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—PM art by Ed Valigursky

Popular Mechanics®

JUNE 1979

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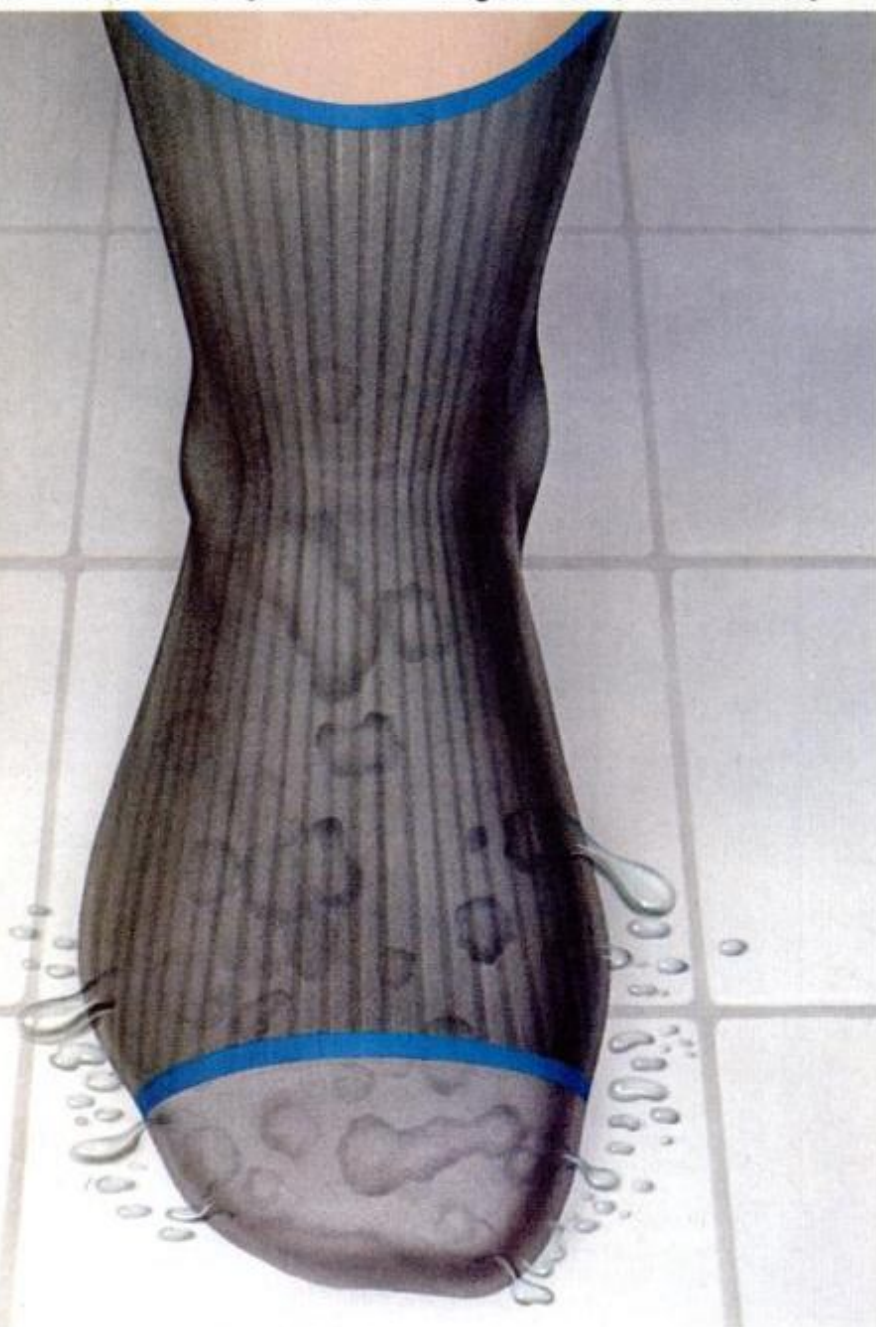
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Copy and Production: Garry Winter, chief; John Bostonian Jr., art; Peter Easton, Shannon K. Kelley, Daniel J. Oates, assistants
Art: Don Mannes, technical art director; Douglas Quinn, Alan Andresen, assistants

Special Publications: Clifford B. Hicks

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Bureau of Information: Sophie Gronowicz, director; 224 West 57th St., New York, N.Y. 10019. (212) 262-4292

Director of Advertising
Daniel J. Coleman

Advertising Offices:

New York: 224 West 57th St., New York, N.Y. 10019; (212) 262-4284

Chicago: 520 North Michigan Ave., Chicago, Ill. 60611; (312) 527-2400

Detroit: 377 Fisher Rd., Grosse Pointe, Mich. 48230; (313) 881-3520

Cleveland: 221 Mercantile Center, 3659 Green Rd., Cleveland, Ohio 44122; (216) 292-7334

Los Angeles: 460 East Carson Plaza Dr., Carson, Calif. 90746; (213) 532-8101

Production Manager: John A. Regina, (212) 262-4800

Classified Advertising Manager: H. E. Kappel, (212) 262-4825

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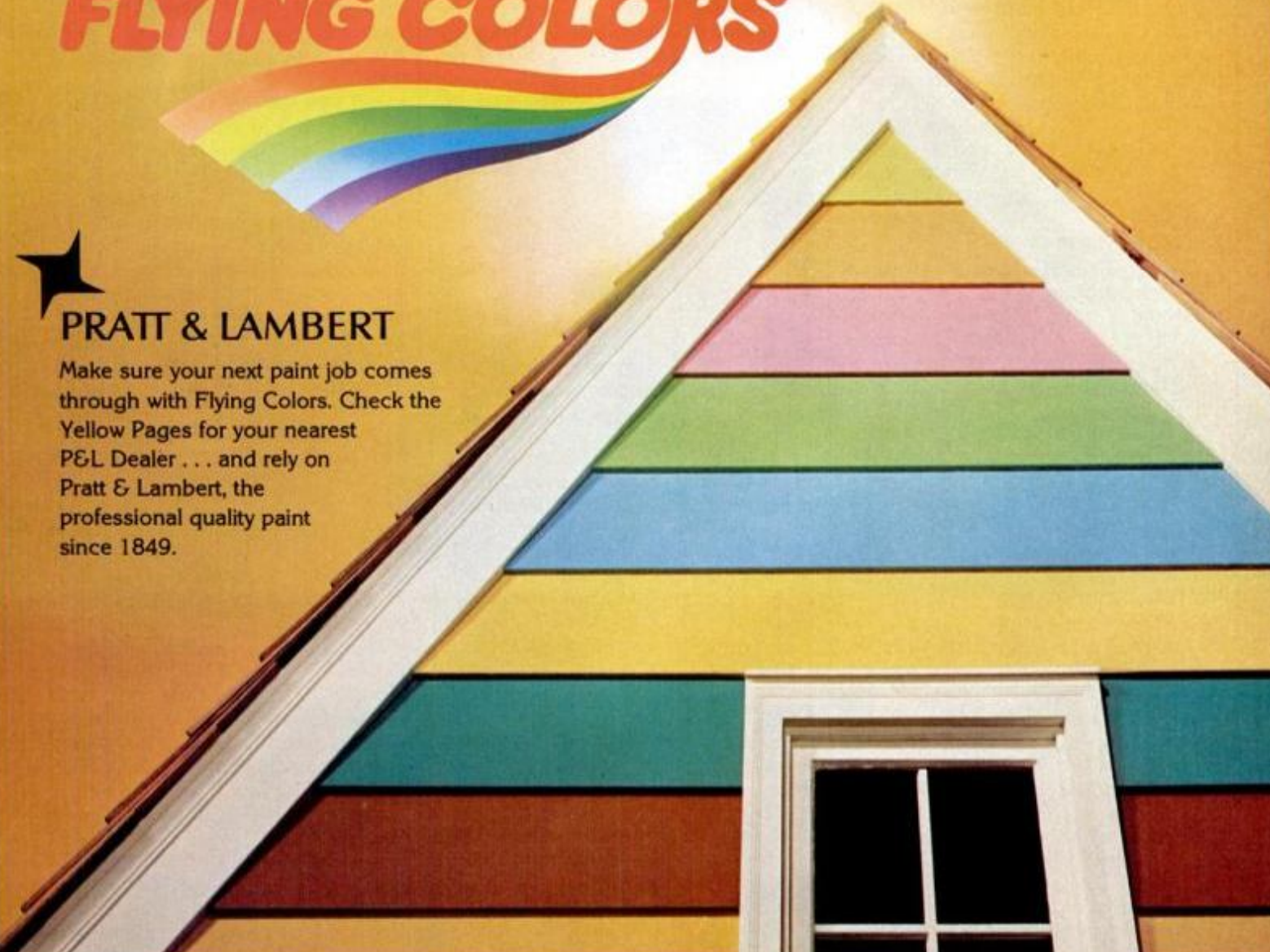


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LETTERS TO THE EDITOR

Omission accomplished

After reading the fine article by Bill Allen on powered ultralight aircraft (*Ultralights: They're Re-Inventing The Flying Machine*, page 87, March '79), I was pleased that I was mentioned in the article, but was also quite disappointed that there was no mention of our company in the supplier listing. Since the introduction of our Power Package kits for the Easy Riser airframe in 1976, our company has delivered more kits to our customers than most of the listed suppliers combined. Our extensive information package is \$5 and is available by writing to Ultralight Flying Machines of Wisconsin, Box 248, Kansasville, Wis. 53139.

JOHN K. MOODY
ULTRALIGHT FLYING MACHINES
OF WISCONSIN
KANSASVILLE, WIS.

Current events

I like to see PM staying strong in electronics, since it has always been a hobby of mine. I've already built two things from the Feb. '79 issue. I like them because they're not too complicated like the ones in some other magazines.

TIM WOOD
HOLLEY, N.Y.

Thanks, Tim. We will try to continue to feature unique and easy-to-build electronic projects.

No reflection on us

The projects in *4 Handsome Mirrors You Can Build* (page 102, Dec. '78) are worthwhile, especially the Infinity Mirror. There is, however, one major problem I've encountered that has made this project come to a screeching halt. It's been impossible to obtain a 1/8-in. one-way mirror, as called for.

Several of the local mirror dealers have informed me that 1/8-in. is not available and they are more than willing to sell me 1/4-in., which is heavier and more expensive. Where can I purchase a one-way mirror of this thickness?

CURT COLLINS
FEDERALSBURG, MD.

Apparently most manufacturers are cutting back on their one-way mirror production—especially 1/8-in. Prices vary widely. In the New York-New Jersey area, 1/8-in. can be bought for

about \$7.50 per sq. ft. The cost may be double that elsewhere. You can use 1/4-in. if deeper aluminum corner trim is provided. Also, 1/4-in. generally costs less than 1/8-in., since the thinner variety is scarcer. Apparently this is not necessarily true everywhere.

The best bet is to find the biggest mirror distributor in your area and order from there. Prices start off at about \$4 per sq. ft. wholesale.

Carriage trade

I have been an avid reader for over 30 years. The general information and projects have been well written



Reader Lang's PM-inspired pool house.

and attractively illustrated. My latest project was your carriage house (*A Backyard Storage Building that Isn't an Eyesore*, page 55, March '72) which, with a few modifications, became a useful and practical pool house.

RICHARD L. LANG
SWARTZ CREEK, MICH.

Only kitting

To imply that workers in developing countries are capable of only very simple projects is not only false, but it perpetuates the damaging myth in the minds of already misinformed North Americans that these people are unsophisticated and incapable of doing quality work. PM claims the Budd prefab railcar (*PM Briefs, World's Largest Kit?* page 53, Jan. '79) could be a cinch for northern handypersons since it is "specially designed for easy assembly by workers in developing countries." Both PM and Budd should find more responsible ways to advertise.

The resourcefulness and creativity of peasant farmers, Indians and workers in Costa Rica and Panama

in constructing buildings, water systems, transport and other necessities at least matches and probably surpasses northern technology. Many needed items are produced do-it-yourself.

CAROL A. MUNROE
SAN JOSE, COSTA RICA

PM was, of course, kidding about the Budd railcar's appeal as a kit for homebuilders. It's not the ingenuity of craftsmen in developing countries that's lacking—as reader Munroe documents—but often their resources are. That's what makes Budd's idea a good one.

I can see clearly now

As an owner of an Audi 5000, my experience and records basically agree with your report (*PM Owners Report: Audi 5000*, page 86, Dec. '78). The headrest visibility problem was solved thusly. Remove the front headrests (owner's manual has instructions); remove rear headrests and place them in front seats. They are lower, but not too low, and provide safety with better visibility. Store the front headrests, thus leaving the rear seat without headrests, as in most American cars, and you'll have full visibility through the rear window.

L.E. LAFEHR
ROLLING MEADOWS, ILL.

Asleep at the switch

The article *17 Low-Cost Ways to Burglarproof Your House* (page 87, Jan. '79) describes a "rudimentary buzzer alarm" using a fishing line to trip a mercury switch. However, mounting a mercury switch in the horizontal position as shown will cause it to stay on continuously. A mechanical "silent" switch, which can be mounted in any position, will do the job.

PETER F. BEYER
OSHKOSH, WIS.

Reader Beyer is correct. A mercury switch must be mounted vertically. In our prototype, we used a silent-type switch, but mistakenly called it a mercury switch.

Correction

The price of the Flymo Cushionaire mower, as reported in the March '79 issue (page 163), is incorrect. The correct price is \$220. **PM**



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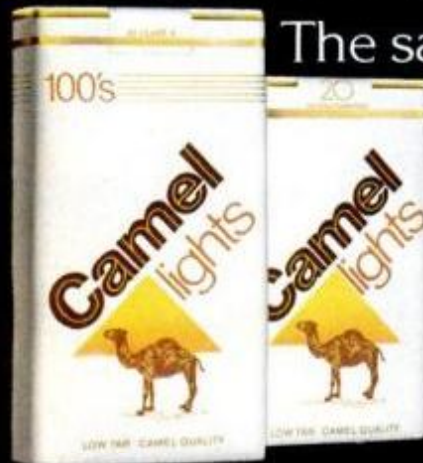
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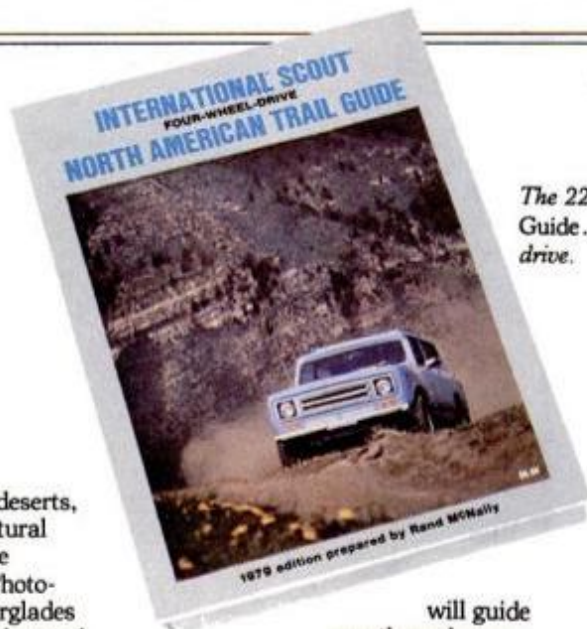
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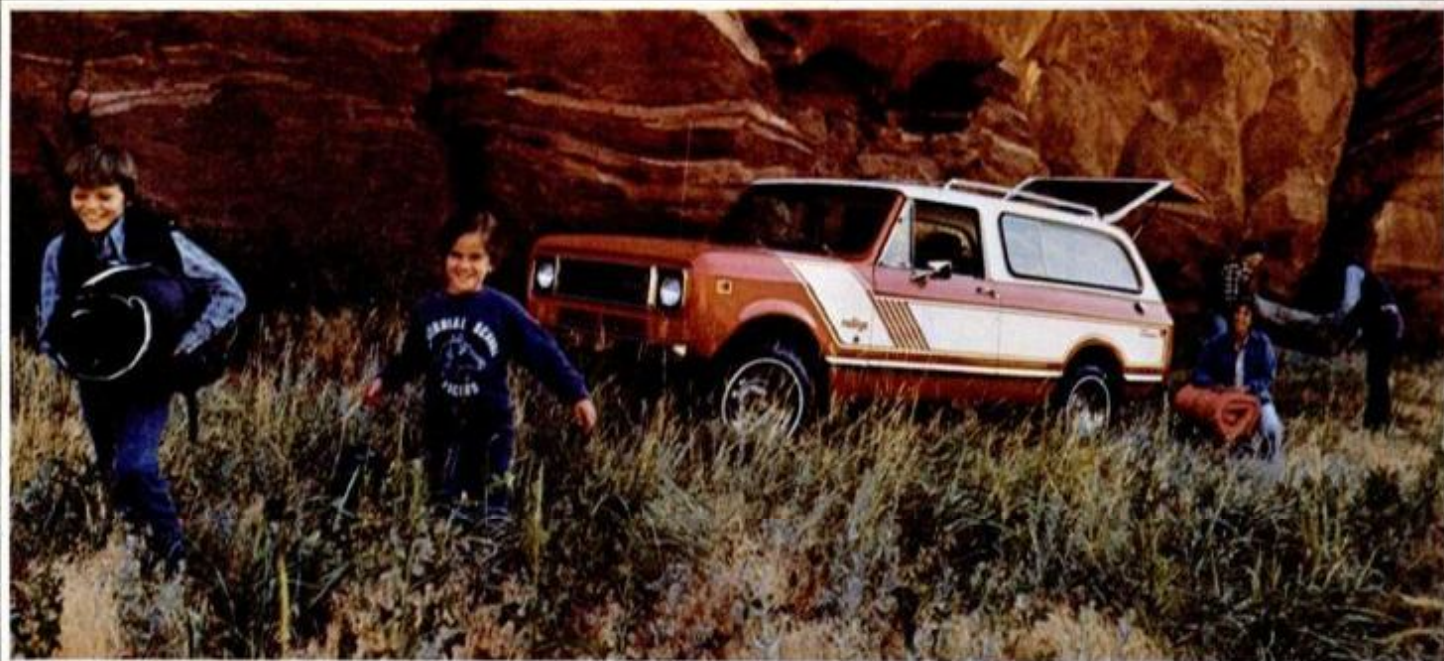
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INTERNATIONAL HARVESTER



HOMEOWNERS' CLINIC

QUESTIONS ANSWERED

Rust stains on roof

I have rust stains beginning to appear on my white asphalt roof shingles. Can you tell me how to remove them, and if I can treat them so they won't reappear?—Dennis Evans, Saugerties, N.Y.

The Asphalt Roofing Manufacturers Assn. suggests one method. Spray a solution of one part chlorine bleach to three parts water on the area. Several applications may be required. Don't brush the roof, as you may dislodge the granules. Take care that the bleach runoff doesn't stain the wood trim. Make a dam to catch the bleach with a fabric drop-cloth. Also cover base plantings. The only way to keep the rust from reappearing is to track down the source (antenna bracket or other metal) and treat it with a rust-inhibiting paint.

Bubble trouble

When our toilet is flushed, it bubbles from the bottom and empties poorly. Thinking our vent pipe was clogged, we hosed water through it from the roof outlet. The water seemed to go right through to the septic tank, indicating that the vent pipe was clear. The toilet still acts the same. Any suggestions?—Mary M. Hill, Chambersburg, Pa.

You've taken the one step most people forget—you've cleaned the vent. However, as that didn't cure your problem, you've got a few more possibilities. It could be an obstruction in the toilet itself, or in the branch line to the soil pipe. I know of a similar case in which the vent was clear, but the obstruction was a tree root in the line between the house and the tank. The line was eventually cleared with an electric auger (rooter) in the hands of a professional. These rooters can be rented by homeowners, but I feel that this is one case of "Penny wise. . ."

Painting over plaster

After I removed the wallpaper from the walls of our 40-year-old house, I covered them with latex paint. The latex ran off the walls like water off a duck's back. Then I primed with two coats of an oil-base primer before reapplying the latex. It lasted for a while, but now the paint is blistering off in spots. I painted one wall twice like this with the same result. What

should I do?—W. Dostal, Los Angeles.

A duck's feathers have natural oils to repel water. Your old plaster walls have wallpaper paste repelling the paint. A check with a paint chemist at Sherwin-Williams resulted in a logical cause and solution. If old paste is not completely removed, oil-base paints, taking longer to set up, can be absorbed by the porous plaster, but the hard-to-see old paste may be on, or suspended just below, the surface. Complete coverage by a slow-setting paint is next to impossible.

After you remove the paint now on your walls, wash with a solution of one pint household vinegar to one gallon of water. Rinse off thoroughly with clear water. Allow a thorough drying time of two days. Then use an alkyd paint, which sets up faster and has a harder surface than oil-base paint. Use an alkali-resisting primer or sealer, such as Sherwin Williams Wall Primer and Sealer, followed by two coats of alkyd wall paint.

Check the instructions appearing on the can regarding ventilation, drying time between coats and temperature.

Locating a cable break

I have electric resistance cable heating in my ceiling. My cable reads open with an ohmmeter. How can I find the break? Can it be located and repaired short of tearing out my entire ceiling? If so, where can I buy the equipment and what is the approximate cost?—Frank Hall, New Haven, Ky.

In an area like yours, where electric ceiling heat is popular, the utility company will usually locate the break. Once it's found, your electrician can make the repair. Briefly, to locate the break, a utility representative will disconnect the power source at the thermostat and hook a transmitter to the heating strip wires. Then he'll walk a receiver with headset under the ceiling in a pattern. A change in signal

shows the break area. If the utility company doesn't have the equipment, you can purchase it for about \$80. Write to Panco Inc., 16335 Lima Rd., Hometown, Ind. 46748. Its unit is called Electronic Heat Fault Locator, Mark IV. You may also be able to rent one from a local electric heating installer.

Undersize ceiling heights

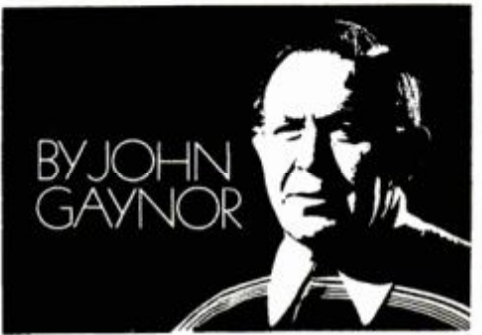
When I build my new house, I'm going to make all ceiling heights 7½ ft. I realize I may pay more for labor by extra cutting for drywall and paneling, but I figure I'll make up for it in heating and cooling savings. Why isn't this mentioned in energy conservation articles? Do you know where I can obtain more data on the subject?—Ray Spencer, Iron River, Mich.

When the early settlers built their homes with low ceilings, a six-foot-six man was a rarity. If you are of average height and plan on keeping the house, you will notice slight savings on heating costs. Incidentally, a 7½-ft. average is the minimum ceiling height that is accepted by the FHA.

However, I do think that you should give serious thought to the resale value of your house and the availability of financing. Some lending institutions insist on a minimum ceiling height (excluding kitchens and baths) of 8 ft. Check this with a knowledgeable local real estate agent.

Since the heat loss is calculated in part on exterior wall area, you are really only cutting down 1/16th of your exterior wall height per lineal foot (90 sq. ft. versus 96 sq. ft. on a 12-ft.-long wall). You can check this out further with a licensed mechanical engineer. Considering resale value and tall guests, I would opt for extra insulation, insulating glass on storm windows and weatherstripping. **PM**

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.



Just about everything that grows in your yard is going to look better when it's fed. And you don't have to know much about your trees, shrubs and flowers to do it right. You don't have to know much about fertilizers, either.

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Here is where some people make it complicated. They tell you you have to use one thing for annuals, another for perennials and something else for roses. But that just isn't so.

Here at Scotts in Marysville, Ohio, we make one fertilizer you can use on all your flowers. And that includes seeds, seedlings and full-grown perennials. We simply call it Grow Flowers.

You don't have to use this fertilizer as often as some other brands.

While most fertilizers are made to release their nitrogen right away, we

make ours to release its nitrogen slowly. Your flowers get a good feeding to start off with, then a little more week after week. This longer feeding is what helps give you more blooms on your plants and brighter color too. (You look better when you eat regularly. And so do your flowers.)

As you can see from the boxes below, we also have some simple ways to take care of your shrubs and trees, acid-loving plants and transplants. The nutritional ingredients in each of these are in correct proportion to their use. (Flowers need more of one thing, trees more of another.)

They're all safe to use if you just do what it says on the package. Like every fertilizer we make, each one has our special slow-release formula for a balanced, prolonged feeding and slow even growth.

We tested all these fertilizers ourselves so we know just what they can do. They will give you healthy looking plants and better growth and that's a promise.

You'll find our guarantee right there on every box. It says, "If for any reason you are not satisfied with results after using this product, you are entitled to get your money back. Simply send us evidence of purchase and we will mail you a refund check promptly."

We made that simple too.



Have carefree back-yard cooking with PM's hickory smoke cooker

PM's carefree hickory-smoke cooker combines the best qualities of the old smokehouse and the modern barbecue grill. It cooks an entire meal with little or no attention, turning inexpensive cuts of meat into tender, delicious dishes boasting a rich, smoky flavor. Smoke cooking can also tame the sometimes objectionably strong flavor of wild game.

The concept is simple. Food is cooked by indirect heat and smoke, not by the fire. Smoke-saturated air moves gently through and around the food, sealing in the natural juices and penetrating the meat with flavor. A simple system (like a fireplace) controls heat and prevents overcooking. While the meat is cooking, a special oven in the chimney cooks potatoes and other vegetables of your choice.

A firebox below the cooking chamber holds the fuel. Some fuels to use are mesquite, hickory and apple logs, or charcoal and hardwood chips. You can also equip your smoker-cooker with an optional gas feature. The easily accessible chamber can smoke-cook a 20-lb. turkey with little attention on your part.

To barbecue, simply lift the front lid, slide the grill into the grill rails in the lid, and place the fire floor on one of the two lower grill rails below the lid. The fire floor then becomes the charcoal tray. It's almost impossible to overcook, and no turning or basting is needed.

While we took these photographs,

HOW TO ORDER PLANS AND KIT

For complete plans, including two 17x22-in. drawings and a 16-page booklet, send your check or money order for \$7.95 to: PM Hickory Smoke Cooker, Box 1014, Radio City Station, New York, N.Y. 10019. Allow three to four weeks for third-class mail; add 75 cents to your remittance if you prefer to receive faster, first-class mail.

For information on kit (\$398, not including plans) containing all hardware needed to build cooker minus bricks and mortar, write Old Hickory, Box 39383, Phoenix, Ariz. 85069.

Popular Mechanics is a publication of Hearst Magazines, a division of the Hearst Corp.



Produce tantalizing, smoke-flavored meals effortlessly with the PM smoke cooker.

A rain guard tops off the chimney of the unit to provide the finishing touch.



Begin work by laying bricks for the firebox and installing the firebox door.

