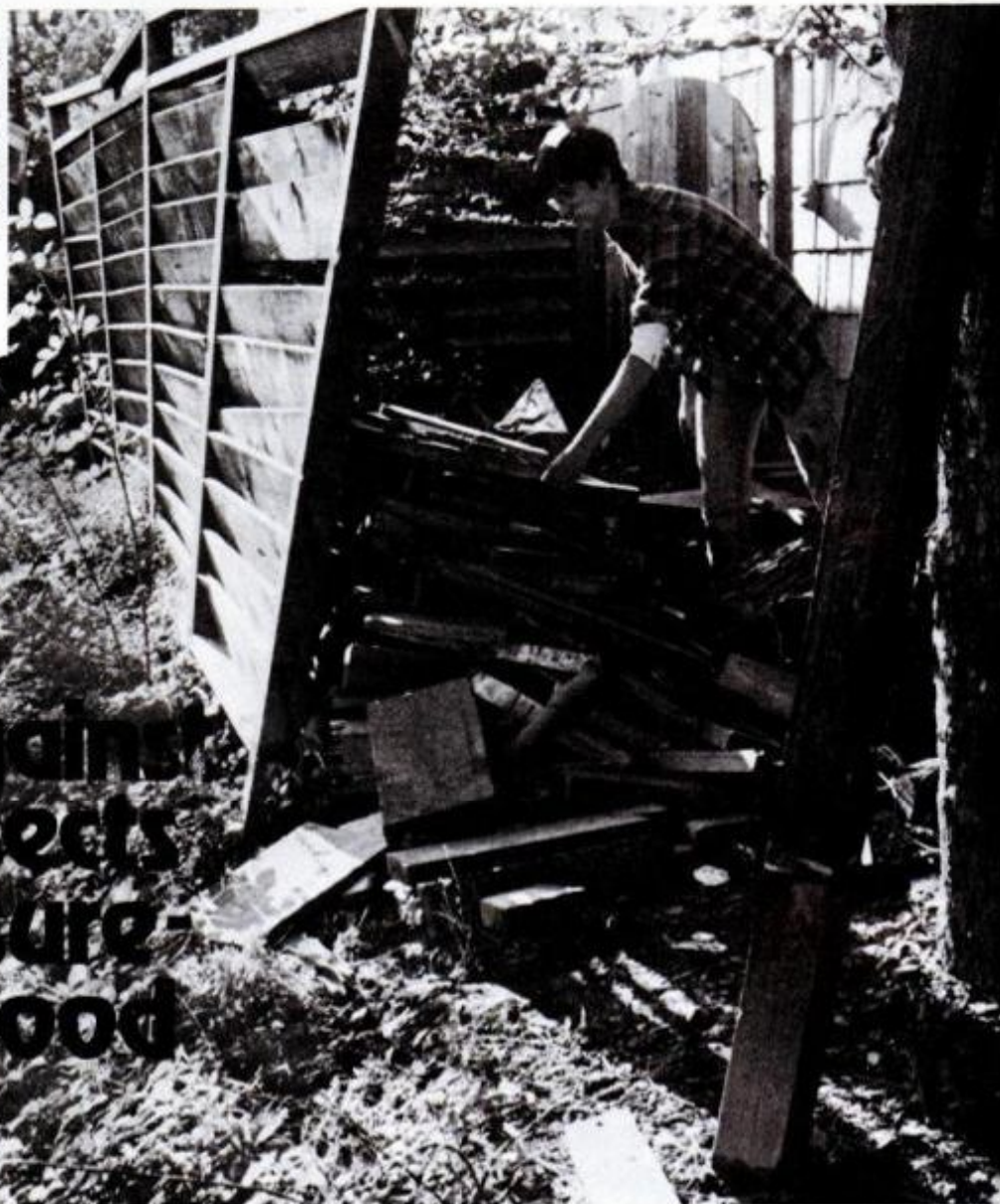
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Non-pressure-treated posts failed because of rot below grade, reducing the 11-year-old fence at right to fireplace kindling.



Protect against rot and insects with pressure-treated wood

Build outdoor projects that are heirlooms—not risks—with super-tough wood.

by John Gaynor and Bob Newbanks

There are three very good reasons for using pressure-treated wood. One, it's likely to outlast you—even when used in constant contact with soil and water. Two, termites cannot destroy it. And, three, it costs less than naturally decay-resistant species.

Pressure-treated wood does, of course, cost more than untreated lumber. One lumberyard quoted "about \$4" for a 4-in. x 4-in. x 8-ft. No. 2 untreated pine post and charged about \$1.25 more for a similarly graded, treated post. (The same yard charged about \$18 for a cedar post.) The extra cost, however, is well worth it in

situations which invite decay or damaging insects.

While termites can be controlled by yearly inspections and on-site treatment, wood decay is more insidious. Often you don't know about the damage until it's too late. The simple fact is that untreated wood, when exposed to moisture for any length of time, whether it's from plumbing leaks or improper grading around the house, will rot.

Michael Levi of the School of Forest Resources at North Carolina State University in Raleigh, N.C., explains what happens:

"Moisture penetrates the minute pores of the wood, allowing tiny fungus strands to grow within the cells of the wood. Eventually the walls of the cells dissolve. If the affected wood is subjected to a load, it will fail.

"One type of fungus first decays moist wood and then, through its own rootlike strands (rhizomorphs), travels several



Darkened areas of 2 x 4 sections, formed by applying preservative-sensitive reagent (test solution), show extent of preservative penetration for three methods.

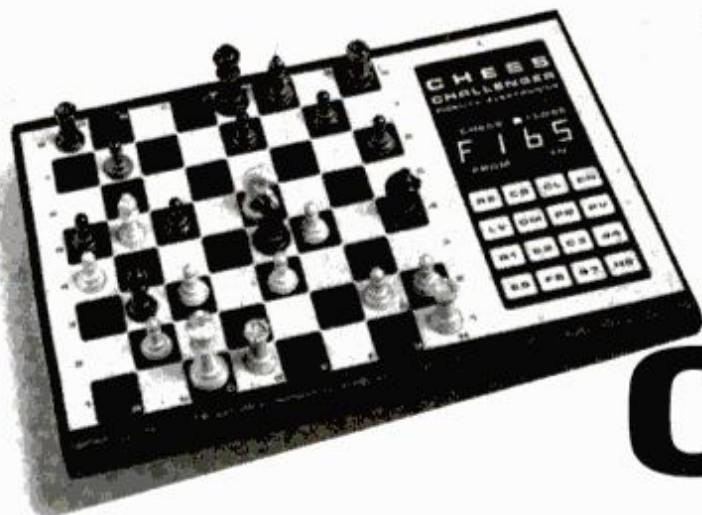
feet and decays otherwise dry wood. This fungus is commonly known as "dry rot." The key to survival from ordinary rot and dry rot in wood is dryness. Fungi cannot decay dry wood. If moldy or decaying

(Please turn to page 164)

"Chess Challenger-10 Wins Microchess Tourney"

—Personal Computing Magazine

February, 1979



Genius Offspring

"Its successor, the new Chess Challenger '7' is infinitely more powerful!"

—S. Samole

President, Fidelity Electronics

Chess Challenger-10 did more than win the Penrod Memorial Microchess Tournament, it literally trounced all opponents. Personal Computing Magazine, February, 1979, reports, "Chess Challenger-10 emerged as the easy victor with ten wins, two draws and no losses."

All Top Name Performers

There were no amateurs in the championship playoff. Every contender bore the brand of a well-known electronic chess game, and each was accompanied by its entourage of coaches, programmers, and engineers. After each contestant had played all of the opponents in round robin fashion, the brilliant Challenger-10, stood far ahead of its second place runner-up.

Nobody Knew

Unknown to the other companies, the undefeated tournament leader was being retired after the contest. Taking its place was a far more powerful chess computer, the Challenger "7". This new micro-computer had already beaten the official undefeated champ during a series of pre-tournament warm-up games at the factory. Its engineers explain that it is simply 14 months ahead in technology, in finer algorithm sophistication and in its superb performance.

Improve Your Game to Near Brilliant

Within its seven different levels of play, you can enjoy every degree of chess competition, from beginner to tournament skill. Its

total flexibility lets you change games mid-stream or switch sides with the computer to see how it would handle your dilemma. You can add pieces to your side or take away the computer's Queen. It is a superb teacher!

Touch the PV key and the "7's" total recall memory will verify every piece position on the board. You can even set up hypothetical encounters to test its reaction at each level.

Fidelity's Challenger "7" is able to analyze over 3,024,000 board positions. It masterfully handles over one thousand book openings and will respond to any deviation. Academic openings as Sicilian, French, Ruy Lopez and Queen Gambit Declined, are just some of the challenges to keep you on your toes.

It Knows Every Rule in the Book

The Challenger "7" will permit you to castle or perform an En Passant capture or do so itself, if that is its best move. When your pawn has reached the eighth rank, it will be automatically raised to a Queen, unless you tell the computer to promote it to another piece. It will take on any player and sharpen his skills considerably...but it won't permit illegal moves.

Sound Signals

You just cannot believe the chess I.Q. of this phenomenal unit. The Challenger "7" has a deep audio feedback which sounds to acknowledge your move, and double beeps when the computer has made its response.

At Level 1, its average response time is 5 seconds. At Tournament Level 7, the Challenger makes championship decisions in just 3 minutes.

Unbeatable in Price As Well As Play

Best of all, the Chess Challenger "7" is the most affordable electronic unit you can own. It is just \$89.95 complete with Staunton designed pieces and UL approved 110V AC adaptor.

All pieces are magnetized, to stay where you place them on the permanent metal board. The set is mounted in a simulated wood-grained housing which measures 12 1/2" x 8" x 1". Bright, one-half inch tall LED electronic digits, provide unmistakably clear readout. The unit is backed by a 90-day manufacturer's limited parts and labor warranty.

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Final Results

Reprinted Courtesy of Personal Computing, February, 1979, P. 66. (Darker lines ours.)

CONTESTANTS	OPPONENTS									Games Won	Games Drawn	FINAL SCORE	FINAL POSITION		
	#1	2	3	4	5	6	7	8	9						
1 MICRO-CHESS 1.0 (Heath H-8)	W	X	½	0	1	0	0	0			1	3	8	2½	7*
2 MICRO-CHESS 1.5 (TRS-80)	W	½	X	½	½	0	0	0			0	5	7	2½	6*
3 MICRO-CHESS 2.0 (PET)	W	½	1	X	1	0	0	½			3	4	5	5	4
4 CHESS CHALLENGER (3 Level)	W	1	1	½	X	0	½	½			2	5	5	4½	5
5 CHESS CHALLENGER (10 Level)	W	1	1	1	1	X	1	½			10	2	0	11	1
6 BORIS	W	1	½	1	1	0	X	1			7	2	3	8	3
7 SARGON I (TRS-80)	W	1	1	1	½	½	1	X			6	5	1	8½	2
8 ATARI Did not play	W								X						

* Note: Microchess 1.5 wins 6th place over Microchess 1.0 by virtue of the tie breaking analysis of relative strength of opponents

Please send me _____ Chess Challenger "7(s)" at \$89.95 plus \$3.00 for shipping and insurance. Ill. residents add 5% sales tax. If not satisfied, I can return it within 10 days for a refund.

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Master Charge # _____ Exp. Date _____

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PM-03

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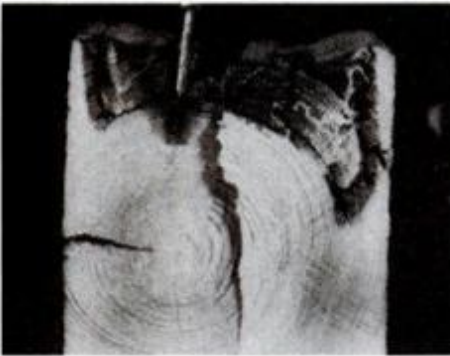
801 Green Bay Rd., Lake Bluff, IL 60044

A DIVISION OF UNITED EDUCATORS, INC.

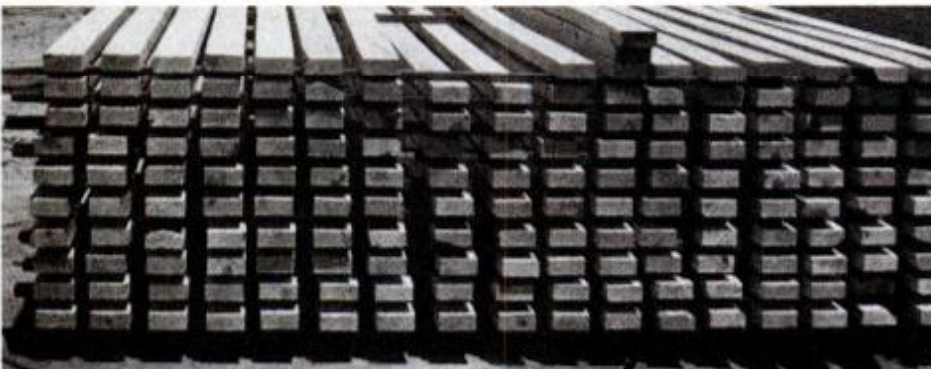
How wood rots



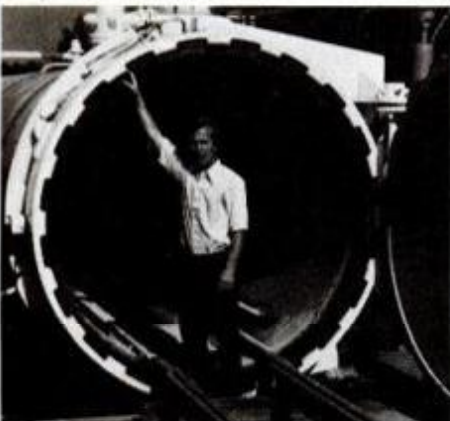
Warm, moist conditions, as are found in damp crawl spaces, promote the growth of fungi from microscopic spores which are present in soil and air. Roots of fungi weaken wood structure and can cause joist failure (left). Untreated cedar 4 x 4 (below) used in walkway rotted where decking nail allowed moisture to penetrate.



How wood is pressure-treated



Wood is first air- or kiln-dried (above) to 25 percent moisture. Next, it's stacked and banded on tram (left) and loaded into treating cylinder (bottom left). Preservative is then forced into wood. Typically, a vacuum is formed in cylinder and chemicals are introduced. Afterward, excess solution (below) is returned to storage tank.



lumber is surface-treated without the source of moisture being eliminated, it will almost certainly continue to rot.

"Rot is spread by microscopic spores, present in the air and ground at all times. They cannot attack dry or pressure-treated wood. With the right amount of moisture and temperature over 40° F., failure-causing decay can take place within two years."

Although the heartwood of certain trees (redwood, cypress and cedar) is not susceptible to rot, younger trees with more sapwood are now being cut. Heartwood is the oldest and innermost portion of the tree. The dwindling supply of this grade of wood and high cost make pressure-treated wood the economical choice.

Using pressure-treated wood

Pressure-treated wood should be used for a lot more than just fence and mailbox posts. Recommended applications include sill plates, joists in crawl spaces where moisture control and air circulation is difficult, and structures exposed to the weather, such as decks, patios, walkways, beach houses and cold frames.

In many areas of the country, entire below-grade masonry foundation walls are being replaced with treated 2 x 4 lumber and treated exterior-grade plywood. This is highly specialized construction, however, and if you are contemplating it, have your architect or engineer write to The American Plywood Assn., Box 2277, Tacoma, Wash. 98101, for information on All-Weather Wood Foundations.

Note: Since fasteners can be the only weak point in pressure-treated wood construction, use only hot-dipped galvanized or other noncorrosive nails, lags, screws or bolts.

Pressure-treating process

First the lumber must be either air- or kiln-dried to a moisture content of not more than 25 percent. The lumber is then stacked and banded on a tram which is pushed into a treating cylinder and sealed inside. The cylinder may be 6 ft. in diameter by about 50 ft. long, enough to accept 10,000 to 11,000 board feet of lumber (that's a banded series of stacks about 45 ft. long x 5 ft. high x 4 ft. wide).

Next, pressure in the cylinder is reduced, pulling air from the pores of the wood, and the chemicals are introduced. The pressure is then increased, and the wood literally "gulps" the chemical. Innermost boards receive the same penetration as those on the outside of the banded stack.

The wood remains in the treating cylinder several hours, depending on the species of wood, while the treating engineer monitors the many valves and gauges to assure the desired degree of treatment.

After pressure is returned to normal, the unused chemical is pumped back into the storage tank. When the cylinder door

(Please turn to page 166)



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All-Weather Wood Foundation is constructed of pressure-treated lumber and plywood. The concrete slab is poured last to cover wood sills and anchor the wall studs.

INTENDED USE TYPE TREATMENT STAMP OF AMERICAN WOOD PRESERVERS BUREAU

1979 OSMOSE

TP AWPBLP 22 AWPB

CCA-C GROUND CONTACT TSO DRY. 40

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YEAR TREATED FIRM OR TRADE NAME AMOUNT OF CHEMICAL

1979 Wolmanized

F&R LP-2 RET. 25 AWPB

CCA-C

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SALT WOOD PRODUCTS CO. INC.
COVE CITY, N.C.

LOCAL LAB AUTHORIZED BY AWPB FOR INSPECTIONS TYPE OF CHEMICAL

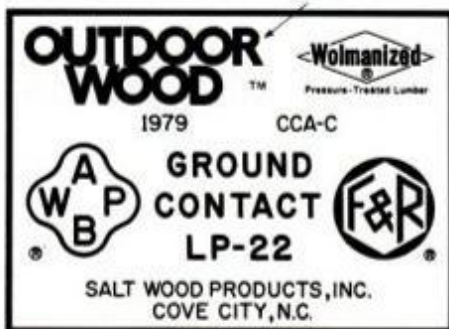
This stamp indicates that preservative retention is suitable for above-ground use only.

is opened, any "drippings" are gathered in a reclaiming pit and are also returned to the storage tank.

