

JANUARY 1980 \$1.00

Popular Mechanics

1982 CAMARO



PM's EXCLUSIVE FIRST LOOK AT THE CARS OF THE '80s

WHEN YOUR FURNACE QUILTS:
39 sure ways to prevent freeze-up

BEST DECKS TO RECORD AND PLAY
NEW 'METAL' TAPES

PM tests the biggest outboard motor ever!

Do-it-yourself plumbing with new plastic pipe

COMPLETE PLANS

- 2 handsome lamps
- Folding snack table
- Small-parts storage cabinet
- Ski-repair bench
- Lightbox for slides



HALF-SIZE F4U CORSAIR

FLY A HOMEBUILT NAVY FIGHTER

Inside: 7 exciting sports planes you make from plans and kits

Illustration: Christopher G. Johnson

Come to where the flavor is. Come to Marlboro Country.

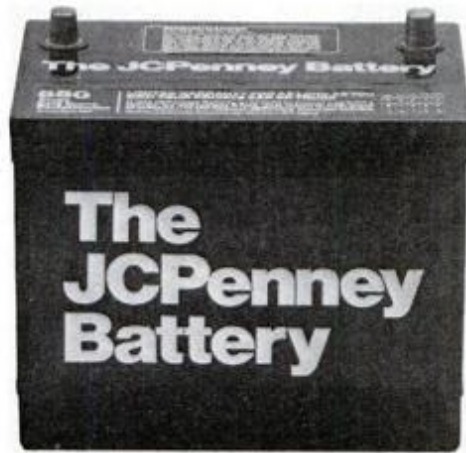


Marlboro Red or Longhorn 100's—
you get a lot to like.

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.

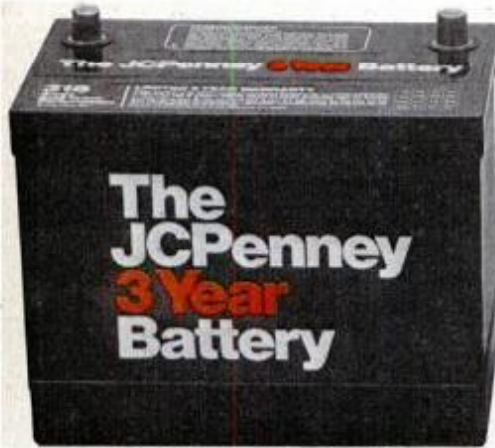
It never needs water. Ever.



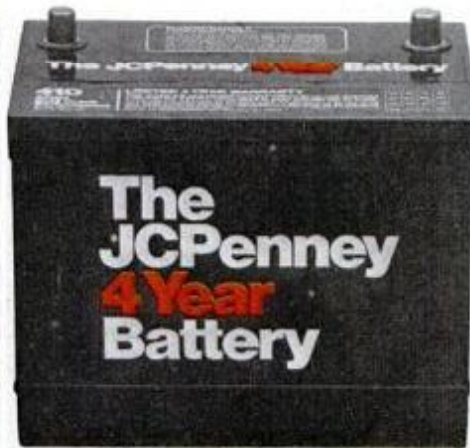
And neither do they.

First there was only one. The JCPenney Battery. The first maintenance-free battery. No water to add or check. Not even filler caps. Just power. Now there are three more. Three equally maintenance-free batteries. The JCPenney

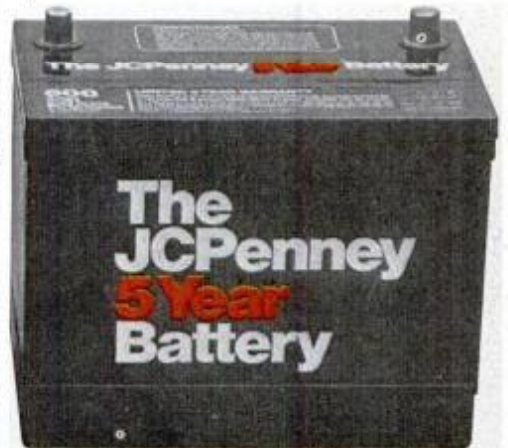
3, 4, and 5 year batteries. Still no water to add or caps to fool with. But now you can choose the power you need and the price you want to pay. The JCPenney 3, 4 and 5 Year Batteries. Take your choice.



315 Amps —(Group Size 24)
Cold Cranking Power



410 Amps (Group size 24)
Cold Cranking Power



500 Amps (Group size 24)
Cold Cranking Power

Limited 3 year Warranty
THIS BATTERY IS WARRANTED AGAINST FAILURE TO ACCEPT AND HOLD A CHARGE FOR 3 YEARS WHEN USED IN YOUR PRIVATE CAR OR TRUCK.

This warranty is void if the battery's failure is due to customer abuse, misuse, accident or negligence or if an electrical test performed by JCPenney shows that the failure was caused by the automobile's electrical system

- If it fails during the first year—we will replace it free.
- If it fails during the 2nd year, we will allow \$20.00 towards the purchase of a new battery.
- If it fails during the 3rd year, we will allow \$10.00 towards the purchase of a new battery.

Just return it with proof of purchase to the nearest JCPenney auto center for Service. Prices slightly higher in Alaska, Hawaii, and Puerto Rico.

Limited 4 year Warranty
THIS BATTERY IS WARRANTED AGAINST FAILURE TO ACCEPT AND HOLD A CHARGE FOR 4 YEARS WHEN USED IN YOUR PRIVATE CAR OR TRUCK.

This warranty is void if the battery's failure is due to customer abuse, misuse, accident or negligence or if an electrical test performed by JCPenney shows that the failure was caused by the automobile's electrical system

- If it fails during the first 2 years—we will replace it free.
- If it fails during the 3rd year, we will allow \$20.00 towards the purchase of a new battery.
- If it fails during the 4th year, we will allow \$10.00 towards the purchase of a new battery.

Just return it with proof of purchase to the nearest JCPenney auto center for Service. Prices slightly higher in Alaska, Hawaii, and Puerto Rico.

Limited 5 year Warranty
THIS BATTERY IS WARRANTED AGAINST FAILURE TO ACCEPT AND HOLD A CHARGE FOR 5 YEARS WHEN USED IN YOUR PRIVATE CAR OR TRUCK.

This warranty is void if the battery's failure is due to customer abuse, misuse, accident or negligence or if an electrical test performed by JCPenney shows that the failure was caused by the automobile's electrical system

- If it fails during the first 3 years—we will replace it free.
- If it fails during the 4th year, we will allow \$20.00 towards the purchase of a new battery.
- If it fails during the 5th year, we will allow \$10.00 towards the purchase of a new battery.

Just return it with proof of purchase to the nearest JCPenney auto center for Service. Prices slightly higher in Alaska, Hawaii, and Puerto Rico.

The JCPenney Batteries

The **Full** Line of Maintenance-Free Batteries.



7FDF-2PQ-289S

**Some of the best things
are measured by the ounce.**



Seagram's V.O.
The symbol of imported luxury. Bottled in Canada.
Enjoy our quality in moderation.

Canadian whisky. A blend of Canada's finest whiskies. 6 years old. 86.8 Proof. Seagram Distillers Co., N.Y.C.

Manufactured by Seagram Distillers Co., N.Y.C.



On the cover

The familiar gull-wing design of the Navy's famous World War II Corsair fighter shows up in a new sports plane you can build from plans. In addition to the half-size Corsair, the article beginning on page 76 details other current homebuilt aircraft favorites, from kits and plans.

Popular Mechanics®

JANUARY 1980

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AS A SERVICE TO READERS, Popular Mechanics publishes newsworthy products, techniques and scientific and technological developments. Due to possible variance in the quality and condition of materials and workmanship, Popular Mechanics cannot assume responsibility for proper application of techniques or proper and safe functioning of manufactured products or reader-built projects resulting from plans published in this magazine.

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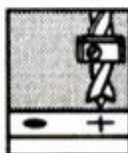
NOW, For The First Time- Use The WOODBITS The PROS Use!

PROFESSIONAL WOODBITS are NOT available in hardware stores. Stores only carry spade bits which tear grain, clog and bind; or metal-cutting twist bits that also bind and — what's worse — "skate" off the mark.

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A PROFESSIONAL WOODBIT has four features designed specifically for wood:

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- 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 WOODBIT SET ONLY \$15.95

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Get the precision of a costly drill press for under \$10.00! Here's how they work: 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. 7 collar sizes, $\frac{1}{8}$ - $\frac{1}{2}$ ", fit each bit in the 7 piece woodbit set. Tool steel.

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Buy Both Bits And Collars And SAVE \$2.00..... ONLY \$23.90

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Buy All 4 Big Woodbits (SAVE \$12.95)..... ONLY \$39.95

COMPLETE 18 Piece Drill Set (SAVE \$16.80)..... \$62.00

18 Piece Set Includes:

7 Bits: $\frac{1}{8}$ - $\frac{1}{2}$ "; 7 Collars to match plus 4 BIG WOODBITS: $\frac{5}{8}$ " - 1 "



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Enclosed is my order for woodbits. As my BONUS, please send your 68 page, 1980 color catalog of hard-to-find woodworking tools, PLUS all catalogs and new tool bulletins FOR THE NEXT TWO YEARS FREE!

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Best fuel economy of any mid-size wagon.



Fairmont Squire Wagon

1980 Ford Fairmont.

Better MPG for 1980.

Fairmont wagon is the right idea for today. Its standard 2.3 liter, 4-cylinder engine has remarkable gas mileage for a wagon.

If you're like many wagon buyers and want a 6-cylinder engine, consider this. Fairmont's 6-cylinder has an excellent estimated MPG of 21. No 6-cylinder wagon sold in America—foreign or domestic—beats it.

23

EPA
EST.
MPG

38

EST.
HWY.
MPG

322

EST.
RANGE

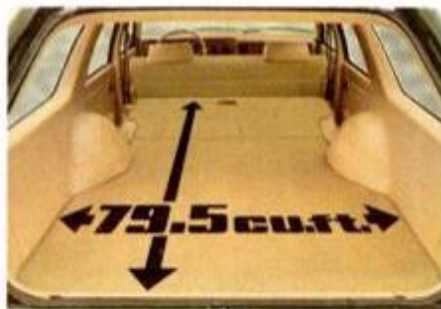
532

EST.
HWY.
RANGE

Compare this 4-cyl. est. mpg to other wagons, excluding other Ford Motor Company wagons. Your mpg and range may differ, depending on speed, distance and weather. Actual hwy. mpg and range will probably be less than estimates. Calif. mpg lower. Range based on EPA mpg estimates and Fairmont's 14-gallon fuel tank.

No American-built mid-size has more cargo space.

Fairmont has been engineered for people, to be trim on the outside yet remarkably spacious inside. It's an ideal combination for today's needs. Based on the EPA index, there is 43 cu. ft. of cargo space with the rear seat up and five-passenger seating.



For even more room, fold down the rear seat for 79.5 cu. ft. and almost 7 feet of cargo space. That's versatility.

A standard of wagon value.



You'll find Fairmont's low sticker price and standard features a pleasant surprise. Choose from a versatile base to the classic Squire Wagon. And be sure to ask your Ford Dealer about the optional Extended Service Plan.

**THE RIGHT IDEA
FOR TODAY.**

FORD FAIRMONT

FORD DIVISION



A man with dark hair, wearing a bright yellow raincoat, is shown in profile from the chest up. He is holding a lit cigarette in his right hand and looking out over a dark blue sea under a bright blue sky with scattered white clouds. The background shows the side of a boat and the horizon line.

No compromise

Winston Lights didn't compromise

13 mg. "tar", 0.9 mg. nicotine av. per cigarette, FTC Report MAY '78.

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

on great taste to get low tar.
Why should I?

Winston Lights taste good
like a light cigarette should.



DO IT YOURSELF WITH THERMAZIP II PIPE INSULATION

Now you can insulate exposed hot or cold water pipes in just minutes with new easy-to-install THERMAZIP II, a product with 15 years of proven industrial use.

Use THERMAZIP II for a variety of uses: over heat tape to prevent freezing, without heat tape to cut costly heat loss. This highly effective product has been tested by UL and found to be safe for use in homes, mobile homes and farms.

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LETTERS TO THE EDITOR

Charged up

In the article *How I Built My Own Electric Car* (page 97, Oct. '79), the author mentioned the Electric Auto Assn. (EAA). Is it possible to find out the address of this organization? I'm an electric-car buff and have owned the Sebring Vanguard type for the last five years.

W.J. MAYES
CAMAK, GA.

For more information on electric-car organizations and activities, write the Electric Vehicle Council at 1111 19th St. N.W., Washington, D.C. 20036.

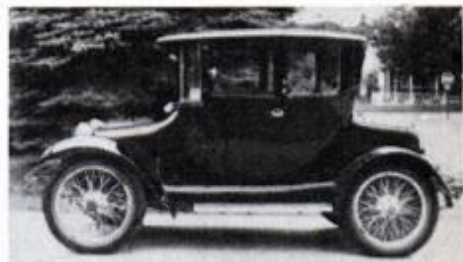
I read with interest *Your First Electric Car—Build or Buy?* (page 96, Oct. '79). This article, along with several others I've read, gives the erroneous impression that electric cars will save the United States from a petroleum deficiency because they do not burn fuel. The article states that "electricity is generated at central sources and 'pumped' to your home..." Pray tell me what they are using to fuel the generators, squirrels in exercise wheels?

I have not read a single article that investigates the conversion ratio of fuel consumed at a power plant and delivered as electricity, versus direct use of the fuel in a gasoline engine. Also, you are not eliminating pollution by using electric cars, but are just transferring it to the area around the power plant.

PATRICIA L. RAUGH
ALTOONA, PA.

Not all electricity is generated by burning oil. Further, the use of electric cars would not necessarily increase oil consumption in plants that burn oil. Power plants have to run 24 hours a day, even when electrical demand is low. If electric cars were recharged at night, the increase in electrical demand would not require the burning of additional oil until there were many, many cars charging. That day is a long way away, and when it comes, there will be even more ways to generate electricity economically without oil.

For many years I have seen this Baker electric (see photo) running around in traffic, even towing a boat. Yet for many years I've been reading that the electric car is not practical. I followed the car's owner



This Baker electric car sees daily use.

home one day and took some pictures and talked with him. He says he uses the car every day, and that it has the latest Pennsylvania inspection sticker.

JOHN CURRIDEN
ERIE, PA.

A real scorcher

I have a simpler, faster and safer way to remove the scorch and pitch from circular saw blades than the one shown in "Cleaning Saws and Files" (*10 Great Shop Tricks From a Master Craftsman*, page 88, Aug. '79). Spray the scorch with foam oven cleaner, wait a few minutes and wipe clean. I probably read this hint in your excellent publication years ago.

A.P. GUADAGNI, M.D.
SACRAMENTO, CALIF.

Because Drano is a powerful product, the method for cleaning saws and files recommended by PM can be dangerous. It calls for the use of the product for a purpose and in a way other than the use and directions specifically recommended on the product label.

There was an effort to supply a caution, but it fell short of providing adequate warning. The caution suggests the reader "follow the instructions for use on the label." Unfortunately, they will find no directions pertinent to the recommended misapplication on the label. We believe that in the best interest of the safety of your readers, you may wish to consider publishing a clarification of this feature.

DAVID S. PERKINS
THE DRACKETT CO.
CINCINNATI

Your concern is understandable. However, our readers are accustomed to dealing with power tools and other potentially dangerous
(Please turn to page 159)

MUST LIQUIDATE BELOW MANUFACTURED COST! \$2,150,000 INVENTORY ELECTRIC AIRLESS PAINT SPRAYERS

FULL FACTORY WARRANTY!

From Sherwin Williams,
the LARGEST paint company in the world!
Swiss made! Swiss quality!

All factory new! Factory perfect!
It needs NO air compressor!
Just plug it in to a 110V socket,
pull the trigger and spray!

Sure you've seen paint guns advertised before, at all kinds of prices. But this one... the Flomatic... is really EXTRA SPECIAL! Here's why:

Flomatic is made by a division of Sherwin Williams, the largest paint company in the world. And who knows more about painting than they do? They wanted an excellent paint gun, so they chose famous Swiss engineering, Swiss precision and Swiss quality for their Flomatic! Here's what we mean by QUALITY:

- Hardened steel cylinder and chromium plated piston for smooth operating efficiency.
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- High power pump section can be easily replaced.
- Two hardened steel jet nozzles. One for thin liquids such as stains, varnish, enamel. The other for heavier liquids such as latex, sealers, anti-rust coatings.
- Simple to use! Just turn a knob to adjust for large or small spray pattern. You get smooth running performance.
- High volume delivery from attached 1-qt. container. Up to 10 1/4 oz. of paint per minute. Big jobs like a house, barn, garage get done fast and easy, without excessive overspray or fogging.
- Cleanup is easy. Just spray water (or the recommended solvent for whatever you were using) through your Flomatic. Simple!
- Includes an 8-ft. heavy duty electrical cord with ground wire.

EXTREMELY VERSATILE!

Use it with latex, primer, varnish, stain, wood sealer, auto enamel, undercoating, lubrication oil. Spray insecticides and weed killers. Apply liquid wax to floors. Spray liquid fertilizer on flowers, shrubs. Spray wax on cars, trucks.

Every paint gun is brand new, factory perfect and has a full factory warranty! You get a top name brand plus excellent Swiss-made quality and a price that's BELOW MANUFACTURED COST! So hurry. Place your order today!

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My check or money order is enclosed.

Charge to my credit card account:

Mastercharge Acct. No. _____ Expires _____
 VISA Acct. No. _____ Expires _____

PLEASE PRINT CLEARLY

Name _____

Address _____

City _____

State _____ ZIP _____ Phone _____

PM ELECTRONICS MONITOR

PM on 'The Source'

I typed out on the keyboard the cryptic words "DATA LIBALL" and stared at the screen of my home television. Instead of the usual fare of cops and robbers, the screen suddenly filled with a list of more than 30 categories, each promising a warehouse of related information.

I was offered programs to balance my checkbook, to sell or buy my house nationally, even to read my horoscope. It was a bit like opening the doors to the fabled library of Alexandria.

I was using a system called The Source from Telecomputing Corp. of America (TCA) that is the first reasonably priced attempt at in-home computer time sharing. My home computer was tied in through the telephone line to a giant, multimillion dollar network of behemoth computers throughout the United States. More computer power was at my fingertips than many giant corporations own.

Time sharing for businesses is old hat. If a company doesn't want to invest in a huge computer, many time-share corporations allow them to "tie into" an extensive computer network for a large fee. Typical costs can approach \$50 or more an hour. Obviously, not many private individuals can afford this.

TCA posed the question: "What do these giant computers do when everyone goes home from the office?" The answer was: "Not much at all."

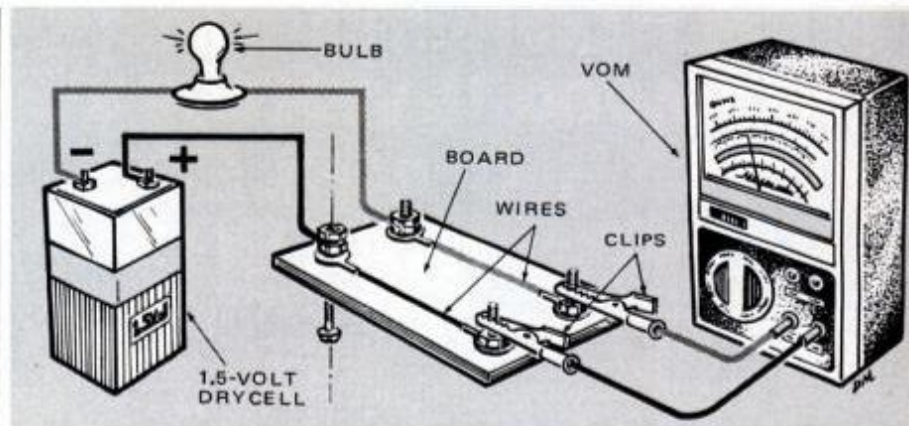
In fact, the time-share companies, in order to utilize their after-6:00 p.m. idle computers, were willing to let computer time go cheap.

TCA sells time on The Source at an unheard of rate of \$2.75 per hour (this applies after 6:00 p.m. and on week-ends—otherwise it is \$15). TCA now hopes to bring the computer into literally thousands of homes.

What does it take to get on The Source? Well, we used a home computer (the Apple II) as a keyboard terminal. All it required was the addition of a *modem* (which sends and receives data signals). The modem (which means modulator-demodulator) we used was from D.C. Hayes Associates.

Suppose you don't own a home computer? Then you're the primary market TCA is aiming at!

Besides computer time, TCA is selling reasonably priced keyboard terminals (no computer-power unless hooked into The Source) that simply have to be plugged into the



Build a VOM helper

One of the first things a person interested in hobby electronics purchases is the redoubtable VOM or volt-ohmmeter. Many people never quite get the hang of using its current-measuring (amperage) capabilities.

Problem is: You have to break the circuit to measure current, because the VOM itself must become part of the circuit. If you are working with a PC board or in a tight area, it can be impossible to fit the bulky VOM probes into the right spots.

We use an old trick—the board detailed

above. All we have to do is to connect terminals on one side of the board to the circuit (using tiny alligator clips or temporarily soldering fine wires), and the other terminals give us a lot of room for the VOM probes to attach.

The board can be cobbled together out of just about any wooden scrap. The terminals and wire can likely be found in your junkbox. All in all, you'll find this device to be one of the most useful—and least expensive—on your electronics test bench.

phone line. TCA sees their system, in many cases, even competing with the home computer.

If you have to process information you obtain, a home computer still comes in handy. But, if all you need is the info, a "dumb" terminal and The Source may be all you need.

And what information! The showcase databank of The Source is the United Press International (UPI) news, feature, business and sports wires. You can automatically search through three years of back news.

If you want to read about President Carter and the Salt II agreement, you would enter the UPI databank and type out "CARTER AND SALT," and then enter from what past date. In a few moments, The Source would respond with the number of stories in the UPI bank that contained both of your keywords and you could read the stories at your leisure, even skimming only first paragraphs if you chose.

Other databanks include up-to-the-minute statistics on everything from sports figures to Dow Jones averages; dozens of games; automotive news and tips; health and fitness and many more. Each databank contains as much data as a good-size almanac, and much of it (if timely) is constantly updated.

Users of The Source can send each other messages (on the Electronic

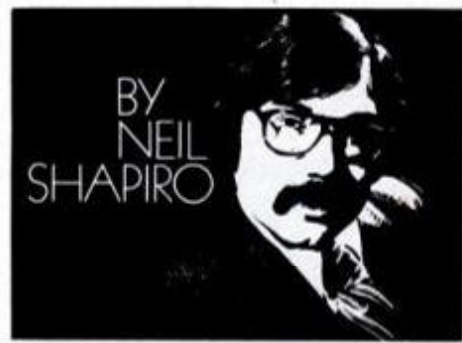
Mail databank), post notices on a community "bulletin-board" and even talk to each other through their keyboards—all without long-distance fees, since the computer network stretches coast to coast.

The Source is tomorrow right now. It is the beginning of a brand-new age of computerized living.

Understand your stereo

When we first heard of the booklet entitled "An Introduction to Stereo," offered free by the Yamaha Audio Corp., we figured this would be a commercial for its products. Were we ever wrong!

The pamphlet is a fine way to comprehend audio terminology and, to us, it seems unbiased and well written. To request a copy, send a self-addressed, stamped business-size envelope to Yamaha Audio, Box 6600, Buena Park, Calif. 90620. **PM**





Introducing the first Chevrolet Wagon with diesel power.



Caprice Classic Estate Wagon

462 estimated miles on a single tank of fuel in the city,
an estimated 682 miles on the highway.

You can also drive that same New Chevrolet Diesel Wagon with the fuel economy usually associated with a compact car—an EPA estimated **21** MPG, 31 highway.

And do it all with an engine that has no spark plugs to change, no distributor to replace, no carburetor to adjust.

Range figures obtained by multiplying the 22-gallon fuel tank capacity by **21** EPA estimated MPG (city), 31 highway estimate for an '80 Caprice or Impala Wagon with available diesel engine. Not available in California at time of printing. See your dealer for availability. ***Remember:** Compare the EPA estimated MPG with that of other cars. Your mileage and range may vary depending on speed, distance and weather. City



Plus a 22-gallon fuel tank.



A convenient 3-way door-gate.



A generous 87 cu. ft. capacity.



Lockable underfloor storage.



A 4' x 7.6' floor (rear seat down).



Stretch-out-and-relax comfort.



Second seat releases at a touch.



Plus side storage and utility trays.

mileage and range will be less in heavy city traffic, your actual highway mileage and range will probably be less than the highway estimate.

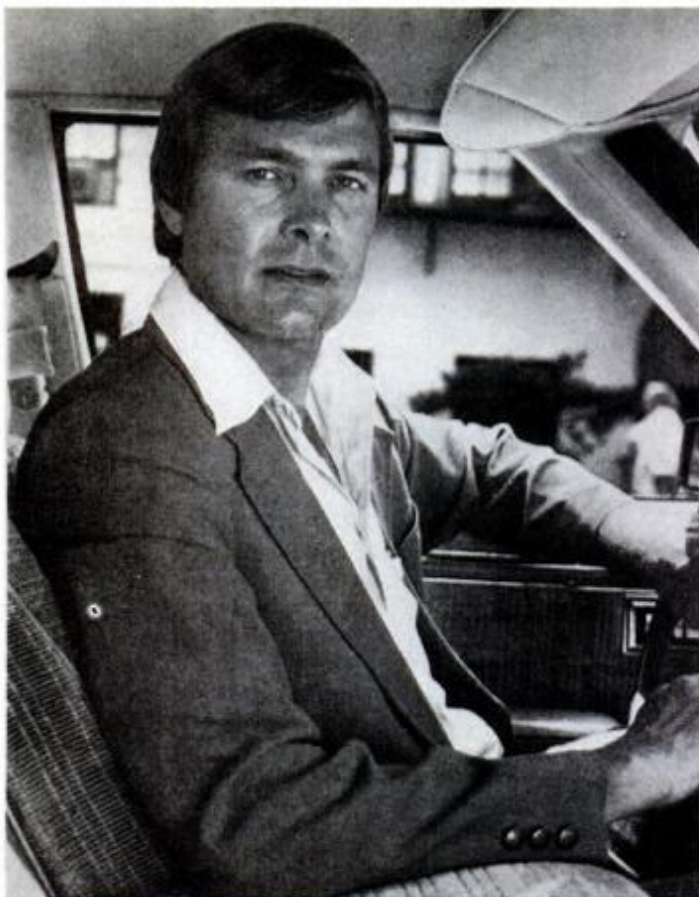
The New Chevrolet is equipped with GM-built engines produced by various divisions. See your dealer for details.

Of course, what makes the new available V8 diesel engine especially attractive is The New Chevrolet it's available in—trim Caprice and Impala Wagons delightful to drive, remarkably pleasant to maneuver and park. Yet with a full measure of those virtues you buy a wagon for in the first place.

See your Chevy dealer about ordering The New Chevrolet Diesel Wagon today.



THE NEW CHEVROLET WAGON. WE MADE IT RIGHT FOR THE '80s.



Why should two men with identical cars and similar driving records have different auto insurance rates?

Both men are about the same age, live in the same state and drive their cars about the same number of miles a year. Yet the man on the left pays more because he lives in a city.

As representatives of a major group of property and casualty insurance companies, we want everyone to understand the reasons why people who live in cities pay higher auto insurance premiums than suburban or rural residents.

Higher Loss Potential

The large number of people driving within a relatively small area increases the likelihood of something unfortunate happening to you or your car. For example: motorists driving in the Manhattan borough of New York City experienced 41% more accidents per thousand drivers in 1977, compared to their counterparts in suburban areas.

Higher Repair Costs

Should your car be involved in a mishap, it will, on the average, cost you more to repair. In cities, the higher cost of commercial space and the higher wages paid to skilled labor result in increased overhead for the auto repair industry, as for most businesses.

Greater Risk

The crime problems associated with densely populated areas increase the risk of your car being vandalized or stolen. To cover this greater loss potential, insurance companies must charge higher premiums.

Some people think this practice is unfair. We disagree. We believe people with lower exposure to loss should not have to subsidize those with higher exposure to loss. Of course, where you live is only one of the many factors that determine the cost of your auto insurance. But it is a factor that can be accurately measured through the accident claims experience of drivers.

Working together, we believe we can keep the costs of auto insurance fairly distributed...and affordable.

Here's what we're doing to keep costs down:

- Reassessing the loss potential of geographical areas.
- Investigating repair claims more thoroughly.
- Working through the Insurance Institute for Highway Safety to make cars more crash-resistant and highways safer.
- Distributing the administrative costs of providing insurance more evenly among rural and urban dwellers.
- Supporting the National Automobile Theft Bureau, which is working to reduce auto thefts and to advise on theft prevention.

Here's what you can do:

- Ask your agent about discounts that may be available.
- Check into a higher deductible. It will lower your premium.
- Join a car pool if you have to drive to work. It will save gasoline and you will reduce your insurance premium.
- Lock your car. Don't invite trouble.

Affordable insurance is our business...and yours.

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

IMPORTS & MOTORSPORTS

Baseball, apple pie and Renault



Renault is sure it has right shape and form for car of the '80s with its R2 prototype.

There's no halting Renault now that its interest in American Motors is up to 22.5 percent. Soon, Renaults will be as American as Rabbits. The scenario for the next couple of years has the French automaker working up to a production of 100,000 cars an-



R2 from rear shows off huge glass area, diminutive dimensions; it's 10.7 feet long.

nually at the Kenosha, Wis., plant. The so-called American Renault will be on the assembly line in 1982. It'll be an all-new car (with 75 percent U.S. parts), between the size of LeCar and the R18 model. The R18 (see *Detroit Listening Post*, page 28, Aug. '78) will go on sale next year, after being assembled here from knock-down parts shipped from France. Already a familiar sight in Europe, the five-door LeCar may show up here this spring. Meanwhile, the three-door LeCar for 1980 gets a little more luxury, more engine displace-



Grand Sport: new Renault prototype.

ment (up to 85.2 cu. in.) and more city mileage (up to 30 mpg). Highway mileage is still an EPA 40 mpg.

Back at Renault's test track in France, two new prototypes were spotted. A mini and a sport coupe are in the accompanying photos.

1980 Mazda models

Zingier than a Z-car and thousands of dollars less than a Porsche 924, the Mazda RX-7 has captured the sports-car crowd in record time. In the sporty-sedan arena, the 626 is garnering defectors from high-buck BMWs (see *PM Owners Report*, page 90, Dec. '79). The GLC isn't as distinctive as the 626 or RX-7, but it's



GLC five-door sedan for '80 has new nose.

Mazda's bread-and-butter product. That's why the company made sure to give it a fresh face for '80. The new hood slopes sharply to meet new grille and headlights. The taillamps, too, are new. The changes apply to the line's three- and five-door and station-wagon models. Prices for the GLC mileage makers range from \$3695 to \$4695.

Rolls runabout

The desecration began with rock-group Rolls-Royces. Resembling yellow submarines more than upper-crust cars, these effronteries to the memory of Frederick Henry Royce and Charles Stuart Rolls paved the

way for even more radical tampering with the sacred marque.

The latest Rolls mutant is a . . . pickup truck. The hatchet man who "reboodies" Rolls models is Clyde Cassady, who does the deed in Rancho Cordova, Calif. What he does may or may not suit your idea of style or status, but he does it well: His workmanship matches that of the original body boys in Crewe, England.

Meanwhile, in New Jersey, the real Rolls-Royce company just opened its North American headquarters (Rolls-Royce Motors Inc., Box 476, Lyndhurst, N.J. 07071).

The Rolls lineup for '80 ranges



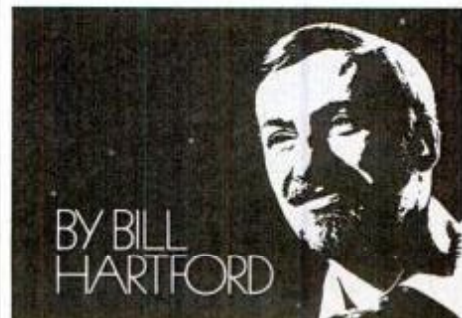
Rolls pickup is California custom cut-up.

from the Silver Shadow II at \$77,600 to the Corniche convertible at \$140,000. Also available here again are Bentley models, those Rolls look-alikes that go for a few hundred dollars under Rolls' prices.

Bentley's T-series sedan is \$77,150. The Bentley Corniches, with coachwork by H.J. Mulliner-Park Ward Ltd., are \$130,900 for the coupe and \$139,500 for the convertible.

Finding fuel

A diesel-station directory is a must for compression-ignition car owners. The latest, from Mercedes-Benz, lists 15,000 outlets for diesel fuel. It's \$2 from some dealers or from Mercedes-Benz of North America Inc., 1 Mercedes Dr., Montvale, N. J. 07645. **PM**



BY BILL HARTFORD

DETROIT LISTENING POST

GM battery breakthrough

The story on practical electric cars has been the same for as long as anyone can remember: "We need a battery breakthrough." The conventional lead-acid battery is just too heavy and bulky for the amount of energy it can store, and it wears out too soon under the constant charge/discharge usage it gets in electric vehicles.

Well, General Motors Research and Delco-Remy engineers have been trying to reinvent the battery for 10 years, and last fall they announced their first major breakthrough: a long-life, zinc-nickel oxide battery suited for automotive use.

A 900-pound pack of zinc-nickel oxide (ZNO) batteries can store the same amount of energy as 2000 pounds of lead-acid cells . . . in technical terms, about 27 watt-hours per pound vs. 12 for lead-acid . . . but past ZNOs have deteriorated rapidly in use. GM, however, says its new ZNO will go some 30,000 miles before needing replacement in a 50-mph commuter-type car with a 100-mile range between charges.

"We still have a tremendous amount of development to do," says GM president E.M. Estes, "but we've cleared a major technological obstacle to our plans to begin offering electric-powered vehicles in the mid-1980s." GM's first production electric likely will be an urban delivery van, rather than a small passenger car like the mini-Chevette-style, two-seater coupe seen on test runs near Detroit.

Ford aero car

Meanwhile, Ford designers have come up with what they call "the ideal aerodynamic shape" for a four-seat passenger car. Called "Probe I," the ultra-sleek concept car has achieved a near-incredible 0.25 coefficient of drag in wind-tunnel testing, compared to more than 0.40 for the best of today's U.S. cars.

Unlike the strange, banana-like creation touted as the ultimate "aero" shape by one Italian studio, Probe I is both practical and attractive. Ford sees it as "a typical car of the late 1980s or beyond" with a four-cylinder engine, probably turbocharged, and generating nearly 40 mpg at a steady 55 mph.

A three-door hatchback about the size of the current Mustang and Ca-



Ford's Probe I has a low drag coefficient.

pri, "Probe I has been designed realistically for a driver and three passengers, and should not be considered just another test exercise," says Donald F. Kopka, executive director of Ford's Advanced and International Design Studios. The concept includes a retractable instrument panel, electronic message and entertainment centers (including TV and computer games for passengers) and a credit-card ignition "key" that also can be used for gas and tolls.

Chrysler plans revealed

Because of its well-publicized financial troubles, Chrysler Corp. has been anxious for the government, the banks it borrows money from and even its dealers and customers to know what's coming in exciting future products. The result is an unusually heavy flow of what would normally be secret information in the car industry.

At a press conference during the 1980-model preview activities, board chairman Lee Iacocca even drew back a curtain to reveal a beautiful prototype of the 1981 LaScala luxury car . . . but it will be called Imperial instead of LaScala, according to Iacocca, even though he prefers the new name to the old one. It's an impressive-looking two-door on the 112.7-in. Cordoba/Mirada platform with a classy "radiator shell" grille, long hood and "bustle"-style rear deck surprisingly like that of the new Cadillac Seville. A four-door version will come a year or so later, and both models will be scaled down and get front-wheel drive (along with Chrysler's other mid-size cars) in about 1984.

Chrysler engine plans call for a new 2.2-liter four-cylinder for '81, a 3.8-liter V6 for '82, a 1.8-liter Four in '83, a smaller (2.8 to 3.0-liter) V6 in '84 and a 3.7-liter "straight-Six" diesel by 1985. All will power variations of the Omni/Horizon, the "K-body" compacts due to replace Volare and Aspen next fall and a third "X-body"

family of cars, that will take over the mid- and full-size slots in '84 and '85 in transverse-engine, front-drive configurations.

More small front-drives due

Ford may have changed its mind about marketing a domestic-built car smaller than the coming 1981 front-drive "Erika" Pinto/Bobcat replacement, sources say. A new program involves a Fiesta-like Erika spin-off with wheelbase around 90 inches, which formerly was considered to be too small by the management of Ford.

Company forecasts say small cars will take up to 60 percent of U.S. sales by 1985, and Ford plans to have at least half of its products converted to front-wheel drive by then.

GM has introduced its new German Opel Kadette, a version of the "T-car" subcompact known as the Chevy Chevette here and made in several variations in England, Brazil, Japan, Australia, Singapore and the Philippines, as well. It's better-looking, roomier inside and more aerodynamically efficient than the previous Kadette . . . and, significantly, it's front-wheel drive, indicating a new front-drive Chevette might be coming to the U.S. market sooner than many industry observers had expected.

Finally, American Motors should decide this month whether to build a front-drive, Renault-based car in its Kenosha, Wis., plant in a few years. The decision, management says, will be based on a study of its economic feasibility.

Meanwhile, AMC is working to increase production of its four-wheel-drive Eagle series and is considering whether to develop a smaller line of 4wd cars.



BY
GARY
WITZENBURG

Feel the
taste of
"Menthol Mist."™

KOOL MILDS

Now you don't have to settle for too much 'tar' or too little taste. Because choice tobaccos "misted" with mellow menthol creates an easy taste that's mild but not too light.

KOOL MILDS
Mild, but not too light.



Kings, 11 mg. "tar", 1.1 mg. nicotine; 100's, 12 mg. "tar", 1.2 mg. nicotine av. per cigarette by FTC method.

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

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LET ORDINARY ANTENNAS
CRAWL INTO THEIR HOLES.
**SHAKESPEARE
GOES MAGNETIC!**



No more drill holes! No more bolts!
Shakespeare has come up with a series of magnetic antennas that hug your car...rooftop or trunk... like a long lost friend.
The Cling's the Thing! Shakespeare's new and improved magnetic mounts incorporate design features that assure you of positive holding power and permanent alignment. They cling at all car speeds, and resist all but the most severe impact from overhanging foliage.
You can have the confidence in Shakespeare's magnetic mounts that you have in Shakespeare fiberglass antennas, the best sellers in CB.

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Enclose this coupon with the "Proof of Purchase" seal you will find inside the antenna package of your new Shakespeare magnetic antenna. Shakespeare will mail you a check for 10% of the manufacturer's suggested retail price. Allow 4 weeks for handling.

Sure, I'll fight inflation! Send me a 10% rebate check:

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Offer good through January 31, 1980, void where prohibited by law.



NOTES FROM THE EDITOR

John A. Sillerton

We can't imagine anyone better qualified to test Mercury's giant new 300-hp outboard (page 84) than PM's quintessential outdoorsman, Bill McKeown. Herding all that power was a piece of cake for Bill, who, over the years, has raced offshore on the factory teams of Bertram, Volvo-Penta, Formula and Donzi with the likes of legendary racers Sam Griffith, Don Aronow, Dick Bertram, Count Agnelli, Jim Wynne, Sir Max Aitken and Tommy Sopwith.

Driving high-powered machines on water is relatively tame, Bill admits if you press him a bit. At least, it's somewhat safer than his first job—flying a P-51 in combat over Europe.

When Shel Gallagher winged in to the most recent Oshkosh Fly-In to research the story that appears on page 76, it was old home week for him. He's attended the last six of these annual events that regularly draw 1200 to 1400 homebuilts, some 7000 or so visiting aircraft and a crowd of spectators in excess of 400,000.



Shel Gallagher tries gunner's seat in seven-tenths-scale replica of World War II Ju 87 Stuka dive bomber.

In the course of getting firsthand experience in the new models offered by the Experimental Aircraft Assn., Shel has flown in such notable homebuilts as the Starduster, Skybolt, Cavalier, Thorp T-18, Dyke Delta, Burt Rutan's VariViggen, Chris Heintz's Zenith and Tri-Z, and the Brokaw Bullet.

Photographer Howard Levy, who has attended even more of the Fly-Ins, took the cover photo and the other pictures that appear in this issue. As an Air Corps photographer in World War II, Levy saw action in North Africa before he decided to turn his camera lens on civilian planes.

In a business that's seemingly more vulnerable than most to Murphy's Law (Anything that can go wrong will go wrong), magazine editors may be forgiven their small shout of ecstasy when the unexpected turns out to be fortuitous. Take, for instance, the unprecedented October snowstorm that paralyzed sections of the East Coast. PM's Moss Miller was off testing an automobile, and the snow would have stopped him in an ordinary car. The lucky twist is that he was in the new four-wheel-drive Turbodiesel Scout, so he was able to give it a true off-road battering in a sloppy field and come back with deep-in-snow photos to prove the rigors of the test (page 88).

Not really unexpected but turning out better than we realized was our choice of a bridge designed by Arvid Grant for this issue's *Grand Design* (page 80). Since we made the selection, Mr. Grant's list of awards has been growing almost daily. Most recent are the 1979 American Society of Civil Engineers Special Outstanding Civil Engineering Achievement Award for Structural Engineering; the National Society of Professional Engineers Outstanding Engineering Achievement Award, and the Portland Cement Assn. Engineering Excellence Award.

PM

New from NRI! 25" color TV that DIAGONAL tunes by computer, programs an entire evening's entertainment.

Just part of NRI's training in servicing TV, stereo systems, video tape and disc players, car and portable radios.

Only NRI home training prepares you so thoroughly for the next great leap forward in TV and audio...digital systems. Already, top-of-the-line TV's feature digital tuning, computer programming is appearing, and new digital audio recording equipment is about to go on the market.

NRI is the only home study school to give you the actual "hands-on" training you need to handle servicing problems on tomorrow's electronic equipment. Because only NRI includes this designed-for-learning, 25" diagonal color TV with electronic tuning, built-in digital clock, and computer programmer as part of your training. With this advanced feature, you can pre-program an entire evening's entertainment...even key lock it in to control children's viewing.

Exclusive Designed-for-learning Concept

The color TV you build as part of NRI's Master Course looks, operates, and performs like the very finest commercial sets. But behind that pretty picture is a unique designed-for-learning chassis. As you assemble it, you perform meaningful experiments. You even introduce defects, troubleshoot and correct them as you would in actual practice. And you end up with a magnificent, big-picture TV with advanced features.

Also Build Stereo, Test Instruments

That's just a start. You demonstrate basic principles on the unique NRI Discovery Lab[®], then apply them as you assemble a fine AM/FM stereo, complete with speakers. You also learn as you build your own test instruments, including a 5" triggered sweep oscilloscope, CMOS digital frequency counter, color bar generator, and transistorized volt-ohm meter. Use them for learning, use them later for professional servicing of TV, audio, and video systems.

Complete, Effective Training Includes Video Systems

You need no previous experience of any kind. Starting with the basics, exclusive "bite-size" lessons cover subjects thoroughly, clearly, and concisely. "Hands-on" experiments reinforce theory for better comprehension and retention. And your personal NRI instructor is always available for advice and help. You'll be prepared to work with stereo systems, car radios, record and tape players, transistor



radios, short-wave receivers, PA systems, musical instrument amplifiers, electronic TV games, even video tape recorders and tape or disc video playbacks.

Send for Free Detailed Catalog... No Salesman Will Call

Mail the postage-paid card today for our free 100-page catalog with color photos of all kits and equipment, complete lesson plans, convenient time payment plans, and information on other electronics courses. You'll also find out about NRI's new Computer Technology Course that includes your personal microcomputer. Or Complete Communications with 2-meter transceiver. If card has been removed, write to:



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Education Center
3939 Wisconsin Ave.
Washington, D.C. 20016

SCIENCE WORLDWIDE

Black holes in the looking glass

The "solar furnace" at Sandia Laboratories, an array of 5550 mirrors aimed at one focus, is so receptive to energy from outer space it can make moonlight feel warm. Now, scientists are about to call on the light-gathering ability of the array to search for black holes.

Black holes, scientists hypothesize, are collapsed stars whose gravitational force is so strong that not even light can escape their pull. It's also been suggested that some black holes, formed about 10 million years ago, could be exploding today. The explosions would send bursts of gamma rays, radiation similar to X-rays, through space to our atmosphere. Some 20 kilometers above Earth's surface, these rays would in turn trigger a shower of cosmic rays which would radiate light in the atmosphere.

An international team of scientists plans in March to use the light-gathering power of the Sandia mirrors to look for the faint flashes.

Scientists on the project told PM they're confident the Sandia mirrors can pick up evidence of exploding black holes—if the evidence is there, glimmering, in the air above. But it won't be easy.

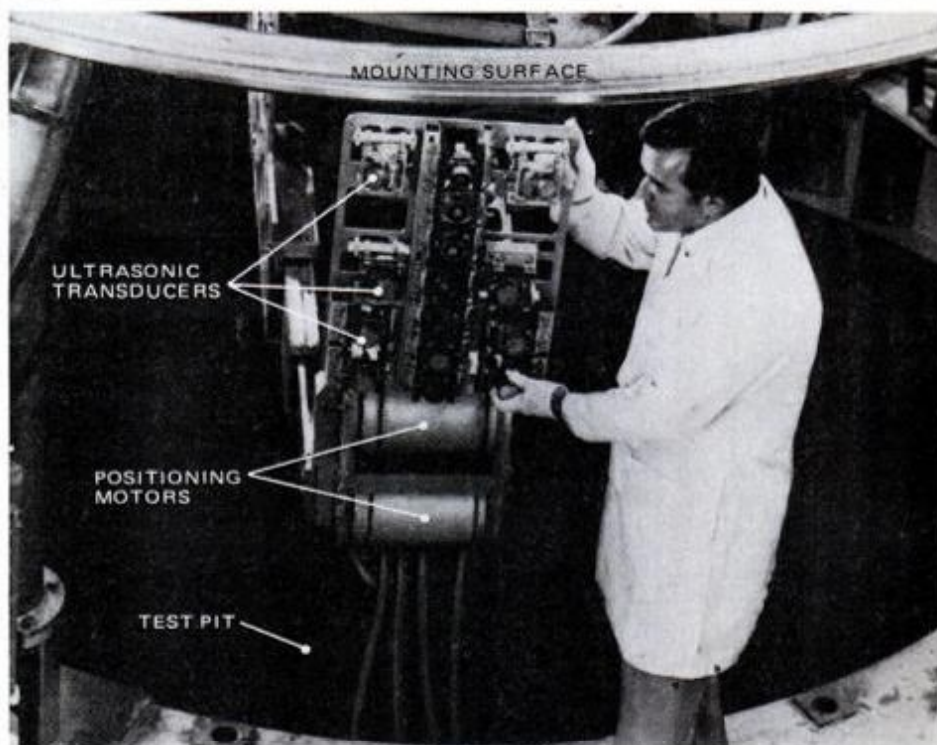
"The system is as big as all of the optical telescopes in the world put together," said Dr. Terry Cole, one of the researchers. "It has enough light-gathering power to enable it to see a match on the moon. The problem is, the images are very fuzzy. So you have to have a device at the focus which further concentrates the light."

Cole's role in the project is to turn the blurred light signals into meaningful electrical signals which can be monitored on an oscilloscope in the 200-foot-high tower centered in the array. There, the researchers will watch readouts on a greenish screen for sudden jumps or spikes that could be the first sign that a "shock wave" of rays from an exploding black hole has reached Earth.

Robot inspects reactors

The machinery shown above is a highly maneuverable 11-ton robot built by Westinghouse to inspect the inside of nuclear reactor vessels.

The robot operates in multistory containers housing the radioactive cores of nuclear powerplants. Its



Like an electronic bat, robot bounces ultrasonic signals against reactor-vessel walls.

working end is an array of 17 ultrasonic transducers that bounce high-frequency sound waves on the inside wall of the vessel. Returning signals give clear pictures of welding joints. To check condition of the vessel, operators compare data from the transducers with that collected during an inspection before the reactor vessel goes into use.

With flexibility comparable to a human hand, the robot roams over every inch of a four- to five-story reactor vessel, completing an inspection within a day. It would take a human a week to do the task.

Rx for cancer jitters

Amid a flurry of reports about cancer-causing agents, the editor of the *Journal of the American Medical Association* offers reassurances.

In an editorial, Dr. William R. Barclay said allegations against artificial sweeteners, food colorings and a variety of chemicals "keep the public in a state of fear that borders on hysteria." Tests behind such reports are often conducted with dosages exceeding any to which humans could be exposed, he said. And data are evaluated by "persons of questionable expertise" in the science of diseased tissues. Dr. Barclay told us that when faced with such reports, the public "should neither panic, nor

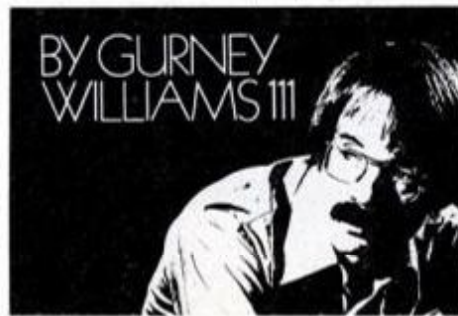
make excessively optimistic judgments" about cancer causes.

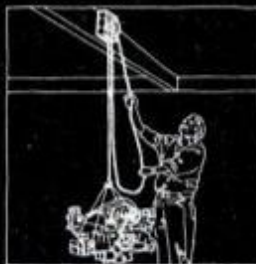
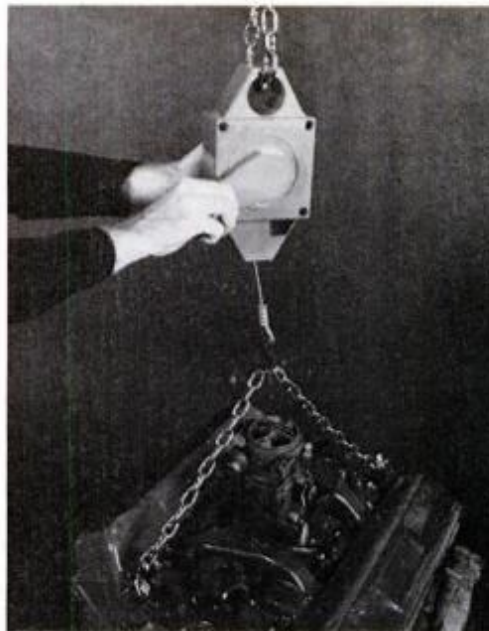
Magnetic pigeons

How do homing pigeons get home? Scientists have known for some time that they use the sun to get their bearings. But that doesn't explain why they are just as able to fly a good course when the sky is cloudy. One clue: Small magnets affixed to their heads foul up their sense of direction. Do they have some kind of built-in compass?

To find out, researchers Charles Walcott, James L. Gould and J. L. Kirschvink recently dissected two dozen pigeon heads and necks. In each pigeon they found small amounts of magnetic material. The researchers are still unsure whether—or how—the birds use the material as a navigational aid when they can't steer by the sun. **PM**

BY GURNEY
WILLIAMS III





Gear breakthrough replaces ratchet catches.

Use it as a winch.

Use it as a hoist.

Use it with your electric drill or socket wrench.

With the Universal Mount, one winch does the job of many.

Automatic two-speed transmission.

Totally rustproof.

Saves time and money.

The Easy Tugger™ Load Handler

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With an Easy Tugger™ handling any heavy load is no more trouble than rolling your car window up or down. The safety, convenience, and low price of the Easy Tugger™ is made possible by a revolutionary new breakthrough in gears and power transmission protected by a variety of U.S. and international patents including U. S. Patent No. 3,895,540. This new technology puts the old-fashioned winch and hoist in a class with the dinosaur—clumsy, unsafe, heavy, out-of-date.

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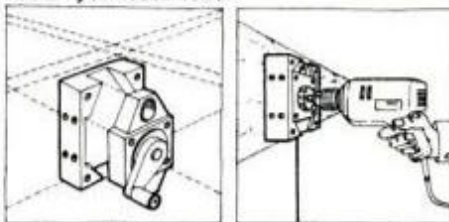
The Easiest to Use

The hand cranked Easy Tugger™ can be driven by an electric drill or socket wrench and will adapt to virtually any load handling problem. The cable automatically locks in

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ALL OUTDOORS

For 1980

New Year resolutions season is a good time to note sporting products and places to try out in the months to come. It makes for pleasant, wishful thinking to review adventure vacation possibilities now and plan well in advance.

For camping, hiking, shooting, fishing, boating and skiing, here are some of the items of gear we want to check out.

Gadgets and guns

Fish can practically smile in color now on your candid camera radar screen. Vexilar's new T.I.M.E. System 4000 sonar fish finder has a small television monitor, rather than graph recorder-tape readout, that shows underwater structure and fish in various colors for easier reading.

A printout that's at the top of the screen gives continuous readings of surface water temperature, as well as any other depth set with a probe. Want a close-up view? Pick one of six depth ranges from 0-50 to 0-1600 feet and turn a zoom knob for an enlarged detail look. It appears on a split screen, with the other half showing the full area.

"Can't you offer instant replay?" we asked Vexilar president John Ulrich as a joke. "We do," he announced. "A built-in tape cassette can keep a permanent record for playback at any time."

"With voice-over by Curt Gowdy to interview the fish you see on the screen?"

"No," John admitted, "but you can turn up sound to listen to weather band radio at the same time, or switch your T.I.M.E. System monitor screen to a regular TV show if the fishing gets slow." But how could the action get slow with a \$3000 fish finder like this?

Last year marked Sturm, Ruger's 30th anniversary, and the noted maker of innovative guns announced a new and different Redhawk double-action, stainless steel .44 Magnum revolver. Though a logical outgrowth of its well-known .38 Special and .357 Magnum models, the Redhawk has a number of progressive features. Its power and 7½-inch barrel should make it particularly suitable for the growing sport of metallic silhouette target shooting. Deliveries to dealers are expected early this year.

For cold sport

Twenty years ago when helicopter pilot Dan Thurman arrived in the little Texas town of Mineral Wells, he got a job in an electronics plant and soon started an Explorer Scout troop for local youngsters. Ten years ago, when he became his company's principal owner and sold out for several million, he turned into an explorer himself. With a backpack, Dan scouted most of the high ranges of the Rocky Mountains, looking for the perfect spot for outdoorsmen who want to get away from it all. After he found his goal, 14 miles west and high above the Colorado frontier village of Crested Butte and its ski resort, he was told the location



Winter mountaineering by snowmobiles is possible with altitude-adjusted machines. From a mountaintop above Crested Butte, Colo., Dan Thurman notes nearby peaks.

was too remote and inaccessible to build on.

So Dan Thurman became a self-taught architect, contractor, heating engineer and builder, and with several helpers he trucked and snaked and packed in supplies to build three-story, 160-foot-long Irwin Lodge. From the 10,300-foot elevation, you can hike, snowshoe, ice-fish, cross-country ski or snowmobile all day, without seeing a house, utility pole, car, other outdoorsmen or any sign of civilization all the way to the horizon. For alpine skiing, Thurman takes you up a nearby peak by snow-cat and you schuss down miles of untouched powder.

There is luxurious warmth, food and generator electricity at the lodge, but no television, no telephones, only occasional contact with the village by private radio. There are 25 rooms for sportsmen or families, but no way to climb the miles of deep snow up from the town for seven months of the year except by the lodge's snow-cat or snowmobiles.

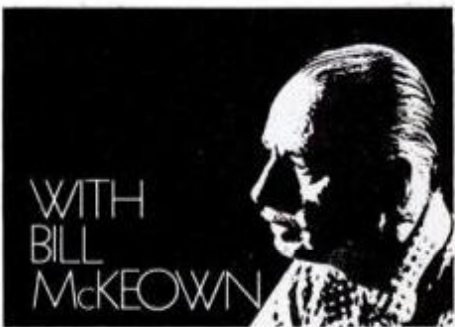
You make reservations by mail or phone to an Irwin Lodge listing, Box 457, Crested Butte, Colo. 81224. For an escape from everything, Dan Thurman may have the answer.

For a winter look at Montana, Yellowstone, and Grand Teton, Wyo., Rockies on cross-country skis, there are 12-day Western Ski Touring Holidays starting Feb. 9 and March 8 arranged by Adventure Guides, 36 East 57th St., New York, N.Y. 10022. They also publish two directories to outdoor action: *Adventure Travel*, \$8.95, and *Farm, Ranch and Country Vacations*, \$6.95, both postpaid.

All-out checkout

As a laudable example of living dangerously, the Camp Trails camping gear division of Johnson Wax decided on a massive test of its equipment. For a really extensive checkout of how its framepacks, softpacks and sleeping bags survive in the field, it is outfitting just about the whole population of Grand Lake, Colo. Last fall the 891 residents were given their choice of equipment, with the agreement that there would be a clinic each month to see how well each item was holding up. Grand Lake is high in the Rockies, northwest of Denver, near Rocky Mountain National Park. If the ardent full-time outdoorsmen, wranglers and packers in this area can't tear up equipment, who can? The results for the rest of us, however, after a year of critical input and worn-out gear, should be development of equipment made to really last.

Camp Trails is also studying recommendations by some of the environmental pressure groups that "minimum impact camping"—a basic concept that no one can argue with—should also include "earth colors" for all outdoor gear. Now if these groups would just cure some of those lurid colored birds, gaudy fall trees and garish sunsets. **FM**

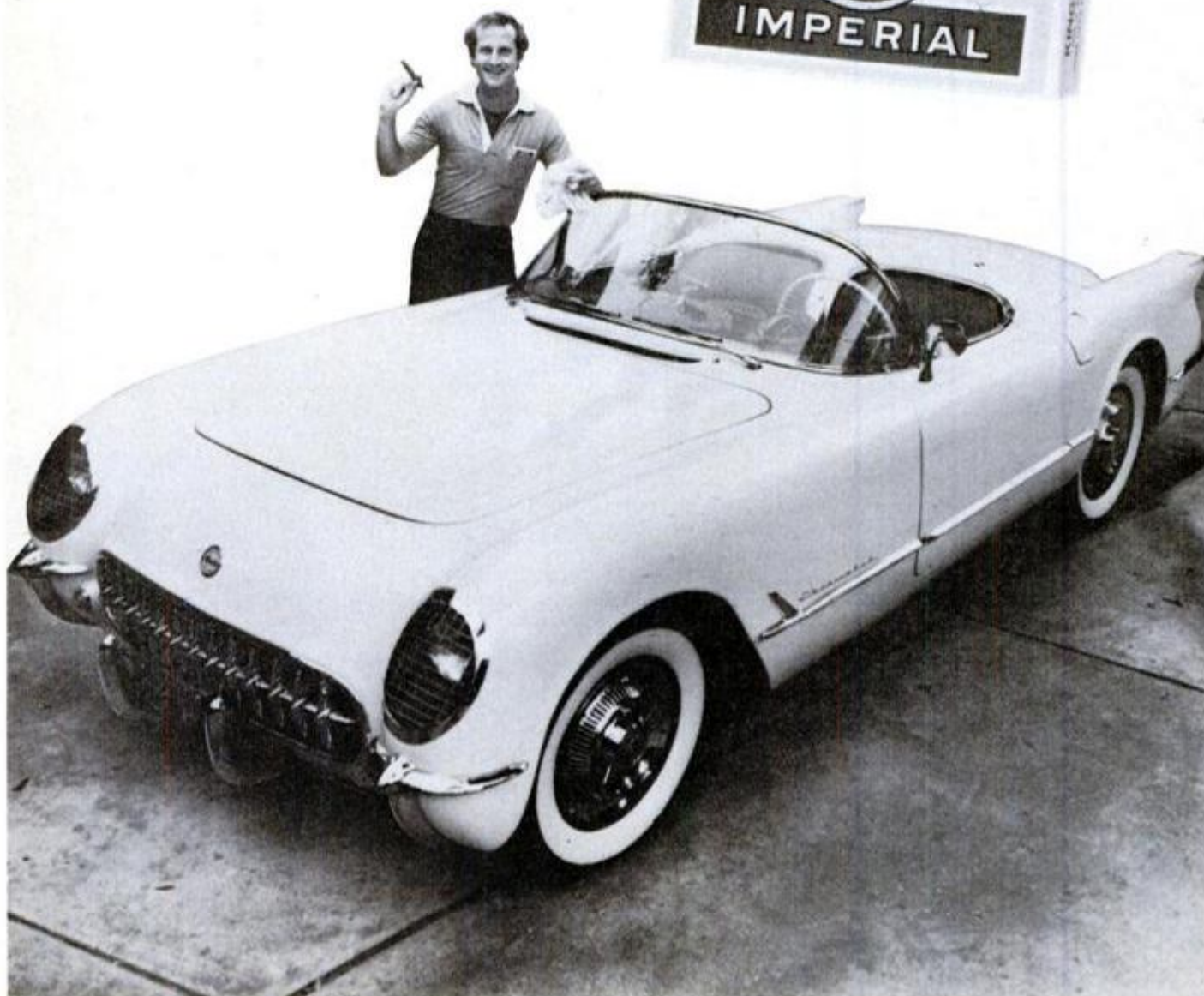
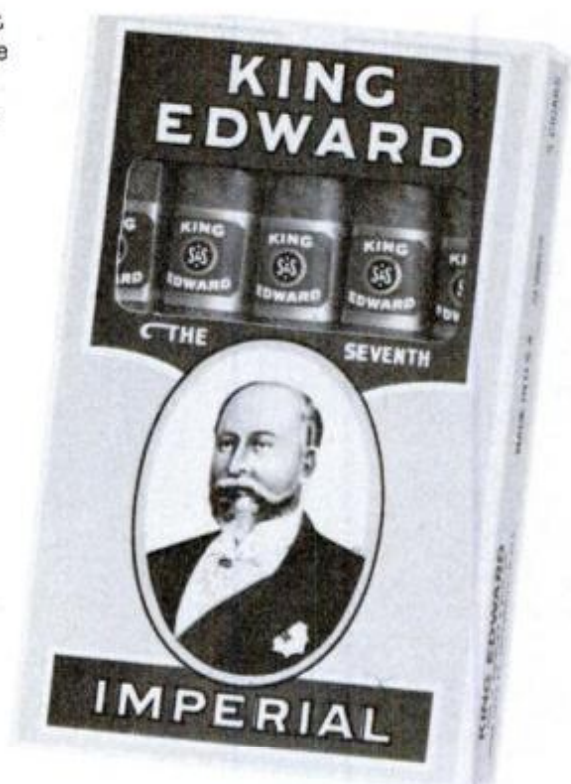


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They Make Those
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PM WORKBENCH

PM EXAMINES PRODUCTS AND SERVICES

About buying solar

Since solar (heating and hot-water systems) is a relatively new, uncharted area of home improvement, many homeowners are confused when it comes to picking a system—or a consultant—for such a project. The Consumer Information Center, Dept. 055G, Pueblo, Colo. 81009, offers an 80-page booklet, *Buying Solar*, intended to help the consumer make a smart purchase. Various systems are explained in detail. It's available for \$1.85 postpaid.—H.W.

Great interior staining

These three finishing products will handle just about any interior finishing challenge that confronts you. Danish Oil Finish has a soft, natural-looking finish on new wood. The StainWax—available in 14 colors—stains, waxes and seals in one step. With a satin-like finish, it's suitable



Three Cabot finishes are easy to use.

for use on paneling, floors and workshop projects. Cabothane is a tough polyurethane finish, in gloss or satin. For details, write S. Cabot, Inc., 1 Union St., Dept. PM180, Boston, Mass. 02108.—H.W.

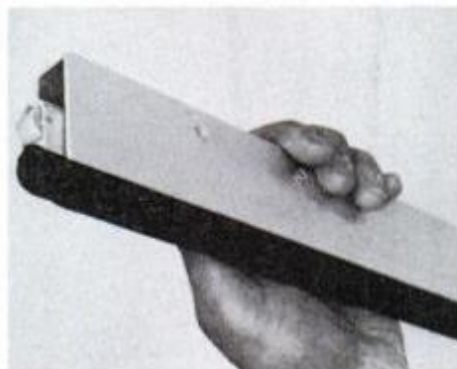
Fuel costs compared

Reliable comparisons of current cost of heating fuels are contained in a vest-pocket folder *Fuel Cost Facts*, available from the Better Heating-Cooling Council, Box 262, Berkeley Heights, N.J. 07922. The useful booklet, labeled BHC-201B, is 25 cents postpaid. Separate tables are included for electric, oil and gas heat, listing various types of heating systems.