Large 480-sq.-in. cooking area smoke-cooks enough for a neighborhood feast.



the chickens and pepper on the roast, we added no seasoning. The meal was delicious.

A drip tray over the firebox catches rich, clear drippings which make excellent gravy. Since the tray extends outside the cooking area, the drippings cannot scorch.

You have a number of options in building the smoker. You can fabricate the oven lid, the fire floor and drip tray, and lay the brick yourself, purchasing the firebox and chimney oven doors locally. The smoker will cost you about \$80. You can also order a kit by mail that includes all metal hardware necessary, and then have a local bricklayer install the unit according to plans. Besides the cost of the kit, brick and mortar cost about \$35 and a bricklaying job costs about \$75. For more details, see the order box at left. **PM**

we fired up the smoker with three 3-in.-dia. mesquite logs, and then placed two large chickens and a 9-lb. standing crown roast in the oven. We loaded potatoes into the chimney oven. Three hours and a couple of extra logs later, the meal was ready. All was equally cooked, moist and saturated with the smoky flavor of mesquite. Aside from a little salt on

SCIENCE WORLDWIDE

Bringing home the heat

Industries and homeowners in the United States pay a high price for moving energy from generating stations through wires or pipes to local heating or cooling devices.

Typically, only 40 percent of the energy generated in an electric power plant, for example, arrives at the other end of the cable. The rest uselessly warms streams near the plant, or evaporates water from its cooling tower.

Now the General Electric Co. is investigating a new system that, by comparison, may double the amount of energy surviving transmission. In GE's system, heat obtained from a generator, reactor or solar installation cooks a mixture of liquids or gases over a catalyst bed, changing their chemical make-up and locking potential heat into their molecular structures. A pump sends the treated chemicals into a pipeline. The pipe carries the energy-rich but cool mixture—typically benzene and hydrogen—under the ground to a station 100 miles or more away. There, the chemical reaction is reversed. Liquids or gases return to their original uncooked low-energy form—typically, cyclohexane, a component of gasoline. They release heat without pollution. The secondary station then sends the spent chemicals back to the original heat source, through a second pipe, where the chemicals are repacked with energy.

Dr. James B. Comly of GE said the company might set up projects to test the idea within a decade.

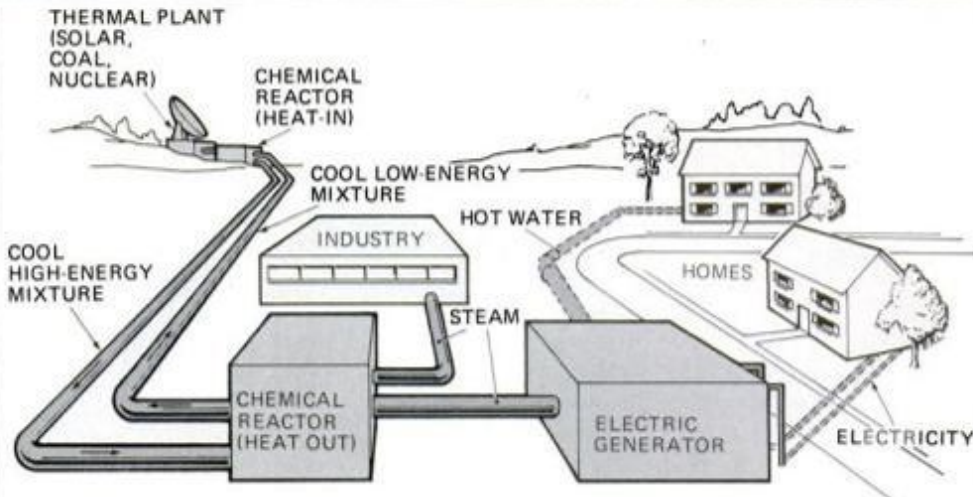
Protecting the ozone shield

A new satellite circling the Earth 15 times a day is gathering data that may help us to preserve the thin shield of ozone protecting our atmosphere.

The NASA satellite, 373 miles up, will collect information on ozone concentrations in the stratosphere for at least a year. The satellite works by measuring light trav-



Blastoff in mission to the stratosphere.



Pipelines carry energy-packed—but cool—chemicals 100 miles or more from source.

eling through the ozone layer each time the satellite passes through a sunrise or sunset.

The layer filters out dangerous ultraviolet light and absorbs heat from the sun. Without ozone above us, there would probably be no atmosphere.

The satellite, first of its kind to give a global picture of the layer, will enable scientists in future years to measure the effects of supersonic jets or aerosol propellants on the ozone and, if the layer is endangered, to issue warnings.

Washoe's brief motherhood

The hopes of University of Oklahoma scientists rose Jan. 8 when Washoe, the chimp with the sign-language vocabulary, gave birth.

The scientists were hoping that Washoe would pass along some of her more than 200 signs to the baby, named Sequoyah. Washoe didn't take to mothering at first, apparently preferring the company of humans. In March her attitude changed, and she became protective.

But then, about eight weeks after birth and before learning any of his mother's signs, Sequoyah developed an infection. Scientists took the baby from Washoe. Pneumonia developed. Despite heroic efforts, Sequoyah died.

When psychologist Roger Fouts gave the news to Washoe by sign language, "she looked up, at nothing, in the corner of the cage." In days following the death, she made signs for "Where's the baby?"

As we went to press, Fouts was seeking an answer, canvassing primate centers for an infant chimp that Washoe could adopt.

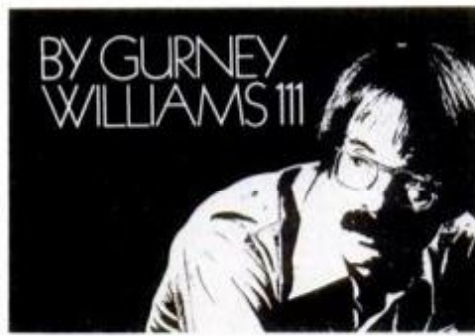
Resuscitating CPR

If you have a heart attack, your chance of survival improves if you're with someone trained in cardiopulmonary resuscitation (CPR).

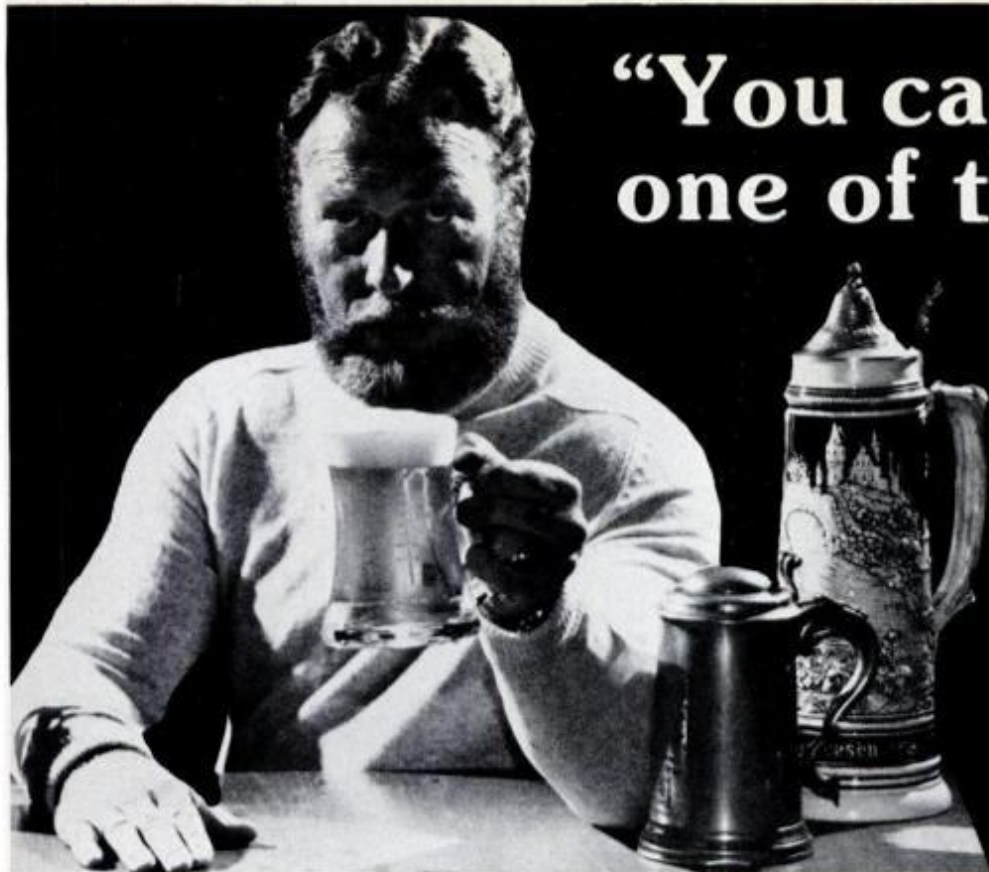
But a new study from the Baylor College of Medicine suggests that CPR itself is in need of some emergency help. The study shows that many of the 12 million U.S. adults trained in resuscitation forget the techniques of chest compression and breathing into the victim's lungs. Frank J. Weaver, one author of the study, reported a "significant decrease" in CPR knowledge and skills six months after his test subjects had completed a course. "Efficiency falls off dramatically," Weaver told PM, "to the point where the technique is nonlifesaving." Poorly applied techniques do no harm, he added, but don't help nearly as much as they might.

Weaver also suggested a complete checkup for the manikins used in CPR courses. Some are reportedly too stiff. One commonly used female model, he said, "wears out."

Weaver urged that organizations teaching CPR incorporate refresher courses, perhaps conducted by mail. And he said he's researching the need for a new and more realistic manikin. **PM**



BY GURNEY WILLIAMS III



**“You can make
one of the best
beers in
America
...in your
own
home.”**

**by Tom Lee and
Bud Weckesser**

I don't sell bottled beer and I don't work for a brewery. The fact is, I make beer as a hobby.

In pursuit of this hobby, a group of us have developed a new way you can make clear natural beer—at home—that actually tastes **BETTER** than most American lagers. What's more, it brews in only 30 minutes. And, I'll guarantee you'll say it's on a par with Heineken, Carlsberg or Coors. In sum, it's excellent beer!

Excellent Taste

The secret is a unique process called anerobic single stage fermentation. Simply put, it means you can make 5 gallons of superb beer in just one container—no mess, no fuss, no odor. It's easy and virtually fool-proof.

Make no mistake. This beer bears no resemblance to “home-brew”, that yeasty concoction you may have tried in the past. In taste, our light lager is comparable to Michelob or Coors. Our amber lager is very similar to Irish Harp or Australian Fosters—both excellent beers. Our Bavarian Dark beer is exquisite. It has all the flavor and body of the original dark German beers.

100% Natural Ingredients

Most commercial breweries use up to 25 artificial additives—many of them inorganic. We use only the purest ingredients—no artificial additives whatsoever.

For example:

- Hallertauer Hops—imported from Germany and used in the finest beers brewed in northern Europe—including Guinness.
- Superbrau Yeast—imported from Germany. Winner of several Grand Prizes on the continent-1977.
- Munton-Fison Malt—imported from Suffolk, England. Winner of the “Best Malt” award for home beer making in England-1977.

33% Fewer Calories

In tests conducted at a major state university our beer was found to contain almost 1/3 fewer calories than commercially brewed American beer.

82% Fewer Carbohydrates

During the same tests, our lager was found to contain 82% fewer carbohydrates than commercial brands of beer—and no inorganic additives.

Brews in only 30 minutes

Making the beer is simplicity itself. The beer brews in only 27-30 minutes. Allow it to ferment for 5 or 6 days then bottle it! It's easy and pleasant—like baking a loaf of bread. One batch yields 2-4 cases.

Costs just pennies a bottle

Since there's no tax or middleman's profit your cost per bottle will be less than half the cost of comparable commercial brands.

If you'd like a **FREE** booklet containing all of my recipes, just send the coupon below. There's no obligation.

FREE RECIPE BOOK



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Box 8376, Dept. PM-6
Erie, PA 16505

Please send me your **FREE** Bierhaus Recipe Book and Brewing Guide. I understand there is no obligation.

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Valvoline 1-2-99 Brings Out the Man in You.

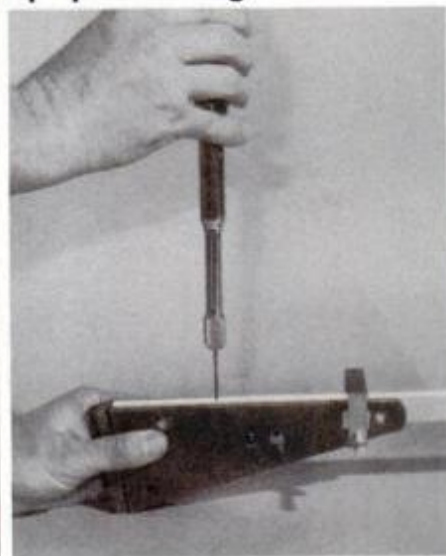


Any ordinary guy can start doing extraordinary things with Valvoline® 1-2-99 multi-purpose lubricant. Here's the muscle you need to loosen bolts, free frozen locks, clean steel and do more than 96 other tough jobs. Valvoline 1-2-99 lubricates, penetrates, keeps out moisture and helps prevent rust. So a can around the house makes the man around the house. Buy one now and Valvoline will send you a 99¢ cash refund. See participating retailers for full refund details.

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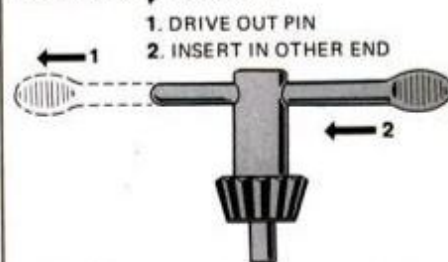
HINTS FROM READERS

Splitproof boring



Prevent thin wood from splitting when it's bored by clamping it in a large hinge. For extra support, clamp the wood/hinge combo in a bench vise.—*Ken Patterson*

Chuck key renewal



Add life to a Jacobs chuck key that has worn teeth on one side. Drive out the pin and reinsert it from opposite end so other teeth are used.—*Chauncey B. Eller*

Magnetic retriever



Small magnets are helpful in picking up nails, tacks and other small items. To keep it handy and easy to use, fasten a cupboard-door magnet to the end of a brush.—*Ken Patterson*

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



RADIATOR SPECIALTY COMPANY
Charlotte, NC 28234

Truth Computer

Can a voice stress analyzer tell if someone is telling the truth? It can and it can't. Here's the true story.



This \$250 unit represents a major breakthrough in voice stress technology.

By David D. Harrison

There is no device that can tell you if somebody is telling the truth. Not even a lie detector.

Lie detectors (or polygraph machines) simply detect stress, but it takes a competent professional polygraph examiner to interpret the results.

The same goes for voice stress analyzers. Voice stress analyzers will detect stress in a person's voice, but there are three types of voice stress and only one type is caused by not telling the truth.

EASIER TO USE

But voice stress analyzers are easier to use than the polygraph machines. A polygraph machine obtains four separate readings from a subject who is strapped into a chair and obviously aware of the test, whereas the voice stress analyzer uses one reading from a subject who may be unaware of the test.

It is therefore easier to obtain and interpret the results from a voice stress analyzer and with the proper instruction, a person can be trained to differentiate between the three types of voice stress.

TRUTH IS COSTLY

The problem with most voice stress analyzers is that they are costly—from \$800 to \$4,000. To make them appear more costly, manufacturers have added tape recorders, graph-producing devices and elaborate carrying cases, and some have even taken out full-page national color advertisements.

There is a voice-stress analyzer that I personally helped design and there is no mysterious secret about its low price of \$250 either. First let me explain the principle of voice stress analysis and why my unit is priced so low.

PRINCIPLE OF VOICE STRESS

When you are relaxed and talk, your vocal chords vibrate at a certain frequency and produce voice tremors. But your vocal chord is a muscle and like any other muscle in your body, when you're tense, the muscle exhibits stress, tightens up and squelches these voice tremors. Voice stress analyzers detect the absence of these voice tremors.

Voice stress analysis was first discovered during World War II. Two OSS officers noticed that when a subject was under mental stress, the central nervous system surrendered

muscular control to the involuntary or automatic nervous system, which squelched the voice tremors. The OSS men then set up a company to manufacture and market devices which could detect stress and which are still used by intelligence groups throughout the world.

Since the tremor is really a frequency, by developing a system to detect and amplify this frequency, similar to an FM receiver, you can indeed determine stress.

When I first analyzed the market I saw the serious manufacturers and the usual fast-buck artists. Any new emerging industry has both. But my investigation revealed that both elements had problems.

TO KEEP COSTS LOW

The serious manufacturers could not produce large quantities to keep their prices low nor did they want to and the fast-buck artists were ruining the reputations of the very serious people in the industry.

I realized that the basic system was nothing more than a very sophisticated FM receiver. I also realized that I could produce that system to sell for \$250. But something was missing.

In order for any of these systems to work, you required training. So I developed a training course that is sent free with each analyzer I sell. With the proper training and my unit you can indeed determine more accurately the nature and the cause of voice stress and you can then intelligently draw your own conclusions.

12 PATENT CLAIMS

My unit uses the highest quality components and I've personally checked it against units selling for up to \$4,000. It works as accurately as some of the higher priced units on the market.

There are over 12 patent claims that were allowed for our unit so not only is it a quality product, it is quite unique. Other units measure the AM component of a voice whereas my system measures the FM component. The signal is cleaner and easier to define. My unit comes with a direct input jack for a microphone or tape recorder. You can therefore record conversations and then play them back later for analysis.

THE NEW MORALITY

There's a new morality in this country. Ask

any professional polygraph examiner. Years ago, it was unusual to find an employee stealing from you. Today it's almost part of the job. In fact, most theft from retail store owners is not from shoplifting, but from employees who feel that it's one of the store benefits.

There is a great moral controversy raised by the sale of voice stress analyzers. Is it immoral to determine whether or not someone is lying to you? We like to look at it the other way. Is it moral for somebody to lie to you in the first place? If people treat you fairly and honestly, would they care if you discovered that they were honest?

I CAN HELP YOU

My voice stress analyzer and my course can help you protect your business from the dishonesty that has come to plague our nation. It can be a great deterrent. It can aid you in making personal decisions, in evaluating prospective employees and finally it can become a very valuable business tool that can help you for the rest of your life.

The JS&A Group was so impressed with my unit that they have agreed to market my system through their outstanding organization. JS&A is America's largest single source of space-age products—further assurance that your modest investment is well protected.

To order my Harrison Voice Stress Analyzer, simply send your check for \$250 to JS&A (Illinois residents please add 5% sales tax) or credit card buyers, please call their toll-free number below. JS&A will send you your unit in a plain box along with my course. Use it for 30 days and if it does not function to your complete satisfaction, return it for a prompt and courteous refund.

I'm really proud to offer this unit. My efforts will make life more difficult for those who believe dishonesty is the new morality and it will make life easier for those of you who still believe that honesty is the best policy. Order one of my systems at no obligation, today.

JS&A PRODUCTS
THAT
THINK
Dept. PM One JS&A Plaza
Northbrook, Ill. 60062 (312) 564-7000
Call TOLL-FREE 800 323-6400
In Illinois Call (312) 564-7000
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IF YOUR TIRES STOP YOU SHORT OF THE FUN, STOP IN AT FIRESTONE.

Somehow, the best places are always at the end of the worst roads. But if you've been passing by those good times because your tires won't get you through, look over the light truck tire lineup at Firestone now.

The Firestone All Terrain has a Baja-proved deep biting, aggressive tread that's quiet on the road and rugged off the road. And a bold, attractive raised white letter sidewall design.

For a firm foothold in a crosswind, and to float you over the soft stuff, there's the Firestone Transport 1 Wide Oval.

And anybody who wants the mileage, handling and wall-to-wall traction of a radial has to like the Firestone Steeltex Radial.

All three are available with extra-traction tread designs. So ask your Firestone man to help you find the tire that'll show you the good times again.



Transport 1
Wide Oval®

Steeltex Radial™

All Terrain™

Firestone

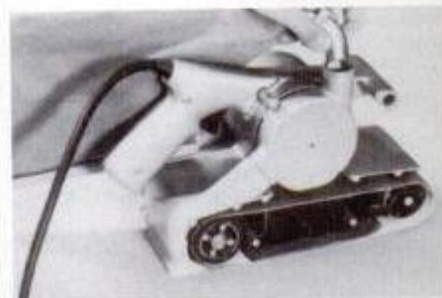
LIGHT TRUCK TIRES

PM LOOKS AT PENNEY'S BELT SANDER

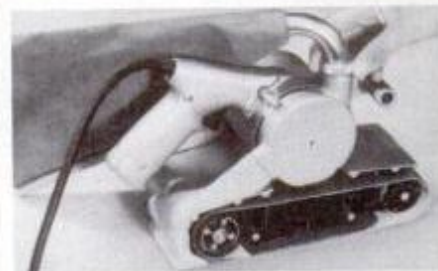


Belt-adjusting knob is used—with belt running—to get belt back on track.

When shopping for any power tool (and especially a belt sander) make certain you pick it up and heft it before buying. More than that, try it so you can decide realistically whether it is a comfortable one for you. I like the feel of this sander from J.C. Penney and it does both rough and finish work with equal ease. Its dust catcher has a fine, positive lock-on collar which keeps the bag where it should be when the tool is in use. (A couple of higher-priced sanders in my shop have bags that fall off.)—H.W.



For \$10 more you can get a sander with dust collector: it's money well spent.



This version has a twist-on collar for positive attachment to sander's chute.

SPECIFICATIONS—BELT SANDER

Model: 2115C. Belt size: 3 x 21 in.
No-load belt speed: 1000 f.p.m.
Motor: 120 v.a.c. only; 25-60 Hz; 5.5 amps., 115 v.
Price: \$79.99 with dust collector, \$69.99 without.
At major J.C. Penney stores and through the catalog. J.C. Penney Co., 1301 Ave. of the Americas, New York, N.Y. 10019

Would you have bought?

The Digital Watch Hoax

Hundreds of consumers took part in an experiment. What it proved can be a lesson to us all.

The story we are about to tell you is the absolute truth. The persons involved, however, will not be mentioned in order to protect their reputations.

It began about six months ago when an enterprising watch manufacturer in Hong Kong started producing watches that were exact copies of the Seiko chronograph alarm selling in the United States for \$300.

The Hong Kong version was sold to several American watch manufacturers for approximately \$25. These companies in turn contacted several American mail order companies and offered the watch to them for around \$50.

Soon, all you saw in newspapers and magazines were watches that looked like the Seiko but were selling for between \$60 and \$100. Although each watch had a different name, they were all made by the same manufacturer. Even JS&A was selling them.

Many of the other mail order companies had just started in business and were not financially stable. If service would ever be required and the company vanished, the watch would be useless.

A friend of ours, who was also in the mail order business, told us that for a low enough price the American consumer would be willing to buy anything, regardless of the stability of the company.

To prove his point, he made us an offer. If we could supply him with those digital watches, he would prove that the American consumer did not pay attention to who was offering the watch and only cared about price. We accepted his challenge. Prices had been dropping and the cost of our stainless steel model was now \$38.

Our friend ran a small ad in the southwestern edition of a consumer publication offering our watch for \$39.95. The ad cost him only \$72. It had no trial period, no accuracy claims and the name of the company used in the advertisement had never appeared before. His customers had to send in a check with their order and there was a \$3.00 postage and handling charge. Even the name of the watch was not shown.

When the response came in, even our friend was amazed. There were 38 orders, and he made a small profit. He delivered the watches and proved his point.

A smart consumer, however, would have never taken this gamble—at any price. He would have made sure the company was substantial, able to back their claims, and assure himself that the company would be around for awhile to service his purchase.

\$39.95

Full Function Chrono Alarm

You've seen it advertised for \$100. But now it's \$39.95. It's a full-function chronograph with alarm. In silver-tone at \$39.95, in gold-tone \$49.95. Please add \$3.00 postage and handling. Checks or money orders only. No COD's. Illinois residents please add 5% sales tax. Send to the address below:
JS&A's Watch Factory

This ad was a hoax designed to prove the gullibility of the American consumer.

Indeed, not all those who responded were gullible. There were 62 letters from people who did not buy but asked for either more information, the name of the manufacturer, or the right to return the watch if it wasn't any good. There were several inquiries made directly to the publication and a few to the Better Business Bureau.

There were more consumers who investigated the offer than those who took the bait despite the tempting price. That was encouraging for us.

But this story took an interesting twist after the experiment. The American watch companies handling the Hong Kong watch were getting overstocked. Prices were starting to drop and a few of the companies were indeed going out of business.

About this time, Texas Instruments introduced their new Chrono Alarm. It looked almost identical to the Seiko, but its features made it far superior.

The TI watch glows in the dark. A small tritium phosphor capsule, sealed by a laser beam, is located under the display. When the lights dim, the display appears to glow. You avoid the button pushing and component failures that are possible with watches that have miniature light bulbs inside.

And the features of the TI are the same as those of the Seiko plus a few more. The TI watch has a full-function chronograph, 12 or 24-hour time selectability, quartz accuracy to within 15 seconds per month, and a really fine quality case.

We felt that the TI Chrono Alarm had better

quality and more features than anything else on the market, but it was priced at \$125—higher than the Hong Kong watches.

So we tried another experiment. We offered the TI watch in a small advertisement in our catalog opposite an ad we created for the Hong Kong watch selling for \$69.95. The TI watch generated four times the number of orders than the Hong Kong version. It was this test that convinced us to offer the TI watch in a national advertising campaign.

We are not showing you the Texas Instruments watch in this ad. First, it looks identical to the Seiko version and secondly, if we showed it and you just read the headline of this ad, you might think that the TI watch was "The Digital Watch Hoax" which of course it isn't.

The TI watch will be sold in a few select stores shortly. Or you can order now directly from JS&A. We promise you prompt delivery and something even the stores don't offer—the opportunity to wear the TI watch and the right to return it anytime within 30 days for a prompt and courteous refund if you are not absolutely satisfied.

If you are looking for the very finest watch you can buy—even better than the Seiko and backed by two substantial companies, we urge you to consider the TI Chrono Alarm. JS&A is America's largest single source of space-age products—further assurance that your modest investment is well protected.

Send your check or money order for **\$125** for the stainless steel model or **\$150** for the gold-tone version plus \$2.50 postage and handling (Illinois residents, please add 5% sales tax) to the address shown below. Credit card buyers may call our toll-free number below.