Chemical preservatives

Although creosote and pentachlorophenol are excellent preservatives for severe exposure conditions such as those encountered by pilings, railroad ties or utility poles, the most common form of chemicals used to pressure-treat lumber and plywood in residential construction are referred to as "waterborne preservatives." These chemicals will not leach out into the soil, and treated wood, when dry, can be painted or stained. A few of these

OUTDOOR WOOD TRADEMARK ASSURES BUYER THAT LUMBER GRADE IS NO. 1 OR BETTER AND THAT IT'S DRY BEFORE AND AFTER TREATMENT



chemicals are: acid copper chromate (ACC), ammoniacal copper arsenate (ACA) and chromated copper arsenate (CCA).

When you go to buy

Everything you need to know as a consumer is indicated on a stamp that should appear on each piece of pressure-treated lumber you buy.

First look for the seal of the American Wood Preservers Bureau. It assures you that the product has been tested to the Bureau's standards. Second, note whether the lumber is suitable for your needs. Pieces designated LP-22 ABOVE GROUND USE ONLY .25 should only be used where wood will not contact soil, as with decking. Pieces marked LP-22 GROUND CONTACT .40 are suitable for on-ground and in-ground applications, such as for sleepers under a shed floor or fence posts. FDN FOUNDATION .60 denotes wood to be used in below-grade wood foundations.

The .25, .40 and .60 designations may not always be indicated, but they denote the pounds of dry chemical per cubic feet of wood treated. A retention of .40 has more preservative than .25.

If you should have a specific problem or question concerning the use of pressure treated wood, contact the American Wood Preservers Institute, 1651 Old Meadow Rd., McLean, Va. 22102. **PM**

MANUFACTURERS LIST

Koppers Co. Inc., Koppers Building, Pittsburgh, Pa. 15219. (Outdoor Wood, Wolmanized and Wolman are Koppers trademarks.)
Osmose, 980 Ellicott St., Buffalo, N.Y. 14209.
To locate a manufacturer in your area, write to the American Wood Preservers Assn., Suite 4444, 7735 Old Georgetown Rd., Bethesda, Md. 20014.

BRING ON YOUR TOUGH JOBS



Mow 3 acres in an hour. Plow 8" deep. Front load 1/2-ton bucket loads into a pick-up. Till, cultivate, bulldoze, blow snow... get your tough jobs done fast!

Power King's dependable cast iron engine provides high-torque workpower. Rugged, all-gear drive delivers nearly 100% of engine power to big, ground-gripping drive wheels... squeezes more work out of every drop of fuel. Ground clearance up to 19" lets you cultivate tall crops and work in rough ground.

Get American-made Power King in 12, 14, 16 and 18 hp models and over 20 man-sized attachments. See your Power King Dealer for a test drive or write for free catalog.

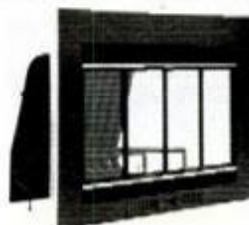
POWER KING

ONE TOUGH TRACTOR

ENGINEERING PRODUCTS CO., INC. 1005-K-3 Anoka Ave., WAUKESHA, WI 53186

Order Your Thermograte® Home Heating Appliance Now . . . Pay For It Later!

Due to the high demand resulting in shortage of our quality woodburning units, and the cost, you may not have purchased the Thermograte® Fireplace Furnace or Fireplace/Stove you need. Order now and have 12 months to pay!



No interest or carrying charge. 6-month trial. Lifetime warranty on stainless steel tubes against burnout.

SATISFACTION GUARANTEED!

IT WORKS!

Cool air in tubes is heated, expands and rises. Heated air flows into your home . . . naturally!



For FREE information, write: Thermograte Ent., Inc. Dept. 840-003 P.O. Box 43021 St. Paul, MN 55164 Or CALL TOLL FREE: 1-800-328-0882

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BE YOUR OWN BOSS!



Start a MONEY-MAKING SMALL ENGINE REPAIR BUSINESS of YOUR OWN

Earn EXTRA CASH income working at home—SPAREtime or FULLtime

Small Engine Repair Is A Wide Open Field

Over 65-Million small engines are in use today, and a million new units are being built each month. This means there's plenty of business and big profits available for qualified men who can service and repair them. Industry growth has been so fast that there is a shortage of small engine repair pros. That's why NOW is the time for you to get into this profitable field where you can command hourly rates equal to any other skilled craft. The sale of parts, engines and accessory items add even more profits... profits YOU earn and keep in YOUR pockets, not someone else's.

Start A Fulltime Business Or Work Spare Hours For Extra Cash Income

When you're the boss in a fulltime business of your own there's never a worry over strikes or layoffs, and you earn year round profits repairing chain saws, tillers, tractors, mowers, mini-bikes, power rakes, generators, snowmobiles, snowblowers and many more items. There is no huge investment for equipment, no expensive inventory. Work right out of your garage, basement or a spare room. Ideal for sparetime income too. In just evenings and weekends you can earn extra cash for a rainy-day or retirement fund, or use the extra money for the things you want NOW.

It's Easy To Learn—No Experience Needed

You can learn this craft at home in your spare hours with our time-tested "hands on" training methods. Age, education, minor handicaps are no barrier. You get latest text materials, special tools and 3 1/2 HP Briggs & Stratton engine, but that's not all. We also help you with detailed data on how to get started, where to get business, what to charge, where to get parts at wholesale... all the shortcuts and proven methods you will need to get your business off to a fast, profitable start.

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YOU GET THESE QUALITY TOOLS AND INSTRUCTIONS PLUS THIS 3 1/2 HP BRIGGS AND STRATTON ENGINE YOURS TO KEEP!

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RUSH COUPON TODAY!

YES, please send FREE Data Kit and full details on how I can start a profitable Small Engine Repair business of my own, and facts about Foley's exclusive 15-Day No Risk Trial Offer. No obligation. No salesman will call on me.

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STATE _____

ZIP _____

PM's Gardening and Outdoor Living Guide

15 new products for yard and garden



During the growing season, use Key-Lite steel-reinforced film to cover cold frames and greenhouses and to protect plants and shrubs. When cold weather arrives, use the sturdy cover as a windbreak, to seal off drafty openings or to enclose a porch. Key-Lite comes in 36-in.-wide by 25-ft.-long rolls (\$13) in hardware, farm-supply and garden centers. It's made by the Keystone Group, 7000 Southwest Adams St., Peoria, Ill. 61641.

Safe-T-Cut Nylon Cutter (inset) slips on the shaft of most gasoline edgers and lets you trim borders of your lawn to give it a neat appearance. The easy-to-install unit has four heavy-duty (80 mil) cutting lines, comes with installation instructions, and costs \$13.95 postpaid from Florindo Inc., Box 05339, Fort Myers, Fla. 33905. Make certain that you specify your edger's shaft size (3/8, 1/2 or 5/8 in.) when you order the nylon cutter.



The Good Guy Tree Support System is easily applied to hold a newly planted tree firmly but gently until new roots spread to anchor it. The kit contains: a tree collar, nylon closing strap, tree cord and three hardwood stakes. Model RU2 (\$5.50 postpaid) fits 3/4- to 1 1/2-in.-dia. trees. Model RU3 fits 1 1/4- to 2 1/4-in.-dia. trees, from Good Guy Products Inc., Box 452, Kent, Ohio 44240.

You can store this Hose and Reel neatly in minimal space. The hose is 3/4-in. dia. x 50 ft. It winds flat and dry in its 9x14 in. reel and takes pressure to 450 pounds per square inch (p.s.i.), more than four times normal water pressure of 100 p.s.i. Hose and Reel sells for \$30 at garden supply and hardware stores. Black and Decker, 701 East Joppa Rd., Towson, Md., 21204, is the manufacturer of the unit.



(Please turn to page 170)

AMAZING SUPER-GROWING SPECIES SOARS INTO A MAGNIFICENT TREE IN JUST ONE YEAR!

**Plant Now—Step Back
Watch It
Skyrocket Forth!**

YES, actually z-o-o-m-s up to roof-high in just one year . . . and keeps on soaring into a tower of flowering beauty just like you see pictured here . . . faster than any tree of its kind on the face of the Earth! In fact, rockets forth with such breathtaking speed you can actually take a ruler and measure the difference in height from week to week . . . or to really leave your neighbors breathless, take a yardstick and measure the incredible difference from month to month. And that's only the beginning:

GROWS MORE IN ONE MONTH THAN MOST TREES GROW IN AN ENTIRE YEAR!

Because when in your life did you ever hear, see or dream of a miracle flowering shade tree that grows higher than even a full-grown Flowering Dogwood **IN JUST ONE SINGLE SEASON!**—grows higher than even a full-grown Star Magnolia **IN JUST ONE SINGLE YEAR!**—Yes, thrusts itself so high, so fast, that it actually soars higher than even a Japanese Red Maple, Cherry Tree or even the most graceful silky Willow in such a ridiculously short time, your neighbors will simply refuse to believe their eyes!

A MASTERPIECE OF BEAUTY IN JUST A MATTER OF MONTHS!

And that's still only half the magic, half the wonder that awaits you when you glorify your home and garden with the most fantastic flowering shade tree ever introduced in America—the incredibly beautiful Royal Paulownia—hailed by U.S. Govt. Plant Research Stations . . . by Botanical Gardens . . . and by University Plant Scientists as the fastest growing shade tree of its kind on this planet! And no wonder!

SOARS FROM A SAPLING TO A TOWER OF ROOF-HIGH BEAUTY IN JUST ONE SINGLE YEAR!

Because, if you think you have to spend a small fortune for a shade tree . . . and then spend half a lifetime growing it . . . then get set for the shock and surprise of your life, starting just a few short months from now. That's right, starting this year . . . you are going to take any spot in your garden, on your front lawn, alongside your patio or driveway . . . and in virtually no time at all you are going to see that barren, sun-beaten patch cast in the cool shadow of the most spectacular, super-growing, flowering shade-tree in all of nature. One that surges skyward with such fantastic speed . . . that in as little as 12 short months from today, you'll actually lean out of a window from the second story of your house and touch its glorious shade-giving branches! And as if that isn't startling enough . . . just wait 'til you see the spectacular show when it starts to flower . . . when it actually smother itself in such lavish masses of blooms, its branches virtually bend down from the sheer mass and weight of the show-stopping flowers!

GROWS IN VIRTUALLY ANY SOIL . . . REQUIRES NO SPECIAL CARE . . . SOARS INTO A LIFETIME TREASURE OF LUSH, GREEN BEAUTY IN JUST A MATTER OF MONTHS!

Best of all, unlike most trees that demand constant pampering and nursing . . . the only thing you do when you plant Paulownia is water it and enjoy it. Think of it! Takes but 10 minutes to plant . . . rewards you with a lifetime of beauty starting this very year. Small wonder leading botanical gardens . . . landscape artists . . . garden editors . . . recommend it again and again for home-owners who want a dazzling display of both beauty and shade . . . and with practically no more work than a couple of sprinkles a season!

WE HAVE AT THIS MOMENT ONLY A LIMITED SUPPLY AVAILABLE FOR RELEASE TO THE PUBLIC . . . FULL SUPPLY WON'T BE READY UNTIL MID TO LATE 1980 . . . SO ACT NOW!

Now, the price of this super-growing shade tree is not the \$20 or \$30 you might expect, but a mere \$3.95. That's right. Only \$3.95 for this magnificent beauty that rewards you with such a glorious display of growth **IN JUST ONE SINGLE YEAR!** However, our supply is limited. Full supplies from the growing fields will not be ready until mid to late 1980. Therefore, all orders must be filled on a first-come, first shipped basis. To make sure you don't miss out . . . ACT NOW!

LOOK WHAT THE EXPERTS REPORT ABOUT INCREDIBLE PAULOWNIA . . . THE FASTEST-GROWING FLOWERING SHADE TREE OF ITS KIND EVER DISCOVERED!

SUPER HEIGHT:

Govt. Plant Scientists and Botanical Experts report 18 to 22 feet of growth the first year alone on specimen trees. That's more than most shade trees grow in 3 . . . 4 . . . 5 or even 7 years!



SUPER SPREAD:

University scientists report breathtaking ornamental spread of almost 40 feet at maturity . . . smothered with thousands of glorious flowers. Think of it! It not only rockets forth in the most spectacular burst of beauty you've ever seen . . . but also arches out in a magazine-cover display of color-drenched branches.

SUPER EASE:

Leading editors hail this "lazy man's dream tree". Grows in almost any soil . . . below-zero root hardy too. And because nature has blessed it with super-growing strength . . . because it is virtually resistant to most every common tree disease . . . it requires no special care at all. Just plant it and forget it . . . it's as simple as that!

VITAL STATISTICS FROM LEADING EXPERTS

MATURE GROWTH SIZE—40 to 45 feet.
MATURE GROWTH SPREAD—30 to 35 feet.
ZONE OF HARDINESS—Hardy from deepest south to as far north as Philadelphia, PA. In areas where the temperature drops below -12°F the tree must be pruned to ground level and is recommended for use as an ornamental shrub.
ONE-YEAR GROWTH—Experts report growth range of up to 22 feet after planting specimen trees under optimum conditions, up to 10 to 12 feet under poorer conditions when pruned for foliage growth only.
DECORATIVE MERITS—Highly recommended by landscape architects as a specimen planting for the front lawn because of its large green leaves.

SOIL REQUIREMENTS—Natural strength and vigor allow it to soar forth in even poor soil. You can plant it almost anywhere.

CARE—No special care whatsoever. No spraying. No dusting. No special feeding. Naturally resistant to most every disease, pest or insect.

(Remember, all claims are based on optimum growing conditions.) Meaning: Just 10 minutes planting time can reward you with a lifetime of beauty starting this very year.

TAKES BUT MINUTES TO PLANT—SOARS UP TO ROOF HIGH IN A SINGLE YEAR!

Yes, grows more in a month than most shade trees grow in an entire year . . . More in a season than ordinary shade trees grow in 2 years, 3 years, even 5 years! NEVER HAS THERE BEEN A FASTER-GROWING, FLOWERING SHADE TREE MADE AVAILABLE TO THE PUBLIC!

Nothing adds more charm to a home than a natural archway at the front of your driveway . . . and no tree can give you this regal effect quicker than super-growing Paulownia.



Just a few minutes planting time . . . a few seasons growing time rewards you with a matched pair of flowering showpieces so strong and sturdy you can actually sling a hammock between them.



What a wonderful gift for the entire family . . . one single tree that gives you both dappled shade and florist-window beauty that you'll enjoy and treasure for years to come.



Illustrations depict magnificent size, spread and beauty of mature Royal Paulownia (*paulownia tomentosa*).

SATISFACTION GUARANTEED OR MONEY BACK!

Remember: Satisfaction is fully guaranteed. You must be thrilled in every way with this spectacular flowering shade tree or RETURN ANY TIME within 90 days for a full refund of purchase price . . . ANY TIME WITHIN 1 year for free replacement. Could anything possibly be fairer? But now is the time to plant—so send no-risk coupon today!

© 1980, Stonebridge House, Inc.

**GREEN VALLEY NURSERY SALES, Dept. GVN-86
21 Brewster St., Glen Cove, N.Y. 11542**

Yes, please rush me the Flowering Shade Tree(s) indicated below:

- (#001) 1 for only \$3.95 plus 75¢ postage and handling.
 (#002) 2 for only \$6.95 (SAVE \$1.00) plus \$1.00 postage and handling.
 (#004) 4 for only \$10.00 (SAVE over \$5.00) plus \$1.50 postage and handling.
 (#010) 10 for only \$20.00 (SAVE over \$19.00) plus \$3.00 postage and handling.
 (#020) 20 for only \$30.00 (SAVE over \$30.00) plus \$5.00 postage and handling.

If after receiving my order I am not fully delighted, I may return anytime within 90 days and you will refund my purchase price in full (less only postage and handling costs).

Total amount enclosed \$ _____ (N.Y. Residents add sales tax). Check or Money order. No COD's please.

Name _____

Address _____

City _____ State _____ Zip _____

Garden Variety

Ariens, the first name in quality front and rear-tine rotary tillers, introduces an exciting garden variety in 1980!

Ariens 5 hp and 7 hp rear-tine tillers continue to be the popular choice of serious gardeners everywhere. And this year, Ariens rear-tine models are joined by the new 8 hp, model RT8028 tiller — a powerful workhorse with a big-job 28" tilling width!

Ariens has also added a new chain drive model to the tiller line — the RT524C. A Till-Trac Conversion Kit makes it a versatile power tool for the gardener who needs more than a tiller!

Ariens line of five superbly crafted front-tine tillers gives you a wide choice of power and features. The 5 hp swing-handle model lets you tackle big jobs with ease — avoid walking in freshly tilled soil. The popular Compact models are lightweight and easy to maneuver — ideal for cultivating under and around flowers, trees, and shrubs.

See your Ariens dealer. There are ten Ariens rotary tillers for your selection, ranging from 2 hp to 8 hp, and each is Ariens-built for years and years of tough, dependable performance. The Ariens line of front and rear-tine rotary tillers truly *is* a great garden variety!

Special money saving offers now available at many participating Ariens dealers.

Ariens — "A Cut Above the Rest!"



Ariens

For literature on Ariens rotary tillers, write: Ariens Company • 806 West Ryan Street • Brillion, Wisconsin 54110

**Look For
Popular Mechanics
"Home Ideas Guide"
In The
April 1980 Issue**

NEW YARD PRODUCTS

(Continued from page 168)



This blower attachment snaps onto Homelite's gasoline-powered ST 100 string trimmer to clear leaves, grass clippings, dust and even light snow from patios and lawns. The blower (\$20) weighs 4 oz. and has a 100-mph windstream velocity. It's from Homelite, 14401 Carowinds Blvd., Box 7047, Charlotte, N.C. 28217.



This hand thatcher removes matted grass and other debris that can pack down and retard turf growth. Operation is simple: Push forward to make it work; pull it back to clean. The model HT-10 is ticketed at \$20 and the unit weighs only 4½ lbs. It's manufactured by the Lambert Corp., 519 Hunter Ave., Dayton, Ohio 45404.



Besides corralling leaves, blowers such as this No. 4, 3.2-hp, gasoline unit (\$256) can dry sidewalk puddles or a family car after washing. Less than 20 lbs., it provides a 180-mph wind. The backpack blower is manufactured by Deere & Co., John Deere Rd., Moline, Ill. 61265.