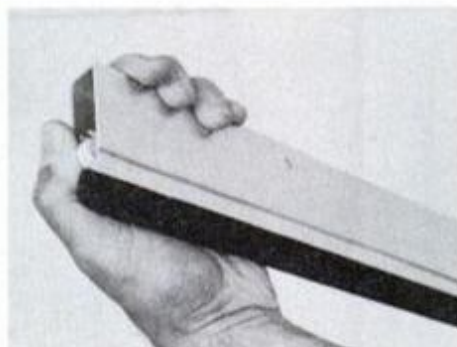
The range of prices for each type of energy covers rates in all parts of the country, as well as foreseeable price increases. The amount of heat is listed directly for each fuel price and heating system; no reader calculations are required.—H.W.

Seal for door bottoms

This noncorrosive Automatic Door Seal can be installed on interior or exterior doors to keep drafts, moisture, dust and noise outside. It is especially useful for doors that open to a carpeted interior, since the thick rubber seal retracts as you open the door and doesn't drag against the



When nylon roller is depressed as door is closed, the seal extends to stop drafts.



As door is opened, roller releases and the seal raises to clear carpeting inside.

carpet. As door is shut, seal locks into its down position. Installation is fast and simple.

These door seals are available in standard door opening widths from 2 to 5 ft. wide and can be cut to suit off-sizes. The 36-in. unit costs \$12.45 postpaid, from Keystone Industries Inc., Box 748, Elkader, Iowa 52043.—J.P.

Lighting decor

Hi-Light, a new decorator-styled lighting fixture with a replaceable Bright Stik, has been introduced by General Electric. The 33-w. unit has a shade that rotates to direct light where it's needed. Designed to add a touch of decor wherever it's used—in work and hobby areas, for example—the 23-oz. unit takes only



Unit provides light on counter surface when installed under kitchen wall cabinet.

minutes to install. It needs no special wiring, and comes with a 6-ft. plug-in cord, at department, discount, hardware stores for \$20.—H.W.

Sawhorse power

These sawhorses come ready to use and can withstand up to 1000 lbs. Predrilled holes let you attach protective boards to cross beam for times when your portable saw blade



The lightweight sawhorse sets up quickly (as shown above). With an auxiliary support clamped in place (below), the sawhorse also serves as a table-saw aid.



is set to cut through a workpiece, to avoid cuts in that member. It's \$14.95 at hardware stores. J & S Manufacturing Co., 18584 Fitzpatrick Ave., Detroit, Mich. 48288—J.P.

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.

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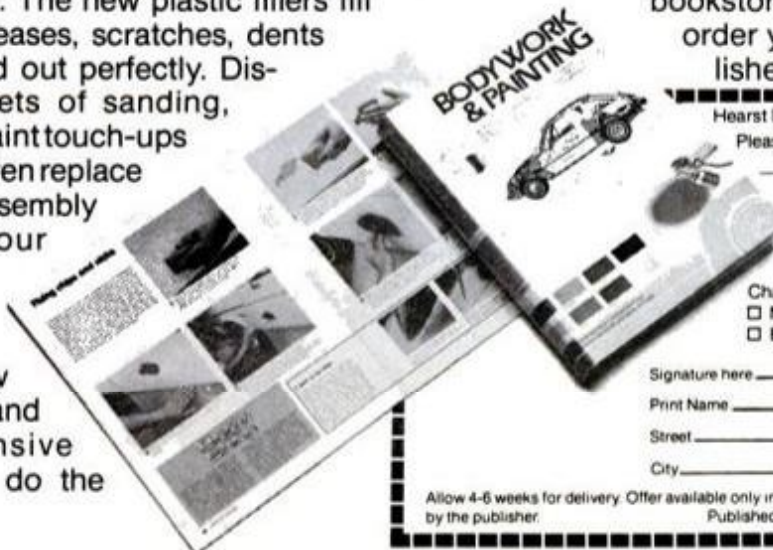
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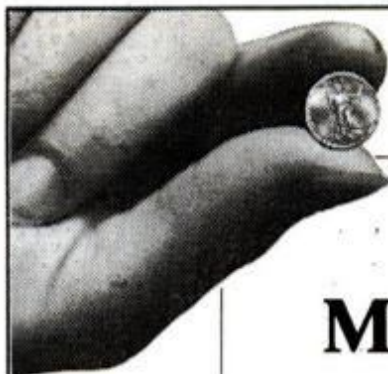
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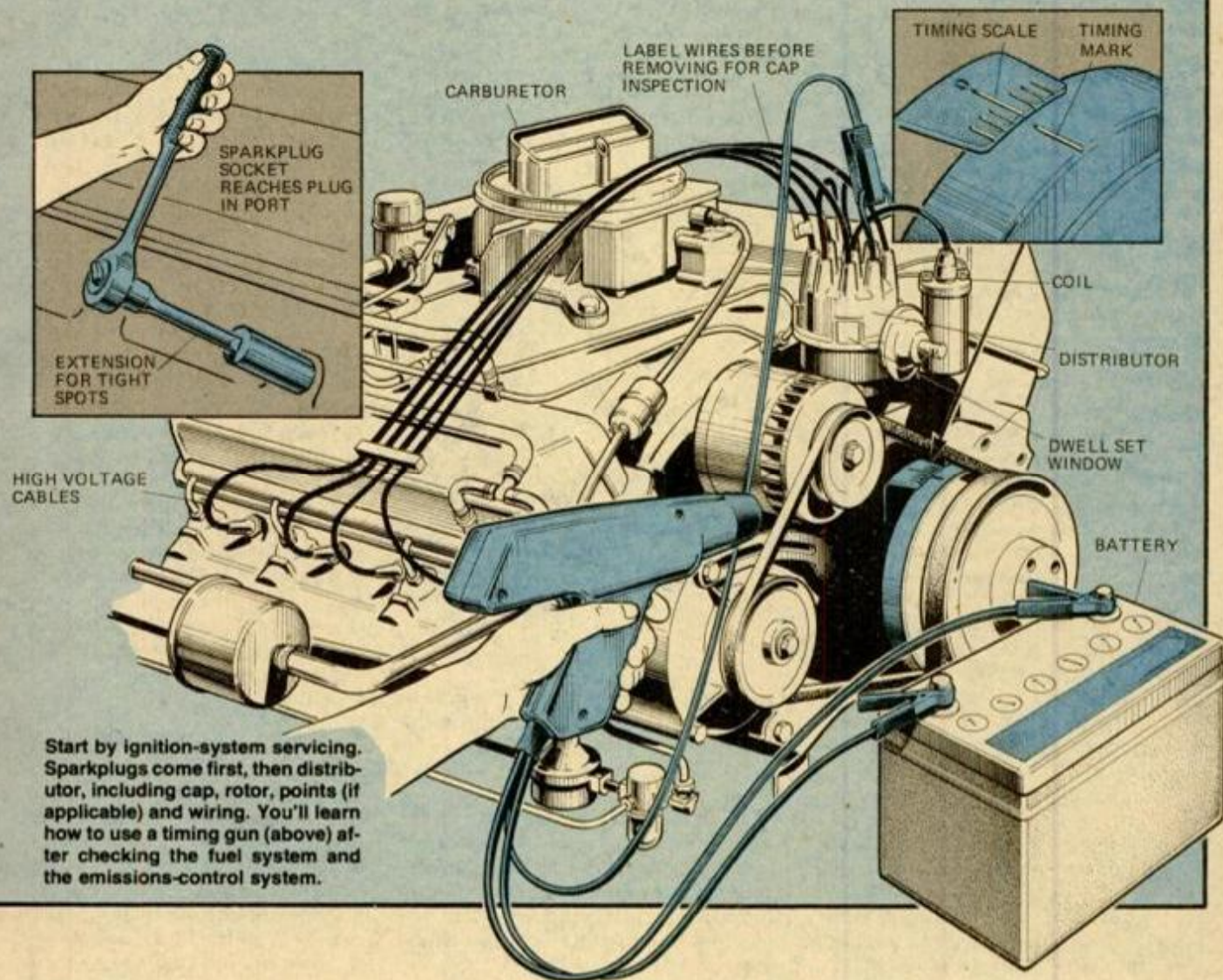
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How to tune up for top fuel economy

by Mort Schultz



Start by ignition-system servicing. Sparkplugs come first, then distributor, including cap, rotor, points (if applicable) and wiring. You'll learn how to use a timing gun (above) after checking the fuel system and the emissions-control system.

Once you establish that your car engine is tunable (see Part 1, page 17, Dec. PM), the tune-up procedure designed to reduce the amount of gasoline your car is using takes four steps. They are servicing sparkplugs, servicing the distributor, servicing fuel and emissions-control systems, and making final adjustments.

Servicing sparkplugs

Some commonly asked questions about sparkplugs are these:

■ If one sparkplug (or several sparkplugs) is in bad shape, but others aren't, should I replace all?

Usually, yes. An engine with a fresh set of sparkplugs gives the best fuel economy and running performance. However, if a sparkplug is physically damaged because it was mishandled when installed, and other plugs are fairly new, then replace only the damaged plug. Mishandling may cause the plug insulator to crack or electrodes to break.

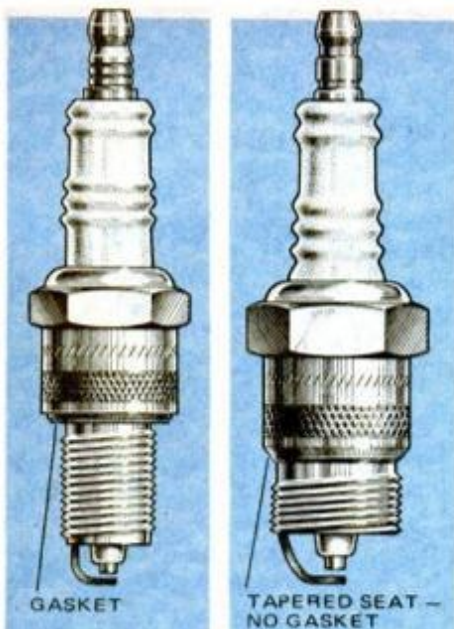
■ If a set of old sparkplugs is going to be cleaned, regapped and put back in service, can plug gaskets also be reused?

No—but I've got to hedge. Replacement gaskets are sometimes hard to find. So what do you do? You

can use old gaskets and take a chance that compression won't be lost. Crushed gaskets often don't seal properly. Or you can replace a usable set of sparkplugs with a new set. I guess it's best to try using the old plugs. If an operational problem such as loss of power occurs because of lost compression, you can get new sparkplugs with uncrushed gaskets. By the way, plugs having tapered seats do not use gaskets, so don't add them. They won't seat and compression loss will result.

■ Can I reuse plugs that are fouled by oil, carbon or deposits?

It depends on the extent of foul-



GASKET

TAPERED SEAT - NO GASKET

Make sure gasket is in place before you install a conventional sparkplug. If your car takes plugs having tapered seats, the gaskets are not necessary.

ing. If tips are heavily coated, discard the plugs. Cleaning, even with an abrasive cleaner, probably won't remove all deposits. Deposits interfere with plug performance, causing misfire and fuel waste. If fouling isn't too bad, clean and reuse the plugs. Plug-fouling is caused by a malfunction of a component other than sparkplugs, such as a clogged air filter, worn piston rings or ignition-circuit failure. Plugs will continue to foul until the problem has been corrected.

■ Can I reuse plugs that have burned electrodes?

No, and you had better find out what caused the condition or new plugs will soon be ruined, too. Maybe the engine has been operated at speeds too high or under loads too heavy for plug heat range; the engine may be preigniting; or perhaps the fuel/air mixture is too lean.

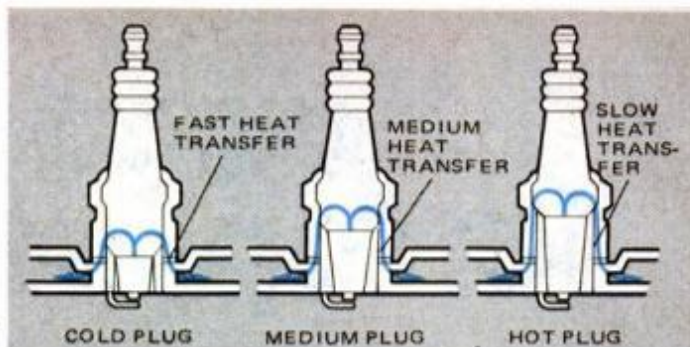
■ Should plugs that can be reused be cleaned in an abrasive cleaning machine?

Abrasive cleaning is the best guarantee that deposits, which can cause misfire, will be removed. You can pay a service station to clean plugs for you, but be sure all abrasive particles are blown out of the plugs. These particles can be transferred to the inside of the engine and cause damage.

After plugs have been cleaned, open electrodes by bending the side electrode with the bending tool of a sparkplug gauge. Never use pliers to bend an electrode. You will ruin the plug. Also, never bend the center



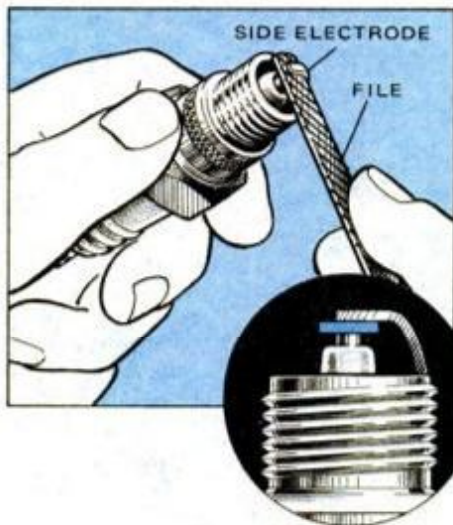
Wire sparkplug gauge (above left) is used to set sparkplug gap; it has a bending tool to adjust the side electrode. Old plug (below) can be reused if electrodes are filed flat. Heat range of sparkplugs (above right) is determined by the distance that the heat must travel from plug's tip to engine block.



COLD PLUG

MEDIUM PLUG

HOT PLUG



electrode. Not only won't you get the correct gap, but you may break or crack the insulator. File electrodes with a fine ignition-point file to flatten surfaces.

Check the service manual or the vehicle emissions-control information decal in the engine compartment for the specified electrode gap. Use a wire sparkplug gauge of the specified size to gap the plugs. Gap is properly adjusted when you can feel slight resistance while moving the gauge between electrodes.

When gapping used sparkplugs, if you have to bend the side electrode to a point where electrode surfaces

are off-parallel, then the electrodes are worn too much and you need new plugs.

By the way, new sparkplugs shouldn't be taken from a carton and put right into an engine. Gaps must be set to specification; this is not done at the factory.

Install plugs in the engine fingertight. Then, turn them 1/8-turn with a sparkplug wrench if they don't have gaskets, or a quarter turn if they do.

Check the condition of sparkplug cables; they are key components in a tune-up for top fuel economy. Bad cables can leak current before it reaches sparkplugs, causing engine misfire that leads to loss of fuel economy.

Remove cables from the car one at a time so you don't get them mixed up. Bend the cable over its length. If insulation is cracked, replace the cable. If you have an ohmmeter, check resistance. Generally, cable resistance shouldn't be more than 30,000 ohms, but check the manufacturer's specification.

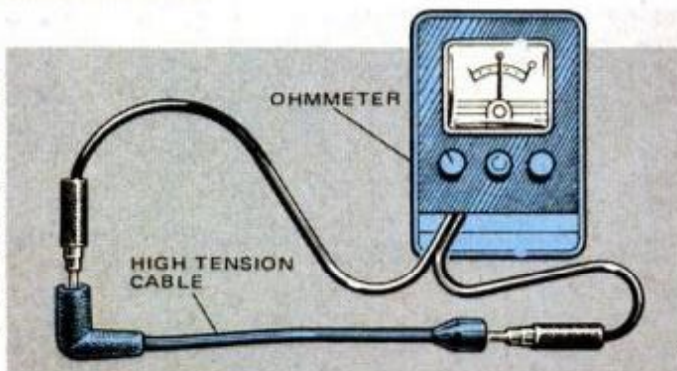
Servicing the distributor

Whether your car has electronic or nonelectronic (conventional) ignition, a tune-up procedure calls for the following:

■ Remove and wipe the distributor cap clean. Identify each cable to its distributor-cap terminal, so they can be reconnected correctly.

■ Examine the cap for cracks or carbon tracks denoting a crack; burned, eroded or fractured contacts; and cracked or broken towers. Replace a damaged cap.

Ohmmeter is used to test the resistance of the sparkplug cables. Usually, if resistance is over 30,000 ohms, cables should be replaced. Cables should also be examined for cracks, which cause loss of current. If any are found, cables should be replaced.

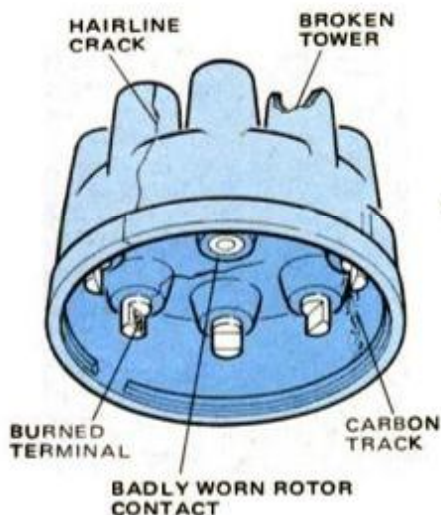


■ If the cap isn't damaged, use a distributor wire brush to clean corrosion from metal contact surfaces inside towers.

■ Remove and clean the rotor. Look for cracks, chips, burned or corroded tip, and weak spring tension. Replace a questionable rotor, but make sure the new rotor matches the old one in size, shape and design. If you use one that doesn't belong, the rotor, distributor cap or both will be damaged.

■ Some rotors require lubrication. Look in the center of the distributor shaft for a felt wick. If it's there, put two drops of SAE 10W engine oil on it.

If your car has conventional ignition, it has breaker points. Remove them from the distributor for inspection. You can't get an accurate picture of point condition with



Distributor cap should be free of the defects identified above. If it isn't, it needs to be cleaned or replaced.

points hidden inside the distributor.

Badly pitted or burned points should be replaced. If they show a slightly irregular surface, pass a fine distributor-point file between them. One pass is all you should use. Excessive filing will remove too much metal, ruining the effectiveness of the points.

Before reinstalling points, check to see if the rubbing block and pivot are loose, and if the spring has tension. Replace points if one of these areas is damaged.

When replacing burned or pitted points, change the condenser as a matter of course. A bad condenser is the main suspect when points burn or pit. If points again burn or pit, look for the cause elsewhere in the ignition system.

After installing points, apply a single drop of distributor-cam lubricant to one lobe of the cam. This will

avoid wear of the cam and point-rubbing block. Don't overlubricate. Excess grease can splatter on breaker points, causing them to burn.

If the cam has a wick, don't add lubricant. Instead, turn the wick one-half turn so a new lubricating surface touches the cam. If the wick is dried out, replace it with a new one.

Make sure the ignition primary wire in the distributor is not worn and is connected tightly. Now, set point gap using a tachometer and dwellmeter.

After connecting the tachometer and dwellmeter, crank the engine while observing the dwellmeter. Adjust points until the meter shows the manufacturers recommended dwell reading.

The correct dwell, or cam angle, refers to the number of degrees the distributor cam rotates from the time points close to the time they open again. Thus, the manufacturer's dwell specification is given in degrees. Refer to your service manual or vehicle emissions-control label for this specification.

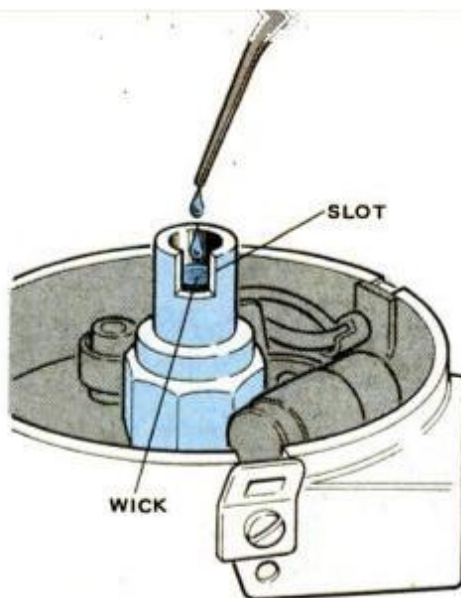
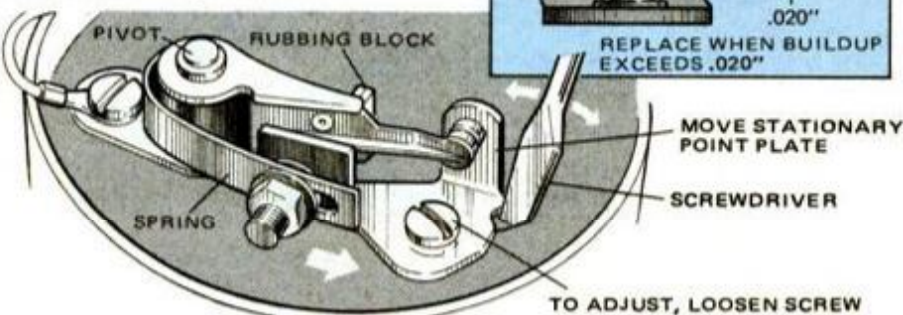
As dwell is increased, point gap decreases. As the dwell is decreased, point gap increases. Too little dwell causes engine misfire at high speed. Too much dwell, which allows points to remain closed too long, causes points to burn.

On distributors of most General Motors V8 engines, the point adjustment can be made with the distributor cap in place and the engine running. There is a small window in the cap. Slide the window up and turn the point-adjusting screw with an Allen (hex) wrench until you see the designated dwell reading.

Don't forget to close the window tightly when you're done. Dirt can enter the distributor through the opening and cause trouble.

Setting timing is the only other ignition-system procedure left to do. (There are no tune-up procedures

When points have pitted severely (right), they must be replaced, along with the condenser. In order for the points to function properly, the pivot and rubbing block (below) must not be loose, and the spring should have adequate tension.



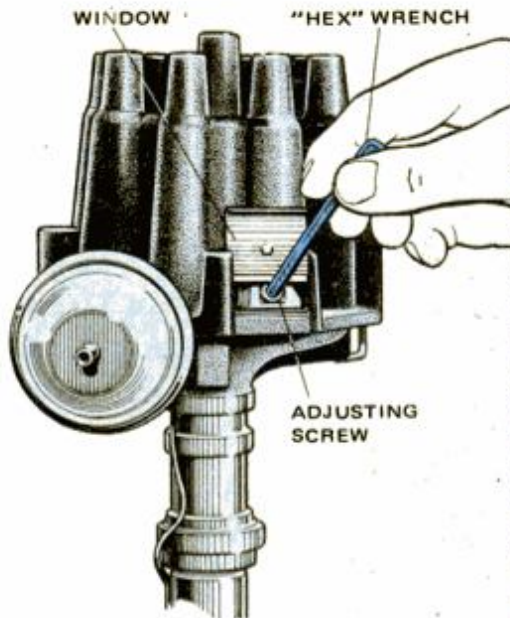
If distributor shaft has a wick, add two drops SAE 10W engine oil to lube rotor.

for electronic-ignition systems other than checking the distributor cap, rotor and cables, and setting timing.) The timing adjustment is done after the fuel and emissions systems are tuned up.

Fuel-system procedure

Whether it's necessary to replace the carburetor air filter and fuel filter, and to repair the automatic choke, will be determined when you test the fuel system for damage at the start of the tune-up procedure (see Part 1). The only fuel-system tune-up procedure that remains, therefore, is adjusting the carburetor. This is one of the most important checks for fuel economy. A precise adjustment is necessary for you to get the best mileage possible for your car.

Because of recent strict exhaust-emissions standards, the carburetor has become one of the most complicated parts of an engine, requiring adjustment using expensive equipment such as an infrared exhaust analyzer, combustion analyzer and artificial enrichment with propane gas. You must consult a shop that



GM-DeLco distributor (also found on some AMC cars) has window for setting dwell with hex key. When finished, be sure you replace metal shutter to keep out dirt.

has this equipment to get an accurate adjustment.

The problem isn't as tough if your car is a pre-1975 model. Generally, you can follow this procedure:

1. Let the engine warm up.
2. Connect a tachometer and remove the carburetor air cleaner.
3. With the engine running at slow idle, check to see if the tachometer shows suggested curb-idle rpm under the conditions outlined in the service manual or on the vehicle emissions-control label. Manufacturers have different requirements for setting idle. Some, for example, require that the transmission be in NEUTRAL; some want it in DRIVE. Some manufacturers call for having the air conditioner turned on; some want it off.
4. If idle speed is not to specification, turn the slow-idle-speed screw or idle-stop solenoid until the tachometer shows the correct idling speed.

Servicing emission controls

The emission controls that are checked during tune-up are the positive crankcase ventilation (PCV) valve, exhaust-gas recirculating (EGR) valve, fuel evaporation system canister, manifold heat control valve, and thermostatic air control system. Your car may have all or some of these.

■ **PCV valve:** With the engine warmed up and running, and a tachometer hooked up, remove the PCV valve from its seat and press the tip of your finger over its open end. Engine speed should drop by at least 40 rpm. If it doesn't, replace the PCV valve.

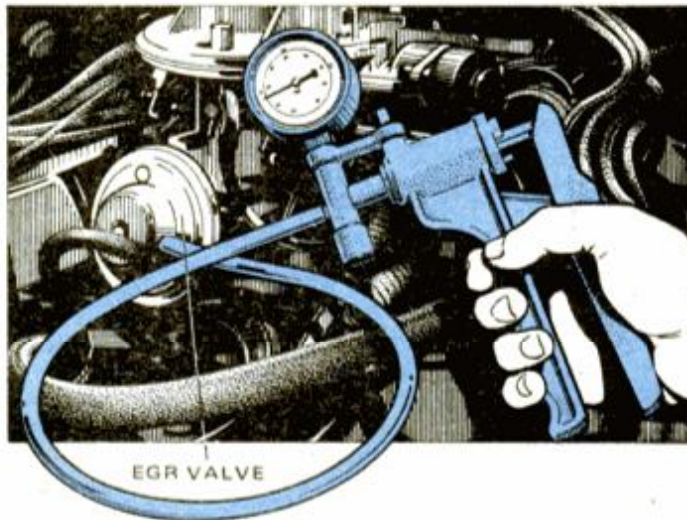
By the way, replace the PCV (crankcase) filter inside the air-cleaner housing when doing a tune-up. A plugged filter causes the same problem as a plugged PCV valve, including rough idle, greater oil use and exhaust odor.

■ **EGR valve:** Use a hand vacuum pump to test the EGR valve. With the engine warmed up and running at specified slow idle, disconnect the hose plugged into the EGR valve. Attach the hand vacuum pump to the valve, and pump up the tool until the gauge reads at least 4 inches of mercury. The engine should start missing. If the engine doesn't miss, the EGR valve needs service or replacing.

■ **Fuel-evaporation-system canister:**

With the engine cold and turned off, see if you can move the valve. If you can, give both ends of the valve shaft a shot of manifold-heat-control valve solvent. If the valve is stuck, try freeing it by tapping lightly with a plastic-headed hammer. Once the valve is free, be sure to lubricate it.

■ **Thermostatic air control system:** If the carburetor air cleaner snorkel is open at the end, see if there's a valve inside the snorkel. Start the engine, which should be cold, keeping your eye on this valve. The valve should close over the snorkel. In about a minute, when engine temperature reaches 100° to 120° F., the valve should open. If the valve doesn't open when it should, some repairs



A hand-held vacuum pump will test any vacuum-operated device in your car, including EGR valve. To test latter, attach the pump to the valve at its hose fitting after setting the idle speed to specs for this test (which is slower than normal). Then pump the gauge up to 4 inches Hg. If the engine does not start missing, EGR valve needs either servicing or replacement.

With the engine off, remove the canister and replace the filter, which, in most cases, is in the base of the canister. This service doesn't have to be done every tune-up. Replacing the filter once every 30,000 miles is adequate.

■ **Manifold heat-control valve:** If your car has one, you will find this valve under the exhaust manifold.

are most likely to be required.

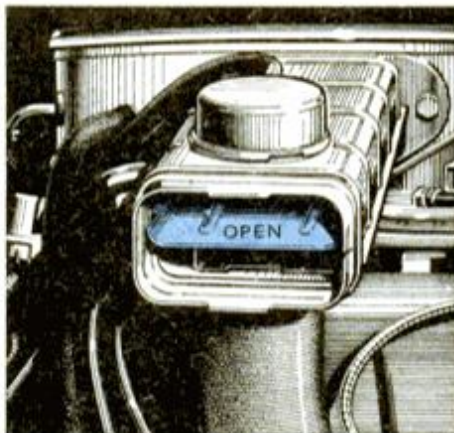
Timing the ignition

Connect a tachometer and ignition timing light. You need the required timing specification from the service manual or vehicle emissions-control label.

Wipe timing marks clean and outline the specified mark and pointer with chalk or nail polish to make them stand out. In most cars, the vacuum hose has to be removed from the vacuum-advance chamber and plugged. Use a golf tee or pencil stub as a plug.

Start the engine, let it warm up and aim the timing light straight at the timing marks. If the specified mark doesn't appear to be stationary in relation to the pointer, loosen the distributor hold-down and turn the distributor until the timing mark lines up with pointer and appears stationary. Tighten distributor and recheck setting.

Now, get the car on the road and run it at slow and highway speeds. See how the engine responds and check your mileage—it should be better than before. **PM**



Flap in air-cleaner snorkel should open fully when engine temperature is 100° to 120° F. (about a minute after starting).

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Simple clamps you make from scrap



Long, thin strips of wood scrap, wedged between ceiling and delaminated guitar top, act as inexpensive clamps.

Clamping parts for gluing bulky or odd-shaped assemblies is often a problem in the home workshop. The method shown here works fine in some otherwise impossible situations. The object is to apply pressure with flexible strips bent and wedged between the workpieces and the joists overhead. Most active shops have an assortment of such strips left over from ripping long boards.

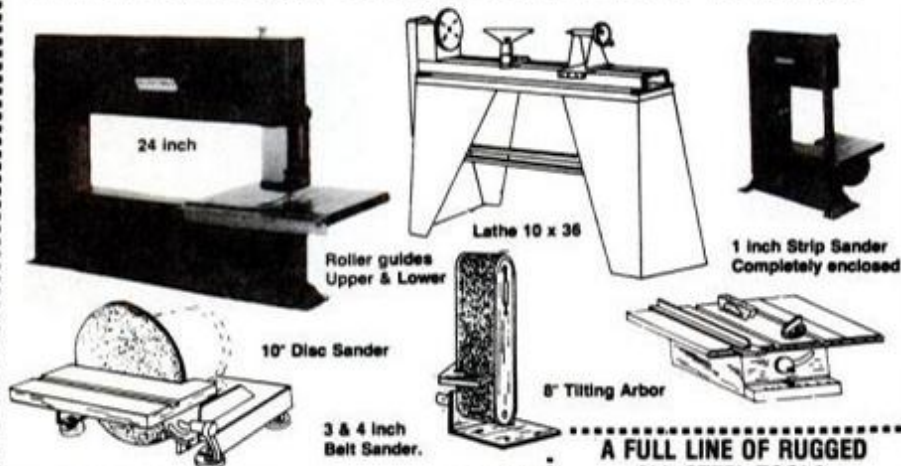
Your circular-saw table, covered with plywood, makes an excellent work surface on which to do the assembly job.

Make a trial run by assembling the work dry on the table surface. Then cut a number of spring strips 1 inch or so longer than the distance from the part to be clamped and the overhead joists. The sticks can be made from any scrap on hand 1/4 in. or more in thickness, 1 1/2 in. or more in width. Even if the strip lacks spring, clamping action may be obtained by tapping the top edge of the strip while sliding it under the joist.—*Emery J. Loiselle.*

Editor's note: Be sure to protect the workpiece surface with a block of scrap wood. The block will help distribute the pressure of the clamping strip evenly.

A convenient, but out-of-the-way place to store the stick clamps is on a rack between the joists overhead.

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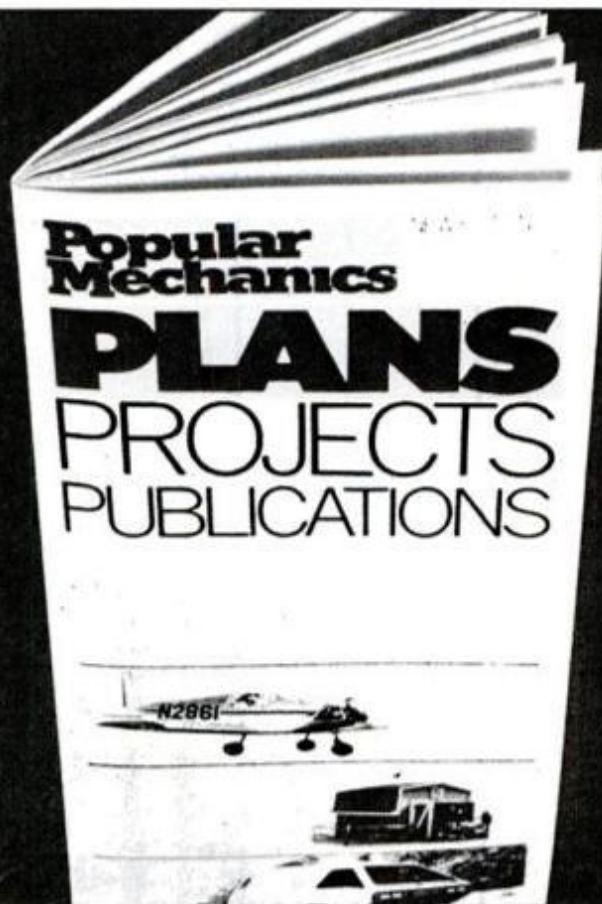
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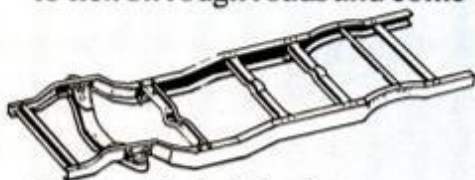
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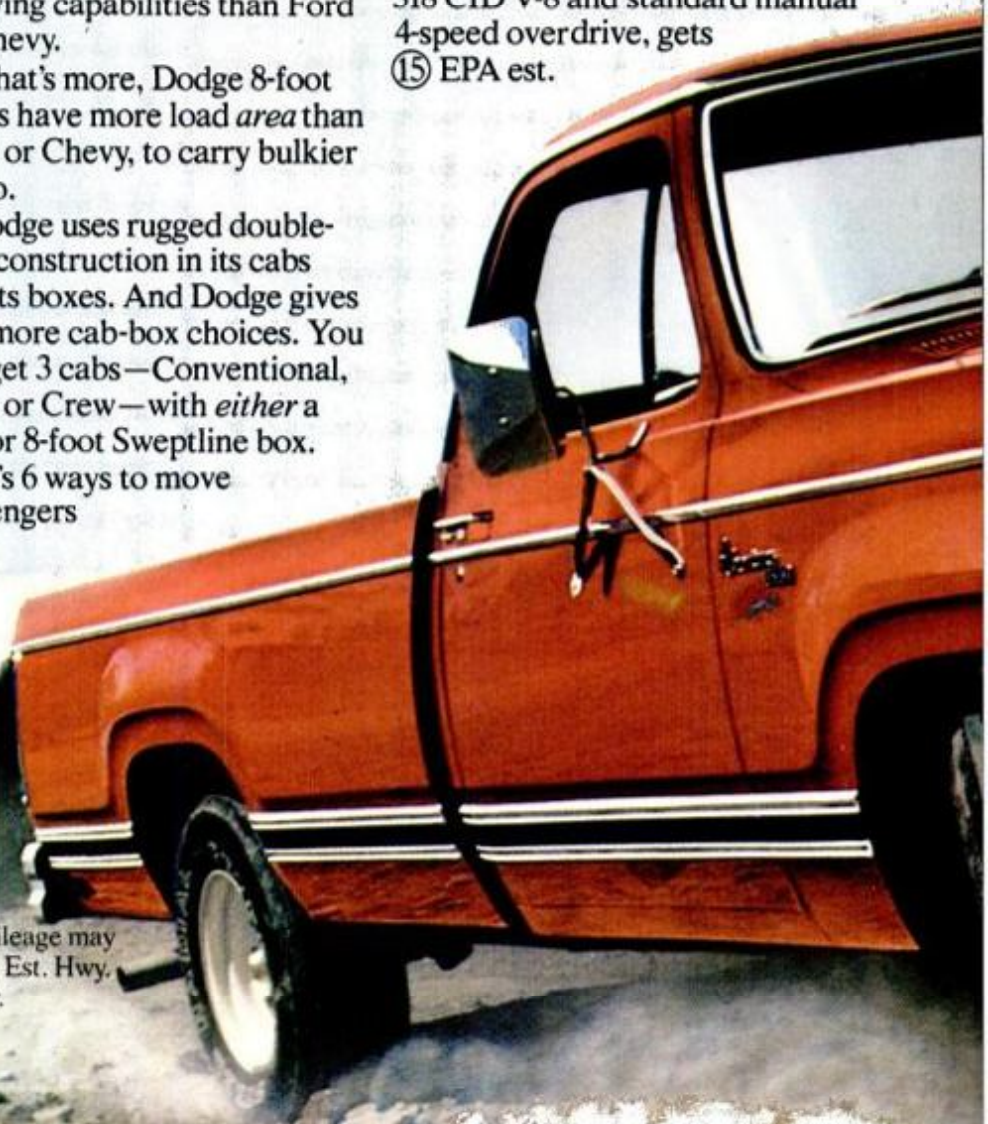
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*Use EPA mpg number for comparisons. Your mileage may vary depending on speed, distance and weather. Est. Hwy. will probably be less. California estimates lower.

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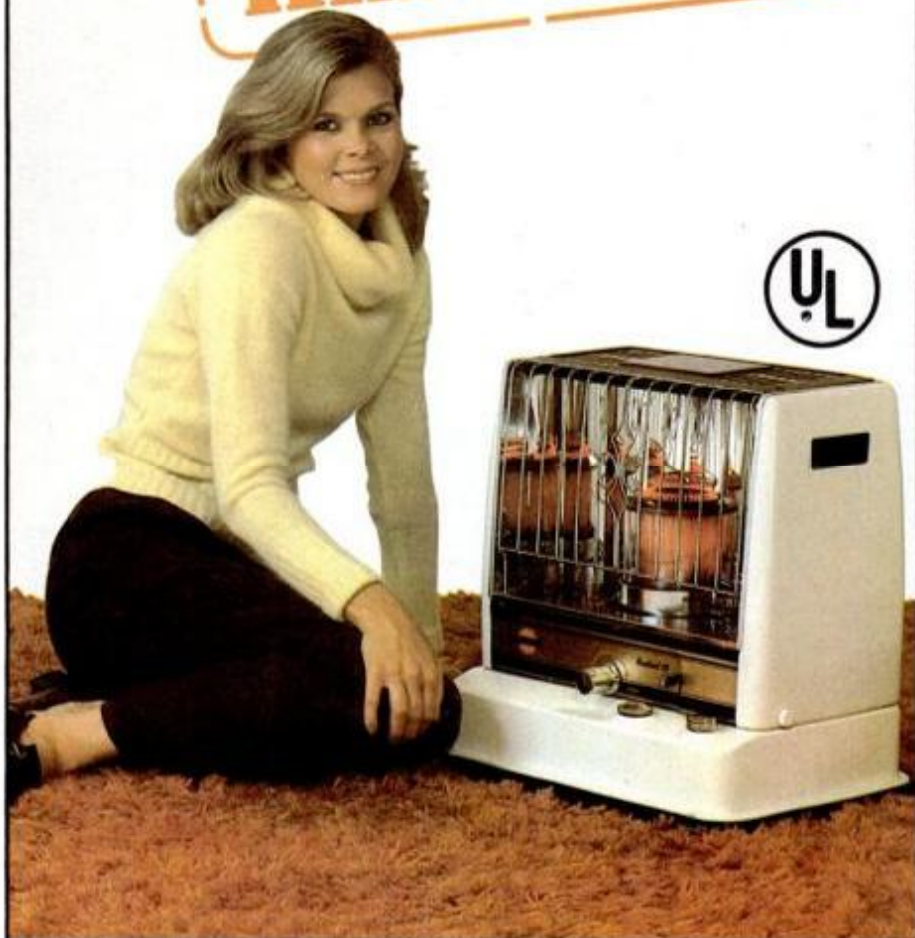
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PHOTO HINTS

Foam base



A 3/4-inch-thick piece of foam in the bottom of your camera bag will soak up damaging vibrations and will lessen the chance of damage if you inadvertently set the bag down hard.—*Bob Berger*

Siamese lenses



By either taping or epoxying two rear lens caps together, back to back, it's possible to increase usable space in a camera bag. As shown above, a 20-mm and 85-mm lens (right) will fit in space of 200-mm lens (left).—*Jim Colburn*

Recycling 35-mm cassettes



Film cassettes can be reused for bulk film. When rewinding film in the camera, stop when it pulls free of the takeup spool. After pulling out the film for processing, cut it so an inch or so sticks out. Tape the new film to this tongue and wind it into the cassette.—*K.A. Wagner*

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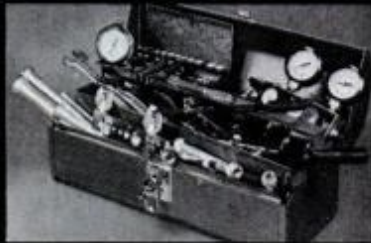
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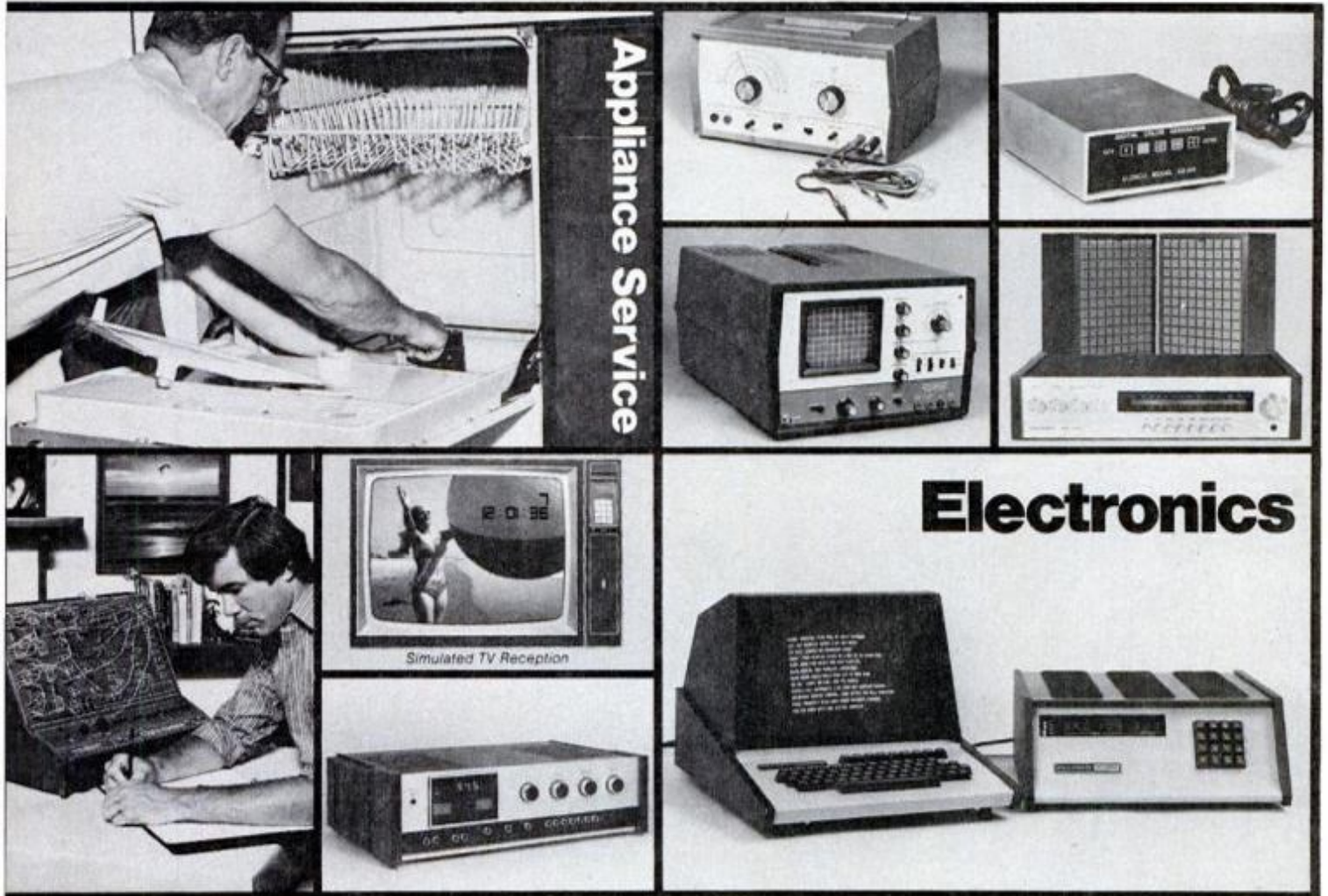
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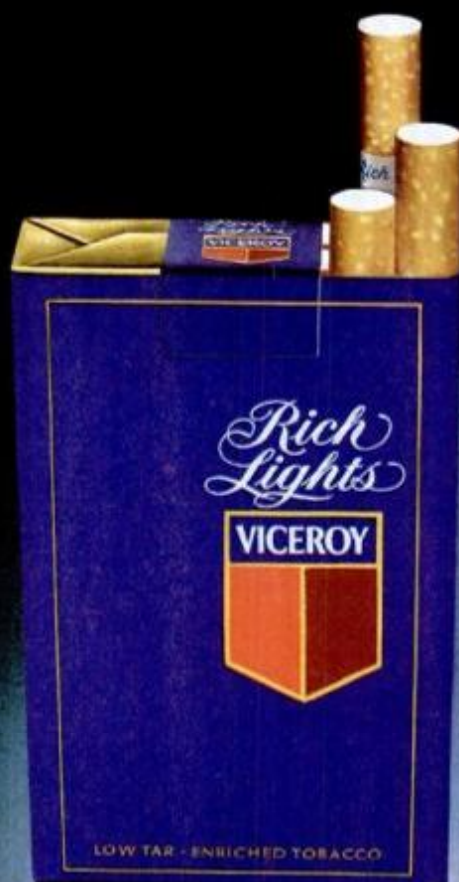
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CAR CLINIC

SOLUTIONS FOR MECHANICAL HEADACHES

BY MORT SCHULTZ



Borderline case

Popular Mechanics has paid for itself with articles on electronic-ignition troubleshooting, particularly the ones in April and June '78. However, I would like to point out that a faulty electronic-ignition coil doesn't always show up with an ohmmeter test, as the articles describe. Your readership may profit from my experience, as follows:

I recently had an ignition problem with my 1977 Buick station wagon and exhausted, without success, all steps in the High Energy Ignition (HEI) part of your article. For example, I swapped electronic modules between this car and our 1976 Buick Regal. As an afterthought, I then switched coils. I had tested the coil from the station wagon with an ohmmeter, and it had tested okay. But switching coils transferred the problem from the station wagon to the Regal. Apparently, the questionable coil had enough integrity to show normal resistance under the low voltage of the ohmmeter. I replaced the coil with a new one and restored the car to proper running condition.—David Stoops, Deer Park, Tex.

You are right. A bad coil may not break down until it is hot and has built up resistance. This is why engines having bad coils often won't demonstrate ill effects, such as failing to run, until they have been driven several miles. This is true not only of electronic-ignition-system coils, but also of coils in conventional-ignition systems.

The whole truth

I cannot get an accurate answer to my question, so I'm turning to you. Because of the gasoline situation, I'd like to know what damage, if any, I will do to my new Lincoln Mark V by burning regular rather than lead-free gasoline. Some filling-station operators tell me to use regular; some say don't. The Lincoln dealer has only increased the confusion. He says to burn regular if I can't get lead-free. If damage is done, what would be required to restore the car to

the condition it was in before using regular gasoline?—Dr. L.M. Holloway, Swartz Creek, Mich.

One tankful of regular leaded gasoline will ruin the catalytic converter. Restoring the car will require installing a new catalytic converter. A new catalytic converter costs several hundred dollars. And those are the facts.

Fancy that

Our Sunday newspaper ran a Sears Automotive Center ad for an engine tune-up that mentioned, among other services, a thing called a cylinder balance test. Is this a fancy name for a compression test, or what?—Duane C. Benson, St. Louis.

It's a name for "or what," Duane. However, better check with the Sears store to see what they mean.

A compression test and cylinder balance test are not the same. A compression test is done with an instrument that tests the compression pressure of each cylinder. Sparkplugs are removed and the compression tester is inserted into sparkplug ports, in turn. The engine is cranked to record compression. A cylinder balance test, on the other hand, is a dynamic test that mea-

sures the contribution of each cylinder to engine performance. By "dynamic" I mean that the test is done while the engine is running, usually at high speed, such as 2000 rpm. The car, obviously, is at standstill so that the person doing the test can short out each cylinder, in turn, and watch the results on a tachometer. The purpose of this is to determine engine response. If there is a sharp drop in engine rpm as a cylinder is taken out of service, it means the cylinder is strong and contributing. If the engine shows little or no response as a cylinder is shorted out, the cylinder is weak and not contributing.

As long as you're asking about engine tests, let me explain another one you may come across. It's called a cylinder leakage test. The procedure involves injecting air pressure through a flow meter into each cylinder, in turn, through sparkplug ports and measuring the amount of air loss.

In other words, you will know how much air is being injected—let's say, 80 pounds per square inch (p.s.i.). If the flow meter shows a reading of 40 p.s.i., then you know that half the air is being lost because of leakage. The areas of leakage include exhaust and intake valves, piston rings and head gasket.

Often, to find the source of the trouble, the one doing the test listens for air escaping at various points while air injection is maintained.

For example, if he can hear air escaping from the exhaust pipe, it means the exhaust valve in the cylinder is at fault. If he puts his ear to the carburetor (intake manifold) and hears air escaping, the intake

(Please turn to page 44)

Use buttons—not zippers

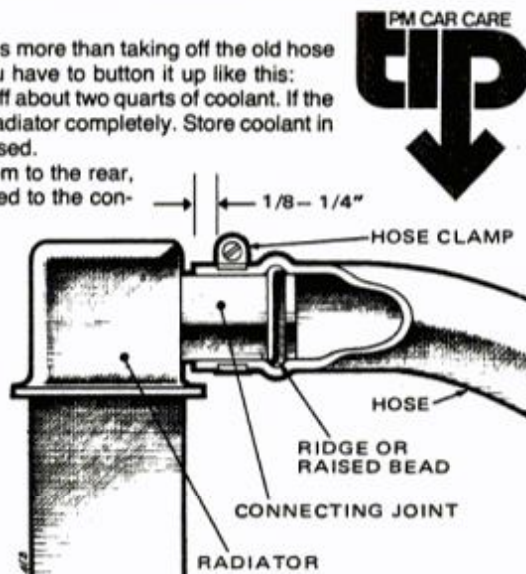
Replacing a cooling-system hose involves more than taking off the old hose and installing the new hose, zip-zip. You have to button it up like this:

If the top hose is to be replaced, drain off about two quarts of coolant. If the bottom hose is to be replaced, drain the radiator completely. Store coolant in a clean container, if coolant is to be reused.

After loosening clamps and sliding them to the rear, twist the hose free, but if the hose is fused to the connector, do not use force. You could damage the connector. Slit hose lengthwise, pry off with screwdriver.

Use sandpaper to clean old, dry sealer off the connector. Then, coat the connector with a thin coating of fresh sealer. Don't apply sealer to the inside of the hose. It might clog the radiator.

Slip hose clamps over the new hose about 1/4 inch from the end. Twist the new hose onto the connector. See that clamps are positioned past the raised bead, but be sure to leave 1/8 to 1/4 inch between clamps and end of the hose as you tighten clamps.



CAR CLINIC

(Continued from page 43)

valve is to blame. Listening at the oil-filler cap opening may reveal bad piston rings, and looking inside the radiator to see if coolant is bubbling can uncover a head gasket that has blown between a cylinder and water jacket.

If the actual source of the leakage doesn't show itself to this point, a compression test is done to determine if the head gasket has blown between cylinders.

Heading for trouble

I recently installed headers and side pipes on my 1979 Jeep CJ-5, which has a 304-cu.-in. engine. I later discovered that I forgot to plug a hose running from the exhaust-gas-recirculation (EGR) system. This produced a vacuum leak, which you could hear by listening to the engine as it idled.

A friend of mine who is a mechanic, brought this to my attention when he inspected my work. He plugged the hose, but warned me that I may have burned a valve. Is he right? If so, how can I test to find out if damage has been done?—Brian Stoll, Hickory, N.C.

Not only could you have burned a valve, or valves, you could have also burned a hole in a piston, or pistons. When an engine is forced to run overly lean, a temperature increase takes place that could exceed the breakpoint, resulting in this kind of damage.

To find out whether damage has been done, make a compression or cylinder balance test (as discussed in the previous item).

A voice from my past

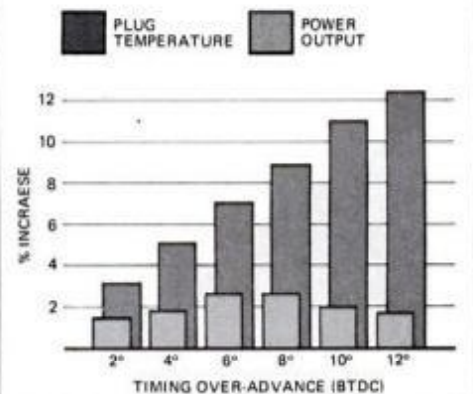
Hope you can help me. I can't get instructions on how to adjust the air space of an electronic ignition in a 351-cu.-in. engine in a 1977 Ford pickup truck.—Irving Lampert, Linden, N.J.

After almost 20 years of writing Car Clinic, I finally got a question from someone I know. Irv hasn't associated my name with the family that once lived in Linden. Hey, Irv, it's me—a voice from the past, to tell you that there are no adjustments to make to the Ford Dura Spark ignition system, other than timing and sparkplug gap.

Could it be possible that you may also have a Chrysler car in which the air gap can be adjusted and, therefore, you think the same

Overadvancing timing

Seeing is believing. So maybe this graph from Champion Spark Plug Co. will convince some people that overadvancing ignition timing beyond a certain point gains you little. The graph compares engine power and sparkplug temperature. It shows that the power output of the particular engine reached maximum at 8° of timing advance. At this point, the additional power output was a meager 2.4 percent more than if the ignition was timed to specification. In other words, there was not much gain. Yet, the rise in sparkplug temperature that occurred with the timing advance could have resulted in serious damage to internal engine components and to burned plugs. Advancing timing also increases fuel usage.



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Available in pump or aerosol.

has to be done in the Ford? Not so.

Starter assist

I couldn't get my 1975 Honda Civic to start on very wet, humid mornings, so I looked for help in an auto-parts store. I spotted printing on a can of WD-40 that said, "Corrects moisture-induced electrical short circuits." Why not? So I bought the product, sprayed it on sparkplug and coil wires when I next had trouble and, sure enough, the engine started right up.

I've used the spray on several occasions since, and it has yet to fail me, even when the engine quit following a downpour. Hope this tip helps some of your readers.—Charles H. Kovarik, Edwardsville, Ill.

Hey, Charley. It'll probably help more than just some. Thanks.

GM comes through

In the Aug. '79 Car Clinic ("Where there's smoke. . .?", page 35), you told about "alleged" failure of the 305-cu.-in. Chevrolet-engine camshaft. [Editor's note: The engine is also in Buick, Oldsmobile and Pontiac cars, and GMC trucks.] I own a 1977 Chevy Nova with the 305 engine. At 15,000 miles, it started knocking. The diag-

nosis given was "camshaft failure."

I had the engine repaired at a local Oldsmobile dealership, because I find this dealer more reliable than the Chevrolet dealer. Three lobes were missing from the camshaft, and cam lifters were cup-shaped and gouged on the bottom. I contacted the Chevrolet zone office in Detroit, and they sent someone to inspect parts. I had a check for the amount of the repair bill within two weeks. I was told that GM has had a problem with the alloy in a batch of 305-engine camshafts.

I was really surprised the company reimbursed me for the repairs. Since I do all my own service work, they took my word that I changed oil as called for under the warranty. The bottom line to my story is this: If anyone out there is getting the run-around, don't give up hope. Keep pressing.—G. Brown, Kalamazoo, Mich.

Good advice, G. Brown.

Service and safety tips

■ Chrysler Corp. has announced availability of a professional tool kit designed especially for the Saturday mechanic. The kit contains 25 "top quality" tools, including a sparkplug gauge; tire gauge; 3/8-, 1/2- and 9/16-in. socket wrenches; 8- and 13-mm socket wrenches; ratchet; universal joint and extension; pliers; combination open-end and box wrenches; screwdrivers and a wrench for a 4-in. oil filter. You can order it from Truecraft Tool, Box 94009, Chicago, Ill. 60690. Price is \$39.95.

■ If you own a 1978 GM car that isn't included in the recall program to repair a front-wheel bearing problem, don't relax yet. The National Highway Traffic Safety Administration is looking into the possibility that all '78 GM cars may be affected, not only the ones initially involved: Chevrolet Malibu, Monte Carlo and El Camino; Pontiac LeMans and Grand Prix; Oldsmobile Cutlass; Buick Century and Regal; and GMC Caballero. If there's an indication of impending wheel-bearing failure, such as noise or hot hubs after driving, get bearings checked. The repair involves installing new outer wheel bearings, lubricating with new grease, coating the spindle with more grease and installing new grease retainer caps.

■ Ford says that if you replace a front-brake rotor on one side of a Fiesta, the engineering number stamped on the outer edge of the new rotor must correspond to the number stamped on the outer edge of the rotor on the other side of the car. At first glance, numbers look alike. So examine each numeral carefully. **PM**

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.

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THE PM GARAGE

CAPSULE REPORTS ON NEW AUTO PRODUCTS

Safe fuel can

Recently, I found a safe can for transporting gasoline, whether it is for my lawnmower, boat, or to extend the range of my car on a gas-tight weekend.

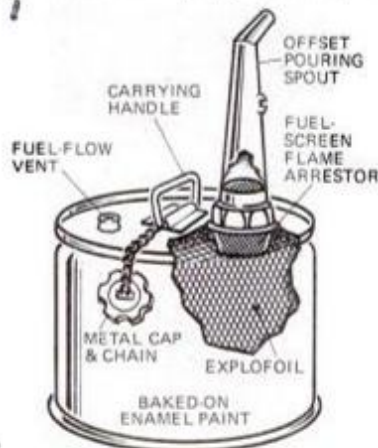
Called Explosafe, the container is a heavy-duty steel can filled with a mesh of aluminum foil. This "Explo-foil mesh" divides the contents of the container into thousands of honeycomb cells. The mesh dissipates heat rapidly and does not support uncontrolled combustion, according to Vulcan Mfg. Co., 15 Bethridge Rd., Rexdale, Ont., Explosafe maker.

Flame-arrester screens in the pouring spout and filler neck prevent an open flame from entering the fuel can.

Explosafe's vent plug is sealed with a low-melting-point alloy that melts at 160° F. to relieve internal pressure. Because the vent plug is normally closed, fumes aren't a problem when transporting or storing.

Explosafe is available nationwide at Western Auto Stores, and at Caldor and Times Square Stores in the New York City area.

If you can't find Explosafe locally, it is available by mail in 1-, 2½- and 5-gallon sizes at \$24, \$30 and \$38 re-



Unique features of Explosafe fuel can make safe gasoline storage possible.

spectively, plus \$2.50 each for shipping. Jens Jurgen Wegscheider, Travel Information Bureau, 14 Mulberry Dr., Huntington, N.Y., 11743 has them.—*Angus Laidlaw*

Tough workgloves

Ever try to change a tire on a cold winter night? It's not a very pleasant chore. If you leave your gloves on, you'll soil them rather quickly, and who wants to ruin a \$10 pair of

dress gloves? If you take off your gloves, your hands will get filthy, and maybe even frost-bitten.

But I've discovered the perfect solution—Wells Lamont's "Hob-Nob" workgloves. Hob-Nobs are soft and comfortable like ordinary cloth workgloves, but their palms are lined with tough, texturized plastic dots for better grip and long wear.

Hob-Nobs are not only useful when changing tires, but also when attending to other outdoor chores during the winter. I keep mine in the



Plastic dots on Hob-Nob gloves help user get grip on tube of Genie Lock De-Icer.

trunk of my car right next to the spare tire. They cost less than \$2, and are available at many hardware, grocery and variety stores.

Wells Lamont, 6640 West Touhy, Chicago, Ill. 60648, makes them, along with a series of vinyl-coated gloves called "claw hand," which are ideal for car washing during cold weather.

If you write to Wells Lamont, you'll receive a booklet describing dozens of workgloves for every purpose.—*Moss Miller*

A genie in a can

I used to be frustrated when the locks on my car iced up. I could no longer use the vehicle—at least not until I had heated the key with a match or just "lucked out."

But now I've got a genie working for me—Genie Lock De-Icer. I simply push Genie's red tip into my car's frozen lock, and a spring-loaded valve directs Genie's aerosol spray directly into the lock's mechanism. Then, presto! The isopropyl alcohol in Genie's tiny 4-inch cylinder magically de-ices the lock. Genie's spray contains a lubricant, as well, and is much easier to use than those old-fashioned lock lubricants in squeeze containers.

Genie is sold at auto-parts and de-

partment stores for under \$1. Auto Aid Mfg. Corp., 195 West First St., Mount Vernon, N.Y.—*Moss Miller*

Blizzard beater

Anyone who drives during the winter faces the threat of being stranded in a blizzard. When the snows come, it pays to be well prepared. Fatality statistics among the snowbound are frightening.

I used to carry a few supplies in my car in case I was stranded, including a bulky blanket and some candy. Recently, though, I discovered a survival kit called Blizzard Beater, especially made for auto use. It's manufactured by Dun-Rus Co. Inc., Box 111, LeSueur, Minn. 56058.

Inside Blizzard Beater's compact 11×5½×3¾-inch red plastic container, there are nine items that are helpful in surviving a blizzard, many of which I would never have thought of carrying. For example, a special blanket that folds into an envelope about the size of a pack of cigarettes, yet, amazingly, this thin 56 by



Compact Blizzard Beater can be a lifesaver.

84-inch blanket can conserve up to 80 percent of its user's body heat. A 12-hour candle fits in the bottom of a burner unit, which is assembled when some hard candy is removed from another container. The burner unit is used to melt snow for water, which in turn can be used to make instant coffee or soup (packets to make these drinks are also supplied). Matches are contained in a waterproof case.

The survival kit also includes a red emergency flag and a booklet of instructions you'll need for weathering the storm.

Blizzard Beater is a necessary item for anyone who drives where heavy snow is a problem. It also makes a wonderful gift. It's \$12.45 postpaid from: Mr. Sun, Airport Rd., Alexandria, Minn. 56308.—*Moss Miller*

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APPLIANCE CLINIC

QUESTIONS ANSWERED

Some quiet, please

I have a new Maytag WU 900 built-in automatic dishwasher in a large kitchen-dining-family room area. The unit makes too much noise. Should I add extra insulation under the pump area to quiet things down?—Mary Lee Winter, Great Bend, Kans.

It's not advisable. Beneath a dishwasher there are moving parts that can get fouled. The drive belt, or pump or motor pulley may get snarled in the insulation. However, you may reduce noise by insulating around the sides and the top of the machine.

Before you do anything, call an authorized Maytag service technician. The noise may not be normal. For example, the belt may be vibrating or the pump may be faulty.