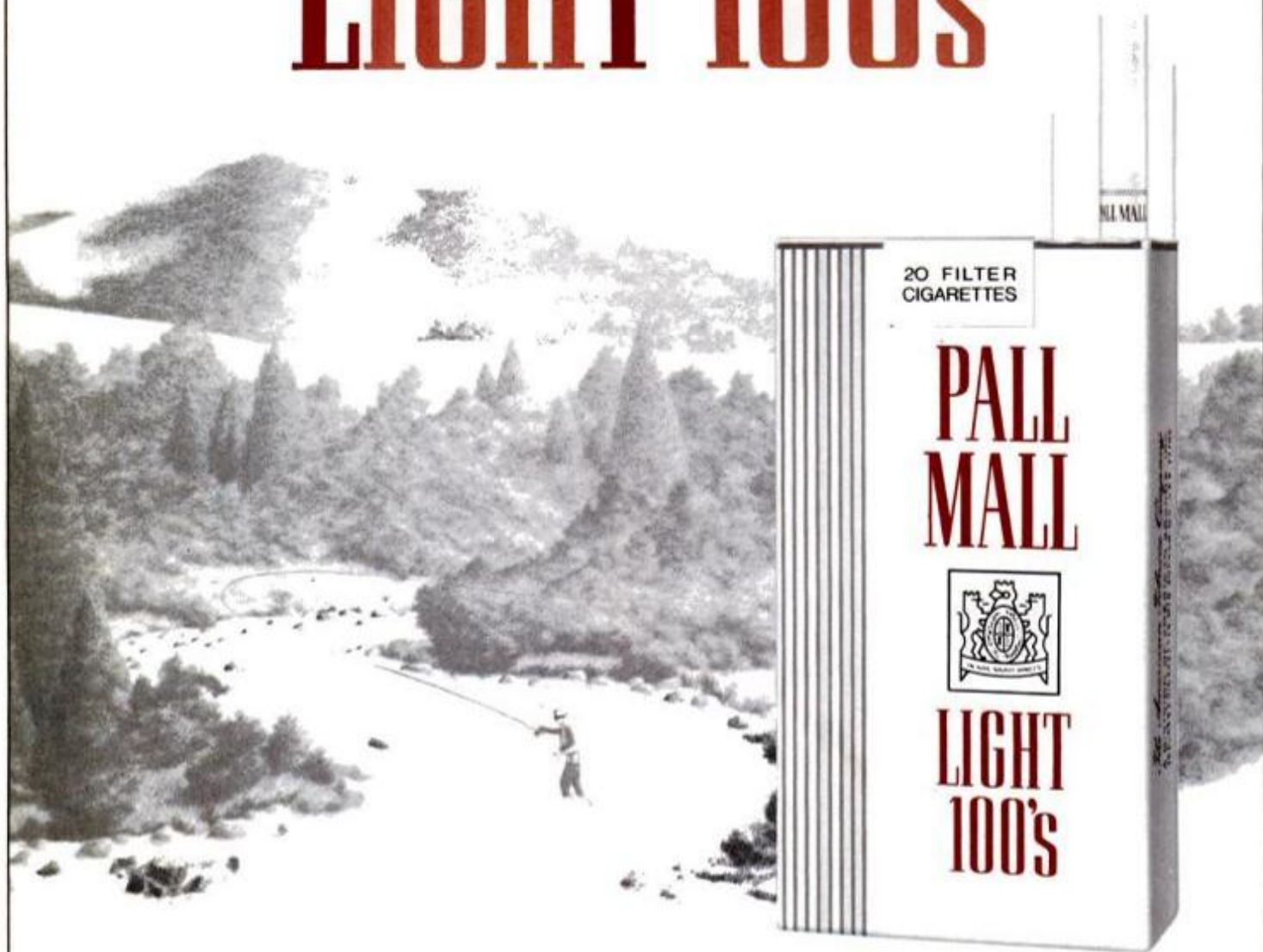
We will promptly ship your watch, one-year limited warranty and complete instructions. Then prove for yourself how outstanding the Texas Instruments Chrono Alarm really is.

There's no gamble when you can own the finest. Order a Texas Instruments Chrono Alarm with complete confidence, at no obligation, today.

JS&A PRODUCTS THAT THINK®
Dept. PM One JS&A Plaza
Northbrook, Ill. 60062 (312) 564-7000
Call TOLL-FREE 800 323-6400
In Illinois Call (312) 564-7000
© JS&A Group, Inc., 1979

Decisions...decisions...Make your decision

PALL MALL LIGHT 100's



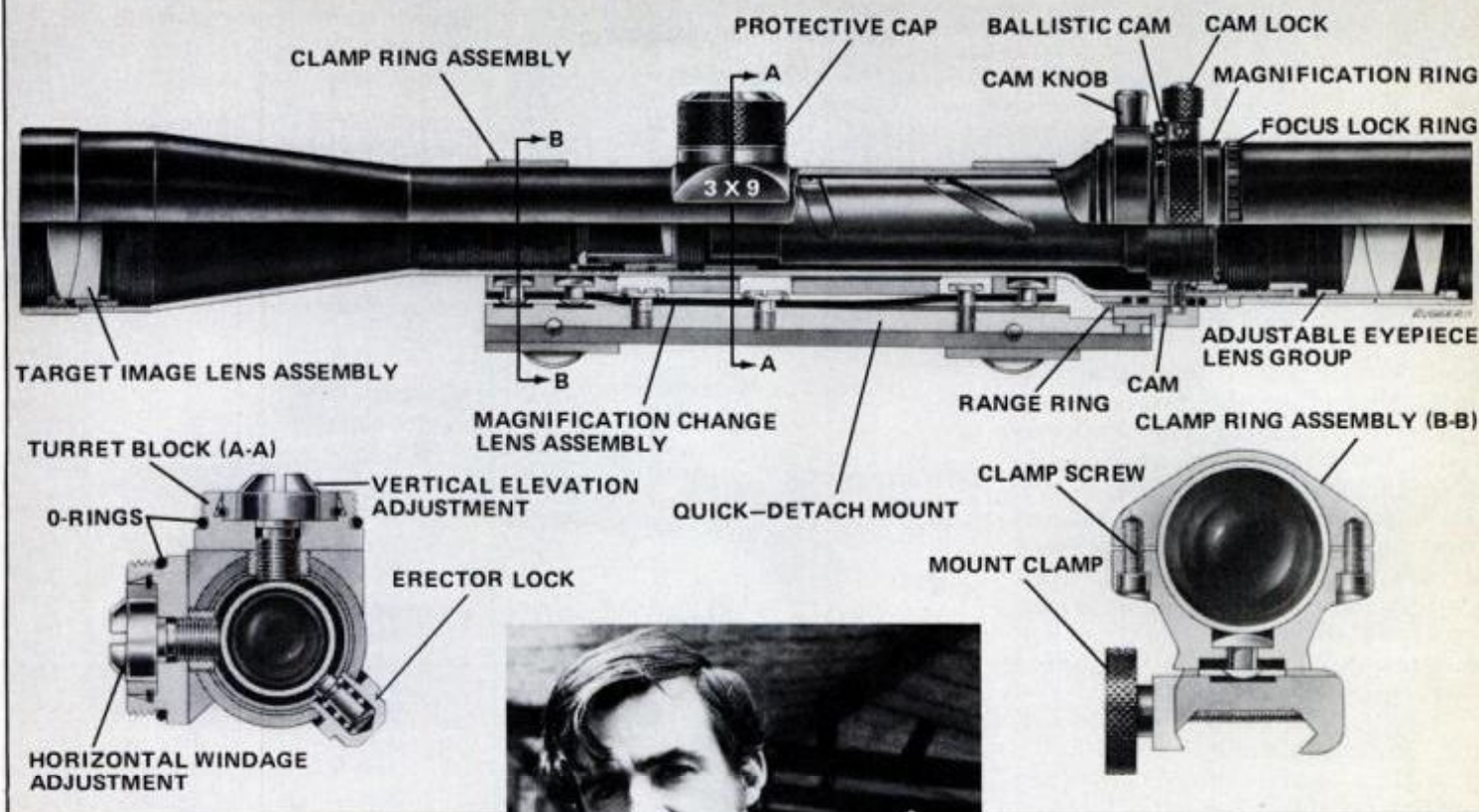
The most flavor you can get in a low tar cigarette!

**Only 12 mg. tar
1.0 mg. nic.**

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

12 mg. "tar", 1.0 mg. nicotine av. per cigarette by FTC method.

New scopes for super shooting



Now sportsmen aim dead-on with SWAT and Army sights.

by Bob Brister

Today's telescopic sight may be the most sophisticated, misused and misunderstood item of modern shooting equipment.

TV and movie writers seem to think that all their villain does is put the crosshairs where a shot is intended to go, at any distance, and thus the scope becomes an ugly, awesome weapon used by the bad guys. Antihunters consider it an unfair advantage over animals. Many hunters believe a scope is worthless for fast, thick-cover shooting, because it makes a target more difficult to locate in the magnified image. And some think it too fragile and too prone to "fogging" for use on dangerous game.

In my experience, none of these contentions is correct. Modern scopes offer a shooter notable advantages, and some recent models provide remarkable improvements. First, a look at how they work.

Telescopic sights increase the range of the eye, not the range of the rifle or pistol. The bullet drops at the same rate by the same laws of gravity that affect it with iron sights. Thus the widely held idea that the



Leatherwood ART II (automatic ranging telescopic sight, above) is a sophisticated scope that figures range and bullet drop in one adjustment. Inventor James Leatherwood holds an early military model.

scope makes hitting "child's play" tells more about the faulty knowledge of the believer than the operation of the scope.

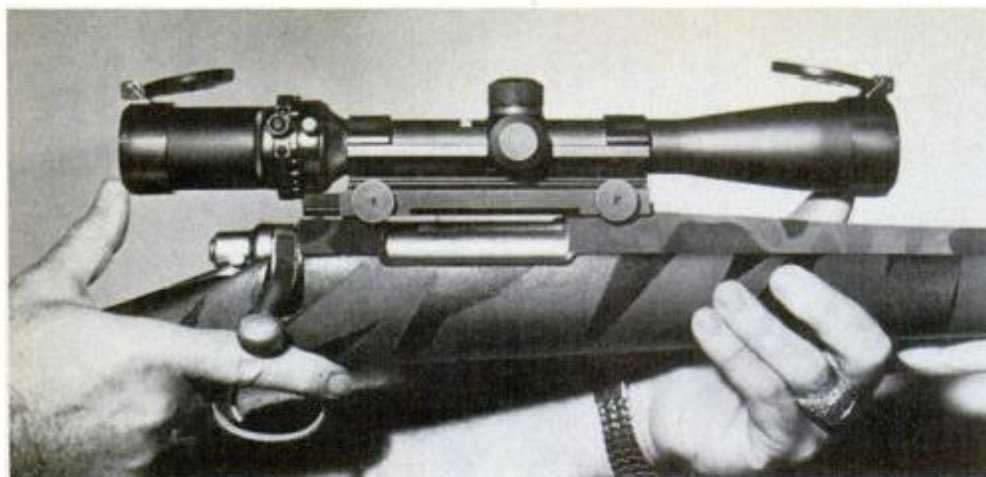
Telescopic sights cannot stop a rifle from wobbling (the cause of most misses), nor squeeze the trigger rather than yank it (another major factor in missing). And if scopes provide unfair advantage against animals, the animals seem to be surviving it very well. Populations of deer, turkey, antelope and many other heavily hunted species continue to increase in America, partly because

of good biological management and partly, perhaps, because the modern American hunter can see better what he's shooting at. There are fewer mistakes made in shooting at protected game, including out-of-season females and immature animals. And if for no other reason than that, and the added safety that scopes provide other humans in the woods, I believe every big game hunter should use one.

The rate of hunting accidents is lower than it was several decades ago, in spite of urban hunters less attuned to the woods than earlier rural generations. I believe part of that improvement is directly related to the increase in popularity of telescopic sights.

I got my comeuppance about rifle scopes as a teen-ager, a period in which I spent every spare moment in the woods. I enjoyed perfect vision and scoffed at anyone "sissy" enough to need a scope. The machinist father of a friend of mine had concocted a mount (like some available today) that permitted you to raise your head to see the scope image or lower it to use the iron sights. I borrowed that early homemade job one day, mostly because I had never looked through a telescopic sight and was fascinated by it. But if I jumped a deer, I planned to use the "faster" iron sights.

Shortly after dawn I saw a fine



ART has spring-loaded hinged mount so full scope tilts for ballistic compensation. Finger push shows scope moves with bumps, but returns to accurate zero position. Cams match bullet characteristics.

Leatherwood ART II military version is slightly larger and heavier than Redfield Accu-Trac below it. Both contain rangefinders, can compensate for bullet drop. Redfield for '79 has lower, improved elevation knob.

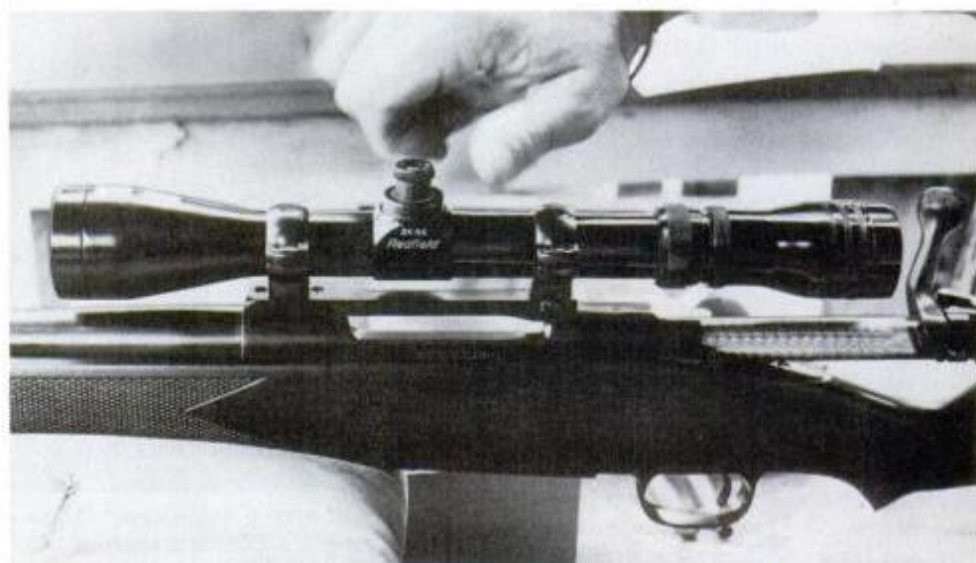
buck chasing a doe into a dense mesquite thicket in the famed South Texas brush country. The cover was thick, the light poor, but I could make out the deer's outline. Was it the buck or the doe? I thought it had to be the buck because of the size. I started taking aim, and at the last instant remembered I had a scope up there someplace. So I looked through it, and I've never hunted much without a scope since.

The "buck" turned out to be the doe. The scope made that instantly clear. It also showed me that what had appeared to be an easy shot was actually a very dubious one, because of some branches in the way that I could not see with the iron sights. Without the scope I might have fired at an illegal doe or, worse yet, wounded it with a partially deflected bullet. That incident, and many since, convince me I'm a better, safer hunter with a scope.

Magnification is only one of the advantages of the telescopic sight, and too much magnification, in fact, is a major enemy of many scope shooters. More important is its ability to put target and sights in the same flat focal plane and with a bright picture that helps the eye correct optical illusions. As a shooting editor and gun consultant, I have received stacks of mail from shooters convinced iron sights are better because a scope is "too slow in heavy cover." I've questioned many of them and found that most have attempted to use some scope with four-power or more, or one that was not properly adjusted to their eye focus or with improper "eye relief" (the critical distance from the eye to where the scope must be mounted to provide its full field of view).

How much power?

The best selling variable scopes in America are three- to nine-power, meaning at their lowest setting they have three-power magnification and can be "zoomed" up to nine times magnification. Even at the lowest



First prototype of Redfield's noted Accu-Trac is adjusted by the author during initial tests. Elevation knob sets internal adjustment for lead-on target sighting.

setting, I believe these have too much magnification for quick shots in heavy cover and are not the best choice for most hunters. Target shooters, varmint hunters and others who use scopes a great deal are familiar with handling higher magnification, but for the average shooter a better choice would be 1 x 4-power or perhaps 1 3/4 x 5. Even in open mountains I rarely find need for more than four or five power.

Few shooters have ever looked through a scope of two-power or less, and don't realize what a quick-point-

ing combination a rifle with low-magnification scope can be after a little practice. When set at one power, most scopes will give around a 70-foot field of view at 100 yards. At four power, the field is reduced to 28 feet or so, and down to about 12 feet at eight power. At 50 yards, a common distance for shots in heavy cover, remember that these viewing fields are cut in half.

A low magnification scope can be used effectively with both eyes open. Once in Africa I was charged by a

(Please turn to page 24)

Yesterday you could admire all-band digital tuning in a short wave receiver.* Today you can afford it.



RF-4900

Tune in the Panasonic Command Series™ top-of-the-line RF-4900. Everything you want in short wave at a surprisingly affordable price. Like fluorescent all-band readout with a five-digit frequency display. It's so accurate (within 1 kHz, to be exact), you can tune in a station even before it's broadcasting. And with the RF-4900's eight short wave bands, you can choose any broadcast between 1.6 and 31 MHz. That's all short wave bands. That's Panasonic.

And what you see on the outside is just a small part of what Panasonic gives you inside. There's a double superheterodyne system for sharp reception stability and selectivity as well as image rejection. An input-tuned RF amplifier with a 3-ganged variable tuning capacitor for excellent sensitivity and frequency linearity. Ladder-type ceramic filters to reduce frequency interference. And even an antenna trimmer that changes the front-end capacitance for reception of weak broadcast signals.

To help you control all that sophisticated circuitry, Panasonic's RF-4900 gives you all these sophisticated controls. Like an all-gear-drive

tuning control to prevent "backlash." Separate wide/narrow bandwidth selectors for crisp reception even in crowded conditions. Adjustable calibration for easy tuning to exact frequencies. A BFO pitch control. RF-gain control for improved reception in strong signal areas. An ANL switch. Even separate bass and treble controls.

And if all that short wave isn't enough. There's more. Like SSB (single sideband) amateur radio. All 40 CB channels. Ship to shore. Even Morse communications. AC/DC operation. And with

Panasonic's 4" full-range speaker, the big sound of AM and FM will really sound big. There's also the Panasonic RF-2900. It has most of the features of the RF-4900, but it costs a lot less.

The Command Series from Panasonic. If you had short wave receivers as good. You wouldn't still be reading. You'd be listening.

*Short wave reception will vary with antenna, weather conditions, operator's geographic location and other factors. An outside antenna may be required for maximum short wave reception.



RF-2900

Panasonic.
just slightly ahead of our time.



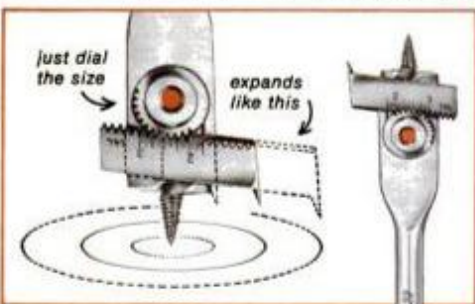
Irwin makes your 'Popular Mechanics' projects easier!

When you're adding the "little" touches to your home projects, Irwin quality products can help!

Highest quality Irwin Speedbor "88" wood bits are ideal for your electric drill or drill press. Original hollow ground point design starts holes faster, lets spade-type cutters bore cleaner, faster at any angle in any wood. 1/4" shank chucks perfectly... no run-out, no wobble.



Available individually or in workshop sets of 6 or 13 bits (in metal organizer rack) or 4, 6 or 13 bit sets (in plastic roll).



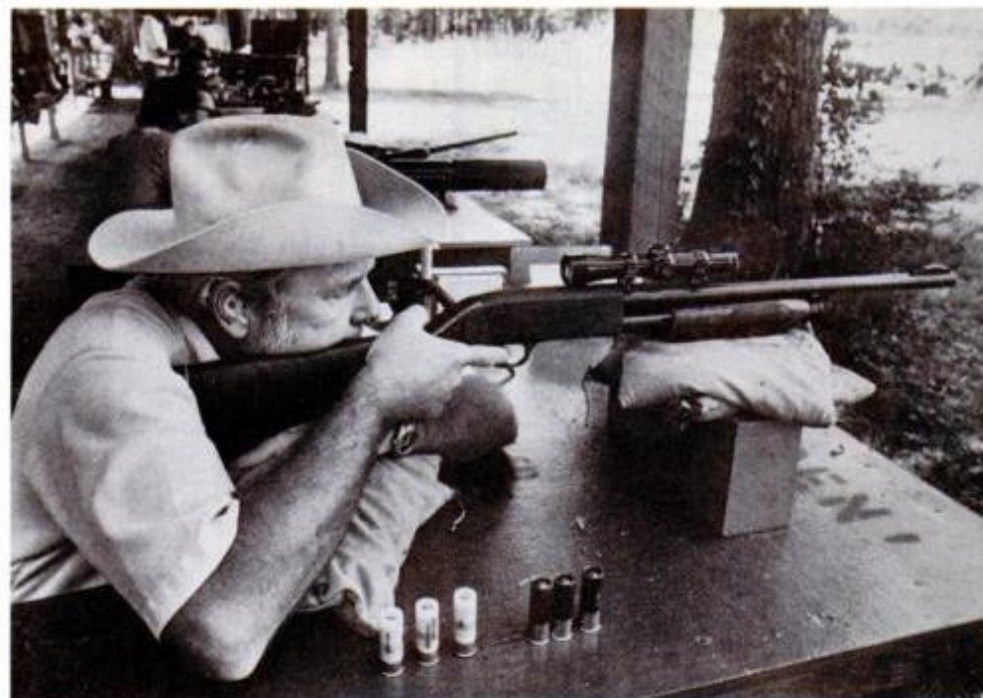
Irwin "Micro-Dial"®: one bit bores 35 standard holes!

One Irwin No. 22 "Micro-Dial" expansive bit for hand braces lets you bore 1/8" to 3" holes... just by dialing the size you need.

No. 21 lets you dial 19 standard sizes, 1/8" to 1 1/4". Both made from the finest Irwin quality steel.

Available from your hardware or building supply dealer, and home center stores.

All items above are available in metric sizes. © Registered U.S. Patent Office



Scopes are for shotguns, too. A two-power Leupold with long eye relief, mounted on an Ithaca 12, gave better slug groups than open sights, yet handled and pointed quickly.

Cape buffalo from about 20 yards, and stopped it with two shots fired so fast from a bolt-action rifle that guides who were nearby thought someone was shooting with a semi-automatic weapon.

Is there really any advantage of a low power scope over iron sights? There sure is, because the scope superimposes the sights over the target with everything in sharp focus. With iron sights, something in the scene must be fuzzy because the human eye cannot focus simultaneously on objects at widely varying distances. The older the eyes, the greater that problem.

How bright?

Optical qualities of scopes vary, with some brighter than others, but the cheapest is better than none at all. In strong daylight, the pupil of the human eye contracts and the brightness of various scopes is hard to compare. During the poor light conditions of dawn and dusk, however, quality optics reveal their special advantage.

I've done a lot of scope testing, mounting half a dozen or more on a tripod side by side to compare brightness and field of view. My observations are that the "wide angle" concept now so popular gives more field of view, but may take away a bit of light-gathering capability. The Burris Widefield, with its round ocular lens, claims the greatest field of view relative to magnification. A fixed-power (nonvariable) scope by any maker seems to be a bit better optically, and maybe a little bright-

er than the same company's variable scopes.

Super scopes

Now there is a new breed of scopes which can compute distance to target and at the same time compensate for bullet drop to permit a dead-on hold (with some military models) out to 900 meters. The Leatherwood ART (Automatic Ranging Telescope, as named by the U.S. Army) was developed by a young Texan, James Leatherwood, during his army service. It has seen use in Vietnam and elsewhere as a sniper scope, and SWAT (Special Weapons Attack Team) groups have acquired it. Presently the ART II is available in limited quantities for the civilian market, though it's expensive (about \$250), and larger and heavier than most ordinary scopes.

The ART computes range by framing a target of 18 inches (about the head and shoulders area of an enemy soldier or the body depth of a deer) between two fine stadia wires in the sight. As the scope's power ring is turned to frame the target and determine range, a large external cam is rotated to raise or lower the rear of the scope and provide proper sighting elevation relative to range. A wide variety of cams are available for different cartridges, and the one selected is a precision instrument matched to the caliber, bullet weight, velocity and other cartridge factors. Down-range firing confirms a perfect ballistics match.

A few years ago in Africa, I tested

(Please turn to page 186)

IRWIN® every bit as good as the name
at Wilmington, Ohio 45177, since 1885

If it feels like somebody else is making all the money, maybe it's time you looked at NRI home training for TV and audio technicians.

No matter how hard you try, there are some jobs that just seem to go nowhere. And others so monotonous, they drive you up the wall. While all around, you see people enjoying what they do and making a good living at it.

NRI Can Set You Free

There's a way out of the rut. NRI home training in TV and audio servicing. At home, in your spare time, you can learn to become a TV electronics technician. Qualified to hold down a good paying job as a serviceman or troubleshooter. Even start your own full- or part-time business. And you learn at your own pace without quitting your present job.

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NRI is more than book learning. Sure, we give you all the fundamentals and theory. But it's reinforced with practical experience every step of the way. In our Master Course, you build actual electronic circuits and test them. You construct a solid-state stereo and a 25" (diagonal) fully computerized programmable color TV with built-in



computer tuning that lets you program a whole evening's viewing. You even assemble test instruments for learning and earning.

Your equipment includes a transistorized volt-ohm meter, TV color pattern generator, 5" triggered sweep oscilloscope and CMOS digital frequency counter...the tools of the pro. And while you build the stereo and color TV, you perform over 140 in-set, "power-on" experiments...introduce and correct typical service problems... gain real bench experience while you learn.

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A documented national survey confirms for the second time that almost half the professional TV servicemen have had home training. And among them, they recommend NRI as first or only choice by more than 3 to 1! That's because NRI training works, as

it has for 63 years and more than a million students.

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APPLIANCE CLINIC

QUESTIONS ANSWERED

Instant insomnia

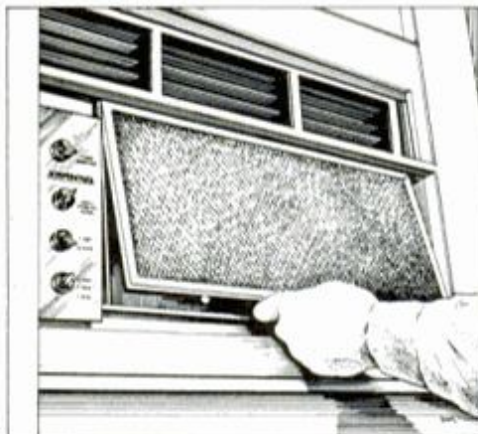
It's 5:00 a.m. and my Whirlpool refrigerator-freezer (model EET 151 PK) is so noisy I can't sleep. The motor runs for 10 minutes on the half-hour. The appliance is only one year old. Should I call the service department or is this normal?—Jeff Fiedeldej, Wyckoff, N.J.

By all means call Whirlpool service on the chance that the noise is not normal. There's been no particular problem with this model, but yours may have a defective compressor that is making noise because of weak, internal springs. The compressor is covered by a five-year warranty.

