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the quality of
home systems

Popular Mechanics

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rod to fit
your suitcase



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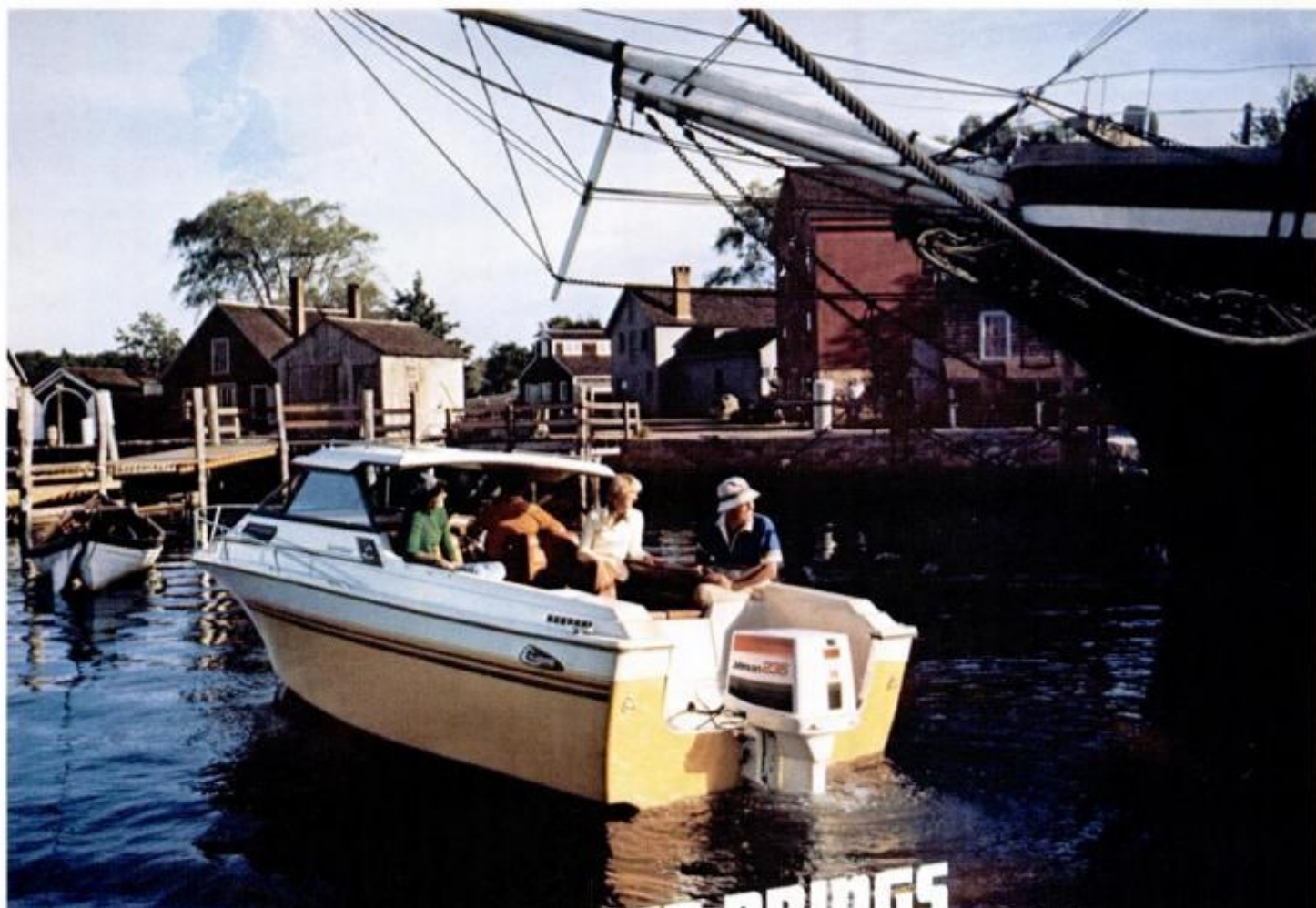
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This is our most powerful production outboard motor—our Sea-Horse® 235 hp V-6.

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Today, we offer four great new V-6s. The 235, 200, 175 and 150. Each packed with outstanding performance features like dual MagFlash® electronic ignition for quick, sure starts. Dual exhaust tuning for optimum

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See the Sea-Horse 235, 200, 175 and 150—and our complete line, down to the "mini" 2 hp—at your Johnson dealer. Or write for free catalog. Johnson Outboards, a product group of Outboard Marine Corporation, 200 Sea-Horse Drive, Waukegan, IL 60085.



NO WONDER THE WORLD RUNS MORE JOHNSONS THAN ANY OTHER OUTBOARD

First in Dependability
Johnson
 OUTBOARDS



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We spare nothing to spoil the Subaru Brat owner. That's why Subaru offers this long list of features:



Full-time front wheel drive. To spoil you forever when it comes to better handling and greater traction.



Four wheel drive at the flick of a lever from inside the car. So your travel plans won't be spoiled even if the road ends.



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A remarkably low price. So with all the money you save right off the bat, you can go out and spoil someone else.

For your nearest Subaru dealer call
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*1979 EPA estimates for our 4 wheel drive vehicle. Use estimated city mpg for comparisons. Your mileage may differ depending on driving speed, weather conditions and trip length. Actual hwy. mileage will probably be less than hwy estimate. Actual city mileage will be less in heavy traffic. †In Conn., call 1-800-882-6500. Continental U.S. only.
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WE'RE CHANGING THE FACE OF

**4 WHEEL
DRIVE**

THE REMARKABLE THING ABOUT THIS BIG SCREEN TELEVISION IS ITS GE VIR COLOR SYSTEM.

In 1977, General Electric won an Emmy for being the first to use the broadcaster's VIR color signal in home television. This year, we bring you a revolutionary new big picture television with the incredible VIR color system built into it. We call it Widescreen 1000.

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vir

VIR

BROADCAST CONTROLLED COLOR

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The Widescreen 1000 is a super-size TV with a picture three times as big as a 25" diagonal console. With all the advanced engineering found in GE sets. Including electronic tuning and the "chairside convenience" of random access remote control.

Call toll-free 800-447-4700 (in Ill. 800-322-4400) to find out where you can see the Widescreen 1000 and other GE VIR color TV sets.



GE "Command Performance" VHS video cassette recorder optional.



This is GE Performance Television.

Cabinet: Solid veneered wood.

GENERAL  ELECTRIC



On the cover

Painting shows how a new concept in fire and rescue vehicles, called the suspended maneuvering platform by its developer, McDonnell Douglas Corp., would be employed. PM found the fan-driven platform to be as easy to "fly" as an elevator. Story on page 90.

—PM art by Ed Valigursky.

Popular[®] Mechanics

APRIL 1979

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Steeltex Radial™

All Terrain™

Treat it to Firestone hard working truck tires for hard working trucks.

The Transport 1 Wide Oval, for wide tread stability and traction, wet or dry.

The Steeltex Radial, for radial handling, traction, and economy plus steel belted strength.

The All Terrain, with a deep-biting aggressive tread that's quiet on the road, rugged off the road. Plus a bold raised white letter sidewall design.

All three are tough, all three are available in extra traction tread versions, all three are priced right.

Check them out at your nearest Firestone retailer. He'll show you how to treat your truck like a truck.

Firestone

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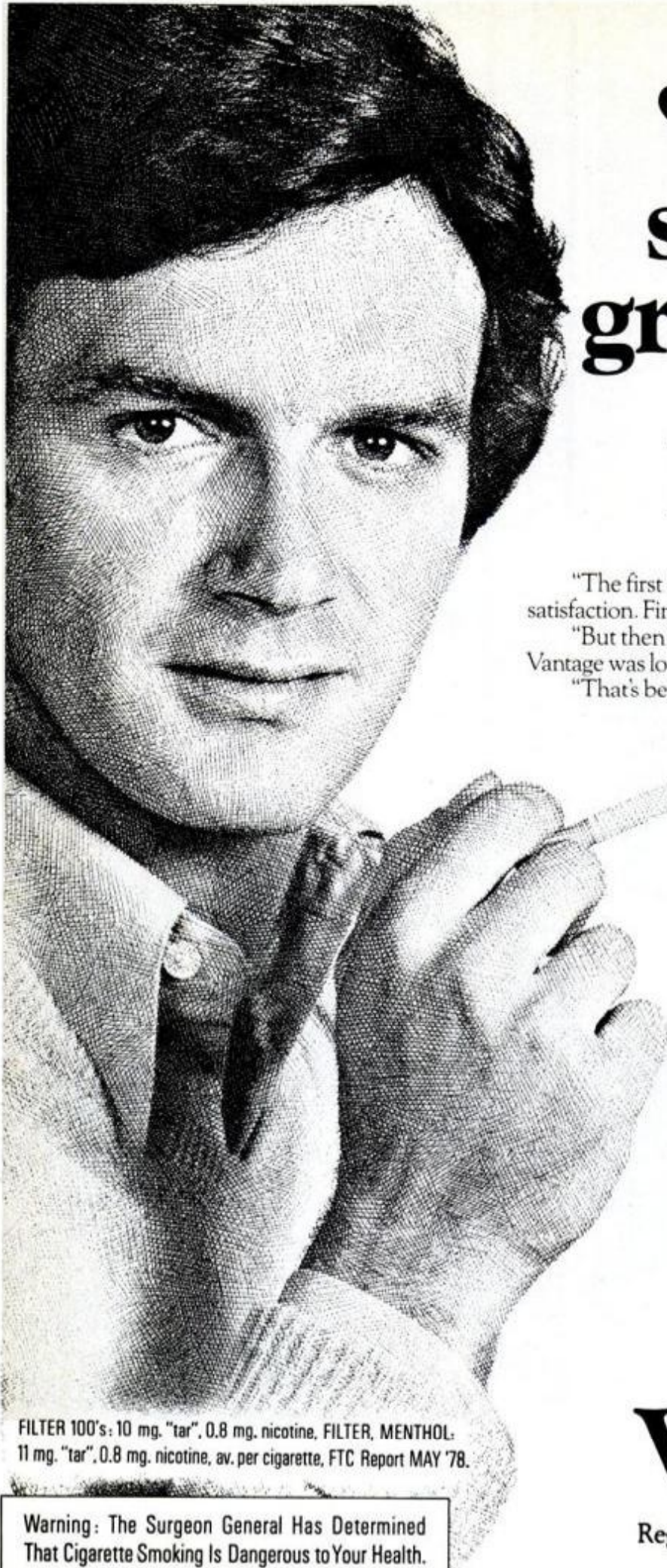


Feelin' Velvet.



There are a lot of whiskies out there. Straights. Blends. Canadians. But none can give you the exceptional feel of Black Velvet® Canadian Whisky. A premium import at a very reasonable price.

Try Black Velvet. And taste the Velvet difference.



'I didn't sacrifice great flavor to get low tar.'

"The first thing I expect from a cigarette is flavor. And satisfaction. Finding that in a low-tar smoke wasn't easy.

"But then I tried Vantage. Frankly, I didn't even know Vantage was low in tar. Not until I looked at the numbers.

"That's because the taste was so remarkable it stood up to anything I'd ever smoked.

"For me, switching to Vantage was an easy move to make. I didn't have to sacrifice a thing."

Peter Accetta
New York City, New York



Vantage

Regular, Menthol and Vantage 100's.

FILTER 100's: 10 mg. "tar", 0.8 mg. nicotine, FILTER, MENTHOL: 11 mg. "tar", 0.8 mg. nicotine, av. per cigarette, FTC Report MAY '78.

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

LETTERS TO THE EDITOR

Number, please

I found it very difficult to find one of the two parts needed to build the blinker in the flashlight (*Build a Beacon Into Your Flashlight*, page 18, Feb. '79) until I found that the correct number for the National Semiconductor LM3909 IC from Radio Shack is 276-1705, not 276-2705. I have already constructed one, and at less than two dollars each, plan to equip each flashlight I own with these very worthwhile devices.

TOM DILDINE
GENEVA, N.Y.

Glad you liked the project, Mr. Dildine. We're sorry for the typographical error on the parts number.

Blow-up

The article *How Experts Are Defusing Rolling Bombs That Ride Our Rails* (page 57, Jan. '79) was most interesting and informative, but I found conspicuous the lack of inclusion of radioactive materials in your first-aid list for hazardous substances. Is this because there are no gas masks or washing off that can protect those exposed?

Also, Mort Schultz states that stopping shipment of hazardous materials "is not feasible since such substances are essential to our living and manufacturing needs, personal comfort and national defense." There is no study anywhere defining just the amount of comfort chemicals add to our lives.

Before the public is told it should accept the growing risk of transportation spills of hazardous materials, the public should be told exactly why, and the public should determine if the chemicals and/or radioactive materials are "essential to our living."

ANNA E. WASSERBACH
N.Y. FEDERATION FOR SAFE ENERGY
SAUGERTIES, N.Y.

Golf weapon still secret

I enjoyed the article *Golf's Secret Weapons* (page 78, Dec. '78), but am frustrated because after telling us idiot golfers a 10-percent increase in distance can result from proper alignment of the brand name on a golf ball, you didn't tell us how to align it.

PETE KELLY
COSHOCKTON, OHIO

... Exactly where is the trademark location in relation to the golf ball being placed on the tee to gain this extra distance? At the top? At the bottom? On one particular side? Your clarification will be greatly appreciated.

ORIN R. LANCASTER
ALVA, OKLA.

Since the United States Golf Assn. does not, in theory, approve balls not having equal aerodynamic properties about every axis, they are reluctant to discuss specifics of their tests on approved balls with trademarks that interrupt the dimpling pattern—which does, after all, mean a slightly unequal aerodynamic profile.

We do know the 10-percent distance differential is a maximum that may affect only one or two brands, and would result only from precise misalignment, as opposed to optimum alignment—rarely possible in normal play. Since the USGA won't tell us, we can only guess that the trademark should have least interference with a tee shot if it is placed to the side—or on the axis of rotation—provided that you hit with perfect underspin every time. Then again, if you hit with perfect underspin every time, you won't be worrying about trademarks.

Mirror, mirror . . .

I checked the construction plans for the Infinity Mirror (*Four Handsome Mirrors You Can Build*, page 102, Dec. '78) and noticed that the wiring of the lights is in series, but on the materials list it calls for parallel-wired lights. Are the lights installed parallel-wired or do you change them to series? Or is the drawing in error?

R. GEIS
BRONX, N.Y.

Can you tell me where to buy the lights for the Infinity Mirror? Also, where can I get Con-Tact brand self-adhesive A-21 black velvet Cushion All 2003? All the stores I've been to don't know what I'm talking about. Thank you.

A.J. ZARLINGA
ARLINGTON HEIGHTS, ILL.

Although the lights in the plans do appear to look as if they are

wired in series, actually they have been parallel-wired with a single-wire return.

Built-in shunting devices in the bulbs keep the set operating if any bulbs burn out. We used General Electric No. S12-50 Merry Midget indoor/outdoor lights for our Infinity Mirror.

G.E. tells us the lights are available nationally, but primarily during the Christmas season. At other times of the year, your best bet will be to write G.E. at Nela Park, Cleveland, Ohio 44112 for the distributor nearest you.

The Con-Tact Cushion All may be hard to find, but can be mail-ordered from Kay's Hardware, 265 Morris Ave., Springfield, N.J. 07081. It's priced at \$1.29 per yard (13 inches wide). Include \$1 for postage and handling.

Shocking

The Taser (*Our Treasury's Armory of Lethal Imposters*, page 85, Sept. '78) is an immobilizing defensive weapon, not a "persuader." While the original model TF-1 was placed under Title II (of the Gun Control Act of 1968—ed.) restrictions for those produced after May 1976, those made prior to that date are exempt from that ruling. Two subsequent models, the TF-76 and TF-76A, were approved by the Treasury Department's Bureau of Alcohol, Tobacco and Firearms (ATF) as Title I firearms and are available through any gunshop or other licensed firearms dealer.

Further, the illustration you show of the Taser on page 87 is of the TF-76A, not the earlier model with the confusing ruling.

Finally, we resent the implication that our product is a freakish curio on a par with assassination attache cases or the like. We have struggled long and hard to offer a really useful, effective nonlethal weapon to the general public and law enforcement.

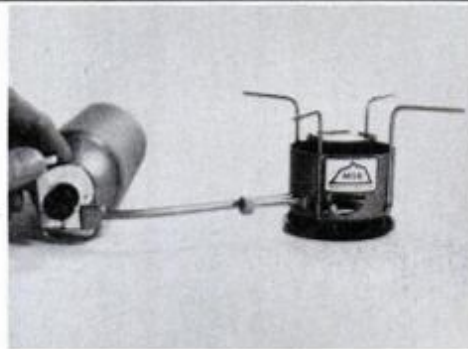
GLEN A. MEAD
TASER SYSTEMS INC.
CITY OF INDUSTRY, CALIF.

It appears that the technician who was interviewed at the ATF did not know of the approval of the newer Tasers as Title I firearms. We regret the error.

IT'S NEW NOW

Carry on

Porta-Handle is designed to help carry bulky or heavy objects like boxes, books, typewriters and other machines. Two adjustable one-inch nylon straps fit around any shape; carrying capacity is said to be 65 pounds. Unit folds down to 12x2x2 inches when not in use. It's \$15 from Arizona Typewriter Co., 122 East Roosevelt St., Phoenix, Ariz. 85004.

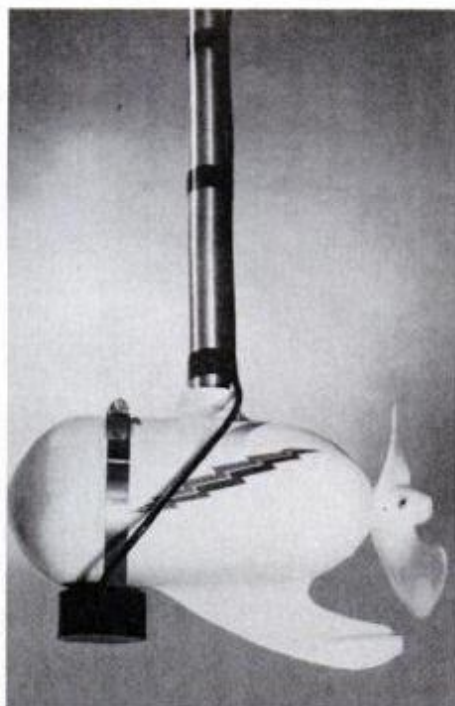
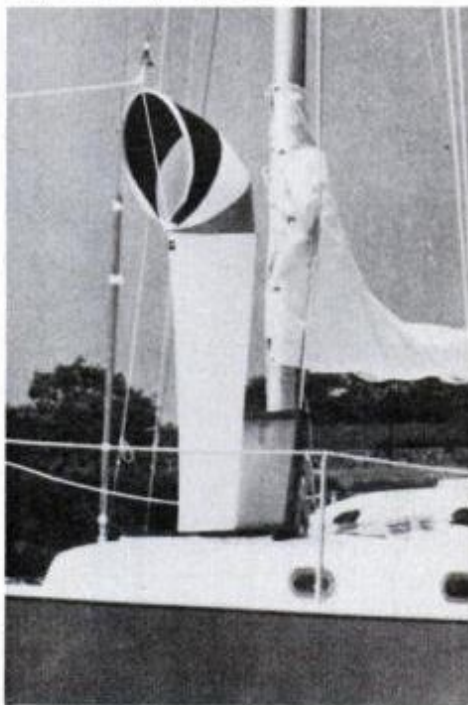


It's a gas

Automotive gasoline, which is much cheaper than other camp stove fuels, may be used in the MSR model G stove. To eliminate the clogging problems brought on by gasoline, the unit incorporates a fuel tube that can be cleaned in the field. The 15-ounce stove is said to provide up to three times the heating rate of most backpacking stoves. Model G is about \$53; model G/K, which also burns kerosene, is about \$57. Fuel bottle is extra. Mountain Safety Research, 631 South 96th St., Seattle, Wash. 98108.

Blow below decks

Ventilate a sailboat while berthed or at anchor with the Yardarm Wind Chute. The funnel hangs from the jib halyard to direct air below decks and folds up when not in use. Made of 3/4-ounce nylon spinnaker cloth, it's 21 inches wide at the top and 10 inches wide at the bottom. The cost is \$28 with storage bag. Yardarm Sailmakers Inc., 925 Webster St., Needham, Mass. 02192.



Bottom view

Mount the Humminbird Trolling Motor Transducer on your trolling motor when you fish from a bow platform and you'll have a more accurate reading of bottom contours, the maker says. The unit is compatible with all Humminbird depth sounders and can also be used with float tubes. It's about \$29 from Techsonic Industries Inc., Box 251, 1 Humminbird Lane, Lake Eufaula, Ala. 36027.

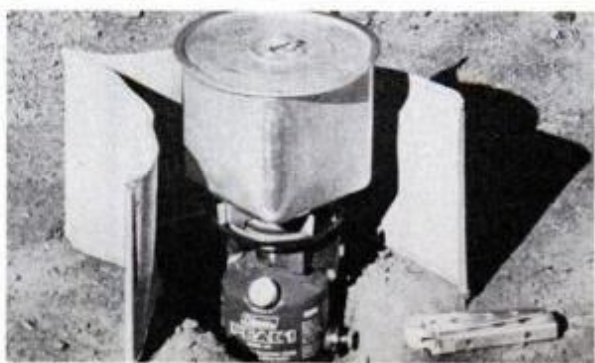
Just puttering around

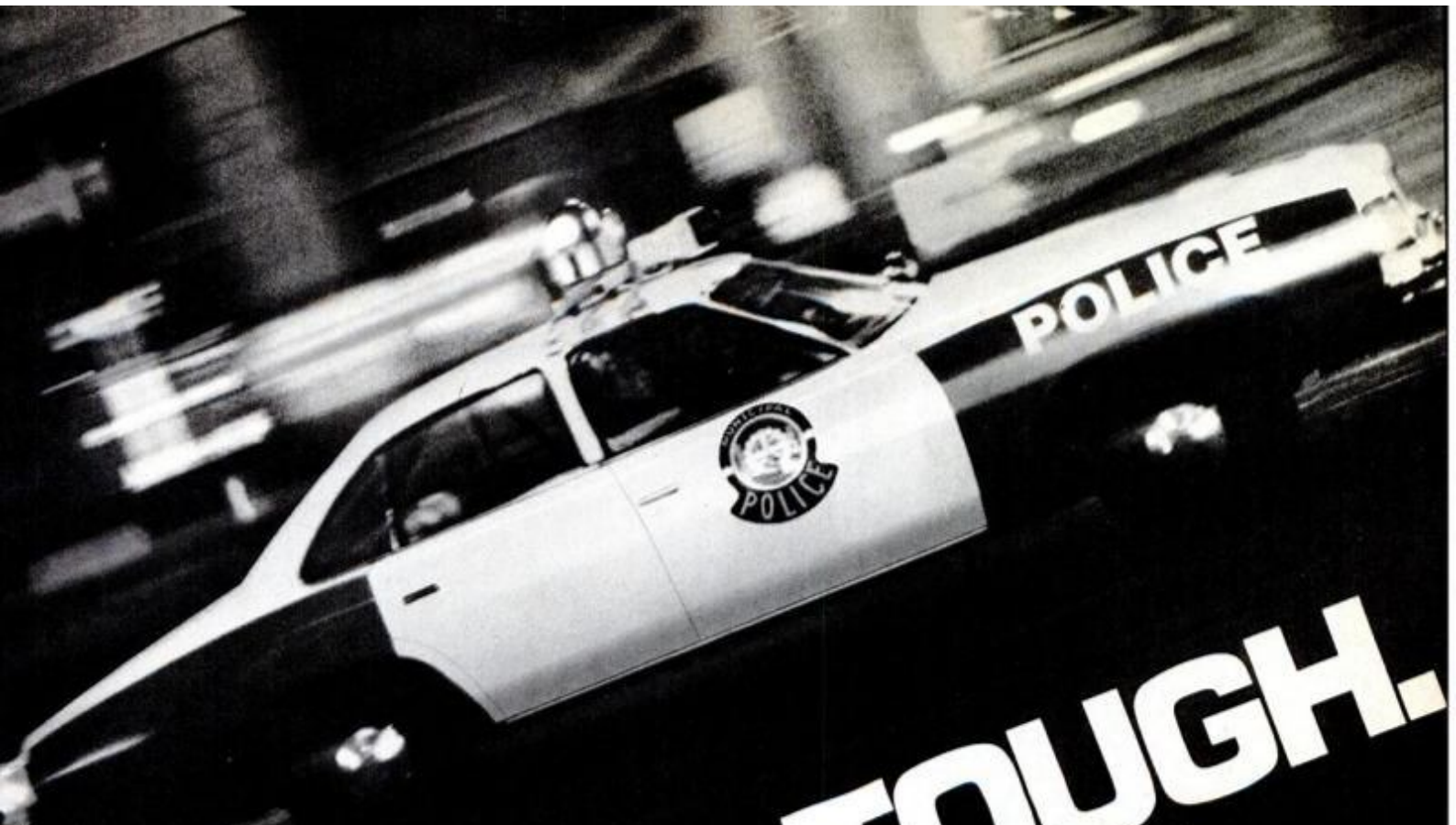
Practice putting on different surfaces indoors with the Adjust-A-Putt. By turning four handles on the device's frame, various undulations can be made in the playing surface to simulate different putting situations. Available from Align Golf Products Ltd., Formby Industrial Estate, Altcar Rd., Formby, Liverpool L37 8DL England.



Wind breaker

The model 6000 windscreen helps conserve the fuel of a backpacker's stove by increasing the stove's efficiency in windy conditions. The four-ounce screen rolls up into a cylinder 1 1/2 x 8 1/2 inches. Price is \$4.25 from Antelope Camping Equipment Mfg. Co., 21740 Granada Ave., Cupertino, Calif. 95014.





COP CAR TOUGH.

Motorcraft Spark Plugs. Tested Tough in big city cop cars.

Want tough plugs? Then get the ones that pass the test. Motorcraft.

Right now, our spark plugs are being tested tough in big city cop cars. Motorcraft Spark Plugs were installed in GM, Chrysler and Ford patrol cars and subjected to a wide range of driving and weather conditions, including heavy snow. From high speed emergency runs to long hours of stake-out idling. From freeway patrols to stop-and-go city driving. A total of more than half a million miles so far.

And not a single Motorcraft Spark Plug has failed. Not one. If this is the kind of performance you're looking for, ask for the plug in the red and black "ghosted GT" box. The one Tested Tough in big city cop cars. Motorcraft. The quality spark plug from Ford.



This One



FOAO-2ZT-2WGF

THE SPARKOMATIC SOUND. CAR STEREO FOR THE TRAVELIN' MAN DRIVEN TO PERFECTION.

Sparkomatic car stereo has taken its directions directly from you, the travelin' man. The result is a redefinition of sound and style for the auto audiophile. A new generation of car stereo loaded with high-performance high fidelity features. And engineered with such extraordinarily efficient reception and sound reproduction capabilities that comparison to high

price home components would not be exaggerated.

Sparkomatic's *ears of experience* have produced perfection in high performance high fidelity. So if you're a travelin' man looking for the ultimate in sound, visit a Sparkomatic dealer to see and hear our full line of 20 styles from basic models to state-of-the-art High Power digital units.



SS 100. If you're a travelin' man who gets down to basics by going under-dash with your car sound, Sparkomatic's continuous play 8-track car stereo installs compactly and easily. Accurate slide controls for volume, tone and balance, program selector and program indicator lights are featured. (An under-dash cassette SS 200, is also available.) The sound of these Sparkomatic under-dash units is outstanding—and that's an understatement.

SR 301. To the travelin' man who says car stereo should look and sound sensational, we say Sparkomatic SR 301 cassette AM/FM stereo (or SR 201 8-track model). They're unmatched in eye and ear appeal even by much higher priced car stereos. And features abound, like balance and fader controls, FM muting, rotary controls for volume, tone and tuning, automatic key-off and push-button eject, locking fast forward and rewind and 10 watts of power. If you're into pure listening pleasure, Sparkomatic talks your language.

SR 330. Any travelin' man with a passion for performance and a lust for good looks will respond to Sparkomatic's auto reverse cassette AM/FM stereo SR 330 (or SR 210 8-track AM/FM stereo). This is all out car stereo sound that sits proudly in your dash like a high performance music machine should. Expect no less than *feather touch* electronic controls, separate bass, treble, balance and fader adjustability and an array of cassette handling features. Under the skin there's the guts of 12 watts of power. Whatever you like to hear, Sparkomatic's got your number here.

SR 2400. For the travelin' man in touch with the times, *High Power* car high fidelity should make your adrenalin flow. Sparkomatic's SR 2400 model digital 8-track AM/FM stereo with a precise digital clock is *super-charged* sound. (Other High Power models also available). A full 45 watts of clear audio power over an incredibly wide dynamic range qualifies these stereo machines as the optimum in auto audio. Highly advanced high fidelity features include *feather touch* electronic controls for all major functions and sophisticated tape handling capabilities. When you want to turn up the power, Sparkomatic is the name to turn to.

SPARKOMATIC
For the Travelin' Man™

For our free catalogs on Car Stereo and Car High Fidelity Speakers, write: "For The Travelin' Man", Dept. PM, Sparkomatic Corporation, Milford, PA 18337.



SS 100



SR 301



SR 330



SR 2400

IMPORTS & MOTORSPORTS

1979 Racing season

They're off and running! The daring drivers of NASCAR were the first to drop the hammers—early in January—and get the season off to a flying start. This is a satisfying year for motorsports fans in the United States because we're all keenly aware that the World Driving Champion is an American: Mario Andretti is running his Grand Prix Lotus with a big Number One proudly displayed. He's the first American to defend the World Driving title since Phil Hill, who won it in 1961.

Mario's achievement will be an inspiration to every motorsports competitor this year—on little dirt tracks and on super speedways from coast to coast. Fans who have followed Mario's career know that he's run them all—the bombers and the beauties. It doesn't matter whether we're midget devotees or SCCA "hillsiders"—we've all shared in the excitement of Mario's Formula One victory and hope he can repeat.

Grand Prix

First chance we'll have to see Mario fighting off the challenges of his international competitors will be April 1 in the U.S. Grand Prix West, when the Formula One cars race through the streets of Long Beach, Calif. Here's how the rest of the season stacks up:

Formula One World Championship Slate

Date	Country	Track
Apr. 29	Spain	Jarama
May 13	Belgium	Zolder
May 27	Monaco	Monte Carlo
June 17	Sweden	Anderstorp
July 1	France	Dijon
July 14	Britain	Silverstone
July 29	Germany	Hockenheim
Aug. 12	Austria	Osterreichring
Aug. 26	Holland	Zandvoort
Sept. 9	Italy	Imola
Sept. 30	Canada	Montreal
Oct. 7	United States	Watkins Glen, N.Y.

Indy cars

Differences between car owners and drivers who comprise the Champion Auto Racing Teams (CART) and the United States Auto Club (USAC) may still affect the Champ Car racing picture this season. But if the USAC season is under way as scheduled earlier this year, the March 18 opener at Ontario is now in the record books and the Champ cars are ready to run in the Texas 200 on April 1.

USAC's rule changes favoring stock blocks (engines derived from

Detroit-built V8s) will affect the Indy 500 next month, probably bringing speeds down to the 180-mph range. Lower allowable boost on the super-charged and turbo-charged Offies, Cosworths and Foyts will make stock blocks more competitive. And with stock blocks it'll be easier to get started in Champ Car racing if you're not a multimillionaire.

Here's how the rest of the season stacks up, according to USAC's calendar published early this year.

1979 USAC Champ Car Race Schedule

Date	Event
April 22	Trenton 200
May 27	Indianapolis 500
June 10	Milwaukee 150
June 24	Pocono 500
July 29	Texas 200
Aug. 12	Milwaukee 200
Sept. 2	Ontario 500
Sept. 23	Trenton 150

Champion Spark Plug Challenge

The International Motor Sports Assn.'s (IMSA's) professional road racing series for domestic and imported sedans is sponsored by Champion again this year. The flag dropped on the series Feb. 3, with a



An AMC Spirit set up by Amos Johnson.

100-miler at Daytona and a three-hour endurance race at Sebring March 16. Here are the other races in this showroom-stock series:

Champion Spark Plug Challenge Series

Date	Track	Event
Apr. 1	Talladega	6 hours
Apr. 8	Road Atlanta	75 miles
Apr. 22	Riverside	100 miles
Apr. 29	Laguna Seca	75 miles
May 13	Hallett	75 miles
May 28	Lime Rock	100 miles
June 17	Brainerd	100 miles
July 1	Daytona	6 hours
July 15	Mid-Ohio	100 miles
July 29	Sears Point	75 miles
Aug. 5	Portland	75 miles
Aug. 19	Pocono	8 hours
Sept. 23	Road Atlanta	6 hours
Oct. 13	Lime Rock	100 miles
Nov. 25	Daytona	100 miles

NASCAR Grand Nationals

The good ol' boys probably had more fun at the White House party in honor of motorsports last year than any of the other racers who were there. Gears, grits and government buzzed the conversation, but gears came up the hands-down winner. The stock-car drivers have a lot of miles ahead of them again this season with—who knows?—maybe another South Lawn party to cap it off.

1979 Winston Cup

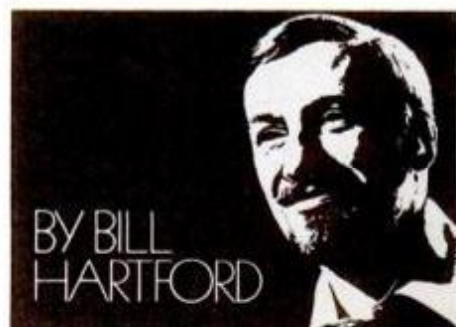
Grand National Schedule

Date and event
Mar. 18, Atlanta 500, Atlanta, Ga.
Mar. 25, Staley 400, North Wilkesboro, NC.
Apr. 1, Southeastern 500, Bristol, Tenn.
Apr. 8, Rebel 500, Darlington, S.C.
Apr. 22, Virginia 500, Martinsville, Va.
May 6, Winston 500, Talladega, Ala.
May 12, Music City USA 420, Nashville, Tenn.
May 20, Mason-Dixon 500, Dover, Del.
May 27, World 600, Charlotte, N.C.
June 3, Texas 400, College Station, Tex.
June 10, NAPA Riverside 400, Riverside, Calif.
June 17, Gabriel 400, Brooklyn, Mich.
July 4, Firecracker 400, Daytona Beach, Fla.
July 14, Nashville 420, Nashville, Tenn.
July 29, Coca-Cola 500, Pocono, Pa.
Aug. 5, Talladega 500, Talladega, Ala.
Aug. 19, Champion Spark Plug 400, Brooklyn, Mich.
Aug. 25, Volunteer 500, Bristol, Tenn.
Sept. 3, Southern 500, Darlington, S.C.
Sept. 9, Capitol City 400, Richmond, Va.
Sept. 16, Delaware 500, Dover, Del.
Sept. 23, Old Dominion 500, Martinsville, Va.
Sept. 30, Wilkes 400, North Wilkesboro, N.C.
Oct. 7, NAPA National 500, Charlotte, N.C.
Oct. 21, American 500, Rockingham, N.C.
Nov. 4, Dixie 500, Atlanta, Ga.
Nov. 18, Times 500, Ontario, Calif.

Check local listings

We've hit only the highlights of the season's motorsports events, of course, so check your local listings for the myriad events in this, the nation's *second* most popular spectator sport:

It would be *ahead* of horse racing if you could bet two bucks on Petty to win, place or show! **FM**



Only Olds offers diesel economy in both full- and mid-size wagons.



Custom Cruiser



Cutlass Cruiser



There's a lot of news in Olds today.

For most car makers, diesel is a thing of the future. At Oldsmobile the future is now. Olds now offers 19 models with diesel engines, including two great wagons—Custom Cruiser and Cutlass Cruiser.

You know that diesel is economical. Just how economical? Well . . . Custom Cruiser's EPA estimate is 20 mpg, 28 mpg estimated highway. Cutlass Cruiser's EPA estimate is 22 mpg, 29 estimated highway.


Both with optional 5.7-l diesel V8. Remember: Compare these estimates to the "estimated mpg" of other cars. You may get different mileage depending on your speed, trip length and weather. Your actual highway mileage will probably be less than the estimated highway fuel economy.

These mpg estimates are significantly better than for any other V8 wagons. And you can expect less cost per gallon, too, based on the traditionally lower price for diesel fuel than for unleaded gas.

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Now, can you possibly think of a reason to buy any other wagon? 

Oldsmobile

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Getaway machines.

That's the incredible Honda XL series. It's an entire family of ingenious Honda on- and off-road motorcycles dedicated to your enjoyment of the outdoor life.

Four-Stroke Dependability.

When you're ready to

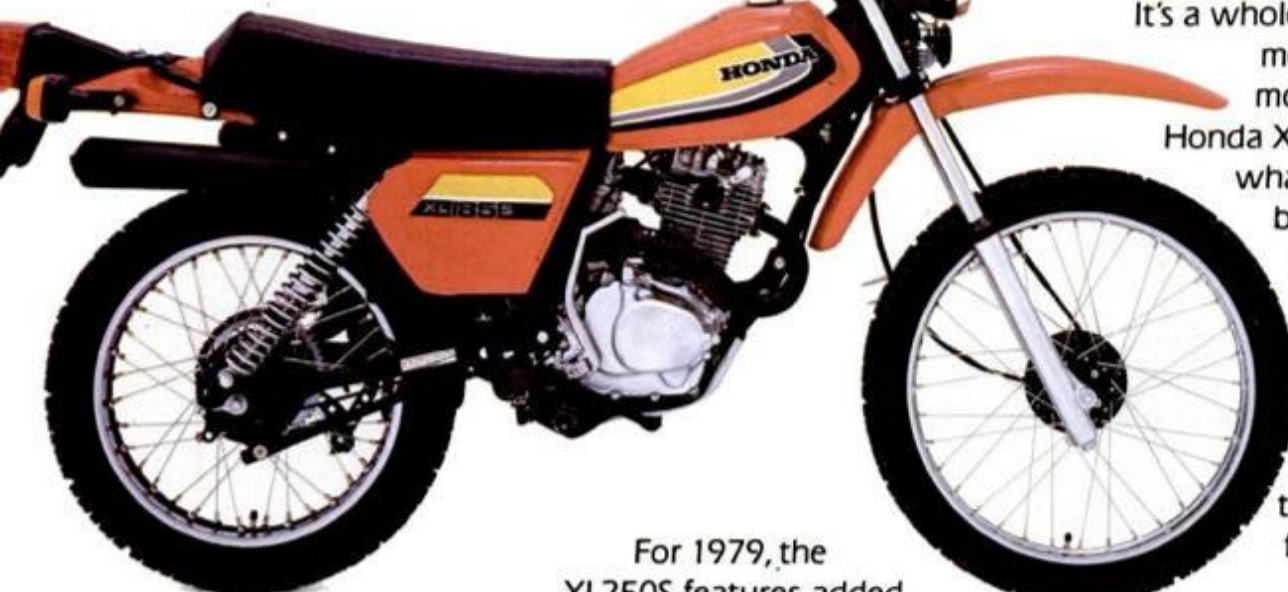
buy a dual-purpose motorcycle, you've got two choices: two-stroke or four-stroke. And when you look further into the matter, the preference becomes clear.

Honda has been the leader in four-stroke motorcycle technology for years. And the Honda XLs are state-of-the-art. They offer legendary Honda dependability, a fact



Speedometer and tripmeter are standard on all XLs (no tripmeter on XL75).

The XL185S, XL250S and XL500S have an automatic decompression system for starting.



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riders all the way to the incredible new XL500S. Each and every one is a getaway machine at heart.

you'll appreciate the further you leave civilization behind. They're quiet. And they deliver better gas mileage than comparable two-stroke bikes.

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Yet, while the great outdoors beckons, workday obligations persist. And your XL is standing by. Each machine is fully set up for the road, street legal in all states.

Take the XL250S for example. It's powered by a strong 249 cc single-cylinder engine. There's a constant-mesh five-speed transmission which makes riding in city traffic easier. Fade- and water-resistant brakes are fitted front and rear.

And like other Honda XLs, it features primary kickstarting that lets you start in any gear with the clutch disengaged.

For 1979, the XL250S features added refinements that enhance its dual-purpose nature. A passenger strap is added to the seat, as are passenger footpegs. And, of course, full road lighting, instrumentation, turn signals and mirrors are standard equipment.



Hot-sparking Capacitor Discharge Ignitions fire the XLs (except XL75 and 100S).



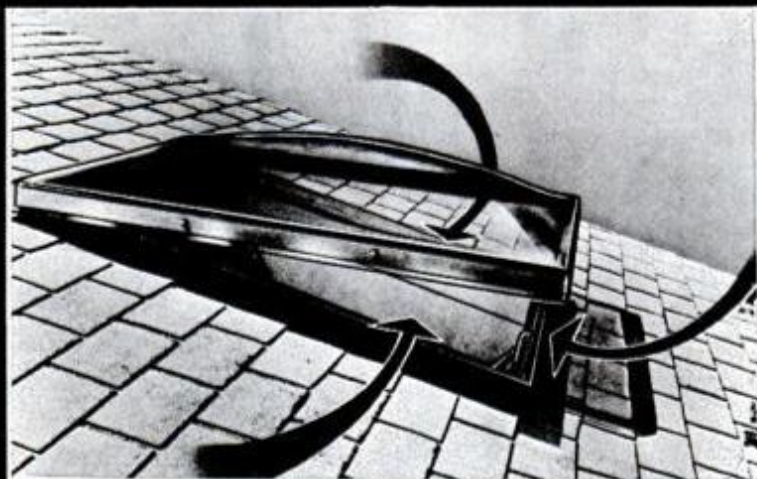
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Always wear a helmet and eye protection when riding, keep lights on and check local laws. The XL75, XL100S, XL125S and XL185S are designed for operator use only. For free brochure, write: American Honda Motor Co., Inc., Dept. PM49XL, Box 50, Gardena, CA 90247. See Yellow Pages for nearest Honda dealer. © 1979 AHM.



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ARBOR HOUSE



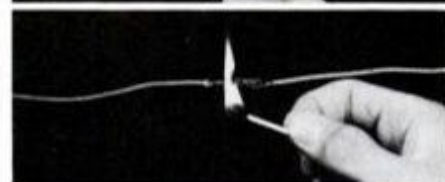
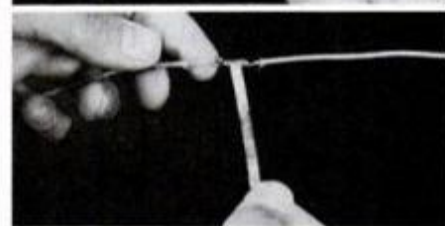
PM LOOKS AT AN EMERGENCY SOLDER



Tape-like solder does repairs quickly.

A new tape-like solder for quick repair jobs has just been introduced by Multicore Solders, Westbury, N.Y. 11590. Dubbed Emergency Solder, it's so compact it fits in your shirt pocket.

The heat of an ordinary match will melt the solder so it can flow into a wire splice. Multiple cores of rosin flux are manufactured in the flat strips, so there is no need for a separate fluxing application. For solderable metal, Emergency Solder is sold at electronic and hardware stores.—*H.W.*



To use Emergency Solder, first twist wires together (top). Wrap solder lightly around wires. Move flame until solder melts, flows into the splice. Finally, apply electrician's tape.

HINTS FROM READERS

Storing small items

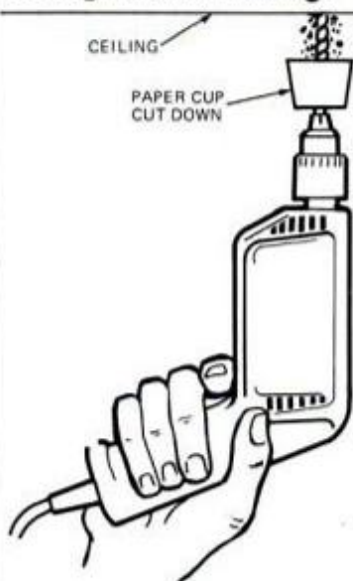


Quickly identify small items in a desk drawer by storing them in 35-mm plastic film containers with an identifying object on the cap. Attach the item by passing copper wire around it and through two holes in the cap and twisting the ends together, or glue the item directly on the cap.—*E.V. Reyner*

Restoring ice-maker trays

To restore old ice-cube trays in automatic icemakers, fill them with vinegar and let them stand for several days. If calcium deposits are the problem, they'll be dissolved.—*Thomas Barnes*

Boring holes in ceilings



Bore into ceilings without getting plaster dust on the floor. Place a small paper cup on the bit as shown, having first cut down the cup so it won't bind when the bit penetrates the ceiling. Wear safety goggles for eye protection.—*Phillip J. Jordan Jr.*

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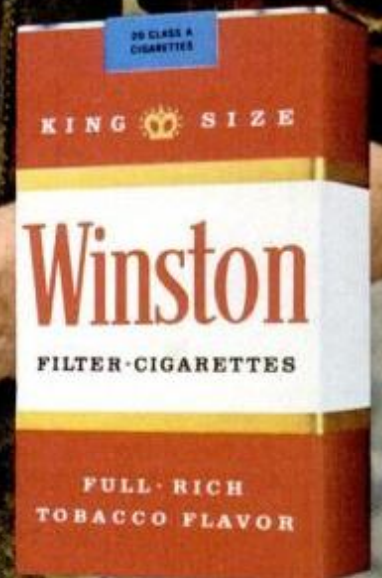
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PM's Whatsit

What we have here — perhaps — is a failure to communicate. But if you do get an instant jolt of significance from this, it means two things: 1. You won't have to turn the page to find out what it is. 2. Chances are you may see it again.

Call the rescue squab

It works like this: Pigeons have keen eyesight. Pigeons can also be trained to respond to sighting an orange object by pecking a lever for a food reward. Putting two and two together, the Navy is flying simulated helicopter rescue missions out of Kaneohe Bay, Hawaii, with two eagle-eyed trained pigeons in a special observation compartment slung beneath the chopper. Bird spots life jacket; bird pecks for food, simultaneously alerting the flight crew. So far, at distances of a half mile or more, the pigeons have been spotting the life jackets at an average of 30 seconds before the crew sees them.

There are a few bugs. The other day one bird rescued an orange surfboard.



This dance is mine

The somewhat shadowy figure in mid-pirouette here may not exactly resemble Rudolf Nureyev but he may someday be the most important personage in the world of ballet and the dance. He's known as "Bubbleman" at the University of Pennsylvania, where he stars... in a computer program. The University's computer can respond to written choreographic notation (a standard form created by Rudolph Laban 50 years ago) by putting Bubbleman through whatever paces a dance master wants to create.

Developed further, the program could store and retrieve choreography in the computer, and would vastly simplify the laborious notation process. But above all, to choreographers, it may mean that for the first time their works can be copyrighted.



Takes a licking...

... And keeps on pulsating. So says the Air Force officer at Wright-Patterson AFB near Dayton, Ohio, who is heading the project to develop a reliable digital (quartz) watch for military issue. "I haven't been able to get one to fail yet," says Maj. Lawrence Ulman, whose testing project is nearly complete. So far, the prototype G.I. watch has been quick-frozen to subzero temperatures, heated to 140°, taken to high altitude and to 250 feet under water, and jolted in vibration and drop tests. Ulman even put it in an ultrasonic cleaning machine for a week. It keeps running.

If and when the super-watch is approved by the military, we'll want to check it out—the anticipated price tag is only \$20.



Whatsit revealed

If you've spent any time on the road in Europe, you probably recognized the triangular shape of a warning sign. But this "concealed exit" pictograph design isn't official, at least not yet. It's the hope of Mr. Rene Herail, a lecturer in French at the University of Leeds, England, that his design will be adopted worldwide. "I have no official figures for accidents caused by blind exits," says

Herail, "but I know they bring about an alarming toll both in England and France — and presumably everywhere." Herail chose a leg protruding, instead of a vehicle, he says, because drivers know a truck or car would be warned of entry into a major road. The possibility of a pedestrian's sudden appearance, Herail believes, would cause motorists to approach with more caution.

The way we were

There is only one significant difference between the two photographs you see here: the passage of 105 years between the time the original one (at the top) was taken, by pioneering landscape photographer William Henry Jackson in 1873, and when its "update" was made last year. Both cameras were placed in an identical position to photograph the moraines on Clear Creek, in the Valley of the Arkansas, Colo. The idea of retracing the steps of the first photographers of the American West was conceived by geologist Mark Klett and historian Ellen Manchester. Called the Rephotographic Survey, the project makes use of Polaroid film positives to finely align the camera and check the perspective for exact duplication of an original scene. Final prints are then made from Polaroid negatives.



A brush with destiny

Consummate modeler Ficklen: 500 hours for an authentic Focke-Wulf.



It never fails to amaze us how model builders become so completely uncompromising when it comes to authenticity. Take John Ficklen here, who once actually took a tape measure to a real Focke-Wulf 190 hanging in the Smithsonian Institution in Washington, D.C., just so he could check his kit model parts for exact scale!

Like many modelmakers of his ilk, Ficklen does not build any old airplane; he decides on a particular individual aircraft, begins by researching its campaigns and victories as well as stories of the man or men who flew it. He may buy a kit model of the basic aircraft, but if any part lacks detail or proper scale, Ficklen chucks it and fabricates his own.

But what sets Ficklen's airplanes off from most models — a friend once quoted \$1000 as a reasonable market price for just one Ficklen model — is the finishing detail. "Actual war planes were used hard," he explains. "They were shot at, climbed over, dented. In the Pacific, for instance, the salt air really made a mess of them. I want my models to show that."

He prepares a model's surface for painting by rubbing it thoroughly with steel wool; then he washes it off with soap and water, masks off appropriate areas with Kleenex or masking tape and puts on a thin coat of DuPont auto primer with a Binks Wren airbrush. A second coat of primer may follow, sometimes even rubbing compound. Finishing coats of lacquer-base paint (he mixes his own colors) are "misted" on with the Binks airbrush.

And after all this, he may even "damage" the painted surface for authenticity. One recent model was sheathed in aluminum foil, painstakingly finished, and then scarred by hard rubbing with steel wool. Why?

"Nothing looks as much like metal with paint chipped off," explains Ficklen, "as metal with the paint chipped off."

The Focke-Wulf 190 eventually consumed 500 hours of his leisure time. When not thus engaged, John Ficklen flies life-size airplanes for Eastern Airlines.

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Now any piano can be a player piano

by Christopher Greenleaf



Wheel this Vorsetzer to cover the keyboard, attach the push rods to the piano's pedal and you're ready to hear the music.



The secret to Pianocorder operation is specially encoded tape. Built-in computer decodes tape to wide-ranging music.

The old player piano keeps rolling along, but now uses cassette tape and futuristic computer technology.

How would you like an add-on unit to convert your present piano into a player piano which uses computer technology to play everything from pop music to the classics? Or, how about owning a player piano with all of the electronics built in?

Superscope (which owns Marantz and is the U.S. distributor for most of Sony's sound systems) is introducing its Pianocorder system, a completely new approach to player pianos.

Remember the paper rolls that old-fashioned player pianos used?

The punched holes make such rolls fragile and they were always considered expensive. The new Pianocorder doesn't require them. Instead, encoded music is stored on the same type of familiar magnetic cassette that small tape recorders use. Getting away from the paper rolls has added a bonus beside inexpensiveness and durability—it is now possible to *record* as well as play! You can record your own piano playing on tape, then play duets with yourself on one of the new Pianocorder pianos.

No need to buy new piano

If you already own a piano, you can still take advantage of this technology without buying a new instrument. You can either have the electronics installed in your present piano—or you can buy what is called a Vorsetzer. The Vorsetzer (German for “something one places in front”) rolls up to the keyboard of a grand or upright piano and secures to the keys and pedals. The Vorsetzer has a set of padded metal fingers sus-

pending over the keys and pedals and thus can operate any piano. A drawback is that the Vorsetzer covers the keyboard so you can't record your own playing.

A Pianocorder piano looks the same as an unmodified piano except for a small cassette player that protrudes from under the right end of the keyboard. A Vorsetzer unit, which has no keyboard, has the cassette recorder on one side.

Of course, the real electronic revolution is revealed inside. Pull off the protective panels and you will see a formidable array of solenoids, switches, printed-circuit boards and other electronic components. Naturally, the standard piano action, soundboard and strings are there, too.

Tapes encoded like a computer

The prerecorded cassettes played by the Pianocorder system do not hold music recognizable to human ears. If you played one of the tapes on a normal tape player, all you

(Please turn to page 196)

PONTIAC'S NEW SAFARIS



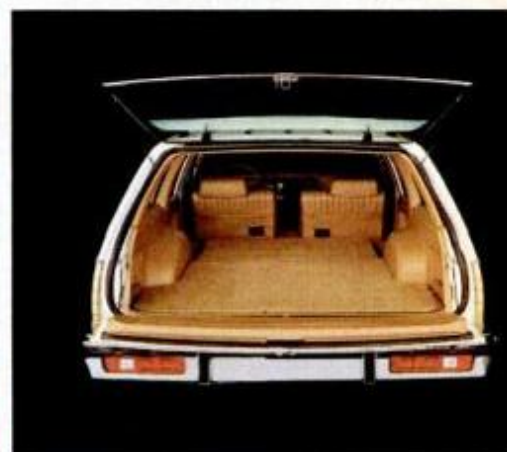
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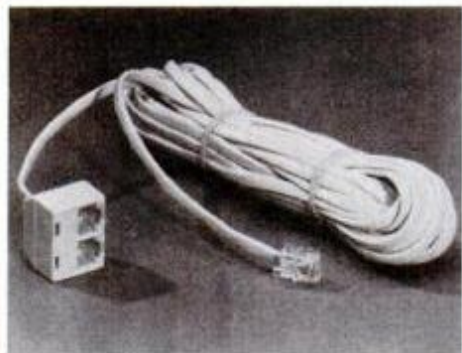


IT'S NEW NOW



What's cooking?

Almost anything, according to the maker of the Sun Cooker, and as fast as with a conventional oven. The 17-pound unit has a reflector area of 4 square feet and a 440-cubic-inch oven. Cooking temperature can be regulated by focusing the sun's rays slightly off center. For storage and carrying, the oven folds flat. It's \$77 from Fischer Sun Cooker, 302 Center St., Redwood City, Calif. 94061.

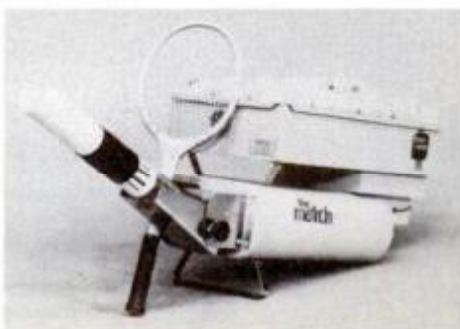


Double extension

The Archer 25-foot Duplex Modular Extension Cord has a modular plug on one end and a double modular socket on the other. Two phones, or one phone and another extension, can be connected. Dummy plug prevents corrosion if only one jack is used. Model 279-363 is about \$9 from Radio Shack, 1400 One Tandy Center, Fort Worth, Tex. 76102.

Have a swinging time

The Match is a portable tennis ball machine with adjustable trajectory, variable delivery interval and a top ball velocity of 85 mph. An optional oscillator varies shots from left to right at random; wireless remote on/off control is also available. Price is about \$380. Oscillator is \$130 and remote control is \$30. D & F Tennis Sales, 358 Fifth Ave., New York, N.Y. 10001.



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pickups, vans, wagons, and Ramchargers.

APPLIANCE CLINIC

QUESTIONS ANSWERED

Kant Stick on the rocks

Not long ago (Aug. '78 Appliance Clinic) you mentioned a product carried by Whirlpool distributors used to coat the trays of automatic ice-making units to keep cubes from sticking. The product sells for \$8.85. I've been using an item called Kant Stick that does the same thing at \$3.75 a throw. It's made by International Edge Tool Co., and is sold at restaurant supply outlets (consult your classified directory). Why not try it?—Robert N. Jarvis, Cranberry Lake, N.Y.

Thanks for the tip, Bob. We'll pass it along to our PM readers who have the same sticky problem.

Basic training

We moved into our new home five months ago. All this time we have been disappointed with the performance of our Frigidaire DWU-33 automatic dishwasher. We have to carefully rinse all but the most lightly soiled dishes and glassware before loading. Even then, dishes don't come out "sparkling clean," as product literature says they will. Apparently, during the final rinse, small bits of food are deposited on the dishes. Heat during the drying cycle bakes the particles on the dishes. These must then be washed by hand. The particular offenders are dishes on the upper rack. I find no filter to clean nor are any mentioned in the owner's manual. We don't overload the machine and we use the right amount of detergent. Two calls by service people have failed to turn up any mechanical problem. What now?—Robert S. Plantz, Westlake, Ohio

Basics, my friend, basics. There are no filters, so let's forget about that possibility. The impeller is supposed to grind up food particles sufficiently so that they are easily ejected.

Forget mechanical problems, too. If two different service technicians failed to find trouble, it's safe to bet that there isn't any. However, check one possibility that may have been overlooked. See that the machine is getting the proper amount of water. Low water pressure can be hampering intake. The water level should be at the seam of the spray arm. Let the machine fill and open the door to check.

After this, consider the only other things that can cause this trouble:

low water temperature, old detergent and hard water. The temperature of the water has to be between 140 and 160° if the detergent is to be chemically active. The detergent has to be fresh if detergent chemistry is to be at its best. A box of detergent which has been on the shelf for five or six months is weak. This is also a reason why you shouldn't buy dishwasher detergent that's on sale—it's a sign of old age.

Finally, a hard-water condition will affect washability. If you have well water, have it tested for hardness. If you have city water, ask the water company or see what your neighbors' experiences are.

Suppose none of this works? Frigidaire has asked us to tell you to get in touch. In Ohio call 800-762-4315. If you live elsewhere in the United States, the number is 800-543-4325. Both numbers can be called toll-free.

Capricious rinse cycle

We have a model A200 Maytag washing machine that has a fickle rinse cycle. Following the washing cycle, the machine kicks into rinse for two or three seconds. Then it stops. Then it starts again. It continues start-stop, start-stop for perhaps 11 times before it really gets going. Can you tell me what's wrong?—G.J. Eckler, Hanford, Calif.

One of three things may be wrong: (1) the motor slide isn't working correctly; (2) the voltage is too low; (3) the motor is burning out.

The motor, which is on rollers, is in a forward position during the wash cycle. When the wash cycle has been completed, the motor is supposed to slide so the rinse cycle can kick in. If the rollers bind or are broken, an intermittent condition will exist until the motor slides into the right position. Have the slide mechanism checked.

Low voltage will affect the machine's ability to kick itself into rinse. There may have been a voltage reduction in your area recently. Find out by calling the electric company. If there has been, you can step up to the necessary voltage by connecting a capacitor between the timer and the motor.

If the motor is burning out, the rinse cycle will be affected. Have a test made of motor performance. Your options, then, are to use the

machine until the motor burns out, have the motor replaced or buy a new washer.

Time(r) out

Does anyone make a timer for a gas water heater? I think it would be an ideal appliance. In our case, we use hot water for 30 minutes in the morning and five hours at night. For 18½ hours of the day we draw no hot water. Yet, the heater is operating. Trying to control the unit manually is a nuisance.—John H. Weeks, Opelika, Ala.

According to Bob Bedford, Vice President of Intermatic, Inc., a major manufacturer of timing devices located in Spring Grove, Ill., "We don't make timers for gas hot water heaters, and I know of no company that does.

"The cost of developing and installing a unit, which would be quite complicated because of safety considerations, wouldn't be justified by the small savings derived by a user. Heating water by gas costs only about one-third what it does to heat water by electricity." Timers are made for electric water heaters.

No name jive

We have a 4-year-old Tappan oven/broiler (model Z-12-1249) that gives off a slight odor of gas when the oven door is open. Also, when the oven is used on a low temperature (250° or so), the flame won't go out when the control is turned off. It stays low until we turn the control to a high temperature, let the flame burn for a minute or two, and then turn the oven off. What's our trouble?—No Name, Hesperia, Calif.

Your trouble is a defective safety valve. The bimetal isn't closing completely, which allows a small amount of gas to escape. If your home runs on LP gas, there's a chance the bimetal is being kept open by the gasket in the valve which may have become saturated and swollen. Tappan had this problem on several units, but has since modified the valve. In any case, replace the safety valve and your problem should be solved. **PM**

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.

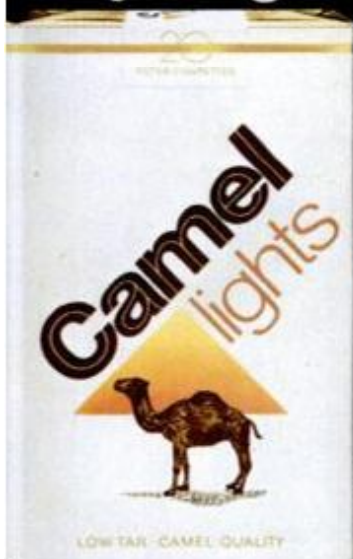
8 mg. "tar", 0.8 mg. nicotine av. per cigarette by FTC method.

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Try the solution. Camel Lights.

Camel Lights solves the low tar/low taste problem. A richer-tasting Camel blend does it. Delivers satisfaction at only 9 mg tar. For taste that's been missing in low tars, try Camel Lights.

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

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Traveling laser shows: DANGER UNDER THE RAINBOW

Those sparkling beams can blind you, the FDA warns.

by Hans Fantel

Short of volcanic eruptions in the tropic night, laser "light shows" may be the most stunning sight you'll ever see. They have been described as "drugless highs" and "the closest thing to tripping out in inner space." But the government says they may also be dangerous to your health.

According to the Bureau of Radiological Health, a branch of the Federal Food and Drug Administration (FDA), the laser lights used in some rock shows or discotheques can cause serious eye damage.

"We're concerned about possible eye injuries at laser shows," says Dr. Alan Andersen, a medical specialist for the bureau. "Our research confirms the danger to the audience." Bureau staff member Dale Smith adds: "We feel certain

that injuries have occurred without the victim even being aware that they were caused by a laser. Radiation injuries are painless. By the time the victim notices any loss of vision, he may not connect the symptoms with having gone to a laser show." Even an eye specialist examining the damage can't tell if the injury was produced by a laser or some other overbright light.

Audiences in this country and elsewhere are just beginning to catch on that there may be danger under the rainbow, but awareness has grown slowly. When laser beams panned through a British audience outside a Royal Academy of Arts show in 1977, an Academy official offered a bland assurance to some who

questioned the safety of the show. "I walked through the beams several times," she said, "and my legs haven't been cut off yet." The

potential danger, of course, was a tiny burn on the retina, not the loss of a limb.

In this country, government agencies have recently begun to do something about the danger—but no one is confident that the effort is sufficient.

"We're stepping up surveillance of laser shows," Smith reports.

5 SAFETY TIPS TO SAVE YOUR EYES

The FDA suggests five precautions to protect you or members of your family against unsafe laser shows.

1. Don't assume a laser show is safe simply because it's being presented in a large theater or disco, or under the stars.

2. Be wary of any laser show in which performers flash beams directly on the audience. Some such shows are safe, but others are dangerous. If you have any doubts, turn your back on the laser source and walk out.

3. Don't look at laser sources through camera viewfinders or binoculars.

4. Avoid looking at shiny surfaces that reflect laser light. If lasers are strong enough, their reflections can endanger sight.

5. If you have reservations or questions about a specific show or disco, call your local FDA office. You'll find the number under the Health, Education and Welfare Department of U.S. government listings.

"Two years back, when we started this project, we checked out eight shows for safety risks. Last year, we inspected 32 productions. This year, with luck, we'll look at as many as 200." With only nine full-time inspectors on the bureau's staff, that inspection schedule is a staggering workload, especially



(Continued on page 232)

* Материал, защищенный авторским правом

Devil's Backbone Reef hides the world's strangest shipwreck... and a case of Canadian Club.



© 1979 46 YEARS OLD IMPORTED IN BOTTLE FROM CANADA BY HIRAM WALKER IMPORTERS INC. DETROIT, MICH. 86.8 PROOF. BLENDED CANADIAN WHISKY

Since Columbus first came ashore here, sailing men have been littering the brilliantly blue Bahamian waters with shipwrecks. Some carried treasure, some crowned heads. But the strangest of all carried a train.

Hell for ships, heaven for divers.

The train lies off Eleuthera's northern tip, scattered on Devil's Backbone Reef. At least six wrecks are strewn here: a diver's paradise, we thought, and a perfect place to hide a case of C.C.

We headed for Romora Bay Club on Harbour Island. The club could provide us a launch and guides to explore the

reef. Nearby Dunmore Town could offer Bahamian entertainment, complete with Canadian Club. But no one could provide us with a reliable story of how or when the train had sunk on the reef.

Seek groupers, and bring muscles.

We combed Devil's Backbone till we found a devilish place to hide our Canadian Club.

To raise the C.C., you'll need scuba gear, guts and muscle: it weighs 200 pounds. Start where a "dinner boat" went down on Devil's Backbone. Follow a channel across the reef to an old Ward Line steamer wreck (try this only in bright sunlight or you'll lose your boat). Take a bearing from its bow. Not more than 200 yards along, where the reef slopes into deep water and a big Nassau grouper lives, we sunk the watertight case of Canadian Club.

May your seas for the search be as smooth as our whisky. Note: nonswimmers may discover their own Canadian Club adventure at bars or local package stores by just saying "C.C., please."



This is exactly where the case lies.



Canadian Club

"The Best In The House"®
is even better in the Bahamas.

The Jolly Roger

THE PIRATES

Weigh anchor with yours for 10-day FREE examination.



Captain Kidd's body hung in chains as a grim warning to other outlaws.



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Enjoy THE PIRATES for 10 days FREE!

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Yes! I would like to examine *The Pirates*. Please send it to me for 10 days' free examination and enter my subscription to THE SEAFARERS series. If I decide to keep *The Pirates*, I will pay \$9.95 plus shipping and handling. I then will receive future volumes in THE SEAFARERS, shipped one volume at a time approximately every other month. Each volume is \$9.95 plus shipping and handling and comes on a 10-day free-examination basis. There is no minimum number of books that I must buy, and I may cancel my subscription at any time, simply by notifying you. If I do not choose to keep *The Pirates*, I will return the book within 10 days, my subscription for future volumes will be canceled, and I will not be under any further obligation.

CPAG40

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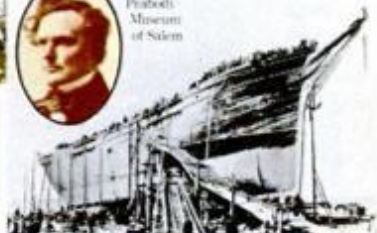
flies again!



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NOW PLANNED FOR
THIS NEW SERIES:**



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THE CLIPPER SHIPS

Called the greyhounds of the sea, they were built for pure speed by men like Donald McKay. The *Sea Witch* set a record that still stands—from Canton to the East Coast of the U.S. in 78 days flat!



National Maritime Museum

FIGHTING SAIL

You'll meet the great commanders—Nelson, John Paul Jones, Villeneuve—and relive their most exciting battles through eyewitness accounts and authentic paintings and drawings.



National Maritime
Museum

THE DREADNOUGHTS

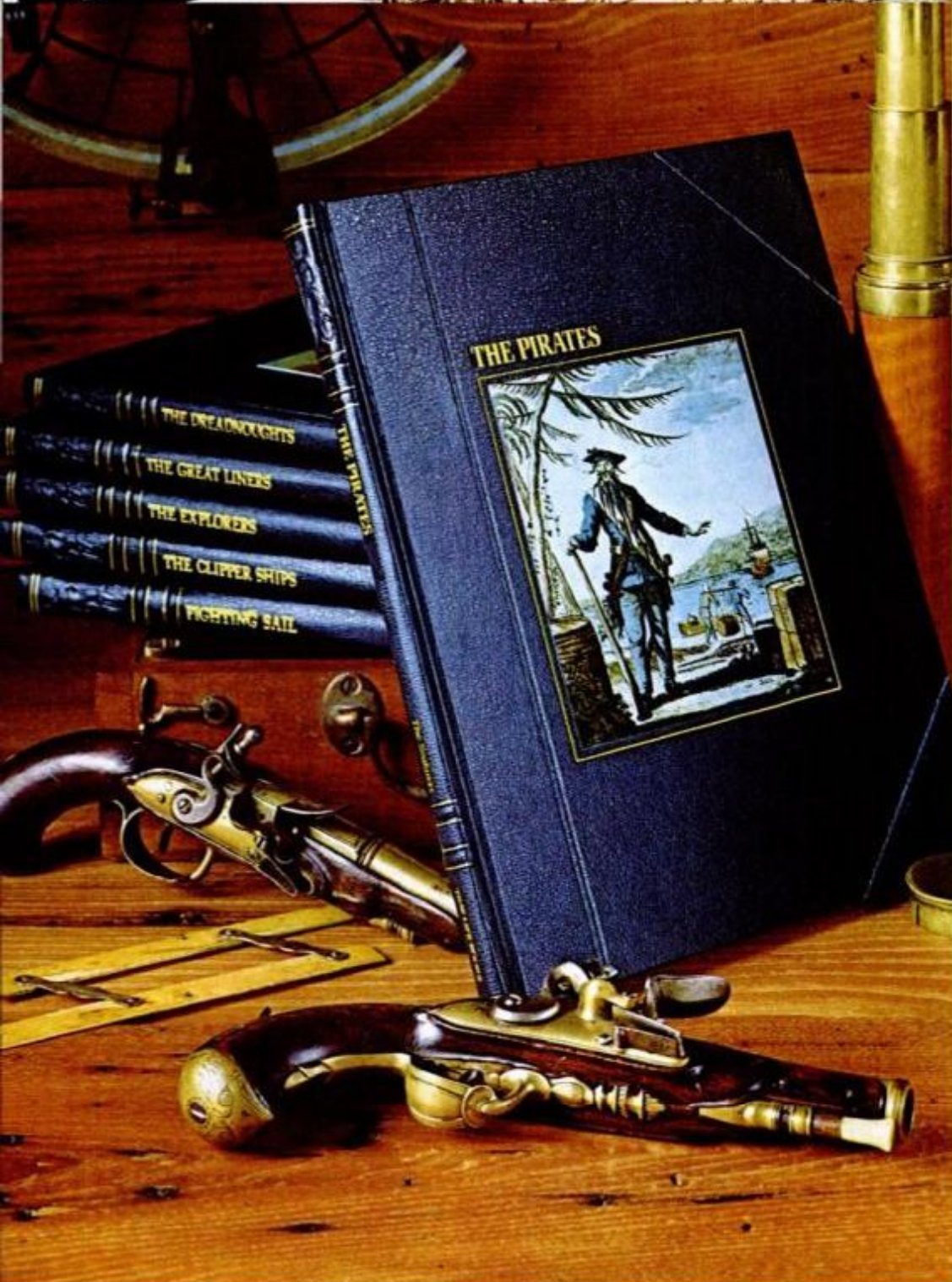
The original *Dreadnought*, built in 1906, for the British Navy, made every fleet in the world obsolete. In the fantastic fire-power race that ensued, ships mounted ever-larger guns, culminating in the giant 18-inch guns of the *Yamato*.



Courtesy Brandywine
River Museum

THE WHALERS

Paintings, drawings and rare 19th Century photographs tell of days when men fought whales, and the wind was the only source of power.



THE PM GARAGE

CAPSULE REPORTS ON NEW AUTO PRODUCTS

Tires for pulling Gs

If you're green with envy when you see those TRX tires and wheels on Mustang turbos, be informed that now you can shoe your Chevy or Dodge with the same treads. RoadHandler TR steel-belted radials and matching wheels can be found at Sears stores.

TR stands for *tension repartie*—French for “distributed stress,” which means that road shock and



New Sears tire is sold with special wheel.

tension are distributed evenly over the tire. Why French? Because the TR is made for Sears by Michelin of Clermont-Ferrand, France. *Tension repartie* is a neat way to get improved traction and control if you drive with *elan*.

The TR is presently available only in one size: 190/65R/390. The 190 designation means the tire is 190 millimeters across at the widest point; 65 spells out the height-to-width ratio (the height of the TR is 65 percent of its width); R stands for radial; and 390 stipulates wheel diameter—390 millimeters is equivalent to 14 inches. (Sears hopes to market a larger-size TR—220/55R/390—later this year.) Maximum air pressure for the TR is 36 pounds per square inch, which lets tires handle a maximum load of 1280 pounds.

When I tested a set of TRs on a 1979 Cutlass, I found the tire to be most responsive. Traveling at 50 mph on dry pavement, I was able to stop in a 15 percent shorter distance than I did in another Cutlass having conventional radials.

Over a slalom course set up at Stewart Airport in Newburgh, N.Y., I found that the TR didn't have a tendency to squirm, which is characteristic of other radials.

My impression of the TR are borne out by tests done for Sears by an in-

dependent agency. The TR was rated against Sears' then current top-of-the-line radial, the RoadHandler (also made by Michelin). The TR rated 40 percent better in holding corners on a wet roadway than the conventional RoadHandler, 12 percent better in dry cornering performance and 12 percent better in traction on a wet pavement.

The unique characteristics of the TR are derived through an unusual belting construction, which also accounts for the 48,000-mile (prorated) warranty you get with the tire. The warranty is the best in the business and is 4000 miles more than the Sears warranty with the conventional RoadHandler.

The TR has two radial body plies, the same as other passenger-car radials. However, instead of two steel or polyester belts, which other radials employ, the TR has a single steel belt inside an aramid belt.

Aramid is a fiber manufactured by



Cross section shows TR construction.

DuPont that is stronger, pound for pound, than steel, but lighter. The aramid sheathing gives the TR exceptional firmness that virtually eliminates tread squirm.

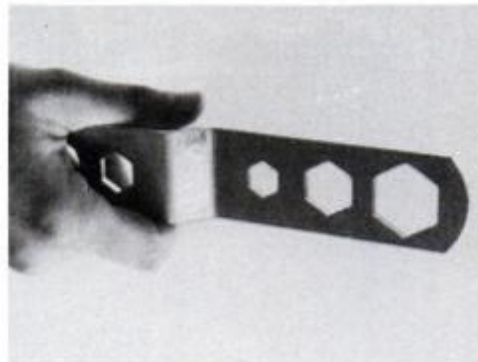
No other tire, except the TRX option offered by Ford on 1979 Mustang and Capri (and some European cars), utilizes this construction. The TR has a lower aspect ratio than other tires. It's about 1/2 inch lower in height, so special wheels are needed for the special size.

TR tires and matching wheels are balanced dynamically at the factory. However, dynamic balancing is necessary when mounting replacement tires on wheels. The four tire/wheel set is \$800. Order them through the Sears catalog service desk at the stores.—Mort Schultz

Oil-change wrench

Since I change the oil in my cars myself, and since I can never remember the drain-plug sizes of any of them, I find this wrench a real boon. No matter which car I'm under, this wrench fits it—and the transmission plug, too.

The wrench is designed to fit six standard SAE bolt sizes from one-



Wrench will fit any oil-drain plug.

half to one inch. It's all steel and costs \$1.49 at parts stores or from the manufacturer, Victor Automotive Products Inc., Chicago, Ill. 60641.—M.L.

Sport steering wheel

A racy steering wheel is a guaranteed way to get more fun from lock to lock. My old car had a huge, truck-like steering wheel of cold, hard plastic with a funny horn ring. Now, after a half hour's work, it's got a small-diameter, leather-rimmed, Nardi Italian sport steering wheel and when I drive the old bomb I imagine I'm grabbing a handful of Ferrari and lighting out for Monza. I owe the beautifully crafted wheel to Vilem B. Haan Inc., long-time friend to driving enthusiasts. The Nardi was \$80 and it's only one of the zillion marvelous motoring accessories in their color catalog. Send for it: 11401 West Pico Blvd., West Los Angeles, Calif. 90064.—B.H.



Sport wheel puts fun back in driving.

New miracle sponge "whisks away" old paint and varnish with one light touch!



AS SEEN ON TV!
incredibly priced at
6 for \$7.95
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Strips Anything Fast!

- No Scraping • No Gouging • No Sanding
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Incredible MIRACLE ERASER actually "wipes away" crusty finishes faster, better than any paint or varnish remover you've ever used...*or your money back!* You simply won't believe your eyes. Miracle Eraser slides across age-old varnish and turns it into dust instantly. Chipped and ugly surfaces are restored to smack-smooth finishes in minutes. Rust vanishes like magic. *No hard rubbing.* Miracle Eraser works best when used in a light, wiping motion. You will never use sandpaper or poisonous solvents again!

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Miracle Eraser never clogs up like sandpaper. Thousands of microscopic points are constantly reshaped as the sponge is used. No matter how hard you press, how messy the job, the Miracle Eraser surface stays keen and perfect and keeps doing its job.

Money Back Guarantee

This incredible product must be tried to be fully appreciated. Once you actually use Miracle Eraser yourself you'll know that it does everything we claim... and more! That's why we extend this guarantee. If you are not totally delighted and amazed with Miracle Eraser, we insist that you return any unused portion for a full and complete refund. No questions asked.



- "Erases" Old Varnish As If It Were Chalk!
- "Wipes Away" Crusty Old Paint!
- Brings Furniture Down to Bare Finish Fast!
- Cleans Tar From Hub Caps!
- Makes Rust Disappear!

Barbeque grills, old tools, garden furniture... Miracle Eraser makes them all look like new—smooth as glass—ready to refinish. Furniture! Boats! Cars! Bikes!—There is no end to the uses for Miracle Eraser!

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- Please send me without delay a carton of 6 Miracle Eraser Miracle Sponges for the low price of only \$7.95 plus 50c shipping and handling (total of \$8.45). I understand that if I am not satisfied with the product I may return the unused portion for a full refund.
- Yes, I want to save \$2.95. Send me two cartons of the Miracle Eraser 6-pak for the low, low cost of only \$12.95, plus \$1.00 shipping and handling (total of \$13.95).
- Check enclosed
 Charge to VISA Master Charge

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We'll stop making razor blades
when we can't keep
making them better.

King C. Gillette



Gillette announces new Microsmooth® blades.

A major improvement for Gillette twin-blade shaving

King C. Gillette promised to keep improving your shave. That's why he would have been more than pleased with our new Microsmooth twin blades.

Microsmooth is a patented new honing process that produces the smoothest Gillette razor-blade edges now possible.

It's the result of a technological breakthrough that uses ultrasonic energy to smooth the blade edge after it's sharpened and honed by conventional methods. And what it means to you is a smooth, safe, comfortable twin-blade shave.

For Gillette TRAC II users Microsmooth blades mean a smoother shave. And for ATRA users Microsmooth blades plus the pivoting head give you Gillette's best shave.

But just because new Microsmooth twin blades give outstanding shaves, don't think we've stopped trying to make them better.

After all, we've got a promise to keep.



Try new Gillette Microsmooth twin blades.



Selected by the U.S. Olympic Committee.

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SCIENCE WORLDWIDE

Skylab's final hours

NASA scientists expect to be able to give no more than 2½ hours' warning before the 84-ton Skylab disintegrates and showers its pieces to Earth. The end could come as early as next month.

First indication that the atmosphere is beginning its final tug on the huge structure will be a sudden deceleration. Trackers may not notice the slow-down at first: Skylab passes out of touch with tracking equipment for brief periods, totaling about eight hours a day. When scientists notice the braking effect, they should be able to narrow down where pieces will fall, during the subsequent one or two orbits. (Each circumnavigation takes about an hour and 20 minutes.) Even then, however, they won't be able to tell precisely where the spinning or tumbling parts will hit.

Approximately three-quarters of the Skylab's track is over water, and NASA has estimated that the probability of injury or damage is less than that from meteorites.

NASA determined last December that intricate rescue plans had little chance of success. Its spontaneous re-entry is expected to tear the orbiting laboratory into 400 or 500 pieces, strewn over a wake 4000 miles long and 100 miles wide.

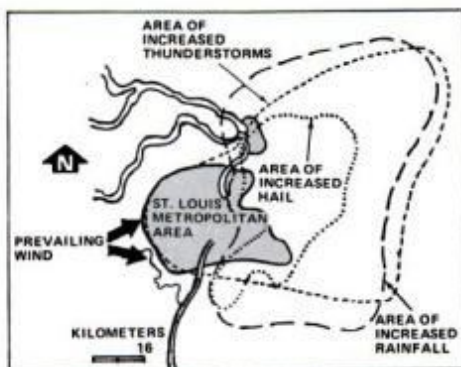
NASA has been working on contingency plans for the past few months in case Skylab's re-entry turns into a disaster. Among other headaches the agency is preparing to face is how to deal with bogus claims from people alleging damage to roofs or lawns from falling space junk.

Meanwhile, another satellite, the workhorse 5665-pound HEAO I, was expected to re-enter the atmosphere and burn to harmless cinders late last month. During its 17-month mission, it discovered more than 1000 new X-ray sources in space. It also provided new evidence that the universe contains so much mass that it cannot continue to expand forever, and must therefore eventually collapse back—implode—on itself.

Modern rainmakers: cities

Everybody talks about the weather, but big cities are doing something to change it.

Studies by the Illinois State Water Survey show that residents of St.



St. Louis seeds clouds above it and prevailing winds push precipitation eastward.

Louis and Chicago are more likely than nearby country residents to need slickers and umbrellas during summer months. A five-year study of the St. Louis area shows that heat on city streets lofts moisture into the air, plumping up clouds. Then dust rising on thermal drafts seeds these overweight clouds, which dump 40 percent more rain on the city than on upwind country farmland. The researchers have discovered that Chicago is similarly soggy, and they predict that any city with more than a million residents acts as its own rainmaker. There are a couple of silver linings, according to researcher Stanley A. Changnon Jr. "The rainfall acts as a scavenger," he told PM. "A fair amount of additional pollution in a city gets scoured out by the rain the city makes." The second bright spot: Wind blows some of the wetness from St. Louis eastward over less-populated countryside, boosting soybean and corn crops.

For safer summer cooling

As summer approaches, the Center for Disease Control has been exploring how to keep Legionnaires' disease bacterium from lurking in large airconditioning systems.

In seven cases over the past 11 years, the potentially fatal bacterium has been discovered in pools of water in large cooling units. Home airconditioners have not been implicated. (See *Is your airconditioner safe?*, page 75, Jan. '79 PM.)

Tests at the C.D.C. have focused in recent months on agents such as chlorine that might decontaminate cooling towers or evaporative condensers. In addition, Dr. David Fraser, an expert on the disease, said the center was now suggesting preventive maintenance of cooling

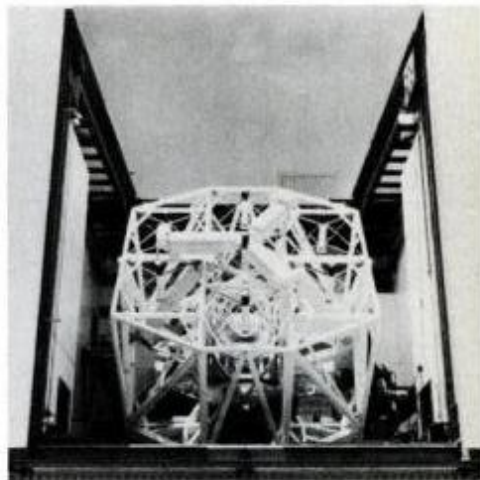
towers, "according to standard recommendations for the control of algae, slime, corrosion and scale, with the hope that those procedures may well have an effect against Legionnaires' disease bacterium—but without any promise that they do."

The pneumonia-like disease has been identified in 505 patients; 95 died. Scientists have recently confirmed that the cigar-shaped bacterium has been attacking people since the late 1940s. They've successfully immunized mice and guinea pigs with new experimental vaccines, although Fraser said there were no immediate plans for human trials of the vaccines.

Telescope to open six 'eyes'

The innovative telescope in the photo below is expected to begin operations early next month at the Mount Hopkins Observatory in Amado, Ariz.

The new scope employs six sepa-



Housing for new telescope rotates as six 72-inch mirrors scan the Arizona sky.

rate 72-inch mirrors carefully aligned to come to a single focus and provide a single image. The system, controlled with the help of laser beams, is the equivalent of a 176-inch reflector, but at a fraction of the cost and weight. **PM**

BY GURNEY
WILLIAMS III



Walt Garrison
Football and Rodeo star

How to enjoy tobacco without smoking.



SKOAL
SMOKELESS TOBACCO

Free. Just fill out this coupon, send it in and we'll send you a can of mild Happy Days, one of America's favorite "smokeless tobaccos." My brand is Skoal. But, if you're just starting out, I'd suggest easygoing Happy Days. It's so easy to enjoy. Just a pinch of mint flavored Happy Days between your cheek and gum gives you real tobacco pleasure without lighting up. And each can is dated for freshness.

Yes, send me my free can of Happy Days.
Fill out and send to: "Smokeless Tobacco"
100 W. Putnam Ave., Dept. PM 049,
Greenwich, Conn. 06830



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Smokeless tobacco. A pinch is all it takes.

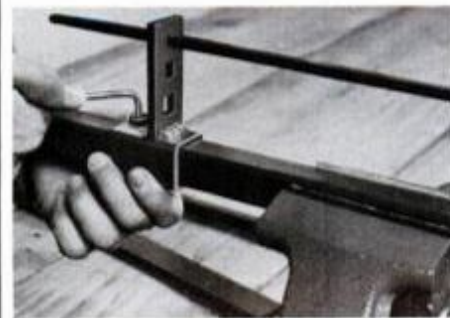
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PM LOOKS AT COLD-STEEL TWISTER



Tool twists common brass, aluminum, unhardened steel $\frac{1}{8}$ to $\frac{1}{2}$ in. square.

Use this twister for making or replacing uprights in porch and stair railings, for fashioning door grilles, or for other decorative metalwork. The longest segment the tool will twist at one time is 26 in. Longer lengths can be fed through holes and twisted in stages. I found that twists tended to be shorter near where torque was applied. To make regular twists, I shortened the distance between the bar holders and made a few twists at a time. The tool is \$24.95 postpaid from William B. Rudow, 9 Reese Rd., Asheville, N.C. 28805.—J.P.



To set up for twisting, clamp tool in vise, insert bar in appropriately sized holes. Rear bar holder slides to set length of twist, locks in position with setscrew.



Cold-steel twister includes adjustable bar holder, turning handle, Allen wrench, plus square bars (not shown).

GARDENING BREAKTHROUGH

A new miniature greenhouse system requires no installation or artificial heat and protects your plants down to 22°

John E. Bryan

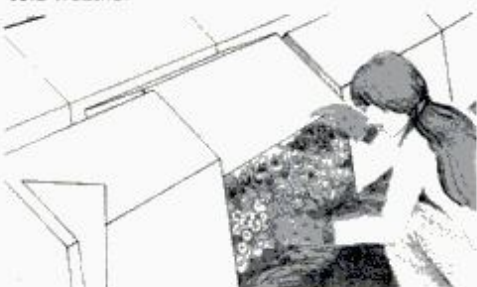
Consultant, Time Life Encyclopedia Of Gardening
Editor, Eatable Ornamental Gardener
Author, Small World Vegetable Gardener

It's a miniature greenhouse system. You can now grow vegetables months earlier this year with a greenhouse system so practical it doesn't require installation or artificial heat---even when it's 10° below freezing.

I've been growing vegetables for 24 years. I've tested every kind of greenhouse for home gardening. And just like you I've been alarmed at the cost of building and heating a greenhouse. But now I've found a miniature greenhouse system that needs no installation, yet protects plants down to 22° without using artificial light or heat.

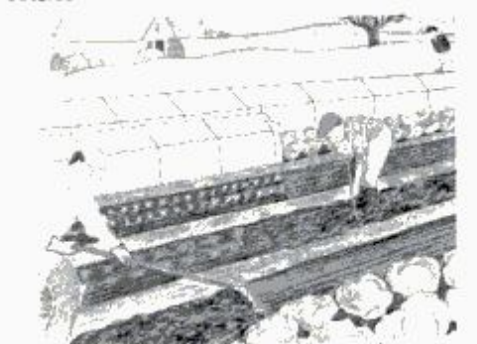
It's true! I've grown vegetables in freezing cold weather when I've used these miniature greenhouses. Without artificial heat I've grown vegetables months ahead of outdoor growing seasons. With GUARD 'N GRO I've grown cool weather crops like carrots, spinach and lettuce when it's too cold to grow anything outside. Without any installation these miniature greenhouses have protected my plants down to 10° below freezing. And now to help my friend who invented GUARD 'N GRO I want to tell gardeners everywhere about this superb gardening system.

But even more important to you is what other average gardeners say. Here's a typical letter...from Mrs. Ruby Schultz of Tucson, Arizona. "Last winter I put my geraniums and tender plants in our GUARD 'N GRO...it was freezing cold - at least 18° to 20° above zero. I like GUARD 'N GRO very much. We have a larger greenhouse, but it gets cold in the winter as it is not insulated - it has to be heated in cold weather."



The basic GUARD 'N GRO unit is 42" long x 18" wide x 21" tall. Extensions that add another 40" to each unit let you connect individual units together. You can expand GUARD 'N GRO to six, nine or twelve feet or as long as you like.

GUARD 'N GRO is different from any cold frame or greenhouse you've ever used. It folds flat for storage, sets up anywhere outdoors and doesn't require installation. Without using artificial heat each unit creates a dependably warm growing environment even when it's 10° below freezing outside.



Your entire garden can be protected by the GUARD 'N GRO system when you join individual units together.

Think what this means to you! Now at last you can grow your own vegetables weeks, even months earlier this spring. You can protect your plants from killing frosts, freezing cold, hail and sleet...and never spend a penny for greenhouse heating or lighting. You can extend your growing season at least 4 weeks, spring and fall. You can grow cool weather crops like lettuce, carrots, broccoli, spinach, beets, Brussels sprouts, cauliflower, onions and broad beans, and do away with buying these vegetables at stores.

QUALITY FEATURES

Don't confuse GUARD 'N GRO with those plastic "bag-like" greenhouses that puncture easily. GUARD 'N GRO is made of tough, shatterproof polypropylene...won't shatter, rip, or puncture. Patented, galvanized metal fasteners anchor GUARD 'N GRO against strong winds. Solar panels trap and seal in the sun's heat...keeps your plants warm even on overcast, freezing cold days.



Grow vegetables weeks, even months earlier this spring. GUARD 'N GRO - with its thermal air cells - keeps soil and plants warm and moist even in 22° temperatures. No installation, no artificial light and no artificial heat is needed. In 46 states GUARD 'N GRO is saving time and money for home gardeners. Now at last you can grow vegetables weeks, even months ahead of normal growing seasons...and never spend a penny for greenhouse heating, lighting or building.

NO RISK TRIAL

No longer do you have to wait until warm weather to enjoy vegetables from your garden. Order GUARD 'N GRO...the miniature greenhouse system that needs no artificial heat...on a trial basis. Then really test the system. Use GUARD 'N GRO anywhere you like...use it as often as you like...to prove it's plant growing powers.

See for yourself how GUARD 'N GRO creates an ideal growing climate for your plants. See how it traps and seals in the sun's heat...how it keeps plants warm and moist...even when it's 10° below freezing outside.

Use it to grow lettuce, carrots, spinach, beets, broccoli...most any cool weather vegetable you like to eat.

Put GUARD 'N GRO to every test. If you don't agree it's the greatest gardening breakthrough you've ever used...if it doesn't pay for itself many times over in the vegetables it gives you, you have used it entirely free. It won't cost you a penny.

FREE BOOK

To get your GUARD 'N GRO system now, mail coupon below. Order now and receive free my 26 page gardening book. It's packed full of tips for year round gardening with the GUARD 'N GRO system. Don't delay. Supplies are limited. Mail the coupon now.

MAIL NO RISK COUPON TODAY

HARRISON-HOGE IND., INC.
DEPT. PM4
St. James, NY 11780

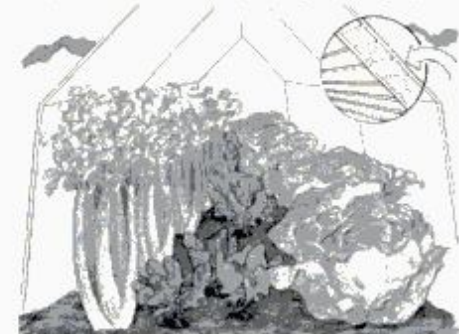
Please send at once _____ GUARD 'N GRO unit(s) at \$22.95 each postpaid with 26 page GARDENING BOOK. If GUARD 'N GRO does not protect my vegetables down to 22° this spring...if it doesn't pay for itself many times over in vegetables it provides, then you will refund my money.

SAVE! Order 3 for \$59.95, 4 for \$75.00
Expand your GUARD 'N GRO SYSTEM with GUARD 'N GRO Extensions. Each extension is 40" long. Doubles length of each GUARD 'N GRO unit (you can add as many extensions as you like). Also lets you connect GUARD 'N GRO units together to protect your entire garden!

Send me _____ EXTENSIONS with metal connectors at \$15.95 each, postpaid.

Total amount enclosed \$ _____ (NY res. add sales tax)

CHARGE IT: (check one) Exp. Date _____
Bank Americard/Visa American Express
Master Charge Interbank Number _____
Card Number _____
Name _____
Address _____
City _____ State _____ Zip _____



Energy-Saving Double Wall Construction. Even on cold cloudy days, thermal air cells sealed between each GUARD 'N GRO panel traps and seal in solar heat to provide a constant warm climate for your plants.

DEVELOPED IN CALIFORNIA

These miniature greenhouses were developed in California by my friend who named them GUARD 'N GRO. He spent years testing every possible kind of solar enclosure on plants and watching the plants react to each enclosure. From these years of testing he developed GUARD 'N GRO, the miniature greenhouses with sealed in thermal air cells.

When he sent GUARD 'N GRO to me I tried them on plants in freezing cold weather. GUARD 'N GRO kept my plants growing even in 22° cold. Soon my friend started selling GUARD 'N GRO to gardeners in other states.

It has produced superb results in Minnesota, Michigan, Colorado and Iowa. 2,000 GUARD 'N GRO systems are being used by gardeners in 46 states.

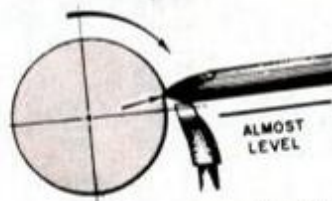
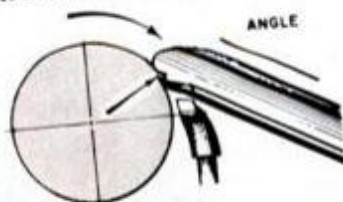
Last winter I gave GUARD 'N GRO to expert, experienced gardeners to test for themselves. They reported "We don't believe it but it's true, GUARD 'N GRO protected plants down to 22° without artificial light or heat." That's what hard boiled experts say.

YOURS FREE!

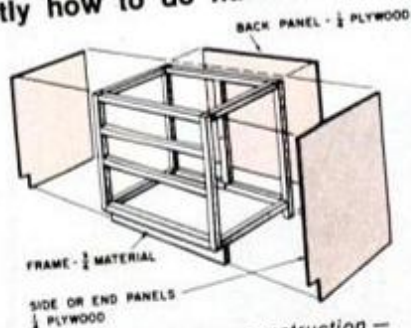
**FEIRER
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**CABINETMAKING
AND MILLWORK**

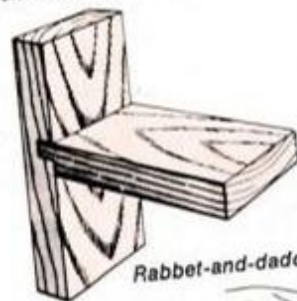
Thousands of explanatory drawings illustrate important points and show you exactly how to do hundreds of woodworking jobs . . .