Icemaker with freezing tube

Water freezes in the icemaker fill tube of our 5-year-old Amana two-door refrigerator-freezer. The blocked incoming water leaks from the water valve and spills onto the floor. Instead of making a permanent repair, the serviceman has been running a heated screwdriver up the tube to melt the ice. What do you think is causing the problem?—Marvin L. Herbst, Simi Valley, Calif.

The problem is probably being caused by one of the following conditions:

■ The freezer may be set to provide a temperature that's too cold. Set it in the 0° to 2° F. range.

■ A clogged water-valve filter may be reducing water pressure at the valve, causing the valve to remain open when it should be closed. Water pressure of 20 pounds per square inch (p.s.i.) is needed to close the valve. If there is a drop in pressure, which a clogged filter will cause, water will leak past the valve into the fill tube and freeze. As more water seeks to enter the tube, it will be blocked by ice and back up. Clean the water-valve filter.

■ A drop in water pressure below 20 p.s.i. for some other reason, such as a restriction in the line.

■ Insufficient insulation around the fill tube.

Follow-up on oven glass

Two worthwhile comments came our way from readers who have had experience cleaning the window panes of an oven door. The com-

ments were in response to the procedure we outlined in "Grease," (*Appliance Clinic*, page 8, Aug. '79)

■ Mrs. Delmar Bequette of Edwardsville, Ill., wrote that after the family disassembled and cleaned the oven glass and used their Tappan range several times, the glass cracked. "Reason: The inside glass is heat-treated. Not knowing this, we reversed the positions of the two panes," wrote Mrs. Bequette. "Be careful," she went on to say. "Heat-treated glass has a T (for tempered) printed in a corner."

■ John Corzine of Rochester, N.Y., wrote that he noticed moisture between the panes after he cleaned the windows of his GE oven. He left the oven on warm in an attempt to dry out the moisture. "Ten or 15 minutes later, the combination of moisture and heat caused enough pressure to break the inner pane into several pieces," he wrote. He urges others to make sure the glass is completely dry before reassembling and sealing the panes.

Critical, but not dead yet

Our Bendix Gyromatic washing machine has been serving us practically daily for 28 years. Now the old door gasket has rotted, and I can't find a replacement. Any advice?—Bart Famularo, Uniondale, N.Y.

Congratulations; 28 years is a ripe old age for any machine, especially a washer that has been used daily. I relayed your problem to Jim Baker, owner of Baker Bendix Service in West Palm Beach, Fla. He suggested that you write to the Parts Div. of White-Westinghouse Corp., which now owns the former Bendix consumer appliance manufacturing business. It is located at 930 Duquesne Blvd., Pittsburgh, Pa. 15222. It's worth a shot, but don't expect too much: Appliance manufacturers continue making replacement parts for 15 years, at most.

Baker also said to drop him a note, giving a complete description of your machine (model number, front-load or topload, and any other identification), and he'll see if he can get the gasket from one of his parts sources. His address is 4667 Gar-

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.

denette Rd., West Palm Beach, Fla. 33406.

Failing this, you may want to get a copy of the April '78 issue of PM. In the *Appliance Clinic* column, we printed the names, addresses and telephone numbers of major appliance parts sources in the country.

As a final attempt to keep your grand old machine in use, you could get in touch with several gasket makers. You can make a list of them at the library in the *Thomas Register of American Manufacturers*. Perhaps one of these makers would be willing to fabricate a gasket for you, or give you advice and material so you can try making one yourself.

SERVICE TIPS

■ Scientists at the Tecumseh Research Laboratory in Ann Arbor, Mich., warn that gasohol may be okay for automobile engines, but could be murder on lawn- and garden-equipment engines. Tecumseh Products Co., which operates the laboratory, is a major manufacturer of engines for lawn and garden equipment.

According to Tecumseh, the grain or methyl alcohol in gasohol reacts with the water content present in the fuel and "tends to form strong acids which can corrode metal parts and eat rubber and plastics." Unlike an automobile engine, a lawn and garden machine's engine runs rich and is usually stored for long periods with fuel kept in the tank.

"The potential for corrosion, then, is very real. This corrosion comes from the acid formations," Tecumseh says.

The scientists advise you to "play it safe." Use only unleaded or leaded regular gas in the engines of lawn and garden equipment.

■ Here are six tips from Maytag that will help you to conserve energy when using a dishwasher:

1. Wash full loads only.
2. Take full advantage of the washing system by following the instruction manual for the correct way to load the appliance. Improper loading results in less-than-clean dishes that may have to be rewashed.
3. Water temperature should be 140 to 150° F.; the dishwasher can be insulated to minimize heat loss.
4. Use detergents designed only for automatic dishwashers. Use the proper amount of detergent according to the degree of water hardness. Maytag offers this general recommendation: Use one teaspoon of detergent per grain of water hardness, with three teaspoons as a minimum in soft water.
5. Do not prerinse dishes. Let the appliance do the job it's built to do. This saves additional water used in prerinsing.
6. Let dishes air dry. Select a cycle with no dry time. Or stop the dishwasher after the final rinse. Usually this is done by opening the latch mechanism. Consult the manual for your unit to be sure.

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100's, 19 mg. "tar", 1.3 mg. nicotine, av. per cigarette, FTC Report MAY '78.

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



Buying points where you buy aspirin is a good idea. You might need it.

Point sets from the super store are usually inexpensive, but that's where the headache starts. All point sets are not alike. An inexpensive point set is made of inexpensive parts.

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IPM BRIEFS



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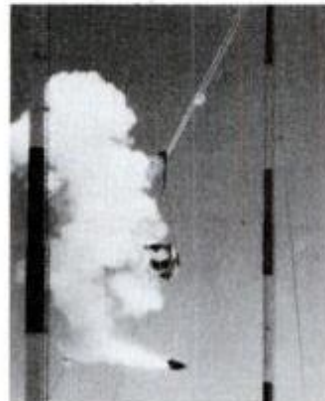
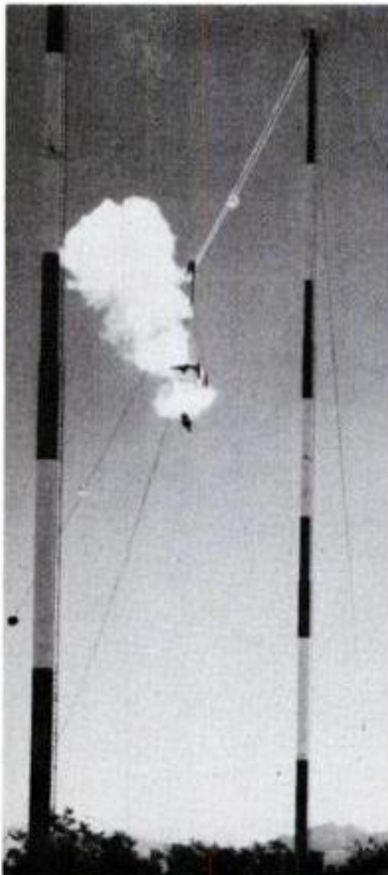
Freddy Van Attenhoven is (1) Belgian and (2) a musician. Knowing only this, Sherlock Holmes would be able to make an extremely good guess as to what's in that odd-shaped case Freddy and his wife are struggling with. To check your own deductive powers, turn the page.



PM follow-up: A moving target

On page 74, Oct. '79, this column showed readers the target ship USS *Ozark*, pointing out that it was one of the vessels serviced by a small "navy" that is actually a branch of the United States Air Force. Our photo showed the *Ozark* resting placidly at anchor well out in the Gulf of Mexico, awaiting whatever cruel fate the Air Force might decide to unload.

Little did we guess that hurricane Frederic would change that picture drastically even before we got it into print. The storm's 90-mph winds broke the *Ozark* free of two anchor cables and blew her ashore nearly 50 miles from her station. *Pensacola News* staff photographer Bruce Graner shot the 5800-ton ship resting in four feet of water off a West Florida beach near the Alabama line. Air Force investigators found her refloatable, with very little damage.



What goes down . . .

It is generally recognized that U.S. Navy pilots deal with fairly hairy flight regimes, as military jet-jockeys put it. Of all emergency pilot ejections from Naval aircraft, some 20-plus percent are ultimately unsuccessful, and it's usually because the ejection is made "out of envelope." This means the aircraft's speed or attitude, combined with that old bugaboo, proximity to the deck, is too extreme to support a normal punch-out.

As these spectacular photos show, however, the Navy intends to do something about it. The device being shown in a test at the Naval Weapons Center, China Lake, Calif., is a vertical-seeking ejection seat. The system uses an 8-inch diameter spherical rocket motor mounted in a two-axis gimbal ring that moves to provide thrust in any direction up to 20° off center. An autopilot coupled to sensors and a micro-computer controls the rate of attitude change through the directed thrust.

Navy testers believe the system has already demonstrated capability for safe ejections from an entirely inverted aircraft with only 50 feet of altitude, and from an aircraft in a 90° vertical bank with its wingtip nearly touching the ground. In the test shown, the dummy cockpit was suspended upside down, 100 feet high.

PM BRIEFS



Whatsit revealed

In 1844, a Belgian named Antoine Sax invented a new kind of horn and persuaded a French Army band to give it a try (his Saxhorn and Saxotromba, ultimately losers, were already on the market). The incredibly hulking saxophone Freddy Van Attenhoven owns is one of nine built in Paris around the turn of the century, of which seven have disappeared. The remaining two are the largest saxophones in the world. Freddy plays it regularly in a concert band, but he does not march with it.

How much (happier) is that doggie in the window?

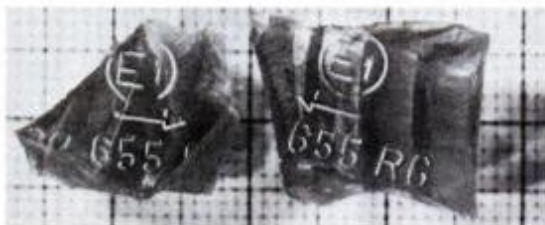
If your dog could talk, as the saying goes, he might complain a little about the view. Experts agree that even though dogs use their noses and ears as primary sensing systems, they tend to feel a lot more secure if they can make visual checks of their surroundings from time to time as well. The photos show how a doggie porthole can be made decorative if the owner wishes, and how a viewing area can be maintained in a heavily shrubbed yard.



PM photos: Allan Farant



Scene on Swiss motorway where an accident victim was struck by hit-and-run drivers.



Magnified taillight lens shards were clues that were responsible for one quick arrest.

On the trail of the hit-and-run driver

The Swiss, often held up as paragons of civilization and social organization, are currently nagged by an increasing number of drivers who commit the most irresponsible of acts—leaving the scene of an accident. The country was particularly shocked by an incident last year in which a man was thrown from the front passenger seat of a car which had skidded into a collision with the guard rail on the N1 motorway between Bern and Zurich. Lying in an active lane, the injured victim was struck by one car while attempting to rise, and run over by at least one more vehicle after that. The man was killed. No driver stopped.

Galvanized by the tragedy, the Swiss police have intensified their already impressive facility for tracking hit-and-run drivers. In one accident, paint chips of an unusual type—from a brown Pontiac—plus computer sorting of registrations led to an arrest only hours after an accident. In another, examination of taillight glass shards under magnification yielded enough of a partial manufacturer's number to direct an investigation which eventually nailed the offending driver.

As of yet, however, no motorist has been connected to the N1 motorway fatality. "We get most of them, though," says Zurich police chief Alfred Hoffman, "either through a member of the public coming forward or through our own tracking methods. As for the increasing number of people who fail to report accidents, the police can only shrug.

"It appears," says Swiss psychologist Adolf von Orelli, "that people are just becoming less ready to accept the consequences of their actions."

The only one to own

Backgammon Panache



From Fidelity—king of the encounter games—comes the most challenging gammon computer you can own or give... and you can, for so very little.

There is something to be said for the universal popularity of Backgammon. Its origins have been traced back 3000 years before Rome.

For most of us, the sum total of this rich history amounts to hours of stimulating play. For the aficionado, it presents an encounter of skill and challenge enmeshed in strategies that have been polished to an art after centuries of practice.

It's no wonder, then, that some of America's finest electronic engineers have sought to put the magic of Backgammon onto a tiny, solid state computer chip. Until recently, the ability of capturing the mathematical complexity of the game, without it costing a small fortune, was near impossible. But, Fidelity engineers have finally done it.

Total Enjoyment

For every enthusiast who has ever moved a tile across a gammon board, the Fidelity Backgammon Challenger is the most exciting and complete electronic game imaginable. Apart from being an exceptional value—we planned it that way—its extraordinary microprocessor brain is pre-programmed with a phenomenal amount of gammon mastery and flexibility.

Play is Easy

Fidelity's success with its chess and bridge games is, in part, its ease of game control. You don't have to become an electronic genius to enjoy their units. In fact, common sense keyboard inscriptions put you in command in minutes.

The Backgammon Challenger is a fascinating teacher as well as an intriguing opponent. You are not restricted to a specific method of play. While some games dictate that the computer roll the dice, the Challenger gives you 3 options:

- You can roll a real pair of dice for yourself, while the computer rolls its own, "dice," for itself.
- Or, you can roll for yourself and the computer.
- Or, it can roll for you and itself.

This flexibility is not available on other, even costlier, games.

Of course, it can double

The doubling cube is very much a part of the Challenger's logic. If, during the action, it feels that it has the edge, it will double the stakes. If you have already done so, it knows to surrender or accept the cube. If it accepts, it quite naturally, can redouble at its own discretion. A tiny red lamp lights to indicate cube possession.

Position Verification

The PV key may be used anytime during the game to display the doubling cube's value. This key is also used to verify stone positions on the field.

Scoring is shown at the end of a game. The Challenger automatically accumulates scores until it is turned off.

It knows the rules

The Fidelity game is exceptionally cunning. It plays a fine backgame and employs duplication and diversification strategies. Its blocking defenses, alone, present an invaluable education for any player. But, it won't permit wrong doing—on either your part or its own. Along with the vast libraries of knowledge that have been fed into its brain, are all the rules that govern regulation play.

Problem Solving

With the Challenger, you can set up specific encounters and then watch how the computer handles them. You can even switch places with it, mid-game, to see how it would carry on with your play.



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Some Specifications

The Challenger is an unusually affordable, intelligent game. Its comfortable half inch square tiles are magnetized to stay where you place them on the scratch proof mylar table. This set is mounted in a simulated wood-grained housing which measures 12 1/2" x 8" x 1". It operates on 110V household current. Bright, half inch tall LED electronic digits provide unmistakably clear readout. It is backed by a 90-day manufacturer's limited parts and labor warranty.

Enjoy it for 10 Days—At our expense

As a gift, or for yourself, the Challenger is a superb Backgammon computer. If, within 10 days you are not satisfied, simply return it for a prompt, no-questions-asked refund.

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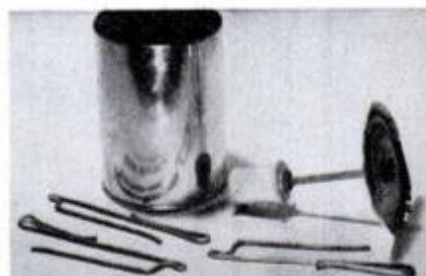
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HINTS FROM READERS

Washer holder

An easy way to keep washers handy is to make hooks of wire from a coat hanger that are slipped over an empty tin can. Add sand to can for ballast. Make a handle of a thread spool, a 3-in. bolt, two nuts and can's lid trimmed to fit. Solder lid at two spots in can.—*Walter E. Burton*



Make hooks of 11¼-in. lengths of coat-hanger wire, bent to shape.



Removable hooks make locating and getting at needed washers easy.

Slippery-steps solution

In winter when wooden outdoor steps tend to get slick, cover them with a rough-surfaced rug. Let it freeze in place on the steps. If possible, use tacks to hold it.—*Helen LeMunyon*

Cutting sandpaper



Edges dull quickly when you use shears or knife to cut sandpaper. You can spare those cutting edges by using a scribe (or awl) and metal straightedge as shown. Score from back.—*H. G. Arelles*

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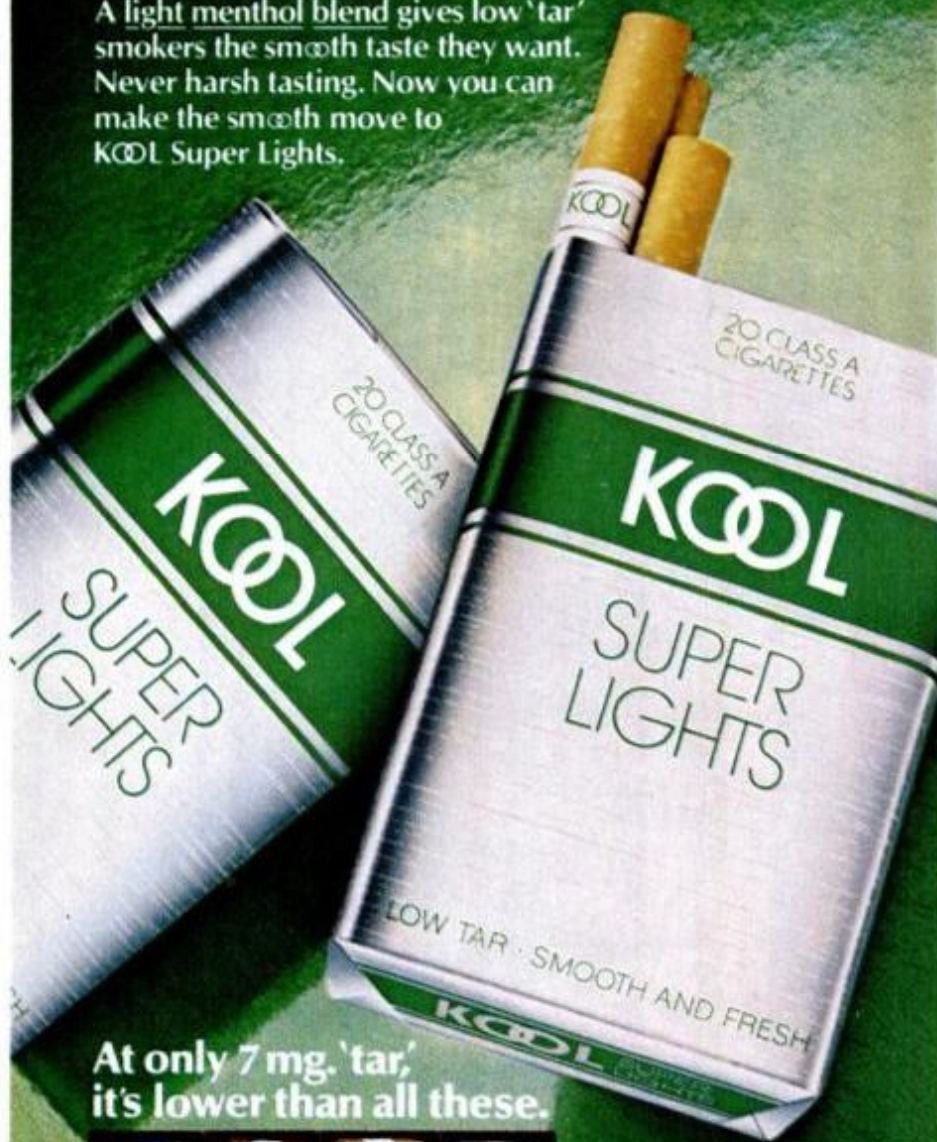
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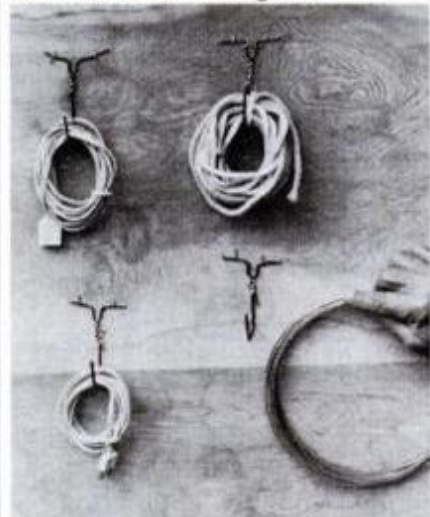
HINTS FROM READERS

Cotter-pin puller



This cotter-pin puller is made of a 7-in. length of 5/32-in. steel rod hammered to shape, and a 1/2-in.-dia. x 1-in. handle with an axial hole bored in it. The rod tip is hammered so it spreads into a head to secure the handle. You can remove pins three ways: Hook the tool end in a cotter-pin eye and pull on the handle; slide bar handle back and forth to produce a hammering action, or strike light blows against the handle with lever-jaw pliers as shown.—Walter E. Burton

Cord and wire hangers

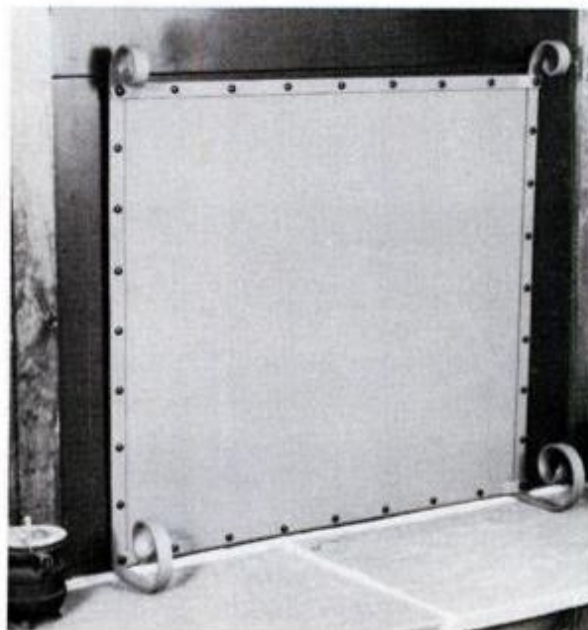


Hooks cut from coat hangers and stapled to a shop wall with heavy-duty staples make excellent hangers for small ropes, wire and electrical cords.—E.V. Reyner

Working with acrylic

If you have trouble removing protective paper from sheet acrylic, apply denatured alcohol to simplify the job.—Robert Stuman

Energy-saving fireplace cover that's easy to make



Do-it-yourself fireplace cover, made of easy-to-work aluminum, offers energy-saving and safety advantages.



To make jig for bending scrolls in bar aluminum, cut slots in one end of 3/4-in.-dia. pipe; clamp pipe in vise. Reposition bar as needed to shape. Test on scrap to see how bend occurs.

This easily-made fireplace cover prevents heat loss up the chimney. It's a boon to those who hate to go to bed with the damper left open. To make it you'll need a metalworking vise, hacksaw, tin snips, portable drill, file, 1-in. or larger C-clamps, centerpunch and model No. K111 Pop Rivettool with a tapered nose.

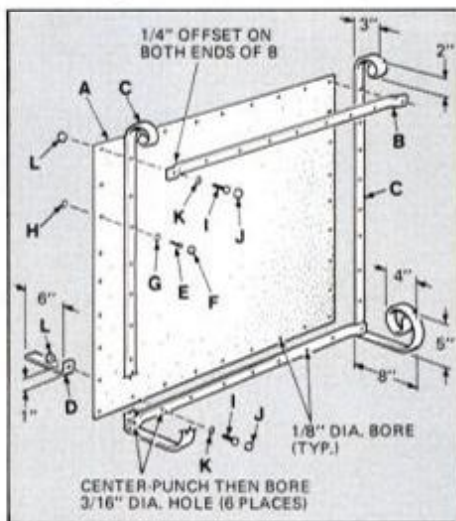
The materials listed are for a fireplace up to 24x34 in. If yours is larger, you can create a cover of two or three panels and use vertical bars (like battens) to conceal the joints.

Cut the aluminum bar stock with a hacksaw (coarse metal blade). Aluminum sheet can be cut with tin snips. Lay out the scrolls on parts C. To start a scroll, clamp a 1/2-in. tip of the bar in the vise and bend. Next, install the slotted pipe in the vise (see photo) and complete the bend. Taper tips slightly with a hacksaw.

After scrolls are made, grip the straight part of C in the vise—where it will bend at a right angle (near the bottom scroll). Hammer the bar as you bend it. Repeat on second bar.

Make the offset bends on parts B as shown. Cut and bend tabs on pieces D. Lay out the frame, check it for square and apply C-clamps at the four corners. Locate, center-punch and drill the corner holes. Assemble temporarily with stovebolts. Next, mark and drill evenly-spaced rivet holes. Align the sheet with the bar frame and clamp. Use holes in the bar stock as a guide to drill rivet

Design and execution: Curran A. Johnson



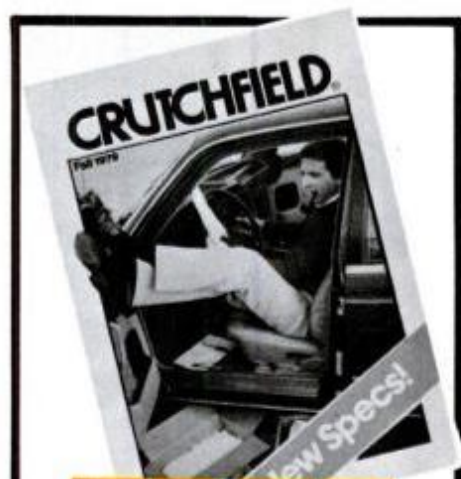
MATERIALS LIST—FIREPLACE COVER

Key	No.	Size and description (use)
A	1	Leather grain embossed sheet aluminum 1/4" less than each o.d. of frame (cover)
B	2	1/4 x 1" aluminum bar; length equal to width of fireplace opening plus 2"
C	2	1/4 x 1" aluminum bar; length equal to height of fireplace opening plus 1", plus 8" (top scroll), plus 21" (bottom scroll)
D	2	1/4 x 1 x 7" aluminum bar (back foot)
E	(as reqd.)	1/4"-dia. x 1/2" Pop Rivet
F	(as reqd.)	small Snap Cap to fit rivet
G	(as reqd.)	Small Snap Cap washer
H	(as reqd.)	Back-up plates to fit 1/4"-dia. rivets
I	6	8-32 x 1/4" rh stovebolt
J	6	large Snap Cap to fit bolthead
K	6	large Snap cap washer
L	6	8-32 nut

Misc.: 00 steel wool, mineral spirits, metal primer and finish coat (such as Rustoleum).

holes through the sheet. Permanently assemble corners; rivet sheet to the frame. Finally, attach D.

File edges. Clean with steel wool and mineral spirits. Use metal primer and finish. Apply Snap Caps. **PM**



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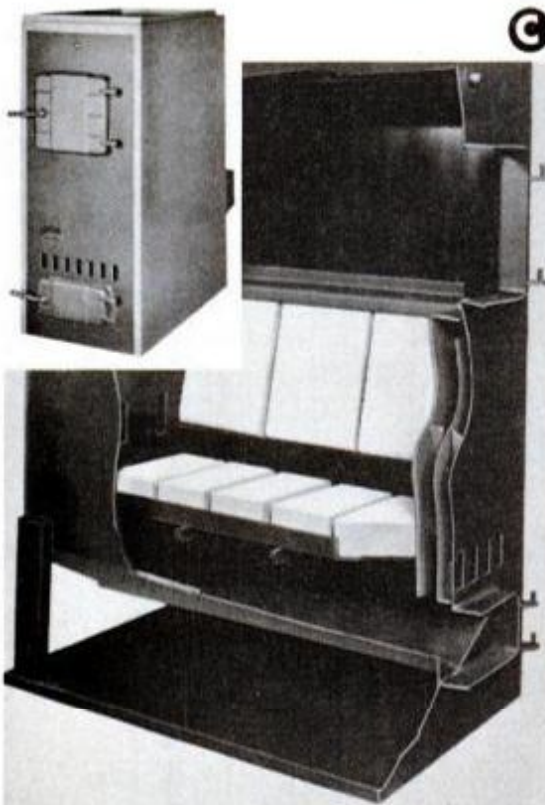
D



B



C



A The Vacu-Flip vise, priced at \$10, mounts by suction. You can carry it to a project, then quickly secure it to a horizontal surface such as a desk, countertop or benchtop; or attach it to walls and other vertical surfaces. Its jaws open to a 2-inch width; they rotate 360°, then lock in place. Wilton's clamp-on vise (inset), \$8, features a clamp for positive mounting. It has a horn-type anvil, dual slide bars and jaws with a 3-inch capacity. Both vises are available at hardware and department stores. Wilton Corp., 2400 East Devon Ave., Des Plaines, Ill. 60018, makes them.

B Glass fiber ceiling panels are from the Owens-Corning "natural series." The design at left is Ambatik, which comes in amber tones. On the right is Cane, which blends with traditional as well as contemporary decors. The panels, which cost 40 cents per square foot, are sold at lumberyards and home center stores. They're backed by a 10-year warranty against warping by Owens-Corning Fiberglas Corp., Fiberglas Tower, Toledo, Ohio 43659.

C The Gemini 2000 wood-burning, forced-air furnace is rated at 85,000 B.T.U.s per hour. It's large enough to heat most medium-size homes. Turbulent, high-temperature combustion is achieved by forcing air from the inducer fan through a bed of burning wood. Furnace requires tending only two or three times a day, according to the company. Output is controlled by a thermostat. An existing gas, oil or electric furnace can be used as a backup system. The unit is priced at \$900 by Gemini Systems Inc., 620 Eliot Ave. S., Rush City, Minn. 55069.

D You can affix this antistatic button with self-adhesive backing wherever convenient to prevent static shock. A finger touch on the "anti-statiz" button draws static electricity away from your body, the maker claims. Light switches, television sets, dashboards and door knobs are objects on which the button can be helpful. Three buttons per pack are priced at \$2. Nan-San Industries, 70 Birch St., North Abington, Mass. 02351 makes it.

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HOMEOWNERS' CLINIC

QUESTIONS ANSWERED

Sweating basement walls

Sweat is forming on the inside surfaces of three basement walls in my brother's new home. There's even a puddle of water forming in the middle of the floor. The fourth wall is exposed entirely on the outside, with no landfill against it. This is a new house, and he would like to have a dry basement. The building inspector says this is common in homes built in this area, as the warm basement walls and cold earth cause sweating. What do you say?—Joseph Feneck, Brentwood, N.Y.

Without seeing the actual condition, it sounds more like moisture seeping through block and joints than sweating. The fact that one wall is exposed indicates that the home is on sloping ground. In this situation there's always the possibility that water is running downhill and hitting the foundation walls.

You might try regrading around the base to divert water away from the wall and adding splash blocks to your downspouts. If this doesn't help, adding a membrane waterproofing and drain tile is, perhaps, the one certain cure. As your brother's home is already built, it may be best to employ a reliable contractor with a small backhoe to do the digging. (See "Musty Basement," *Homeowners' Clinic*, page 70, May '78.)

I cannot stress enough the importance of this work to anyone contemplating building a new house. At that point, the cost is relatively low. Damp basements are high on our lists of reader letters.

Watch for a feature story on solving wet basement problems in an upcoming issue.

Shower curtain woes

How can I keep water from spilling out around the shower curtain while I'm taking a shower? I don't want glass doors.—R. Weber, West Milford, N.J.

The shower curtain must be hung with the ends looped inward, forcing the curtain to hang inward. Caution the family to make certain that the curtain is always inside the tub, with ends tight against the walls.

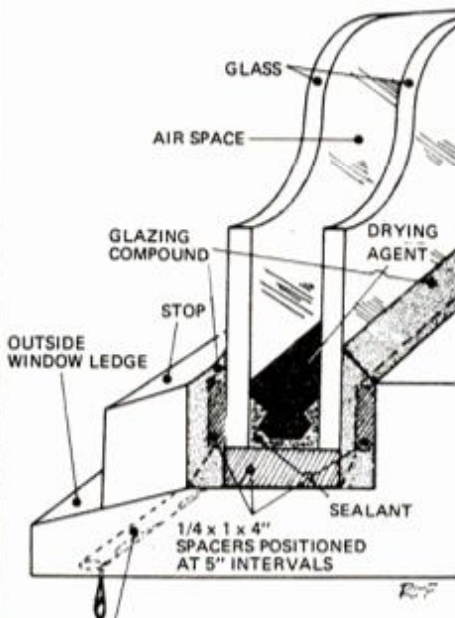
More on insulating glass

James F. Effinger of the Sealed Insulating Glass Manufacturers' Assn. has more tips on insulating glass. (See "Condensation in Insu-

lated Glass," *Homeowners' Clinic*, page 23, Mar. '79.) If you're replacing insulating glass or converting to it, check the following:

1. The glazing compound must be compatible with the sealant (see drawing). This is especially important if, as in the drawing below, there is no optional metal band around the edges of the glazing. Without this metal band the compounds can seep together. Check with your glazier when you make your other purchases for glazing recommendations.

2. The sealant shouldn't rest in accumulations of water. Bore weep holes in the frame before setting the glass. Use special spacers made of



WEEP HOLE IN AREA BETWEEN SPACERS ALONG OUTSIDE WINDOW LEDGE

Weep hole drains water off glass sealant.

synthetic materials to isolate the glass from the wood frame. These may be purchased at a glazier.

3. The sun's ultraviolet rays could destroy the seal rapidly. You can combat this by installing a larger stop, as shown, or by applying a bead of caulking between the edge of the stop and the glass.

4. Obtain complete installation instructions from the manufacturer

Do you have a home maintenance or repair problem? Send it to *Homeowners' Clinic*, *Popular Mechanics*, 224 West 57th St., New York, N.Y. 10019. Letters cannot be answered individually, but problems of wide interest will be discussed in this column. For more home repair and maintenance help, get *PM's Home Care Guide*, \$4.95 postpaid. Send order(s) to *PM*, Dept. HCG, Box 1014, New York, N.Y. 10019.

prior to building the new frames for a conversion job.

Low-radiant heat for doghouse

The plans I have for building a doghouse state that low-radiant heat can be used during the cold winter months. Just what is meant by low-radiant heat and where can I get the required parts?—C. Maynard, Carteret, N.J.

This type of heat radiates directly to objects; it doesn't have to heat the air surrounding them. Low-radiant heat is usually supplied by electric cables in the floors or ceilings.

To protect the cables from damage by the animals, lay them in a bed of sand over polyurethane insulation and vapor barrier, followed by a minimum 3 in. of concrete.

Some cables can be laid directly in the concrete, but insulation is still required to keep bottom heat loss to a minimum. (Use Styrofoam panels.) Temperature controls are required. Protect all wiring in the conduit so your dog won't chew it.

For further information, write: Easy Heat, Engineered Heating Products, New Carlisle, Ind. 46552.

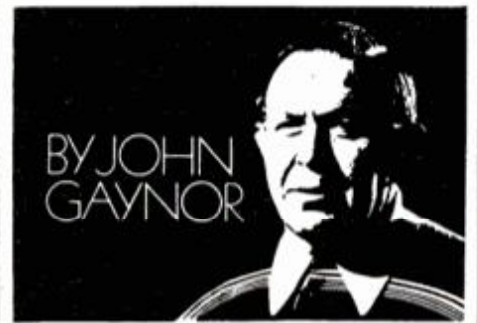
SERVICE TIP

Although cold weather concreting is normally associated with commercial buildings, subways and the like, homeowners don't have to wait until spring to do concrete work, provided guidelines are followed.

For example, you can keep subgrades and forms from freezing. Cover them with tarps and either straw or hay. (Concrete placed on frozen ground will settle as the ground thaws.) Heat the concrete mix to assure that lumps of frozen aggregate are not present.

Protect the placed concrete from freezing prior to its setting. Additives such as High-Early-Strength-Cement are sometimes used to reduce the time that freeze protection is required.

For a brochure defining proper methods of cold weather concrete work write: R.D. MacLean, President, Inland Cement Industries Ltd., Box 2555, Main P.O., Edmonton, Alta., T5J 2T1. **PM**

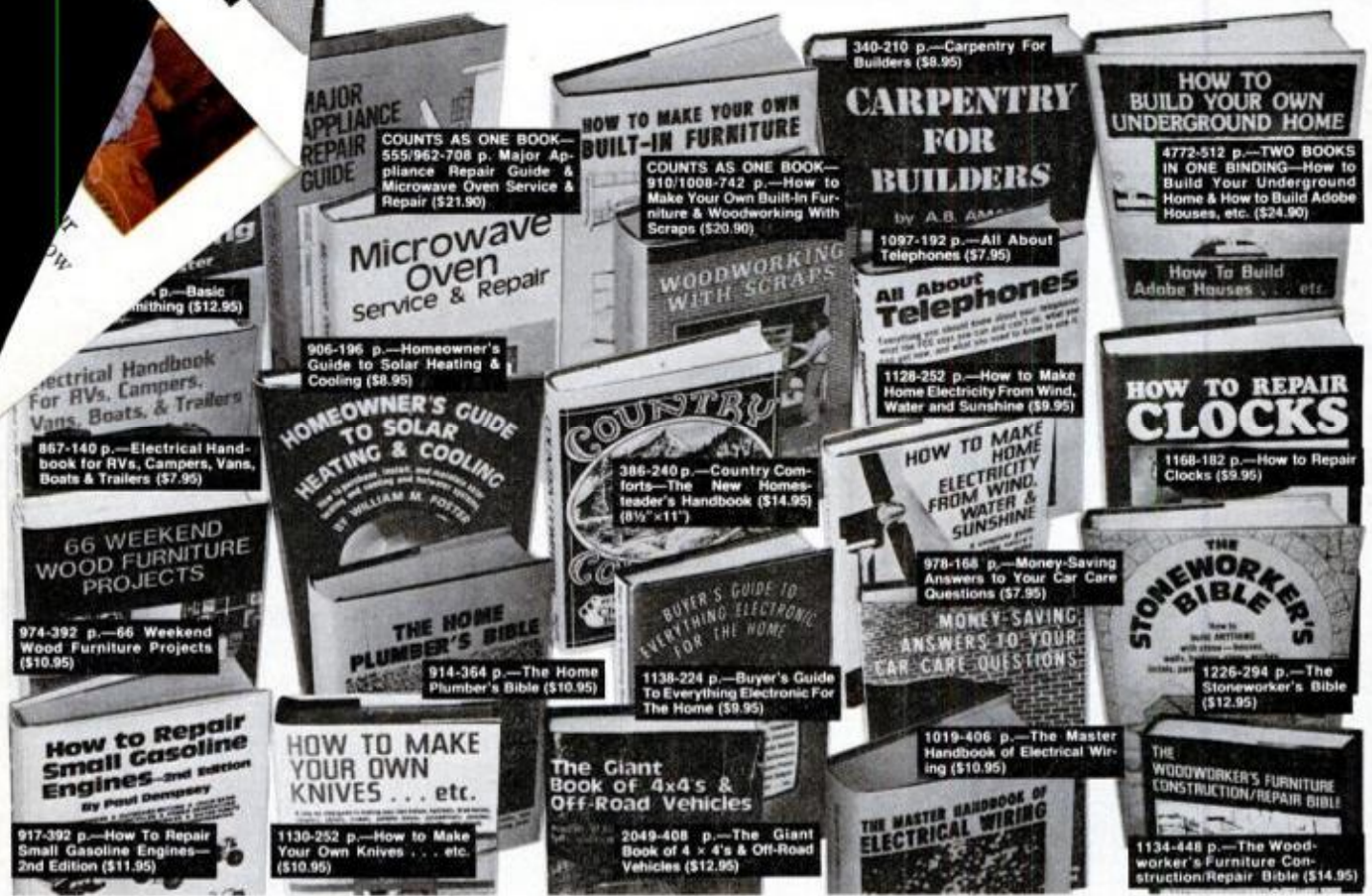


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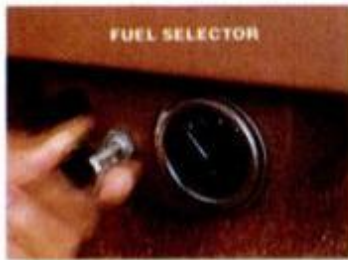
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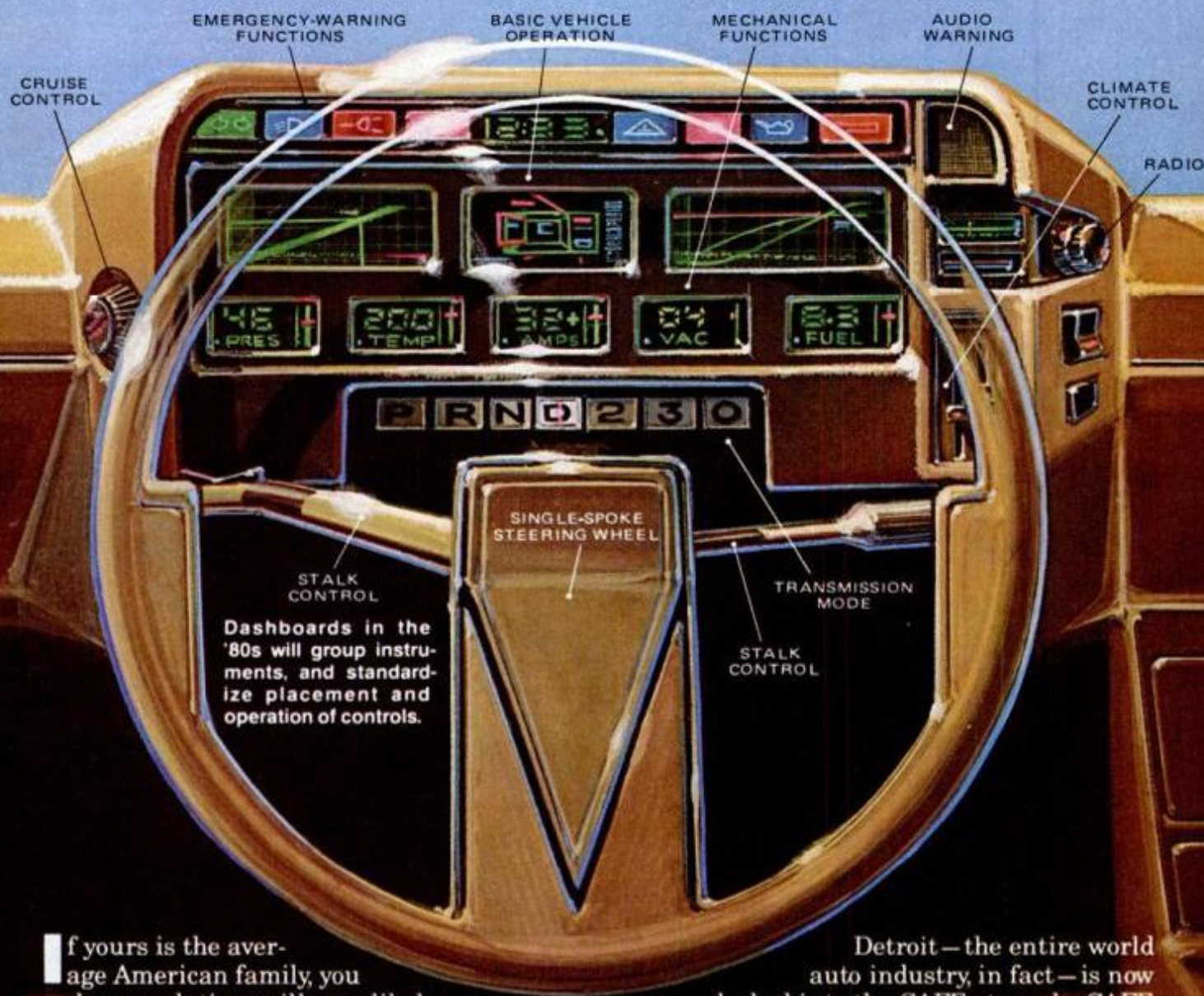
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PM puts you in the driver's seat of... **THE CARS OF THE '80s**

Before you slide behind the wheel of your next new car, here's what you should know about the road ahead.

by Michael Lamm WEST COAST EDITOR



If yours is the average American family, you and your relatives will very likely buy three, four, maybe half a dozen new cars during the decade ahead.

What will those 1980s cars be like? Longer? Lower? Sleeker? More powerful? Not likely.

Smaller? Lighter? More fuel efficient? Better handling? Safer? Slower? More plasticky? More expensive? Yes to all *those* questions.

PM art: Harry Bradley

Detroit—the entire world auto industry, in fact—is now locked into the CAFE struggle. CAFE stands for Corporate Average Fuel Economy.

Each major automaker's No. 1 priority has become fuel efficiency. With the government mandating a 27.5-mpg fleet average by 1985 and around 30 mpg by 1990, all carmakers will have to work furiously just to keep up. Will it be expensive? You bet it will! Ameri-

can Motors board chairman Gerald C. Meyers estimated recently that it'll cost \$110 billion worldwide to meet government and market demands by 1990. Chevrolet's chief engineer, Lloyd Reuss, calculates that it now costs Detroit one billion dollars for every half mpg gain in fuel economy. And as inflation rises, so will that figure.

But while you *will* be paying more, you'll be getting more value per dollar—you'll save on gas, insurance and maintenance, and perhaps save your life in the event of an accident.

"Between now and 1985," a General Motors spokesman told me in a recent interview, "we plan to redo and resize every car line we presently produce." Ford and Chrysler said the same, and even American Motors has some surprises up its sleeve.

Weight is the enemy

Before I began this article, I talked to a number of Detroit engineers, designers, product planners, supplier reps and manufacturing personnel. All agreed that cars will

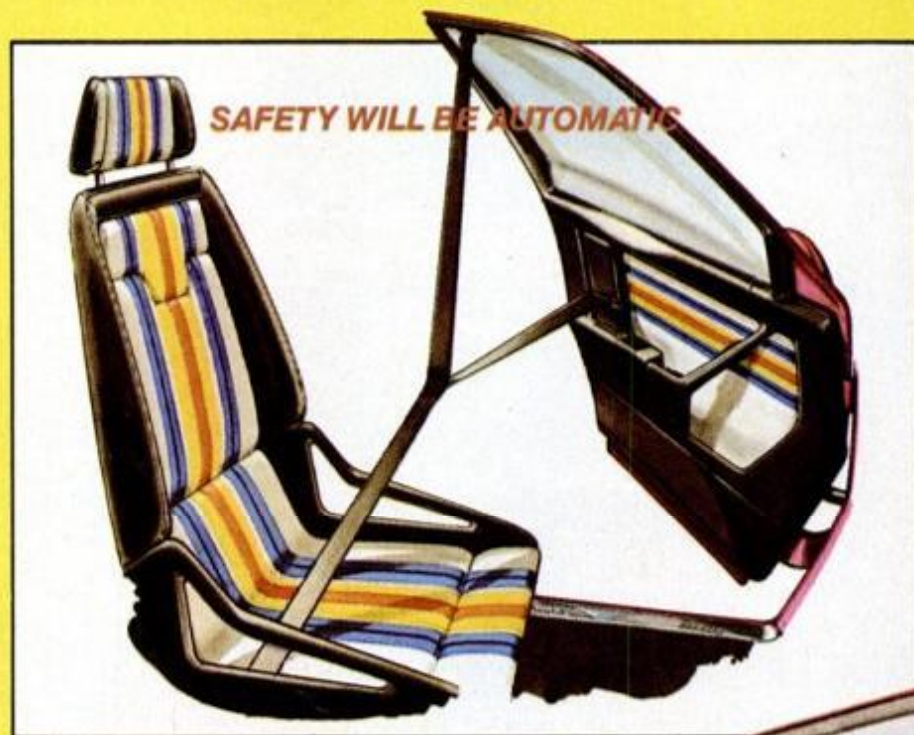
On the seats of a typical sporty car of the 80s (right), a thin aluminum shell saves weight, while automatic three-point seat-belt system complies with new standards. Aerodynamics will play an increased role in Camaro styling: smooth, pointy nose and clear covers over the headlights.

change more—and more rapidly—during this next 10 years than in any decade since the automobile's infancy.

Different? Yes, cars will be very different by 1985; even more so by 1990, with different materials, more electronics, more diesels, more turbochargers, some electric vehicles by mid-decade; maybe even some gas turbines by 1990. Detroit sees world petroleum sup-

plies adequate to support a growing auto industry through at least 2000 A.D. After that, who knows?

American cars will continue to shrink and shed pounds. They have to meet federal CAFE standards. Each of the Big Four carmakers must hew to a corporate fleet average that rises 2 mpg every year through 1983: 22 mpg in 1981, 24 in 1982, and 26 in 1983. Then the law levels off to 27 mpg for 1984 and



'82 CAMARO: FLUID CONTOURS AND FLUSH WINDOWS



FORD'S FWD ERICA

Ford's new code-name Erica will replace dated Pinto and Bobcat in 1981. Erica will borrow several parts from German-made Fiesta (no longer to be imported), such as front doors.



27.5 for 1985. After that, it's likely the regulations will call for annual half-mpg improvements, reaching 30 mpg by 1990.

By 1986-87, the average American car will be a four-passenger sedan with front-wheel drive, a cross-wise V6 engine that might be a diesel and might be turbocharged. It'll stand on a 98 to 100-inch wheelbase, will weigh around 2600 pounds, and probably be a liftback or hatchback.

Does that sound a lot like GM's 1980 X-car? Absolutely. The X-car represents the archetypal model of what American cars of the 1980s will look like and be like. Detroit will build smaller and larger versions of the X-car—and mostly they'll be smaller.

Yes, the six-passenger American automobile *will* survive. It'll be shorter and smaller on the outside, a lot lighter, have a V6 and fwd, and room for six plus luggage. By 1985, only 20 percent of American cars will be six-passenger, and the price gap between large and small automobiles will become greater. So if you need space for six people, better buy that big car soon.

Lighter-weight materials

Weight reduction will result from a combination of downsizing and material substitution. Use of lightweight materials—reinforced plastics, high-strength steels, aluminum, magnesium—will increase during the decade.

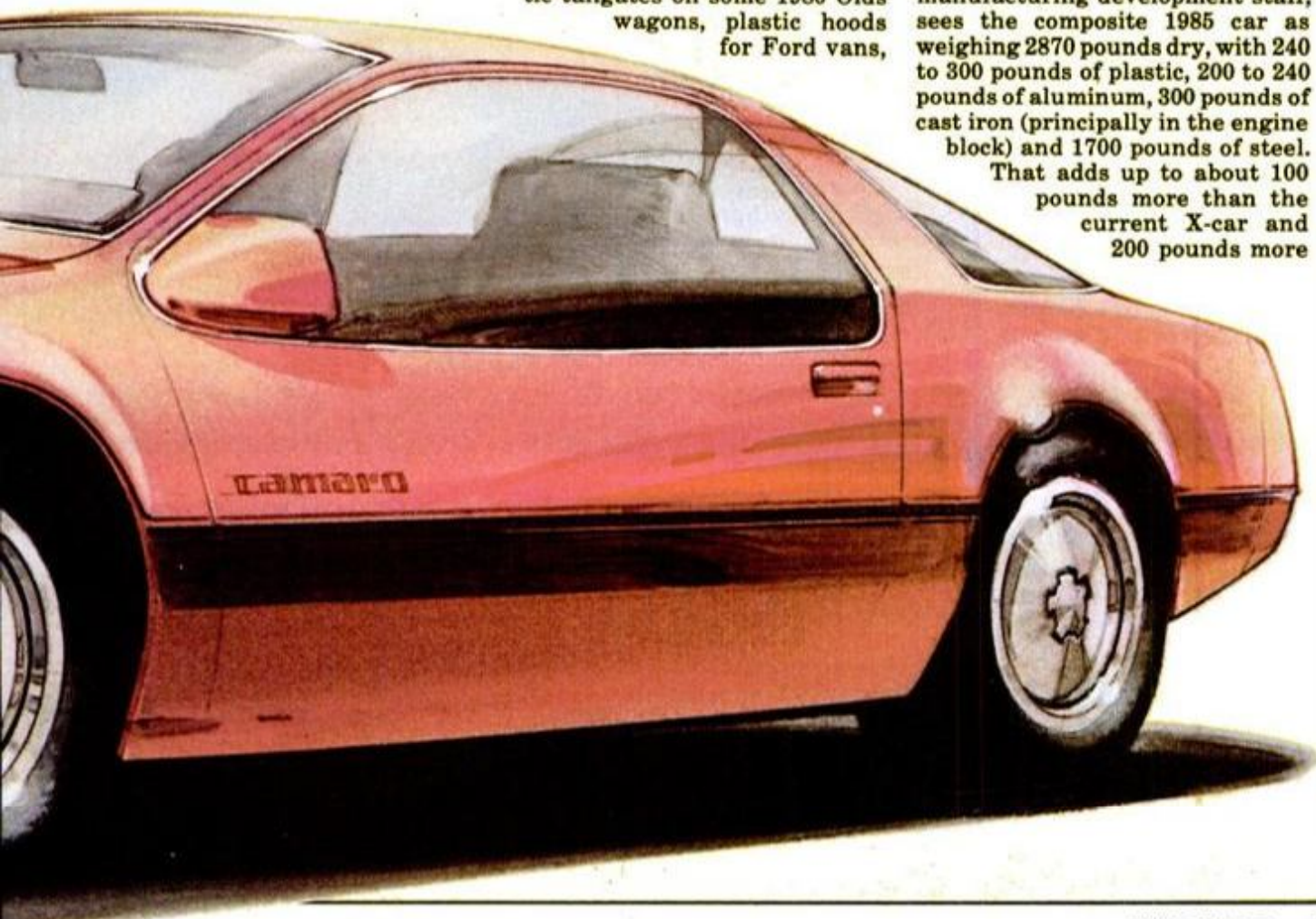
We already have reinforced plastic tailgates on some 1980 Olds wagons, plastic hoods for Ford vans,

fiberglass-reinforced nylon oil pans on Cadillac engines and superstrength rear springs on Corvettes. PPG Industries says it's developed a *single-leaf plastic* rear spring that'll show up on several 1981 models. This spring weighs 8 pounds and replaces a 45-pound multileaf unit.

Injection-molded plastic front fenders (called "friendly fenders") are currently being tried on 1980 Ford Fairmonts and Mercury Zephyrs. Chrysler now uses nylon heater-core end tanks in several car lines. GM's X-cars employ plastic belts to roll windows up and down. We'll see plastics put to even more innovative and unexpected uses in the '80s.

Frank Daley, director of GM's manufacturing development staff, sees the composite 1985 car as weighing 2870 pounds dry, with 240 to 300 pounds of plastic, 200 to 240 pounds of aluminum, 300 pounds of cast iron (principally in the engine block) and 1700 pounds of steel.

That adds up to about 100 pounds more than the current X-car and 200 pounds more



than the composite car I envision for 1986-87.

High-strength steel (HSS) is another up-and-coming weight-saver of the future. It allows thinner gauges, but doesn't compromise strength. Detroit needs to work some bugs out of HSS manufacturing techniques, but wheels, side-intrusion bars, bumper reinforcements and blades, hinges, suspension members, plus inner and outer

differential housing, the Eagle's transfer case and Buick's rear brake drums.

Ford has begun casting magnesium for several small parts like key locks, mirror mounts and vacuum housings. Ford is also pioneering the use of graphite-reinforced plastics (GRP). The company has made everything from experimental driveshafts to experimental fender panels from GRP.

nals the minicomputer, which can change carburetor settings, ignition timing, idle speed and exhaust-gas recirculation (EGR) flow.

I'm oversimplifying, because added sensors signal engine temperature, manifold vacuum, crankshaft and throttle position, barometric pressure and more. The minicomputer can thus compensate for a cold engine, altitude, ac-

1983 OLDS DELTA: FWD FOR FULL-SIZED CARS



Second phase of GM downsizing starts in 1983 with full-size cars like this Olds Delta 88. Wheelbase goes down 5 inches, weight 400 to 600 pounds. Turbocharged V6, front-wheel drive will be standard.

body panels, can be produced and are being made from HSS even today. More applications will follow.

Aluminum tends to be expensive, but you'll be seeing it used more. Cadillac is working on a 250-cu.-in. aluminum V8. Today, you'll find aluminum hoods on 1980 Lincolns, some Bonnevilles and Oldsmobiles. Aluminum wheels grace several Chrysler models, Camaros, the sportier Buicks, some Jeeps, Thunderbirds and Cougars. Polycast wheels (urethane bonded to steel) will probably wane because they're inherently heavy, but aluminum and perhaps all-plastic wheels will replace them.

Aluminum is used for intake manifolds on a number of engines; also for seat pans, radiator supports, bumper bars, the Corvette's

The first practical application of GRP by Ford came in 1000 1980 air-conditioner compressor brackets on four-cylinder engines. Each GRP bracket weighs 29 percent as much as its iron counterpart. GRP and magnesium are quite expensive, but as technology and their uses increase, prices will come down.

The revolution in electronics

Detroit's other great challenge—besides boosting gas mileage—centers on cutting exhaust emissions. Auto engineers have already reduced unburned HC and CO by 96 percent and NOx by 76 percent below precontrol days.

As smog standards toughen, carmakers will rely more on the microprocessor and minicomputer. Ford and GM three-way catalytic converters work best when the carburetor delivers a fuel/air ratio of 14.7:1. Sensors can sniff an engine's exhaust, and if one deems the exhaust too rich or lean it sig-

celeration, and so on. It can also determine optimum shift points in an automatic transmission and lock up the torque converter.

Ford presently uses what it calls the EEC-III emissions-control system, while GM uses the C-4 system. AMC, International Harvester and Checker buy their smog technology and some hardware from GM. Chrysler recently got permission from the Department of Justice to examine samples of GM's C-4 system and will probably go that way in the future.

As you know, the cleaner an engine's exhaust, the greater its fuel consumption. So engineers are faced with a double dilemma. They have to bring up mpg while reducing pollutants. Multiple sensors, the microprocessor and the minicomputer are their best weapons, because fuel/air ratios and ignition timing *have* to be precise.

The computer could regulate a fuel-injection system (f.i.), which

(Please turn to page 126)

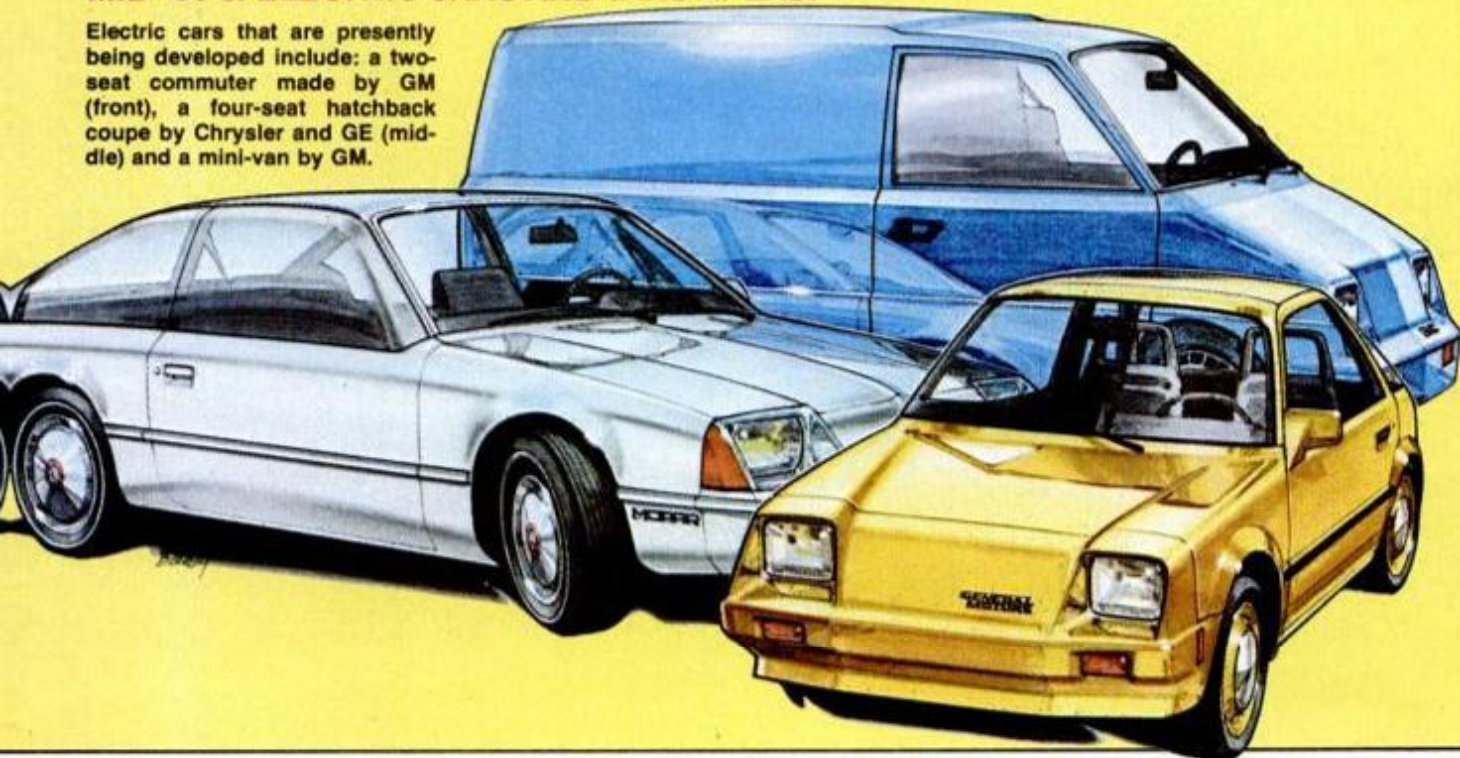
MORE SAFETY DESIGNED IN



Cars of the mid-'80s will show a general move toward "organic styling": Contours will be subtly rounded to improve aerodynamics. Tires will be narrower and lower in profile to lessen rolling resistance at the expense of a smooth ride. Partial belly pans (top, left) will reduce drag and thereby increase fuel mileage. High-intensity panic-stop light is mounted on deck lid above the license plate. Multitread tire (top, right) enables driver to select tread pattern best suited for his particular driving conditions. Patterns come on separate "bands." To install a tread, you simply drive over a band. New "run-flat" tire (above) will have a 100-mile range at 40 mph. It eliminates the spare tire to save weight.

MID-'80's: ELECTRIC CARS AND VANS AT LAST

Electric cars that are presently being developed include: a two-seat commuter made by GM (front), a four-seat hatchback coupe by Chrysler and GE (middle) and a mini-van by GM.