If a faulty compressor is causing the problem, the noise is a hammering sound. If noise isn't the result of a defective compressor, perhaps the tubing, fan motor, compressor or some other part is loose and rattling. The serviceman should be able to help. You might also refer to Feb. '79 Appliance Clinic (page 84, *Tracing Refrigerator Noise*) for information

SERVICE TIP

Time for the yearly airconditioner check-up. Clean or replace the air filter now and once a month during the summer to keep it operating at top efficiency. Replace fiber-



in summer, clean or replace filter monthly.

glass filters. Wash sponge-type filters in soapy water, rinse and squeeze dry. But that's not all.

To get your airconditioner in shape for the season, clean the interior. This requires sliding or removing the unit from the cabinet. Vacuum parts. Loosen crusted dirt with trichloroethylene, a solvent sold in paint and hardware stores. When you reinstall the unit, be sure it tilts slightly ($\frac{1}{8}$ to $\frac{1}{4}$ in.) toward the rear to allow condensation to drain. Scrape rust off outside case, touch up spots with a metal primer and paint.

on how to handle refrigerator noise.

The fact that the refrigerator runs every half-hour isn't an indication of trouble. It's normal.

Brushing away trouble

After several years of good service, our Westinghouse blender model HA21-1 started to give off a burning odor. I took the appliance apart, did a test meter check for shorts and grounds, and inspected the commutator for burn marks. Everything was okay, so I cleaned the commutator and reassembled the unit. Turning the blender on now results in odor and a constant electrical arc at the commutator. What's the trouble?—Fred Freeman, Cambridge, Ont.

What else but brushes? They probably are out-of-round, which prevents them from seating against the commutator. Arcing (and odor) occurs when current is forced to jump a gap between brushes and commutator. Replace the brushes and dress the commutator by rubbing lightly with emery cloth. Do not use sandpaper.

If the brushes aren't to blame, then the motor fields have probably solidified. Replace the motor.

The ghost of St. Peter

My model A78F Speed Queen automatic washing machine makes haunting moan and groan sounds during the spin cycle. I've raised the agitator shaft and shot in some WD 40, but it hasn't helped. How do I lubricate the shaft bearing to get rid of noise?—Otto Runge, St. Peter, Ill.

You don't. The agitator spins with the tub. So unless there is bearing wear, the agitator assembly isn't uttering a sound. Lubrication won't cure a worn bearing. Besides a worn bearing, parts that could be making noise are the fluid drive, clutch lining or motor.

Noise may be announcing the onset of a major problem. For this reason, leave things alone and run the machine until further symptoms develop that will allow you to pinpoint the exact cause of the noise. Let's hope it will be the shaft bearing, because the cost of repair isn't as heavy for this as it is for a fluid drive, clutch and motor.

Getting relief

What causes my gas hot-water heater to lose about a pint of water through the relief valve every time water

heats? The unit is less than two years old. I've changed the valve once.—John Cable, Zelienople, Pa.

You probably are confusing relief valves with drain valves. The relief valve (the exact term is pressure/temperature valve) is fitted into the top of the tank or into the hot water line—wherever the manufacturer figures the hottest water accumulates. If there is an extreme rise in temperature (to approximately 210° F.), the valve will open to relieve the extreme pressure. Valves are generally rated to open at 150 lbs. p.s.i. If it weren't for the valve, a malfunctioning water heater could explode.

When pressure is relieved through the relief valve, a loss greater than one pint would take place. You would lose gallons. I guess there is the remote possibility that one of the following is taking place to permit loss of a relatively small amount of water:

■ A defective pressure/temperature relief valve, which you've discounted by replacing the original valve.

■ Water overheating to a point just below the danger limit so it leaks from the valve. Water in the vicinity of 210° F. may do this, but you would fast realize that the water is too hot. You would virtually be scalding yourself when washing.

■ A relief valve handle that is not seated securely. Some types of valves are equipped with handles that allow the valve to be flushed periodically. If the handle isn't securely seated, water can be lost through the partially open valve.

The drain valve is placed in the bottom of the tank to allow sediment and rust to be flushed. It is more common for water to leak from the drain rather than the relief valve.

If water is leaking from the drain valve, look for the following:

■ A valve that isn't installed tightly enough.

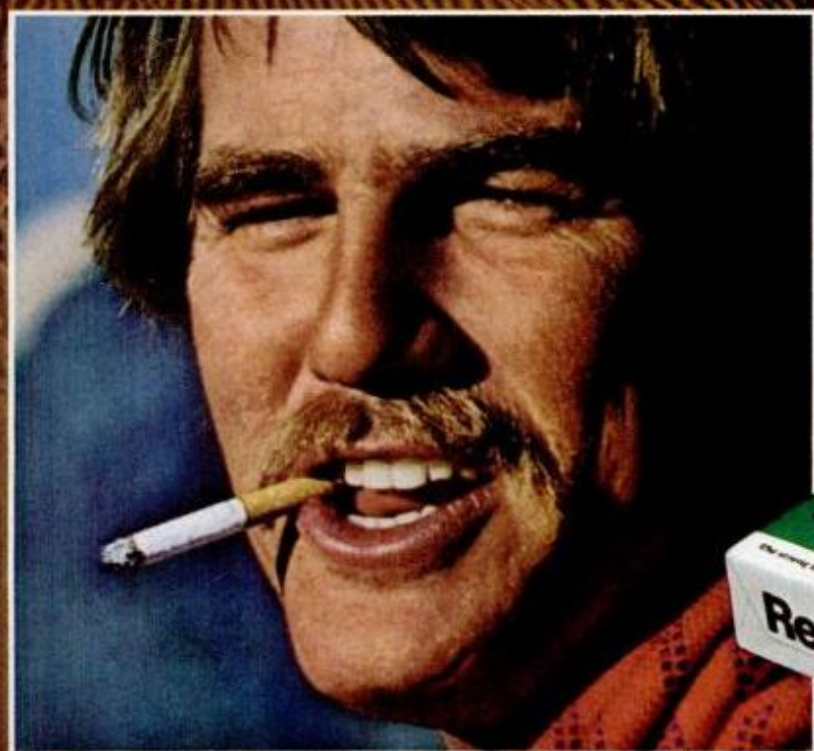
■ A defective tap.

■ Excessive water pressure. Check this by placing a pressure gauge on a faucet. If pressure is above 80 lbs. p.s.i., install a pressure-reducing valve in the water system. **PM**

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

MENTHOL: 8 mg. "tar", 0.6 mg. nicotine, FILTER: 9 mg. "tar",
0.7 mg. nicotine, av. per cigarette, FTC Report MAY '78.

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



Only
9 mg tar.

***"Real's got dynamite taste!
Strong...more like a high tar."***

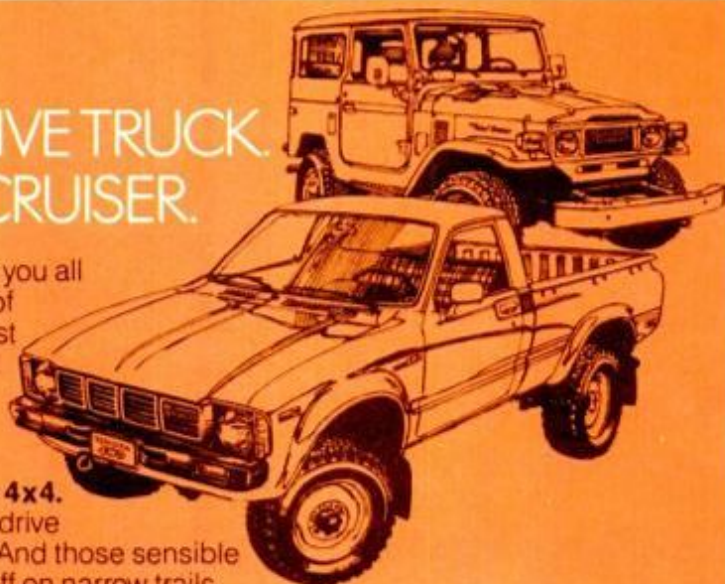
The strong tasting low tar.

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INTRODUCING THE ALL NEW, 4-WHEEL DRIVE TRUCK. IT'S THE SON OF A LAND CRUISER.

Toyota's new 4-wheel drive truck. The only 4x4 that gives you all this. Practical size. Toyota quality. And Toyota's 30 years of experience building the Land Cruiser, one of the toughest 4-wheel drive vehicles going. Good reasons why we call the new 4-wheel drive truck the Son-of-a-Toyota Land Cruiser.



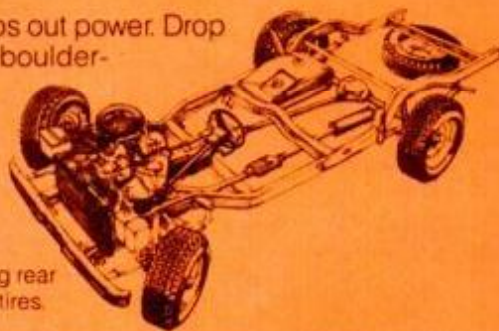
Now, a maneuverable 4x4.

The Toyota 4-wheel drive truck is trim, agile. And those sensible dimensions pay off on narrow trails.

You'll go on ahead when others go back home.

Now, a well-equipped 4x4. Toyota's new 4-wheel drive Sport Truck has full carpeting, AM/FM radio, locking front hubs, and full instrumentation—standard. Tilt steering wheel and power steering are available options.

Now, a tough 4x4. The 2.2 liter overhead cam engine pumps out power. Drop the transfer case into "low" for tractor-like torque to climb a boulder-strewn path. Tough. That's Toyota's new 4-wheel drive truck. It's available in 3 models—Deluxe Truck, Sport Truck, and a special Black Package Truck (all the options listed above as standard, and more).



Shown below with optional rear bumper, sliding rear window and owner installed wide wheels and tires.

YOU

GO IT



TOYOTA THE NEW 4X4.

IT'S NEW NOW

Water, water everywhere . . .

Except inside an Ewa camera housing, the maker claims. The easy-to-carry, collapsible plastic envelope can be used in wet, dusty or sandy environments or down to 30 feet underwater. Models for SLR and movie cameras have optical-glass windows. SLR models have a built-in glove for operating controls. From \$50. Pioneer and Co., 900 Haddon Ave., Collingswood, N.J. 08108.



Rising to the occasion

Many manual-turntable owners like the simplicity of their machines, but have become tired of having to get up and lift the tone arm at the end of a record. The Safety Raiser automatically raises the arm when the cartridge stylus reaches the final groove, reducing stylus wear, as well. It's about \$20 from Audio-Technica U.S. Inc., 33 Shiawassee Ave., Fairlawn, Ohio 44313.

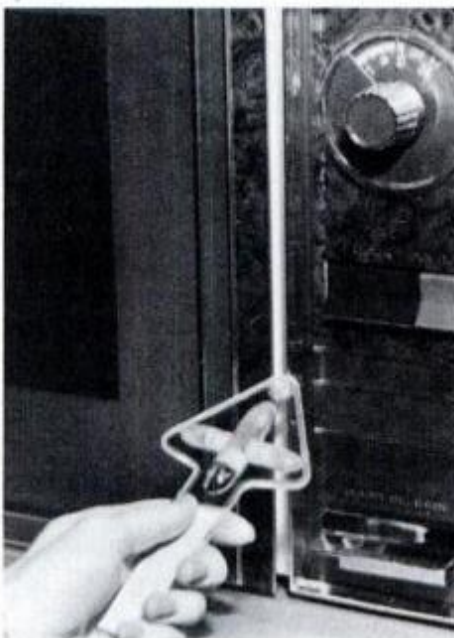
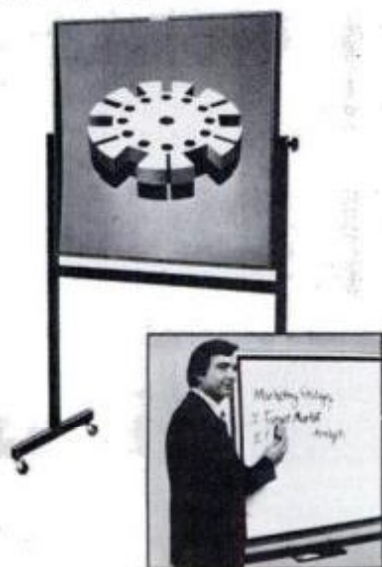
Hear, hear

The Confidencer is said to permit clear, intelligible speech over the phone, even in noisy environments. The unit screws onto a telephone receiver to replace the original transmitter. Two models reduce background noise by 14 and 17 decibels, respectively. Each is priced at about \$23 from Roanwell Corp., 180 Varick St., New York, N.Y. 10014.



Write on this movie screen

Project slides or movies onto the Navilux Executive screen or flip it over to write on. Both the daylight-type screen and the whiteboard are washable, the maker says. The screen is slightly curved to provide a 160° viewing area. Ink from felt-tip pens or oil-base markers is claimed to erase easily off the whiteboard. The 40x40-inch screen comes with a rolling stand and costs about \$400. D.O. Industries, 317 East Chestnut St., East Rochester, N.Y. 14445.

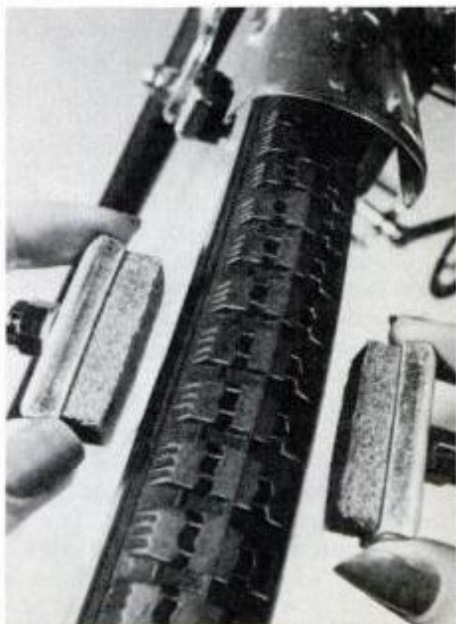


For oven leaks

When the Vexilar microwave leakage detector is in contact with a microwave oven, an LED glows if leakage is greater than 5 milliwatts per square centimeter. It takes about a minute to test an entire oven, and the unit, with no moving parts or batteries, is said to be good for 5000 hours of use. Under \$20 from Vexilar Inc., 9345 Penn Ave. S., Minneapolis, Minn. 55431.

All wet

Fibrax brake pads for bicycles provide stopping power in wet weather close to that in dry conditions, the maker claims. The chromed leather pads are said to be able to stop a bike moving at 15 mph on a wet road in 17 feet. Model SH300 costs \$8.35 a pair. From Victoria Distributors Inc., Box 753, Lancaster, Pa. 17604.



FIRSTHAND REPORT

by Michael Lamm
WEST COAST EDITOR



Photos by John W. Lamm

While most cars grow smaller, the Audi Fox will be replaced by a slightly larger model for 1980—the 4000.

The new Audi's wheelbase is up 2.5 inches, with overall length increased 4.6 inches. U.S. dealers expect to be selling the 4000 this summer.

I had a chance to drive a 4000 four-door in Bavaria last fall. Audi engineer Hans-Juergen Sassor, the man in the five-cylinder TV commercials, told me that the factory likes to field test all its cars in the home market before releasing them for export. So the new 4000 (called the Audi 80 over there) has become a familiar sight on the *Autobahns* and byways of Germany.

The 4000 has been completely rebodied, although it uses the same basic engine and front-wheel-drive mechanicals as the Fox. Styling was done in Ingolstadt, with Italian designer Giorgetto Giugiaro serving as consultant. He also contributed to VW Scirocco and Rabbit designs. Audi, Porsche and Volkswagen all share parts and sales organizations.

It's a nice-looking car, in my opinion, but the surprise comes in the way it utilizes space. The deep, square trunk boasts a capacity of 17.8 cubic feet. That's only 2.5 cubic feet smaller than the trunk of a full-sized Chevrolet.

Interior dimensions, too, are more than generous. Four tall adults can sit in total comfort, front and rear. There's plenty of legroom, and the four-door's rear doors have been made two inches longer for easier entry. (The Fox wagon has been discontinued, but a two-door sedan will still be available.)

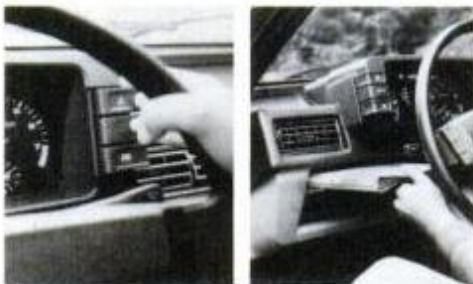
Driving the Audi 4000



Less Foxy and less boxy, the Audi 4000 for 1980 takes on lines of popular 5000.



Germanic efficiency is tone of cockpit, but stick could have more positive feel.



Fingertip switches (left) and map bin, (right) provide convenience for driver.

Front-wheel drive holds the key to the 4000's spaciousness. The car retains basically the same overhead-cam, fuel-injected engine used in the first-generation Fox and VW Dasher. This powerplant is placed length-



Trunk is especially spacious for this size car; it boasts a volume of 17.8 cu. ft.

wise in the chassis, ahead of the transaxle and axle centerline, which makes for a fairly long hood and a large trunk.

Driving the 4000, I found the body very tight and silent—extremely well insulated. Visibility would be great except for the bulky front headrests. But at least the 4000 doesn't have four headrests, as in the Audi 5000.

The gearshift isn't very positive, and clutch engagement on this particular car seemed rough. I doubt that it's rough on all 4000s. The four-speed's ratios are well spaced for good acceleration, with fourth being a slight overdrive (0.969:1). A three-speed automatic is available as an option.

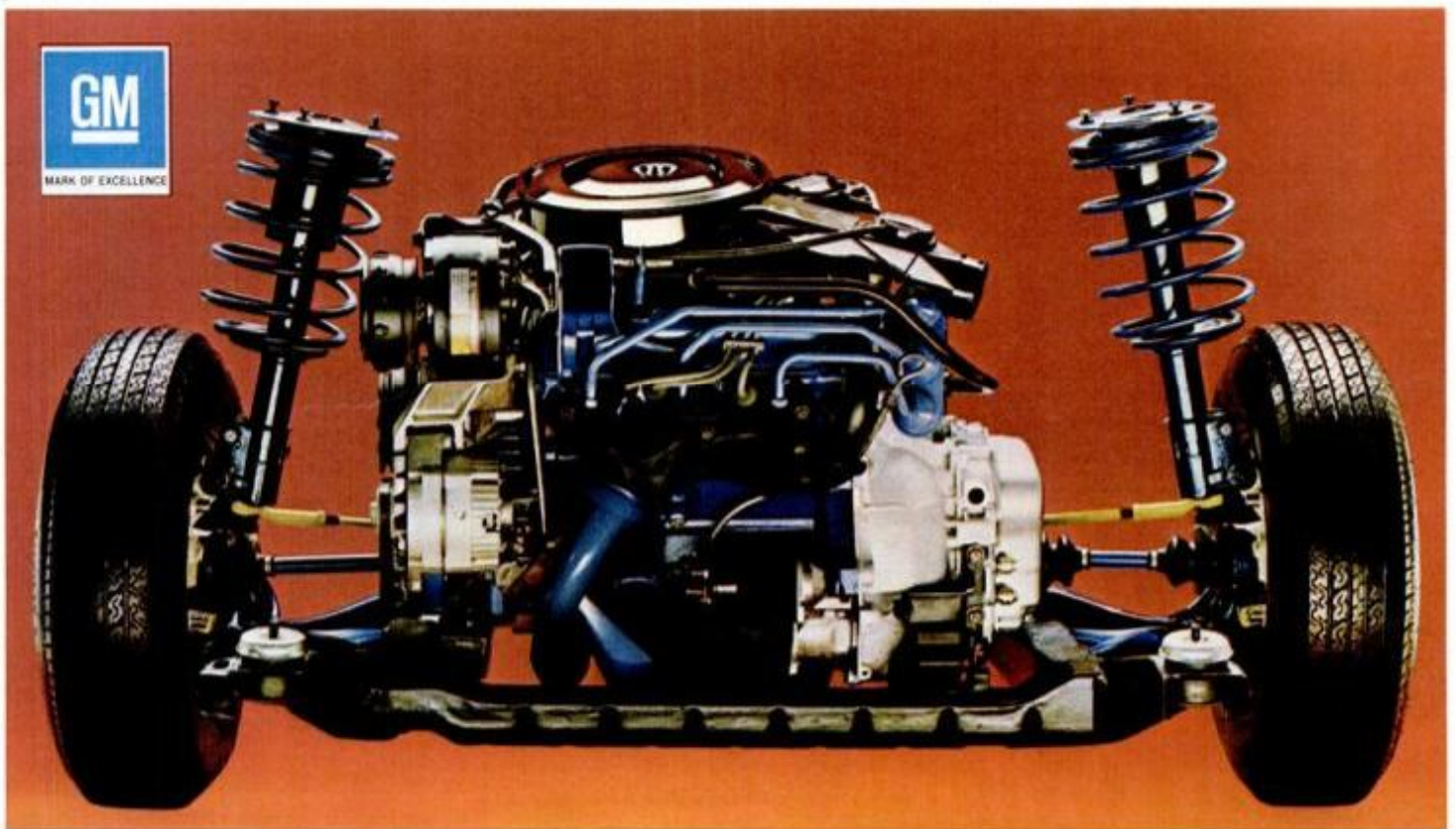
The 4000's handling tends toward the understeering side, not surprising considering all that weight ahead of the front axle. Yet in normal driving, you don't feel any plow or discomfort. Steering by rack and pinion is quick and not heavy. Power steering eventually will be available as an option.

The car rides very well on all surfaces, both pavement and dirt. The suspension tends toward the tight

(Please turn to page 34)

GM's New Front-Wheel-Drive Cars

With a host of standard features including transverse-mounted engine, MacPherson Strut suspension, rack-and-pinion steering, front disc brakes, radial tires and more.



The above photograph contains a remarkable story. It is the heart of the new front-wheel-drive Chevrolet Citation, Pontiac Phoenix, Oldsmobile Omega and Buick Skylark. And it has a number of features that are standard equipment.

Transverse-mounted engine.

Because the engine sits sideways, we can reduce overall length, yet design a car with plenty of room for passengers and luggage. The one you see here is the available V-6, a 4-cylinder engine is standard. (These GM-built engines are produced by various divisions. See your dealer for details.)

MacPherson Strut front suspension.

Helps us design a roomier passenger compartment.

Rack-and-pinion steering. Offers quick, easy response.

Front disc brakes. A new low-drag design with audible wear indicators.

Radial tires. A new design with a special rubber compound to lower rolling resistance even more than "conventional" radials.

Delco Freedom® battery.

Maintenance-free, never needs water.

Maintenance-free wheel bearings.

Completely sealed bearing assemblies are preset for precise clearance and lubed for life.

And more. The aforementioned features are just some of the standard items you get on these exciting new front-wheel-drive cars. You also get others like self-adjusting brakes, carpeted passenger compartment, Body by Fisher construction and many more.

Take a test drive. If you've never driven a car with front-wheel drive before, we're convinced our front-runners for the '80s offer you a great, new and rewarding experience.

If you have driven front-wheel-drive cars before, well—these are about to bring something brand-new to the ball game.

Look into buying
or leasing at your
GM dealers today.

GM's Front-Runners for the '80s.

Chevrolet Citation, Pontiac Phoenix,
Oldsmobile Omega, Buick Skylark.



THE EASY WAY TO A PASTE WAX SHINE.

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The New One that's Made to Order!

Here's the one you've been asking for! New LUBRIPLATE APG 90 Gear Oil! It is made with the finest base oil and the best additives money can buy.

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

DRIVING THE AUDI 4000

(Continued from page 32)

side, which I like, but there's none of the jiggling associated with short wheelbases. The 1980 4000 uses the same basic suspension as before, namely MacPherson struts up front and torsion-stabilized dead axle aft.

Axle travel has been increased about $\frac{3}{4}$ inch so that spring rates could be softened a tad. The rear axle design not only saves space but also incorporates an antidive feature so the rear doesn't lift during hard braking. And I found the 4000's vacuum-assisted disc/drum brakes effective in repeated stops.

Instruments are well placed, with all switches at the driver's fingertips. The instrumentation includes a tachometer, quartz clock and vac-



Lines of the wedge-shaped 4000 resemble those of the 5000, especially in the rear.



Clean front end uses single badge, Audi's four interlocking rings in center of grille.

uum gauge but only telltales for oil, temperature, and battery. The vacuum gauge gives some indication of fuel consumption. Yet without a direct mpg readout, I'd put this gauge in the gadget category. Frankly, I wish Audi had included the missing gauges and made the vacuum gauge optional.

Storage compartments abound in the new 4000—a big glovebox, a bin for maps and booklets at the driver's left, another for tapes and cigarets in the mini-console, and a practical shelf surface atop the dashboard.

The heater warms up quickly and puts out really hot air in very controllable amounts. The vent system lets the driver mix fresh, cool air with the heater/defroster's output. Or in summer, cool air alone can be

(Please turn to page 176)

Your grass will be here 10 years from now. What about your lawn tractor?

Before you lay out good money for a lawn tractor, we'd like you to remember one thing. That lawn of yours is going to need mowing next week, next month, next year, and 10 years from now.

So you might as well get a lawn tractor that will last. Like a John Deere.

Many of the original John Deere lawn tractors, built 12 years ago, are still going strong today. And our new 1979 models are just as tight and solid as ever.

They're a lot more versatile, too, with a big 4-bushel rear bagger to collect grass clippings and leaves. And an optional snow thrower or front blade to save you snow shoveling in winter.

Of course a real test of how well lawn tractors are built is how well they maintain their trade-in value. And John Deere trade-ins are tops in the industry. Bar none.

Come in and choose from our 8-hp lawn tractor with 30-inch cutting width or our 11-hp tractor with 38 inch cut (widest of any bagging lawn tractor on the market).

You may pay a little more for a John Deere now. But ten years from now, you'll be money ahead.



Nothing Runs Like A Deere.®

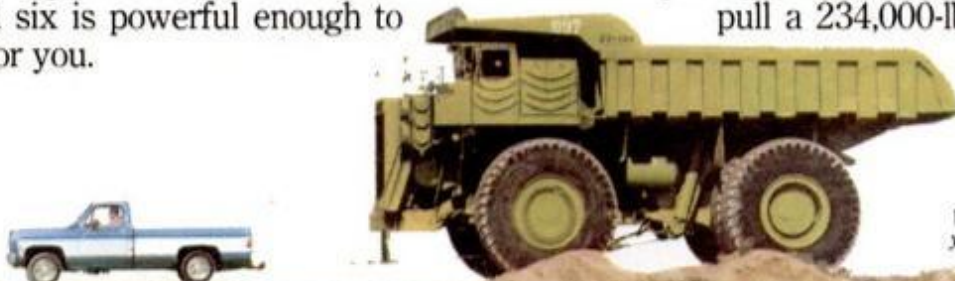


For more information write John Deere, Dept. 50, Moline, Illinois 61265.