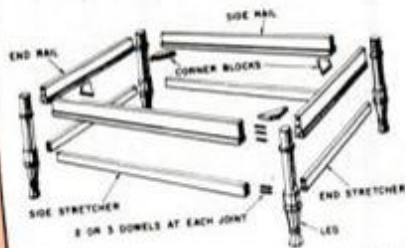
The two basic methods of turning on a lathe: cutting (top) and scraping.



This is frame construction—often used in kitchen cabinets.



Rabbet-and-dado joint.



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



When sharpening a hand saw, make sure the file is level as the stroke is made.

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More than 300 pages of specific construction plans for built-ins, kitchen cabinets, room dividers, tables, bookcases, furniture of every description. You even get a big wood finishing section with more than 100 pages of step-by-step how-to for all kinds of fine hardwoods and practical softwoods, plywood, composition, hardware, plastic laminates, etc. There's much, much more on how to read blueprints, how to make construction drawings, estimate costs, purchase materials at big bargains. Every detail you need to know is given the complete, clear-cut treatment in this excellent do-it-yourself book. You'll use it for years as one of your favorite "handyman's tools".

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- Then, about every four weeks, 15 times a year, you'll receive a bulletin describing the main selection and alternate books also available. If you want the main selection only, do nothing. It will be sent to you automatically. If you don't want the main selection or want an alternate book, just indicate your wishes on the form that comes with the bulletin and return it by the date indicated. You will always have at least ten days in which to do this but in the unlikely event that you don't, and you receive an unwanted selection, you may return it at our expense. In addition, you may return any book within ten days, after examining it, if you're dissatisfied with it.
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This excellent book was custom written especially for Popular Science Book Club. It tells you everything you need to know to install, repair, improve and troubleshoot the entire electrical system in your home.

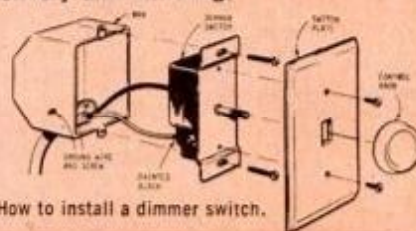
How to determine wiring needs. How to draw up plans for "go-aheads". How to install complete systems. And how to wire low-voltage devices (intercoms, etc.), rural buildings, service entrances, workshops, heavy-duty machines, appliances—everything!

For example, how to rewire an old house inside and out. Hang a chandelier. Put in handy closet fixtures. Install dimmer switches, convenience outlets, three-ways. Set up an intercom. Install door chimes.

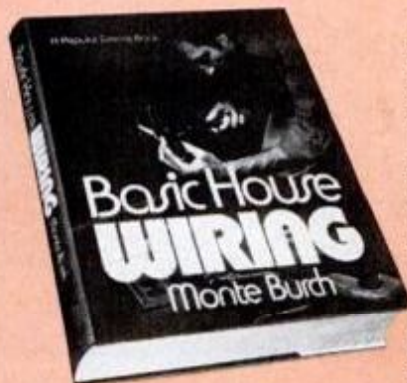
Ground your TV or radio antenna.

And this new book makes all these things easy. More than 500 illustrations guide you through each job step by step.

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How to install a dimmer switch.



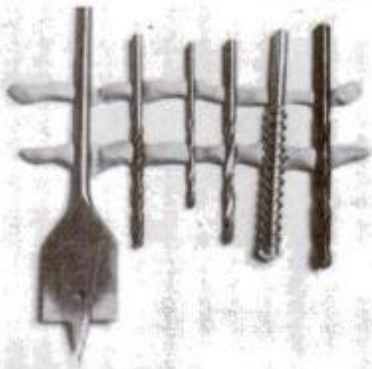
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UNIQUE SAW SHARPENER

A major new design concept to sharpen 4½ to 15 point crosscut, rip, tenon and fleam saws. A replaceable three-square file rides back and forth under the guide bar assembly. The filing depth is adjustable and the filing angles are automatically controlled. Illustrated, step-by-step instructions included. Care for your fine woodsaws with our innovative new tool. \$12.50, plus \$1.50 handling and postage.

New adhesive solves old problems



Keeping drill bits within reach is easy. Use Fun-tak to hang them on a wall.

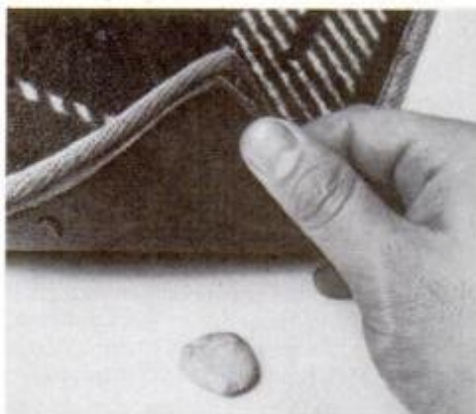
Now there is a solution to that common problem facing do-it-yourselfers: how to keep materials in position while working on them. Fun-tak, a putty-like, reusable adhesive from Permabond International Corp., holds the materials.

Fun-tak is nontoxic and doesn't stain objects. A pack of four 3½-in. strips costs \$1.70 in hardware and houseware stores. The adhesive has endless uses besides those shown. Use it to hang small tools and parts, blueprints and or other light objects on walls. The items can be taken down and replaced as often as needed without the adhesive losing holding power. You can also use it to anchor bottles that contain staining liquids, preventing accidental spills. Also, secure fragile items, such as china, to protect them and electrical wiring, to keep it out of sight. Pencils and erasers won't roll off tables if they're anchored in place.

A mound of the stuff on the end of a long stick quickly picks up pins, tacks and other small items that are spilled. This is handy for retrieving items dropped behind furniture and in other hard-to-reach places. Fun-tak can be used in certain emergencies, too. For example, you can temporarily seal a leaky pipe until it can be permanently fixed.—*Douglas Eisman*



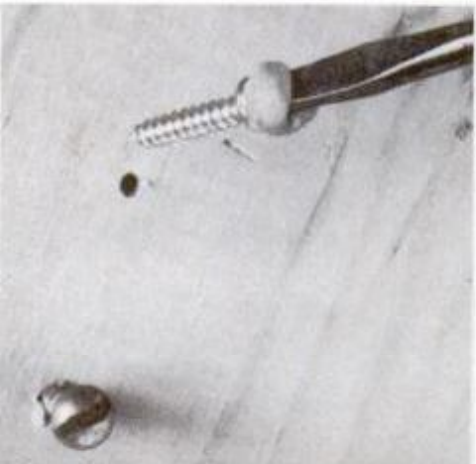
Press the adhesive on typewriter keys, then remove it to clean off ink and dirt.



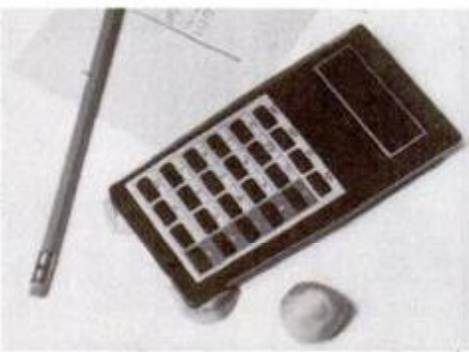
Anchor throw rugs with a pinch of adhesive at each corner to prevent slipping.



Stop pictures from tilting by using a flattened-out spot of the adhesive.



Try using the stuff on the heads of small slotted screws for easier starting.



Stop calculator travel while figuring your tax this year; park it in the adhesive.

OK PRINCETON, here's \$23.95 plus \$1.50 (H&P) for the "DOVETAILER" JIG. Include your 1979 catalog By Phone: (617) 464-5209
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 1979 CATALOG of Quality Hand Tools, \$1.00. MC-VISA Welcome! Give Card No. & Expiration Date!

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THE FRAM EXTRA LIFE AIR FILTER. IT'S LIKE GETTING SOMETHING FOR NOTHING.

Some years ago, the Army asked us to design a special air filter for helicopters: one that could hold a lot more dirt.

First we tried adapting ordinary car air filters, but they just didn't have enough capacity.

Then we experimented with other materials. Some could hold more dirt, but they weren't as efficient as paper filters.

Finally, we found the answer.

TWO FILTERS

Why not combine both kinds of filter?

Outside, we used a material that could hold an enormous amount of dirt. Inside, we put a regular paper filter.

It was tested on Army helicopters and passed with flying colors.

NOW AVAILABLE FOR YOUR CAR

Now we are making the same kind of filter for every kind of car, domestic or foreign.

It's an incredible filter. In tests* we found that the new Fram holds 50% more dirt and lasts 50% longer than our regular filter. And keeps more dirt out of the engine.

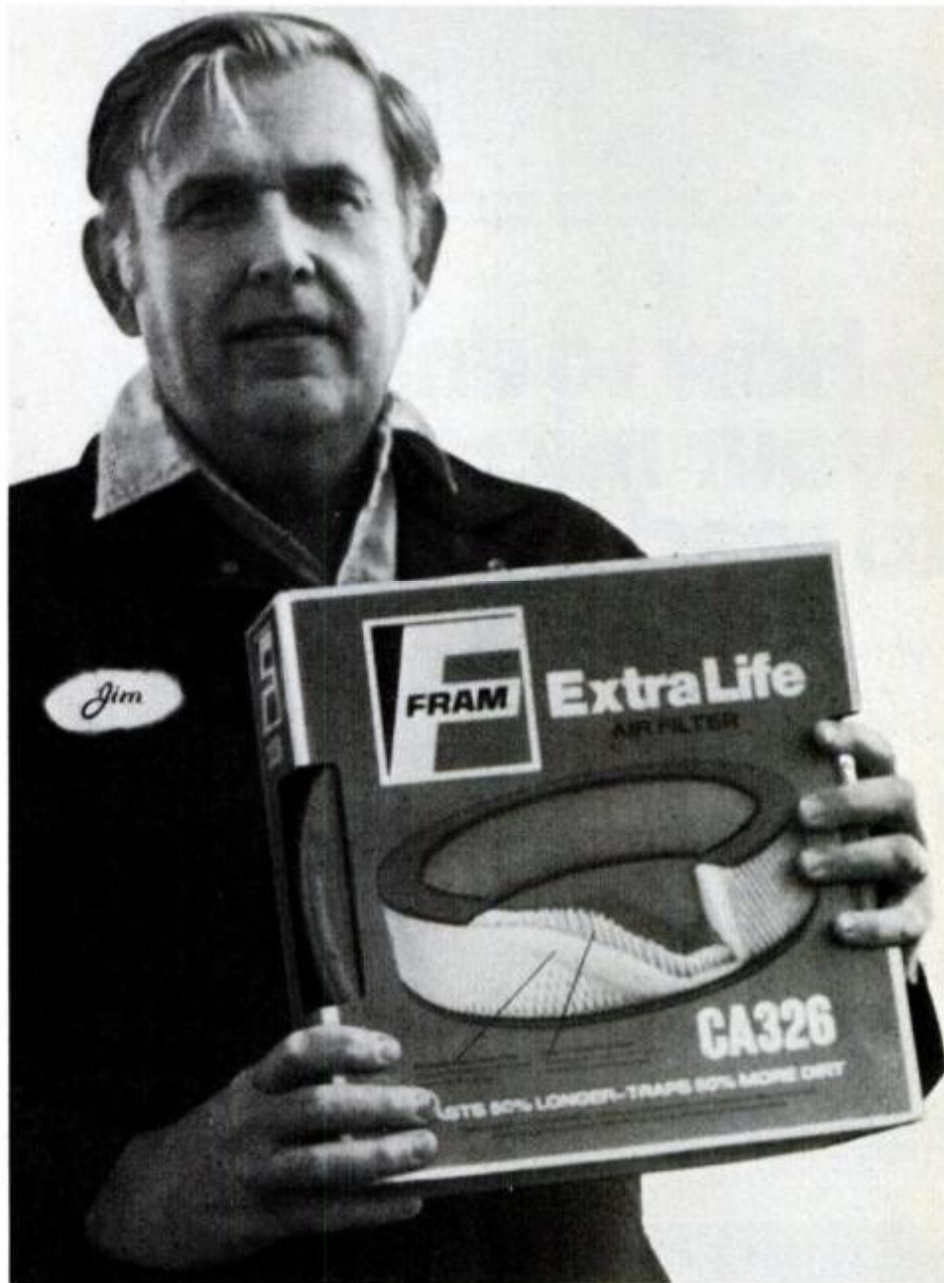
But, just because it's 50% better, don't get worried that it's going to cost 50% more.

SAME PRICE

The new Fram Extra Life doesn't cost any more than our old filters.

In other words, you get extra life.

And extra protection.
At no extra cost.



50% EXTRA LIFE AT NO EXTRA COST.



Fram and Autolite are Bendix Companies
Fram Corporation, Providence, Rhode Island 02916

*Tested against our conventional air filters in accordance with SAE procedures. Results may vary according to car's condition, filter change interval and where and how you drive.



If you build this hybrid tool, you can turn your small 1-in. micrometer into a precision instrument that has up to four times its original capacity.

How to enlarge your micrometer to read larger spans

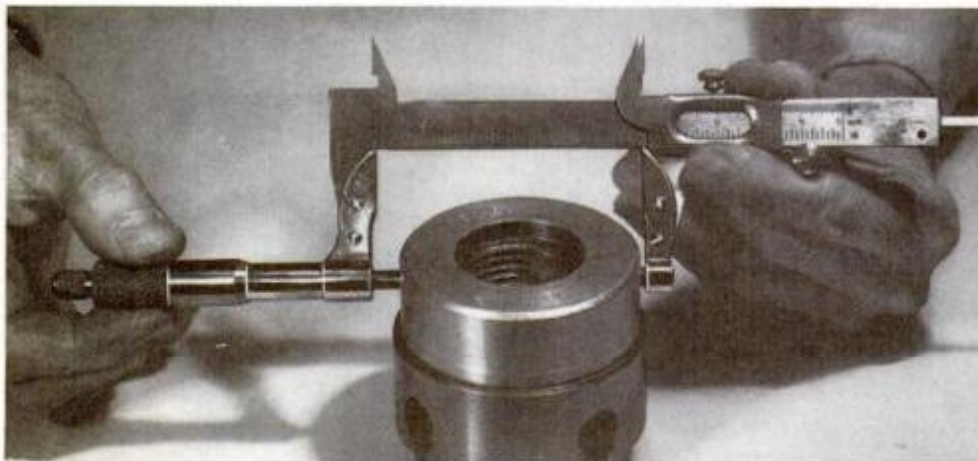
When you bolt it in place on a vernier caliper, you won't need to buy a more expensive model.

Marry a vernier caliper to a micrometer and increase the accuracy of the former and the capacity of the latter. This hybrid, accurate to .001 in., eliminates the need for a larger, more expensive micrometer. My enlarged micrometer is made with a 1-in. micrometer and 5-in. caliper, but select the size combinations that best suit your requirements.

Begin by opening the caliper jaws slightly to align the microm-

eter as shown. Then clamp the micrometer tightly to the caliper jaws and drill four holes through both tools using a No. 50 bit. For calipers with surface-hardened steel, use a small, high-speed grinding tool to penetrate the surface. A good bit will then drill into it. If the bit doesn't deliver chips, grind more. Tap threads in the caliper holes for No. 2-56 machine screws and enlarge micrometer

(Please turn to page 54)



New tool measures lengths up to 4 1/4 in. using a 5-in. vernier caliper. You may want to remove the depth gauge tongue seen projecting at right on the caliper.

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- AUTO REPAIR MANUAL, (11437) 1974-79 \$14.95
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Ever wonder where the professionals go for authoritative repair and maintenance information? They turn to Motor.

All you need to do a really professional job is the new 1979 edition of the famous Motor Auto Repair Manual. In one big comprehensive fact-filled book there's everything you need to know about your American-made car... models 1974 to 1979. It's a must for everyone from master mechanic to the weekend do-it-yourselfer.

Here are just a few of the money-saving features you'll get with Motor... more than 2,800 clear-as-crystal diagrams and pictures... 55,000 essential service specifications... 225,000 service and repair facts... more than 300 quick check specification charts... a big Trouble Shooting section... detailed tune-up instructions... and much more. There's even an imported car version. Motor easy-to-use, step-by-step instructions make every job easy for professional and amateur alike.

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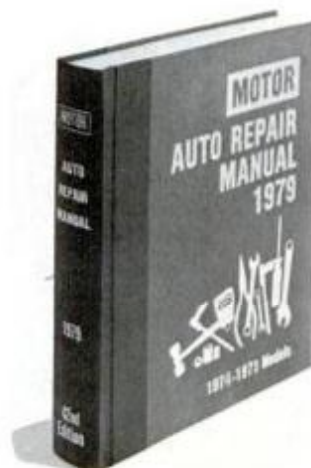
Motor Auto Repair Manual

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LINCOLN
ELECTRIC

ENLARGE YOUR MICROMETER

(Continued from page 52)

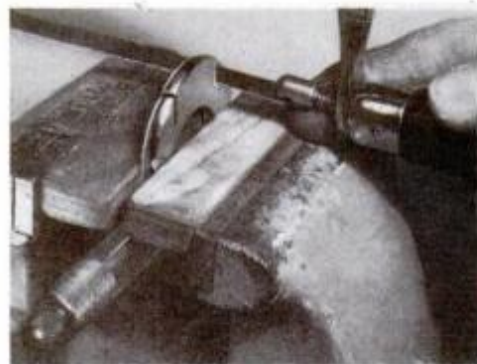
holes with a No. 43 bit to accommodate the screws. Use a hacksaw to cut out the middle section of the micrometer. Screw the remaining anvil and spindle ends to the caliper as shown.

To measure, set the micrometer's handle gauge at 0 and slide the caliper jaw to bring the anvil snugly against the spindle. On our prototype, the jaw stops at 1-7/32 in. At this "standard" setting, lengths from 0 to 1 in. are measured by



For accurate alignment, drill the holes and fasten the micrometer to the caliper jaws to test fit before cutting off the middle section of the micrometer frame.

placing the work between the anvil and spindle of the micrometer and adjusting the micrometer gauge to obtain a reading. For larger measurements, slide caliper jaw in 1-in. increments away from spindle (e.g. to measure between 2 and 3 in. with micrometer, set caliper at 2-7/32 in.; between 3 and 4 in., set caliper at 3-7/32 in., and so on).



Clamp micrometer in a vise and use a hacksaw to cut out middle section. When assembling, align anvil and spindle accurately as if frame still connected them.

Apply the same pressure on all readings to insure accuracy. Using a larger caliper increases the range of the micrometer. However, accuracy will be no better than the finest unit on the micrometer gauge.

—John F. Dryer



Cobra Sports Van



Cobra Van Conversion

Catch The Cobra Spirit!

Cobra's new low-profile Sports Van has what you need for sporting weekends or family travel. Equip it as a luxury turnpike cruiser or a self-contained camper. Either way, the Cobra Sports Van is a new dimension in dual purpose leisure vehicles.

It's time you owned a recreation vehicle beautifully in time with the times but emphatically apart from the crowd. Write today for information on the new Cobra Sports Van and Cobra motor homes, mini motor homes, fifth wheels and van conversions.

Please send dealer name and free information on Cobra products.

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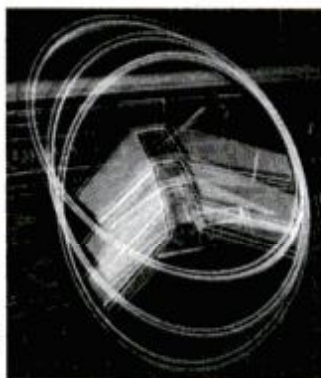
MAIL TO: Cobra Industries
Dept. D-8 P.O. Box 1251, Elkhart, IN 46515

Interstate stiffness?



Tilt-Wheel to the rescue!

Mile after mile and hour after hour, the highway stretches out. Mile after mile and hour after hour, your arms stretch out. Stiff. Tired. Achy. Tilt-Wheel Steering can help you unbend and unwind. First of all, Tilt-Wheel moves up out of the way to help make getting in and out easier. Then you simply select the most comfortable position, because it adjusts to drivers of various shapes and sizes.



And you can change the position of the wheel while you drive, as often as you like, to make long trips more relaxing.

Some GM cars offer Tilt & Telescope Steering. With it, you can move the wheel toward you or away from you, as well as up and down, for even greater comfort.

Tilt-Wheel Steering is available on all American-built General Motors cars, light-duty trucks and vans. Ask your GM dealer for a demonstration.

Saginaw Steering Gear Division • General Motors Corporation

HOMEOWNERS' CLINIC

QUESTIONS ANSWERED

Too much baseboard heat?

Our home is heated by electric baseboard units. This winter there seemed to be too many units in the house. Aside from using a good deal of energy, they restrict the placement of furniture and drapes. Do you have any suggestions as to alterations I can make now so we won't have the same problem next winter?—E.F., Sunnyside, N.Y.

Those strip heaters can be shortened. However, if controlled by a thermostat, either on the wall or on the units themselves, a shorter strip will have to operate longer to heat your room—and there goes your energy saving. On the other hand, shortening the strip heaters will increase your furniture placement possibilities.

Last resort

The cedar-shingled (four sides) hip roof of our house has a leak at the southeast hip line when the wind blows from the southwest. The roof has 16-in. prefabricated cedar shingles applied in what is called the Boston ridge method (alternating courses lapped). The slope is 4 in 12. To combat the leak, we have done the following to the southeast hip shingles:

1. Removed them and changed their shingle exposure.
2. Removed and added roofing felt.
3. Removed and snugly fitted the hip shingles.

After all that, the roof still leaks. I'm beginning to think my pitch is too low, but I don't know how to resolve this. The ceiling is finished with redwood and has 6 in. of insulation in the 2x8-in. framing. As I want the roof to breathe, I don't want to switch to an asphalt roof.—Roy L. Ellison, Cleveland, Okla.

I believe you should have stopped blaming the ridge shingles after you added roofing felt and it still leaked. Roof leaks are extremely difficult to locate if the underside isn't exposed. Water can penetrate in an area 10 feet away from the interior drip just by following the framing members to either a low spot or until it meets an obstruction (a nailhead or other framing member). It seems as if you have a leak somewhere else in your roof.

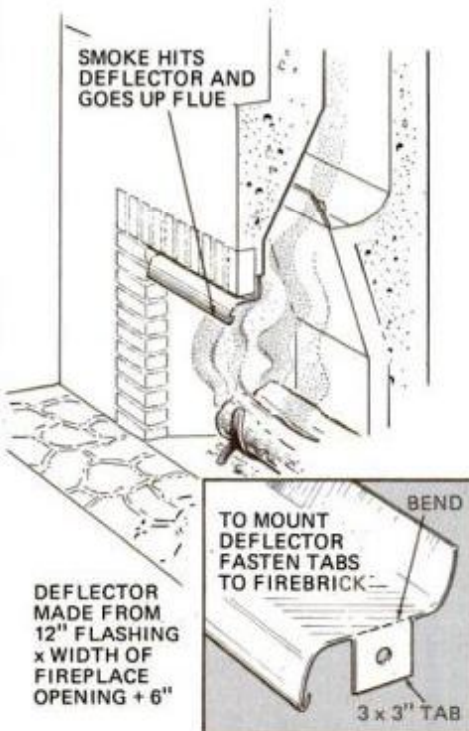
I suggest that you remove some of your redwood, possibly 3 ft. above

where the leak appears to be, then look for telltale stains. Follow these stains until you come to the errant shingle. You can make the repair from the roof.

A well-installed cedar-shingled roof should last a long time. Don't allow leaves, pine needles or other wind-blown debris to accumulate. Incidentally, the Federal Housing Administration recommends a maximum exposure of 4½ in. on roof pitches of 4 in 12 and 5 in 12 in.

Fireplace smokes up room

How can a handyman install an outside fresh-air supply to his fireplace?



Deflector keeps smoke out of the room.

I have a totally electric home with each room individually heated. Since I don't have ductwork to get air, smoke rolls back into the room.—Patrick L. Murphy, Clarendon Hills, Ill.

Ductwork is not the answer, Patrick. Steam, hot-water and radiant heating systems don't have ducts, either. Your mason didn't know that

Do you have a home maintenance or repair problem? Send it to Homeowner's 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 help, get PM's Home Care Guide, \$4.95 postpaid. Send order(s) to PM, Dept. HCG, Box 1014, New York, N.Y. 10019.

the fireplace opening has a direct ratio to the size of the room. From the photo you sent, yours looks quite high. The smoke is hitting the lintel on its rise. Although part goes up the flue, an annoying amount comes into the room. A simple deflector or fairing can be fashioned from 12-in. aluminum flashing. Bend over the front edge of the deflector for rigidity (see sketch). A 2x4 and the front edge of your workbench are all the bending gear you'll need. A mallet will do fine in smoothing out the front edge once the bend is started.

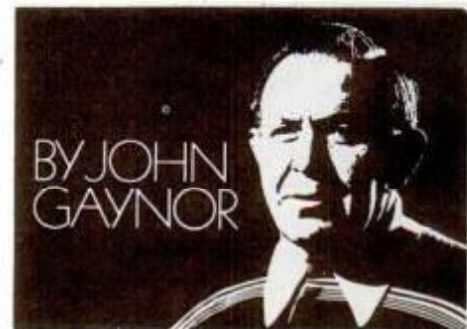
Cut the flashing about 6 in. longer than the opening. After the deflector is formed, cut off 3 in. from both ends, leaving tabs for screwing into the firebrick. The metal doesn't have to fit tightly to the smoke chamber. After fastening, paint the flashing flat black. If fresh air is required, open a window (slightly) on a side of the room opposite the prevailing wind.

Shower-faucet leak

My shower hot-water faucet has a worn and leaking nonreplaceable seat located behind a tile wall. Is there a kit to tap and thread a new seat into this type valve, maybe using an epoxy cement?—J.W. Binsack, Staten Island, N.Y.

If you're sure there is no spot in the center of your valve for an Allen wrench, you do have a nonreplaceable seat (this is rare nowadays). Before you have the valve replaced, purchase an inexpensive valve-seat dressing tool at your hardware store.

Don't apply too much pressure while rotating the stem. Try a little at a time, flushing the seat clean prior to testing. Worn seats are most often caused by overworn washers, so make certain all your washers are in good condition. **PM**

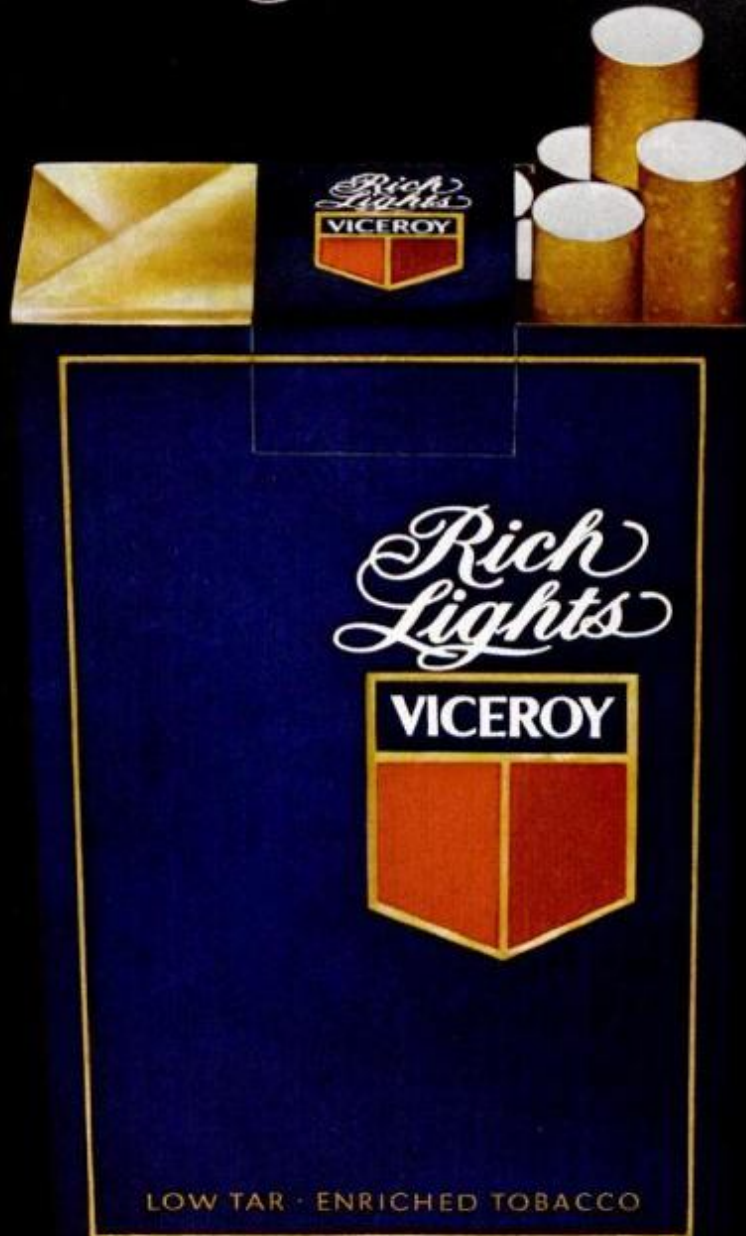


BY JOHN GAVNOR

9 mg. "tar", 0.8 mg. nicotine av. per cigarette by FTC method.

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That Cigarette Smoking Is Dangerous to Your Health.

Introducing
Rich Lights from Viceroy.



The first low 'tar' cigarette
good enough to be called *Rich*.

Kings and 100's.

PM WORKBENCH

PM EXAMINES PRODUCTS & SERVICES

Snap-on disc sanding

Tough, laminated nylon-backed abrasive discs don't snag or tear like conventional paper discs. They're great for when you're doing bodywork on your car. Use them to grind metal or to sand fiberglass and paint. Clean them with a wire brush. The patented snap-on holder has no



Holder shank chucks into a 1/4-in. drill.

center screw to mar the work surface. The kit contains a 3-in.-dia. holder and six discs that come in coarse, medium and fine grits. You can purchase it for \$4.99 from Merit Abrasive Products Inc., 201 West Manville, Compton, Calif. 90224.—H.W.

Lightweight, long-lasting tape

This 25-foot tape measure has two noteworthy features. When the slide lock is pressed into the locking position, it holds the tape blade precisely where you want it—there's no chance that it will pull back slightly into the case as it locks. Second, the



Rule features positive lock, durable case.

Cyclolac plastic case resists high impact. The maker claims it will not wear, break or chip under any conditions. It's available for \$9.70 from the Evans Rule Co., North Charleston, S.C. 29411.—J.P.

Spare your thumbs

This Thumb-saver tool lives up to its name—especially when you work with brads as small as 1/2 in. It will also hold up to 10d nails. A clamp holds the nail firmly, away from fingers as you start hammering. Once the nail is started, press side of



Use Thumb-saver when nailing in tight, hard-to-reach spots. Ideal for model building, picture-frame assembly and delicate repair work in home and shop.

clamp to remove the tool from the nail. Then finish hammering. Thumb-saver is priced at \$1.95 from the Bostik Consumer Div., USM Corp., 4408 Pottsville Pike, Reading, Pa. 19605.—H.W.

Carve a chain from wood

Ever wonder how some whittlers come up with intricate, interwoven carvings? Send for this kit and learn some of their secrets—and you end up with an interesting conversation piece.

The kit consists of a pre-cut block of wood and a small saw to get you started—you supply the knife. After you've mastered the technique, try it out on some of your own designs. It's \$8 postpaid from Log-Chain, Box 668, Bursleson, Tex. 76028.—J.P.



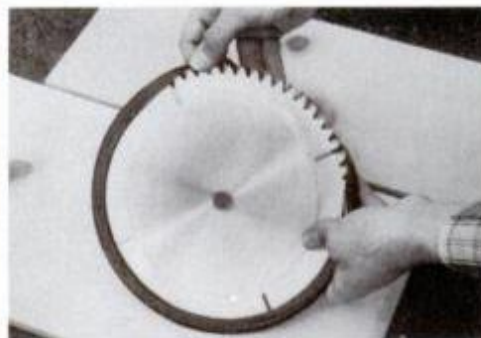
Score cutout lines with razor-sharp knife at outset to prevent splitting at ends.



Use small saw supplied with kit to separate links, then use knife to clear out waste.

Carbide saw-blade shield

Circular-saw blades, when they're not in use, can be easily damaged by careless handling, and expensive carbide-tipped blades are especially susceptible to broken or chipped teeth. However, now you can pro-



Cover stretches to slip over blade teeth.

tect your blades with a PVC shield made by the Allen Co., 8417 Little Rd., Bloomington, Minn. 55437. Stock sizes range from 6 to 20-in. dia., at prices from \$1.60 to \$2.30 each. Quantity discounts are available.—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.

INTRODUCING A WOLF IN WOLF'S CLOTHING.



It comes dressed in special paint, a sleek teardrop tank, flashy megaphone pipes, and lots of chrome. All the markings of a bigger beast.

And like its big brothers, it's ridden in a more natural, laid-back position. With a low-riding stepped seat. And handlebars that reach back for you instead of the other way around.

But our XS400 has more than the profile. It has the power.

In fact, *Cycle Guide* magazine found that it's the fastest accelerating four-stroke 400 you can buy. And one of the best handling motorcycles anywhere.

Or, as they put it, "the only limit to how much fun you have is how much lean angle you like."

How did all this come about? Engineering.

For example, the suspension system not only gives you big bike steadiness, but it can be fine tuned for any rider, any riding style.

And the carburetors automatically adjust to engine load. So there's a lot of power, but not a lot of temperment.

Plus there are features like an overhead cam, electric starting, 6-speed transmission, self-canceling turn signals, disc brakes, and

complete instrumentation that's angled back for easier reading.

There's even an economy model, the XS400-2F, for those of you on a little tighter budget. It has wire wheels instead of cast alloy, slightly less chrome, a kick starter, drum brakes. And it comes in one color instead of two. In all other respects, it's identical to our regular model.

Which means it does a whole lot more than look like a bigger bike.

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Simply focus and shoot with a Yashica FR Series camera. It's that easy.

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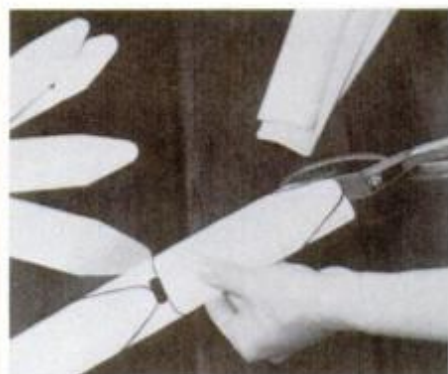
YASHICA

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HINTS FROM READERS

Venetian-blind garden markers

You can cut dozens of garden markers from a discarded Venetian blind. The aluminum slats hold up for many seasons. The 1-in. slats make good markers for pot plants.—*Jim Quinn*



Tin snips easily cut thin-gauge aluminum. It's usually possible to cut through two thicknesses at once.



Felt-tipped indelible pen label markers, or slip empty seed packets over them. Spray-paint if desired.

Carpet conservation

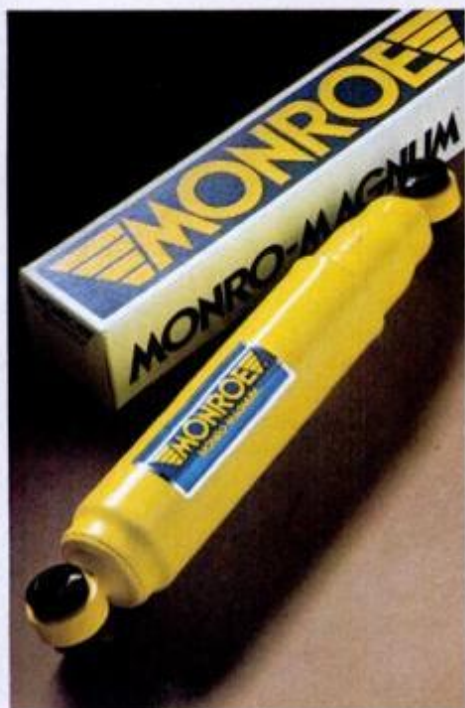


You can double the life of stairway carpeting by turning the section's front edge to the back after it wears.—*Jorma Huypia*

Give your tools a new lease on life with **GUNK** & **SOLDER SEAL** products

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Smooth sailing.



vehicle behaves when you've got your wheels firmly planted on good ol' terra firma.

Simply speaking, the new Monro-Magnum is a huge shock. It's almost twice as big as the one-inch shocks that are standard on most vans, 4x4s and pickups. This gives us room to give the Magnum a bigger bore, bigger piston and nearly two times more oil capacity. And that gives you a firmer, more stable ride.

We're putting our money where our mouth is.

We're so sure, either on or off road, no standard shock will ride as well as Monro-

Magnum, we're backing them with this special offer: "If in 60 days you don't agree four Monro-Magnums give you the best ride you've ever had, Monroe will replace them, no charge, with any comparably-priced shocks." Offer extended to October 31, 1979. See your Monroe dealer for details.

If all this sounds great to you, truck on over to your Monroe dealer. And happy landings.

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Monroe Auto Equipment
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Introducing Monro-Magnum®.

All pickups, 4x4s or vans sail through the air with the greatest of ease. This ad is about Monro-Magnum® and the way your



DETROIT LISTENING POST

Rabbit pickup delayed



Volkswagen Rabbit pickup truck will be on a longer wheelbase than the hatchback models.

VW's Rabbit-based front-drive pickup truck, slated for spring production startup at the Westmoreland, Pa., plant and midsummer introduction, will likely not become available until fall. Engineering and component supply problems have caused the delay. VW will probably debut the mini-truck in September as a 1980 model.

Pet peeves

We all have our particular pet peeves about cars. You know, those dumb design mistakes the automakers never seem to correct—the ones that drive us all crazy. Here is just a sampling of mine:

■ Car doors that won't stay open in the slightest breeze or on the tiniest grade. Bruised legs are very often the result.

■ Rear-view mirrors without a day/night feature. They make you buy an "interior convenience package" to get the reversible mirror.

■ Nonadjustable steering columns that are mounted at some ridiculous angle, or so high you have to reach up for the wheel like you did as a kid in your daddy's car.

■ Nonadjustable seatbacks designed on an angle that some product planner's mother thought was "comfy."

■ Ashtrays so small they hold only one ash, or so tight they spring open with a jolt and dump ashes on the floor, or conveniently located right in front of your floor-mounted shift lever.

■ Gloveboxes too small to hold more than one glove.

■ Seat belts and harnesses that lock up and can't be further extended until they're completely retracted again—or that bind and resist being retracted at all.

■ No handy places to put your coffee cup, sunglasses, toll-booth change and all that other stuff that clutters up your car.

What are your pet peeves? Let us know. Maybe if we all complain loud enough and long enough, some of them might get changed.

Federal bumpers near useless

William Haddon's Insurance Institute for Highway Safety (IIHS), after bashing nine new cars into poles, angled barriers and even each other at 5 and 10 mph, has concluded that today's mandated 5-mph bumper systems aren't much better in real-life impact situations than were '74 model designs. Estimated damage from the front angled barrier shunts at 5 mph, for instance, ranged from a high of \$366 for a Chevy Malibu to a low of \$14 for a Ford Mustang—and in most cases the major share of repair costs went into the bumper system itself.

The conclusion was that much tougher standards are necessary—in spite of the obvious high cost and weight penalties that bigger battering rams would bring. NHTSA chief Joan Claybrook countered that existing standards for 1980 models greatly reduce allowable damage to the bumpers themselves and will result in a major reduction in real-life repair costs. We'll see.

Chrysler's 'Ten Commandments'

Chrysler Corp. is offering some sage advice on getting your car serviced. Some lemons are created by their owners through lack of attention, and Chrysler's Ten Commandments of Auto Repair point out how best to deal with your service department and prevent that new peach from turning sour. Boiled down, and skip-

ping the Biblical-style language, they go like this:

1. *Preventive maintenance:* Read your owners manual and do what it says when it says.

2. *Plan your appointment times:* If possible, avoid Mondays and Fridays, when service departments are jammed and working under greater pressure.

3. *Prepare for the appointment:* Have warranty book and past service log or records with you.

4. *Prepare a list:* No service writer can remember every conversation. Give him a written list of what you want done and be sure that you include any special instructions or circumstances.

5. *Be specific:* Don't say "Do what needs to be done." Leave the car with an estimated cost of mutually agreed-on items to be accomplished.

6. *Be reasonable:* Don't expect long lists of items to be done in one day. Leave the car longer or bring it back for some of the lower-priority problems.

7. *Don't leave pets or kids with the car:* Sounds ridiculous, but people do it.

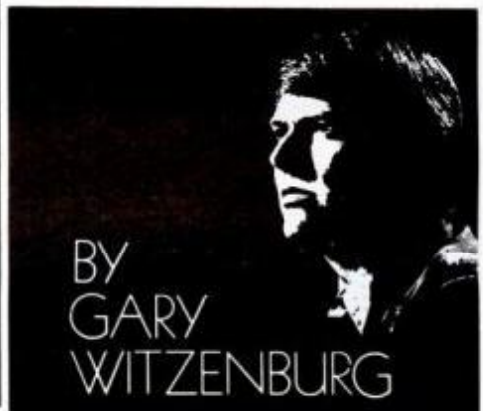
8. *Don't expect to watch:* Technicians don't need the pressure and distraction of someone looking over their shoulders, and insurance rules usually forbid it anyway.

9. *Make complaints promptly:* Check repairs and report any dissatisfaction immediately, not weeks later. Make another appointment if necessary.

10. *Be an appreciative customer:* Good service is hard to find. When things are done right, say so... and reward that shop with repeat business and recommendations to your friends.

And I'll add, "Good luck!"

FM



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Feel the refreshing coolness of
KOOL SUPER LIGHTS

Discover the special kind
of coolness that could
only come from KOOL.
No other low "tar"
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Mako P158 LSSP



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These three Case Sharks are considered by experts to be among the finest lockblade knives made anywhere — at any price.

More than 150 hand operations go into the making of each knife. For

quality you can see and feel. Brass liners and bolsters give them greater strength. For a lifetime of hard use. Case Sharks can handle any job you can put to a knife.

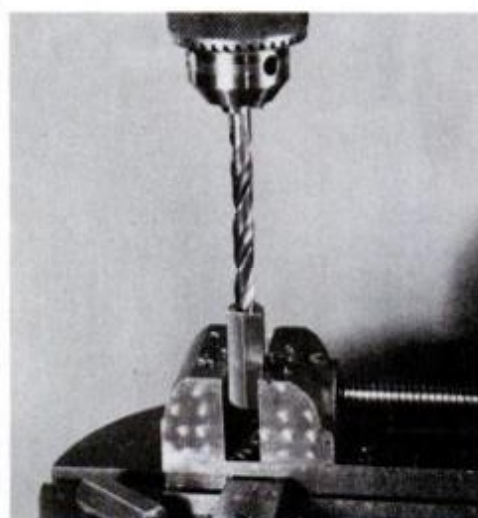


The world's finest cutlery.
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Make your own steel bearings from a rod-coupling nut



Steel bearing made from rod-coupling nut will outlast several wooden bearings.



To make bearing, inside threads of coupling nut must be removed by drilling.



Bearing may be used with unthreaded rod on pulley setup, or on shank of bolt.

An inexpensive steel bearing for pressing into wood can easily be made in the shop. For instance, if you should need a $\frac{3}{8}$ -in. bearing, take a $\frac{3}{8}$ -in. rod coupling nut and drill out the threads with a $\frac{3}{8}$ -in. drill. You will find that the nut will slide on the shank of a $\frac{3}{8}$ -in. bolt or on $\frac{3}{8}$ -in. rod, making a good fitting bearing. To fit the bearing into wood, drill a $\frac{3}{8}$ -in. hole to allow a press fit for the $\frac{3}{8}$ -in. nut.

The same method, using appropriately sized nuts and drills, can be followed to make steel bearings in a wide variety of sizes.

—Jim Harris



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over 6' of headroom,
lots of storage.



Station Wagons
3 great models.
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Outstanding options.



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Headed for college? Air Force ROTC can help you through. Full-tuition scholarships and \$100 a month tax free. Flying lessons for qualified students. Or there's the Air Force Academy. It's a college education second to none.

For college graduates, there's Air Force Officer Training School to get you started. Then on to hone the skills you've learned, and work beside professionals in the Air Force.

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CAR CLINIC

SOLUTIONS FOR MECHANICAL HEADACHES

BY MORT SCHULTZ



Double-time overtime

I was interested in an item you published recently (Car Clinic, Oct. '78) about using GM Carbon Solvent to alleviate hard-start problems when an engine is warm. Nobody here has heard of the stuff, including two GM dealers and a hardware store. Could your imagination be working overtime?—Stephen Hoye, Pawtucket, R.I.

Sure—I even dreamed up a GM part number: 1050002.

Shook to the roots

The steering wheel of my 1978 BMW 320i vibrates when I drive between 55 and 61 mph. The tires have been balanced five times (I've had the car two months). The dealer originally blamed the tires—the tire dealer blames the car's suspension. Now, the dealer admits that I'm just one of thousands of 320i owners who have the problem, and that there's nothing he can do about it.

I've talked with several other BMW 320i owners, who confirm that their cars have the same vibration. The only difference between them and me is that they have accepted the annoyance. I can't. Why wasn't I told about this trouble before I bought the car?—Linda L. Smith, D.D.S., Atlanta

Only the dealer can answer this question but BMW knows of owners' complaints about excessive steering-wheel feedback. BMW cites the tendency of high-performance, steel-belted tires to oscillate. Sensitive and precise steering systems don't mask these vibrations as in other cars. BMW says that Hunter and Auto-Dynamics equipment, specifically, can measure force variations in a tire and tread can be ground slightly to balance it.

That's the story, Dr. Smith. If you feel like telling your story to someone in authority, call the National Highway Traffic Safety Administration Hotline (800-424-9393). This agency deals with car safety problems rather than matters of cus-

tomers satisfaction, but you may still want to report your experience.

Hardly digestable

Why has my 1975 Ford Pinto Squire station wagon (V6 engine) devoured four electronic-ignition control modules in 60,000 miles? At \$50 a crack, I can't afford to keep buying modules and gas for this monster. Help!—William J. LaValle Jr., West Monroe, La.

You may be having trouble because you're getting the wrong part. The electronic-ignition control module that's made for 1974, 1976 and 1977 models cannot be used on your car. While this module will fit into the '75 Pinto, it will burn out prematurely because of a difference in the wiring.

The correct module for your Pinto should have the number D5AE-12A199 stamped on the face of the module. Modules for other years have the same number except for the second digit. Thus, the module for a 1974 model has part No. D4AE-12A199, the module for the 1976 model has part No. D6AE-12A199 and the module for a 1977 model has

part No. D7AE-12A199. You can see how easily a mixup can occur.

However, if you have been installing the correct module for your Pinto, check for corroded and dirty terminals in the primary circuit, loosened primary-circuit connections or a malfunction in the resistance-wire circuit as the cause of your replacement problem.

Oil guzzler

The 454-cu.-in. engine of my 1976 Chevrolet truck uses two quarts of oil in 500 miles. The vehicle has been driven 16,000 miles, and the problem has been with me since the 7000-mile mark was reached. I spent \$92 to have Teflon spring-loaded valve guide seals installed, but this hasn't helped. My dealer says nothing else can be done. Are two quarts per 500 miles Chevy's standard for this engine?—Jack Turner, Opelika, Ala.

The 454 seems to consume more oil than other engines, but the standard, as you call it, is a quart in 800 to 1000 miles. Your dealer was on the right track when he installed Teflon seals, because the heat that's generated by the 454 engine causes the original rubber valve guide seals to harden and crack.

The superior Teflon seals withstand heat. However, if the dealer didn't check valve guides for damage when he replaced the seals, he may have left the cause of the problem in the engine. Furthermore, there is always a chance that at least one of the new seals was installed incorrectly.

In other words, Jack, the engine should be disassembled again to check on these possibilities. If everything appears to be okay, make a

(Please turn to page 70)

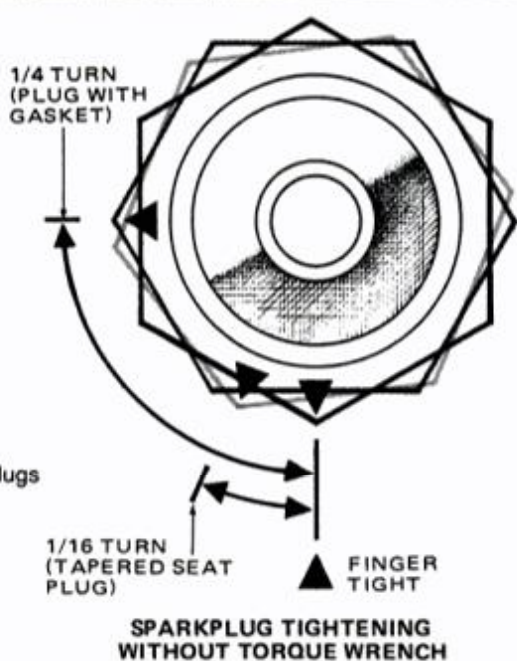
With finesse



If you don't have a torque wrench, use the following recommendations for tightening sparkplugs with a standard wrench:

1. Install new plugs by hand until they are finger-tight.
2. Tighten plugs that have gaskets 1/4 turn.
3. Tighten tapered-seat plugs (no gaskets) 1/16 turn.

These recommendations assure that sparkplugs will make a gas-tight seal and that they will be easy to remove from the cylinder head during your next tune-up.



SPARKPLUG TIGHTENING WITHOUT TORQUE WRENCH



Introducing Shell Fire & Ice[®] All Season Motor Oil

Protect your car's engine in both blistering heat and shivering cold. Ask for the motor oil that's true to its name.
Shell Fire & Ice 10W-40 Motor Oil.

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CAR CLINIC

(Continued from page 68)

wet-dry compression test to check for a broken oil ring in one of the cylinders.

The Firestone recall

Can you tell me which Firestone tires have been recalled?—John A. Meyer, Pioneer, Iowa

1. Five-rib No. 500 steel-belted radials sold on or after Sept. 1, 1975, and manufactured before Jan. 1, 1977. Tires in this group have DOT identification numbers that indicate the 35th through 52nd weeks of 1975 (355 through 525) and all weeks of 1976 (016 through 526). These three numbers are the last three digits of the DOT identification number and they are molded into the tire sidewall.

The final digit (5 or 6) tells the year (1975 or 1976), and the two digits preceding it indicate the week of that year.

2. Seven-rib No. 500 steel-belted radials and Firestone TPC tires sold on or after Sept. 1, 1975, and manufactured before May 1, 1976. These tires have DOT identification numbers ending in 355 through 525 and 016 through 176. The Firestone TPC

tires are sold as original equipment on cars made by General Motors.

Private brands included in the recall, bearing the same identification numbers as tires that have the Firestone name, are Ward's Grappler and Grappler II Steel Radial, Shell Steel Radial, National Steel Radial, Seiberling RT 78 Steel-Belt

Radial, Holiday Supreme Steel-Belt Radial, LeMans Steel-Belted Radial, Atlas Goldenaire II, Caravelle Supreme and Caravelle Double Steel Radial, K-Mart Radial 40, Union Steel Radial, JTW Ferrari Supreme Steel Radial, JTW Ferrari Steel Radial and Zenith Supreme Steel Radial.

A beneficial oil shortage

Electronic ignition notwithstanding, distributor breaker points (lots of them) are still with us. A simple job that do-it-yourself mechanics perform is setting these points. However, a common mistake, made by mechanics, do-it-yourself and professional alike, is using an oil-covered feeler gauge to do the job. Oil transferred to points causes premature erosion. Furthermore, oil gives a false drag impression that leads to an inaccurate setting. To be safe, get into the habit of wiping the gauge with an alcohol-dampened rag. Then wipe the gauge dry with a clean cloth.

PM CAR CARE

TIP



Purolator introduces The HOT ONE

The oil filter specially designed to take all the heat that trailer-towing cars, vans, pick-ups, RV's, 4WD's and Motor Homes can dish out.

Specialty vehicles, those used for towing or rough and tumble driving, on and off the beaten track, can cause normal motor oil temperatures to soar to 250° 300° or more.

This surging hot motor oil can inflict severe damage on your oil filter, often causing the paper filtration medium to break down.

That's why Purolator designed the HOT (High Oil Temperature) ONE oil filter. It provides extra protection against sizzling hot oil.

Here's how:

- A synthetically reinforced primary filter medium.
- A second 100% nonwoven synthetic fiber for additional high temperature stability.
- A special synthetic rubber heat-resistant gasket.
- Steel end caps and steel center tube.

Take advantage of this new Purolator first. Protect your specialty vehicle's engine with the HOT ONE.

Purolator.

When you can't afford to take a chance.

Purolator Filters Division, Inc., 970 New Brunswick Ave., Rahway, N.J. 07065



Get The Dry Look... and don't be a stiff.



The Dry Look pump leaves hair feeling as soft and natural as it looks.

The Dry Look gives you more than a great look. It leaves your hair feeling soft and natural, too — not stiff. The Dry Look in pump spray or aerosol — with a formula that's right for your hair. Get The Dry Look... and don't be a stiff!

© The Gillette Company, 1978



Inside job

My car is a 1971 Plymouth Satellite equipped with a V8 engine and power brakes. The master cylinder has two compartments. In two months' time, the rear compartment of the cylinder (the compartment closest to the firewall) loses its brake fluid. The front compartment stays full. I swear that there is no brake fluid leaking at any point in the braking system. This being the case, can you tell me where the leak is? —H.C. Wong, Honolulu, Hawaii

Inside the master cylinder. The secondary piston O-ring or cap in the master cylinder is bad, permitting vacuum to pull fluid from the rear compartment of the cylinder into the brake booster, and from there into the engine. You can confirm this by removing the brake booster-to-engine vacuum hose at the booster. Twirl a screwdriver inside the hose. I'll bet that it will come out wet with brake fluid, which means the master cylinder needs to be either overhauled or replaced.

Quickie

What causes a pronounced shudder-

ing in a 1977 Chevrolet Vega station wagon when the brakes are applied? —Capt. Bruce L. Ullman, Morgantown, W. Va.

An out-of-round rotor is indicated.

Running wild

The temperature and fuel indicators of my 1976 Chrysler Cordoba are going wild. Simultaneously, they jump to HOT and FULL from the normal readings. Do you have any advice for me? —Loren L. Pace, Findlay, Ohio

You bet I do. I see the cause as an erratic voltage limiter. My advice is to remove the instrument cluster and connect a voltmeter to the temperature sending unit, while leaving the sending unit wire connected. Then turn on the ignition switch. The voltmeter needle should fluctuate. If it doesn't fluctuate, you should have the voltage limiter replaced.

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.

SAFETY AND SERVICE TIPS

■ Chrysler has announced availability, in booklet form, of technical service bulletins for 1977 model cars, trucks and imports. They cost \$7.25 apiece. Write to Chrysler Service and Parts Div., Customer Relations, Box 40, Detroit, Mich. 48288, and request publication 81-070-7156A. TSBs for 1975 and 1976 models are also available.

■ Concern over a possible transmission defect in 1970 to 1978 Ford Motor Co. cars and light trucks has prompted readers to ask questions. Here are some answers:

The government is presently investigating the possibility that C6 and FMX automatic transmissions slip out of PARK into REVERSE when the engine is left running. Fatalities and injuries have been reported. To determine if your model has the suspected transmission, check the certification label on the door pillar or door edge on the driver's side. If your car has the letter "X" or "U" under the column TRANS, or your truck has the letter "G," watch it. When you leave the car, turn off the engine, set the parking brake and shove the transmission lever firmly into PARK. Never leave the vehicle unattended with the engine running.

■ If the rear axle housing of your 1975 to 1978 AMC model is leaking a bit, relax. The leak is probably due to a pinhole in the casting, which can be repaired by cleaning and drying the leaking area and spreading silicone adhesive sealant over the spot.

How to break in a new bike

by Bill Hampton



Straddling your brand-new bike, you hit the starter. The engine comes to life, you click into gear and take off. You're anxious to chase some road to the horizon.

But wait!

How are you going to break in that new piece of machinery? Should you baby it for the first 1000 miles or run it hard right from the start?

Well, you can play it safe and follow the recommendations in the owner's manual. But you'll probably find little information other than a warning not to exceed a certain speed or rpm level during the early stages. You may even get the impression that break-in isn't all that critical. But it is.

During those early miles the parts of a new engine get to know one another and stresses are relieved. The components that benefit most from break-in are the pistons, piston rings and cylinders.

To the naked eye the surfaces of these parts appear smooth. But, microscopically, they're really like sandpaper. And until they've worn off their roughness and developed adequate working clearance, they'll generate considerable friction.



Tachometer is a helpful break-in tool, but there's a lot more to consider than rpm.

In some engines, furthermore, the pistons may be a press fit. If they expand too much from overwork, the pistons can distort and squeeze through the thin film of oil separating them from the cylinder walls. Tiny bits of aluminum are torn loose from the pistons' high spots and lodge themselves on the cylinder walls. When that happens it's only a matter of time before new pistons and cylinder reboring are necessary.

So, avoid abusing a new engine

and allowing it to overheat. Operate in an rpm range where the engine is neither overrevved nor lugged down. Either condition overstresses your engine.


If the owner's manual advises against exceeding 4000 rpm during the first 500 miles, you have a guideline. You can, however, exceed cruising rpm limits for brief periods of time. An occasional spurt of speed above cruising rpm followed by closing the throttle and coasting will break in that new engine faster and more effectively.

You may use this technique as soon as you take delivery of your new bike. It will help the pistons skim off high spots and allow the piston rings to seat before the cylinder walls glaze.

Here's what you do: As you're cruising along in high gear, every so often drop down a gear and accelerate the bike. Be sure the engine isn't lugging when you "turn up the wick." Keep an eye on the tach to make sure you don't exceed "red-line." Once you let the rpm run up, close the throttle and coast for a few seconds. Don't hold it open so that

(Please turn to page 209)

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Come to Marlboro Country.



Marlboro Red or Longhorn 100's—
you get a lot to like.

Kings: 17 mg "tar," 1.0 mg nicotine—
100's: 18 mg "tar," 1.1 mg nicotine av. per cigarette, FTC Report May '78

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

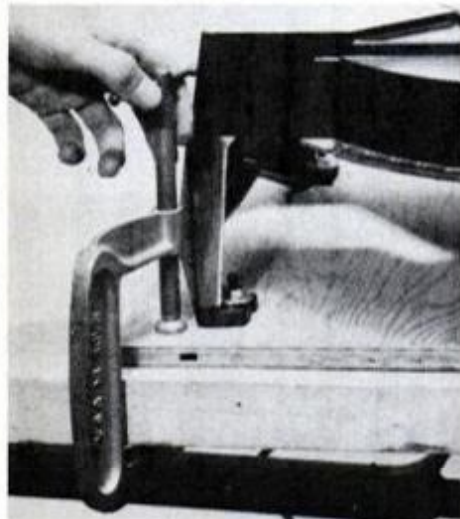
PM LOOKS AT SEARS MOTORIZED MITER SAW

Who needs a power miter saw? After using the gutty little saw shown, I'd say all woodworkers who do a lot of around-the-house-improvements that call for frequent mitering. But it is also a dandy shop tool; you can cut any angle up to $47\frac{1}{2}^\circ$ (which means you can correct for out-of-square corners). Once adjusted, the saw produces accurate cuts—and that's what good shop tools are all about. If you have a table saw, consider adding this saw instead of the radial-arm model.—*Harry Wicks, Home and Shop Editor*

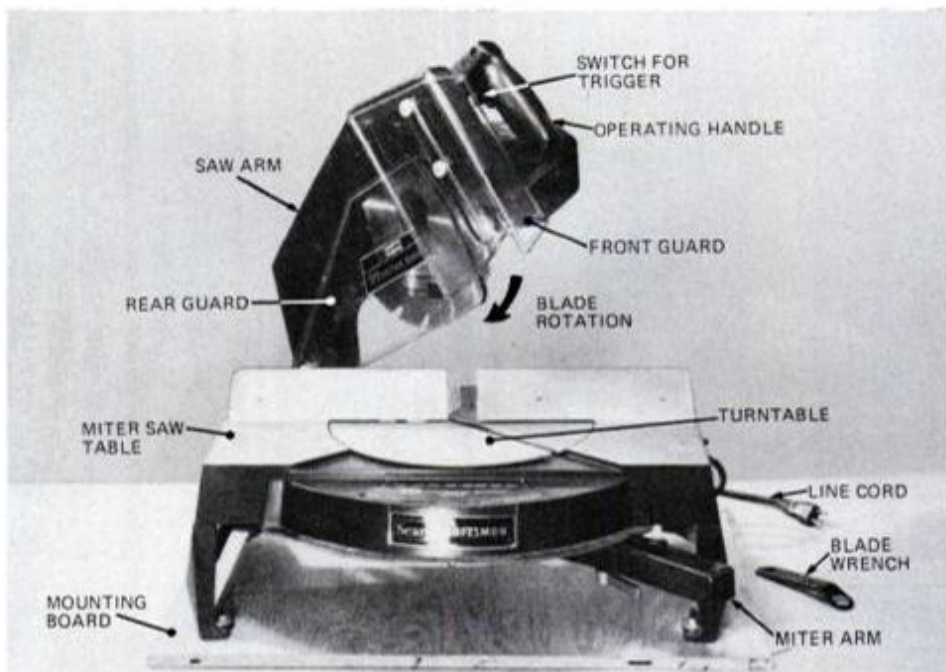
SPECIFICATIONS—Model 2373 Motorized Miter
 Motor: 115-120-v., 60 Hz a.c., 1260 w., UL-listed, 1½ hp.
 Speed: 5500 rpm (no load), 10-in. blade, ¼-in. arbor.
 Capacities: 5½ x 2⅞ in. thick at 0°, 3¾ x 2⅞ in. thick at 45°.
 Other features: Blade locks at any setting from 0° to 47½° right and left; electric brake stops blade when trigger releases; 100% ball and needle bearings; year warranty.
 Price: \$189.95., at Sears outlets and through catalog. Sears, Roebuck and Co., Sears Tower, Chicago, Ill. 60684.



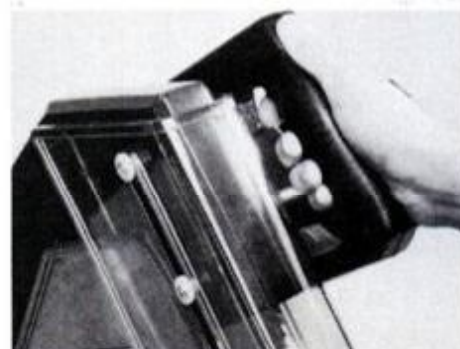
To prevent any chance of saw moving when in use, mount it on a ¾ x 18 x 24-in. sheet of plywood. Board is then clamped securely to workbench (below).



Blade is held on by screw, spring washer and an outer blade washer (right). When trigger is released (far right), brake instantly stops the spinning blade.



Tool is compact, easy to use; it's the right size for toting to the job.



It took Honda to build a rotary lawn mower this advanced.

You're looking at the world's most advanced rotary lawn mower.

It's the new Honda HR-21, with the advanced safety feature no other major manufacturer currently offers: Honda Roto-Stop™ which stops the rotor blade within seconds after the handle lever is released, while the engine is still running.

Of course, this mower comes with a Honda engine. The rugged GV-150 3½-hp four-stroke. It has a cast-iron cylinder for long life. And it's not only a tough power plant, it's also a quiet one.

For quick, sure starts the Honda rotary lawn mower features Honda's Automatic Decompression easy-start system. And the operating controls are on the handle, within easy reach.

The HR-21 is a dynamic performer on the lawn. It has powerful suction, aided by a one-piece cast-aluminum deck and carbon-steel blade.

Cutting height is adjustable from 1" to 3," in half-inch increments.

And its slim rear-bag design makes it maneuverable when you get to walls and shrubs. The bag is easy to attach and remove.

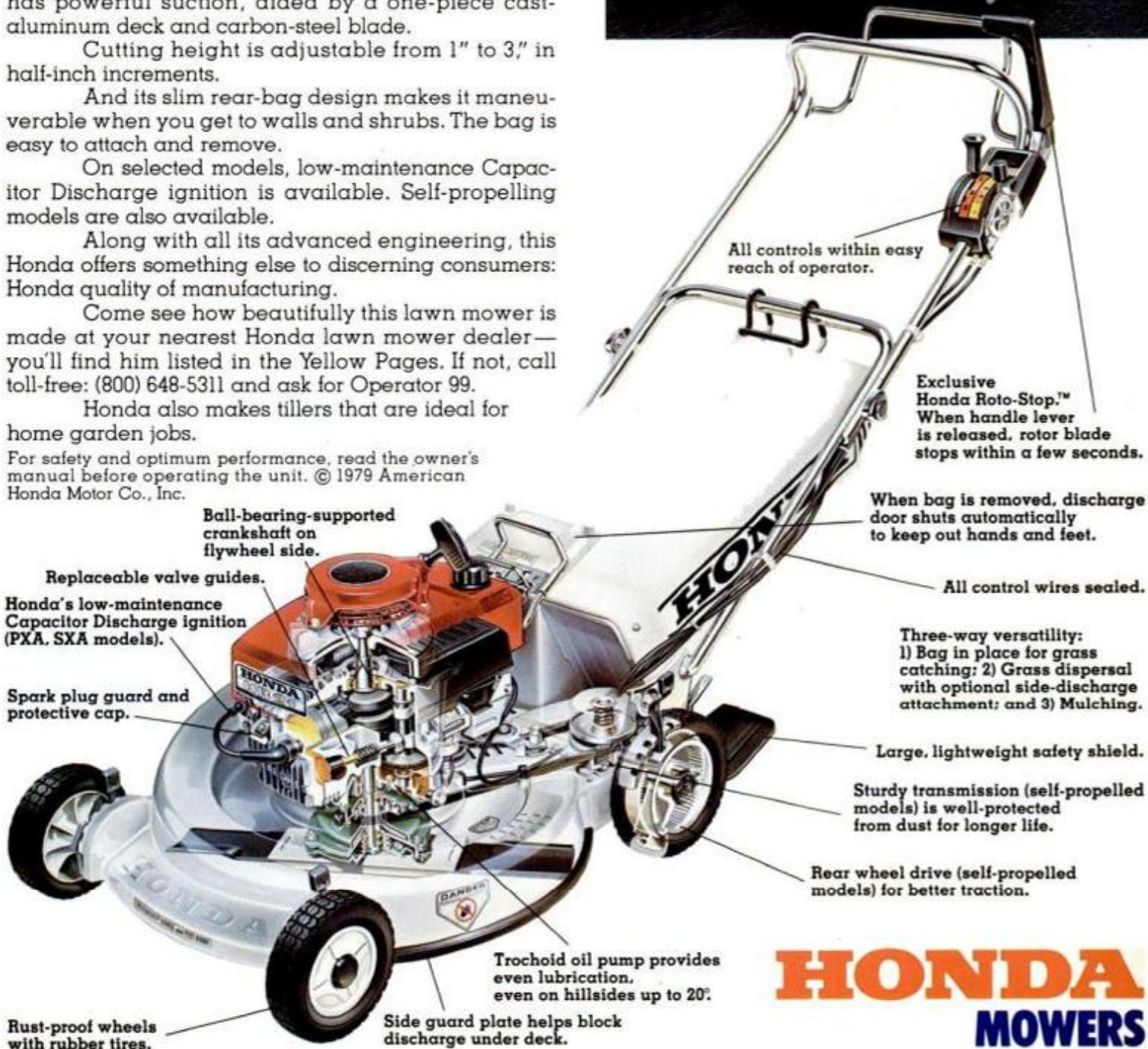
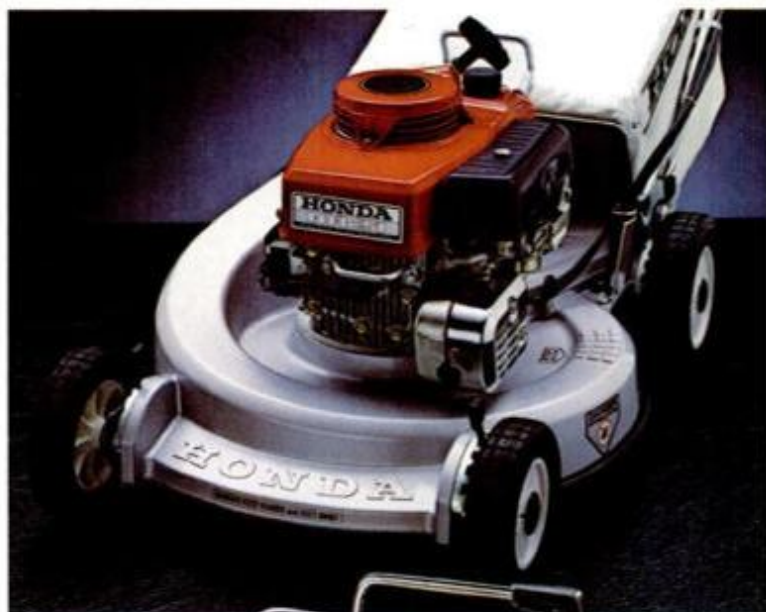
On selected models, low-maintenance Capacitor Discharge ignition is available. Self-propelling models are also available.

Along with all its advanced engineering, this Honda offers something else to discerning consumers: Honda quality of manufacturing.

Come see how beautifully this lawn mower is made at your nearest Honda lawn mower dealer—you'll find him listed in the Yellow Pages. If not, call toll-free: (800) 648-5311 and ask for Operator 99.

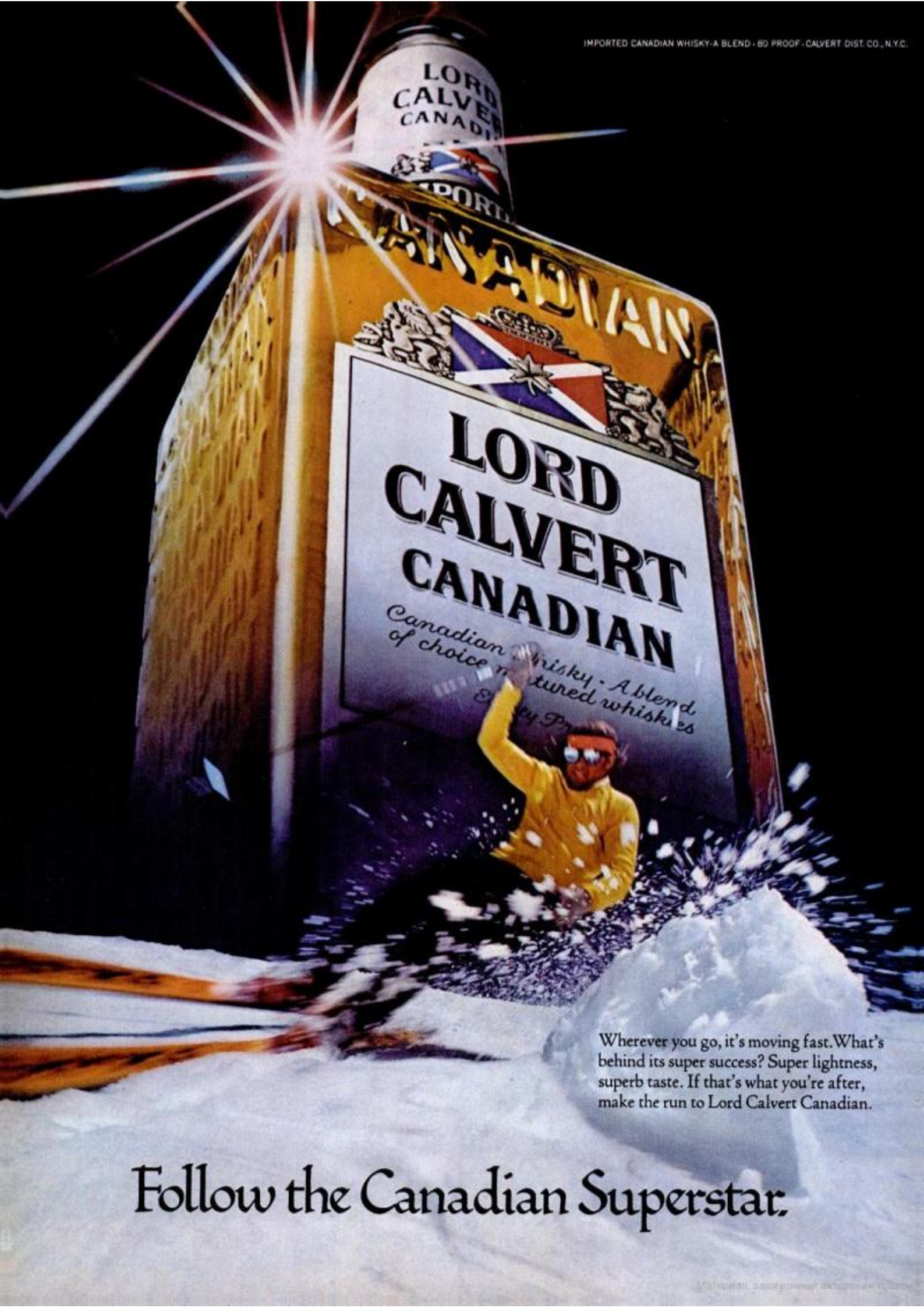
Honda also makes tillers that are ideal for home garden jobs.

For safety and optimum performance, read the owner's manual before operating the unit. © 1979 American Honda Motor Co., Inc.



HONDA MOWERS

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Follow the Canadian Superstar.

Two electronic kits to make your home secure



The Heathkit Informer has two built-in relays. One is to be used for a lamp and the other triggers an outboard alarm. First the light is turned on, then the alarm goes off. A delay time may be changed by altering the value of a capacitor.

Delta Electronic's motion detector (right) is an unobtrusive box. You can set it to trigger its own built-in alarm, or you can connect your own alarm to the interior relay. The front of the case has a round cutout for the lens atop the integrated circuit.



Ultrasonics and light detection are two motion-sensing methods used in these easy-to-assemble kits.

by Neil L. Shapiro
ELECTRONICS EDITOR

If you are interested in home security—and who isn't—there are two new kits available which will help protect your home against an intruder.

Delta Electronics (Box 2, Amesbury, Mass. 01913) has a motion detector kit that retails for \$24.50, and Heathkit (Benton Harbor, Mich. 49022) has a different type of intrusion alarm kit for \$49.95. Both kits are excellent buys. Each one, however, depends on entirely different areas of electronic technology. Be-

cause of this, one or the other will likely prove better for you.

Delta Electronics uses a new form of integrated circuit (encapsulated, microscopic circuitry commonly called a "chip"). This chip (so new that as yet it has no official part number) has a transparent body with a lens attached. The lens protrudes through an opening in the unit and the chip will detect light-level changes as small as ± 5 per-



Delta Electronics employs a clear-packaged, integrated circuit. Unusual in appearance, it is an advance in solid-state technology because it combines digital and linear circuitry in one package. It is sensitive to light change as small as ± 5 percent.

cent. It requires no separate light source and can detect motion-induced changes in light completely unnoticeable to the human eye. It can be used from exceedingly low light levels (.1 candlepower) up to bright levels (100 candlepower).

When the special chip detects any change in light intensity, a whooping built-in alarm is set off. There is also a relay output so that other devices (lights, bells) may be used.

Heathkit uses a different approach to achieve motion detection in the kit they have named The Informer. The Informer uses two ultrasonic transducers which transmit and receive ultrasonic RF (Radio Frequency) signals.

While one transducer is transmitting, the other is receiving the signal and monitoring it for any change in amplitude, which would be caused

(Please turn to page 74D)

HOW MANY MILES SINCE YOU CHANGED ENGINE OIL?

If it's been three thousand miles or over 60 days, engine experts will tell you your oil has used up its additives and your engine is probably starting to collect gum and varnish.

That means it's time for a RISELONE Engine Treatment. Time for adding RISELONE to clean out deposits before they start problems such as noisy valves, lost compression and power, oil burning due to stuck rings, overheating caused by restricted oil flow.

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THE SHALER CO.

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MAKE YOUR HOME SECURE

(Continued from page 74C)

by an object moving and affecting how the ultrasonic waves echo around the room.

If the transducers detect any movement, The Informer triggers two relays. The first one goes off immediately and turns on a lamp. After a short delay, the second relay switches on an alarm.

Trying them out

Delta Electronics' unit, the proverbial black box, has two switches. One controls on/off; the other selects the "audible" or "remote" modes. There are two jacks, one for charging internal Nicad batteries, the other for connection to the inside relay. If you want to use the built-in

alarm, the switch is set to the audible position. Changing to remote will run an outside alarm, of your own devising, from the internal relay. The cycle continues for 12 seconds.

Heathkit's Informer is all dolled up in an undercover disguise—between the covers of a phony book. The back of the unit has two switched outlets, one for an alarm, the other for a lamp. The lamp goes on first, then (after a user-set pause of 10 to 50 seconds) the alarm sounds. There is also a sensitivity control and a switch that resets the alarm after a half-minute or will let it go on indefinitely.

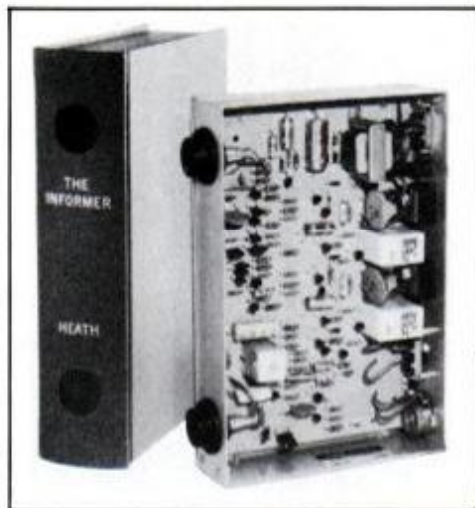
Both units had very good sensitivity. No matter how I tried, I was unable to sneak past either one. I did, however, discover some significant differences between the units.

Delta's light-sensitive unit was at a disadvantage in my living room, which has a large bay window. Car headlights would occasionally set it off. However, it worked fine in the dining room and there would be no such trouble in any other room without a large, street-facing window.

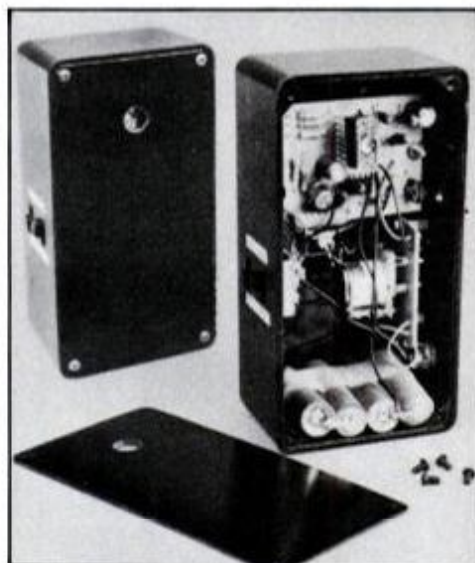
I am a fanatical book collector. The Heathkit Informer was sandwiched between a three-volume set of *Lord of the Rings* and a thick, morocco leather-bound *Canterbury Tales*. Once I hid the a.c. cord, it was as good as invisible. Of course, a fine-appearing volume, such as *The Informer*, would be quite conspicuous in some places. You can slide it out of its book-style cover, but it's a fairly large unit.

The Informer's delay circuit is nice; it gives you time to switch the thing off before the alarm sounds. There is also the convenience of two outlets.

When you choose a unit, keep in mind the area it will protect.



Heathkit's ultrasonic motion detector, The Informer, masquerades as a book to hide among less watchful volumes. It uses two transducers that send and receive signals through front-panel cutouts in order to sense motion within the room.



Delta Electronics' motion detector is a blank, black box—but with a powerful, "whooping" voice. It uses very advanced circuitry to detect tiny changes in the room lighting, changes which are caused by objects moving across its field of view.

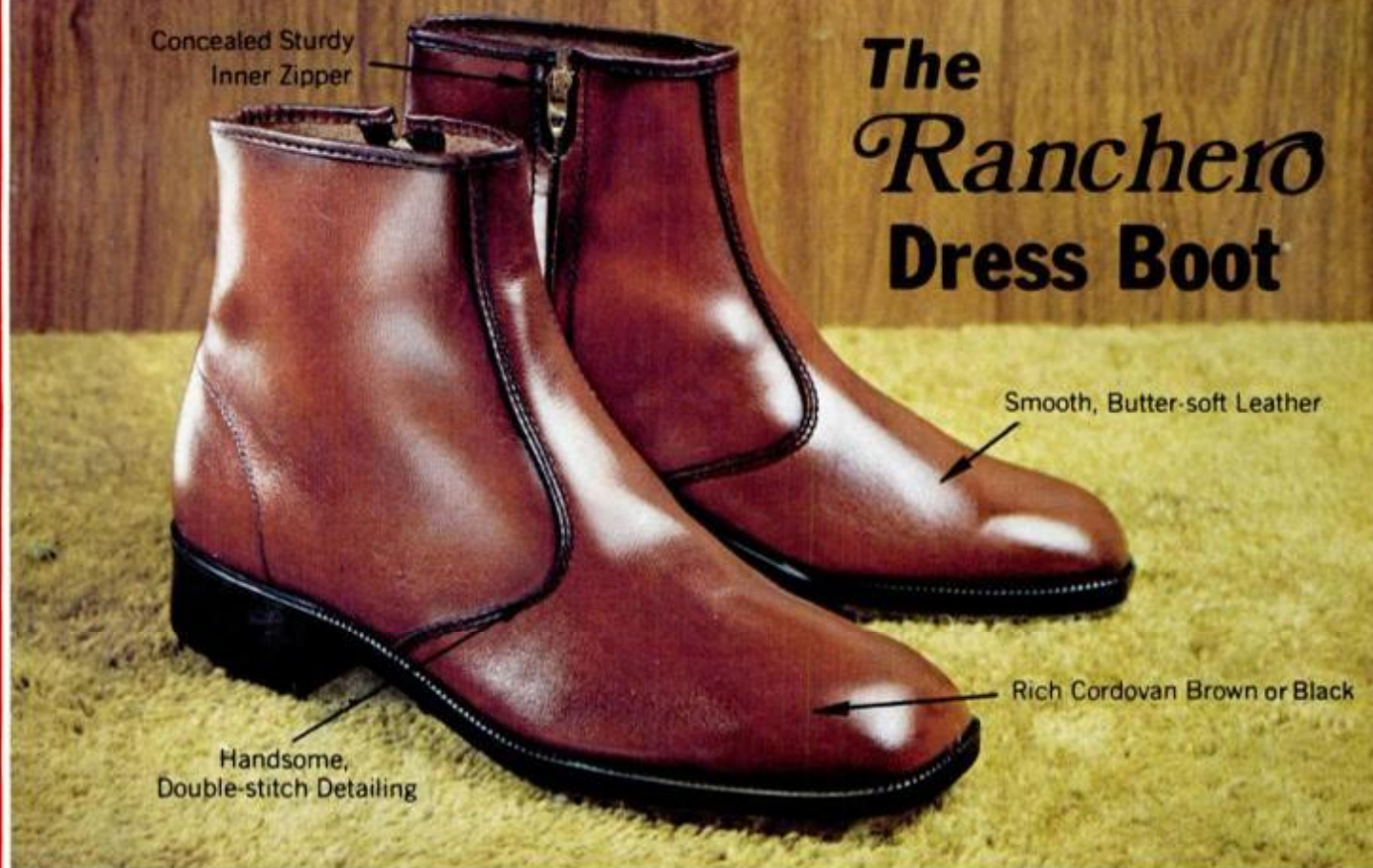
Assembling the kits

Both these kits are two-evening projects. Neither should be your very first try at soldering, but even minimal experience will let you breeze through assembly. The instructions are easily followed and should assure first-time success.

Both companies supply silk-screened PC boards. Actual components and parts numbers are on the board to simplify assembly.

Heath's cabinet is just a matter of mechanical assembly. Delta Electronics, however, supplies only a blank box and a drilling template. Making the cabinet added an evening to assembly here, or the Delta Electronics' detector would have been a one-evening event. Once built, adjustments on both units are quick, easy and reliable.

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Men's Sizes: 7½, 8, 8½, 9, 9½, 10, 10½, 11, 12

Widths: C, D, E **Colors:** Cordovan Brown, Black



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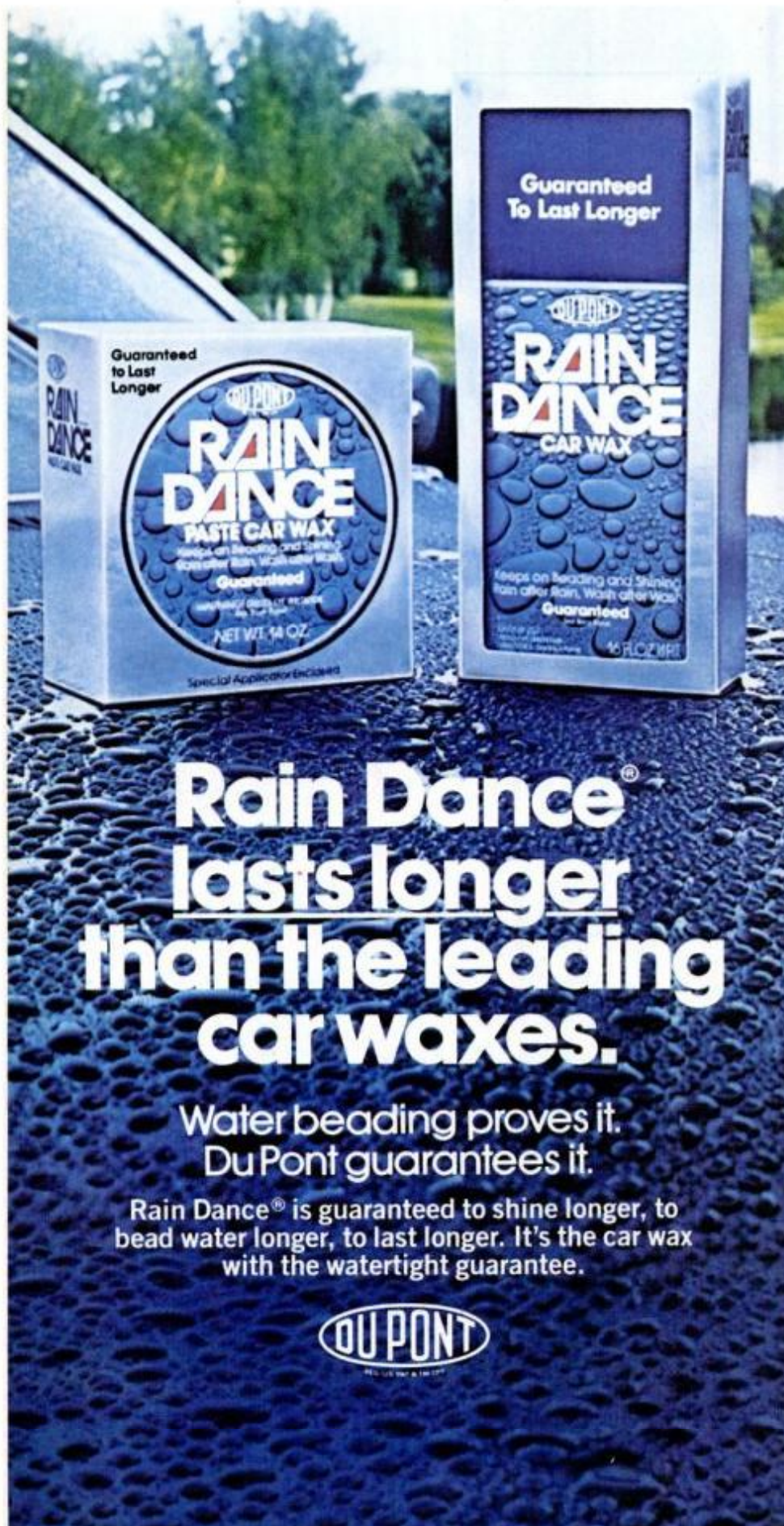
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GUARANTEE: "RAIN DANCE" is guaranteed to keep on beading and shining longer than the leading liquid or paste waxes. If not completely satisfied, return unused portion to B-4233, DuPont Company, Wilmington, DE 19898, for full refund of actual purchase price and postage.

HINTS FROM READERS

Pliers in tight spots



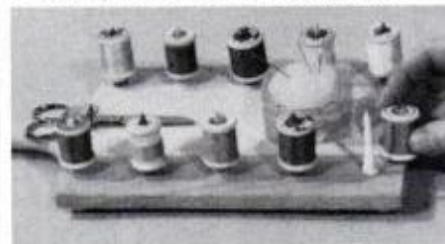
When using pliers in tight places, slip a piece of rubber hose over the handles. It acts as a spring to keep the jaws apart, making it easy to get a new grip.—*William Swallow*

Dish drainer in shop



When a wire dish drainer has outlived its usefulness in the kitchen, transfer it to your shop and use it to keep small boards in order. Use the tableware cup to keep screws, nails and tools handy.—*Walter E. Burton*

Cutting board is sewing aid

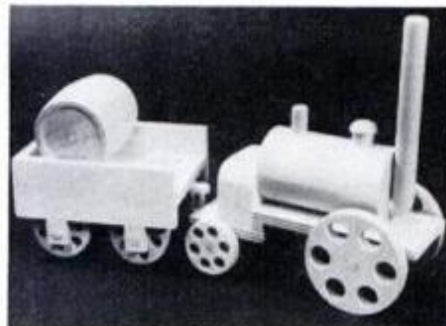


Keep thread, needles and scissors together on a kitchen cutting board that's been turned into a sewing aid. Golf tees glued to the board hold spools. A small plastic container holds pins and needles. Plastic foam glued to the lid serves as a pincushion. A metal clip near the handle keeps scissors in place. Hang the board by the hole in its handle on a wall near the sewing machine, or put rubber-headed tacks on the board's bottom and place it on a nearby table.—*Ken Patterson*

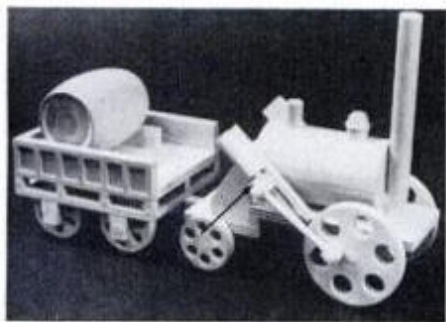
PM LOOKS AT ROCKET MODEL

Build this striking replica of the famous "Rocket" locomotive, a pioneer in rail travel, using authentic plans, scrap plywood, dowels and glue. No hardware or lathe work are needed.

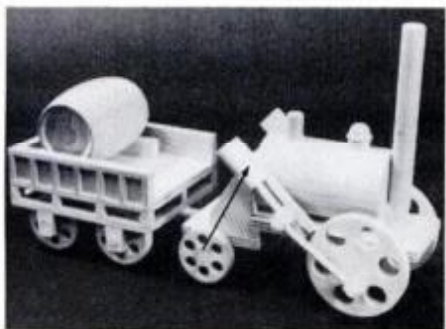
The plans, \$1.50 postpaid from Intrigue Design, Box 271, Veradale, Wash. 99037, outline both a simple and more-detailed model of the steam engine that set land speed records in the early 19th century. Use 1/4-in.-thick, quality-grade hobby plywood if possible, or cut fir pieces to suit. Plans also suggest salvaging many parts from common household items—plastic washers from coffee lids, barrel on tender from a macrame bead, boiler from an old banister. The finished Rocket is an attractive, durable toy with historic appeal.—*D.O. and H.W.*



Use the authentic plans to build this simple replica of the 1829 locomotive.



Plans also include a detailed version with pistons that actually drive (arrows in photos above and below). Model is made from wood scraps, glue, no nails.



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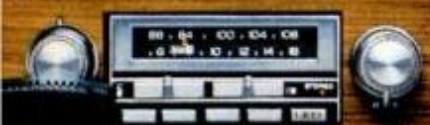
And that sound! Your new GM car and Delco-GM sound systems are made for each other. Made by Delco's experts in automotive sound. The result is that ear-pleasing "Delco-GM sound."

You've got to experience it to believe it. So insist on Delco-GM when you order your new GM car.

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Electronically Tuned Receiver (ETR) AM/FM stereo with cassette



AM/FM stereo with Citizens Band and 8-track



AM/FM stereo with cassette

MADE FOR EACH OTHER.



Delco Electronics Division
General Motors Corporation

PM LOOKS AT AN EFFICIENT KEROSENE HEATER



When lever is depressed, mantle tilts, battery-powered igniter lights wick.



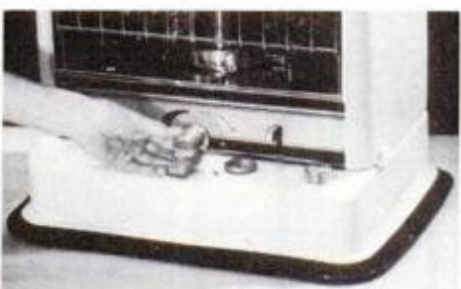
Siphon that comes with unit makes it a snap to refuel heater without spills.

If you've been searching for a space heater to help cut your furnace fuel bills, take a look at these kerosene heaters. As the April issue goes to press, the weather is still cold, and both of the units are performing in outstanding fashion. I installed the Radiant 10 model in my kitchen—which is on the north side of the house—and turned off the radiator. Whenever outside temperature drops below 30° F., we turn the heater on.

Depending on outside temperature, the room is always between 60° and 70° F.—we have never used the heater full blast. We now set our thermostat at 60° F. when retiring and our oil bill has been cut dramatically.—Harry Wicks, Home and Shop Editor



Gauge (A) gives tank reading. Filler tube is secured over clip in tank (B).



Knob on front panel turns to control wick elevation—the amount of heat.

SPECIFICATIONS—Kero-Sun Heaters

	Radiant 10	Omni 105
Fuel	Kerosene	Kerosene
Capacity	2 gallons	2 gallons
Igniter	Battery-powered	Battery-powered
Safety feature	Automatic shutoff	Automatic shutoff
Dimensions	21" wide, 15¼" deep, 19" high	19¼" wide (at base), 22¼" high
Output	9400 B.T.U./hr.	18,000 B.T.U./hr.
Burning time per tankful	30 hrs.	18 hrs.
Price	\$198	\$214

Manufacturer: Kero-Sun Inc., Box 340, Main St., Kent, Conn. 06757. Write maker for nearest dealer and address.



Author used an Omni 105 in unheated garage, found it fine for heating tasks.

ANNOUNCING 4-WHEEL-DRIVE CHEVY LUV.

A TOUGH HALF-TONNER WITH BETTER MILEAGE RATINGS THAN MANY CARS.

The Series 9 Chevy LUV model with 4-wheel drive is brand-new and a winner! It features impressive fuel economy, solid engineering, traction, drivability, and plain ol' fun. A 2-speed transfer case, free-wheeling front hubs, styled spoke wheels and all-terrain tires are standard. See the tough import that received Motor Trend magazine's "Truck of the Year" Award. Now at your Chevy dealer.

23 EPA
ESTIMATED
MPG

32 ESTIMATED HIGHWAY

Remember: compare this estimated MPG to the "estimated MPG" of other vehicles. Your mileage may differ, depending on your speed, trip length, weather and 4-wheel-drive usage. Your actual highway mileage will probably be less than the estimated highway fuel economy. Lower in California.