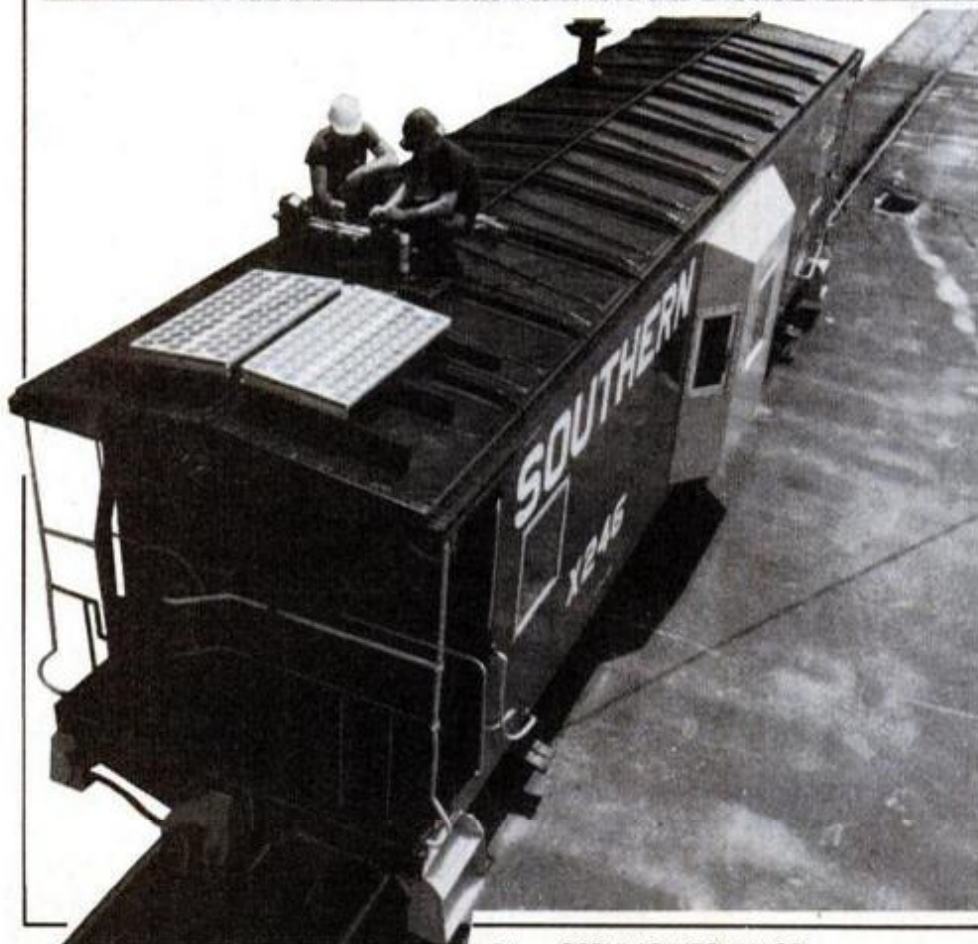
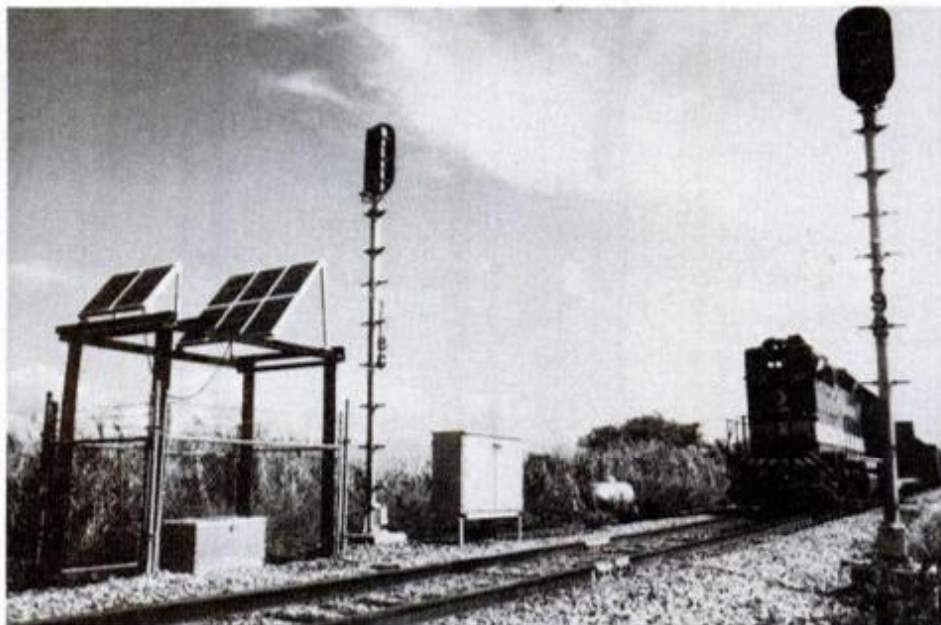


IT'S NEW NOW

The little caboose that does

When federal regulations required rear-end lighting on its cabooses, the Southern Railway decided to use solar cells to provide power (bottom). It turns out that the solar system is cheaper than conventional types, and the cost is still dropping. This isn't Southern's first brush with solar

power; they've been using a similar system to power crossing signals since 1974 (below). Such installations require little maintenance and are economically attractive, especially in remote locations. Southern may try other solar applications, like heating train workers' dormitories.



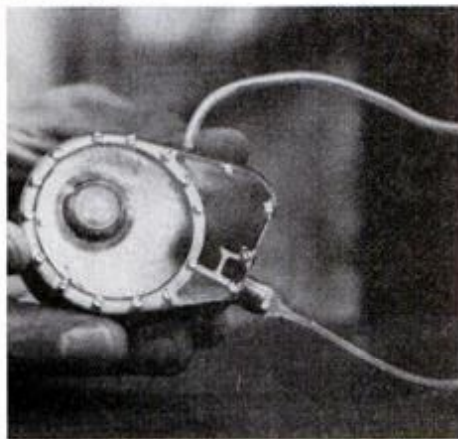
Pipe finder



The maze of gas lines, electric cables and sewers that lurks beneath most streets can pose great danger if there is excavation nearby. Location maps are often inaccurate because of shifting soil. Electro-location Ltd. of England makes a device to help find these lines (above). It detects electric cables by their magnetic field. A separate transmitter is used to detect metal pipes in the same way by sending a signal through them (top). Sewer drains are mapped by tracking a small transmitter floated through. Signal peaks are said to be so sharp that two lines close together can be distinguished. Accuracy is ± 5 centimeters at one-meter depth.

Implanted pump

An implantable insulin delivery system has been tested on dogs and awaits testing on humans. The device, comprising a small battery-powered pump and a reservoir of concentrated insulin, is about the size of a pocket watch. A self-contained timer administers frequent, steady doses; a signaling device can trigger extra insulin if needed. The unit is intended to imitate the natural insulin secretion of the pancreas. Long-life batteries will recharge via transformer without surgery, and insulin will be refilled by injection into a self-healing reservoir. Researchers emphasize that the device will not be marketed for several years.



Pop top

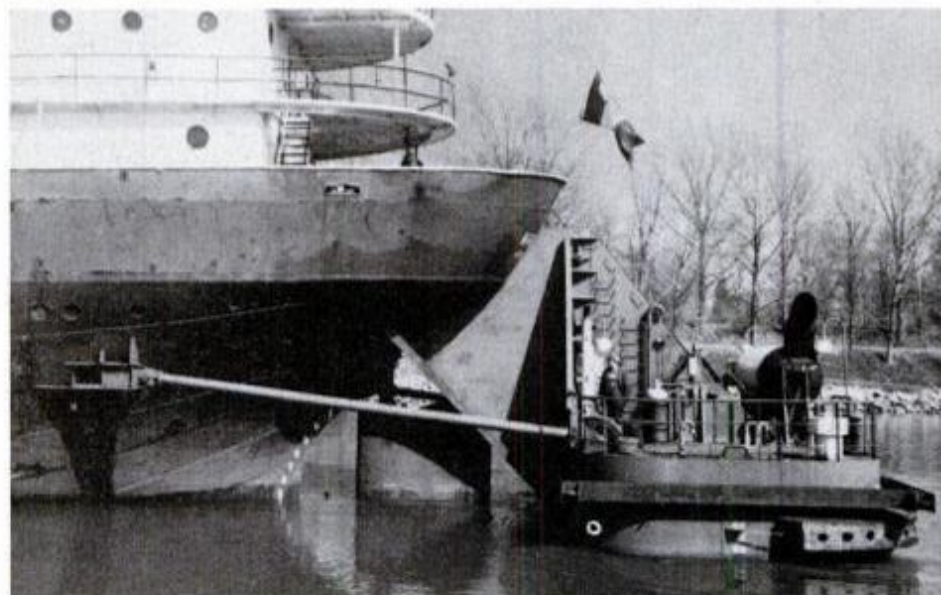


So-called secondary accidents occur when drivers happen upon a previous collision without adequate warning. A police vehicle on the scene may flash a warning beacon, but it might not be visible, espe-

cially below a dip in the road. This British device telescopes 15 feet, if necessary, to provide better viewing of its blue flasher at greater distances. It retracts to a more conventional height for most purposes.

Pushmi-pullyu

Faced with the possibility of serious congestion in the Welland Canal, the St. Lawrence Seaway Authority had to choose between increasing traffic efficiency or building a new canal (at a cost of 5 to 6 billion dollars). The experimental ship shunter shown here may help boost traffic capacity by 20 percent or so. A shunter is a floating platform with a 3600-hp, transverse-mounted engine. Driven off each end is a fixed-pitch propeller that can rotate 360°. One shunter on each end of a ship could yield faster times through locks, improved navigation in bad weather and more accurate traffic scheduling. Early test results have been promising. The use of shunters could defer the need for a bigger canal until the year 2000.



7 exciting new sports

Here are the latest in build-your-own flying machines from vintage

by Sheldon M. Gallager and Howard Levy

If you harbor a secret Walter Mitty dream of donning helmet, goggles and a long white scarf, strapping yourself into a gleaming fighter and roaring off into the wild blue yonder, the dream may not be so far-fetched at that. You can build your own fighter—the romance and nostalgia of historic warbirds are showing up more and more on the homebuilt scene. Other new homebuilts offer a variety of intriguing designs. The trend for the '80s is toward innovative shapes, simplified construction techniques and advanced engineering.

Your fighter may be a scaled-

down replica of the real thing, but the thrills are full scale. The sleek blue Corsair below is a half-scale copy of the famous "bent-wing" F4U Navy fighter of World War II, one of the most devastating prop-driven warplanes of all time. The reproduction, following the original's graceful inverted gull-wing design, is one of a series of authentically scaled warbirds being developed by War Aircraft Replicas, whose initials appropriately spell WAR.

The Corsair shown here was built by Fred Bauer Jr. of Winona, Minn., at a cost of about \$9500. Powered by a 108-hp Lycoming, it has a top



Mini-sized F4U Corsair, half-scale reproduction of heroic "bent-wing" fighter of World War II, is one of several famous warbirds for which plans are or will be sold by War Aircraft Replicas (W.A.R.). Powered by 108-hp Lycoming, it hits 170 mph, was built by Fred Bauer of Winona, Minn. At upper right, it tucks in alongside German FW-190, another half-scale W.A.R. design.

planes you can build

warbirds to exotic shapes of the future.

speed of 170 mph and is stressed to permit real combat maneuvers. The construction is wood covered with fiberglass over hand-shaped foam to produce smooth-flowing curves. Wingspan is 20 feet; length, 16. Plans are \$145 from War Aircraft Replicas, 348 South Eighth St., Santa Paula, Calif. 93060.

Two exciting new sports planes are the single-seat Adventure and two-seat Polliwagen, both trim little tri-gear monoplanes using the latest in composite fiberglass-foam-epoxy construction. The Adventure was designed by George Mead, a Cessna flight test engineer of Colwich,



Trim little single-seat Adventure is only 13 feet long, with a 20-foot wingspan. Of composite glass-foam-epoxy construction, it has both flaps and ailerons, takes engines from 60 to 85 hp, hits speeds up to 180 mph. Plans and partial kits will be available.



PM photos: Howard Levy

Sporty two-place Polliwagen, shown in art concept at left, above, features side-by-side seating, T-tail, wingtip fuel tanks for extended range. Swing-up canopy (right) retracts fully for entry. Plans and kits to come.

New Micro-IMP, partly completed at right, is smaller version of Mini-IMP below. Extremely light—250 pounds—it uses unique fiberglass-paper construction to save weight, cut cost, simplify building. Features include inverted-V tail, full-span flaperons, two-pitch prop. Kits are planned.





German Stuka dive bomber, dreaded by ground troops in early World War II, lives again in this 7/10ths-scale replica. It has same rear-facing gunner's cockpit as original. At lower left is full-scale reproduction of famous Gee Bee racer that won Thompson Trophy twice, in 1931 and '32. Below is full-scale replica of sleek Travel Air Mystery Ship—first civilian racer to beat a military craft.



HIGH ROAD TO ADVENTURE IN HOMEBUILT REPLICAS



Huge biplane is full-scale replica of World War I Bristol F.2B, a two-seat British fighter with 40-foot wingspan. Six are being built for movie *High Road to China*.

The four aircraft shown here look like the real thing—but aren't. They're replicas of historic planes so authentically reproduced they're hard to tell from the originals. It's no coincidence that two are famous warbirds and two illustrious air racers—some of the most memorable and exciting airplanes of all.

That big, nostalgic biwinger is a full-scale reproduction of the old Bristol F.2B, a two-seat British fighter straight out of World War I. It's one of six being built for the forthcoming movie *High Road to China*, a fast-paced adventure yarn about a flight of aging biplanes on a desperate mission to the Orient.

Though less heralded than the single-seat SPADs, Camels and S.E.5s, the Bristol proved deadly in combat and is considered the best two-seat fighter of its time. The repli-

ca, a huge craft with a 40-foot wingspan, is powered by a 200-hp Ranger engine and has a top speed of 145 mph (the original got only 123 mph from its 275-hp Rolls-Royce V12). The reproductions are the work of Vernon Ohmert and his two brothers of Ypsilanti, Mich. Cost of the first: a cool \$100,000.

Louis Langhurst of Carriere, Mich., wanted to build something different and did—a 7/10ths-scale replica of Germany's dreaded Ju 87 Stuka dive bomber. Though already obsolete, the screaming Stuka spread terror through Europe in the early months of World War II, its success due largely to lack of opposition. Not until the Battle of Britain did it meet its nemesis in superior RAF Spitfires and Hurricanes. The reproduction gets 137 mph from a 220-hp Lycoming—not bad com-

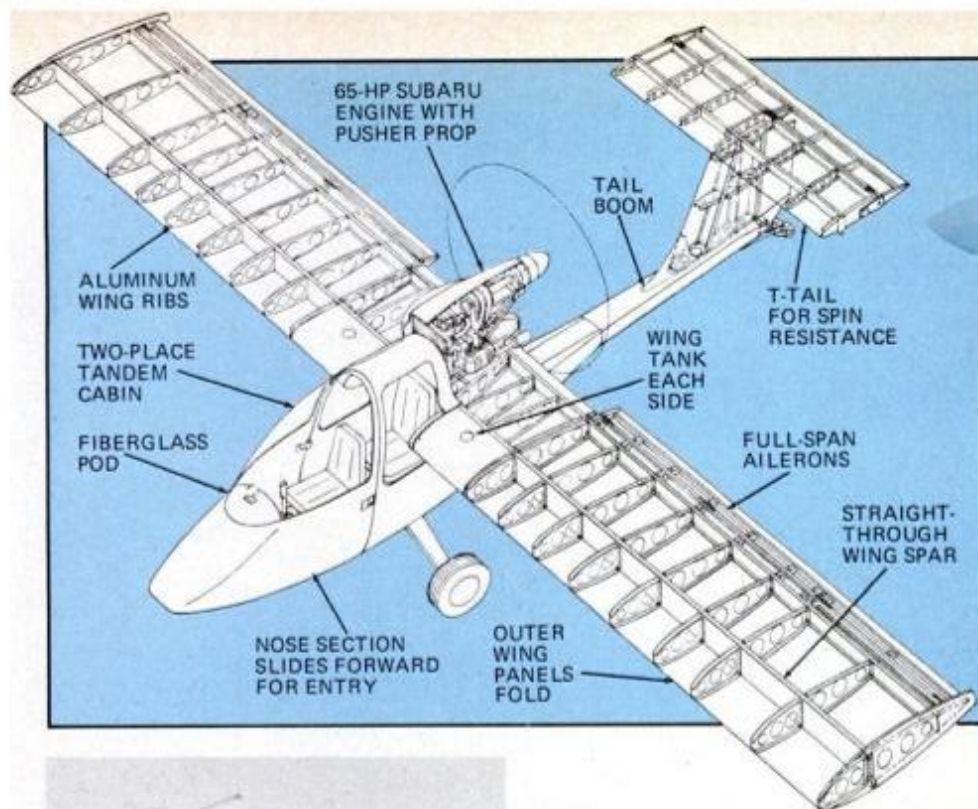
pared to the original's 255 mph from 1400 hp. As in the real Stuka, the gunner's seat faces backward to protect the craft against attacks from the rear.

Jim Younkin of Springdale, Ark., and Bill Turner of Riverside, Calif., are air-racing buffs with a fond regard for the sport's glory years of the '20s and '30s. Their full-scale replicas of the sleek Travel Air "Mystery Ship" and mighty Gee Bee Super Sportster represent two of the most famous names in racing history.

The Mystery Ship, so dubbed because its design was shrouded in secrecy, won the 1929 Thompson Trophy, posting a top speed of 208.66 mph—the first privately built civilian racer to beat the till-then-invincible military entries. The replica is powered by a 300-hp Lycoming (the original had a 400-hp Wright). Younkin has cautiously refrained from pushing past a cruise speed of 185 mph, so doesn't know what it can do all out.

The barrel-shaped Gee Bee, though plagued by controversy and tragic crashes, took the Thompson Trophy two years running, in 1931 and '32. It was, for a time, the world's fastest landplane, hitting a then-record speed of nearly 300 mph. The originals had engines of up to 800 hp. Turner's replica has 450 hp and cruises easily at 210 mph. Like Younkin, he doesn't know the top speed—and has no intention of finding out.

While commercial plans are not available for these aircraft, all were constructed from original drawings and photos, proving that you can build just about anything if you really want to.



Superb visibility is keynote of mid-wing, pusher-prop Taylor Bird. Rear-mounted 65-hp Subaru engine puts two-place, tandem cabin ahead of wings, free of obstruction. Entire nose section slides forward for entry (above). T-tail shown in drawing will replace conventional tail used in prototype. Plans and parts will be available.



Fully aerobatic, little kit-built Minibat motor glider flies on 3-hp engine, can be assembled in a week from premolded parts.

Kans. It's powered by an 80-hp Continental and has a top speed of 180 mph. Flaps provide a stall speed of 57 mph. Wingspan is 20 feet; length, 13. Cost of the prototype was about \$5000. Plans will be around \$100 from Mead Engineering Co., Box 354, Colwich, Kans. 67030. Materials and parts will also be available.

The Polliwagen, so named because of its polliwog shape and Volkswagen engine, offers side-by-side seating with dual controls, ideal for companion flying and student instruction. Fully aerobatic, it's stressed for 9 Gs positive and 6 Gs negative. Its 78-hp, turbocharged VW gives it a brisk cruise speed of 230 mph. Stall speed with flaps is a comfortably tame 45 mph.

A T-type tail is used to raise the elevator up into clean air and incorporates a full-flying "stabilator"—the entire horizontal stabilizer pivots to act as elevator. Other features are electric trim tabs, retractable tri-gear, hydraulic brakes and wingtip fuel tanks for extended range (up to 1300 miles). Wingspan is 26 feet; length, 14. Plans are \$55 from Polliwagen, 8782 Hewitt Pl., Garden Grove, Calif. 92644. An info pack is \$6. Premolded parts for key components will also be available.

Coming: a 'paper airplane'

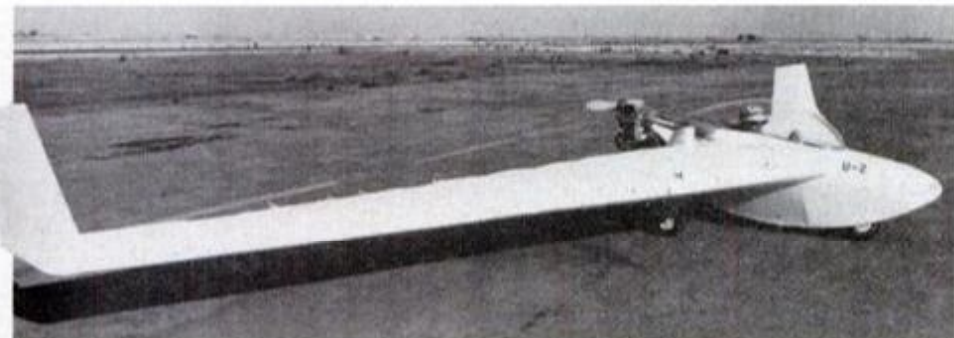
One of the farthest-out new designs is Molt Taylor's "paper air-

plane," a craft literally made of paper reinforced with fiberglass. Called the Micro-IMP, it's a slightly scaled-down version of Molt's earlier Mini-IMP. The news here, however, is not size, but weight. The Micro-IMP is only a foot shorter than the Mini-IMP, but it weighs *half* as much—less than 250 pounds. The secret lies in the unique use of paper as a structural core, a method that not only saves weight, but cuts cost and simplifies building. All the parts are printed full size on what looks like ordinary brown wrapping paper. You merely cut them out and apply fiberglass to form a strong, rigid structure. Much of the fastening can be done with a staple gun.

Like the Mini-IMP, the new Micro is a high-wing, single-place monoplane with an inverted-V tail that, *(Please turn to page 124)*

From hang glider to airplane: New Mitchell Super Wing is out-growth of Mitchell Wing glider. It has 10-hp engine, fully enclosed

cockpit pod, retractable tri-gear. Top speed is 80 mph; wingspan, 34 feet; weight, 140 pounds. Kits will be available.



**GRAND
DESIGN**

THAT'S SOME

TOWER HEAD

POLYETHYLENE-ENCASED
STEEL CABLES (VARY FROM
83 TO 283 1/4-IN. STRANDS)

PRESTRESSED CONCRETE
(SEGMENTED) GIRDER

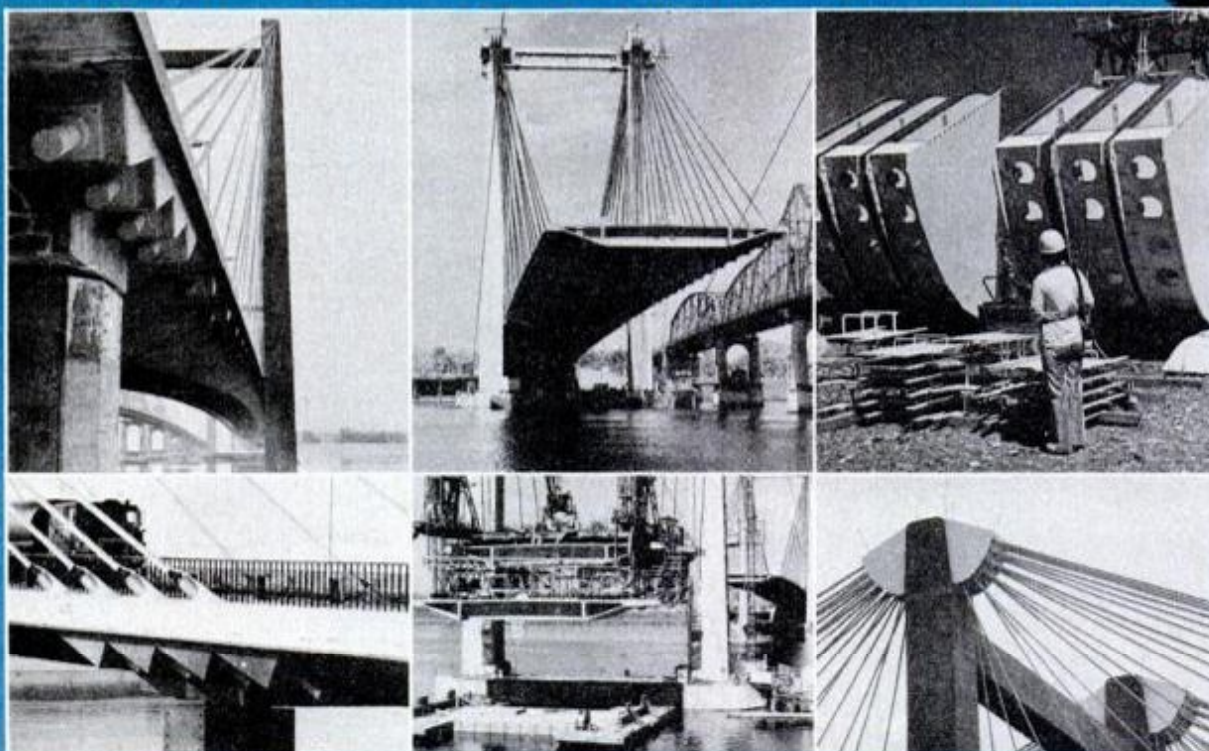
250-FT. TOWER

CABLE ANCHORAGES

Cables are encased in grout-filled polyethylene pipe to resist corrosion and prevent vibration.

Barge positioned 300-ton girder sections; as crane lifted each into place, towers were slightly bent.

Head assemblies installed at the top of 250-foot towers, are 25 feet wide, 16 feet tall, weigh 70 tons.



KIND OF SUSPENSION

New engineering, old geometry make the cable-stayed bridge a contemporary winner.

by Terence L. Day

The first American cable-stayed bridge of contemporary design, linking the Washington cities of Pasco and Kennewick, is a spectacular structure. It won its designer, Arvid Grant of Olympia, Wash., top 1979 engineering

achievement awards from both the American Society of Civil Engineers and the National Society of Professional Engineers.

The cable stays enter tower heads, placing the weight of the prestressed concrete girder onto the towers. The girder itself was assembled in 300-ton, 27-ft. sections, the heaviest prefab bridge segments ever lifted into place. The combination of weight and leverage when the last segment was attached caused each 250-ft. tower to compress by $\frac{3}{4}$ in. and bend enough to deflect the girder by a foot—all accounted for in advance. **PM**



NEOPRENE ANCHORAGE SEALS
TO DAMPEN VIBRATION

Материал, защищенный авторским правом



New boats

More flash and lower fuel consumption are features of the latest in pleasure craft.

by Bill McKeown BOATING EDITOR

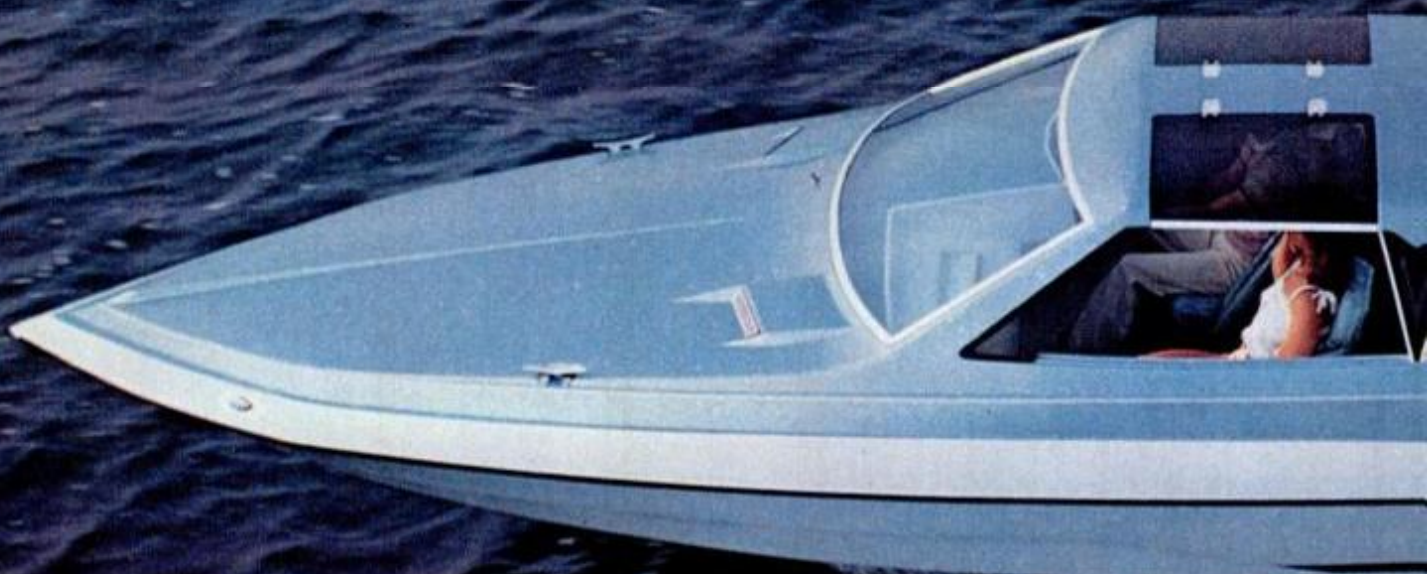
With pleasure craft using less than one-half of one percent of all gas consumed, boatmen are looking forward to no cutbacks in their sport. The new boats previewed so far show more style, performance and versatility—without burning more fuel.

Here are trends to watch.

Runabouts

Flashy models may have the stripped-down, metal-flake, California ski-boat look with long foredeck and token cabin

Flashiest of eight new models in Glastron's 45-boat line, the Carlson Scimitar (above and below) with T-roof and 260 Volvo or MerCruiser I/O power is 23½ feet long with a 91-inch beam.



Runabouts that double as ski-tow boats, like this Baja SS 15 with Spirit 85-hp oil-injection motor, omit windshield for a sporty windblown ride.

A sportdeck with the power to pull three skiers while carrying a crowd, the new Viking Step-In 190 19-footer

for the 1980s

bunks below, upholstered cockpit and gleaming exhaust stacks aft over a monster mill below. Hardly a hull for offshore where the waves lump up, but fun for skimming lakes and impoundments. The new padded afterdeck is no place to ride while underway. Instead, it is a sunning deck, imported from the rich mahogany speedboats that anchor off the French and Italian Rivas as the fanciest kind of swimming rafts. In addition, many runabouts and cruisers have that excellent Australian development, the transom swimming platform. It's both a convenience and safety aid for reboarding.

Deck boats

Rectangular hulls that started as simple pontoon rafts and party barges now are being styled up and powered up. Craft that once had trolling speed for top speed will be pulling water skiers easily this year with outboard or sterndrive power. Accessories

can include everything from a barbecue grill to a convertible navy top and screens to turn one into a floating gazebo. Zip-up canvas side curtains graduate the rig into the cabin-cruiser class with overnighting capabilities.

Inflatables

The blow-up boats have been around for years with attractions for the closet boatman who has no room to store a hull, so needs one that can load up in a car trunk or luggage rack. Quality inflatables this year are not flimsy swimming-pool toys, and will cost as much as the same-size boat built of more rigid materials. But now these flat-bottomed passenger-pounders are mounting stiffeners along the keel line, and extra compartments that add a V to the hull to tame a porpoising ride. Ugly duckling life rafts are becoming graceful runabouts, tenders, and even sailboats with wind outside and in.



Growing in popularity, versatile inflatables like Boston Whaler's 10-footer can carry an outboard and heavy loads easily.



mounts up to a 180-hp outboard or 230 sterndrive. It can be trailered and options include full weather curtains.

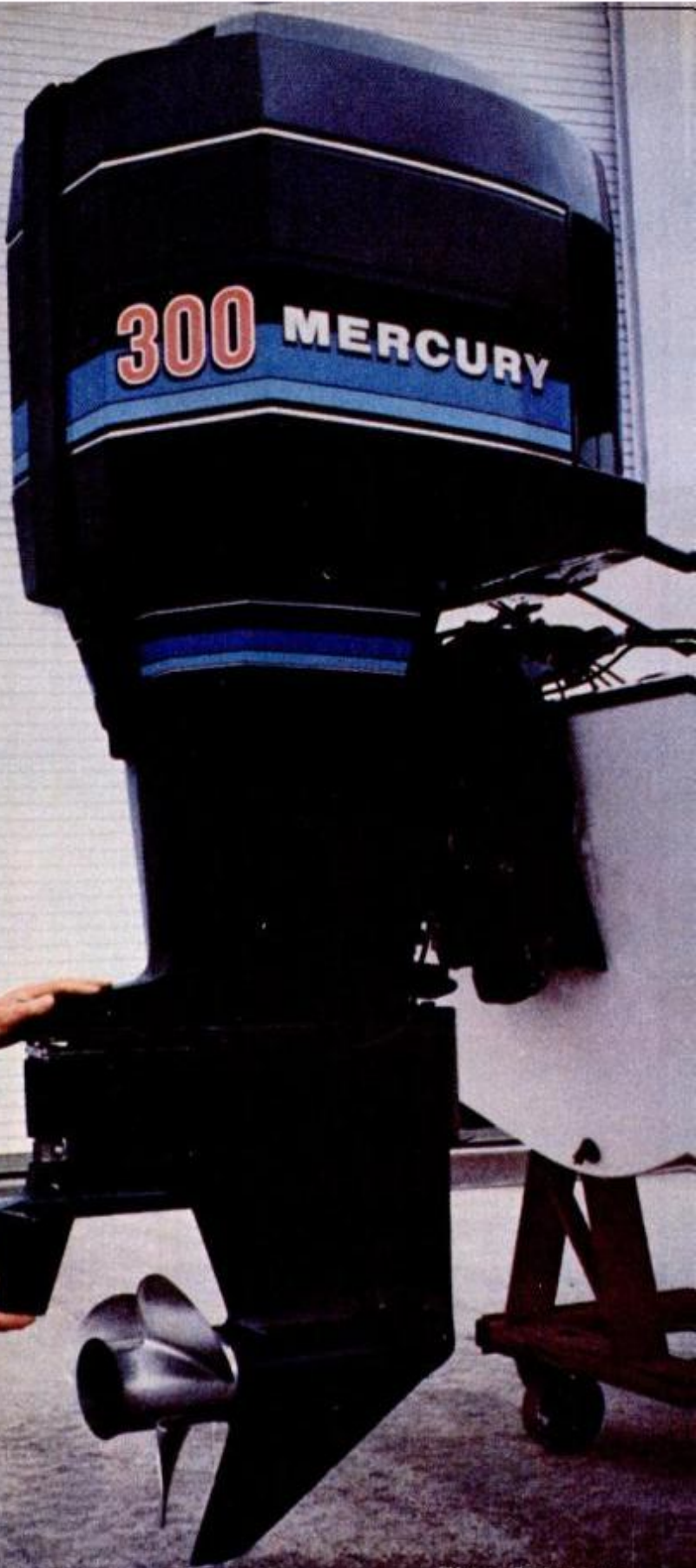


Padded afterdeck is a European styling trend found on luxury runabouts like the Hammond V-1925 Espada. Transom swim platform is a safety aid.

PM tests the biggest outboard ever

by Bill McKeown
BOATING EDITOR

A herd of horsepower is harnessed under the hood of this newest Merc. Its innovations cut fuel consumption and improve handling.



Mercury's most powerful outboard package weighs 565 pounds, steers easily with assist from a trim fin (above) that pivots in propeller slipstream. Wellcraft's high-performance 30-foot Scarab Sport (right), trailerable fishing machine on racing hull, mounts twin V-300s for speeds to 70 mph.

PM photos: Stephen Lylegren





Fuel-flow meter readings indicate the new mill will not gulp extra gas to deliver bonus performance on large, heavy hulls.



Testing on a 24-foot Regal, we found the rig handled easily over 50 mph, could be trimmed for no-torque steering resistance.

Now, in one quantum leap, Mercury Motors has announced an outboard more powerful than your average car. The Merc V300 is 65 horses more potent than any production kicker ever built before, and 75 bigger than Mercury's previously announced 225 line leader for 1980. There's no doubt who's now on first in the outboard horsepower race.

Who needs it? Enough boatmen so that, at present, you'll have to go on a waiting list with your \$6000 just to get one. Big offshore-rig owners will certainly see advantages of more push at less than half the weight of a sterndrive or inboard. But speedsters will also be tempted to try turning it on along wet straightaways where there are no speed limits.

The engine is a development from lessons that were learned on the racing circuits. To drive it for the first time, we put on a prized red racing jacket we'd been awarded after driving Reggie Fountain's record-holding tunnel hull (page 96, Feb. '77) at 120 mph. The 122-cu.-in. V6 Merc on that skimming machine turned up to 8500 rpm and had no official horsepower rating. Now we'd be steering the 207-cu.-in. V6 that evolved from it.

First boat rigged and ready to go at Mercury's Oshkosh, Wis., high performance center was a handsome 30-foot Wellcraft Scarab Sport, a smaller version of Betty Cook's 38-foot offshore world champion. This is one of the few hulls around that can take twin 300-hp outboard motors. Though not set up for speed trials, it promptly lifted onto plane, and the speedometer climbed through the 60s as we reached clear water and pushed the throttles full forward. Here was a trailerable but 30-foot hull handling like a runabout, even tending to chine-walk

slightly as it rode high on the water. Merc test driver John Litjens told me this speedy Wellcraft could reach 70 when trimmed and tuned just right for these remarkable new motors—that in spite of its size and weight, as fitted with center console and cuddy cabin.

Next we switched to a 24-foot Regal with single-Merc-300 installation for all-important gasoline consumption tests. Early reports had been so good when compared with less powerful competition (31 percent better fuel economy at mid-range throttle settings than a 235-hp motor, 35 percent advantage wide open), that we had a fuel-flow meter installed for our own inspection. At various rpm settings, we ran a measured course and recorded our



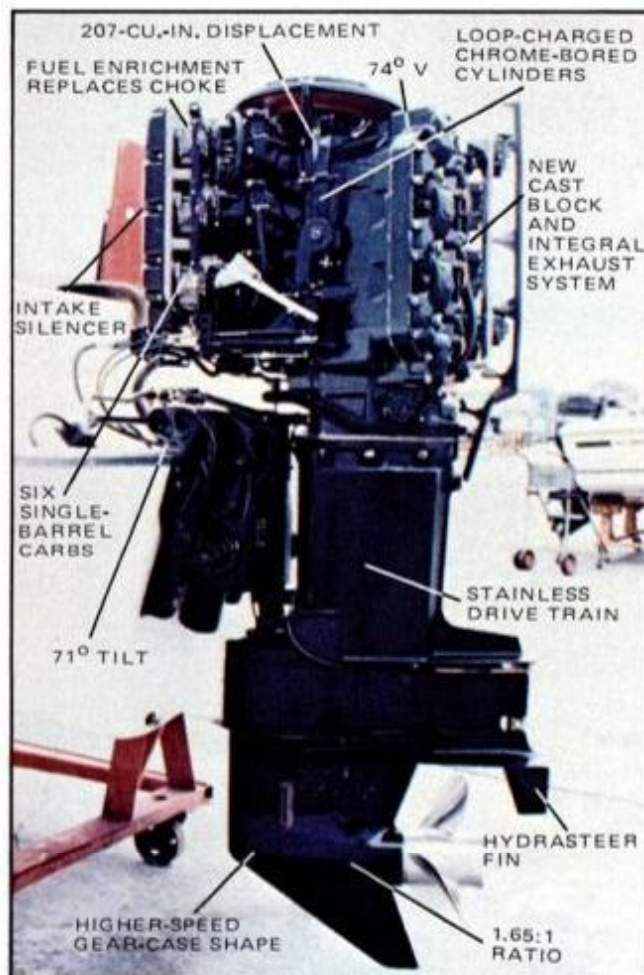
New, larger powerhead and this refined lower unit make possible higher speeds without vacuum "blowout" around prop.

elapsed time in seconds on each lap through the traps, while reading fuel flow in pounds per hour.

Although using a different boat and passenger load weight, figures for the Merc V300 appeared to be comparable with published results, and a mid-range performance of over three miles per gallon was a creditable result for this size rig. Merc engineers attributed the impressive totals to loop charging, cleaner lower unit, an accumulation of refinements and the fact that they had been able to start from scratch with this big new engine.

Three years of intensive work have gone into the mill, including lower-unit streamlining at the Berlin Surface Tunnel Tank in Germany. At this facility, pressure controls can simulate the high speeds that create the phenomenon of "blowout." Blowout occurs when a vacuum created by the propeller gear housing sucks forward a void in which the prop spins with no contact with the water.

Merc knows this new rig has remarkable speed potential. We're pleased to find it's prepared for it. **PM**





In Japan, some expensive rigs carry a heavy load of light and color.

TRUCKERS WITH THE YEN

by Victor Chase and Milton Mann

What you see on these pages are running lights with a difference: They run in the neighborhood of 3.5 million yen—about \$17,500.

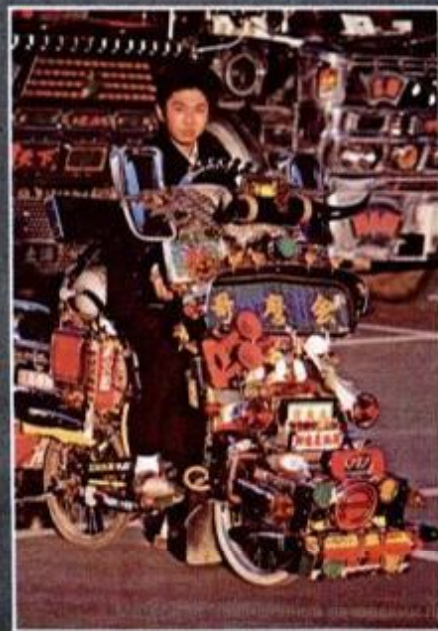
The price (up to \$40,000 for some trucks) includes more than light bulbs. The 300 members of Japan's Utamaro Kai—Utamaro Club—also adorn their trucks with paintings in classical style, lighted signs ("Neon Blossom," and "In All the World I Have No Enemies" are two of them) and metal polished to mirror finish.

Their inspiration is Kitagawa Utamaro (1753-1806), an artist who liked to paint women and insects. Utamaro-style women, at least, often wind up painted on the trucks, carefully copied by hired sign painters. Interiors gain a teahouse-of-the-August-truck ambiance through the use

of straw mats on the floor and paper dividers.

Shortly after the club's formation in 1974, the trucks caught the eye of a movie producer. And since 1975, Japanese moviegoers have been offered a couple of trucker movies a year. The latest, called "Truck Guys," is about this Japanese driver who imports big U.S. trucks and steals business. It features five Utamaro Kai members as actors. Their trucks play supporting roles.

Incidentally, in between lighting up the roads and movie marquees, club members haul some cargo, mostly sand and gravel. To protect the glitter, drivers carry tarpaulins to drape their creations during the mundane business of loading and unloading.





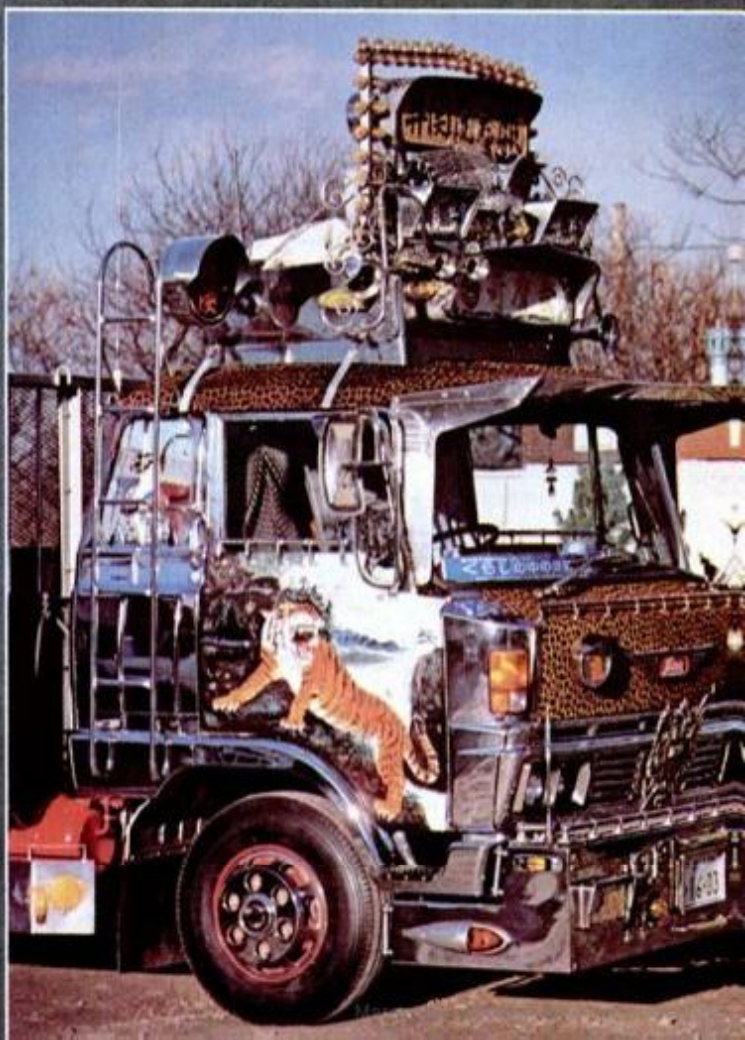
Like the marquee on an old movie theater, Utamaro Kai trucks (left) glow with winking—and illegal—lights, doused whenever the rigs near police. Typically, trucks carry two 750-watt alternators and two 120-ampere-hour batteries to power the light show. By day, painted tigers on a truck's rear (above) scare off tailgaters. Some truckers decorate interiors (right), adding homey trappings like a tatami, a rice-straw mat and a shoji, a sliding paper wall behind the driver. The CB adds a modern note, but another touch is strictly traditional: You take your shoes off, good buddy, before you climb in.



FOR BEAUTY



Individual parts of vehicles sometimes reflect the delicacy of classic Japanese painting, like the eagle on a tailgate (above). Back off a bit, however, and the style is, well, about as subtle as a truck (right). A 14-year-old boy (left) mimics the big rigs—there's a bicycle under there somewhere—and dreams of the day when he can hit the road with his own cargo of dazzle.



Driving the 4wd turbodiesel Scout



International Scout Traveler gets 18.6 mpg in PM's 1000-mile test.

by Moss Miller

There are few vehicles on the market as versatile as the International Scouts. Mechanically, the Scout Traveler is similar to the familiar Scout II, except its wheelbase and overall length are both 18 inches greater than the Scout II's at 118 and 184.2 inches, respectively. The Scout Traveler is much roomier than the Scout II, especially in rear seat legroom, yet it's still compact enough to park easily. Both vehicles offer a turbodiesel option for 1980. I drove the Traveler from Chicago to New York, logging nearly 1000 miles on this "special purpose" vehicle (according to EPA jargon). Call it what you will, it's as rugged as any truck around—maybe even more so.

As soon as I picked up the Traveler at International's huge service complex just north of Chicago, I headed for Interstate 90. While crossing the flat plains of Indiana, I had a chance to see just what the new turbomotor could do.

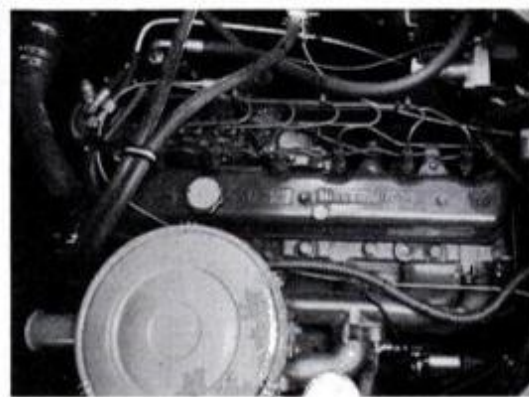
The Scout's six-cylinder engine is

manufactured for International by Nissan (the Datsun folks) in Japan. It has a 198-cu.-in. displacement and puts out 101 hp at 3800 rpm. Torque is a hefty 175 ft.-lb. at 2200 rpm.

My best 0 to 60 time was 22 seconds flat, but ordinary specs can't explain fully what the turbomotor does for this heavy 4200-pound wagon. No longer are you restricted to life in the slow lane, like drivers of older Scouts. Slip the standard, close-ratio, four-speed tranny (which is perfectly matched to the performance characteristics of the turbodiesel) into third gear at 30 mph and you'll find that your revs drop to 2000 rpm—just where the turbo's boost begins. You'll reach 50 miles per hour in just nine seconds—fast enough for comfortable passing on two-lane roads and parkways.

The engine is governed to go no more than 4000 rpm, which translates into 20, 38 and 59 mph in first, second and third gears with the standard 3.73 rear-axle ratio and the test car's Goodyear Tiempo P225/75 R15 tires. I could obtain optimum acceleration times by shifting at 18, 35 and 55 mph—just before the governed point was reached. If I went beyond these speeds, I noticed that my acceleration rate would go down,

(Please turn to page 120)



Turbocharger is nestled with exhaust manifold under air cleaner (left side of engine); note metal fuel-injection lines (on right side). The oil and water are easy to check if you stand on wheel hub.



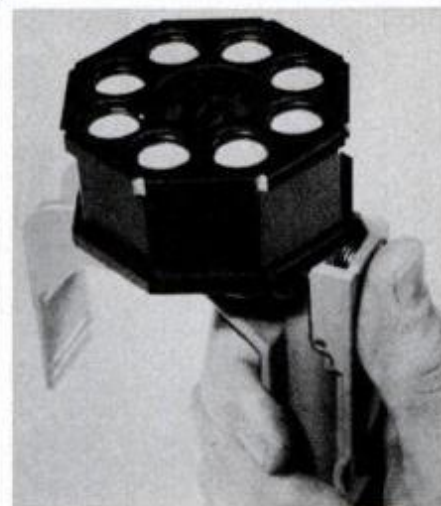
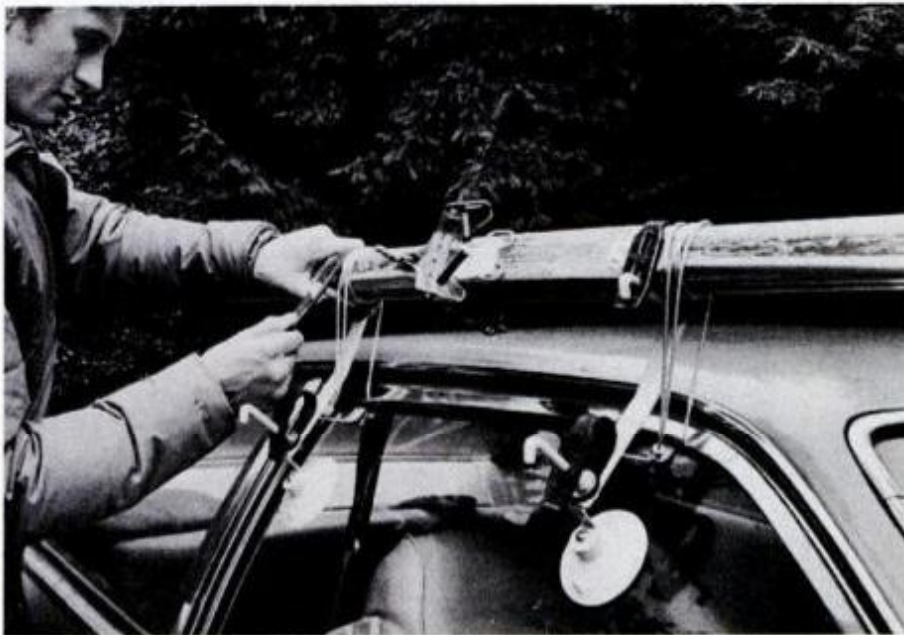
Automatic wheel hubs are \$97 option: They enable 4wd to be engaged from driver's seat. Hubs can be locked manually for engine braking on front wheels. Test car had Goodyear Tiempo P225/75 R15 tires on styled alloy wheels (\$440 for set of five).

IT'S NEW NOW

Window rack

The Rabbit Ski Rack mounts on a car window, without tools. It can also mount on a trunk deck or rear door of a van. Single model carries two pairs of cross-country or one pair

of downhill skis; double holds twice as many. Both include cable locks. Single is about \$14; double, \$18. Early Winters Ltd., 110 Prefontaine Pl. S., Seattle, Wash. 98104.

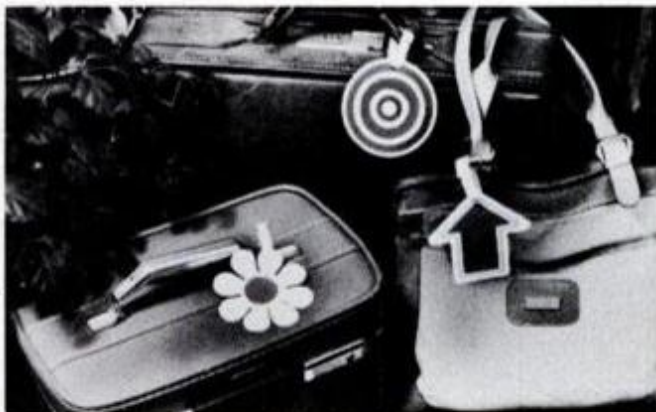


Flare up

The Dial-A-Star flare launcher can be cocked by hand, foot or mouth, so that an injured person can fire it in an emergency, the maker says. Its rotating cassette holds eight flares that shoot over 300 feet high and burn for six seconds. Launcher needs no watertight storage; flares have five-year shelf life. About \$70, Jay Stuart Haft and Co., 8925 North Tennyson Dr., Milwaukee, Wis. 53217.

Spot check

Ever miss a flight connection because you couldn't pick your bag out from its look-alikes? The Luggage Spotter is a rigid plastic identification tag that ends such confusion. It comes in 24 designs and can be written on. It costs about \$2, and is available from Quality Products Mfg. Co., 125 West 157th St., Gardena, Calif. 90247.



Extended engagement

The X-Tend-A-Fire Tray is said to help synthetic logs burn up to 50 percent longer. It keeps logs together while burning to provide more color for a longer time, maker claims. About \$8 from Eastern Trading Co., 5916-K, West 34th St., Houston, Tex. 77092.

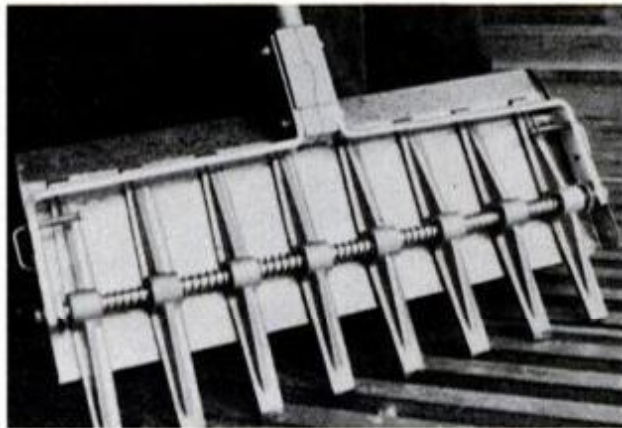


Reflect on this

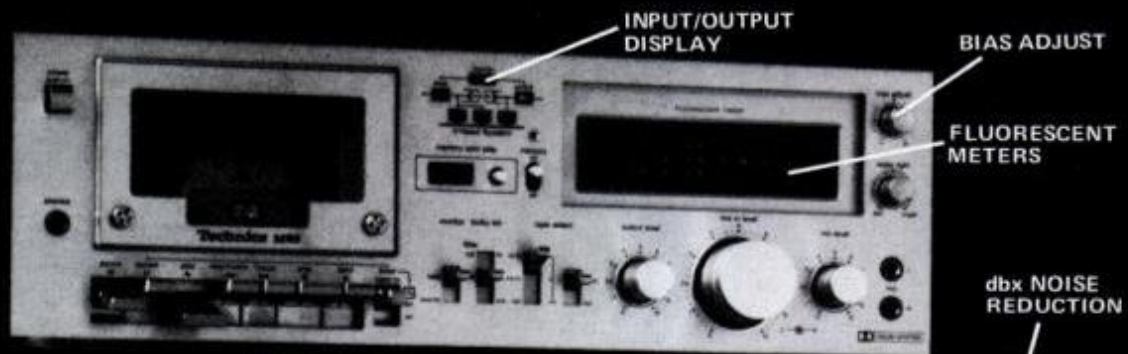
Bausch & Lomb has introduced sunglasses incorporating mirror-coated Ambermatic lenses. The Double Gradient mirror coating is thickest at top and bottom and becomes thinner and less dense toward the center of the lens. Ambermatic lenses change density and color to adjust for sunlight and temperature. The glasses are said to be ideal for outdoor sports. About \$27 to \$48.

Groovy

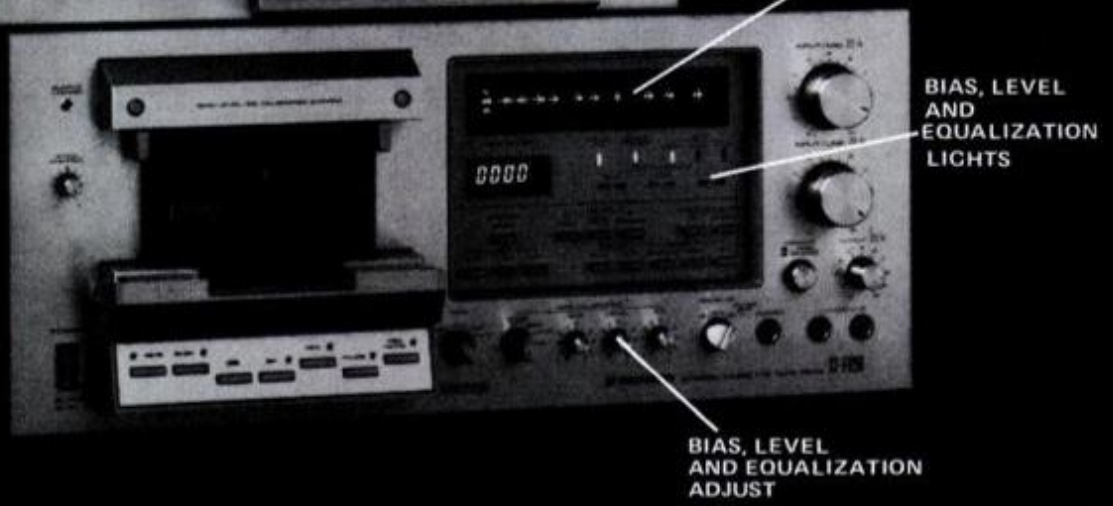
The grooved floor of a 40-foot refrigerated trailer ("reefer") is easier to clean with the Reefer Scoop, the maker says. The spacing of the eight steel teeth can be adjusted to fit most trailer floors; teeth can be flipped end to end for double life. The tool can also be used as a shovel. The unit sells for about \$140, and is available from the Murphy Advantage Corp., 3012 Duncan St., Louisville, Ky. 40212.



4 new tape decks worth singing about



Four decks we tested use the new, pure-metal recording tapes. From top; Technics' M63, Teac's A-550RX, JVC's KD-A6 and Pioneer's CT-F1250. All have unique features, sophisticated controls—and they sound spectacular!



New pure-metal tapes require metal-capable tape decks. We listened to—and lab-tested—four new decks.

by Neil Shapiro
ELECTRONICS EDITOR

Pure-metal recording—is it pure gold or pure bunkum? In our opinion—supported by our lab tests—the new tapes can only be described as brilliant, and we found some new decks to play them on, ranging from very good to fantastic.

Recorded sound is a function of the magnetism used to record that

sound onto the tape. The new metal tapes can be magnetized to a much higher level, by the proper equipment, and give correspondingly better fidelity on playback. That is the theory in a nutshell—but putting it into practice has been causing somewhat of a tempest in the audio industry's teapot.

NOMINAL FREQUENCY RESPONSE FOR CHROME-BIAS AND METAL TAPES

Frequency in hertz	30	31	40	50	75	100	300	500	1K	3K	5K	8K	10K	11K	12K
Metal tape (in db)	-3.0	-2.9	-1.2	-1.3	-0.3	0	0	0	0	-0.2	+0.5	0	-2.5	-5.0	-8.0
Chrome-bias tape(in db)	-3.5	-3.0	-1.5	-1.5	-0.6	-0.8	0	0	0	-0.6	-1.1	-2.5	-6.0	-8.5	-13

FREQUENCY RESPONSE AT 0-VU/0-DB RECORD LEVEL

Frequency in hertz	30	40	50	75	100	300	500	1K	3K	5K	8K	10K	11K	12K	13K	14K	15K
JVC KD-A6	-2.2	-1.0	-1.2	-0.8	0	0	0	0	-2.0	-1.5	-1.2	-1.5	-1.5	-2.0	-3.0	-4.0	-6.0
Pioneer CT-F1250	-3.0	-1.2	-1.3	-0.3	0	0	0	0	-0.2	-0.5	0	-2.5	-5.0	-8.0	—	—	—
Teac A-55ORX	-3.0	-0.5	+2.0	+1.8	+1.5	0	0	0	-1.0	-1.0	-2.5	-5.0	-7.0	-10.0	—	—	—
Technics RS-M63	-4.3	-2.0	-1.0	+0.5	+0.5	+0.5	0	0	0	-0.5	-1.5	-2.5	-2.9	-4.0	-5.0	-6.5	-8.5

Medal-winning metal performance

The charts above tell two things: Metal tape can give great performance on the right equipment, and the decks we show you here do, indeed, get the best out of the new tapes. It's more than just a numbers game; such figures are how audio "sounds" on paper!

A new kind of machinery

Two magnetic properties, called *retentivity* and *coercivity*, determine that pure-metal tapes will perform better than their metal-oxide cousins—if the right conditions are met. The electrical currents to record and erase these tapes must be at a higher level than for everyday tape.

The most metal-critical currents are the bias and erase requirements. To record on metal you must have a high bias current; to erase properly calls for high erase currents.

This is why a deck that can play chrome tapes can also play metal, but cannot record

or erase properly on metal. The critical currents are wrong—only metal-capable decks have the proper current capabilities for this new medium.

Lab tests on the decks revealed their true specifications as ranging from very good to state of the art. Playback distortion on all was 1.5 percent or below; hum and noise ratios were also all acceptable. Wow and flutter ratings were best on the JVC and Pioneer decks (.06 percent and .03 percent respectively), but the Teac and Technics decks turned in respectable ratings, too (.08 percent).

Getting better sound

The charts show that if you use the new tapes on these new decks you do, in fact, get a better sound—particularly in the higher frequencies. You'll note that (in our own lab tests) metal even beat out chrome at the upper end of the hearing range.

Note (top chart) how metal and chrome

tapes compare up to about 10 kHz (10,000 cycles). There is very little difference. The major improvements of metal show up around the top 2 kHz, from 10 kHz to 12 kHz. By the top of the scale, there is a measured variance of five decibels between metal and chrome tape, and chrome *already* sounds good.

So, is your present nonmetal deck obsolete? By no means! Many people do not need, or may not appreciate, the further step of quality that metal tape brings.

The important thing is this: We have found not only a listenable difference, but one that can be measured. Some reports have stated that metal tape makes hardly any difference. We tend to disagree, and above are the figures to back us up. Metal tape does sound better.

Why not listen to metal tape played on one of these machines? Perhaps you, too, will be saying "Vive la différence!"

Compatible may not be capable!

First thing we discovered is that not all decks—not even those billed as "metal" decks—can take full advantage of the new pure-metal tapes. There is *metal-compatible* and *metal-capable* to worry about.

If you want to record on pure-metal tapes, you *must* have a metal-capable tape deck. Metal-compatible will not record or erase metal tapes properly, though such a deck will give adequate *playback*—only—of pre-recorded metal tapes.

Beauty for ear and eye

The first thing we noted about the four metal-capable decks was the lavish attention to design details evident on all. There are many unique and interesting features on these decks besides their metal-capabilities.

Pioneer's CT-F1250, the RS-M63 from Technics, Teac's A-55ORX and the KD-A6 from JVC all represent high levels of technology harnessed to give audiophiles a real treat.

Pricewise, the decks are more expensive than nonmetal ones, but not prohibitively so. The Technics and JVC are around \$450, the Pioneer is

the most expensive at \$695 and the Teac goes for \$550.

■ **Pioneer CT-F1250:** In some ways, this is the most advanced of the four decks and the one we found easiest to use.

The control panel is studded with one feature after the next. If it were not for the great sound, you might think it to be the control panel of a starship!

Pioneer has taken full advantage of the instant response time of its new fluorescent VU meters. The meters light up bar-graph fashion for output and recording. Beneath the meters are a whole range of fingertip-sized controls.

You can switch the meters from averaging to read peak-indications only and you can even have the meter readouts remain at peak levels. This is ultra-handly for setting recording levels on a difficult selection.

Tape formulations from different manufacturers call for slightly varying settings of bias and equalization. On the CT-F1250 these settings are done by matching indicator lights one to the other—the deck does all the hard work of testing the actual tape you are using. Once set,

you get precise standardization of these all-important levels.

Besides Dolby noise-reduction and a tape-memory to return to a previous selection, there is also a pitch-control knob. You can vary deck speed ± 6 percent—nice if you must record from another tape that was recorded on a less-than-exact machine.