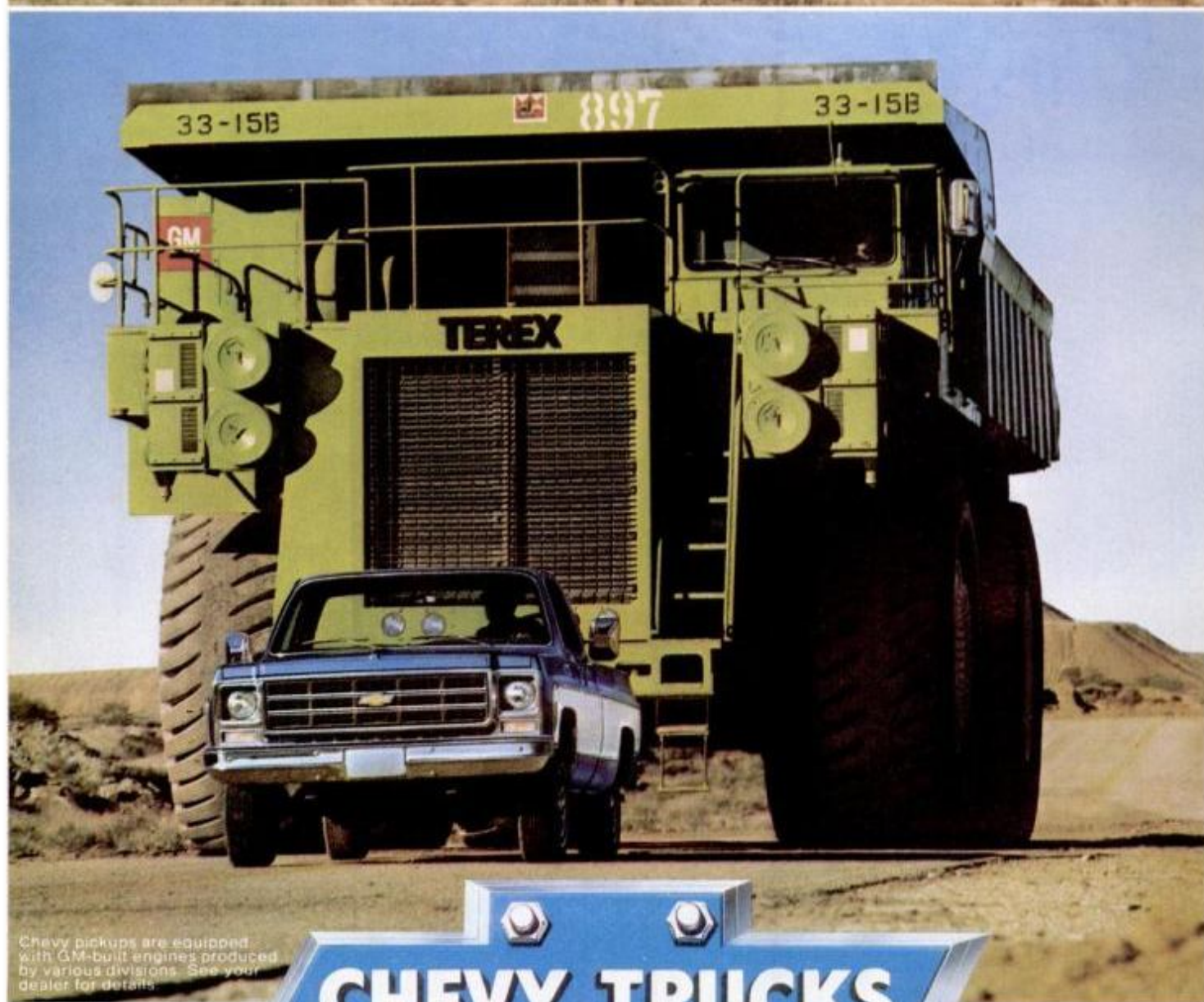
Материал, защищенный авторским правом

This Chevy pickup with a standard six pulled 234,000 lbs. Think what it can do for you.

In a recent TV demonstration, this Chevy 1/2-ton pickup with available full-time 4-wheel drive, automatic transmission and 4:11 rear axle, pulled one of the world's heaviest trucks—GM's Terex 33-15B. The engine? The newly improved 4.1 Liter (250 Cu. In.) Six that's *standard* in many Chevy trucks. (This 6-cylinder engine is available in Calif. on 2-wheel-drive pickups only.) Surprised a 1/2-ton pickup with a standard six is powerful enough to pull a 234,000-lb. truck? Just think what it can do for you.



We don't recommend you abuse your truck in this manner.



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

CHEVY TRUCKS

BUILT TO STAY TOUGH

Keep track of your engine with PM's Auto Tach



With a manual transmission, you'll shift with race-driver skill. If you drive an automatic, you'll be able to keep an eye on how it's working!

by Jeffrey Sandler

Reminiscent of the "Christmas tree" lights at a drag strip, our AutoTach's green, yellow and red LEDs colorfully guide you through shift after perfect shift. The AutoTach will help you get maximum performance from your car, as well as more miles per gallon from your ever-more-costly fuel.

AutoTach monitors your engine's rpm. As you approach the correct shifting points, the green LED lights to tell you to get ready to shift. Then on comes the yellow light, telling you it's time to shift. If the red LED should then light before you shift, you're being told that you waited too long and the engine has over-revved.

AutoTach is useful in powerful V8s as well as in sedate four- and six-cylinder cars, and in automatics, too. All cars, including automatics, have proper shift points.

Surprised? Well, the fact is that all automatics have slippage, which should not be allowed to get excessive. In a manual, it's easy to feel slippage. But a quiet automatic can

pull the wool over your eyes with the silkiness of its ride. If your automatic does act up, AutoTach will alert you by lighting at lower road speeds than before—because the engine will be going faster to make up for the slippage. With a little luck, you'll be able to remedy things with just a touch of transmission fluid.

If you suspect slippage in an AutoTach-equipped vehicle, there is a very simple test. Travel in any gear at a few mph below the turn-on point of any of the LEDs. Floor the accelerator. What should happen to the engine rpm the instant you "step on it"? Answer: Nothing! The car does not accelerate instantly and neither should your engine's rpm—if the clutch is not slipping. So, if the AutoTach should light the next light in its sequence in immediate response to your "flooring it," that would be an indication of slippage.

How often have you driven off and then had your transmission accidentally shift into a lower gear? You'll notice this right away in highway driving. But if you drive primarily in city traffic, you may not notice the problem—until you get to the gas pump and it costs you a fortune! The AutoTach will alert you to this by lighting much sooner than normal.

Teaching someone to operate a manual shift properly is one of AutoTach's strong points. As the driver will be shifting at the same rpm each time—rather than at many differ-

ent points—each shift will "feel" the same. A student can concentrate on shifting without having to compensate for speed-variation effects. *Voilà*—AutoTach teaches smoother shifting!

There are all sorts of other uses for AutoTach. If you have a lead-foot in the family, set each of the LEDs to light at progressively higher speeds—and label the red one "watch out for cops"! Here, of course, the AutoTach won't also tell when to shift, but could be readjusted to do so any time the lead-foot's touch becomes lighter.

How it watches the revs

Whether you have electronic ignition or a conventional type, every time a plug is fired there is a voltage spike at the primary of the coil. The AutoTach adds and averages these spikes. The result is a smoothed voltage output whose value is dependent on the engine's rpm.

Each LED can be adjusted to light at any voltage level (rpm). So they can each light at any engine speed from idle to full throttle. What rpm levels you set the LEDs for will depend on what use you put the AutoTach to.

If you intend to use it to monitor a manual transmission, first find your ideal shift point—expressed as a range in your owner's manual. Use the center of that range—say 2300

(Please turn to page 38)

KEEP TRACK OF YOUR ENGINE

(Continued from page 37)

rpm. Good levels to set the LEDs for would then be 2000 rpm, 2300 rpm and 2600 rpm.

If you'd rather, you could just set two monitor shift points, while the other one keeps track of your idle speed in order to prevent creeping and/or stalling. The settings are up to you and your requirements.

Tacking the tach together

Construction of the AutoTach is straightforward. If you'd like, you can order a complete kit (see parts list) with a drilled and etched printed circuit board and *all* the other parts you will need.

If you'd rather, you can go the home-brew route. We supply you with a PC board template and component side view to make your own PC board. Take a look back at our

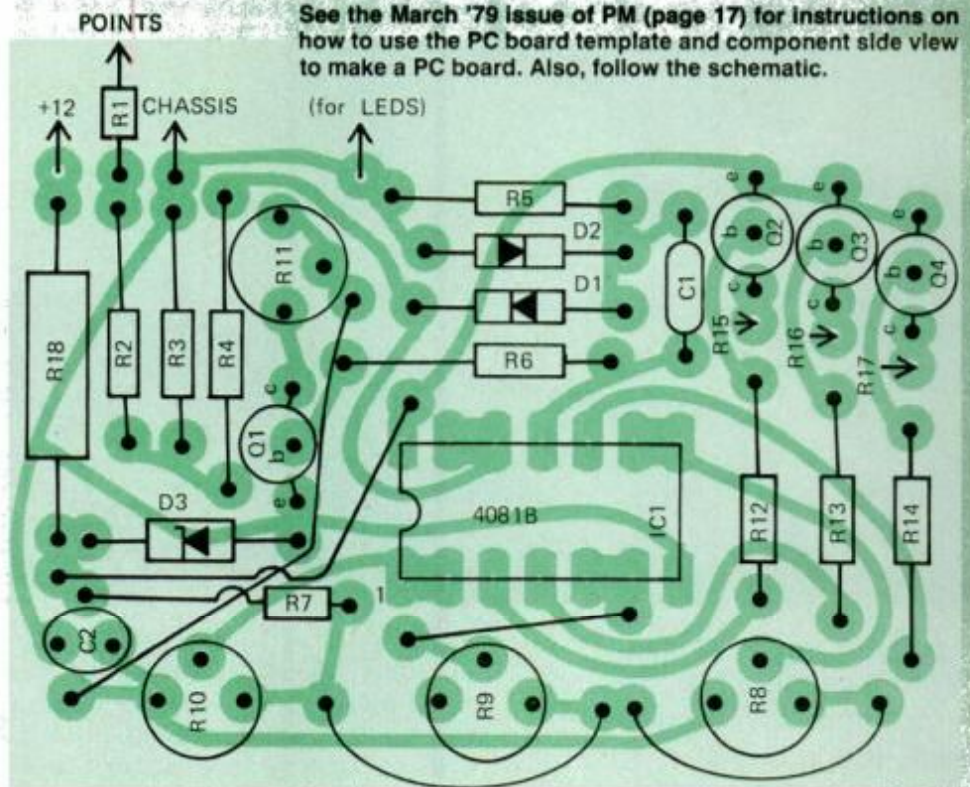
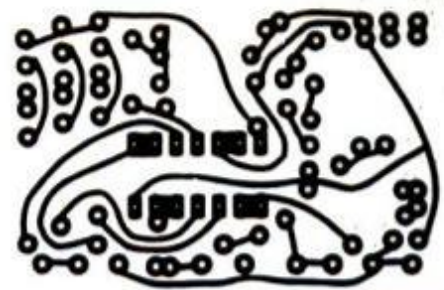
PARTS LIST—AUTOTACH

- C1—1-mfd. capacitor
 - C2—10-mfd. electrolytic capacitor, 16 v.d.c.
 - D1, D2—1N4148 diode
 - D3—zener diode, 2-W., 9 v.d.c.
 - IC1—4081B CMOS integrated circuit (quad and gate)
 - LED1—red light-emitting diode (Monsanto MV5752 or equiv. high-brightness device)
 - LED2—yellow light-emitting diode (Monsanto MV5352 or equiv. high-brightness device)
 - LED3—green light-emitting diode (Monsanto MV5252 or equiv. high-brightness device)
 - Q1—2N4401 NPN transistor
 - Q2, Q3, Q4—2N4403 PNP transistor
 - R1, R3—33,000-ohm (33K) resistor, 1/2-w.
 - R2—430,000-ohm (430K) resistor, 1/4-w.
 - R4—220,000-ohm (220K) resistor, 1/4-w.
 - R5, R6—10,000-ohm (10K) resistor, 1/4-w.
 - R7—22,000-ohm (22K) resistor, 1/4-w.
 - R8, R9, R10—100,000-ohm (100K) potentiometer, PC-board type
 - R11—5000-ohm (5K) potentiometer, PC-board type
 - R12, R13, R14—10,000-ohm (10K) resistor, 1/4-w.
 - R15, R16, R17—240-ohm resistor, 1/4-w.
 - R18—33-ohm resistor, 1-w. (do not use smaller wattage)
 - Misc.—shielded 3-wire cable; cabinet (we used a Pomona No. 2104); PC-board materials; press-on lettering; wire
- Note**—A complete kit of all parts is available for \$19.95, or an assembled AutoTach for \$29.95, postpaid from Circuit Craft Inc., 10 Idell Rd., Valley Stream, N.Y. 11580.

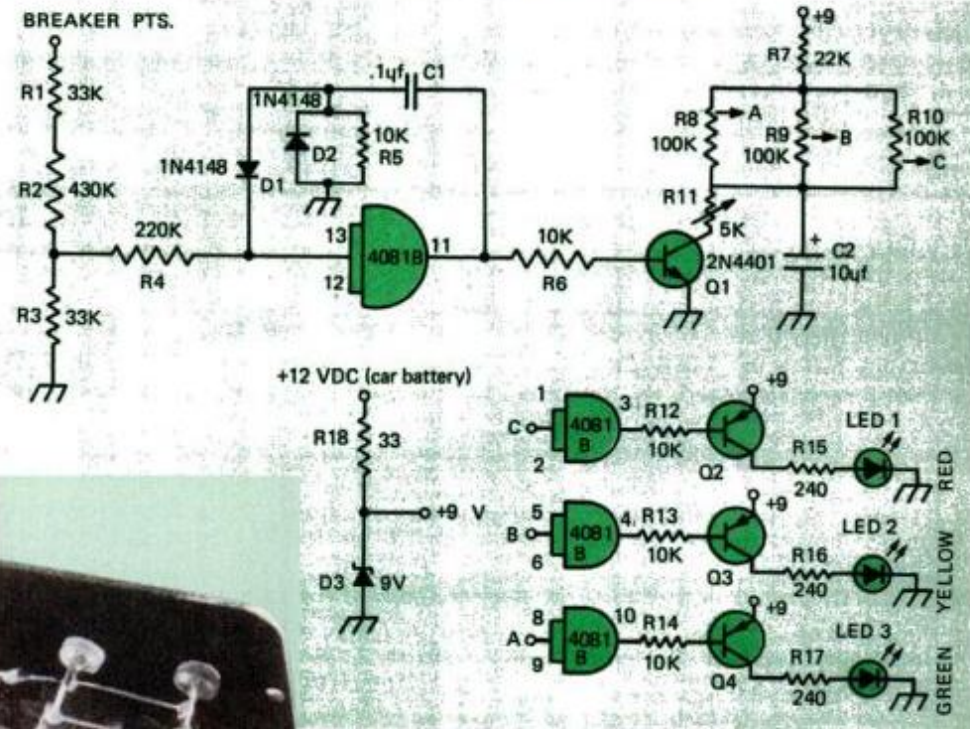
March '79 issue (*Printed Circuit Board Processing*, page 17) for instructions on how to fashion a PC board.

No matter which way you go, the AutoTach will only require three connections to the car: to ground, to +12 v.d.c. and to the primary of the

(Please turn to page 128)

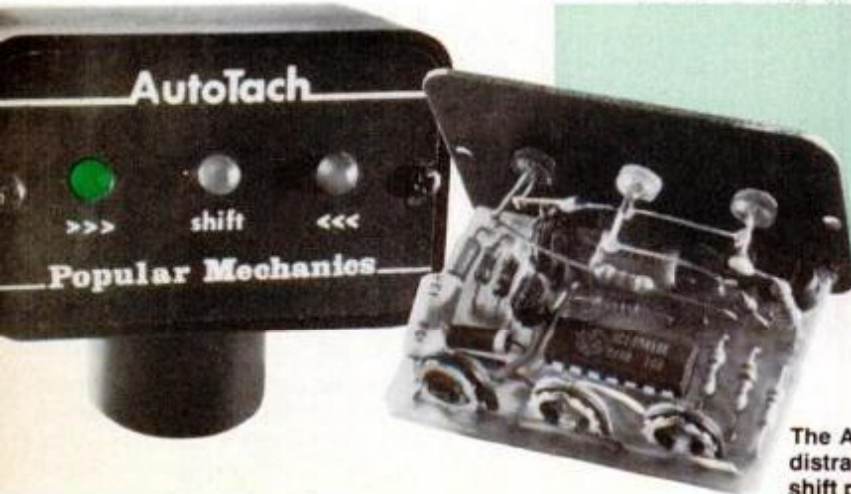


See the March '79 issue of PM (page 17) for instructions on how to use the PC board template and component side view to make a PC board. Also, follow the schematic.



Note that although only one 4081B integrated circuit is used, the schematic shows all four of its AND gates separately. Also, be certain to use high-intensity LEDs!

The AutoTach should be built into a case small enough not to be distracting if mounted above the dashboard. Set LEDs to monitor shift points and you'll never squint at a tachometer dial again!



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

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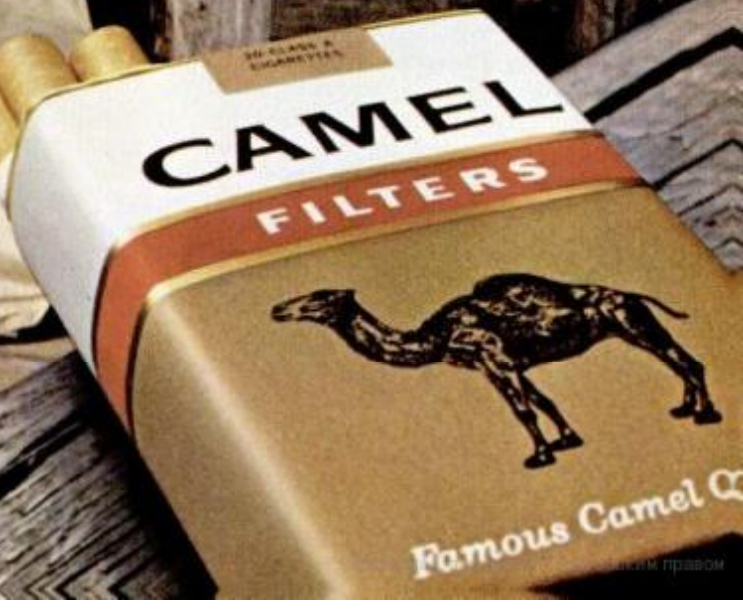
Its blend of Turkish and Domestic tobaccos gives him what he smokes for.

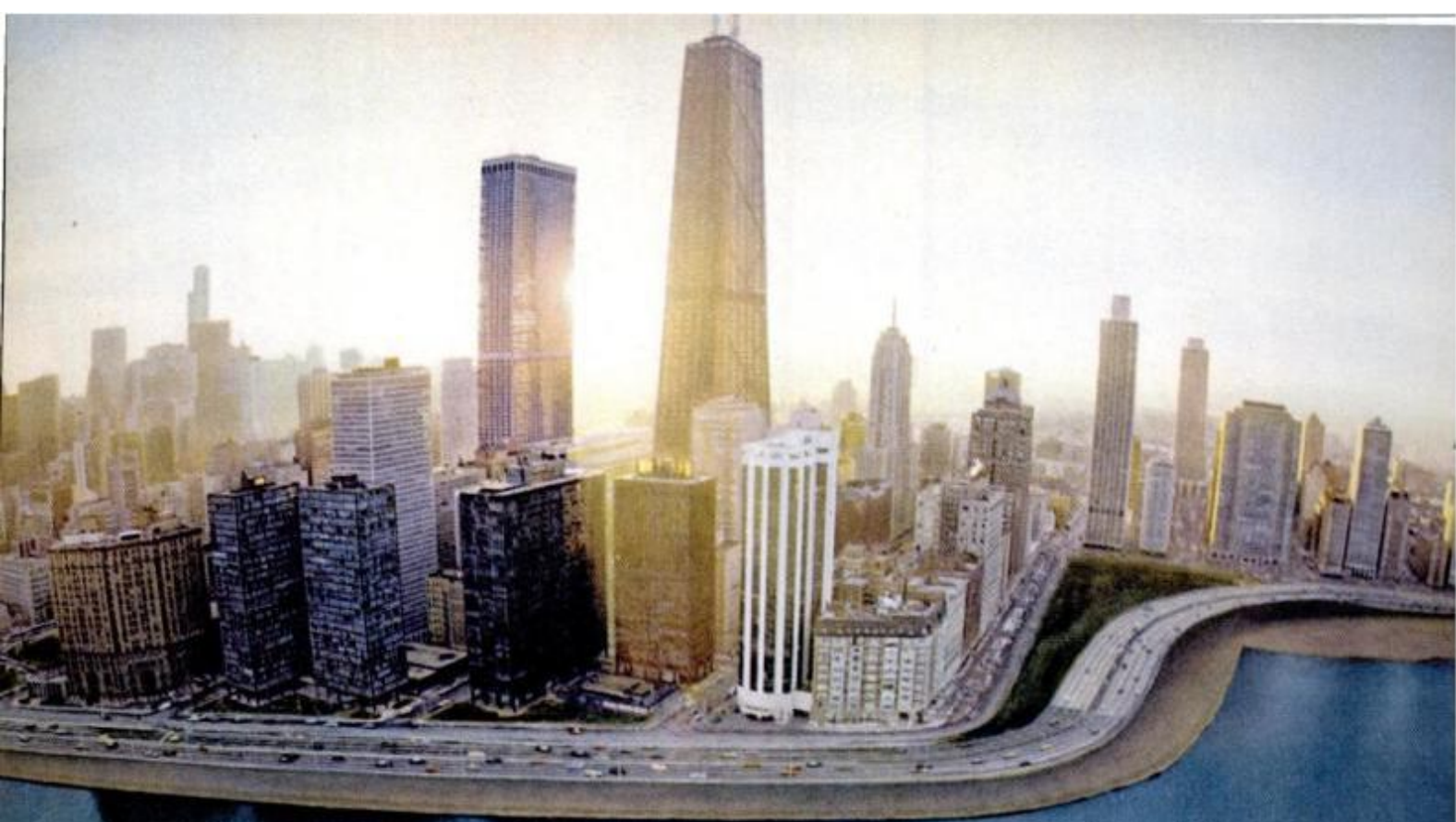
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Chicago.

If you ever needed more reason to visit than its spectacular architecture and windy spirit, you've got it now. For here we've hidden a case of Canadian Club.

To find the C.C., start at a tower with stones from around the world, and cross the street nearest the Alamo stone to an ex-president. Hail the Chief with "The Best In The House," then walk right to the nearest flagpole, turn left and pass eight more. Pass 11 light poles, cross a street and pass three more. Still with us?

Who said "Less is more"?

Now look right and find Mr. "Less is more." Back on your former path, continue past a plaque recalling the last time the "outs" were "in," and head straight across an island to an "old bald cheater." Next, head toward Chicago's oldest dwelling,



counting columns in the street to 14. Here cross the street, turn right, and walk till you reach footloose rocks (not the kind you'd pour C.C. over). Then traverse the nearest lobby, and head again for the oldest dwelling until you find "Arris."

Find an island and a mountain.

You're warm now, so retrace your path past an eastern island and mountain until you're kitty-corner from a famous paddler's place. Here turn left, walk to the ninth light pole, and find a date four years older than C.C. inside the second door to the right. Now retrace your steps to the corner. In sight once stood a warehouse designed by a famous Bostonian. Learn what its owners did, enter the nearest building whose owners are in the same business, then exit toward water. But don't get wet 'cause now you're very hot.

Ascend and descend.

Go against the flow till you spot what Chicago newspapers are full of. Count 'em, ascend that number of floors, descend 90 steps. Enter a place that doubles itself, say "C.C., please," and claim your case. Arm-chair adventurers can discover C.C. at any of Chicago's bars, restaurants or package stores with the same request. Just say "C.C., please."



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"The Best In The House"® in 87 lands.

IT'S NEW
NOW



Sew what's up?

An electronic feedback control allows the New Home XR-VII to stitch through up to 32 layers of cotton with no loss of power or speed. Machine has 26 built-in stitches, four settings on presser foot. About \$900. New Home Sewing Machine Co., 171 Commerce Rd., Carlstadt, N.J. 07072.

On the spot

Spot Finder uses a simplified method of visual triangulation to help a fisherman return to a particular fishing spot. It can also be used by hikers or campers to return to a specific location on land. The unit costs about \$3 and is available from Willie Products Co., Box 532, Brookfield, Wis. 53005.

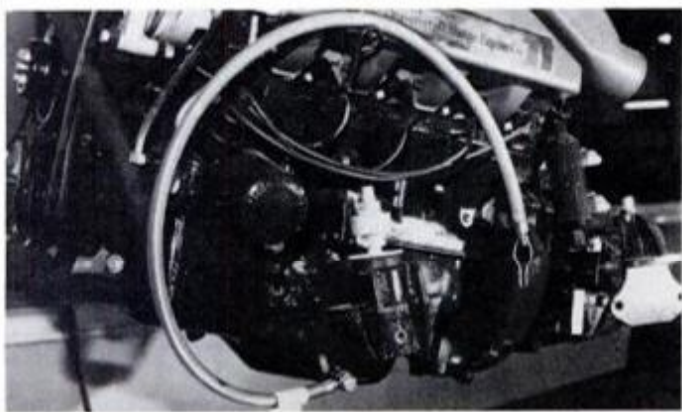


Seat-rest beverage cooler

Shaped to fit the seats of cars, trucks and boats, the Kool Rest can hold two six-packs, with room for ice. It has two drink holders and is made of high-impact plastic, the maker says. When not used as an ice chest, it can be used for storage. About \$30 from Igloo Corp., Box 19322, 1001 West Belt Drive, Houston, Tex. 77024.

Down the drain

The Crankcase Drain Kit for boat engines consists of a 90° swivel fitting and a neoprene hose. Insert the hose through a standard transom drain hole and the oil can be drained when the boat is on a trailer. Model OD-P costs about \$13 and is made by Westwind Products, 150 Tejon St., Denver, Colo. 80223.



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- You get a complete how-to book on laying out the foundation, how to do concrete block construction, house framing, chimneys, fireplaces, porches, patios, insulation... *and more.*
- You get a complete how-to book on every aspect of roofing, flooring, doors, windows, stairs, plus how to use stationary and portable power tools, plus tips on painting, maintenance, repairs, termite protection... *and more.*

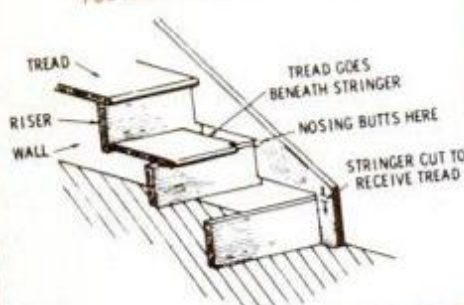
You get step-by-step instructions on everything from reading a building plan to building a house (including the foundation), doing all the carpentry in it—and keeping the house in A-1 shape for a lifetime. And thousands of show-how pictures make it all amazingly easy, even for a novice. Let's look at a few of the remodeling and fix-it jobs you learn how to do... You learn how to replace worn or missing shingles. How to fix chimney flashing leaks. How to repair stairs (or build them from scratch).