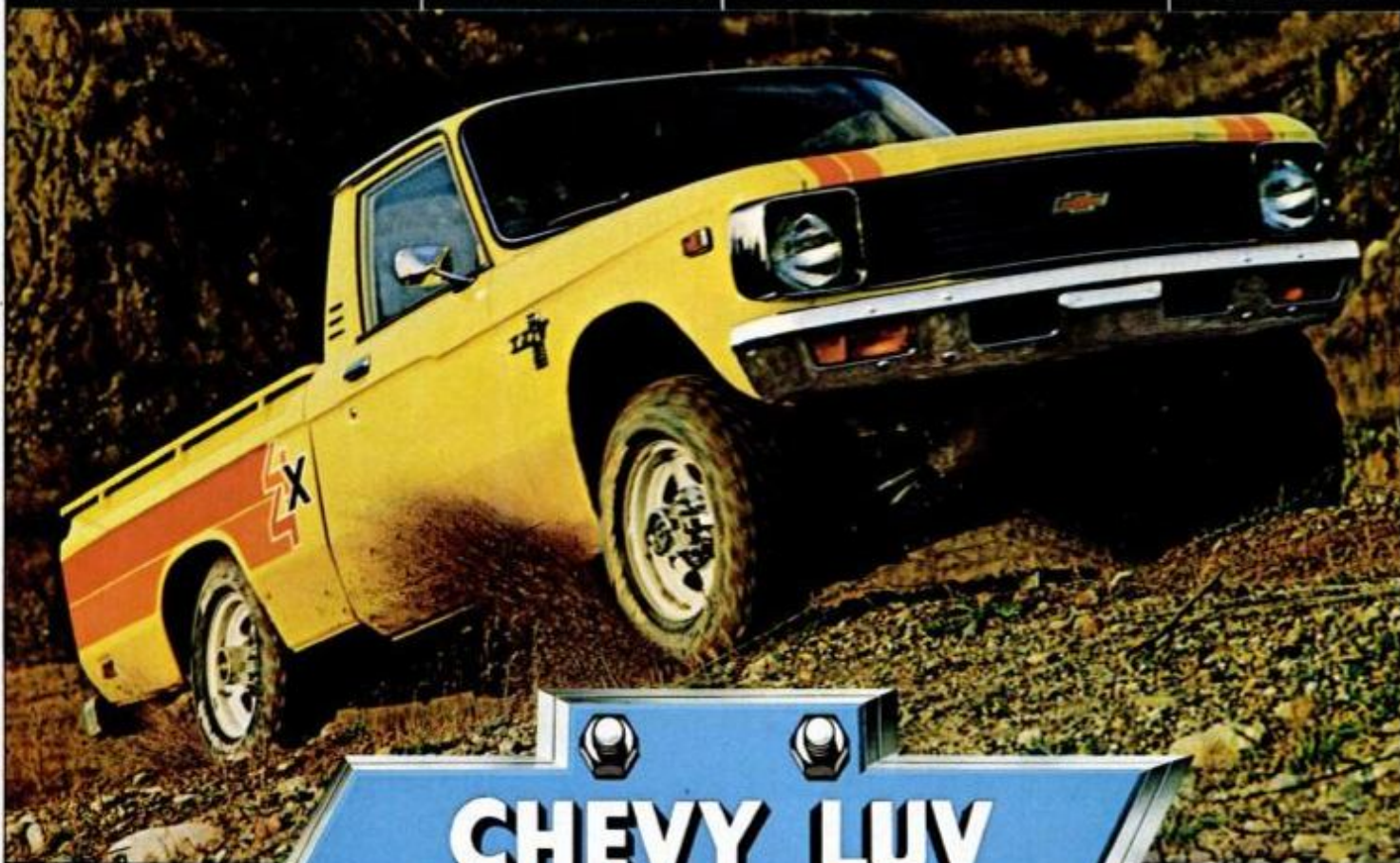
Tough independent front suspension with front stabilizer bar helps absorb bumps.



Higher ground clearance, lower entry height than many full-size 4-wheel-drive pickups. Test drive one now.



Tighter turning circle than any full-size 4-wheel-drive pickup.



BUILT TO STAY TOUGH



Since you have to pay the penalty for being in your bracket, you might as well get some of the rewards.

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28	
29	21180
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31	132720



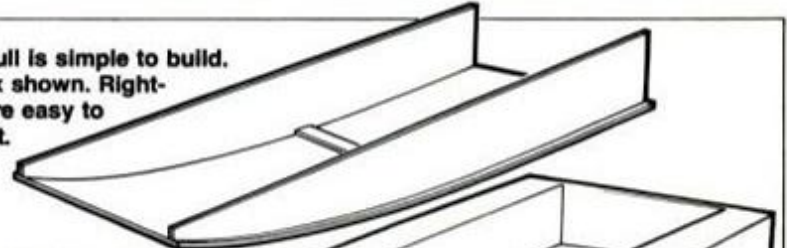
Super fishing boat you can build

Bass boat is good performer and can be used for skiing, too.

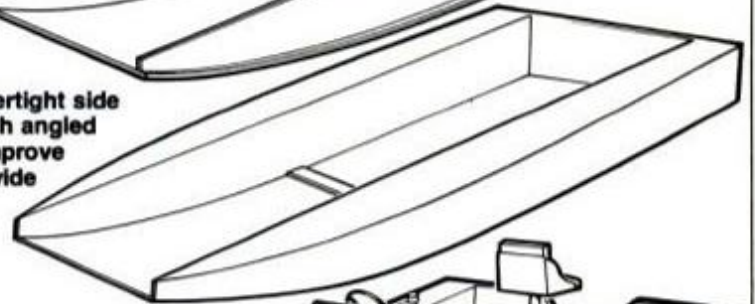


PM's bass boat, designed for avid fishermen, can be built for less than \$450 (excluding engine and remote controls). The prototype, developed with the American Plywood Assn. and Mercury Marine, features plywood construction, stability and lively performance from engines up to 20 hp. Watertight center scow box and side boxes, plus flotation foam, make the boat virtually sinkproof. Plenty of lockers protect gear from weather, offer uncluttered fishing space. Other features are seats and bridge that can be moved, carpeted deck space, and wind/spray shield.

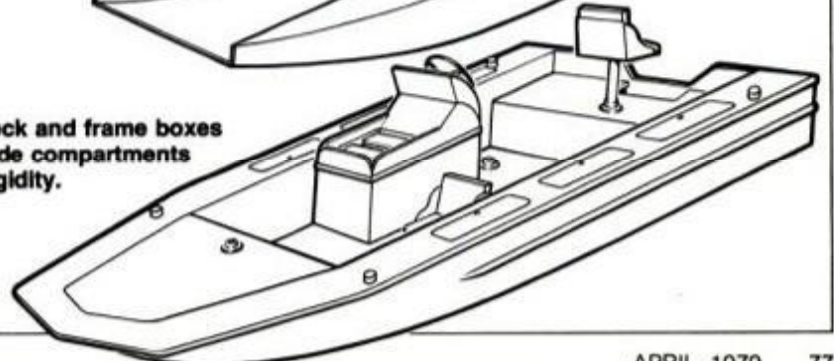
1 Bass boat hull is simple to build. Make basic box shown. Right-angled joints are easy to make watertight.



2 Attach the watertight side compartments with angled bottoms; these improve handling and provide storage for gear and bait.



3 Build deck and frame boxes between side compartments for extra rigidity.



HOW TO ORDER PLANS

For a complete set of plans and instructions, send a check or money order for \$6.95 to PM Bass Boat Plans, Stevenson Publications, Box 584, Del Mar, Calif. 92014. Allow three weeks delivery for third-class mailing. For faster first-class delivery, include an additional 75 cents.

THE OLDEST PROBLEM IN OUTBOARDS. AND AN ANSWER SO SIMPLE IT'S EMBARRASSING.

Ask a fisherman what feature he values most in an outboard, and the answer is almost always — “Easy Starting”.

No subject has been given higher engineering priority by Evinrude over the years.

But despite notable progress, one nagging problem remained — the problem of maintaining a uniform fuel-air mix in a cold engine at hand-cranking speed.

Now we have an answer, and it's almost embarrassingly simple. We drilled holes in the carburetor jet tube to let air into the fuel to make it lighter and easier to lift — Air Lift Carburetion.

This lighter aerated fuel mix pulls more quickly



and easily through the jet orifice and into the engine. And it disperses more thoroughly and uniformly into the incoming intake air stream.

Result: a finer fuel emulsion that gets into the engine faster, stays mixed longer, and fires easier. So the engine starts quicker. And it trolls smoother, slower, and better.

Add the high-intensity voltage of Evinrude's Firepower III™ electronic ignition, and you've got it made.

All because Evinrude found a powerful way to put more spark in your start, and a simple way to put more air in your fuel.



EVINRUDE 
PRODUCT GROUP, OUTBOARD MARINE CORPORATION *first in outboards*

ALL OUTDOORS

A killer that keeps you alive

You may be one of the boatmen who will die this year for lack of a simple, inexpensive gadget. It costs less than \$25, you can install it yourself right now at the start of the season, but the Coast Guard recently estimated that 39 people won't be around by the end of '79 because they didn't use emergency "shut-off" or "safety-stop" switches in their boats.

Usually it's just called a kill switch because if you're thrown away from your steering position or flipped overboard a lanyard is pulled that kills your engine. Instead of running away from you or circling back to cut you up with the prop, the boat stops to let you get safely back aboard.

Wouldn't a law requiring a kill switch aboard all pleasure boats be worthwhile? At present the Coast Guard doesn't think so, according to a report by the Outboard Boating Club of America. There may be enough unenforceable rules around already, and in a cost effectiveness study the CG estimates installation charges would average \$2 million to \$8 million per life saved. I'm worth that and so are you, but the current use-rate of kill switches is projected at about seven percent and, based on seat-belt use by car drivers, only about 25 percent of boatmen would hook up the switches if they were mandatory and installed.

Do-it-yourself?

That doesn't mean we shouldn't install them, demand them in boats we buy, and use them to stay alive. Though it would be simple to cobble up a quick-disconnect device to pull the plug on the engine ignition, it should be specially engineered so that contacts don't corrode, especially around salt water, and cut you off just when you need power. The gadget should also let someone still aboard restart the engine and come back to pick you up if you land in the water with the shutoff lanyard attached to your belt or life jacket. Bass Anglers Sportsmen Society (BASS), a leader in safe boating and catch-and-release fishing, wisely specifies kill switches in all tournament boats. Mass production should bring down the cost of kill switches, and mass agitation by concerned boatmen should help get them installed, at least in all small, fast powerboats.

Off-road preview

All the vehicles below have one feature in common—all offer four-wheel-drive, an advantage that has seen growth in sales of nearly 500 percent over the last 10 years. Leading our lineup is an artist's conception of what a Jeepster II might look



Off-roaders—have you seen these rigs? Can you name them? Tell where they are from? Know what they all have in common? Hint: power can be supplied to each wheel.

like in the 1980s. Created by Richard Teague, vice president of styling at American Motors, the sporty 100-inch-wheelbase prototype would be made of lightweight materials, provide a structural built-in roll bar, and use power from a four-cylinder

turbo gasoline or diesel engine. Detachable fender flares would allow superwide off-road wheel/tire combinations. Overall measurements are predicted at 160-inch length, 65-inch width and 60-inch height.

Leaping away from the past is an Explorer with a code name of "G", under development by Mercedes and Steyr-Puch in Germany and Austria. The Daimler-Benz 4wd is expected to be introduced early this year in the two-door model shown, a three-door utility van and a five-door bus or van unit. Engine options will include a choice between gas and diesel power.

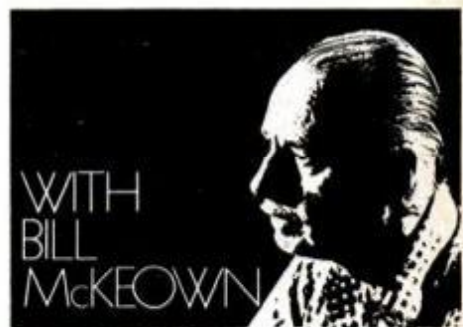
Volkswagen's military 4wd is called the *Iltis* (German for "polecat"). It has the 75-hp engine of the VW Dasher and speed approaching 100 mph. It's reported able to tackle slopes up to 77 percent, and though it is not designed to float, it can perform well in up to two feet of water.

A station wagon not meant for off-road use but offering extra traction options, Subaru's 1979 GL Four-Wheel-Drive Station Wagon from Japan is the only rig of its type around with front-wheel drive that can switch to 4wd with the flick of a lever at speeds up to 50 mph. It even adds a useful extra inch of ground clearance in 4wd when the going gets rough.

Many of these off-road vehicles will never take to the trails but make the going easier over snow in the winter, beaches, launching ramps and campgrounds this summer.

Short shots

At the new Shooting, Hunting, Outdoor Trade Show (SHOT Show), Savage introduced a new over-and-under rifle/shotgun combination with a .357 Magnum barrel over a 20 gauge. Marlin showed a new lever-action carbine that can use the same ammunition as fired in the popular .357 handgun. **FM**





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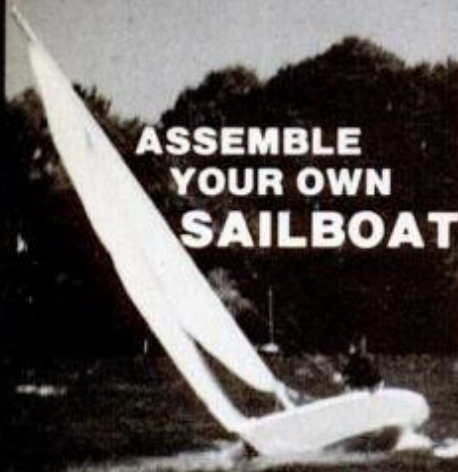


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PM-4

ASSEMBLE YOUR OWN SAILBOAT

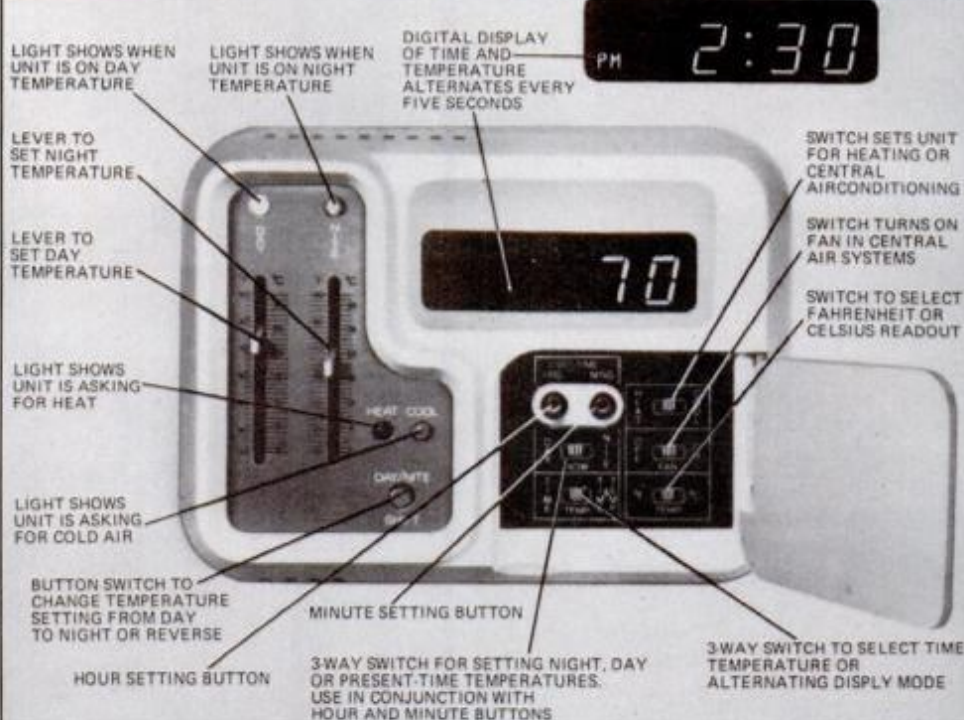


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PMS4

PM LOOKS AT: ELECTRONIC CLOCK THERMOSTAT



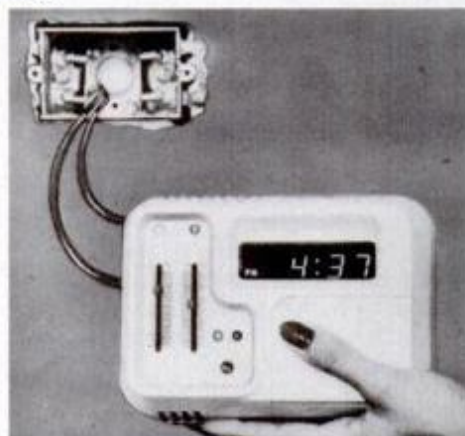
No extra wiring is required to replace conventional, nonclock thermostat with RC-3000. Clock draws power from two wires serving temperature controls.

The RC-3000 is a sophisticated solid-state clock thermostat with digital readout of time and temperature. It can automatically turn heat down at night in your home and back up before morning. (It does the reverse with an airconditioning system.)

Touted as an energy-saving device, it's really a convenience, like all clock thermostats and thermostat timers. It will save energy (9 to 30 percent, claim federal agencies) if you forget to turn down your thermostat before you go to bed.

Nevertheless, it is a convenience. The new RC-3000 does away with batteries and mechanical timers. It offers round-the-clock versatility in time settings and is no more complicated than setting a digital alarm clock. The digital readout is in easy-to-view, half-inch numerals, and can be set for time, temperature or the alternating of each every five seconds.

Additional features include a button switch on the face of the case which changes the temperature control from DAY to NIGHT—allowing manual control as well as automatic. This is a potential energy-saving option, since it lets you quickly shift to a lower temperature when you leave for the day.



LED signals show plainly whether DAY or NIGHT temperature is in effect at any time. Another light indicates when furnace or airconditioner is on and the thermostat is asking for hot or cold air.

As far as installation goes, there's not much to it. The unit is adaptable to any voltage and compatible with any size heating, airconditioning or combined system and can be installed by the average do-it-yourselfer. Since it's a solid-state device, there are no moving parts making it practically maintenance free.

The extremely accurate, built-in electronic differential is factory-set at 3°F.; can be varied 1 to 18°F.

The price tag is \$200 from Rapid-Circuit Corp., 5721 18th Ave., Brooklyn, N.Y. 11204. It has a thermometer instead of the digital temperature readout for \$100.—J.P.

When you buy a Winnebago, you're not tied down to the lake, the mountains or the seashore. You can enjoy them all. And you don't have to tie up all your money. Winnebago motor homes start as low as \$15,093*.

You buy solid comfort, homelike convenience and safe, sturdy construction, engineered by the people who've built far more motor homes than anyone else. Plus a wide choice of floor plans, interior furnishings and colors.



Three important Winnebago extras safeguard your investment. A strong limited warranty, with a strong company behind it. Expert service coast-to-coast, even in Canada and Alaska. And an excellent record of high resale value.

Before you invest in a condominium, look at Winnebago. Check the Yellow Pages for the dealer nearest you.

You'll sleep better in a Winnebago.

**Winnebago. It's a condominium that goes places.
For about half the going price.**

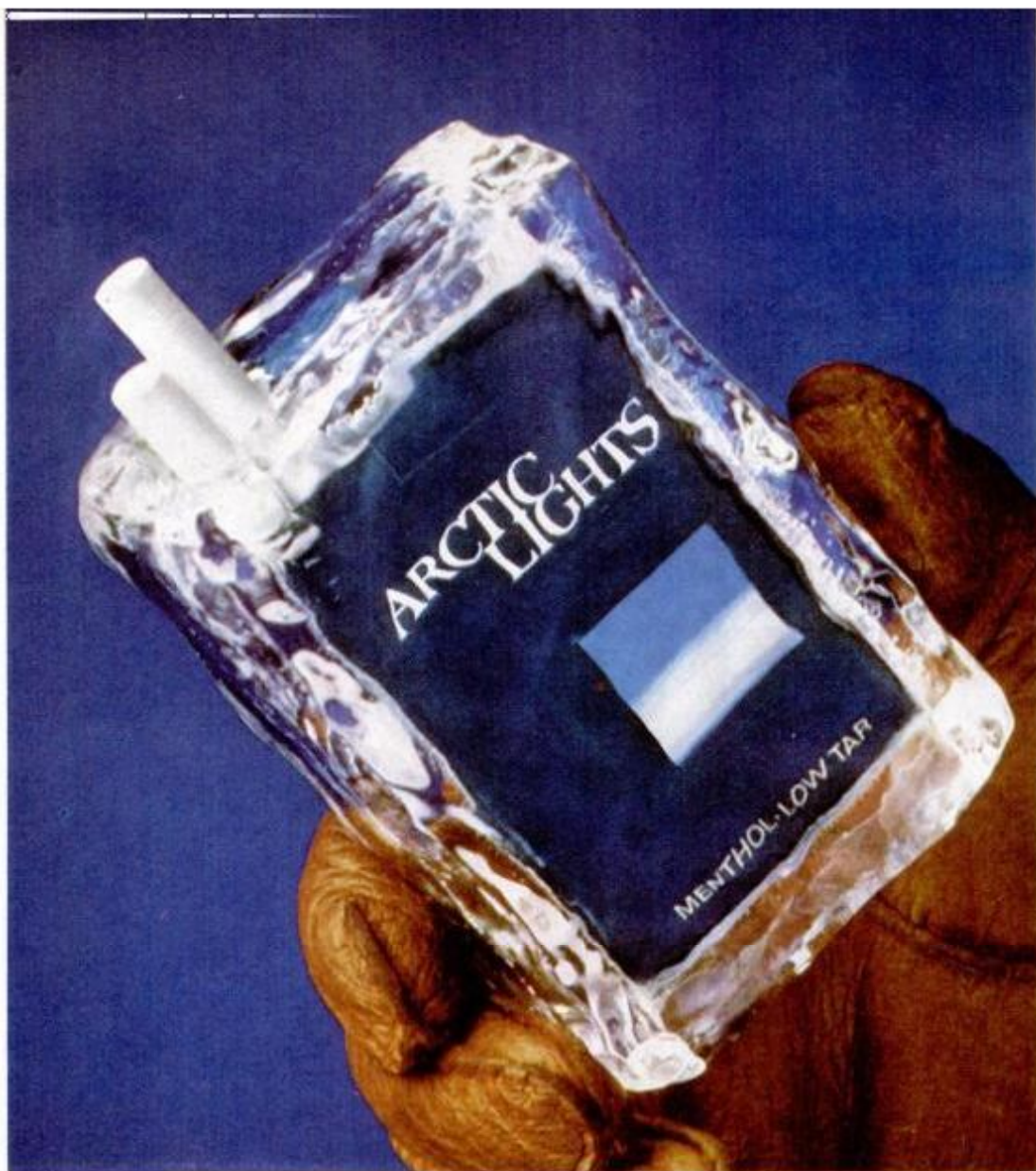


*Manufacturer's suggested list price, \$100 freight included, taxes and dealer prep extra.

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—more menthol refreshment than
any other low 'tar' cigarette.

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A very special kind of menthol refreshment you just won't find in any other low 'tar' menthol cigarette.

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Arctic Lights: Kings & 100's

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9 mg. "tar", 0.8 mg. nicotine av. per cigarette by FTC method.

THE CHANNEL CHALLENGE:

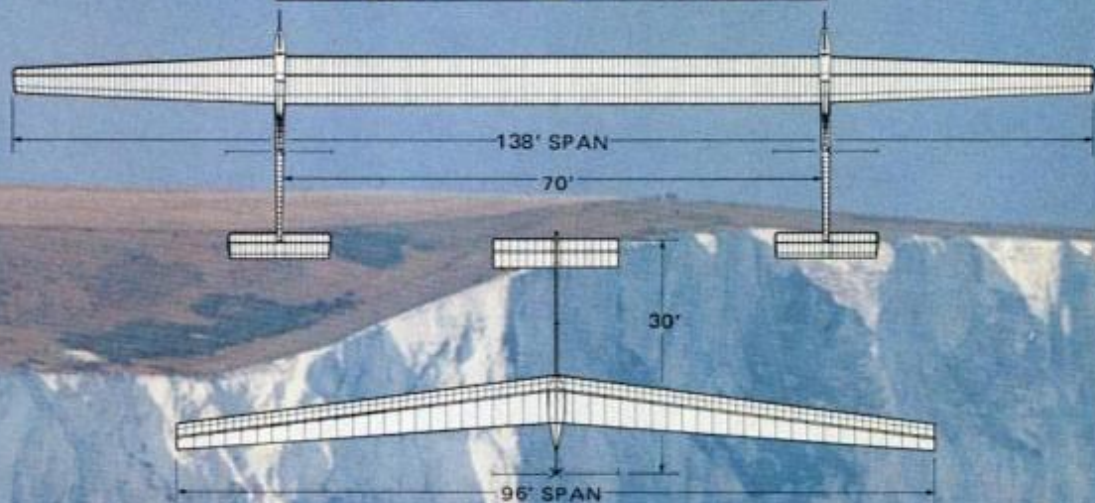
Manpowered flight's second giant step

In the annals of epic flights from England to France, this has all the makings of a classic.

by Bill Allen



Britain's Newbury Manllier utilizes the power of two pilots pedaling in separate pods; while airframe-to-crew weight ratio is about the same as that for one-person Gossamer Albatross (below), a single, longer wing (138 feet) can be slightly more efficient.



From the white cliffs of Dover across the English Channel to what sailors long ago dubbed the "gray nose"—Cap Gris-Nez—of France is only some 22 miles. Yet this cold, usually wind-tossed stretch of open water has become over years of tradition the test of fire for the pioneers of aviation. Not until nearly six years after the Wright Brothers broke ground at Kitty Hawk was a man, Louis Bleriot, able to successfully cross the Channel in a heavier-than-air flying machine. But right now, less than two years since the *Gossamer Condor* negotiated the 1.25-mile, figure-eight course that made a new form of flight a reality, not one but several teams are



Paul MacReady's new *Gossamer Albatross* has pilot Bryan Allen sitting upright rather than semi-reclining as in the pioneering *Gossamer Condor*. Experience is the reason experts think MacReady will take the Channel prize, but logistics are tough.



preparing manpowered aircraft for the challenge of the Channel.

Thus far, the media consensus of aeronautical experts has installed Dr. Paul B. MacReady Jr., the engineer and former sailplane champion from Southern California, designer and builder of *Gossamer Condor*, as the odds-on favorite to claim the \$194,000 (100,000 British pounds at rate-of-exchange as this is written) prize offered by British industrialist Henry Kremer through the Royal Aeronautical Society of Britain for the first manpowered craft to conquer the Channel.

But relatively little attention has been paid MacReady's potential competition. In one case, an English entry called the *Newbury Mantlier*, it could well be

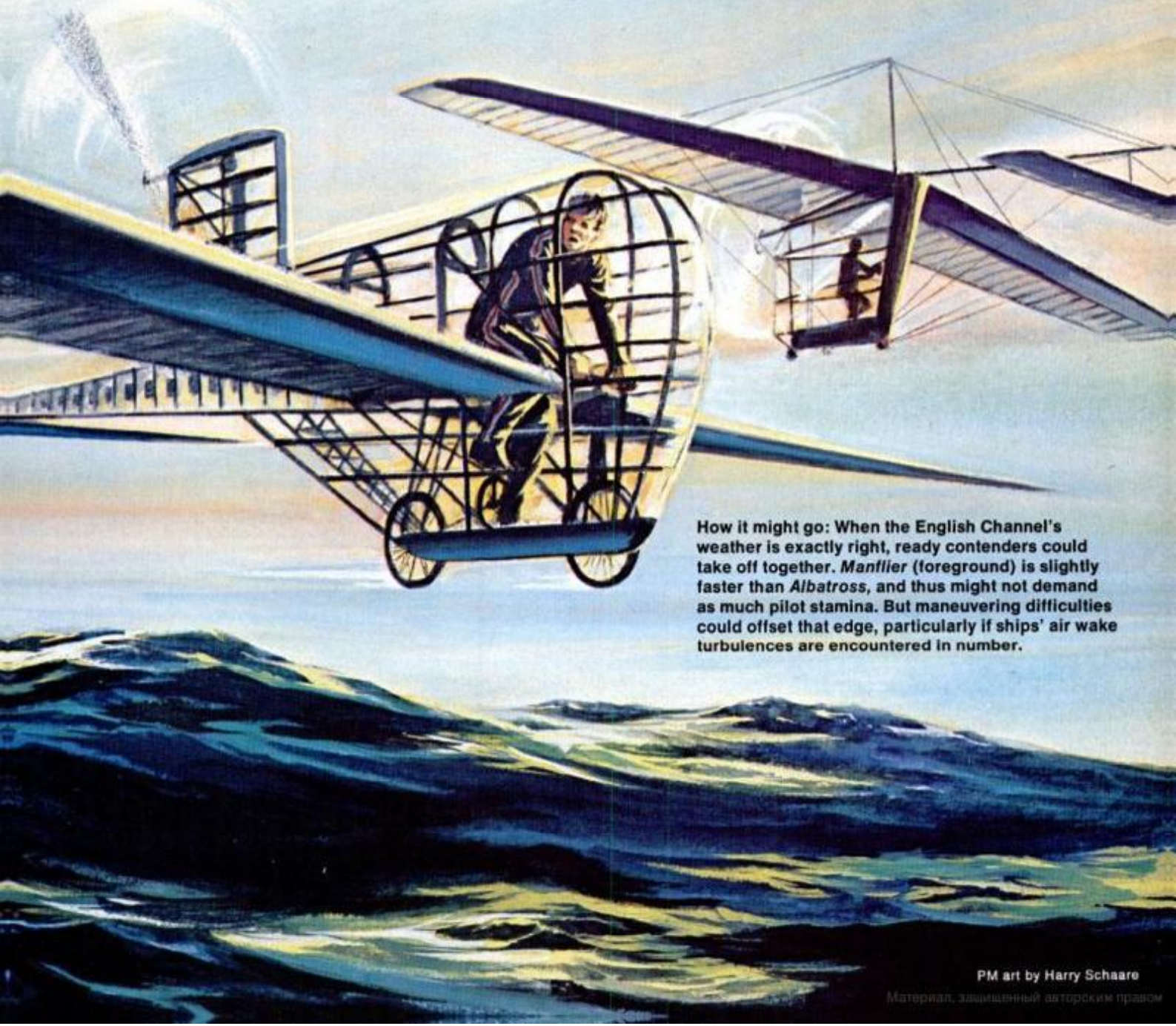
formidable. And a handful of reasonable dark-horse contenders are being mounted in aircraft hangars and back yards ranging as widely as Belgium and New Jersey.

Weather conditions permitting an attempt by the fragile (by nature) manpowered planes are not an everyday affair in the Channel. They occur only sporadically, but the odds would be best between May and July. Sometime within the next three months, then, when the "weather window" opens, aviation history may again be made between Dover and Calais.

Kremer's initial prize of 5000 pounds sterling—later doubled and finally raised to 50,000 as claimants failed and the pound devalued—stood for 18 years and



seemed to symbolize the futility of the manpowered flight concept rather than its promise. Then one August day in 1977, a young man



How it might go: When the English Channel's weather is exactly right, ready contenders could take off together. *Mantlier* (foreground) is slightly faster than *Albatross*, and thus might not demand as much pilot stamina. But maneuvering difficulties could offset that edge, particularly if ships' air wake turbulences are encountered in number.



Better weight distribution, power-to-weight ratio favor multi-crewed craft. "Airliner" concept was developed by engineers at Nova Scotia Technical College.

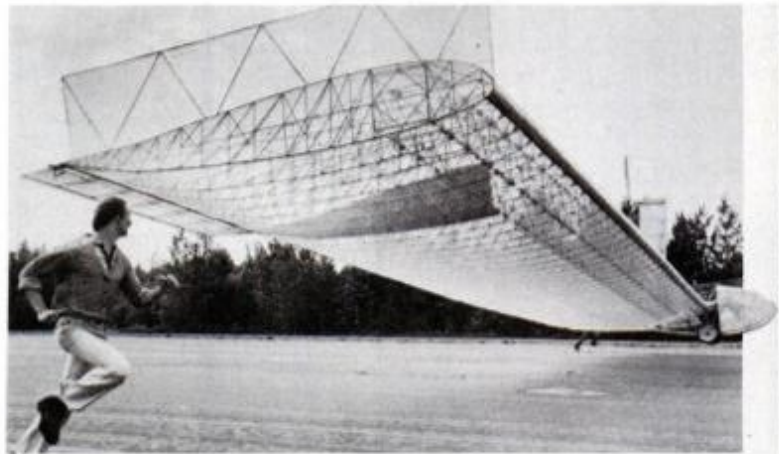


Photo at left shows designer MacReady doing some actual flying of Gossamer Albatross. Above is Seattle Slow I, an MPA designed by Boeing Co. aerodynamicist Dr. John H. McMasters.

named Bryan Allen, pedaling furiously on a chain drive connected to a propeller, muscled MacReady's *Condor* over what had become known as the "Kremer Course" near Bakersfield, Calif. (page 100, Dec. '77 PM). An era had begun.

Shortly thereafter, word got out that Kremer would back a Channel contest. Rules call for a heavier-than-air machine launched, powered and controlled solely by its crew (no limit on crew size, and up to three ground personnel may be used to stabilize the craft during launch), without the aid of energy-storing devices. The flight must begin on British soil, there can be no intermediate landings or physical assistance, and no equipment or crew can be dropped along the way.

Permissible landing zone? The first dry piece of France you can find.

Britain's *Toucan* has wingspan of over 100 feet and a pusher prop at the tail. In the wake of later, more efficient craft, it's already a museum piece.

Last year, MacReady's team began building a new aircraft, *Gossamer Albatross*, for the Channel. It looks nearly identical to its high-wing, Mylar-covered, canard predecessor—*Condor*—but there are major differences: Primary fiber

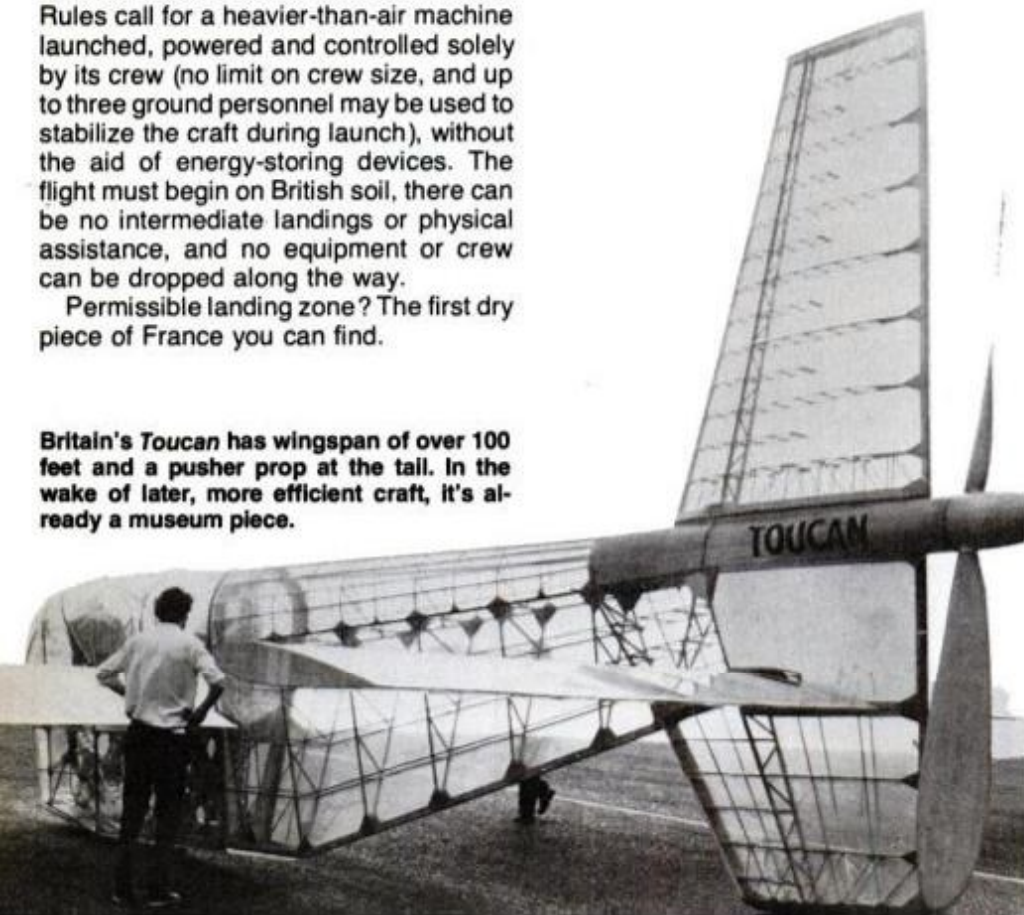
composite tubing replaced aluminum to save weight (approximately 10 to 15 pounds over *Condor*), and the wing ribs are made differently and spaced more closely together for better airfoil control. Pilot Allen is still ensconced in a giant vertical stabilizer suspended from the wing, but he will be in an upright position, rather than semi-reclining, for more power output.

Allen's optimistic impression is that it will take about one-sixth hp to fly *Albatross* at 10 to 11 mph—about half of *Condor's* power requirement.

Back in 1956, when MacReady was winning the world soaring championship in single-place sailplanes, first honors in the two-place sailplane category were taken by a British Naval officer named Nick Goodhart. Now a retired Rear Admiral, Goodhart will duel head-to-head with MacReady this time out, for he is the designer and builder of a manpowered aircraft (MPA) called the *Newbury Manflier*, which was recently completed after some 3000 hours under construction. Most manpowered aircraft built thus far have drawn from sailplane, hang-glider and balsa-model technologies; *Manflier* does also, but is unique.

Wingspan of a 707

Two pilot pods are situated 70 feet apart, equidistant from the center of a wing that, at 138 feet, has a span a few feet short of that of a Boeing 707. Each of these "nacelles" sports a vertical stabiliz-



Ibis was designed and built at the University of Tokyo as a contender for Kremer figure-8 prize. A successor may be built for the Channel contest.



er, propeller and boom extending aft to a horizontal tail assembly.

There are no rudders or ailerons—and the only cross-connection of controls and “power” is by human voice. They will literally shout at each other. By using the individual elevators differentially as “tailerons,” and by slowing one pilot/engine, the craft can be banked and turned. Despite its seeming ungainliness, *Manflie* should cruise at about 16 mph, or some 50 percent faster than *Albatross*.

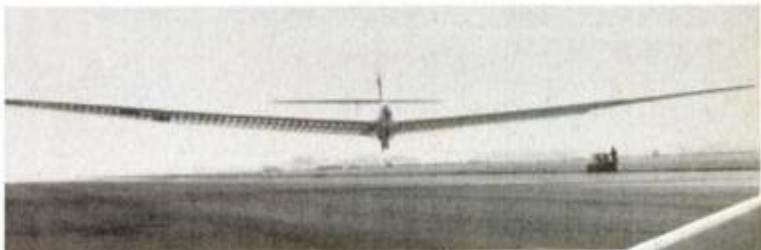
Other two-man MPAs have been built and are being tried, and the concept of a multiple crew offers advantages cited by Dr. Orest Cochkanoff, dean of engineering at Nova Scotia Technical College: Longer, thinner wings for deeper ground effect (see box, page 216) and better performance, plus shared workload producing higher hp per pound of aircraft.

With his students, Cochkanoff designed a seven-person manpowered “airliner” (see drawing, page 86) with pedalers in the fuselage and two wing pods and having a wingspan of 185 feet. Presently on sabbatical, Cochkanoff declines to speculate on plans for construction.

In addition to MacReady and Goodhart,

(Please turn to page 216)

Photo at left and those below show MPAs being tested at Calais-Dunkerque Airport by Belgians Paul and Stephan Massachelein and Eric Verstraete. Dark horses in the Channel competition, since little is known about their designs, the Belgians have nonetheless built five different aircraft—and began preparing for the Channel as early as 1976.



Who says styling no longer sells cars? Perhaps today's buyers do tend to be more aware of fuel economy, handling, size and space efficiency, but never let it be said that design counts for naught.

Nearly 70 percent of the 1979 Mustang owners we surveyed gave *styling* as their No. 1 reason for purchase.

"The new 1979 look really appealed to me from the beginning," notes a New York computer manager. And he goes on to say, "Looks are sporty and flashy—all I get are favorable comments."

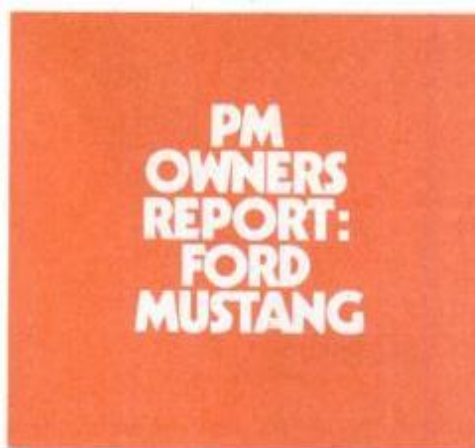
A Michigan secretary agrees: "I like sporty cars and think the new Mustang really looks sharp. So do my family and friends."

"Sporty design," echoes a Texas general manager.

"It's the prettiest car on the road,"



Owners say that instrumentation is complete and controls are well laid out. They also give high marks to handling.



says a proud New York college student.

And a Michigan product design engineer states boldly, "Best-looking new offering in the 1979 Ford line."

We next asked Mustang owners to list the qualities beyond looks that they see in their cars.

"Handling and performance are a dream," comments a New York corporate officer. "Very smooth and quiet ride with the TRX suspension, unlike most special 'tuned' systems. Michelin radials are super. Also the car has excellent quality—all work seems top-shelf. Car in general very tight and secure; no annoying rattles or shakes. It's tough for any six-foot-five person to get comfortable in a car these days, but I find the Mustang excellent in this respect. It's nice to see the attempt

made toward better corrosion protection, but I'd like even more steps taken. Modern technology is certainly capable."

A self-employed West Virginian told us the following about his car and himself: "I own the Ghia two-door coupe with V8, automatic and leather interior. It's a quiet-riding, good-handling, good-mpg car with excellent construction and near-perfect workmanship. My wife and I love the style; in our opinion it's the sharpest-looking small car made in America."

"In 10,000 miles, all I've needed was a



Front seat shape, amount of seat travel came in for criticism from some owners.

minor tune-up and carb adjustment. The dealer has given us excellent service and prompt attention at *no* cost. West Virginia roads are rough on any car, and if the Mustang continues to take this punish-

BY MICHAEL LAMM WEST COAST EDITOR

Most find Mustang a fine bit of horseflesh, but not all owners sit tall in the saddle

Headroom is fine, says a six-foot-five owner



Fuel economy ranges from 15.4 mpg (V8 around town) to 24.1 (base Four on trips)

ment, it's got to be a helluva buy! I'm getting 18 mpg in town and 28 on the highway. The only thing I'd want to change is to make a four-speed trans with overdrive available with the V8. I'd most definitely buy another Mustang; in fact, we plan to do just that next June!"

(Editor's note: An overdrive four-speed is now available with the 302-c.i.d. V8—



After base Four (44.7 percent), owners pick V8 (30.6), V6 (15.3) and turbo (9.4).

it's the Borg-Warner SR4 transmission.)

A Michigan telephone drafting clerk has this to say as a long-time Mustang owner: "I bought this 1979 Sport hardtop partly because my first Mustang, which I purchased on May 18, 1964, has been the best friend I've ever owned. It can rest in the garage for weeks and always starts immediately. I still have it.

"This new car is plagued with minor problems, however. The emission valve had to be replaced, but the car still backfires. I've returned to the shop five times now. The dealer's service people don't seem to pay attention, especially not to complaints from females. I rate workmanship very bad; the car is literally falling apart. I wish they'd put 1964 quality into their 1979 cars. I'd also like to see the horn put back into the steering-wheel center instead of on the turn-signal stalk. The storage compartment and ashtray are poorly placed in the console. I hit my elbow on the storage compartment and have to reach around the gearshift to get at the ashtray. I don't believe I'm going to buy another Mustang."

Now to a Michigan restaurant supervisor with the base Mustang hatchback: "I had owned a 1974 Mustang II that gave me good service and was fun to drive. This new car has a lot better style and roominess. It's also fun to drive, has a solid ride for a small car, and I like the fold-down rear seat.

"Workmanship is good—not perfect but very solid. The only planning mistake I can see is the driver's seat. It ought to slide back another six inches. I find it difficult to get under the steering wheel. I'd rate dealer service average. The service people seem disoriented. I ask a question and they say they'll have to ask someone

(Please turn to page 228)

The foaling of Mustang

Ford based its original, highly successful 1964½ ponycar on the Falcon. This latest Mustang claims the Fairmont as its parent. Taking the Fairmont floorpan, Ford removed 5.1 inches just ahead of the rear wheels and narrowed the body 2.1 inches. Tread dimensions are identical in the two car lines. So are basic suspension systems, brakes and steering.

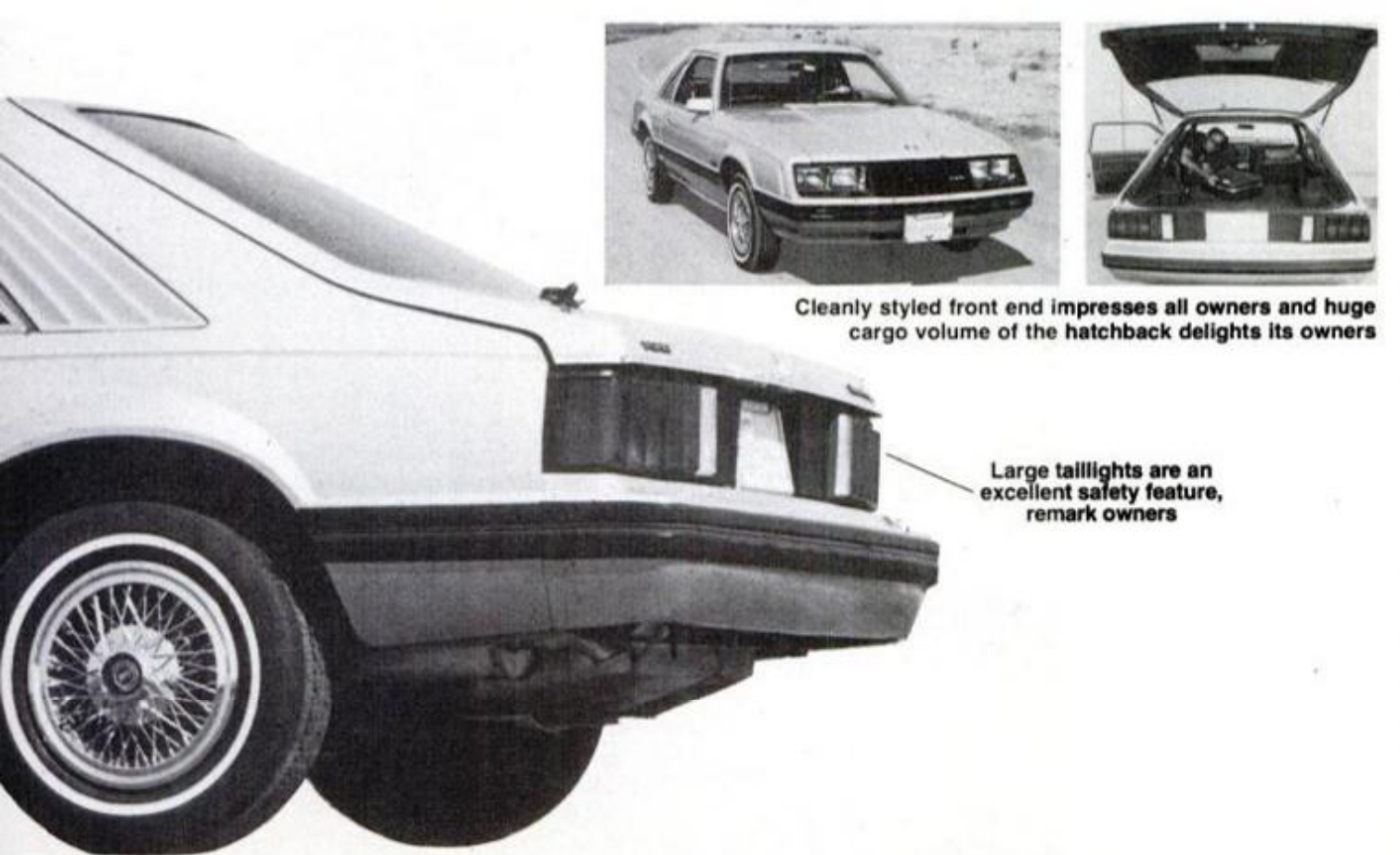
The 1979 Mustang shares much of its sheet metal and running gear with the new, American-made Mercury Capri. Also shared are a turbocharged version of the 2.3-liter ohc Four, which is much stronger than the nonturbo Four. The turbo comes standard in the Mustang Cobra and is optional elsewhere. Other engines are the 2.8-liter V6 and 5.0 liter (302-c.i.d.) V8.

The 1979 Mustang comes in two body types—coupe and hatchback—plus four trim levels: base, Sport, Ghia and Cobra. Standard equipment in all Mustangs includes tach, full instrumentation, front disc brakes, rack-and-pinion steering and front stabilizer bar.

A special TRX handling package mates forged alloy wheels with low-profile Michelin steel-belted radials and beefed-up suspension. This puts the Mustang's cornering power into the 0.85-G range—better than some sports cars. The TRX package costs \$550.

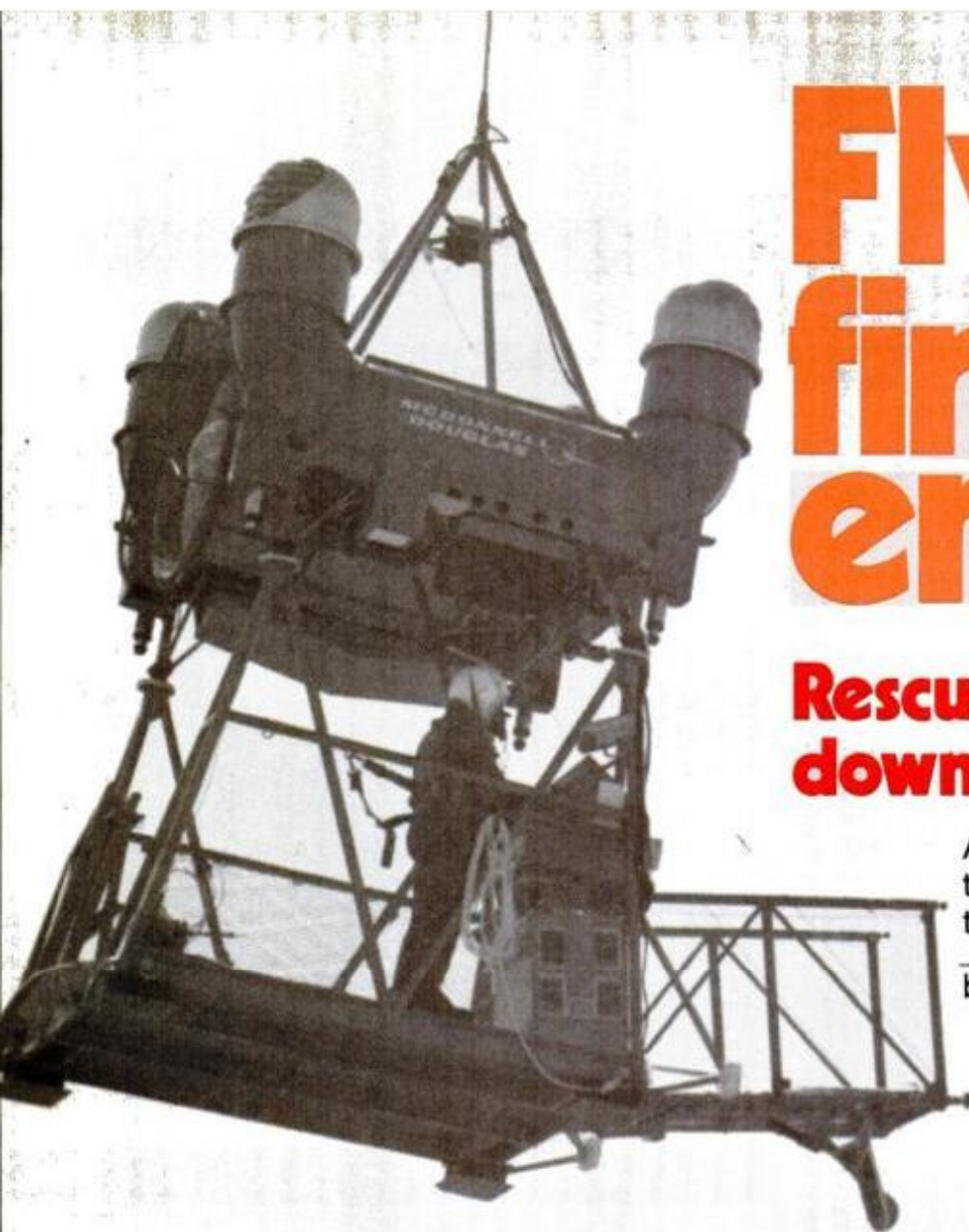
The 1979 Mustang can match the Lincoln Continental option for option. Compared with the '79 Mustang II, this new edition weighs 200 pounds less, yet makes better use of interior space.

A NATIONWIDE SURVEY BASED ON 505,162 OWNER-DRIVEN MILES



Cleanly styled front end impresses all owners and huge cargo volume of the hatchback delights its owners

Large taillights are an excellent safety feature, remark owners



Flying fire engine:

Rescue "angel" in down-to-earth action

An odd-looking craft is designed to drop from the sky to help handle those nightmare emergencies.

by Gurney Williams III

In McDonnell Douglas test of firefighting ability, pilot floods target with water pumped from ground through hose at left. The system can also carry foam or chemical to fight high-rise flames.

The scenarios are excruciating. Flames jet from a window on the eighth floor of a high-rise building, just out of reach of firefighters, as people on the tenth floor begin choking on the smoke. . . . A skier with multiple fractures faces a bumpy ride down a mountain on a toboggan. . . . A car plummets from a bridge into a deep ravine, critically injuring the driver. It'll be hours before a medical team can descend sheer cliffs to make a rescue. . . .

Now McDonnell Douglas, the St. Louis aerospace corporation, has come up with a cage-like contraption that will literally drop out of the sky to make each of these scenarios a little less frightening. Their Suspended Maneuvering System, hanging on $\frac{3}{8}$ -inch steel cable under a helicopter, will dart into tight rescue situations where helicopters alone can't go. It'll move like a fish on the end of its line, turning, circling or docking with a high-rise window. It will snatch up survivors or act as a platform for firefighters battling a blaze with foam. All of that and—I found in a flight test—it's about as easy to run as an elevator.

McDonnell Douglas hasn't made a final decision on whether to market its "flying fire engine," but has bet \$2.5 million on developing it. And about 25 large-city



System does more than fight fires. In simulated bridge accident, suspended platform dangling under helicopter (left) drops into inaccessible ravine to pick up "victims," hoist them to safety.



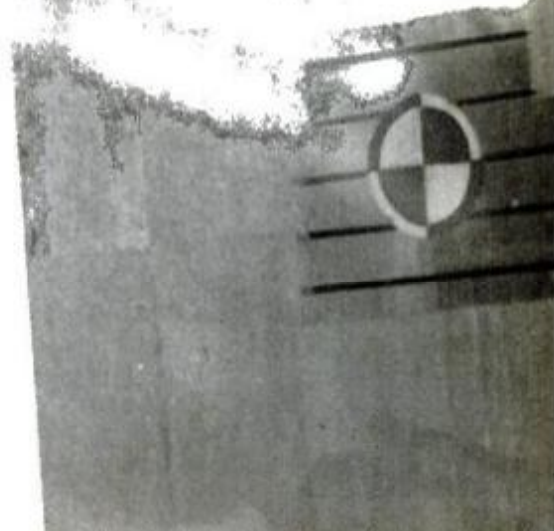
fire departments have expressed interest in buying one.

The main reason for what the company considers a strong response to the idea is frustration with existing firefighting equipment: Often, in cities, flames dance just out of reach of the tallest ladder.

"Most aerial ladders in the U.S. are only 100 feet long," said Paul R. Sawin of the National Fire Protection Assn. in Boston. "Then you take a 100-foot ladder and put it against a building, and now it's the side of a triangle. It won't get you up much past the seventh floor." And it won't get people on the 10th floor *down*.

The McDonnell Douglas system, on the other hand, hangs on a cable up to 1000 feet long, dangling a maximum of 50 floors from the top of a building while the chopper hovers high above smoke and heat. It can land four to eight firemen at a floor below the blaze, pick up a fire hose from within the building, hoist it out through a window and up to the level of the fire. Or its 7-by-8-foot platform will carry to safety up to 16 persons.

Despite these attractive features, not every city will be able to afford the \$400,000 price currently projected for the basic Suspended Maneuvering System—without heli-



copter. "I'm sure they'd like to have something like this, but the dough at the moment is bad news," said a spokesman for the New York City Fire Department. Currently, the department in the financially beleaguered city can't even afford its own helicopters.

But McDonnell Douglas quickly points to other possible applications for the fledgling system. And some interesting potential users are lining up. Among them is Bill Shuler, an organizer for next February's Olympics. If tests of the system in the Lake Placid, N.Y., area are successful, Shuler said he'd like to turn the McDonnell Douglas module into a workhorse for rescue work and security at the Olympics.

One of Shuler's nightmares in setting up medical services for the games is a serious skiing accident on 4900-foot Whiteface Mountain. There are no roads running parallel to downhill and slalom courses, he said. Helicopters can't land on the trails. Shuler said the ski patrol was well drilled in sliding injured people on toboggans down the mountain. But what about serious fractures? "If you get a Priority One—that's a broken neck or something that's touchy or life-threatening to move—I'd sooner move it with the McDonnell Douglas system than I would with a toboggan."

Contending with terrorists

Shuler said he might also call on the system for rescue work on the 30 kilometers of narrow, level trails used for cross-country events. In the worst scenario of all, he envisions a role for the Suspended Maneuvering System if violence—like the terrorist action that marred the 1972 Munich Olympics—breaks out.

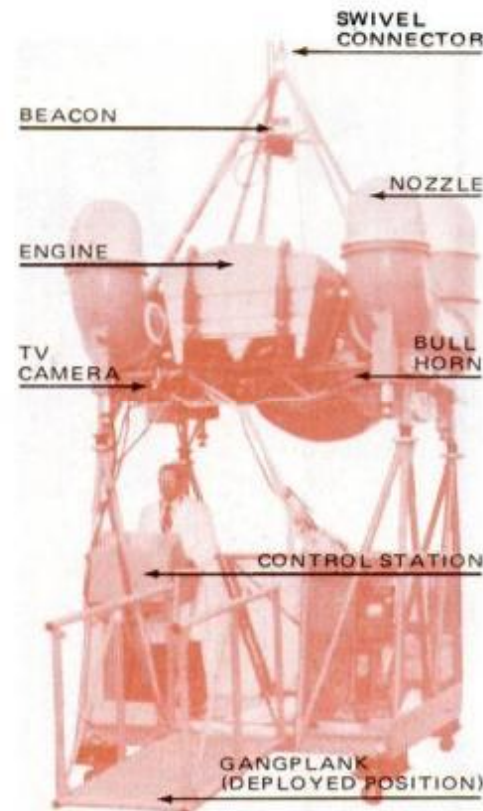
"A helicopter is quite vulnerable in the air," Shuler said. "But if you suspend this module from its 500- or 1000-foot cable and put a bulletproof skirt around it, it could be used to advantage for deploying something like a SWAT team. I hope to hell we're not involved in a shootout like Munich"—11 Israeli athletes died—"but we can't overlook that possibility."

McDonnell Douglas itself has drawn up a list of other applications, from rescuing air crash survivors from a swamp, to cleaning salt off powerlines in Florida, to ferrying crews to ships in high seas. And it has tested some of the ideas by staging simulated disasters and then dropping the module into the scene.

In one test last summer, for instance, the company called on the system after a staged bridge accident based on an actual event. In late 1977, a gas truck collided with a car on a high bridge running across the Mayberry branch of the Warrior River near Birmingham,

Ala. Birmingham Fire Chief John Swindle said that when the 900 gallons of fuel in the truck roared into flame, bridge trusses warped and the span collapsed. Miraculously, both drivers escaped before the fire destroyed the bridge. But what if the car or truck had fallen into the inaccessible ravine?

"It's a 100-foot drop," Swindle said. "Banks of the ravine are almost straight up and down. It would have taken a mountain climber to get down there and even then it would have been almost impossible to get victims back up."



Prototype of Suspended Maneuvering System hangs from cable at St. Louis plant.

Rescue from a ravine

In the test, a housewife and two children hiked to the site where rescue workers had lowered a derelict car. Joyce Howard, her daughter Leslie and a friend, Tim Popham, pretended they were injured and waited for help at the edge of a dried river.

Within minutes of the start of the exercise on a rainy day, the module, maneuvered by a helmeted pilot, dropped below the wrecked bridge. It landed softly on its four short legs near the car. Paramedics including Mrs. Howard's husband, Forney, picked up the simulated victims on stretchers, carried them onto the module, and fastened the stretchers down. The helicopter rose on command from the module's pilot. The entire rescue exercise took less than 10 minutes, and left the "victims" hungry for

more of a ride. "I've been on elevators where I was more afraid," Mrs. Howard said.

When I saw the bright orange module hanging a few feet above the ground on a cable at McDonnell Douglas' plant in St. Louis, it was running itself. The rounded shining nozzles atop the ungainly cage spun back and forth like nervous sentries in armor. F. Peter Simmons, the man in overall charge of developing the system, explained that the nozzles were responding to commands from an onboard computer. It constantly analyzed signals from a small gyro, he said. Without any help from a human pilot, the independent nozzles shot streams of air in exactly the right direction to compensate for puffs of wind, thus holding the platform steady.

Simmons invited me to try to spin the module on its cable. I stood on the ground near one corner, grabbed the sides of the cage, and put my back into turning the module around. The nozzles automatically fought the turn. I managed to make a few degrees before Simmons hopped on the platform, took the controls and raised the rpms to more than 2000—closer to a kind of "cruising speed" for the 210-hp aircraft engine that delivers air to the nozzles.

Simmons laughed. There was no turning the module now: The gyro-computer-nozzle system had locked it into position, preventing yaw.

I stepped up beside Simmons at the control panel, and in five minutes knew all I needed to know to take over.

"Flying" the module

Most of the work is done with a single hand control, Simmons explained. The module moves relative to the mother ship above depending on the angle of the stubby control. A pilot could hold position directly under a hovering helicopter as the module moved between high-rise buildings, for example. Then he could push the stick forward to dock with a window ledge.

Twisting the same control makes the module turn—but not too fast. As I had discovered in trying to turn the module from the ground, the system has safeguards against spinning so fast that control becomes difficult. No matter how hard you twist the stick, the turn rate doesn't exceed 15° per second, a rate McDonnell Douglas engineers calculate is comfortable for average operators. If that system fails, there's a backup, Simmons said, which cuts off the engine when spin exceeds a dizzying six revolutions per minute.

"We found in tests that if the nozzles take a swastika position, you can get the thing spinning up to 30 revolu-

tions per minute," Simmons said. "We let it spin, then cut the engine. We found that eventually it slows to the point where you can set it down without screwing it into the ground."

The only other control I needed was a throttle. During an actual mission, Simmons said, it would be set to idle, saving fuel from the 22-gallon tank. At the scene of an accident or fire, the engine—driving a 36-inch fan to deliver air to the nozzles—would be revved up to 2600 rpm, about 80 percent of full power. That's enough thrust to enable the module to roam more than 150 feet in front or back of the helicopter while hanging 1000 feet below the chopper.

The helicopter pilot doesn't need to keep looking down, Simmons explained, to keep track of the satellite ship. A "hover indicator"—a simple dial with crosshairs—tells the helicopter pilot the position of the hand control. And an eight-inch color TV screen picks up the scene confronting the module pilot from a small camera just under the nozzles. Communication lines pass up through the middle of the steel suspension cable.

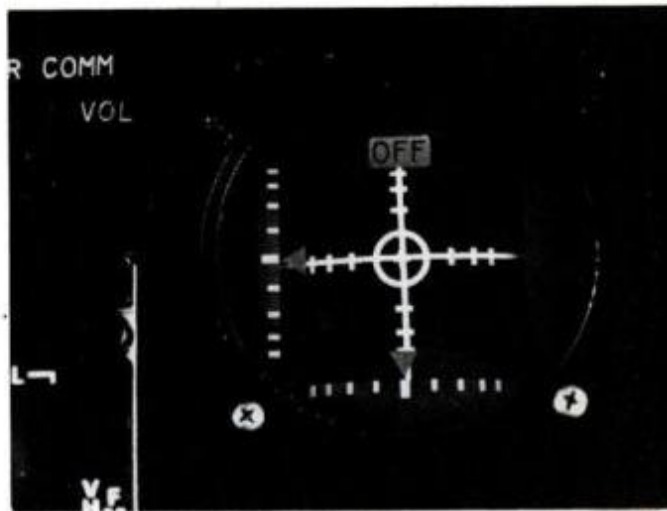
Simmons turned the controls over to me and jumped off the nonskid platform. I shoved the throttle and hand controls forward. The engine overhead sounded like a truck engine hauling a load up a hill. Pitch rose. The cage floor tipped and trembled slightly and the module swung forward. At the top of the arc, I pulled the control straight back, and instantly the floor tipped the other way. I found I had some trouble holding the module in position after it had reached its maximum distance from the center of the suspension point. It tended to slip slightly and then climb back up, a problem McDonnell engineers attributed mainly to the short tether line on which I hung. (A faulty gyro also contributed, they said. It was replaced after I left.)

Precision turns are easy

The most impressive performance feature was the way the module turned. A slight twist on the hand control set the one-ton cage in motion. I released the control, and the module stopped with military precision, holding its new direction even when wind gusts blew through the cage. After a couple of minutes at the controls, they seemed second-nature.

The only other complaint I had about the system after a brief stint as helmetless pilot was noise. My ears rang as I stepped down off the platform. But I realized that that ringing sound would be pretty harmonious to someone backing and turning from a burning building, and swinging away on a cable to safety. **FM**

Pilots need little more than T-bar throttle and hand control to maneuver suspended platform. Hover indicator, enlarged at right, shows position of flying fire engine relative to "mother ship"—helicopter—overhead.



Author (at controls) learned simple maneuvers after five-minute flight lesson.

Plug-in parking meter



Limited range continues to hinder the use of electric cars. But an Australian engineer may have a solution to the problem, especially in urban areas. A car used for commuting or shopping is idle much of the time, time that could be well spent

charging batteries. By plugging into the 240-volt socket in the parking meter shown above, a car could be partially recharged for a nominal fee, in this case 20 cents. Car is British Enfield 8000 owned by Chloride Batteries Australia, Ltd.

Help for hypothermia victims



Victims of cold-weather accidents and exposure run a high risk of death from hypothermia. The Warm-Rite, made by Energy Systems Corp. of Nashua, N.H., is a portable heat source developed from systems installed in aircraft ejection seats. A propane flameless catalytic burner heats a glycol fluid that circulates through tubes embedded in an insulated nylon bag. Thermoelectric modules provide electricity to power a pump. According to the company, volunteers have slept in unit in snow at -29°C . with no discomfort.

Quick lift for pilots



Here we see two approaches to the problem of short runways. The Quiet Short-haul Research Aircraft (left) is an experimental craft built by Boeing for NASA. Specially constructed high-bypass turbofans mounted above the wings reduce

noise and increase lift. In recent tests, the plane took off in less than 700 feet. According to NASA, scaled-up versions would take off in one-third the distance and make 1/30th the noise of comparable current airliners.



Meanwhile, the McDonnell Douglas AV-8B (right), derived from the British Aerospace AV-8A Harrier, needs even less runway. In this vertical-takeoff test, it hovered at 130 feet for seven minutes. It has a graphite-epoxy composite wing.

Plush digs on wheels

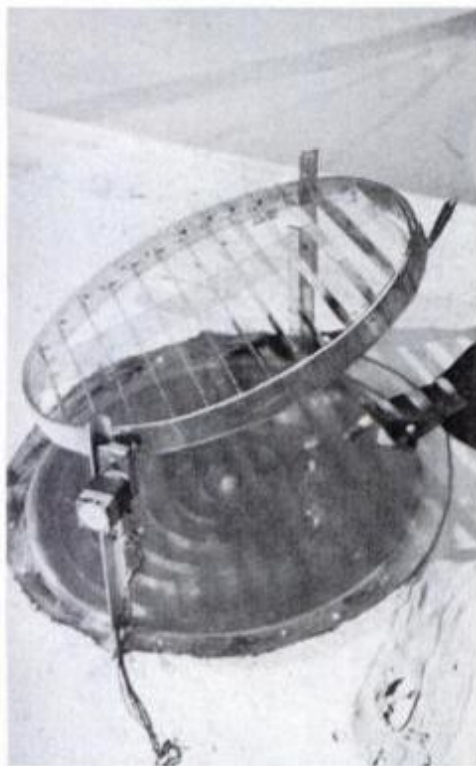


There may be more expensive cars than the \$230,000+ TAG Function Car, but does it matter? Based on the Cadillac Eldorado, the Swiss-built machine has the

usual TV, telephone, two-way radio and airconditioning. A walnut writing desk is also included. For budding James Bonds, the car is said to be armor plated to with-

stand rocket attack. Press a button to release poisonous gas (this from the country of the Geneva Convention); press another to spew nails onto the road.

Skylight tracks the sun



Lee Dominguez, owner of the Arizona Music Center in Glendale, Ariz., has designed a sun-tracking skylight to help lower electric bills in his store. A series of fixed mirror slats mounted on a circular frame directs sunlight downward (far left). Two 10-watt motors rotate the mirror assembly to track the sun. The light passes through two $\frac{3}{4}$ -inch-thick plastic Fresnel-type lenses, one in the roof and one in the ceiling. A dead-air space between the lenses and a partial vacuum in each lens provides insulation to reduce heat transmission in or out.

Dominguez says a section of his store using the skylights uses proportionately one-third as much electricity as the rest of the store. He says his repair technicians prefer working under the natural light (left), and that the skylights transmit adequate light for much of the day, even on cloudy days. He estimates that if the lenses and mirror were injection-molded, the devices could be made to sell for \$200.

You CAN take it with you

While the Casa Cama Pack Frame can't compete with the four-poster at home, it might be an acceptable substitute on the trail. Made of aluminum tubing, it's a pack frame and folding cot in one unit. A tent covers the frame in inclement weather. The prototype weighs about 25 pounds with sleeping pad; inventor Ed Taylor hopes to reduce that to 20. He is trying to market frame through Inventors Licensing and Marketing Agency in Tarzana, Calif.

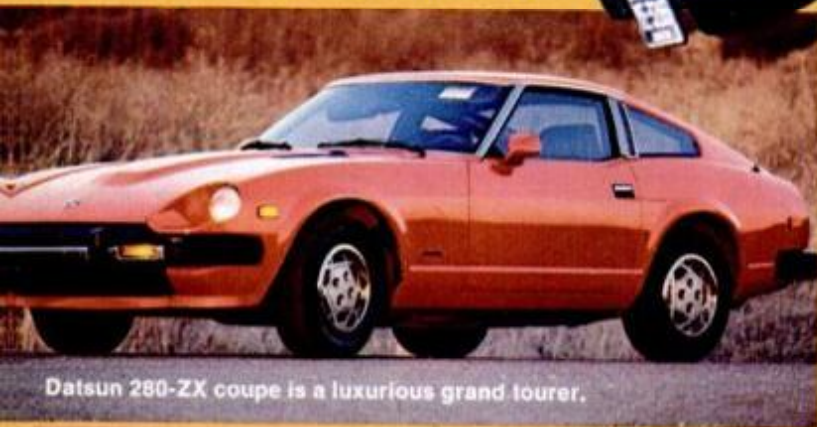


The most exciting cars for '79 are...

Just off the boat!

by Bill Hartford AUTO EDITOR

They're not crowded into the lower east side of New York, not these sophisticated immigrants. They're packed into suburban garages, clogging California freeways, stealing tight parking spots in every city from coast to coast and are very much at home on the range. The cars of Europe and Japan are in demand here not because they're cheap—they're certainly not that anymore—but because they



Datsun 280-ZX coupe is a luxurious grand tourer.



Datsun 310GX is a nimble fwd coupe.



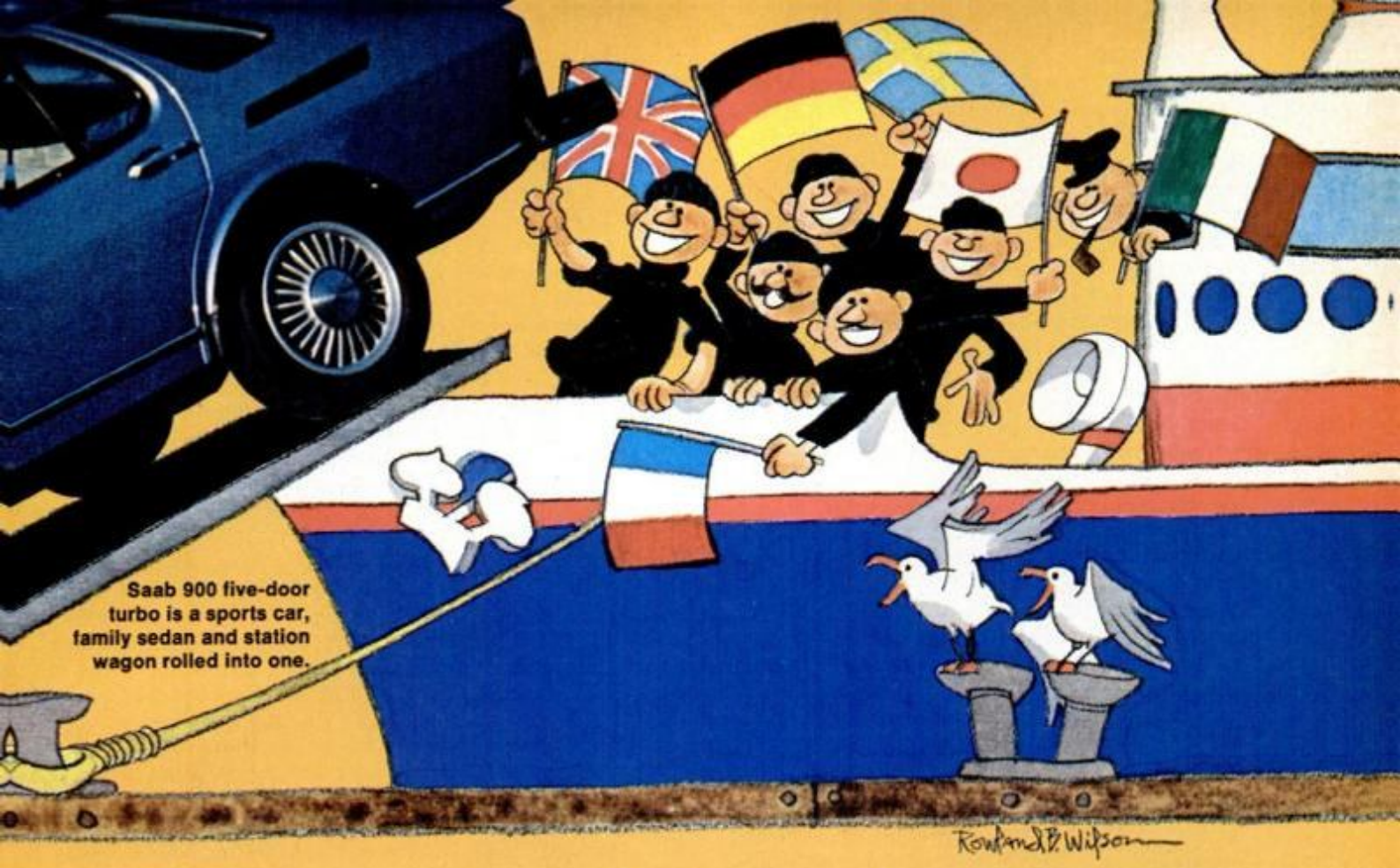
Mazda 626 sport coupe is bound to shake up the competition.



The Dodge Colt hatchback is a little marvel from Mitsubishi.



Mercedes-Benz 300TD is a 28-mpg diesel station wagon with an automatic load-leveling system.



Saab 900 five-door turbo is a sports car, family sedan and station wagon rolled into one.

Ronald B. Wilson



Porsche 928 is a V8-powered rocket sled.



BMW 320i fuel-injected Four is used in European Formula 2 racers.



Mazda RX-7, a twin-rotor racer, offers speed and style.

offer something that has not always been available in the cars from Detroit.

It was, simply, fuel economy (and careful workmanship) that appealed to the practical-minded motorist during the heyday of the Beetle. Early MG enthusiasts got a sports car that sipped petrol, too. Years ago, Mercedes offered a diesel passenger car that combined luxury and fuel economy. Italian sports cars thrilled drivers who worshiped the sound and fury of a V12 at redline.

Today, imported cars still offer careful assembly, economical performance, sportiness and excitement, but have added unique safety engineering, emissions-control techniques and space-efficient design layouts that Detroit has been slowly and sometimes reluctantly copying. Later this month when GM presents its new front-wheel-drive Chevy Citation (Nova replacement), Pontiac Phoenix, Buick Skylark, and Olds Omega (full report next month), Detroit will have its largest squadron of import fighters to date.

They'll be the first 1980 models and welcome additions to the market, but these front-wheel-drive compacts still won't be any competition for many imports. Consider a car with front-wheel drive since the start of the marque: The Saab shown rolling off the ship on the previous pages is a 900 series, five-door turbo. It's a unique automobile with extraordinary performance, precise handling, superb comfort and, amazingly, room enough with the rear seat folded to roll out a sleeping bag. The five-door turbo is a notch above the average new-car price range of \$6000 to \$9000, but is a complete package with—catch this!—heated front seats, electrically operated rear-view mirrors, sunroof, four-wheel disc brakes, Michelin TRX tires, Bilstein shocks, pollenproof ventilation system, power steering with great road feel and grab handles, secret stash spots, little lights everywhere, including the glove box and a backup light at the *front* that illuminates everything on the left

side of the car whenever you're in reverse gear.

Under the hood is a two-liter, Bosch fuel-injected, overhead-cam Four with turbocharger. You won't get less than 20 mpg even if you spend all your time at the wheel clocking zero-to-sixty times. It's a solid machine and, to us, the most exciting of the '79s—a sports car, station wagon and family sedan all rolled into one.

The five-door turbo is the Saab flagship; it's accompanied in the '79 900 lineup by GLi, EMS, GLE and two-door turbo models.

The other tough-as-a-troll Swedish car, Volvo, has a tried and true lineup for '79: The 242, 242GT, 244, 245, 264, 265 and 262C sedans, station wagons and luxury coupe have minor styling changes and very nice suspension tweaks that improve ride and handling. The addition of a rear stabilizer bar on the 245 and automatic self-leveling shocks on the 265 increases roll stiffness and makes these wagons better balanced than in previous years. (The Volvo wagons are only the *second* classiest on the road, now that Mercedes has a station wagon model.) Engines are a Volvo forte, and they're smooth, strong and clean for '79. A diesel Six will be along later this year and if it's anything like the gas powerplants (my '68 145S just hit 116,000 miles and the engine has never been touched), a Big-D Volvo will keep you cruising right into the next century.



Jaguar XJ-S is a V12-powered 2+2 Grand Touring coupe.

Renault LeCar is a French charmer that'll soon be in American Motors showrooms.



Volvo 265GLE V6 wagon has headlight wipers only in European version.

Stylish Fiat Strada is latest entry in small, economy car class.





Triumph TR-7 convertible is on way to the United States.



Honda Prelude 2+2 coupe joins Civic and Accord models.



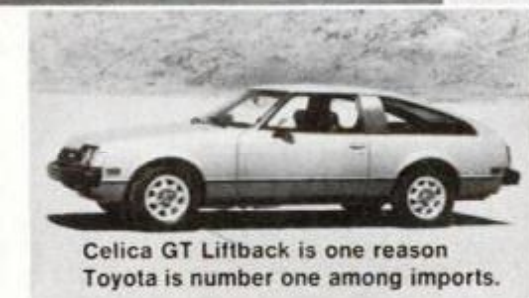
VW Rabbit is now U.S.-built, but engine's off the boat.



The 604 is Peugeot's V6-powered flagship.



Subaru station wagon switches from fwd to 4wd with flick of a stick.



Celica GT Liftback is one reason Toyota is number one among imports.



Alfa Romeo Spider Veloce is one of the all-time great roadsters.



Fiesta is a winner from Ford of Europe.

The cars of Japan

The Japanese have changed our driving habits. Small, five-speed, front-wheel-drive hatchbacks aren't just economy cars, Americans have found. They're fun. They can even be a way to beat the system: Some models, those without catalytic converters, don't need unleaded fuel.

Not all cars from Japan are visually exciting, but they do have top value and high technology. It was Japanese ingenuity, remember, that put things like CVCC, MCA-Jet and SEEC-T into our vocabularies and onto our roads.

The Big Three here—Toyota, Datsun and Honda—alone have over half the U.S. import market. Subaru, Mazda and Mitsubishi don't have the big numbers, but do have many outstanding models. Here's the '79 rundown.

Mazda's latest car, just introduced, is the 626, in four-door sedan and coupe models. It's a gem: styling's clean, performance is crisp and comfort and convenience abound (a First hand Report on the 626 will appear next month).

Most exciting model in the line, and the only rotary engine machine in the United States is, of course, the RX-7 sports car. Demand is still greater than production a year after



Audi 4000 is a mini 5000 that'll be here before the year is out.

its introduction rocked the sports-car market.

With the introduction of the five-door wagon for '79, the number of GLC models is four, the others being the three and five-door hatchbacks and the GLC Sport. Engine displacement is up from 1.2 liters to 1.4.

Honda's latest model, shown above, is the notchbacked Prelude coupe which should be in showrooms now. The 2+2 is traditional Honda: fwd, CVCC and independent suspension front and rear. It sports a feature that's a first for a Japanese automaker: a sliding steel, power sunroof. The instrument panel has several innovations, including a combination speedometer/tachometer, indicator needles of both instruments on the same axis shaft; and a "Rotary Radio" with a readout panel, in-

stead of conventional tuning dial.

Three and four-door Accords, and two and three-door Civics, and the Civic wagon make Honda's lineup for '79 the fullest ever.

Subaru's fwd and 4wd models, the standard, DL, FE, GL and GF coupe, sedans and station wagons are refined somewhat from last year, with new electronic ignition and side window defrosters. The excitement of these cars is in the way they go, especially through snow. Heaven knows they're not exciting to look at. According to some sources, the eye appeal of the line is being worked on now and we'll see a new look when the 1980 models are introduced.

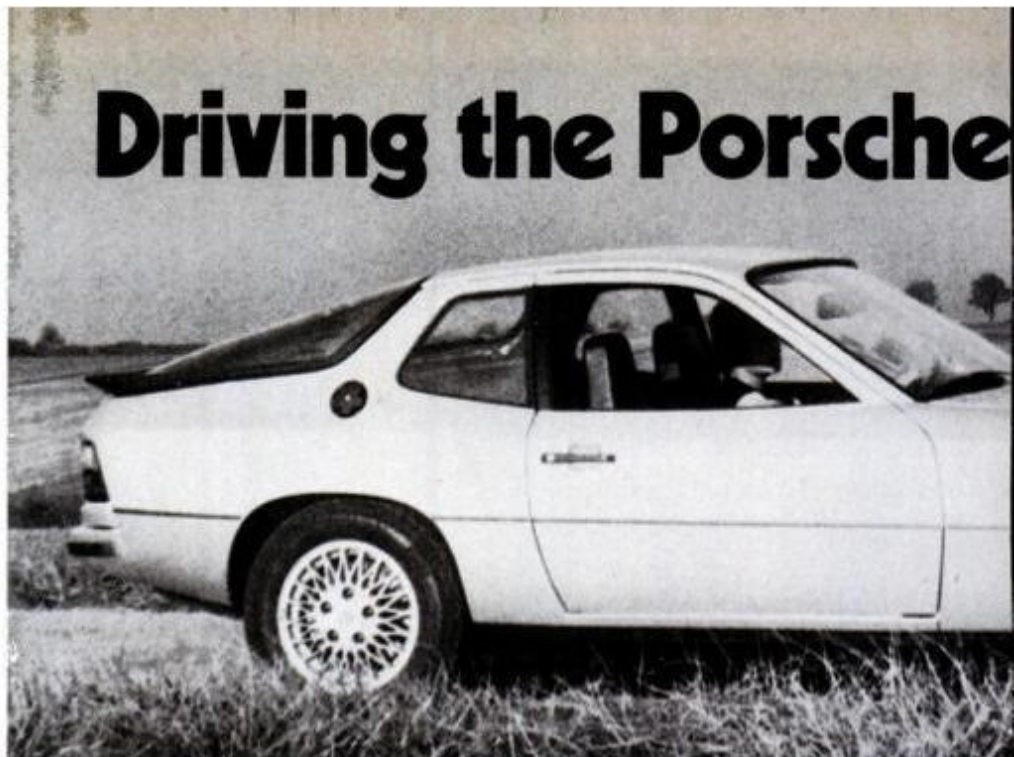
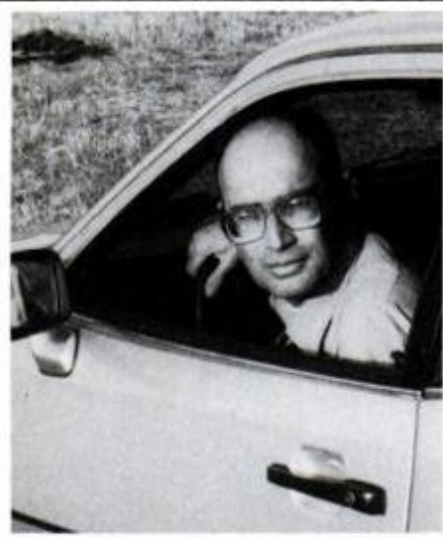
Mitsubishi's arrangement with the Chrysler Corp. has its cars being sold as Plymouth and Dodge models in those dealerships. Just added to Dodge Challenger/Plymouth Sapporos and Dodge Colt/Plymouth Arrows are Colt hatchback and Plymouth Champ models (see page 112, Oct. '78 for more details on this '79 lineup). These neat little hatchbacks feature fwd and twin-stick drive trains powered by MCA-Jet Fours of 1.4-liter displacement.

Isuzu Opels are the Japanese cars with the German name that Buick

(Please turn to page 238)

FIRSTHAND REPORT

by Michael Lamm
WEST COAST EDITOR



In countryside around Stuttgart, we found the punch of the turbo to be as neck-snapping

Turbocharging completely turns around the Porsche 924, from a very decent performer into an absolute rocket sled.

The first time I stood on the gas pedal, I'd been putt-putting along a country lane in southern Germany. I'd just shifted from low to second and was curious to see what would happen at wide-open throttle. So I pushed the accelerator to the floor.

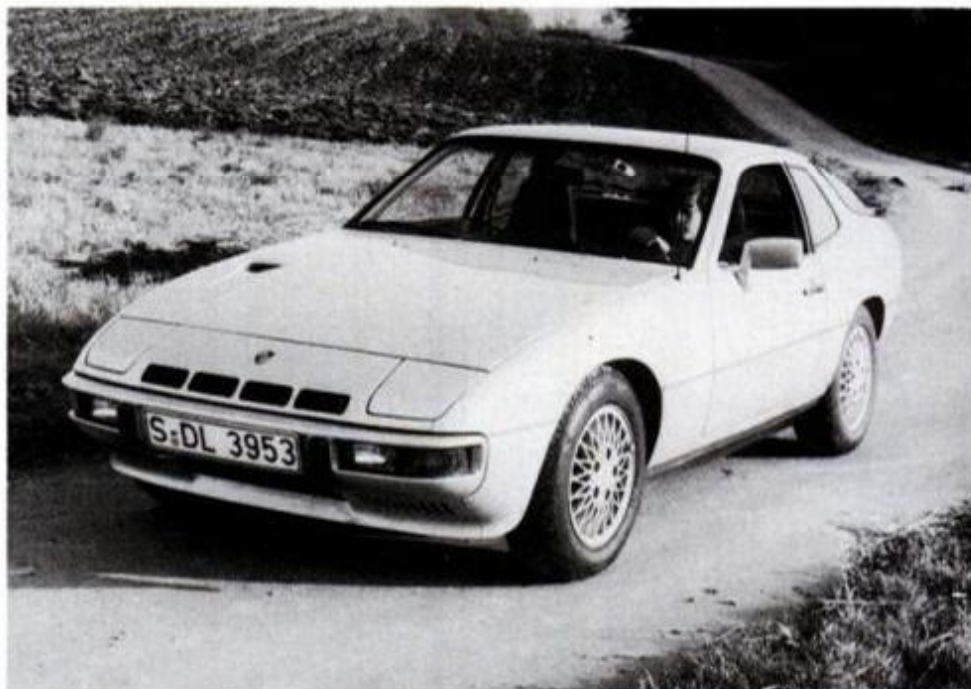
At first, not much did happen. I glanced at the tach, which at that point stood near 2000 rpm. Keeping my foot on the floor, I watched the tach go upward normally.

Between 2000 and 3000 rpm, acceleration felt unspectacular, and I told myself, "Well, this is nice, but nothing like I'd expected."

Then all of a sudden, at 3000 rpm—*varoom!* It felt as though I'd been hit from behind by a truck. Without warning, the turbo took hold and propelled the car with something akin to JATO power. The only two stock cars I've ever driven that felt anything like it were a 427 Cobra and a 427 Corvette.

The Porsche's power kept getting stronger and stronger, though, shoving me back in my seat even harder as rpm climbed. According to factory charts, torque peaks at 3500 rpm and horsepower tops out at 5500. Yet the engine winds willingly to 7000 rpm and feels strong almost all the way to that speed, especially in second and third.

I went from second to third and again felt this fantastic jolt from behind. Even in fourth there's an amazing reserve of power for passing on the *Autobahn*. But always only above 3000 rpm. Below that, takeoff feels strictly so-so. And

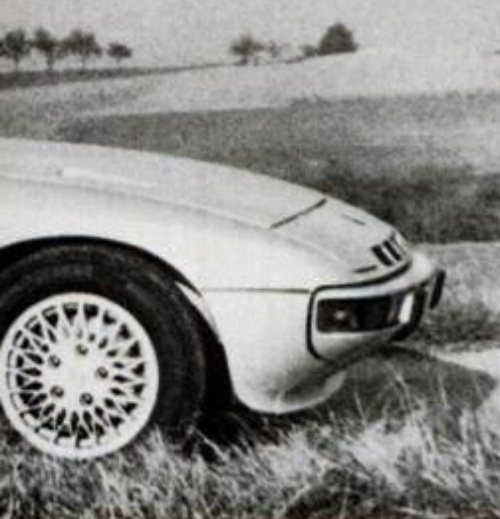


Four "nostril" openings on hood of the turbo are needed to provide the additional air engine needs for cooling and breathing—and make car easy to recognize.



Rear spoiler aids aerodynamic flow over the turbo to reduce coefficient of drag. It's attached to the hatch lid and is soft rubber so it doesn't get nicked.

924 Turbo



as that of old 427 Corvette and Cobra.

there is that usual turbo lag that lasts about a second, no matter what the rpm.

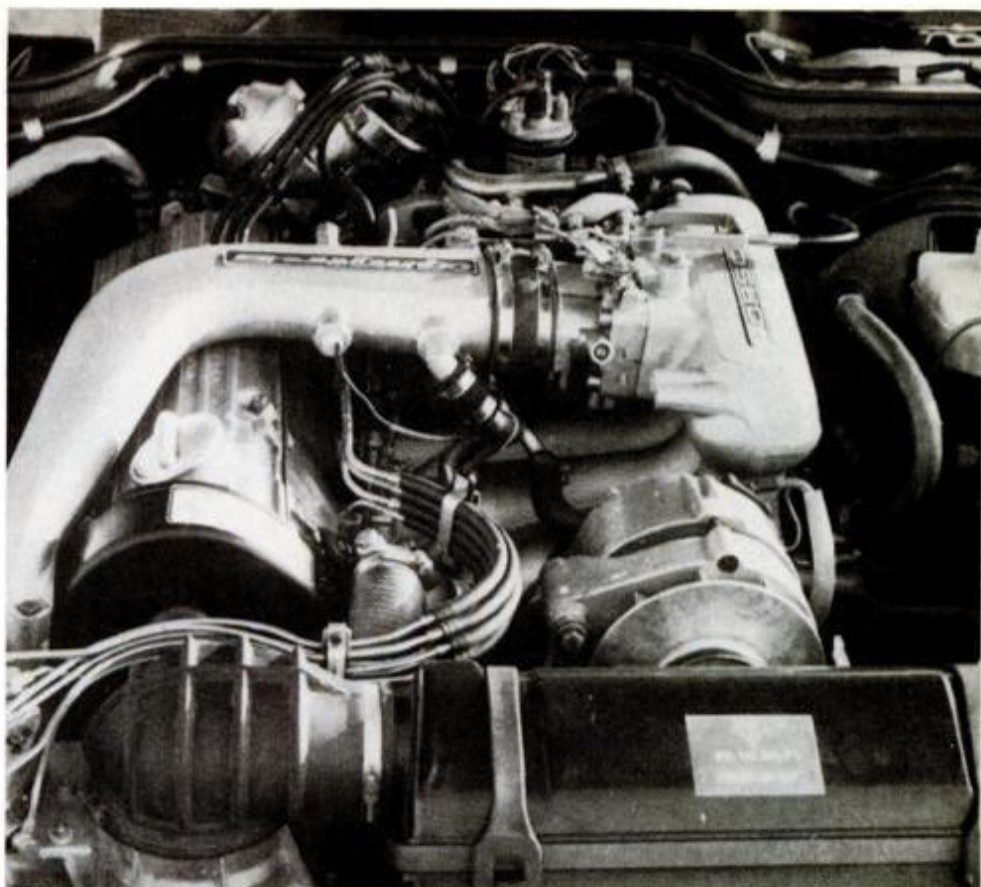
Porsche hasn't changed the turbo-charged 924 much externally. If you look closely, you'll find a row of four new radiator openings in the nose, a NACA duct on the right side of the hood, a soft-rubber rear spoiler, and new aluminum wheels. But Porsche purposefully didn't gitchee up the 924 too much, so it's sort of a sleeper.

Down inside, though, are quite a few subtle changes. The KKK supercharger (KKK stands for Kuhnle-Kopp-Kausch, not Ku Klux Klan) tucks underneath the right front edge of the tilted engine, where it's all but inaccessible. However, since turbos tend to be reliable, there's no big worry on that score.

Under normal driving conditions, the turbo freewheels, thus not adding to power or to fuel consumption. Floorboard the gas pedal, though, and the KKK kicks in as soon as exhaust pressure builds up. The turbo can turn up as many as 90,000 rpm, giving as high as a 10-p.s.i. boost.

This turbo boost, of course, affects only the volume of air entering each combustion chamber. Fuel is metered to fit ever-changing engine requirements—metered by the Bosch K-Jetronic fuel-injection system. The turbo, by the way, has a very soft whine, something like a far-away diesel truck.

To go along with the extra horsepower and torque, Porsche engineers have made a number of drivetrain and chassis changes. The 924's central backbone tube is heftier, as are gears and bearings inside the five-speed transaxle.