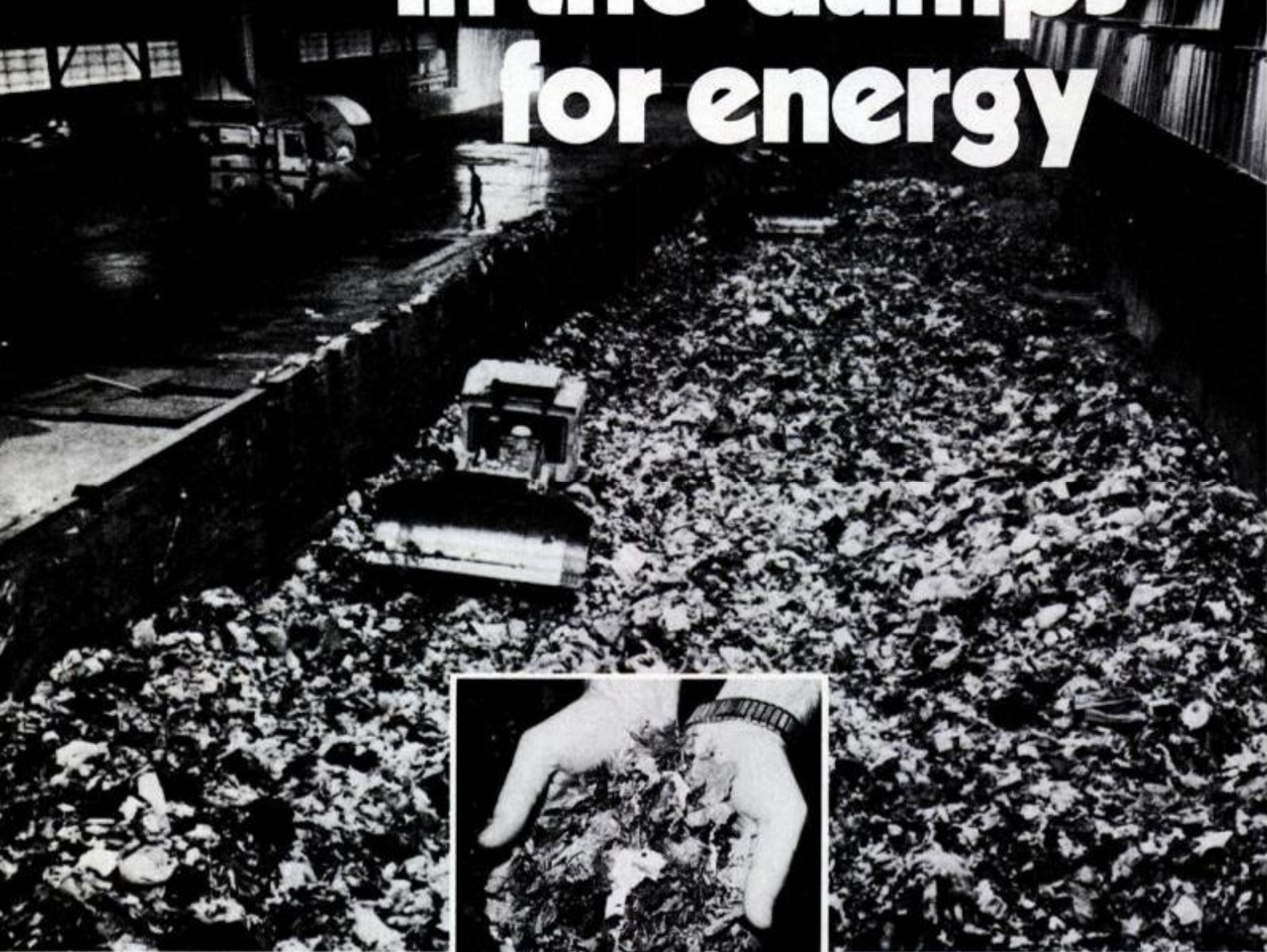
■ **Technics RS-M63:** The first thing we noted on this deck was the trio of helpful lights on the center of the panel above the counter. Labeled INPUT, SOURCE and OUTPUT, they tell the listener whether the sound he hears is from the tape or from a different sound source. You might not have needed this some years ago, but now tape sounds so good you may not be able to distinguish it from the source.

This deck also has the new, fluorescent meters. Though they are peak-only variety, the new style makes them easier to read and follow than a standard "pointer."

Bias adjustment on this deck is fine-tuned by setting a control to a range, depending on the tape you are using. The ranges are given in

(Please turn to page 154)

Looking down in the dumps— for energy



PM photos: Frank Lusk

by Dick Teresi

*"The world's so full of manure
you're gonna have to put your
foot in it sometime."
—Paul Newman in Hud, 1963.*

The time has come to put our foot in it. Caught between vanishing fossil fuels on one side, and mounting garbage on the other, the obvious way out is to turn trash into energy. And, in many areas, it's already being done:

■ In Palos Verdes, Calif., the Los Angeles County Sanitation District has drilled "methane wells" into its



Millions of pounds of refuse pour daily into a pit at Hempstead, N.Y., resource-recovery plant (top). After processing, some garbage becomes usable fuel (above).

garbage landfills. Methane gas, normally a hazard in a dump, is sucked into pipes, purified and delivered directly into the pipelines of the California Gas Co. Two million cubic feet of gas per day is extracted from the Palos Verdes dump. Although not every landfill site is suitable for methane drilling, similar processes are drawing off usable gas at almost

a dozen other dumps in the nation.

■ In Hempstead, N.Y. (on Long Island), a new garbage recycling plant is processing 2 million pounds of garbage each day—turning it into enough electricity for 120,000 persons—and recovering 80 million pounds of ferrous metals each year. An unexpected fringe benefit: Plant officials are extracting \$50,000 annually in nickels, dimes and quarters from the waste.

■ In China it has long been a common practice to collect human and animal excrement in wooden buckets and turn it into methane. Now this grass-roots type of action has reached America. One Wisconsin

farmer, Leonard Schieffer Jr. of Rice Lake, puts manure from his dairy barn into a 48-foot-long, 12-foot-diameter pipe, in which bacterial action produces methane. He siphons the gas off the top and uses it to drive a generator, which supplies the farm with electricity.

■ And not only can you get power out of sewage, some scientists at New Mexico State University say, but cattle can eat it. After a 90-day test, cattle fed on protein-rich sewage sludge disinfected with radioactive cesium-137 appeared to be in better shape than cattle eating normal feed.

A "refuse renaissance"?

The list of new uses for garbage goes on and on. And proponents of garbage power—sometimes called by the fancier name of biomass—are claiming we're on the eve of a refuse renaissance. You've probably seen a few articles in your local newspaper with titles like "Garbage is Gold" that proclaim all our dumps will be gone soon and in their place will be cheap electricity, gas and cattle feed galore.

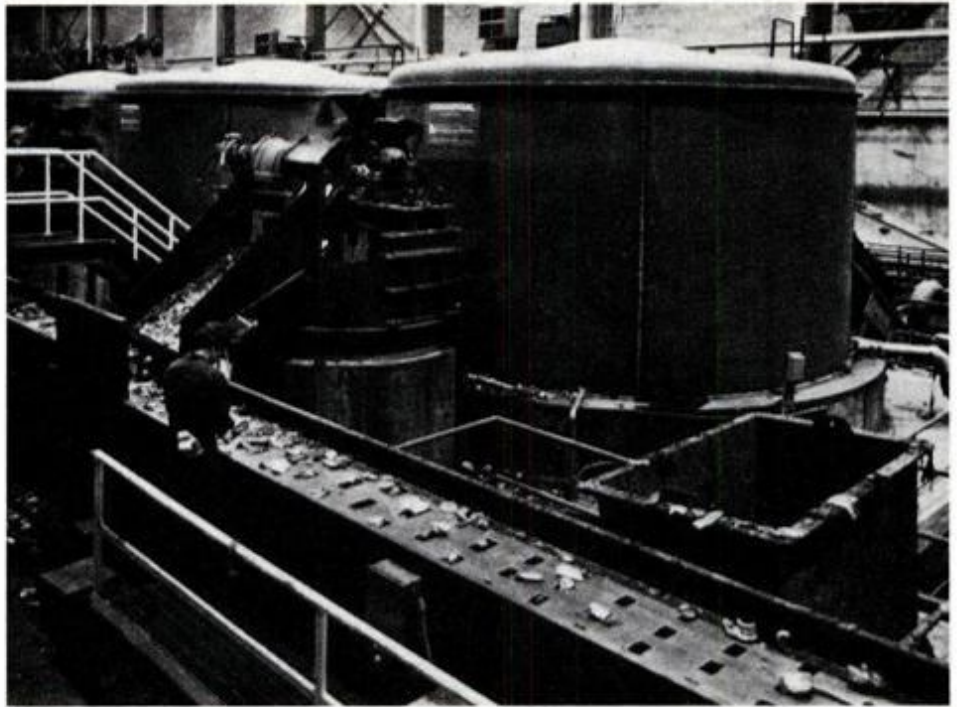
This is not one of those articles. While garbage offers great hope, it is too early to say whether that hope will be fully realized. Let's face it, if oil were still plentiful and landfills were begging for business, no one would give garbage power a first, let alone a second, thought.

Despite all the hoopla, the amount of garbage being recycled into energy or raw materials is statistically insignificant. Of the 160 million tons of garbage generated by Americans every year (that's 1400 pounds from each of us), 69 percent is thrown in open dumps, 22 percent in sanitary landfills and 8 percent is incinerated. The remaining 1 percent is recycled and recovered.

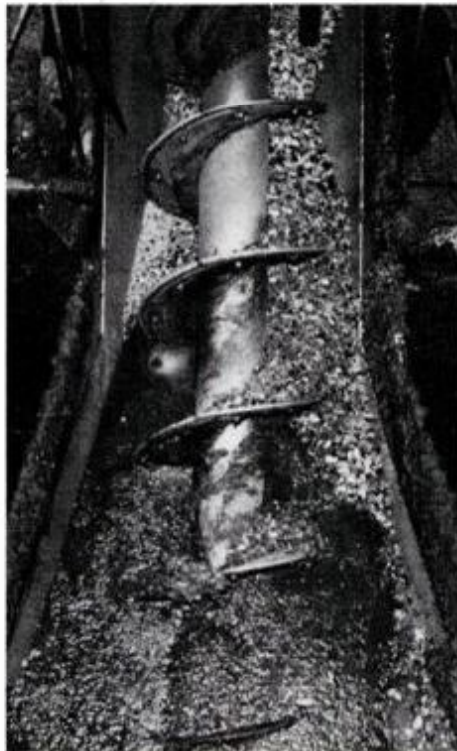
That will, of course, have to change. But the pressure will come not so much from the need for energy as from the fact that we're about to choke on our own waste.

What a waste!

The United States, with only five percent of the world's people, produces over half the world's waste. Our dumps take up 780 square miles, which at the going rate for undeveloped real estate means that \$5 billion worth of land is wasted. Many urban areas now find themselves with no more landfill available and no place to put their garbage. And that means shipping it elsewhere, which in turn means more expense. Garbage disposal costs averaged \$15 per ton 10 years ago. Today it's \$35 a ton, and



From pit (previous page), garbage moves to water tanks (above) where blades chop solids. Heavy metal is drawn out of garbage "soup" for sorting on conveyor belt.



Large screw pulls out pieces of aluminum and glass for further sorting. Plant also harvests carelessly discarded coins.

some cities must pay up to \$50 a ton.

Mass, of course, can be converted to energy. And while doing this with garbage is a highly inefficient method of obtaining energy, we have to get rid of the mass anyway, so . . .

There are several ways of squeezing power and other useful products out of trash; here are some of the leading contenders:

The dump drillers

Methane gas (the technical term



With unburnable solids removed, garbage slurry is pressed and dried. Conveyor belts carry resulting fuel toward boilers.

for natural gas) is a normal byproduct of landfills. And up until recently, an undesirable one. Methane from rotting garbage can build up in explosive concentrations and leak into nearby homes, schools, hospitals and other buildings, rendering them unlivable. Reports of actual explosions are becoming more and more common.

The solution is to draw the methane off and sell it. The Los Angeles County Sanitation District was the

first garbage authority to undertake such an endeavor—at the Palos Verdes site. That was in 1975, and today the project is going strong.

Here's how the system works: Ba-

sically, sanitation engineers actually drill wells in the garbage. (They have to be careful though. Joked one supervisor on another similar project, "We don't want to hit a re-

frigerator door by mistake.") The wells are about a yard in diameter, and spaced at intervals throughout the dump. Into each hole is placed an 8-inch plastic pipe with perfora-

HOW YOU CAN PULL CASH FROM TRASH

An ambitious group of teen-agers in Ohio has bought two Cessna airplanes and a spare engine during the past decade so they could learn to fly. Their successful \$1000-a-year scheme: paper routes in reverse.

The 20 members of the Astro Air Explorers of Berea collect old newspapers and put the \$3-per-ton recycling fee into a pot. In return, members get an hour's flight instruction for every ton of paper collected. The current income from the scavenging is ample to pay insurance for the planes, according to organizer LaMar Williams.

"We've shown you can turn old paper into new airplanes," Williams told PM.

Williams' club isn't unique. Across the country, churches, scout groups and individual entrepreneurs are getting cash from used aluminum, paper and glass. Recycling, modern society's version of the old compost heap, has become a multimillion-dollar enterprise in America—with the enthusiastic en-

dorsement of some major U.S. corporations.

Reynolds Aluminum, for one, paid the public more than \$25 million for cans and household aluminum in 1978. The pay was a pittance compared with the extra profit for the company resulting from recycling: Producing new aluminum from used metal saves 95 percent of the energy required to produce molten aluminum from ore.

Here's an item-by-item report on the current rubbish market, suggesting that there's probably spare income in your trash if you're willing to fish it out:

Aluminum

Reynolds currently, pays 23 cents per pound for aluminum cans and clean household aluminum—old storm-window frames, for instance. The company offers cash on the spot at more than 85 centers. Call 800-228-2525 (toll-free) to find the collection site nearest you. Another company, Alcoa, owns buy-

ing centers in San Diego, Dallas-Fort Worth, Pittsburgh and Atlanta; Alcoa also deals with a network of independent buyers. Reynolds (Richmond, Va. 23261) and Alcoa Recycling Co. (1501 Alcoa Building, Pittsburgh, Pa. 15219) offer free booklets on how to begin. Both will send you a free magnet, to sort out ferrous metals, if you request it and enclose a self-addressed stamped envelope.

Glass

Federal figures show there is somewhat more glass than metal in municipal solid waste, but the reward for recovering it is paltry by comparison. Glass pays between one-quarter and one-half cent per pound (sometimes up to a penny), according to the Glass Packaging Institute (1800 K St. N.W., Washington, D.C. 20006).

Whether you can make a profit at these rates depends on your supply and your proximity to a glass-buying center. The Institute will supply a free list of these customers. They're somewhat *tough* customers: They usually expect glass to be color-separated (clear, amber, green) with caps and rings removed. No ceramics, please. And some require glass to be broken into small pieces. Even when this isn't required, it's best to handle glass with gloves and eye protection.

Paper

The same federal figures show that paper is by far the most abundant waste.

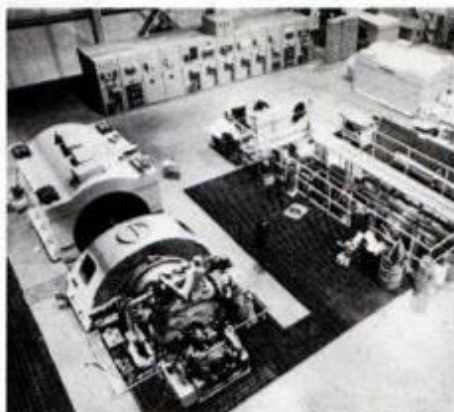
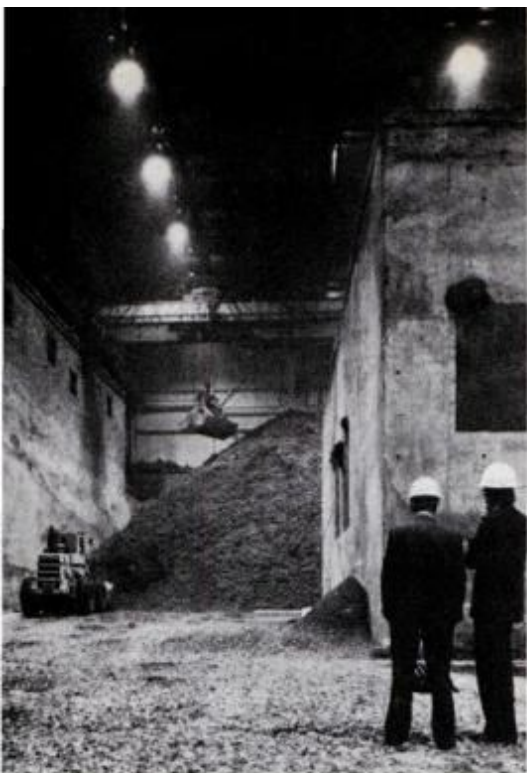
Used-paper prices vary widely: In the New York area alone, dealers are paying between \$30 and \$50 a ton for corrugated cardboard (1.5 and 2.5 cents per pound)—still much less than the price of aluminum. But the abundance of paper—on an average there's three times as much paper in solid waste as either glass or metal—makes it worth scrounging for.

Start by checking your classified directories under "Waste Paper" to find customers and confirm local prices. Then write the Paper Recycling Committee (Box PM, American Paper Institute, 260 Madison Ave., New York, N.Y. 10016) to ask for free booklets on how to turn old paper into fresh green stuff.

—Gurney Williams III



Aluminum cans, shown here in recycling plant, are worth 23 cents per pound.



Fuel made from garbage (left) in Hempstead plant is burned in a multistory boiler. Steam drives generators (above) feeding power to a local utility. Black Clawson, company operating the plant, estimates its system will save 36 million gallons of oil a year, even though fuel has only one-third the energy of coal. A similar plant is due to open in 1981 in Miami; it'll handle a million tons of garbage annually.

tions in its lower half. The area around the pipe is filled with gravel to a point just above the perforations. Concrete is poured over the gravel to form a seal, and the well is then filled up with dirt. Each of these wells is connected by lateral pipes to a main header pipe that goes directly into the purification plant.

A large compressor in the plant creates a vacuum in all the wells that sucks the dangerous methane through the perforations and into the pipes. Up it goes into the plant's complicated system of pretreatment towers, molecular sieves and carbon dioxide-removal towers. It comes out 99 percent pure, to be metered into the pipelines of a natural-gas distributor.

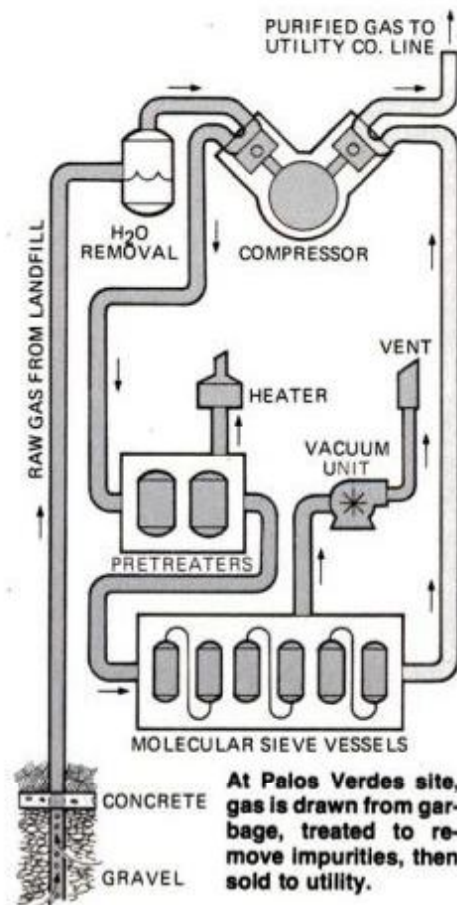
Strict requirements

It takes a special dump to qualify as a site for methane mining. A spokesman for Reserve Synthetic Fuels Inc., the company that runs the Palos Verdes project, said that before a landfill site is considered it has to pass stringent tests. Engineers feed data on garbage tonnage, the composition of the waste and other information into a complicated formula to see if there are profits in the piles of rubbish. The company is close-mouthed about details on its site at Palos Verdes, and another at Monterey Park. And it won't reveal where a third operation is to begin until it has negotiated the future sale of methane. The spokesman did volunteer that the company is privately funded, in part by Getty Oil, and that it is making money from methane from garbage. How much? Sorry, no comment.

There are now close to a dozen

such methane-recovery operations around the country, according to Dr. Donald Klass of the Institute of Gas Technology (IGT), in such cities as Mountain View, Calif. (near San Francisco); Chicago; Pompano Beach, Fla., and Shreveport, La.

Methane recovery is no longer in the development stage, but a practicing reality. "It is," says Dr. Klass, "commercial technology already." But Klass, director of engineering at IGT, points out that the real purpose



of methane recovery is to get rid of dangerous gas and to help defray the cost of garbage disposal, rather than to help solve the world's energy crisis.

He says that most methane recovery plants now in operation produce only half a million cubic feet of gas per day. And the United States uses 20 trillion cu. ft. of pipeline gas per year. "Figure out how many landfills would be required to supply that much gas," Dr. Klass says, "and you'll discover that we haven't got that much garbage."

Electric garbage

Another "simple" way to get rid of garbage is to turn it into electricity. All you have to do is burn it, which will produce heat to turn water into steam. The steam will power a turbine and the turbine will make salable electricity.

Unfortunately, it is a complicated and costly process to turn garbage into a burnable fuel. A waste/electricity plant must put the waste through several steps:

First, the garbage is processed in a paper-industry machine called a hydropulper. The hydropulper is sort of a giant Cuisinart with huge blades that pound and shred the garbage underwater and condense it. The resulting slurry is run through various separators and sorters to remove metals, stones, glass and other hard, noncombustible objects. Minus this material—which may or may not be sorted, reclaimed and resold—the slurry is run through a maze of presses that squeeze out the liquid and produce a dry fuel.

The residue from all this can be burned in a furnace to make electricity. The only catch is that despite all the complicated procedures—and the above description has been vastly oversimplified—the fuel produced from garbage has only one-third the energy of coal.

The largest and perhaps most sophisticated operation in the world is the Hempstead, N.Y., plant built by Black Clawson, a pulp and paper company.

A risky deal

A maze of conveyors, vats, boilers and shredders, the plant takes up more than 15 acres of land and was built at a cost of \$92 million. The equipment is expensive and, like most pioneering ventures, unproved. And the deal Black Clawson made with the Town of Hempstead was risky.

In essence, the company agreed to build the plant, absorbing any con-

(Please turn to page 140)



New gear for snow sport

Winter outdoor action is easier, warmer and more fun with improved cold-weather equipment, clothing and off-season, off-road vehicles.

by Bill McKeown
OUTDOORS AND TRAVEL EDITOR

Skates, sleds, skis, camping, hunting, fishing and hiking essentials—they're all being improved to make outdoor activities better this time of year. Plastics that take the cold without turning brittle, rust-resistant metals, thermal-barrier insulations, breathable waterproof fabrics are incorporated in new designs for old-fashioned snowdrift sport.

Many cross-country skis now have fish-scale designs molded into the center kick area for better uphill traction, without the use of waxes or climbing skins. Even skateboard skis have been announced. Lightweight plastic bindings are available.

Ski clothes are becoming more streamlined and backpack parkas are graduating from the quilted, down look with the use of 3M's new high-heat-retention, low-bulk Thinsulate. For garments, tents and sleeping bags that need to keep rain out and yet let sweat evaporate, Gore-Tex fabrics have proven successful. Foul-weather gear that can overlap seasons is included in the Red Ball system with a waterproof Go Parka that is PolarGuard-lined, plus Calhoun insulated Bush Boots, or Lightfoot thermal boots. Catalytic heaters are still the safest way to get heat inside a tent, and camp stoves are being improved to make bitter-weather starting easier.

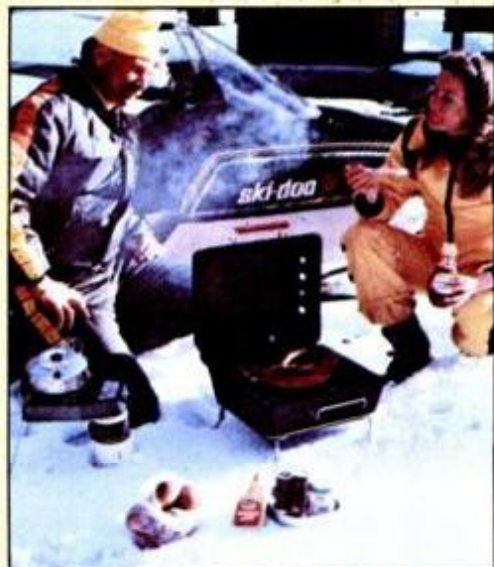
Winter mountain climbers have such refinements as avalanche radio signalers and sectional probes for survivors, a flexible pack frame by Peak 1 and a pack board that converts to a cargo sled from Mountain-Man Industries, 616 North Rouse, Bozeman, Mont. 59715. Called the Pack-N-Sled, it weighs about 7½ pounds and comes in Standard, Mountaineering and Child's Snow Stroller models. Accessories include a safety harness and roll bar, so

Mountain climbing by snowmobile, above Crested Butte, Colo., is test of new garments.

Cook stoves and utensils for warm-weather camping, like Coleman's one-burner model and Charmglowette LP barbecue, make quick meals.

An airfoil skating sail that is claimed to outspeed iceboats, the Ice-Wing from Sweden surrounds the skater for races

with other Ice-Wingers or conventional sail-skaters. Plans, kits, skates are available from the sail-foil designer.





In a Peak 1 tent, an externally supported A-frame type with a roof spreader bar and new shock-corded ribs, are Holubar and Peak 1 sleeping bags.



Cross-country boots with ankle support, camp boots, booties warm feet. Skier wears Trak Rallye Nowax fish-scale skis, flex-frame Peak 1 pack.



New all-plastic cross-country bindings of Celcon, by Pinso Sport, are claimed to collect less ice and snow while in use.



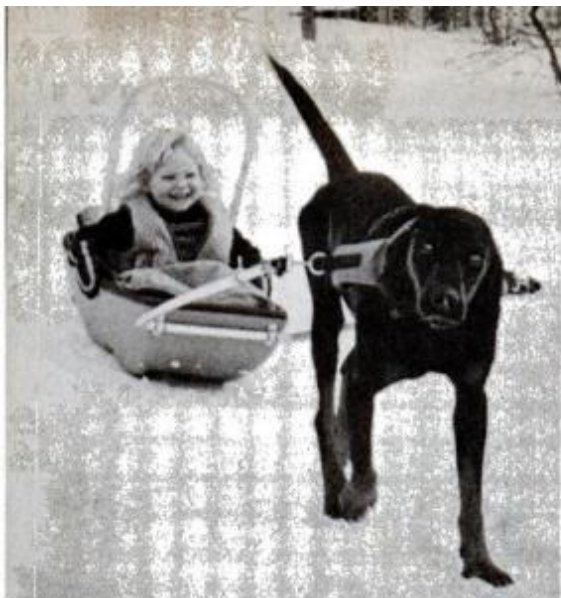
Latest cross-country skis, including models with built-in no-wax climbing treads, can be fingertip-measured for fit.



Off-season sport includes camping in a winterized Winnebago, snowmos on new TracPac trailer by Cheney Weeder, Spokane.

Even ice fishing is more pleasant with thermal insulated clothes and a 1-hp. 2-cycle ice auger for drilling holes.





A backpack that turns into a youngster's sled with rollbar, or a cargo sleigh for hiker, skier or man's best friend, the Pack-N-Sled is winter sport and camp aid. Tow-poles fasten to a hip-belt harness.



One remedy for cold wrists between gloves and sleeves, Woolrich Blanket Thumb Shirt has thumb hole to hold sleeve down.



Extending to protect eight-foot skis, or telescoping to less than half that size, plastic Ski-Pack case from K-Mac is \$50.



Specialized safety aid, plastic safety ski racing gates from RapidGate, Aspen, Colo., are hinged, replace bamboo spears.



For repairing cross-country ski boots, or making your own, new stainless \$5.75 rebuilding clips are by Ryder, Salem, Ore.

a youngster can be carried papoose-style or in the sled. Hip-belt towing harness and poles let you tow cargo while on skis or snowshoes, and even a dog harness is offered.

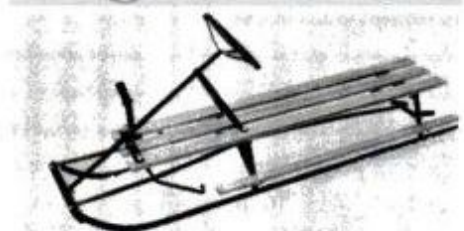
Recreation vehicles, once water lines have been well insulated, provide winter camping. Antifreeze can be added to holding tanks.

Another ingenious design is the

Ice-Wing, available in plan, kit or completed form from the inventor, Anders Ansar, Upplandsgatan 19B, S 113 60 Stockholm, Sweden. Speeds to 50 mph are claimed. Plans are about \$20, kits \$300 and completed Ice-Wings \$800. Skate blades that can mount on ski boots and lift a skate sailor above snow-covered ice are also available. **PM**

How cold is cold? Taylor Instrument's new hand-held Wind Chill Meter gives temperature, wind speed and chill factor.

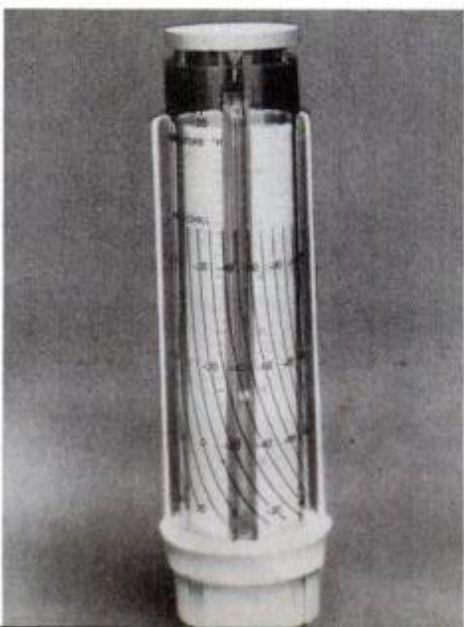
Lightweight aluminum avalanche probes that join to make up various lengths are from Mountain Safety Research, Seattle.



A combination of sled, skis and scooter, imported folding Norwegian Kiks (top), and Commander mini-bob with wheel are from Cardon Enterprises, Arlington, Wis.



Winterized for cold weather, Jimmy 23-foot mini motorhomes from Consolidated Leisure have hot-water showers and tubs.



Snowshoeing— old sport, new action

by Ray Gill

Instead of putting it out of business, the booming sports of downhill skiing, cross-country skiing, winter off-roading and snowmobiling have transfused amazing new life into that ancient North Country device — the snowshoe. The speedier sports were supposed to leave snowshoeing far behind, but it turns out that they all can break down far afield where only a snowshoer can come to the rescue. And these web-footed tennis rackets will still carry an ardent outdoorsman to remote spots that can be reached no other way.

Suddenly, even the looks, shapes and abilities of these classics are changing. Refinements in traction make possible climbs over breakable crust that were not attempted before. Better designs, mass production and durability mean products that more people can afford and enjoy. Wintertime races, hikes and climbs are creating a whole new sport, an exciting way to see and savor snowscapes without using fuel or impacting in any way the fragile ecology.

Old-timers don't all welcome the enthusiastic new crowds wearing their "synthetic looking" snowshoes in place of the classic wooden frames filled with woven rawhide webbing. But aluminum and plastic canoes, spinning reels, fiberglass fishing rods in place of bamboo and outboard power replacing oars were once greeted in the same way. Meanwhile, cold-country newcomers to the sport are greeting the space-

age improvements with warmth.

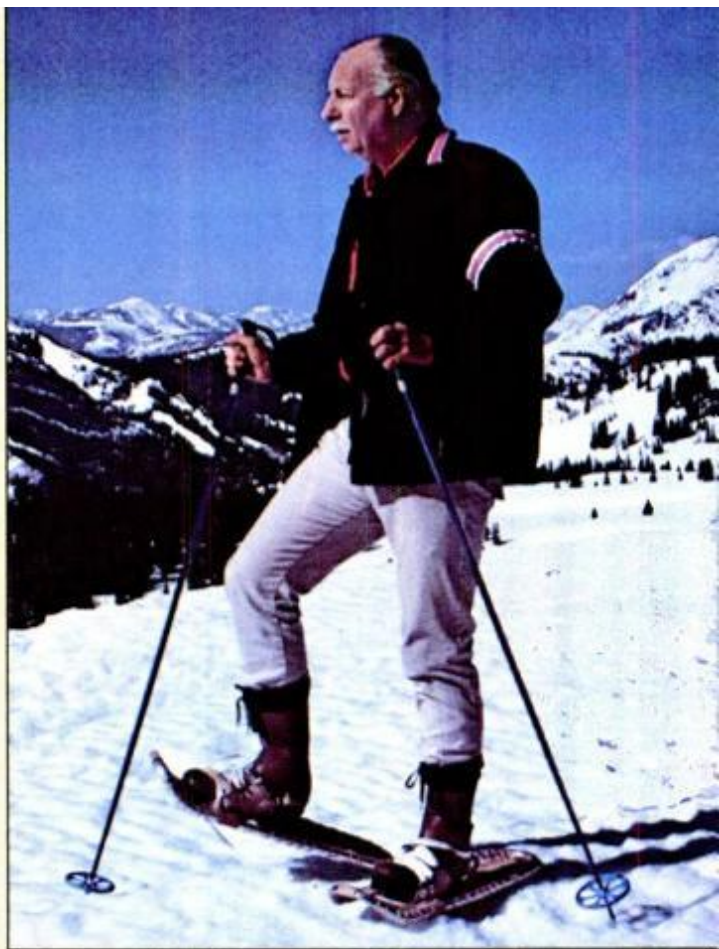
Gold-anodized aircraft aluminum tubing and I-beam, aerospace, aluminum alloys are showing up as frames. Vermont Tubbs, one of the major manufacturers, also employs DuPont's Hypalon for toe and heel pads, and stretch-resistant Hytrel coated cable for webbing for its Alum-a-Shoe line. All of Sherpa's SnowClaw models use lightweight tubular aluminum frames, vinyl-covered nylon decking, neoprene lacing and stainless-steel rods and claws in their bear-paw ovals. All-plastic models, some with screw-in metal studs, are made by Trappe Woodstream and others. They are less expensive and are considered good standby shoes for a car trunk or snowmobile in case of a sudden emergency.

Improved traction, however, is one of the true recent breakthroughs, a new ability that allows snowshoers to climb icy slopes previously impassable without crampons. The simplest approach for slick conditions in the past with conventional snowshoes has been to wind a length of quarter-inch rope around the frame and through the webbing. Use plastic rope, if possible, with this technique since manila tends to soak up water and freeze. The real improve-

(Please turn to page 118)

Races, like this event near Duluth, are becoming community affairs. Cross-country and orienteering tests are new activities.

Skis and snowshoes are used by mountain rescue teams. Bill Lockey of Tacoma, Wash., team wears Sherpa Lightfoots.



Kit-built Sherpa Snowclaw Featherweights (top) tested successfully on ice crust and deep drifts of Colorado Rockies. Wearer's view (above) shows bindings that can be laced on wearing mittens.



Turbocharging increases power, yes, but can you have extra horses and still get decent fuel economy?

Saab owners say you can—that the Turbo comes within a hair of its conventional brother's thriftiness (see chart). The fuel-figure gaps are so tiny as to be virtually insignificant. And it's the Turbo's 100 additional pounds that account for the .3- to .4-mpg difference.

Nearly 40 percent of the Saab owners we surveyed had opted for the Turbo. All of them, it seems, consider the car at least terrific and sometimes better.



New nose on 900 is low and aerodynamic; grille design varies among models.

A Texas musician rhapsodized: "I judge the Saab 900 Turbo five-door with four-speed the finest sport sedan available anywhere for the money. It's a joy to

handle, steering is perfect, and the acceleration—especially from 40 mph up—is fantastic!"

A New York sales rep: "I selected the Saab Turbo because I wanted a sports car that would be fun to drive, yet large enough to accommodate my family and luggage on trips."

A New York nursing home administrator: "I find the Turbo a most agreeable blend of performance, luxury, handling, sportiness and practicality—all for a comfortably moderate price compared with BMW, Mercedes-Benz, Cadillac and Corvette."

Another area in which the Saab excels is safety. To prove the point, a Colorado oil worker told us, "A few weeks after I bought my three-door Turbo Saab, I was driving on a mountain road at night. An-

other car came by and forced me off an embankment. The car sailed through the air over the tops of some trees and landed on its right front fender. It then bounced end over end, smashing the roof and rear panel. Finally it rolled sideways, flattening the doors and breaking out all windows.

"The car ended up upside down 120 feet down an embankment so steep that you needed ropes to climb it. But because of the built-in rollbars, the passenger compartment was literally untouched. I was suspended upside down in my shoulder harness and couldn't undo the buckle because of my weight. I was finally cut loose and climbed out the driver's window with no injuries. The car had only 500 miles on it, but was a total wreck.

"I was so impressed with the Saab's



All instruments and controls are within easy reach from driver's heated seat.

BY MICHAEL LAMM WEST COAST EDITOR

It's a marvelous machine whose dealers are too few and far between

Roll-cage passenger compartment saves lives (see text for one owner's gripping tale).



Cellular bumpers "self-repair" after low-speed collisions.

PM photos by the author

Five-speed transmission is new for 1980 models.



Two-liter, overhead-cam, fuel-injected Four puts out 115 hp; with turbo, 135 hp.

safety that I went out and immediately ordered another one—a five-door Turbo. I now have 8600 miles on this car and have had no major problems."

Feelings are so enthusiastic about Saabs that 19 percent of our respondents said they own not one, but two. And nearly 95 percent volunteered that they'd go for another Saab next time they buy a new car.

"I've been driving Saabs for eight years," proclaimed a Wisconsin vice-president, "and have found them all excellent in terms of handling, safety, comfort and economy. Our company currently owns five—a Turbo, an EMS, and three

GLEs with automatic. We find the cars with automatic transmissions to be more sluggish than those with four-speeds; they also get fewer miles per gallon."

A retired Maine professor reminisces, "I started buying Saabs back in the days of the three-cylinder, two-cycle models and have purchased 10 from the same dealer. I've also owned eight Mercurys and one Lincoln. The Lincoln rusted through the trunk, but I've never had a rust spot on any Saab, in spite of living in a region where roads are heavily salted."

When we asked owners about the Saab's workmanship, 95.4 percent gave this area marks of *good to excellent*. "Far superior to U.S. cars," observed a Georgia steel-plant engineer. A Wisconsin teacher noted, "We hope our 1979 Saab holds up as well as our 1972 did. The '72 had over 100,000 miles with no rust and no mechanical problems." (For PM's last Saab Owners Report, on the Model 99, see page 106, Aug. '72.)

A New York administrator: "Quality and workmanship are excellent, but the Saab's structural strength is legendary. My previous Saab 99 added great rust resistance to an already superior car. The new Saab 900 brings excellent detail finish to the interior—a substantial improvement over previous models."

And while most Saab owners praised

(Please turn to page 150)

Sophisticated Saab

The name Saab is an acronym for Svenska Aeroplan AB, a company that built aircraft long before producing its first car in 1950.

The latest Saabs—the 900 series—are four models in two body styles: the GLI, the EMS, the GLE and the Turbo. The GLI and EMS are available only as three-door hatchback sedans. The Turbo comes in three- and five-door forms (see page 96, April '79).

A list of all Saab features would take a book, but briefly: front-wheel drive, four-wheel disc brakes, rack-and-pinion steering, crash-crush body panels with a unitized rollcage main section, multijointed steering column to minimize thrust, cellular bumpers that compress on impact, an ohc Four with alloy head, Bosch mechanical fuel injection, and turbocharging on the top-line models.

The Turbo also has an engine oil cooler, aluminum wheels, Pirelli P6 steel-belted radial tires on three-door Turbos and Michelin TRXs on five-doors, Bilstein telescopic gas shock absorbers, rear spoiler, electric outside rear-view mirrors, tach, heated driver's seat, and sliding sunroof. And there's more.

Saab options include a selection of radios with stereo and cassette combinations, airconditioning, automatic Borg-Warner transmission, speed control, auxiliary lighting, roof rack, trailer hitch and accent stripes. All Saabs come with extensive anticorrosion treatments and folding rear seats.

For the 1980 model year, Saab has improved the front seats (better lateral support and lower head restraints) and adds a new five-speed gearbox to its power-train lineup.

A NATIONWIDE SURVEY BASED ON 1,297,875 OWNER-DRIVEN MILES

Huge hatch door opens wide for station-wagon utility.



Extraordinary cargo volume and versatile arrangement are praised by owners. With the rear seat folded (left), the luggage compartment length is 71.7 inches; volume, 53 cu. ft. Trunk is formed when the back seat is upright and the parcel shelf is in place (right).

Four-wheel disc brakes and steel-cord radial tires are standard.

SLIDE PREVIEWER



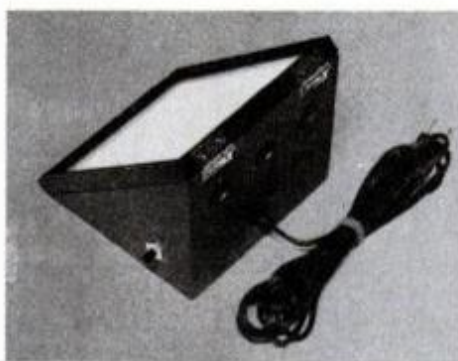
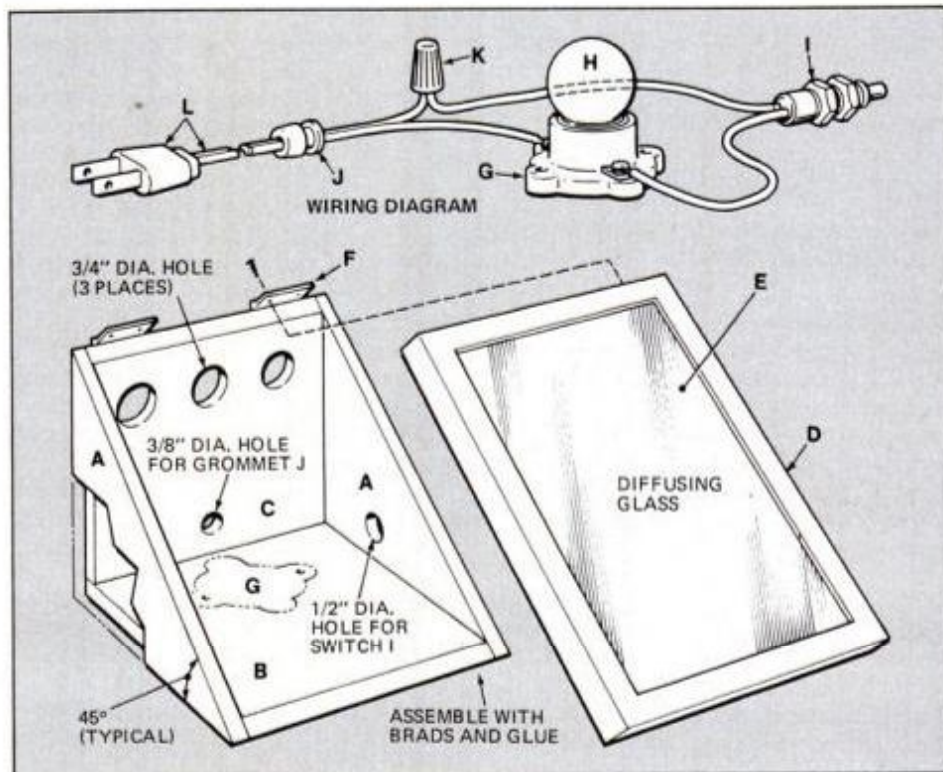
Several small scraps of 1/4-in. plywood, a few odds and ends from the local hardware or variety store, and an evening or two in the home workshop are all that is required to build this little illuminated slide previewer and negative-spotting stand. Never again will an upside-down slide interrupt your family slide show. It's also useful for examining movie film for splicing, if you don't happen to have an editing board.

The unit is constructed around a standard 5x7-in. (glass size) wood picture frame in which the regular clear glass is replaced with a piece of opal, or diffusing glass, for more even light distribution. If you have difficulty obtaining the special glass locally, it is readily available at many camera stores.

Use the plans shown above to cut all parts. Prior to assembly, bore 3/4-in.-dia. holes in back (C) to provide ventilation for the 7 1/2-watt bulb, and a 3/8-in.-dia. hole near the bottom for the power-supply cord. Also bore the 1/2-in.-dia. hole for the rotary on/off switch in one side (A).

Assemble sides, bottom and back with glue and brads. Then paint the device before mounting the hardware and required electrical parts.—James R. Oswald

(Editor's note: If you want a larger unit for examining many slides at once, a horizontal viewing surface is



Three holes at rear of unit vent heat; grommet secures and protects line cord.

MATERIALS LIST—SLIDE PREVIEWER

Key	No.	Size and description (use)
A	2	1/4 x 5 1/4 x 5 1/4 x 7 1/2" plywood (triangular side)
B	1	1/4 x 5 x 5 1/4" plywood (bottom)
C	1	1/4 x 5 x 5" plywood (back)
D	1	frame for 5 x 7" picture (top)
E	1	5 x 7" diffusing glass
F	2	butt hinge to suit frame
G	1	Porcelain socket
H	1	7 1/2-watt light bulb
I	1	on/off switch with attached pigtail
J	1	rubber wire grommet
K	1	wire nut
L	as reqd.	No. 18 lamp cord and plug

Misc.: Glue and brads to suit.



Hinged frame provides ready access to bulb. Cleat-type porcelain socket is wired in series with rotary on/off switch.

recommended instead of the 45° slope of the previewer. Note that larger units are normally lit by fluorescent

bulbs to help prevent heat buildup and to provide a light that is closer to daylight; i.e., 5000° Kelvin.)

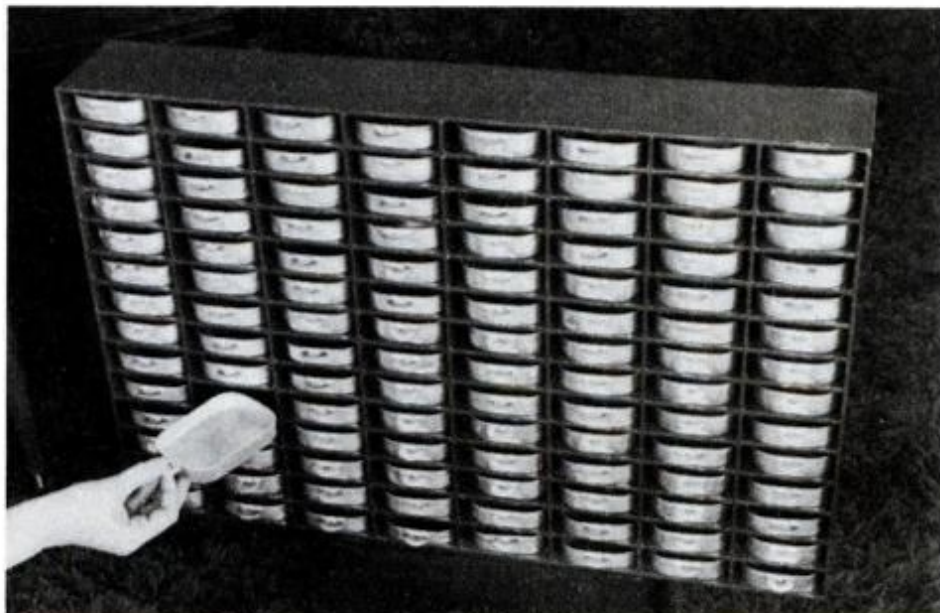
easy projects

SHOP ORGANIZER

This shop organizer is not as tedious to make as it looks—you just need to know a couple of shortcuts. For the “drawers,” you can use plastic boxes, sardine cans, tuna cans, jar lids—whatever you can collect in quantity and at low cost. Use 1/8-in. hardboard for a light-duty organizer, 1/4-in. for heavy duty.

Determine strip lengths and widths according to the size and number of drawers you desire. To cut slots, clamp, drill and fasten about eight strips together with two 5/16 bolts, washers and nuts. Counter-sink the bolt head if you intend to cut the slots on a stationary power saw. Lay out the slots on the top strip. You can cut the slots with a handsaw, bandsaw, jigsaw or table saw. (The latter allows you to cut more plies per pass, but don't cut more than six plies per pass.) Use one of finished strips as a template for laying out top strip on next stack.

Test-assemble the dividers without glue, front side down on a flat surface. Remove one vertical strip at a time and coat all contact surfaces with yellow carpenter's glue.



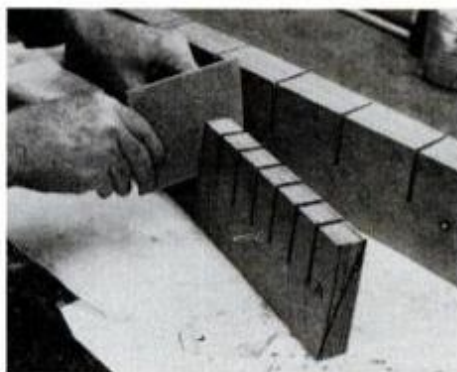
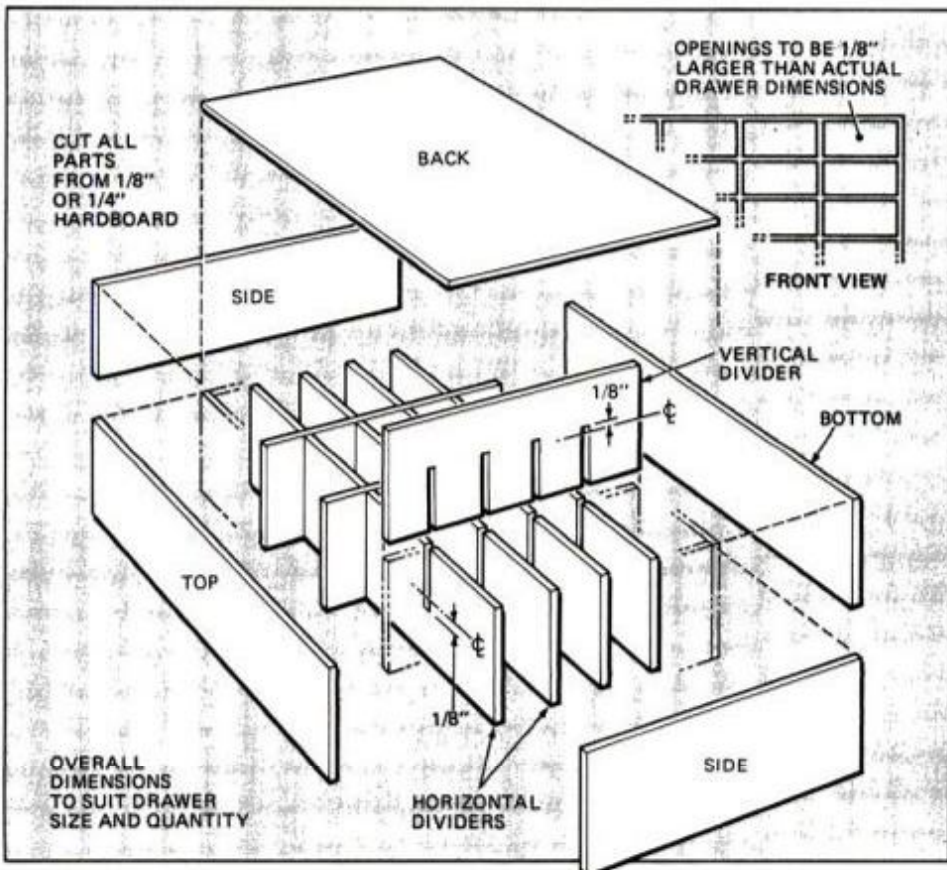
Once all strips have been glued, square up unit and allow to dry. Finally, glue on sides.

I have made seven of these units for various drawer sizes and all turned out well. The first organizer I made is still in use after 25 years.—*M.R. Kirstein*

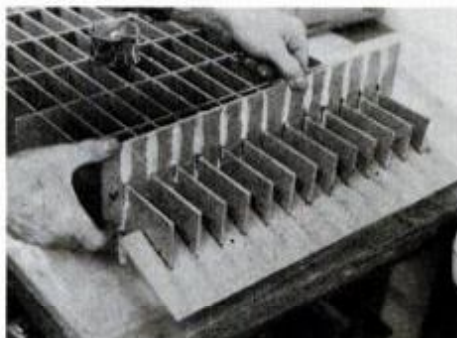
(Editor's note: Sides can also be made of 1-in. pine for greater rigidity. To fasten sides to dividers, glue and clamp. Organizers can be used in kitchen, shop, child's room, studio.)

MATERIALS LIST—SHOP ORGANIZER

Misc.: 1/8 or 1/4" hardboard ripped to suit, yellow glue.



Check width of divider slots with scrap of hardboard prior to assembling organizer.



Apply glue to dividers at joints and assemble on flat, plastic-covered work surface.

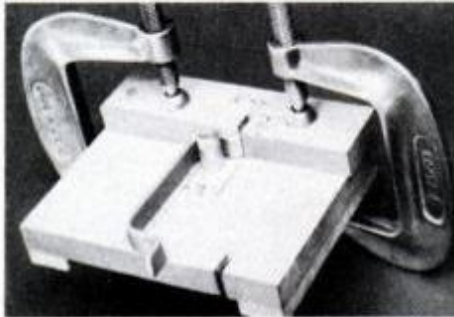
FOLDING TABLE

One piece of furniture that always seems to be in short supply around most households is the folding snack table. No matter how many you have, you frequently wish you had more.

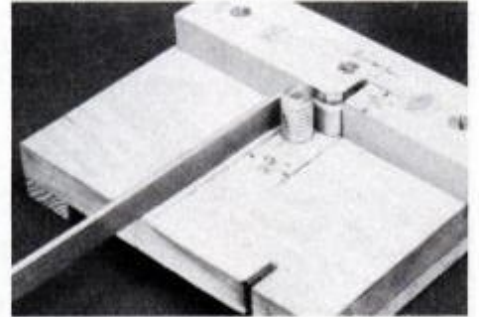
This beauty folds perfectly flat and only 1 3/4-in. thick for compact storage. It is made of redwood with a tortoise-shell laminate top, but pine or hardwood and a different style laminate can be used to suit your taste and budget. Along with the



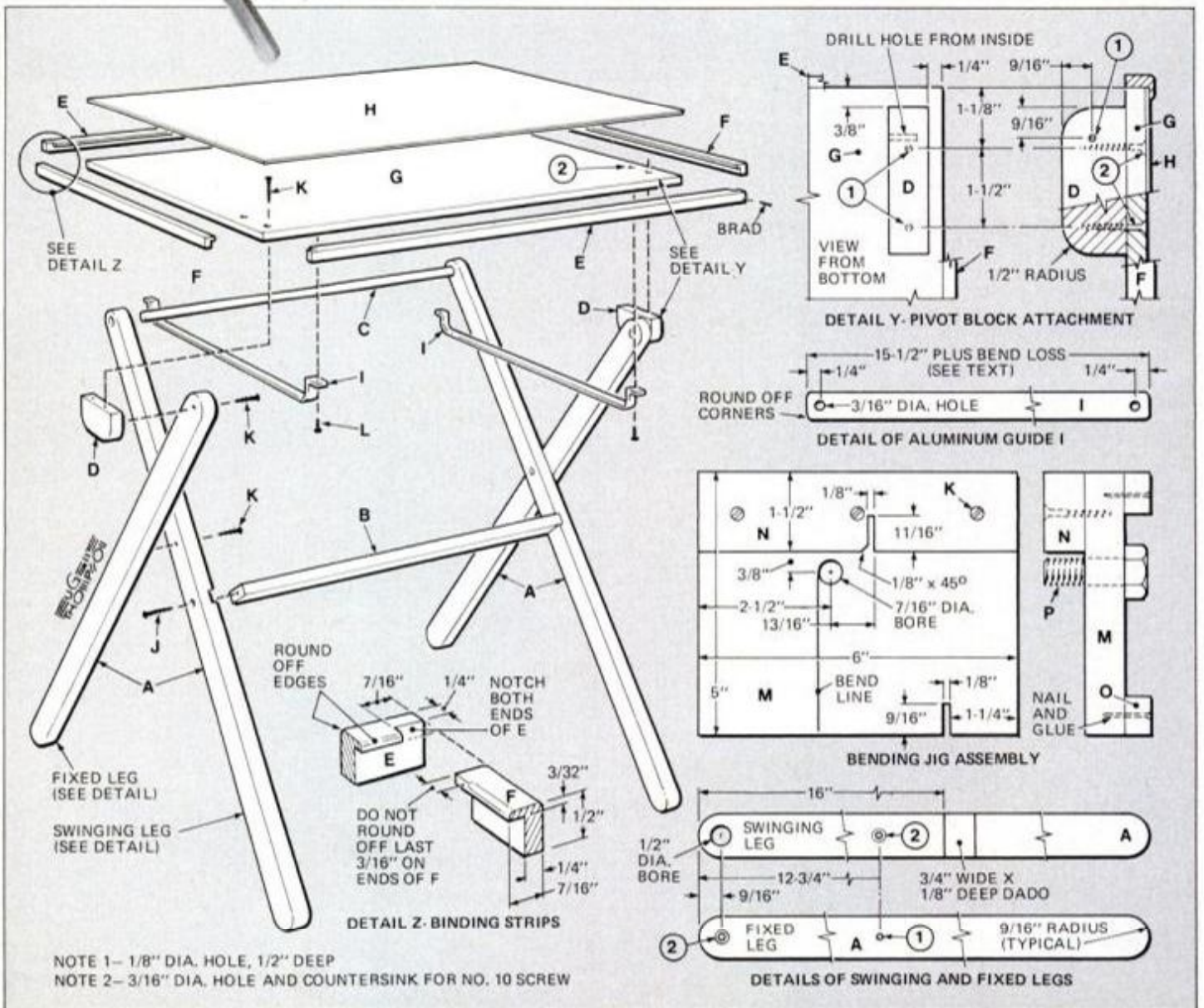
Use edge slot to make first bend in guide. Strike aluminum strip close to the bend.



Make trial bends on jig before screwing on block (N); use clamps to secure temporarily.



Insert bent end in slot on N and force strip around bolt threads to bend line.



plans below, here are some additional hints to help you along:

1. The pivot blocks (D) must be attached to the underside of the top (G) with screws and glue prior to applying the plastic laminate. Be sure to countersink the screws.

2. Cut the laminate (H) slightly smaller than the top (G). Apply laminate contact cement to both surfaces to be joined and allow it to dry until it's no longer tacky. Since the laminate will be difficult to move once it is bonded to the top, use kraft paper slipsheets to keep the surfaces apart until they are aligned. Assure a good bond

by rapping laminate surface with a hammer on a softwood block.

Don't worry if you don't have a veneer trimmer to dress the edges. Binding strips (E and F) will cover any roughness left by sawing.

3. The binding strips can be mitered at the corners, but the joint shown in the plans is less likely to splinter and is also good looking. Attach the binding to G with glue and brads.

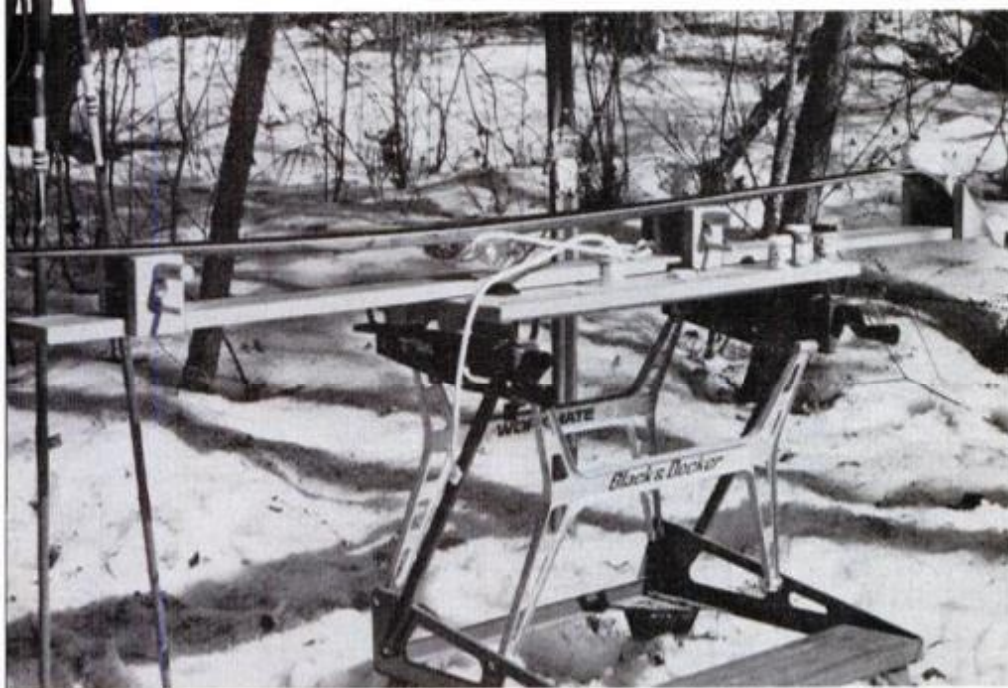
4. Since folding tables generally take a beating, be sure all joints are tight. A brad driven through the top of the leg and dowel (E) will help

(Please turn to page 160)

MATERIALS LIST—FOLDING TABLE

Key	No.	Size and description (use)
A	4	$\frac{3}{4}$ x $1\frac{1}{2}$ x $28\frac{1}{2}$ " redwood (leg)
B	1	$\frac{3}{4}$ x $1\frac{1}{2}$ x $14\frac{1}{2}$ " or to fit redwood (brace)
C	1	$\frac{1}{2}$ " dia. x $15\frac{1}{2}$ " or to fit dowel (stop)
D	2	$\frac{3}{4}$ x $1\frac{1}{2}$ x $2\frac{3}{4}$ " redwood (pivot block)
E	2	$\frac{7}{16}$ x $\frac{1}{2}$ x $20"$ redwood (edging)
F	2	$\frac{7}{16}$ x $\frac{1}{2}$ x $15\frac{1}{2}"$ redwood (edging)
G	1	$\frac{3}{4}$ x $15\frac{1}{2}$ x $19\frac{1}{2}"$ plywood or particle board (top)
H	1	$\frac{1}{2}$ x $15\frac{1}{2}$ x $19\frac{1}{2}"$ plastic laminate
I	2	$\frac{1}{8}$ x $\frac{1}{2}$ x $18"$ cut to suit aluminum (guide)
J	2	$1\frac{1}{2}"$ No. 10 fh screw
K	11	$1\frac{1}{4}"$ No. 10 fh brass screw
L	4	$\frac{1}{2}"$ No. 10 pan head screw
M	1	$\frac{3}{4}$ x 5 x $6"$ hardwood (bending jig)
N	1	$\frac{3}{4}$ x $1\frac{1}{2}$ x $6"$ hardwood (bending jig)
O	2	$\frac{1}{2}$ x $\frac{3}{4}$ x $6"$ hardwood (bending jig)
P	1	$\frac{1}{2}"$ dia. x $1\frac{1}{2}"$ hex bolt (bending jig)

Misc. $\frac{3}{4}"$ brads, glue, and laminate contact cement as you require.



SKI BENCH

It's tough to hold a ski in one hand and try to sharpen or wax it with the other. One inexpensive solution to this problem is this portable bench, which can be affixed to a work surface with a C-clamp or portable vise—or mounted in a Black and Decker Workmate as shown in the photos.

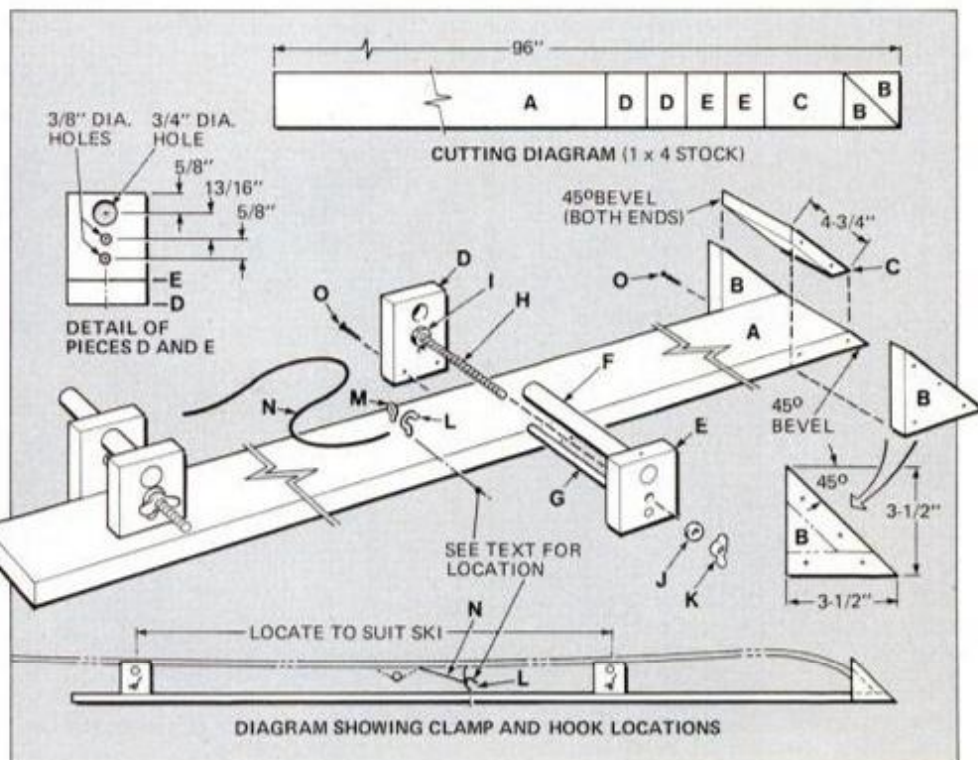
To build the bench, cut parts according to plans below and materials list on page 131. Assemble base (N) and tip stop (B and C) first. Then assemble and attach clamps so that bindings will not interfere. Add hook screw and screw eye about 6 in. in front of binding top pieces.