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You learn how to build stairs.



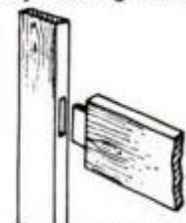
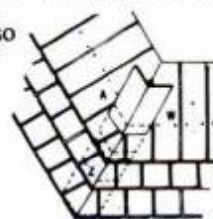
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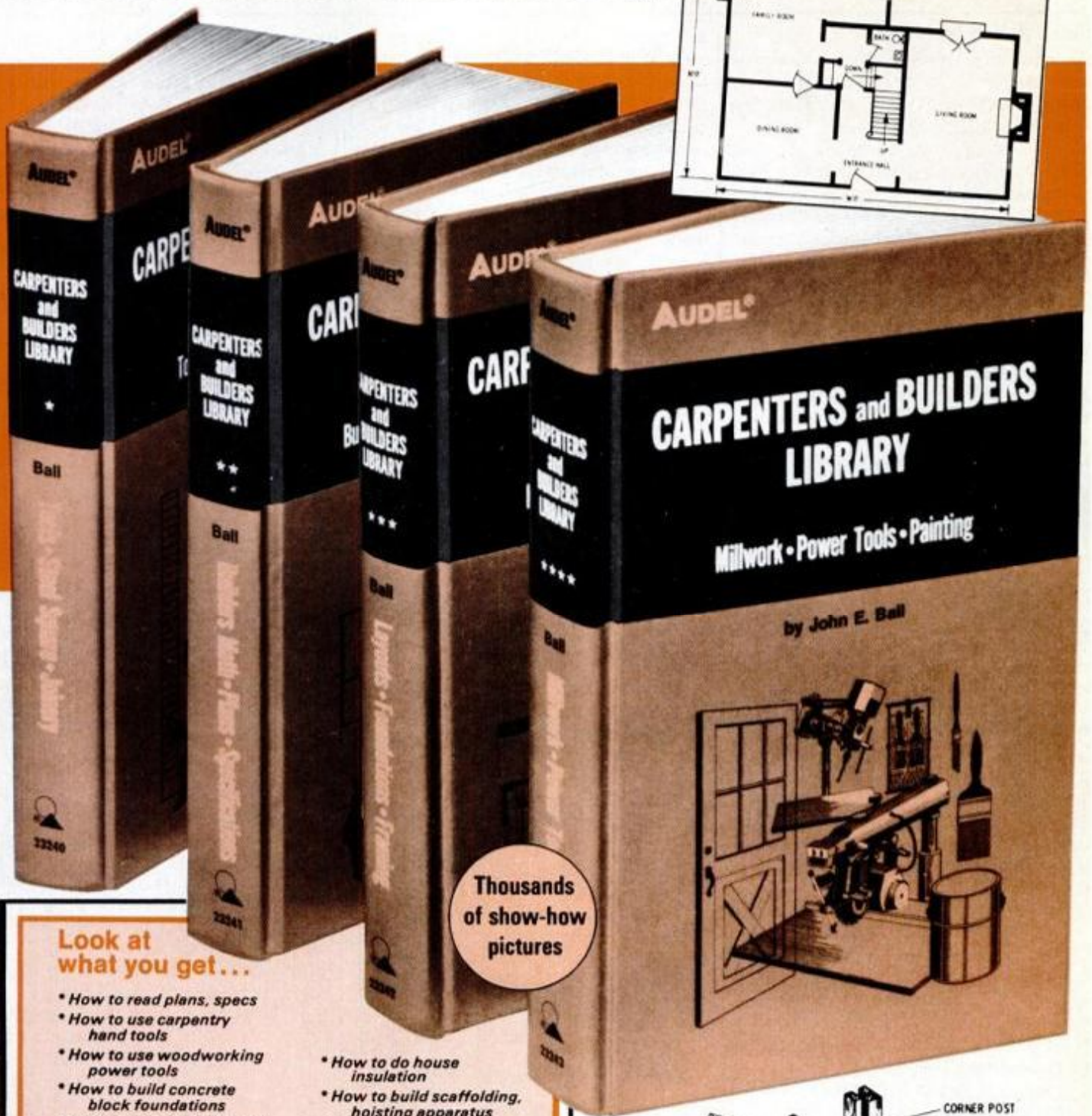
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Single mortise and tenon joint.

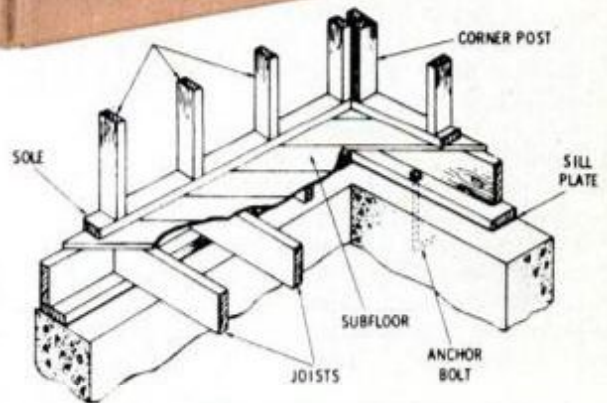
Installing metal shingles under wood shingles.

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a foundation, installing new paneling,**



**Look at
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- * How to use woodworking power tools
- * How to build concrete block foundations
- * How to choose best woods, materials, fasteners
- * How to plan and build roofing, flooring
- * How to construct walls, doors, windows
- * How to make joints
- * How to build stairs
- * How to build chimneys and fireplaces
- * How to use builders' math, do surveying
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- * How to do cabinetmaking joinery
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- * How to do house insulation
- * How to build scaffolding, hoisting apparatus
- * How to do wood pattern-making (for castings)
- * How to do sheathing and siding
- * How to do cornice construction
- * How to plan termite protection
- * How to do interior-exterior painting
- * How to build girders and sills
- * How to make concrete forms (and molds)
- * How to sharpen saws
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- ... and much more



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ALL OUTDOORS

More go on less gas

New fuel for the old efficiency argument between outboard and inboard engines showed up unexpectedly this spring. Evinrude Motors bought a 28-foot Bertram Sports Convertible model without the two standard inboard engines usually installed. Cutting down the transom, they then mounted a pair of 200-hp V6 Evinrude outboards to take the place of two 233-hp inboards and tried a series of tests to see how the well-performing hull would run with two-cycle power.

At slow displacement speeds, the inboards were as much as 34 percent more efficient in miles per gallon.



After cutting down transom to mount a pair of 200-hp outboards on a Bertram 28, Evinrude engineers found they added 14 mph, raised miles per gallon 83 percent.

Up on plane, however, the 400 horses of two-cycle power beat out the 466-hp inboard figures by a 21-percent fuel saving at 25 mph, an 83-percent gain in miles per gallon at the inboards' top speed of 34 mph. Then the twin outboards added 14 for a top speed of 48.2 mph, amazing even the Evinrude engineers. Range of the boat could be increased from the inboards' 200 miles to 300 with the outboards, or to 500 miles with tanks installed where the inner engines had been.

What makes the difference? Probably the lighter weight helps, but other factors are the increased mechanical efficiency of the big new high-performance outboards, their weight placement all the way aft on the speedy deep-V hull, and the ability to trim for less wetted surface and the very best angle of drive. With miles per gallon becoming an ever greater concern, these figures may mean large outboards deserve a new look as big-boat power.

Better gear

Among improvement in shooting and fishing equipment are new shotgun shells and spin-casting reels. Winchester-Western is introducing

a Super Double-X nonmagnum game load in 12- and 20-gauge, with a polyethylene granulated filler to hold the shot and help each pellet retain its spherical shape. Denser patterns should result.

Zebco combines spinning and spin casting in an ultralight Omega 144XL closed-face reel that balances under the rod and has a trigger release, new smooth "Straight-Line" drag.

Puff-up preservers

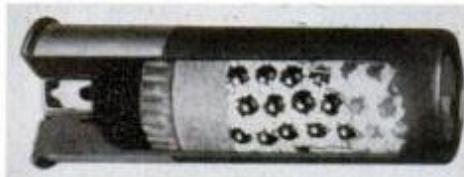
Miss Mae West should be pleased the Coast Guard is finally considering making her namesake life vests legitimate. For 40 years they have been unapproved because they must be inflated, might puncture, could not be activated by an unconscious person. They are so convenient to store and wear, however, that the CG is now considering them for pleasure craft and seeks opinions.

Where it's at

Though sources for products and plans tested or reported on here can be supplied by PM's excellent Information Bureau, some general questions get more complicated.

Several boat owners have asked if there is a do-it-yourselfers' chemical mix to make the foam that adds flotation and reinforcing inside a hull? Where to get it? Is it dangerous?

One mail order supplier is Defender Industries, 255 Main St., New Rochelle, N.Y. 10801. Yes, it can be dangerous—like many other prod-



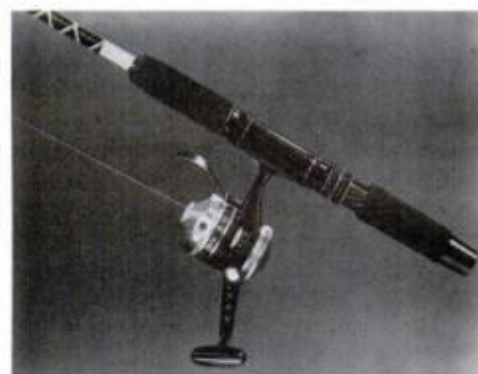
Gently packed in granulated polyethylene inside a plastic collar, shot pellets hold shape inside new Winchester-Western Super Double-X 12 and 20-gauge shotshells.

ucts—if not used according to directions. Some brands give off noxious fumes while foaming, so don't work in a close compartment with them. Some have the strength to distort a thin-skinned hull if foamed in a sealed area with no relief vents. But properly used, they offer great benefits. Defender also carries complete lines of marine construction materials, sealants, gadgets and hardware in their catalog, available to PM readers for a \$1 handling charge.

Campers and backpackers have

asked about stoves that can burn both leaded and unleaded gasoline. Mountain Safety Research, 631 South 96th St., Seattle, Wash. 98108, has a neat, expensive little MSR Model G/K that can cook with any gasoline, kerosene or No. 1 diesel. It weighs less than 12 ounces, costs about \$68 with fuel bottle from local camp gear dealers or MSR.

Families, as well as singles and

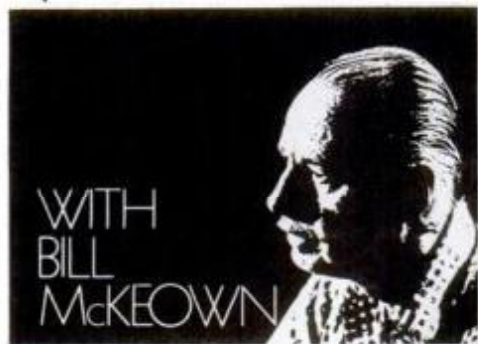


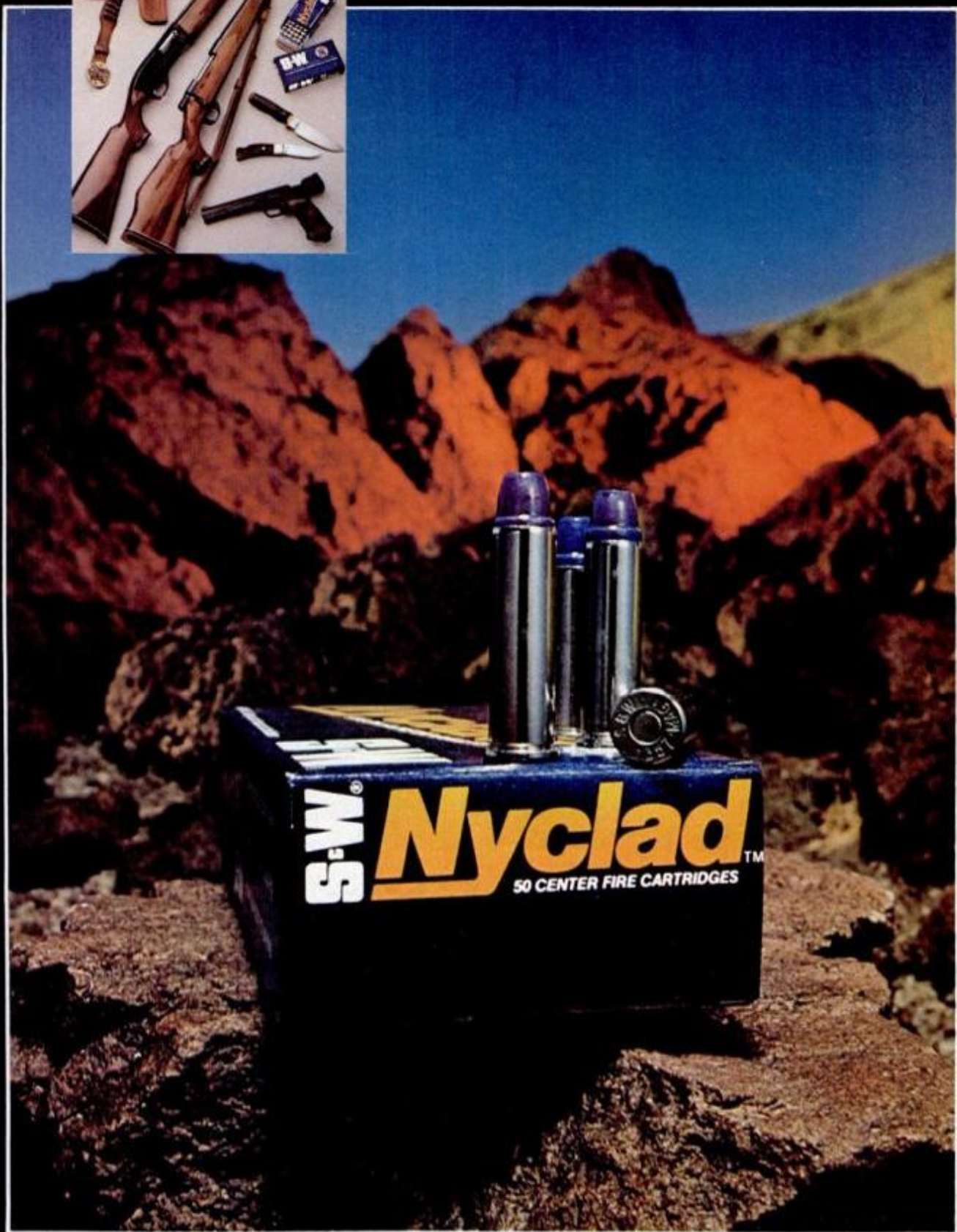
A trigger release for Zebco's Omega 144XL reel balanced under the rod allows line feathering and a combination of spinning and closed-face ultralight spin casting.

couples, can now find outdoor action with the help of a couple of nonprofit organizations. One-week Conservation Summits will be held in the Blue Ridge Mountains in late June, the Rockies in early July, and in the Adirondacks during early August by the National Wildlife Federation, 1412 16th St. N.W., Washington, D.C. 20036. Informal how-to classes include backpacking, compass use, camp cooking, nature study and photography. Get details and reservations from the federation.

Wilderness adventure programs offer a choice of hiking, sailing, horseback pack trips and rafting, combined with environmental training that in some cases carries college credits. They are organized by the American Wilderness Alliance, 4260 East Evans Ave., Denver, Colo. 80222.

PM





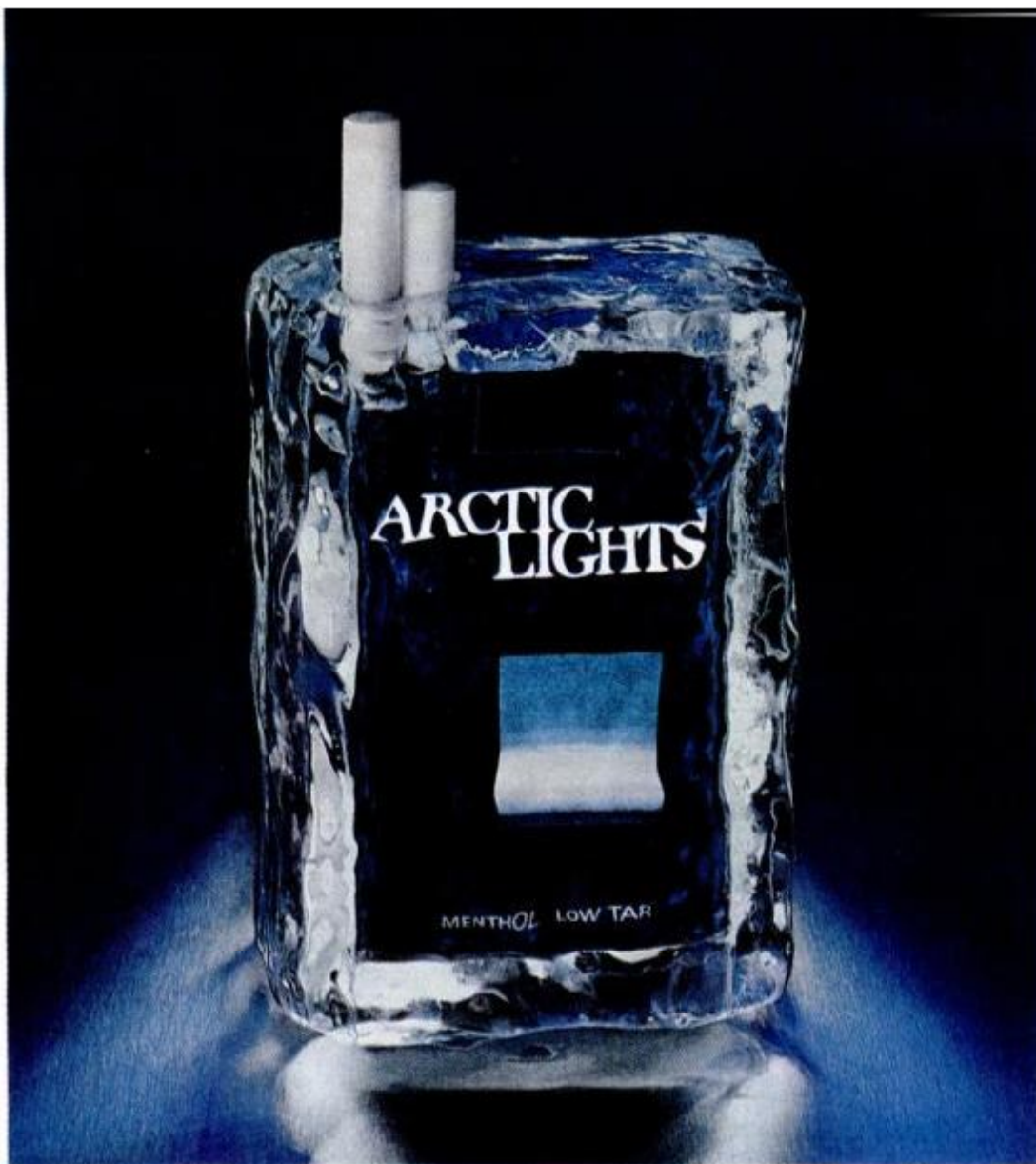
This isn't ordinary ammunition sparkling in the crisp, clean air of America's western mountains. It's Smith & Wesson's revolutionary breakthrough, Nyclad™ ammunition. With nylon jacketed bullets that dramatically reduce leading, bore fouling and smoke. And slash poisonous lead oxide emissions, a hazard on indoor ranges, to a minimum. All while maintaining Smith & Wesson's coveted accuracy, velocity and energy. You'll find new Nyclad ammunition at your dealer's along with Smith & Wesson's popular, traditional centerfire handgun ammunition.

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

Full menthol refreshment. That's what ARCTIC LIGHTS delivers.

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

You see, while the filter holds back 'tar,'

the unique new ARCTIC LIGHTS menthol blend comes right through. Result? You get the iciest, brightest taste in menthol smoking—puff after puff. Light up your first ARCTIC LIGHTS. **You just won't believe it's a low 'tar' menthol.**

Arctic Lights: Kings & 100's

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

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

DETROIT LISTENING POST

More fwds from GM

GM's highly touted front-drive X-body compacts, introduced April 19 and tested in last month's issue, represent just the beginning of GM's transverse-engine, front-wheel-drive revolution. At least three other product lines will spring from the X-car body/chassis platform in the next few years.

Due next spring are a series of "J"-car subcompacts to replace the aging H-body Monza/Sunbird/Starfire/Skyhawk series. These will include both economy and sporty-car derivatives for Chevrolet and Pontiac, plus longer-wheelbase sport coupes for Olds and Buick.

Next will come an innovative "multipurpose carrier" (MPC), probably by late 1981. Half van, half station wagon, the MPC will likely be marketed by all four divisions. It was originally intended to debut alongside the regular X-cars, but was delayed to spread development and cost over a longer period.

Third X-car derivative will be an



Cover of editor Lamm's Camaro book.

all-new series of A-body intermediates to replace the current Malibu/LeMans/Cutlass/Century. Latest word is that these front-drive intermediates have been moved up to be unveiled as '83 models late in 1982.

As of now, the "A-special" Monte Carlo/Grand Prix/Supreme/Regal are in line for another minor downsizing for '83, but will remain rear-drive, as will the B-body and C-body full-size models of five GM car divisions and the F-body Camaro/Firebird. The T-body Chevette will likely go front-drive in 1982.

Current model Camaros and Firebirds are still red-hot sellers and their drivers comment on the mystique in this issue (see PM Owners Report on page 84.) And our West

Coast Editor, Mike Lamm, has taken a close look at "The Great Camaro" in his just-published book of that title. It's a handsome history of the marvelous marque. (Lamm-Morada Publishing Corp., Box 7607, Stockton, Calif. 95207, \$14.95).

'80 T-Bird, XR-7, Mark VI

The '80-model Ford and Mercury personal coupes, downsized to a 108-inch wheelbase (from a previous 114 inches) and based on stretched Fairmont/Zephyr chassis, look nearly as massive as ever, say insiders.

Front ends are designed to appear little changed compared to the larger '79 models and the Thunderbird's rear still sports those huge horizontal taillamps that have become the car's trademark. Cougar XR-7, on the other hand, has a new rear-end look dominated by large, vertical wraparound taillamps with horizontal ribs. All LTD II and "ordinary" Cougar models will be dropped for 1980, leaving only the two personal coupes in this size range.

A new addition to Lincoln's line will be a Mark VI four-door sedan to cash in on the growing market for ultra-luxury four-doors. The two-door "Mark" and both two- and four-door Continentals remain, but downsized to help the company leap that tough 20-mpg fleet fuel economy hurdle for the 1980 model year.

Chrysler diesel and turbine cars

Chrysler Corp., which quietly dropped the six-cylinder diesel engine from its light-truck option list last fall due to lack of demand, has publicly shown a pair of diesel-powered cars at a Department of Transportation research conference in Boston. The engines were converted 225-cu.-in. "slant" Sixes—normally aspirated in a Dodge Aspen and turbocharged in a St. Regis. Lessons learned with these research vehicles will be applied to production versions, as soon as Chrysler engineers are certain their diesel can beat EPA's super-tough future diesel emissions standards.

Also shown were Chrysler's latest experimental turbine-powered cars, a Dodge Aspen (drivable) and a customized show-car LeBaron. Although work is continuing on these seventh-generation automotive turbines, production feasibility remains many years away . . . if ever.



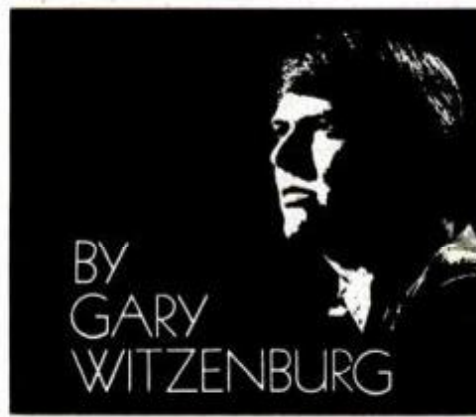
Still made in the U.S.A., the '79 Avanti.

Avanti record set

One small carmaker doing quite well, thank you, is Avanti Motor Corp. of South Bend, Ind. The company was formed in 1965 to continue building the lovely Avanti four-seat sports car after Studebaker had discontinued production at its South Bend factory, and it has not only survived but thrived ever since. The 1977 mark of 164 Avantis was beaten by 22 units in 1978; and the company's eventual production target is 240 cars per year, according to *Ward's Automotive Reports*. Avantis are hand-built to individual customer order for \$18,000 to \$23,000 per copy, each powered by a 350-cu.-in. Corvette engine.

AMC 4wd near; V8 endangered

Good news at American Motors is that the four-wheel-drive Concord is nearing production, and summer introduction seems a good possibility. Bad news is that the corporation may have to discontinue its 304 V8 engine option in passenger cars to meet the 20-mpg fleet fuel economy law for 1980. Pontiac's 2.5-liter Four will replace the VW-built 2.0-liter as base AMC unit, and the 258-cu.-in. Six will be the largest engine for the '80-model Pacer, Concord and Spirit if the V8 is dropped. **PM**



BY
GARY
WITZENBURG

CAR CLINIC

SOLUTIONS FOR MECHANICAL HEADACHES

BY MORT SCHULTZ



Shining a light

I have a cold start problem with a 1977 Mustang II that has the dealer completely in the dark. The car has the 140-cu.-in. Four and manual transmission. After it has been parked eight or more hours, the engine stalls three or four times as I try starting. On the fourth or fifth attempt, the engine will run, but it surges and I have to feather the throttle to prevent stalling. When speed hits 1800 rpm, operation smoothens and the car runs fine for the rest of the day. Advice, please.—John F. Bianchetto, Milwaukee.

See that curb and fast-idle speeds are set to specification, but adjust ignition timing to 14° BTDC, which is an advance of 8° from the manual-stated setting.

If stalling and surging occur only in winter, change motor oil (and filter) to SAE 5W-30 grade that meets Ford specification ESE-M2C144-A (popular brands do). When temperature exceeds 32° F., switch back to the grade of oil recommended in the owner's manual. This procedure should light your way to smoother engine operation.

Hard to believe

In May, 1977, I bought a '77 Dodge Aspen station wagon with the 225 Super Six engine. It ran well until September, when it began hesitating and stumbling on acceleration. The dealer replaced the accelerator pump, which alleviated the trouble for a while. To make a long story short, I have been to the dealer 12 times, met with two different Chrysler zone officers, had the carburetor replaced, had an accelerator pump put in the new carburetor, and had the carburetor and automatic choke adjusted many times.