At 3000 rpm, exhaust turbocharger on two-liter Four comes on strong. Engine torque peak is at 3500 rpm and horsepower reaches its maximum of 170 at 5000 rpm. Redline is 7000 rpm and maximum boost or intake air pressure provided by turbo is 10 p.s.i.

The four-wheel disc brakes and axle shafts are bigger than on the standard 924, too. Wheels are of a new design, also larger than before, with 185/70 VR 15 tires stock and 16-inch wheels and tires available as an option.

Otherwise, the 924 turbo uses much the same components as its nonsupercharged cousin. Suspension still feels a bit too stiff, and an

adjustable steering column might help take the wheel out of the driver's lap.

In terms of figures, the well-driven turbo 924 will do zero to 60 in approximately eight seconds. Top speed is said to be 141 mph, and I don't for a minute doubt it. Price is equally impressive. The turbo adds about \$6000 to the normal 924's \$14,000 price tag. **PM**

SPECIFICATIONS—PORSCHE 924 TURBO

Vehicle type

2-door liftback 2/4 passenger coupe; front engine placement; rear transaxle.

Price, U.S. port of entry

\$20,000 approximately

Engine

Type: In-line, sohc Four, watercooled, 5 main bearings
Bore and stroke: 3.4 x 3.3 in. (86.5 x 84.4 mm)
Displacement: 121 cu. in. (1984 cc).
Compression ratio: 7.5:1.
Induction system: Bosch fuel injection, KKK turbocharger.
Max. bhp @ rpm (DIN): 170 @ 5500.
Max. torque @ rpm: 180 @ 3500.

Drivetrain

Clutch: single dry plate with hydraulic actuation.
Driveshaft: Flexible shaft inside rigid tubular housing, no universal joints.

Transmission: Rear-mounted transaxle, fully synchronized five-speed manual gearbox in unit with differential, overdrive 5th.
Brakes: Four-wheel discs, floating calipers, vacuum assist.

Suspension and steering

Front suspension: Independent, by MacPherson struts, antiroll bar.
Rear suspension: Independent U-jointed half-shaft axles, angled trailing arms, transverse torsion bars, hydraulic shocks, antiroll bar.
Steering: Rack and pinion, 20:1 ratio.
Wheels: Diecast aluminum 6J x 15.
Tires: 185/70 VR 15.

Body and dimensions

Bodywork: Unitized steel construction with backbone tube.
Wheelbase: 94.6 in.
Overall length/width/height: 166.0/66.4/50.0 in.
Track, front/rear: 55.9/54.9 in.
Curb weight: 2601 lbs.

Going to see-underwater

A lookout below is easy for this armchair diver/inventor who uses pushbuttons to head down and out.



At 1/2000th of a league under the sea, Floridian Max Taylor becomes a modern Jules Verne as he steers his scuba submobile through the clear waters of Homosassa Springs, powered by electric trolling motors above his elevator.



Why burden yourself with expensive diving tanks, regulator, weight belts, buoyancy-compensating vest and swim fins whenever you want to go underwater?

Max Taylor, an inventor and retired postal employee who lives in Crystal River, Fla., pondered that question 11 years ago. Now, at 78, Taylor rides around his local waterways in the rig he developed to answer the question. If anyone thinks Taylor's scuba-mobile with its pipe-fitter's delight of pipes and hoses looks funny, he should try to come up with something that can drop you eight feet under water in three seconds and bring you back up in the same length of time—all while you are sitting in the catfish seat, comfortably pushing buttons on the arms of your submersible easy chair while inquisitive fish watch to see how you make it look so easy.

Taylor claims he could have cut

down on his research and development time—he built six experimental models—if he'd had a junkyard nearby as a source for parts. Research is expensive, but his machine will now travel two to three miles an hour for about seven hours at a cost of about 80 cents a day.

The 300-pound rig is floated on two parallel pontoons, catamaran style. At the bow sits the submarine captain, while astern he has a pair of Mercury Thruster trolling motors powered from storage batteries in the pontoons. Between them is an air compressor that provides air, both for breathing and for the ballast tank that lowers and raises the diving seat.

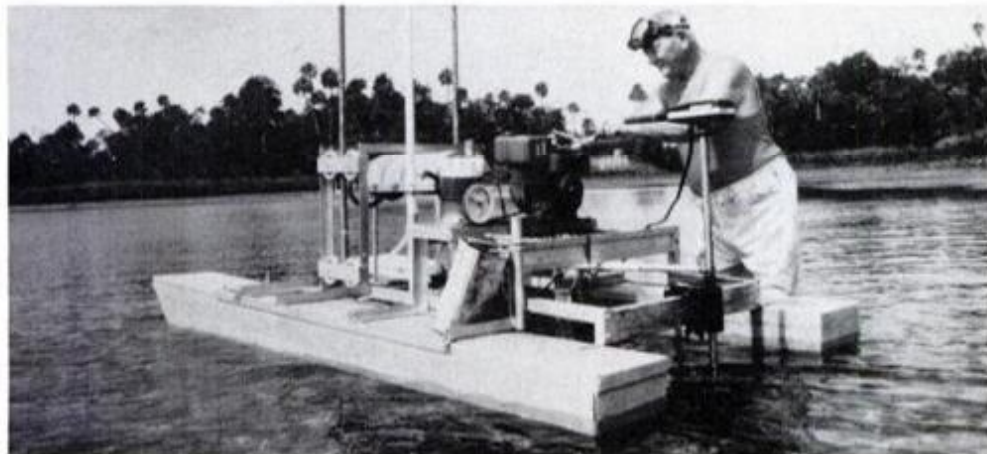
Steering is accomplished by selecting power for either the port or starboard Thruster motor, rather than using both at once. Pushbuttons on the seat armrests, next to the ballast valves, control all neces-

sary operations. Max, who reports that learning to drive and dive takes about five minutes, plans similar two- and three-passenger craft.

Depth of diving, currently about eight to 10 feet below the surface, is determined by the length of the support pipes that extend above the vessel when the seat is surfaced. For submerged running, the wide beam of the pontoons and the subsurface weight of the seat and ballast tank help the pipes stabilize the rig. Thus progress is smooth and small chop does not give the helmsman a bronco ride below.

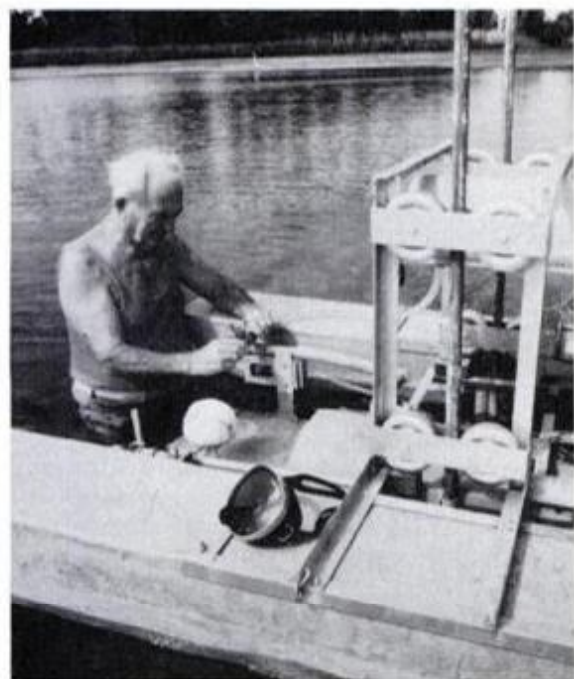
Though the boat cannot go under another craft as a diver might, the driver-diver can easily make underwater repairs on the sides or transom propeller of another hull. But, best of all seems to be the sight-seeing potential, as you ease along in your own unlimited aquarium.

—Bill McKeown

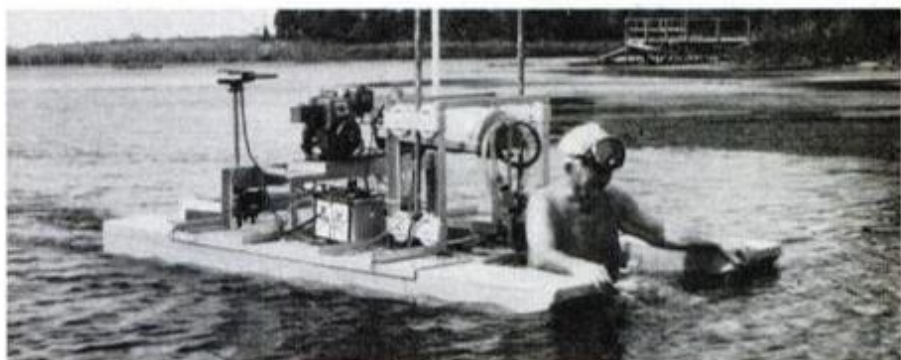


Powering up for subsurface sightseeing, Florida inventor Max Taylor starts compressor that gives him air and raises and lowers him aboard his scuba-mobile.

It's pushbutton boating for this machine's skipper, as he fingers armrest controls that run elevator seat and turn on trolling motors that ease the rig along.



Elevator seat for down-and-under helmsman can rise or descend eight feet in three seconds by activating two-way valve. The demand breathing system has compressor and reserve tank supply.



Under way, Taylor's prototype surges along at 2 mph with one Mercury Thruster trolling motor. The latest version uses two for easier steering.



Starting down, Taylor is not fastened into seat, could easily swim to surface if necessary. The 300-lb. rig provides stable platform for scuba photography.



Shoot panoramas with your snapshot camera

Make those wide-angle photos without any special equipment.

by Tom Sahagian

How often have you trotted out a snapshot album only to be disappointed by the dullness of many of the photos? Have you wished for pictures that showed the sweep of a city skyline, the breadth of a rolling valley or the stretch of a winding road—in short, a panoramic view of the world?

One way to take such pictures is with a \$1000 panoramic camera. If that isn't possible, there is an alternative. You can make panoramic pictures yourself, even with a snapshot camera. The results won't equal those obtainable with a camera made for the purpose, but they will give your snapshots a new dimension.

Taking the pictures

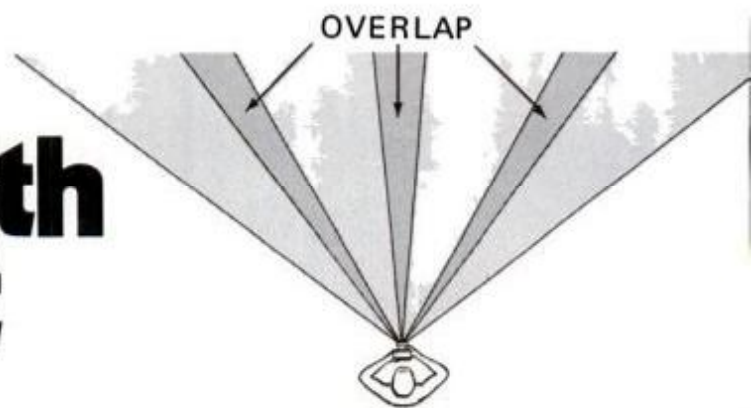
Pick a scene you think would lend

itself to the panoramic format. While skylines and valleys are naturals, many ordinary scenes take on added drama when photographed panoramically.

While standing in the same spot, take several shots of a given scene in sequence. Don't be afraid to overlap shots as much as 25 to 30 percent. While a tripod helps to keep the camera always at the same level (many snapshot cameras have a tripod mount), it is easy enough to shoot without one. Best time of day is around noon because lighting is more uniform, but for panoramas of two or three shots this is not as crucial.

Taking photos for panoramas is easy; mounting them in an attractive way is a bit more difficult. Successful mounting is mostly a func-

How to overlap shots for panorama. It's sometimes possible to move parallel to the scene and take all shots head-on, but often there's not enough room to move around. Also, object sizes in photos may vary, preventing matching of adjacent photos.

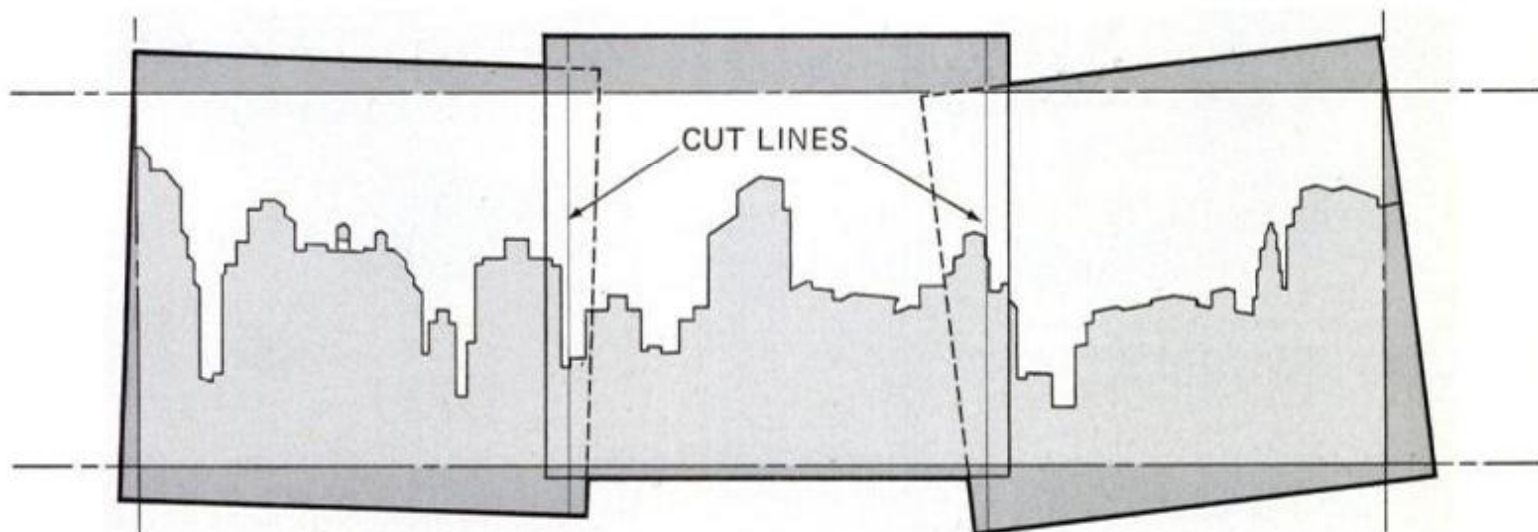


tion of patience and thoroughness. It's almost impossible to achieve perfection, but the difference between a rush job and a careful one is painfully apparent.

Essential materials

To start, assemble all necessary tools and materials on a large, flat work area. A drafting table is perfect, but a table or countertop will suffice. You'll need, besides your photos, a sharp knife (like an X-acto knife), cardboard, clear cellophane tape, spray glue, a straightedge and a cutting surface. A T-square and triangle are helpful, but not essential. Since you'll be spraying glue around and cutting up photos, protect the work surface. And work with clean hands.

To have a preliminary idea of how



The panorama above was shot with 35-mm SLR, but similar results are possible with a 110 camera. Careful scrutiny reveals seams and some unavoidable mismatching where photos meet, but overall effect is impressive. Diagram (above) shows how photos are

matched. Few remain uncut; matching process involves repeated cutting and trying. Do your experimenting with unimportant photos to become familiar with the technique so that your important ones won't be botched.

the panorama will look, arrange the photos you've chosen so they present an unbroken scene. There will be some overlap, of course. Few, if any, snapshots will match up against other photos without any overlap because the inevitable distortion in a picture is most pronounced at the edges. You'll also notice that the photos don't line up parallel, but are at slight angles to one another. This also is caused by distortion.

Patience needed

Now that you have an idea of what the panorama will look like, you can begin the final cutting. This step requires the most patience. It is perhaps chores like this that produced the expression "cut and try," for you'll be doing plenty of that.

Begin by taking the middle photo of the group and lining up one of the photos that goes on either side. Because of the edge distortion, you may need to cut pieces from both photos. Use a straight-edge and a sharp knife that will make a clean, straight cut; a dull blade will shred the border.

Once you've made the proper cuts, use a small bit of tape to hold the two photos in place. You can tape them to some scrap cardboard for now. Cover as little of the photos with tape as possible. Continue cutting and arranging and taping until the photos are lined up in their final positions.

Although you now have an unbroken panorama in front of you, the outer perimeter is quite jagged. To have a rectangular panorama, some

additional cutting will be needed. Here a T-square and triangle will come in handy, but careful measuring and cutting will yield an equally good result.

Cardboard works best

You may mount your panorama on just about anything, although cardboard is easiest to find and to work with. For extra stiffness, or if you want a good-looking border, matte board is excellent. Some people simply tape their photos together, with the extra tape holding the photos to the mounting surface. But this is ugly. Better to use spray glue (available in art supply stores and hobby shops). Make sure you spray the backs of the photos evenly, especially along the edges. Otherwise,

(Please turn to page 222)

Car stereo—better than home on the road

Add-on car stereos let you ride down the highway to the accompaniment of at-home quality music. We look at the major brands.

by Fred Petras



Panasonic's CQ-8520 is representative of what is happening in auto sound. This unit offers a full 25 watts total output, FM noise-quieting, automatic search and 12 station presets.

The first time you ride in a car equipped with one of the new high-power auto sound systems you will have a truly eye-opening—and ear-opening—experience. Not just loud—but good! The days of tinny car stereo are over. If it weren't for the roadside scenery moving by the window, a listener might think he was in his own living room.

Such sound is not cheap—prices can be \$500 and even higher, but the power outputs are greater, and distortion far less, than used to be the case.

Just about every feature you can think of is offered. Do you want automatic tape reversing, so that you will never have to take out a cas-



Signal-seeking automatic tuning and six-over-six (AM, FM) station presets are featured on this Kraco Model LED-509.

sette just to flip it to the second side? If so, you've got it—in at least 15 high-powered models. How about a digital readout that will display station frequencies as lit-up numerals—just like on a home-style, fancy component tuner or receiver? Auto stereo manufacturers now offer digital readouts—some that even display the *time*—in an ever-increasing number of quality tape/radio combinations. Would you like the convenience of scanning where the receiver itself finds or hunts for the preset radio stations you want to hear? The convenience is yours. You want high power for the same kind of "gut" or "visceral" listening lev-

els as in your home audio environment? That, too, is yours. As for sound quality, many of the deluxe players will produce true hi-fi if they are hooked up to speakers that are responsive.

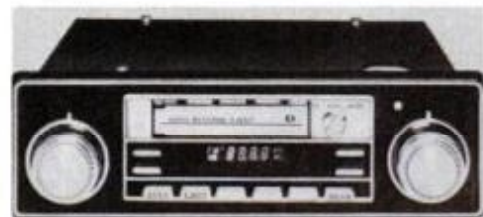
Before you put your money down

If you are thinking of buying, the best advice we can give is to look a lot and listen a lot. Consider the features of the units you are looking at and listen to how they sound. Compare them by using two or three different sets of speakers. *Your ears* must be the final arbiters, no matter what the spec sheets or salesmen tell you.

When you look at equipment, be



Dual tone controls are featured on this Audiovox Model CAS-600A. It also has a Dolby circuit and runs at 20-w.p.c. output.



Electronic scan/pause tuning sounds a note of convenience in J.I.L.'s Model 634E, with auto-reverse and a digital dial.

certain it will fit your car's dashboard. Nothing is more heartbreaking than to fall in love with a mismatch. Try out the operating controls and be sure they have a smooth and comfortable "feel." Ease of operation can be a safety factor when you buy car stereo—you do not want to be distracted when you're driving by hard-to-use gear. Tuning dials should move smoothly with no backlash; pushbutton lock-ins should depress easily and precisely; volume and tone controls should be handy to your fingers and rotate easily; and you shouldn't have to take your eyes off the road to load a tape.

Confusing power ratings

If you're a high-power buff, beware! You will have to rely more on your ears than on what the spec



Clarion's PE-838A under-dash cassette player (no record) features Dolby circuit, auto-reverse and "component" styling.

sheets say. A current trouble area in the auto-sound marketplace is that there are no true power standards for measurement. One firm may give a power spec of 45 watts and not say if it is per-channel power or a combined-channel total. Another may say 15 watts per channel, but not tell you if the wattage is RMS, music power, peak power or whatever. There may be no indication as to distortion level, and speaker-ohm ratings are often missing from the specifications.

The auto-sound industry still has to get its act together. (The home stereo industry, in 1974, was presented with a set of FTC guidelines to follow. If the auto-sound manufacturers do not soon regulate themselves, they also may find the FTC at their door.) Until that day arrives, do your listening with your ears on the music and not your eyes on the spec sheets. Listen to determine if the maximum volume level of a unit is adequate for your own needs. When you make comparisons, do them on the best speakers in the store so you will know the optimum sound quality.

Spec sheets, right now, will give you little idea of frequency response, wow, flutter or signal/noise ratios so listen as carefully as you can for balance, clarity and realism



An elapsed timer for timing trips and checking speedometer accuracy highlights San-yo's Model FT-1670 cassette/radio.

with a minimum of distortion at both high and low volume listening levels. By the way, if a piece of equipment sounds good in the store—it'll usually sound even better once you have it installed in your car!

out the major and/or unusual features of each set. All the sets offer the basics: balance, volume, tone, fast-forward/rewind, tuning and fader. Radio sections are all AM/FM stereo. Prices may fluctuate, but those listed were current at press time.

Automatic Radio offers two automatic-reversing cassette/radio combinations. Model CTH-2392 at \$283, with 15 watts per channel (w.p.c.) output, features pushbutton tuning for five preset stations. Model CLA-3740, at \$390, with 15-w.p.c. output, features similar tuning, plus digital readouts of station frequencies and the time. Automatic Radio also offers Model ELR-3742, which is a cartridge version of the CLA 3740, at \$365.

Audiovox's CAS-600A has 20-w.p.c.



Jensen's R430 offers 30 w.p.c. using an outboard amplifier. The unit features Dolby, bi-amplification circuitry, FM interstation muting and electronic switching of controls.

Surveying the field

In the brands we examined, we limited ourselves to the so-called "step-up" models—better quality, cleaner sounding and with 10 or more watts per channel. The survey is listed by brand name and points

output, and features Dolby noise reduction circuitry for noise-free sound with better high-frequency response. Price: \$340.

Boman's Mach 50, at \$440, offers 15-w.p.c. output and automatic reversing, in addition to Dolby noise reduction.

Clarion PE-751A with 12-w.p.c. output has Dolby circuitry, automatic reversing and five-station preset pushbutton tuning, all for \$377.

Cobra Models 99GTL (at \$200) and 97GTL (at \$150) both offer 12-w.p.c. output, but additionally have plug-in adaptability to a power amplifier/equalizer and remote CB. The 99GTL has five-station pushbutton preset tuning.

Concord Models HPL-110 (\$240), HPL-200 (\$300), and HP-350 (\$350) are look-alikes, differing only in their power outputs, which are 10, 15 and 20 watts per channel, respectively. They all feature Dolby circuitry, and Sendust-Alloy heads for long-life performance.

Craig Models T685 (\$300), T683



Pioneer's Model KPX-9000 uses a separate 20-w.p.c. amplifier. The amplifier may be mounted behind dash or on firewall.

(\$210) and T681 (\$180) are designated Powerplay and offer 12 watts per channel output. The T685 features a digital clock and digital readout of station frequencies, five preset station pushbuttons and automatic reversing. The T683 has auto-reverse. Model S685 is the cartridge equivalent of the T685, at about \$280.

J.I.L. calls its high-powered tape/radio combinations Power Pumpers. They have 10 watts per channel output. Model 634E features LED numerical readout of channel frequencies during AM or FM play, scan/pause station search across the dial, seek/lock-in for adjacent station tuning, four programmable AM and four programmable FM station settings, digital-readout clock and auto-reverse. It sells for \$490. A car-



Electronic controls and digital readouts contribute to the new design "feel" of Sparkomatic's 22½-w.p.c. Model SR-3400.



Cobra Model 99GTL has plug-in adaptability to power amplifier/equalizer and remote CB—along with five station presets.

tridge version, Model 874E, sells for \$450. Model 633 features automatic reversing and sells for \$300.

Jensen's high-powered car tape/radio units reveal their hi-fi origins in their "component look." Model R420, with 10 watts per channel output operating into two woofers and two tweeters, can produce 18 w.p.c. through two regular speakers by the flick of a switch. Other features include Dolby circuitry, loudness compensation for full bass at low volume, automatic tape-end alarm and feather-touch microswitches. Its equivalent in the cartridge format is Model R320. Both units are priced the same: \$370. Model R430 (cassette) and R330 (cartridge) are higher-powered units with separate amplifiers that provide 30 watts per channel outputs into two woofers/two tweeters. Price of each model is \$470.

Kraco's "computerized" Model LED-509 (\$400) allows presets of six AM and six FM stations. Featured



Metro Sound's MS-8650 has a long-life Sendust-Alloy head, auto-reverse and a loudness switch. It has a 25-w.p.c. output.

are signal-seeking, auto-tuning, automatic scanning of radio frequencies, and green LED displays of station numbers and the time. Power output is 15 w.p.c.

Metro MS-8650 is an automatic reversing unit with 25-w.p.c. output, featuring Sendust-Alloy long-wear head, loudness switch and connections for external amplification/equalization and loudness controls.

Panasonic offers electronic tuning in its CQ-8520, priced at \$400. It features automatic station search, "memory" tuning of six AM and six FM stations, digital LED readouts of station frequencies and time, auto-reverse, and FM impulse noise-quieting circuit. The power output is 12-w.p.c. Model CQ-6520 (\$240) offers 12-w.p.c. output and features impulse noise-quieting circuit, Repeat-track for automatic replay of a re-wound cassette, and 10-station preset (five AM, five FM). Model CQ-2520 is the cartridge equivalent of the 6520 and costs \$220.

Sanyo's Audio/Spec Models FT1490A (\$200), FT1495 (\$220) and FT1670 (\$370) offer 10- and 12-w.p.c. output in regular operation with two speakers, or 14 w.p.c. in "biamplified mode" using two individual woofers and two tweeters. Features common to the 1490A and 1495 are Dolby, auto-reverse, automatic antenna operation (raise, lower), and loudness control. The 1670 features remote signal-seeking, 10-station preset, precise solid-state tuning, digital station frequency/time readouts, and an elapsed timer for timing trips and checking speedometer accuracy. A cartridge type Audio/Spec unit with biamplification similar to the above is Model FT1877, at \$200. It features Dolby and five-station preset.

Sparkomatic has three 22½-w.p.c. units, Models SR 3300 (\$260), SR 3400 (\$300) and SR 3100 (\$230). Key features of the 3300 are auto-reverse and electronic switching. The 3400 has electronic controls, elapsed time and reset controls, and LED digital time and frequency display. The 3100 also has electronic controls. A cartridge equivalent of the 3400 is the SR 2400 (\$270).

A few companies are offering hybrid models—we could call them "semicomponents"—consisting of a "head" unit (player-only, or player/

radio) for in-dash or under-dash mounting, packaged with a separate power amplifier module for out-of-the-way mounting behind the dash, on the firewall, in the trunk or elsewhere. These generally offer a bit more power than the all-in-one types because the amplifier section can be built larger, with better cooling potential.

Pioneer Models KP-88G (\$230) and KPX-9000 (\$350) are typical. The former is an under-dash cassette play deck with Dolby noise reduction, locking fast-forward and rewind, and automatic play after rewind. The 9000 is an in-dash AM/FM stereo Supertuner/cassette deck combo with phase-locked-loop for FM stereo separation and five-station preset tuning. Both of these units come packaged complete with



Note the five preset station buttons and instant station readout. These make the S685 from Craig an easy unit to operate.



Model ELR-3742 from Automatic Radio has a digital readout of both frequency and time in an eight-track cartridge/radio.

a 20-w.p.c. RMS power amplifier.

Boman, in its Gold Label series, has two in-dash combos that come packaged with 25-w.p.c. amplifier/graphic equalizer that contains a tuning level meter. One, Mach 90, uses an AM/FM stereo radio/cassette player featuring digital station frequency and time readouts, five/five preset AM/FM pushbuttons, and auto-reversing cassette transport with Dolby at \$600. Mach 80 has similar radio features, with a cartridge player. Price: \$550.

You'll also find models basically similar to those we've discussed in the Automatic Radio, Bristol, Grundig, Marantz, Midland and Royal Sound lines.

If you're looking for higher power in under-dash models—in both cassette and cartridge—there are a few to be had. Typical are Clarion Models PE-453A (cartridge) at \$160 and PR-838A (cassette with auto-reverse) at \$244, both straight players-only with outputs of 12 w.p.c. **FM**

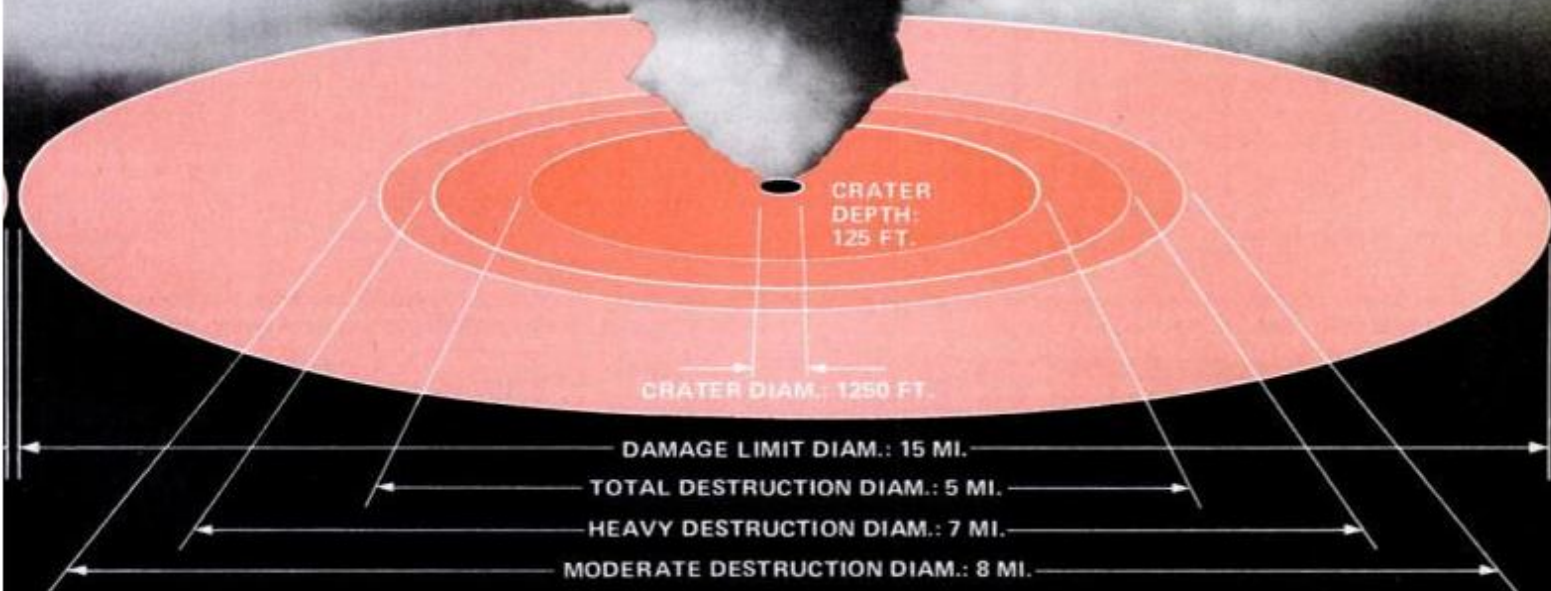
CIVIL DEFENSE: Fix it or forget it?

Effects and dimensions of a one-megaton nuclear weapon detonated at ground level are shown. **Zone of complete destruction:** All buildings are destroyed, as are blast shelters near ground zero; but 75 percent of underground shelters remain intact. **Zone of heavy damage:** Some buildings remain upright. Blast shelters, including some basement-type shelters, remain undamaged. **Zone of moderate damage:** Shelters completely undamaged; conflagrations from thermal radiation. **Zone of light damage:** Isolated rubble and some fires. Beyond the zone of light destruction (7.5 miles from ground zero in this case), the blast's shock wave is harmless. Danger from exposure to radioactivity would vary with time person remained in the blast area or fallout zone, which would spread upwind from blast center in an elliptical pattern. A 10-megaton weapon would have similar blast effects on an area having twice the diameter of this one.

Adapted from a widely circulated civil defense manual published in the U.S.S.R.

While food supplies rot in fallout shelters, experts disagree on how to patch our domestic armor.

by Jim Toedtman



Our civil defense is down. Decades of false starts and patchwork policy have left huge holes in the system that's supposed to protect us if we're attacked. And there's wide disagreement today on how to beef up our domestic armor—or whether we should even bother.

You needn't look back more than a generation to chart some of the zigzags in civil defense strategy.

October 1962: Huddled in a White House hideaway, President John F. Kennedy and his national security advisers contemplate the military retaliation they can expect if the United States is to at-

tack Cuban missile bases. Air Force bombers, armed with nuclear weapons, are actually poised on runways, engines running, in preparation for a Cuba strike. Other Strategic Air Command bombers fly toward Russia, turning back when close enough to underline United States determination, but



The President's command post, in case of nuclear attack, would be one of four jumbo jets, each carrying a crew of 27. At right, technicians on one of the planes man communications center from which the President would monitor an all-out war.



not so close as to invite Soviet attack. American missile batteries stand ready with our heaviest nukes, while air, sea and land forces mass to invade Cuba if necessary.

Kennedy has a question: Could Miami and Florida's other coastal cities be evacuated? The question is passed to Stuart L. Pittman, then an assistant defense secretary. "I was called into the marathon crisis meeting and had to tell him it would not be practical," Pittman recalled recently. Evacuation had been discarded as a national strategy, Pittman told the meeting. In a burst of national enthusiasm in the Eisenhower years, it had been replaced by the concept of *shelters*—underground bomb-blast and fallout shelters, both homebuilt and public.

November 1978: The White House leaks a story that spending for civil defense will double over the next five years, with emphasis on *evacuation*—"crisis relocation" in bureaucratic parlance. President Jimmy

Carter himself later denies the reports, but Federal civil defense officials continue to talk about the favored modern strategy: moving millions of people out of cities, away from danger. Today, the national system of fallout shelters has been relegated to the scrapheap. For the most part, the vast effort of building, surveying, marking and stocking shelters that began in the 1960s is now part of a closed chapter in the nation's history.

Gone are the yellow and black warning signs, the helmets, the practice alerts, the air-raid drills. Gone is a time when the United States and Russia were ready to unleash their entire nuclear arsenals, setting off an *On-the-Beach* scenario in which only a few submarine crews and isolated areas survive.

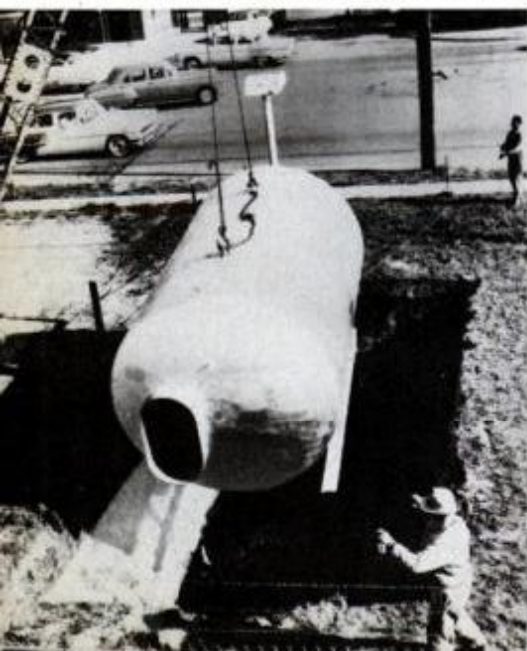
Now the unthinkable has become thinkable. Now, despite a dramatic growth in quantity and accuracy of nuclear weapons, military theorists talk of *survivors*.

80 million would survive

U.S. strategists today say that even if there were no civil defense effort, 80 million Americans would survive a nuclear attack. Efficient evacuation of people from the 400 urban, industrial and military centers into less risky, outlying areas could save as many as 100 million more. That analysis, plus the massive Soviet emphasis on protecting and evacuating its population and industry (see related story, page 000), has prompted a grinding change of gear in the U.S. civil-defense effort.

"We know that the Soviet Union has devoted substantial resources and planning to civil defense, and we know that the United States has done little and has little or no logistical ability," says Bardyl Tirana, the Pentagon's chief civil defense planner for the past two years. "We are facing up to the fact that we have very little capability of protecting our population from the conse-

1955: Blast shelter is dropped into a back-yard hole, in line with civil defense strategy based on hiding in shelters.



1979: Mrs. Adrienne Sahagian uses former fallout shelter as ceramics workshop. Today's strategy: flee from target areas.



quences of nuclear attack."

The proposal by Tirana and other federal planners to spend more than \$1 billion to develop a national evacuation program between now and 1985 has raised much controversy.

"It's madness," says Congressman Thomas Downey, a third-term Democrat from New York who is prominent among those advocating a new disarmament treaty with the Soviets. New civil defense spending is a waste of money, he and his colleagues argue. But critics and proponents of the latest civil defense strategy agree on one point: Fallout shelters, backbone of civil defense in the years of Camelot, don't offer much hope of shelter today.

Shelters would melt

The United States does have shelter space for 233 million people, but that comforting figure is deceiving. Much of the space is located in urban areas, where shelter walls would melt if the city were struck point blank by nuclear blast. Further, the distribution of shelters is uneven: Population outnumbers available space in suburban and rural areas.

During the 1960s, more than 165,000 tons of food, worth about \$122 million, were distributed to shelters throughout the country. In recent years, local authorities have been told to empty shelves of the food and medical supplies that were spoiled and rancid and had outlived their prescribed period of usefulness. Federal officials estimate that nearly half of local civil defense officials may not have complied with that directive. In some cases, the officials have simply lost track of the rations. In Detroit several years ago, workmen razed a building and discovered a cache of old crackers and cheese, buried to sustain bomb survivors and then forgotten.

At one time, there were about a million home shelters. But in recent years many have fallen into disuse or been converted for storage, recreation rooms and mushroom farms.

In the early 1950s, Nathaniel Hess of Long Island told builders to add an extra layer of cement and include a bomb shelter in his new home. "It was built to withstand anything but a direct hit from an atom bomb," he says. But with time, his fervor waned and he had the basement complex of extra doorways and air vents made into a wine cellar.

Charles Sahagian of Massachusetts built his fallout shelter in 1961 for about \$200. Today, it's a ceramics workshop. The conversion came af-

(Please turn to page 212)

THE CIVIL DEFENSE 'GAP'—HOW DANGEROUS?

The illustrations at right are from a book published nearly 10 years ago in the U.S.S.R. and titled: *Civil Defense, A Soviet View*. Among the book's less technical drawings, they show various items of clothing that can be provided for, or improvised by, both military and civilian nuclear blast survivors for protection from radioactive fallout; at the bottom is a diagram showing how high a shaped mound of earth should be piled to provide blast protection for a dwelling.

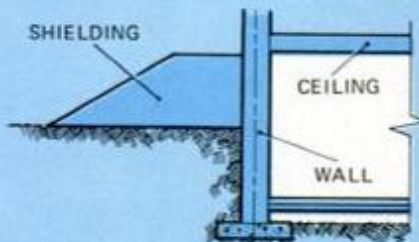
Widely circulated in the Soviet Union, and apparently read, the book refers to elaborate and complex evacuation plans for communities of all sizes, as well as to sheltering and "hardening" of vital utility and industrial sites for immediate startup following an atomic attack. It has been one of the major sources of a growing "hawk/dove" controversy among United States civil defense experts and military strategists. Even moderates admit that it is further evidence that the average Russian is considerably more informed on the contingencies of nuclear war than the average American. The most alarmist consider it proof that the Russians believe nuclear war is survivable, therefore thinkable.

In the latter view, the fact that some 20 million Russians were killed in World War II has shaped Soviet strategy to the point where loss of 30 million today—consequences of an all-out nuclear war—and even fewer if civil defense plans are diligently undertaken, would be a justifiable risk to assure the destruction of the United States in a critical confrontation. In this scenario, a perfected and well-rehearsed Soviet plan for evacuation of cities and hardening of industrial sites becomes as significant a "weapon"—at the SALT talks, for instance—as a fleet of ICBMs.

A recent article in the *Bulletin of the Atomic Scientists*, by arms control expert Fred Kaplan of M.I.T., notes: "On paper the Soviet evacuation plan seems impressive at first glance. There are nine warning signals, each indicating different stages of a crisis . . . At the final alarm, ordering urban evacuation, the people are to take prespecified motorcars, trains or buses to prespecified shelters in rural areas . . . This entire procedure, according to Soviet documents, is to take 72 hours. . . ."

Kaplan goes on to say, however, that even on paper these plans are inadequate to protect anything close to 90 percent of the population, as the Soviets imply. Another arms control expert who takes issue with overestimation of Russian civil defense is Stanford physicist Prof. Sidney Drell. He quotes a recent government study asserting that U.S. forces could survive a complete surprise attack and still mount a strike sufficient to cause 60 million Soviet civilian casualties even if the urban population were to use the best available in-place shelters.

If the Soviets were to initiate a nationwide evacuation before attacking the United States, Drell adds, our own forces would presumably be put on alert. This simple change, he claims, would leave the poten-



tial level of Soviet casualties from a U.S. second-strike unchanged.

With regard to industrial hardening, tests carried out by the Boeing Co. and others show that vital equipment can be impressively protected from blast effects by simply packing dirt around it.

Says Drell: "Even buried facilities, if targeted, cannot survive."

Some observers note that Soviet citizens have reacted to civil defense drills with much the same apathy as Americans. But as tensions wax and wane, individuals on either side may decide that apathy is no longer their best policy. Still, many Americans apparently believe that even if nuclear war is survivable, it may not be worth surviving.—R.N.

THE CONVENTIONAL SULKY

DESIGN PLUS FLEXIBILITY MAY ALLOW WHEELS TO WANDER SLIGHTLY OFF TRACK

SEAT ON OR NEAR WHEEL AXIS; PART OF DRIVER'S WEIGHT OFTEN TRANSFERRED TO THE HORSE

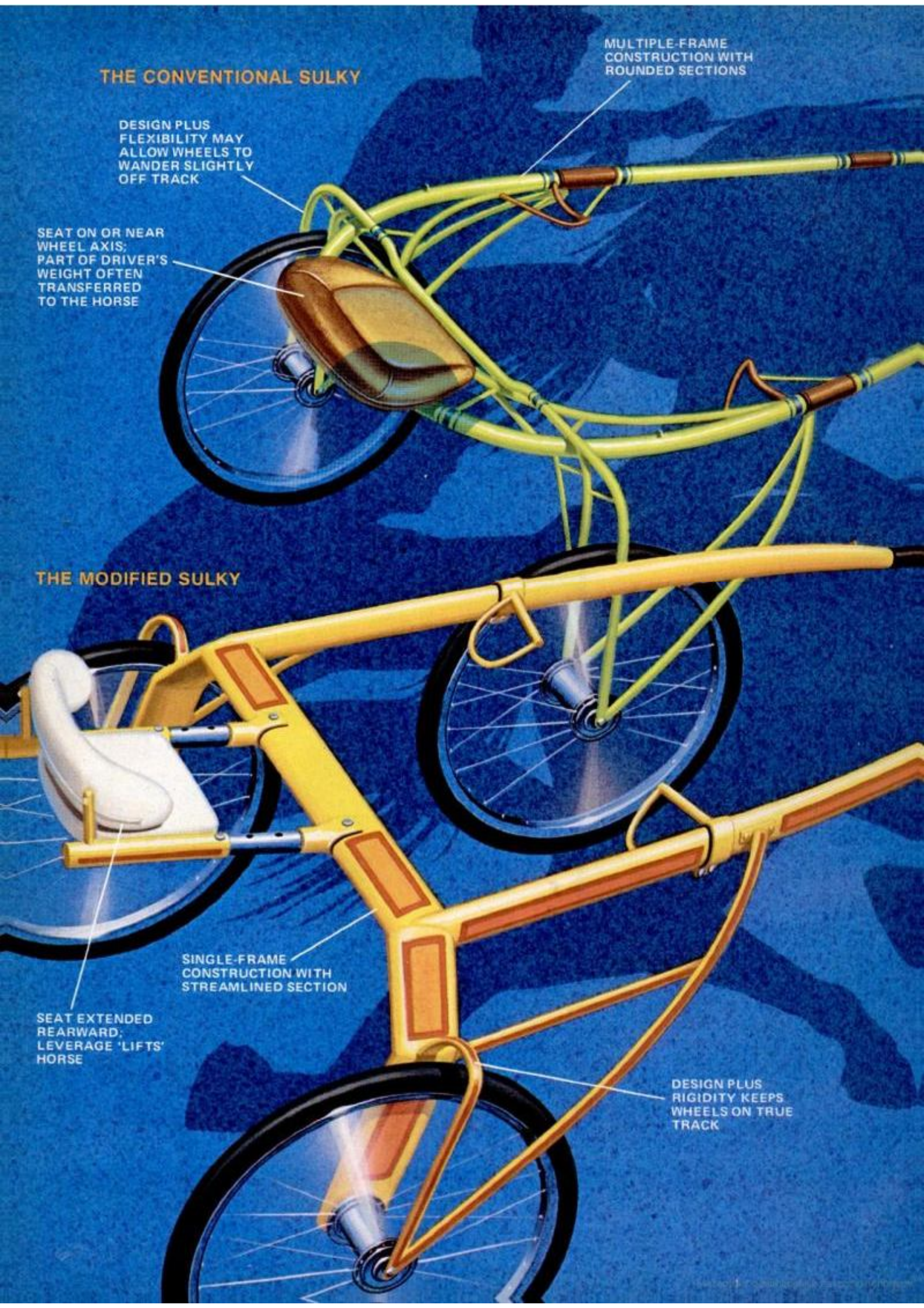
MULTIPLE-FRAME CONSTRUCTION WITH ROUNDED SECTIONS

THE MODIFIED SULKY

SEAT EXTENDED REARWARD; LEVERAGE 'LIFTS' HORSE

SINGLE-FRAME CONSTRUCTION WITH STREAMLINED SECTION

DESIGN PLUS RIGIDITY KEEPS WHEELS ON TRUE TRACK





High technology at the track

A space-age redesign of the traditional sulky has suddenly put the cart before the horse in harness racing.

by Charles Leerhsen

Bill Haughton, the world's richest harness racing driver, seemed to be holding an invisible pickle. "If it helps me just this much," he said, gapping his thumb and index finger, "I want it. I'm not sure what it does, and I'm not entirely convinced it does *anything*, but on the chance that it might, I want it."

Haughton, a winner of \$26-million in purses, was discussing harness racing's modified sulky—the mysterious and oftentimes controversial vehicle that has made a museum piece of its predecessor, the conventional sulky, practically overnight. Before the modified was introduced just three short years ago, every driver at every track used a rig that had changed only slightly since the days of Dan Patch. But by spring of the bicentennial year, harness racing—second only to thoroughbred racing in terms of overall "spectator sports" attendance—was in a mad rush to retool. Orders slowed to a trickle at the three sulky companies that had sewed up the American market generations ago, while the fledgling modified manufacturers, some of them mere back-yard operations, reaped the harvest.

No matter that the modified costs about \$1000 compared to the conventional's price tag of roughly \$700; the new sulky seems to work like magic. In its first 435 races at Long Island's Roosevelt Raceway the modified won 248 times, even though it was pulled by 1300 fewer starters than were "conventionals." Moreover, the trotters and pacers who used it tended to lower their individual records for the mile, the standard distance in the standardbred sport,

PM art: Dale Gustafson

After some three-quarters of a century as harness racing's standard conveyance, the traditional sulky has been outmoded by space-age engineering.



Biggest win for the modified sulky was the 1976 Hambletonian (finish above). After that, drivers began to pay attention.

and the faster times increased their value.

In 1974, the last unmodified year, the United States Trotting Assn. (USTA) recorded 685 two-minute miles, a measure of a horse's excellence. In 1976 there were 1849 races in two minutes or faster.

"The Racer's Edge," one modified-sulky maker dubbed his product. But for a few sweet weeks before everyone had them, the new bikes were the bettor's edge, too. An improver of the breed could have turned a tidy profit at Roosevelt simply by backing every horse hitched to the newfangled rig. One night, the bet-the-bike system produced a payoff of \$16,800.60 in the Pick Four—an exotic

wager involving a quartet of winners—for an investment of \$24.

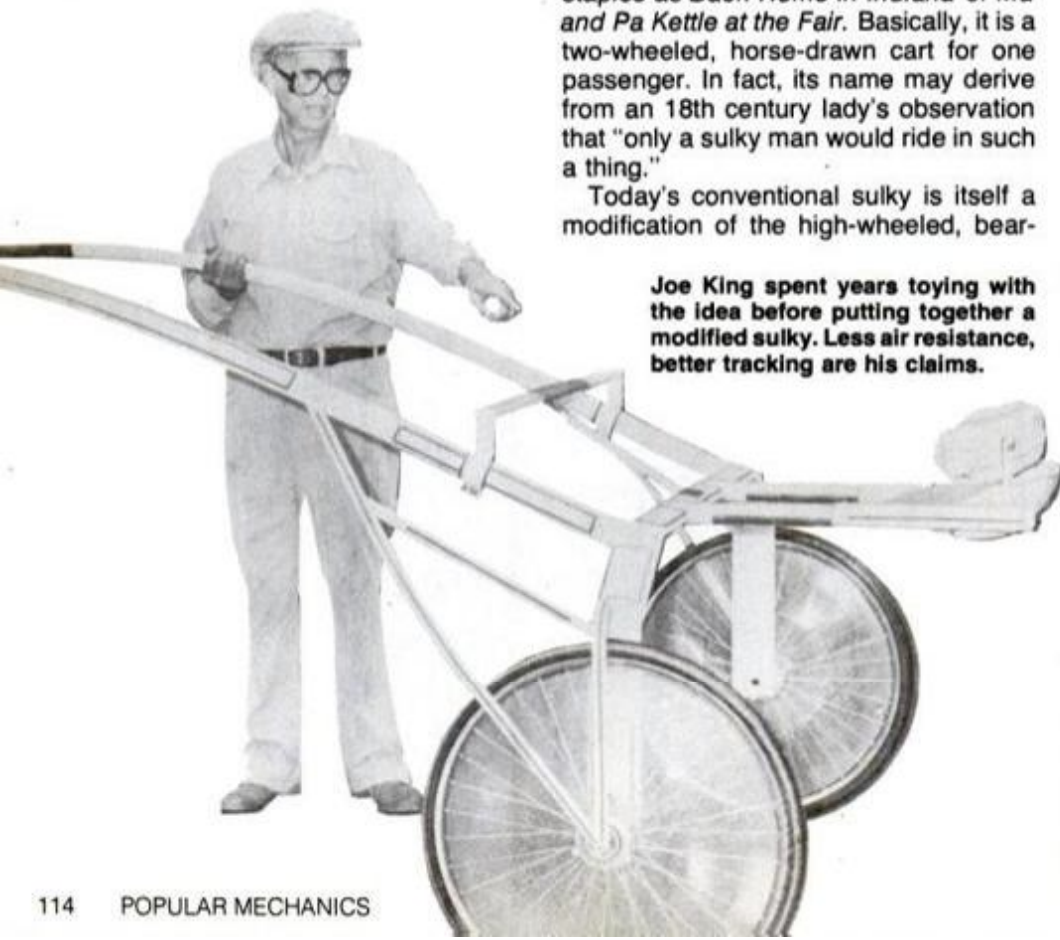
Yet most horsemen, even as they placed rush orders for the modified sulky, expressed skepticism. A typical reaction came from Del Insko, a top New York-area trainer-driver, who told racing writer Tony Sisti: "I use the modified sulky because the [horse] owners want it used. It's the popular thing right now. If I don't use it and I lose, my owners want to know why. . . . I use it to avoid those kinds of problems."

Today Insko's doubts linger, but not one of his 95 horses gets hitched to the old sulky. Ditto for Haughton, whose far-flung stable numbers 225.

Almost everyone has seen a sulky, if not at the track, then in such Late Show staples as *Back Home in Indiana* or *Ma and Pa Kettle at the Fair*. Basically, it is a two-wheeled, horse-drawn cart for one passenger. In fact, its name may derive from an 18th century lady's observation that "only a sulky man would ride in such a thing."

Today's conventional sulky is itself a modification of the high-wheeled, bear-

Joe King spent years toying with the idea before putting together a modified sulky. Less air resistance, better tracking are his claims.



Lift from seat leverage in modified (below) is obvious. But many drivers discount the importance of the streamlined frame.



ingless "bone rattler" that crops up in so many Currier & Ives prints. Standing against a barn, the conventional sulky resembled a large wishbone—wide at the bottom for freedom of hindquarter movement; narrower at points where it attached to the harness; curved outward at the ends so a horse would not poke himself on the turns. Its rounded shafts were usually made of white ash. Its wheels and suspension system owed much to the bicycle. Indeed, it was a Watertown, Mass., bikemaker named Sterling Elliot who turned out the first sulkies with small, steel-spoked wheels and pneumatic tires in 1892.

The modern-day Elliot is Joe King, a 65-year-old MIT alumnus who supervised the design of the Bell X-1 series of supersonic aircraft, was program manager for the Rascal air-to-surface missile, and worked as a safety engineer on the Apollo 11 moonshot. King began training harness horses as a hobby in the early 1950s—and started dabbling in the redesign of equipment shortly thereafter.

In a way it seems ironic that a fellow who developed a plane that could fly at Mach 2 at 70,000 feet would choose the slowest breed of racing horse. Unlike thoroughbreds or quarterhorses, standardbreds are not prized for their raw speed, but rather for their ability to accel-



Conventional sulky (above) looks well put together, but modified makers claim added stiffness cuts down wheel "wandering."



erate on either of two gaits, the trot or the pace.

There are certain things about standardbreds, however, that would make them attractive to King. In the first place, they are a do-it-yourself horse in the sense that an owner can take the reins for morning workouts and, with the proper licenses, nighttime races. Secondly, they are remarkably manageable animals; they can be repeatedly taken aside, experimented with, and retested in actual competition. And running horses, prima donnas by comparison, have much shorter competitive lives.

After a few hundred miles in a conventional sulky, King was thoroughly appalled: "Aerodynamically, the conventional was a real disaster, comparable to the Wright biplane with its interconnecting struts and brace wire," he says. "It simply had too much drag."

King fiddled with the design of a new bike and off from 1952 to 1971. Still, the staunchly conservative harness racing industry was not ready for what he first delivered: a single-shaft sulky. It had one aircraft-quality steel tube that started in the middle of the arch (seat-support bar), rose high over the horse's rear end and then ran downhill to the harness. The single-shaft was one weird-looking rig. To

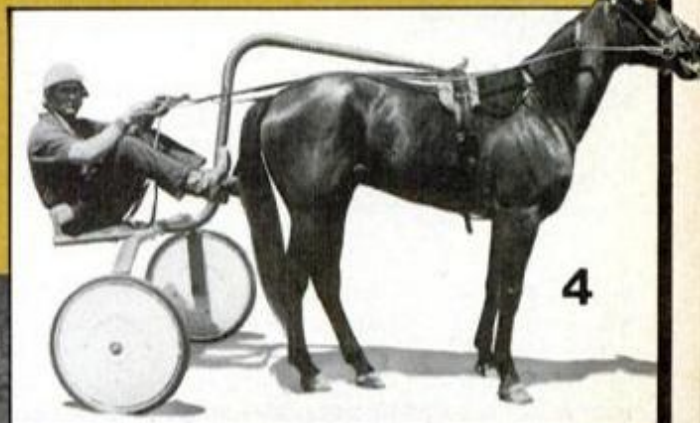
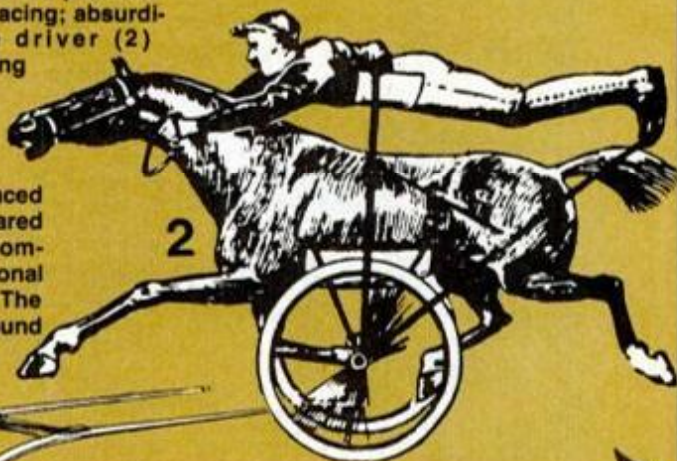
(Please turn to page 188)



A CENTURY OF TURNING CARTWHEELS

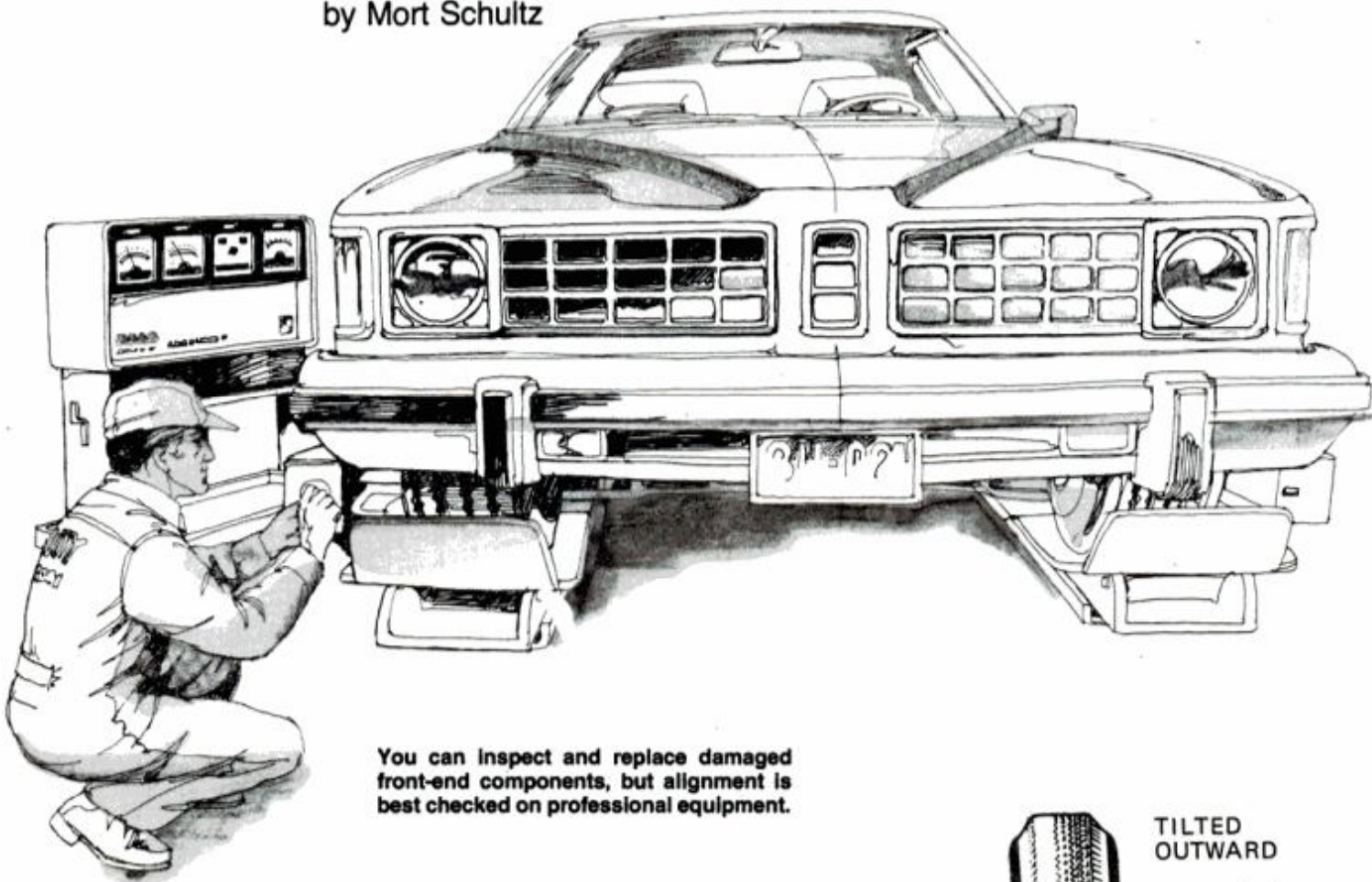
The standard high-wheel sulky (1) of post-Civil War America was known as the "bone-rattler." Replicas and originals are exhibited at the harness racing museum in Goshen, N.Y. Back-yard inventors have not ignored the possibilities offered in harness racing; absurdities like the prone driver (2) coexist with those having possible merit—like the single-wheeler (3). Joe King's single-shaft sulky (4) preceded today's modifieds. It was raced in the early '70s and appeared to do very well. But complaints from the conventional set (said one driver: "The horse can turn right around

and look you in the eye!") led to its banning on safety grounds. The "wishbone" sulky (5) was an attempt at a legal cart using single-shaft materials, but it never caught on.



Now that winter potholes have taken their toll... Know how to check your front end

by Mort Schultz



You can inspect and replace damaged front-end components, but alignment is best checked on professional equipment.

According to the Automotive Information Council, damage suffered by the nation's roads during the winter of '77-'78 led to \$882 million in damage to tires, steering systems, suspensions and brakes.

With Proposition 13-type budgets a fact of life, this year's toll will be greater. The size of road repair crews has been cut to a minimum or crews cease to exist altogether, and roads are a mess.

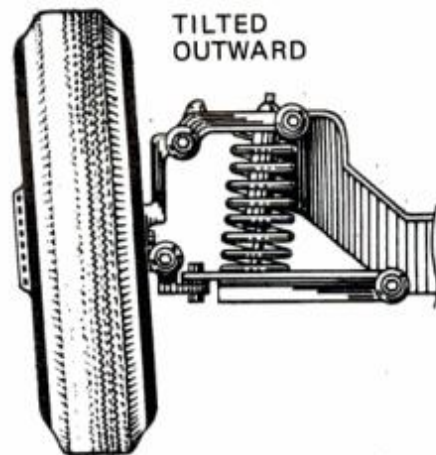
As your car is battered by potholes and massaged by washboard ridges this spring, your safety and the safety of passengers may be put in jeopardy. Damage to steering linkage, suspension components and front end can make a car difficult to steer and control.

Even more pronounced will be the

effect of road damage on tires. Poor pavement bruises tires and knocks front-wheel alignment out of whack. Unless misalignment is detected early, tires wear out.

"A car with improper alignment can easily destroy an expensive set of tires in less than a month," says an engineer at Bear Manufacturing Co. Bear is a major manufacturer of front-end-alignment equipment. (The terms "front-end alignment" and "front-wheel alignment" mean the same. They refer to the geometry of the front wheels.)

What can you do about the destructive forces caused by winter-battered roads? You can recognize what happens to a car as it travels these roads day after day and take steps to minimize the damage.



TILTED OUTWARD

Too much positive camber causes greater wear on outside shoulders of front tires.

Alignment problems certain

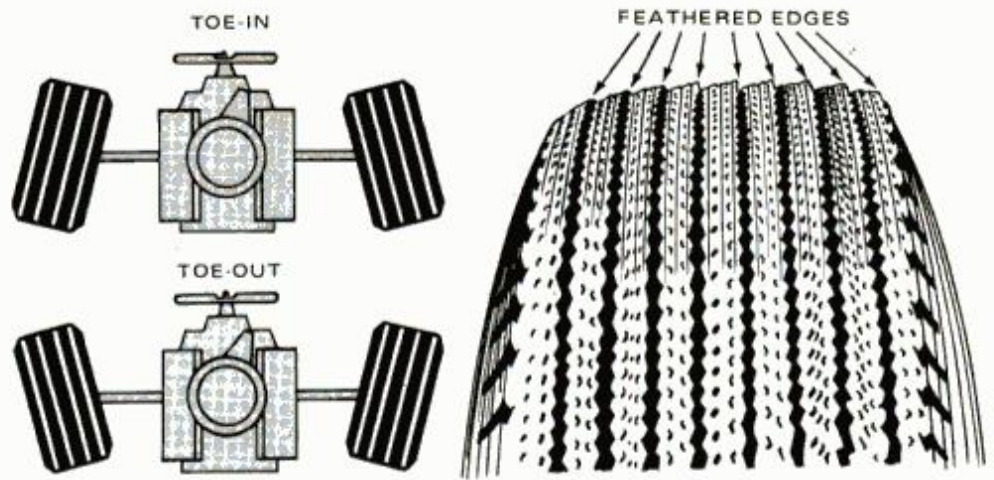
When a car is beaten by rough pavement, front-end alignment is almost always affected. The wheels literally lose alignment. To prevent premature tire wear and control

problems, correct alignment has to be re-established.

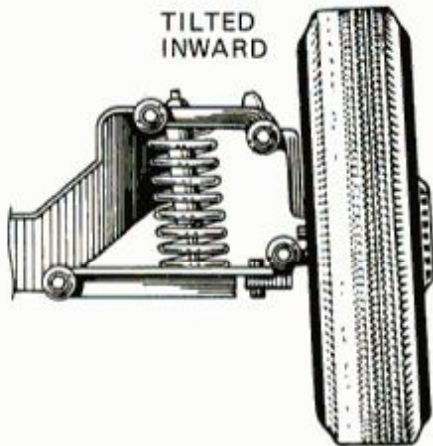
Alignment affects the ability of a vehicle to follow a true course on the highway with minimal steering effort on the part of the driver. There are five angles connected with wheel alignment. They are camber, caster, toe, steering axis inclination and turning radius.

Each angle works in harmony with the others. When one angle deviates from a specified setting, a deleterious influence is exerted on steering, control and tires.

Camber refers to the angle of wheels from true vertical. When camber angle is properly set, tire contact on the road is more nearly under the point of load when the car



Slight toe-in condition is normally specified since wheels tend to line up parallel at speed. Incorrect toe-in setting will result in abnormal tire wear as shown at the right.



Negative camber that exceeds spec will cause wear on inside shoulders.

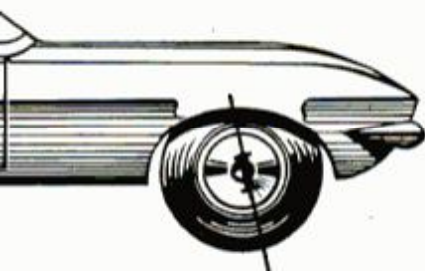
is in motion. In other words, tire tread is flat on the road.

When camber angle is not right, there is excessive pressure on the portion of tread that meets the road. This causes abnormal tire wear on that section. Pressure also puts undue load on the ball joints and wheel bearings.

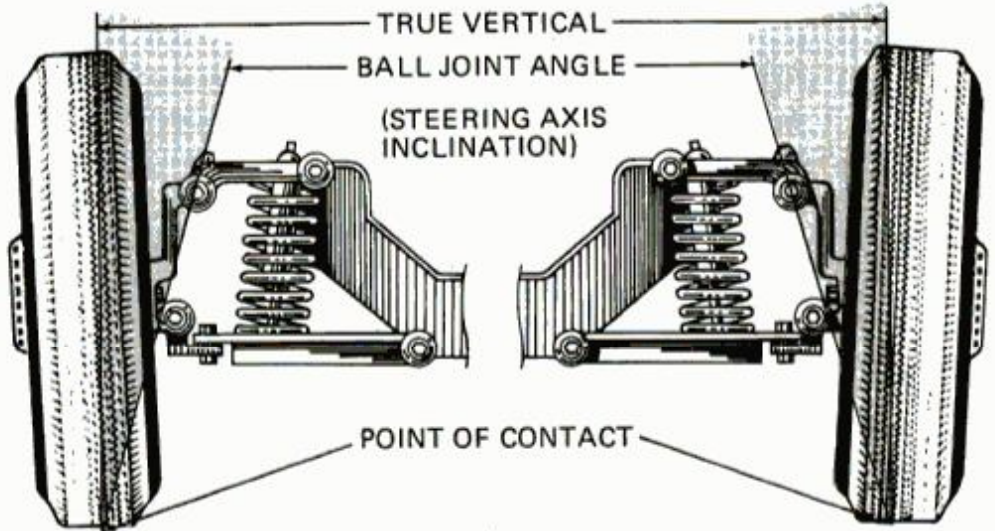
If there is too much positive camber, wear develops on the tire's outer shoulder. Positive camber is the outward tilt of the wheel at the top from true vertical.

Excessive negative camber makes the tire wear on the inner shoulder. Negative camber is the inward tilt of the wheel at the top from true vertical.

Improper camber setting is often



Positive caster is backward tilt of wheel spindle; it helps wheels track properly.



Damaged ball joints can affect steering axis inclination, which is the inward tilt of the ball-joint axis. Inclination that's not to specification will affect steering stability.

detectable by the way a car handles. When camber is not correct, a car often pulls to one side without brakes being applied. If camber setting is not equal from one wheel to the other, you will usually feel shimmy at low speed.

Keeping wheels straight

Caster is the tilt of the wheel spindle. Its effect on the vehicle mainly involves steering and handling.

Correct caster is needed to keep wheels tracking straight. It's also needed so wheels return to straight ahead from a turn.

Too much caster makes a car with manual steering hard to steer. If your car has power steering, too much caster creates shimmy at low speed, and shock and wander at high speed.

If there is a difference in caster angle between the two wheels, the car will pull to the side having the least caster when brakes are applied.

Negative caster at one wheel and positive caster at the other wheel causes the car to drift and to pull when brakes are applied since the wheel with negative caster tries to

turn outward. Negative caster is the forward deviation of the wheel from vertical. Positive caster refers to the backward deviation of the wheel from vertical.

Toe—the wheel alignment angle with the greatest effect on tire life—is a setting that compensates for the tendency of wheels to spread out when a car is in motion.

When toe is set to specification, wheels roll freely without scuffing across the road surface. When toe is not to specification, tires scuff. The first indication of this is the appearance of feathered edges on tread ribs.

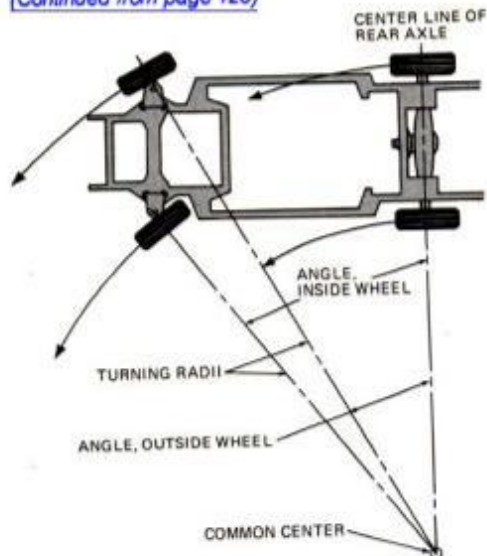
Toe means the difference in distance between the front of the wheels and the rear of the wheels. The proper toe setting keeps wheels parallel to each other when they are moving. In other words, for wheels to roll freely so tires don't wear down, the toe setting specified by the car manufacturer allows toe to be as near zero as possible when the vehicle is moving.

More angles on angles

The other two alignment angles—steering axis inclination and turn-

HOW TO CHECK YOUR FRONT END

(Continued from page 120)



Inner and outer wheels turn freely in turns when turning radii angles are to spec.

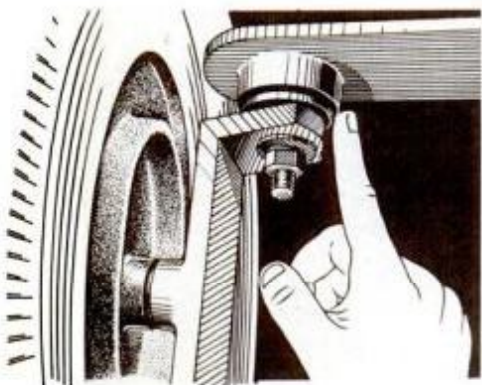
ing radius—depend on the condition of front-end parts for their proper settings. Camber, caster and toe angles can be knocked away by the car hitting a pothole. Physical damaged to a component need not be involved.

But this is not so with steering axis inclination and turning radius. If either angle is out of spec, there is a damaged part which has to be replaced.

Steering axis inclination is the tilt of the ball-joint axis inward toward the center of the car. If steering axis inclination is not to specification, the ball joint tends to rise rather than to seek its natural position, which is to stay as low as possible. This affects steering stability and keeps wheels from turning easily.

A vehicle loses its ability to maintain correct steering axis inclination when there's excessive play in a ball joint, or when the wheel spindle or wheel spindle support arm, which are parts associated with a ball joint, is bent. Replace the damaged part.

Turning radius refers to the amount that one front wheel turns



When checking ball joints, look for cracks, grease, other indications of damage.

in relation to the other. Set to specification, turning radius allows wheels to roll freely on turns. Turning radius is also called toe-out on turns.

Turning radius depends for its setting on the other alignment angles. As long as these angles are within specification, turning radius will also be correct unless the steering arm is bent. Thus, if your car shows correct camber, caster, toe and steering axis inclination, but turning radius is not to specification, replace the steering arm.

Alignment's not enough

The toe of every car I know is adjustable, usually by turning adjusting sleeves on tie-rod ends and measuring the distance between wheels. The camber and caster of most domestic cars are also adjustable by turning adjusting bolts, or adding or subtracting shims from the steering control mechanism.



Alignment angles can't be held if you've got a loose idler arm. Check it carefully.

On some models, especially foreign makes, camber and/or caster cannot be adjusted. Deviation from the specified setting indicates damage to a steering or suspension system component. The damaged part has to be replaced to bring camber and/or caster back to spec.

Alignment angles are measured and adjusted on an alignment rack that costs from \$2000 for a mechanical system to over \$8000 for electronic instrumentation. The job will cost you \$15, give or take a couple of dollars. You should not try setting angles yourself by feel, observation, ruler or whatever. Professional equipment is needed to do your alignment job right.

The procedure for using this equipment is outlined in manuals for the technician by the equipment manufacturer. Procedure varies from one make of equipment to the next. However, the alignment specifications for your car are dictated by the manufacturer of your car. Use no other specifications than these to guarantee accurate alignment.

Having a professional technician set alignment is not enough to as-



Loose tie-rod ends will cause shimmy, poor steering control and abnormal tire wear.

sure that alignment will be maintained after you leave the garage. Wheels may show perfect alignment on the rack, but lose alignment the minute you take your car out for a test drive.

Why? Because of an undetected loose or damaged steering or suspension system component.

Listen to what Bear Manufacturing says about this: "Every good alignment job starts with a careful inspection for worn and damaged suspension and steering parts."

And to the opinion of Moog Industries, a leading manufacturer of components: "If worn or excessively loose front-end parts are present, but overlooked, a car will probably not hold its alignment and can develop premature tire wear."

Finally, this is what TRW, another major manufacturer of components, has to say: "The ability of a car to hold proper alignment is di-



Body-height checks at all four wheels will reveal possible damage to your springs.

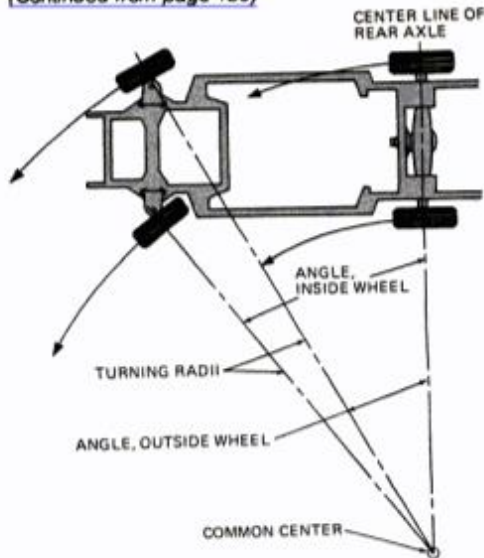
rectly affected by the condition of parts in the steering system. Although these parts don't support a great deal of weight, they are subject to jarring, twisting and turning forces (especially on winter-damaged roads) that tend to wear them and create looseness."

It boils down to making sure that the technician who does alignment for you performs the following checks before he sets angles. Don't

(Please turn to page 200)

HOW TO CHECK YOUR FRONT END

(Continued from page 120)



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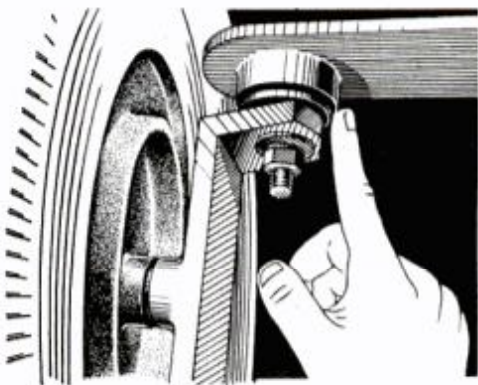
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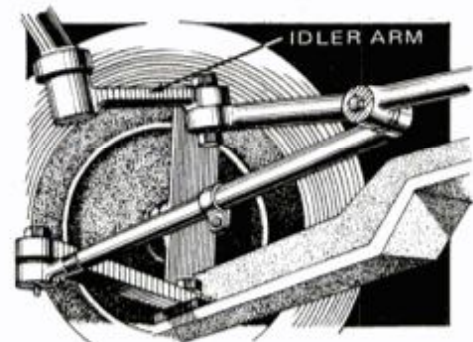
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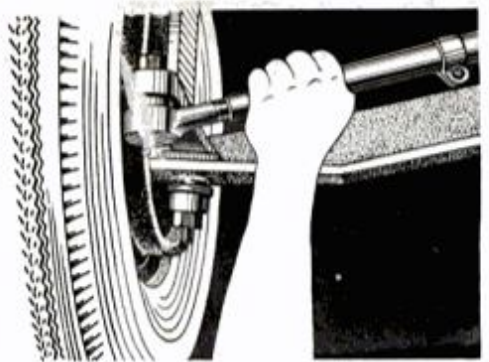
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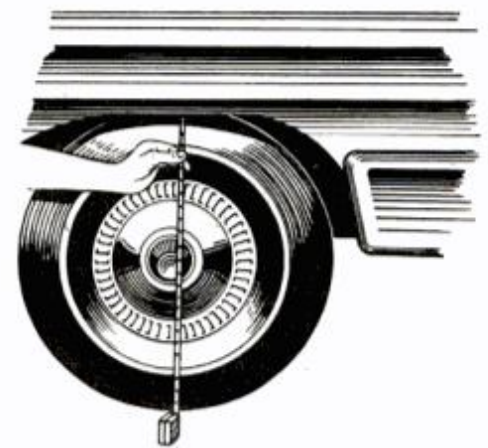
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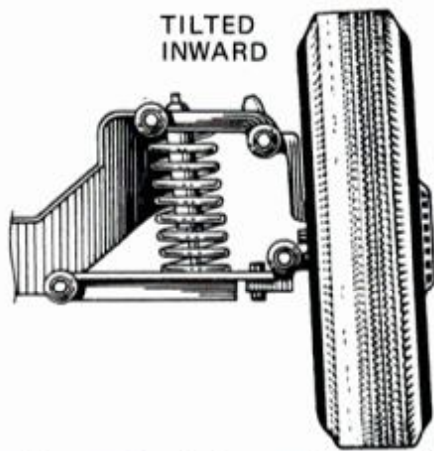
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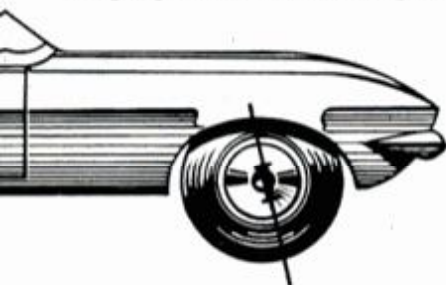
is in motion. In other words, tire tread is flat on the road.

When camber angle is not right, there is excessive pressure on the portion of tread that meets the road. This causes abnormal tire wear on that section. Pressure also puts undue load on the ball joints and wheel bearings.

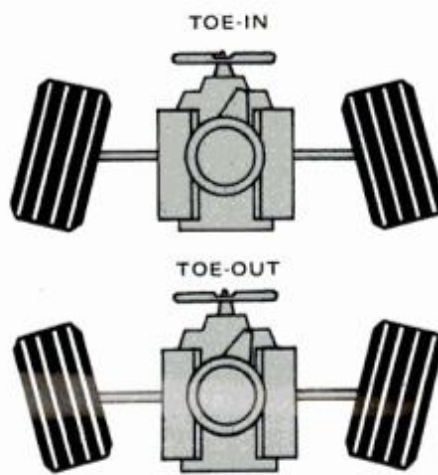
If there is too much positive camber, wear develops on the tire's outer shoulder. Positive camber is the outward tilt of the wheel at the top from true vertical.

Excessive negative camber makes the tire wear on the inner shoulder. Negative camber is the inward tilt of the wheel at the top from true vertical.

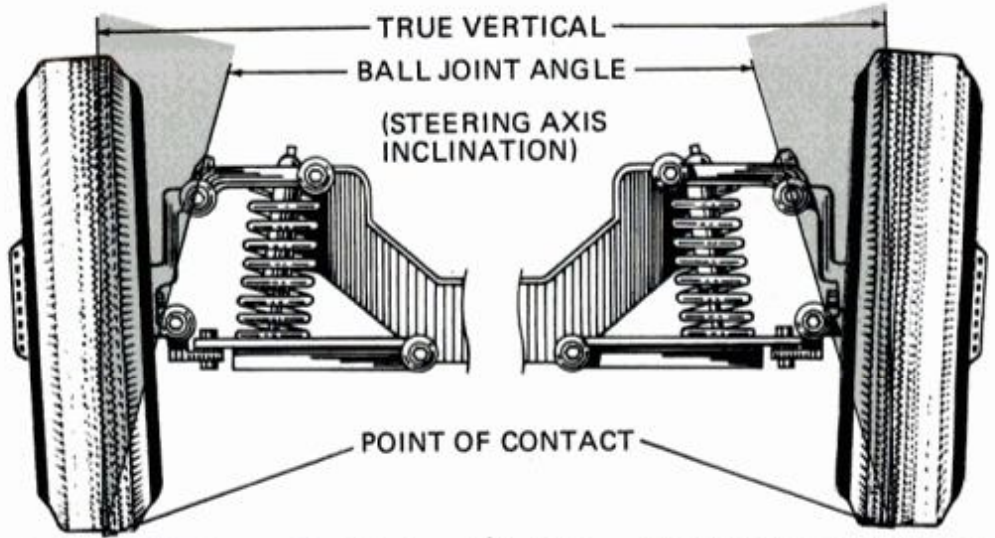
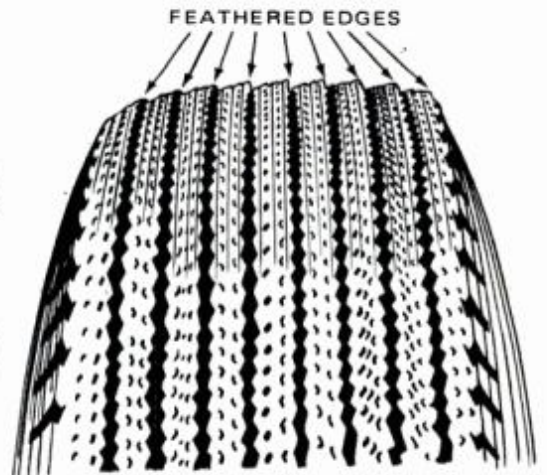
Improper camber setting is often



Positive camber is backward tilt of wheel spindle; it helps wheels track properly.



Slight toe-in condition is normally specified since wheels tend to line up parallel at speed. Incorrect toe-in setting will result in abnormal tire wear as shown at the right.



Damaged ball joints can affect steering axis inclination, which is the inward tilt of the ball-joint axis. Inclination that's not to specification will affect steering stability.

detectable by the way a car handles. When camber is not correct, a car often pulls to one side without brakes being applied. If camber setting is not equal from one wheel to the other, you will usually feel shimmy at low speed.

Keeping wheels straight

Caster is the tilt of the wheel spindle. Its effect on the vehicle mainly involves steering and handling.

Correct caster is needed to keep wheels tracking straight. It's also needed so wheels return to straight ahead from a turn.

Too much caster makes a car with manual steering hard to steer. If your car has power steering, too much caster creates shimmy at low speed, and shock and wander at high speed.

If there is a difference in caster angle between the two wheels, the car will pull to the side having the least caster when brakes are applied.

Negative caster at one wheel and positive caster at the other wheel causes the car to drift and to pull when brakes are applied since the wheel with negative caster tries to

turn outward. Negative caster is the forward deviation of the wheel from vertical. Positive caster refers to the backward deviation of the wheel from vertical.

Toe—the wheel alignment angle with the greatest effect on tire life—is a setting that compensates for the tendency of wheels to spread out when a car is in motion.

When toe is set to specification, wheels roll freely without scuffing across the road surface. When toe is not to specification, tires scuff. The first indication of this is the appearance of feathered edges on tread ribs.

Toe means the difference in distance between the front of the wheels and the rear of the wheels. The proper toe setting keeps wheels parallel to each other when they are moving. In other words, for wheels to roll freely so tires don't wear down, the toe setting specified by the car manufacturer allows toe to be as near zero as possible when the vehicle is moving.

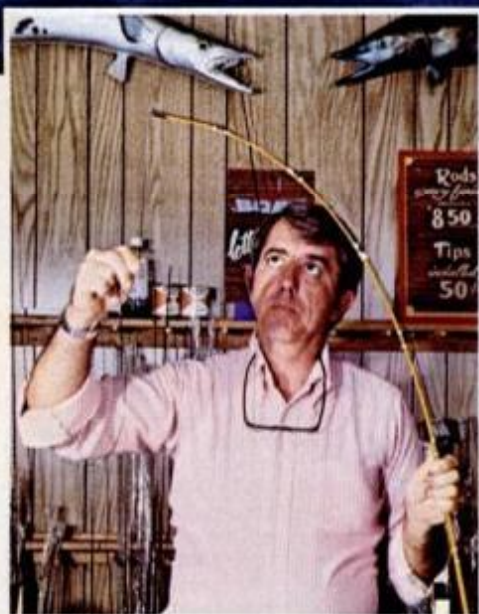
More angles on angles

The other two alignment angles—steering axis inclination and turn-

Make your own take-along custom rod

You'll have one that exactly fits your suitcase, and it'll be styled to suit your taste.

by Bob Stearns



By flexing rod carefully, famed custom-rod builder, Miamian Ned Segar, notes rub of line on blank as he checks position of the line guides temporarily taped to the rod.

If you're like most fishermen and must travel to get to the water, you'll find this compact, customized suitcase rod particularly handy. You needn't bother with the usual long fishing-rod storage and shipping tube or case—just pick a length that will be most suitable for stowing in your bag or backpack.

Almost any rod, even your present ones, can be converted into a compact model by means of fiberglass ferrules, but the best rod of all is the one that is designed from scratch for this purpose. The technique is quite simple and can be used for spinning, baitcasting and fly rods. Don't try it, though, with graphite rods or rod blanks. The ferrule systems that fit together sections of graphite rods are complicated and



Ready for action: Record-holding Miami angler Chico Fernandez (above) unlimbers our suitcase rod to test tarpon and snook in the Everglades.

A personalized rod requires only a few simple supplies and about five hours of work. Blanks, guides, grip, epoxy, wrapping thread and varnish, stand and wax are essentials.



Cuts for ferrules in new or old rod come after careful measurement and can be made close to line guides or between them to divide rod into lengths that are easy to pack, yet will be able to retain the rod's strength and flexibility.



An underwrap base for the feet of the line guide provides an added contrasting color. Guide is held in place with masking tape as each foot receives wrap to secure it.

Divided and ferruled into lengths to suit the travel needs of its owner, custom rod has attractive diamond wrap next to the grip.



...And don't forget to SAFETY CHECK YOUR TIRES



Minimize the likelihood of a blowout by knowing how to inspect your tires.

Damage from potholes or neglect—or defects in a tire from manufacturing—could lead to a blowout the next time you hit the road.

Radial tires, bias and belted-bias tires often give warning that they're about to fail. These warnings can be seen and/or felt. If you're aware of the warning signs and check your tires often, you shouldn't find yourself in the position of trying to control a car which has just blown a tire.

For example, a steel-belted radial that is on the verge of failing may develop blisters or bubbles on the sidewall, or the tire may develop a distorted tread pattern, uneven wear or an out-of-round condition. These defects will alter the car's ride, and vibration will probably become apparent.

You don't have to be a professional tire technician to detect a problem like this. However, you do have to know what to look and feel for. Before discussing these "visual" and "feel" trouble signs, let's review the basics about tire safety:

1. Make sure tire size, load range and construction meet manufacturer's recommendations, and that tires on the same axle are not mismatched. Mismatched tires can seriously affect odometer readings, vehicle ground clearance and tire wheel-well clearance.

2. Check tire air pressure at least once a month, using your own accurate tire gauge. At this time, inspect tires for damage.

3. Stay aware of changes in driving feel. A vibration may be caused by a problem in steering or by the condition of the road. On the other hand, a vibration may be caused by a tire that is about to blow.

4. If a tire is worn or otherwise defective, get rid of it. Surveys show that too many of us take chances. For instance, a recent survey of 4500 in-use tires across the United States showed that 1125 of them were worn below the tread-wear indicator (danger) level.

The things to look for when you eyeball your tires are listed in the chart below.

Trouble signs you can feel

Expert test drivers rate abnormal tire performance in three categories: (1) vibration, (2) wobble (or waddle) and (3) lateral pull.

Some drivers believe a fourth characteristic, harsh ride, is also abnormal, but it isn't. The first time you drive a car having radial tires you might get a feeling of firmness, which is more evident at slow speeds. Some drivers call it harshness. This comes from the stiff belts used in radial-tire construction.

You'll get used to it. If you don't, the only way to avoid the firm ride is to switch to bias or belted-bias tires.

A harsh ride does not indicate a tire malfunction. Vibration, wobble and lateral pull might.

Vibration can be hazardous

A car can vibrate for many reasons. Often the reason is mechanical, such as a worn or damaged steering or suspension component, or an out-of-balance driveshaft. But just as often the reason is a tire problem. If the tire problem is physical damage, vibration usually warns of a safety hazard.

Physical damage may have occurred when the tire was mounted. A damaged bead could cause an undetected loss of air. The

underinflated tire would overheat and, in time, weaken and blow out.

Physical damage can also result from a manufacturing problem that caused steel belts to separate from the tire body. This would put belts in a position to burst through the sidewall or tread surface when the car is driven at high speed. Vehicle vibration should never be dismissed as insignificant.

Vibration is a continuous or cyclical shaking in the steering wheel, floor pan or seat when driving at a steady speed between 55 and 65 mph on a smooth road. If the shake is caused by a tire, you can often isolate the location.

If a front tire-wheel assembly is at fault, the steering wheel, front fenders, hood and/or instrument panel have a tendency to shake. If a rear tire-wheel assembly is at fault, the sensation is usually felt in the floor and/or seat. If the whole car vibrates, a front and rear tire-wheel assembly may be responsible.

When vibration occurs, taking the car to a mechanic who has a piece of specialized equipment known as a Tire Problem Detector (TPD) will permit a quick, accurate diagnosis. Cadillac dealers often have a TPD.

The TPD allows the mechanic to establish with one test whether vibration is caused by a defective tire, unbalanced tire-wheel assembly

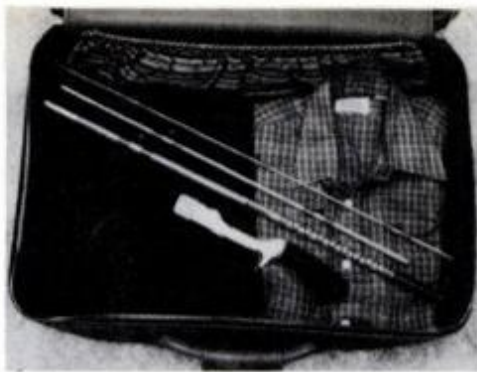
(Please turn to page 200)

VISUAL TROUBLE SIGNS

SIGN	PROBABLE CAUSE	CORRECTION
Abnormal wear of outside tread.	Underinflation.	Check inflation frequently with tires cold (not run for three or more hours). Inflate to spec.
Abnormal wear of center tread. Cuts and bruises from hitting objects and potholes also result when tires are overinflated.	Overinflation.	Check inflation frequently with tires cold (as above).
Tread-wear indicators appear over two or more adjacent grooves, but wear pattern is even.	Normal wear.	Replace tire.
Left front and right front tire wear is not equal.	Front-wheel misalignment.	Check wheel alignment. Rotate tires. ¹
More wear on one side of front tires than on the other side.	Front-wheel misalignment.	Check wheel alignment. Rotate tires. ¹
Treads of front tires are scuffed (feather-edged) on one side of tread ribs or blocks.	Front-wheel misalignment.	Check wheel alignment. Rotate tires. ¹
Cupping (spotty wear).	Front-wheel misalignment, imbalance or underinflation.	Check inflation, front-wheel alignment and tire-wheel balance. Rotate tires. ¹
Out-of-round condition when tire is viewed head-on (bumps, bulges, knots).	Impact. ²	Replace tire.

¹ Some manufacturers say radial tires don't have to be rotated if wear is even and normal. Rotate if uneven or irregular wear develops and switch radials front to rear on same side of car.

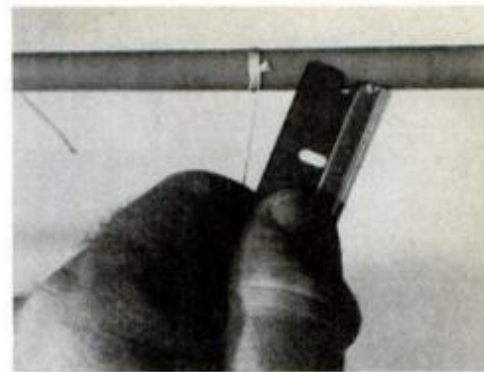
² Radials have tended to develop tiny cracks on sidewalls prior to tire failure. Goodyear says this is often caused by ozone in the air. If cracks penetrate into the cord body, replace the tire.



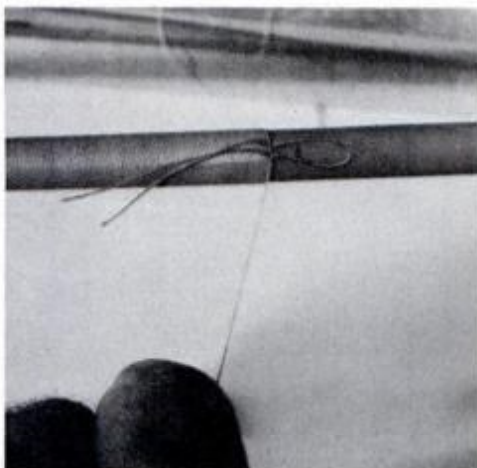
Positioned diagonally, your suitcase rod will be protected without that extra rod case, can slide under an airplane seat.



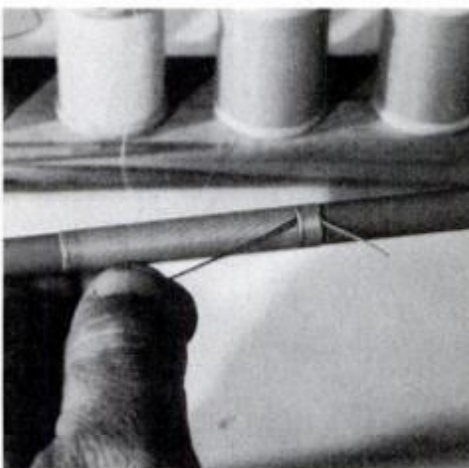
After guides are taped in position on rod blank, equal lengths are marked on each side of guide feet for area of underwrap.