(Please turn to page 172)

LOOKING FOR IDEAS ON HUNTING, FISHING, CAMPING, BUILDING, TOOLS, ETC.? CHECK THESE LISTINGS. THEN USE THE COUPON BELOW.

WORTH WRITING FOR

220 The Key to Success

Four colorful 16-page booklets on success with outdoor greenery, flowers and vegetables are available to homeowners from O.M. Scott & Sons. Each one is based on Scott's extensive research in the lawn and garden field and includes a wealth of easy-to-follow advice and many illustrations. Free.

221 Man-size Tractors

Here's complete information on the powerful, heavy-duty tractors from Engineering Products Co. - they're built for faster, easier grass cutting, snow removal, garden plowing, tilling, cultivating and many other chores. Includes descriptive information on 12, 14, and 18 horsepower tractors and attachments, as well as complete specifications. Free.

222 Ideas Set in Concrete

Transform your yard into an outdoor entertainment area in just a few summer weekends. Sakrete Cement gives you step-by-step instructions for 18 different projects in this 16-page booklet. 50¢.

223 Getting More of the Outdoors

Find new freedoms in your life with these two full-color brochures from Holiday Rambler. Within these brochures you will find a complete selection of motorhomes, mini-motorhomes, travel trailers and fifth wheels. This is the way to really see the country. Free.

224 Long-lasting Wood Decks

Design ideas and complete construction details for people with basic carpentry skills. Decks made with pressure-treated Outdoor Wood resist decay and insect attack indefinitely. This 24-page booklet covers everything from estimating to staining. From Koppers Company. \$1.00.

225 Luminous Landscaping

A color booklet on landscaping your home inexpensively with fountains, waterfalls and lighting systems is offered by the Little Giant Pump Company. Also included are catalog sheets on lawn, garden and swimming pool products. Free.

226 More From Your Chain Saw

Learn about the *Brushette*SM attachment that enables you to do more cutting jobs with your chain saw. Converts most lightweight chain saws into weedcutter, brushcutter, monofilament trimmer, tree pruner and edger. Descriptive brochure and specification information from Hoffco. Free.

227 Better Lube Jobs

A how-to-grease wheel bearings booklet is available from General Electric, makers of Silicone Grease & Lube — a high performance, synthetic grease. This synthetic protects against corrosion, resists water wash-out and provides lubrication over a wide temperature range. Applications include: lawn & garden equipment, cars, trucks and sporting equipment. Free.

228 Picnic Table Stowaway

Finding storage space for a picnic table indoors when summer is over is almost impossible. POPULAR MECHANICS helps solve this problem with its plans and instructions for a folding picnic table. Both table and benches fold scissor-fashion for easy storage in a small space. Complete plans. \$3.95.

229 Get It Cheap

Discover thousands of unusual and hard-to-get items for the hobbyist, mechanic or sportsman. Airborne Sales wants you to know there are savings up to 90% on some merchandise in their new, illustrated government surplus catalog. \$1.00.

230 Lawn Grooming Tips

You too can have a lush green lawn this season just by following this lawn grooming-made-easy pamphlet. Advice on fertilizer, pest control and thatching is offered by the Parker Sweeper Co. Free.

231 Catch More Fish

Learn how-to with Mepps 1980 fishing guide. 40 pages of valuable fishing information containing tips, photos, new ideas and proven methods that work. From Sheldon's Inc. 25¢.

232 Easy Riders

A 12-page, full-color brochure details wide range of rear-engine riding mowers from 6 hp to 10 hp. Includes information on available attachments, as well as front-engine Yard Tractors. From the Ariens Company. Free.

233 Design-a-deck

Design and build a custom redwood deck that fits your house, yard and lifestyle with plans from the California Redwood Association. Complete kit includes large-scale drawing, 20-page manual and patterns for modular deck sections. \$4.00.

234 What a Finish!

An 8-page, fully illustrated guide to furniture refinishing, staining and care from Formby's. Gives you all the facts and information you'll need on furniture refinishing. Free.

235 PM's Complete Gardening Guide

Here is every bit of information needed to have a beautiful lawn and garden. All the basics with more than 20 fact-packed tables and charts, and 130 "shot-how" drawings. 12 heavy plastic-coated cards — 24 pages in all, spiral bound for quick reference. Only \$4.95 + 50¢ for postage and handling.

236 Stop Climbing the Walls

Planning to panel a room and want to do a pro job? A brochure from HB Fuller gives you valuable tips and hints to make the paneling job easier. 35¢.

237 Build a Magnatrac

A brochure from Struck Corp. describes their Magnatrac tractor kit — it's a versatile outdoor machine you can easily assemble yourself. The Magnatrac's heavy-duty track gives you the same ground-hugging grip as its bulldozer big brother. A choice of three motor sizes, plus a wide assortment of attachments. 50¢.

238 Staying Camera Conscious

This 8-page pamphlet covers common loading and handling problems that arise with the use of 35mm cameras and film. Information is given in a question and answer format by Eastman-Kodak. 25¢.

239 The Grass is Always Greener . . .

Lawn Care, edited by Scotts, the lawn and garden people, contains seasonal checklists, how-to articles and the latest information on lawn and garden care. Now in its 52nd year this colorful publication is available Free.

240 Looking Through the Window Glass

A detailed owner's manual provides owners of Andersen windows and gliding doors with helpful information needed to keep these units working and looking like new. Booklet also includes offer for free brochure on cures for window condensation and home energy conservation. From Andersen Corporation. Free.

Popular Mechanics 3/80
Box 1718, Sandusky, Ohio 44870

Please see that I receive the items checked below

<input type="checkbox"/> 220	<input type="checkbox"/> 225	<input type="checkbox"/> 230	<input type="checkbox"/> 235 \$4.95 + 50¢	<input type="checkbox"/> 240	Total money for priced items \$ _____
<input type="checkbox"/> 221	<input type="checkbox"/> 226	<input type="checkbox"/> 231 25¢	<input type="checkbox"/> 236 35¢		Service Charge \$ _____ .35
<input type="checkbox"/> 222 50¢	<input type="checkbox"/> 227	<input type="checkbox"/> 232	<input type="checkbox"/> 237 50¢		Total money enclosed \$ _____
<input type="checkbox"/> 223	<input type="checkbox"/> 228 \$3.95	<input type="checkbox"/> 233 \$4.00	<input type="checkbox"/> 238 25¢		
<input type="checkbox"/> 224 \$1.00	<input type="checkbox"/> 229 \$1.00	<input type="checkbox"/> 234	<input type="checkbox"/> 239		

Total items requested _____

Name (Please Print) _____

Address _____

Town _____ State _____ Zip Code _____

(Please send cash, check or money order made out to POPULAR MECHANICS. No stamps, please.)

Note: Popular Mechanics processes your requests for the above information and forwards these inquiries to the organization making the offer. Each company mails the material directly. Your order will be on its way to you within 90 days.

This coupon Expires May 31, 1980

Own a
DIXON ZTR.
mower and
you might
never get
to use it
yourself.



Once the family finds it's *mower fun* on a DIXON, you've lost the mowing job. Maybe forever.

DIXON mowers appeal to all kinds, all ages. A great many operators are *under 18 or over 65* and more than half are women; many are farm wives.

Big 42" cut or 30" town lawn size, all have Zero Turning Radius that easily cuts mowing time on many lawns in half. That's Mowbility!

Test drive one today; it might be the last time you get to drive it yourself!

Tell me more about DIXON Zero Turning Radius mowers. Please send a free brochure to:

NAME _____

ADDRESS _____

CITY _____ STATE _____ ZIP _____



I might like to be a DIXON Dealer; please tell me how:

TELEPHONE _____
DIXON INDUSTRIES, INC.
BOX 494, DEPT. PM
COFFEYVILLE, KANSAS 67337
(316) 251-2000

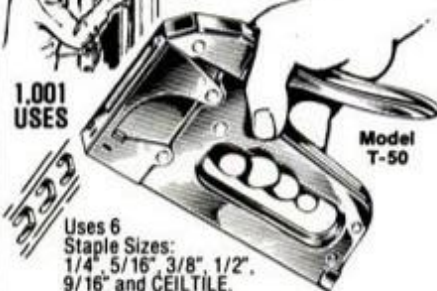
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America's basic home
fix 'n fasten-it tool!

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HEAVY DUTY
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GUN



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T-50

Uses 6
Staple Sizes:
1/4", 5/16", 3/8", 1/2",
9/16" and CEILTILE.

**SHOOTS A STAPLE
WHEREVER YOU'D DRIVE A NAIL!**

The faster, cheaper, better way to handle hundreds of home repair and improvement jobs — insulation, weatherstripping, ceiling tile, screening, wiring, upholstering, etc. One squeeze you've nailed it — with one-hand ease! Your other hand is always free to hold material in place for neater work!

The Arrow T-50 Staple Gun is precision-built of all steel with a patented jam-proof mechanism for dependable, trouble-free performance!

Available at all leading Hardware, Home Center & Discount Department Stores Everywhere.

ARROW FASTENER COMPANY, INC.

271 Mayhill Street, Saddle Brook, N.J. 07662

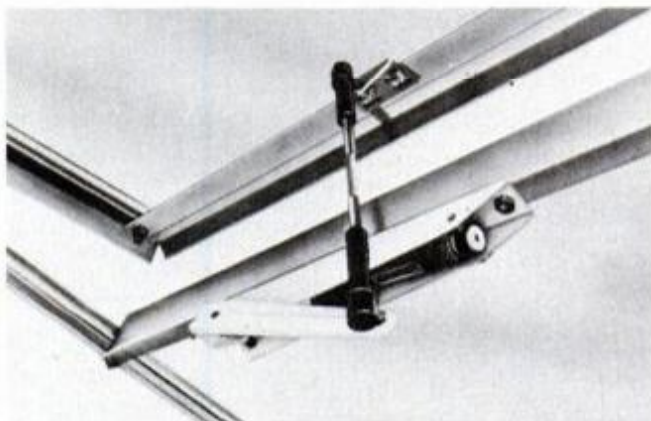
PM's Gardening and Outdoor Living Guide



You need no special tools to install this in-a-kit, lawn-sprinkler system. It hooks up to a faucet, so no plumbing is needed. Sprinkler heads pop up (inset) to spray and, when turned off, drop below lawn level for mowing. Kit (\$99.99 postpaid) services a 6000-sq.-ft. lawn. A smaller kit for 3,000 sq. ft. is priced at \$69.99 postpaid, available from Green Park Co. Inc., 226 Chestnut St., Roselle Park, N.J. 07204.



This trigger nozzle (\$6) lets water feed through a coupling in the body rather than in the handle, so your shirt sleeve stays free of water dribbles and your hand isn't subjected to hot or cold water surges. A solid brass tip, the Memory Nozzle, has a preselected spray pattern from mist to downpour. Rain Bird Sprinkler Manufacturing Corp., 7045 North Grand Ave., Glendora, Calif. 91740, makes it.



Solar-powered, automatic vent opener for greenhouses opens a 30-lb. sash up to 12 in. for full ventilation, or holds it at any intermediate point to maintain temperature. You set a knob from 55 to 85° F. to control temperature. The 11-in.-long opener is available at garden centers for \$50, from Bramen Co. Inc., Box 70, Salem, Mass. 01970.

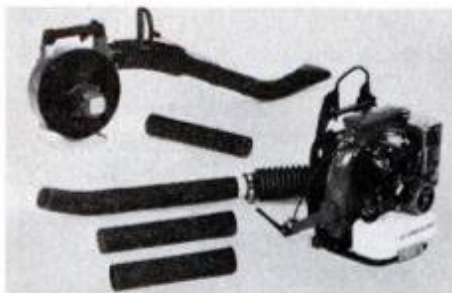


You can discourage squirrels and bats from entering attics, or protect summer homes at close-up time, with Sudbury Chaperone Squirrel and Bat Repellent. Spread this flake material on attic floors and between walls or other closed areas. Although it's harmless to humans and other animals, squirrels and bats can't tolerate its odor. A 1-lb. box is \$4; Sudbury Laboratory Inc., Sudbury, Mass. 01776.



This differential temperature thermostat controls a blower-fan in a passive solar greenhouse. The controller measures temperature at two locations: at the storage mass and at fan level. When air temperature is more than 4½° F warmer than the storage mass, the fan blows warm air toward the mass to heat it. Thermostat (\$56) is from Heliotrope General, 3733 Kenora Dr., Spring Valley, Calif. 92077.

CEMENT YOUR IDEAS WITH SAKRETE MIXES



Sweep sidewalks and driveways clean of grass clippings, pine needles or light snow with a hand-carried blower (\$180). It weighs less than 10 lbs., yet has a two-cycle gas engine and 21-cc power plant producing up to 247 cu. ft. of air per minute. It's made by the Toro Co., 8009 34th Ave. S., Minneapolis, Minn. 55420.



Model 21700 front-tine rotary tiller tills a 26-in. width with two 13-in.-dia. tines that adjust from a 6- to 9-in. depth. The 5-hp machine (\$320) has optional accessories that make it a walk-behind tractor to plow, rake, hill, furrow, cultivate and doze soil or snow. It's from Yard-Man Co., Box 36900, Cleveland, Ohio 44136.



Trim tops and sides of hedges with the Quick Cut hedge trimmer. It's a conventional hedge clipper mounted on a carriage that you push like a lawnmower. Standard Quick Cut (\$499) works up to 6-ft. heights, operating from a rechargeable battery. D.J. Wilson Co. Inc., 2707 Churchill Dr., Huntsville, Ala. 35801, makes them.



Build a backyard as beautiful as this. It's easy and economical ... when you do it yourself ... with SAKRETE Mixes. You'll save up to 80%, and you'll increase the value of your home.

With SAKRETE Mixes, all you add is water. You can work at your own pace, doing large jobs one step at a time. By just working on weekends, you can create an entire backyard setting ...

with the professional look of the one shown here.

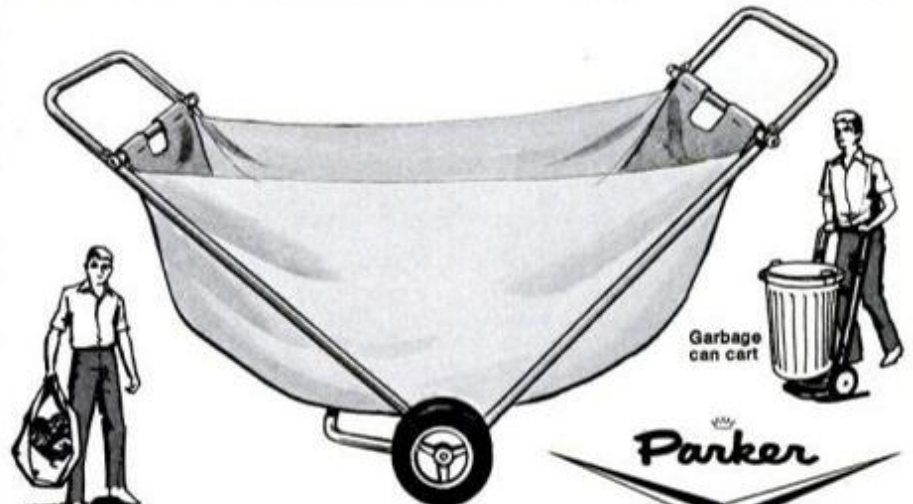
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simply release the clutch and the pipe (and table) will be held rigidly.

Besides the stool, tail stop and pipe, you will need a piece of 1/2- or 3/4-in. x 14-in.-dia. plywood for the tabletop (use an exterior grade for longer life); a pipe flange; a pipe cap and a 3-ft. length of 1x2 pine. (Editor's note: For superior clamp-gripping power, use black pipe, not ordinary galvanized pipe.)

The pipe must be threaded at both



With turntable in lowest position (left), gardener can easily trim upper branches. Elevated, the turntable lets user prune bottom of plant with only minimal bending.

Make this turntable for grooming bonsai

Here's a cleverly designed worktable that's sure to appeal to home gardeners. It's a handy "turntable" that you can quickly adjust to provide working heights ranging from approximately 36 to 47 in. The result is that grooming bonsai, topiary and other decorative plants can become an even more enjoyable, fulfilling pastime.

The table was created by Frederic L. Ballard, an acknowledged bonsai expert. You will probably be able to build it with

parts that you already have in your workshop. Its major components are a 24-in.-high, four-legged kitchen stool, the tail stop from a Pony pipe clamp (see drawing, page 176), and a 3-ft. length of 1/2-in. (i.d.) black pipe. The assembly of the set-up is shown in the drawing.

Using the turntable

Due to the smooth functioning of the pipe clamp, the turntable is particularly easy to use. To position the table, you simply depress the stop's clutch discs with one hand so you can raise, lower or revolve the table with the other. When the table is at the working height you want,

ends to receive the flange and cap. If you lack the necessary equipment to do your own threading, chances are that your local hardware store can do the job (at the time you purchase the pipe) for a minimal charge.

Building the turntable

1 Begin by cutting the plywood for the tabletop. Though the version shown is round, the table can be cut square if preferred. Fill all edge voids with wood filler and sand smooth. Dust and seal the table with several coats of an exterior-grade varnish such as Zar. Set the top aside.

2 Measure the space between the stool legs to determine the length of the pair of braces needed at the bottom. The cross-brace assembly is located approximately 12 in. below the seat. Tack the cross brace together temporarily and bore a 3/8-in.-dia. pipe hole in the center of the brace as shown, using a spade bit. Then install the bracing using glue and screws.

3 While you have the drill and bit

This article is adapted from *The Green Scene*, a magazine published by the Pennsylvania Horticultural Society. Turntable designer Frederic L. Ballard is a lawyer with wide-ranging interests in horticulture. He writes regularly about bonsai.



handy, locate and bore the hole through the center of the stool seat.