To use the bench, lay ski bottom up with tip against front stop. To prevent back-and-forth movement, loop rope around toe piece of binding

(Please turn to page 160)



Waxing bench holds ski firmly so that tip may be cleaned, waxed and smoothed.





Do your own plumbing with plastic

Most do-it-yourselfers delegate their home plumbing jobs to the pros. Now, plastic piping lets you do the job with skill.

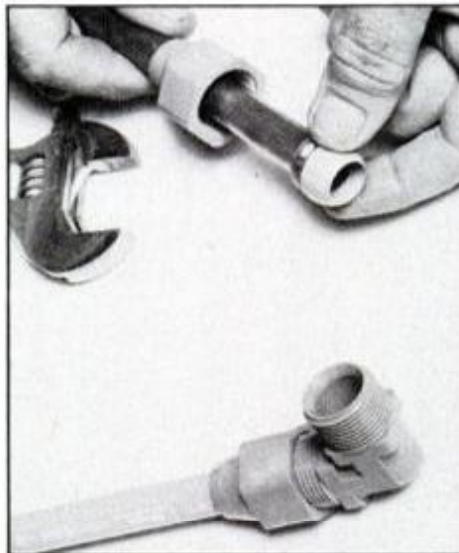
by Rosario Capotosto

Twist-Lok plumber's cleanout fitting by Genova fits easily without tools and seals tightly with a twist. Slotted ears hook over pins in drain-waste-vent hubs.

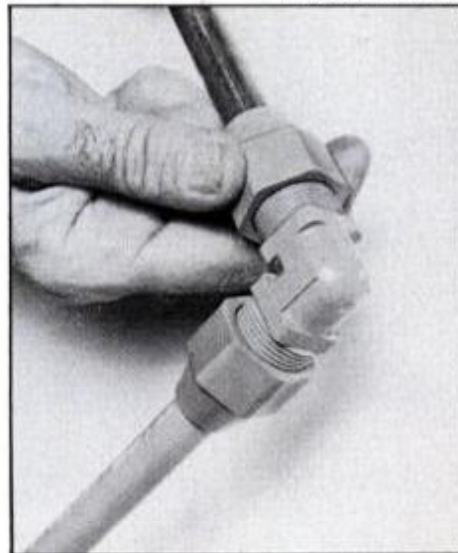
HERE'S HOW TO CONNECT COPPER AND PB PIPE



Slip a plastic nut (Qest is shown) over copper tubing; then slip on metal ring.



Next, slide the seal cone (the large end first) over the copper tubing.



Slide the nut onto the threaded fitting. Tighten by hand, then with a wrench.

The use of plastic to manufacture plumbing pipe, tubing and fittings has made household plumbing jobs much less formidable for do-it-yourselfers. Plastic materials are less expensive than metal and don't require special tools.

Hardware stores and building-supply houses stock plastic plumbing supplies. The fittings, with instructions, come in transparent packages for quick identification. Items for some projects are available in kits containing all needed parts. Products are adaptable to fit existing plastic, copper, brass or iron pipe systems.

Several types of plastics are used to make these plumbing parts. Five common plastics are polypropylene (PP), polybutylene (PB), polyvinyl chloride (PVC), chlorinated polyvinyl chloride (CPVC), and Celcon. These are intermixed in the two branches of home plumbing: potable water supply and waste disposal.

Plastics in supply systems

A typical water-supply system has hot- and cold-water main pipes that branch off to sinks, tubs, showers and toilets. CPVC and PB plastics are used to make piping or tubing. (The terms pipe and tube are interchangeable.) CPVC and Celcon are used to make fittings.

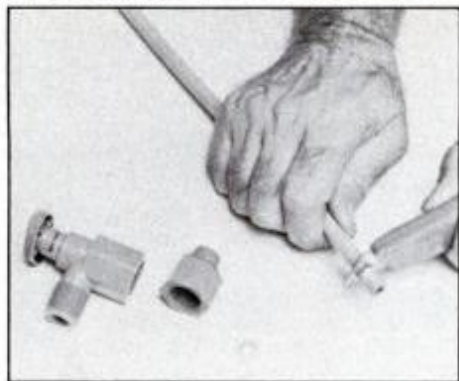
CPVC pipe is rigid and is cut with a fine-tooth saw. You apply solvent to each part and press parts together to solvent-weld them.

PB is a relative newcomer in the plastic-plumbing field. It's the first flexible tubing approved for hot-water service.

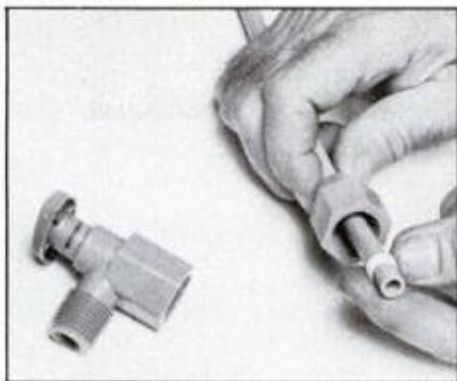
The flexibility of PB permits it to be fished through structural members and behind partitions and

PM photos by the author

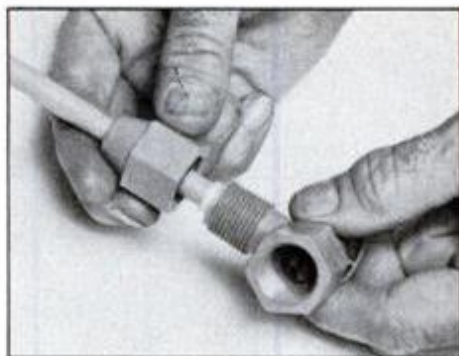
QUICK WAY TO CONNECT TO AN ANGLE VALVE



To make a Qest basin-supply connection to angle valve, first cut PB tube to length.



Second, slip the nut over the supply tube; then slip on the compression ring.

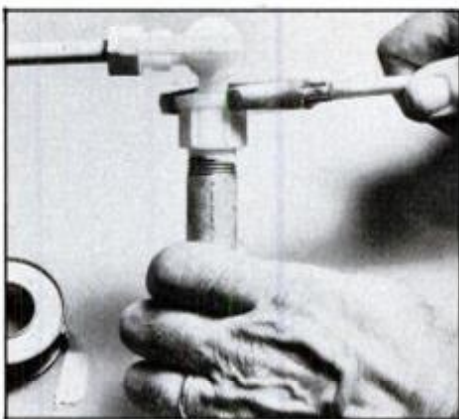
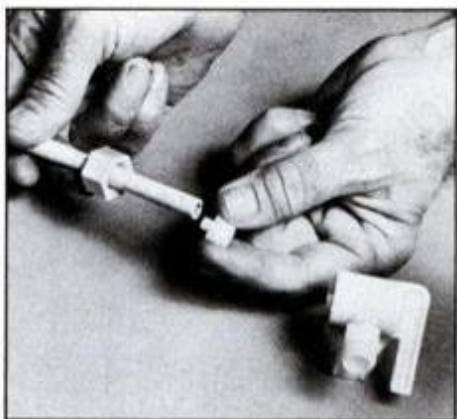


Third, insert the tube end into the valve and tighten assembly securely. Procedure is the same when using copper tube.

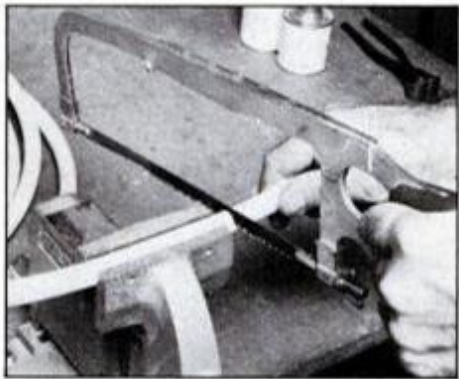
HOOKING UP TO A VALVE

To make a Cohnex-All basin supply connection to a valve (right), cut supply tube to length with a knife, slip nut over the tube and insert compression fitting into end of tube. *Note:* This connection can be made without disconnecting the nut from the tube.

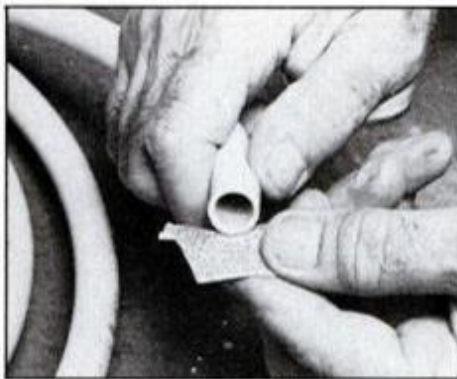
When valve is to be connected to a threaded pipe (far right), first wrap the threads with Teflon tape to assure a watertight joint.



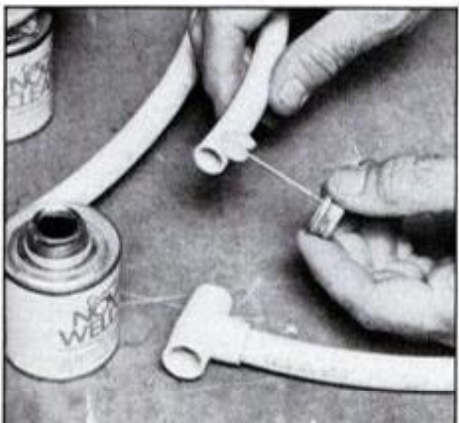
YOU 'WELD' THIS CONNECTION WITH SOLVENT



To solvent-weld Genova CPVC pipe, first cut it squarely with a fine-tooth saw.



Second, use sandpaper or a knife to remove all burrs on the pipe end.



Third, wipe the parts with cleaner and apply solvent to the pipe and the socket.



Fourth, push pipe into socket with a slight twisting motion until pipe bottoms.

GENOVA HOOKUP



To hook up CPVC to water heater with Genova transition fittings, slip nut on heater nipple. Thread brass fitting onto Teflon-wrapped nipple; tighten the assembly.

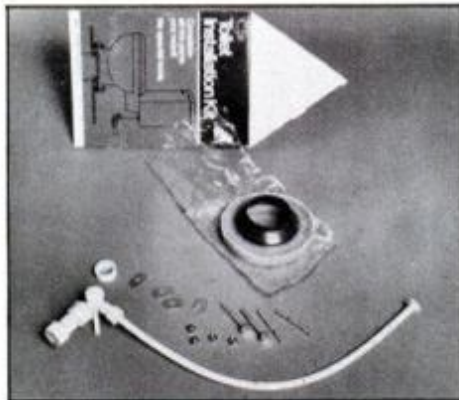
hard-to-reach places, making it a boon to remodelers. Precise measurement of PB for runs and risers isn't essential. The tube flexibility also cuts down on the number of fittings required; it bends around corners. PB absorbs shocks so that water hammer doesn't occur.

You can cut PB with a knife or plastic-tubing cutter and make connections by simple mechanical means.

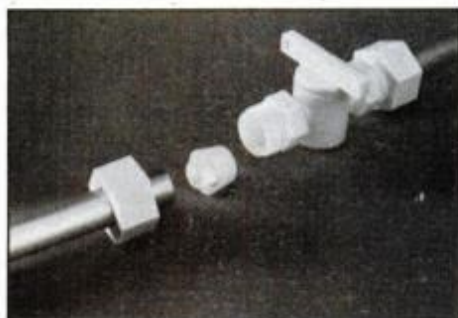
Both CPVC and PB conserve en-



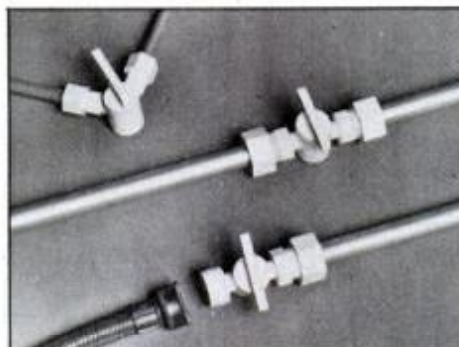
The plumbing-parts system from Chicago Specialty includes all fittings for water supply and waste drain. PB tubing, not shown, and kits with parts for sink and toilet installation are also available.



Toilet installation kit includes bowl wax with plastic collar, angle valve, flexible water-supply tube, bolts and screws.



To make a typical Chicago Specialty connection, loosen nut and push plastic or copper tubing into fitting. Then tighten nuts with wrenches. Connector is shown disassembled in photo for clarity only.

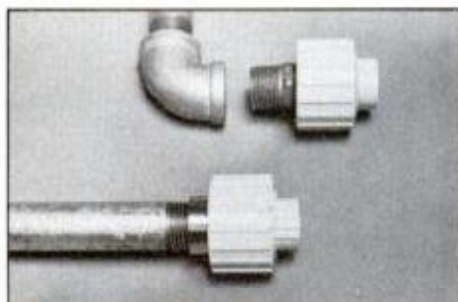


Some Chicago Specialty hookups are (from top): 1/4 to 1/4-in. PB tubing; 1/2 to 1/2-in. copper tubing; 1/2-in. copper pipe to hose. Tubing can be PB, copper or CPVC.

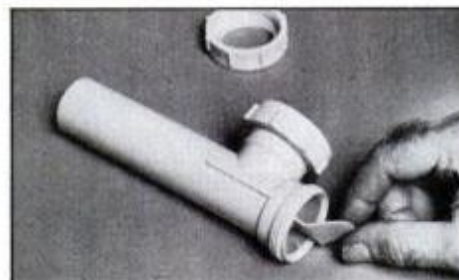


GENOVA SYSTEM

Genova has full line of products for do-it-yourself water-supply and waste-disposal installations. PB tubing shown and rigid CPVC tubing and PVC waste pipe are available.



Transition unions by Genova permit male and female pipe thread hookups that can be disassembled without cutting the pipe.



This Genova baffle tee connects garbage-disposal discharge into kitchen-sink drain to utilize existing trap. Baffle prevents discharge from backing into sink.

ergy by retarding heat transfer. In cold-water piping, this reduces sweat-dripping during hot, humid weather. Neither material corrodes nor is prone to lime-up. Pressure and high-temperature resistance ratings are about 100 pounds per square inch (p.s.i.) at 180° F.

CPVC and PB materials are approved by major regulatory and standards agencies, including the American Society for Testing and Materials (ASTM), Federal Housing Administration (FHA), and National Sanitary Foundation (NSF).

PVC water pipe has been questioned from a safety standpoint because vinyl chloride, used to make PVC, is carcinogenic. Although there is a potential for vinyl chloride to be leached out by water in contact with PVC surfaces, in today's PVC resin little unreacted vinyl-chloride monomer remains. PVC water pipe is acceptable for potable water use and is approved by the NSF. CPVC and PB are also NSF approved.

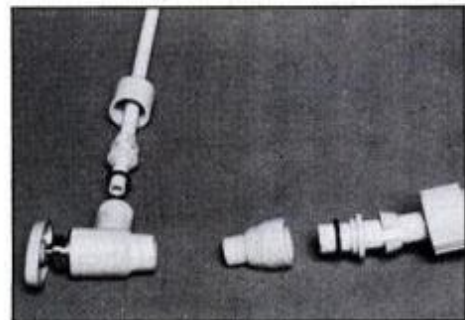
The waste-disposal part of the plumbing system, commonly referred to as the DWV (drain-waste-vent), has various traps and tubing under sinks, tubs and showers. These, as well as the toilet, empty into the main stack, which is topped by the vent stack leading outside.

Tubing made with PP is less expensive than traditional brass and is highly resistant to heat and the corrosive action of household chemicals and drain cleaners.

Waste and vent piping made of PVC is less costly than traditional galvanized metal and is easier to assemble with leakproof joints. It lasts indefinitely, with no corrosion.

Major manufacturers

■ **Chicago Specialty**, one plastic-parts-maker, has two lines: Connex-All water-supply systems and Fit-All tubular drain pipes.



The Genova angle stop (left) adapts mechanically to 3/8-in. o.d. PB tubing (top). Genogrip adapter (right), shown disassembled, solvent-welds directly into fitting and permits joining PB tubing mechanically by clamping a tapered split-grab-ring and rubber O-ring around pipe. In use, adapter is pushed on pipe, hand-tightened.

The Connex-All system has Celcon acetal fittings and utilizes a plastic insertion seal that fits over the end of flexible PB, rigid CPVC and flexible or rigid copper.

Fit-All tubular drain parts combine PP and PVC for kitchen and bathroom use. All bend sections are made with highly heat resistant PP. Combination kits to install water-supply and drain systems in kitchen and bathroom sinks are available.

■ **Genova**, another plumbing-materials maker, has a full line of plumbing and pipe fittings. For water-supply systems, products include CPVC tubing and fittings and PB tubing. For waste-disposal systems, Genova makes PVC pipe and fittings and PP tubular items such as waste arms and traps.

Rigid CPVC pipe is solvent-welded to CPVC fittings. The rigid pipe is often preferred for installations that will be exposed to view. By using a special Genogrip adapter, flexible PB connects to CPVC, for example, to fish a run through walls.

Genova PVC-DWV pipe and fittings for waste disposal are lightweight and easy to handle. They are solvent-welded with a different solvent from that used on CPVC. Genova also has a Bath Pak for sink, toilet and bath DWV installation.

■ **Qest** (pronounced "kest") specializes in water-supply plumbing utilizing flexible PB tubing and Celcon fittings and valves. Celcon is a rigid, tough plastic that has optimum wrenching strength. The system uses an end-compression connection, a conventional-looking male fitting with threaded ends.

Although Qest fittings utilize threads, no tape or dope is usually required to render the joint watertight. Qest fittings can be joined directly to existing systems. **PM**

MANUFACTURERS LIST

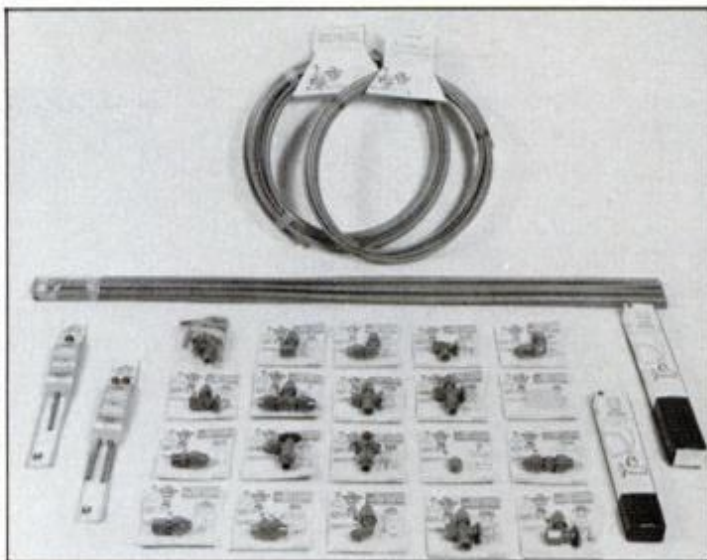
Chicago Specialty Manufacturing Co., 7500 North Linder St., Skokie, Ill. 60076

Genova Inc., 7034 East Court St., Davison, Mich. 48423.

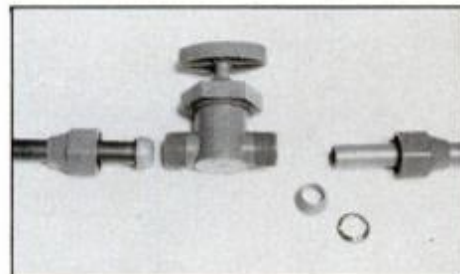
Qest Products Inc., 1900 West Hively, Box 1746, Elkhart, Ind. 46515.

QEST PLUMBING SYSTEM

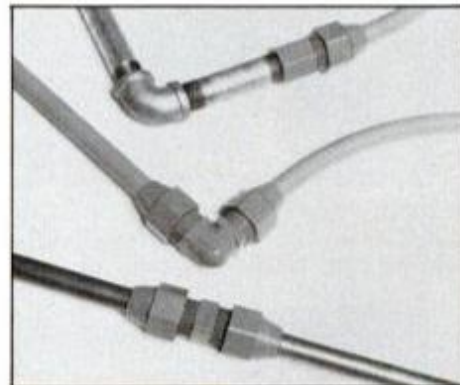
The Qest system includes the needed parts for water-supply plumbing. Flexible PB tubing comes in straight lengths and coils. Fittings and valves are of Celcon, a tough, rigid plastic that holds up under a wrench. The system is known as Qicktite. It uses an end-compression connection. A major advantage of the system is that transition fittings aren't needed. Fittings join directly to existing, installed systems.



When flexible PB tubing is used, corners can be negotiated without elbows or tees.



In the Qest hookup, a nut, ring and cone slip over pipe and thread onto fitting. The nut is tightened to complete the seal. System is used on copper, PB or CPVC.



These Qest connections are (from top): PB coupled to a threaded pipe; right angle bend of PB tubes; copper tubes coupled.



Sealing cone is built into Qest female fittings and valves. The cone eliminates the need for thread dope or tape.



Polybutylene tube (foreground) is bent to 10 times its diameter without kinking. For example, a 1/2- to 3/8-in.-dia. tube can be turned in a 5- to 6-in. radius. Wrench and knife are used on Qest system.



Molded faucet ends of PB riser tubes won't come apart. Risers shown (left to right): Qest, Genova, Chicago Specialty.

Sweep your flues clean and

Chimney fires caused \$23 million in damage during 1978. When was the last time that your chimney was swept?

Wood-burning fireplaces and stoves are sweeping the country. But who sweeps the chimneys and stovepipes which carry smoke and gases out of the house? In at least 40,000 cases, the answer is, "Apparently, no one." This is how many chimney fires occurred last year.

Chimney fires result from creosote buildup. According to August West Systems Inc., a chimney-sweep company in Westport, Conn., the ac-



Brush of proper size and shape for flue is a prerequisite: Too small a brush won't clean; one that's too large might jam.



Topside cleaning can be hazardous. If you're not sure-footed, let pros do the job.



Professional sweep should be well equipped, guarantee clean-up and carry insurance. The average fee is about \$40.



Creosote appears in several forms, from a syrupy liquid which can dry to a tough glaze, to powdery crusts shown above.

cumulations can be ignited if you burn a slightly larger or hotter fire than usual, or if a flaming piece of newspaper shoots up the chimney or stovepipe.

If a chimney fire doesn't burn the

house down, it can "at the very least, scare you to death," says West. "A chimney fire burns very hotly (over 3000° F.) and very loudly. It sucks in a tremendous amount of air. The noise alone is terrifying."

Although you may extinguish a chimney fire before it damages the house, it often weakens the chimney to an extent that it's no longer safe.

Unfortunately, creosote buildup

(Please turn to page 148)

avoid costly chimney fires

Clean your own chimney and save money

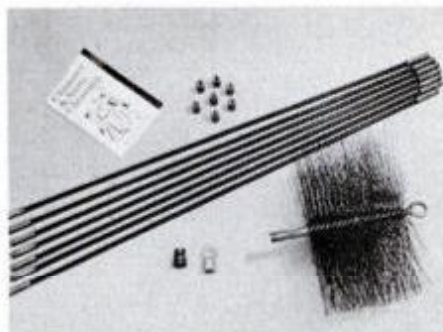
There are several approaches to cleaning a chimney, but the two basic rules are: Use the proper tools and make every effort to contain the mess. The right tool for flue cleaning is a wire brush sized for your flue—not a bunch of tire chains or an evergreen tree.

Containing the mess starts with being overcautious. I use about two Sunday newspapers' worth of paper. Tape the sheets together to cover the hearth and toss the whole pile when you're finished. Sweeping chimneys when the outside temperature is below 40° F. makes for the best draft, minimizing the chance of soot entering the room.

Using extension rods on your brush, you can sweep from the inside or from the roof. From the inside, first remove the damper (if it's removable) and insert the flue brush with a couple of rods attached into the flue. Tape an old sheet over the fireplace opening, but leave a slit so you can manipulate the brush and rods. From the roof, leave the damper closed and cover the fireplace opening as an extra precaution. With both approaches you have to reach through the fireplace throat to shovel fallen creosote from the smoke shelf. (See diagram.)

The best book I've seen on the subject is *Be Your Own Chimney Sweep*

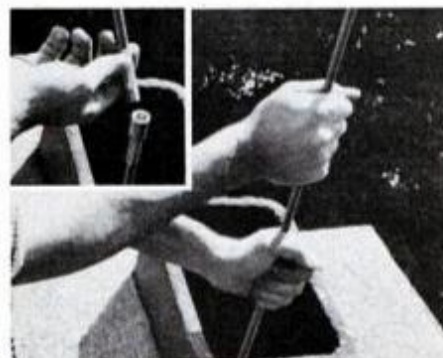
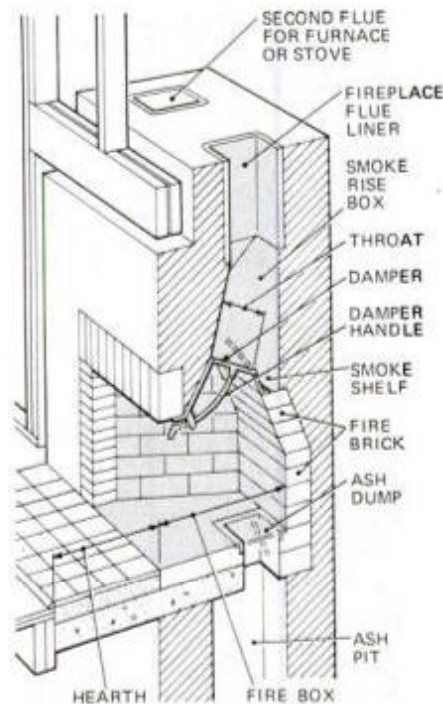
by Curtis and Post. It's \$5.60 postpaid. Garden Way Publishing, 9524 Ferry Rd., Charlotte, Vt. 05445.—*Joseph R. Provey, Assistant Home and Shop Editor.*



Black Magic sweep kit, manufactured by Worcester Brush Co., Worcester, Mass., is \$45 to \$76, depending on brush size.



As precaution against airborne soot, tape old sheet or newspapers to fireplace opening before scrubbing from roof.



Flexible fiberglass extension rods let you scrub entire flue. Clean one section at a time, adding rods as you descend.



Flue can also be scrubbed by tying rope to both ends of brush, stationing helper below and alternating pulls on ropes.



Clean creosote accumulations from fire-box walls with a hand wire brush. Trouble light lets you spot buildup.



After removing damper, scrub with wire brush. Then clean smoke-rise box, using flue brush with one or two rods.



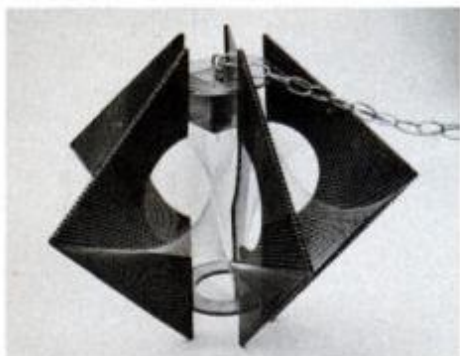
Carefully scoop creosote from smoke shelf into trash bag. If you don't own an ash shovel, use a child's sand shovel.



Don't neglect dirty stove pipes either; 1/4-in.-thick encrustations should be scrubbed clean before cleaning stove.

Using plastics and workshop common sense, you can make these decorator lamps to enhance your home.

CONTEMPORARY HANGING LAMP



String-art techniques, fishing line and plexiglass combine to produce spectacular lighting for foyer or dining room.

Anyone who has recently visited a lamp store knows that this hanging lamp would cost many times the \$15 it costs to make it yourself. Although the project requires some patience, it's easy to create if you follow our instructions.

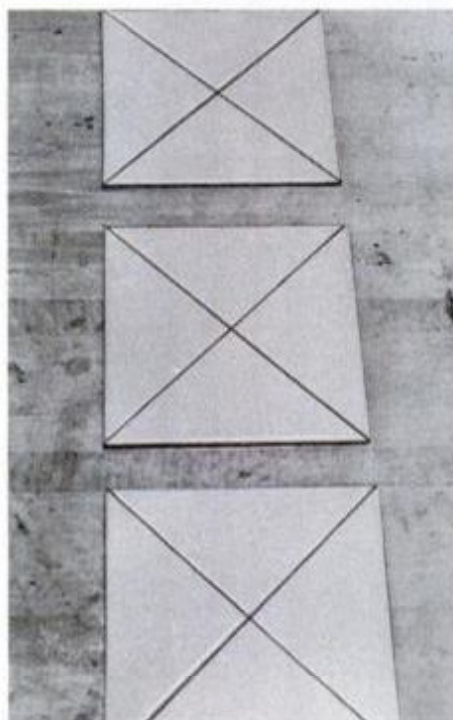
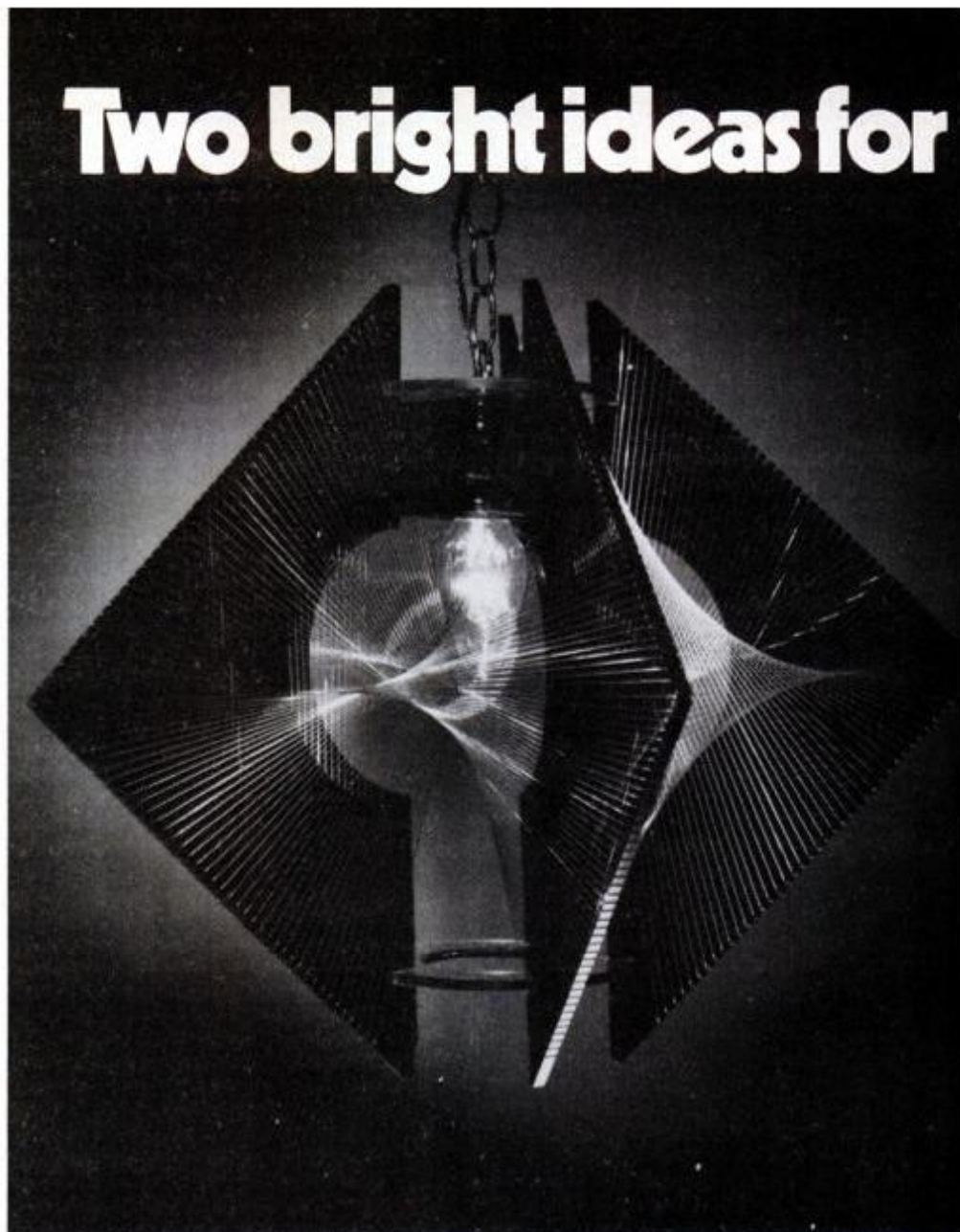
First, get some smoked plexiglass. It's available at most plastic dealers—where you may be able to buy scrap pieces by the pound to save money. Be sure the scraps are all the same color and still have protective paper on.

Cut pieces to size, with table saw and a plywood blade or sabre saw and a fine-tooth blade. Use a circle cutter and drill press to make the circular cutouts. To make the cuts, clamp workpiece to the table and, at slowest speed, cut halfway through the plastic. Then stop the press, turn the plexiglass over, re-clamp and finish the cut.

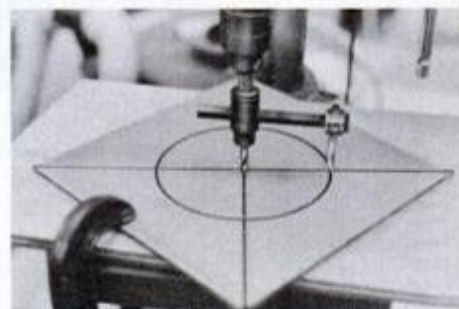
Using a bandsaw, cut the three squares into six triangles. To sand edges even, first glue the triangles with rubber cement, matching edges as closely as possible. Also glue discs B and C together. Use an electric sander with a rough grade of paper to even the edges. Then use a scraper to smooth all exposed plastic edges. Buff edges with double O steel wool until they begin to shine. Continue buffing until shiny with an electric buffer or plastic polish (rouge) and a rag.

With triangles and discs still glued, cut all notches with the bandsaw as shown in plans. Carefully cut notches for joining triangles to discs for a snug fit.

Carefully pry apart triangles and
(Please turn to page 114)



Three squares of plexiglass are required for lamp; draw diagonals to find centers.



Clamp square securely to work surface, use circle cutter to cut 6-in.-dia. circles.



Cut a second, 3-in.-dia. circle, but do it in only one of the 6-in.-dia. discs.

shop-made lamps

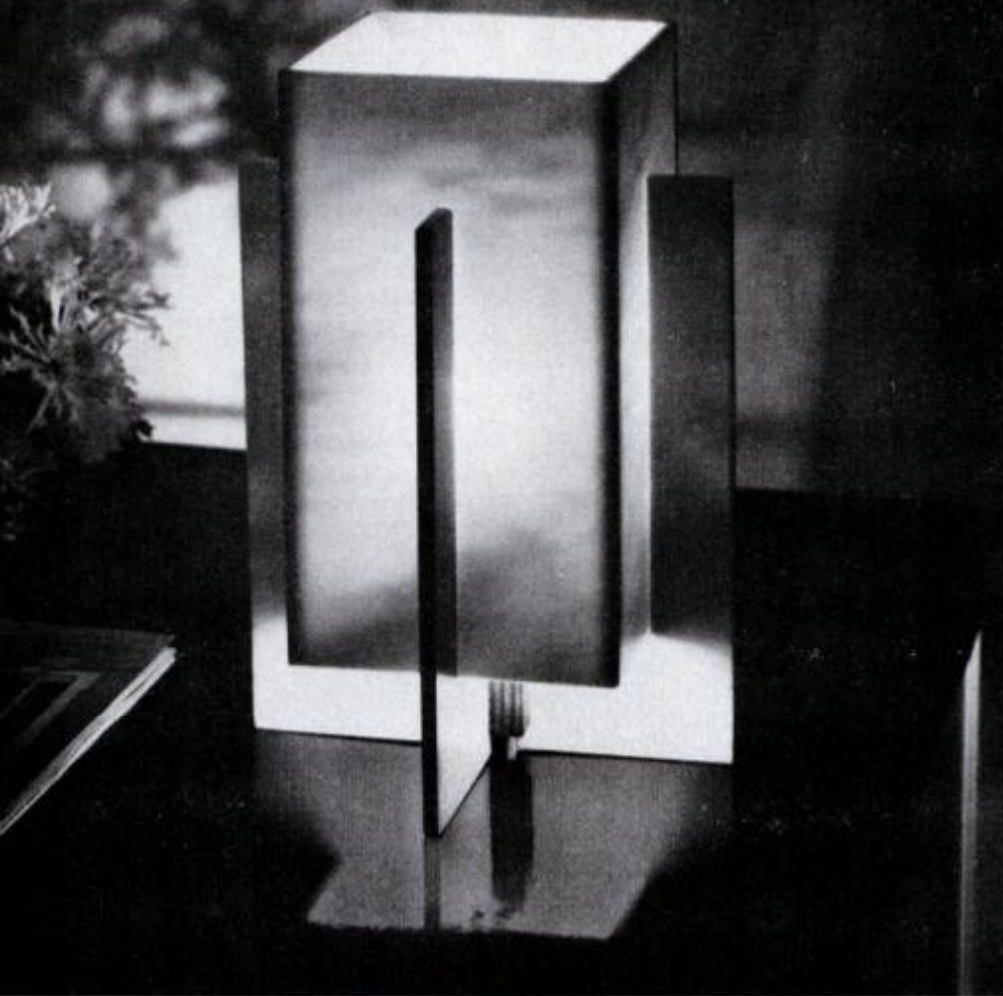
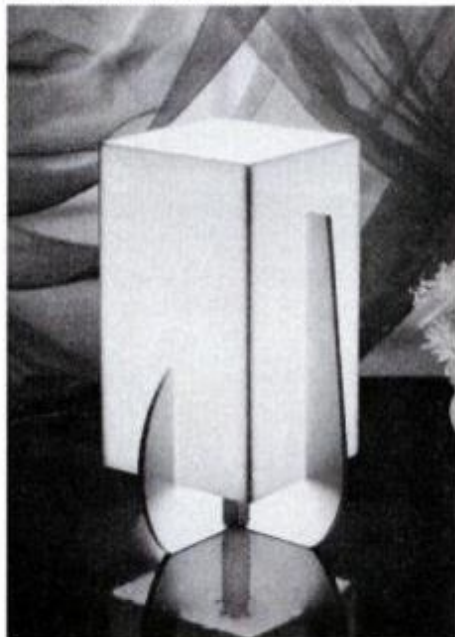


TABLE LAMP FROM BUILDING MATERIAL



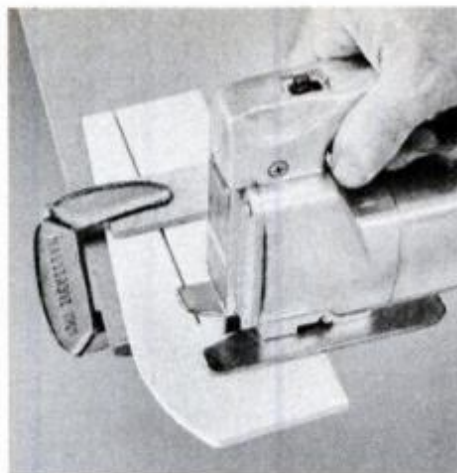
Luminous table lamp can be made with curved (above) or rectangular "spokes."

Create the right mood lighting for your next dinner party with this elegant table lamp made from Dupont's marble-like Corian. We used translucent Cameo White for this project—it's available at many plumbing supply houses and at some lumberyards. Other uses include tub enclosures, countertops, bathroom vanities and preformed sinks.

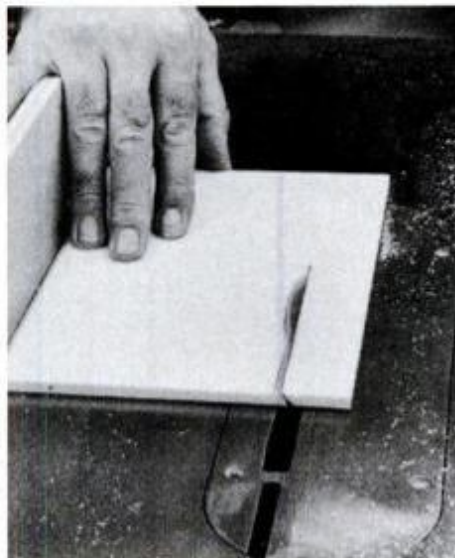
Corian can be sawed, drilled and sanded. Either a carbide-tipped blade or a plywood blade is required for cutting. A hacksaw is also useful for completing inside corner cuts. A belt sander is best for dressing the edges. For bonding the material use any one of the new cyanoacrylate adhesives.

To build the lamp, start by making the rectangular shade. Cut the four panels (B) as shown in the plans. It's necessary to clamp a board parallel to your table saw's rip fence so it rests firmly against the table top. This will prevent the sharp edge of the 45° bevel from slipping under the

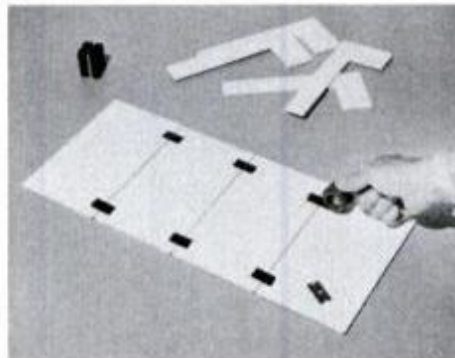
(Please turn to page 115)



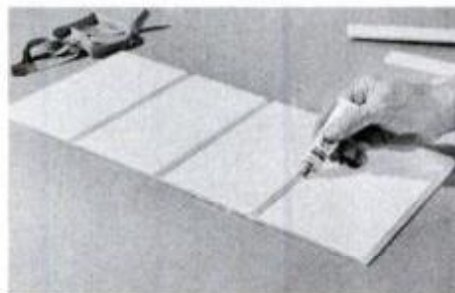
Make final short cuts at spoke corner with sabre saw, tungsten-carbide grit blade.



Clamp wood strip to fence to stop beveled edge of side (B) from slipping below.



After cutting bevels on the shade panels, apply tape to facilitate gluing.



Apply glue along each beveled edge; cyanoacrylate adhesive works best.

discs with a putty knife. Then remove protective paper covering. Re-drill the center hole in B and buff the inside edge of the other circle.

Assemble with rubber bands and solvent glue at joints. A syringe is best for applying the solvent at the joints. Capillary action will draw the solvent into the joint surfaces. Be careful not to spill glue on the plexiglass, as it leaves a permanent blemish.

At this point you may want to make a plexiglass cube to hide the light socket. Use the spare triangle to cut pieces (D).

Clean surfaces thoroughly with an alcohol-soaked rag. Then tie a knot in one end of the fishing line so it catches in a side slot. Leave a 5-in.-long tail. Beginning at an end slot in one side, thread the lamp. End at

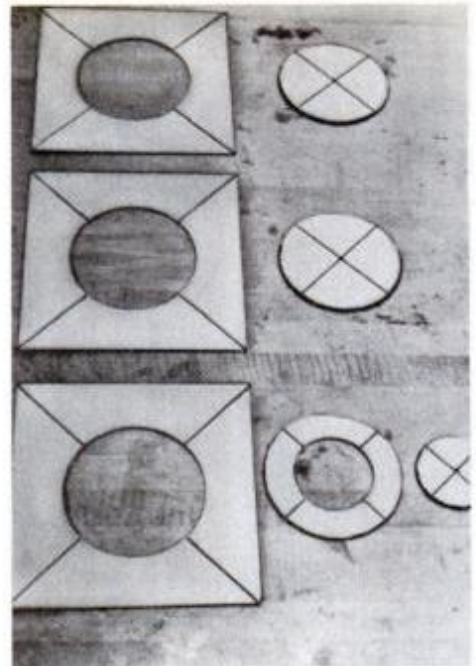
the middle slot on one side. Tie another knot in the fishing line to catch in the last slot and snip, leaving a 5-in. tail. Tie tails together.

Install electrical parts and hang the lamp with a toggle bolt and decorative hook. *Caution:* Use a 60-watt (or less) bulb to avoid heat damage.—David Blodgett

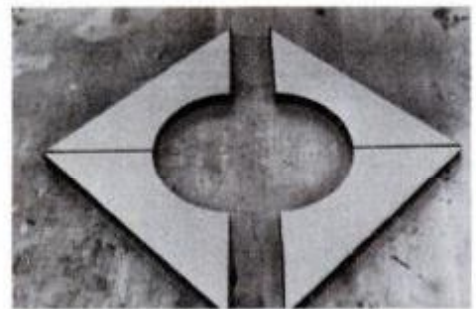
MATERIALS LIST—HANGING LAMP

Key	No.	Size and description
A	5	1/4" smoked plexiglass (see cutting diagram)
B	1	1/4" smoked plexiglass (see cutting diagram)
C	1	1/4" smoked plexiglass (see cutting diagram)
D	4	1/4 x 2 1/2 x 2 1/4" smoked plexiglass
E	as reqd.	25 to 40-lb. monofilament fishing line
F	1	light socket
G	1	3/8"-dia. threaded pipe
H	1	3/4" female nipple
I	1	10 to 12-ft. link chain
J	1	line cord switch
K	1	12 to 15-ft. No. 18 lamp cord
L	1	plug

Misc.: Toggle bolt and decorative hook, 25 to 40-watt bulb, cyanoacrylate-type glue.



Small disc, one large disc and one triangular half-square are spare parts.



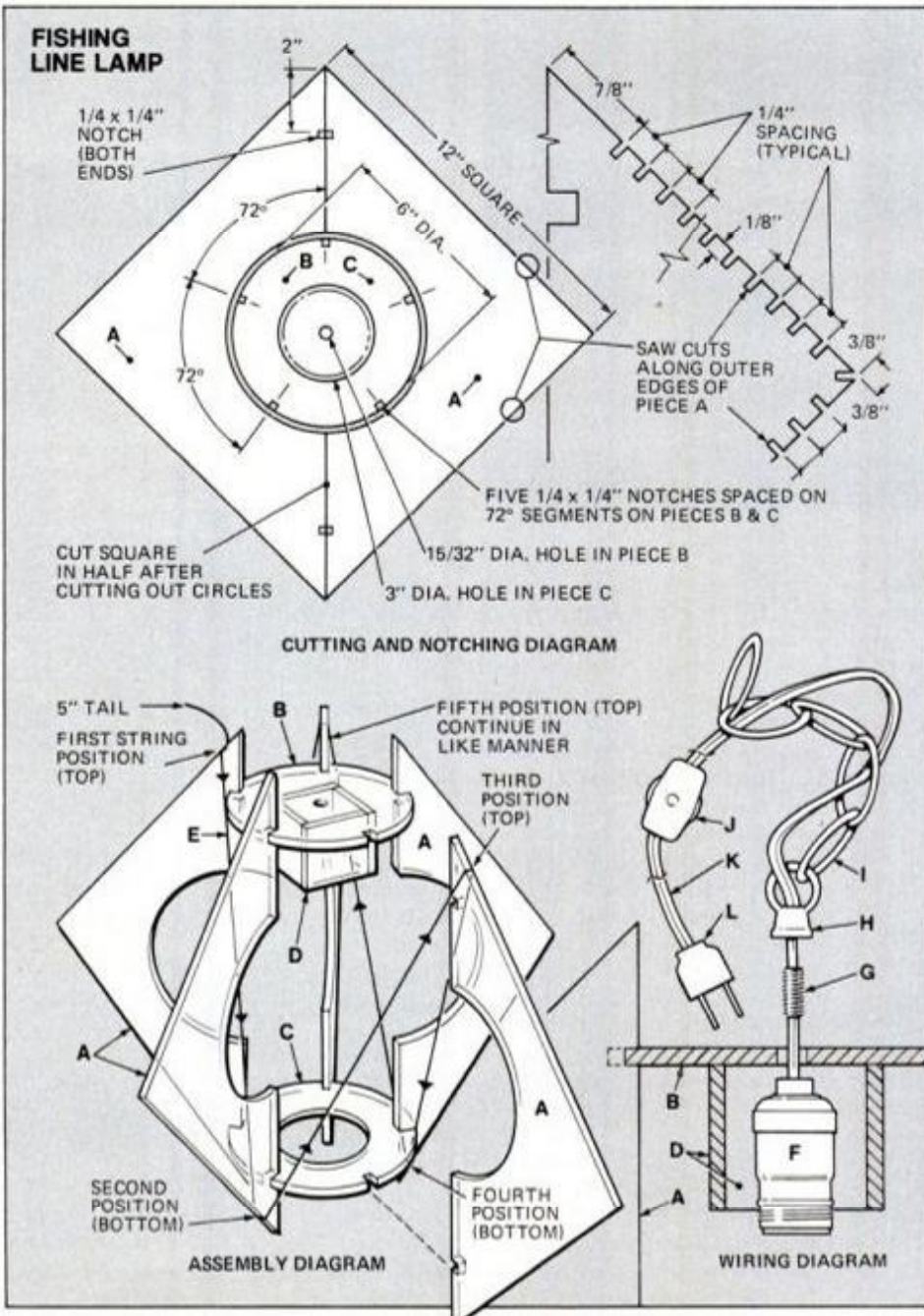
Saw squares in half along a diagonal; temporarily glue them with rubber cement.

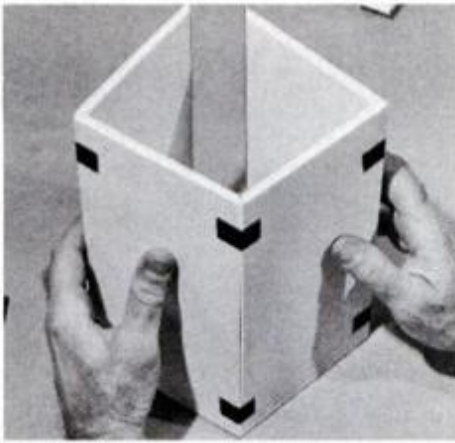


To even straight edges, use stationary sander fitted with coarse grade abrasive.

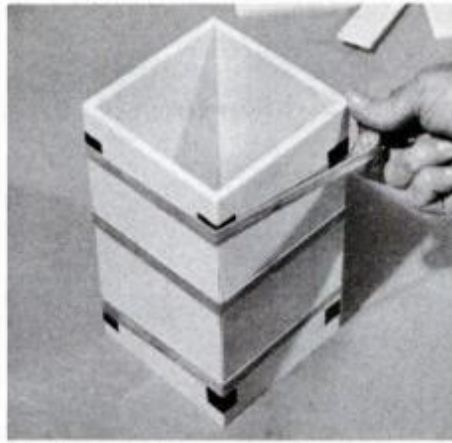


Use bandsaw to cut notches for fishing line. (See the notching diagram above.)

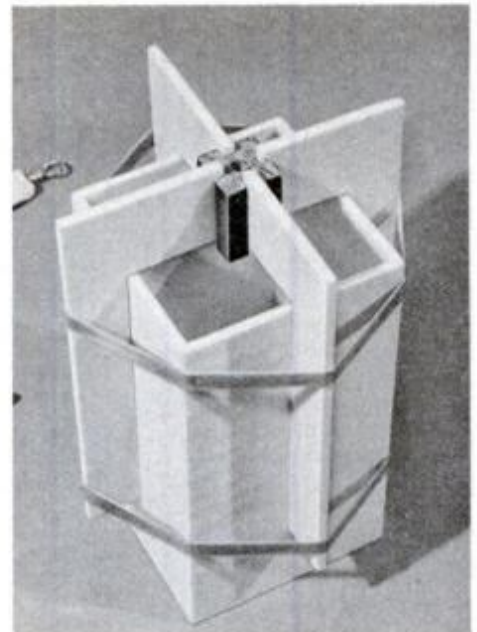




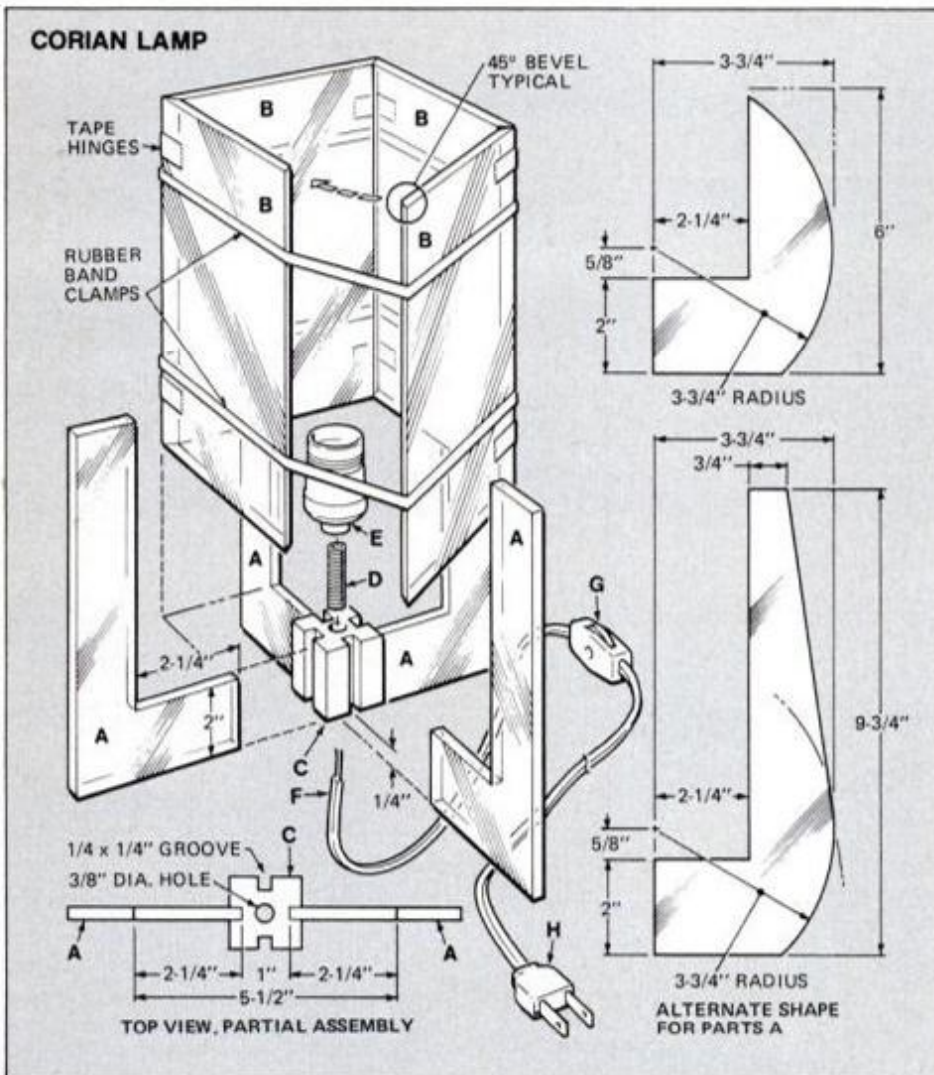
Next, fold side panels (B) to form shade. Tape pieces act as temporary hinges.



Check shade for square and use heavy rubber bands as clamps while glue sets.



Rubber bands are also used while joining spokes (A) to hub (C) with glue.



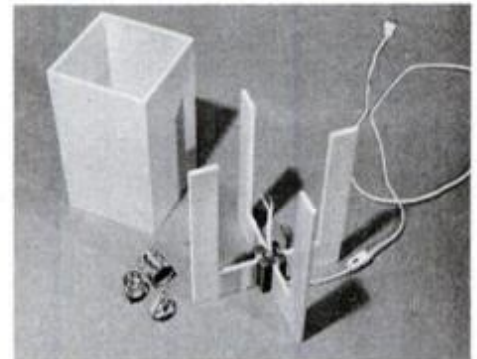
fence while you make the cut on the opposite edge.

After cutting the panels, lightly sand all bevels with fine sandpaper. Line up all four sides (with the bevels down), and tape the edges together for easy assembly. Fold the four hinged panels into the rectangular shade shape and check for fit. If it's okay, apply glue and form the rectangle, taking care that it remains

square. Use rubber bands or tape to hold the pieces together while the glue sets. Sand rough edges and excess glue with fine paper.

Next, cut and bore the wooden hub to the dimensions shown. Make a test groove in some scrap first. The spoke legs should fit the hub tightly. Sand and spray the hub black.

Now cut the spokes to the shape of your choice—either square for the



Before connecting cord to socket, pass leads through hub and nipple (D).

look of a modern sculpture, or curved to evoke thoughts of hurricane lamps of the past. It's a good idea to cut the feet on the spokes slightly long. After a trial assembly, use the belt sander to shorten them so the spokes fit snugly against the shade.

Make the final assembly by forcing the threaded pipe (D) into the hub (C), connecting the cord to the socket and installing the switch and plug. The hub should be glued to the spokes so it rests 1/4 in. above the table to allow clearance for the lamp cord.

For extra strength, you should bond the shade to the spokes with a few drops of adhesive.—John Gaynor

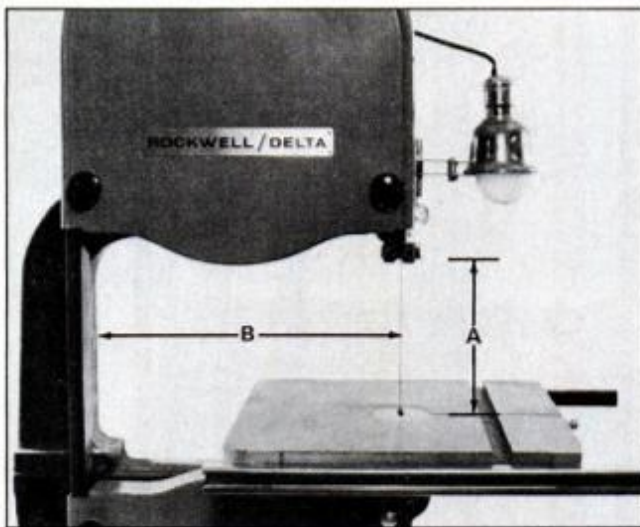
MATERIALS LIST—TABLE LAMP

Key	No.	Size and description
A	4	1/4 x 3 1/2 x 9 1/4" Corian (Cameo White)
B	4	1/4 x 5 1/2 x 9 1/4" Corian (Cameo White)
C	1	1 1/2 x 1 1/2 x 2" hardwood (painted black)
D	1	1/4"-dia. threaded pipe
E	1	light socket
F	1	12 to 15-ft. No. 18 lamp cord
G	1	line cord switch
H	1	plug
Misc.		Rubber bands, tape, solvent-type cement for acrylic plastic.

WORKSHOP MINICOURSE

MORE ABOUT THE BANDSAW

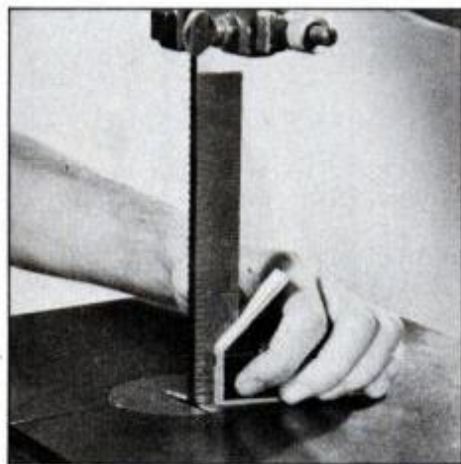
Two capacities to check before buying a bandsaw are its maximum depth of cut (A), and the throat (B). The first determines the thickest piece of wood that will fit between table and guard, with latter fully raised; the throat limits the width of work that can be swung around or pushed through the blade. Bandsaw size generally refers to the tool's throat. Thus, a 14-in. bandsaw is one that has 14 in. between blade at both vertical positions of its travel. Bandsaw size can also refer to the diameter of its wheels.



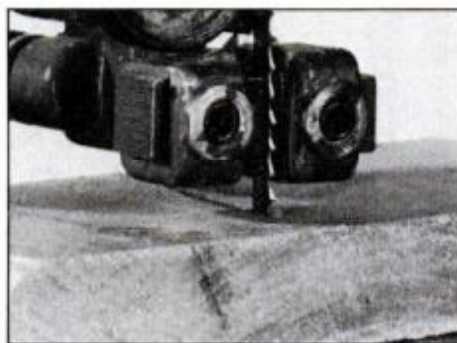
As with any cutting tool, it is imperative that you keep a sharp blade on your bandsaw. A dull blade creates the tendency to push a workpiece with your thumbs in line with the blade. If the workpiece has a soft spot (or, if plywood, a void) there is great danger of the work advancing with a sudden spurt toward—and carrying your thumbs into—the blade.

Before turning the power on, it is a good idea to check the blade for squareness with the table, as shown at left. Also, periodically inspect the blade for cracks and checks. Metal fatigue (brittleness) is indicated if any are found and, when this is the case, the blade should be discarded. Check the blade's tension to assure that it conforms to the maker's recommendations. Turn on the power and allow the blade to reach full speed before you start feeding the work to it.

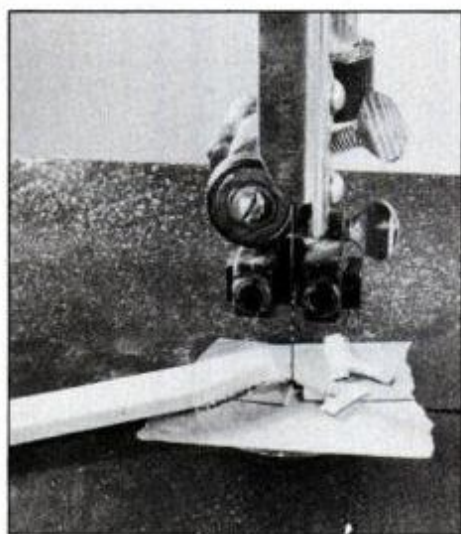
Though preference will vary from one user to the next, I like to feed by pushing with my right hand and guiding with the left. Don't hesitate to shift one or both hands to the rear of the blade to *pull* the work through, if that is the safest technique for the cut that you're making at the moment. **PM**



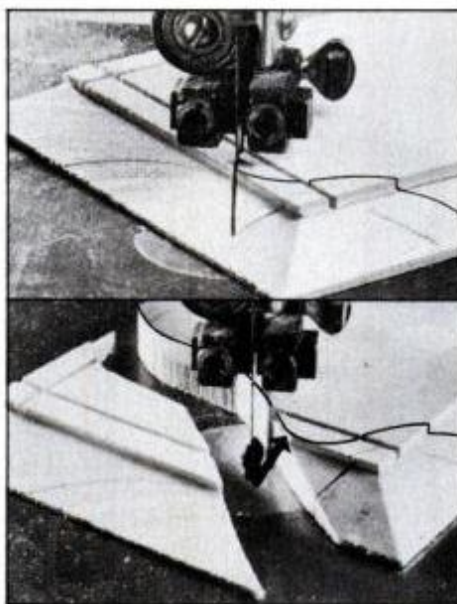
Before starting a cutting session, use a square to make certain that the blade is at a 90° angle to the table. If it isn't, you should adjust the table so that it is.



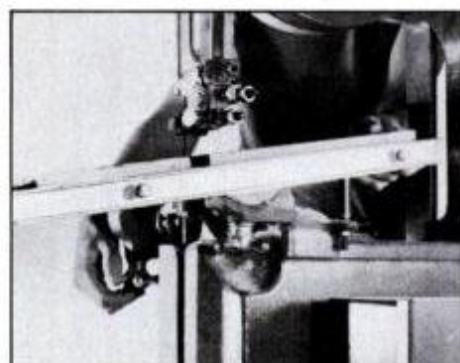
The blade guard should be set to just clear work to protect hands from the blade.