Wrapping is started with end tucked under to anchor it. Frayed tip is then trimmed off with razor, wrap wound to other mark.



To finish off a wrap, thread loop can be positioned near end, covered with wraps up to mark. End is then threaded in loop.



By pulling loose end of the loop with wrap end threaded through, end anchors out of sight under wrap and is trimmed off.



Four-inch plug, cut from solid white fiberglass blank, has been sanded; larger taper will be epoxied into hollow blank.

the work must be done at the factory. Otherwise there is great danger that you may split an expensive blank.

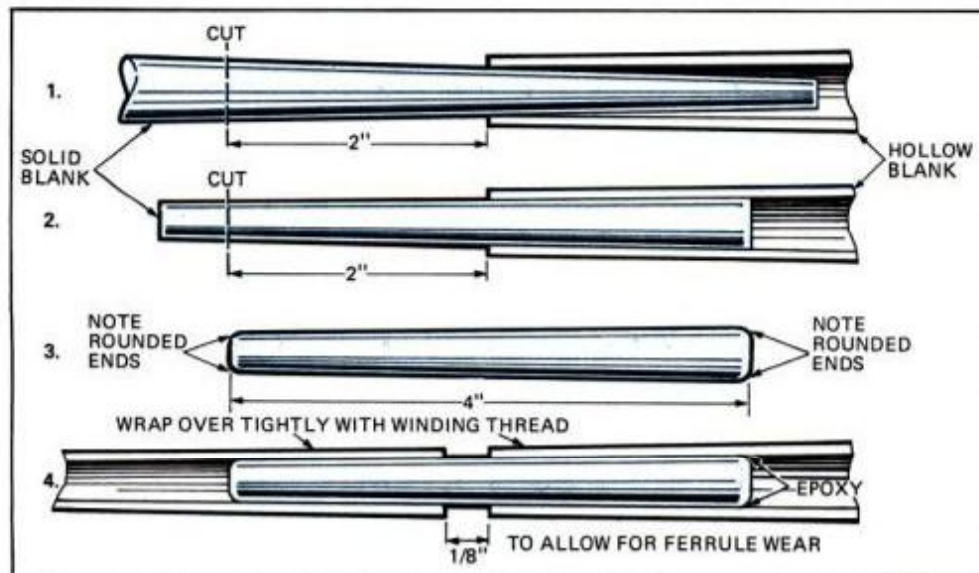
Internal fiberglass plug ferrules are extremely tough and will not weaken the rod if installed correctly. The rod will actually become stronger at the joints and, because the ferrules themselves are fiberglass, too, unwanted stiffening at ferrules is markedly reduced. This allows the

rod to retain most of its natural action.

We went to Ned Segar of Rodmakers Supply in Miami, Fla., for a how-to-do-it demonstration. He is considered one of the top custom-rod creators in the country. For a suitcase model, he selected a Lamiglas SC-69-1F blank to be mated to a Fuji Speed Casting Handle (Model OCB). The 5½-foot blank has light action for casting light lures. With the handle,

the finished rod totals 6½ feet, yet when disassembled the longest piece is just 26 inches. This lets the rod be easily fitted diagonally into a 24-inch suitcase that will slide under an airline seat.

Construction of the rod shown took about five hours. If you want to do further customizing with more diamond wraps in various colors, you can lavish extra hours on your project. The cost of components was approximately \$30. The same rod from a custom builder would cost \$65 to \$85 or more.



After rod has been cut at ferrule position, solid blank is fitted into larger section and cut 2 inches on each side of its center. Tight fit and gap allow for plug wear.

Determine section length first

First and most important step is to determine how many sections the rod must be divided into for manageable packing. For the rod shown here, three sections requiring two ferrule joints were sufficient, since the handle would also come off and attach to the rod with a Fuji adapter ferrule sold just for that purpose. This particular blank had a relatively slow taper near its light tip, so it was better to avoid ferruling it too close to the tip. Blanks of faster tapers can be ferruled at points along the blank that divide the sections almost equally. Longer blanks, such as fly rods, may need to be ferruled

(Please turn to page 215)

Play ball! You can make this game in a weekend



PM photos and construction: Rosario Capotosto

You'll enjoy endless hours of baseball excitement.

by James F. O'Brien

Adults as well as kids will want a turn at bat with this inexpensive game that's easy to build. If the large marble used as a ball lands in one of the circular depressions, you're out. If it lands in one of the areas marked "one base," "two base" and so on, it's scored as a hit. Standard baseball rules regarding fair and foul balls apply. Draw a separate baseball diamond on a piece of cardboard and use markers to represent the runners. Also use it as a scorecard to keep track of the inning, number of outs and runs scored.

How the game works

By manipulating the levers on the sides of the game board, you hurl a

fast ball or a slow ball. To pitch a fast ball, cock the pitching sling and simply pull the trigger marked F. The fast-ball release bar is cut with an angle at one end which, when pulled away from the L-shaped sling, sends the marble toward the batter. To pitch a slow ball, cock the sling as usual, push the lever marked S toward the playing field, then pull the trigger marked F. The travel of the pitching sling will be stopped short at the notch filed into the end of the slow-pitch bar and the marble will be delivered with less velocity.

For added challenge, a pitching contestant can cup hands over the fast and slow levers to conceal his actions and keep the batter guessing. Easily replaced rubber bands are used to hold both the release bar and stop bar in their normal positions while a third rubber band powers the pitching sling.

To swing the bat, pull it back and

then release it with your fingers. A rubber band tacked to the underside of the game and attached to a pulley and hook assembly transmits the power to the bat.

Building the game

Cut the game board to size from $\frac{3}{4}$ -in. A-D fir plywood. Game sides can be made of solid pine or other easy-to-work wood measuring at least 1 in. thick. We chose poplar. Five-quarter stock which measures $1\frac{1}{16}$ in. will do just fine.

Mark the locations of the depression on the good face of the plywood board. At each mark, bore a hole of the same diameter as the pilot tip of your $\frac{1}{2}$ -in.-radius cove router bit. The holes allow clearance for the pilot so you can plunge the router straight down to obtain a neat spherical depression. Set the router base so the bit projects about $\frac{1}{2}$ in. Hold the router perpen-

dicular and turn on the power.

Work the pilot into the hole, then slowly push straight down. When you reach the bottom, pull the router straight up and away. Plug the pilot holes with filler. Before routing out the home-run well, cut a $\frac{9}{16} \times 2\frac{3}{4}$ -in.

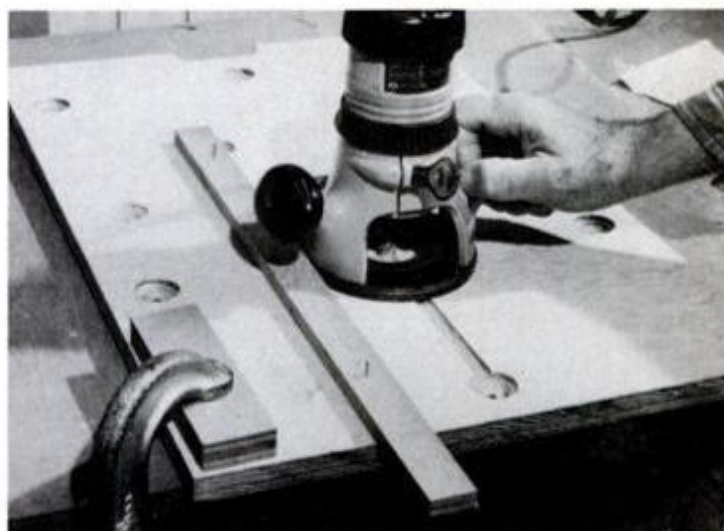
notch in the edge of the board. This notch will allow the router bit's pilot to reach far enough into the playing field to make the cut. Afterward you can plug up the void by gluing in a filler block.

Cut the rectangular hole for the

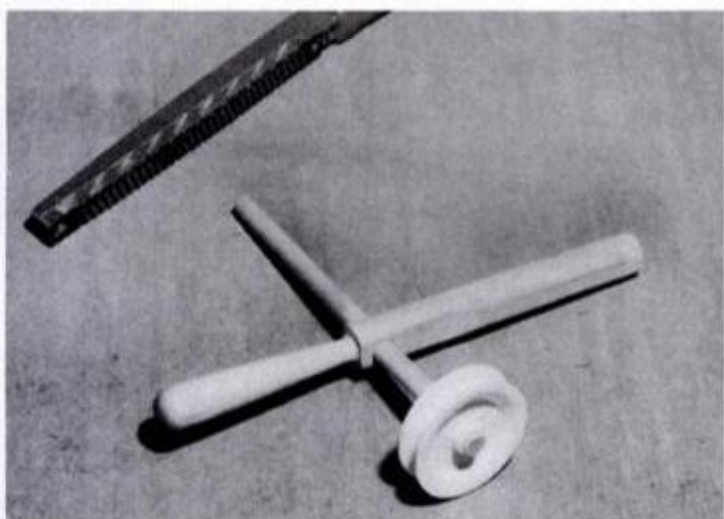
pitching sling by drilling two $\frac{1}{2}$ -in.-dia. holes and chiseling or sawing out the waste. Sand or file the sides of the cutout so the $\frac{1}{2}$ -in. metal bar will slide through freely. Next, use a core box bit (round bottom) to make a shallow groove from the pitching sling cutout



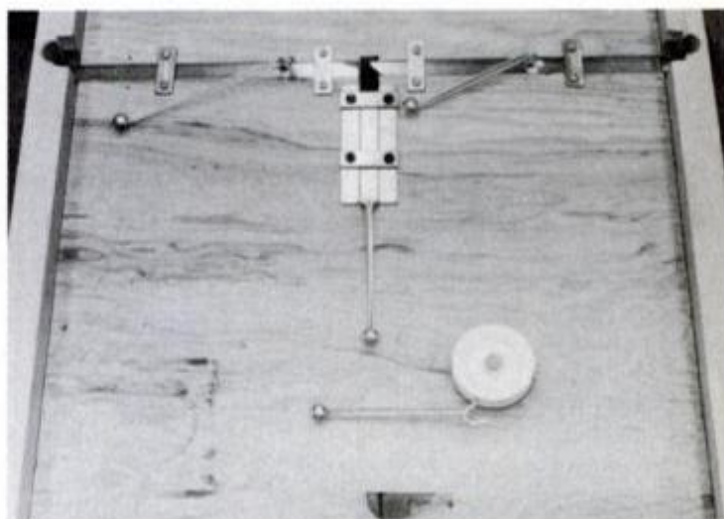
Cover router bit is used to make depressions in field. A clearance/guide hole for the bit's pilot end must be pre-drilled.



Use straightedge guide and core box bit to route a shallow groove between the catcher and pitcher positions.



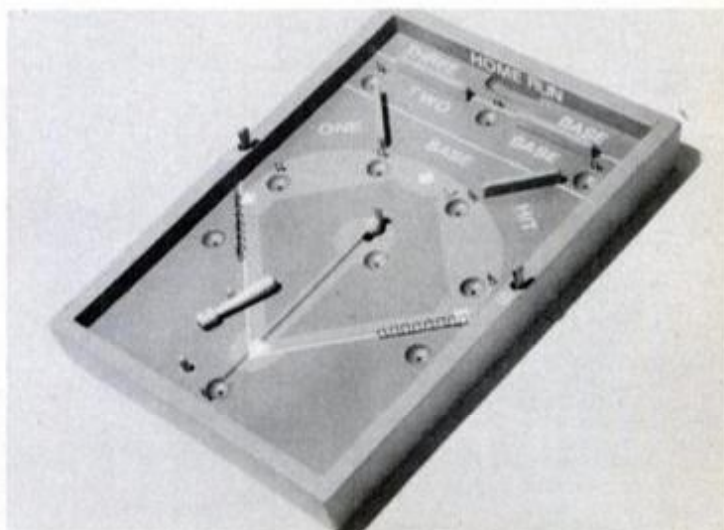
Bat is carved or turned from a piece of $\frac{3}{4}$ -in. dowel. A $\frac{3}{8}$ -in. dowel connects the bat to the pulley wheel.



Bottom view shows simple game mechanism. Fast- and slow-ball levers ride in groove cut with router and mortising bit.



Press-on white letters, available in art supply stores, are applied by rubbing back of decal sheet with soft-lead pencil.



Charting tape, used to get perfect white lines on base paths and in field, adds finishing touch to completed game.

to the catcher position. Use a straight strip of wood, tack-nailed to the game board, as a guide.

Assembling game mechanism

Lay out for the pitching and batting mechanisms in pencil on the underside of the board. Proceed once you're sure all the pieces will line up. First use a mortising bit with the router to cut the groove for the pitching control bars. Then bore lever and trigger holes in the sides and chisel or rebores to make clearance holes for the controls. Bore a $\frac{3}{8}$ -in. hole for the bat post.

Make all bends in metal while holding the bars in a vise. Grind or file shapes on the ends as indicated by the plans. Steel loops for tying on rubber bands are cut from screw eyes and soldered to the pitching control bars.

At this point, glue and nail the sides to the game board. Then attach the pitching mechanism to the underside of the game board with short lengths of steel bar and screws. Upholstery tacks can be used to anchor the ends of the rubber bands to the underside of the board. Try the tacks in different locations in order to increase or decrease the tension on the pitching sling and bat. The tighter you make them, the more skill will be required to play the game. Use No. 32 rubber bands.

The bat is carved out of a piece of $\frac{3}{4}$ -in. dowel using any of several means to taper it, such as a Surform rasp or knife. After shaping and sanding it smooth, file a slight flat at the handle end of the bat and bore a $\frac{3}{8}$ -in. hole through the center. A plastic pulley wheel from a clothesline pulley is used as a takeup reel. The original hole will very likely be under $\frac{3}{8}$ in. so you'll have to rebores it to fit the dowel. Insert the dowel into the bat. Then drill a hole for a screw through the bat end into the dowel to lock the two together. Insert the bat with dowel through the hole in the board, with a washer on each side. Then slide on the wheel. Allow about $\frac{1}{32}$ to $\frac{1}{16}$ in. play and then

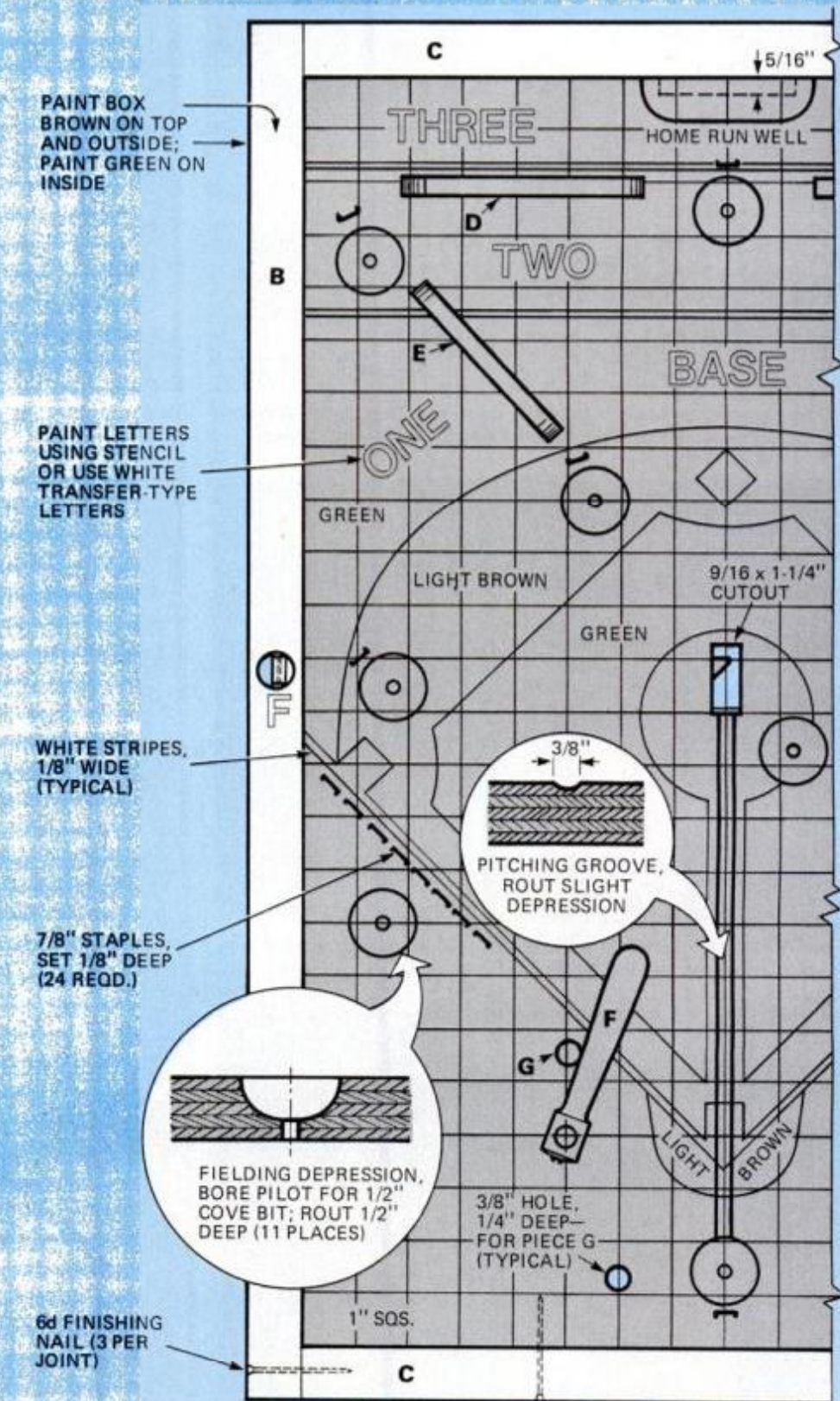
mark the cutoff point on the dowel. Remove bat assembly and saw off waste. Reassemble bat, post and pulley, but do not install in the board. Drill a pilot hole through the edge of the wheel and into the dowel. A screw hook inserted in this hole and driven

into the dowel will lock the wheel to the dowel and provide a hook for the rubber band.

Painting and lining the field

With the bat and rear fences removed, paint the entire playing field

PLAYING FIELD LAYOUT

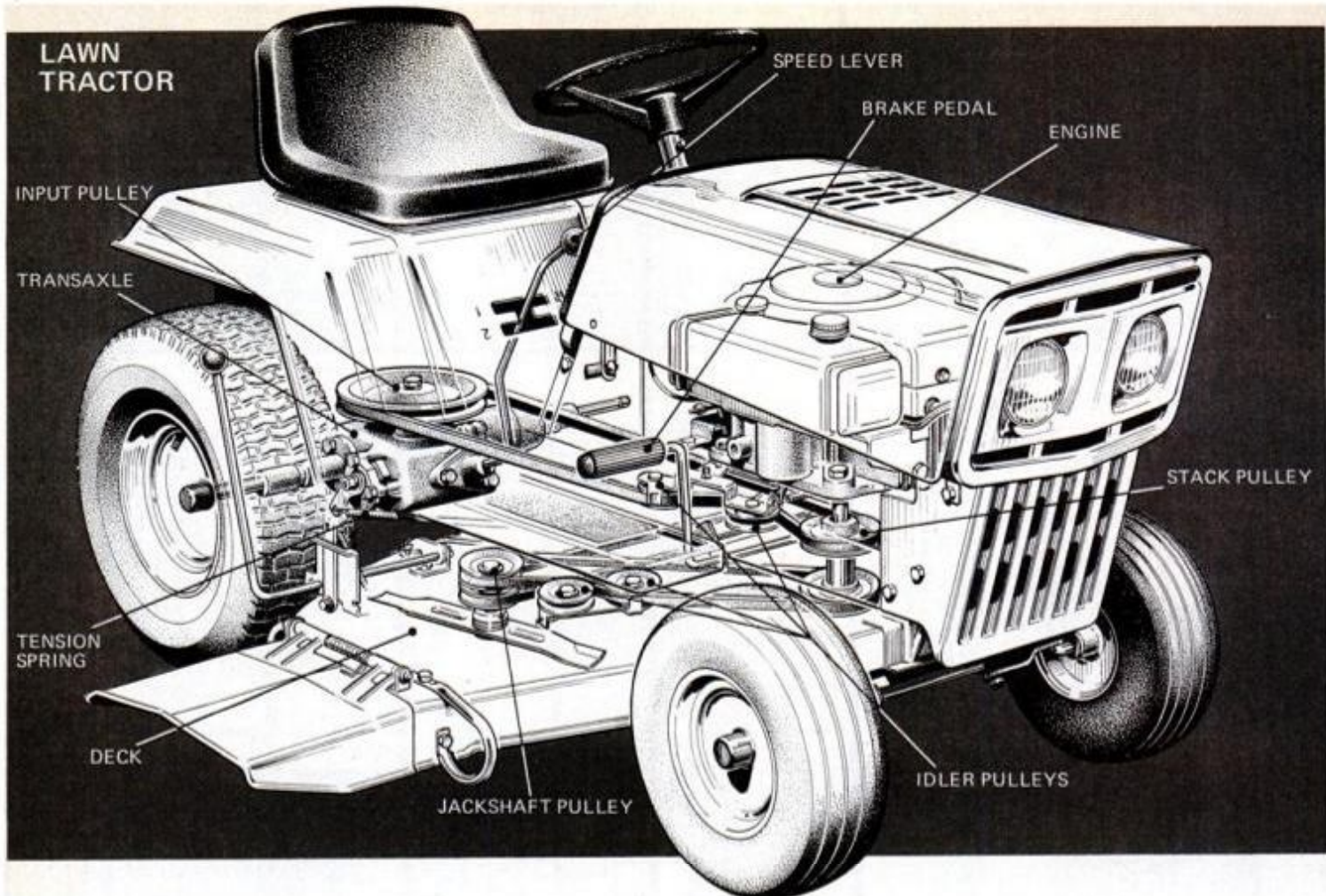


MATERIALS LIST—BASEBALL GAME

Key	Pcs.	Size and description (use)
A	1	$\frac{3}{4}$ x 16 x 24" plywood (table top)
B	2	1 x 2 $\frac{3}{4}$ x 26" poplar (side)
C	2	1 x 2 $\frac{3}{4}$ x 18" poplar (side)
D	2	$\frac{3}{8}$ x $\frac{3}{4}$ x 4 $\frac{1}{2}$ " pine (wall)
E	2	$\frac{3}{8}$ x $\frac{3}{4}$ x 3 $\frac{3}{4}$ " pine (wall)
F	1	$\frac{3}{4}$ "-dia. x 4 $\frac{1}{4}$ " dowel (bat)
G	2	$\frac{3}{8}$ "-dia. x 1 $\frac{1}{4}$ " dowel (bat stop)
H	1	1/16 x $\frac{1}{2}$ x 12 $\frac{1}{2}$ " mild steel (slow-ball bar)
I	1	1/16 x $\frac{1}{2}$ x 12 $\frac{1}{2}$ " mild steel (fast-ball bar)
J	1	1/16 x $\frac{1}{2}$ x 7" mild steel (pitching sling)
K	6	1/16 x $\frac{1}{2}$ x 3 $\frac{1}{4}$ " mild steel (bar support)
L	2	1/16 x $\frac{1}{2}$ x 3 $\frac{1}{2}$ " mild steel (pitching bar guide)
M	1	$\frac{3}{8}$ "-dia. x 2 $\frac{1}{4}$ " dowel (bat post)

Misc.: Green, brown and white paint; white transfer lettering; 24, $\frac{7}{8}$ -in. staples; 6d finishing nails; 2 screw eyes; 13 No. 5 RH wood screws; 4 rubber bands; 2, $\frac{3}{8}$ -in. washers; clothesline pulley wheel; $\frac{5}{8}$ " or $\frac{3}{4}$ " marble; white glue.

Note: Cold-rolled steel bars can be obtained at hardware stores, steel suppliers or in a precut set for this game from Armor Co., Box 290, Deer Park, N.Y. 11729. Price is \$3 postpaid.



How to pick a riding mower

Here's the information you need to simplify your buying.

by Glenn S. Hensley

This spring many homeowners will be getting ready to shell out cash or sign a credit card slip in return for a lawn tractor or rear-engine riding mower. Both machines are becoming increasingly popular—especially those in the 8- to 11-hp category.

Industry sources say that some 6 of every 10 purchasers of riding mowers now select the tractor style, front-engine machine. When you're shopping around, you'll face a perplexing range of features and quality. So learn about these mowers before you venture out.

Be sure you get parts and service

There are relatively inexpensive lines of mowers that won't stand up to rugged, long-term use. Then there are the better engineered units, built for years of service, that are, naturally, priced higher.

Mr. Hensley is the editor of *Farm and Power Equipment*, a publication serving farm and power equipment dealers.

12 SHOPPING TIPS FOR SELECTING A MOWER



1 Since all engines need some service, lift the hood and check access to the sparkplug, air filter, oil filter and oil drain. The hood should lock securely.

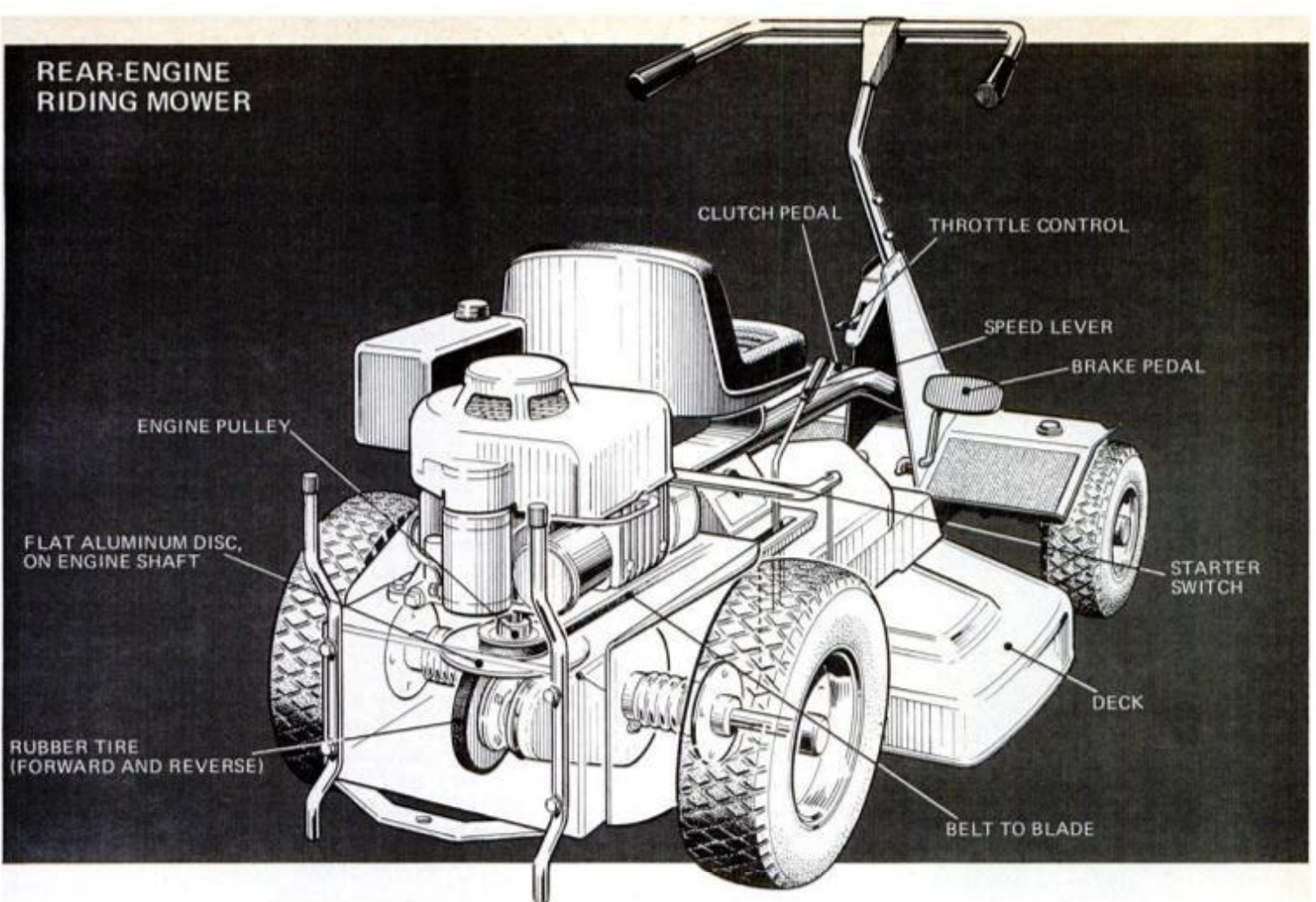


2 Look at the frame. It should be heavy, welded or bolted steel with a rugged, stamped frame and engine support combined. These frames are sturdy.



3 The unit you select should have footrests that tilt upward at the forward end. The larger the step, the greater the protection for the operator.

REAR-ENGINE RIDING MOWER



For example, a high-quality lawn tractor, good for many seasons of use and purchased from a reliable servicing dealer, will probably require an investment of more than \$1100. With such a machine, however, you'll be able to count on a dealer's service shop and parts department—absolute essentials in the purchase of anything mechanical.

Wider cutting swath saves time

The width of strip a mower can cut (also called swath) ranges from about 30 in. on the 8-hp machines to 42 in. on the 11-hp models. When you make comparisons, remember that a 42-in. mower will cut your yard in half the time needed by a 30-in. unit, providing you maintain a 2-in. swath overlap. Also, a 36-in. mower will do the job 25 percent faster than one with a 30-in. cut.

Steering mechanisms and turning radii

Some lawn tractors and rear-engine riders have much more precise steering than others. Geared steering, with

provision for wear take-up, usually provides less than 1 in. of steering-wheel movement (play) before the front wheels move. This is considered precision steering—with it you can easily maintain a 2-in. cutting swath overlap.

Units that have more steering-wheel play will probably force you to allow about 3 in. of swath overlap to keep from leaving stray strips of grass. Naturally, more overlap means extra time on the job.

Before buying, determine a mower's turning radius either firsthand or by asking. The tighter the radius, the less hand trimming you'll have to do around trees and plantings. Direct comparisons between two mowers of equal cut width, horsepower and ground speeds have shown that the one with the tightest turning radius saves from 5 to 10 percent of total job time.

To save more time you can pay a little more and get hydrostatic drive—a system in which oil under pressure activates a hydraulic motor. Besides cutting work time, you'll eliminate gear shifting and clutching. Time for



4 Sit at the wheel. You should be positioned comfortably with controls convenient. Instruction decals and labeling should be understandable at a glance.



5 Keyed ignitions give you control of the mower use. When the key is out, the mower shouldn't start. This extra measure of protection is well worthwhile.



6 Seat backs that are as deep as the spread of a hand provide good, basic support and keep you from accidentally sliding off when working rough ground.



combined mowing and trimming can be cut up to 10 percent with a hydrostatic-drive tractor as opposed to a manual-shift model. Hydrostatic also allows for instant forward, reverse and speed change.

Check the mower blade and mounting position

The mower blade tip (and shield) should extend beyond the wheels by about 2 in. This is convenient when trimming along flower beds and curbs. The less overhang, the more hand trimming you'll do. Some units accomplish trim overhang by offsetting a narrow mower to the side opposite the discharge chute. Overhang is automatic if the blade tip circle is wider than the tractor wheels.

Authorities say that no more than one-third of the standing height of grass should be removed in one mowing or there can be plant damage. If a spinning blade bounces off the ground, it not only scalps the lawn below proper cutting height, but becomes dull.

Mowers mounted so they tilt with the vehicle's front axle greatly reduce scalping. If the front wheels follow ground contours so will the mower blades.

Scissors hitch-type mountings rely on the rear wheels to adjust the mower's vertical position. They are more prone to scalping on irregular lawn surfaces, since they are guided by terrain already passed over. Look for anti-scalp rollers or wheels mounted on the front of the mower. They also greatly reduce the scalping tendency. The wider the ground-contact surfaces of those rollers, the more accurately they will guide the mower over bumps and slumps. Mowers suspended entirely from the vehicle and without antiscalping rollers, work well only on level lawns.

Side vs. rear-discharge mowers

Side discharge mowers fan grass clippings over a wider area than do rear discharge machines, which are designed to leave a swath of clippings behind them.

If the rear discharge mowers have a chute between the vehicle's rear wheels, they will leave a relatively narrow swath of clippings and will keep you and the mower cleaner and safer from flying objects. A towed sweeper picks up all debris in one pass. Side discharge mowers with special bagging attachments can do a good job collecting clippings, but the lowest cost and fastest way to remove cuttings is to use a pull-behind sweeper. This lets you dump the clippings from the tractor seat.

Front vs. rear engine

You'll get a greater feeling of security with a front rather than a rear engine. The front-engine units actually do give greater uphill stability and are better at climbing steep grades. Engine weight placed forward reduces any tendency to tip over backward. As power is

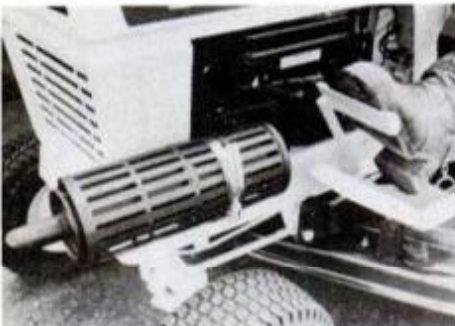


THREE TYPICAL LAWN TRACTORS OFFERED IN 1979

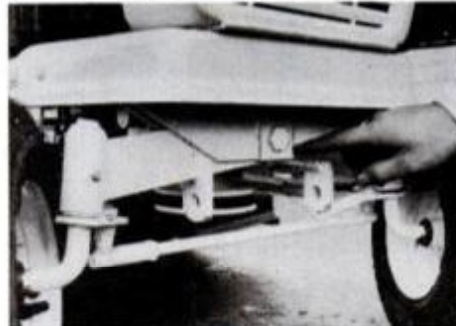
Murray Model 9-3667 (above) has an 11-hp engine, cuts a 36-in. swath. It's priced at \$875. Attachment options include blade and a snowblower. Gilson Model 52051 (left) also has 11-hp engine. It comes with mower deck, lists for \$1280. Jacobsen Model 80 (below) is \$1430 and its Model 110 lists at \$1582, both with mowers.



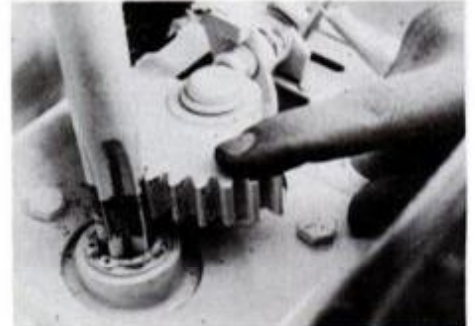
12 SHOPPING TIPS FOR SELECTING A MOWER, CONTINUED



7 Look for mufflers that direct exhaust away from the driving position and are shielded against possible contact that could cause nasty burns.



8 Front axles must be rugged to take constant pounding. They should be pivoted with a sturdy bolt at a solid point under the front part of the frame.

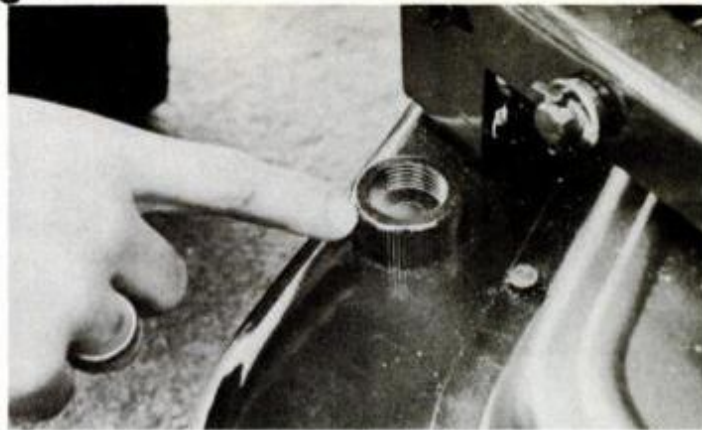


9 Geared, automotive-type steering allows more precise guidance than the "bent rod" type. Ask to see the exact steering system used in model you want.

Two good ideas in lawnmower design



The simple piece of curved pipe on Simplicity tractor engines lets you drain oil without the black, greasy stuff drowning other tractor components or swamping the mower deck. Just remove the cap and let the oil run into a container.

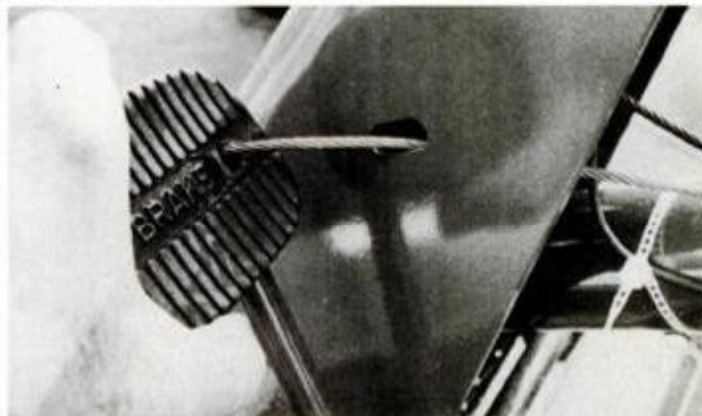


Bolens puts a garden-hose fitting on top of its mower decks to aid cleanup. Twist a hose into the fitting, turn on the water and start the mower. The blades switch clippings and other debris out of this hard-to-reach mower part.

Two design features that are questionable



Sharp, metal edges aided by vibration will soon chew through soft insulation around electric wiring. If the line feeds into such an opening, it should be protected by using a soft rubber grommet around it. Setup shown can cause trouble.



Cable that abrades against rough-punched metal hole edges will fray. This weakens the cable—plus the sharp ends of frayed wire can catch clothes and scratch your skin. Better hole and cable alignment can help eliminate this problem area.

applied, leverage action causes a weight transfer which increases rear-wheel traction—especially important when you use a rear-mounted grass catcher. Vibration is reduced, too, since the engine is physically located farther away from operating position.

Test the machine before you buy

Rear-engine units, in turn, give greater forward visibility, are easier to get on and off and usually have less

complicated traction-drive belting. You'll be wise to select a machine using belts with the fewest number of turns and twists.

Your comfort starts with confidence in a machine, so test it. Only by driving a mower can you become familiar with it. Also look for the Outdoor Power Equipment Industry (OPEI) seal, which means the machine conforms to industry standards. This helps assure that you're making a safe choice. **PM**



10 Standard grease fittings make maintenance servicing easier. Check to see that points needing regular lubrication are equipped with nipples.



11 The mower mount should be of a heavy steel, pivoting on large-diameter pins and giving evidence of careful design, construction and finish.



12 Finally, ask to look under the mower shroud. Check bearings, welds, blades, finish and baffles. This is the "working" part of your lawnmower.

fun to make projects



1 PIPE TRAY

This practical and attractive pipe tray is sure to please any discriminating pipe smoker. Made of contrasting woods, walnut and maple, to which is added the mellow luster of spun copper, it is a welcome addition to a man's den or office. If you have never tried metal spinning before, making the copper liner will give you a start on a fascinating and relatively easy extension of your shop skills.

Use a $2 \times 6\frac{1}{2} \times 6\frac{1}{2}$ -in. walnut block for the main turning. Refer to the cross section of the tray on the drawing and make a full-size cardboard template of the curve to be shaped on the lathe. Next, lay out the three concentric circles on the face of the block. The lathe is then set at its slowest speed and the round-nose chisel used to shape the interior of the tray. Stop the lathe frequently and check with the template when nearing the proper depth and shape.

Remove the toolrest and sand with 100-grit paper at low speed until the interior of the tray is a smooth, even curve. This step is important—irregularities can cause difficulties in spinning, which can lead to the thinning and tearing of the copper.

Cut a $6\frac{1}{2}$ -in. square from No. 22

copper and anneal it. Annealing is done to soften the copper, and consists of heating it cherry red, then quenching it in a pickle bath (50 parts water to one part sulphuric acid). The bath cleans the scale from the copper caused by the annealing.

Leave the copper in the bath to remove all traces of oxide or scale; this will take a minute or two. Then rinse off the solution with clear water and dry the copper. When it has a soft pink color, it is ready for spinning.

Bore a $\frac{1}{8}$ -in. hole at the exact center of the copper square. Drill a

matching $\frac{1}{8}$ -in. hole in the exact center of the walnut block, about $\frac{1}{2}$ in. deep. Fasten the copper to the walnut with a $\frac{3}{4}$ -in. No. 7 rh screw in the center and tack it to the waste corner stock with four $\frac{1}{2}$ -in. brads.

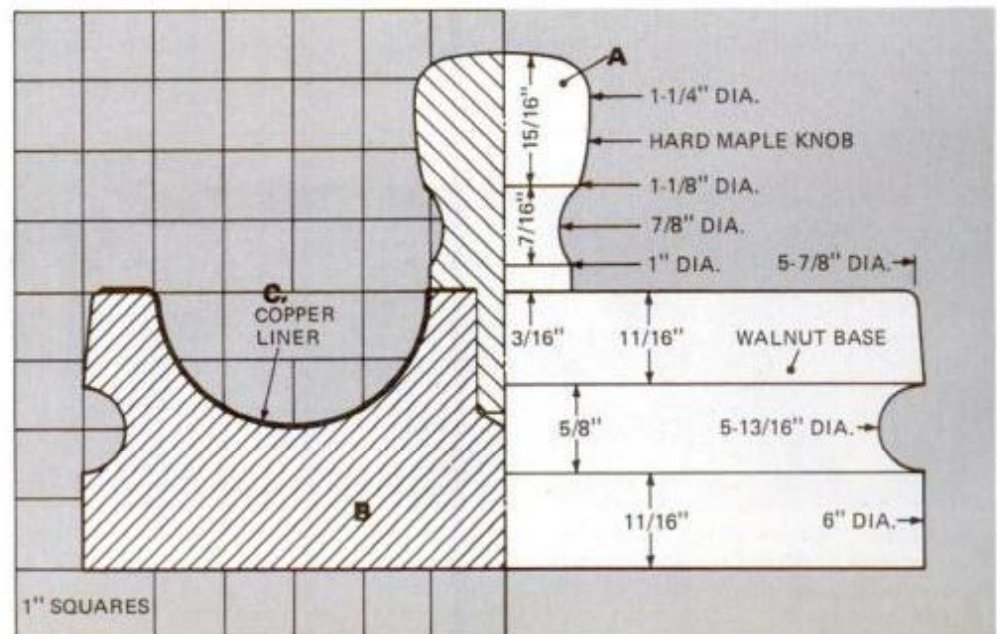
Make a "spinning toolrest" from a bar of $\frac{3}{4} \times 1$ -in. cold-rolled steel, 8 or

[\(Please turn to page 252\)](#)

MATERIALS LIST—PIPE TRAY

Key	Pcs.	Size and description (use)
A	1	$1\frac{1}{2} \times 1\frac{1}{2} \times 4$ " maple (knob)
B	1	$2 \times 6\frac{1}{2} \times 6\frac{1}{2}$ " walnut (bowl)
C	1	$6\frac{1}{2} \times 6\frac{1}{2}$ " No. 22 copper (liner)

Misc.: Screws, glue, urethane varnish, sandpaper.





At this point, let your youngster "mount up" so you can determine where the hand and foot dowels should be located. Our plan, as is, will fit even a toddler; if most of your riders are taller, you might position the foot dowel at a lower level.

Attach the nose with glue and corrugated fasteners. Or, if preferred, use dowels in the edges. Enlarge the pattern for the face (see drawing on 1-in. squares) using pencil and carbon paper. Transfer the face onto both sides of the swing. Use a hammer and narrow chisel to scribe the face design into the wood.

Smooth off the head and the curved rump area with sandpaper. For the flowing tail, tie a half-hitch in the hemp rope and fasten it with a No. 8 wood screw to the top center of the rump. Unravel the ends all the way up to the knot.

At this point, you may finish the flying horse with a rich brown or dark red protective stain, and hope he dries before he is ridden away.

However, there are four options you might consider. A halter fashioned from an old belt or leash can be nailed in place with decorative upholstery nails. Also, additional hemp rope can be used to make a mane on the upright 2x6. An old bike seat can be added to the back of the horse for a "saddle." And if the swing will be getting unusually heavy use, as at a playground, pieces of pipe can be used for bushings around the carriage bolts.—
Virginia Barrett

MATERIALS LIST—HORSE SWING

Key	Pcs.	Size and description (use)
A, B	1	2x6x48" pressure-treated pine
C	1	2x4x30" pressure-treated pine
D	2	1x6x36" pressure-treated pine
E	2	¾ x 5" carriage bolts, nuts
F	6	¾" in. fender washers
G	2	1" lengths, 1" wood dowel or broom handle
H	1	2/0 galvanized chain x 24" (more if desired)
I	1	¾" hemp rope x 4" (tail)
J	1	U-shaped rod hanger, bent from ¼" steel rod as shown

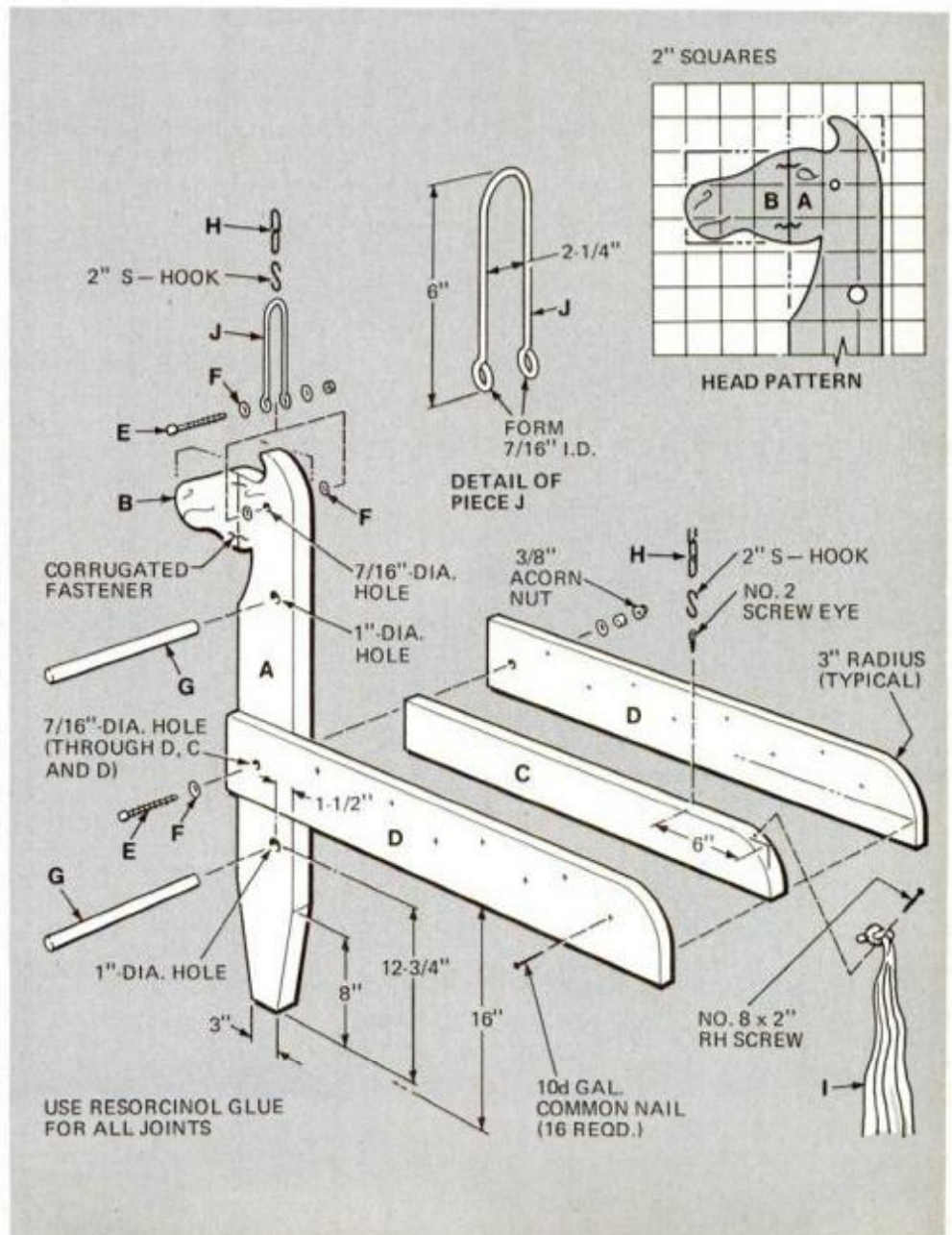
Misc.: Resorcinol glue, 8d common galvanized nails, corrugated fasteners, No. 8 x 2" rh wood screws, 2 2" S-hooks, No. 2 screw eye, sandpaper, carbon paper, wood stain or paint. Optional: Old belt or leash for "halter," extra hemp rope for mane, bike seat, pipe for bushings.

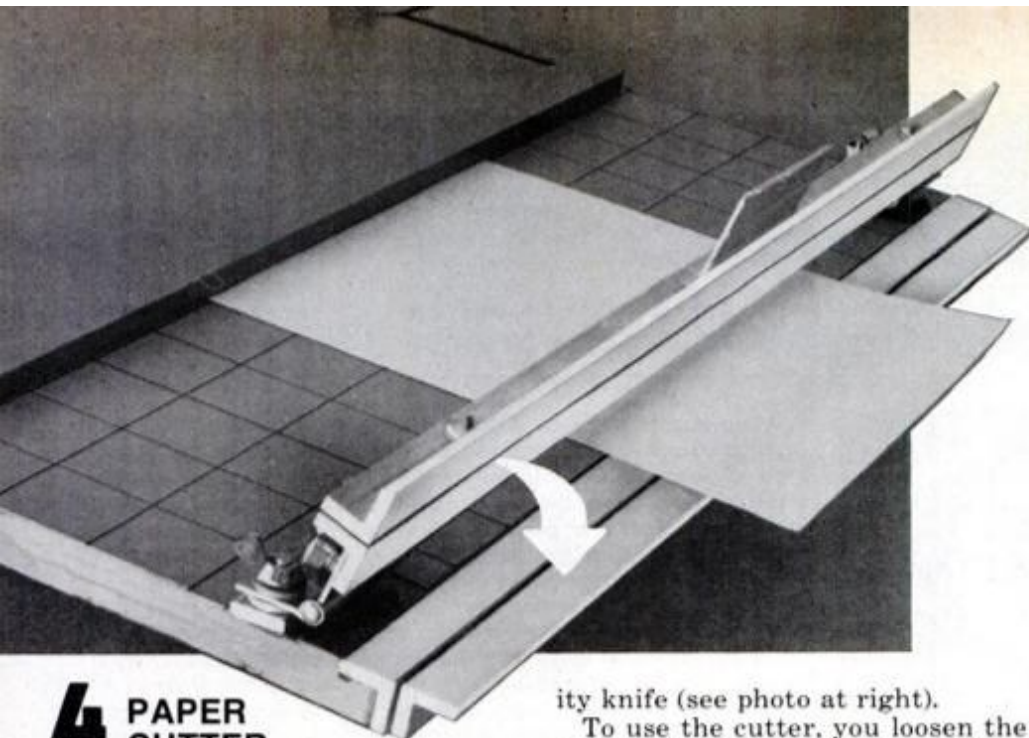
2 HORSE SWING

Here's a horse your family can afford. He burns kids' energy instead of hay, and is easily built with simple tools and a minimum of material, for as little as \$20.

The sturdy swing will carry your youngsters on flights of imagination for years to come. As a youngster's legs grow longer, the chains can be shortened. You may catch grownups riding him, too. Because the horse will have hard use and will hang in the weather year-round, choose pressure-treated lumber and galvanized hardware. This will also make the swing safer, as it will not suddenly fall apart in use. When choosing a location for the swing, allow plenty of room for a sweeping arc. The size of the arc will depend on the length of the chains that suspend the swing; the higher up they reach, the more breathtaking the ride. Thus, a toddler's swing should hang on a relatively short chain.

Cut the lumber and assemble the three pieces that form the back of the horse as shown. The magic ingredient of this flying horse is the U-shaped rod (J) that enables the front chain to clear the horse's head. Heat and bend a ¾-in. steel rod to the shape shown. Assemble the head and back without boring holes for the dowels, and hang the swing.





4 PAPER CUTTER

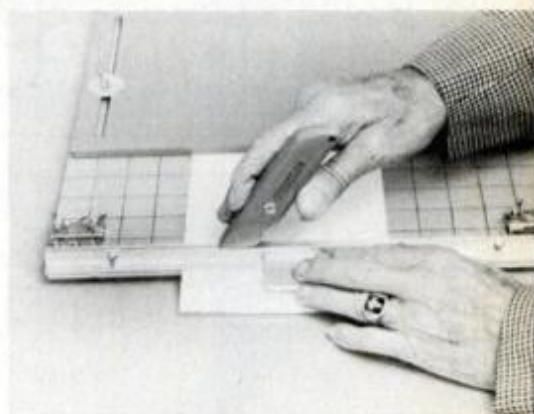
Here's a handy tool you can build for shop, darkroom and hobby functions. All it takes to build the cutter is a piece of plywood (for the baseboard), some 1/2-in. aluminum angles, a pair of hinges and a utility knife. The photo above shows how the paper or cardboard to be cut is positioned and aluminum angle guide bar simply swings into place (arrow). The cut is made with a util-

ity knife (see photo at right).

To use the cutter, you loosen the pair of wingnuts holding the adjustable hardboard and slide the board to desired cutting width. After re-tightening nuts, check space between it and cutting-board edge to make certain cut will be desired width.

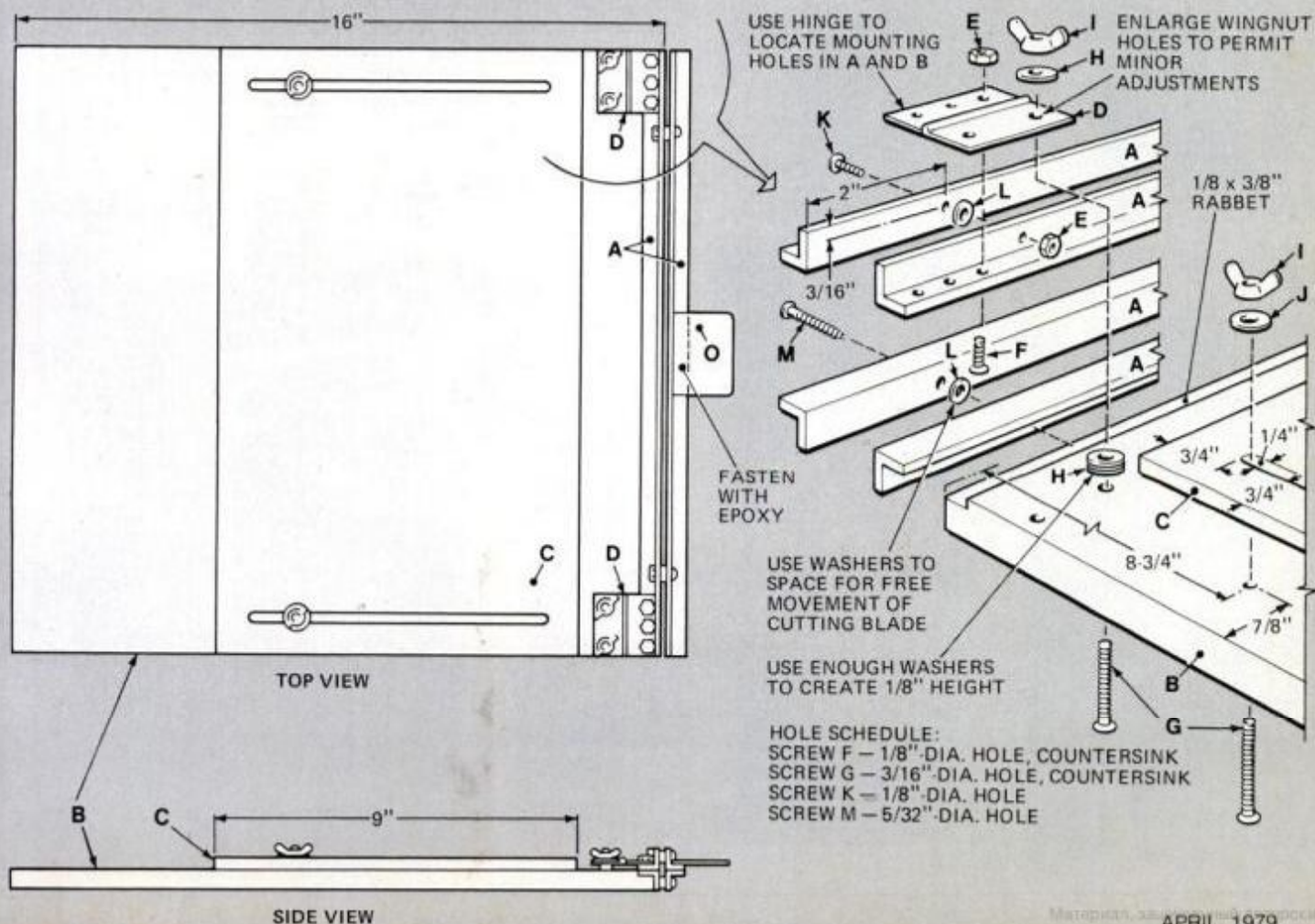
Now: insert the paper to be cut and swing the angle cutting guide into place. Then make the cut with a utility knife. The aluminum angle strips are permanently spaced with wash-

ers (L); these washers should be just thick enough to allow free sliding movement with the cutter you plan to use.—Fred Haitz



MATERIALS LIST—PAPER CUTTER

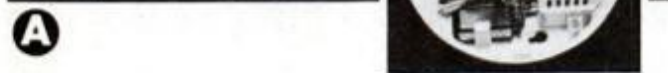
Key	Pcs.	Size and description
A	4	1/2 x 1/2 x 1/2 x 15" alum. angle
B	1	1/2 x 15 x 15 1/8" baseboard
C	1	1/4 x 9 x 15"
D	2	1 1/2 x 1 1/2" butt hinge
E	8	No. 6 hex nut
F	6	No. 6 x 1/8" rh machine screw
G	6	No. 10 x 1" rh machine screw
H	(as req'd)	No. 10 flat washer
I	6	No. 10 wingnut
J	2	Over-size flat washer
K	2	No. 6 x 1/8" rh machine screw
L	(as req'd)	No. 6 flat washer
M	2	No. 6 x 1" rh wood screw
N	1	1/16 x 1 1/2 x 2" aluminum



NEW NOW for home and shop



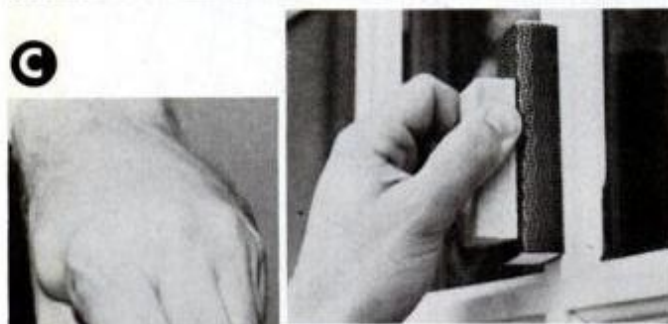
A Honeywell's model CD300A smoke and fire detector is a.c. powered with a backup nicad battery. A red LED indicates a.c. power is on; a yellow LED shows battery is charging. With detector cover open, battery can be tested. Unit can be plugged into a wall socket or permanently wired. Wire up to six together so that if one detects smoke or fire, all units sound the alarm. It's about \$50 from Honeywell Inc., Minneapolis, Minn. 55422.



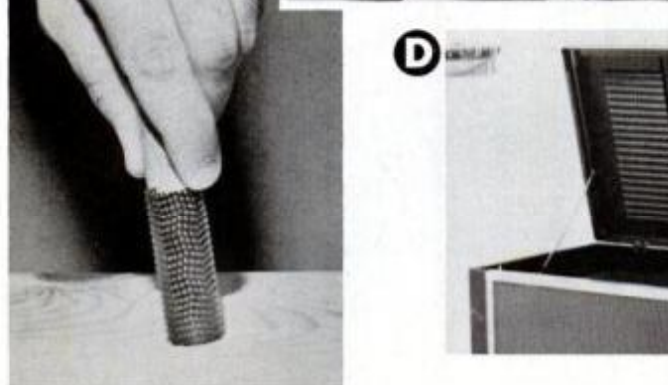
B Hang utensils, pans, tools or other household items in an infinite variety of ways with the Hookery. Six different types of hooks can be plugged into any of four lengthwise slots in an aluminum rack. Each hook has a locknut to secure it in place. Hooks can be moved around or added and subtracted without removing the rack from its mounting. An 18-in. model with three hooks is \$9.89; 30-in. with five hooks, \$12.89; extra hooks, pegs and snap rings, 98 cents to \$1.39. Homecraft Div., Gries Reproducer Co., 400 Beechwood Ave., New Rochelle, N.Y. 10802.



C Steel sandpaper takes the place of rasps and regular sandpaper when you remove paint from wood trim, window sills and clapboards. It is made with thousands of tiny, perforated cutting edges so that scraped-off particles pass through and the "paper" doesn't clog up. The abrasive can be wrapped around a regular sanding block or any other shape. Cut into strips and wrapped around a dowel, it can be used to enlarge holes (see photo, far left). A 4 1/4 x 5-in. sheet is \$1.09; 9x11 is \$3.59 from Red Devil Inc., 2400 Vauxhall Rd., Union, N.J. 07083.



D Lift the top on the Wonderwood Lift-Top wood-burning stove to use its auxiliary cooking surface. A positive safety latch keeps top upright when cooking surface is in use. A load of wood heats for about 12 hours, and an improved automatic thermostat provides more accurate heat control, the maker says. This airtight circulator heater uses no electricity unless optional two-speed blower is added. Stove lists at \$343.62, blower at \$72.21. U.S. Stove Co., South Pittsburg, Tenn. 37380.



'79 Home Ideas Guide

Popular
Mechanics

Doing it yourself is still your best hedge against inflation: Time spent fixing up and improving your home is 'money in the bank' should you decide to sell later. In this special section you'll learn how to remodel a porch, choose and use siding, build PM's vacation home decks, install a sump pump, take care of spring fixup chores that should be tended to right now, and more — lots more.

Solar-heated porch

All about siding

Springtime
fixups

Install a
sump pump

Two decks to build

Tiled fireplace





Bird makes solid vinyl siding for people who love the looks of wood.

We'll be the first to admit that wood can look beautiful. It's just that taking care of it is a constant job. That's why the people who live in this house covered it with Bird solid vinyl siding.

We make siding a little differently than anybody else. The bottom of each panel is squared off to look exactly like wood clapboards. And we invented the natural woodgrain texture you see on our Woodside™ solid vinyl siding.

But unlike wood, Bird solid vinyl siding takes care of itself. The color goes all the way through, so scratches don't show the way they can on other materials. And it can't rot, blister or peel. So it never needs painting.

We make solid vinyl siding in narrow and wide widths, with smooth and textured finishes. If you'd like a free estimate, talk to your Bird Siding Dealer. He's in the Yellow Pages, and he'd be glad to hear from you.

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Please send me your revised, 36-page color booklet, "What you should know about roofing and siding before you build or remodel." I'm sending 50¢ in payment, and I'm planning to build remodel.

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Address _____ City _____

County _____ State _____ Zip _____



FROM PORCH TO FAMILY ROOM— using the sun for heat

by David Warren



This home improvement squeezes heat out of the winter sun, yet minimizes excess heat gain during the summer months.

The sun—whether you own a solar house or not—has an influence on your space-heating requirements. Maximizing the potential for solar heat gain in winter and minimizing it in summer can bring annual savings in your energy bills and may even earn you a federal tax credit. This PM home improvement is full of energy conservation ideas that can be useful to you.

The inspiration for my application of solar energy came by simply observing existing conditions and being receptive to possibilities. For example, at the end of each summer season for several years, I have tacked Visqueen plastic over our porch screens to keep out spring and fall driving rains and midwinter snow drifts.

Aside from keeping the porch dry



Original porch (left) was converted to solar plenum with Peachtree wooden insulated glass patio doors (above). Bar and muntin details, teamed with Bird's architectural shingles and Masonite's lap siding, retain traditional flavor.

and saving me from lugging porch furniture elsewhere, I also noticed a marked greenhouse effect in the porch on cold but sunny days. The porch was usually 20° or 25° warmer than the outside. Unintentionally I had created a passive solar energy system that reduced the heat loss of adjacent living areas.

It occurred to me that if 4-mil plastic was this effective, walls designed specifically for capturing solar energy would be even more so. The plan I developed was to install heavy insulating glass to trap the sun's rays, add a dark floor to absorb those rays, and insulate the perimeter of the slab and the ceiling to retain the captured heat.

To go one step farther, I decided I could draw that warmth into the living areas of the house. Such a solar system would be simple in design, functional, healthy, nonpolluting, durable, repairable and energy-cheap.

One major problem in getting rapid commercialization of solar systems is their cost effectiveness. It can take too many years for fuel savings to equal installation costs. To assure a daily return on my solar investment, I decided to make the porch a handsome family room giving us additional attractive, comfortable living.

The room is designed for easy maintenance. Masonite Casa Blanca wall paneling has a tough finish that needs only occasional wiping. Sliding-door grilles (muntins) can be removed quickly for easy window cleaning, the Jenn-Air range ventilating system keeps the ceiling clean, and Nevamar plastic laminate on the peninsula food-preparation center requires little maintenance. Wooden furnishings wouldn't stand up in a solar plenum. We chose rattan, which has the warmth of wood furniture but is more durable in sunlight.

A dark floor was desirable because it had to serve as a heat bank. Black

was out because it shows dust too quickly. So we opted for American Olean's Primitive 865 walnut floor tiles.

To use the porch on cloudy winter days, it was necessary to install supplementary heat. A number of electric resistance-heating alternatives were considered. Heating cable in the floor would wash warm air up the glass doors, but would not provide the quick pickup desired because the entire concrete slab would have to be heated.

Sufficient 2x4-ft. radiant-heat ceiling panels would provide the quick heat needed. But "sufficient" is too many; the panels would nearly fill the ceiling and be difficult to arrange attractively. Nor was there much space for radiant wall panels.

When heating engineers think of quick heat, they usually think of fan-blown hot air. I thought this unsatisfactory because a wall fan heater with sufficient B.T.U.s for quick pickup in this room inevitably would be noisy and throw hot blasts on the occupants.

Blinds control amount of sunlight admitted—they can be tilted to direct sun to dark tiles which serve as a heat bank. Warm air is then ducted from the porch to the heat pump to reduce load on the pump compressor. The room also features a handsome peninsula for food preparation, storage; has a ducted Jenn-Air range.



View above was replaced by the one below. Studio couch converts to bed. Peninsula unit features grill, ceramic cooktop, undercounter refrigerator, built-in food center.





Dining area is separated from living/sleeping area by the peninsula unit. The open room arrangement increases the feel of spaciousness. Complete plans for building the peninsula will be in the May issue of Popular Mechanics.

We settled on a modern heat pump. It provides fan-blown warm air efficiently. Westinghouse states that the overall seasonal performance of its Hi Re Li heat pump is about twice that of electric resistance heating. Its efficiency varies according to temperature zones, but is in keeping with the solar heat/energy saving direction wanted.

The heat pump functions much like a normal central airconditioning system, except that during the heating cycle it has a reversing valve inside. Rather than discharge heat from the condenser to the outdoors, this heat energy is transferred indoors through the refrigeration lines.

Compared with normal electric resistance heating, the heat pump will





1 Powered roof vent in the attic space exhausts any summer heat buildup and reduces the heat pump cooling load.



3 Inside screens stay cleaner than conventional screens, and are easily removed in winter to let in solar radiation.



5 Rigid foam insulation around foundation and heat sink (existing slab) reduces heat loss at building perimeter.



2 Peachtree insulated glass patio doors can be installed to slide left or right depending on the roller placement.



4 Urethane foam from can insulates the crevice around the sliding doors prior to installing paneling on the walls.



6 To seal cracks and protect exposed surfaces of rigid insulation, apply coat of Thoroseal mixed with Acryl-60.

save energy dollars. The solar assist for the heat pump by our family room should yield another 10 percent reduction in our space-heating fuel costs. We are gathering data and will report results later.

How to get started

Carefully plan all details of your design by preparing 1/2-in.-scale sketches. Use your plans to prepare a bill of materials, check prices and get bids from professionals for any work to be contracted.

The first thing we did was to remove light fixtures and the plywood ceiling. Then wiring was roughed-in for the lights, security, vent and intercom systems. The 240-volt wiring for the grill and heat pump required an electrician.

Insulating the foundation

To insulate the solar heat sink, we ex-

cavated along the foundation walls of the porch to below the frost line and installed two 1 1/2-in. layers of Styrofoam. The sheets were propped with boards until we were ready to backfill. For appearance and protection, we applied a thick mixture of Thoroseal and Acryl-60 latex, obtained from a cement contractor supplier, to the exposed surfaces of the rigid insulation.

Next we laid out the door openings so that the vertical spaces between them (and at corners) were all of equal width. After assembling the door frames supplied by the manufacturer, the rough openings were framed to suit the overall door-frame dimensions, allowing a 1/4-in. space at top and sides.

The siding was applied after sheathing and exterior door trim were up. To achieve a traditional clapboard appearance, 6-in.-wide Masonite siding was

lapped 2 in. (the maximum recommended), leaving 4 in. exposed to the weather. Ringed siding nails were used to fasten siding every 16 in.

To begin, we made a starter strip by ripping a piece of lap siding 2 in. wide and nailing it level along bottom edge of sheathing. Then the first course of siding was nailed 1/8 in. below starter strip. Joints were butted at stud locations only and staggered so they didn't fall on the same vertical line.

Quarter-round molding was installed at the siding-eave joints. Joints where siding meets door trim were caulked and the exterior received two coats of paint.

Turning our attention to the inside, the heat pump, along with its wiring and duct work, was installed. Designing the air-handling system and installing the components are jobs for professionals. Choose your contractors with care, and get competitive bids on the work.

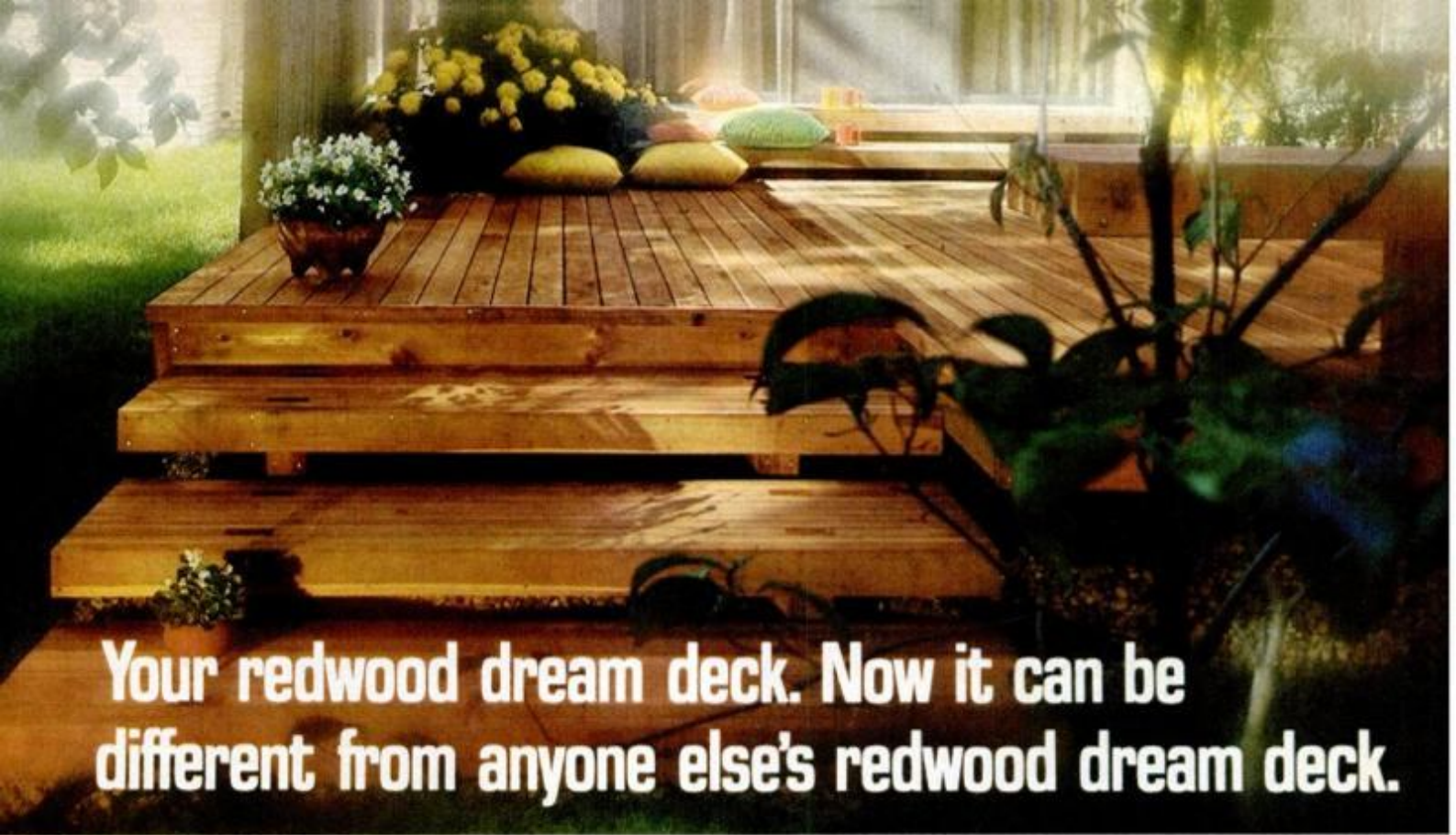
After the duct work was completed, 10-in. (R-30) fiberglass batts were stapled between the ceiling joists with the Kraft paper facing the living space; 4-in. fiberglass batts were fastened to the wall above and between the doors. Canned foam insulation was used in crevices.

The wall paneling we chose (Masonite's Casa Blanca) simulates rough plaster and is installed with white nails. We minimized exposed joists by locating architectural features to coincide with them. For example, the vertical track lighting fixtures at the end wall conceal two major vertical joints. The remaining wall and

(Please turn to page 143)



Durable plastic laminate was used on the peninsula counter butcherblock design on the countertop, cane pattern on the sides—to blend well with the room's wicker and wood decorating scheme. Besides being a convenient food preparation area, peninsula does double duty as a bar when entertaining. Brown glazed floor tiles hold up to traffic.



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7 Fiberglass batts, Kraft-backed side down, are stapled between ceiling joists following electrical and duct work.



8 Insulated air-handling ducts transfer solar heat to the heat pump and to rooms on the north side of the house.

corner joints were hidden by applying latex caulk to the crevices and spreading it in a pattern similar to the adjoining panels. Afterward, the patch was blended to the wall surface with latex paint.

To prepare for installing the ceiling tiles, we nailed 1x3 furring strips to the ceiling joists, 12 in. on center, since our tiles (Armstrong's Olde Hickory) were 12 in. wide. Stapling flanges for fastening tiles to the furring strips were provided. Courses were laid out in both directions beforehand to be sure that the border tiles along opposite walls would be approximately the same width.

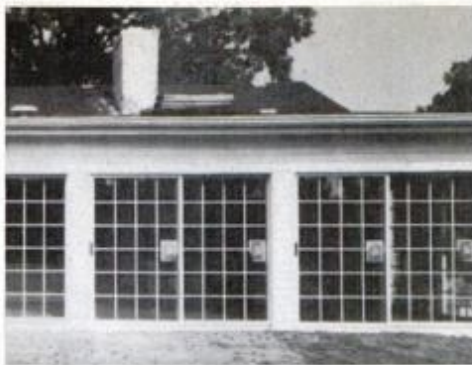
For the floor we wanted the real feel and durability of ceramic. This job can be done in small bites and therefore lends itself to do-it-yourselfing. Undertake only as much tile laying or grouting as you have time to complete in one session.

Thinset-type cement was carefully selected as having the best heat-conducting properties to transfer solar heat to the cement slab heat sink. We used H.B. Fuller's Lifetime Cement and Fuller's Sand Beige Joint Filler (grout) with 868 additive.

To start the tiling installation, snap a chalkline grid (24-in. squares) on the concrete floor. Each tile was inspected before laying to be certain it wasn't chipped.

The running bond pattern we used calls for half tiles to start every other row along the sliding-glass-door wall. Our tile supplier rented us a tile cutter for the job. The half tiles were cut from the few flawed tiles we found in some of the boxes.

Starting in a corner of the porch, we used a 3/8-in. notched trowel to spread ce-



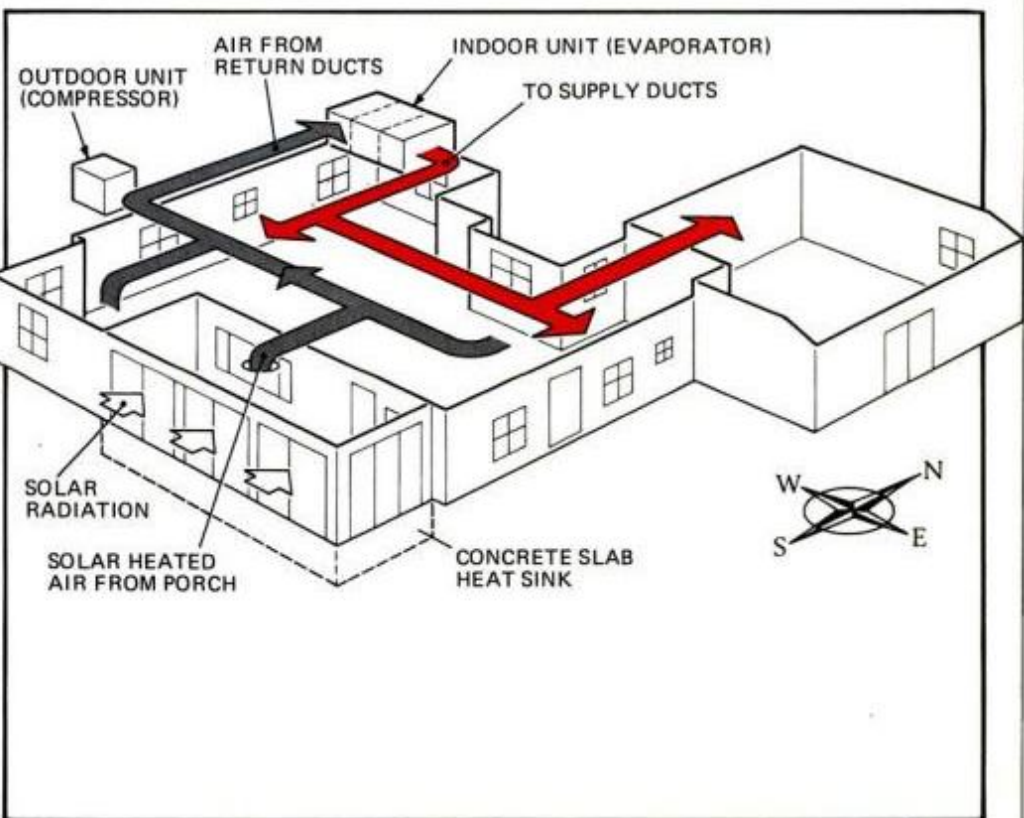
9 Vertical wall sections between door units should all be same width. New roof was applied over original shingles.



10 Installing blind headrails on face of door casing allows blinds to clear the door pulls without snagging.

ment evenly in the first chalklined grid. Half and full tiles were placed on the cement and pressed down firmly so no non-heat-conducting dead air space remained between tile and floor. The cement bond was about 1/8 in. thick. Open joints between tiles were 3/8 in. apart.

After the completed floor dried 24 hours so it could be walked on, grout was prepared and spread in the open joints. To



SHOPPING INFORMATION

All materials used in the PM porch-family room are available nationwide. For buying information or nearest dealer, write directly to manufacturers.

American Olean Tile Co., Lansdale, Pa. 19446 (floor tiles).

Armstrong Cork Co., Lancaster, Pa. 17604 (ceiling).

Bird & Son Inc., East Walpole, Mass. 02032 (shingles).

Certain-teed, Box 860, Valley Forge, Pa. 19482 (insulation).

The Dow Chemical Co., 1703 South Saginaw Rd., Midland, Mich. 48640 (Styrofoam brand insulation).

H.B. Fuller Co., Construction Products Div., 315 South Hicks Rd., Palatine, Ill. 60067 (cement, grout for floor).

Halo Lighting Div., McGraw-Edison Co., 400 Busse Rd., Elk Grove Village, Ill. 60007 (track lighting).

Insta-foam Products Inc., 2050 North Broadway, Joliet, Ill. 60435 (insulation in a can).

Jenn-Air Corp., 3035 Shadeland, Indianapolis, Ind. 46226 (range).

Levolor Lorentzen Inc., 720 Monroe St., Hoboken, N.J. 07030 (blinds).

Lutron Electronics Co. Inc., Coopersburg, Pa. 18036 (dimmer).

Masonite Corp., 29 North Wacker Dr., Chicago, Ill. 60606 (siding).

Nautilus Industries, Div. of Broan Manufacturing Co. Inc., Hartford, Wis. 53027 (roof vent).

Nevarmar Corp., 8339 Telegraph, Odenton, Md. 21113 (plastic laminates).

NuTone Div., Scovill Housing Products, Madison & Red Bank Rds., Cincinnati, Ohio 45227 (food center, intercom).

Peachtree Door, Box 700, Norcross, Ga. 30091 (glass doors).

Sub-Zero Freezer Co. Inc., Box 4130, Madison, Wis. 53711 (refrigerator).

Westinghouse, Interstate Dr., Norman, Okla. 73069 (heat pump).

Design consultant, Barbara Honquest; photos, Matt Doherty; heat-pump system design, William Suttie; construction adviser, Ray Peterson.

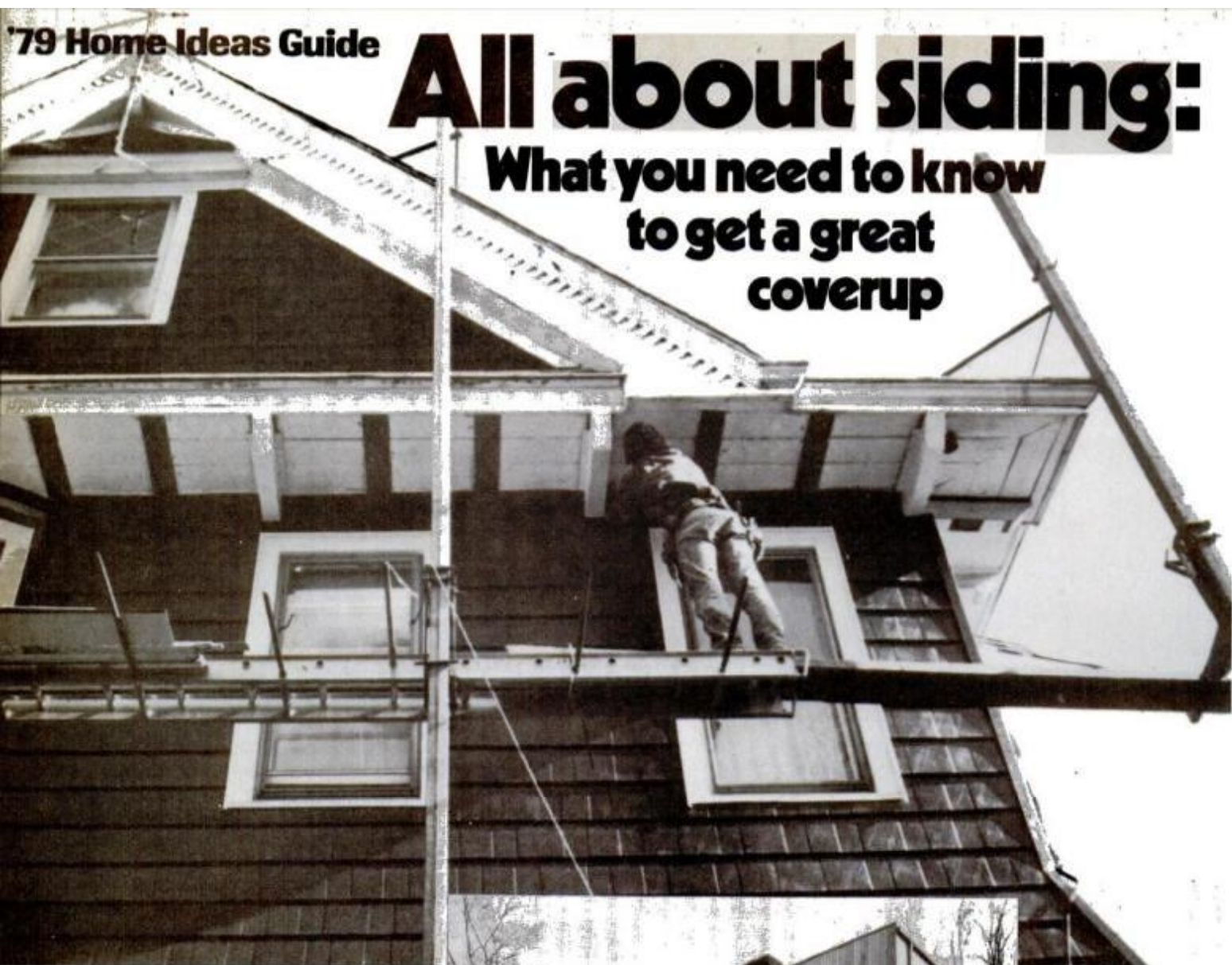
do this, use a rubber-faced float that won't scratch the tile surfaces. Excess grout should be wiped off using a large 6x8-in. manmade soft sponge.

Installation of the blinds completes the construction. The blinds block sunlight on summer days, insulate windows on winter nights, and provide privacy at any time desired. We chose Levolor Riviera Blinds with 1-in. slats in Eggshell Satin (142).

The remodeling was started early last spring and finished by fall just in time to start harvesting the inexhaustible warmth of the sun. **PM**

All about siding:

What you need to know to get a great coverup



PM surveys the pros and cons of what's available—and tells you how to pick a reliable contractor.

by Mort Schultz

Since the material you use to re-side your home will probably be with you for a long time, take a few minutes to consider all the possibilities. In this article we'll discuss the relative merits—and demerits—of metal sidings (aluminum and steel), vinyl siding, natural wood, and combination wood and synthetic compound (hardwood and plywood) which we will refer to as sheet siding. Asbestos is not considered since leading manufacturers have discontinued production because of the health problems associated with it. Masonry siding will also be considered a separate topic.

Which is best?

Each siding material has its advantages and disadvantages. The one you choose for your home will probably be



Quality plywood siding can approximate the look of vertical cedar siding—especially if the horizontal joints between panels are carefully worked into a house's design as visual elements. In addition, this can save you material and labor dollars.

selected on the basis of budget, esthetic preference, and/or willingness to put up with certain drawbacks. For example, some homeowners want to avoid painting, no matter what. They shy away from wood and sheet siding and end up paying more money for vinyl or metal. [When speaking about metal siding, we mean aluminum, primarily. However, what is true of aluminum is basically true of steel. Steel siding is stronger than aluminum and offers the advantage of not denting as easily; but it costs 30 to 40 percent more than aluminum and has not been in demand.]

Other homeowners don't think the additional cost is worth the advantages that vinyl and aluminum offer. Furthermore, they want the greater selection of styles and colors afforded by wood and sheet siding.

What about cost?

As matters stand, homeowners have made aluminum the best selling siding material. Over 10 million homes have been sided with aluminum. Cost? A company in my area recently offered to re-side 24×36-ft. ranch houses with 8-in.

(Please turn to page 146)

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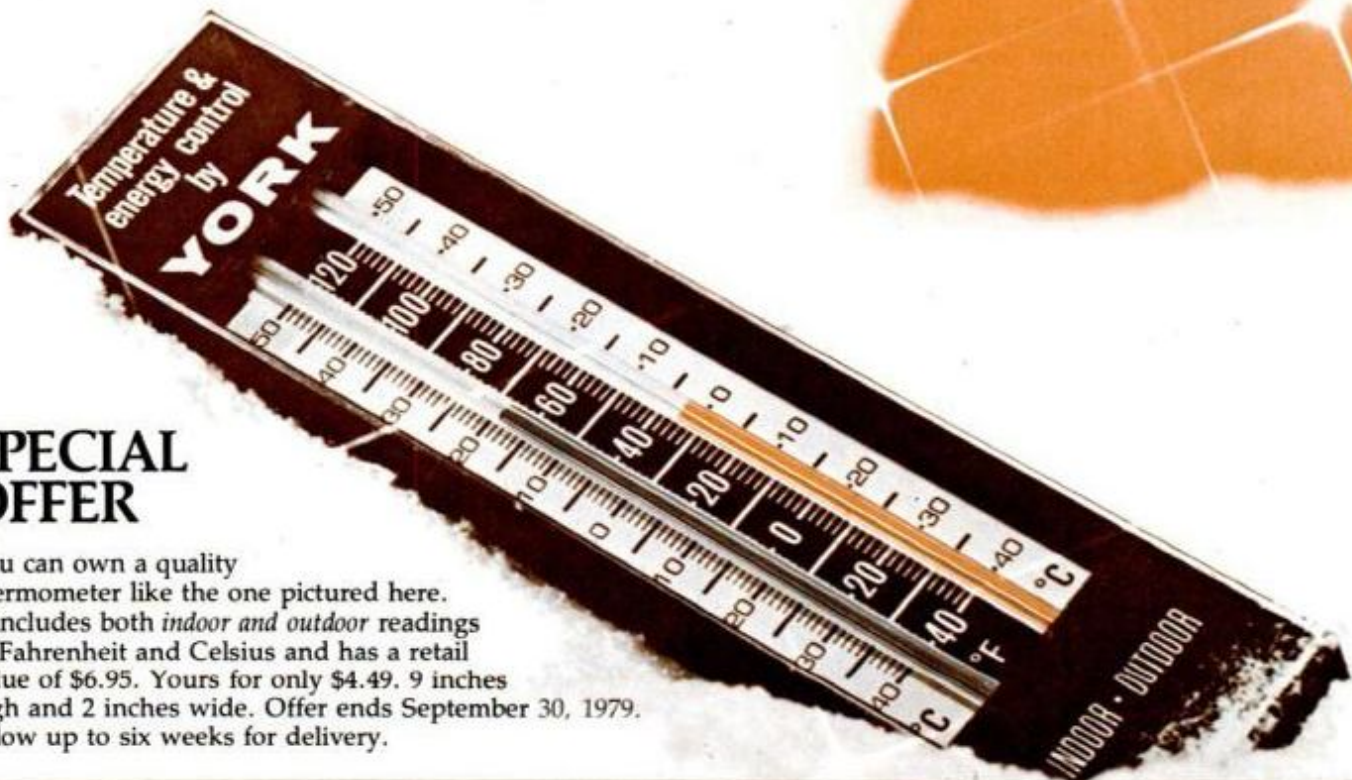
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ALL ABOUT SIDING

(Continued from page 144)

clapboard aluminum for \$3500. The product the company presented sounded like good quality material, being manufactured by Alcan, Revere or Kaiser. Investigation revealed, however, that the material was not outfitted with backer board, which gives siding more insulating value. The addition of backer board adds \$1000 to \$2000 to the cost of the job, depending on the type and thickness of the backer board.

Vinyl is next in line as the best selling siding material, with wood and sheet siding following. The cost of contractor-installed vinyl siding is 20 to 30 percent more than aluminum.

There is no way to pinpoint accurately the cost of wood and sheet siding. Cost varies significantly from type to type, from locale to locale and from week to week because of fluctuating building-product prices. Generally, though, the cost of residing a home with wood, plywood or hardboard is 25 to 40 percent less than residing with aluminum.

The chart below, prepared by the Weyerhaeuser Co., compares price differences between natural wood, plywood and hardboard. It shows that hardboard and plywood sidings are comparable in cost with lesser-grade solid lumber materials. However, the cost of superior grade solid lumber siding is higher than that of sheet siding.

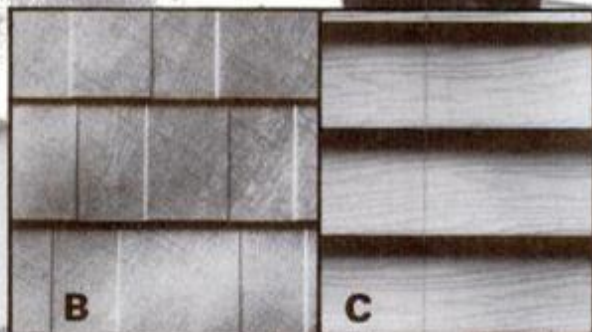
Wood and sheet types

Hardboard siding is composed of wood fibers that are combined with resins and other synthetic compounds. The materials are permanently bonded under heat and pressure into boards or panels.

Siding made of hardboard is grainless. Where finished panels have a wood-grain appearance, the grain has been em-



Vinyl sidings come in 8-in. (above) and double 4-in. lap panels. They are available in several colors, untextured or with a wood-grain texture.



Use of backer board (A) under vinyl or aluminum siding increases their insulative value while reducing noise infiltration. There is a wide variety of styles that range from a rough-sawn shingled look in aluminum (B) to a vinyl lap siding embossed with a barn-board-like texture (C).

COST INDEX COMPARISON: WOOD AND SHEET SIDING

Type of Siding	Rating
Hardboard, lap or panel, textured	100
Hardboard, lap or panel, smooth	90
1/2" plywood—cedar and southern pine	93
Superior-grade wood drop siding—horizontal and vertical Douglas fir and southern pine	314
Cedar siding, unseasoned and rough-sawn face—vertical siding with battens	100
Tropical hardwood (shorea), bevel siding	314
Cedar hand-split shakes	141

* Calculated using hardboard textured siding as base of 100.



Cedar shingles? No, they're actually horizontal strips of hardboard embossed to look like courses of shingles. "Courses" are available in 16-ft. lengths.

bossed into the panel. In other words, the grain is simulated. Hardboard siding is available unprimed (least expensive), primed (moderately expensive) and prefinished (most expensive). A suitable quality of such siding is at least 7/16 in. thick. The material comes in two general styles: lap (or clapboard) and panel.

Lap denotes boards that are 16 ft. long and of varying widths (6, 9, 12 in. and so forth), which are installed horizontally. The panel style is available in panels measuring 4x8, 4x9 and 4x12 ft. or larger. These panels are nailed to a structure so the long dimension runs vertically. The most readily available size is 4x8 ft., however. Longer sizes may have to be specially ordered.

Hardboard lap sidings are available several ways:

- Prefinished or primed horizontal clapboard style.
- Unprimed or primed horizontal clapboard style with a simulated rough cedar texture.
- Unprimed simulated wood-shingle siding.
- Primed or unprimed lap siding with a simulated rough-sawn surface.

Similarly, hardboard panel sidings can be bought in the following forms:

- Prefinished or unprimed simulated cypress. Panel edges are shiplapped with 1/2-in. V-grooves, 8 in. on center, to provide the appearance of individual vertical planks.
- Prestained, primed or unprimed simulated rough-sawn cedar with 3/4-in.-wide square-cut grooves on 8-in. centers. Also unprimed board-and-batten panels. Battens are integral (they come attached to panels) on 12-in. centers to reduce installation time.
- Primed or prefinished smooth or wood-grained panels with grooves on 8-in. centers or battens on 12-in. centers.
- Prefinished or primed panels having a simulated skip-troweled stucco texture or aggregate stone appearance.