Now the problem is really worse than ever. The thing that really frosts me is the conclusion Dodge has now reached: "You have to expect this kind of trouble, because you live in a seaside town and it's normal to have problems in damp weather." Please

help.—Joseph Sturges IV, Westhampton Beach, N.Y.

I can't believe this. Nowhere does your letter mention that you've been notified of a recall or that any company representative mentioned a recall. Something is seriously wrong with someone's lines of communication.

On Dec. 23, 1977, 1,670,000 1975-'77 Chrysler Corp. vehicles were recalled to correct a problem of persistent hesitation and stalling. The recall classification is 77V242. You should have received notification through the mail. The recall involves modifying the carburetor and exhaust gas recirculation system to alleviate the trouble, which is brought on by an accelerator pump seal that becomes distorted. In addition to your car, the recall involves the 1975 Valiant, 1976 Volare, 1976 Dart and 1975-'76-'77 Fury, Gran Fury, Coronet, Charger, Monaco, Royal Monaco and Cordoba.

Shakespearean-type drama

If other owners of 1976 Oldsmobiles with four-barrel Quadrajets carbure-

tors are like me, they suffer the slings and arrows of engine hesitation. But I found a solution. I raised the float settings from the specified 13/32 inch to 3/16 inch. I am now enjoying a smooth ride. What do you think?—Tom Tufankjian, Carlstadt, N. J.

Just hope that you get through the tough New Jersey emissions control phase during your car's next safety inspection, Tom.

Hanging by a wire

We have a 1976 Pinto that has the exhaust system held to a rear hanger by a bracket which is welded to the resonator. The bracket rusted and the exhaust system dropped.

"Just get a new bracket," you say? It's not that simple. The dealer tells me the exhaust system back to the muffler has to be replaced although other parts are in good condition. All this for the sake of a two-bit bracket. We have wire wrapped around the resonator and the system tied to the undercarriage. Do you have a better idea?—J. Quinn, Moscow, Pa.

Short of finding a shop to weld a new bracket to the resonator, no.

Eeny, meeny, miney and more

The water temperature gauge of my 1974 Hornet Sportabout is giving out with wild, intermittent fluctuations. I replaced the gauge and constant voltage regulator, but the trouble persists. What now?—John Komada, Long Island City, N. Y.

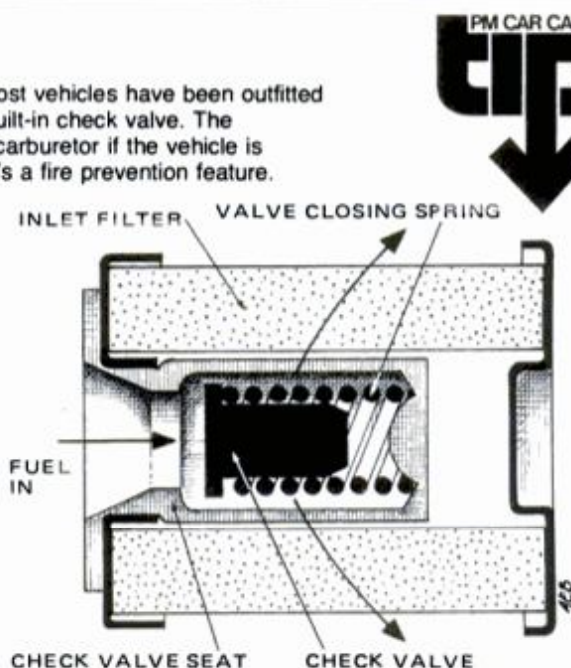
I can't be specific, John, but I can tell you that whoever did the work picked only two of 10 procedures that are recommended by AMC to correct the problem—the two most costly, I may add. The diagnosis chart in the 1974 AMC service man-

(Please turn to page 52)

Fire prevention

Since 1976, the carburetors of most vehicles have been outfitted with a fuel inlet filter that has a built-in check valve. The valve prevents a fuel leak at the carburetor if the vehicle is involved in a roll-over accident. It's a fire prevention feature.

When the engine isn't running, the check valve is held closed by a spring. During starting and engine operation, pressure exerted by the fuel pump pushes the check valve off its seat, which permits fuel to flow unimpeded. When you replace a fuel inlet filter of a 1976 or later-model car, be sure the filter you buy has this built-in valve. It could make the difference between walking or being carried away from an accident.



The test results are in! Jeep Pickup proved superior!



Superior traction
on slippery mud!



Superior traction
on loose sand!



Jeep proved superior to Ford, Chevy and Dodge in a test of automatic 4-wheel drive systems.

In an independent test of the leading 4-wheel drive pickup trucks, Jeep Pickup with Quadra-Trac® proved, that in normal automatic, it had the best traction of the automatic 4-wheel drive systems tested. Better than the systems of Ford, Chevy or Dodge!

See your Jeep dealer for the test results or send the coupon to Jeep Corp., Literature Distribution Dept., 37200 Amrhein Road, Livonia, Mich. 48150. Don't buy a Ford, Chevy or Dodge until you read the facts. If you want the best traction, you want Jeep!



Jeep tells it
like it is!

Independent
traction test
results

Jeep



vs.
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Dodge

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information on Jeep
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We wrote the book
on 4-wheel drive

CAR CLINIC

(Continued from page 50)

ual, beginning on page 3-46, is the most complete and accurate instrument troubleshooting chart I have seen in any manual in many moons, and I don't often give that kind of compliment to service manuals. If the chart is followed exactly, from word one, the guy doing the work will find the trouble.

Miracle in the making

If you answer this one, it will be a miracle. Endless tests by dealer mechanics have failed to uncover a reason for performance problems with my 1975 Pontiac LeMans. The car surges, misses on acceleration and lacks power. The trouble hit suddenly at about 25,000 miles. Tune-ups have been done and instrument checks reveal that, internally, the engine is in good shape.—Larry Shapiro, Tampa, Fla.

Miracles I don't generally perform, but here's a try: A friend of mine who operates a fleet of Chevy pickups and vans had the same trouble, which hit at about the same mileage. We found it was caused by damaged axis holes in the advance weights of the HEI distributor.

Take off the distributor cap and look down on the unit. See where the springs hook to the axis pins, and where the axis pins ride in the axis holes? These are the points to be concerned about. A drop of lubricant is applied in production, but in time the lube dissipates and leaves the axis unprotected. No one ever thinks to grease the spots, which permits metal-to-metal contact to elongate the axis holes. This upsets the advance curve and brings about shoddy engine performance.

If this is your problem, you will have to replace the weights. This time, though, see that the new ones get a tiny shot of silicone every 10,000 to 15,000 miles.

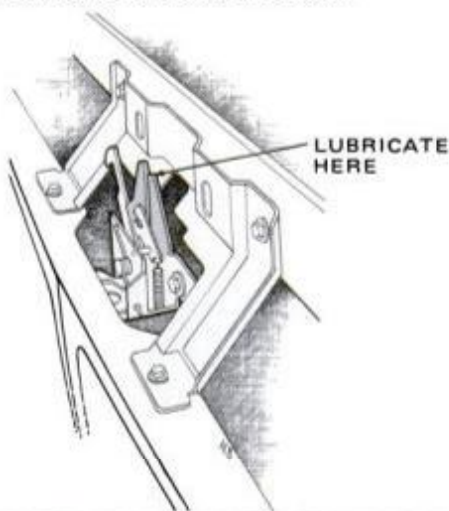
Pop-off dashpot

Tell me, Mort, why does my 1977 Chevrolet Vega (140-cu.-in. engine and stick shift) pop back through the exhaust when I draw my foot off the accelerator to throttle down?—Jack Stevenson, Portland, Ore.

Well, I'll tell you, Jack. It may be that your dashpot is out of adjustment. The dashpot is supposed to engage the throttle lever at 2800 rpm during engine coast-down to allow a gradual, smooth decrease in speed. If the dashpot fails to engage the

Stickum with slickum

Nothing beats old-fashioned grease for solving sticky problems. Suppose the hood of your car or light truck fails to open easily. Sure, the latch and release mechanism may not be aligned properly, but before jumping to a conclusion that can cost you money, take some chassis grease and spread it on the latch handle pivot, catch pawls and spring. Give hinges a shot, too. These parts may feel so indebted to you for your thoughtfulness that they will begin working free and easy once again.



Purolator introduces The HOT ONE

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

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

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

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

Here's how:

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

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

Purolator.

When you can't afford to take a chance.

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



Black & Decker announces the car massage.

Buy Black & Decker's new car polisher now, and get a 50-foot extension cord free.

Introducing Black & Decker's new Random Orbit Polisher—the easy way to put a gleaming healthy shine on your car's finish.

"Random Orbit" means our polishing wheel travels in ever-changing circles—a lot like the natural motion of your hand. So it helps prevent the "swirling and burning" that can spoil your car's finish. Buy one now, and we'll send you a handy, double-insulated 50-foot extension cord free. Details on the package.

When America has a job to do, it reaches for Black & Decker.



Black & Decker

throttle lever, indiscriminate throttle plate movement results that affects the air-fuel mixture, causing possible popping back, as you call it.

To adjust the dashpot, set fast idle speed at 2500 rpm. Let the engine run at this speed as you loosen the jam nut that holds the dashpot. Back the dashpot out, so it won't come in contact with the throttle lever. Now, screw the dashpot in until the cap on its plunger just touches the throttle lever. Give the part a half turn more and torque the jam nut to 12 to 15-in.-lb. Return the engine to idle speed and test. Got it?

Keeping cats from coolant

The American Animal Hospital Assn. offers a tip about automotive antifreeze/coolant: Watch out for animals. Antifreeze/coolant solution has a sweet taste, pleasant aroma and color which attracts animals and children. It is also highly toxic. Compounding the problem is the fact that spilled antifreeze evaporates slowly, even in hot weather.

Animals may lap up or ingest small quantities of the summertime coolant spills. They might take just enough of the solution to cause kid-

ney damage, which may go undetected for a considerable length of time. In other words, it could seriously affect the animal's health without leaving visible signs.

Coolant spills from "boil-overs" occur often enough to encourage the use of antifreeze/coolant recovery systems. Some late-model cars are equipped with the devices. But many cars do not have them.

The American Animal Hospital Assn. says it is particularly concerned about cats, which have a tendency to lick their paws and thereby ingest small quantities of the toxic glycols.

The association urges caution in the handling and disposal of antifreeze, windshield washing solutions and other potentially toxic additives. Many of the warnings are written for people or children, and we seem to forget that they also apply to pets, wild animals and birds.

Good tip, guys!

GOT A PROBLEM WITH YOUR CAR?

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

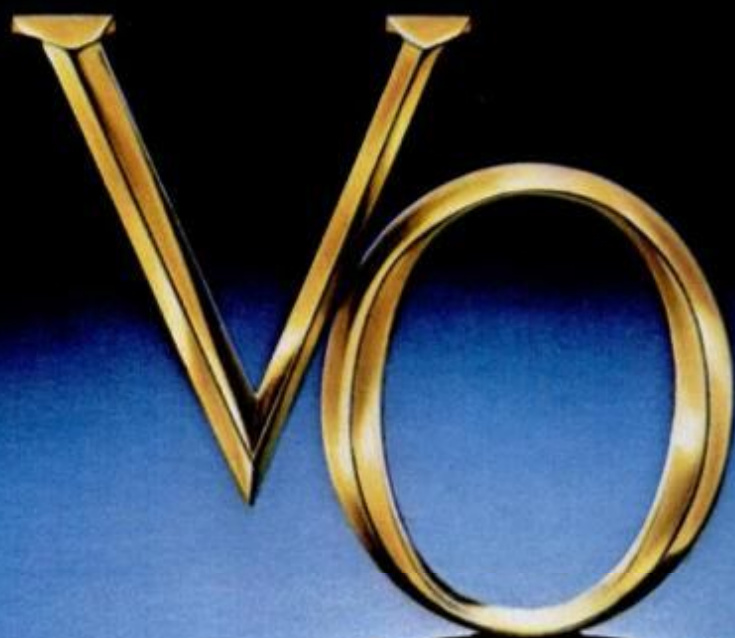
SERVICE TIPS

■ Word from Chevrolet about slight engine detonation is this: If setting the engine to specification doesn't eliminate ping, retard the ignition timing in 1° increments from the original spec. However, retarding the spark too much can adversely affect fuel economy, so you shouldn't set it any more than is necessary to get rid of spark knock, and never more than a maximum of 4° from specification. If the procedure works for one set of GM cars, it works for the others—maybe for engines made by other manufacturers, too.

■ Ford suggests testing the charging system whenever you replace a battery to make sure the alternator regulator isn't to blame for battery failure. A malfunctioning regulator causes a battery to overcharge, leading to plate buckling and eventual failure. With the new battery connected, test no-load voltage at the battery posts with the engine running at 1500 rpm and all electrical equipment turned off. If voltage is greater than 14.8 volts, replace the regulator, but test the new regulator also—just to be sure it's okay.

■ When you go to adjust the ignition timing of your 1978 AMC Matador with 360-cu.-in. engine, you may find that the distributor vacuum advance chamber hits the power steering pump bracket, preventing you from turning the distributor. If you can't turn the distributor, you can't adjust timing. What to do? Pull the distributor out of the engine and advance its drive gear one tooth. Reinstall the unit. Now you can time ignition as much as you like. **PM**

Dad always enjoyed your letters.
He'll especially enjoy these on Father's Day.



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.

THE PM GARAGE

CAPSULE REPORTS ON NEW AUTO PRODUCTS

Battery need a boost?

This charger not only revitalizes your battery, but can generate enough juice to start your car. When your battery gets too sluggish to spin the starter, just hook up the Mity Mite, switch to "motor start," and you'll be delivering 50 amps into



Special charger can put out 50 amps.

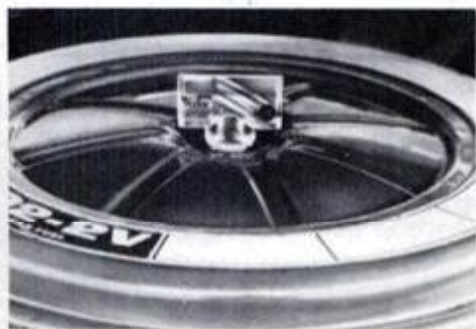
the battery. If your battery is completely dead, begin with a slower charging rate (10-30 amps) for 15-20 minutes before turning the charge up to 50 amps.

The Mity Mite Model WS 12-50 is not "automatic," and you can overcharge if you don't keep an eye on it. It does, however, have two circuit breakers to interrupt too-heavy current loads. Available in auto and department stores, the Mity Mite retails in the \$40 range. It's manufactured by Schumacher Electric Corp., 7474 North Rogers Ave., Chicago, Ill.—M.L.

Air filter peek-a-boo

The little gadget below is for those who forget to open the carburetor air cleaner to inspect the filter. The Filter Check, as it's called by Vexilar Inc., 9345 Penn Ave. S., Minneapolis, Minn. 55431, which markets the device, fits American and imported cars.

Easily installed in seconds, a clear plastic case houses a brightly colored ball indicator. When air is restricted because of a dirty filter, the



Tricky device tells condition of filter.

indicator ball rises. "Unit can be kept in use for an indefinite period," says Vexilar. About \$4 at auto-parts stores and service stations.—Mort Schultz

Allen wrench jackknife

For years I've looked for ways to hold all my Allen wrenches together. For a while, I used a rubber band. Later, I tried an aspirin bottle. Both broke, and I had Allen wrenches all over the bottom of my toolbox again.

I recently spied a fold-up hex key set. A clever idea, it's made by Eklind, 2255 West Logan Blvd., Chicago 60647. Sets come in three SAE sizes, two metric versions. My Eklind Model 91 has nine Allen wrenches



"Jackknife" holds Allen wrenches together, ranging from 5/64 through 1/4 inch. It costs \$2.89 at most tool stores.—M.L.

Carbon-monoxide detector

A leaky exhaust system can kill you. Body rust-outs compound the danger. Carbon monoxide has no odor, although auto-exhaust fumes usual-



Color change indicates high CO in car.

ly do. If you suspect that CO might be leaking into your car, van, camper, or boat, there's an easy, inexpensive way to tell.

Lifesign is a small, wafer-like detector that turns from tan to gray if there are harmful amounts of carbon monoxide in the air. The wafer's useful life is 30 days after unsealing.

They're \$2.50 each (postpaid) from General Scientific Equipment Co., Limekiln at Williams Ave., Philadelphia, Pa. 19150.—M.L.

Electronic ignition revisited

When electronic ignition kits first came out, I bought one—a Borg-Warner unit—and installed it in my 1967 Camaro (*How to Retrofit an Electronic Ignition Kit*, page 82, July '75). It's served me well all these years. Except for an early short, I've never had to service it nor make any adjustments.

That initial kit cost \$65, which, with inflation, translates to about \$90 today—fairly expensive. As they've gotten more popular, prices of electronic ignition kits have come down. There are now several on the market in the \$40-\$45 range, and we decided to give one of these less expensive kits a try.

It's a Zenith (no relation to Zenith Radio Corp.), and each unit costs \$41.88. Installation took me about an hour and required no special tools. The Zenith instruction manual turns out to be beautifully detailed and comprehensive. The Zenith ignition works by magnetic impulse instead of light-beam interruption.

Zenith electronic ignition kits are available at most car-parts chain stores. Or you can order an ignition kit directly from the manufacturer: Zenith Electronic Ignitions, Auburn Rd., Seneca Falls, N.Y. 13148.—M.L.



Ignition kit installs easily, operates on magnetic impulses instead of light beams.

Stop that annoying turntable rumble



Wild, growling noises from speakers can be quieted by taming a turntable's shakings and vibrations.

by Ivan Berger

Ever hear a public-address system ring or howl when the volume is turned up? That's acoustic feedback at work—and the same thing may be happening to your hi-fi or stereo system.

Acoustic feedback occurs when sound vibrations from speakers are picked up (by your turntable at home or by the microphone in a P.A. system, for example), amplified, and sent out through the speakers again, louder than they were at first. In extreme cases, it causes an identifiable howl—but even when you can't hear it directly, it can make your bass sound muddy.

But don't worry if you think you have this problem. It's easy to identify, and needn't cost much to cure.

How to recognize feedback

Unless you have old, vacuum-tube equipment that can pick up external vibrations, only your turntable can

cause feedback. Turn the system to "phono," put on a record (with the needle in the grooves but the turntable motor off), set your volume a little louder than you normally have it, and tap the edge of the record *gently* with your fingertip. If you hear a smart "thud" that instantly dies away,

you don't have feedback. If there's a slowly dying hum or howl after the thud stops, then you do have it.

Turning up the bass control will usually accentuate the problem; turning it down may make it go away. As a final check, lift the stylus gently from the record (use your system's cueing lift if it has one). The hum should go away as soon as the stylus rises from the record.

Curing it for free

You may have already spotted an easy cure for feedback in our diagnostic technique: Lower the bass level and feedback will lower, too. If your system has a low-filter control, try switching that in instead. Low



Audio Technica's audio insulator set goes under the turntable. Units have springs inside and rubber feet outside.

filters work on only the lowest bass tones (which don't occur often) and don't affect the whole bass region as bass controls do.

Subsonic filters probably won't do the job, because feedback usually occurs at higher, audible frequencies. In our system, in fact, a subsonic filter actually increased feedback sensitivity.

If your controls won't do the job, or can't do it without exacting too steep a price in reduced bass, you still have two more free, if increasingly arduous, solutions.

The first is to reverse the phase of *both* speaker connections, tying the wires now on the amplifier's positive

(Please turn to page 59)



If it's worth your time, it's worth True Temper.

Tubular steel handle
for strength, long life.

Power collar ring for
extra strength.

Rolled step puts
cutting power into the ground,
not your foot.

Thicker blade
lasts longer.

Blade tempered
for strength
and durability.

ALR ROCKET® SHOVEL

TRUE TEMPER

Материал, защищенный авторским правом

"I want the best taste
I can get.
I get it from Winston."

BOX: 19 mg. "tar", 1.3 mg. nicotine,
KING: 20 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.



Soft Pack or Box.



New ADC turntables have bases of two dissimilar substances; not only does this increase mass, it filters resonance. Sony's new cabinets use a nonresonant material and fluid-filled feet to dampen rumble. Kenwood uses a heavy base and highly damped rubber feet in its attempt to avoid turntable vibes.

STOP TURNTABLE RUMBLE

(Continued from page 56)

terminals to the negative and transferring the old negative wires to the positive terminals. This could set the system out of phase at the feedback frequencies. It might, however, only shift the feedback problem to a new frequency, where the system is now in phase... if it has any effect at all.

A more likely but more difficult cure is to move the speakers or the turntable. Bass, in most rooms, causes *standing waves*, alternating areas where bass is abnormally strong at certain frequencies and areas where it's weak. A turntable sitting in the peak of such a wave is

a sitting duck for feedback.

To find those standing wave areas, put on a record with a lot of bass. Turn your bass control up until you hear the bass go overwarm and mushy (a sign of incipient feedback howl). Then walk back and forth along the length and breadth of the room, listening for areas where the bass gets unexpectedly louder. If your turntable is sitting in such a zone, move it a few feet. If your turntable can't be moved, try moving the speakers.

There's one more easy cure to try before you begin spending money: remove your turntable's dust cover. Dust covers sometimes pick up sound vibrations.

Inexpensive cures

Fortunately, not all the solutions which cost money necessarily cost a lot. All solutions, though, take one or more of three approaches: increasing turntable mass, changing resonant frequency, or isolating the speaker and turntable from each other.

Since the turntable shelf, rather than the turntable, may be picking up speaker vibrations, it may help to lay a slab of marble or other heavy material under the turntable. This isn't a cure-all (what is?), so don't invest in a custom-cut slab of marble unless you're sure that the decorative effect alone will be worth the money to you.

You can also surround your turntable base with

hardwood planks or other weighty materials, working on the turntable housing instead of the shelf supporting it. Technics sells an obsidian base to support a few of its turntables.

The less obvious effect of increased mass is to lower the turntable system's resonant frequency. Shift it below the audible range, and audible feedback may disappear.

Isolation is the third area where you can undermine feedback problems. If the speaker doesn't shake the turntable, feedback can't occur. Short of moving the turntable to another room, you can't isolate it against airborne vibrations, but you can isolate those vibrations transmitted from speaker to turntable by your walls and floors.

Both spring and damping isolators are possible. Springs usually change the resonant frequency of the system. Each set of springs, new and original, will transmit vibrations at a certain frequency that is a function of both the spring and the weight it bears. But the set will absorb other frequencies. If you couple two systems with different resonances, the second will pass only those frequencies which the first system failed to block, so virtually no vibrations are transmitted.

Dampers absorb resonant energy, converting motion into heat. Some people find that this approach alone suffices. Speakerlab, for instance, recommends resting turntables and/or speakers on damping pads made from stick-down, foam-backed carpet material.

But others find that pads compress (especially if you put them under heavy speakers), and that springing is necessary.

Netronics makes two types of spring accessories. Their Acousti-Mount is a spring-mounted platform (available in two sizes) on which the turntable sits. Their Speaker Pods are round suspension platforms designed to be placed under the speakers' corners rather than the turntable's, reducing feedback, rattles and buzzes caused by wall shake.

Audio-Technica has similar-looking feet, but these are designed for use beneath the turntable. Each of their AT-605 Acoustic Isolators has a chrome housing, supported by a forest of small rubber projections. Centered in each chrome shell is a black, felt-topped platform mounted on a stiff spring for additional isolation from both transmitted vibration and lateral shocks.

New turntables fight feedback

If all cures fail with the turntable you have, a new turntable may help.

■ **More mass** is one way originally tried by Kenwood and now used by Optonica, Technics and others. Kenwood has several models whose bases are made of "ARCB," a compression-molded resin concrete made from limestone particles and powder, glass powder, and polyester resin. Kenwood claims this compound lowers resonant frequency by its mass and also damps vibrations under 1 kHz—the frequencies where feedback takes place. Optonica uses "Mikage granite stone," a granite/resin mixture.

■ **Changing resonance** is B.I.C.'s approach in their newest turntables called "V.I.A." (variable isolation adjustment). The spring suspension

(Please turn to page 62)

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Make this 'wrought iron' planter of aluminum

This planter of easy-to-bend aluminum is painted black to look like wrought iron. Cut A and side flange (detail X), bore hole near top and bend to form hook. Cut B and notch (detail Y), bend to form shelf support. Cut C scrolls. To shape, cut slot in end of a pipe, lock it in vise, insert tip of C in slot; bend.