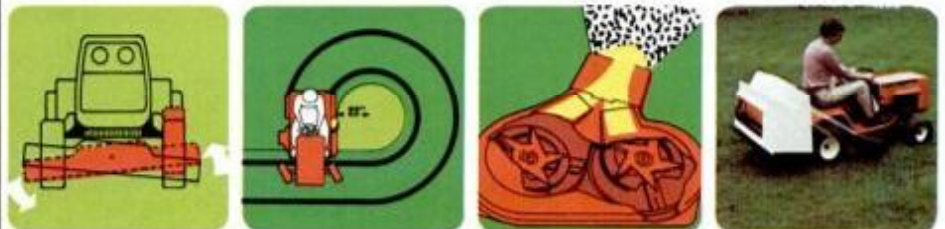
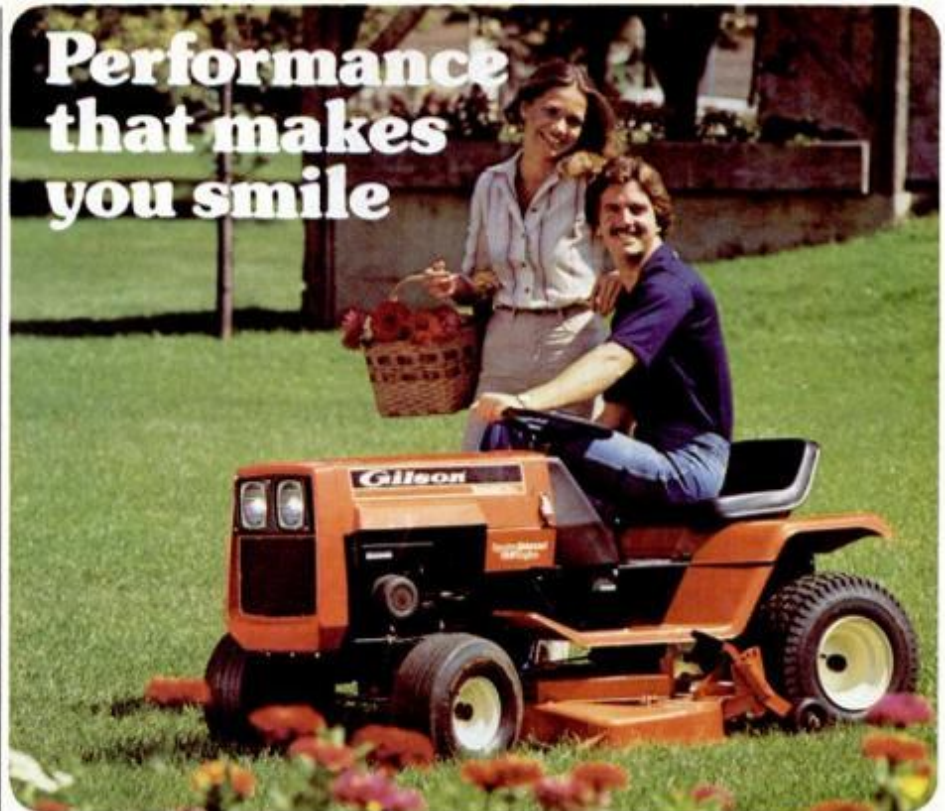
4 Next, locate the center of the worktable and mark the location on the bottom surface of the tabletop. Position the flange and mark for flange-holding screws. Remove the flange and bore screw pilot holes. Install the flange using 3/4-in., No. 8 panhead sheet-metal screws for good holding power.

5 Secure the clamp tail stop in a vise and use a center punch to locate two points for boring holes for screws. Since you will use No. 8 panhead screws to fasten the clamp to the seat, bore shank holes through the stop that will let the screws pass through easily.

6 Slip the stop on the pipe, making certain the stop is facing in the correct direction, and pass the pipe through the holes in both the seat top and the cross bracing.

7 Install the pipe cap on the pipe's lower end and screw top to seat.

Use judgment when working with the table. Don't overload it with tall or heavy plants; otherwise, it may tip over. Keep in mind that the turntable is designed for use with small plants and miniatures, and you will have years of use from this practical gardening aid.



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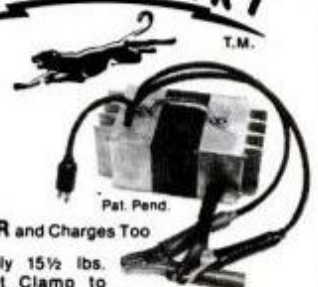
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Sturdy, stylish gate is easy to build

A gate design should complement, but not necessarily duplicate the fence pattern on either side of it. By varying the size and spacing of the gate pickets and by cutting off the tops to make a wide arc, you can create an interesting entrance. The rhythm change at the gate also flags visitors to the gate's location—even from a distance.

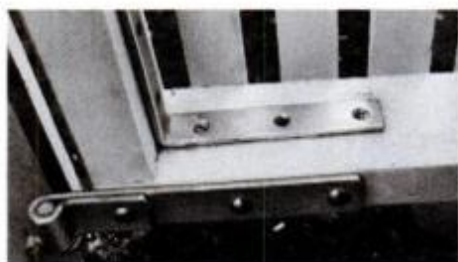
Cut curved picket tops *after* nailing uncut lengths to the gate frame. Spaces between 1 x 2s should be equal. Using a string with a pencil tied to one end as a compass, carefully scribe the arc. For a perfect half circle, make the radius one half the gate's width. For a shallower arc, make the radius longer than the gate's width.—*Joseph P. Provey, Assistant Home and Shop Editor.*



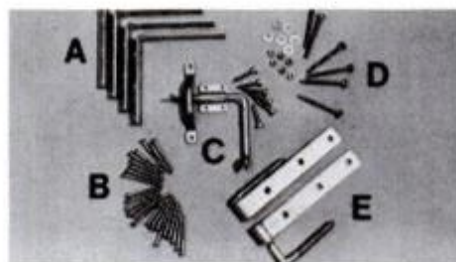
Picket tops can be cut with sabre saw.



The gate frame, constructed of 2x4s, is rabbet-joined at the corners and is glued up with two-part, waterproof resorcinol glue.



Corner braces keep gate frame square. Sturdy screw hook and strap hinges provide no-sag, smooth swinging action.



Gate hardware includes: corner braces (A), 1½-in., No 10 fh screws (B), latch (C), 4-in. carriage bolts (D) for hinges (E).

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*This is the minimum savings nationally. Regular prices vary in some markets.

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Prices and dates may vary in Alaska and Hawaii. Available in most Sears retail stores. ©Sears, Roebuck and Co. 1980

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This advertised item is readily available for sale as advertised



Attractive Air Alive unit measures only 4 1/2" x 4" x 1 3/4" and cleans a 20' x 15' x 8' room in up to 15 minutes.

AIR ALIVE

Uses "Nature's Air Cleaners" to electronically destroy odor, smoke, dust, and pollen. Now research shows it may do more!

Little-understood particles, called negative ions, are said to be nature's best air cleaners. They attach themselves to dust, smoke, pollen or anything else floating in the air, and cause it to fall harmlessly to the ground. Now there is growing proof that negative ions may affect your moods, health and sense of well being.

THE ION CONTROVERSY

For the past 20 years, scientists and scholars-world wide have been studying the effects of electronically charged particles in the air called negative ions.

Russian scientists have recently proven that the presence of ions in the air is essential to animal life. Research conducted at the University of California has shown that plant growth is stunted when the ion content in the air is decreased.

Some researchers claim there's evidence that negative ions can relieve allergic ailments and headaches, help control virus, retard the growth of bacteria, increase mental alertness and energy, reduce pain, tension, fatigue and depression and produce sound sleep.

Interestingly, while the number of those who believe that negative ions do, in fact, produce these benefits, has grown, the number of doubters has decreased over the years.

THE ION IMBALANCE

The air is made up of molecules that contain either a majority of electrons, making them negative particles, or a majority of protons, making them positive particles.

Although nature produces a nearly equal number of positive and negative ions, there are a number of reasons why we are surrounded by an over abundance of protons: air pollution depletes the number of negative ions in the air, the static charge from synthetic fibers produces positive ions and natural earth radiation, that would normally produce negative ions, is retarded by concrete and asphalt covering the land.

In effect, we are breathing air that nature never intended us to breathe ... air that has been depleted of negative ions. What is needed is a way to correct this ion imbalance.

NATURE'S AIR CLEANERS

There is almost no disagreement among scientists that negative ions are unmatched in their ability to cleanse the air of impurities. This is how they do it: negative ions attach themselves to dust, smoke and pollen, neutralize them and cause

them to fall harmlessly from the air.

Engineers and doctors have recently recognized this benefit and have begun to take advantage of it. Many now use commercial units that emit negative ions and effectively destroy odors and pollutants in the air.

It has only been during the last year that technology has developed an affordable consumer model. These units were first introduced in Europe where there is a high level of interest in the benefits of negative ions.

Now we are introducing one of the first consumer units to be sold in this country!

ONE OF THE FIRST UNITS UNDER \$100

When we were offered the opportunity to introduce Air Alive to the American market, we jumped at the chance! Why? Because it's one of the first consumer models in this country to be sold for under \$100. And because it's manufactured by Western Systems, Inc., a pioneer in the ion generation field.

MOST COMPACT UNIT ON THE MARKET TODAY

Air Alive measures only 4 1/2" x 4" x 1 3/4" and puts out 3 trillion negative ions per second per cubic centimeter. That's as many or more than larger, more expensive units now on the market. It is so powerful that it cleans a 15' x 20' x 8' room in up to 15 minutes. Air Alive brings you more cleansing power in its compact size.

WARRANTED FOR TWO FULL YEARS

Air Alive is an all solid state unit ... it has no moving parts. The unit is so trouble free that it is warranted by Western Systems, Inc. for two full years, in the unlikely event that anything should go wrong.



FREE BOOK JUST FOR TRYING AIR ALIVE

Just for trying the Air Alive unit, we are offering a 160 page book entitled "The Ion Effect".

Absolutely Free!

It is yours at no additional charge. It's yours to keep even if you should return the Air Alive unit during our 30 day trial period. "The Ion Effect" traces one man's 10 year effort to discover the truth about the effects of ions. Judge for yourself the benefits of negative ions.

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Now Western Systems, Inc. brings something new to the American market that Europeans have used for years ... an optional auto adapter that allows you to use your Air Alive home model in your car, truck, van or RV. Hardware included for mounting under your dashboard and adapter plugs into your cigarette lighter.

30 DAY NO-RISK TRIAL

We believe Air Alive to be the most compact negative ion generator on the market today. It will destroy the dust, smoke, pollen and odors in the air in your home, office or car.

And we want you to decide for yourself whether or not you can benefit from the effects scientists are claiming that negative ions can have on your health and sense of well being.

We offer you a 30 day, no risk trial period on every Air Alive unit you order. If during that time you decide the Air Alive unit does not meet your expectations, for any reason, you can return it for a prompt refund of the purchase price.

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THERE'S A HITCH IN TOWING WITH COMPACTS

(Continued from page 115)

options are available. Car manufacturers willing to discuss trailering with their small-model buyers specify Class I (trailers up to 2000 pounds) hitches with a tongue load of not more than 200 pounds.

Trailer equipment manufacturers are less conservative. They recommend first determining gross trailer weight (GTW) on a truck scale; tongue weight can be measured with a bathroom scale or by a system well described in *Travel & Camper Trailer Safety*, a useful free booklet from NHTSA, 400 Seventh St. S.W., Washington, D.C. 20590.

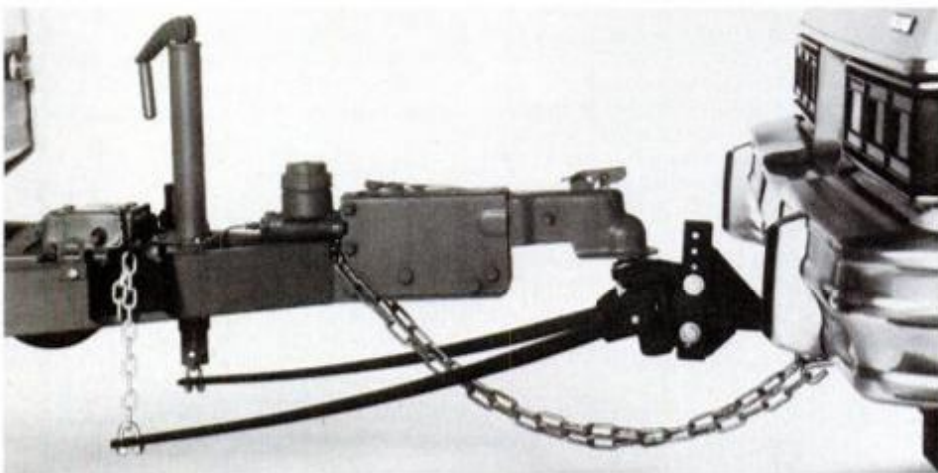
Thirty years ago, as larger and heavier trailers began to aggravate

arms that extend back for chain and clamp attachment to the trailer. They can swivel and turn with road conditions, and exert the leveling force that distributes the trailer weight.

Sway prevention

The other major difficulty encountered while towing with any size car is trailer sway. This can be caused by faulty tire inflation, trailer design, excessive towing speed or high winds, and can get bad enough to cause a driver to lose control.

There are several devices that help minimize sway. Simplest and least expensive is a friction sway-



Levers under the ball of the Reese Mini Hitch swivel with road conditions and trailer tracking, but distribute trailer and trunk luggage weight for safer, level ride.

towing problems like bottoming out of the rear springs, reduced steering control and trailer sway, the weight-distributing hitch was developed. Using clever engineering and leverage, some of the undesirable weight on the rear wheels of the towing vehicle is transferred to the front wheels, while additional load is shifted back to the trailer wheels. Properly set up, the tow car and trailer can both ride level.

Equalizing the load

Weight-distributing hitches have recently been designed and introduced for compact and minicars, and experienced trailer equipment dealers now claim that some small cars can haul loads up to 4000 pounds with an equalizing hitch installed. As with larger vehicles, a tow bar is bolted or welded to the car frame. Its platform has an open box-beam hitch box, into which the trailer's hitch bar with ball mount is locked with a hitch pin.

A spring-bar assembly fits into sockets on the ball mount. These are two tapered and tempered-steel

control fitting attached to the hitch. More advanced methods include the Dual Cam Sway Control from Reese Products, Elkhart, Ind. The device is claimed to prevent sway before it starts, instead of reducing it after it has begun. Valley Tow-Rite of Lodi, Calif., also has a sway control system. New from Reese, a Mini Hitch equalizing model is especially designed for "downsized" vehicles and is reported to handle up to 4000 pounds of gross trailer weight.

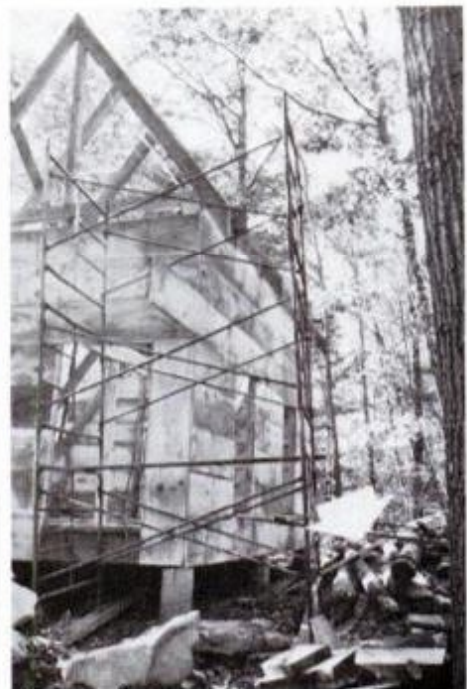
Other equalizing and standard weight-carrying hitches include models from Draw-Tite, Eaz-Lift and Equal-I-Zer, and all are better and safer than a simple hitch-ball clamped on your bumper. For any tow car—and especially a compact or mini—your best guide is to talk to several experienced trailer owners and equipment dealers. Often it's best to then have the dealer make the hitch installation for you. Later, if you trade in, you can usually switch your equalizing hitch to your new car. Now even compacts and minis can become safe, level-riding tow cars for sway-free trailers. **PM**

CHEAP FIREWOOD

(Continued from page 126)



Municipal road-widening and sewer projects leave many cords of wood behind.



Construction sites often have wood. Check with the builder or owner first.

6. Homeowners in wooded areas will often welcome you—and your chainsaw—after a storm has downed trees. Even under normal circumstances, wooded lands often need thinning. For a small fee, the landowner may let you take dead or downed wood.

7. Commercial sources of cheap wood include orchards that require thinning, furniture manufacturers who have leftover scrap and mills that must dispose of slabs (curved, bark-covered sections left after squaring lumber). Commercial logging operations also leave behind treetop branches (slash). Check with the property owner before loading up.—*Joseph R. Provey, Assistant Home and Shop Editor*

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Tephguard Corporation
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* Teflon® is Du Pont's registered trademark for a fluorocarbon resin.

LOW-COST CAMPING GEAR

(Continued from page 116)

bility at sometimes half the weight—but at more than twice the cost.

So you save a lot of money and use top-quality materials when you work with a kit. What's the catch? It's not that the kits are hard to use. Those we checked out all have clear and detailed instructions. Thumb-fingered friends who tried them found that by working slowly and carefully, they could turn out an excellent ski jacket, snowshoe, backpack or tent. Experienced seamstresses and tailors found instructions almost too detailed,



Quick change from vest to jacket is easy with zip-on/zip-off sleeves with polyester insulated linings in kits by Altra.

and reported they longed to try shortcuts.

Time is really the only catch. It costs less to use a kit than to buy the finished product because it takes time to complete the project. You're doing it for fun and the satisfaction of accomplishment and aren't charging yourself an hourly rate.

Some kits come with an estimate of the time required to complete the item, and the ones we tested seemed fair. Several evenings of work probably won't bother you as you see a down parka being created, but might annoy someone used to sewing quickly.

Don't count on borrowing your wife's sewing machine or getting her to finish off the canvas duffel bag you've started. Materials used in outdoor equipment are stiff and tightly woven, as they should be, but some break the needle of an aver-

age sewing machine. Heavy-duty machines are used for commercial production of the tents, fabric luggage and hunting vests you may be assembling at home. The alternative is hand stitching, and sometimes a sailor's palm and a pair of pliers to push and tug the heavy needle through. This tends to bore the experienced seamstress used to her versatile machine, but it has worked successfully for the generations before sewing machines were



Snowshoes, or furniture that looks like them, are in Country Ways kits, 3500 Highway 101S, Minnetonka, Minn. 53343.

invented, and most kit workers don't seem to mind the extra time and effort required.