Plywood siding is a construction of wood veneers that are bonded together with exterior-grade adhesives. The surface of plywood is real wood—not simulated. The siding is manufactured from lumber—usually southern pine, fir or cedar—not from wood fibers as in the case of hardboard.

As with hardboard, plywood siding comes in lap and panel styles: unfinished, primed or prefinished. Varieties are numerous, but not as many as hardboard. For example, siding having a shingle or stucco appearance is not available.

High quality solid lumber siding comes available in clapboard panels and shingles. Surface finishes are grained and rough-sawn.

Metal and vinyl types

Compared to wood and sheet sidings, metal and vinyl sidings come in a limited number of styles. They are virtually maintenance-free and the colors are fast. Painting or staining is not necessary.

At one time, metal had the advantage of outpacing vinyl in the number of colors it offered consumers. It still does, but the gap has closed. You can select from as many as 9 different colors when choosing vinyl siding and up to 12 colors from one manufacturer of metal siding.

Neither do you have to settle for the traditional smooth 8-in. or double 4-in. lap panels with vinyl siding. The "woody" look (simulated, of course) is now available. For example, Bird & Son introduced a solid vinyl siding in January of this year called Woodside. The 8-in. and double 4-in. lap panels display a wood-grain face in each of the six colors is offered.

Aluminum siding, however, does provide greater versatility than vinyl. In aluminum, you can select from the traditional smooth clapboard look (8-in. or double 4-in.) and from panels having a wood-grain appearance, a rough-sawn surface, vertical board-and-batten or vertical walnut look and hand-split shingle appearance.

Test data from AlSCO Anaconda and Champion Building Products demonstrates that metal and vinyl with backer board have greater insulating properties than wood and sheet siding. Assuming that new siding will be applied over existing siding, the chart on page 148 is a summary of relative R values. (The R value denotes the efficiency of insulating materials; higher R numbers have greater resistance to passage of heat.)

Warranty: More than a number

Champion Building Products offers a three-year warranty. Masonite offers five-year and 15-year warranties, depending upon the product. Hunter Douglas and GAF offer 20-year warranties. Bird & Son, Certain-Teed and AlSCO Anaconda offer 40-year warranties.

Length of warranty is important, to be sure, but what the warranty covers is just as important. Also of concern should be the limits of the warranty—how much of a rebate you get over certain periods of time if the product fails.

Let's consider two typical warranties: those from Bird and GAF. Both companies make vinyl siding. Bird warrants that its vinyl siding panels and accessories (soffits, fascia and rain carrying equipment) are "free from manufacturing defects and won't corrode, blister, peel or flake, won't conduct electricity as to require grounding, and won't deteriorate as a result of salt spray, windblown sand or termite activity."

It assumes 100-percent responsibility for the first three years. If defective, the siding will be replaced without charge.

In the ensuing 37 years, if a defect is found with Bird's siding, the company will contribute the following percentage toward repair or replacement cost: First year, 90 percent; second, 80; third, 70 percent; fourth, 60 percent; fifth, 50 percent; sixth, 40 percent; seventh, 30 percent; 8th through 16th, 20 percent; and

(Please turn to page 148)



Prefinished hardboard panels simulating a stone aggregate finish are also available.

SIDING: ADVANTAGES AND DISADVANTAGES						
	Aluminum	Vinyl	Steel	Hard-board	Ply-wood	Natural Wood (Painted)
No refinishing needed	■	■	■			
Won't split, crack or warp	■	1	■			
Won't blister, peel or flake	■	0	■			
Resists stains	2	2	2, 3			
Won't show scratches	4	■	4			
Won't rot	■	■	■	5		
Resists dents	■	■	■	■	■	■
Electrically nonconductive	6	■	6	■	■	■
Fire-resistant	■	7	■			
Noiseless	8	■	8	■	■	■
Immune to insects (termites, carpenter ants)	■	■	■			
Comparable ease of installation	Average	Hard	Hardest	Easy	Easiest	Easy

1. Some critics contend that vinyl may crack in extreme cold weather, but others view this as inaccurate.
2. Staining materials usually wash away with rain runoff. If not, a heavy hosing may work. Stubborn stains can usually be eliminated with soap and water or household cleaners.
3. If burred edges are present when siding is installed, rust may form.
4. If scratches aren't treated, corrosion (aluminum) or rust (steel) may form.
5. Not usually.
6. Requires grounding.
7. Polyvinyl chloride products are not combustible, but they will smolder and emit toxic gases when in a fire.
8. Critics contend that a metal siding will amplify the noise of rain and hail. However, the use of backer board will reduce the noise level.



Aluminum and vinyl manufacturers provide soffits, fascia and trim to match sidings.

SIDING: INSULATION (R FACTOR)

Material	Resistance (R)
5/16" plywood	.40
3/8" plywood	.48
1/2" plywood	.64
5/8" plywood	.77
7/16" hardboard	.62
.035" vinyl siding and .024" aluminum siding	.87
.035" vinyl siding and .024" aluminum siding with insulating backing material	2.5-6.0*

* Actual insulating value depends on thickness and makeup of backing material, and construction techniques. For example, more air space, thus greater insulating value, is obtained by nailing to furring strips instead of directly to old siding. Thicker backer boards have higher R values; thus polystyrene backer board offers a greater insulating effect than aluminum reflector foil.

for the 17th through 37th, 10 percent.

GAF warrants that its vinyl siding panels are free from peeling, flaking, rusting, blistering, corroding "or other conditions" arising from manufacturing defects. It will assume 100 percent of the cost of repair or replacement during the first five years up to a maximum of \$150 per 100 sq. ft. From the 6th through the 10th year, the company will assume 50 percent of the cost up to a maximum of \$75 per 100 square feet. From the 11th through the 20th year, the amount of responsibility assumed is reduced by 5 percent each year from the 6th through the 10th year.

Bird's warranty can be transferred to someone who buys your home. The GAF warranty is nontransferable.

Picking a contractor

Along with consulting the Better Business Bureau and Chamber of Commerce, you should follow these suggestions when seeking a contractor:

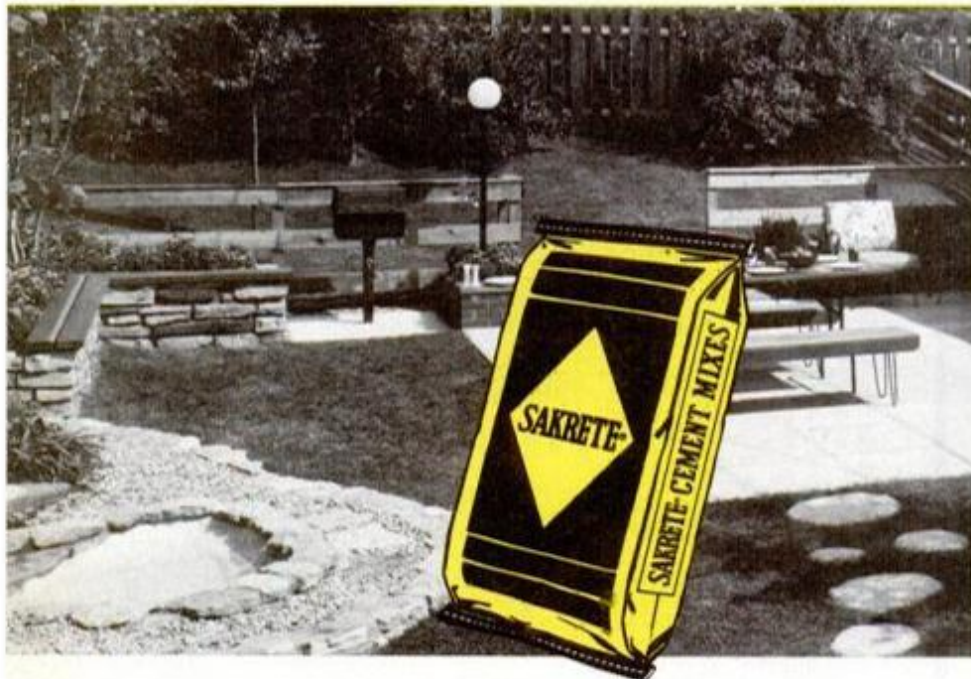
1. Ask for and check references.
2. Ask the contractor questions based on information contained in installation manuals. You can get the installation manual for the type of siding you are putting on the house by writing to the siding manufacturer. If you are installing aluminum siding, request a manual called *Alu-*

minum Siding Application Manual from the Architectural Aluminum Manufacturers Assn., 35 East Wacker Drive, Chicago, Ill. 60601, or from the Aluminum Assn. Inc., 818 Connecticut Ave. N.W., Washington D. C. 20006. For vinyl siding, write for *Rigid Vinyl Siding Application* to the Society of the Plastics Industry Inc., 250 Park Ave., New York, N.Y. 10017.

If I were having vinyl siding installed, some of the questions I would ask a contractor would be:

1. What kind of nail are you going to use? (Answer—Aluminum or another kind of corrosion-resistant nail.)
2. Where will nails be placed? (Answer—Manufacturers provide slots for nails in the siding. Nails will be hidden. Face nailing is not good practice.)
3. How will you make sure that panels are securely tightened? (Answer—I won't. Panels should "float" on nails to allow for expansion and contraction.)
4. How will end joints of adjoining panels be joined? (Answer—They will be overlapped about half length of factory notched cutouts to allow for vinyl's movement as temperature changes.)
5. My home is finished in stucco. How are you going to get siding attached evenly? (Answer—We use furring strips and shim to get an even, nailable base.) **PM**

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LIST OF MANUFACTURERS

Get a line on the siding style you would like to have installed on your home before you check re-siding contractors. Obtaining brochures from several makers, such as the following, will help.

For metal and vinyl siding:

- Alcan Aluminum Corp. (metal)
280 North Park Ave.
Warren Ohio 44482
- AlSCO Anaconda (metal and vinyl)
1 Cascade Plaza
Akron, Ohio 44308
- Bird & Son (vinyl)
East Walpole, Mass. 02032
- Certain-Teed (vinyl)
Box 860
Valley Forge, Pa. 19482
- GAF (vinyl)
Building Materials Group
140 West 51st St.
New York, N.Y. 10020
- Hunter Douglas (metal)
400 West Main St.
Durham, N.C. 27701

For sheet and wood siding:

- Champion International Corp.
1 Landmark Square,
Stamford, Conn. 06921
- Georgia-Pacific Corp.,
900 Southwest Fifth Ave.
Portland, Ore. 97204
- Masonite Corp.
29 North Wacker Drive
Chicago, Ill. 60606
- Weyerhaeuser Corp.
Box B
Tacoma, Wash. 98401



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SPRING FIX-UP TIME: 15 quick repairs you can do

Now that winter is over, it's time to thoroughly check your house for much-needed repairs—then make them.

by Rosario Capotosto

Harsh winter elements and time combine to work their destruction on your house and property. Spring is just the time to thoroughly check your home and equipment for needed repairs pro-

voked by fluctuating temperatures and daily wear.

Blacktop driveways, for example, can become an eyesore when the freezing-thawing action of water that's seeped into hairline crevices spreads them into gaping cracks. Oil, grease and coolant dripping from your car add to the problem.

The list of outdoor repairs your property might need could seem overwhelming. But repairs made now will help you enjoy the summer—and prevent more expensive repairs later. Check your roof for damaged shingles and gutters. Make sure that putty around windows has weathered the season and that stored screens are in shape. Here are 15 problems that you may encounter, along with tried-and-true solutions.



1 Sealing driveways starts by cleaning oil-soaked spots. Use a stiff brush and driveway cleaner poured on the stains.



Thoroughly hose off the solution with a fine, hard stream of water. Let the driveway surface dry, then sweep it clean.



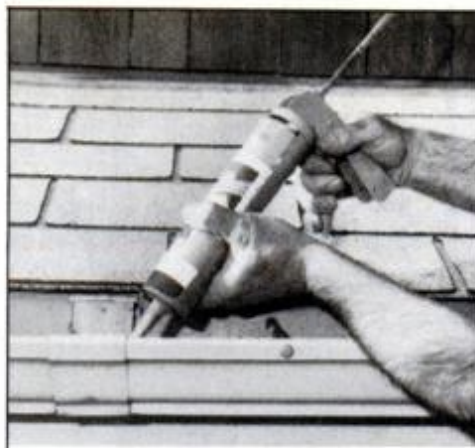
Fill and level shallow depressions and small holes with an asphalt driveway patch mix. Tamp it thoroughly into the holes and trowel it smooth, removing excess material.



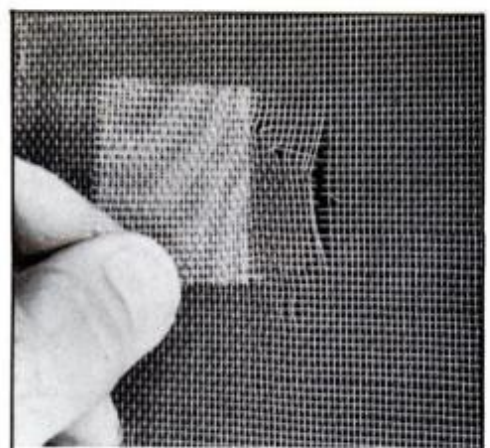
Use an applicator with a brush on one side and a squeegee on the other. Spread the sealer with the squeegee, then brush the coating smooth and free of overlapping ripples.



2 Wood ladders should never be painted. The coating could conceal rot or contribute to its development by sealing in moisture. Instead, apply a coat of boiled linseed oil at least once a year to protect your ladder from moisture and from drying out. Check for and replace any rusted hardware.



3 Slip-fit do-it-yourself gutter-joint fittings often develop leaks because they were improperly sealed during installation. Thoroughly clean and dry problem joints. Then apply a bead of butyl rubber caulking along all edges of the fittings—on the inside of the leaking gutter.



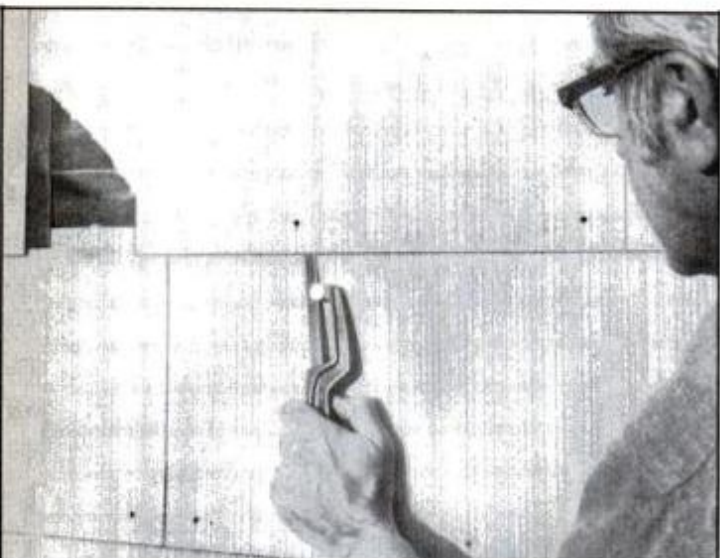
4 Easily repair holes in screens with patches you can buy at hardware stores. A patch consists of screen material which has hooked ends on two sides. To make the repair, simply press the bent hooks through the screen. A pack of eight patches costs about 80 cents. Gang up patches on large holes.



5 Loosened, crumbling mortar joints in brick can let moisture penetrate. Use a chisel to remove old mortar to a 1-in. depth or until you reach solid mortar. Refinish with fresh mortar. For a more lasting joint, break off mortar around brick's corner and form a T- or L-shaped, interlocked joint. Clean joint with an old



paintbrush or by blowing into it (wear goggles), then dampen brick so moisture from new mortar won't be absorbed. Press mortar into vertical joint, then horizontal one with a joint-filling tool (shown). After mortar hardens, keep moist for a few days by sprinkling it with water to get a strong cure.



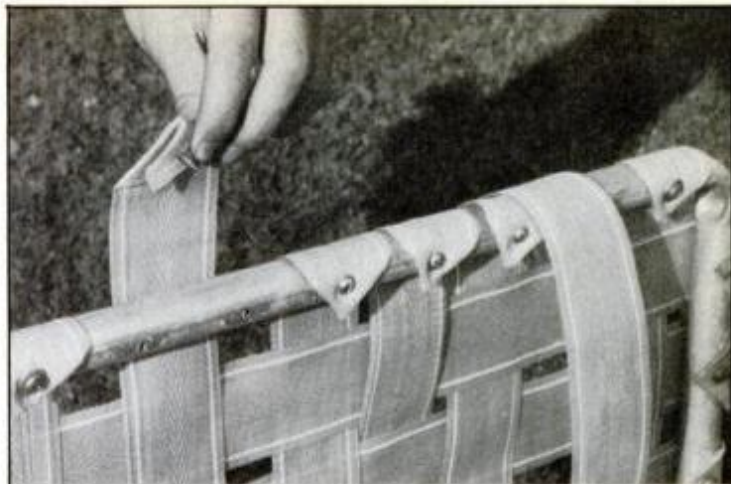
6 If you try to remove a broken shingle by prying, you may damage the ones above it—particularly when working with asbestos shingles. For good results, try cutting through nails with a hacksaw blade. The Stanley Mini-Hack is a good tool for the job. It uses an ordinary hacksaw blade in a handle that allows flush cutting. Work old shingle downward.



7 Crumbling putty lets in water which rots the wood. Check bars and mullions and use a chisel to remove old putty. Heat from a soldering iron will soften stubborn spots. Let damp wood dry, then brush on linseed oil to seal wood. Roll a ball of putty in your hands to form a long strand. Press in place with the tip of a flexible putty knife, then draw the knife lengthwise across the frame to form a tight, triangular bead. Allow at least one week before painting.



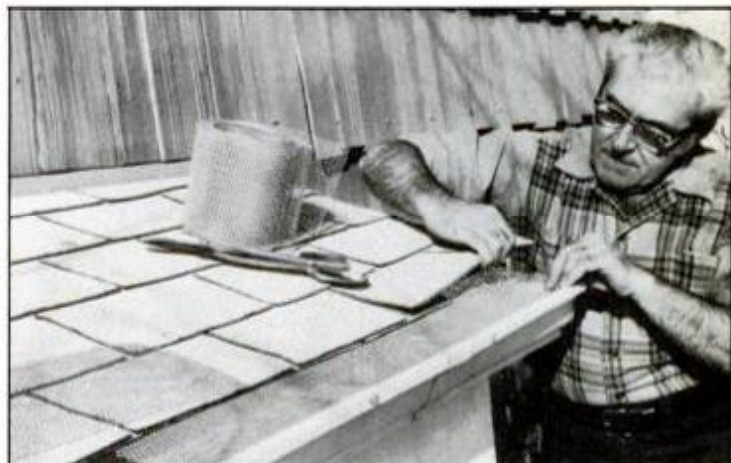
8 Small cracks in concrete cannot be patched by simply adding cement. Heaving will break it. Use a flexible crack filler containing butyl rubber which remains intact when joints expand and contract. One product is Campbell Krac-Kalk; one cartridge of it seals about 25 ft. of cracks $\frac{1}{4}$ in. wide by $\frac{1}{4}$ in. deep. Use a chisel to remove loose particles, clean and apply a continuous bead of the crackfiller.



9 Fix a plastic-webbed lawn chair with webbing in 38-ft. rolls. Measure between opposing screw holes on the frame, add $3\frac{1}{2}$ in. and cut webbing. Fold one end over at 45° to form a triangle, then fold again, dividing triangle in half. Fasten this end to frame with a screw. If hole is stripped, use a heavier self-tapping screw. Repeat the folding procedure on the other end of the webbing and fasten it to the frame.



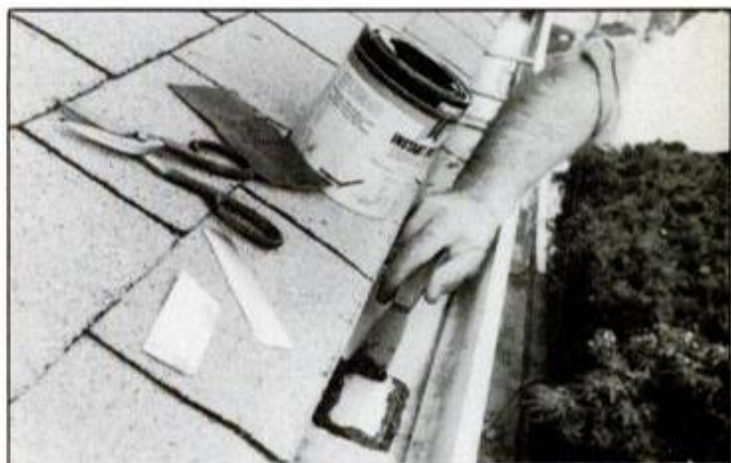
10 Tree limbs are frequently split in severe storms. When this happens, don't be quick to amputate. Open the split and liberally coat exposed wood and bark edges with tree wound paint. Tie the fracture tightly with stout nylon rope and secure it to a higher branch. Fertilize the tree.



11 Leaves and other debris can clog downspouts and cause several problems. Backed-up water will overflow gutters, damaging plants, eroding topsoil, staining the house or leaking inside it. A long gutter filled with water and weighing several hundred pounds can pull away from the house. Install aluminum-mesh leaf guards to keep out debris. Insert 3-ft. lengths of mesh under shingle ends and snugly against gutter lip. Overlap lengths about 1 in.

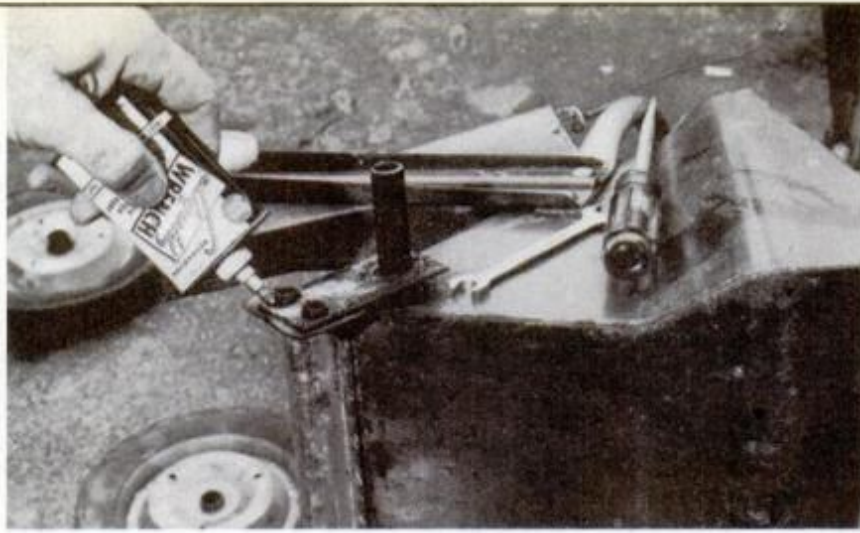


12 You can make a lasting pothole repair. To lock in the patch undercut the hole with a chisel so it's slightly larger inside than at the top. Clean out all loose particles, then fill hole with ready-mixed blacktop material. It should project slightly above the surrounding surface. Use end of a 2x4 to tamp patch firmly into hole and flush with ground level. Or place plywood over the mound and drive the front wheel of your car over it several times.

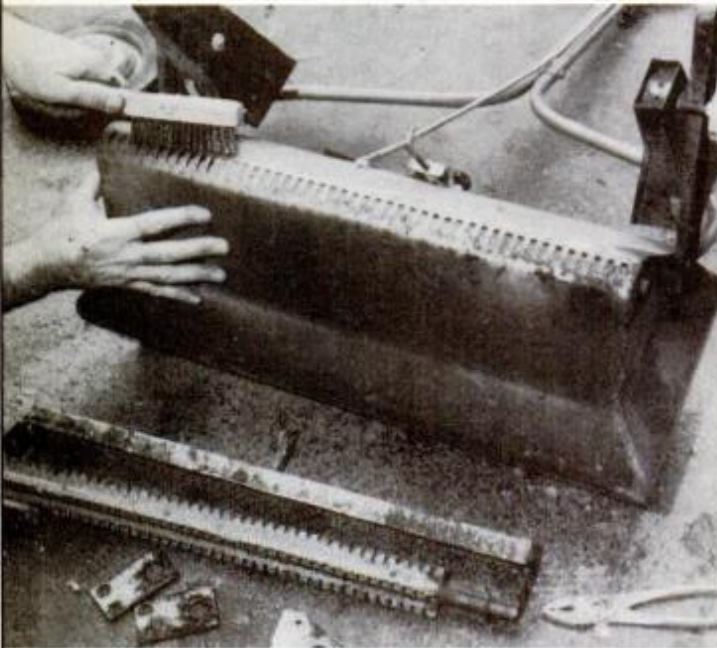


13 Repair a large gutter hole with a metal patch and asphalt roof cement. Sand and clean the damaged area; apply a liberal coat of roof cement. Cut a piece of thin sheet metal (galvanized or aluminum), coat bottom with cement and lay it in place over the hole. Complete the seal by applying additional cement over and around the edges of the patch.

14 Because strong fertilizers tend to corrode lawn spreaders, these tools usually wind up on the junk pile prematurely. A thorough washing after each use could add years of active service to their life. If your spreader has been neglected, these photos show how to get it into like-new condition for use this spring.



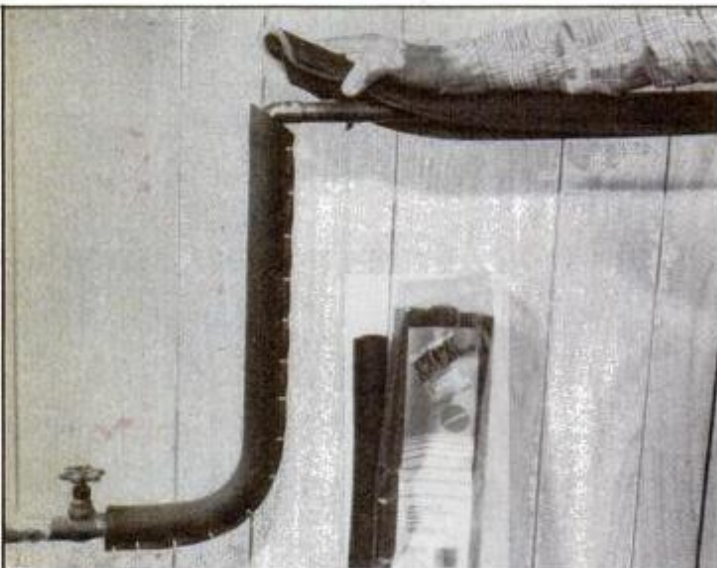
First, disassemble the lawn spreader to thoroughly clean the parts. Use penetrating oil to loosen badly corroded bolts. This will permit you to take apart the hopper and deflector bar. Tap the bolts with a hammer and apply more oil if necessary as you work to free the bolts from the spreader parts.



Second, use a wire brush to remove loose scale, then sand the rough spots down to the bare metal. Treat the hard-to-reach spots with rust-removing chemicals such as Naval Jelly.



Third, apply rust-inhibiting plastic paint such as Flecto's Varathane, protecting axle ends from paint. Always keep axles and wheel hubs oiled; hose down spreader after each use.



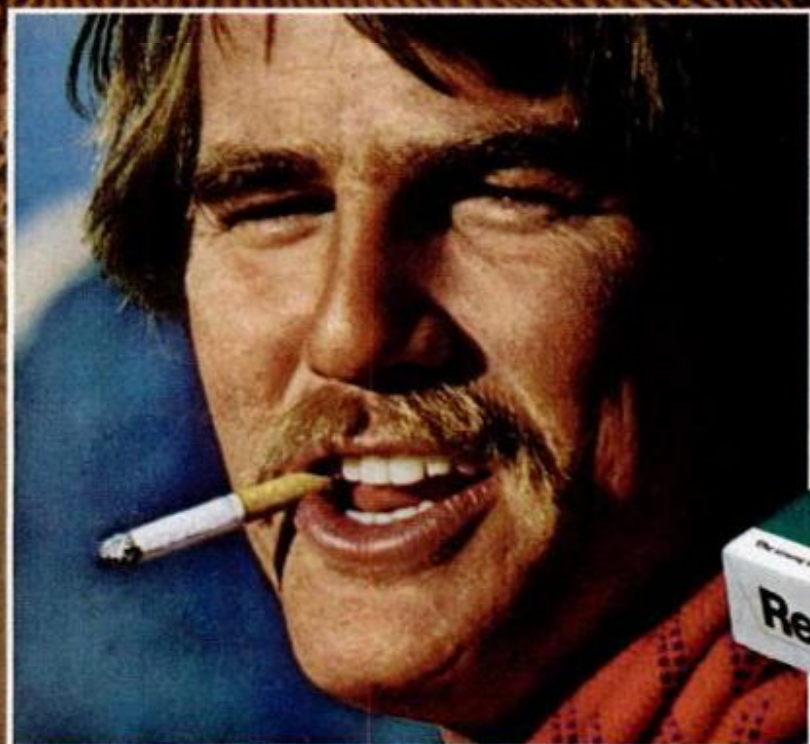
15 Cold-water pipes can sweat when water condenses on warm, humid days. Eliminate by covering pipes with insulation. Do-it-yourself foam pipe insulation made by Armstrong Cork Co. is flexible, durable and easily cut with scissors to make snug-fitting mitered corners at the bends. A pack containing 13 ft. of insulation costs about \$6.



Special metal clips are used over the insulation's flange to close the seam as shown. Clips are supplied with the insulation and should be applied every 2 in. along the run.

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Two great decks you can build

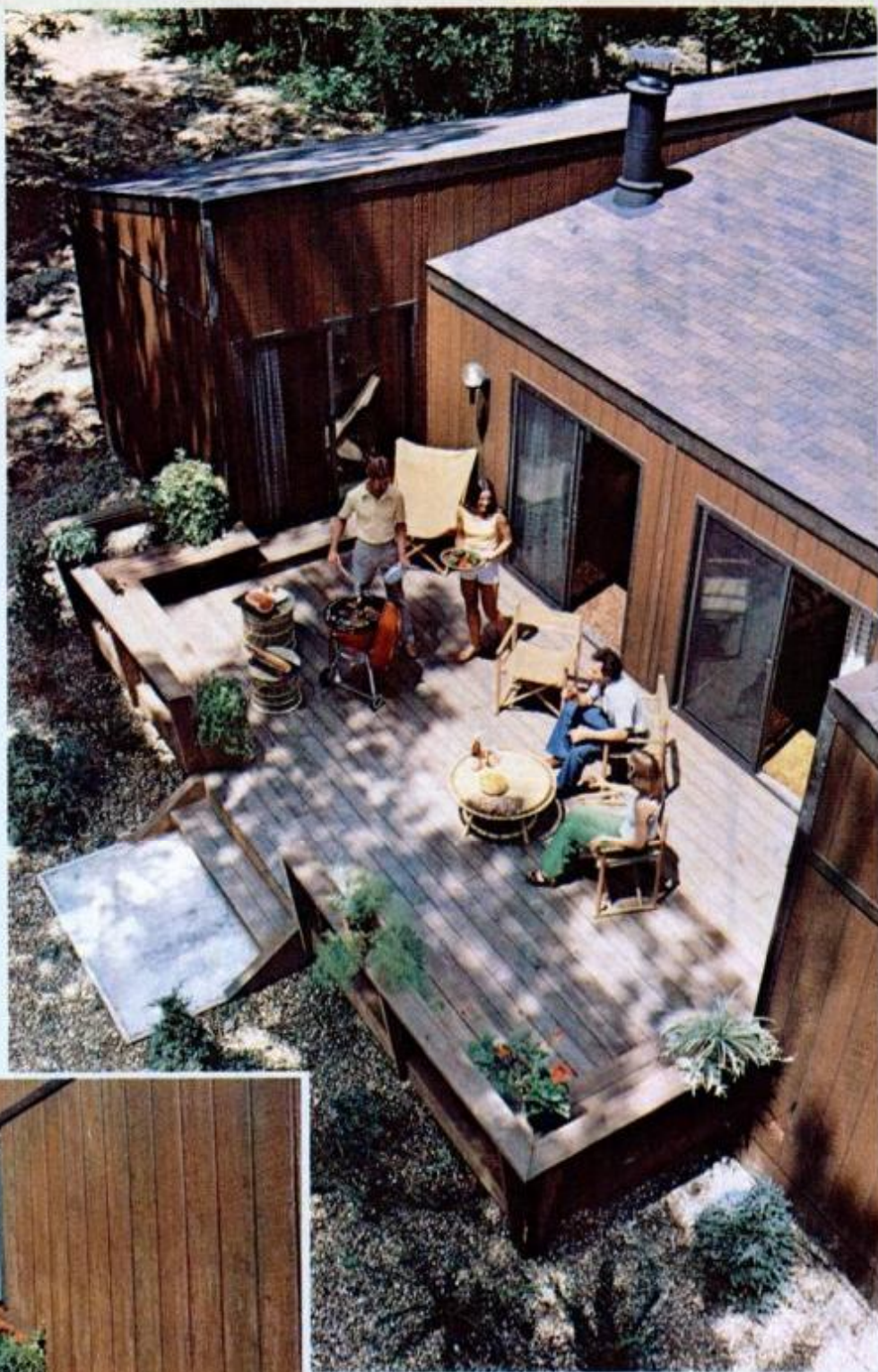
The handsome front and rear decks "made" the PM vacation house. Here's how both of them are built.

by Harry Wicks

HOME AND SHOP EDITOR

If you have the space, a well-designed, solidly built deck or patio will add a great deal to your home. Besides improving the looks of many homes, a handsome deck can alter a family's life style during the warm-weather months. And a well-built deck increases a home's value. If it is do-it-yourself built, the investment

PM photos by G. Ancona and R. Garland



Rugged rear deck (above) on PM Vacation Home is built for years of outdoor living. Perimeter railing incorporates benches to provide ample seating for large gatherings. The front deck was kept simple; the focal point is the container plantings grouped alongside the house wall. Steps are thick wooden slabs.



will probably be returned in full if you decide to sell your house.

When the PM Vacation Home appeared last fall (page 106, Sept. '78), a number of readers wrote in asking for the plans and how-to information for the good looking decks that we added to the front and back of the factory-built home. On these pages we show you how to duplicate both decks.

Choose material with care

For longevity, as well as appearance, be a little choosy about the wood that will make up your patio. You should settle for nothing less than Wolmanized (pressure-treated) or redwood lumber.

The first is pressure treated to assure many years of resistance to rot and decay, while redwood has a natural resistance to insect infestation. The latter is

frequently chosen for use on decks because of its beauty. When treated periodically with the recommended clear preservative, redwood ages to a handsome silver gray patina.

Both types of wood (even the pressure treated, with its slight greenish cast) can be stained to suit the decor you plan for your yard. A sensible lumber choice might be to use Wolmanized material for the

understructure—piers, joists, etc.—and redwood for deck and railings.

Planning your deck or patio

It's easiest if you start by sketching your planned deck on 1/2-in.-scaled graph paper. Though the temptation may be great to make the deck extra large, keep in mind that as its size increases so does the cost to build.

When you are satisfied with your floor plan sketch, move out to the actual job site. Carry along a number of 1x3 wooden stakes, a ball of mason's line, a tape measure and a hand sledge. Using the tape, lay out the perimeter of the deck, using the stakes and mason's line. Check corners for square, using the 6, 8 and 10-ft.

method (when one leg of a corner is 6 ft. and the second is 8 ft., the corner is perfectly square when the hypotenuse equals 10 ft.).

When the deck has been staked out, step back and take a long, hard look. If you're dissatisfied with the shape, size or appearance, rearrange the lines until you find a deck shape that seems to be compatible with both house and yard.

Rework your sketch, if necessary, and take it to your local building department to learn if a permit will be required.

Deck-building hints and tips

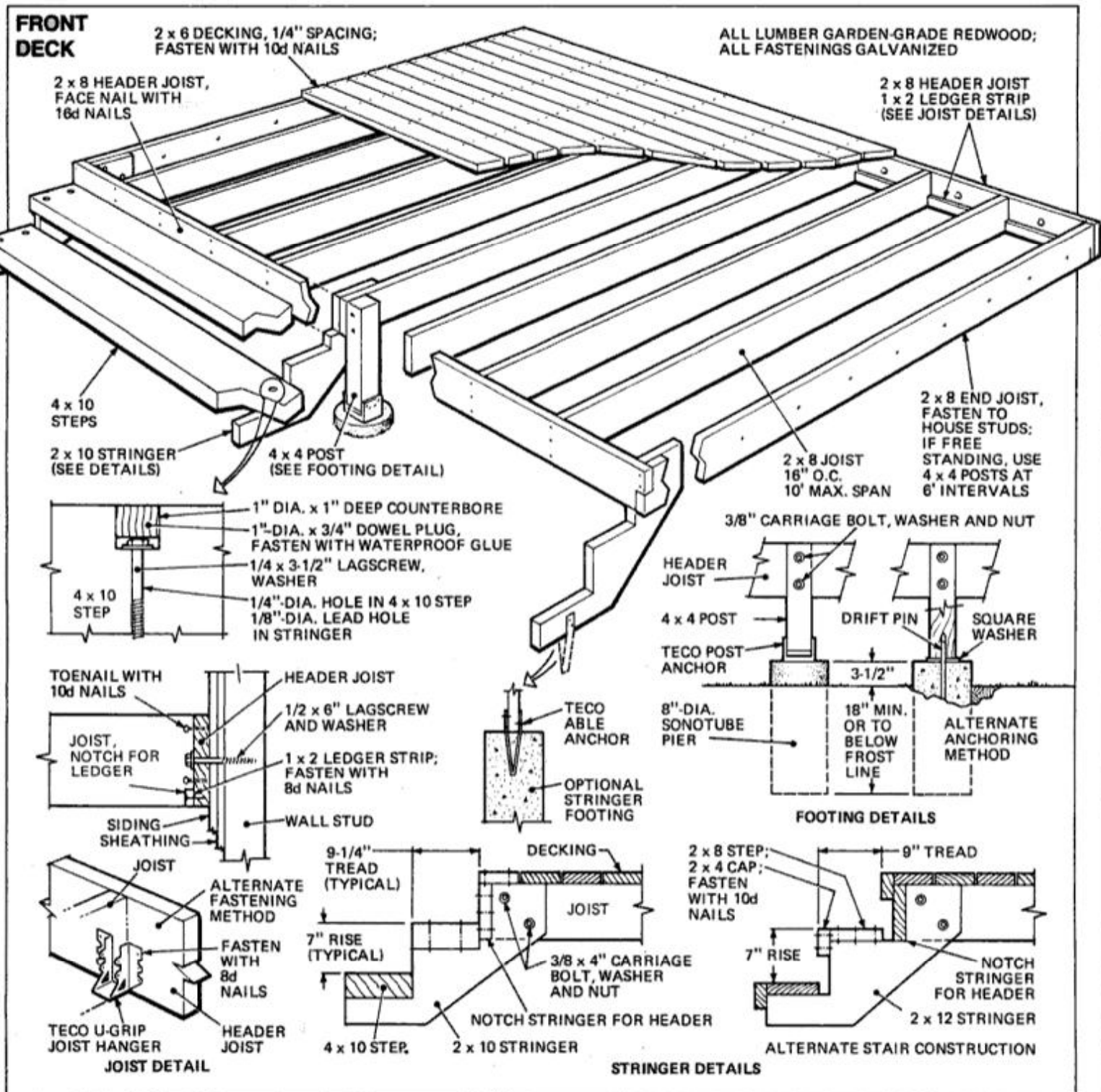
In general, building a deck is a chore well within the skills of the average do-it-yourselfer. But there are exceptions: If

yours will be on steeply pitched ground, or well up in the air, you may be well-advised to call in a qualified professional contractor for some assistance in pouring the footings and the like. Hillside construction is tricky, at best.

You can build a deck with mostly hand tools—hammer, saw, square, brace and bit, level, and shovels, but a couple of the right power tools will make the job go faster and save your back. A portable drill and circular saw will save many arm-wearying hours when building a deck.

Since dimensional lumber is the best bet when building a deck, we designed ours to make use of such readily available stock. With the exception of the 4x10

(Please turn to page 159)





Got a ceiling problem?

Cover it up! Dress it up! Light it up! Quiet it down! With a new Armstrong suspended ceiling.

Whatever your ceiling problem—covering up an old or damaged ceiling, adding a new room, or finishing off a basement—an Armstrong suspended ceiling is a problem-solver with style. Beautiful. Washable. Fire-retardant for extra protection. Preengineered for energy-efficient fluorescent lights.

Best of all, with an Armstrong suspended ceiling, like Bennington shown above, solving your ceiling problem is a do-it-yourself project. There are no staples or glue to mess with, no plastering or sanding. The big 2' x 4' ceiling panels simply drop into the color-matched Super White Grid. The ceiling is easy to install and easy to keep looking fresh and new. If a panel gets damaged, just lift it out, and lay in a replacement.



If lighting is a problem, you can install Armstrong fluorescent fixtures with the ceiling . . . for lighting where you want it, not just where the builder put it.

You can install a beautiful new Armstrong suspended ceiling almost anywhere in your home. Briefly, here's how:

Hang the Armstrong Super White metal runners about three inches below your existing ceiling or open joists (about six inches with light fixtures).

Snap the Armstrong Super White cross tees into the main runners, and lay in the ceiling panels. It takes some time, but it's easy. You can do it!

See your Armstrong ceiling retailer for a broad selection of suspended ceilings. Find him under "Ceilings" in the Yellow Pages. Or send us this coupon, and we'll send you his name and a free full-color brochure.

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GREAT DECKS YOU CAN BUILD

(Continued from page 157)

steps on the front deck, all materials are carried by well-stocked lumberyards and home centers. To save frustration and hunting for the 4x10s (such stock may be hard to come by in some areas), we show an alternate step construction that gives the same slab appearance, except that you make the treads using 2x4s and 2x8s. (See detail in lower right-hand corner of drawing on page 157.)

There are several ways of fastening a deck to a house. We decided to use the header joist-and-joist-hanger method. The header joist is well secured to the house with hefty lagscrews through siding and into wall studs. (Note: Lagscrews

must be anchored in studs, or the header joist may separate from house wall.) On the model house we used metal (Teco) hangers to secure joists to header joists; but you can avoid buying the connectors by fastening ledger strips to header joists as shown in the drawing. In this case, every joist should be carefully notched to assure its seating squarely on the ledger strip.

Use rustproof hardware

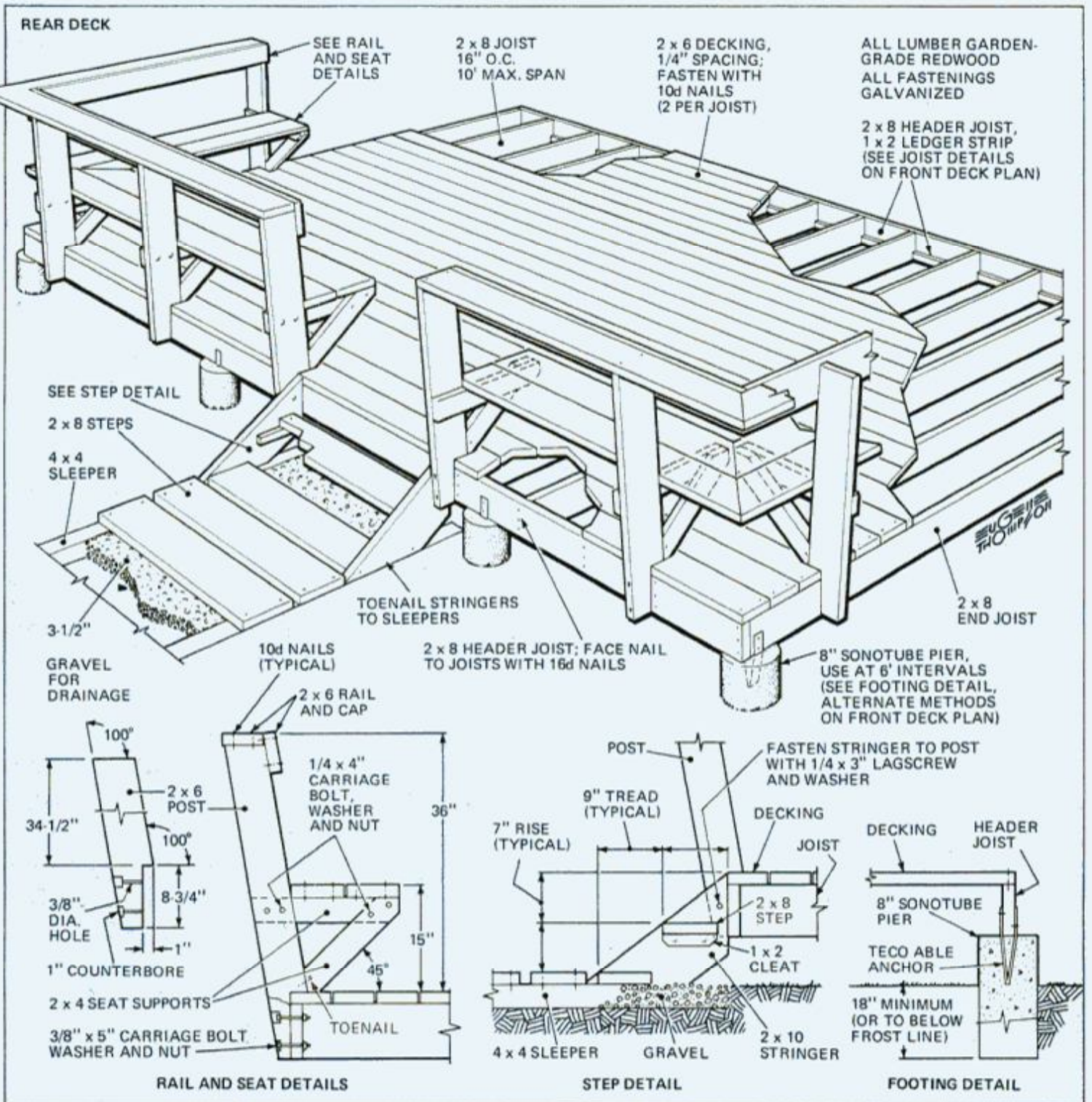
You do not need a great deal of hardware to build either deck. So spend a couple of more bucks and buy only galvanized hardware. It is worth the extra cost to avoid the rust stains that will appear if you use ordinary steel hardware and expose it to the weather. And, do take time

to bore pilot holes for nails when fastening near the end of a board; this will prevent splits in your expensive lumber.

About the deck floor

The deck floor is the most visible part of your deck. Take your time when installing the floor to make certain it will have a craftsman-like appearance. Our pattern is a simple one—the same-width deck boards are laid parallel with ends staggered over various joists. You may opt for a herringbone design, or experiment with alternate widths to come up with a look of your own choosing. No matter which pattern you elect to use on your deck, make it a point to lay each board with its bark side up. That is, when viewing a board from its

(Please turn to page 250)



Give your fireplace a custom look with tile

If you're going to install one of the new prefab, zero-clearance fireplaces in your home, consider facing the front of it with ceramic tile. We chose American Olean's Renaissance Copper style for its beauty, as well as its utility. Glazed tiles are durable and ideally suited for surfaces that tend to collect soot or dirt, since they wipe clean with a damp sponge. A specially formulated flameproof wall-tile adhesive (AO-1700 by American Olean) makes it easy for the do-it-yourselfer to tackle the job.

After framing out the enclosure for your unit, sheath it with gypsum board and begin to lay out for the courses to be centered above the fireplace opening. Spread the wall tile adhesive with a notched trowel and then set the tiles, leaving a 1/8- or 1/4-in. space between them. Next, lay out and set the tiles at the sides of the firebox opening. A rubber mallet can position and level the tiles.

The border tiles can be cut by scoring and breaking with a hand cutter, or by using a power saw and carbide blade. We checked with a local tile supplier and found the rental fee on these to be reasonable—\$2 a day.

The hearth tiles are set in a 2-in.-thick bed of mortar while it's still wet. Adhesive is not necessary on horizontal surfaces. Our mortar bed was laid out to accommodate three full courses of tile, plus the trim tiles at the edge. Plan full courses wherever possible—the less tile cutting, the better.

A rubber-faced trowel is used to force grout into joints because it won't scratch the glazed tiles. We chose a matching dark brown Renaissance grout since we wanted the fireplace wall to be a solid, visually quiet focal point for a room abounding in organic shapes and textures.

PM



1 Spread wall tile adhesive over drywall. Level line (arrow) guides courses.



2 Set all tiles over fireplace, draw vertical line for setting tiles below.



3 Next, measure for the width of border tiles which must be cut.



4 Cut border tiles with power saw or with hand-operated cutter (shown).



5 Use a carborundum stone to smooth rough spots on cut edge of each tile.



6 Make certain the border tile joints line up with the full tiles.



7 Wire lath is nailed to plywood to anchor mortar bed for the raised hearth.



8 Trowel concrete 2 in. thick over wire lath, using a mortar mix.



9 Screed mortar bed with a straight board; check with a spirit level.



10 Hearth should extend 18 in. from opening at front, 12 in. at sides.



Tired of a plain-looking fireplace? Consider a face lift with variegated copper-colored tile and brown grout in the joints for a look of understated elegance and warmth.



11 Draw line (arrow) where full tiles start. Apply skim coat of mortar.



12 Level and seat tiles in mortar by tapping the board with a hammer.



13 Position edge tiles carefully so the joints line up properly.



14 Corner tiles must be mitered using a power saw with carbide blade.



15 Force grout into joints with rubber-faced trowel; protect adjoining wall.



16 When grout starts to set, wipe excess from tile face with sponge.



Prevent basement flood damage

All you need to know about sump pumps—how to buy, install and use one.

by Joseph R. Provey
ASSISTANT HOME AND SHOP EDITOR

Put away the bucket and mop and invest in a sump pump if you're plagued with water seepage in your basement. A sump pump can prevent damage to your heating plant and appliances. It can also be used in conjunction with a pressure relief system (see page 167) to convert what has always been a wet basement to a dry workshop or finished family room.

If you already own a sump pump, but its capacity is too low, it's not automatic or you want a standby pump in case the old one fails, consider buying a new one. Study the features and accessories mentioned in this article and then look over the pumps firsthand in a plumbing supply outlet or hardware store. If you don't find what you want, write the manufacturers for their nearest distributors.

Choosing the right model

A vertical (tall) sump pump will generally give you the most pumping capacity per dollar. A submersible pump, which operates under water, costs more because the motor housing must be com-

pletely sealed. On the plus side, the shorter pump will give you quieter performance—and, since it's installed below floor level, there's less chance one will get in your way.

A pump motor's horsepower rating is a rough indicator of how that pump will perform. Generally speaking, $\frac{1}{2}$ hp is adequate. Since horsepower ratings can be nebulous, however, also check a pump's capacity and current draw (amperage rating). Pump capacity (measured in gallons per minute or per hour) indicates how much water will be pumped from your basement through a discharge pipe at a given head (height to which the water is pumped). The current draw or amp. rating will give you a fair idea of how many watts—and dollars—the pump will consume when you run it (watts = volts \times amps). The most efficient pump is the one that delivers the greatest capacity for the least amount of current drawn. Note: All the pumps listed in this article have enough capacity for almost any residential basement.

Next, decide whether to buy an automatic or manually activated pump. Two good reasons for choosing an automatic pump are convenience and peace of mind while you're away. Before buying one, examine the device which is supposed to click the system on in your absence. If you choose a float-activated type, be sure it's constructed of materials

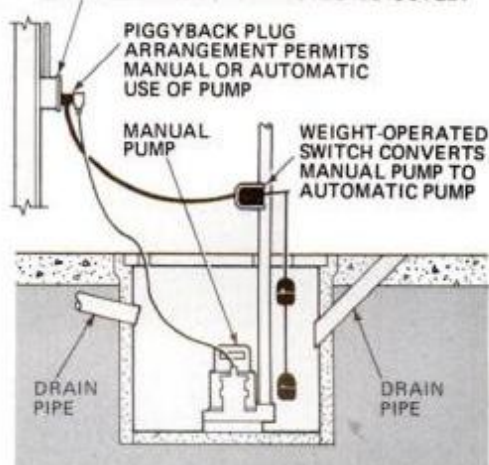
that will not corrode, crack or puncture. Submersible models with diaphragm-type switches are the least likely to fail due to an obstruction.

For light duty and portability, consider a manually operated, low-level floor drainer—also known as a sumpless sump pump. They are ideal for slurping up lo-

(Please turn to page 164)

CONVERT MANUAL TO AUTOMATIC

SEPARATE AND G.F.C.I.-PROTECTED OUTLET



Turn a manually activated sump pump into an automatic to prevent flooding while you're away. Weight-operated switch clamps to discharge pipe. Piggyback plug accepts pump plug, eliminates need for wiring. Parts kit (Little Giant) is about \$10.

11 Liberty Model 101F



12 Jacuzzi Model 3JCT



13 Goulds Model DVP



14 AMT Series 233



10 Kenco Model 58N

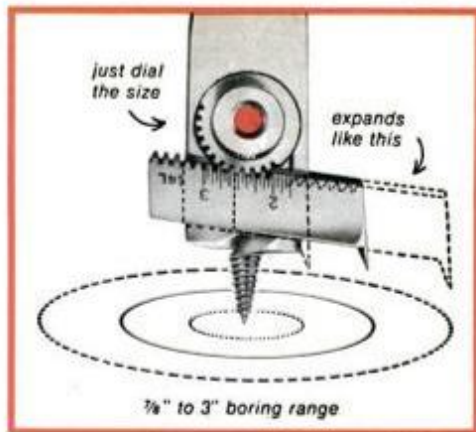


with a sump pump

SUMP PUMP EQUIPMENT SOURCES

- Number in parentheses after price is a model shown above.
- American Machine & Tool Co., Box 70, Royersford, Pa. 19468; (14), \$100-\$115; capacity, 2750 gal./hr. at 10-ft. head; 1½-in. discharge; automatic.
 - Aquanot Enterprises, Inc., Box 121, Chicago Ridge, Ill. 60415; emergency pump system, \$379 without battery; capacity, 2400 gal./hr. at 10-ft. head; 1½-in. discharge; automatic.
 - Barberton Plastics Products, Inc., 65 Robinson Ave., Barberton, Ohio, 44203; sump basins.
 - Expert Corp., 1754 North Paulina St., Chicago, Ill. 60622; power reserve sump pump system, about \$700; capacity, 2100 gal./hr. at 10-ft. head; 1½-in. discharge; automatic.
 - Flotec, Inc., 14510 South Carmentia Rd., Norwalk, Calif. 90650; (7), \$80; capacity, 1300 gal./hr. using garden hose or 1-in. pipe; automatic.
 - Goulds Pumps, Inc., Box 330, 240 Fall St., Seneca Falls, N.Y. 13148; (13), \$96; capacity, 2400 gal./hr. at 10-ft. head; 1½-in. discharge; automatic.
 - Hydr-O-Matic Pump Div., Wylain, Inc., Box 327, Claremont and Baney Rds., Ashland, Ohio 44805; (2), about \$100; 1800 gal./hr. at 10-ft. head; 1½-in. discharge; automatic.
 - Jackel, Box 1024, South Bend, Ind. 46624; fiberglass reinforced polyester sump pits, check valves, pump accessories.
 - Jacuzzi Bros., Inc., 11511 New Benton Highway, Little Rock, Ark. 72203; (5), \$139; capacity, 2300 gal./hr. at 10-ft. head; (12), \$119; capacity, 2940 gal./hr. at 10-ft. head.
 - Kenco Pumps Div., American Crucible Prod. Co., 1305 Oberlin Ave., Lorain, Ohio 44052; (6), \$90; capacity, 1800 gal./hr. at 10-ft. head; 1½-in. discharge; automatic; (10), \$145; 1200 gal./hr. at 10-ft. head; 1½-in. discharge; manual.
 - Liberty Pumps, Inc., 8629 Buffalo Rd., Bergen, N.Y. 14416; (11), \$75.60; capacity, 2610 gal./hr. at 10-ft. head; 1½-in. discharge; automatic.
 - Little Giant Pump Co., 3810 North Tulsa St., Oklahoma City, Okla. 73112; (8), \$129; capacity, 2500 gal./hr. at 10-ft. head; 1½-in. discharge; automatic; UL listed.
 - Penberthy Div., Houdaille Industries, Inc., Box 112, Prophetstown, Ill. 61277; (3), \$177; capacity, 2400 gal./hr. at 10-ft. head; 1½-in. discharge; automatic.
 - Sta-Rite Industries, Inc., Water Equipment Div., 234 South 8th St., Delavan, Wis. 53115; (9), \$93; capacity, 2520 gal./hr. at 10-ft. head; 1½-in. discharge; automatic.
 - Tail Inc., 500 Webster St., Dayton, Ohio 45401; (1), \$140.50; capacity, 2000 gal./hr. at 10-ft. head; check valve built into unit; 1½-in. discharge; automatic, UL listed.
 - Zoeller Co., 3280 Old Millers La., Louisville Ky. 40216; (4), \$96.30; capacity, 1700 gal./hr. at 10-ft. head; 1½-in. discharge; automatic.

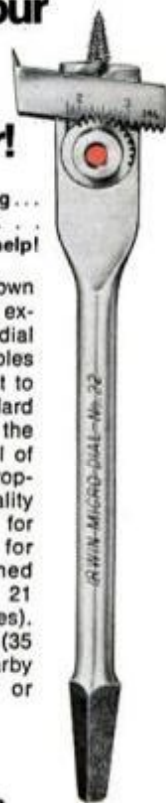
Lightweight, prefabricated plastic pit simplifies pump installation. Cutaway of seamless basin (by Barberton Plastics) shows vertical pump (Zoeller Model 73) installed with pit cover and check valve. Hub can be used to tie into drain system.



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Set of 6 Speedbor "88" bits with metal hang-up rack. Sizes 3/8", 1/2", 5/8", 3/4", 1". No. 886M.



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Chalk Line Reel Box—50 ft. & 100 ft. sizes. Popular-priced Irwin self-chalking aluminum alloy box. Easy action reel. Leak-proof. Practically damage-proof. Fits pocket or hand. © Registered U.S. Patent Office



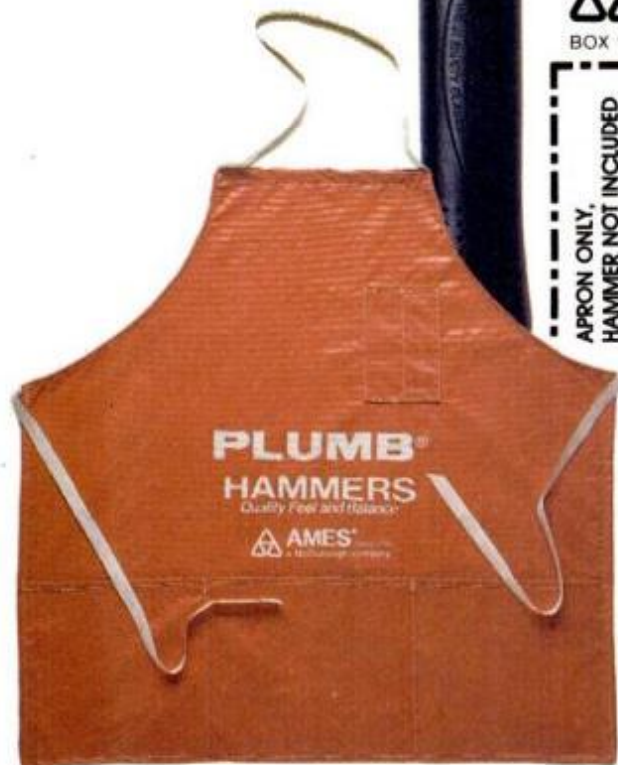
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And if you need a shop apron, look at this dandy. It's laminated of nylon and vinyl, flame-resistant and sheds oil, grease and gasoline. Cleans up with soap and water. Features reinforced neck strap, heavy-duty pockets, and 50 pound test nylon thread stitching throughout. A \$7 value, it's yours for just \$3.99 and the coupon below.



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Aquanot Safeguard sump pump (left) operates on house current or, during emergencies, on regular 12-volt truck battery. It pumps about 4000 gallons of water per full battery charge. When equipped with solid-state power pack (below), system automatically converts to d.c. battery power in event of a power outage. After power is restored, power pack recharges battery; built-in safeguard protects against overcharging.

SUMP PUMP FLOOD PROTECTION

(Continued from page 162)

calized overflows from washing machines, dishwashers, sinks and so forth, and do not require digging of a sump.

Those pumps made with corrosion-resistant materials where they are exposed to water are, of course, more desirable—and more expensive—than those which are not. Pumps with cast-iron housings will eventually rust away, however slowly. Pumps made with brass, bronze and stainless steel should last longer. Plastics are suitable for pump construction with one drawback—they do not dissipate heat from the motor as well as metals. As a consequence, plastic-housed pumps must often be designed to run at lower capacities.

Other features to look for include built-in check valves, UL listings and certification by the Sump Pump Manufacturer's Assn. (SPMA).

If you want to protect yourself even when a severe storm knocks out the power, consider a sump pump which can run on batteries. A do-it-yourself installation, complete with batteries, can cost well over \$500. Other options include generator-run sump pumps and jet pumps which are powered by household city water pressure.

How to install a sump pump

First mark the location of the sump on

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WARRANTY.

Unit includes: depth control,
fold-down handles, oil, wrench,
Briggs & Stratton engine,

shipping box.
DIRECT FROM FACTORY.
Brochure Free



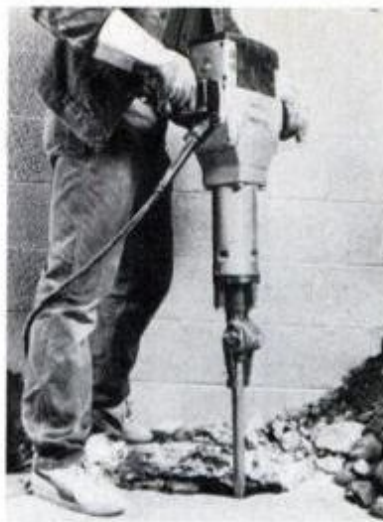
PRECISION VALLEY MFG. CO.

Box 9041, Springfield, VT 05156

DIGGING A SUMP PIT



If your basement floor chips easily, masonry drill (above) used in conjunction with sledge hammer may be all you'll need to start sump. For slabs with coarse, hard aggregates don't break your back—rent electric hammer (right).



Floor of concrete block laid over fine wire mesh provides base for pump, helps keep sand and dirt from damaging pump.



Use trowel to slightly bevel concrete patch toward edge of pit housing. We used round flue pipe for housing on this job.

the basement floor. If possible, choose a low spot about 6 in. from a wall. Scribe a circle with a diameter about 6 in. longer than the finished sump diameter recommended by the pump manufacturer (usually about 18 in.).

Break through the concrete slab and excavate to the depth recommended by your pump manufacturer (usually about 24 in.). Install the base and sump hous-

ing. A clay tile or round flue pipe like the one used in the photos requires two men and ropes slung under the pipe in order to ease it into the hole. A prefabricated sump makes a lot more sense. They're lightweight and cheaper. Choose one that looks like it will last (see photo on page 163).

The electric outlet for your sump pump
(Please turn to page 167)

SUMP PUMP WITH POWER RESERVE



Expert's Reserve Power pump system is powered by two 6-volt, heavy-duty, 100-amp./hour batteries designed for this use. They are rated for 20-year service.



To activate batteries, fill with acid (supplied) per maker's instructions. Wear plastic gloves and splashproof goggles. Have water handy for flushing skin.

Nightscape with Starbrite



Starbrite low-voltage outdoor lighting enhances landscape beauty, discourages prowlers. Child and pet safe. Installs in minutes with no special tools.



Six lens colors let you change to match the spirit of the season. Other accessories include high/low switch and automatic timers.



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TRACTION PLUS.
Power King's size and weight combine with big, ground-gripping tires for superior traction. Addition of wheel weights and/or loading of tires gives you enormous pull-power.



Power to take on tough jobs. It takes real muscle to handle big plowing jobs. To move mountains of snow. To mow acres of lawn. And have power to spare when tilling, discing, cultivating, dozing, loading, log splitting and more. Power King's got the muscle to handle jobs like these. And what's more, Power King is built super tough, super strong, for years of reliable service.

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Engineering Products Co., 1005 K-4 Anoka Ave., Waukesha, WI 53186.

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Up to an amazing 19". Compare that with other garden tractors! You can cultivate taller crops, handle big, Power King implements, work easily over rough ground.

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With twenty-five quick-change attachments, you can put your Power King to work to handle all the tough jobs on your place.

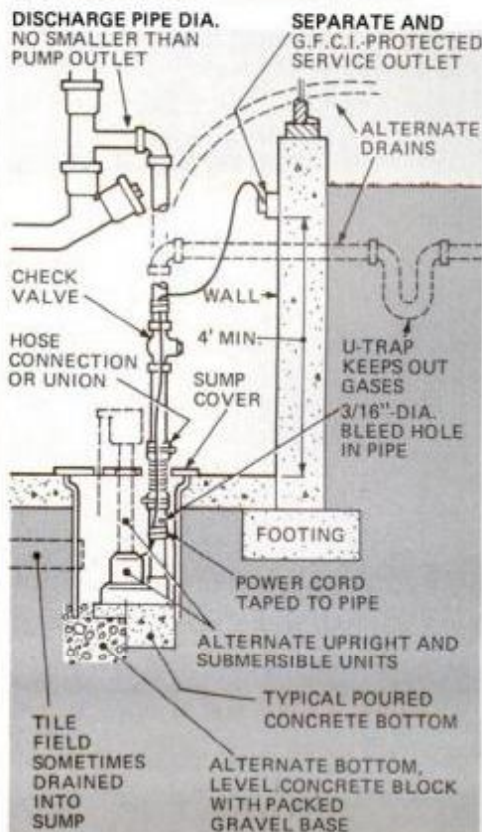


Check valve, installed in discharge pipe, prevents backflow into sump. Connect it 3 ft. above the pump's discharge and be sure that the flow is away from the pump.



Connect batteries in series to controller. Avoid overtightening at terminals and coat with petroleum jelly to prevent corrosion. After charging batteries, cover them and place controller on top of one.

TYPICAL PUMP INSTALLATION



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Airguide
2212 Wabansia Chicago 60647

SUMP PUMP FLOOD PROTECTION

(Continued from page 166)

should be on a grounded and separately fused or breakered circuit. A ground fault circuit interrupter is highly recommended. Install or have the outlet installed at least 4 ft. above the floor—do not use an extension cord.

You can discharge your sump out a window to the nearest sewer, or to a splash block (at least 24 ft. from the house). You can also connect it directly to the house drainage system or to a dry well. No pipe or fitting should be smaller than the discharge port of the pump at any point along the discharge route.

A flexible union installed just above the sump will facilitate removal of the pump for cleaning and repair and will also reduce vibration and noise when pump is in operation. Where a check valve is used, drill a relief hole in discharge pipe (below

floor level) to prevent an air lock.

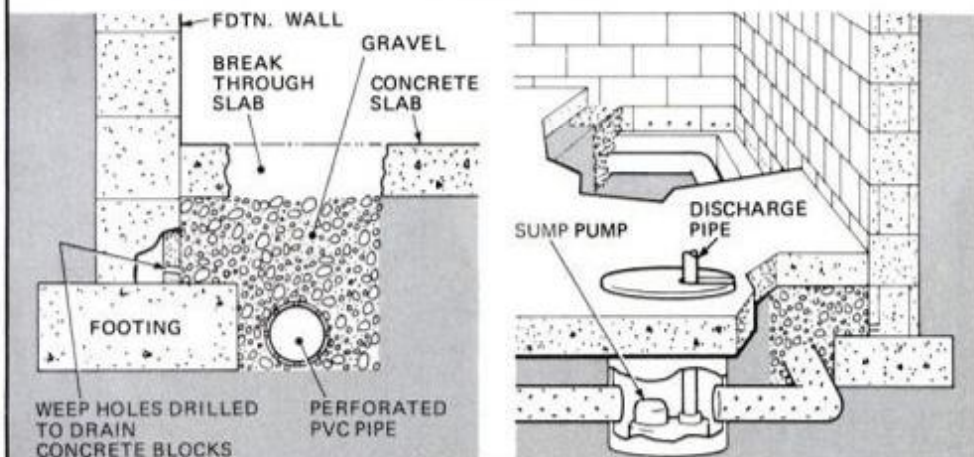
After the discharge piping is complete, clean any debris from the pit and set the pump in place. Secure the power cord to the discharge pipe so it will not interfere with the float mechanism or wear against the abrasive edge of the pit.

Finally, install a cover to keep garbage out of the sump, prevent odors and, more importantly, guard against accidental injury. Test the pump by filling the sump with water and turning on the pump. *Do not run pump dry.*

The SPMA, which assisted with gathering information for this article, has literature available on installing and troubleshooting sump pumps, plus a list of pump standards. The package costs \$1 from the Sump Pump Manufacturers Assn., 221 North La Salle St., Chicago, Ill. 60601. A list of certified sump pumps and SPMA members is also available on request.

FM

WHEN TO INSTALL A PRESSURE RELIEF SYSTEM



TYPICAL PRESSURE RELIEF SYSTEM

A simple sump pump installed in a sump is fine if you are willing to tolerate some dampness and an occasional puddle or two. Most basement floors are not perfectly graded to a single low spot and, since convenience usually dictates locating the pump in an out-of-the-way corner, some water is bound to accumulate in depressions. While this is tolerable when a basement is only used to house your furnace or store a few odds and ends, it's undesirable if you have plans for turning the space into a family or recreation room. Even a few puddles can lead to the ruin of your expensive finished floors and paneling.

According to the experts at Vulcan Basement Waterproofing, a pressure relief system is the only way to handle situations where water penetrates basements due to pressure buildup outside foundation walls or due to a chronically high water table. Their experience has shown that other methods, such as injecting soil around the foundation with chemicals to fill voids or coating the foundation walls with a tar-based membrane, are hit-or-miss temporary solutions at best.

How a drain system works

A pressure relief system works because it

removes water pressure at the base of the footing (20 to 30 in. below the basement floor), permitting no buildup of water pressure. With no pressure, there is no water penetration through the walls or floor.

Installing such a system requires laying 4-in. perforated PVC pipe on a bed of No. 2 stone around the inside perimeter of the basement at the footing level. The drains are connected to a sump where a pump discharges the water.

This job is not one for a weekend do-it-yourselfer. It entails breaking through the basement slab with a jackhammer and digging to the footing—backbreaking work to say the least. While the channel is open, holes are drilled in the bottom course of block to drain any water that might be trapped in the blocks. Then the drains are laid as nearly horizontal as possible. If any pitch is allowed, it would, of course, be sloped toward the sump connection. Afterward, a fairly large quantity of concrete must be mixed to patch over the channels to the level of the existing slab. Remaining rubble must be carted away (usually through a basement window).

Your best bet is to call in professional waterproofers for this kind of work. Get several estimates and references first.



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Low-voltage Power-Trac spotlight lamp holder by Halo is designed to cut energy usage and provide better light control. Its filament shield traps spilled light and reduces glare; stippled reflector is said to promote a uniform beam. The lamp holder fits all Halo Power-Tracs. Pivot the units by hand in the direction desired. Halo Lighting, 400 Busse Rd., Elk Grove Village, Ill. 60007.



Plaskolite shower stall (left) is knock-down unit that can be assembled in the bathroom. No need to position it directly over the drain—the optional raised stall floor, shown here, allows hookup to remote drain. It comes with base, grab rail, faucets, shower head, drain, soap dish, curtain and hardware for about \$120. Plaskolite Inc., 1770 Joyce Ave., Box 1497, Columbus, Ohio 43216.



Although it looks like embossed wood, ceiling (left) has 2x4-ft. panels of mineral fiber. The panels are inserted in a metal grid that hangs from wires attached to the ceiling joists. The Bennington pattern is based on Early American door designs. Cost is about 63 cents per sq. ft. for panels; wires and grid-work for 10x12-ft. room run about \$30. Armstrong Cork Co., Lancaster, Pa. 17604.

Easy-to-handle Marlite planks come in 1/4 x 16-in. x 8-ft. size—only one-third the size of conventional paneling. Tongue-and-groove edges assure tight joints. Concealed metal clips and adhesive provide strong bond to old walls or framing. Planks come in accent colors, wood-grained and patterns; smooth surface at \$12; textured at \$14 per panel. Masonite Corp., Dover, Ohio 44622.



22 new products for better living



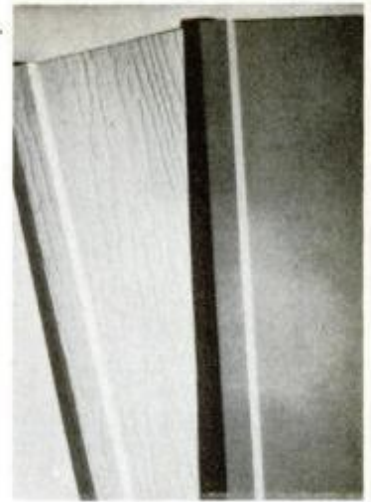
When plastic webbing of your aluminum lawn chairs wears out, you can replace it with durable wood slats—fir and other white woods given a redwood stain (above). Slats are mounted on adjustable aluminum bands. You can install seat and back in several minutes; the only tool you need is a screwdriver. Kit is priced at \$7 by Sun Terrace Casual Furniture, Box 2377, Clearwater, Fla. 33517.



Harmonic III paneling combines three textured wood-grain prints—oak, ash and pecan—alternating in six random planks per panel. It is made of tropical hardwood plywood in 4 x 8-ft. sheets, 5/32 or 1/4 in. thick, priced at \$10 a sheet. Manufactured by Georgia-Pacific, 900 S.W. Fifth Ave., Portland, Ore. 97204.



Add a decorative touch to wood or metal furniture and cabinetry with rust-proof 50B bronze grill. A 30-in. width is priced at \$8.75 per ft. Wireway Co., 368 Pratt's Junction Rd., Sterling, Mass. 01564.



Get a new look in siding with Hunter Douglas vertical aluminum panels. They come in eight colors, smooth or wood-textured, 15 panels in a carton for \$53. Hunter Douglas Inc., Box 650, Durham, N.C. 27702.



Adapt these Classic Harvest modular wall units where you need extra storage. Base cabinets start at \$230 per pair; two-shelf wall units at \$240. Haas Cabinet Co., Sellersburg, Ind. 47172. [\(Please turn to page 170\)](#)



"GRIT-EDGE" BLADES CAN CUT IT

Remington tungsten carbide "Grit-Edge" blades cut materials you wouldn't or couldn't cut with ordinary saw blades.

MATERIAL	ROD SAW	HACK-SAW	SABER SAW	CIRC. SAW	BAND SAW
Asbestos-Cement	•	•	•	•	•
Beryllium	•	•	•	•	•
Carbon	•	•	•	•	•
Cast Iron	•	•	•	•	•
Composites	•	•	•	•	•
Composition Board	•	•	•	•	•
Fiberglass	•	•	•	•	•
Foamed Glass	•	•	•	•	•
Friction Materials	•	•	•	•	•
Glass	•	•	•	•	•
Hardened Steel	•	•	•	•	•
Honeycomb Materials	•	•	•	•	•
Marble, Natural	•	•	•	•	•
Marble, Synthetic	•	•	•	•	•
Plaster	•	•	•	•	•
Plastic Laminates	•	•	•	•	•
Plywood	•	•	•	•	•
Stainless Steel	•	•	•	•	•
Stranded Cable	•	•	•	•	•
Superalloys, Iron-base	•	•	•	•	•
Superalloys, Nickel-base	•	•	•	•	•
Tempered Hardboard	•	•	•	•	•
Tires, Steel-Reinforced	•	•	•	•	•
Titanium	•	•	•	•	•
Tile, Ceramic	•	•	•	•	•

*Requires coolant and variable-speed machine



When ordinary blades can't cut it.

Remington DU PONT

Remington and "Grit-Edge" are trademarks registered in the U.S. Patent and Trademark Office.

STRATA SYMBOL



Cutting right through a layer of ceramic tile, mortar and metal lath is not a job for an ordinary saw blade. You need a Remington tungsten carbide "Grit-Edge" saber saw blade for that. And for cutting fiberglass, particle board, plastic laminates, synthetic marble and plenty of the other "unsawables."

Long-lasting "Grit-Edge" blades have no teeth to snag, dull or break. Never need resharpener. Economical to use for all of those cutting jobs where you wouldn't or couldn't use an ordinary saw blade.

See your hardware dealer or write: Abrasive Products, Remington Arms Company, Inc., Bridgeport, Conn. 06602.



When ordinary blades can't cut it.

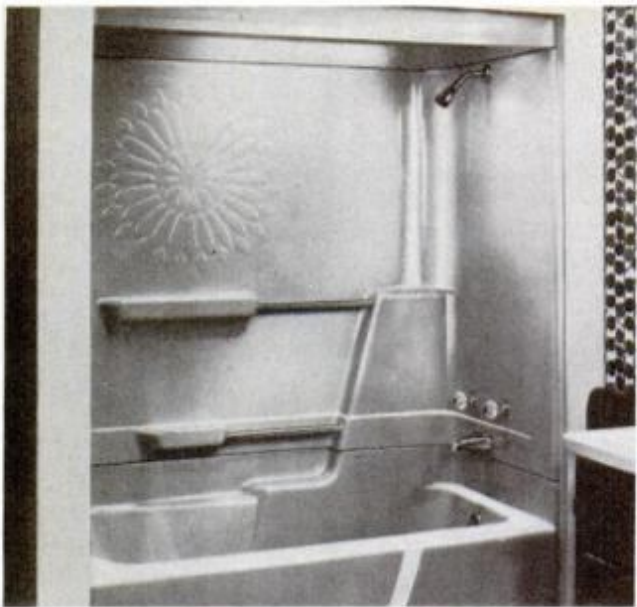
Remington DU PONT

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'79 Home Ideas Guide

22 NEW PRODUCTS FOR BETTER LIVING

(Continued from page 169)

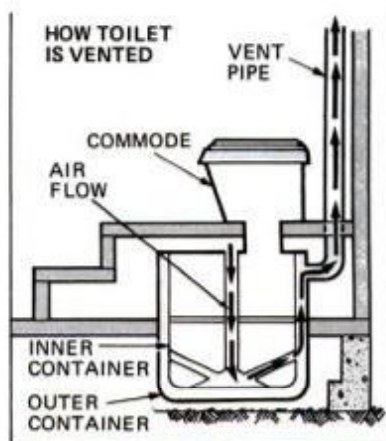


This two-piece fiberglass tub/shower unit called Gemini fits through bathroom doorways, making it ideal for bath remodeling. The tub section has a large-size sump area and the upper three-wall section fits tightly on the tub. Setting compound makes a watertight seal between the two sections. Other features include two grab bars and four soap/shampoo ledges. The unit is priced from \$340 in white; for \$20 more you can get it in blue, green, gold and cream. Universal-Rundle Corp., 217 North Mill St., New Castle, Pa. 16103.

Helpful for older persons and wheelchair patients, the Highline Water-Guard toilet is 18 in. from floor to rim top—3 in. higher than conventional units. Toilet flushes with 3½ gallons of water, 36 percent less than standard ones. Prices begin at \$134 in white; it also comes in eight colors (\$162). Optional Lustra supporting arms for toilet seat are about \$110. Kohler Co., Kohler, Wis. 53044.

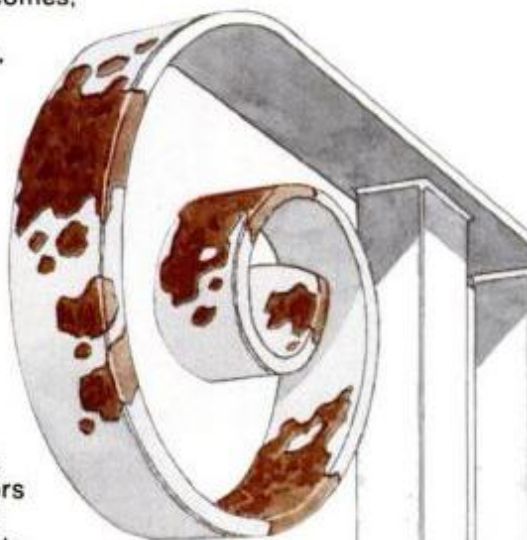


The Carousel is a waterless toilet that decomposes human and organic kitchen wastes into humus. It's particularly helpful in rural and vacation homes where sewage systems are costly. Containers come in two sizes. Smaller, 30-in.-high (5-cu.-ft.) size handles a family for two to three months in summer and some winter use. Small containers are \$695, plus commode (\$90) and vent kit (\$130); other options available. Enviroscope, Inc., 2400 West Coast Hwy., Suite D, Newport Beach, Calif. 92663.



You'll have to take care of rust now or later...

and when that time comes, you'll want **Derusto Minute Finish Spray**. Derusto puts a special rust-inhibitive primer in the color. That means each application primes, beautifies and gives extra protection against corrosion. You can use it to renew rusted lawn furniture, wrought iron and mowers. It dries quickly to an attractive high gloss, and there are 17 colors plus white to choose from. It's also available for brush-on application.



Derusto makes other special paints for your needs. To prime and protect gutters and downspouts, apply **Derusto Galv-A-Grip™**. It covers in one coat. And it won't crack or peel like ordinary paint. To prevent or stop rust on metal surfaces, use **Derusto Protective Coating**. The built-in, rust-inhibiting primer lets you protect with each semi-gloss coat. To renew rusty, weathered barbecue grills and hoods, ask for **Derusto Barbeque Black Spray**. A special heat-resistant paint, it dries quickly to a black matte finish.



and when you do...
all you gotta know is

DAP
Derusto

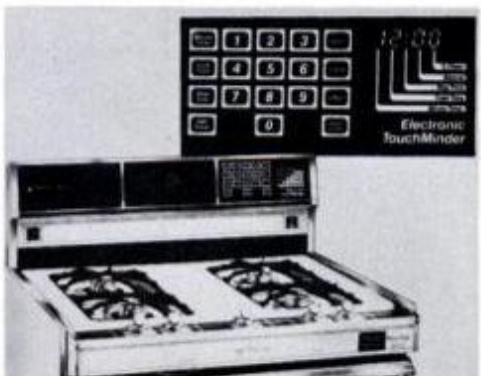
© 1979 DAP Inc. DAP and Derusto are trademarks of DAP Inc. DAP Inc., General Offices: Dayton, Ohio 45401/Subsidiary of Plough, Inc.



These collapsible shelving units are great for students, people with vacation homes or those on the move. Units fold to a 2½-in. storage thickness, assemble in seconds without tools and are stackable. Made of hardwood and veneers with a walnut finish, each unit is 33½ in. high and priced at \$40. Great Eastern Lumber Co., Inc., 2315 Broadway, New York, N.Y. 10024.



Turn on TV or appliances from a distance. Plug in this remote-control switch and piggyback the appliance plug. Squeeze the bulb to turn on the appliance; another squeeze turns it off. There is no electrical current between switch and control bulb; no danger of a short if the 20-ft. air line is cut. Unit is \$6; Softline Inc., Box 6395, Bridgewater, N.J. 08807.



TouchMinder has advantages over many other ranges: Pilotless ignition uses gas only when food is cooking; solid-state controls let you program meal-cooking time. Controls record hours a meal should cook and time when ready. Self- and continuous-cleaning models available from \$650. Magic Chef, Cleveland, Tenn. 37311.

(Please turn to page 172)

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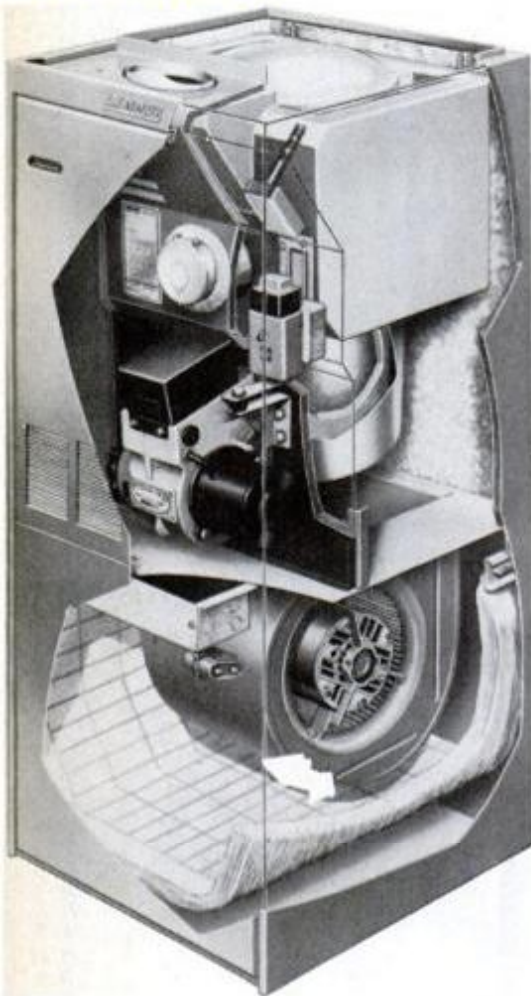
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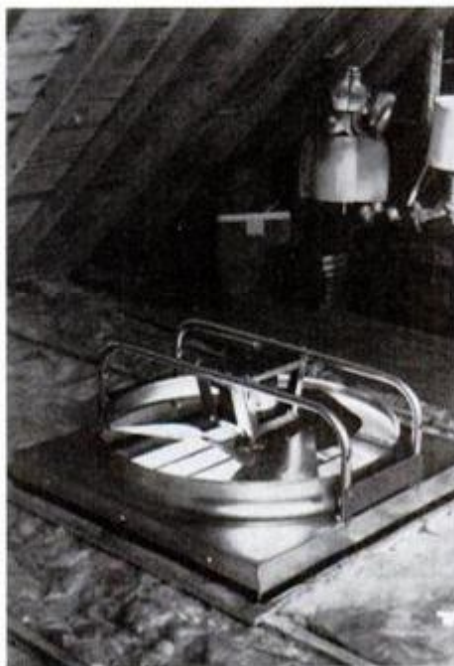
'79 Home Ideas Guide

22 NEW PRODUCTS FOR BETTER LIVING

(Continued from page 171)



The new 012 series of oil-fired furnaces is designed to be extra quiet. The 70,000-B.T.U. model is made for more accurate heat load sizing of small homes and today's tightly sealed large homes. It accepts two tons of add-on air-conditioning. The 105,000-B.T.U. model accepts up to 4 tons of air-conditioning. The heat exchanger has a larger primary drum which provides a greater combustion volume to reduce the noise level and eliminate hot spots. Made by Lennox Industries, Inc., Box 40050, Dallas, Tex. 75240.

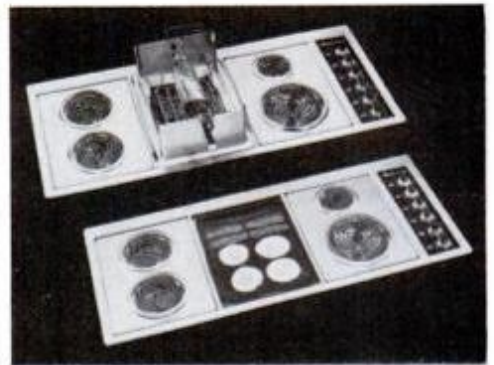


Move heat and stale air from attic and living areas, and bring in outdoor air, with a 300 series Whole-House Ventilator. The 24 and 30-in. models have direct-drive fans; 36-in. model fan is belt-driven. Use them horizontally or adapt for vertical use. They begin at \$200; Hunter Div., Robbins & Myers, Inc., Box 14775, Memphis, Tenn. 38114.



For convenience and security, you can operate indoor and outdoor lights and appliances by pushbutton. The 16-switch command console of Sears Home Electrical Control System plugs into a 120-v. a.c. wall outlet and transmits coded signals to lamps, appliances and wall switches. System includes (clockwise from top left): console (\$40), cordless remote control (\$20) to work command console 30 ft. away, wall switch and appliance module (\$15 each), lamp module (\$14) from Sears, Roebuck and Co. catalog.

Seal windows, doors and trim with this latex caulk that comes in a color to match most sidings. Red Devil caulk is available in wood-tone, redwood, gray, green, brown and black. The gray is designed to match metal windows; redwood, brown and wood-tone caulks match exterior shakes and siding. Also use it on interior surfaces such as plaster baseboards and doorways. Sealant is water and mildew resistant and won't stain. An 11-oz. cartridge is \$1.50; Red Devil, Inc., 2400 Vauxhall Rd., Union, N.J. 07083.



This convertible cooktop allows cooking versatility. The 46-in. unit (\$365) has modules that easily change it from a regular cooktop to a grill. Options include rotisserie, griddle and cutting board. Whirlpool, Benton Harbor, Mich. 49022.



Spindle-rail molding combines with base molding for plate display; 8-ft. long each, \$13/ft. together; they match Haas cabinets. Ceiling trim is 8 ft. long, 35 cents/ft. Haas Cabinet Co., Inc., Sellersburg, Ind. 47172.



This microwave and conventional oven combo from Sears fits into a wall cabinet to conserve counter space. Microwave has touch-sensitive controls and electronic readout timer. Eye-level dials operate self-cleaning conventional oven below. It's 27 in. wide; \$1000 in Sears catalog. **PM**

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APPLICATION FOR DEALERSHIP

Dept. [PM49]

WITHOUT OBLIGATION, please mail me all of the materials mentioned above including my FREE 48-page CONFIDENTIAL DEALER'S MANUAL AND WHOLESALE PRICE LIST, FRANCHISE & DEALERSHIP, AND SAMPLES. I own a home which needs to be re-sided and I understand that I must purchase a HOME-KIT for my home before I can sell them to the public. NOTE: No salesman will knock on your door, we distribute exclusively by mail.

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I would like to be considered for a: Part-time dealership Full-time dealership

Address of property I own which needs re-siding: STREET _____

CITY _____ STATE _____ ZIP _____

This property is in _____ county.

My mailing address is: STREET _____

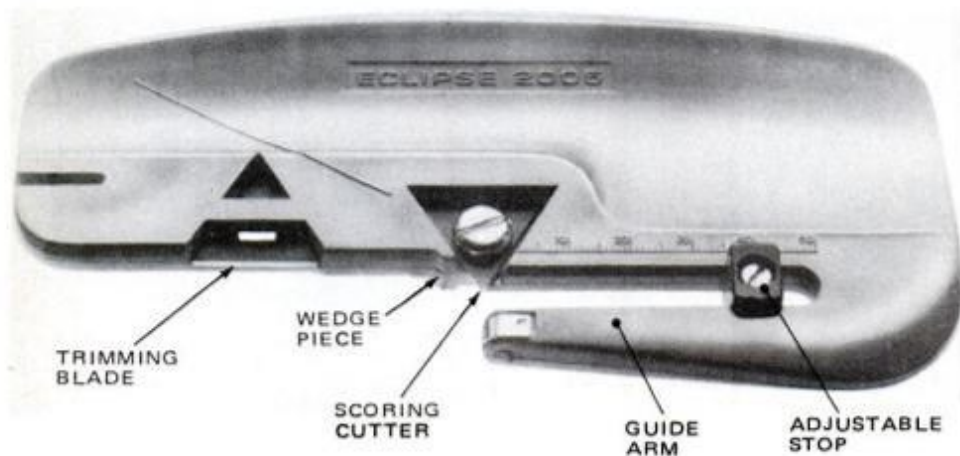
CITY _____ STATE _____ ZIP _____

My present occupation is: _____

My phone number is: _____

SIGNATURE _____ DATE _____

13 new tools for home improvement



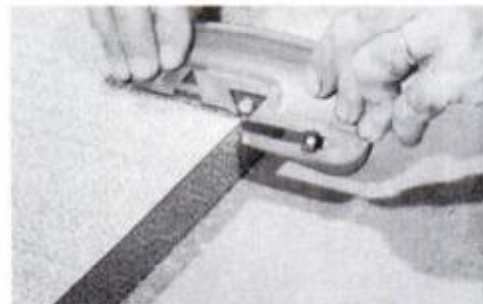
You can make slick, professional-looking edges on plastic laminate countertops with this inexpensive trimmer. The tool cuts edging strips up to 2 in. wide, then neatly dresses the edges with a 30° bevel. Drawing its cutting blade across the laminate in several passes scores the material so strips can be easily snapped off. An adjustable stop in the guide arm determines the width of strip. Using the side of the cutter after the laminate is applied finishes the edge to a smooth bevel. The handy tool is priced at \$4.95 from Crain Cutter Co., 2125 Ronald St., Santa Clara, Calif. 95050.



To cut edging strips, set guide to needed width and draw trimmer across laminate.



Insert slot of trimmer in laminate edge; bend gently upward to break strip off.



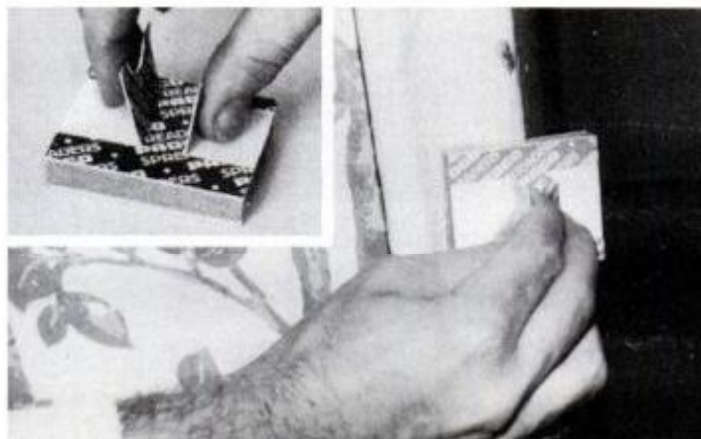
Use side of cutter blade to dress counter-top edge to a smooth, finished 30° bevel.



This low-cost 100-amp. arc welder is designed for home shop use, yet is said to have the capacity to do professional-quality work. It operates on conventional 120-v. house current, has heat range of 25 to 100 amps., converts to a carbon-arc torch for brazing and silver soldering. Price of \$99.95 includes face shield. Century Manufacturing Co., 9231 Penn Ave. South, Minneapolis, Minn. 55431.