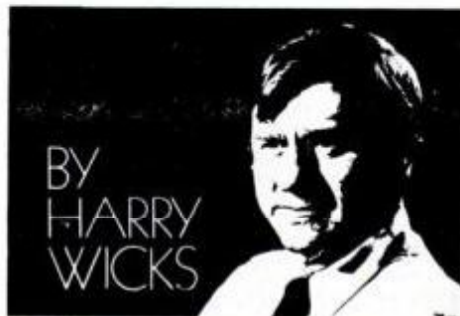
When cutting off small pieces which must be saved, apply masking tape to table surrounding blade to keep the parts from falling through the table insert.



Don't force the blade when cutting tight turns or it will break. When blade reaches apex of curve, you can either back the blade out (top) and nibble your way around the corner, or continue the cut to board's edge (above). With this method, cutting is resumed at apex (arrow). Sequence can be repeated as often as needed.



Quality-built bandsaws include a table-tilting feature that permits you to make bevel cuts. This is a must for compound angle cuts, as well as for relief work.



Five major power tools packaged into one unique, big-capacity unit.

Now you don't have to spend a fortune to enjoy a complete woodworking shop

Whether you're an experienced craftsman, a dedicated hobbyist, or a week-end "do-it-yourselfer", at one time or another, you've probably dreamed of owning a complete woodworking shop. And as anyone who has ever tried any woodworking project more complicated than nailing together a birdhouse knows, a table saw and maybe a couple of hand-held power tools just can't hack it!

At a minimum, you should have—in addition to that table saw—a top-quality vertical drill press, a lathe, a boring machine, and a disc sander. So equipped, the world of the true woodworking expert, and all its rewards, becomes your oyster!

But there are two problems. One is space. A woodworking shop with five separate major power tools takes up more space than a lot of people can manage to find in their basement or garage.

The second and larger problem is sheer cost. Those five precision power tools, purchased separately, have got to run you at least a couple of thousand dollars.

The Perfect Answer

Insurmountable problems? Not at all! The world famous, time tested Shopsmith Mark V combines all five major power tools in a single unit that actually takes up less space than a bicycle... and can be yours for about ONE-THIRD the price of the five separate units!

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Even if you have plenty of space and an unlimited budget, the Shopsmith Mark V can outperform a shop-full of individual tools. Its unique design not only gives you greater accuracy and more convenience—it allows you to do things you just can't do with other power tools.

This truly ingenious woodworking system combines a 10" table saw, a 12" disc sander, a horizontal boring machine, a 16½" vertical drill press, and a 34" lathe—all powered by a rugged 13.5 amp, 110-volt motor that develops 2 hp. That's more than enough power for the toughest jobs. And an exclusive speed dial even lets you change operating speeds without turning off the motor.

After only an hour of practice, even a novice can change from one tool to any of the other four tools in less than 60 seconds.



The Mark V as a 10" table saw offers a 3¼" depth-of-cut with a 48" ripping capacity. The exclusive Speed Dial permits power sawing of hardwoods.

With the 5-in-1 Mark V, you can perform literally dozens of sophisticated woodworking operations—including sawing, rabbeting, beveling, mitering, grooving, concentric drilling, spindle turning, doweling, edge sanding, and metal drilling. With optional accessories, you can perform more specialized operations such as mortising, dadoing, shaping, routing, molding and many others.

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The Mark V as a 12" disc sander gives you operations not possible on other sanders...like finishing edges to precise dimensions.



The Mark V as a lathe offers exceptional capacity with a 16½" swing for face-plate turning. Speed Dial allows a speed range of 700 to 5200 rpm.



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SNOWSHOEING

(Continued from page 99)

ment—even more than frames that don't dry out or warp, lacings that don't attract teething squirrels—is better footing grip.

Trading up

Famous Mount Rainier guide Lou Whittaker recalls a search for a climber missing in a winter blizzard. "As we climbed the final slopes toward the rescue base camp, I found myself straggling behind. Finally I took off my long wood snowshoes, which had served well on many



Texas sportsman John McKeel tests Yukon-size Sherpa Musers with SnowClaws on an icefall. Possible, but not advised.

climbs, including Mount McKinley, but step-kicking wasn't the answer either. Then I realized the other climbers were all moving easily ahead on SnowClaw Sherpas. Fortunately, at the upper camp, I was able to trade a park ranger out of his, leaving my webs for his descent while four of us pressed on up to the ridge successfully."

Cleats for traction

The patented design of the Snow-Claw binding provides a cleat at the leading edge of the boot toe and two more framing the sides of the instep to prevent lateral motion, hinged under the ball of the foot so the front snowshoe tip lifts easily with each step. To prevent snow from freezing, balling and building up on the metal, a loose plastic panel covers the reinforcing between the claws and flexes to prevent ice accumulation. The SnowClaws are also available separately from Sherpa dealers for installation on other makes. Early Winters, Vermont Tubbs and others

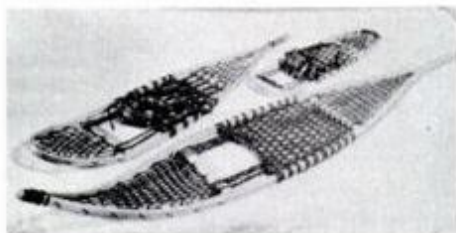
offer bolt- or tie-on traction bars and crampons.

Build 'em yourself

Sherpa, Northern Lights from Early Winters, and Vermont Tubbs all offer build-it-yourself kits. Tubbs uses conventional ash-frames and neoprene lacing. Traditional wood snowshoes in their eight-model line can be obtained with neoprene or rawhide lacing.

Purist Carl Heilman II of Brant Lake, N.Y., makes classic custom snowshoes to order. First he starts by selecting a white ash tree which has been growing in moist earth and has a small diamond bark pattern following in a straight line up the tree. Elongated bark patterns are rejected, and the trunk must be large enough to supply four lengths when split in quarters, long enough to allow some trimming when bent.

These pieces, called bows, are trimmed to size before steaming. The bark surface becomes the outside edge of the snowshoe, and is inserted in a forming jig after steaming, when it is most pliable. After drying for a couple of weeks, the bow is removed, scraped and sanded smooth. Crossbars are made and mortised into the frame, which is now balanced so it is slightly tail-heavy at a spot midway between the two crossbars. Holes are drilled for the lacing and notches cut between the holes on the frame exterior, so the lacings will fit snugly with less chance of abrasion.



Medium-size cross-country beavertail, the small racing bearpaw and long Cree-style Ojibway are examples of Heilman's work.

After final sanding, a craftsman, following Carl Heilman's technique, dismantles frames and braces and brush-varnishes them, using polyurethane varnish plus pipe cleaners to coat the inside of each hole. Dipping, he advises, might not accomplish this. Heilman's racing Bearpaw, Adirondack, Maine, Cross Country, Green Mountain, Alaskan and Ojibway models range from about \$65 up to \$115 for the largest with neoprene lacing, more for rawhide.

Learning how to snowshoe is easy, but learning *where* can require additional skill. Trails in snow over thin ice, overhang drift ledges and

below avalanche paths require experience to recognize and handle. When mountaineering, it is well to travel in groups of no less than four; in case of injury, one can stay with the victim while two head back for help. *Snowshoeing*, a book by Gene Prater and published by The Mountaineers, Seattle, Wash., gives a good introduction to the sport.

'Around the world'

Long-distance hikes on snowshoes are joining races in popularity. Bill Lokey of Tacoma, Wash., while working for the U.S. Antarctic Program in 1974, set an impressive-sounding record of sorts at the South Pole by strapping on his snowshoes, heading out about a quarter mile, and walking around the pole while passing through the 24 time zones to "hike around the world" in about half an hour. Lokey has also taken part in the annual Snowshoe Thompson Race over sand up the Baja Peninsula, sponsored by the San Diego Mountain Rescue Team to commemorate an 1870s snowshoer who delivered mail and medicines to snowed-in prospectors in the High Sierras.

Choose oval-shaped Bearpaws or narrower Modified Bearpaws for mountaineering and brush hiking. Beavertails and larger Yukons have the conventional rudder-action tail. Use long Ojibways, Crees in deep powder snow.

Two organizations help coordinate activities. The U.S. Snowshoe Assn. (USSA) is contacted through George Bosworth, Box 170, R.D. 1, Corinth, N.Y. 12811. Canada's Union Americaine de Raquetteurs Executive Secretary in the United States is Albert Cote, 138 Bartlett St., Lewiston, Me. 04240. **PM**

MANUFACTURERS LIST

- Bastian Brothers Inc., 136 Est Des Erables St. Emile, Que.
- Big Chief Mfg., Box 176, Loretteville, Que.
- Black Forest Snowshoes, Box 1007, Nevada City, Calif. 95959
- Canadian Lacrosse Mfg., 2440 Bonin St., Sherbrooke, Que.
- Carl Heilman II Snowshoes, 213A Route 8, Brant Lake, N.Y. 12815
- Chestnut Canoe Co. Ltd., Box 85, Fredericton, N.B.
- Country Ways, 3500 Hwy. 101 S., Minnetonka, Minn. 55343
- Early Winters Co., 110 Prefontaine St., Seattle, Wash. 98100
- Faber & Co., 180 Bouldela Riviere, Loretteville, Que.
- Floyd Westover Snowshoes, Meco, Box 63, R.D. 1, Gloversville, N.Y. 12078
- Iverson's Snowshoes, Shingleton, Mich. 49884
- JDK Sports Inc., Box 1014, Boulder, Colo. 80302
- North American Alloys & Synthetics, 15 Commerce St., Williston, Vt. 05495
- Pebb Snowshoe Co., Box 53, South Prairie, Wash. 98385
- Sherpa Snowclaw Co., 2222 West Diversey Pkwy., Chicago, Ill. 60647
- Snocraft Div. Garland Mfg., Box 487, Scarboro, Me. 04074
- Sportsman's Products (Snowtreads), 1845 30th St., Boulder, Colo. 80302
- Trappe of Aspen, Div. of Woodstream Corp., Litz, Pa. 17543
- Vermont Tubbs, Rt. 73, Forest Dale, Vt. 05745
- Woodstream of Canada (Astro), Box 120, Niagara Falls, Ont.

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	What a pro would charge	Probable time required	Savings if you do it yourself	Your return per hour
Replace crankcase valve	\$6.30	5 min.	\$4.64	\$55.68
Replace air filter	\$11.80	3 min.	\$8.11	\$162.20
Tune up engine	\$71.80	2 hr.	\$61.27	\$30.63
Replace fan belt	\$18.70	20 min.	\$15.71	\$47.13
Replace alternator	\$121.50	45 min.	\$85.25	\$113.67
Replace muffler and tailpipe	\$142.75	2¼ hr.	\$80.03	\$35.57

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Now, understanding, maintaining and repairing your car is a lot easier thanks to **Basic Car Care Illustrated**. This is a new, fully pictorial guide. It shows you how to make hundreds of repairs and adjustments with 827 clear illustrations, over 400 of them in color. It uses easy-to-understand picture captions instead of long wordy explanations. Yet it gives you the technical specs you need to do the job right on your car.

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From a tune-up for the beginner to replacing a rear axle for the more experienced, **Basic Car Care** shows you the way.

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TURBODIESEL SCOUT

(Continued from page 88)



View from rear shows large hatch. Ample windows provide good visibility.

since I was passing the engine's power peak.

To test highway performance, I left the tranny in fourth and accelerated from 50 mph (2400 rpm) to 70 (3400). My best time with the airconditioning off was 17.4 seconds—not bad when you consider that a Mercedes 300TD five-cylinder station wagon takes 14.5 seconds to do the same run.

Over 20 mpg at one stretch

Top speed is 82 mph, but the Traveler gets rather noisy once you go over 55 mph; on the test car, wheel imbalances above this speed caused further discomfort, so I did most of my cruising closer to the speed limit. During one highway run of 314 miles, the Traveler turned in an impressive fuel economy figure of 20.25 mpg. Overall, I got 18.6 mpg, driving about 10 percent of the time in city traffic, 90 percent on the highway.

The Scout Traveler I tested was loaded with options (the test car has a base price of \$10,378, but its total cost was a whopping \$13,320). Many of the options were designed to make driving the Scout more comfortable. The most notable one was the cloth-covered bucket seats (\$129)—they were extremely comfortable, offering good lower-back and thigh support—just what you need for long hours behind the wheel. The air conditioner (\$607) helped to keep things cool, but was extremely drafty even on its lowest setting. An AM/FM 8-track stereo gave good reception, but is overpriced at \$358.

The Traveler's driving position is good. Since this wagon has an overall height of 65.7 inches (about a foot higher than most cars) you look down on traffic. Visibility is excellent on all sides, thanks to the large, flat windows.

All controls are easy to reach, and power steering is standard, as is a tilt steering wheel on diesel models.

Gauges include oil pressure and water temperature, but the clock (which was inaccurate) will set you back \$37.50.

The clutch is stiff, and both shift levers take some muscle to operate. Fortunately, the clutch pedal is large, to prevent undue pressure on the ball of your foot, and both shifters have large knobs to facilitate an easy grasp.

On smooth roads, handling is fine for such a tall vehicle. A front anti-sway bar helps to keep body roll in check through turns. The power steering is somewhat vague on center, but road feel through the test car's optional 15-inch sport steering wheel was reasonable—I could feel surface irregularities without the wheel being jarred from my hands.

The Traveler's rugged suspension has leaf springs at all four corners; solid (nonindependent) Dana model 44 axles are found both front and rear, the only difference between them being that the rear axle can hold 3500 pounds, while the front



Plaid-cloth bucket seats are comfortable. Pattern carries over onto doors, brightening up the cab's spacious interior.

one can only hold 3200.

Despite the fact that this vehicle has such a rugged suspension and a high 7.6-inch ground clearance, the ride remains good over most surfaces. Small bumps are soaked up well, but larger ones sometimes cause the rear of the car to sidestep slightly, necessitating a steering correction to remain on course. The Traveler does tend to pitch over most bumps, but no more so than the average van.

The Traveler's muscular demeanor can really be put to the test on back roads. Our test car had the optional automatic front-wheel locks for its 4wd system (cost: \$99; see page 98, Feb. '79, for technical details). In brief, the locks let you engage and disengage the front wheels, using the transfer case shift knob without having to manually unlock the front wheel hubs for normal, 2wd highway operation.

There are two speed ranges in

(Please turn to page 122)

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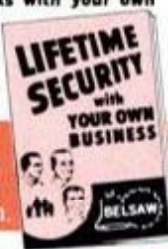
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TURBODIESEL SCOUT

(Continued from page 120)

4wd: One is "4H" (high), with the same overall gearing as in 2wd. The second, "4L" (low), increases engine rpm by a factor of 2.62 in each gear for greater momentum.

I found the 4wd system easy to engage and disengage, once I had practiced using the transfer case shift lever while easing the Traveler through a Chicago traffic jam. To engage 4wd, the regular shifter is put into first gear after the vehicle has been stopped. Then, as the clutch is let out, the transfer case shifter is either moved forward (low) or backward (high). An indicator under the speedometer goes on to remind you that the front axle is engaged.

I put the 4wd feature to the test the next day in rural Pennsylvania. I drove the Traveler down a hill that was made of smooth mud—it was



Easy-to-read instruments include those for temperature, oil pressure, amperes. Padded sport steering wheel is \$45 option. Note twin shift levers below steering wheel: one on right is for transfer case.

slick as ice. The Traveler climbed back up the hill effortlessly.

Great off the road

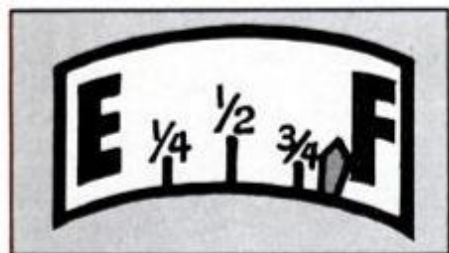
A few weeks later, during an early autumn snowfall in Connecticut, I drove the Traveler onto a snow-covered field to photograph it. Despite the slipperiness of the snow, the Scout was able to negotiate the thick foliage effortlessly in "4H"—both on hills and level ground. The Scout is truly a blast to drive off the road.

In total, the Traveler is an extremely well-made vehicle—though costly—when you compare its price to that of an ordinary car. It can carry huge amounts of cargo just about anywhere a driver and four good buddies would care to go. When the going gets rough, the Scout simply plows ahead effortlessly. And it's enjoyable to drive, with well-designed controls and comfortable seats.

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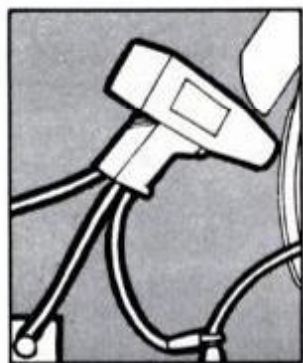
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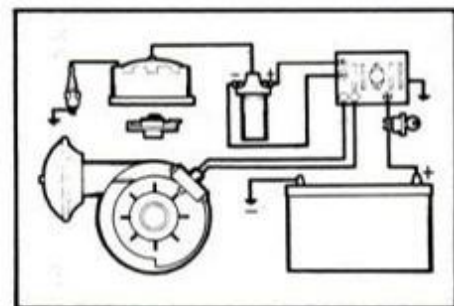
for your car. If you have Tuneup & Troubleshooting by Saturday Mechanic, the book that actually takes you step-

by-step through the entire tune-up process with clear illustrations and simple language.

A timing light like this costs less than \$20 and allows you to set your car's ignition for efficient fuel combustion. If you have the book that's almost like having a mechanic standing next to you. The book that points that timing light at every U.S. make and model produced in the last six years — including vans, pick-ups and 4WD's.



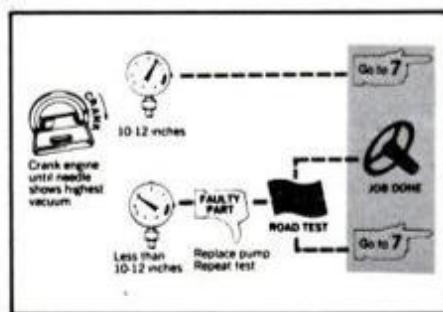
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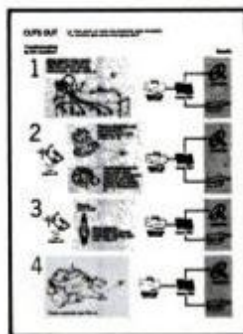
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SPORTS PLANES YOU CAN BUILD

(Continued from page 79)

at quick glance, makes it appear to be flying upside down. It's powered by a 25-hp Citroen engine, driving a pusher prop in the tail. The advantage of this is that, with the prop in back, the craft is always flying in clean air instead of its own propwash. Dual-function "ruddervators" in the tail serve as both rudders and elevators. The idea behind the inverted-V arrangement is to get the tail down into undisturbed air at high angles of attack, such as during landings, when maximum control and stability are critical.

Full-span "flaperons" in the wing work collectively as flaps and differentially as ailerons, providing both precise control and simplified construction. Other features include retractable tri-gear, steerable nose wheel, removable wings for towing and storage, and a two-position, switchable-pitch prop for maximum efficiency in both climb and cruise situations. Wingspan is 27 feet; length, 15. Performance specs are not yet definite, but are expected to equal or exceed those for a Cessna 152—a remarkable achievement on 25 hp. Kits will be sold by M. B. Taylor, Box 1171, Longview, Wash. 98632.

Old Cub goes modern

Another new pusher-prop configuration comes from C. G. Taylor, designer of the famed Taylor Cub, and his son Bruce. Called the Taylor Bird, it's a mid-wing, tandem two-seater aimed at good visibility and easy construction. Mounting the engine behind the cabin puts pilot and passenger ahead of the wing, with a clear view all around.

The main structural element is an aluminum-tube boom on which all other components are mounted. Except for a fiberglass skin, most parts are aluminum and are supplied already predrilled and aligned, so they can be assembled without jigs. The engine is a 65-hp Subaru, providing a top speed of 125 mph.

Like the Micro-IMP, the Taylor Bird is loaded with sophisticated engineering. Slots in the leading edge of the wingtips permit flat stalls, without the tendency of a wing to fall off into a spin. Air rushing up through the slots exerts a force on the underside of the wing proportionate to the speed of the wing's downward travel. If one wing starts to drop, air pressure on that side increases, forcing the wing back up. The wings thus are self-leveling.

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Stability is provided by ingenious wingtip end plates that toe in at the front and slant out at the top—like the front wheels of a car. The forward toe-in gives directional stability, while the outward slant creates a dihedral effect to assure lateral stability. The ailerons run full span for ease of construction, and a T-tail further aids spin resistance. The wings fold for trailering and storage. Wingspan is 26 feet; length, 18. Plans are \$165 from Taylor Aero Industries, Box 3162, Camarillo, Calif. 93010. An info pack is \$5. Partial kits run from \$3000 to \$7000.

Gliders that grew up

Mitchell Aircraft, maker of hang gliders, now has a true airplane, the Mitchell Super Wing. A tailless flying wing, it sports a fully enclosed cockpit pod, clear-plastic canopy, retractable tri-gear, steerable nose wheel, even brakes. A 10-hp engine with pusher prop gives a top speed of 80 mph. Wingspan is 34 feet.

A system of spoilers and "elevons"—combination elevators and ailerons—provides directional control without the need for a rudder. The outer wing panels fold so the craft can be easily cartopped. Kits for the Super Wing will be about \$2300 with engine, \$1500 without, from Mitchell Aircraft Corp., 1900 South Newcomb, Porterville, Calif. 93257.

One of the lightest motor gliders yet developed is the little 80-pound Minibat designed by Larry Haig of Muskegon, Mich. Powered by a 3-hp chainsaw engine, it has an enclosed cockpit pod and can carry a payload of 220 pounds—nearly three times its own weight. It can't take off under its own power, but can sustain itself in flight once it's aloft. An auto tow or bungee catapult is all that's needed to get it airborne.

Stressed for 6 Gs both positive and negative, the craft is fully aerobatic. It has three-axis control with rudder, elevators and ailerons. In addition, the ailerons and elevators can be used collectively—both ailerons up and the elevators down—for precise glide-path control during descent. In this case, the ailerons act somewhat like spoilers and the elevators like flaps. Wingspan is 25 feet; length, 9 feet.

The Minibat will be sold as a ready-to-assemble kit for \$3500 to \$3900, with the power pack an additional \$250 to \$300. It will be available from GLA Inc., 841 Winslow Ct., Muskegon, Mich. 49441. An info pack is \$5. Construction is so quick and easy it's said to take only five to 10 days—that's getting off the ground pretty fast.

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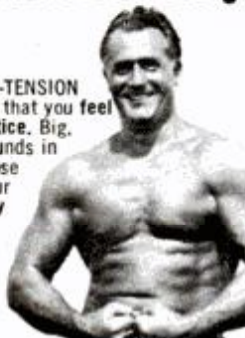
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THE CARS OF THE '80s (Continued from page 72)

gives exact fuel shots at regular intervals. But f.i. is expensive, and a more practical, economical solution seems to be the electronically controlled, variable-venturi carburetor, whose metering can be altered almost instantaneously by minicomputer signals. We'll see the rise of the electronic carburetor in the 1980s—also less costly f.i. systems.

Electronic gamesmanship

"Once you've got electronic engine controls on-board," says Chrysler's director of product planning John D. (Jack) Withrow Jr., "then it's just a small step to the electronic instrument panel with digital readouts, electronic message centers, trip computers, electronically tuned radios, electronic door locks and security systems, temperature regulation—myriad things."

That's echoed by planners at other auto companies. They all foresee an electronic blitz in the '80s, and are gearing up for it.

One advantage seen for digital instruments is that they'll be thin. Donald A. Forman, Chrysler's advanced engineering director, observes that wafer-thin LED or LCD readouts for such things as the speedometer and gauges might leave more space behind the instrument panel—space that's at a premium as cars grow smaller. What'll they stick back there? Computer modules, airbag equipment; perhaps the usable glovebox will make a comeback.

Whether functions not related to engine and emissions should be hooked into the car's main computer, though, remains a topic of some debate. Jack Dinan of GM's AC Div. told me he believes the emissions/engine-control system will be kept separate because "... tying in other sensors and functions might lead to failure of the emissions/economy system." He sees separate microprocessors and black boxes used for future displays and functions.

But Ford and Chrysler don't agree. They predict one master computer for everything. The same sensors that tell such facts as engine temperature, manifold vacuum, and so on, could be hooked not only into instrument-panel readouts, but could also serve the car's on-board diagnostic computer. Such diagnostic computers have been developed, pioneered by Volkswagen. They're the plug-in variety, but could easily tell the driver—via LED displays—what's going wrong.

Other possible applications of electronics in future cars include service-cycle reminders, on-board oil analysis, shock-absorber control, brake antiskid systems, ventilation and air-conditioning regulation, and the already-with-us trip computer. Some of these items may become popular during the 1980s.

One auto engineer referred to what he called "gimmick electronics" and predicted they might get out of hand during the decade. Just as Detroit plunged headlong into chrome-and-tailfin overkill in 1958, it might do the same in terms of electronic overkill by 1988. Drivers might tire of trip-computer games. Digital displays might be found too distracting.

This same engineer made another good point by saying that although many electronic gadgets might seem luxurious and expensive at first—digital instruments, computers of all types—production plus Japanese competition will bring prices down in a hurry.

Shapes of the future

All automakers will go to fewer basic body platforms in the future. Just as Ford presently

uses one platform (dubbed "Fox") for its Fairmont/Zephyr, Mustang/Capri and Thunderbird/Cougar, so others will create larger and smaller lines from the same basics to maximize interchangeability and thus cut costs.

In some cases, cars built overseas will have body and power-train components interchangeable with cars manufactured here. Examples: AMC/Renault's upcoming 1982 subcompact, Ford's "Erika" Pinto replacement, and GM's T-car (Chevette) and next-generation J-car (Monza/Opel/Isuzu/Vauxhall). Exterior skins might look different, but more cars in each corporation share inner members, floor pans, subframes, and so forth.

As American cars shrink on the outside and grow internally, you'll see doors become thinner, trunks taller, hoods shorter and more sloping, C-pillars less blind, seat-backs more slender, and interior designs more flexible to accommodate different combinations of passengers and cargo.

Aerodynamics are even now playing a growing role in auto design. This trend will continue. Even so, you won't soon be seeing egg-shaped cars. Many will look like variations of the X-car, as mentioned.

Sportier models like the Corvette, Camaro, Firebird, Mustang, Capri and Chrysler's L-bodied coupes will go to pointed noses, lower profiles, and sculpted-in spoilers and air-dams—generally along the lines of the present Lotus Esprit.

But conventional passenger cars of the '80s will still be rather square and boxy, despite greater use of design aerodynamics (or "aero," as stylists like to call it). Comments Chrysler's design vice president Richard G. Macadam, "People expect an aerodynamic car to look like a teardrop. That just won't happen. What we're finding is that we get a tremendous improvement in fuel mileage through careful detail execution and relatively minor adjustments in form.

"For example, slightly more curvature in a windshield pillar, bringing the door glass outward more flush with the metal, fairing in mirrors—all these and many similar detail changes can yield better gas mileage and reduce wind noise at relatively little expense."

The theory that streamlining is effective only at higher speeds no longer cuts much ice in Detroit. GM's executive assistant to the vice president of engineering, Dr. Craig Marks, notes, "It's not true that aerodynamics affects a car only at speeds above 60 mph. That's an old wives' tale. It can make a difference even at 30 mph."

So your composite car of the 1980s will still be a notchback or fastback sedan, with two to five doors. We'll have notchbacks because many people want enclosed trunks where they can keep cargo out of sight. Folding seat-backs will be common even in notchbacks.

There'll also be a rise in popularity of semi-fastbacks—fastback coupes and sedans with little bustle trunks. These will be more common on the shorter wheelbases. The larger fastback sedan, despite the thudding response to GM's 1978-79 A-body examples, will also grow in popularity. Station wagons, liftbacks and fastbacks will tend to blend, especially since downsized wagons will no longer be big enough for a third seat.

The popularity of vinyl roofs will wane, but the use of exterior graphics will rise to differentiate nameplates. Just as you can instantly

(Please turn to page 126)

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THE CARS OF THE '80s (Continued from page 126)

tell a new Z-28 from a Trans Am by its graphics, other basically similar cars will be identifiable through decal and paint treatments.

The powerplant picture

The only American automaker (not counting VW, that is) currently producing diesel engines predicts that diesels will power 13 percent of its cars by 1985. General Motors—specifically Oldsmobile—is currently readying a 90° V6 diesel that's not a converted gasoline engine. It's designed as a diesel from the pan up. So is the aluminum V8 being engineered for the 1982 fwd Seville. You'll probably see it in both diesel and gasoline versions, but the gas will be derived from the diesel, not the other way around.

Ford Motor Co. recently entered a diesel development program with Cummins Engine Co. Inc., but still pins a major hope on its so-called PROCO (Programmed Combustion or stratified charge) engine (see page 78, Dec. '79, for details). Ford has successfully built and tested PROCO versions of its present 302 V8 and an experimental, soon-to-be-released 225-cu.-in. V6.

Tests show the PROCO definitely gets 20 to 25 percent better fuel mileage than its conventional counterpart. That equals the diesel's advantage, but the PROCO burns unleaded regular instead of diesel fuel.

Ford's PROCO engines would be considerably lighter than diesels; they wouldn't need fuel injectors, glow plugs or heavy-duty components. Thus the PROCO could be cheaper to build (American diesels now cost about \$1000 more than nondiesels). And if diesels run into continued EPA certification problems, the PROCO could give Ford a real leg up.

There is a rub, though. Ford hasn't yet confirmed that its PROCO engine can be built in quantity at a reasonable cost. Ford's vice president of car engineering, Thomas J. Feaheny, told me, "The research phase has been successful. The real question is whether the PROCO can be mass-produced. We're now entering the pilot production phase and should get an answer before the spring of 1981."

Even if all goes well with the PROCO, though, salable engines probably wouldn't be ready before the 1982-83 model year.

The EPA recently granted NOx waivers to diesels for 1981. Without them—and if EPA doesn't soften its 1982-83 NOx and particulate standards—GM and Mercedes say they simply won't be able to sell diesels in the United States. So diesel cars possibly might vanish even more quickly than they came—an advantage to Ford if the PROCO materializes.

Chrysler recently showed dieselized versions of its 225-cu.-in. Slant Six, with and without turbocharger. These were strictly experimental, and so far Chrysler purchased diesels from Nissan in the past and might again find it advantageous to buy its diesel engines from other manufacturers.

American Motors could get diesel engines through its Renault connection, although Renault's present diesels are probably too small to power even the Spirit, let alone Jeeps and Concord. Turbocharging might be an answer.

Turbocharging, both of diesels and gasoline engines, will definitely increase through the 1980s. Currently Buick turbocharges its 231-cu.-in. V6, Ford offers a turbo for its 2.3-liter Four, and you can order a turbocharged 301-cu.-in. V8 on Pontiac's Trans Am and Formula Firebirds.

Several overseas automakers offer turbos, including Saab, Porsche and the Mercedes diesel. Turbocharging is a natural for the diesel. GM seems to be looking in that direction, too.

Notes Oldsmobile assistant chief engineer Ted Loukes: "Turbocharging can be utilized to keep engines smaller. On the other hand, we're not counting on the turbo in any way as an emission-control device. A year or so ago, it was hoped that turbocharging might cut particulate emissions in diesel engines. We've found out since that apparently that is not so—that particulates probably increase in diesels with turbochargers."

The sales potential for turbochargers, though, looks excellent. GM's Saginaw Div. is looking into the feasibility of mass producing turbos in-house. At the moment, both GM and Ford buy turbochargers from outside suppliers, notably Garrett AiResearch.

The diesel's destiny hinges on four major factors: the future price of diesel fuel, easier access to that fuel (i.e., more pumps), EPA diesel emissions regulations and the cost of diesel engines vs. their gasoline counterparts. Another problem: As diesel fuel becomes more popular and available, the government might want to add pump taxes.

It seems reasonable to assume that gasohol will become more popular, too. GM is presently experimenting with ethanol blended into diesel fuel. And, jumping off the deep end, Brazil has mandated that all its cars run on pure ethyl alcohol by 1990! Even today, Brazil's gas-to-spirit gasohol ratio is 80/20, instead of 90/10 as in the United States. Will Brazil be able to make its alcohol fuels work?

The safety factor

Cars will become safer, partly through industry effort and partly by government decree. No one I talked to in Detroit seemed happy with federal passive-restraint standards as they're now mandated.

The DOT regulation calls for automatic passive restraints in all larger cars for 1982, the intermediates and compacts by 1983 and all cars by 1984. For larger 1982 cars seating three abreast airbags seem the only answer because no automatic belt system can reach across the middle rider. For four-passenger cars passive belts will become standard equipment, probably with airbags optional in some intermediates.

The automatic or "passive" seat-belt system first appeared in VW Rabbits some years ago. That's where one end of the belt attaches to the far edge of the door and automatically comes across the torso and lap when the door closes. Since May 1978, Chevrolet has offered an optional automatic shoulder harness in its Chevette, but has sold fewer than 10,000 at \$50 each. For 1980, the Chevette offers an automatic shoulder-plus-lap belt, but again, there seem to be few takers.

GM has offered airbags for years. A fleet of 1000 Chevrolets was so equipped in 1973, and between 1974 and '76, GM offered airbags as a factory option in some full-sized lines. But only about 10,000 were sold.

For 1982, GM will again offer airbags. They will be standard on full-size cars; optional on smaller ones. GM's safety people, however, see bags alone—without lap belts—as only 15 to 30 percent effective against fatalities and injuries. GM stresses that drivers and passengers in airbag-equipped cars must still buckle

(Please turn to page 130)

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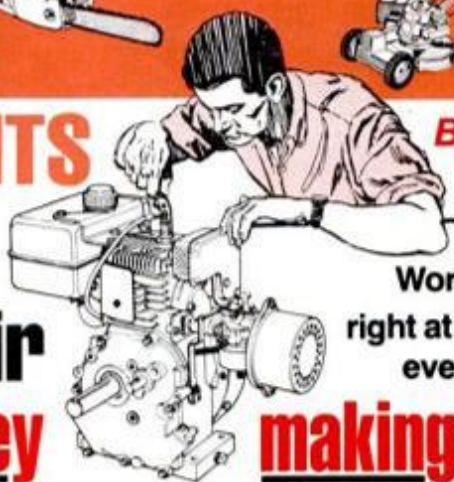
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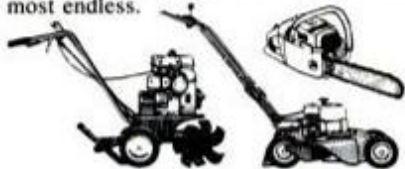
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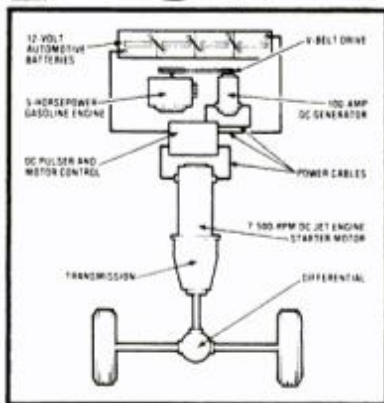
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THE CARS OF THE '80s

(Continued from page 128)

up to have a decent chance to survive a moderate-to-severe collision.

All U.S. car companies continue to work on "crash crushability." That's where front-end sheet metal, bumpers, frame horns and powerplant mountings are designed to "give" or fold to absorb impact.

The GM X-car is a prime example of what can be done. When the National Highway Traffic Safety Administration (NHTSA) crash-tested three X-cars at 35 and 40 mph, they passed with flying colors. Federal standards call for 30-mph barrier crash survival, and successful 40-mph crashes classed the X-car with experimental safety vehicles. That sort of technology will appear in future vehicles from all major American automakers.

Side impact beams will have to become lighter and less bulky as cars are slimmed down and doors get thinner. The challenge calls for high-strength steels plus different window mechanisms—perhaps along lines of GM's plastic tape system as in its X-cars.

Upcoming pickups, vans and 4wd

Starting in 1979, the EPA set fuel-economy standards for light trucks and four-wheel-drive (4wd) vehicles, in addition to passenger cars. These standards covered trucks up to 6000 pounds gross vehicle weight (GVW) and included captive imports like Ford's Courier and the Chevy LUV. Gas mileage for two-wheel-drive trucks had to come up to 17.2 mpg fleet average, with 15.8 mpg for 4wd.

By 1980, the standards have advanced to include trucks up to 8500 pounds GVW, and by '81 18 mpg will be required for 2wd trucks and 15.5 mpg for 4wd, even though the trucks will be heavier. Or will they? Detroit foresees a downsizing trend in pickups, vans and 4wd, too. But, as Ford's Bob Harner points out, too much downsizing could be counterproductive. There's no point in making pickups so petite it would take two to haul one full-size's load.

Back-road sport vehicles like Ford's Bronco, AMC's Jeeps, Chevy's Blazer, MoPar's Ramcharger and Trail Duster and International's Scout will see some downsizing, plus lighter materials. Chevy will begin building its LUV pickup in the United States in 1982, and Ford will do likewise with the Courier. Chrysler says it'll stick with Mitsubishi.

Upcoming electric cars

New zinc-nickel batteries won't mean that GM will be building electric cars soon: GM's first mass-produced electric will probably be delivery vans, not passenger cars. GM's Dr. Craig Marks points out that vans make more sense for initial field-testing, because they operate close to their charging stations, keep regular hours and standard routes, get good maintenance and will be easy to study.

After that, you *might* see some electric commuter vehicles from GM and other major makers, probably not before mid-decade. These will carry two people plus shopping bags or light cargo. Bodies will be fiberglass and urethane, probably on a steel platform.

The DOE has given go-aheads to two companies to build integrated test vehicles: Garrett Corp. and General Electric. GE, working with Chrysler, recently completed a sleek two-seater urban experimental ETV-1.

Eight more contractors have DOE nods to work on electric-car battery development. Gould, Yardney and ERC are working on zinc-nickel batteries, as is GM. Westinghouse and

Eagle-Picher have contracts to develop nickel-iron batteries. And C&D Electric, Gould and ESB are developing improved lead-acid batteries for electric vehicles.

GM, meanwhile, says its electric cars—if available by 1985-86—will be relatively expensive compared with conventional automobiles because initial quantities will be small, and manufacturing technology new. In time, the price of electrics should come down.

Not that electrics will provide a free lunch. Where will the household current come from when millions of drivers plug in every night? What happens to all those batteries in a severe crash? Will the ozone generated by electric motors become a problem?

Looking past 1990, GM considers lithium-iron sulfide batteries feasible eventually, as a successor to zinc-nickel. Lithium-iron batteries operate at high temperatures—800° F.—to keep electrolyte molten. Lab tests show they can be recycled theoretically over 500 times in the field. Problems include lowering costs and coping with temperatures.

Future federal standards

Government hoppers are overflowing with proposed rules for cars of the 1980s. Here's a sampling of some you're likely to see:

By model-year 1982, one proposed rule will mandate that all cars and trucks under 10,000 pounds GVW must have brakes designed so pads and shoes can be inspected for wear without removing the wheels. Presumably this applies to both disc and drum brakes.

Another rule proposes that all cars have twin outside mirrors meeting breakaway and foldaway standards to protect pedestrians.

All 1982 cars will likely have to meet field-of-vision standards limiting thickness of roof pillars. Formal roofs like those now on Rivas and Marks would thus be outlawed.


In 1983, under another NHTSA proposal, new cars wouldn't be allowed to have any projections that might harm pedestrians when hit. Bumper guards, hood edges, mirrors and ornaments couldn't stick out unduly. Another 1983 rule would put bright brake lamps high on the deck lid or C-pillar of all new cars. A recent experiment with a 50-taxi fleet showed that high-mounted brake lights cut rear-end collisions. Proponents of this rule feel the lamps should be visible three cars back.

By 1985, it's possible that all cars' instruments, controls and switches will have to be positioned and operated in standardized ways. NHTSA is proposing to tell Detroit (and the world) exactly how to lay out a dashboard.

Before you shake your head, consider this. People who rent cars at airports often complain that, usually late on a rainy night, it takes two minutes to find the light switch and another two minutes to find the wipers. After that, is the dimmer on the floor or the steering column? Does the horn sound when you push inward on the column stalk; is it in the middle of the wheel, or do you squeeze the steering-wheel rim with your thumb? Helpful improvements might be made in this area.

Other contemplated standards mandate low-pressure warning systems for tires, regulate electromagnetic interference, handling and stability standards (especially yaw), and further tighten noise regulations.

We won't see flying cars during the 1980s, or automated roadways, but we'll definitely see many changes during the decade. **PM**



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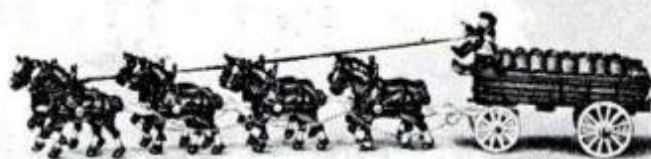
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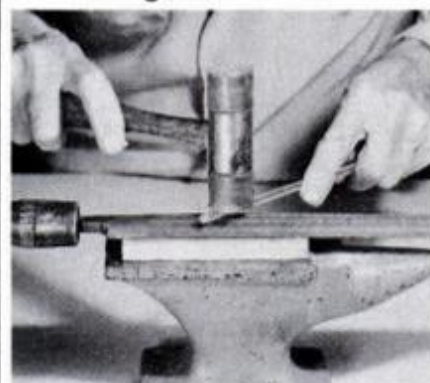
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HINTS FROM READERS

Texturizing file



To make a rod of brass or other soft metal fit tighter in a hole, roughen the rod's surface. Place it on a large, coarse file and strike it repeatedly with a nylon-faced or other soft hammer. Rest the file solidly on a block of wood supported on a heavy base.

—Walter E. Burton

On the ball

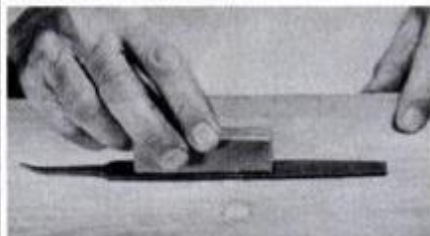
The halves of a Styrofoam sphere that have been glued to a workbench can be used to hold thumbtacks, pins, needles.

—Howard E. Moody

Live-in chimney sweep

You can make an inexpensive chimney-cleaning brush of two wire brushes placed back to back, sandwiching and bolted to a block of wood. Attach the block to a 15-ft. length of electrical conduit. Store it lengthwise above garage collar beams.—Paul R. Bliss

File for flat surface



Modify a file for use on a large, flat surface to smooth projecting nails and hole plugs. Glue a block of wood to one side of a flat file to serve as a handle. Bend the tang upward so it won't dig into the work; grind off sharp corners. After the usable side is worn, knock off the handle, glue it to the worn side and curve the tang the other way.—Richard Robin

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39 STEPS TO WEATHER A WINTER POWER FAILURE

Whether you stick it out or leave your home, these common-sense steps will save you grief.

by John H. Ingersoll

For five-and-a-half bone-chilling days during the winter of 1977, a large number of Long Island, N.Y., residents were cut off from electric power. An ice storm had twisted power lines into frozen spaghetti.

After 24 hours of fighting off the shivers, owners in droves began abandoning their homes for motels and homes with power. When power was finally restored, many returning families paid dearly for lack of foresight. Ice-ruptured water pipes had damaged ceilings, walls, floors, furniture, carpet, wall coverings, insulation and even structural members. According to remodeling contractor Ben Zino of Levittown, water damage repairs ran in the \$5000 to \$8000 bracket,—one job topped \$25,000.

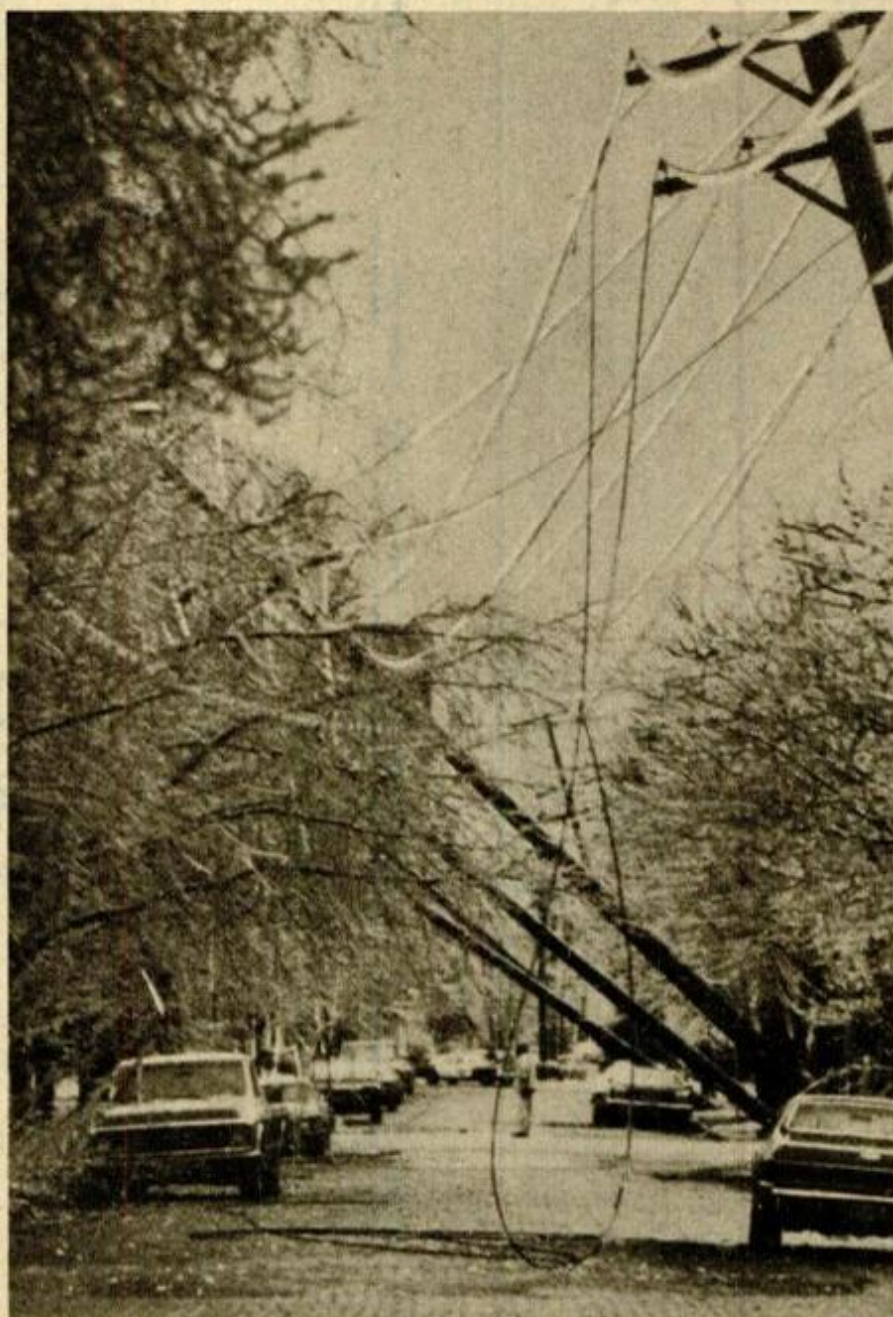
Following the steps outlined here, those owners could have saved a bundle by draining pipes before leaving home. Even having it done, says Zino, would have cost but a fraction of repair charges.

How likely is a power outage in your area? A spokesman for the Edison Electric Institute, representing the nation's electric utilities, admitted that in some north central states, winter storms have knocked out power lines for as much as a week. But he said the average blackout brought on by storms ranged from 1 to 24 hours.

Ironically, ice storms wreak the most damage in the band of states stretching across the U.S. midsection, where municipalities are unprepared for a winter onslaught.

Being prepared is the best defense, whatever this winter brings. With the right supplies, and attention to preserving the heat you have, it's doubtful you'd ever have to abandon your house.

The exception to that is lack of water. Warned ahead of time, you might get by for 24 hours by filling tubs, sinks and household containers with water before the faucets run dry. But surviving with only a fixed amount of water is nearly impossible.



Storm-downed power lines can cost unprepared homeowner thousands of dollars.

If you stay in your house . . .

1. Water is critical. Find out now how long your municipal water supply can last after power dies. Three conditions built into systems will keep water flowing: gravity feed from an uphill water source; plants with standby diesel-pow-

ered pumps; plants with standby generators. Water companies depending on tower-tank storage for emergencies may supply water for two hours to two days, depending on storage capacity and population.

HOW TO WEATHER A WINTER POWER FAILURE

If none of these conditions apply to your water company, or you depend on a private well and have no standby generator (see page 135), better plan now to leave your home when an extended power outage occurs. See *If You Leave Your House* on page 136.

2. Doors, even those with good weatherstripping, leak small quantities of precious heated air. During the blackout, limit entry and egress to a single exterior door. Pick the one best protected from the cold (with a storm door or vestibule). Seal cracks around all oth-



Easy-to-assemble inside storm window fits over window-frame casing for extra protection during winter power outages.

er exterior doors with whatever you have handy.

3. Windows, triple-glazed and thoroughly caulked, rack up the best energy conservation performance. Even these, and certainly any window less sealed, can use an emergency layer of protection. Close storm and prime windows tightly. Then tape a layer of clear plastic over the openings.

4. Heat pipes carrying hot water to baseboard connectors or stand-up radiators ought to be drained if the emergency is expected to last more than 36 hours. Piping around the perimeter of a house without wall insulation is immediately in danger of a freeze-up. But even piping protected by insulation may rupture if water within lies still. Here's how to drain the system:

- Turn off the switch for the circulating pump.

- Close the fuel-supply valve.

- Shut the water-supply valve.

- Attach garden hose to boiler drain cock. Lead hose to drain below boiler. If no drain exists and the sump pump is inoperative, you'll have to slog out the water in buckets. Pour it into a street drain or existing garden at least 15 feet from the house (to prevent water from leaching back against the foundation wall).

- Open the boiler drain cock.

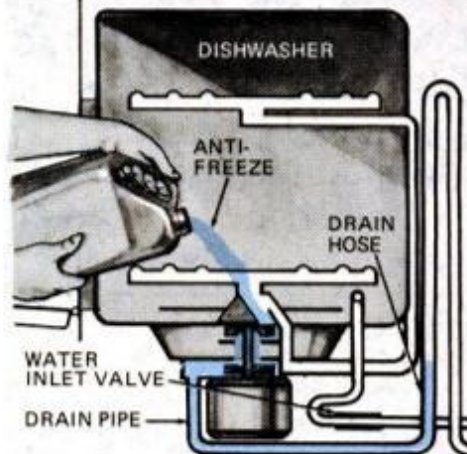
- Proceed to convector(s) or radiator(s) and open all the air valves you can find so air will flush the system back in the boiler and out the cock.

In the unlikely event there are no air vents, you'll have to jerry-rig a fitting on the line beyond the pump hose. By pumping air through the system, you should evacuate most of the water.

Forced-warm-air or electric resistance systems need a cutoff from power and/or fuel supply.

5. Set faucets at a fast drip. Moving water will stave off freezing for the emergency duration. If your house has a separate gas-fired domestic hot water heater, run hot water through the system every four hours or so for a 10-minute spurt.

6. Cooking is no problem with gas equipment. Heating is. When the heat is out, you may be tempted to turn on the oven and open the oven door. That could strain or even warp the burners, which could send traces of deadly carbon monoxide into a closed kitchen. For heat from your oven, set the dial at 350°, keep the oven door closed and let the heat slowly warm the room.



When house temperature drops below 32° F., protect dishwasher drain lines with 1 to 1 solution of antifreeze and water.

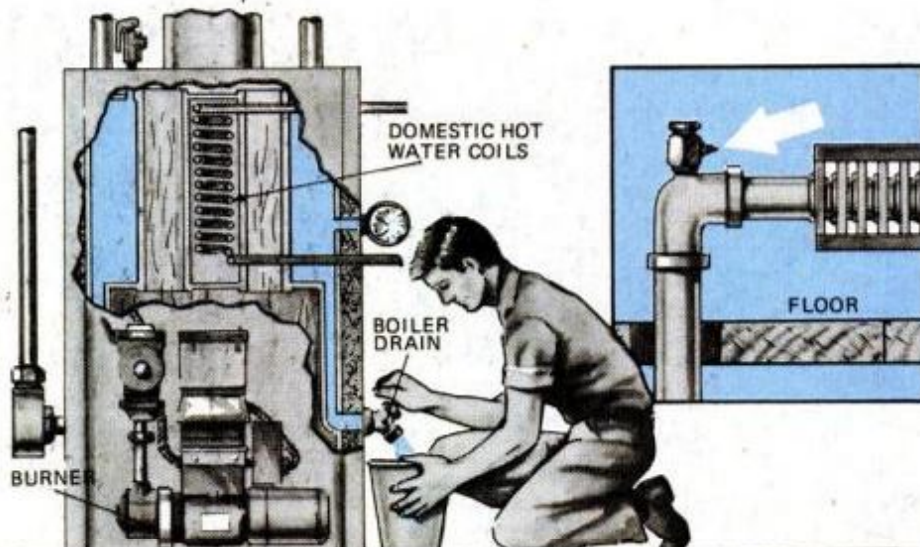
Caught in a power failure with an electric range and oven, you can use a propane camping stove. Crack the window for ventilation while the burner is on. Another option: Cook on top of a wood stove.

Do not cook with your charcoal grill inside. Charcoal smoke includes carbon monoxide. If a grill is your only means of cooking, do it in an open garage.

7. Or, buy food precooked.

8. Heat from a wood stove may be all you need to keep the house comfortable. Quality model prices start around \$300 and can top \$1000, less accessories and installation.

Or consider a kerosene heater. In a quality-built, fire-safe unit, kerosene burns more cleanly than natural gas, propane, butane, and far cleaner than gasoline or wood. Since many oil dealers are selling No. 1 fuel oil for kero-



To drain boiler, radiators when house temperature drops below 32° F. for indefinite period, open radiator valves (Inset) and run off water or route it to floor drain.



Many airtight wood and coal stoves can keep area in house warm in power outage. Some units also let you cook food.

sene, you are well advised to keep a window cracked in the room in which the heater stands and to keep doors to adjoining rooms open for ventilation. (See *PM Looks at an Efficient Kerosene Heater*, page 74H, Apr. '79).

9. Use a fireplace? Of course. But conditionally if the fireplace opening is uncovered and the fire draws on room air for combustion. Unless you can close off the room in which the fireplace

is located, the flue draft may suck out heated air from the entire house.

In any case, don't build a roaring fire. Stack logs against the rear wall of fire brick where, started slowly, the wood will burn low to a red glow, drawing less air.

10. Leave on only a couple of lights to show when power is restored.

11. Let the sun help you. Throw open shades, blinds and drapes on south-facing windows during sunny weather. Ditto for east windows in the morning; west windows in afternoon. Close drapes over north windows.

12. Block the night cold, and the chill on dark sunless days by keeping drapes closed. Lacking drapes, cover windward windows with blankets.

13. Don't bother with water-use appliances. So long as you're reasonably comfortable, dishwashers and clothes washers won't freeze up.

14. Mammalian pets will survive, probably in better shape than you do. But tropical birds, fish and reptiles may not live through a cold snap. Provide heat for their environment. Run a gas

oven, as described in Step 6, or buy a portable kerosene heater (see Step 8) and station the unit near your tropical pets. Failing that, transport them to a friend's house that has power.

Tropical plants fare better than tropical pets. Serious damage won't occur until the ambient temperature drops below freezing.

15. Seal off unused rooms. Stuff toweling or rags into the crack beneath the door, also under the door or around the scuttle to the attic.

16. If your house has a basement, be thankful. Ground temperatures, ranging in snow country from 52° to 58° F., help keep basements above 50° mark. This "warmth" rises and helps prevent house temperatures from dropping below 50°.

17. Frozen food will last for 48 hours if (1) it's stored in a separate freezer cabinet; (2) the lid isn't opened more than once a day and then for the shortest time possible, and (3) the locker is brim full with food completely frozen before the blackout.

If the cabinet is only half full, figure 24 hours. Reason: The thermal mass in a full freezer contributes to the cold. Food in a refrigerator's freezer compartment

STANDBY POWER EQUIPMENT

Although most standby power equipment requires a significant investment, it can—and often does—pay for itself the first time you face an emergency.

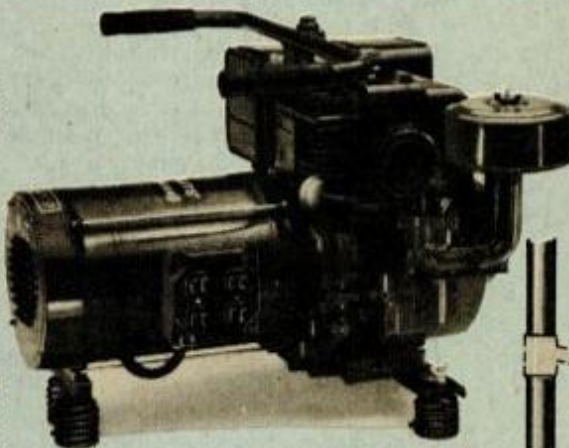
Generate your own power

Many generator models are available to today's homeowner. Small, portable units producing about 1350 watts are priced between \$350 and \$400. This capacity will keep a furnace, water pump and refrigerator/freezer operating; plus a few lights. Larger, more expensive portable units can keep all but the most power-hungry appliances, such as water heaters and dryers, running. Generators are normally fueled by gasoline, but some can be adapted to burn propane or natural gas.

In order to use a portable 120-volt a.c. generator as a standby unit, it must be converted to supply dual voltage (120/240 volts, single phase) required by most home electrical systems. A special conversion kit costs about \$13.

Some generators are designed specifically for standby use. They cost more, but much of the wiring is done in the factory. (See *How to Install and Use a Standby Generator*, page 18B, Aug. '78).

In any fixed generator installation where house circuits are to be supplied, a transfer switch *must* be installed between the gener-

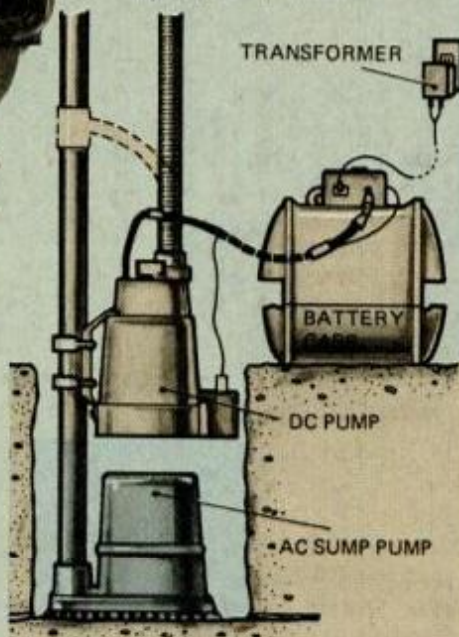


Portable 4000-watt generator (left) is \$800 from Homelite, 14401 Carowinds Blvd., Charlotte, N.C. 28217. Battery-run sump pump (below) starts automatically if required; is about \$260 from Simer Pump Co., 5960 Main St. N.E., Minneapolis, Minn. 55432.

ator and the utility power. Otherwise, power from your unit could feed out to the utility lines and seriously injure men repairing those lines.

Battery-powered sump pumps

Flooded basements often go with power outages. A battery-powered sump pump will bail you out—at least for a few hours. The advantage of a power-reserve sump pump is that you needn't be there to turn it on, making it perfect for vacation homes or for people who travel extensively. Otherwise, a generator can be used to power your pump. (See *Prevent Basement Flood Damage With a Sump Pump*, page 162, Apr. '79).



HOW TO WEATHER A WINTER POWER FAILURE

ought to last 24 hours into a power outage, assuming the same three conditions noted for the cabinet freezer.

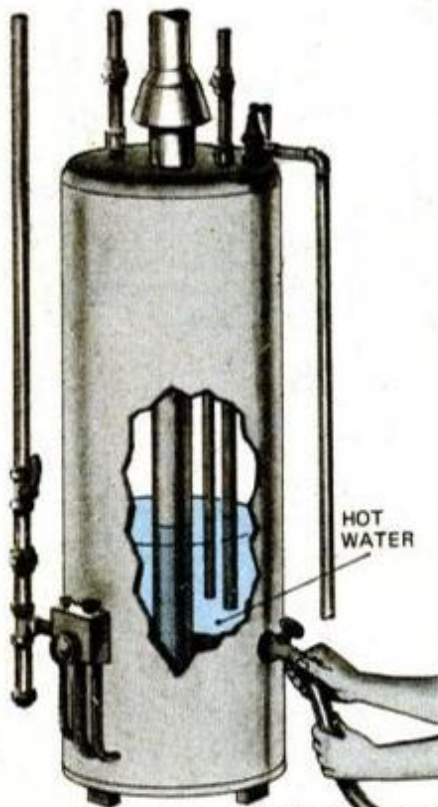
If it looks as though the power failure will last longer, pack in dry ice if you can get it.

18. Ice and sleet storms may dump water into your basement. There are two courses: (1) Keep an eye open for water seepage. You may be forced to bail out the sump by hand. Dump the water into a street drain or far from the foundation. (2) Invest in a stand-by pump (see page 135).

19. Keep emergency aids on hand. Start with a working flashlight for each bedroom, since storms have an omery way of hitting power lines at night. Lay in a store of spare batteries. Invest in a 6-volt lantern that can light up a kitchen. Consider Honeywell's plug-in emergency light that turns on when power fails (about \$13). Another source: kerosene lanterns.

Gasoline and propane lanterns require ventilation and aren't practical indoors. Wide use of candles is a potential fire hazard.

20. If fair warning precedes the



After cutting off water supply, use hose to empty domestic water supply in floor drain—or use laundry sink if possible.

storm, and your range is electric, heat coffee, tea, soups and stew; store them in thermos bottles.

If you leave your house...

21. Drain the hydronic heating system. (See Step 4.)

22. Drain the domestic hot-water system. Here's how.

- Shut tank's supply valve.
- Shut down the fuel supply.
- Attach hose to tank drain cock and lead hose to a drain at a level below tank. If there is no drain, see Step 4.
- Open the tank drain cock.
- Open all hot-water faucets so air pressure can evacuate the lines.

23. Drain the cold-water lines.

- Shut off the main supply valve (usually where supply pipe enters house.)
- Attach a garden hose to the main drain cock, positioned just beyond water meter, and lead hose to drain.
- Open the drain cock.
- Open cold water faucets.

24. Flush water from toilets. After turning off main water supply do this:

- Flush water in tank and bowl. Keep flushing until nearly all water has disappeared. Sponge out remaining water.
- Fill bowl with a 50/50 mixture of antifreeze and water. This prevents a freeze in the trap and blocks sewer gases from rising into the house.

25. Drain sink traps. Place a bucket below the trap and unscrew the drain plug. When the trap is clear of water, replace the plug and fill the trap with the same 50/50 mix of antifreeze and water. For hard-to-reach tub and clothes washer traps, pour (about four cups) directly into the drain.

26. Preserve the dishwasher lines with a cup of 50/50 mix. The washer drains into the sink trap, but a small residue of water that remains in the lines may freeze and burst flexible piping. Pour mix directly into the bottom of the washer.

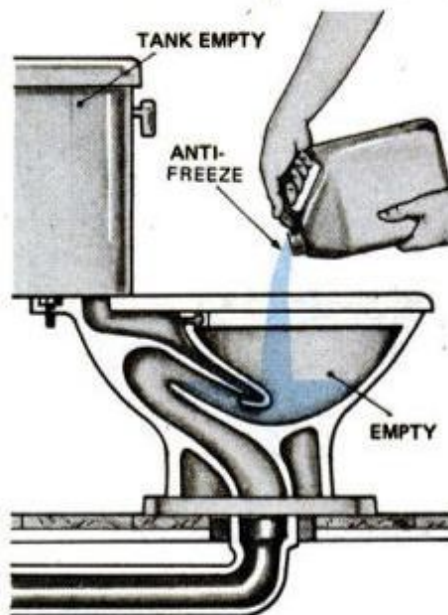
27. Cut electricity at the entry box.