Each kit supplier's catalog recommends projects that are particularly suitable for a beginner. Often it is a poncho or down booties, vest or youngster's sleeping bag that can be stitched up on a home sewing machine and gives a good lesson in following directions. Kit projects for children are particularly worth-



Traditional Canadian canoes, kayaks, packs, knives, outdoor clothing, banjo and maple sugaring kits are by Country Ways.

while. Kids need rugged gear, but it's often a shame to invest in expensive quality when the item may be outgrown before it is worn out. Outdoor, cold-weather clothing and sleeping bags are good kit projects for the junior set, and often the kids will really enjoy lending a hand with the job.

And for the added touch, you can customize. With experience, the kit maker can alter fit and sew on personalized designs. Some suppliers are branching out, as well, and offer fishing rods, furniture and even musical instruments you can assemble from a kit.

PM

Thousands across nation using Ohio man's sure-fire way to get rich quick

Are you an 8 hour a day working person? Do you have little or no savings in the bank? Are you in debt with mortgage, car payments and charge accounts? Do you have little experience at anything except the small specialty of your job?

If you've answered "yes" to all these questions, you are a prime candidate for a foolproof get rich quick system developed by a working man from Canton, Ohio. His name is Benjamin Swarez and he was in your exact same position not long ago. But, he changed all that by inventing a get rich quick system designed especially for the working man.

How did this system come about? You probably already know about Mr. Swarez and his system. Ads on his system and stories about Mr. Swarez have appeared in nearly every major newspaper and magazine in the country. Thousands of people across the nation have purchased the system and the stacks of letters from satisfied customers received by Mr. Swarez are overwhelming.

Mr. Swarez did not develop his system overnight. But his final, perfected version certainly does generate income overnight.

Mr. Swarez's first successful system netted him \$80,000 clear. What's it like to get \$80,000 almost overnight in one lump sum?

"It's almost impossible to verbalize. My wife and I just stared at the check for a long time. We had a two day celebration with a dinner and party. Then I went into work and told my smug boss, who thought he had me under his thumb, where he could stick his low paying, lousy job. Next we paid off all our bills including our house mortgage and had a burn-the-mortgage party.

The following day we went to an auto dealer's showroom and laid down cash for a new luxury car. I never had the experience of a new car even as a child."

"Then my wife and I went on a shopping spree for clothes. We had been making do with old clothes for so long they had become worn out. She always had to shop for clothes with very little money. I always joked with her that 'If I gave you \$5,000 to spend on clothes could you do it in one day?' She used to say 'I could do it in a couple hours.' So that's what I did. I gave her \$5,000 to go out and buy clothes. It ended up taking all day and she said she relished every minute."

"Finally, we took a long trip. In New York I bought her a large diamond at Tiffany's — another thing we always dreamed about."

"But I can tell you that the money was not the most important benefit in this. What money really does is give you precious time. Time to be with your wife and children before they grow up before you know it — and time to do things you really want to do. Another priceless thing you gain is your self respect. No more crawling and kneeling because you're dependent. The words of Frank Sinatra's song 'My Way' says it all."



Benjamin Swarez

How much money can you make and how fast can you make it? Mr. Swarez averages around \$200,000 for each system he produces. He says doing a system to make \$10,000 or \$20,000 is literally duck soup. "I

have these available to me all the time and don't even use them," he says.

How fast can you make money? Mr. Swarez stated, "You can actually make money within hours in some cases. You can compile a system in one afternoon one day and start having spendable money in your hands produced by the system the very next morning."

Who all can do it and how sure fire is it? Mr. Swarez says, "I've done it 14 times in a row now. I taught my younger brother and brother-in-law the system and they've already made over \$500,000 each. All you need is the ability to follow simple directions, common sense, and the ability to see a job through to completion."

This system is also perfect for people who are confined to homes, such as housewives. Mr. Swarez named his system "7 Steps to Freedom". He has been selling his system to others for a year now. The reason? "Why not?" he says. "First I thought I'd have to keep it secret. But then I found out the system can't be saturated, so why not sell it and make money by selling the system on top of the other money I am making using it."

People from every state in the union have purchased Mr. Swarez's system. What do these people have to say? Here are just a few comments:

"... It is such an excellent product that anyone who can read and follow instructions can be a millionaire. ..." — William J. Bontrager, Peoria, IL

"... This is the first time I have purchased a 'get rich' product that I sincerely feel will work." — Earl J. Davis, Chicago, IL

"... Adjectives alone cannot describe its hidden wealth. After many years, much money and a bellyfull of frustration, I believe I have found an honest man, and yes I truly mean it." — John T. Vaughn, Norridgewock, ME

"I have just received your system and have taken it to college. It has really lifted some eyebrows especially the first and last parts..." — Mark Kimble, Rockhill, SC

A word to the doubting Thomases. Of course there will be those who will doubt that the system is for real. Mr. Swarez has featured this system in nearly every newspaper in the country and he has sold his system to thousands of people across the nation and in every state of the union. The story has been checked repeatedly by newspaper reporters and government authorities at literally every level. The story checks out. Every word he has stated about his system is true or he would've been out of business long ago.

You can make \$100,000 in a matter of weeks or days. In some cases money starts in hours. Here's how it works...

1 You will receive Mr. Swarez's system in the mail which contains everything you need to complete one of your own systems. From anywhere, such as your kitchen table, you complete the preliminary steps. This involves filling out provided forms and following provided outlines.

2 The preliminary steps of the system are done only one time. After these preliminary steps, you can do the steps for each individual system anywhere, from your home, while you are traveling. (Mr. Swarez does his individual systems in his motorhome) or from a favorite vacation spot. Again, by following outlines and filling out forms, you complete your individual system (each of which is in two parts, Part A and Part B).

3 After completing Part A and Part B of the System, depending on the type of system you do, you may either phone in Parts A and B of your individual system, or you drop it in the mail. In the type of systems where you phone in Parts A and B, you can virtually complete a system one afternoon and have spendable money in your hands the very next morning.

4 In a matter of days or weeks, depending upon which system you do, you can receive \$100,000 for each system. In some cases, over 80% of the money will be in your possession in less than a week. Your money will either be deposited in your bank account or brought to you by mail to your home or your vacation spot.

For those who wish to purchase the N.P.G.S. System, called "7 STEPS TO FREEDOM", it is being distributed by mail only for the present by a well known established distributing company called P.C. A. in Canton, Ohio. Mr. Swarez has kept the price of the system low so those who most need it can afford it.

To order: 1.) Get a blank piece of paper 2.) At the top of the paper, print the words "7 Steps to Freedom" 3.) Print your name and address 4.) Mail this along with \$20.00 in cash, check or money order to P.C.A.; Dept. G-160 P.C.A. Square; Canton, Ohio 44767.

Or, if you want us to start processing your order immediately, phone in your order as follows: 1.) Dial this TOLL FREE number, 1-800-321-0888 (Ohio residents dial 1-800-362-0636) and ask for operator G160 2.) Say the words "7 Steps to Freedom, N.P.G.S. system" 3.) Give your name and address 4.) Give the operator one of your following credit card numbers: Master Charge or Visa (also include your Interbank number). Or, if you don't want to use a credit card, tell the operator you want it mailed C.O.D. Operators are on duty right now and around the clock.

Direct any inquiries to (216) 494-0285. Please do not dial the toll free number for information. The operators are not permitted or qualified to answer questions.

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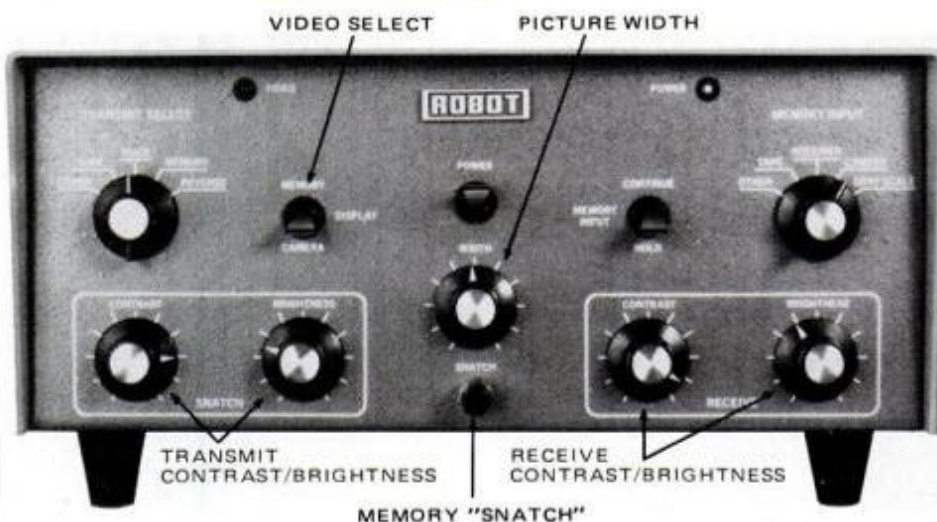
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HAM OPERATORS (Continued from page 123)



Pictures are first "snatched" from the monitor and stored in the Robot 400's memory. Video select is placed on memory and the picture is encoded and sent via ham radio.

but how to put it into practice? In the past few years many ways have been tried, but the computer has won hands down.

A computer can instantly recognize the tones and know which shade of gray they each represent. One company, Robot Research, 7591 Convoy Ct., San Diego, Calif. 92111, has developed what it calls the Robot 400 converter, which uses computer technology to send and receive slow-scan. Of the dozens of slow-scan stations we have spoken to, all but a handful used the Robot 400. One or two used a home computer for coding and decoding. We tried one home computer program from C.H. Galfo (602 Orange St., Charlottesville, Va. 22901) on an Apple II computer. Results were impressive (and low-cost, if you already have a computer), but the Robot 400 is the admitted king of the slow-scan frequencies.

Can anyone see me?

We hooked up the Robot 400 to our own ham radio station. Then we plugged in the RCA TC-1000 video camera and the RCA video monitor. In less than five minutes we were equipped for slow-scan TV.

We typed in CQ CQ DE WB2KQI on the keyboard of our Apple II computer. (Most hams use simple keyboards for letter displays, but we had the Apple handy.)

The CQ appeared on the video monitor just as on a bulletin-board. CQ means "general call" and DE is slang for "from," so our message read: "General call from station WB2KQI."

Once we had a nice image of our CQ on the monitor, we "snatched" it with the Robot 400. This means that we pushed the "snatch" button which automatically stored the im-

age in the Robot 400's computer memory. Contrast, brightness and picture width all looked good, so we hunted for a frequency.

We were on the 20-meter ham band, around a frequency of 14.230 Mhz, which is where most slow-scan TV is transmitted, thanks to informal agreements. The frequency was clear.

We picked up the microphone and voice-identified: "CQ slow-scan from WB2KQI now going video!"

We reached to the Robot 400 and threw the switch to "memory." Instantly, it began to code our bulletin-board-style CQ into tones. Then it fed the tones into the microphone input of our ham radio, which transmitted them out over the airwaves. We settled back and let the message repeat six times, or six "frames" worth.

We switched off and went to receive: A station called us by voice and then switched to his own canary-like, slow-scan transmissions.

We switched the Robot 400 to receive and watched the video monitor. The picture slowly began to scan downwards. We couldn't suppress a laugh! A cartoon of a Magilla-style gorilla was being sent to us—the ape proudly wearing the other fellow's call letters. "And that," the ham said, as he switched back to voice, "is a picture of the chief operator here—back to you!"

It wasn't long before we were exchanging video pictures of our different ham radio equipment (we both had the Robot 400, but our transceivers and accessories were not alike), and of ourselves, too. In a very short space of time, I felt I almost knew the fellow.

Then, in one pause after he turned it to me and before I went to trans-

(Please turn to page 184)

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MPMO

HAM OPERATORS

(Continued from page 182)

mit, I heard a weak slow-scan signal. I transmitted, via voice, "Standby, I think we have a breaker." I fiddled with my receiver's controls and the weaker station began to come in clearer.

A video conversation such as we were having is much like a slide show. Since it takes eight seconds for a slow-scan picture to fill the screen, only still shots can be transmitted. The ham in Denver I was talking with had made a tape of various cartoons and photographs.

Using a video camera, he first captured each image in the Robot 400's memory. Then, via the Robot 400's memory output, he simply recorded the slow-scan tones onto everyday cassette tape.

In this manner, a ham slow-scanner can produce any number of canned "shows" for later transmission. It's even possible to tape another ham's pictures right off the air to enjoy again later or to share with other radio amateurs.

I switched on the Robot 400 and studied the monitor. Reception was not too good, but was gradually clearing. The third station was sending a picture of his call letters—and I realized he was an Italian amateur.

The ham in Denver (whom I had started with) also could copy the Italian station and so we wound up with a three-way video conversation: Bethpage, N.Y., to Denver to Rome.

Where no one has gone before

In the weeks to come I was to enjoy many slow-scan TV contacts with hams all over the United States, as well as in six countries on three continents. But it even came as a shock to me when I received the first of a series of pictures from outer space!

Before I'm tossed in a rest home somewhere, I should explain the pictures were sent courtesy of the Jet Propulsion Laboratory's ham radio club. As the Voyager space probe drew ever closer to the planet Jupiter and her moons, the hams at JPL, a NASA contractor, kept their ham friends informed worldwide. As photos taken by Voyager were sent back to Earth, the hams at JPL took time to rebroadcast them slow-scan—a most exciting series of photos.

Still, it wouldn't surprise me if someday soon I actually *did* speak and send pictures to a fellow radio amateur residing on the moon or an orbital space colony. In ham radio anything is possible!

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OLD-TIME SHUTTERS

(Continued from page 130)

ly against both fence and saw table. Finally, use a fence or miter gauge to square off the shoulders on the work face.

Cutting the frame

Cut stiles A, B and C to length. Rabbet one edge of stiles B and C $\frac{1}{4}$ -in. wide \times $\frac{3}{8}$ -in. deep. Rabbets of the center stiles overlap to insure your privacy when the shutters are closed.

Stiles A are hinged to the window frame and are not rabbeted. Order of stiles across one window is: A, B, C, B, C, B, C and A (one set).

When you cut a rabbet with an adjustable (wobble-type) dado blade, the actual line of cut can't be measured from blade to fence. To get a cut precisely as you want it, adjust the blade for cutting width, set elevation using a ruler, and run a scrap of wood through the blade. Check the cut with a ruler and mark the line of cut on the blade insert with a pencil. Set up your groove cuts this way, too.

Stile A is grooved $\frac{3}{8}$ -in. deep with a $\frac{1}{4}$ -in. setting on the dado blade. You can also groove it with about three adjacent passes using a rip blade.

Next, cut the top and bottom rails D and center rails E. Groove rails on the inner edge to fit panel F; groove center rails E on both top and bottom edges. Apply steady downward pressure at front and rear to cut the pieces.

Cut a $\frac{1}{4} \times \frac{1}{4}$ -in. tongue on each side of rails D and E to mate them with the stile grooves. A block setup like that used to bevel the panels will help.

Assembling the shutters

Test-fit all pieces dry. Then sand before final assembly. Tongue-and-groove construction gives panels F room to expand or contract with temperature and humidity changes. The raised panels aren't glued; they "float" in the grooves.

Before adding shutter hardware, set the four sections in the window opening and adjust spacing to allow for the hinges and the rabbet overlaps. Plane the edges if you think it's necessary.

Sand, dust and wipe with a tack cloth between each of these finishing steps.

Apply pigmented shellac such as Bin or Enamellac to seal the wood, then two coats of a satin-finish enamel paint. Or you might seal the shutters and apply a stain finish followed by varnish.

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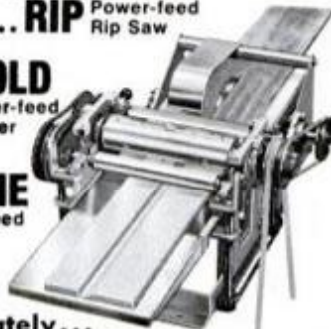
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Stephen Schultz - Orangeville, Penna.

"I bought a batch of walnut in the rough, and after planing it on the Belsaw I figured I saved enough money to pay for two-thirds the cost of the Planer. It really does a good job."

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GMC is a division of General Motors.

More pickup information...

NEW DIGITAL SOUND

(Continued from page 119)

graph was unveiled at a meeting of the Audio Engineering Society in New York City. "It's more important than the change from 78s to LP, or the change from mono to stereo."

Strong words, but nobody argued.

Major change in principles

Digital recording *does* mark the first fundamental switch from the recording principles worked out by Edison more than a century ago. Edison's method was analog; that is, the actual musical waveform was engraved into the recording—first through the primitive tin-horn and since 1925 through the microphone.

Even when tape recording came along later on, the analog principle was still followed: The magnetic patterns on the tape spelled out the shape of musical waveforms. In either case, the wiggly groove or the magnetized ribbon carried an actual image of the musical sound—the sort of waveform you would see if you "played" the audio signal on an oscilloscope screen.

The trouble with this analog—or "imaging"—method is that distortion comes to it as naturally as dirt comes to a hog. On its journey from the microphone to the listener's loudspeakers, the signal gets mucked up every step of the way. The worst happens at the stylus tip. That little diamond chip has a terrible time keeping up with all those fast wiggles in the record groove.

And when the going gets really rough—as in loud passages or at extreme highs or lows—even the best phono pickup tends to cut corners in the groove path or overshoot the mark. The net result is rough, distorted sound. Tape can't take it, either. Loud signals cause magnetic overloads (distortion and loss of highs), and the soft sounds are swamped by tape hiss.

The whole history of sound recording, in the 100 years since Edison, has been one long effort to overcome these drawbacks, and we've come a long way. But even at its best, analog recording still suffers from background noise and marginal distortion. And the dynamic range—the span between the loudest and softest sounds that can be put on a disc—doesn't come close to the actual dynamics of live music.

An audio marriage

Digital recording solves all these problems at a single stroke. Roughly speaking, digital recording can be described as the wedding of the com-

puter with the phonograph—and from the sound of it, it's a good match. Computers have given audio engineers the basic clue to avoid the pitfalls of analog. The secret lies in "digitizing" the signal. The original sound, captured by the microphone, is fed to an analog/digital converter where every musical frequency is encoded as a binary number intelligible to computer circuits.