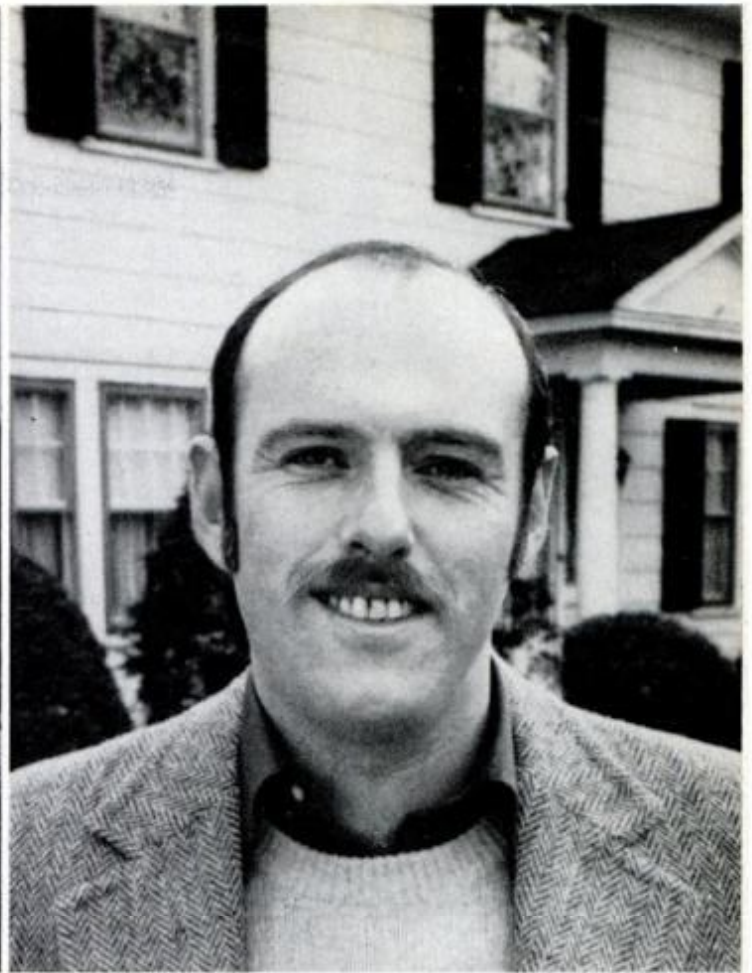


You don't have to operate a thumb lock with this new Stanley measuring tape. Just pull the blade out and it locks automatically at the desired length. Squeezing a lever on the bottom then releases the blade and retracts it into the case. The Leverlock rule has a 3/4-in.-wide blade and comes in 12 and 16-ft. lengths for \$5.49 and \$6.49, respectively. Stanley Tools, New Britain, Conn. 06050.



If you don't like cleaning paintbrushes, here's a disposable paint spreader you throw away after use. The 2x2½-in. nylon pad is handy for fast touch-up work, painting around trim and applying stains. Cardboard tabs on back bend outward to form a simple handle. Costs 25 cents at paint, hardware and variety stores. Padco, Inc., 2220 Elm St. S.E., Minneapolis, Minn. 55414.

(Please turn to page 176)



One of these homeowners is thrifty, safety conscious, and a sitting duck for financial disaster.

He doesn't even know it. He thinks he's done his best to protect his home and his possessions. He hasn't.

Many people, like the man on the left, believe they have adequate homeowners insurance. But inflation has been pushing up the value of their homes. They don't update their coverage every year. So when disaster strikes, they are unable to fully recover their losses.

Rising replacement costs are one reason. In the last 10 years the cost of re-siding a home jumped 132%, re-shingling a roof 155%; and repainting a living room 142%.¹ In the last five years alone, the cost of building a new home has increased 63%.²

As a group of property and casualty insurance companies, we don't want you to be a sitting duck by not having your insurance provide full protection for your home. Check with your agent to be sure your homeowners policy reflects the amount of additional coverage inflation has made necessary.

Here's what we're doing to help protect you:

- Offering policies with a built-in inflation clause.
- Supporting strict building codes to reduce fire risk.

- Designing new coverages to meet the special insurance needs of older homes.
- Helping to develop safety standards which protect life and property.
- Operating special claims assistance and damage repair programs in times of catastrophe.
- Conducting fire prevention and arson control programs.

Here's what you can do to protect yourself:

- Re-evaluate your home insurance needs annually with your agent.
- Take a higher deductible if you can. It lowers your premiums.
- Install a smoke detector or burglar alarm. Many companies offer premium discounts for such devices.
- Get a receipt or appraisal for all major household items (furniture, antiques, jewelry, art). Duplicate it and keep it and all such records in a safety deposit box away from your home.
- Inventory all your possessions and take photos of each room to document what you have.

¹ Source: U.S. Dept. of Labor ² Cost does not include land. Source: U.S. Dept. of Commerce

This message is presented by: The American Insurance Association, 85 John Street, New York, NY 10038.

Affordable insurance is our business...and yours.

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'79 Home Ideas Guide

NEW TOOLS FOR HOME IMPROVEMENT

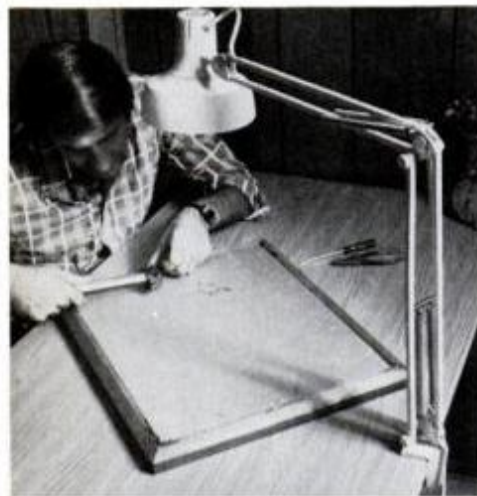
(Continued from page 174)



This handy plastic pouch holds 20 of the most commonly used blade-type thickness gauges and folds neatly to fit in a shirt pocket. Gauge sizes, marked on the blades, can be readily identified through clear plastic see-through pockets, making selection easy. Sizes range from .001 to .025 in. Price is \$8.03. Precision Brand Products, Downers Grove, Ill. 60515.

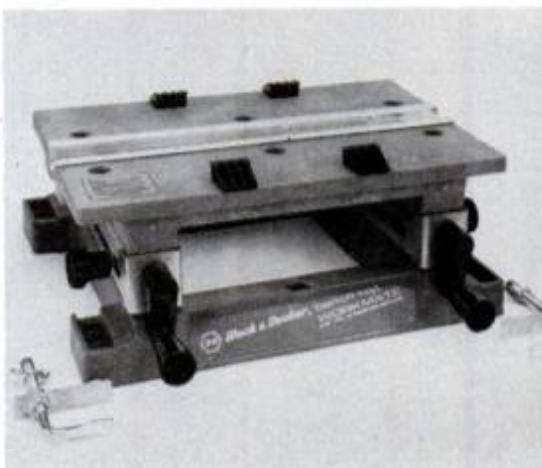


If you work with Romex cable, you'll find this tool helpful. It makes quick work of removing the outer casing to expose the wires. The springy ends are slipped over the cable, pressed together and pulled. Result: a clean cut through the covering without danger of slicing into the insulated wires. Sells for \$1.15. Vaco Products, 1510 Skokie Blvd., Northbrook, Ill. 60062.



You get bright light for reading or hobby work from this fully adjustable swing-arm lamp that clamps to desk, bench or worktable. Because of an insulating lining, it can take a 100-watt reflector bulb and remain cool. Accessory fittings are made for wall or screw-down mounting. Costs \$39.95. Dremel Div. of Emerson Electric Co., 4915-21st St., Racine, Wis. 53406.

This versatile, lightweight plastic storage reel is designed to take the annoying tangle out of long lengths of power cord, garden hose, rope, chain and the like. Its width can be adjusted to suit whatever is wound on it by adding or removing spacers that form the hub. Offset hand knobs on opposite sides of the flanges make it easy to reel its contents in or out. Called the Spool Tool, it's \$9.95 from Spool Tool Co., Box 2268, Waco, Tex. 76703.



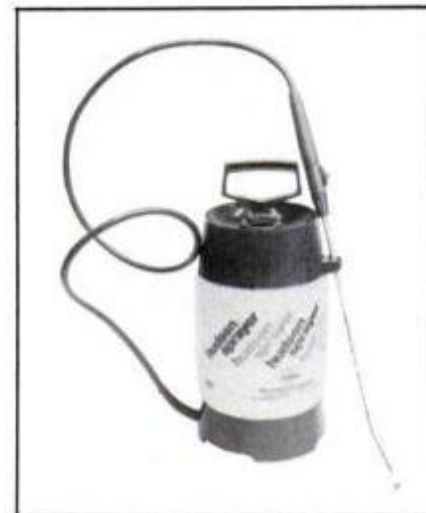
Anyone who's had the pleasure of using Black & Decker's portable Workmate bench knows how versatile and handy a tool it can be. Now B&D has come up with a benchtop version that's equally versatile. A multipurpose work center, it clamps to any work surface up to 2½ in. thick and consists basically of two 16-in.-long vise jaws that do a variety of clever tricks. Its main feature is its ability to hold virtually any odd-shaped workpiece securely. The jaws can be opened up to 5½ in. by turning crank handles at the front. Since each handle oper-



ates independently, the jaws can be angled to hold tapered work. V-grooves in the jaws grip pipe, tubing or round stock firmly. Plastic swivel stops fit into holes in the top to grasp irregular workpieces up to 12½ in. wide or 14 in. long on the diagonal. Even round objects can be anchored tightly, as shown at right above. Another trick: The entire top can be tilted 15°, 30° or 45° to position awkward pieces at easier working angles. Model 79-020 costs about \$35. Produced by Black & Decker Manufacturing Co., Towson, Md. 21204.



Two new features make this Hudson garden sprayer especially convenient. The wide-mouth, funnel-like opening at the top permits easy filling without spilling; see-through translucent plastic tank lets you keep visual tabs on the liquid level. Model 6621 with gallon capacity can spray pesticides, weed killer, liquid fertilizer and most other sprayable chemicals except corro-



sive or flammable materials. Nozzle adjusts for fine mist or solid stream up to 15 ft. The sprayer costs about \$29 at hardware stores and garden-supply centers. Made by H. D. Hudson Manufacturing Co., 500 North Michigan Ave., Chicago, Ill. 60611.

(Please turn to page 178)

DIESELS FROM BOLENS.[®]

POWER YOU NEED
FROM PEOPLE
YOU KNOW.



17 hp. with center-mounted mower.

If you have acres of work on your hands, get a tractor with enough power to handle it.

Get the Bolens Diesel tractor.

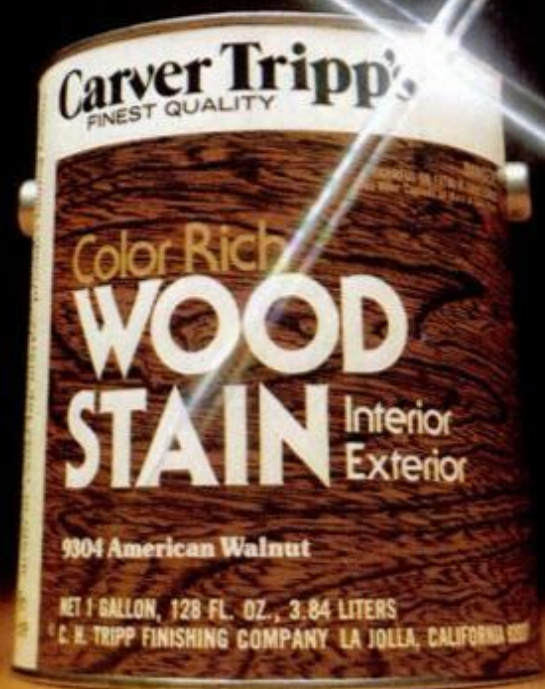
Its long-life diesel power assures that every job you want done, gets done. Day after day. Year 'round. And if after all that trouble-free service something should go wrong, relax. Your Bolens dealer is just a phone call away. He's been factory-trained so he knows what makes a Bolens Diesel tick. And the parts are in-stock. Or available within 24-hours. It all means we'll help you get the job done. Quickly.

There are 4 easy-to-operate Bolens diesels

ranging from 15 to 24 hp. Each is water-cooled, has standard multi-speed PTO, a 3 point hitch, and your choice of 2 or 4-wheel drive. Plus, a variety of custom-matched, quick-change attachments. Like mowers, snowthrowers, tillers and more.

The Bolens Diesel and the Bolens dealer. Equally capable. Equally dependable. See them today. For the name of the Bolens Diesel dealer near you, call 800-447-4700 toll-free anytime (in Illinois, call 800-332-4400). Or write the FMC Corporation, Port Washington, Wisconsin 53074.

FMC



THE ULTIMATE FINISH

Carver Tripp® Wood Stain is so rich, so smooth, so true in color it makes any staining job easier and better. Use it on any surface—furniture, woodwork, even metal and plastic, without removing the old finish. One quick coat gives you perfect results—job after job.

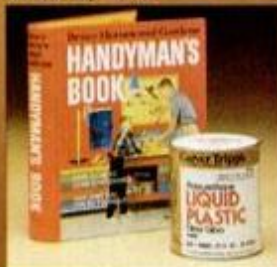
And to preserve that beautiful look, use Carver Tripp's New Polyurethane Liquid Plastic, the ultimate protection for beautiful wood.

SPECIAL OFFER WITH PURCHASE OF CARVER TRIPP'S POLYURETHANE LIQUID PLASTIC. Get *Better Homes and Gardens® Handyman's Book*—a \$9.95 Value for Just \$6.95.

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LOOK FOR THE CAR CARE GUIDE IN THE MAY ISSUE OF POPULAR MECHANICS

'79 Home Ideas Guide

TOOLS FOR HOME IMPROVEMENT

(Continued from page 176)



Super Plunge Router Model 90305 from Stanley Power Tools, 195 Lake St., New Britain, Conn. 06050, is a dream tool designed especially to meet professional demands. Motor develops 3½ hp and 24,000 rpm. Price for such luxury is about \$460.



Accurate measurements start with a comparator stand for dial indicators. This one has a 2-in.-thick granite base and 8-in. post with micro-screw zeroing-in. About \$50. Montgomery & Co. Inc., 111 Eighth Ave., New York, N.Y. 10011.



The Roto-Flex 120 electrician's tool cuts ½- to ¾-in. flexible conduit and strips large-size BX cable. The clean cut eliminates deburring, the maker says. About \$20 from Seatek Co. Inc., 1156 East Putnam Ave., Riverside, Conn. 06878.

This weekend seal your doors and windows with M-D weatherstripping

Save from 5% to 30% on home fuel cost!



Drafts around doors and windows of your home are costly. They can cause your home fuel bills to soar! And it is so easy to stop drafts with do-it-yourself M-D window and door weatherstripping. Many M-D weatherproofing products come in kits ready to install on standard doors and windows. This weekend cut your home fuel bills as much as 5% to 30% by sealing out those drafts around your doors and windows with M-D weatherstripping. You'll find a complete line of energy-saving M-D weatherproofing products at your hardware, building supply or home center dealer. And always ask for M-D products by name.



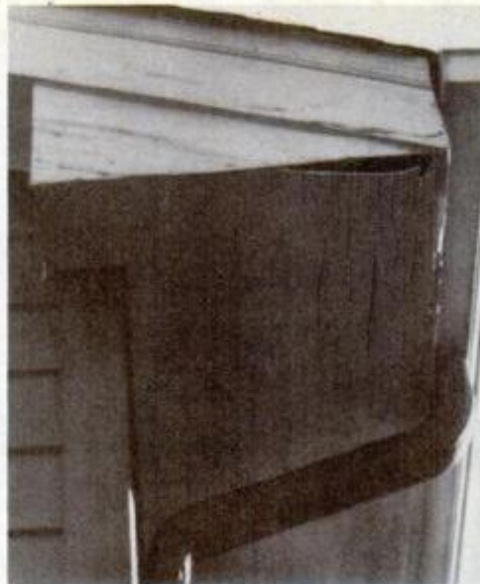
MACKLANBURG-DUNCAN CO.

Yes I want to cut my home fuel cost. Rush me your 10 page booklet on "How to Save Money with ESP"

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 Address _____
 City _____
 State _____ Zip _____

Mall with 25 cents in stamps or coins to:
 Macklanburg-Duncan Co.
 P.O. Box 25188, Dept. M2
 Oklahoma City, Oklahoma 73125

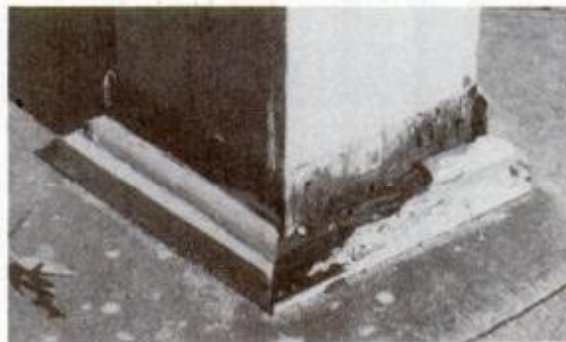
DAMAGE DUE TO WATER



Flimsy 1/4-in. plywood at soffit and rake return combines with shoddy workmanship. Warped soffit clues you to possible leak.



Rotten fascia is caused by lack of caulking at the joint and/or no drip edge or shingle overhang along the eaves.



Rotted base of column (left) hints that concrete slab was graded improperly, leaving a depression which collects rainwater. Paint peeling from wooden gutter and shingles (below) shows neglect and poor maintenance habits of the previous owner. Inside of gutters should be tarred at least once every two years. Extensive peeling of shingles is a signal to check the attic for adequate ventilation.



Joints between dissimilar building materials, such as at the doorsill (right), should have been caulked to prevent water infiltration and the consequent paint peeling and rot.

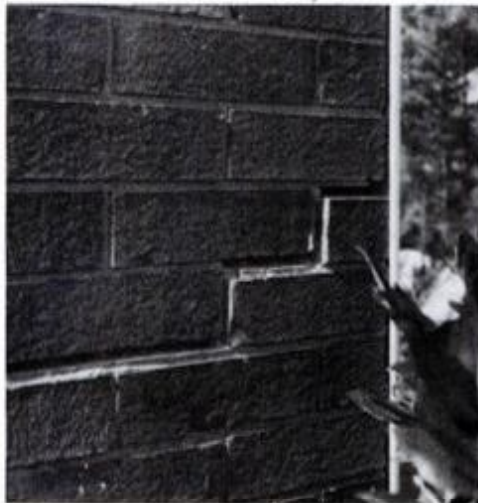


INSPECT A HOUSE

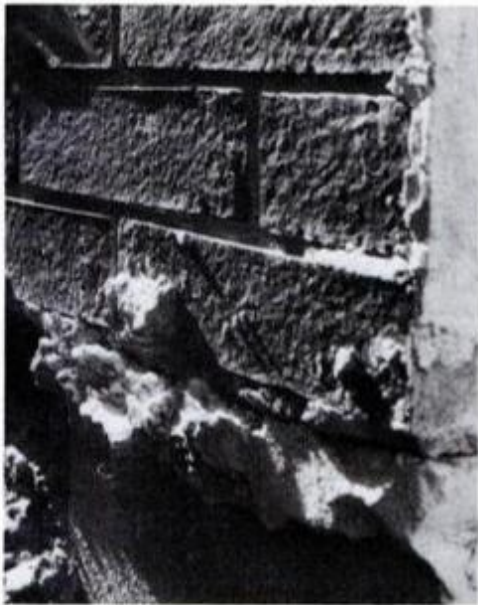
(Continued from page 179)

buyer if he knows what clues to look for.

A handy tool for evaluating a house is the checklist on page 179. Although it appears lengthy, you'd be surprised at how quickly the items can be covered. If, after a conscientious inspection, most of your checks are in the YES column, you have a favorable report. When comparing several houses, make duplicate copies of the form and use a number system to allocate grades for specific items. For instance, if



Masonry veneer crack at house corner (above) indicates a lack of footing ledger under first course of brick. Shoddy attempt to rectify omission can be seen below.



both houses have driveways, but one is badly cracked, you may put down 10 points for the good one and five for the one with the crack. When you're down to making your final choice, the houses with the most points in the YES column would be the ones you'd like to go back and take another look at.

Take a little time to familiarize yourself with the following brief explanations of the major checklist categories. Afterward, you should be able to face your next house-hunting excursion with confidence.

(Please turn to page 182)

SHOOT a staple wherever you'd drive a nail



faster ... cheaper ... better ...

ARROW
Automatic
STAPLE GUN

America's most wanted staple gun for 1,001 heavy duty home and professional tacking jobs. Takes 6 staple sizes from 1/4" to 9/16", including Ceiltile Staples for ceiling tile.



USES
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HB FULLER COMPANY

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Architect: Royal Barry Wills & Associates, Boston;
Developer: Emil Hanslin Associates, New Sea-
bury, Mass., Cabot's Stains throughout.

Cabot's BLEACHING OIL

For a beautiful weathered gray, stain with Cabot's Bleaching Oil. Apply to new or untreated wood surfaces; achieve the natural driftwood effect within six months. Preserves, protects, beautifies.

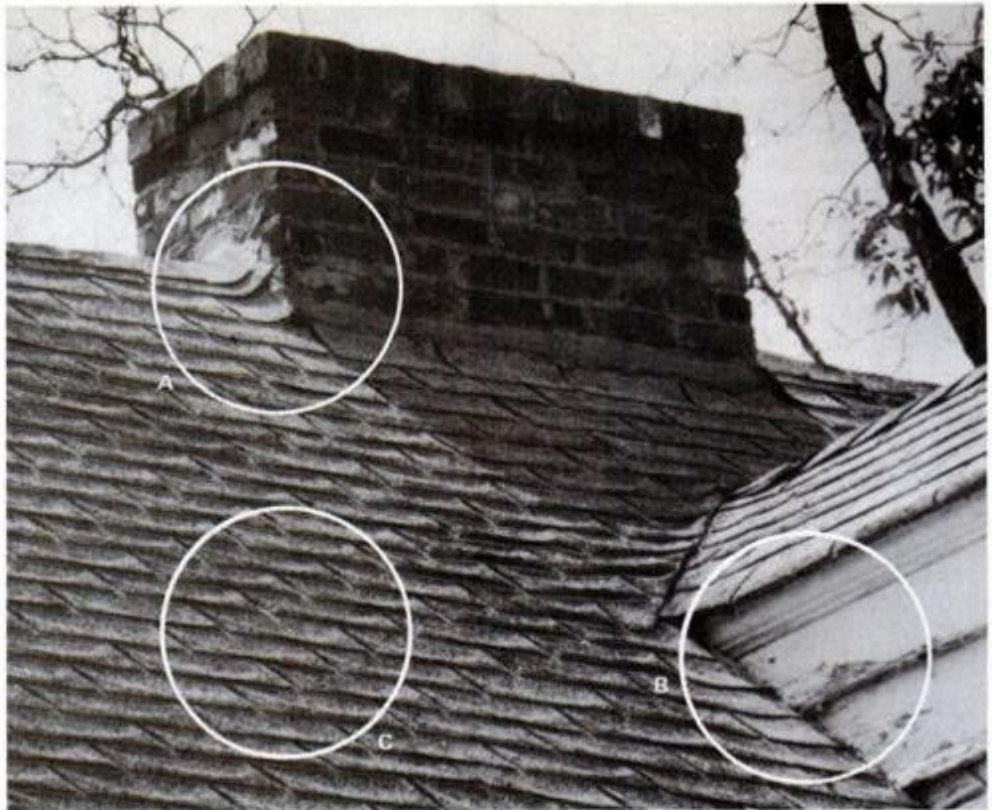
For further information, write:

Samuel Cabot Inc.

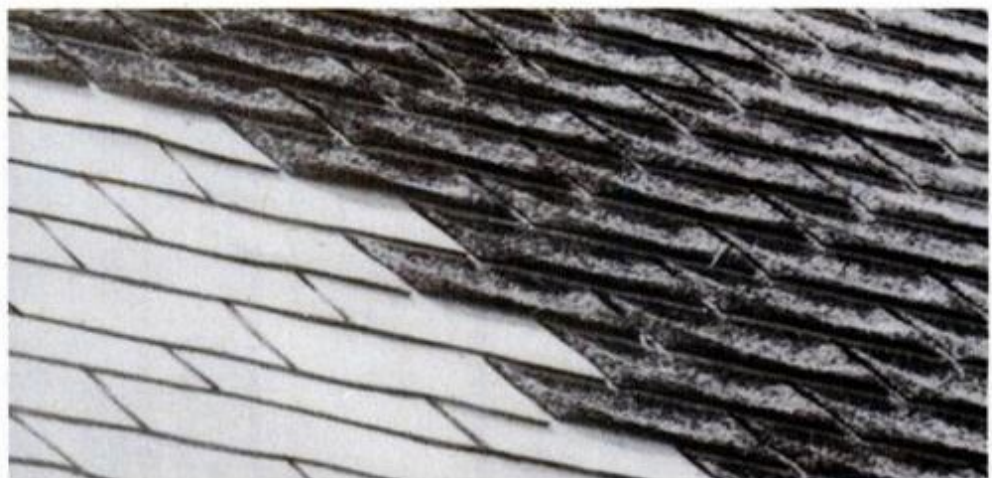
One Union St., Dept. 450, Boston, MA 02108

- Send information on Cabot's Bleaching Oil.
- Send color card on Cabot's Stains.
- 25¢ enclosed for Cabot handbook on stains.

EXAMINING THE ROOF



A lack of flashing around the base of the chimney (A), no step flashing where the dormer intersects roof (B), and badly cupped shingles (C) all combine to spell the need for a new roof. Also remember to check for shingles where protective mineral granules have worn away—another sign that the roof is a goner.



Patched area is sure sign that roof has leaked in the past—and is likely to again. Exception to rule is where addition's roof has been spliced to existing roof.

INSPECT A HOUSE

(Continued from page 181)

Finding a preferred site

Although landscaping and vegetation around a house add to its desirability, don't forget also to take note of a site's functional aspects.

- The ground should slope away from the house, to prevent rainwater from seeping into the basement. Corrective measures can be costly.
- City water and municipal sewer hook-ups are preferred to a well and septic tank or cesspool. If a house has the latter, ask who cleaned it out last and when.
- Gutter and leaders should be well fitted and maintained with no signs of leaks

at the joints. Splash blocks should carry rainwater away from the house.

- Make a note of the nearest fire hydrant.

Examining the building's exterior

A ladder may prove handy for this part of the inspection. When making your appointment, ask if one will be available—if not, bring one along.

- If the exterior is masonry, the mortar joints should be tight. Bricks that have sheared or stucco that has buckled may indicate that the structure has a severe settlement problem.
- If the exterior is of wood, observe whether the material is straight, flat and

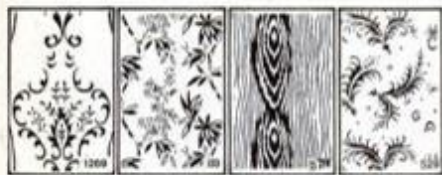
(Please turn to page 186)

ROLLERWALL™

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Enjoy the warm, rich look of wallpaper for the price of ordinary paint. No peeling. No seams. No steaming off old paper. Snap rubber design roller into applicator and roll. Pattern automatically transfers to walls or other flat surfaces. Goes on in minutes — washable — lasts for years. Remove simply by repainting. Use with any color, any paint. This sensational new crafts tool also decorates furniture, fabrics, anything. We guarantee *delightful* results! Circle designs of your choice

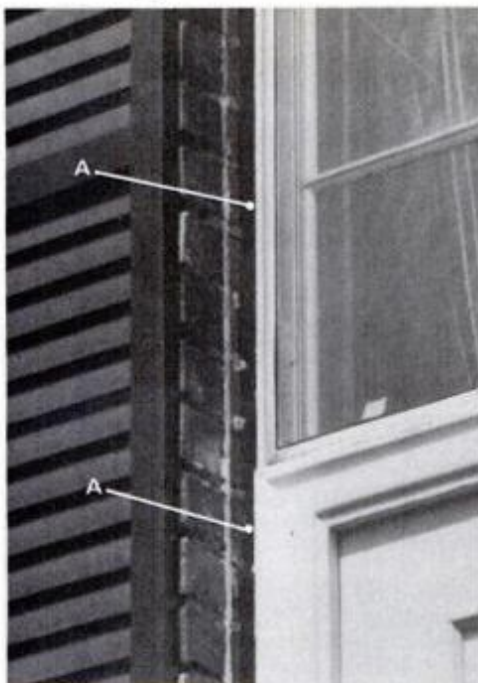


- Rollerwall with 1 design \$15.90
- Rollerwall with 2 designs (save \$2.00) \$21.85
- Rollerwall with 3 designs (save \$5.00) \$26.80
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- Add Postage \$ 1.50

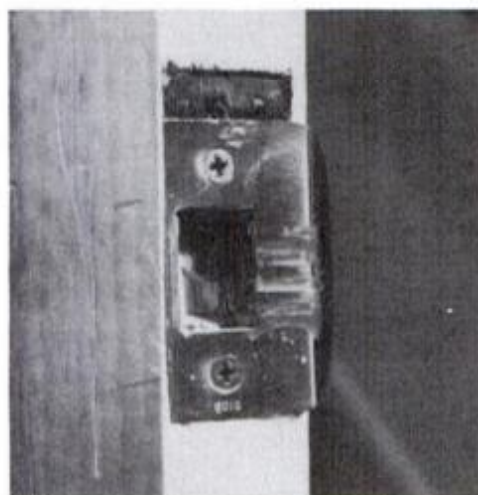
Charge it Check enclosed
 Charge it VISA Total \$ _____

Card # _____
Exp. Date _____ ROLLERWALL INC.
P.O. Box 757 PM-4 Silver Spring, Md. 20901 © 1978

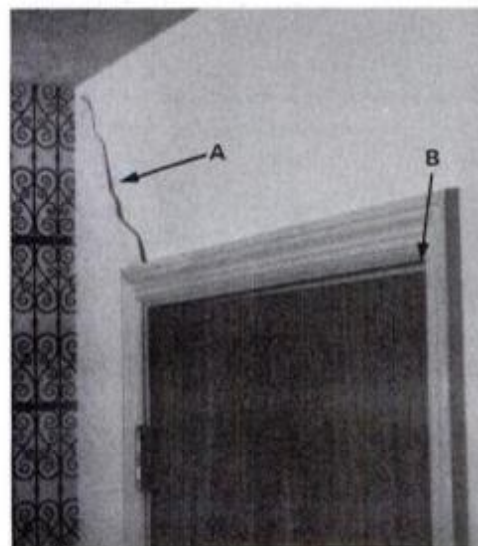
SIGNS OF FOOTING SETTLEMENT



Gap (A) between brick veneer and siding is due to lack of wall ties. Original caulk line shows how far brick has pulled away.



Lowered strike plate is a clue to the house having settled—or may simply indicate amateurish lock installation.



Diagonal crack (A) and sagging door (B) are two other signs that the house you're inspecting has probably settled.



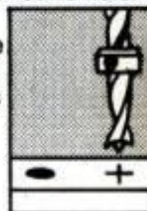
NOW, For The First Time— Use The WOODBITS The PRO's Use!

Professional woodbits are **not** available in hardware stores. Stores only carry spade bits which clog and bind, or metal cutting twist bits that also bind and tend to "walk", or move off course.

Why is a WOODBIT Best ?

A professional woodbit has four features designed specifically for wood:

- A CENTER SPUR that locks your bit on course and so prevents "walking".
- TWO CUTTING SPURS that begin and dimension a perfectly round hole.
- EXTREMELY SHARP FLUTES extend from the two cutting spurs and continue the cutting action all the way through the wood . . . shaving the sides smooth. Most important, the two spurs will not splinter the wood as the bit cuts through . . . as spade or metal cutting bits do.
- THE CUTTING FLUTES ARE ENGINEERED for maximum chip ejection so that your drilling machine won't bind and burn out.



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7 piece Chrome-Vanadium alloy set includes $\frac{1}{8}$, $\frac{3}{16}$, $\frac{1}{4}$, $\frac{5}{16}$, $\frac{3}{8}$, $\frac{7}{16}$ and $\frac{1}{2}$ " sizes. Made by German professionals for pro's or "wood-be" pros.

7 PIECE WOODBIT SET..... ONLY \$14.95



Matching Depth Adjusting Collars

Get the precision of a costly drill press for less than \$10.00.

Here's how it works: Figure the desired depth of the hole;

Slip the collar over the bit to that depth; fix the collar

position with the set screw - and drill. This set has a collar to fit each

bit in the 7 piece woodbit set. Tool steel. **ONLY \$8.95**

BUY BOTH BITS AND COLLARS AND SAVE \$2.00 \$21.90

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Tools By Phone:

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Yes Ric Leichtung, please send me:

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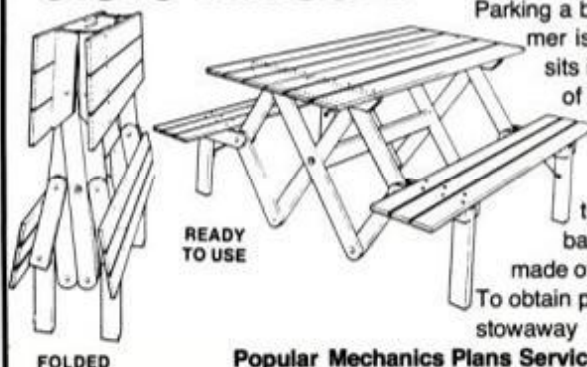
As my **BONUS**, please send your 68 page 1979 Catalog of Fine Tools, etc., for the next two years **FREE!**

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Build a picnic table you can store indoors



Parking a bulky picnic table indoors when summer is over is practically impossible. So it sits in the yard or on the patio 12 months of the year. Not so with this unique design. Both table and benches fold scissor-fashion into an incredibly small unit which means the whole thing can be stored in your garage or basement with room to spare. And if made of redwood, the table will last for years.

To obtain plans and instructions for building this stowaway table send \$3.95 to

Popular Mechanics Plans Service, Box 1014, New York, N.Y. 10019.

LOOKING FOR IDEAS ON HUNTING, FISHING, CAMPING, BUILDING, TOOLS, ETC.? CHECK THESE LISTINGS. THEN USE THE COUPON BELOW.

WORTH WRITING FOR

935 Keep it up.

MAKE SOMETHING WITH SAKRETE—Home and Yard Cement Projects. Step-by-step instruction booklet featuring 18 projects for home beautification or improvement. SAKRETE, INC. 50¢

936 Before You Begin

"Before You Begin" is a color how-to brochure on staining and painting. Illustrated step-by-step instructions simplify finishing for the homeowner, all the way from selection of materials through cleanup. The 16-page brochure covers Olympic Solid Color and Semi-transparent Stains, acrylic latex Olympic Stain and Olympic Overcoat." Free.

937 Man-size tractors

Here's a 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 the complete specifications on all. Free.

938 ABC's of Pool Care

Here's an easy-to-use problem/solution selector guide, plus an instruction booklet on the basics involved in keeping pool water clean and sparkling from Pennswim® pool chemicals. Answers common questions on pool water maintenance including: estimating pool capacity, pH adjustment and daily chemical treatment rates.

939 Be a Repair Master!

Can you handle an electrical emergency, repair your roof, silence squeaky floors, and cut fuel bills? Now you can! The fully-illustrated POPULAR MECHANICS Master Home Care Guide will show you how to speed through these and scores of other costly home repairs. In step-by-step format and spiral bound for easy use. \$4.95 plus 50¢ postage and handling.

940 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¢

941 Guidelines for a better looking lawn

With the proper care, your lawn can be greener, healthier and more beautiful. This valuable, 16-page, full-color booklet from Scotts tells you how to care for your lawn throughout the year. Hints on what to do during each season, including tips on seeding, fertilizing, weeding and disease, prevention. Highly informative and free.

942 Start your own siding dealership

Do you want to become a full or part-time siding dealer? Aluminum Industries of Arkansas will send you all the material you need to begin selling their do-it-yourself aluminum, steel or vinyl siding. Free information package.

943 Save energy with windows

A 16-page booklet from Andersen Corp. explains the role of windows and gliding doors in energy conservation. Covers such topics as how to heat with windows, planning to save fuel in cold and warm climates and how to shop for windows. Free.

944 Bird Tells All!

"What You Should Know About Roofing and Siding Before You Build or Remodel" is a beautiful, 32-page booklet packed with ideas, money-saving consumer advice, and full-color illustrations. 50¢ from Bird & Son, Inc.

945 Need Home Fix-Up

You can do home repairs and remodeling jobs that last—the easy way. Colorful brochure gives details on DAP products for a wide range of home fixup and paint-up needs. From DAP Inc. Free.

946 Put The Warm Where You Want It

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INSPECT A HOUSE

(Continued from page 183)

free of loose or split boards. All trim should be sound and free of rot.

- The house's coat of paint should have minimal chalking (dusty residue which comes off painted surfaces when rubbed) and be free of peeling and blistering.

- Caulked joints around windows and doors should be tight and pliable—not cracked, loose or crumbling.

- Adequate weatherstripping, insulated glass windows or well-fitting, easy-to-operate storm windows are other pluses.

- The roof should be vented at both the gable ends and soffits. Roof shingles should lie flat, not curled or cupped.

Examining the interior

Cosmetic appearance of a house interior is important, but be wary. A recent paint job may be covering up some serious defects.

- Look closely for signs of diagonal "settlement" cracks on the walls over doors and windows.

- Close the doors and windows slowly and see if they close squarely.

- Does the floor bounce or squeak? Soft spots may indicate skimping on underlayment thickness.

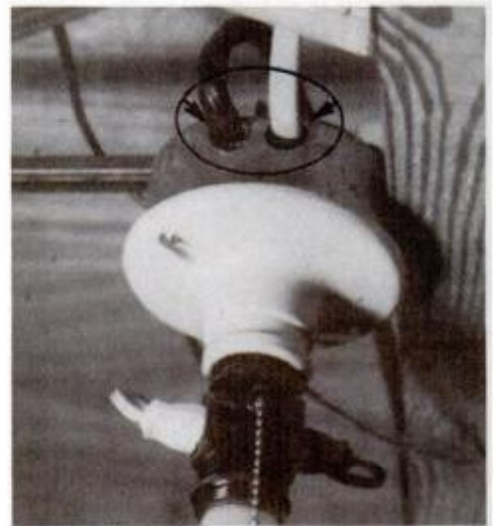
- Check for signs of water leaks at ceilings and walls.

- Also look under sinks for signs of plumbing leaks.

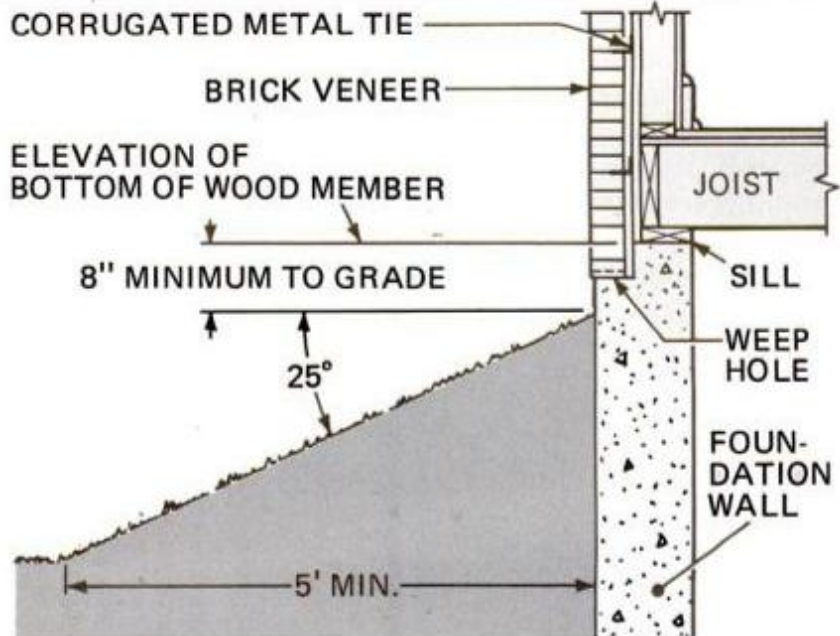
- Turn on bath and sink faucets and flush the toilet. All should drain rapidly.



Efflorescence (white chalky substance) stains on walls and floors are telltale signs of water seepage in the basement.



No connectors on Romex cable at junction box is a sign of poor-quality electrical work, as well as a potential hazard.



GRADE REQUIREMENTS AROUND A HOUSE

If you're looking at a home in an area where water runoff is a problem, check whether the ground slopes away from the house, as shown above. This helps to prevent puddles of rainwater from collecting close to the foundation, where the water would be most likely to seep into the basement.

While checking the ground slope around

the house, note how high the grade is in relation to the top of the foundation. The Federal Housing Administration requires a minimum of 8 in. between the structure's bottommost wood member and the outside grade. Soil, mulch and plantings that pile up against the foundation wall are an open invitation to insect infestation.

■ If the owner does not know the thickness of his wall insulation, put your hand on the inside surface of an exterior wall. Then put your hand on an interior partition. The temperature differential should not be too great, no matter what the season.

Even more important when it comes to insulation is what's up in the attic. In most areas, its R-value should be about 30 (example: 10 in. of glass-fiber blankets or 14 in. of vermiculite).

A thorough look at the basement or crawl space can tell you a lot—it's like catching the house without its make-up on.

■ First check for signs of water seepage, which might show as mildew or mold on the walls or floors.

■ Also observe the general cleanliness. Piles of scrap wood or other debris left to rot on the floor are a stepping stone for termites. Be sure to ask the homeowner if he has a termite bond; get the exterminator's name. If he doesn't, call a reliable exterminator and have him make an inspection.

■ A crawl space should have vents in the walls and a plastic vapor barrier over the earth (unless there's a slab floor).

■ Look for signs of plumbing leaks under the kitchen and bathroom.

■ The floor system should look neat and solid, with no split or rotted floor joists. Spaces between the joists should be secured by X-shaped braces.

■ If the house wiring is aluminum instead of copper, a licensed electrician should check that all receptacles and switches are of the type manufactured for use with aluminum wire.

Heating, airconditioning systems

This is one phase of home inspection where the neophyte buyer may require assistance. If the seller has a service contract, you've got it made. Call the company for an evaluation of the system. If there is no contract and the system is over eight years old, the amateur can only examine for general cleanliness of the equipment, burned or frayed wiring and signs of smoke stains on the housing.

■ Turn the thermostat on (*heat and cool*) and listen for a response from the equipment (a slight time lag is normal).

■ Obtain the make and model number and call the nearest distributor for information on the equipment.

In general, buying a house should not be a chore. Don't be over-alarmed if you see indications of settlement. Shrinking of lumber due to drying may show as settlement cracks. Settlement itself may have reached its limit and only require minor patching. If you have any doubt along these lines, have a contractor or engineer make a double check.

Your completed checklist should be a useful tool when negotiating the house sale price. Even those required repairs which seem minor can become bargaining points. **PM**

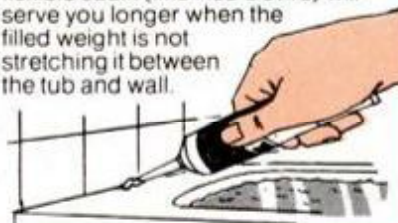
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T.M.
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Fill the tub before you caulk. (Get in if you can, too.) Then, when the tub is empty, it'll rise slightly and squeeze the caulk. Even a good flexible caulk (like Red Devil's) will serve you longer when the filled weight is not stretching it between the tub and wall.

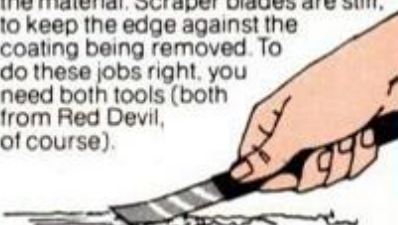


Caulk is caulk is caulk? Wrong!

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A putty knife is not a scraper. And vice versa. Putty knives (for spackling walls and putting windows) have flexible blades to smooth-on the material. Scraper blades are stiff, to keep the edge against the coating being removed. To do these jobs right, you need both tools (both from Red Devil, of course).



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HIGH TECHNOLOGY AT THE TRACK

(Continued from page 115)

King, though, it was almost perfect, even though the USTA outlawed his radical bike, citing "safety reasons," in 1973. "They can claim what they want," King says, "but the single shaft was used in thousands of races and no one ever lodged an official complaint on the grounds that it was unsafe."

Advantages of the single shaft were more obvious than those of the modified. With nothing on either side, the horse had newfound freedom, especially on turns. And it did not take an aerodynamic genius to realize that one shaft should have less wind resistance than two. Not so apparent, but nevertheless important, was the lift the single shaft provided. King had placed the driver's seat far behind the

wheels. The arch thus served as a fulcrum allowing the driver to displace some of the horse's weight simply by sitting down.

The idea of lift was not new with King. Conventional sulky will provide some lift if the shafts are hitched high, and a so-called underslung sulky (a conventional with a pushed-back seat) has been on the market since the early '60s. But King was the first to offer lift as part of a complete, streamlined package.

Did the single-shaft work? Is the Double daily? According to *Hoof Beats*, the USTA's own magazine, the one-armed bandit stole 225 of the first 470 races in which it was used. It won 54 percent of the time, despite being used by only 26 percent of the starters. No less than 69 percent of the horses using the single shaft

(Please turn to page 190)

THE 'POWER PROMPTER'—WORLD'S LARGEST HOOD ORNAMENT



Fiat-mounted fiberglass steed, complete with recorded hoofbeats, gets contender's adrenalin pumping during trial.

The ultimate hood ornament? No, just another example of technology at work in the ancient sport of harness racing. Officially known as the Power Prompter, this is actually a 1976 Fiat X19 with a life-size model horse standing in its trunk. Its object: to take the place of the actual horse "prompter" in time trials—races against the clock in which a single trotter or pacer attempts to lower his individual record for the mile.

"Before I came along with my invention," says Bruce Nickells, a professional trainer-driver who developed the Power Prompter, "people relied on old thoroughbreds who frequently broke down and sometimes dropped dead." Nickell's fiberglass pacer "Arty Ficial" is not only stronger than his flesh-and-blood forerunners, he's cheaper, too. He gets \$100 a mile as compared to \$250 for the real thing.

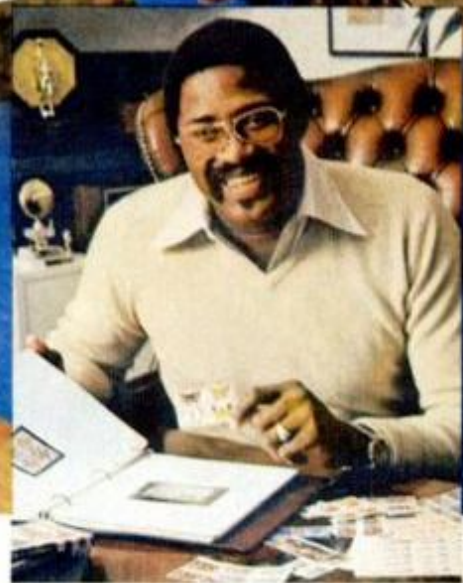


Except for a canvas hood and a platform for Arty's front feet, the Fiat needed virtually no modification. The speakers on the front and rear emit what Nickells calls "a Lone Ranger sound of hooves beating on a hard surface." Toward the end of the mile, the car's driver adds the prerecorded sound of a human voice urging a horse to give its all.

Although he says he has yet to meet the horse he can't fool, Nickells is working on an improved Power Prompter. "The new one won't have the car," he says.—C.L.



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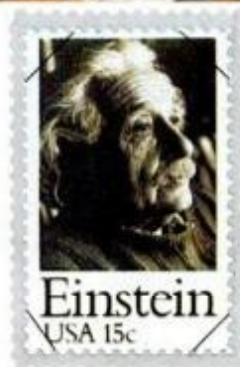
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"Stamp collecting's number one in my book," says Willis Reed. "After basketball, that is."

U.S. Postal Service 

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Albert Einstein Stamp (Available March 5)

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HIGH TECHNOLOGY AT THE TRACK

(Continued from page 188)

for the first time won with it, and more than 90 percent of all single-shaft winners lowered their lifetime marks.

King's problem was that his bike appealed mostly to the younger, hungrier drivers. It frightened the older, more influential horsemen who preferred things the way they had always been. At the urging of the latter group, the USTA was forced to define a sulky for the first time, as "a vehicle having two shafts . . ."

Shafted, King dropped out of sight—for good, some people thought. But they didn't know King had converted his life savings into single shaft sulkies that now were standing worthless in a Florida factory. He *had* to come back.

Instead of the drawing board, King went back to his primary testing device—a Pontiac Grand Prix with a red light on top and balance arms sticking out from either side. On the end of one arm was a life-size fiberglass horse complete with sulky and dummy driver. On the other arm was the sort of aerodynamic drag plate used in wind-tunnel tests. Riding up to 60 mph (about twice as fast as harness horses race) King could measure total drag with unprecedented accuracy.

"One of the first things I learned," King says, "was that the horse is a beautifully

designed animal who incurs one-third to one-quarter of the wind drag you might expect, considering his frontal area. The air gets organized as it moves around his hindquarters and strikes the driver almost as if there were nothing in front of him." These simulated wind-tunnel tests figured predominately in the development of King's Signature Sulky.

Actually, what King modified was the single-shaft bike. The newer sulky uses the same heavy-duty, lift-inducing arch and the same wheels with automobile-type spindles. Partly because of that, the Signature is, at 42 pounds, perhaps the heaviest of the now 40-odd modifieds on the market and weighs as much as a conventional sulky. (Most other modifieds weigh about 10 pounds less.) But not to worry, says King. "The extra weight adds perhaps one ten-thousandth of one percent increased drag. But I've gained a sulky that holds alignment exactly straight, even for a 250-pound driver."

Horsemen, King often implies, are poor mechanics. "A lot of drivers race for big money with their wheels all out of alignment," he says. "And they will test a bearing by turning a bike over and giving the wheel a spin. Heck, I could put in a gyro that would spin for weeks. But bearing drag is a function of how the bearing works under a particular load. The truth is, as long as they're not too small, bear-



The lone conventional sulky holdout among big-money drivers, veteran Joe O'Brien insists the modified has no edge.

ings don't mean a damn thing."

The bearing used in King's sulky is similar to that used by Jerald, the oldest name in conventional sulkies—that is, *before* Jerald switched to the making of modifieds.

Sulkies come in sizes to fit the horse, but the standard conventional measures 50 inches between axles and stands 28 inches above ground at mid-arch. So does the median modified (though it has a

(Please turn to page 192)

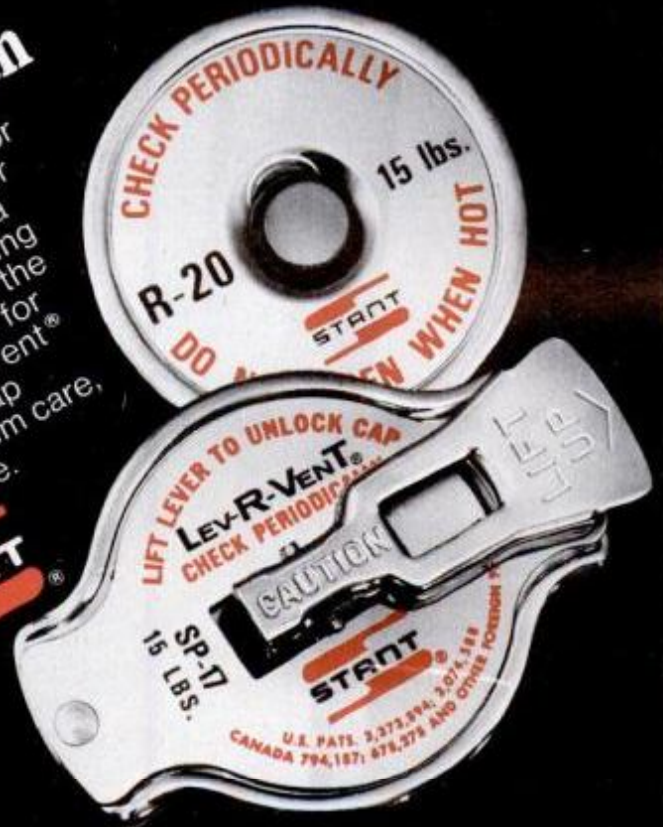
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HIGH TECHNOLOGY AT THE TRACK

(Continued from page 190)

somewhat wider track because the wheels ride outside a thicker arch). It is in shaft length where the old and new part company. The conventional shaft, with its wide bow, is, on the average, 88 inches long. The modified shaft—straighter and perhaps truer—is 8 inches shorter.

King's shafts are streamlined elliptical tubes that follow convergent paths from the arch to the tips, where they become rounded and virtually parallel. They fit a horse much more snugly than the conventional shafts—yet King insists that the modified is next best to the single-shaft sulky, which provided no lateral restraint.

Part of the modified's secret, King maintains, is that the shafts, though they may look constrictive, actually respond better to a horse's natural movements. But he refuses to rank such features as decreased wind drag, improved tracking and lift in order of importance. "My bike is better because the combination of improvements adds up to about 10 pounds less drag," he says.

King's rivals agree that the modified does a few things simultaneously, but each manufacturer seems to emphasize a different feature, if only to avoid the lawsuits that King threatens from time to time. At Nassau, the leading modified-maker in terms of sales, president Walter Twarkowski soft-pedals lift while speaking warmly of wheels that track to within 30/1000ths of an inch of perfection. Dave Hutchins, of Jerald, says his modified wooden shafts offer "greater resiliency and ease of replacement." Murrelle Parker of the Better Time Co. claims that wind drag is not a factor at 30 mph; he uses aluminum tubing to make bikes he claims are "the strongest and safest around."

The defiant one

The horse owners put up the money, and the somewhat befuddled drivers take their choice of modifieds. That is, all the drivers except Joe O'Brien. At 61, O'Brien is a Hall of Famer at the top of his game. He has driven more than 4000 winners, earned nearly \$17,000,000 in purses and posted a record 397 two-minute drives, including a trip with Steady Star in 1:52—the fastest harness racing mile. He alone among North America's top drivers refused to convert to a modified sulky.

"My sulky is better," O'Brien says. "It's got lift and an arch that's only five-eighths of an inch in diameter. The claim that the big, bulky arch on the modified has less wind resistance is absolutely crazy."

O'Brien goes on. "The modified came along at the right time—just as the horses and track surfaces were improving. We would've had all these fast miles even if that thing has never been invented."

Joe King no longer bothers to rebut criticism. Mention O'Brien, and he does a fine Cheshire cat impersonation. **PM**

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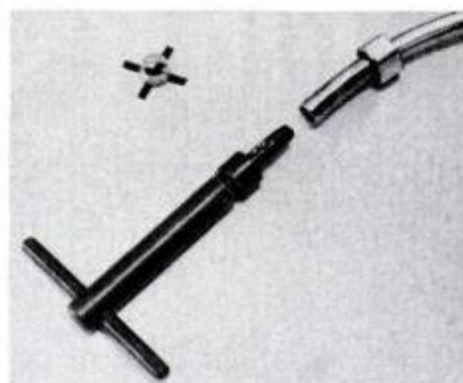
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The Quik-Ring tool eliminates need for the compression sleeve (above left).



TOOL'S DOUBLE BEAD MAKES IMPRESSION ON COPPER TUBE

Bead mechanism on the tool forms a double bead on 3/8-in.-dia. copper tubing.

The brass sleeve which forms the seal on a compression fitting can cause problems when it doesn't seat squarely. However, you can eliminate this trouble-causing sleeve by using a Quik-Ring Tool. It has two beads that form impressions in 3/8-in.-dia. copper tubing to make tight joints.

Use the tool by first turning its handle counterclockwise to recess the beads for entry into the tubing. When tool is seated in tube end, turn handle clockwise to engage beads and form impressions.

Quik-Ring is \$13 from Quik-Line Products, Box 285, Bernardville, N.J. 07924.—Rosario Capotosto



One bead on the tubing seats against the valve fitting, the other against the nut.

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These are the weeks when thirty minutes with your spreader and our Turf Builder® will help you get the most out of Spring's good growing weather.

This is one of the easiest tasks a good lawn calls for. You can do it the same morning you have a golf date and still tee off on time.

It's also one of the best things you can do to make your lawn thicker this Spring. The sun's moved far enough north now to warm up the earth and your grass is trying its hardest to grow.

But this is where nature needs some help. There's a desperate competition for food among the roots your lawn already has. Your soil alone can't come up with the nutrition all those grass plants need to branch out and form new plants.

A half hour with our Turf Builder and your plot will thicken.

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And the exclusive way we make Turf Builder gives your lawn not just a quick feeding but also a prolonged feeding for up to two months.

We put this fertilizer up in tiny granules which provide a balanced mixture of plant nutrients, including both soluble and insoluble nitrogen. Rain or watering releases the soluble food right away. The insoluble food is then released slowly by organic action in your soil.

(This also keeps Turf Builder from burning your lawn. Just do what it says in the directions. In fact, you could accidentally put on four times too much this



Now when it's growing again your lawn needs a good feeding.

Spring and it still wouldn't burn.)

We make a different Turf Builder for different parts of the country. We've done research all over, from the West Coast to the Northeast, to make sure you get what's best for where you live.

You can also get some free advice from the Scott's Lawn Pro® in your area. He's your local expert on lawn care.

We'll give you his address if you call us toll-free in the Continental U.S.: from east of the Mississippi 800-543-1415. West, 800-543-0091. Or if you call from Ohio, 800-762-4010.

And if you ever come by Marysville, Ohio, drop in. Take a look at our lawn.

PLAYER PIANO

(Continued from page 24)

would hear is a collection of thuds and screeches far from melodious.

The tapes are encoded in much the same way that computer tapes hold computer programs. Two distinct coded signals are read by the Pianocorder's computer logic circuitry. One signal (pulse-code modulated) controls the pedals and note values. The other signal (pulse-width modulated) controls the dynamics of each note (loudness, length). Signals, on the same tape, are noninterfering.

Logic circuits decode these signals into information that controls a bank of switches. The switches activate powerful solenoids, operating push rods. These plungers hit the keys on the opposite side of their fulcrums from where a human finger would hit. The net effect, however, is the same. The key, a lever, is rocked, and the piano action is triggered. The Vorsetzer unit, having true "fingers," presses down on the keys in the same way a person would. (By the way, a Pianocorder draws a healthy amount of current. A crescendo can dim lights if the house has low available amperage!)

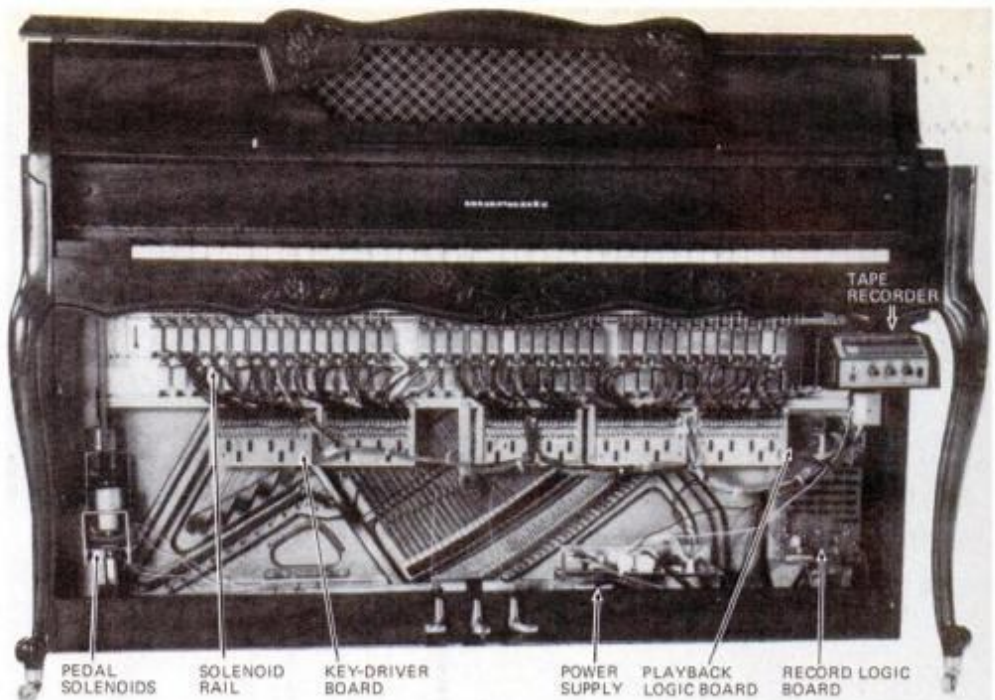
To record, much the same steps are taken, but in reverse. (Don't forget that you *cannot* record with a Vorsetzer, but only on a Pianocorder piano with built-in circuitry.) Any movement (above a certain threshold) of the pedals and keys registers through the solenoids. Then the logic circuits convert the notes into tape-storable, encoded sounds. Everything—including mistakes!—is recorded. During the playback, you have control of speed, loudness and softness.

Big selection of tapes to come

Joseph Tuschinsky, Superscope chairman, for years supplied player-piano rolls for the radio show "Piano Immortals Play Again." His collection of player-piano rolls numbers over 18,000—and they are now being transferred to magnetic tape in Pianocorder format. Superscope will release the selections in volumes, each containing 10 cassettes having a playing time of 45 minutes each.

How does the Pianocorder sound? Some critics have said it "chatters relentlessly," and the tone is all the same. Others call it an astonishing improvement over the old, mechanical player piano.

One modern composer, Gerald Busby, certainly approves of its sound. He has composed a piece especially for Pianocorder. His composition, "Touch," was played at New



A Marantz Pianocorder—or a piano that has been converted to the Pianocorder system—is an interior juxtaposition of piano mechanics and computer logic.

York City's Carnegie Recital Hall.

Sound is so objective that you must really hear a Pianocorder to decide for yourself just how close it simulates actual playing. There is

still some room for improvement, but it may not be long before it will be impossible to distinguish a player piano from a live artist—until you open your eyes!

FM

THE SPOOLISH PAST OF PLAYER PIANOS

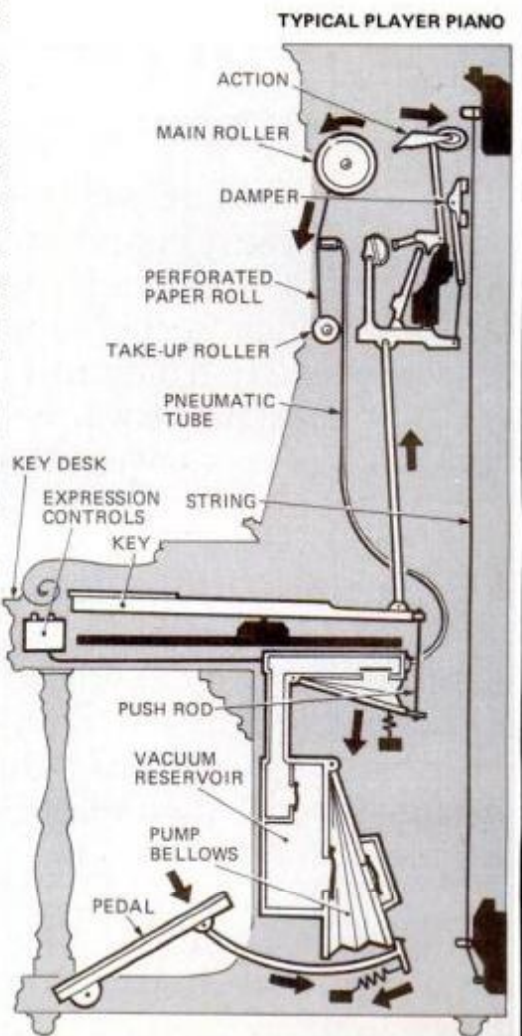
The Pianocorder is the most modern and so far the best-sounding example of the player piano, but it has many ancestors.

The first players were small and played at a dismayingly constant volume. At first, their programs were pinned on large, cumbersome barrels (as in a music box) that jerked each key into action. Later, stiff sheets of accordion-folded paper were punched with holes to be "read" by a pneumatic tracking device. Emil Welte, a prominent German pianomaker, patented the now familiar rolls of thin paper. The final—until now—development was so refined and sought-after an instrument that, by 1920, over 360,000 were made each year.

The old player pianos depended on twin sets of bellows for power. These were operated by foot treadles or electric motors to create a partial vacuum in a reservoir with regulating valves for the pressure. A precut roll was fastened over a foot-long "tracker" bar that had a row of small holes on one side. Each hole's opening or closing controlled a note or a note's dynamics.

As the punched paper revolved on its rollers, holes were exposed. This would break the partial vacuum in a small bellows, called a pneumatic, so that it would collapse under normal air pressure. A push rod was attached to each pneumatic and pushed up the back of a piano key and released. The rest happened as if a human finger had hit the key.

Some few players had expression systems to vary the degree of loudness smoothly from pianissimo to fortissimo. However, most had a limited range. In the widened range—the expressiveness of the piano—technology has, with the Pianocorder, "discovered a whole new chord."



19 mg. "tar", 1.3 mg. nicotine av. per cigarette, FTC Report MAY '78.

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"We can't believe it! From just our small home, to over half a million dollars in rental homes in one year—\$75,000 net! (We'll have over a million by next year!) Your method is fantastic! The highest return we ever heard of, let alone received—and no risk! Please feel free to use our figures."

—Mr. & Mrs. Don Hartsell—Concord, CA

"E. D., using your program I made over \$107,000 this year in rental homes, with just a few hours time (I used your two management plans that eliminate problems). I had no previous experience and was shown how to get capital. It's sure great to eliminate income tax. Please use my example if it will encourage others to try."

—Carl Hoeckner—Fremont, CA

"Dear E. D.: Many thanks—we just bought our 4th house with perfect leverage—no money down. Thanks ever so much for the chapter on 'creative financing.'"

—Tom & Paula Green—Napa, CA

"Dear E. D.: Thanks so much for bettering our lives with your 'Formula.' We can't tell you how much more we are able to get from life now and that petty money problems no longer plague us. Keep up the good work!"

—David & Debbie DiBiase, Dublin

RICHES WHILE RELAXING USED BY ANYONE—ANYWHERE!

These people (and many others) will make another \$75,000 to \$107,000 next year without lifting a finger. But they will probably make much more as they will use the rest of the formula—literally, *riches while relaxing*. And they keep it, as very few pay much in taxes.

You might be aware of what is beginning to happen around the country in single-family homes—*The greatest appreciation in history!*

Total home equities are jumping to astronomical figures and larger and larger numbers are *cashing these in at incredible returns, within a year.*

Thus, I found the unusual tool, and then formulated the safe, easy method to escape from being a wage-slave and real money-worrier. My name is E. D. White. As a low-paid school/college instructor, I put in long hours, chasing every second income to keep one step ahead of the bills. It finally dawned on me that time was marching by. I wanted to do more in life for my family and me."

RESULTS WERE IMMEDIATE! BEGAN WHAT EVOLVED INTO 2 PROGRAMS

"I kept my job as they developed. You can bet that I started without capital! I wouldn't have believed that I could be where I am now. You take the part of the teacher and grade the results:

"I have recently deposited over \$120,000 in the bank as a direct result of program # 1—The Investment Formula. I just turned in my year-old Cadillac, and picked up a new one. I have been able to elect independence fifteen years before most people retire. I own a number of businesses and a string of income properties. I now teach as I desire or pursue other exciting interests. I guess it's best to summarize by what my daughter said to me, 'Daddy, rich is beautiful.'"



E. D. WHITE

THE SECOND PROGRAM

It was immediately clear that the program # 2 not only helped attain my riches but was needed to retain them and enjoy them to the fullest. New, correct principles of financial practice were fully activated.

I have addressed state Business Education conventions, and many others, sharing these same principles. Thousands of educators have now attended my institute's seminars to get new financial principles, not taught in the schools. The 8 chapter program they use is now available. It is titled "Financial Freedom Formulas".

THOUSANDS CAN'T BE WRONG

Those who wrote didn't just tell me they *liked* the material. They stated that they have already made large sums of money, directly from the program. Our home return is much higher than our apartments. Homes zoom up immediately on the cost of new houses, and are not tied to low and slow rents. Two management plans eliminate all time problems, (even out of state).

I have drafted every step—and here is where an educational background paid off, as it is refined to a logical, short easy to follow sequence. Thousands of dollars worth of brain-power and thousands of hours of testing and refining are available to those who are sincere and decisive.

The value of the 2 programs is priceless, if they indeed have the guaranteed results described.

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Please send me your 2 programs.

If I return them for any reason within 30 days, I understand my money will be refunded in **three working days**. On that basis, here is my twelve dollars. (If you wish to use any major credit card, except American Express, list the name of card, number, expiration date and billing address.)

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Once experienced, you would be willing to pay a lot more than the \$12 I'm asking you to invest in your own financial well-being or at least to test without risk.

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I am so confident of the value that I can offer this under written guarantee: If not completely satisfied, simply return within 30 days for immediate unquestioned refund. Further, to completely eliminate any risk, since you don't know my integrity yet, just post-date the check for 30 days.

I will furnish references on request. My CPA is David Hulme, 2975 Treat, Concord, CA.

As you begin, you are not alone. I stand ready to offer instruction and consultation. People are phoning and writing me from all over the country. In a short time, I expect to hear of your success as well. On a safe-money-back guarantee you have nothing to lose and a great deal to gain.

All it requires is belief: enough to read the material and absorb it. I know that you will have the same results we did, or even better.

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All clocks are approx. 22" H, 13" W, 4 1/2" D; except Parlor Clock, approx. 20" H, 9 1/2" W, 4" D, and Traditional Schoolhouse Clock, approx. 19" H, 12" W, 4 1/2" D.

We urge you to take heed. These are truly the last of the Great Old Clocks. At our low price, you may never see these values again. Authentic circa 1900 antique schoolroom clocks, the kind that once ticked happily away in the front parlours, general stores and one-room schools of America's childhood. Lovingly restored and in 100% running order. Each is unique—yours will be numbered, registered to your family or whomever you designate and accompanied by a handsome Certificate of Age and Ownership (suitable for framing). Order now, to avoid disappointment. When these clocks are gone, they're gone forever.

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Choice of Arabic or Roman Numerals. (Add \$8.50 for each insured delivery.)

If these clocks are to be Gift orders, please attach a separate sheet of paper stating the name the clock is to be registered to, and name and address for shipment. We will enclose a gift card at your request. On multiple orders, be sure to specify who gets which clock.

My check is enclosed for \$_____ (N.Y. State residents add 5% tax).

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HOW TO CHECK FRONT END

(Continued from page 118)

let him tell you they aren't necessary.

Steering, suspension checks

■ Check ball joints. Inspect for cracks in the joint and for grease leaking from the joint. If ball joints aren't the self-testing type which have nipples protruding that indicate the amount of wear, test the load-carrying ball joints for looseness, using the pry bar and dial indicator method. Don't take chances with questionable ball joints. A bad one, when it breaks loose, can cause you to lose control of the car.

■ Shake front wheels from top to bottom and then from side to side. Excessive top-to-bottom play signifies loose wheel bearings. Too much side play indicates looseness in the steering linkage.

■ To make sure there's no damage to steering linkage, shake the idler arm vertically. A car with a loose idler arm won't hold wheel alignment. Try tightening the part. If this doesn't work, replace the idler arm.

■ Shake the pitman arm, tie rod ends and center link rods. Shake the pitman arm vertically. Grasp the other parts firmly and exert a push-pull force. Loose parts tend to cause shimmy, poor steering and tire wear.

■ With a ruler, check ground clearance at each wheel well with the car on level ground. Height should be to the specs in the service manual, which is equal all the way around unless the suspension has been modified. Unevenness between heights of wheels on the same axle indicates that a spring is damaged. It is not possible to attain correct wheel alignment if the vehicle height isn't correct.

No guarantees

Unfortunately, there is no guarantee that wheel angles will stay within specified limits. Five minutes after leaving the front-end shop, your car can hit a pothole and lose alignment. Those are the breaks of the game.

As far as I'm concerned, therefore, the sensible approach is to have wheel alignment checked once a year. Between alignment checks, I check steering linkage and suspension components for damage when I think there's a change in the way the car's handling.

Above all, I keep an eye on tires. At the first sign of abnormal wear, zip—back on the alignment rack she goes.

SAFETY CHECK YOUR TIRES

(Continued from page 119)

bly or mechanical failure. Without a TPD, a mechanic would probably balance tire-wheel assemblies. If this failed to correct vibration, he would examine steering and suspension. Finally, he would substitute each radial tire, one at a time, with another tire that's known to be good in an attempt to discover the faulty one.

Wobble (or waddle)

This condition is also called radial lateral force variation. Wobble is usually caused by an out-of-round tire or tires. It's a side-to-side movement at the front or rear of the car. It is especially noticeable at lower speeds—up to 30 mph—and may reappear between 50 and 70 mph.

If the problem tire is in the rear, the rear of the car shakes from side-to-side. From the driver's seat, it feels as if a force is pushing against the side of the vehicle. If a front tire wobbles, the hood looks as if it's moving from side to side, which makes the driver feel as if he were a pivot point in the car.

Checking tires for out-of-roundness (runout) is done with the TPD or a radial runout gauge. The distance is measured between the high and low points around the circumference of each tire-wheel assembly. If runout is excessive, the tire should be replaced. According to General Motors, excessive runout is .030 inch for a full-size car, .040 inch for an intermediate-size car and .050 inch for a small car.

Tire manufacturers claim that a certain amount of wobble occurring between 7 and 12 mph is inherent to radials. You may be able to reduce this wobble by switching front and rear tires.

Lateral pull

This is called "lead." It means the car pulls to the left or right.

Some lateral pull is normal, because roads are generally crowned. However, you can hardly mistake a truly abnormal lateral pull.

Lateral pull is usually caused by incorrect tire inflation, front-end misalignment or faulty front-end construction. If rear-tire construction is faulty, a condition called dog-tracking occurs, which gives a feeling similar to wobble.

A faulty radial tire causes lateral pull if belts have been accidentally placed offcenter, or one tire is a trifle larger in diameter than the other. In either case, side forces develop which divert the tire (and hence the vehicle) from a straight path.

Follow these steps to correct lateral pull:

1. Inflate tires to recommended pressure. Road test.

2. If lateral pull continues, switch the front tires side to side. Road test.

3. If lateral pull is in the same direction as before, put tires back in their original positions and have front-wheel alignment checked.

4. If switching tires reverses the direction of lateral pull, substitute a tire known to be good for one on your car. If lateral pull is corrected, discard the tire you took off. If lateral pull is not corrected, reinstall the tire you took off, and install your test tire on the other side.

Grass Seed Is For The Birds!

Zoysia Saves Time, Work And Money

SPECIAL "EARLY BIRD" BONUS PLUGS OFFER!
ORDER NOW AND GET UP TO 200 PLUGS FREE!



By Jack T. Johnson
Agronomist

Every year I see people pour more and more money into their lawns. They dig, fertilize and lime. They rake it all in. They scatter their seed and roll and water it.

Amazoy is the Trade Mark Registered U.S. Patent Office for our Meyer Z-52 Zoysia Grass.

Birds love it! Seeds which aren't washed away by rain give them a feast. But some seed grows, and soon it's time to weed, water and mow, mow . . . until summer comes to burn the lawn into hay, or crabgrass and diseases infest it.

That's what happens to ordinary grass, but not to Amazoy Zoysia.

"MOWED IT 2 TIMES," WRITES WOMAN

For example, Mrs. M. R. Mitter writes me how her lawn ". . . is the envy of all who see it. When everybody's lawns around here are brown from drought ours just stays as green as ever. I've never watered it, only when I put the plugs in. . . . Last summer we had it mowed (2) times. Another thing, we never have to pull any weeds—it's just wonderful!"

Wonderful? Yes, Amazoy Zoysia Grass IS wonderful! Plant it now and like Mrs. Mitter you'll cut mowing by 2/3 . . . never have another weed problem all summer long the rest of your life!

And from Iowa came word that the state's largest Men's Garden Club picked a Zoysia lawn as the "top lawn—nearly perfect" in its area. Yet this lawn had been watered only once all summer up to August!

These represent but 2 of thousands of happy Zoysia owners. Their experiences show that you, too, can grow a lawn from part shade to full sun, and it will stay green and beautiful thru blistering heat, water bans—even drought!

CUTS YOUR WORK, SAVES YOU MONEY

Your deep-rooted, established Amazoy lawn saves you time and money in many ways. It never needs replacement . . . ends re-seeding forever. Fertilizing and watering (water costs money, too) are rarely if ever needed. It ends the need for crabgrass killers permanently. It cuts pushing a noisy mower in the blistering sun by 2/3.

WEAR RESISTANT

When America's largest University tested 13 leading grasses for wear resistance, such as foot scuffing, the Zoysia (matrella and japonica Meyer Z-52) led all others.

Your Amazoy lawn takes such wear as cookouts, lawn parties, lawn furniture, etc. Grows so thick you could play football on it and not get your feet muddy. Even if children play on it, they won't hurt it—or themselves.

CHOKES OUT CRABGRASS

Thick, rich, luxurious Amazoy grows into a carpet of grass that chokes out crabgrass and weeds all summer long! It will NOT winter kill. Goes off its green color after killing frost, regains fresh new beauty every Spring—a true perennial!

NO NEED TO RIP OUT PRESENT GRASS

Now's the time to order your Amazoy Zoysia plugs—to get started on a lawn that will choke out crabgrass and weeds all summer long and year after year.

Plug it into an entire lawn or limited "problem areas". Plug it into poor soil, "builder's soil", clay or sandy soils—even salty, beach areas, and I guarantee it to grow!

PERFECT FOR SLOPES

If slopes are a problem, plug in Amazoy and let it stop erosion. Or plug it into hard-to-cover spots, play-worn areas, etc.

If it isn't Amazoy, you're not getting the plugs that made Zoysia famous

EVERY PLUG GUARANTEED TO GROW
In Your Area • In Your Soil

- **AMAZOY WON'T WINTER KILL**—has survived temperatures 30° below zero!
- **AMAZOY WON'T HEAT KILL**—when other grasses burn out, Amazoy remains green and lovely!

Every plug must grow within 45 days or we replace it free. Since we're hardly in business for the fun of it, you know we have to be sure of our product.

PLUG AMAZOY INTO OLD LAWN, NEW GROUND OR NURSERY AREA

Just set Amazoy plugs into holes in ground like a cork in a bottle. Plant 1 foot apart, checkerboard style.

When planted in existing lawn areas plugs will spread to drive out old, unwanted growth, including weeds. Easy planting instructions with order.

Your Own Supply of Plug Transplants

Your established Amazoy lawn provides you with Amazoy Zoysia plugs for other areas as you may desire.

NO SOD, NO SEED

There's no seed that produces winter-hardy Meyer Z-52 Zoysia. Grass and sod or ordinary grass carries with it the same problems as seed—like weeds, diseases, frequent mowing, burning out, etc. That's why Amazoy comes in pre-cut plugs . . . your assurance of lawn success.

FREE! UP TO 200 PLUGS

Just for Ordering Now!

More than a HALF-BILLION of our Zoysia plugs have been sold. Our Early Bird Bonus Plug Offer means clear savings to you. Order now—don't take another chance with lawn disappointment.

WORK LESS • WORRY LESS • SPEND LESS

- Easy To Plant, Easy To Care For
- Perfect For Problem Areas
- Chokes Out Crabgrass
- Reduces Mowing 2/3
- Stays Green Through Droughts
- Resists Blight, Diseases, And Most Insects
- Won't Winter Kill
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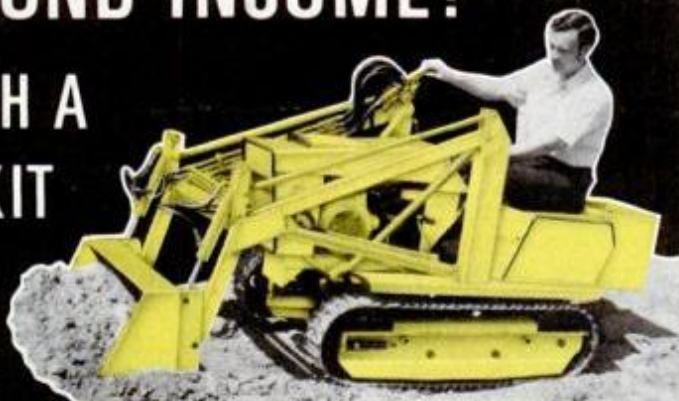
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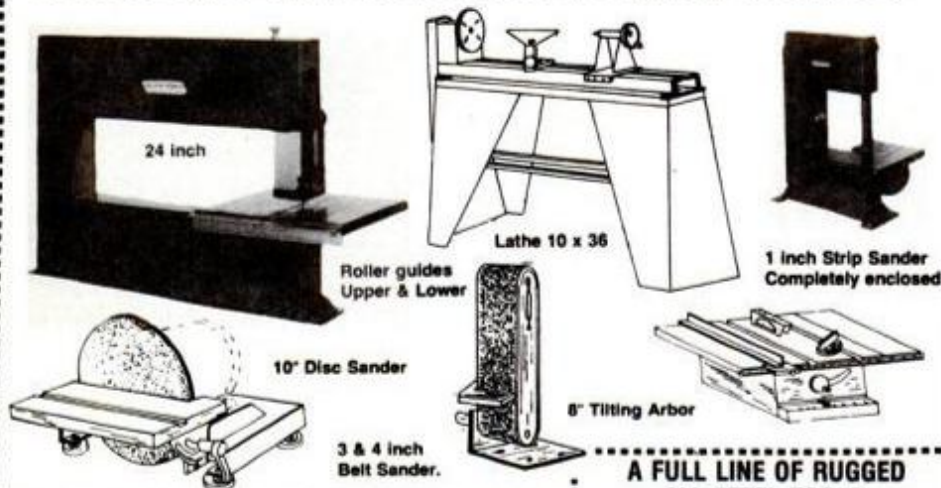
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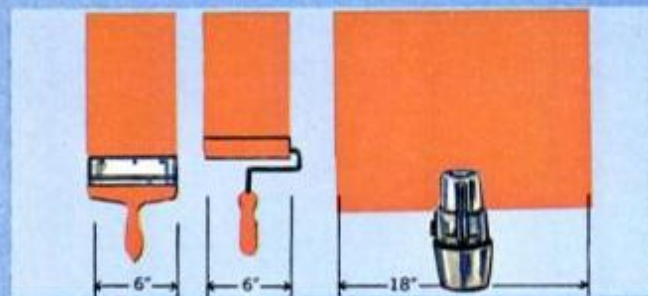
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HOW TO BREAK IN A NEW BIKE

(Continued from page 72)

the engine is screaming its guts out.

By grabbing a handful of throttle you're permitting combustion pressures to force the pistons against the cylinder walls so they can rub off any high spots before they glaze over. Moreover, the rings are forced out against the cylinder walls, which helps to shave off any high spots on the cylinder walls.

As the rings are thrust against the cylinder walls, they tend to seat in faster before the walls can become glazed. If the rings don't seat in early, they may not do so until a lot of mileage is clocked.

Closing the throttle creates a vacuum in the cylinder that sucks oil up the cylinder walls. This little breathing spell lessens the chances of a piston seizure which results when a



Cruising speed on a new bike should be varied often; don't sit at same rpm or mph too long with a young and tender bike.

piston expands so much that it "locks up" in the cylinder. In the early stages of seizure, the engine will slow down or act sluggishly. A severe seizure will lock up the rear wheel. If you suspect a swelling piston, shut off the throttle and whip in the clutch. A tight piston will also stop an engine suddenly when the ignition is turned off.

By sensitizing yourself to the way the engine sounds and feels, you can recognize impending piston seizure before it brings your bike to a screeching halt. If your new bike doesn't have a tachometer, listen carefully to that engine to prevent its being overrevved or lugged down. Where no tach is provided, the owner's manual will recommend certain throttle openings or speed during different stages of break-in. But you can't always go by these methods. For instance, a certain throttle opening may be adequate when the bike is running in high gear on the level. But trying to

maintain that same throttle position and gear on a steep hill will overstress the engine. If that engine stumbles along, sounds dull, and acts as though it has no power, gear down a notch or two. Let the engine turn easily.

Engine speed is more critical than ground speed. It's easier on an engine to whistle down a hill at 65 with the engine turning easily than to lug up that hill doing 35 in top gear.

Operating in an ideal engine-speed range is only part of break-in. The engine must also be given progressively more work to do as the mileage rolls by. For example, during the first 500 miles the owner's manual may recommend not exceeding a cruising rpm of 4000. Then for the next 500 miles, engine cruising speed may be upped to 6000 rpm. Finally, at the end of 1000 miles, the engine may be revved up to its red-line figure of 9500 rpm. Remember, though, that occasional spurts of speed above normal cruising rpm will help seat in the piston and cylinder assembly. Holding to one relatively low rpm or mph setting during the entire period you're breaking in the bike will do an engine more harm than good.

Although the manufacturer of your motorcycle may give a break-in distance extending up to 1000 or 1500 miles, your bike may still not loosen up fully until you've driven farther. Some large-displacement motorcycles, in fact, do not give their best performance until some 4000 or 5000 miles have passed. So don't expect your machine to suddenly jump out from under you when you complete the 1000 miles of break-in.

There are other aspects of break-in besides twisting the throttle. Lubrication is important. A clean, full supply of oil will dissipate heat generated by all those close-fitting moving parts. So, before you ride that set of wheels out of the showroom, make sure all oil levels are where they should be.

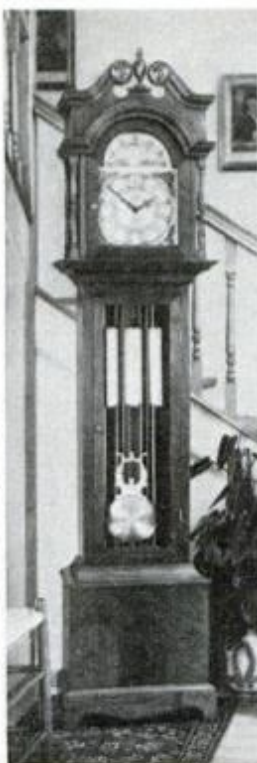
On a four-stroker make that first oil change early. As parts wear in, they shed minute particles of metal, and you don't want them grinding around in a new engine. And some dirt may have found its way into the engine during assembly.

Drain the oil while it's still hot, when all those bits of dirt and metal are in suspension, so that most of them will drain with the oil.

Although some owners' manuals are vague on just when to make that first oil change, don't wait any longer than 200 or 300 miles. If you're really fussy you may want to make

(Please turn to page 210)

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HOW TO BREAK IN A NEW BIKE

(Continued from page 209)

another one after another 200 or 300 miles. If your bike has an oil filter, it's a good idea to replace it (if possible) or at least to clean it during the first oil change. Don't overlook cleaning other filters or the magnetic sump plug, if there is one.

If your bike has a separate oil supply for the gearbox, change it at the first 500 miles. After all, those new gears are wearing off their rough edges, too. It wouldn't hurt to change fork oil around that mileage either.

Don't use any oil additives until the engine has been thoroughly broken in. They'll keep load-bearing surfaces, such as the pistons and rings, from seating in.

Occasionally get out the toolkit and go over the various fastenings on the bike to make sure they're all tight. Check the aluminum cylinder-head studs or nuts with a torque wrench following specs in the owner's manual. An unevenly tightened cylinder head will warp. Torque the head when the engine is cool.

Various components like the rear chain, clutch, and valves (four-stroker) will probably need adjustment throughout the break-in period. And if it's your first new bike, study the owner's manual until you know it by heart.

Even the brakes require some breaking in. Like the high spots on the pistons and cylinder walls, brake pads on disc brakes, or the linings of drum brakes, can glaze over if worked hard right from the start. So, use moderate braking pressures for the first few miles until they bed down.

Drum brakes in particular will benefit from a gentle touch. Because of their curved surface area, the linings won't make full contact with their drums when new. Hard braking pressures glaze and harden the linings' high spots. Harder braking pressures will be necessary to stop the bike, which will worsen the glazing. If this condition becomes too severe, replace the linings.

Besides using moderate pressures at first, avoid "riding" the brakes and overheating them, as when descending a steep hill. Brake with the engine by dropping down a gear or two. Just keep the engine revs within reason.

Break-in is really a matter of common sense. Don't be tempted to wring out that new bike to see what it can do or to keep up with a buddy who has already broken in his mount. A little consideration now will make for a better-performing and longer-lasting bike.



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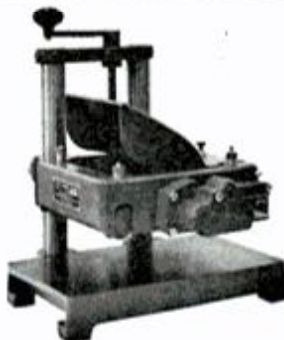
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CIVIL DEFENSE

(Continued from page 111)

ter all three children had moved away from home, the probability of attack declined and Mrs. Sahagian's ceramics business grew. But Sahagian says he doesn't regret building the fortification in the first place. It could be made ready in less than 15 minutes in the event of attack. "I felt the shelter was a minimum investment for a fighting chance," he said. "Who can tell me it was the incorrect thing to do?"

Warning system outmoded

As underground shelters have been remodeled in many homes, other parts of the country's civil defense structure have simply become outmoded. The system to warn the population of an imminent attack, for instance, is something like an old New Year's noisemaker: It may sound off, but most people won't attach much meaning to it.

At last count, half of the nation's population lived outside the range of local sirens. Further, most of the nation's population lives or works in closed or airconditioned buildings and might never hear sirens.

Misgivings about the system come easy to Robert J. Weitzel and Bill Sweeny of the Mack Volunteer Fire Department just outside Cincinnati. In 1977, a tornado whirled through their community and, Weitzel says, because someone either hesitated or dialed a wrong number, sirens didn't sound until after the tornado hit.

The real classic among foulups occurred in 1971 when the duty officer at Cheyenne Mountain (Colo.) Federal Emergency Communications Center mistakenly signaled a nuclear attack alert including a coded announcement that the President had declared an emergency, which meant all local radio stations should cease broadcasting. Months later, a federal survey found that fully 90 percent of the nation's radio stations had ignored the report.

Today, Tirana questions the usefulness of sirens in a nuclear attack. "If New York is targeted, the concrete melts. So whether you have 30 minutes to go downstairs doesn't make any difference," he says.

Industrial plants unprotected

Warning systems aren't the only weak link in our civil defense system. Another: Private industry—a vital component in the nation's ability to recover after an attack—is virtually unprotected. For the most part, U.S. industries have staked the future on deterrence, confident that an attack won't occur.

Practically unique among U.S. industry is the Boeing Aerospace Corp., which studied the option of relocating parts of its vast Seattle complex, much as the Russians did with their aviation industry in World War II.

Boeing officials have refined a process of reinforcement, packing their machinery with aluminum shavings and pushing mounds of soil against the sides of their factories.

At a Defense Nuclear Agency test last June at Miser's Bluff in western Arizona, Boeing built two factories and equipped each with lathes, mills and desks. In one of the factories, the machinery was packed in shavings and piles of sand nine feet high were heaped against the walls.

After a simulated blast one-twelfth the intensity of the atom bomb dropped on Hiroshima the unprotected factory was strewn across the Arizona desert, while the protected plant was buried under a mass of sand that took a day to uncover. Once cleared, however, the machinery was operable.

Most industries have not followed Boeing's example in planning for a nuclear doomsday. "We put up special doors one year, then took them down the next," said one Exxon official. "If there's an attack, we're all gone."

Other parts of the civil defense structure have been patched up recently as planners have faced at least some of the problems squarely. One such problem, for instance, was the President's escape strategy in the event of all-out war. Within weeks of taking office, President Carter's staff sounded a mock emergency and began a drill to get the President from the White House to Andrews Air Force Base. It fizzled. The helicopter ride usually takes 10 minutes. But it was 45 minutes before the Airborne Emergency Command Post was ready to take off—15 minutes after a missile launched in Russia would have impacted on Washington.

"They've cleaned up their act since," a civil defense official says.

Organizing emergency forces

Federal planners have also moved recently toward untangling the bureaucratic web in which civil defense funds have sometimes gone astray. In one bizarre case reported to Congress, for instance, civil defense funds were used to pay for traffic control at the Calaveras County Fair and International Frog Jumping Jubilee at Angels Camp, Calif. Strange as that may sound, the principle isn't bad: Earth-

(Please turn to page 214)



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CIVIL DEFENSE

(Continued from page 212)

quakes, tornadoes and floods often bring out the same army of rescue workers who would be called into action after a nuclear bomb fell. So some civil defense funds, local authorities have long maintained, ought to go toward maintaining that organization for all kinds of emergencies. The Carter administration agreed, and ordered consolidation of a number of separate agencies under one wing, the Federal Emergency Management Agency. Now, it has

responsibility for everything from international terrorism, dam safety, earthquake detection, flood insurance—to nuclear attack.

There is little disagreement that consolidation is a good idea. And no one argues with attempts to fine-tune the President's escape plans. But there is widespread debate on proposals to evacuate some 130 million people from urban and military base areas to outlying regions—the keystone of current U.S. civil defense philosophy.

On one side, Tirana argues that, by itself, the plan is a deterrent. The

theory is that the very existence of a plan will discourage the Russians from launching an attack. At worst, relocation will limit casualties.

Biggest rush hour in history

On the other hand, critics call the plan a waste. Former U.S. disarmament negotiator Paul Warnke, for one, has suggested that massive evacuation would be "the biggest rush hour in history, and probably the last."

On the local level, many civil defense volunteers still favor the idea of taking cover, rather than running for the hills. "We would like to see blast shelters," said J. Herbert Simpson, executive director of the National Civil Defense Agency, an association of local civil defense workers. But Tirana argues that the cost would be prohibitive: between \$50 billion and \$100 billion, compared with the \$1 billion estimated cost for an evacuation program.

All sides in the debate agree that the prospect of uprooting the Northeast cities, San Francisco and Los Angeles poses problems. "Enormous problems," Tirana says.

For example, three Federal studies have questioned the feasibility of relocating 11 million people in metropolitan New York. In the latest study, the Stanford Research Institute envisioned what it would take: an armada of 2 million cars, 5000 buses, 5300 freight and passenger rail cars, 273 commercial aircraft and dozens of boats.

Still, Tirana argues it's worth a try to match the massive Russian civil defense effort. "We've got to have a plan so we never have to use it," he says.

Plans don't stay on the track

Tirana has set aside a corner of the conference table in his Pentagon office for a small, HO-gauge electric train, a leftover from his 40th birthday party last year. In the grim dream world of awesome speculation, the train adds a cheerful touch. As for symbolism, it also reflects the path of civil defense strategy since World War II.

"In the 1950s," Col. William Smith, former president of the U. S. Civil Defense Council, told Congress recently, "that was our cry. Evacuation. Move the people out. And then we went into the shelter program and then our funds ran out again and we are out of the shelter program and back into evacuation. There is no wonder the citizenry is upset and wondering what is taking place in civil defense. We can't stay on one track long enough to do a job."