28. Store canned and bottled food in wall cabinets or on closet shelves on inside partitions.

29. Take valuables with you.

30. Take your pets with you. Even long-haired dogs and cats, not used to staying in a frigid environment, may become ill if left behind. (See Step 14.)

31. Lock all entries—doors and



A 50/50 antifreeze and water solution keeps china-toilet trap from cracking in a freeze (also blocks sewer gases).

windows. Leave shades at various levels and drapes at different openings as a ploy that someone is still at home.

32. Check your house daily. It's some insurance against vandalism.

When power is restored...

33. Turn on your electrical circuits.

34. Close the water-supply drain cock; replace cold-water faucets and open the main valve.

35. Start up the house heat.

Close the drain cock on a hot water boiler. Shut air vents on upstairs convectors or radiators. Open water supply valve to the boiler. Open fuel valve.

Not all boilers fill alike. Check the maker's manual for instructions. Do the same to restart the burner.

Follow furnace-maker guidelines to restart your forced-warm-air system.

36. Close all water faucets; close the water-heater drain cock and open the water-supply valve. Open the fuel valve and restart burner according to maker's instructions.

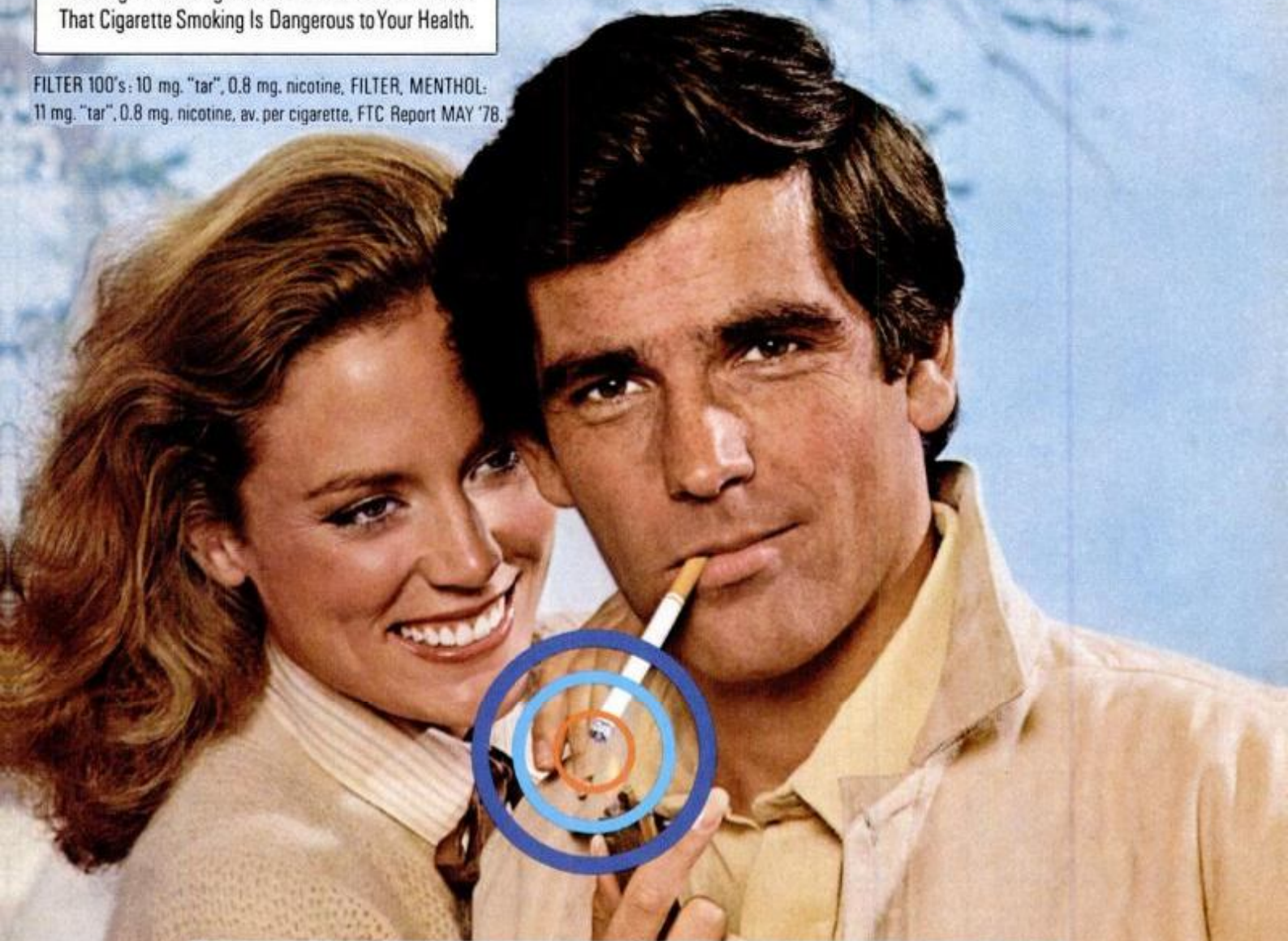
37. Flush antifreeze mixture from all fixtures or appliances.

38. Discard frozen food stored without power for longer than noted in Step 17, unless you protected the freezer contents with dry ice.

39. Take an inventory of missing equipment or steps not taken that could make next blackout easier. **FM**

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Camp gear comes out of the closet in emergency. Valuable items: heater, radio, batteries, Thermos, flashlights, lantern, stove, candles, extra waterproof matches, lighter, sleeping bags, water jugs, canned and dehydrated food, stove fuel in metal can.

keep track of what's going on, put away a small transistor radio with spare batteries, and a Citizens Band set if you have one.

Campstoves, with the exception of charcoal-burning hibachis and barbecues, work as well indoors as out in a normally ventilated room. (Don't leave a portable gas stove set up on top of your electric range, however, in case the power is restored with an electric

burner left on.) Unfortunately, charcoal burns up so much oxygen that it should never be used indoors. Practice with your stand-by stoves if you don't normally use them when camping. Some flare up when starting; keep a fire extinguisher handy.

Catalytic camp heaters are especially safe—no open flame, no lethal carbon monoxide—but they do use up oxygen. Don't use one overnight in a weatherstripped bedroom.

Even if you don't normally lose water pressure during a power outage, fill a couple of your plastic water jugs or Thermos containers for the back of your closet, just in case. If water failure threatens, fill the bathtub and your big ice chests, as well. A camp toilet saves water normally used for flushing.

Ice chests can also hold the food from a deep freeze if it looks like the power loss will last for several days, and you can store the chest outside in sub-freezing temperatures. Don't try to keep foods frozen by burying them in a snowbank, however. Snow and ice can insulate from deep cold.

If you own a recreational vehicle, you have an emergency home. One PM editor became a neighborhood hero when he drove his motor home to the houses of friends during a blackout and gave each a few hours of power with his generator.—Bill McKeown

No one is lucky when the power goes off, but if you are a well-equipped camper, you're probably as well off as anyone can be.

Many residents of the snow belt store warm-season camping gear in a handy closet and car trunk, ready for an emergency. And after watching tornado, flood and earthquake disasters on television, people in every part of the country are reminded that trouble can strike anywhere.

Shelter, water, food and comfort are the basic requirements at a campsite—or at home. These start with light, heat and communication. So first place candles, a flashlight, lantern and spare batteries on your emergency supply shelf. Camp stores sell plumber-type, long-burning candles and waterproof matches. Several candles bunched together can be used to heat water and are good primers when starting a fireplace fire. Smart campers stash away a small box of those joke birthday candles, as well—the ones that keep relighting themselves after being blown out. They're made to order for drafty conditions.

A faithful Coleman lantern can go on the shelf as well, with its LP gas, liquid fuel or kerosene supply stored in a sealed metal container. Gasoline, of course, should be stored in a well-ventilated place outside the house. To

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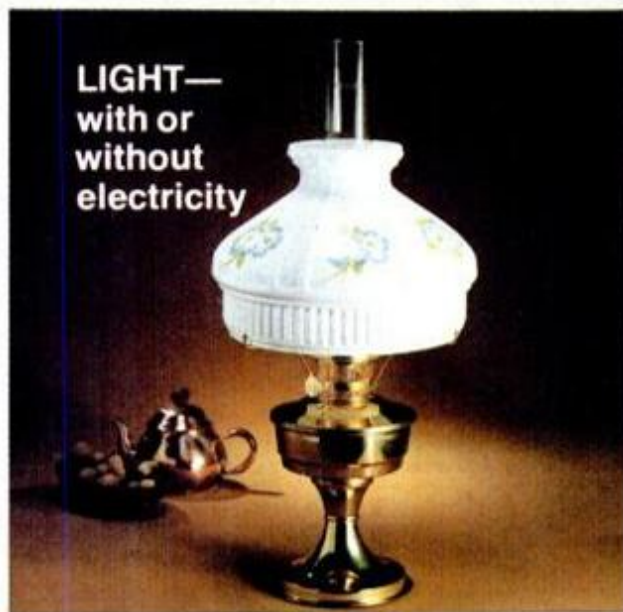
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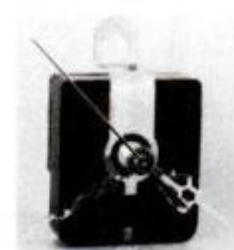
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ENERGY FROM GARBAGE

(Continued from page 95)

struction-cost overruns (to the tune of \$19 million), and must now operate and maintain the plant with no help from the town. Black Clawson must also fork over up to 40 percent of what it earns from the sale of electricity, plus a smaller percentage of the profits from the sale of recycled materials.

In return, Hempstead pays the plant for dumping its garbage there. According to William Landman, Hempstead's sanitation commissioner, the "tip fee" is about \$16 a ton, compared to the \$20 a ton the town used to pay at local landfills. And, says Landman, the town is presently averaging a return of \$2 to \$3 per tipped ton from the sale of electricity, resulting in a net cost of about \$13 per ton of garbage. A company official agrees that the town got a good deal, and mutters that "No one will ever get this good a contract again."

Despite some early pollution problems and a still-lingering odor problem—nearby residents complain that the plant smells terrible and that ash sometimes flies in their eyes—the plant appears to be working out for Hempstead. Landman says the air-pollution problem has been eliminated and that they're on the verge of getting rid of the bad smell. ("The odor is simply an annoyance," Landman says, "for those living in the community and those of us who have to stand for election.")

Whether the plant makes money for the town is almost irrelevant. Landman explains that Long Island's dumps were overflowing and that they really had few choices. In the end, waste/electricity plants like Hempstead's are more valuable for their capacity to get rid of garbage than for their ability to produce profitable electricity.

Robotic scroungers

Material recovery is just a fancy name for scrounging valuable metals, glass and other materials from the mass of garbage. In a technical sense, it's not really garbage power because it recovers materials rather than energy, but it's still inextricably connected to the whole process.

There's nothing new about materials recovery. In 1903 one enterprising—and very strong-stomached—businessman paid New York City \$47,000 for the privilege of hand-picking through its mountains of trash. Today, the secondary materials industry reclaims \$8 billion of scrap a year.

Current technology is quite a few

(Please turn to page 142)

To the men & women who want to quit work, someday.

Isn't it about time, you found out, the misunderstanding that most people have about becoming Financially Secure?

As incredible as this may sound, there is a way to accumulate great wealth without working sixteen hours a day, every day, for the rest of your life. But, because of the bold implication of this statement, I would like you the reader to be the judge.

My name is Robert E. Shindler. I wrote a book entitled "The Get Rich Report," but I am **not** going to tell you how to become a millionaire. Furthermore, I am **not** going to show you how to become rich overnight. What I am going to tell and show you are ideas and methods that have made people from all walks of life successful, independent and financially secure for the rest of their lives.

If you are still with me this far, and I hope you are, I would like to share with you some of my accomplishments that I have included in my new book.

Now I know that you expect me to tell you about some "secret success formula", that I found in the attic of some old mansion. Or that I spoke to and studied the richest and most powerful men in the country. **Not true.**

Quite the Opposite

What I learned over the past five years about success and financial independence was quite the opposite from any formulas that you may have heard or read about.

Take Robert Gorman, a middle-aged man from Alexandria, Virginia. He works as a carpenter restoring old houses, because he likes it, and has a net worth of over a million dollars. He owns two office buildings and twenty-five houses (all of which he accumulated over the past seven years starting with nothing).

And then there is Alice Ragan who is a widow with four children from Arleta, California. Five years ago she was flat-broke and so heavily in debt that she came very close to applying for welfare. Today she has over \$250,000 in the bank and 35% ownership in one of the states largest corporations. All of this was acquired by using the same ideas and methods that Mr. Gorman used.

I found that these two cases were not isolated by any means. From one end of the country to the other I talked to small groups of people from all walks of life (all applying and using the same ideas and methods). All starting without any capital and all becoming financially secure.

Definitely Different

The methods and ideas were definitely different. The concept was unique and far superior to anything in any book I had ever read.

I began by putting the information and methods I had learned into practice, revising and improving them to work even faster. I was amazed at the results in just six months.

Today I am my own boss and I am spending a lot of time traveling around the country doing things that I only dreamed about before.

In the first six months of operation, with just one of my methods, I earned over \$100,000. The second half of the year I doubled that figure. After three years of perfecting my methods, I am the president of my own corporation which planned a series of acquisitions back in 1978 which by 1980 should surpass the \$6 million dollar mark.

I'll tell you one thing: anyone can make

\$200,000 a year using my methods and ideas and they would be a fool not to try. Things are tough for people living on salaries. Tomorrow they'll be even tougher.

All over America new fortunes are being created. People from all walks of life are embarking on an adventure that few experiences in life can match: A journey into excitement, success and — just possibly — great wealth and the kind of personal freedom that few others will ever enjoy.

The Real Proof

But you will find the real proof of my accomplishments in the last eleven chapters of my book. I will show you that you don't have to be a genius. I'm definitely not. You will find that you don't have to live in any particular part of the country. Nor do you have to have experience or outside financing.

My book "The Get Rich Report" will show you more than how to make a substantial income and become financially secure. It will stimulate your mind and reveal to you NEW ideas and methods that will work for you NO MATTER what kind of job or business you are in. I have already received many letters from housewives, lawyers, businessmen, doctors and government elected officials who have thanked me and profited from the ideas and suggestions in my book.

\$2,800 in Twenty-Eight Days

"I am a retired railroad man 75 years of age. I used to just sleep all day and watch TV at night. Now that I received your Get Rich Report, I have something to do with my time and making money besides. Last month I made \$2,800 using your methods. I could easily double that if I were a younger man. I feel useful again."

Thomas Sheehan
Saginaw, Michigan

A Blueprint for Success

"I am a school teacher. Before that I was in show business — New York, Dallas, Europe. Also wrote for Broadway shows. After seeing a sample of your work I can only say; your systems are like a blueprint for becoming successful. You can count on me. My goals are set very high!"

John McCall
New York, N.Y.

\$24,000 in Four Months

It seems all my life I've been faced with bills, bills, and more bills. I was always up to my ears in debts, and there never seemed to be any let up. If it wasn't one thing, it was another. I just couldn't get my head above water. Since I started using your methods in your book I've gained a second income of \$24,000 in just four months, besides my regular salary. I am now free and clear of unpaid bills. I have \$34,000 in savings in the bank and I have just purchased a new home \$125,000. It seems like I have a new lease on life.

John Seals
Indianapolis, Indiana

\$14,028.77 in One Week

Five days after your book arrived I set one of your plans into action. I made \$14,028.77. I have never in my life time, seen a program work so fast. PS. I still don't have a job.

Joseph Altizer
Springfield, Illinois

\$32,000 in Just Three Months

Three months ago I took what you taught me in chapter 10 to heart. The results were remarkable. I made \$32,210.00. Not bad for a person with a seventh grade education.

Samuel Thornton
Riverside, California

Those were just some of the comments from people, just like yourself, from all walks of life and various parts of the country. The only difference between them and you is their use of certain basic principles taught in The Get Rich Report. In just one week from now you can know what they know.

I have written the book in plain English to make it easy to read and easy to follow. If you are asking yourself about now, "I wonder if his book is about mail-order?" let me answer you by saying you are dead wrong. The Get Rich Report has ABSOLUTELY NOTHING to do with or about mail-order.

You will find twenty-one chapters that are full to overflowing with facts, methods, ideas and techniques, that are working for me and several hundred others across the country. Methods like: A six month step-by-step plan for building a \$200,000 income without having a job or business. Or the system that allows you to receive \$10,000 two weeks after the book arrives.

You will find that you don't need an education to make these methods work. Nor do you need lots of experience. Both men and women, all ages, are acting on my seasoned advice. What is required? A willingness and a determination to put this knowledge to work for you and your family. Believe me when I say, it does not require you to leave your present job or business and there is positively No Selling or buying of any products. In fact, you don't need to have or rent an office to get started. You can do it anywhere — out or your house or in your apartment. With my methods and ideas you will be able to earn an extra \$5,000 to \$100,000 in a matter of months.

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ENERGY FROM GARBAGE

(Continued from page 140)

levels above hand-picking, but still in its infancy and not really that sophisticated as yet. The technical name for the process is front-end separation, referring to the fact that it's best to get the valuable stuff out of garbage up front before burning it or turning it into electricity. The basic materials sought are iron, steel, aluminum and glass.

Several machines are used, all with fancy names hiding the fact that basic principles are involved. A specific-gravity separator, for instance, is a large tub of water. Some materials dumped in it float, and some sink to the bottom where they are recovered.

A hydrasorter, as you can guess, also uses water. Basically, it's a complicated waterfall that drops onto lower and lower plateaus. It relies on the principle that different materials have different weights. Aluminum will be collected on the first plateau, glass on the second, stones (with a diamond or two on lucky days) on the bottom. And, of course, there's that old standby, the magnet, which pulls iron, steel and other ferrous metals out of garbage at various stages. Some operations also use photocell units that sort the glass from garbage by color—making separate piles of clear, green and amber.

Markets are limited

There are impressive statistics available to illustrate the potential of resource recovery. Our dumps hold enough aluminum to rebuild all our commercial aircraft 71 times; enough steel to rebuild Manhattan; enough glass to make 1500 wine glasses for every person on Earth. Still, today's recovery techniques are in the experimental stage, and the problem is complicated by the fact there are few markets for reclaimed metals.

The Hempstead garbage plant is one of the few that recovers iron, steel, aluminum and glass, in addition to producing electricity. But sanitation commissioner Landman says there has been little revenue from the materials-recovery part of the operation. He sees some small profits in aluminum and steel, but describes the economics of recycling glass as "borderline."

There are other problems, too, such as the fact that the minerals industry is given generous tax breaks in the form of depletion allowances for taking metals out of the Earth, but no one gets a tax

(Please turn to page 144)

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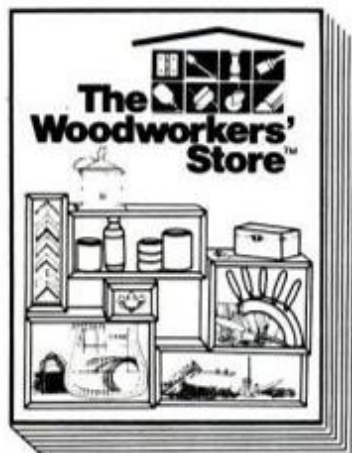
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ENERGY FROM GARBAGE

(Continued from page 142)

write-off for recycling old materials found in garbage.

Another plant, established two years ago with hope and the promise of mountains of refuse, now has more garbage than it can handle. Americology, a division of the American Can Co., gets 1600 tons of garbage from Milwaukee every day. After processing, some of the garbage is sold to a local electrical utility where it is burned for power. The plant also pulls out and peddles ferrous metals.

The main trouble is that there's still a lot of unsalable garbage left, so occasionally the young company has to pay to dump its waste in a landfill site. The bottom line: Americology is losing \$3 million annually, and doesn't expect to break even for three to five years.

Still, the potential is there, and the technology is improving. And some day materials recovery may become a necessity—no matter what the economics—because of vanishing resources.

Garbage of the future

Garbage power takes many other forms, as well. For instance, sewage sludge, the biologically active muck from sewage plants, can be turned into a dry fertilizer. Sewage skimings can also be de-watered and incinerated to produce steam power. And the potential of turning manure and other intimate wastes into methane at a grass-roots level is only beginning to be explored. Plants on both coasts are proving—at least in some communities—that municipal waste does contain usable energy.

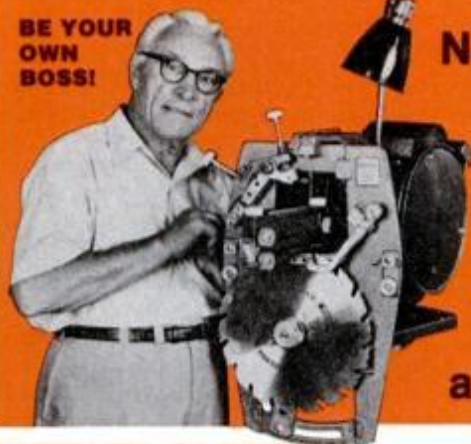
But to make municipal garbage power a reality, there's still that old bugaboo, money. Someone has to get rich off of it. Hempstead's Landman gloomily recalls the economic disaster that befell a garbage plant in Baltimore, and he admits the financial community is somewhat edgy about investing.

"What we need is a real published success," he says, hoping that the Black Clawson/Hempstead operation will become that success story. "Then the money will fly back into this business."

This is the proverbial garbage-is-gold argument, and with time and technology, it may work out that way. In the meantime, garbage power still serves a valuable function, no matter what the profit, or lack of it. It gets rid of the stuff. And in the final analysis, garbage is just garbage.

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William Wescott
Willoughby, Ohio 44094



Husband and wife have a going spare time shop

"I'm a construction foreman, and my wife is a nurse's aide. Our Foley shop fits in nicely with our regular jobs, and we earn extra money. Our sons help out too, so ours is a real family business."

"I'm still too young to retire, but when I do I'll have a very good business built up. Foley equipment helps us to do good work and brings customers back with more jobs on a regular basis... we have a lot of repeat business the year around."

Victor Kosloski
Sturgis, Michigan 49091



Glad he chose Foley for his saw shop

"I worked as a carpenter all my life, but when a back injury forced me to quit I decided to go into sharpening full time. I'm very proud of my shop and glad my choice was Foley equipment... it is superb. I made over \$48,000 last year, and this year it will go more than \$50,000."

Victor Johnson
Lincoln, Nebraska 68507

This can be one of the most important decisions you ever make. Going into business for yourself can be the most exciting and rewarding decision you're likely to make in your lifetime.

Owning your own business brings you a sense of independence. You're the boss, setting your own work hours. Your own effort builds the business for yourself and your family. You can achieve great satisfaction and profits, if you choose and manage your business wisely. That's why so many men, just like you, are cashing in on the big profits to be made in this fast-growing service field.

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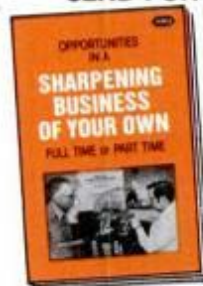
If you need only \$200 or \$400 extra income each month, a sharpening business is ideal for spare time. The additional dollars can be SPENT for more of the good things of life. Or they can be SAVED in a rainy-day fund that the family can bank on.

More sharpening businesses are needed every year

As original equipment continues to climb in cost, owners are becoming more concerned that the equipment be maintained so that it performs like new. This means more companies, contractors, carpenters and home owners are having their old saw blades and tools resharpened many times, where in the past, they would have replaced them with new blades or tools. This is where you

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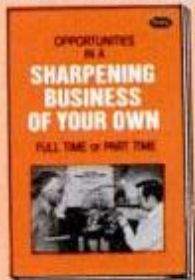
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AVOID CHIMNEY FIRES

(Continued from page 110)

occurs more quickly in well-constructed and properly installed systems. "If your system is very energy-efficient in heat transfer—that is, it recovers most of the heat of combustion—you can count on fast rates of (creosote) buildup," states Black Magic Chimney Sweep Inc., of Stowe, Vt.

To reduce creosote buildup, while keeping the system as efficient as possible, burn dry hardwood and add fuel in small amounts, rather than large loads. The most positive safeguard against a chimney fire, however, is frequent inspection for creosote buildup and sweeping of the chimney or stovepipe *before* buildup reaches the critical point.

The National Fire Protection

If you have a chimney fire . . .

1. Call the fire department.
2. If a fire extinguisher is available, direct the nozzle up the chimney. Flare-like extinguishers designed for chimney fires are available from fire-equipment companies.
3. If an extinguisher is not available, try to slow the fire by depriving it of oxygen. If the fire is in a stove, close the draft controls. In a fireplace, cover the opening with a piece of plywood or a wet blanket. Don't pour or spray water directly into the chimney. The rapid contraction will crack the ceramic flue.
4. Check outside. Flying sparks and embers can ignite nearby roofs and brush.
5. When the fire has been extinguished, examine the chimney for damage.

Assn. recommends that you inspect and clean a chimney annually. Use a powerful light and mirror to look up the flue. If bricks appear black or furry, sweeping is needed.

Black Magic Chimney Sweep Inc. is more specific: "Fireplaces, generally, don't need cleaning every year unless they get heavy use—four or five times a week. Look at the upper part of the firebox or up into the smoke-rise box. If the buildup is 1/4 inch or more, clean the fireplace or chimney."

As for woodburning stoves, they should be cleaned at least once a year—more frequently if the stove is the primary source of heat.

If you hire a professional to do the job, get estimates first. Ask about methods the company uses and be sure they carry their own insurance. If you do the job yourself, invest in the proper equipment and read the instruction sheets carefully. Chimney-sweeping kits for homeowners are sold at many hardware stores, fireplace and stove equipment dealers and through Sears, J.C. Penney and Montgomery Ward.—*Mort Schultz*

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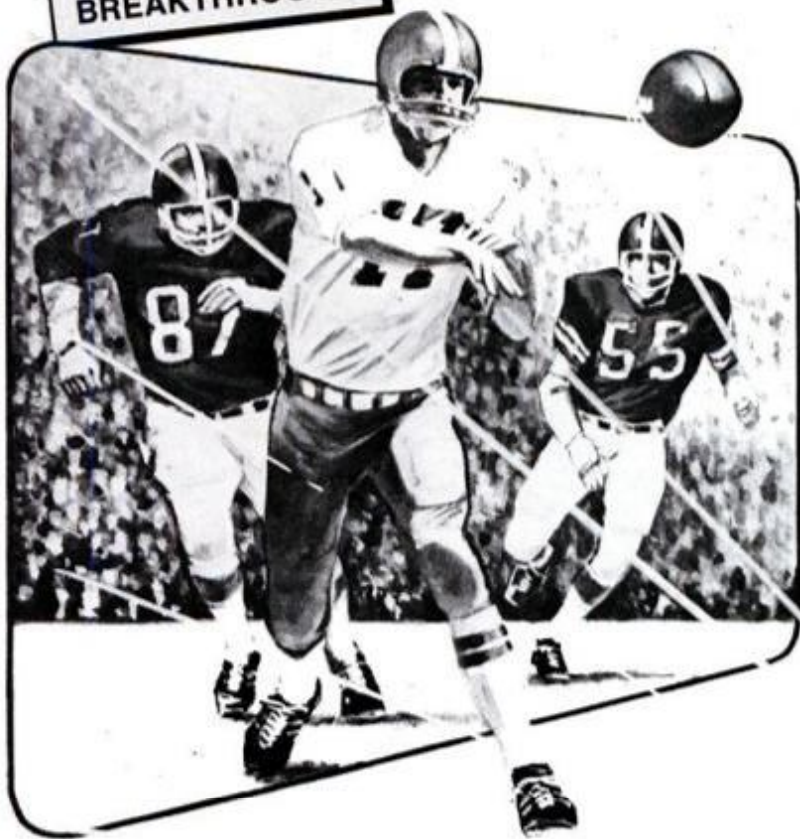


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DEALER INQUIRIES INVITED

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their dealers, a vociferous 12 percent rated dealer service *poor*. In all, some 30 percent weren't impressed. "My dealer lacks technically competent mechanics," says a Delaware computer programmer. A Florida tobacco distributor: "They don't tell the truth about the availability of parts. It took nine weeks to get a replacement hood. I've talked with other Saab owners who've waited three or four months!"

On the topic of interior comfort, a California store owner commented, "The Saab is a good, mid-sized, five-passenger car. I'm 6-2 and can sit comfortably even in the rear seat, with plenty of head- and kneeroom."

Seats are orthopedically designed, with electrically heated cushions on some models. There's no wheel-well intrusion in the rear area, nor is there a floor hump. The standard Saab ventilation system includes 12 air outlets and a filtering system on non-airconditioned models that takes out pollen, dust and moisture.

The rear seat folds flat and opens up a huge cargo deck with a total volume of 53 cubic feet. Many owners mentioned this feature and were grateful for the Saab 900's versatility.

One area of minor complaint centered on the Saab's high head restraints, which

tend to obstruct vision, both for the driver and for rear passengers. The optional center cushion for these rests comes out, however, and can be left out for a see-through effect. New seat backs for 1980 models should eliminate these complaints, says Saab.



Extra space for tools and valuables is under trunk floor; volume is 1.1 cu. ft.

The Saab's ride and handling scored well, with 54.8 percent of our respondents proclaiming "handling" as the car's best-liked feature.

"I like the tightness of handling in a variety of driving conditions," mentions an Ohio salesman. "This is a fun car to drive, not just a means of transportation. I really like the aesthetics and lines of the Saab, too; but best of all I like the way it handles."

A Louisiana executive chef: "A superb highway cruiser that loves twisty roads."

A California police inspector: "Spectacular handling and performance from the Turbo with four-speed. I really like the power-assisted steering and the smooth, quiet freeway ride. I've owned many two-place sports cars that can't hold a candle to the Turbo."

As always, we asked owners to list features they would like changed. Here's a cross-section of replies.

A Georgia nursery wholesaler: "The air conditioner is way below par for an \$11,000 car. It's weak; the high fan speed is too strong and the low speed too weak."

An Illinois attorney: "Larger fuel tank."

The Greenwood Eagle Burns Unsplit Green Logs without the usual creosote build-up

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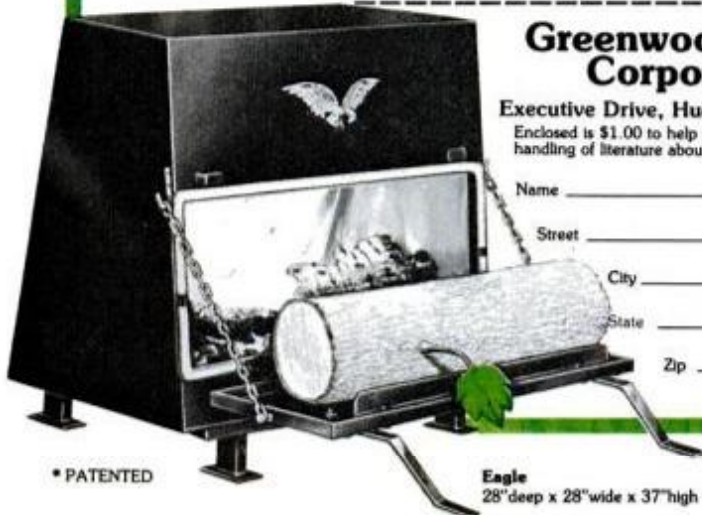
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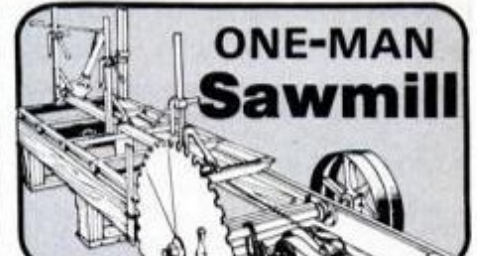
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A Tennessee manager: "I'd like to see Saab offer a five-speed overdrive transmission." (It will on the 1980 models.)

A Vermont lawyer: "Move the ignition key out from between the front seats. And not being able to remove the key before shifting into reverse is an even bigger nuisance!"

But by far, owners praised their cars, and even those who suggested improve-

ments struck some positive chords.

A California computer analyst: "The Saab's responsiveness is incredible. It's like riding a safe motorcycle—really fun to drive. I can use it as an ordinary four-passenger business car and yet carry more cargo than in my old Olds station wagon."

An Illinois railroad conductor: "I'm fortunate because I live in a metropolitan

area with two good Saab dealers. But with only about 400 dealers in the United States, some owners who want to keep their cars running, but who don't live near a dealer should consider joining the Midwest Saab Club. The club puts out a monthly newsletter chock full of technical information and how-tos. It's edited by Dick Grossman, 1916 West Hood, Chicago, Ill. 60660. **PM**

SUMMARY OF 1979 SAAB 900 OWNERS REPORTS*

Total miles driven 1,297,875	Specific likes:	Comfort opinion (front seats):	Dealer service opinion:
Average miles per gallon	Handling 54.8%	Excellent 81.0%	Excellent 34.9%
GLVEMS/GLE	Comfort 50.3	Very good 16.0	Good 35.4
In town 21.4	Styling 29.9	Good 2.5	Average 11.5
Long trips 26.6	Performance 28.9	Fair 0.5	Fair 6.2
900 Turbo	Economy 28.4	Poor 0.0	Poor 12.0
In town 21.1	Specific dislikes:	Comfort opinion (rear seats):	Number of vehicles owned:
Long trips 26.2	No complaints 19.6%	Excellent 60.2%	Saab only 31.5%
Model choices:	Service and waits for parts . . . 18.0	Very good 33.2	Two cars 49.5
Saab 900 GLi three-door 18.3%	Airconditioner 11.1	Good 5.6	Three cars 13.0
Saab 900 EMS three-door 15.2	Road noise and rattles 10.1	Fair 1.0	Four or more cars 6.0
Saab 900 GLE five-door 29.3	Lack of power 7.4	Poor 0.0	Makes of other cars owned:
Saab 900 Turbo three-door 19.4	What changes would you like?	Had any mechanical trouble?	Saab 19.0%
Saab 900 Turbo five-door 17.8	No changes 20.1%	Yes 54.3%	Chevrolet 15.3
Transmission choices:	Add five-speed gearbox** . . . 12.2	No 45.7	Volkswagen 10.9
Four-speed manual 79.5%	Redo seats** 7.9	What type of trouble?	Ford 8.8
Automatic 20.5	Better airconditioner 3.7	Airconditioner 24.3%	Datsun 8.0
Why did you choose the Saab?	More horsepower 3.7	Electrical 14.0	Age distribution of owners:
Styling 23.5%	Workmanship opinion:	Shock absorbers 8.4	Under 20-29 years 27.4%
Economy 22.0	Excellent 70.7%	Wiper/washer system 6.5	30-49 years 42.6
Front-wheel drive 20.5	Good 24.7	Dealer repairs satisfactory?	50-plus 30.1
Handling 18.5	Average 3.5	Yes 57.7%	Would you buy another Saab?
Performance 17.5	Fair 0.0	No 42.3	Yes 94.9%
	Poor 1.0		No 5.1

*Percentages might not equal 100% due to rounding or insufficient data. **Available in 1980 models.

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The medication used in the tests was Preparation H[®]. No prescription needed for Preparation H. Ointment and suppositories. Use only as directed.

4 NEW TAPE DECKS

(Continued from page 91)

the manual. Also offered are Dolby and memory-repeat functions, plus standard tape-deck features.

■ **JVC KD-A6:** This deck also enables you to fine-tune your settings for recording on various brands of tape. Similar to the Technics deck, the JVC KD-A6 has a chart in the manual that lists different control settings recommended for different tape brands.

The JVC deck offers an alternative to Dolbyization with the ANRS and Super-ANRS systems. We found, in the "super" position, results that were as fine as any of the other decks. Tape hiss was down on ferric tapes and gone, to our ears, on both chrome and metal. The meters have five built-in lights that indicate peak readings.

JVC, too, offers memory repeat and the standard functions.

■ **Teac A-55ORX:** This deck has what Teac calls its *dbx II Noise Reduction System*. It takes noise reduction all the way down to 30 decibels. This means high level recordings can be made without loss of high-frequency response.

The deck also offers bonuses like memory-repeat, timer control and standard features (among these decks) such as Record Mute to leave blank spaces between selections.

Back in the lab

As we said, we played all of these decks with metal tape (both TDK and Scotch Metafine) and were well pleased with the results. To us, they sounded superb.

Our lab test verified the extraordinarily fine frequency response of these decks in the higher-frequency ranges. The only question you have to answer is how important this is to you. If your listening doesn't require such response, then there's no reason to have it.

But don't be scared away from metal tape or metal-capable decks like these on the basis of idle rumors such as: "You can't erase metal tapes!" Let's scotch (no pun intended) this rumor for once and for all.

Sensitive laboratory test equipment revealed that every one of these decks was fully successful in erasing the metal tapes to well below any meaningful figure.

Give a listen to these new decks and to metal tape—if it sounds like it's for you (and you can justify the still-high tape prices to yourself), we think you can go right ahead and buy. Metal tape is an idea whose time and whose equipment has come.

PM

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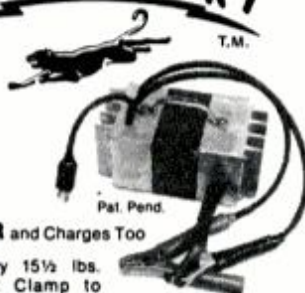
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PM LOG SPLITTER

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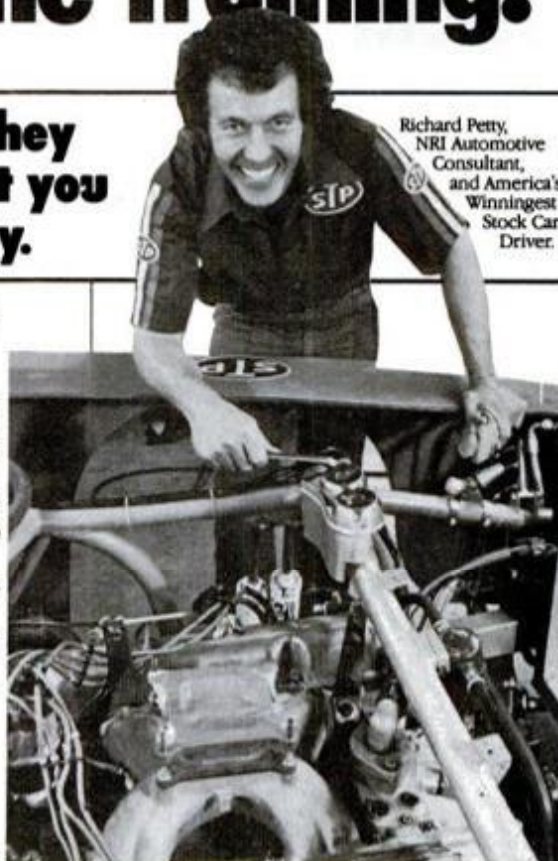
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NRI's 51-lesson Master Automotive Technician Course includes what you need to be a real pro. In addition to carefully planned

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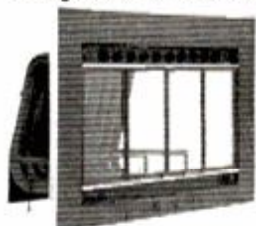
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LETTERS TO THE EDITOR

(Continued from page 8)

items, and we are confident they will exercise caution in the use of your product.

Sidewinder

In two of your articles in the Oct. '79 issue (*Car Stereo—Install It Like a Pro*, page 24, and *PM Owners Report: Chevrolet Citation*, page 92), you mention that the only radio that can be used is the factory-installed one. That's true if you want the dial on the radio to be vertical. I installed a Craig T683 AM/FM cassette unit in the dash where the AM radio had been.

The new radio fit just fine, but I still had to do a minimum of filing on the dash opening to fit over the radio face. It looks like the original and I find no problem with its position. In fact, I find it very convenient having it close to the steering wheel. The numbers on the radio are sideways but they still are very easy to read.

NICK CASSARA
EUREKA, CALIF.

What's left?

Although I've read many interesting articles about chain saws (including *Ten Features to Look For When You Buy a Chain Saw*, page 129, Oct. '79), I've never seen one that discusses the brand or brands that are easiest for left-handed people to use. I nearly wore myself out using a rented saw. Yet my right-handed companion thought it was just fine.

LAWRENCE B. CLARK
BIRMINGHAM, ALA.

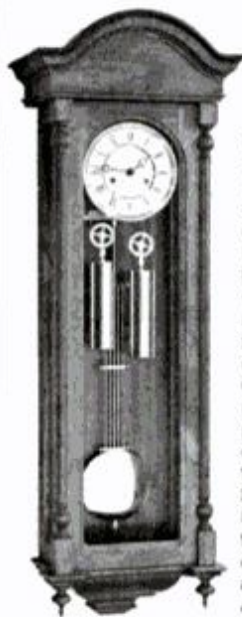
We know of no manufacturer who produces a chain saw especially designed for the use of a left-hander. Perhaps one of our readers has heard of one.

Raising a flap

On page 144 of the Aug. '79 issue (*What We're Learning From Airplane Flight Recorders*), there is a glaring error. The autopilot cannot compensate for loss of lift on the left wing by raising spoilers and flaps on the right wing. Autopilots do not control flaps. Even if they did, they would operate both left- and right-wing flaps together, which would further reduce left-wing lift. (Even the pilot cannot operate flaps differentially.) The autopilot would raise the ailerons and spoilers to decrease lift on the right wing.

RAYMOND KOSTANTY
WOOD-RIDGE, N.J.

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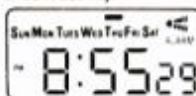
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WEEKEND PROJECTS: TABLE

(Continued from page 105)

keep this joint from pulling apart. Similarly, a drop of white glue on the tip of the screw that passes through the fixed legs and into pivot block (D) will help prevent it from backing out with use.

5. The aluminum guides (I) must be identical in length and formed so that the swinging legs of the table will slide easily.

Accurate forming of the guides is greatly simplified by the use of jig shown in plans and photos on page 104. Make trial bends on a short piece of aluminum to check for clearance before screwing block (N) to jig permanently.

Then take a short measured length of aluminum strip, say 8-in. long, and form the two ends. Measure the finished length. The difference between the two lengths is the distance that must be added to the length of aluminum strip from which the finished guide will be formed.

6. Finishing the tables is a matter of individual taste. If a hardwood has been used, a rubbed finish with Danish or tung oil topped off with polished hard wax gives a handsome effect.

The aluminum guides can be covered with brass-colored spray lacquer to match brass screws, or with a color that will harmonize with the wood.

All the brads should be set and holes filled with matching wood putty. Use of a hollow-ground saw blade on all cuts will produce surfaces that require only fine sanding to achieve a sexy-smooth finish.—Frank H. Day.

WEEKEND PROJECTS: SKI BENCH

(Continued from page 105)

and secure to hook screw. Close two clamps to prevent side-to-side movement.

Now you can wax, file and make repairs on your skis quickly and easily.—Wayne Homstad

MATERIALS LIST—SKI BENCH

Key	No.	Size and description (use)
A	1	3/4 x 3 1/2 x 76 1/4" pine or to suit (base)
B	2	3/4 x 3 1/2 x 3 1/2" pine (sides)
C	1	3/4 x 3 1/2 x 4 1/4" pine (end)
D	2	3/4 x 2 1/2 x 3 1/2" pine (fixed end of clamp)
E	2	3/4 x 2 1/2 x 2 1/4" pine (sliding end of clamp)
F	2	3/4" dia. x 6" dowel
G	2	3/4" dia. x 6" dowel
H	2	3/4" dia. x 6" carriage bolt
I	2	3/4" hex nut
J	2	3/4" i.d. washer
K	2	3/4" wingnut
L	1	screw hook
M	1	screw eye
N	1	3/8" clothesline rope
O	24	1 1/2" No. 8 fh screw

Misc.: glue and clear paint or clear finish.

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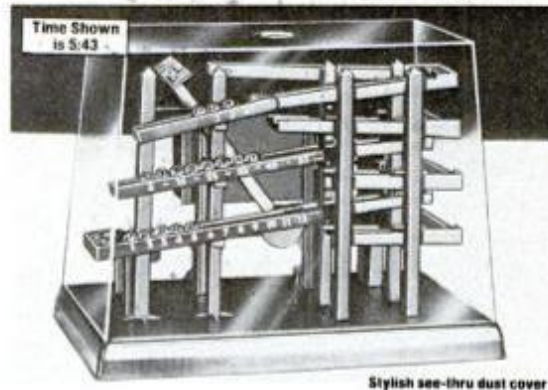
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1.



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2.



Every fifth ball, one rolls to 5-minute track.

3.



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4.

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PM's Silencer cuts off nagging TV commercials



The next time a commercial interrupts your TV show, at least you won't have to listen. PM's Silencer will shut off your TV's sound so it doesn't bother you.

by Walter Sikonowiz

Here's a typical weekend scene: You're unwinding with a late-night horror movie. Inevitably, just as the vampire is ready to pounce, on comes something like a talking-tuna commercial to break the spell.

A touch stops the noise

While there is little that can be done about the timing of such nuisance interruptions, it is possible to stifle them, using our Commercial Silencer. A light touch to the top of an innocuous-looking little wooden box sends the sound of commercials, extra-loud sportscasters, or whatever else, into oblivion for up to two minutes. At the end of that time, your television's audio returns to normal automatically. Construction is simple, and only a very slight modification of your TV is required.

More details on the Silencer can be found in the diagram (page 164). S1 is a touch-activated switch—basically, just a pair of metal plates in close proximity, but electrically isolated from one another. When a finger bridges the gap between the plates, a minute current flows from the 9-volt battery, through the finger (which acts as a resistor), and fi-

nally through R2, back to the battery. Our prototype switch is easily duplicated, using printed-circuit material. If you are not able to fabricate your own printed circuits, however, don't worry. Two strips of aluminum or copper, spaced $\frac{1}{16}$ in. or so apart, will work equally well.

Once IC1 has been triggered with a brief touch at S1, it remains activated for a fixed interval of time, and then automatically resets itself. For the duration of IC1's activation, a current flows through R6 into the base (B) lead of transistor Q1. This current turns on Q1, causing it to act like a closed switch. As you would expect, this allows a current to flow through relay K1 and the light-emitting diode, LED 1. The diode lights, indicating that the circuit is activated, and the relay's armature

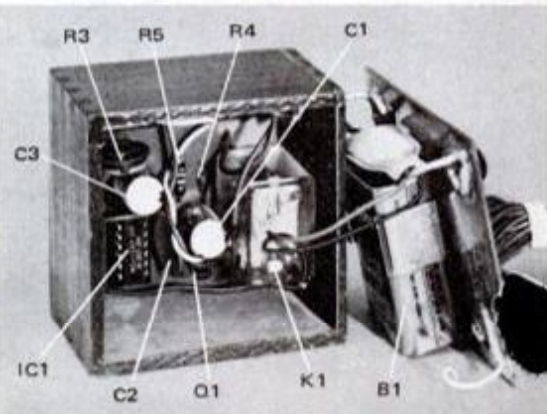
pulls in. This, in turn, interrupts the circuit supplying the audio signal to your TV's speaker.

For the interval during which the Silencer remains activated, your TV will be silent, but its picture will not be affected in any way. The length of the quiet period is determined by R3, R4, C3. R3 allows adjustment of the timed interval to vary between 30⁺ seconds and two minutes. TV commercial breaks are most frequently one minute in duration; however, some commercial periods are one-and-a-half or two minutes long. The prototype was adjusted to cut off sound for one minute. When necessary, longer commercials can be silenced with a second tap of the switch.

Modification of the TV requires [\(Please turn to page 164\)](#)



The Silencer (left and below) can be easily held in the palm of your hand. The red LED glows to alert you when it is on, but the welcome silence will also inform you. Follow our guides to construct this project and block out those annoying commercials.





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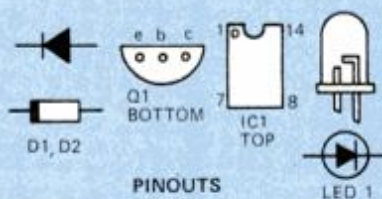
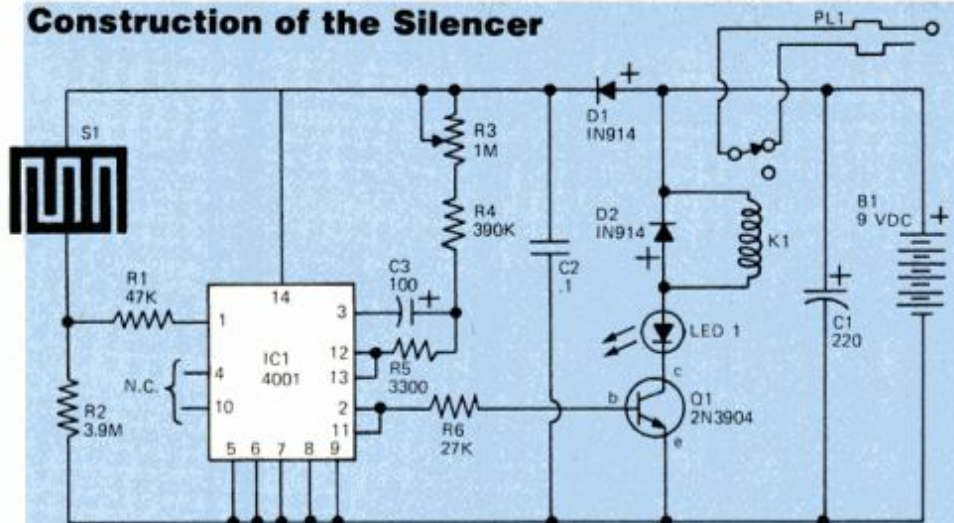
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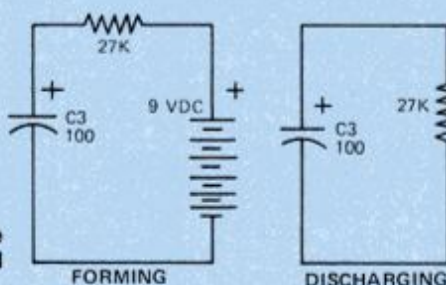
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Construction of the Silencer

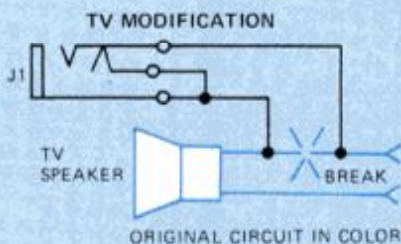


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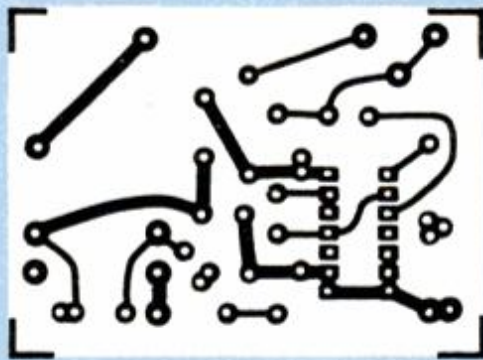
Schematic diagram, pinout guide (above) help you figure polarities and pin orientations as you build.



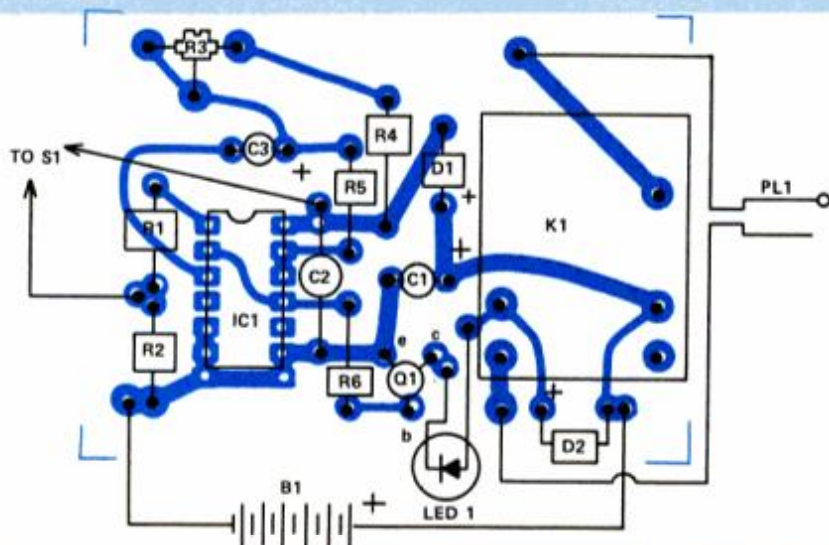
Follow the instructions in the text for information on how to "form" C3.



ORIGINAL CIRCUIT IN COLOR



Both switch S1 and the PC board can be made from this template (above).



Follow this component side view of the Silencer's PC board as you build.

PM'S COMMERCIAL SILENCER

(Continued from page 162)

that one of the two leads feeding your set's speaker—it doesn't matter which—be cut. A closed-circuit phone jack, J1, is then installed on the TV's back panel and wired in accordance with the schematic. Whenever plug PL1 from the Silencer is inserted into J1, relay K1's normally closed contacts are in series with the speaker; therefore, your TV's audio is under the Silencer's control. If PL1 is removed, J1 automatically closes the speaker circuit, thus restoring normal audio operation to your set.

For long, maintenance-free service, an alkaline-type 9-volt transistor battery is recommended. Alternatively, six 1.5-volt AA cells in series could be used, but a bigger case would then be necessary.

Silencer construction

Construction is straightforward and should pose no problems for experienced builders. While it is not absolutely necessary, PC-style construction (see page 17, March '79) will allow you to build a more compact circuit than perfboard. The layouts accompanying this article may be copied by those who desire a printed circuit; however, be careful not to confuse the foil and component sides of the board. Also, note that the PC pads for relay K1 are appropriate only for the Radio Shack device listed in the parts list. Other equivalent 6-volt, 500-ohm relays could be substituted, but the PC layout would then need to be altered.

For those choosing PC construction, S1 can be etched from a piece of single-sided phenolic board. One light wire should be soldered to each plate of the switch for later connection to the main printed circuit. On the other hand, if you elect to use

(Please turn to page 164A)

PARTS LIST—SILENCER

- B1—9-v. alkaline battery
 - C1—220-mfd., 16-v. electrolytic capacitor
 - C2—.1-mfd. ceramic capacitor
 - C3—100-mfd., 35-v. electrolytic capacitor
 - D1, D2—1N914 diode (Radio Shack 276-1122 or equiv.)
 - IC1—4001 CMOS quad NOR gate (Radio Shack 276-2401 or equiv.)
 - J1—¼-in. closed-circuit phone jack
 - K1—6-v., 500-ohm relay (Radio Shack 275-004 to fit our PC board template)
 - LED1—Light-emitting diode
 - PL1—¼-in. phone plug
 - Q1—NPN transistor, 2N3904 or equiv.
- All resistors are ¼-watt and 10% tolerance
- R1—47K resistor
 - R2—3.9M (megohm) resistor
 - R3—1M trimmer
 - R4—390K resistor
 - R5—3300-ohm resistor
 - R6—27K resistor
 - S1—Homemade touch switch (see text)
 - Misc.—Box, PC fabricating kit, wires, solder.

PM'S COMMERCIAL SILENCER

(Continued from page 164)

aluminum strips for your touch switch, contact wires will have to be attached to soldering lugs, which can then be screwed to the aluminum plates.

IC1 is a device which can be damaged *easily* by either the a.c. current leakage from a soldering iron or a static discharge from your fingertips (especially in cold, dry winter air). So be careful installing it. When making all connections, it is important to use rosin-core solder, like Erskin Multicore or Kester 44. Acid fluxes are corrosive to copper. *Never* use them in electronic construction.

Before installing electrolytic timing capacitor C3, take the time to properly form it. "Forming" refers to the application of a d.c. voltage, in order to electrochemically deposit a complete layer of insulation between the plates of an electrolytic capacitor. While forming is not absolutely necessary, especially with brand-new electrolytics, it is recommended here so that there is no initial timing error after the circuit is constructed. To form C3, hook it up as shown on page 164 in series with a 27K resistor (R6) and a 9-volt battery—making sure that battery positive goes to the capacitor's plus (+) terminal. Let forming proceed for about 15 minutes, then disconnect the battery and discharge C3 through the 27K resistor. Note that it is *not* necessary to form electrolytic capacitor C1.

Housing the Silencer

The prototype Commercial Silencer was built in a small wooden box with a maximum dimension of about 2½ in. You may be able to locate a ready-made box to satisfy your needs. If none can be found, however, try this procedure: Get the cedar gift box from a bottle of English Leather after-shave. The box is too large in one dimension, but since its sides are only ¼-in. thick, it's a simple matter to cut it down. Apply walnut stain and varnish, and you'll end up with the prototype shown here.

In normal use, the Commercial Silencer is placed on a table or shelf that's easy to reach from your favorite chair. Connection between your TV set and the Silencer can be made through a pair of thin, twisted wires running under a rug. Terminate the wires with plug PL1.

Once all construction is complete, install the 9-volt battery and adjust R3 to about the midpoint of its range. After briefly touching S1 with the tip of your finger, you should see LED 1 begin to glow and

hear a slight "click" as the relay pulls in. Note the length of time that LED 1 remains on. Adjust R3 for the desired time interval. Touch S1 again and check time again. Repeat until desired cutoff time is obtained.

Finally, plug the Silencer into your TV and check to see that the sound is properly cut off when the circuit is activated. A few closing notes: First, do *not* use the Silencer to control the sound from a high-powered stereo system. Relay K1 is ideally suited to TV sets and table-model radios; however, an FM receiver in even a modest stereo sys-

tem could damage K1's contacts at high volume. Also, it's necessary to use the sensitive inner tip of a finger or thumb to activate the touch switch; the rough, dry skin on the outer (nail side) normally has too high a resistance to be effective.

A last note: *Be very cautious when you cut the TV's speaker wire.* That wire is not dangerous, but be careful not to touch or tamper with any other wires or components while cutting the speaker wire. Most servicemen can make the connection for you at a low cost. The unit will add to happy, peaceful viewing. **FM**

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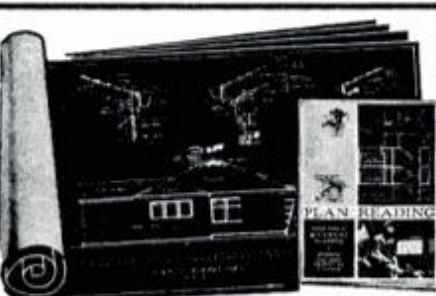
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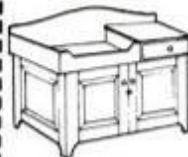
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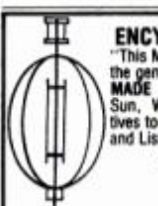
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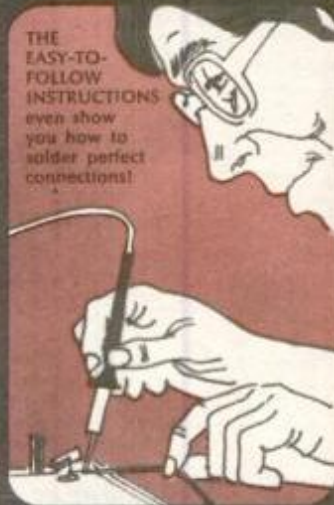
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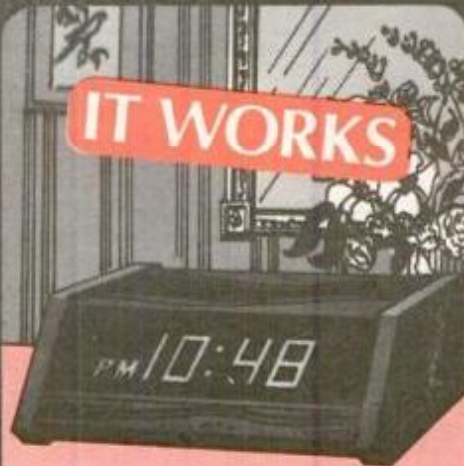


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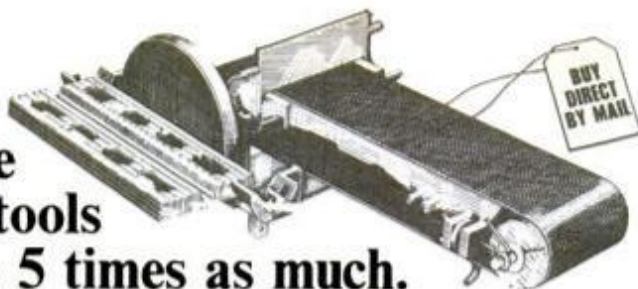
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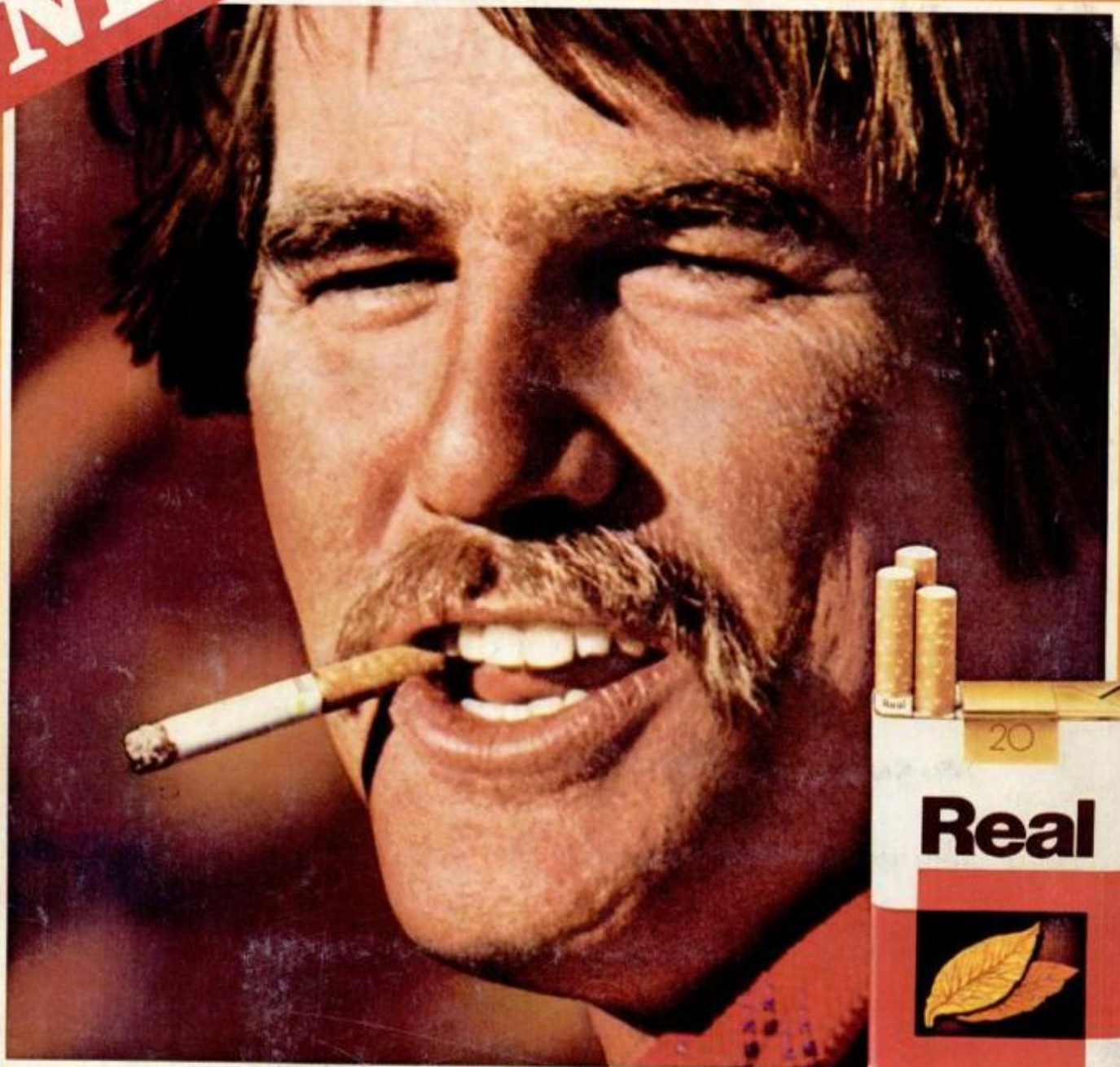
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