As in most computers, these numbers are expressed as a series of pulses representing 1 and 0. That's why this system is also known as "pulse code modulation," or PCM for short. Gone is that tricky, wiggly analog waveform. Nothing is left but a fast data stream of digital "bits" to spell out the frequencies and amplitudes of musical sound. In the recording studio, these bits are recorded on tape just as information is recorded by digital computers.

The advantage is obvious. Translated into numbers, the signal becomes immune to distortion and noise. The numbers are precisely defined and permit no distortive ambiguity. The numerically defined waveform can't be altered by faulty groove tracking or amplification.

What's more, the musical "information" becomes independent of the material on which it is recorded. In other words, the surface has no effect on the sound. And if you've ever gritted your teeth at noisy, dusty or scratchy records, you can easily appreciate what this means in terms of sheer listening pleasure.

Recording with light

To "cut" a digital record, the pulsing signal is used to modulate a laser beam that burns tiny pits into a swiftly rotating master disc. The sequence of pits and blank spaces represents the "zeros" and "ones" of the digital information. Once the master disc is cut in this way, copies can be pressed, just as in the case of ordinary phonograph records. This is a fast, inexpensive process, which makes the basic cost per disc (not counting the cost of the musical performance) low enough to compete with standard phonograph records.

In playback, the process is reversed. A small, solid-state laser—the crucial part of the digital phonograph—shines its beam on the spinning disc. Each pit and each blank space then reflects the beam back in a different manner. The reflections are projected through prisms into a light-sensitive detector diode which—like the light meter on a camera—converts the incident light into electric impulses. The varying reflections thus reproduce the digi-

(Please turn to page 192)

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NEW DIGITAL SOUND

(Continued from page 190)

tal signal, because each pit counts as 1 and each blank space as 0. The numbers thus recaptured are reconverted to analog form to drive the final amplifier and speakers.

The playback laser beam must be precisely aimed and focused on the spiral of pits on the record. To compensate for any record warp or off-center pressing, a special mirror monitors the beam's reflections. Linked to a precision servo-controlled drive, it keeps the laser "on track"—aligned with the spiral pit pattern—somewhat like an autopilot keeps a plane on course.

Laser scanning has an enormous advantage over the mechanical scanning done by conventional phono cartridges. There is no direct contact with the disc at all. The only thing "touching" the record is the light beam, which causes no wear whatever. For all we know, digital discs may last forever. As one engineer pointed out, they are the most durable "archival" medium ever devised. Anything digitally recorded will outlast any other mode of message preservation—even engraved stone, which crumbles with age.

The digital disc also makes obsolete all kinds of fussy record care. No more brushes and chemical cleaners—and you needn't hesitate to lend your records to fumble-fingered friends. The disc is coated with hard, translucent plastic. Scratches, dust and fingerprints on this coating have no effect on the sound because the laser beam searches out the information *beneath* this plastic shield. The beam doesn't "read" surface blemishes. It "sees" right through them to the digital information below.

Both sound—and picture!

If you've been following developments in television, you probably recognize that the digital phonograph is basically an audio version of the MCA/Magnavox videodisc system now being test-marketed in several American cities, notably Miami, Fla., and Portland, Ore. (see *PM's Complete Guide to the New Videodiscs and Cassettes*, page 118, Sept. '79). The same laser method is used for recording either video or audio. In fact, some industry leaders believe that with this method the traditional split between video and audio will come to an end. In the future, a single laser playback unit

will be able to feed top-quality signals to a video screen or a stereo system—or to both simultaneously.

But that's looking far ahead. So far, the experimental digital phonographs shown are audio only, and they are different in their particulars. The Philips disc is only 4½ inches in diameter and no thicker than a dime. A dozen of them would slip easily into your pocket. The laser player is correspondingly compact, much smaller than conventional LP turntables. Sony uses a standard 12-inch record, which carries 2½ hours of music compared with one hour on the smaller Philips disc.

In other respects, differences between the two systems are slight. Each encodes the musical signal by "sampling" the waveform at a rate roughly twice that of the highest audible frequency. Since the top sounds in audio are roughly 20,000 hertz (Hz), the waveform is sampled by electric pulses at a rate of about 40,000 Hz. Each sample represents a single point in the waveform, which is then assigned a digital number.

To register the proper loudness for each frequency, Philips employs a 14-bit digital code that permits 16,000 combinations, creating a dy-

dynamic range of 85 decibels. Sony uses a 16-bit code, achieving a range in excess of 90 decibels. To the listener, this means that the music emerges against a background of virtual silence and that even the most shattering orchestral climaxes come through with undiminished force. Of course, the playback amplifiers and speakers must be capable of handling this astounding loudness range.

In both the Philips and Sony systems, the laser scans the disc from underneath and travels from the inner diameter toward the outside rim—exactly the opposite of conventional records. To keep the speed of the recorded track constant, regardless of whether an inner or an outer part of the disc is played, Philips features variable turntable speed, ranging from 500 rpm near the center to 215 rpm at the turntable's outer edge.

The pits on the record are about 0.6 microns wide and 0.2 microns deep. To get some notion of these dimensions, just consider that the printed period at the end of this sentence has a diameter of about 500 microns. The incredibly small size of these pits allows the tiny Philips disc to hold a total of about six billion bits, which is what it takes to spell out an hour's worth of music in digital form.

Disagreements on standards

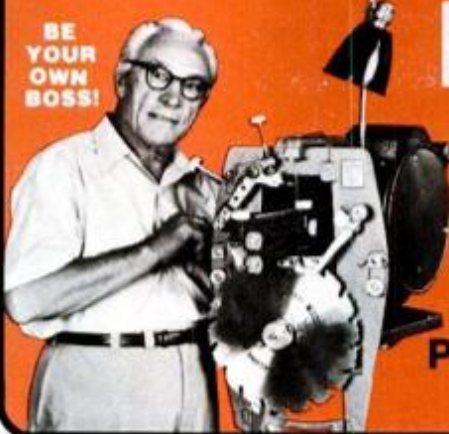
Technically, the digital phonograph is ready for the market, but it's not about to become a household item just yet. What's holding it up is the lack of agreement on technical standards. Before the digital format makes economic sense, discs and players all over the world would have to be compatible—just as standard stereo LPs are today.

But setting standards is a tricky task because of commercial rivalries. Each company is pushing its own system in hopes of getting it accepted internationally, then collecting license fees from everyone else. Digital politics are so tangled (especially in the United States where standards must be formulated without violating antitrust laws) that we may yet have to wait a couple of years for all-digital home delivery of recorded music.

Meanwhile, however, we can enjoy digitally recorded sound on standard LPs. Granted, such records still have to cope with problems like surface defects and groove-tracing distortion. But the new digital studio process gives even the present discs a big margin in fidelity, far ahead of anything the recording industry has produced so far. **PM**

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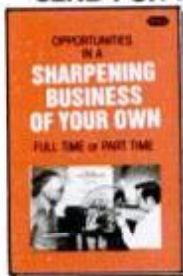
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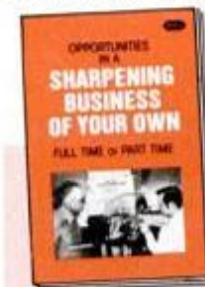
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PATROLLING THE PIPELINE (Continued from page 97)

the transponder sails up and away, like a captive balloon released.

Arms folded back in a stowed position, the sub continues its flight up the pipeline, stopping along the way to photograph sacrificial anodes. These are designed to corrode, protecting the pipe itself against corrosion. It all seems controlled and routine, exactly the way it should be, as the crew munches cookies. The PLEM—the pipeline end manifold joining the main line to a vertical hose—comes into view.

Routine. But there are some reminders of potential dangers facing this pipeline patrol. There's the notice on a gray canister a few inches above my head, for instance. "Emergency," it reads. "In case power supply fails, spread ¼-inch depth over flat surfaces not in contact with water..." The canister contains carbon dioxide-absorbent lithium hydroxide.

And there are a few alarming stories, known well by everyone aboard this vessel, about North Sea work. One comes from Dick Winchester of Intersub about another company's trapped submersible.

"The other sub became a little overenthusiastic," explains Winchester, "and it moved in too close to a wellhead, getting itself completely tangled in cables and netting in the process. After getting the call, our ship, *Intersub Two*, arrived at the scene within 11 hours." The mother ship lowered a submersible, which in turn released a diver. He was able to cut the trapped sub loose. No one was injured.

Dangers of diving bells

Much more frightening, though, are stories told about diving bells, dangling chambers hung under their support vessels and connected by cable and air lines. At least for now, diving bells are still the acknowledged workhorses of North Sea diving, with good reason: Divers can work outside a bell longer—more than twice as long as divers from a submersible—since heat and breathing mixture come down through an umbilical from the mother ship.

The threat to divers working from bells is that the mother ship on the surface will drift off station, dragging and bouncing the bell along the bottom or—worse—toward something hard enough to sever lifelines. An anchor cable sheared through one bell's lines, for instance, cutting off its two crewmen's supply lines. By the time it was brought to the surface 14 hours later (with the help

of a submersible), the men had died. Duffin told me four bells have been lost in the past year.

By contrast, the submersibles are independent—their only umbilicals run from diver to sub. They're not restricted to the seabed, as bells are, since Intersub has perfected a clamping system permitting subs to be attached to any bracing member of a platform. Best of all, the subs appear to be comparatively safe: To date, there have been no fatalities in North Sea submersibles. Nor have there been any accidents involving divers operating from subs. Man and machine seem perfectly at ease beneath the surface of the North Sea, and bob back to the mother ships ready for more.

A sigh of relief

After a careful survey of the PLEM, pilot Miller delicately guides the sub, like an undersea helicopter, around and up the flexible hose that leads to a turntable-like CALM buoy on the surface. CALM stands for "Catenary Anchor Leg Mooring" to which, ultimately, tankers will connect their hoses to load oil at sea.

The hose looks okay to me, and apparently to the crew, and soon the sub blows out its ballast with—it seems to me—a sigh of relief. It begins to rise to the surface. With more light penetrating by the minute, we pass through "five zero" feet at 14:58 and break surface at three o'clock landlubber time, rolling and dipping in the chop that has developed in the nearly five hours that we've been below. Had rough weather developed, as happens often in the North Sea, retrieval would have been unsafe and we would have been forced to remain on the seabed to wait out the weather. This would have been no problem, since the subs have life support for a week.

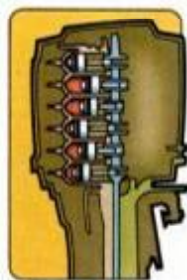
A hand, then a flipper, pass by a conning-tower porthole, indicating the swimmer is on the job. He's attached the towing cable to the sub's nose and now rides the sub as it's winched to the stern of the mother vessel. Once the main hawser and side restraining leads are attached, we're plucked from the grip of the sea, up, in and down on the cradle with a minimum of juggling, thanks to relatively calm waters. The dive is over. The hatch opens, and we're again breathing unbottled air.

"How was it?" asks one of the swimmers, as I wobble across the slightly sloping deck. And without hesitation, I answer: "Just routine." Strangely enough, I think I really mean it.

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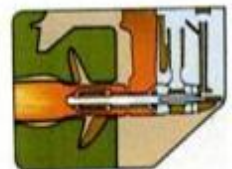
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DRIVING FOR ECONOMY (Continued from page 111)

marked in five-inches-of-vacuum increments.

The indicator-light gauge informs the driver of vacuum level through indicator lights (for example, green for okay, orange for fair, red for poor). This type of gauge is used in some cars, such as Cadillac, as original equipment.

With a piston-type gauge, the piston is pulled into its housing as vacuum increases. A different color is displayed on the piston dial at various vacuum levels.

DOE tested dial- and piston-type gauges at the Nevada test site in conjunction with its driver test program. It found that drivers using either type of gauge were able to attain similar increases in fuel economy during the highway segment of the test. Drivers indicated that, in traffic, the dial-type gauge was easier to follow than the piston type.

Vacuum gauges are relatively easy to install, requiring that you tap the gauge into a vacuum line subject to full manifold vacuum. Be sure installation instructions accompany the gauge you buy. Installation should take less than 30 minutes.

Four companies that have indicated a willingness to send you information concerning their gauges are:

Stewart-Warner Corp., Alemite and Instrument Div., 1826 Diversey Pkwy., Chicago, Ill. 60614. The most popular S-W vacuum gauge, the Motor Minder, has a suggested retail price of \$21.34.

Cal Custom/Hawk, Consumer Service Div., 23011 South Wilmington, Carson, Calif. 90745. Cal Custom makes an indicator-light gauge and a dial-type gauge. Each sells for \$15.95. To find a Cal Custom sales outlet in your area, call their toll-free number: 800-421-1295.

TRW Inc., Replacement Div., 8001 East Pleasant Valley Rd., Cleveland, Ohio 44131. The TRW vacuum gauge Model 610507 has a suggested price of \$24.59.

Rite Autotronics Corp., 3485 South La Cienega Blvd., Los Angeles, Calif. 90016, attention of Tom Wilson. This company's vacuum gauge, called the Motor Monitor, retails for \$26.73.

Gas-saving tips taught by ARCO and DOE follow. Some you've heard before. Others, I'll bet, will surprise you.

■ **Observe the speed limit** and maintain a steady speed.

■ **Don't tailgate** and don't cut in and out of traffic.

■ **Anticipate stops.** When approach-

ing traffic lights, slow down by taking your foot off the accelerator and try to hit the green rather than racing up to the red and having to stop suddenly.

Also, back off on the gas pedal and let the car's rolling resistance help slow you down, instead of using heavy braking. Always brake with your right foot. People who use the left foot to brake often unconsciously keep light pressure on the gas pedal with their right foot.

■ **Keep windows closed at highway speeds.** Use vents or air conditioner to reduce the wind resistance your car meets with windows open. Avoid using airconditioning at lower speeds.

■ **In cold weather, try to keep the car warm** by turning up the temperature and letting vents force heated air through the car. If possible, avoid using the heater blower. If the blower is needed, keep it at the lowest possible setting.

■ **Drive slower when you're bucking a head wind.** Wind resistance is a key factor in reduced gas mileage at speeds over 40 mph.

■ **Shut off power-consuming accessories before you turn off the ignition,** so engine load is minimized the next time the engine is started.

■ **Don't rev the engine just before turning off the ignition.**

■ **Try to avoid idling the engine for more than a minute.** With the engine warm, it is more efficient to shut it off and restart it when you're ready to go. However, you have to judge whether the engine will restart in very cold or hot weather.

■ **Avoid unnecessary steering-wheel movement.** Each sideward movement of the tires causes drag, which increases fuel consumption. When making turns, back off on the gas pedal and let the car slow down on its own. Touch the brake pedal lightly, if you have to. Roll through the corner and accelerate back to cruising speed as rapidly, but as smoothly, as possible.

■ **Accelerate to speed as rapidly as possible, but smoothly.** Avoid jack-rabbit starts.

■ **In cold weather, do not allow your car to warm up at idle for more than 30 seconds.**

■ **Accelerate slowly on sand, gravel, and snowy, icy or rain-slick roads,** so your wheels don't spin.

■ **Anticipate hills.** Gently press the gas pedal and maintain momentum to carry you over the top. Don't increase speed going uphill. Once over the crest, ease off on the gas pedal and let gravity help you down the other side. **PM**



Who says the Toyota 4-Wheel Drive Truck is leading the off-road pack? *OFF-ROAD* and *PICKUP, VAN & 4WD!* Both magazines named it "4WD of the Year" when introduced!

One reason is a 2.2 liter engine. It's bigger than any other small 4WD. That's extra power to move you out front, on the road or off. Our machine also has the highest running

ground clearance of any small 4WD.

The Toyota's high-riding good looks and fancy interior haven't hurt its popularity any, either. The Sport Truck model has locking front hubs, full carpeting, AM/FM Multiplex stereo radio and full instrumentation — standard. Tilt steering wheel and power steering are available options.

Surprised that a new design

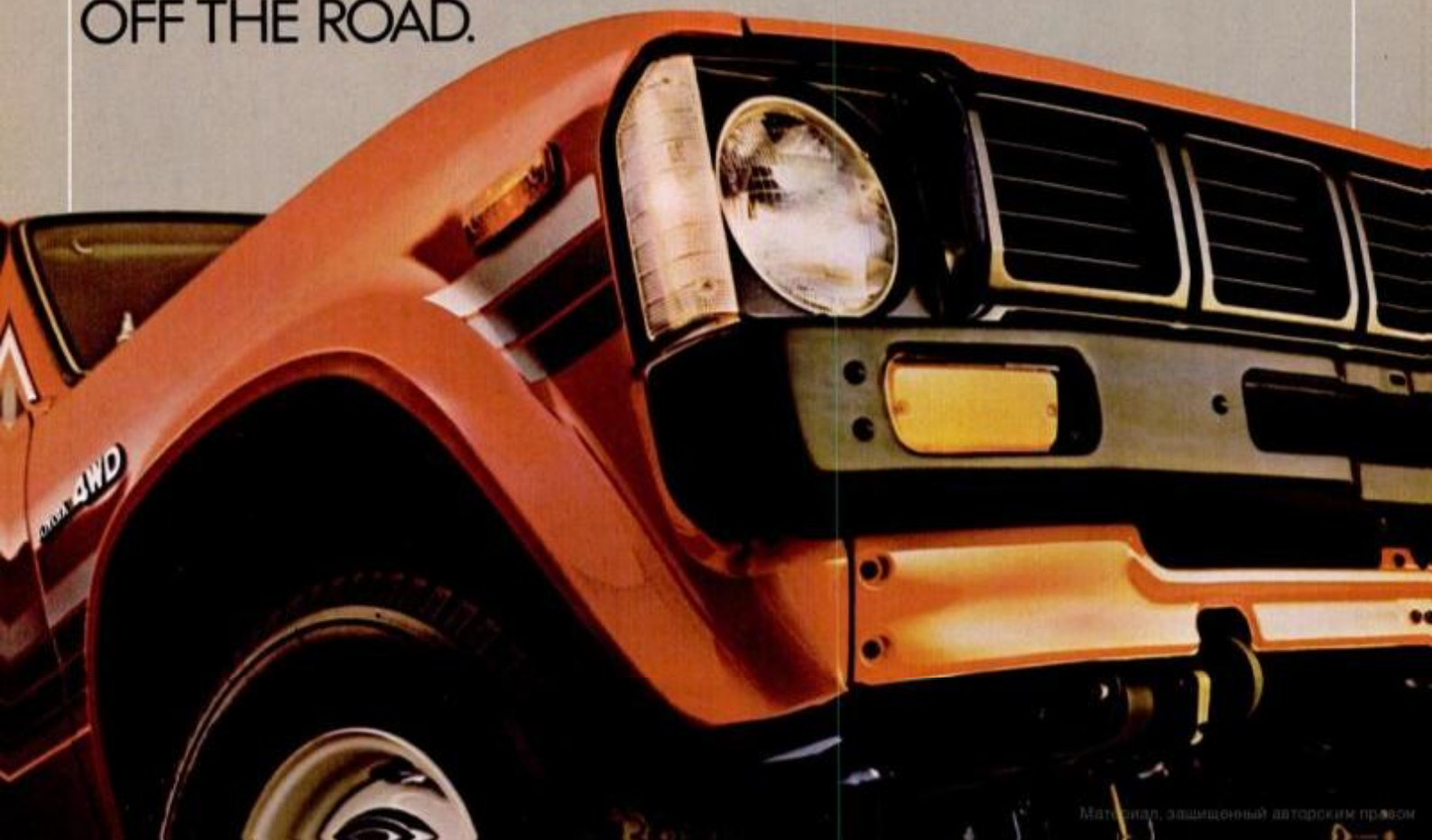
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submachine gun. His prices for these two miniature specimens are about \$5500 and \$8400 respectively.