PM

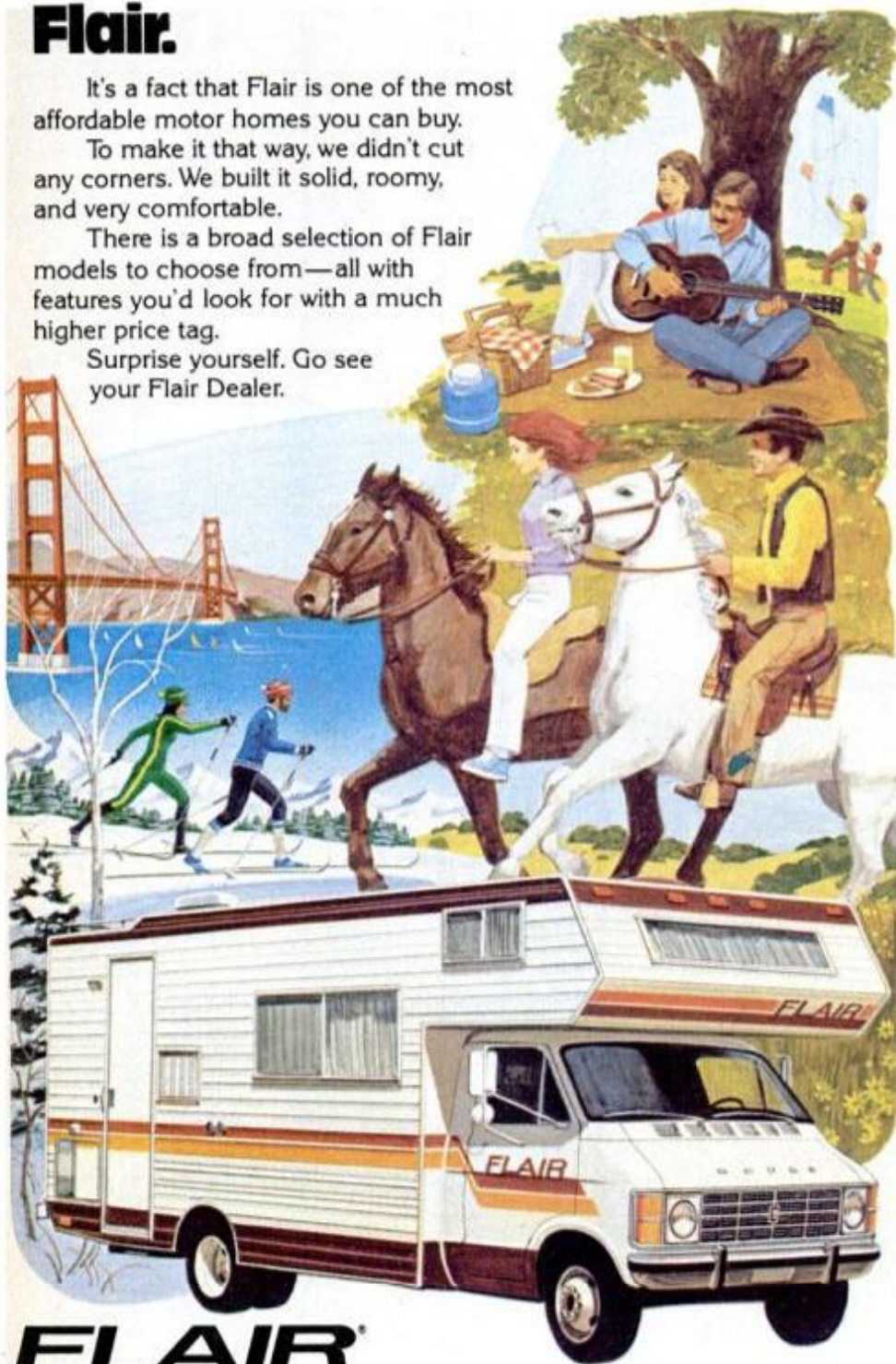
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MAKE YOUR OWN CUSTOM ROD

(Continued from page 121)

at four or five points, while shorter rods might get by with a single ferrule in the middle. Careful preplanning is as important as the final finishing.

Ned Segar begins by flexing the blank in order to determine proper position for the guides. Next, the guides are temporarily held in place with masking tape and a line strung through the guides. The rod is then bent to be sure the placement of these line guides is correct. If guides are too far apart, the line will not stay on top of the rod when under load. Casting distance will be reduced, since the line will slap the rod as it is flexed during the casting stroke. Segar selected seven Fuji speed guides and a speed tip for our suitcase rod blank.

Securing the guides

Wrapping holds the guides in place and provides the opportunity for colorful customizing. You'll need nylon wrapping thread, a wooden rod wrapping stand (which you can easily build or order from Rodmakers and others), epoxy glue and Q-tips for applying it, a solid glass rod



With one half of ferrule plug epoxied in the larger rod section, smaller taper end is rounded, sanded for tight ferrule fit.

blank of about the same rate of taper as the rod, and a block of household wax to help the ferrule plugs fit.

With the guides carefully positioned along the rod, they can be secured right on the rod or on an underwrap, as we selected. Marks were made $\frac{3}{8}$ inch beyond both ends of the foot of each guide and the wrapping started with a few turns back over itself to anchor the loose end. The wrap is continued almost to the second mark, where a thread loop is placed and wrapped over. At the mark, the wrap end is threaded through the loop and then pulled back under the wrap to secure it. The guides are then placed on the



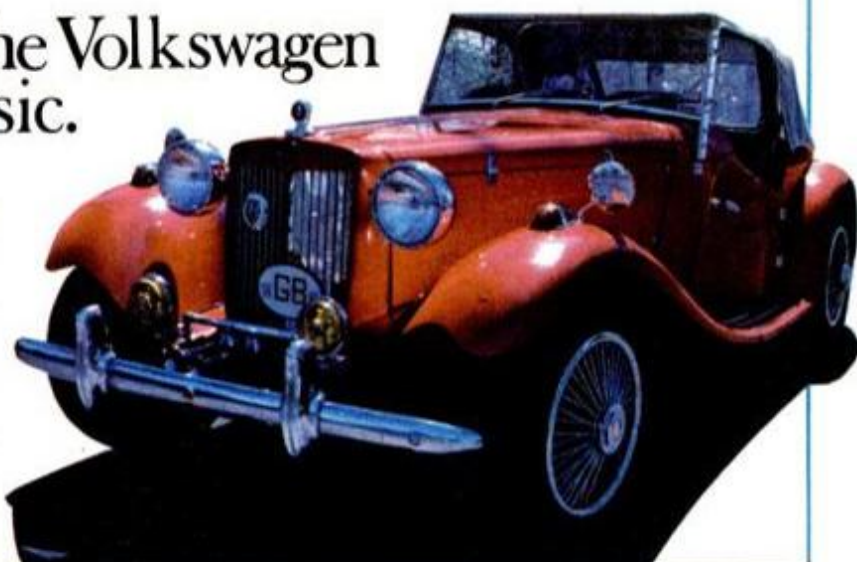
About 2 inches on each side of cut have been wrapped with same color thread; reinforcing of ferrule hardly shows.

underwrap and the feet secured in the same way.

Now, with all guides in place, cut the rod carefully with a hacksaw at the spots marked for ferrules. Slide the smaller end of the solid blank into the larger diameter of the cut rod. Mark where it fits and then cut off the plug 2 inches on each side of this mark. Sand, then epoxy the larger end of the plug into the larger section. Wrap, using the same color as the rod, for 2 inches on each side of each ferrule to prevent splitting. *The Rod Builder's Guide and Catalog*, \$1.50 from Rodmakers Supply, 10346 Southwest 187th St., Miami, Fla. 33157, lists all supplies. **FM**

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MANPOWERED FLIGHT

(Continued from page 87)

a number of other MPA designers are working out the bugs of fledgling aircraft, and any one of them could pop through a quick-opening weather window in the next few months for a ride either to glory or a cold (52-60° F.) dunking in the Channel.

New Jerseyan Paul Osadchy, a 56-year-old engineer and former commercial pilot, has built five MPAs to date. Osadchy claims to have arrived at MacReady's design formula before MacReady did; using it, Osadchy plans a sixth aircraft for the Channel that will have a wingspan of about 60 feet and will weigh 45 pounds. He'll build it of carbon composite and urethane foam with a Mylar covering.

Californian Norman Davidson won't be pinned down about his Channel contest entry. He only says the design is "a wild one," and much modified from his original craft, which was about 70 percent complete when MacReady walked off with the first Kremer prize.

Fitness counts

Wayne Bleisner, 24, a graduate aero-engineering student at the University of Washington, has almost finished reworking his third machine into his fourth since 1976. His potential Channel craft will be "pretty much conventional," Bleisner says, leaving one to wonder what "conventional" might mean in the wild world of MPAs. Whatever it is, it will be made of spruce, plywood and plastic foam, Mylar covered; its wingspan will be about 80 feet, having an elliptical (Spitfire-type) planform, and anticipated total weight of 90 pounds. Bleisner's first design was a highly unusual flying wing which flew only

once, under tow, before a hangar accident demolished it.

Bleisner is a private pilot, but by his own admission "not too much of an athlete"—which brings up a point worth remembering when it comes to MPA endurance flights: Just getting off the ground takes a degree of fitness that eliminates the lame, the halt and the out-of-shape as pilots. Bleisner is currently in training to do his own flying. But the idea of physical endurance coupled with bicycle-type pedaling points up a definite Channel dark horse: the Belgians.

Belgians would rather win a bike race than eat waffles with whipped cream. They know more about bicycles and what makes them go than practically anyone. Since pedaling is currently the exclusive power mode for all known MPAs, it is not surprising that the Belgians have been tinkering with them.

Belgian brothers Stephan and Paul Massachelein, with an associate, Eric Verstraete, began building MPAs at least five years ago—with no fanfare and practically in secret—with a Channel crossing as their avowed goal even before a prize was offered. By 1976 they had built five markedly different MPAs and were testing them at the Calais-Dunquerque airport (PM's photos of these tests, on page 87, are believed to be the first published in this country). Little is available in the way of details on whichever MPA design the Massacheleins will try over the Channel, but they are definite contenders.

To get some idea of how an actual attempt at a crossing might proceed, and the odds on success, PM talked at length with British aviation authority Ron Moulton, who supplied a number of details for this article. Crossing attempts are likely to

(Please turn to page 218)

Ground effect—how it works

All existing manpowered aircraft are flown only in what aerodynamicists call the "ground effect"—and in fact some people take issue with their even being defined, technically, as aircraft. Certainly without this phenomenon, the English channel would be far beyond existing MPA technology.

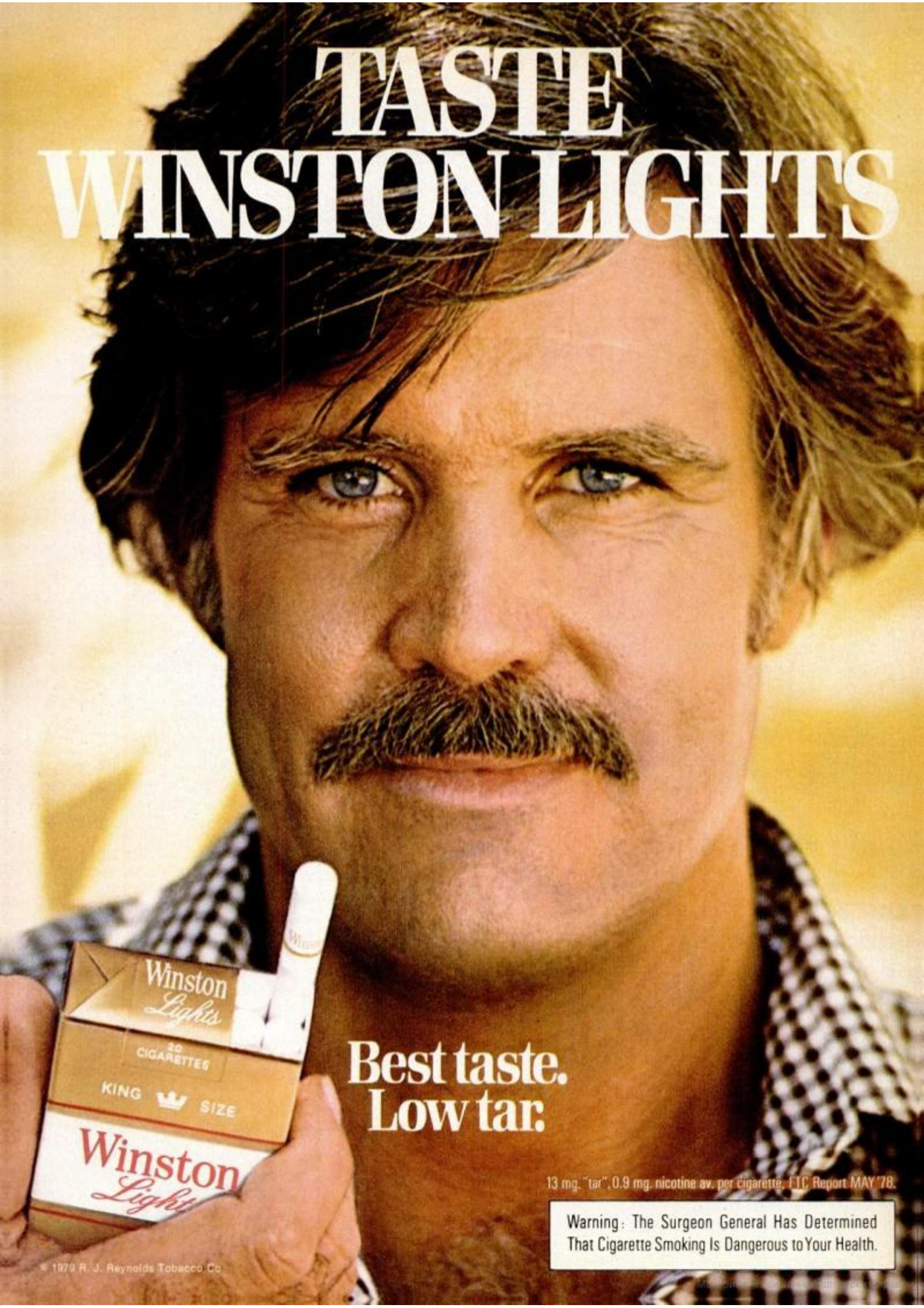
Ground effect is often described incorrectly as an "air cushion" between an aircraft's wing and the ground—pilots of conventional airplanes descending into it feel a definite floating sensation. But Boeing aerodynamicist Dr. John H. McMasters says ground effect can be correctly summed up as "downwash interference."

Air flows around a wing, producing lift and drag, and then is

deflected downward as a net effect of the wing's passage through it. When this aft-flowing downwash stream is interfered with by the ground, the result is an upward rotation of all the aerodynamic forces acting on the wing. To picture this, you must keep in mind that air has properties of a fluid. It means that drag is reduced as the net forces vector moves more toward the vertical.

Ground effect affects all aircraft up to an altitude of about half a wingspan—the longer the wings, the higher they "feel" ground effect. It significantly reduces the power required to remain airborne, and without it there would not—yet—be any successful, working manpowered aircraft.—B.A.

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MANPOWERED FLIGHT

(Continued from page 216)

begin, Moulton speculates, from large concrete platforms near Folkestone, southwest of the Dover Cliffs (the cliffs themselves, or any heights above 98 feet, are ruled out for launching).

Simulator tests indicate that a reasonably fit pilot can maintain the necessary 0.25 to 0.4 hp to sustain flight for the hour-and-20-minutes to three hours a crossing might take, depending on winds. Yet no MPA has ever come closer than a 10th of this time in actual sustained flight (*Condor* still claims the MPA time and distance records of 8 minutes and 1.3 miles respectively).

Winds over the English Channel are reported "calm" only 8 percent of the time; they normally blow either from southwest or northeast, which would make them 90° crosswinds to MPA fliers headed generally southeast. Velocities average under 12 mph, but an occasional west wind—more likely after midsummer—blows often at more than 13 mph and would be a helpful, quartering wind to the Channelnauts. Fog is frequent over the Channel and in the Calais region, posing a threat in the absence of winds.

Ships could bring them down

The natural elements may be of far less concern to MPA pilots, however, than a specific kind of manmade turbulence—the air wakes of passing ships. Dover Station Officer William Carter of H.M. Coast Guard told me that there are about 350 ships in the Channel on an average day, plus some 200 ferries. For MPAs, flying over these ships is as unlikely as outrunning them (Bryan Allen probably set the MPA altitude record when he inadvertently zoomed *Albatross* to 35 feet one day). "We can't control the ships, we only keep them under surveillance," says Carter, "but we probably would issue a warning in the event of a Channel-crossing attempt by one of these aircraft."

For a frail MPA, the vortices behind a massive ship could prove fatal. It is hoped that there will be sufficient intervals between vessels to permit a direct flight with not too much energy spent on avoidance maneuvering.

Perhaps no problem will prove so insurmountable as that of finances. MacReady, who is seeking a sponsor as are several other MPA designers, estimates the costs of transporting several aircraft (in case of accident) and his team to England will exceed nine times the development costs of *Gossamer Albatross*.

Albatross was never in the air for more than five minutes' duration before a crash grounded it; events later forced its removal, before repairs were effected, from MacReady's area at Shafter Airport near Bakersfield—to facilities yet unknown as we go to press.

(Please turn to page 220)

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MANPOWERED FLIGHT

(Continued from page 218)

Observing the "marvelous conditions" that prevailed for MacReady at Shafter Airport when Condor made its epic flight, Ron Moulton comments: "I can see now how they had a relatively easy time camping out and working on the [Kremer figure-8] competition. But it won't be that easy when they get to England."

Whether MacReady or someone else conquers the Channel this year makes little difference to at least one aviation authority, Boeing aerodynamicist Dr. John H. McMasters, perhaps the leading expert on ultralight aircraft.

"It's akin to a circus stunt," says McMasters. "MacReady should just fly off

English Channel aviation firsts

1785, Jan. 1—First aerial crossing: Jean-Pierre Blanchard and Dr. John Jeffries, hydrogen balloon.

1909, July 5—First airplane: Louis Bleriot, Bleriot monoplane (£1000 prize).

1910, Oct. 16—First nonrigid airship: *Clement Bayard II*.

1915, Jan. 19—First military attack: German Navy's rigid airships L-3 and L-4.

1919, Feb. 8—First passenger service: Societe Farman, converted World War I Goliath bomber.

1931, June 20—First sailplane: Robert Kronfeld (£1000 prize).*

1963, April 13—First hot-air balloon: Don Piccard and Ed Yost, Raven balloon.

1977, July 20—First hang glider: Ken Messenger, flex wing.†

1978, May 9—First powered hang glider: Dave Cook, VJ-25E (£1000 award).

*Air-towed to high altitude.
†Balloon-launched at 18,000 feet.

into the sunset. If he can fly for an hour, he can fly forever."

McMasters suggests, in any case, that MacReady fly two *Albatrosses* wingtip to wingtip (up to five feet apart), which would reduce the total power requirement by 11 percent. This hypothetical configuration suggests something that already exists: *Newbury Mantler*.

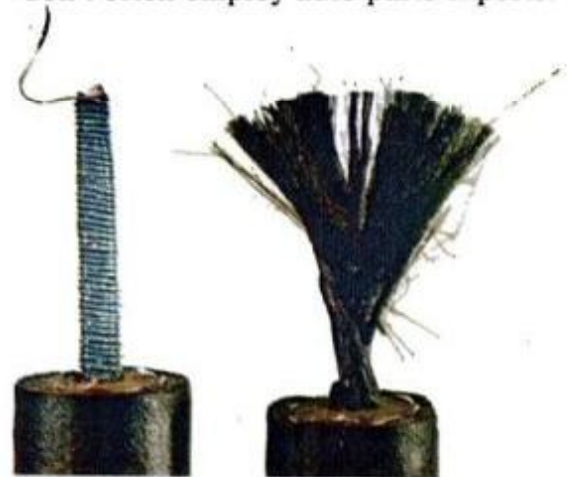
Perhaps a little distracted by all the attention—as well as the challenge that lies ahead—MacReady appears to remain very optimistic.

"I'm 100 percent confident," he says, "that *Gossamer Albatross* or some nearly identical plane can do it." **PM**



Would you buy plug wires from a lady who sells wired bras?

When she runs over from Lingerie to help you in the Automotive Department, she wants to be helpful. But does she know that the "wire" in those plug wires is probably carbon and fiberglass? not "wire" at all. Has she ever heard of Sorensen Mono-Mag, the real WIRE wire? Probably not. Super stores don't often employ auto parts experts.



The wire on the right has a core of hundreds of fiberglass strands impregnated with graphite particles. It's OK, but it does break down eventually from heat and vibration until the voltage can no longer reach the plugs. Sorensen Mono-Mag lasts and lasts and always delivers full voltage because it is "Real" Monel steel wire. There's no radio static, so — you enjoy living room quiet stereo, tape deck and CB radio.

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To learn more about your ignition system, write:

Sorensen

the extra power ignition system

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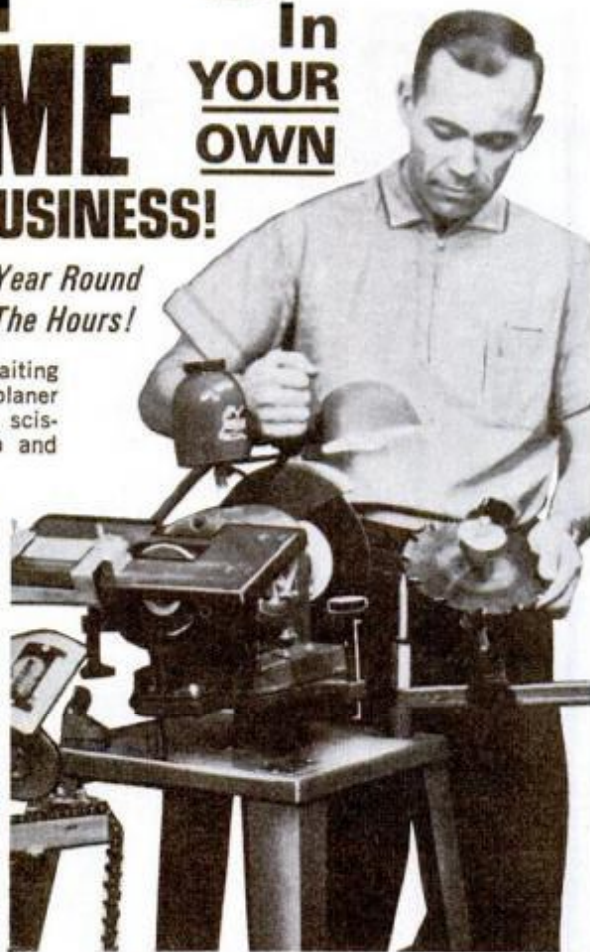
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Wallington, Texas 79085

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Y. O. Miller
Hubert, North Carolina 28539

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SHOOT SNAPSHOT PANORAMAS

(Continued from page 105)

the edges come unstuck and curl up, which is uglier than tape. After the photos are mounted, carefully clean the surface of the panorama. Cover it with a cloth and put some heavy books on it for a while to make sure the glue sticks. Remove the books and you will have yourself a most intriguing new dimension in snapshots.

Some tips

While you're doing all that cutting, you'll quickly discover the two most irksome problems with this method of panorama-making. There are visible lines where the photos butt, and it is virtually impossible to line up two adjacent photos perfectly. Luckily, both problems can be minimized.

The ugly lines are most pronounced where sky meets sky and with other light-colored areas. The obvious solution is to frame your photos so there is not much sky in them. But remember to leave enough so that when you cut the panorama into a rectangle you aren't forced to cut off the top of a mountain, building or other prominent feature.

To solve the matchup problem, avoid scenes with lots of horizontal parallel lines. Also, large expanses of flat, patchy ground (as in the panorama on pages 104-105) are tough to match up. Many matching problems can be eliminated by cutting and butting photos along heavily shadowed areas or along natural verticals like tree trunks or the line where two buildings meet.

Panoramic rewards

The above procedure may sound like a lot of work, but it's not. Neither is it something that takes five minutes. It takes a bit of practice, but the necessary skills are easily acquired. The best way to learn is to experiment with different techniques. Take some photos of your house or the block you live on and make a practice panorama or two. Start out with a two or three-picture panorama. As you become more proficient, you'll want to try spreads of four, five, six or more. Once you achieve even greater expertise, you can make even larger ones.

Any camera can be used to take panoramas, from a 110 pocket model to an 8x10 view camera. The same principles apply. While you won't be able to duplicate the results available from a special camera, they'll be good enough—and, in a way, will be more fun.

PM

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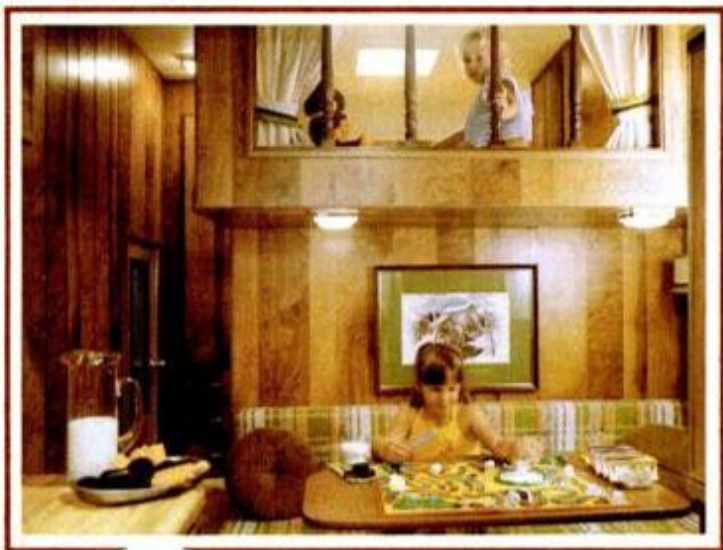
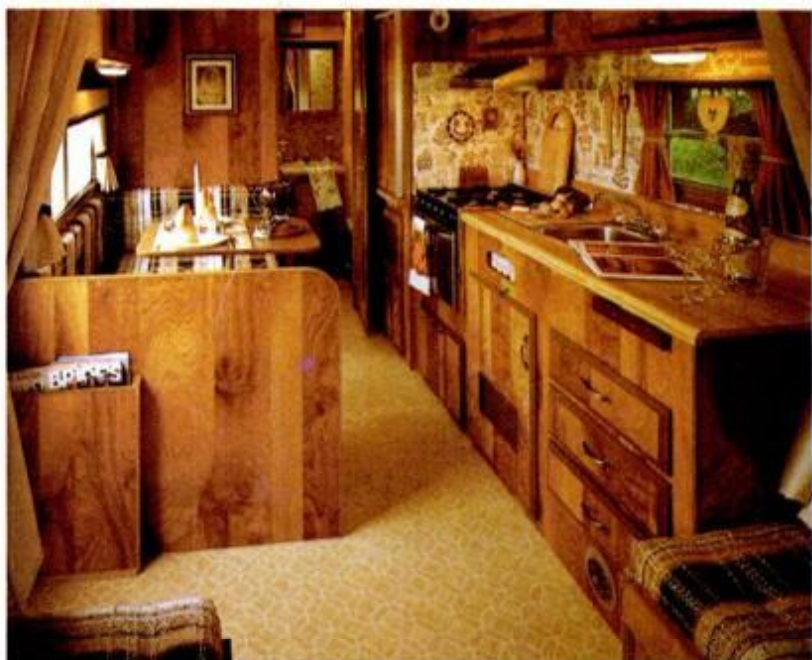
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- AC Air Pump (Item 0004) **\$29.95**
- DC Pump-plugs into auto cigarette lighter. (Item 0005) **\$29.95**

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Usually major problems. Look for 0.00% or close to it.	
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Other ingredients. The listing *Crop Seed* can mean timothy, brome or other undesirable seed hard to kill. It's ideal to have no crop seed.

Another listing is *Inert Matter*—basically filler such as chaff, ground corn cobs or leaves. You're getting excessive filler in any package containing 3 or so percent.

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else—someone who's not there at the moment."

(Editor's note: A tilt steering column is offered optionally for all Mustangs.)

Only 9.4 percent of our sampling reported owning 1979 Mustangs with the turbocharged four-cylinder engine. We asked them for their comments about the Turbo Four, and here are some representative replies:

"Sporting performance plus good fuel economy," responds a computer hardware analyst from Michigan. "My average gas mileage is 19.5 mpg, with a low and high of 17.2 and 22.5 mpg. I do note a high-rpm vibration in the engine, but nothing serious."

A Wisconsin warehouseman reports, "I am impressed with my Cobra's acceleration and gas mileage."

Several owners of early turbocharged Mustangs reported engine pinging under full power. In all, the turbo delivered 18.6 mpg in city driving and 22.6 on the highway—a respectable figure undoubtedly aided by the overdrive four-speed. Actually, the turbocharged Four came in only about one mile per gallon below the standard Four and a couple of mpg above the V6.

We received very few specific complaints about the 1979 Mustang, and even the most frequent gripe—workmanship—was voiced by only 19.1 percent of our respondents. More typical was this opinion by a North Carolina highway engineer: "Excellent quality. Windows, doors, and all seals fit tight. No rattles. Trim lines up, with small gaps between sheet metal (doors, fenders, hood, trunk) well matched and even."

More owners hadn't experienced mechanical troubles than had. Dealer service departments came in for good marks generally, with 50.7 percent rating them *good to excellent*. And by and large, dealers made needed repairs the first time.

An Oregon school director writes, "When I took delivery, the radiator was empty. Some dealer prep! Also the manual transmission wouldn't shift into reverse. The dealer said a part of the shift linkage was missing. He fixed this but hasn't been able to trace a stumble in acceleration, although I've had the car back twice. The first time I picked it up, the engine ran worse than before. I'd rate the dealer's service department average."

A few owners of standard four-cylinder Mustangs complained of sluggish accel-

eration, especially with automatic transmissions. "I'm probably spoiled," confesses an Ohio retiree, "because my previous cars had six or eight cylinders. Now with this Four, I miss the power I feel is necessary for fast passing. And why can't they make the 16-gallon V8 gas tank optional for the Four? My car came with the standard 11.5-gallon tank . . . ridiculous."

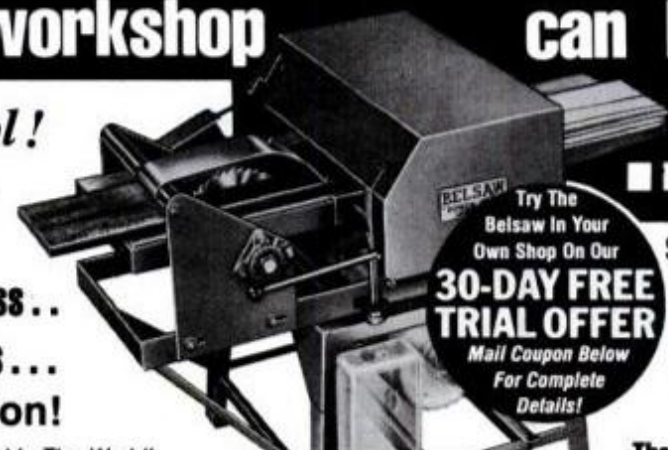
A few owners of two-doors grumbled about scanty trunk space. Most hatchback buyers, conversely, praised cargo capacity. An Arizona physician added, "The hatchback concept is great and allows a small car more luggage and carrying room. However, it also allows would-be thieves to see all the contents of the car. There ought to be a folding or collapsible cover as in the Celica. Or how about an optional hidden compartment for small items—one with a lock on it?"

All told, however, most Mustang owners like their cars just the way they are. And most are enthusiastic in their praise. A Texas retailer, for example, boasts that, ". . . my Mustang rides and handles better than a Camaro Z-28 or Trans Am and is more comfortable than the Volkswagen Rabbit, Nova and Malibu we tried. It's the

(Please turn to page 230)

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best-handling, best-riding small car I could find."

An Illinois garage owner adds, "I drove my Mustang 1500 miles to Arizona and back and found its handling excellent under all road conditions. This car's European styling and design should make the 1979 Mustang a possible future collec-

tor's item, just as the first Mustang has become."

A New Mexico attorney: "What a terrific design improvement over the Mustang II of 1974-'78. I admire this new car's road performance, its handling and acceleration in hilly country, and particularly its styling."

And a New York computer department head caps it by saying, "I feel as if I've cheated everyone by choosing the right options on the right car and, in effect, getting a \$16,000 European-type, American-built sports car for \$6000. Thank you for giving me the opportunity to comment on this mechanical masterpiece." **PM**

SUMMARY OF 1979 FORD MUSTANG OWNERS REPORTS*

<p>Total miles driven 505,162</p> <p>Average miles per gallon: Base 2.3-liter ohc Four In town 19.5 Long trips 24.1 Turbo 2.3-liter Four In town 18.6 Long trips 22.6 2.8-liter V6 In town 16.6 Long trips 20.2 5.0-liter V8 In town 15.4 Long trips 19.3</p> <p>Engine choices: Base 2.3-liter ohc Four 44.7% Turbo 2.3-liter ohc Four 9.4 2.8-liter ohv V6 15.3 5.0-liter ohv V8 30.6</p> <p>Series choices: Basic Mustang 35.1% Sport-optioned Mustang 29.8 Mustang Ghia 28.6 Mustang Cobra 6.5</p> <p>Body style choices: 2-door hardtop coupe 58.6% 3-door hardtop hatchback 41.4</p>	<p>Transmission choices: Automatic 3-speed 61.1% 4-speed manual 30.5 4-speed with overdrive 8.4</p> <p>Why did you choose the Mustang? Styling 69.6% Economy 18.7 Past experience 14.6 Size 11.7 Handling 10.5</p> <p>Specific likes: Styling 63.1% Handling 55.4 Economy 29.2 Comfort 18.5 Ride 17.9</p> <p>Specific dislikes: Poor workmanship 19.1% No complaints 14.2 Gas mileage below expectation 9.9 Low-quality materials 8.0 Lack of power 8.0</p> <p>What changes would you like? No changes 13.2% Reshaped seats 10.5 Better materials 10.5</p>	<p>Better rear ashtray location... 6.6 Better workmanship... 6.6</p> <p>Workmanship opinion: Excellent 15.6% Good 42.8 Average 19.7 Fair 9.2 Poor 12.7</p> <p>Comfort opinion (front seats): Excellent 30.0% Very good 41.8 Good 22.9 Fair 4.1 Poor 1.2</p> <p>Comfort opinion (rear seats): Excellent 8.5% Very good 19.6 Good 28.1 Fair 30.1 Poor 13.7</p> <p>Had any mechanical trouble? No 52.9% Yes 47.1</p> <p>What type of trouble? Transmission 18.5%</p>	<p>Carburetor 12.3 Electrical 6.2 Oil leaks 4.9 Cold starts 4.9</p> <p>Dealer repairs satisfactory? Yes 56.1% No 43.9</p> <p>Dealer service opinion: Excellent 23.0% Good 27.7 Average 14.2 Fair 18.2 Poor 16.9</p> <p>Number of vehicles owned: Mustang only 31.2% Two cars 43.9 Three cars 15.6 Four or more cars 9.3</p> <p>Age distribution of owners: 15-29 years 44.2% 30-49 years 37.3 50-plus 18.7</p> <p>Would you buy another Mustang? Yes 69.1% No 30.9</p>
---	--	---	--

*Percentages might not equal 100% due to rounding or insufficient data.



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sible for the safety of industrial lasers. That's why the bureau is counting on local health authorities to help out in checking laser shows throughout the country—dozens of traveling concerts and hundreds of discos.

But the local health authorities aren't much help. Often they lack the manpower to make sure that laser shows in their communities are run safely. What's more, the locals usually lack legal backup. On the Federal level, the bureau has authority to control any radiation-emitting devices, including lasers. But little has been done to beef up enforcement on the spot.

Too few inspectors

The problem facing local governments is exemplified in Texas, where there are just two inspectors in the state's health department to cover 267,339 square miles. Supervisor Joe Thiel says he and another man now investigate about 20 laser shows a year, more than 10 times the number checked two years ago.

Many are patently unsafe. In one recent case in Texas, a laser performer was planning to scatter powerful two-watt beams into the sky in an open-air light show situated near an airport. One of the beams might easily have struck a commercial airplane pilot in the eye, Thiel said, perhaps causing a temporary loss of night vision during a landing. "The guy was very upset that we wanted him to change his system," Thiel said. After an argument, he did comply with Thiel's suggestions for redesigning the show, averting the danger.

But the two inspectors are responsible for far more than just entertainment lasers, Thiel said. There may be many entertainers riding the Texas circuit who fail to comply with a 1974 state regulation requiring registration of laser shows. As it is, travel expenses and time to check out shows that do register are gobbling up a high percentage of Thiel's shoestring \$60,000-a-year budget. Thiel worries a lot these days about the laser show setups he doesn't see.

The really frightening thing about laser shots in the eye is that there's no time to blink. Beams are so powerful that by the time you realize the light is searing into your retina, the damage is done. The damage can range from partial blindness—hardly noticeable—to complete loss of sight, if the burn is located at the site where the optical nerve enters the retina.

Limiting laser light

Laser injuries are the product of beam intensity and exposure time. Or, as one FDA official puts it: "How badly you get burned depends on how hot the stove is and how long you keep your finger on it." Under current government rules, laser light falling on the audience must be too weak to cause any biological damage. This means a limit of 0.39 millionths of a watt—the threshold beyond which animal tests show that lasers damage tissue. Lasers themselves may be more powerful, provided the audience isn't exposed to dangerous levels. Beams of up to four thousandths of a watt can play across an audience, for instance, provided the beam is kept in motion so that the effective exposure doesn't exceed the 0.39 millionths of a watt threshold.

The Federal regulations—balancing power against exposure time—are complicated. It often takes an engineer to tell a group whether it's following Federal rules.

The idea of using lights to heighten the emotional impact of music dates back several millenia. Only in the last decade has the idea gotten complicated and potentially dangerous. As long as 2000 years ago, musical shadow plays provided light shows of a sort in China and Java. Around 1910, soon after electric lights first appeared in Russia, the composer Alexander Scriabin wanted a "light organ" to play along with his passionate *Poem of Ecstasy*. He envisioned dousing the orchestra with floods of changing color and tried to build an instrument around rotating prisms and moving lenses controlled by a keyboard. But the project failed. The dim bulbs of that day did not furnish sufficient brightness, and the more intense arc lamps sputtered out whenever the carbon electrodes broke off under their searing heat.

Origin of laser shows

Early in the 1970s, a young California film-maker named Ivan Dryer happened to watch a Caltech scientist, Elsa Garmire, perform some laser experiments. Immediately, Dryer realized the laser's artistic potential. Knowing that the laser beam, unlike other light sources, could be controlled by ultrafast electronic scanners, Dryer envisioned the laser as a speedy electronic paintbrush creating images in the purest possible light—light of a single wavelength. And, since laser beams don't spread, the images

(Please turn to page 234)

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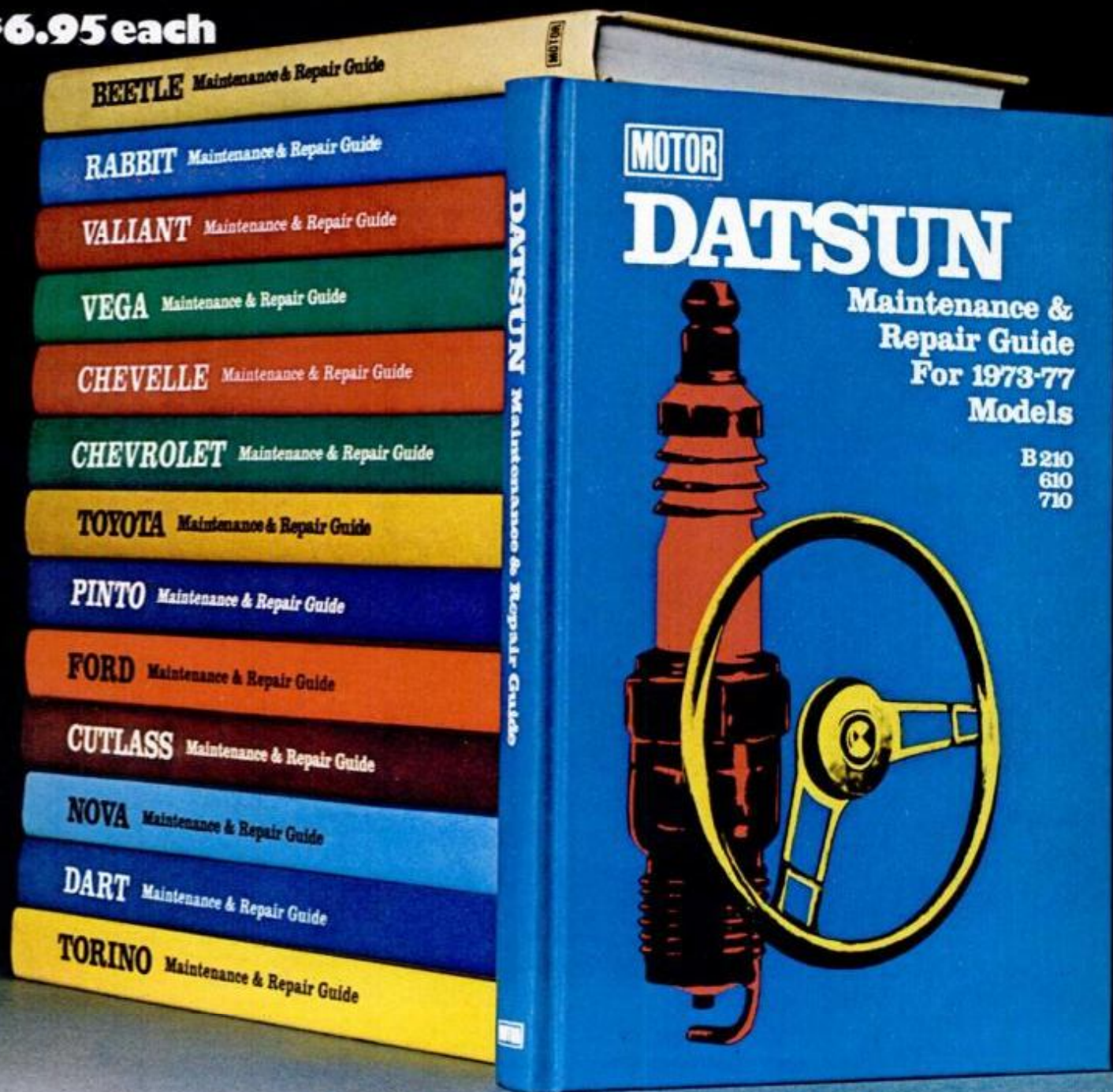
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DANGER UNDER THE RAINBOW

(Continued from page 232)

would have a dramatic sharpness never seen before.

Designing his own equipment, Dryer founded a company called Laser Images Inc., and in November, 1973, presented the first laser light show in Los Angeles' Griffith Observatory. It was an instant sell-out. Following in Dryer's footsteps, at least a dozen companies now produce laser-show equipment, hawking their wares to singers and musicians. Some put on laser shows at trade conventions and sports events, and later this year the first laser billboard will blaze over New York City. In short, the laser, one of technology's most arcane items, has become a popular fad—and a potential danger in the wrong hands.

The FDA isn't the only Federal agency exploring the danger. Ironically, in recent years while the FDA has worked hard to render lasers harmless, the Department of Defense reportedly has labored secretly to make lasers more lethal. According to a report in *Aviation Week & Space Technology*, a powerful laser beam blew an antitank missile out of the sky last year. The ray either burned a hole in the missile, the report said, or weakened the air frame so it became rubbery in flight. Entertainment lasers, of course, don't have anywhere near that much power. But some are more potent than audiences realize.

A laser 'lighter'

"One rock group used a laser so powerful that you could stick a cigarette into the beam and get it lit," reports an FDA spokesman. "We sure cracked down on that one." The Blue Oyster Cult, a nationally known rock group, also had a run-in with the bureau. Their lead singer was shooting out a laser beam from a fiber-optic bracelet on his arm. It could easily have hit someone in the eye.

Today, after FDA intervention, he's still wearing his blazing ornament, but the audience is safe now. To keep within Federal rules, the singer now has a safety rig strapped to his forearm. It consists of three mercury switches oriented along different axes to respond to arm movements in any direction. Whenever the singer's arm levels toward the audience, the circuit closes, triggering a solenoid and actuating a metal shutter that instantly blocks the beam.

After their flap with the "Feds,"

(Please turn to page 236)

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DANGER UNDER THE RAINBOW

(Continued from page 234)

Blue Oyster Cult bends over backward on safety. "We're concerned about the ethics of this," says Tony Sabbatini, technical consultant for the group. "We don't want to hurt anyone. And besides, to be blunt about it, we'd hate to get a dose into our own eyes."

Sabbatini detailed some other safety measures. "We always keep the beam in scanning motion. We never concentrate the beam—we scatter it. Even the mirror-balls re-

flecting the beam throughout the hall are kept twirling. That way, the reflections constantly shift. The light never stands still." The restless motion of the beam is an added safety factor. No single spot in the auditorium is ever exposed long enough to get a dangerous overdose of light energy.

'Playing' the laser

Of course, many other laser shows meet FDA standards. I visited one at New York's Hayden Planetarium. There, I sat at the console, next to Gregg Weissman.

As a "laserist," Weissman belongs to a new profession—a small group of specialists skilled in operating lasers for entertainment purposes. The job requires a keen musical sense, along with solid technical know-how. In addition to controlling the display, the laserist must also monitor such crucial factors as voltage levels, laser temperature and gas pressure.

Trained as a classical pianist and composer, Weissman plays the laser like a musical instrument. He twirls and flips knobs and levers to mix colors, generate and move the light patterns, and vary brightness in keeping with the mood of the music. With a joystick control he makes the light dance a Viennese waltz or throb to the rhythms of Pink Floyd. Some of the patterns are preprogrammed on tape. "But I can override the program by working the board," Weissman explains. "It's got to be a hands-on operation to make the show spontaneous and artistically convincing."

Next to Gregg's console stands a 7-foot-high vertical box with a slanted top, looking like an upended coffin, which contains the "works." A single 1-watt krypton gas laser puts out a beam containing a rainbow of red, blue, green and yellow. A prism separates the colors, and then each beam bounces off two tiny vibrating mirrors set at right angles to each other—one mirror for vertical, the other for horizontal deflection. The vibration frequency of the mirrors is continuously and independently variable, so that almost any kind of light pattern imaginable can be created by the laserist.

Beyond that, special lenses can be switched in and out of the beam path to create diffusion effects—lacy webs and whirling mists of multicolored light that seem to be floating into each other. By combining all these control options, the laserist fills the entire dome of the planetarium—or any other projection surface—with a mad ballet of glowing mirages. None of the beams plays directly on the audience.

The FDA doesn't worry much about the Laserium and other laser theaters, where the equipment is permanently installed and beam intensity and direction are reliably controlled. Their main concern is with traveling shows that lug primitive laser rigs out for one-night stands in unfamiliar settings. "People producing rock music shows know more about music than laser technology," says FDA staffer Anabel Hecht. "They do not understand the power and hazards of their equipment."



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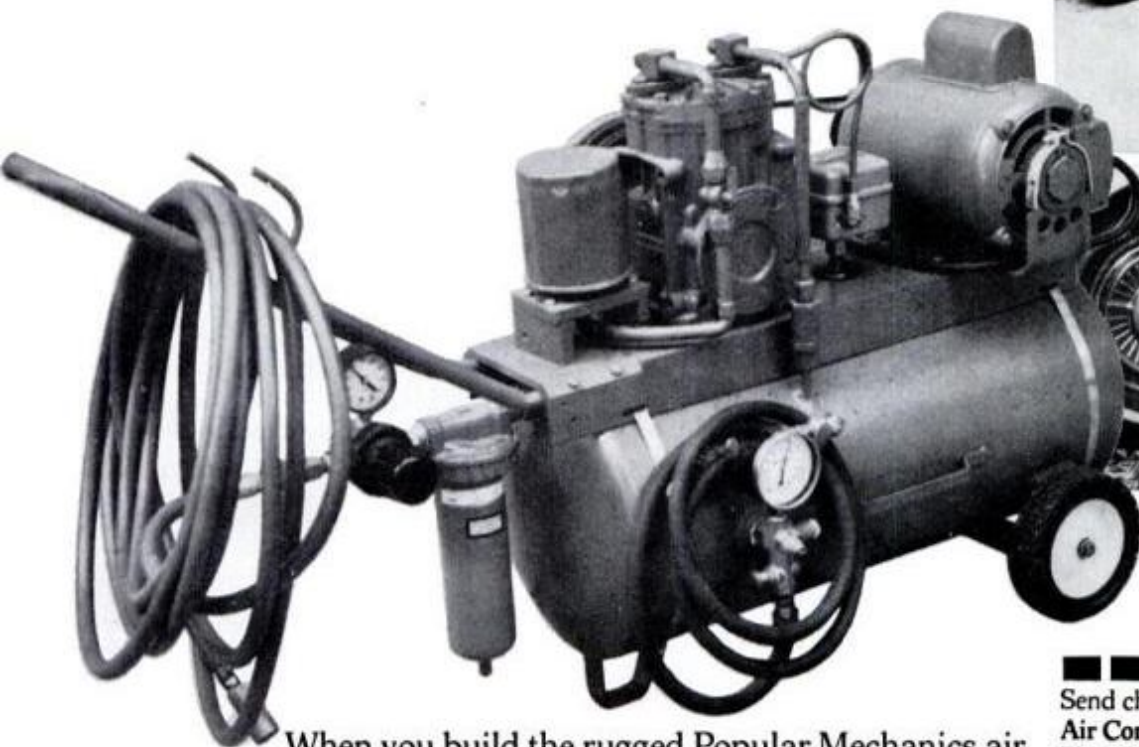
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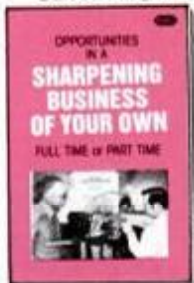
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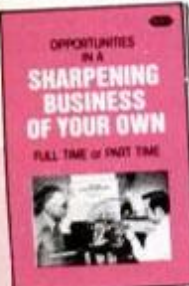
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'79 CARS JUST OFF THE BOAT

(Continued from page 99)

dealers, unfortunately, tend to forget they have on their lots. Solid, but conventional, they're facelifted for '79 and have minor suspension changes. A deluxe sedan is offered along with three coupe models; base, deluxe and sport. Engine is a 1.8-liter, 2-bbl. Four and transmission choice is four or five-speed manual or three-speed automatic.

Datsun's lineup of 210, 200-SX, 310, 510, 810 and 280-ZX models is its most impressive since Nissan cars hit these shores. The front-engine, rear-wheel-drive models for '79 (page 122, Nov. '78) were joined early this year by the front-wheel-drive 310 sedan and 310GX coupe (page 47, Mar. '79). With a range of economy cars of all configurations, a luxury 810 series and new, grandtouring 280-ZXs, Datsun has the waterfront covered. And with 14 of Datsun's passenger car models you'll discover that the expense of—and maybe the search for—unleaded fuel is not your worry: They meet emissions standards without need for a catalytic converter.

Toyota models accounted for almost a quarter of the nearly two million imported cars sold here last year. The Corolla, available in 10 different models (including the SR-5 fun machine), is one



Opel Sports Coupe gets rectangular headlights and revised suspension for '79.

of the best, basic transportation modules on the road. Still pegged under \$4000 (but taken home closer to \$5000), the Corollas are powered by a 1.2-liter Four with 1.6 optional.

The Corona lineup—four-door sedan, five-door Liftback and five-door station wagon—are restyled for '79, taking on more European design elements that the Japanese automakers are copying like crazy these days.

Cressida models are designed for passenger pampering (imagine electric windows in a Toyota!). They also have a neat mechanical innovation: a four-speed overdrive automatic transmission. Fourth has a .689 ratio which drops engine speed a good 30 percent. A lockout switch on the dash lets you stay in the 1:1 third gear if you elect.

Celica for '79? Toyota isn't ready to mess with a good thing. The ST and GT Sport Coupes and GT Liftback are refined slightly for the model year.

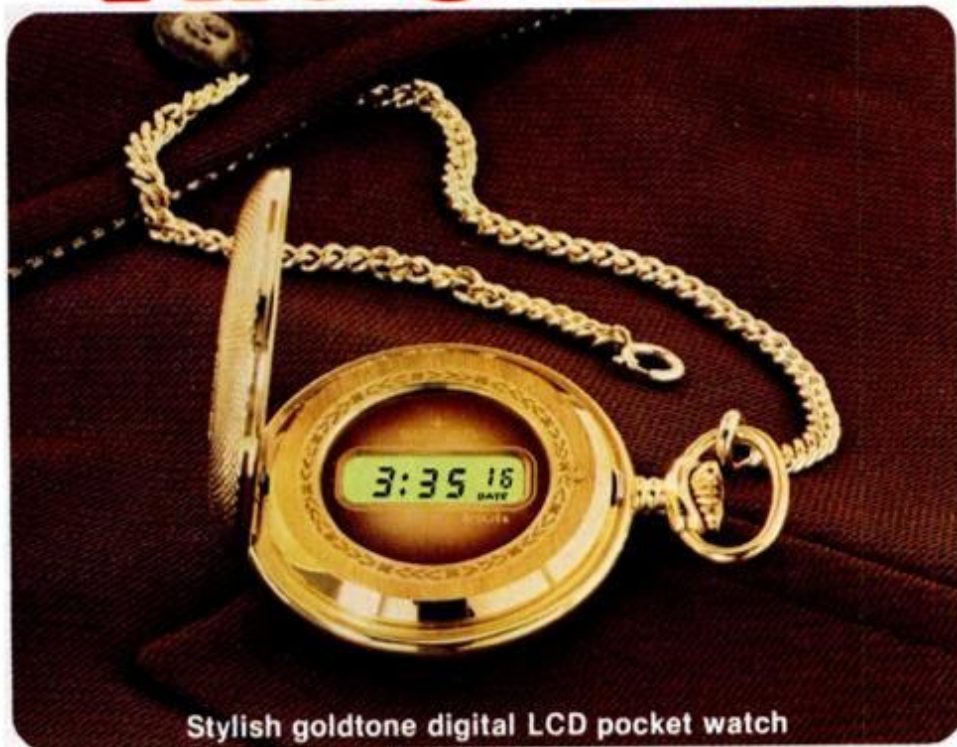
The cars of Germany

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(Please turn to page 240)

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Both watches also feature TriLite™, a new space-age illuminating technique developed by Sensor. Two tiny glass tubes, lined with phosphor, injected with tritium, are sealed permanently by laser beam and mounted behind the digital display. Perpetual interaction between phosphor and tritium emits a constant glow. The soft green light becomes more pronounced as exterior light dims.

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tionally respected design for today's popular vested suit. The large display of hours, minutes, seconds or date is at the same viewing angle as the famous "railroad watches" of yesterday. Elegant 3 microns gold Waldemar chain is also included.

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'79 CARS JUST OFF THE BOAT

(Continued from page 238)

spected automakers. There has always been a premium to pay for their fine machines, but now, with the Deutsche Mark/Dollar ratio less than 2 to 1, down from the 4 to 1 of days gone by, the prices are steeper than ever. True, the base Rabbit still starts at less than \$5000, but prices skyrocket from there to a mind-boggling \$48,728 for a Mercedes 6.9 or a nifty \$41,160 for a Porsche turbo coupe. Back at the low end, though, are good pickings in the less than \$10,000 range.

Volkswagen is about to pop with three new models—a Rabbit convertible (from the Karmann coachbuilders), a Rabbit



Plymouth Sapporo (from Mitsubishi) is a luxury compact with sports-car handling.

pickup (see page 62) and a new Type 2—the bus. The bus will be bigger and have a bit of a nose up front even though it will remain rear-engine. The engine compartment will, however, have room to slide in a diesel. None of these is in showrooms yet, but you will find the Beetle convertible (not to be scrapped just yet); Rabbits (base, C and L models) with gas and diesel engines; Scirocco; Dasher two- and four-door hatchbacks and wagons—again with gas or diesel engine; and the current bus in seven- and nine-passenger models.

Audi Fox models are soon to be replaced by the 4000 and we'll have a full report on this car in a summer issue. The "big" 5000 gets a five-speed this year and some nice options. If you don't want to pick and choose among them, just order the 5000S model; it's loaded.

Mercedes-Benz has recognized that station wagons are not just for tradesmen anymore. The 300TD is M-B's first series production wagon, and what a beautiful leisure-time machine it is. No, it's not a woodie and wasn't meant to carry anything as mean as plywood; no 4x8s please. The five-door wagon uses the five-cylinder diesel of the 300D sedan. Mercedes expects diesels to take 60 percent of its sales this year. That'll be shared among the 300TD, 300D, 240D, 300CD and 300SD turbo diesel. Gas-engine cars are 280E, 280CE, 280SE, 450SEL, 450SL, 450SLC and the 6.9. Drive the 6.9 and it will spoil you for any, any car on the road today.

Porsche's mean machine is the V8-powered 928, introduced just a year and a half ago. Tailing it very closely on the Autobahn out of Stuttgart is the turbo-charged version of the 924. A firsthand report on this marvelous machine, soon to be available here, appears on page 100. The base 924, 911 coupe and Turbo coupe complete the lineup.

Bavarian Motor Works is putting a line of engines into boats now, but that's not

(Please turn to page 246)

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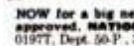
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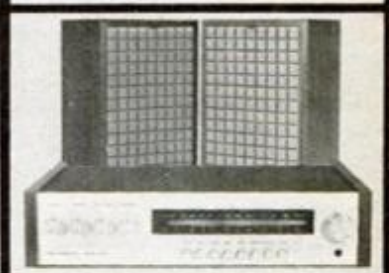
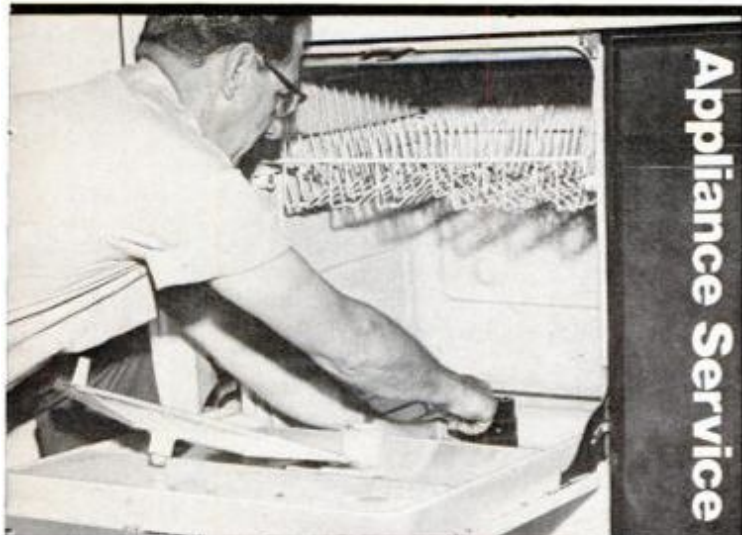
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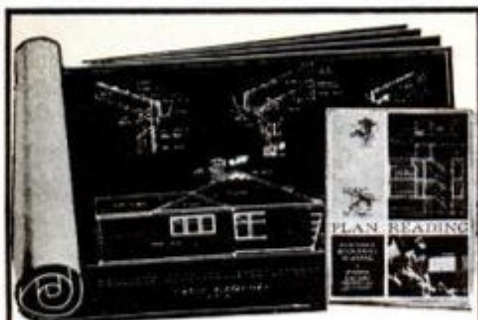
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'79 CARS JUST OFF THE BOAT

(Continued from page 240)

keeping them off the road. The M-1 mid-engine muscle car was shown, and the '79 passenger car lineup was listed last month (page 47, Mar. '79). The M-1 won't likely be seen here—not even in Beverly Hills—but the 320i, 528i (displacement is trimmed to 2.8 liters from 3.0, hence the designation change), 733i and 633CSi are a joy to behold (and, alas, the prices will break your heart).

Ford Fiesta, don't forget, is a German car, but is more often considered among the growing number of "world cars" that are designed to be at home in many countries and meet those countries' safety and emission standards. The three-door hatchback has met with great success here and will continue among Ford's winners if fuel-economy legislation as applied to domestic-sponsored imports doesn't push it back to the shores.

The cars of France

Swirling around the *Arc de Triomphe* they're a colorful blur, and French cars—even the smallest and lightest—eat up cobblestones as if they were cream puffs. A zippy Renault Le Car is as

smartly, and Jaguars at a more careful pace.

MG midget and MGB models just won't quit. Even when U.S. bumper standards threatened these cars, the British bounced back with cars that thumbed their new noses at the goings on. You didn't think these two would be any different for this year did you?

Triumph Spitfire is its same old self, too, but there are new things happening with the TR-7: Next month we'll see a convertible (see page 99) and the V8-powered TR-8. We'll see and drive them soon and have more in a summer issue.

Jaguar, too, has some changes in store—for the Series III XJ6 and XJ12 sedans—and we'll be showing the updated versions soon. The swift XJ-S, England's refined answer to the ponycar, will stay as sweet as it is. Jag-u-ars exude a carefully polished elegance—rich woods, leathers, little hidden cabinets, good Old World craftsmanship. They haven't made cars like Jaguars in this country for 45 years.

Lotus's wedge-shaped Esprit went for a swim, you'll recall, with James Bond in



Rabbit convertible in this unofficial photo has no bumpers or trim, but you can see what an exciting run-about this will be.

Lancia Zagato is an open car based on Beta chassis. Front roof section removes; rear folds like convertible top.



cute as a beret and a luxurious Peugeot is quieter than a Marcel Marceau.

Renault for '79 boasts the Gordini coupe/convertible (it has a removable hardtop) as its flagship, and continues its Le Car in base and deluxe versions. The Renault 18 four-door sedan, a contemporary design now sold in Europe, will be here next year.

Peugeot 504 sedans and wagons (gas or diesel Four powerplants) have aged beautifully. A 604 has fewer wrinkles around the eyes, being Peugeot's most recently introduced model, but it doesn't give you a diesel option.

The cars of Great Britain

There are no DeLorean sports cars coming here from Northern Ireland yet, so we'll postpone any further mention of that one. Down in the English Midlands, however, British Leyland is cranking them out: MGs and Triumphs right

The Spy Who Loved Me. Giugiaro designed the Esprit's body, which cloaks a five-speed transaxle behind its mid-placed engine. The Lotus Sprint and Elite look like twins to the untrained eye, but the Elite boasts airconditioning, AM/FM stereo, and an automatic transmission for the first time. Sprint and Elite go with front-mounted engines and rear drive.

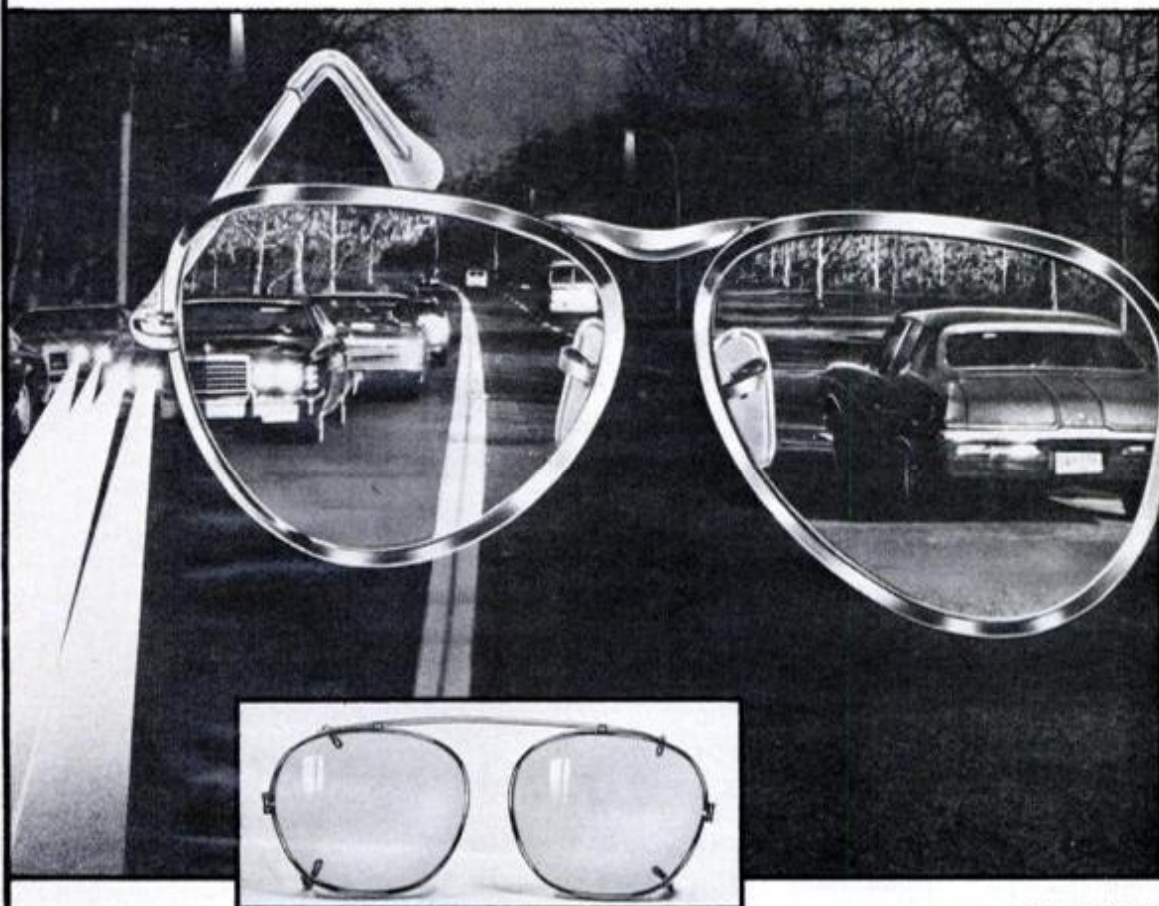
Just introduced is a fourth model, the Lotus Eclat 2+2. It, too, offers automatic transmission (which bumps its price to \$28,500).

Rolls-Royce has one of the world's quietest auto factories. Craftsmen, not-machines, put these legendary cars together. All four Rolls-Royce series use the same 412-cu.-in. V8. Its horsepower remains undivulged but is "adequate." Prices for Rolls start around \$50,000 and swing up over \$104,000.

(Please turn to page 248)

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'79 CARS JUST OFF THE BOAT

(Continued from page 246)

The Silver Wraith II is a longer-wheel-base version of the Silver Shadow II sedan. Then there's the Corniche convertible or four-place coupe for the more sporting. And the Italian-designed Carmargue teases those who spare themselves no vanities.

TVR became the marque of TreVoR Wilkinson who marketed his first coupe in kit form in 1957. For years, the TVR used Triumph TR-6 in-line Sixes. Today's TVR Taimar 3000 coupe and 3000-S



MGB is powered by 1.8-liter Four; optional on four-speed box is electric overdrive.

roadster borrow the Ford ohv V6 engine, which gives acceleration equal to or surpassing the likes of Corvette, Porsche 911, and even Ferrari.

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Only about 400 TVRs get produced each year, and they're quickly snapped up by a corps of diehard enthusiasts who are willing—nay, eager—to shell out \$17,000 or so per copy.

Aston Martin's two-pronged attack is with its Volante convertible and V8 Grand Tourer. The V8 that rockets these cars to 60 mph in seven seconds displaces 5.4 liters and is assembled with great care at the Aston Martin Lagonda, Inc. shops. The ragtop runs \$70,000 (see *Imports & Motorsports*, page 17, Feb. '79) and the GT coupe, \$50,000.

The cars of Italy

Italian car designers do a lot of work away from home. Their ideas are in cars made all over the world. The yet-to-be-born DeLorean, for example, has its gull-wing door and roof structure being engineered by Grumman Aircraft and high-technology Lotus is also involved in its design, but the lines are . . . Italian.

Fiat's new Strada is the hot one right now. The \$4296 (base) hatchbacks have just gone on sale in two body styles (three and five-door) and three trim levels (standard, custom and luxury). We'll have a Firsthand Driving Report next month.

The rest of the Fiat line includes the Fiat Spider 2000; Brava coupe, sedan and wagon and the X1/9.

Lancia cars, also in the Fiat family, include a new, limited-production Zagato for '79. This year we'll get only 2000 of this Targa-topped Lancia built by Carrozzeria Zagato.

(Please turn to page 250)

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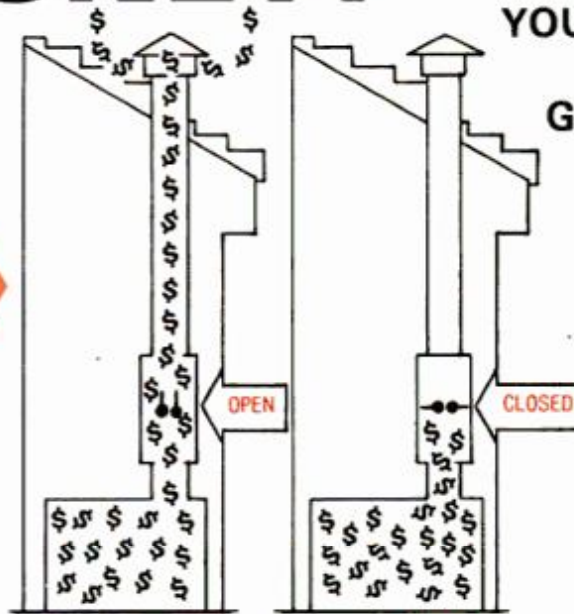
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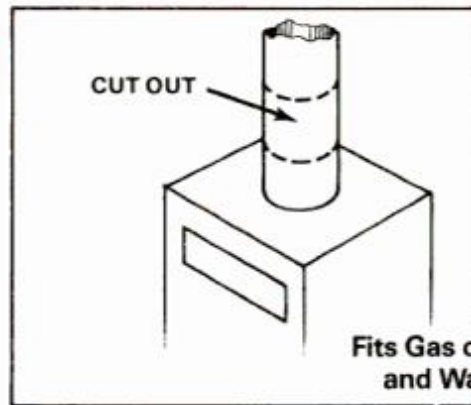
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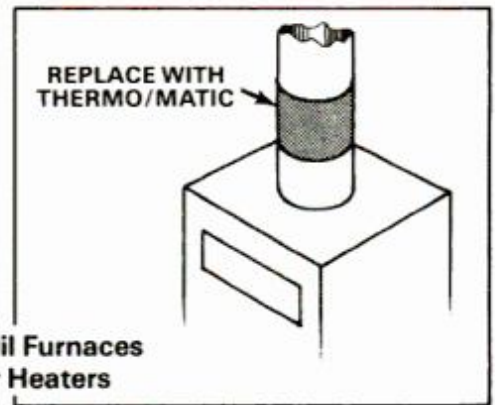
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'79 CARS JUST OFF THE BOAT

(Continued from page 248)

The mainstay of the Lancia line is slightly changed: The Beta coupe has a new roofline for more headroom. Beta coupe changes are shared by the HPE model (for High Performance Estate). The Beta sedan continues as the bargain Lancia at \$8551. All Lancia models offer an automatic transmission for the first time in the marque's 70-year history.

Alfa Romeo also boasts an automatic for the first time. The Automatic Sports Sedan joins the Sport Sedan, Sprint Veloce and Spider Veloce models.

The exotics

I'm sure Maserati, Lamborghini and Ferrari won't mind being lumped under a single heading. The last thing they are, are lumps. Maserati, the masterpiece of Modena, comes in three styles. First, there's the Merak SS, a V6 mid-engined 2+2 with five-speed. Next, the four-place Khamsin with aluminum V8, four Weber carbs, choice of TorqueFlite or five-speed, plus power steering. Finally, we have one of the world's quickest four-door sedans, the Quattroporte, which tops out at 145 mph. The company might also import the exotic Kyalami coupe at the end of this year.

Ferrari turns heads quicker than a wink. It's the supreme sports car—the ultimate object of most drivers' automotive fantasies. In the 308 GTS, Ferrari's mid-placed, twin-cam, transverse V8 delivers 240 horses, giving a top speed in the neighborhood of 160 mph.

Lamborghini makes the ultimate exotic: The Lamborghini Countach S sports car aluminum body, tubular space-frame chassis, and mid-mounted dohc V12. They form the basis of what, in every way, goes far beyond the call of everyday motoring. Countachs are built to special order only for customers willing to part with over \$80,000.

The other Lamborghini that's available Stateside is the Silhouette, a 2+2 coupe with single-overhead-cam V8, again mid-placed. The Silhouette weighs 2600 pounds and, like the Countach S, comes with five-speed and fully independent springing.

These last cars are exciting, indeed, but don't fully qualify as being "just off the boat," since many of their buyers pay, oh, \$5000 to have them shipped here . . . by air freight. **PM**

GREAT DECKS YOU CAN BUILD

(Continued from page 159)

end, the annual rings should arc upward (bridge fashion). This will minimize cupping and warping of the floorboards.

Be sure to add railings to all elevated decks. Also, if toddlers, youngsters and dogs will use the deck, it's wise to add chicken wire to the railings to keep a child or pet from crawling through and falling. The stairs can be kept simple as ours are. But, if yours are more than three steps high, add a banister.

The decks shown were finished with an exterior latex stain from PPG Paints. **PM**



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PIPE TRAY

(Continued from page 130)

9 in. long. Bore a series of $\frac{3}{8}$ -in. holes through the bar. Weld a 3-in. length of 1-in. cold-rolled steel to the center of the bar. Next make two fulcrum pins, 2 in. long, from $\frac{1}{2}$ -in.-dia. stock. Machine half the length of each dowel down to $\frac{3}{8}$ in. to fit the bar holes.

Mount the faceplate on the lathe and set the lathe at slow speed. Lubricate the copper where it is to be spun with beeswax or an old candle. The spinning tool is an old mop handle that has been sanded round on the end. Now start the lathe and exert pressure against the copper and against the fulcrum pin with the spinning tool. It is very important that the metal be stretched evenly, and that the spinning tool be *kept moving* so the metal won't become thin enough to crack.

At first, the copper begins to take the shape of the walnut bowl quite easily, but spinning causes it to "work-harden" and it will gradually become more difficult to spin. When it does, at about $\frac{1}{2}$ in. deep, stop the lathe and remove the copper.

Repeat the annealing and pickling steps and replace the copper on the walnut. Lubricate, and continue to spin. It may be necessary to anneal and pickle the copper once more before it is spun to its full depth. Spin the outer rim of the copper so it rests flat on the walnut block.

If you find that copper is too difficult at first, substitute the same size piece of No. 20 soft aluminum. It requires no annealing for this project and is easier and faster to spin.

Spinning projects usually have the edge or rim trimmed while still on the lathe, but this operation will damage the walnut block in this case. Stop the lathe, remove the spun copper and, with the use of tin snips, cut a $\frac{3}{8}$ -in.-wide rim. This layout is made with a pair of dividers, using the hole in the copper for a center point. File the edge of the rim true with a single-cut file.

Fasten the copper liner to the walnut with the center screw. Polish with fine steel wool as it turns at slow speed. Stop the lathe, remove the completed copper liner and remove the faceplate from the lathe headstock spindle. Cut the walnut block to shape on the bandsaw with the faceplate still attached.

Return the faceplate to the lathe and turn the outside shape of the tray to match the dimensions of the drawing. Sand with 100 grit, followed by 150 grit. Apply two or three coats of urethane varnish, followed by light rubbing with 000 steel wool and a coat of paste wax. Remove the

faceplate from the lathe and insert the drive center into the headstock spindle. Carefully remove the walnut tray from the faceplate. Using a drill press, drill a $\frac{3}{8}$ -in.-dia. hole $\frac{7}{8}$ in. deep in the center of the tray. The center hole used for holding the copper for spinning has now been removed, and the hole thus drilled is used to secure the knob. The center hole in the copper liner must also be drilled from the bottom side of the copper to $\frac{3}{8}$ in. dia. using slow speed.

The knob (drawing, page 130) is turned from a piece of $1\frac{1}{2} \times 1\frac{1}{2} \times 4$ -in. hard maple, using standard spindle-turning techniques. After sanding, finish with three coats of urethane varnish. The tenon, which is $\frac{3}{8}$ in. dia. by $\frac{7}{8}$ in. long, has no finish.

Place the copper liner in the walnut base and complete the pipe tray by gluing the tenon of the knob into the center hole of the base using the lathe as a clamp.—R. Swinyard.

PENTAGONAL MAILBOX

(Continued from page 132)

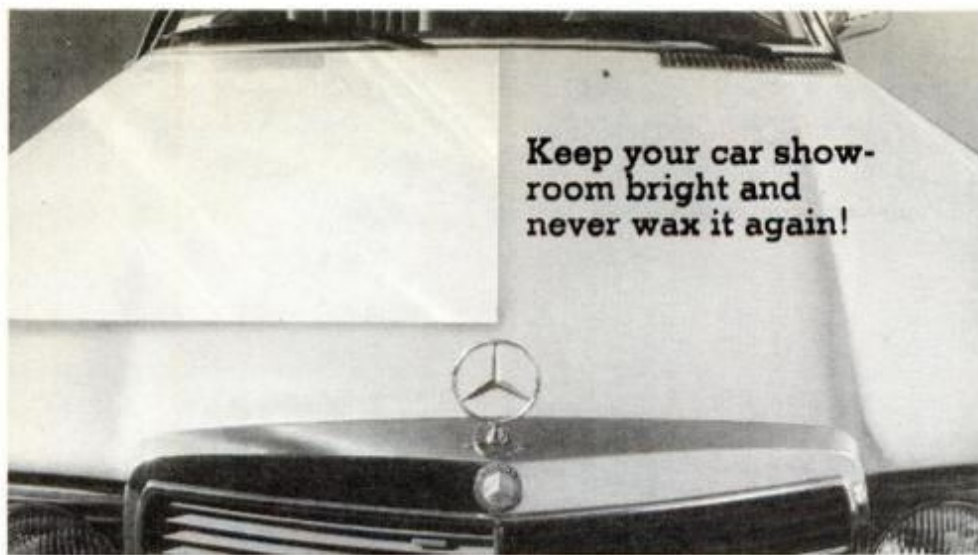
surface and glue the front, center rib and back end in position. Use small brads to hold these pieces perpendicular to the floor until the glue sets. Then attach the two sides with brads and glue.

Fit the roof pieces and mark where they touch the ribs and ends. Paint these pieces on their inside faces, but leave glue contact surfaces unpainted. Caulk any gaps in the floor/rib assembly and paint the entire inside with exterior primer. Next, glue and brad the top sides to floor/rib assembly. Caulk outside seams, fill holes and sand smooth.

Temporarily attach the door in place with the 4-in. piano hinge. Attach the hardwood knob. Cut and drill the brass striker plate, bend it to the curvature of the door top, and recess it into the top of the door. Attach it with two $\frac{1}{2}$ -in. No. 4 fh screws. Check the door action and bend the catch down so that it just grips the door and holds it closed. Drill a $\frac{1}{4}$ -in. hole in the front of the floor for drainage and a $\frac{3}{16}$ -in. hole in the right side for the flag mounting. Remove the door for painting.

Prime and paint the mailbox and door with at least three coats of enamel, sanding lightly with No. 400 wet-or-dry paper in between coats. Make the flag assembly as shown.

Now all that remains is to mount your new pride and joy to a new or existing post using at least four bolts of a suitable length. Make sure the mounting meets local postal rules; if you are not sure, check your post office.—Warren W. Bender Jr.



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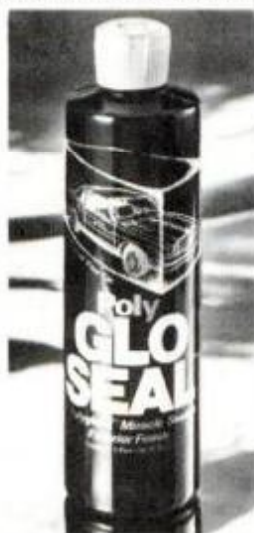
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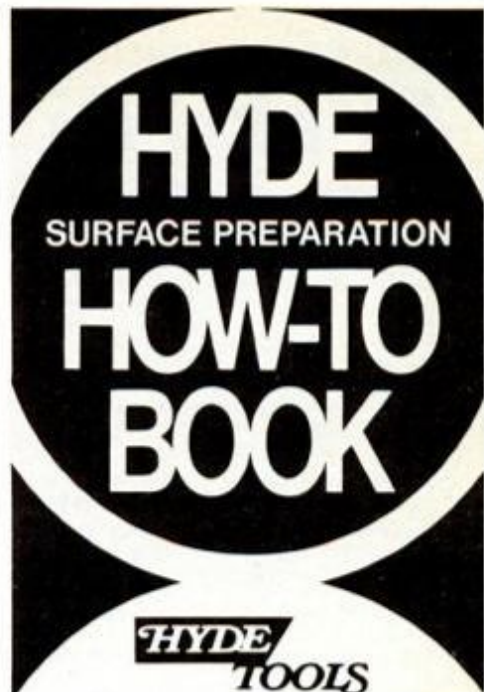
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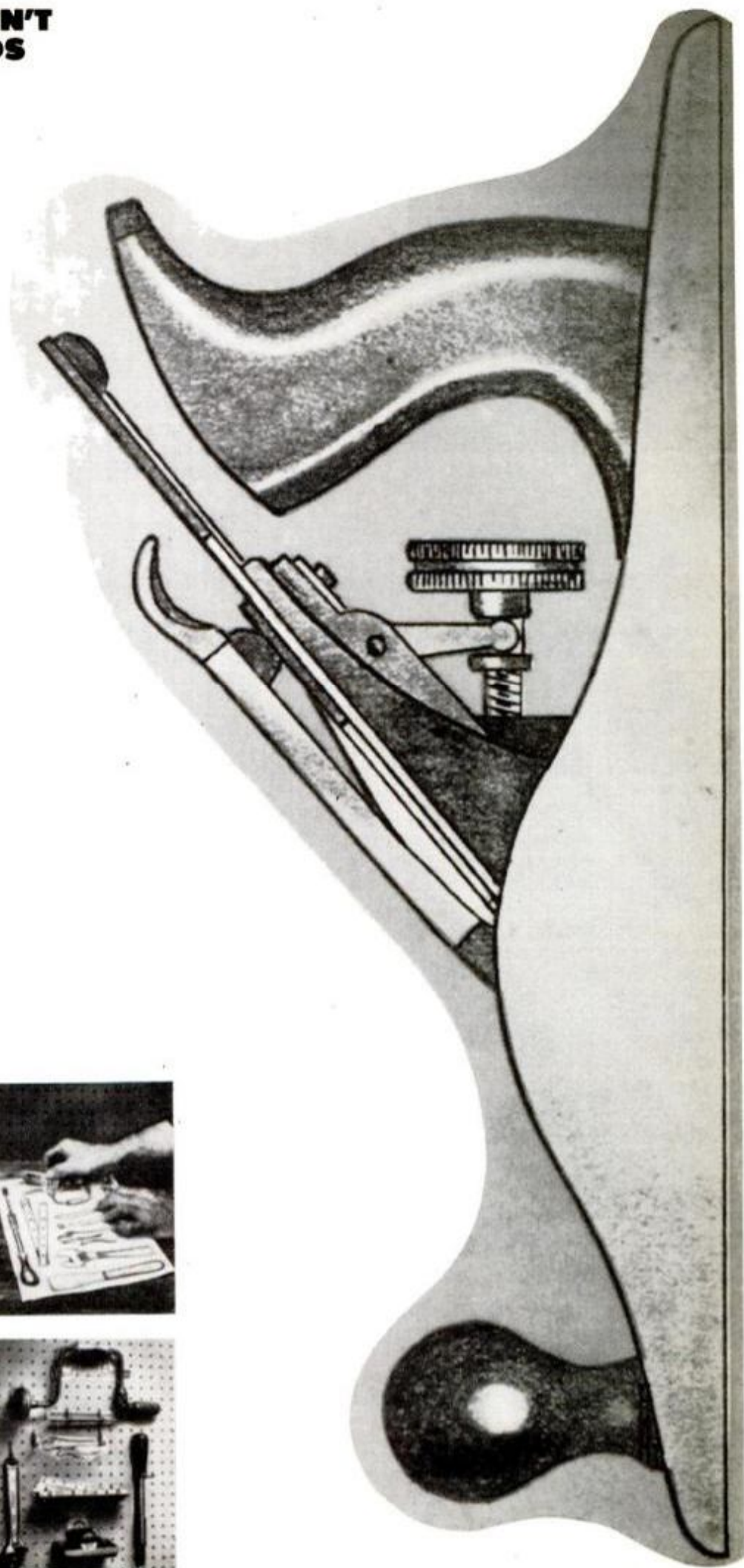
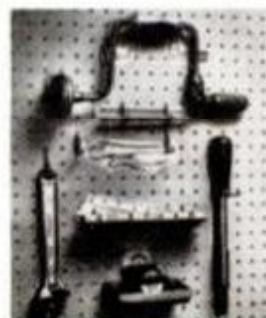
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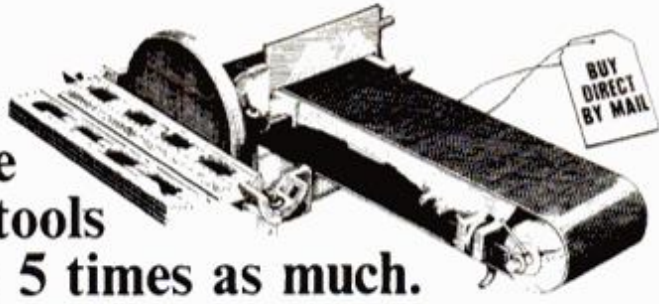
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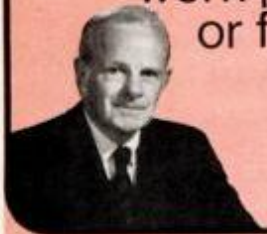
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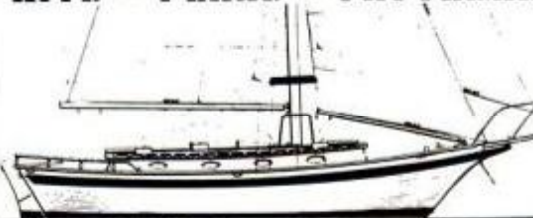
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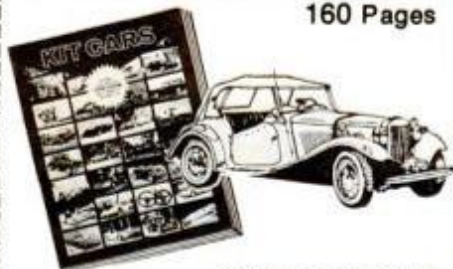


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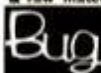


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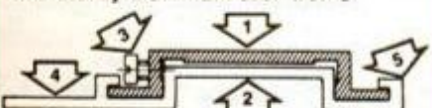
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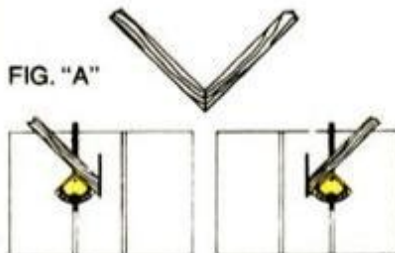


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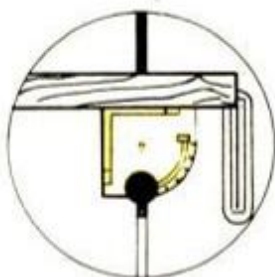
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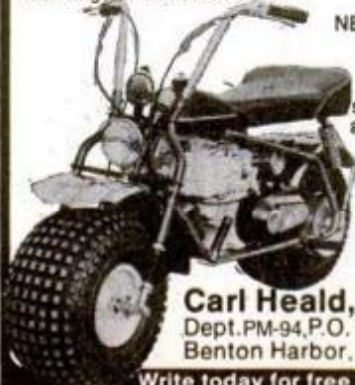
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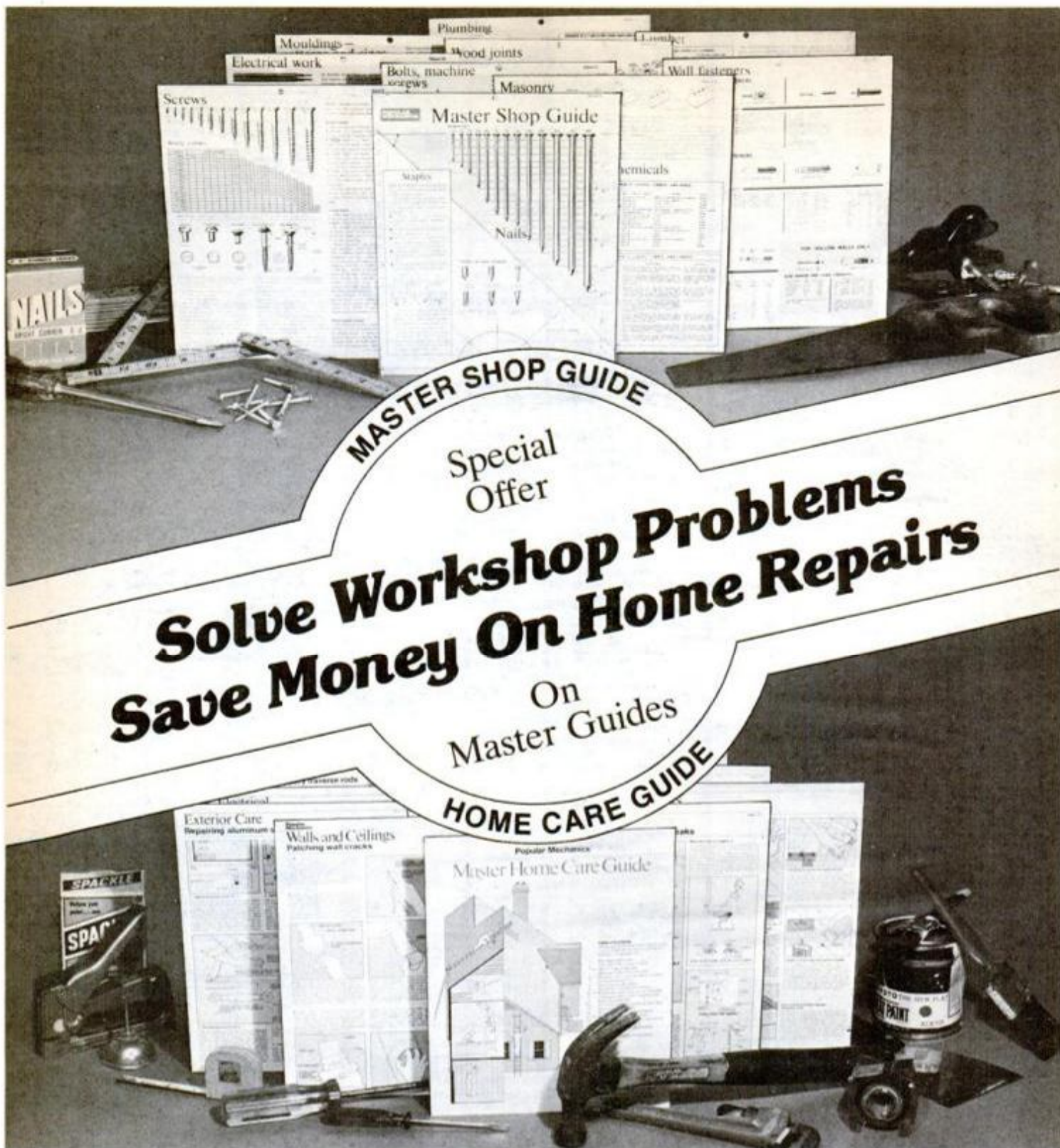
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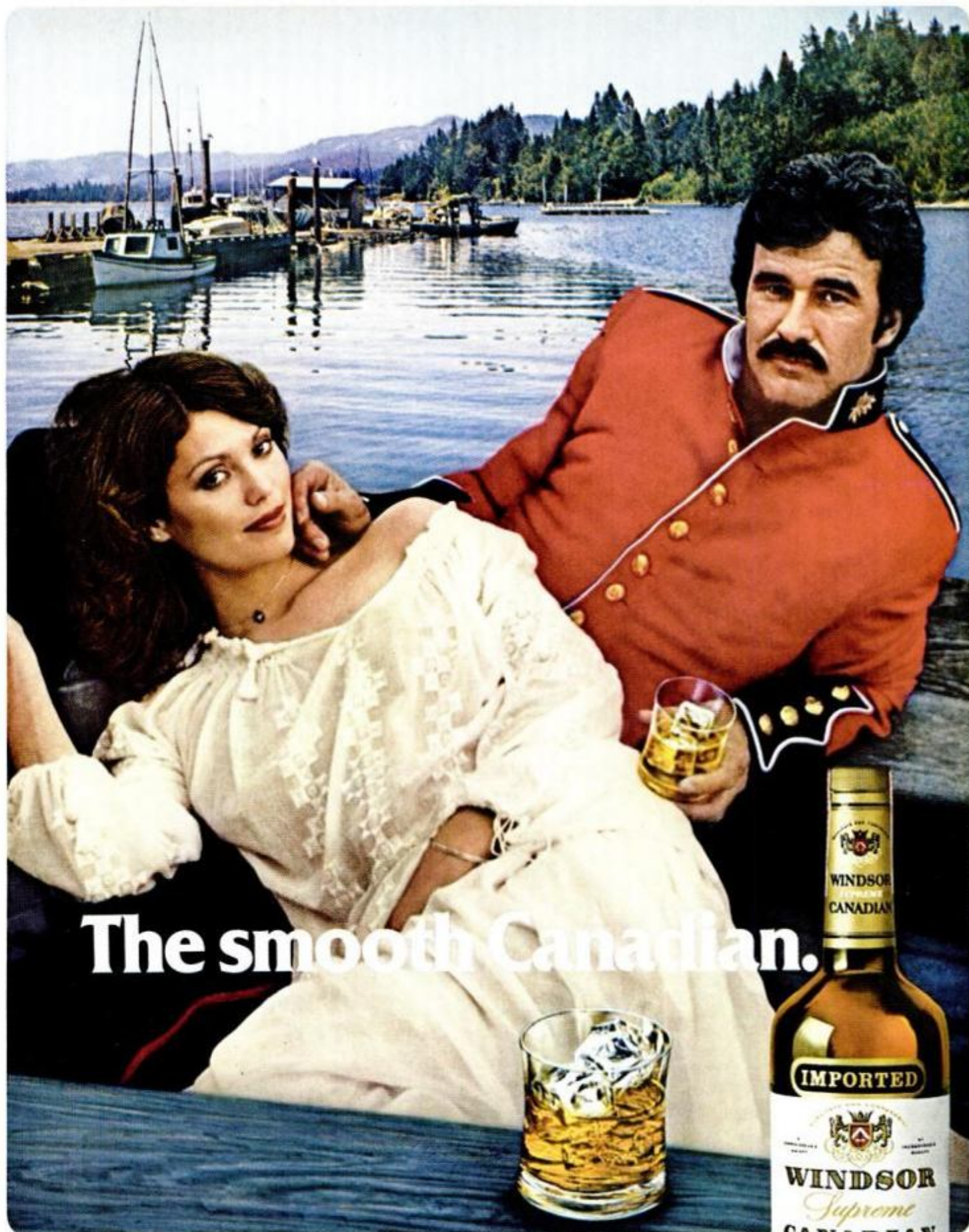
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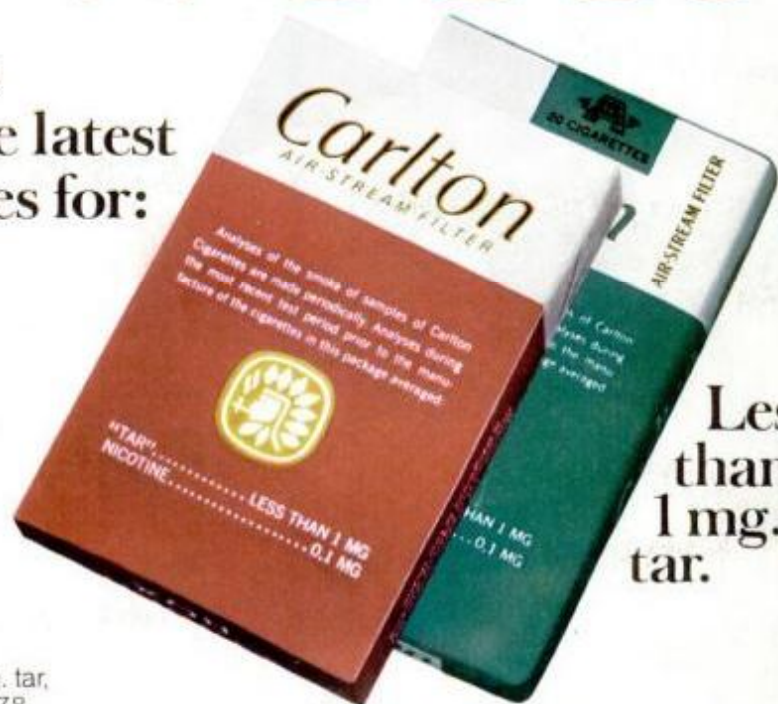
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