Usually, fine miniature guns bring four-figure prices. However, by combining modern production methods with good old-fashioned handcraft, Larry Smith can sell his jewel-like miniature pistols at comparatively low prices.

Modestly priced miniatures

For example, prices of one-third-scale Colt Paterson pistols start at \$95; the model shown cased with accessories is \$300. As illustrated, the Smith Pepperbox is \$200 and the Remington derringer \$95; cased sets are available at higher prices. The Reid "My Friend" knuckle-duster is a prototype and not yet priced. All of these pistols are one-third scale. Smith's cased half-scale replica of the Remington Vest Pocket pistol sells for \$115. At these prices, needless to say, Larry Smith has a considerable backlog of orders.

All of the Smith miniature pistols are available chambered for the miniscule 2-mm pinfire blank. But collectors who prefer more authentic—if nonshooting—models can obtain the Colt Paterson with a percussion cylinder, the Remington derringer and Vest Pocket chambered for one-third-scale .41 rimfire and half-scale .22 short respectively.

Old-time quality

Often when we see a fine example of earlier craftsmanship, we say "They don't make things like that any more." Well, it's not altogether true. Take another look at these superb specimens of latter-day miniature gunsmithing. **PM**

MINIATURES THAT SHOOT

(Continued from page 106)

addition to the Model 1874 that is pictured on page 106, one-third-scale replicas of the Model 1883 and Model 1893 Bulldog Gatling guns are offered. The carriage-mounted Models 1874 and 1883, both 10-barrel, are priced at \$5000 each, while the smaller, tripod-mounted, six-barrel Bulldog is available at a cost of \$2500.

Swiss precision

The work of master miniaturist Leon Crottet is characterized by traditional Swiss craftsmanship and high quality. Many collectors regard his half-scale replicas of cartridge firearms as the finest of their kind.

Crottet's miniature Colt .45 automatic pistol and Thompson submachine gun are typical, with even the most minute details authentically reproduced half-size.

The little "Tommy gun" is complete with detachable shoulder stock, 50-shot drum and 20-shot box magazines. These guns are fully functional and, given half-scale cartridges (not commercially available), would shoot.

The half-scale cartridges pictured with these miniatures are dummies. Crottet says that he can make live rounds in this size, but the cost would be about \$15 for one cartridge.

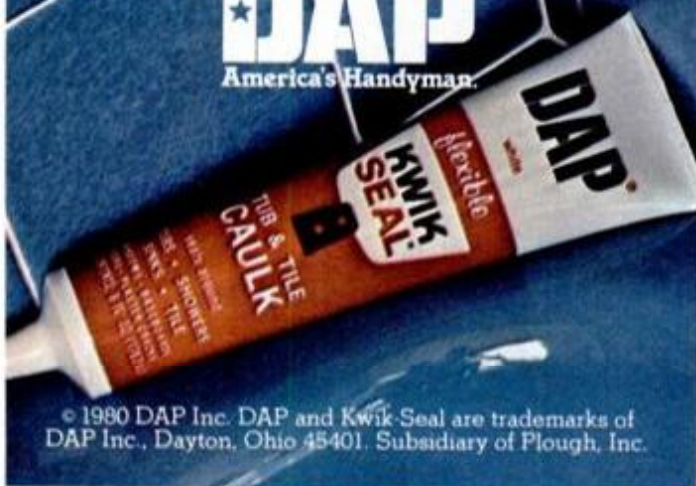
Only five pieces of each Crottet miniature gun are made. It takes him about 250 hours to complete a Colt .45 automatic replica and 380 hours for a Thompson

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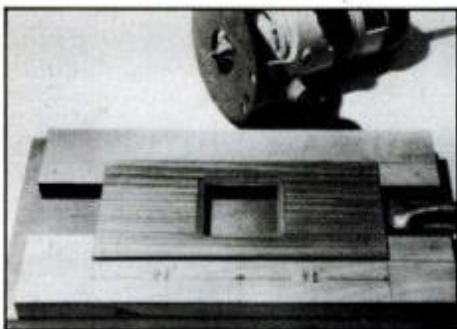
America's Handyman.



© 1980 DAP Inc. DAP and Kwik-Seal are trademarks of DAP Inc., Dayton, Ohio 45401. Subsidiary of Plough, Inc.

BUILD PM'S DESK CALENDAR

(Continued from page 131)



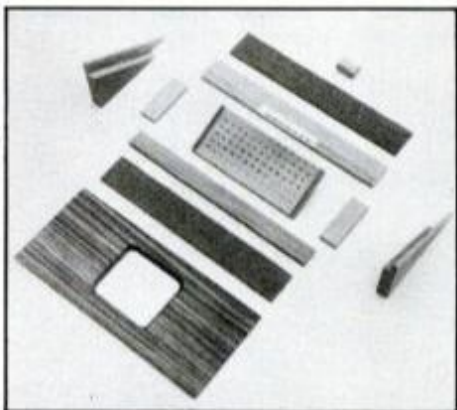
Inner jig edges guide router bit when you bevel cut around the window in piece A.

bly for a trial front-to-back fit of the slider. If B fits too loosely, sand the back of the spacer strips. If it is too tight, sand its back. Glue G, H and I in place.

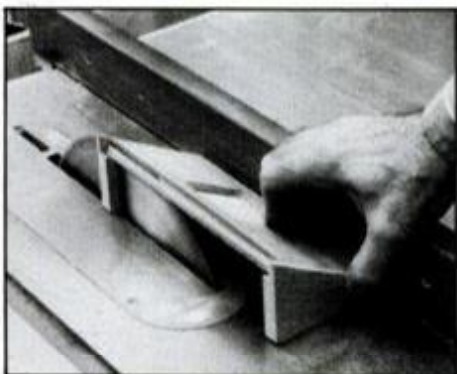
Trim the ends of the assembled front to size and attach end blocks (F) with glue. After the glue has dried, trim the bottom of edge A.

The stand is ready for final sanding and finishing. Oil the wood sparingly, then wax it. Varnish is not recommended as it may hinder the action of the slider.

Now the calendar is ready to use. For a given month, just move the slider until the number 1 is under the proper day of the week.—*Frank H. Day*



Parts are cut and ready for assembly. Attach the days and numbers with rubber cement, then cover with clear film.



After the glue at side joints is dry, place the stand face up, with the top against the rip fence; trim bottom edge.

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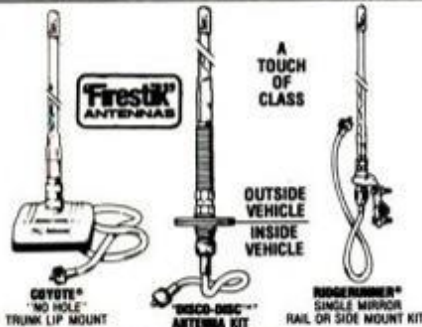
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BUILD THIS 'ROLL-TOP' DESK (Continued from page 125)

back of the ends. Using a 1-in. brad as a drill bit, bore a hole near the center of each slat for nailing the adjacent slat. (Editor's note: Offset

these nailholes slightly on adjacent slats so that brads won't interfere with each other.) Run a thin line of glue between slats, being careful to

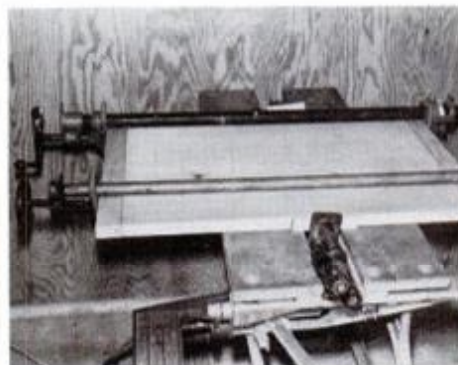
(Please turn to page 202)



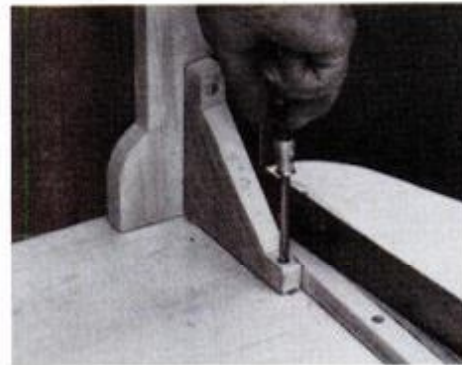
Tongue-and-groove joints are used on work surface (E) to minimize warping.



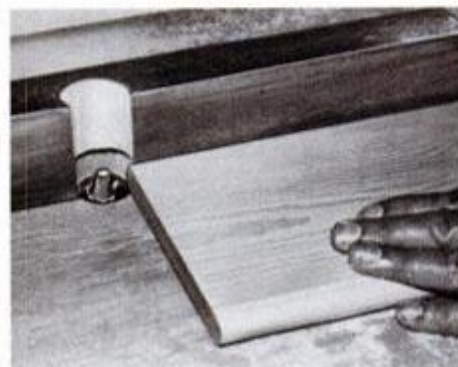
Apply glue sparingly to mating surfaces, wait 30 seconds, then put parts together.



Clamp the boards together using bar or pipe clamps; leave to dry overnight.



Corner braces (H) are shop-made; install them using glue and screws.



Clear-pine slat edges are rounded using a shaper, router, or block plane sander.



After shaping slat edges, finish with a thorough sanding using 120-grit paper.



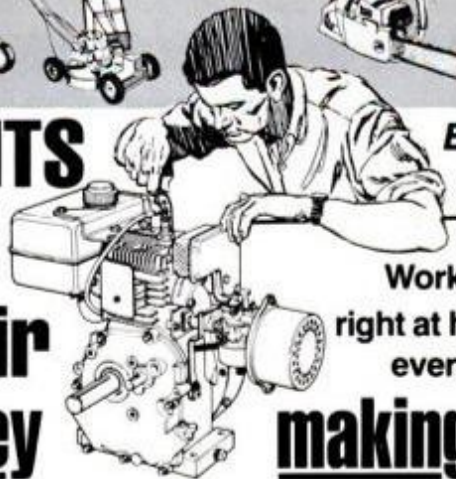
Bore a slightly offcenter hole in each slat using a 16-ga., 1-in. brad as bit. Run a thin glue line near the back edge of the slat.



Bore angled pilot holes at ends, apply glue, set 3/4-in. wire brads slightly. Temporary plywood on back aids assembly.



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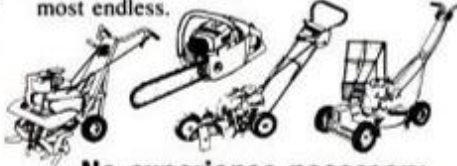
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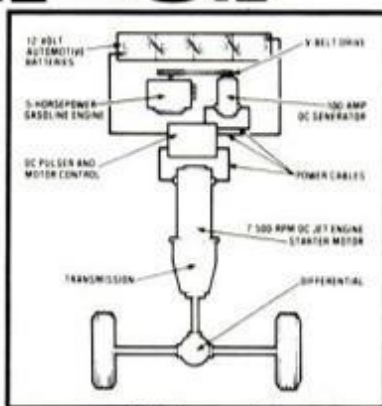
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The layout of the new drive system.

BUILD THIS 'ROLL-TOP' DESK

(Continued from page 200)

avoid getting glue on the surface. Use a damp cloth to immediately wipe up glue squeezeout.

Bore an angled hole at each end of each slat; use glue and 3/4-in. brads to fasten slats to ends. Set the heads slightly. Use 1-in. nails at slat centers. An alternate, much simpler, procedure for making the roll-top front is to use 3/4-in., half-round pine molding. But, the stain may "take" differently than on your pine case.

Thoroughly sand all surfaces before applying stain and finish with a 150-grit paper. Dust and wipe with a tack cloth. I used a mellow pine stain; make certain you follow directions for the stain that you use.

Allow stain to dry for 24 hours, sand *lightly* with 180-grit paper, and dust and wipe with a tack cloth. Apply two coats of varnish. Thin the first coat 50 percent with turpentine. When dry, sand, dust and wipe with a tack cloth. Apply the last coat as it comes from the can. **PM**

TWO HURRICANE SCONCES

(Continued from page 135)

the soldering-iron tip to both parts. Use rosin-core solder and remember that to produce a good solder joint the work must be heated to a point where it, not the iron, will melt the solder. After that, remove the arms from the wood and wash off flux residue at the joints.

The ornamental ring and finial have female threads that fit 1/8-in.-i.p. reducing bushings. The latter have a small inside-threaded hole for a 1/4-27 bolt. You can drill and tap holes into the ends of the wood to receive bolts, but it's easier to disregard the bolts and attach the bushings directly to the wood with dabs of epoxy glue. (Editor's note: Lamp-part sizes are somewhat confusing—i.p. stands for iron pipe. The size thread that fits ordinary lamp sockets is 1/8-in. i.p. The diameter of this pipe is actually 3/8 in.)

Finishing is the same for both lamps. Stain and/or top-coat the wood with a clear finish. Before final assembly, apply two light coats of spray enamel (such as Krylon No. 2202 brass) to all the metal parts. Other metallic colors such as gold, copper or silver, may be substituted.

Making the spindle sconce

Make a full-size pattern of the turning and draw in the parting cuts as indicated to aid in rough shaping of the spindle. Start with a square

(Please turn to page 210)

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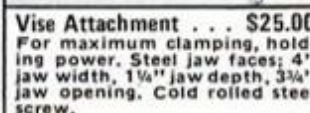
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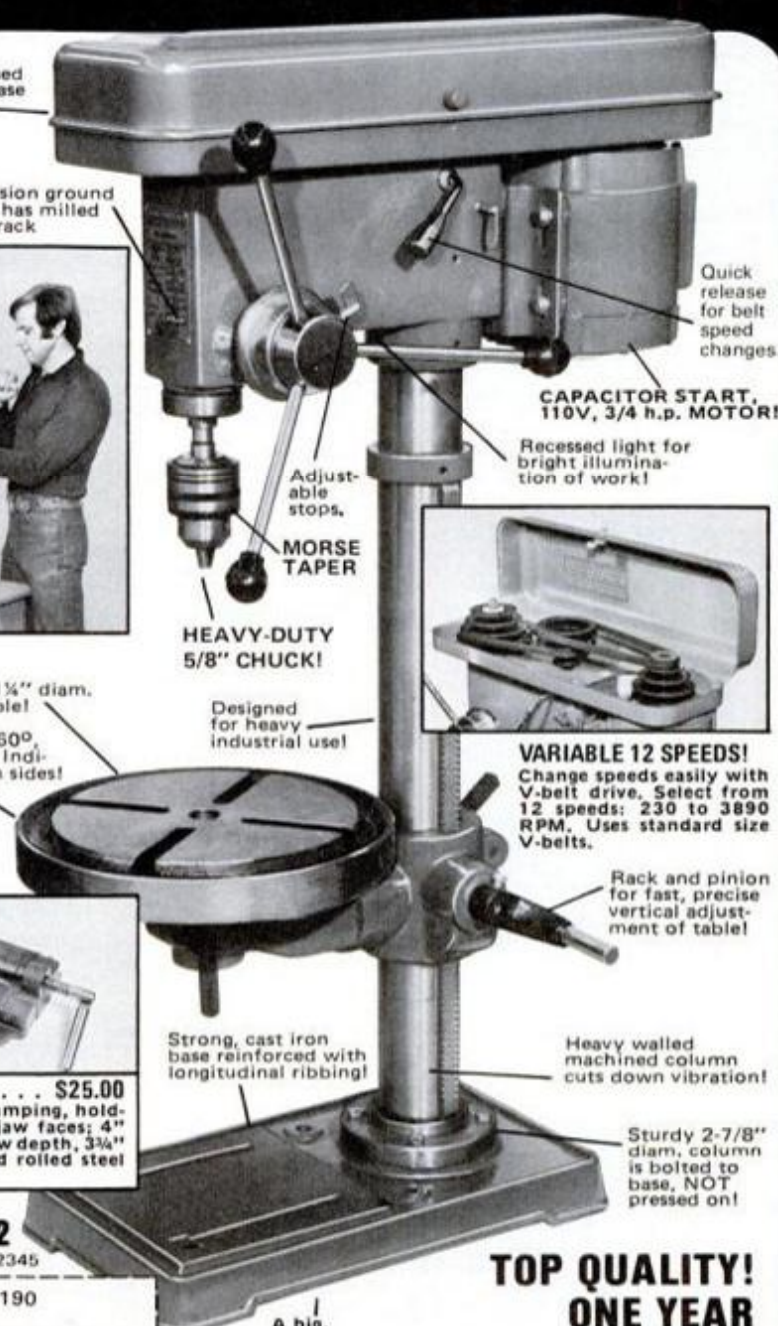
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PM LOG SPLITTER

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He's been a woodworker for years — for the fun of it. But his work is so professional he could sell everything he makes.

Jerry R.
He's your basic weekend "putterer". He's always got a project going to add value to his home.

Walt and Mary D.
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TWO HURRICANE SCONCES

(Continued from page 202)

turning block. Bring the blank to rough round with the gouge, but leave a square portion at each end—you will need it to saw the back of the spindle flat later.

Use the parting tool to make the sizing cuts. Set the caliper against the drawing and check constantly. When depth cuts have been made, shape the spindle by tooling from groove to groove with the spear point, skew and round-nose chisels. When the turning is ready, sand it smooth and apply sealer and paste wood filler. Then apply stain and/or top-coat finish. Do all finishing with work still on the lathe.

With the square ends supporting it, slice off the spindle flat at the back on the table saw. Cut a shallow groove into the back for flush fitting of the arms. Then cut off the waste ends. Epoxy bushings for the ring and finial to the ends.

A mild-steel bar is required to make the scrolled arm. Form the curved portion in the jig as described earlier, then secure the strip in a vise and form the 90° twist with a wrench or locking pliers. Note position of the strip in the vise and location of the pliers in the drawing, to insure that the twist occurs at the right place. Rotate the pliers 90°. Be sure to make a right- and left-hand twist, respectively, on each strip so the two will be symmetrical.

After forming the twists, place each strip horizontally into the vise, 1 in. in from each end. Grasp both strips and draw them toward you to make a bend of about 35°. Then make a downward bend, also about 35°. Check the bends with a T-bevel. Angles need not be precise, but both arms must be the same.

Use two flathead screws at the back of each arm to secure arms to the spindle. Drill an angled hole into the upper part for hanging. Solder the bushings to the arms as described earlier. Attach the candle cup and glass holder to the arm with a hex locknut. Since space doesn't permit insertion of a nut driver into the candle cup, the nut must be nursed into position with a finger. Once the nut reaches bottom, rotate the cup to tighten the nut.

Shopping for parts

The hurricane glass can be obtained at lighting-fixture supply stores, as can some, but perhaps not all, of the metal parts. A kit with all parts (except glass and candles) is available from Armor Co., Box 290, Deer Park, N.Y. 11729, for \$10. post-paid.

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The feeder, available at many hardware stores, costs \$30. The price includes six Hi Nitrogen cartridges. Each cartridge dissolves in about 15 minutes and fertilizes 1000 to 1500 sq. ft. of lawn. Refills come in two formulations: Hi Nitrogen (\$13 for six cartridges) and Basic Diet (\$15 for six cartridges) from Burgess Vibrocrafters Inc., Grayslake, Ill. 60030.—*Rosari Capotosto*



Loading is simple: Unscrew the transparent cover (above, left), peel the label off the bottom of the cartridge, insert the cartridge in the feeder (above, right) and replace the cover. Turn the water on to feed and water the lawn simultaneously.



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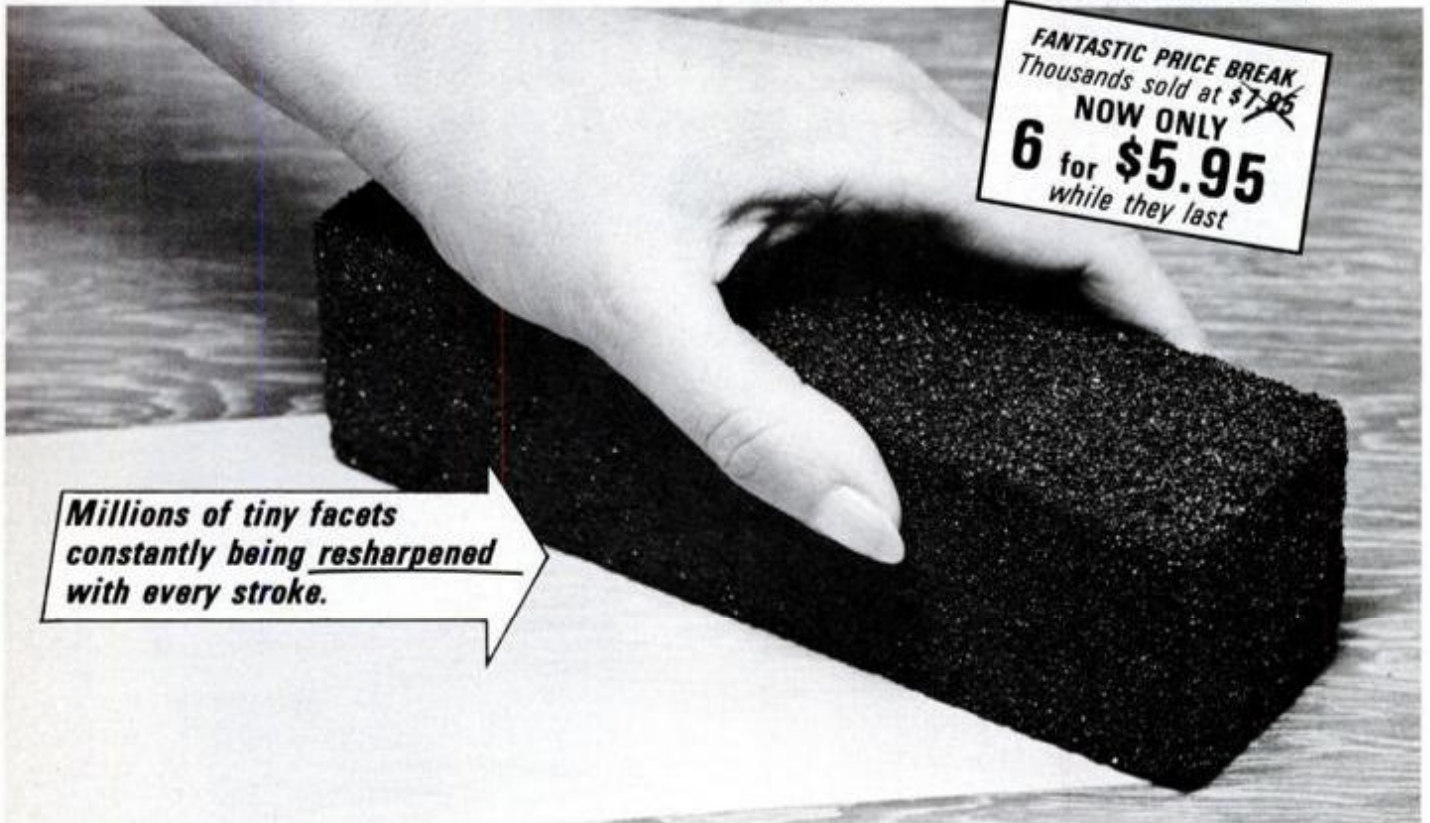
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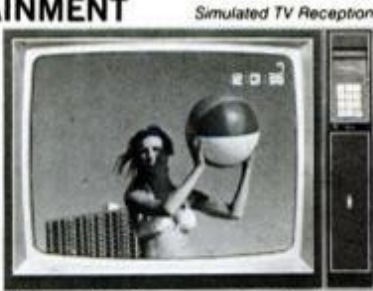
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PM OWNERS REPORT: AUDI 4000 (Continued from page 121)

front and rear for better 'turning in' on fast cornering... but I'm probably being too critical."

On the topic of driver and passenger comfort, here are some representative comments.

"Seats are extremely comfortable; plenty of head and leg space in the back."—Michigan economist.

"More than adequate legroom in the rear for passengers."—Ohio nurse.

"Excellent comfort and plenty of trunk room. I love the infinitely adjustable front seatbacks."—Florida motel owner.

"I recently drove my Audi for 16 hours straight and experienced no back pain."—California salesman.

"People are surprised by my 4000's roominess and comfort."—New York dietitian.

Owners rated their dealers fairly high both in service and sales. Nearly 70 percent gave dealer service marks of good to excellent. On the sales front, demand for the Audi 4000 outstripped supply in many cases, reducing the chance for haggling and causing low trade-in allowances.

A Texas distribution vice president remarked, "It was a case of I-have-it, you-want-it. The dealer's salesman was cour-



Owners praise rear legroom and comfort, dislike bulky, vision-cutting headrests.

teous, yes, but he gave me nothing off the sticker price."

A New York bank executive: "The dealer made sure that everything from the sale to getting the license plates was well

done. The car was in excellent condition at delivery."

An Illinois operations manager: "Since demand far exceeds supply in this area, the two dealers I visited weren't about to discount their sticker prices."

When we asked owners to tell us what they'd like to see changed or added to their cars, we got the following responses.

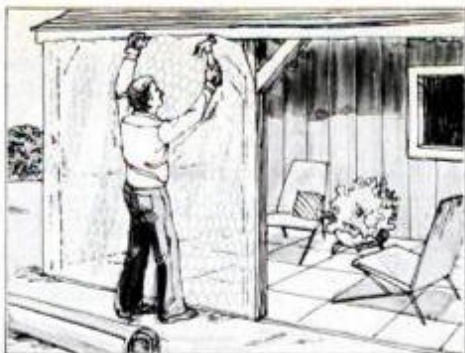
"A five-speed transmission and maybe a turbocharger."—California insurance processor.

"Console redesigned to accommodate driver's right leg; also the trunk lid to open lower so luggage needn't be lifted so high."—Texas personnel manager.

"An oil-pressure gauge, along with the gauges that are already there."—Texas machinist.

"I wish they'd replace the high-pressure, space-saver spare with a full-sized tire. As it is, this is the worst U.S. idea ever adopted by the Germans. I'd rather give up the trunk space. The mini spare keeps me from rotating this tire with the other four and also prevents my mounting a snow tire on the fifth wheel."—Ohio repairman.

But praises outweighed complaints by a very wide margin. A hefty 93.4 percent



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of our owners said they'd buy another Audi when the time came to trade. Many of them hoped to move up to the Audi 5000 by then.

"It's a well-designed car; makes good use of space," declares a Vermont ski laborer. "It's also fun to drive, good-looking, sporty, spirited, safe and well suited to long trips."

An Oregon real estate salesman: "The

Audi 4000 is engineered to give maximum comfort for four people, reasonable mpg and troublefree operation."

And the last word comes from the owner of a fire-protection company based in Illinois:

"I traded a '78 Monte Carlo for my 4000. All I gave up were four cylinders and some brute power. What I gained was about 10 mpg. My wife has no problem

driving this car—she's barely aware that it's a stick shift. As for handling, it's superb—responsive steering, good road feel. It must be close to a racing car in terms of feel. Despite the relatively high purchase price, I feel I got a good value for my money; also the resale should be high.

Yes, I'll buy another Audi 4000—unless I can afford a 5000 diesel!" **PM**

SUMMARY OF 1980 AUDI 4000 OWNERS REPORTS*

Total miles driven 1,034,311	Comfort 35.7	Good 9.9	Average 13.0
Average miles per gallon	Performance 14.8	Fair 0.0	Fair 7.6
In town 25.5	Specific dislikes:	Poor 0.5	Poor 10.3
Long trips 31.6	No complaints 22.9%	Comfort opinion (rear seats):	Number of vehicles owned:
Body style choices:	Noisy engine fan 9.0	Excellent 53.2%	Audi 4000 only 33.8%
Four-door sedan 71.2%	Lack of horsepower 8.5	Very good 36.2%	Two cars 52.7
Two-door sedan 28.8	Would like five-speed trans. 8.5	Good 8.5	Three cars 10.0
Transmission choices:	Car too noisy 8.5	Fair 2.1	Four or more cars 3.0
Only four-speed manual available	What changes would you like?	Poor 0.0	Makes of other cars owned:
Automatic and five-speed available mid-1980	Add a five-speed transmission 22.3%	Had any mechanical trouble?	Volkswagen 21.1%
Why did you choose the Audi 4000?	No changes 9.8	No 58.4%	Chevrolet 13.5
Economy 48.0%	More horsepower 8.7	Yes 41.6	Ford 13.5
Styling 39.5	Thinner console 7.6	What type of trouble?	Toyota 9.0
Front-wheel drive 16.0	Quieter engine fan 7.1	Wipers work loose 15.5%	Datsun 6.8
Reputation 13.5	Workmanship opinion:	Air conditioner 10.7	Age distribution of owners:
Quality 13.0	Excellent 66.7%	Electrical ills 9.5	15-29 years 30.4%
Specific likes:	Good 29.4	Fuel-injection 8.3	30-49 years 52.8
Economy 60.7%	Average 2.0	EGR light 7.1	50-plus 16.8
Handling 59.7	Fair 1.5	Dealer repairs satisfactory	Would you buy another Audi?
Styling 44.4	Poor 0.5	Yes 76.6%	Yes 93.4%
	Comfort opinion (front seats):	No 23.4	No 6.6
	Excellent 65.8%	Dealer service opinion:	
	Very good 23.8	Excellent 37.3%	
		Good 31.9	

*Percentages might not equal 100% due to rounding or insufficient data.

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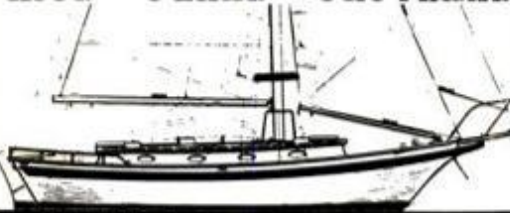
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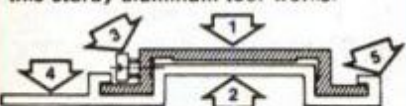
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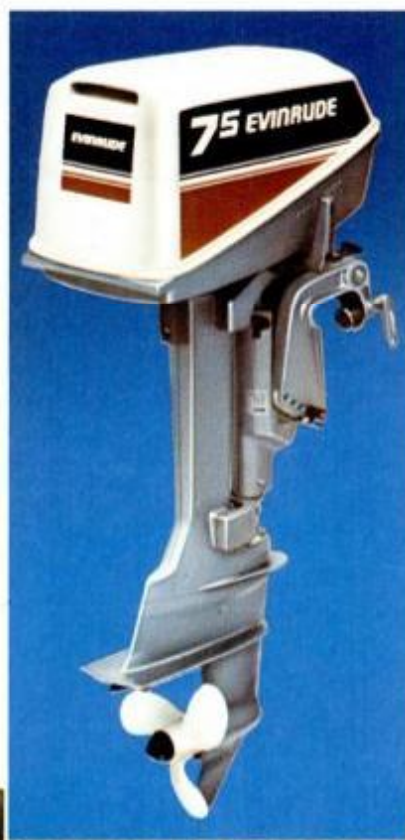
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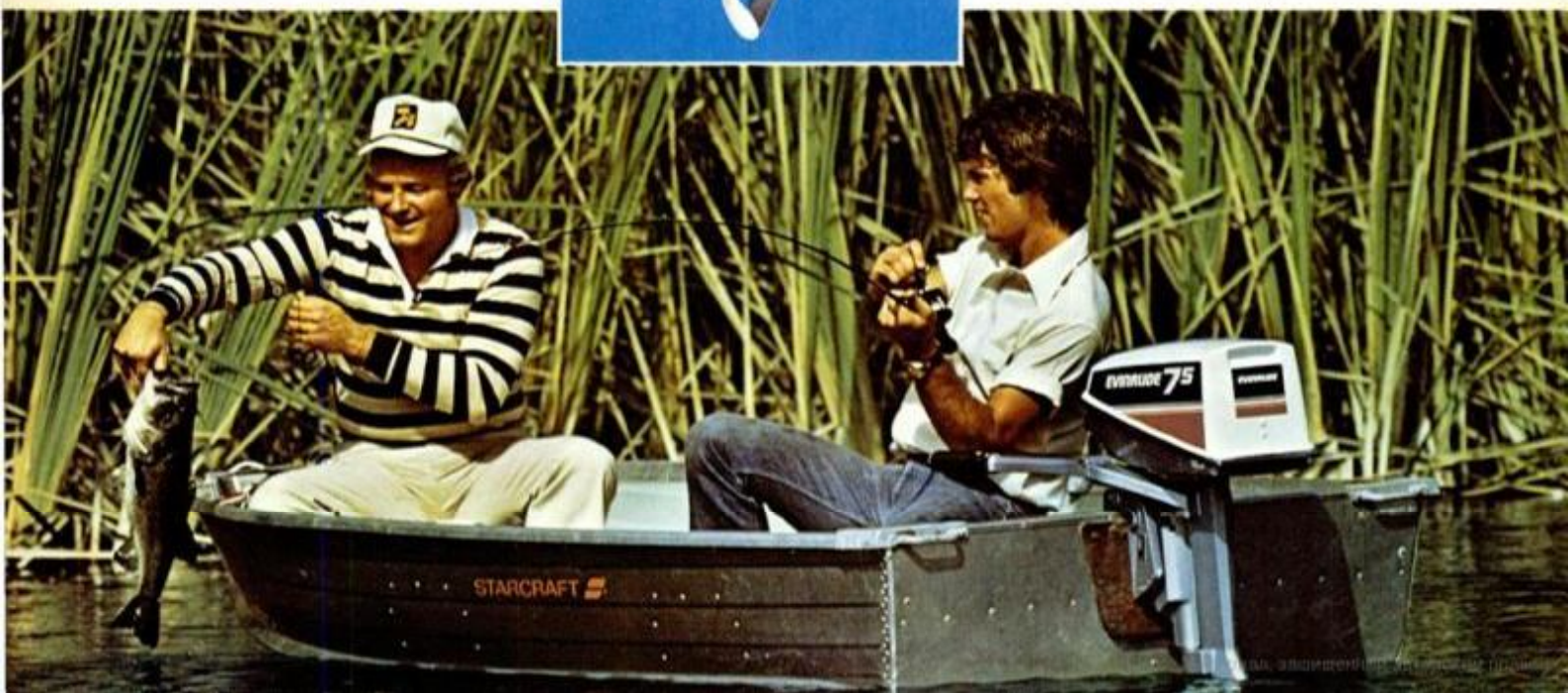
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