Mark spot for supports B on A. Clamp parts and bore 1/8-in.-dia. holes to attach B to A; rivet with 1/8-in. short rivets. Clamp scrolls C in place on A, center punch, bore two 1/8-in.-dia. holes, attach with 1/4-in. medium rivets. Attach B to scroll at top of curve. Steel wool, clean, paint, install A to sash.—Curran Johnson

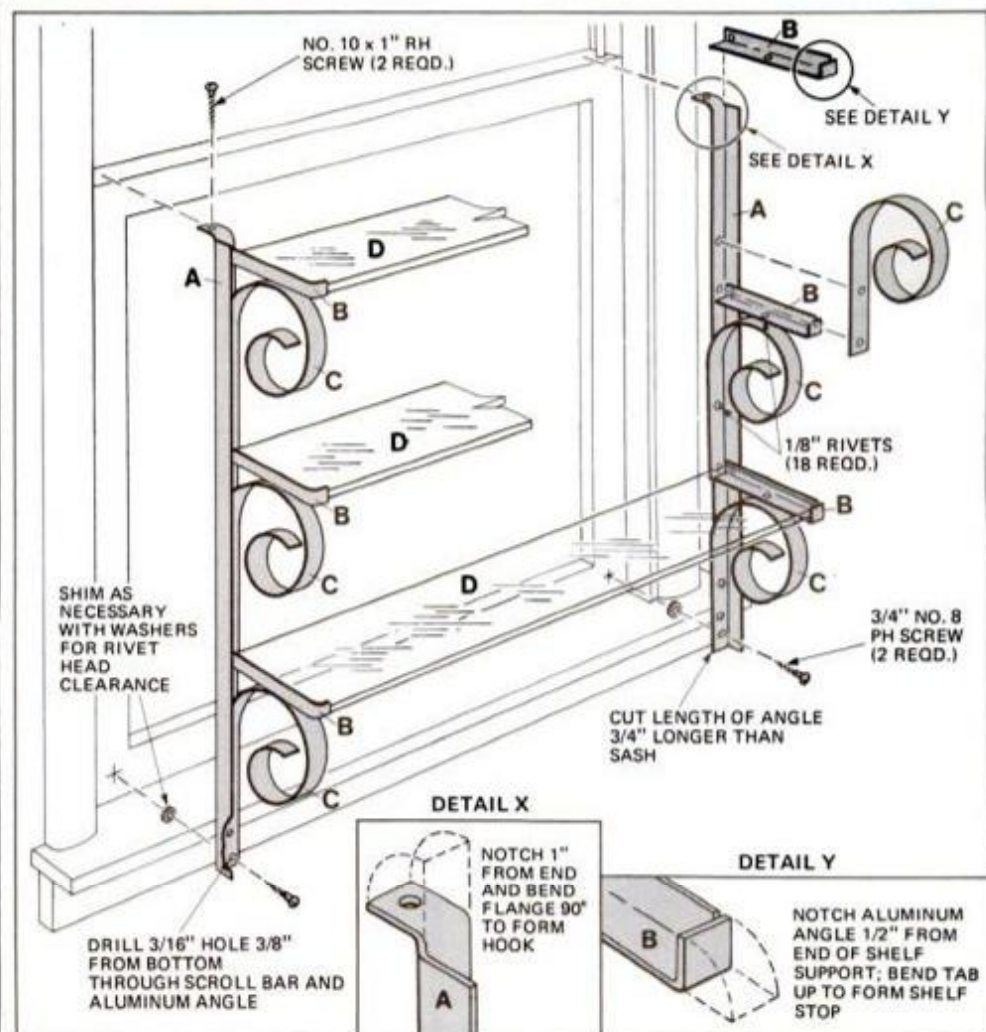
MATERIALS LIST—ALUMINUM PLANTER

Key	Pcs.	Size and description (use)
A	2	1/2 x 1/4 x 1/2 x 3/4" longer than lower sash aluminum angle (standard)
B	6	1/8 x 1/2 x 1/2 x 5 1/2" aluminum angle (shelf support)
C	6	1/2 x 3/4 x 24" aluminum bar (scroll)
D	3	1/4 x 5" x length to suit, plate glass

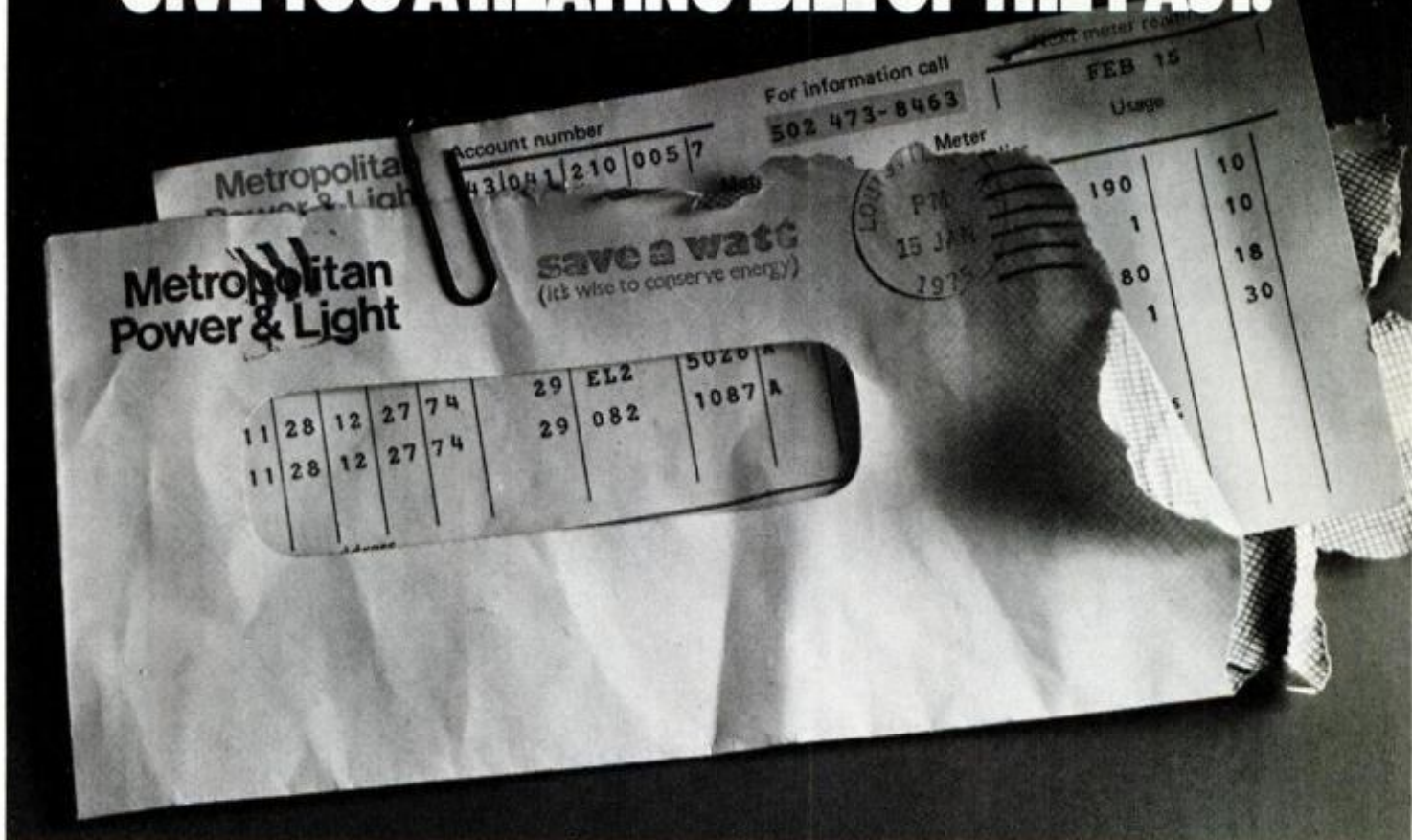
Misc.: 4 No. 10 x 1" rh screws/washer-shims; Bostik Pop Rivet-tool; 1/8"-dia. rivets—1/4" and 1/8" long; 3/0 steel wool; metal paint.



Planter (top) fits double-hung windows. Scroll, support are Pop-riveted (above).



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How does it work? By actually getting heat from cold air.

That's right. Even on most freezing winter days, the Weathertron heat pump extracts heat from the outdoors and transfers it indoors.

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In warm weather, the thermostat reverses the whole process, and the Weathertron cools, using the same

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No wonder the General Electric Climatuff™ compressor, the device that helps extract heat from the air, has been operating in over two million cooling as well as heating installations.

THE WEATHERTRON HEAT PUMP WILL MAKE YOUR ENERGY CRISIS LESS OF A CRISIS.

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The Weathertron heat pump from General Electric uses electricity and nature's heat to save you money on heating. That's why it could be one of the most important things you put in your home.

THE WEATHERTRON® HEAT PUMP AMERICA'S #1 SELLING HEAT PUMP.



GENERAL  ELECTRIC

STOP TURNTABLE RUMBLE

(Continued from page 59)

in these models consists of four leaf springs whose compliance—hence, resonant frequency—can be adjusted by a single knob.

An even more common approach among the latest turntables is to use two materials with different resonances in series.

The latest ADC and BSR Quanta turntables have bases molded in layers in two materials whose resonances differ.

Dual's anti-resonance system concentrates on the tonearm counterweight, which contains two filters—one tuned at the factory to the resonant frequency of the chassis, the other tunable by the user to attenuate the resonance of his particular cartridge.

Isolation is a very common approach, with special attention paid to damping, springing or both in many turntable designs. The Kenwood, for example, uses highly damped rubber feet to absorb vibrations. This also lowers the "Q" or sharpness of the system resonance—important, here, because the high mass of the ARCB base raises the system Q, making it more susceptible to vibration at resonance. Additional isolating cushions are built into the arm. Further damping is designed into the turntable mat.

Sony's new turntables have cabinets molded of a nonresonant, inorganic "Sony Bulk Molding Compound," mounted on fluid-filled feet for high damping.

■ **Floating suspensions** are used in many turntables. Here, the platter and tonearm rest on a separate sub-platform suspended below the top of the turntable base. Stromberg-Carlson used this approach years ago, Acoustic Research has been using it for about a decade, and it's used by Thorens, Pioneer, B.I.C. and many others now. The unique Oasis T-1 turntable, however, literally floats. Its two motors (wired out of phase, so their vibrations will cancel) drive an impeller at the bottom of a fluid bath. The turntable platter, with a similar impeller on its bottom side, floats in the fluid. Oasis claims this system isolates all external vibrations from the platter, as well as smoothing out minor motor-speed irregularities. The Oasis also comes on Audio-Technica feet.

You'll find this kind of attention to feedback problems in most new turntable designs. But then, with speakers and amplifiers in even modest systems that can shake walls, let alone turntables, the problem deserves attention. **PM**



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PHOTO HINTS

Tong-tied



Clip an ordinary spring clothespin to the side of a developing tray. It will provide support for print tongs so they won't fall into the tray.—*Ken Patterson*

'Reely' dry

In a hurry to use a wet film reel or tank? Dry it with a hand-held blow dryer at the coolest setting. Use only on metal equipment; plastic reels or tanks will distort or melt.—*Margaret Shauers*

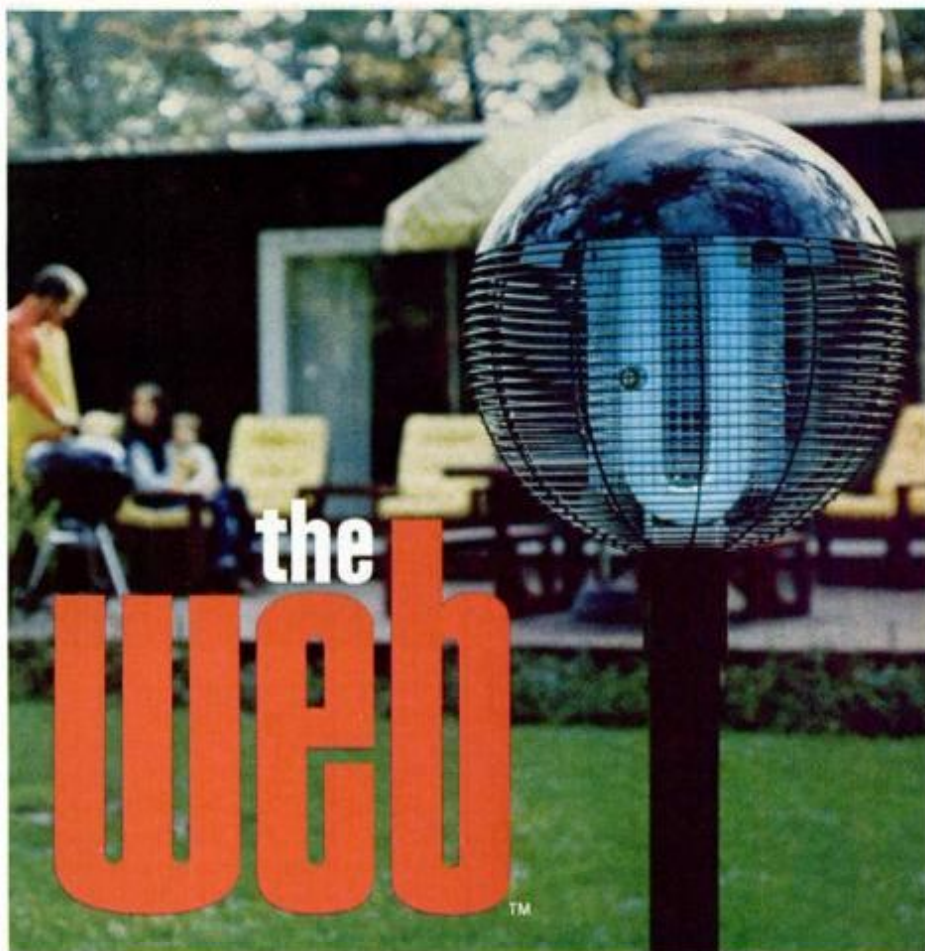
Using waterproof wrap



The black plastic-coated wrap found in photo paper boxes is waterproof. After the photo paper is used up, recycle the black paper by using it to protect counter surfaces where you mix chemicals or where spills are likely. Also use it in conjunction with a layer of absorbent newspaper.—*Rudy and Martha Schulze*

For rough going

Canvas gas-mask bags and metal ammunition boxes, available at military surplus stores, make excellent camera equipment cases. The gas-mask bags have sewn-in pockets for storage, and the ammo boxes have gaskets and clamps that make them water- and dust-proof. Line a box with foam for a custom fit.—*George C. Graham*



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IMPORTS & MOTORSPORTS

Earth Rover

In the showroom on Piccadilly, the Rover 3500 Saloon carries a list price of 6834 pounds (that's before adding Britain's special car tax and value added tax). The equivalent in American dollars is roughly \$14,000. This may sound like trivia, but later this year or early in 1980, it won't: Rover is re-entering the United States market. So, the price of the 3500 will be of real interest to anyone in the market for a sporty, luxurious five-door in this price class.

The Rover nameplate goes back to 1904, but most of us remember it for the respected 2000TC model of the

Rover 3500 will arrive in Jaguar Rover Triumph showrooms for 1980. Powerplant in the luxury hatchback is a 3.5-liter V8.



Unique instrument pod sits on 3500 dash.

late '60s; in fact, you still see some of them around. The odd jumble of angles and planes that marked the 2000 have given way to perfect harmony in the lines of the 3500.

We had the opportunity to drive a right-hand, home-market 3500, and watch the car being built in the new Solihull plant in the English Midlands. We found the car a strong performer, extremely comfortable and with a marvelous pod-and-module,

sci-fi ambiance in the cockpit—a space voyager out of 2001 would find it a natural for his Earth-based transportation.

When the Rover lands here (U.S. models are currently undergoing federal regulatory tests), it will be sold by the newly named Jaguar Rover Triumph organization (which also markets MGs).

Jet-lag Jags

In showrooms now are the new XJ6 and XJ12 Jaguars that we also drove in England earlier this year. If these smooth cars didn't have such good road manners, we might still be picking hedgerows out of our teeth: Driving with jet lag on the "wrong" side of the road is a real challenge.



Bigger taillights are among Jag changes.

Most welcome change on the sedans is a roof raising that results in more headroom and glass area—a boon for driver visibility. (Drivers of cars in the \$20,000-plus range seldom enjoy fiddling with carburetors and that was ended last year with the adoption of fuel injection.) Obvious on the Series III sedans are other external changes—at the grille and taillights, specifically. All the rest of the improvements are inside, where driver and passengers inhale only the aroma of fine leath-

ers, feel wood veneers and enjoy easy, switch-operated motoring.

Pleasures of old petrol pumps

There's a romance in antique gas pumps (the old prices per liter or gallon being only one of their appeals!), and some of the nicest I've seen are

at the Donington Collection of single-seater racing cars and Leyland Historic Vehicles near Derby, England. The brass on the pumps is highly polished and a sure clue to the absolutely immaculate and astounding exhibit of cars.

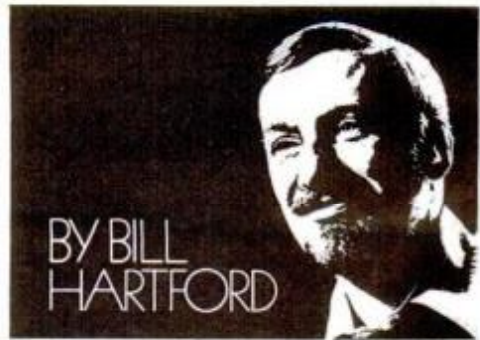
Rows and rows of famous Grand Prix cars are in the collection, along with the Leyland vehicles—an overwhelming assembly that begins with an 1876 Coventry Lever bicycle and includes almost every British vehicle made since then.

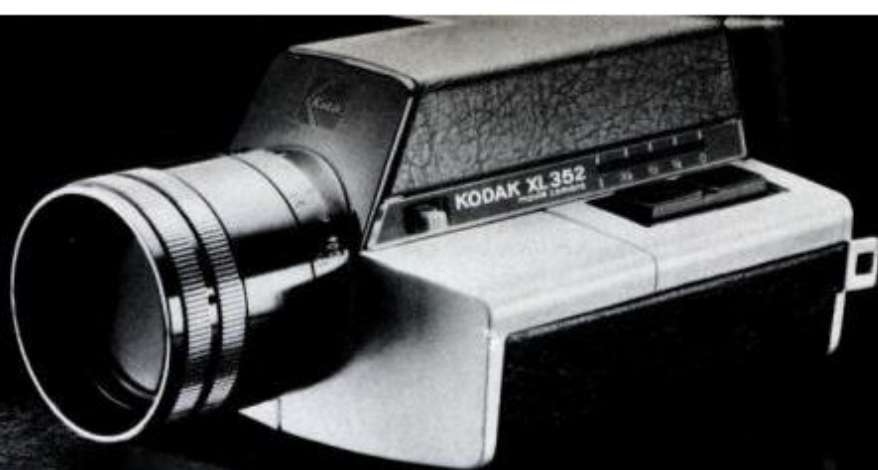
It was at Donington Park where Jaguar Rover Triumph put the top down on their new Triumph TR-7 convertible, but there will be more on that next month . . .

If old English pump were used gas would top \$1.50 per gal. **PM**



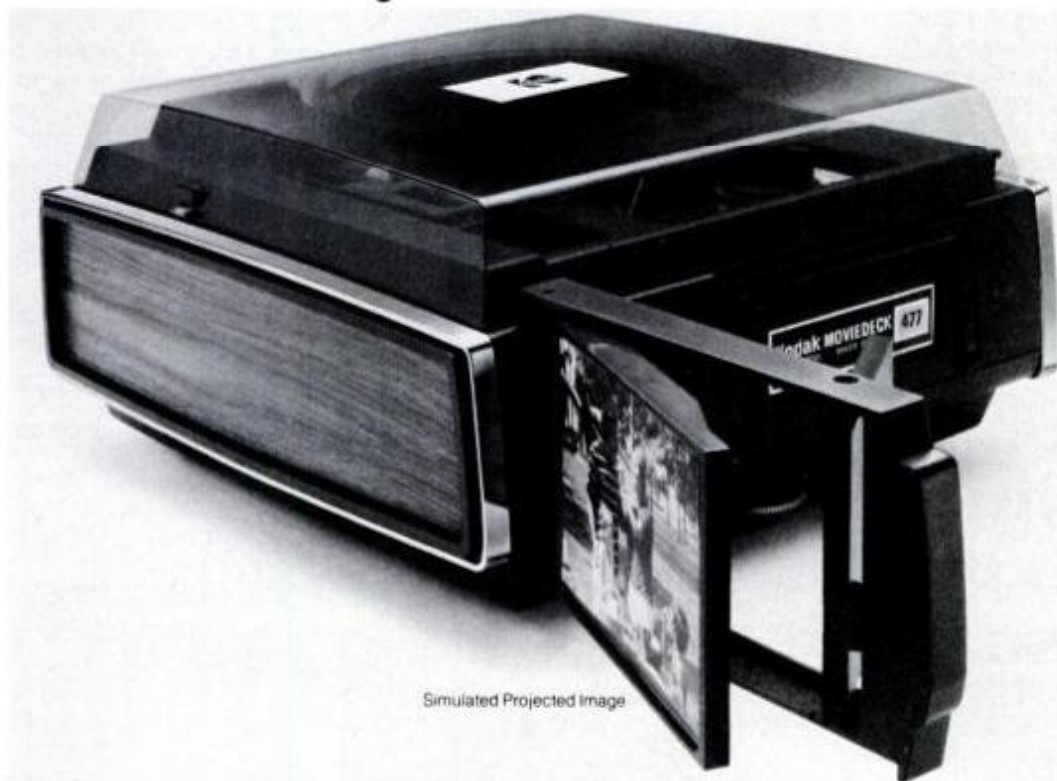
New roofline marks XJ6, XJ12 sedans.





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BY MICHAEL LAMM
WEST COAST EDITOR

An Ohio controller sums it up for most Spirit owners when he states, "I don't know how AMC can produce such a nice car and only have enough room in the back seat for a midget."

The majority of the 1000 Spirit owners we surveyed agree. They give the Spirit a strong vote of confidence as a basically fine automobile—good-looking, great-handling, economical, smooth-riding, and quite comfortable for two people.

But the cramped rear seat, they say, keeps the Spirit from giving total owner satisfaction—that plus a few much more minor bobbles.

"The rear seat lacks head and foot space," writes an Indiana foundryman, "but I realized that before I bought the car. With only two of us in the family, we never use the back seat anyway."

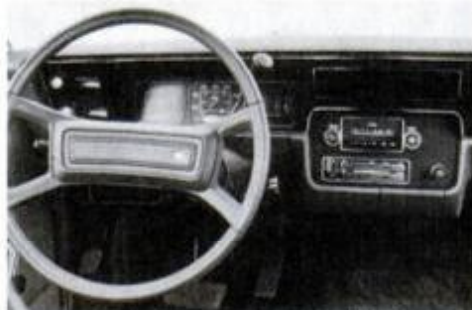
Spirit owners tend to be young—53.5 percent in our survey are under 30—and many are unmarried. Another goodly portion said they had small children, who fit fine in the rear seat. So even minimal rear seating didn't negate the car entirely.

The Spirit is one of those rare cars that still offers a wide choice of engines. The Volkswagen-supplied Four, two sizes of in-line Six, plus AMC's 304-c.i.d. V8 are all available. We were curious to find out how different owners felt about their



various engines' power and economy.

Relatively few owners opted for the V8—only 6.8 percent. "I really like the V8," purrs a North Carolina IRS clerk, "because I guess I like small cars with big



Up-option DL series makes digital clock, gauges and AM/FM standard equipment.

engines. But this car also comes with a strong, reliable front suspension, heavy-duty rear springs that don't bottom out on rough bumpy roads, and a solid feel when the wind blows. The heavy-duty rollbar and strut rods help handling and keep the front end in alignment."

"The V8 Spirit performs well, gets good gas mileage, and really handles and parks easily," says an Alabama worker.

And an Illinois trucker chimes in: "The V8-with-four-speed combination reminded me of the old days when we used to race around the streets—the car feels as peppy as our presmog cars did."

Four also lively

At the other end of the engine spectrum, owners of the Four (18.5 percent) said very nearly the same thing. "It runs very well; I like the looks and performance," reports a Rhode Island salesman. Four-cylinder Spirits with four-speed gearboxes outnumbered automatic-shift models almost two to one, and it seems drivers with manuals were happier with performance and fuel mileage. Overall, the Spirit Four tallied about five miles per gallon more than the V8.

Nearly three quarters of our respondents owned the six-cylinder versions though, principally the 258. Again, these drivers expressed satisfaction with economy and performance. Here, the majority had shown a distinct preference for

(Please turn to page 69)

A NATIONWIDE SURVEY BASED ON 795,733 OWNER-DRIVEN MILES

American Motors pulls off a styling coup at the expense of rear seating

Spirit offers a choice of four powerplants.

Spirit's clean styling rates high with owners.

Owners claim rear head and legroom nearly unusable.

Spirit borrows 96-inch wheelbase from previous AMC Gremlin.

AMX version sports heavy-duty suspension.

PM photos: Robert J. Lamm

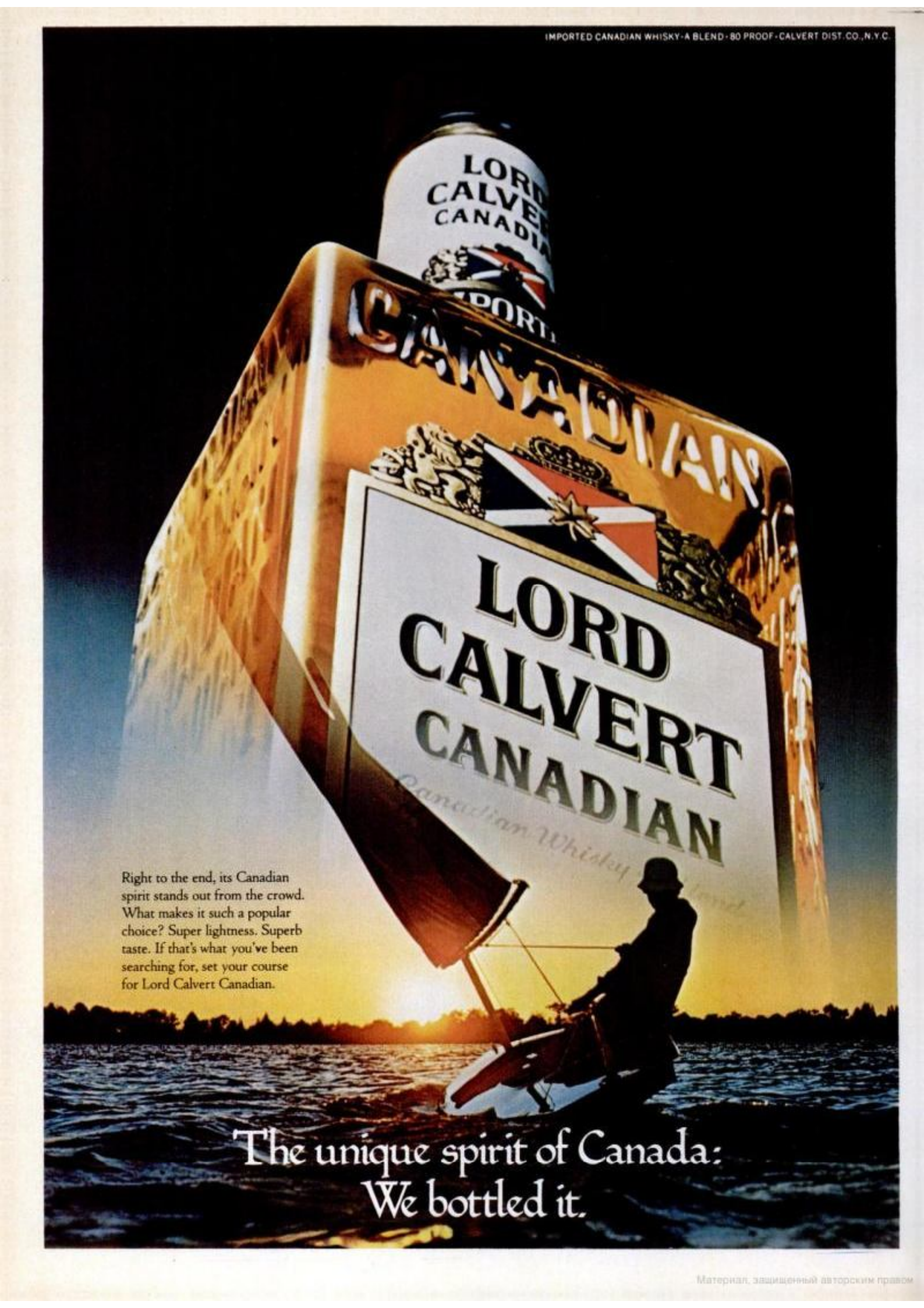
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KING, 16 mg. "tar", 1.1 mg. nicotine,
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The unique spirit of Canada:
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Huge rear window provides good visibility, but leaves the cargo deck exposed.

those having automatic transmission. A Michigan warehouseman who reportedly owns two AMC Matadors, in addition to his Spirit, remarks, "I trust American Motors, and the Six is a proven, reliable engine. AMC products have the fewest recalls in the industry. My Spirit is compact, yet in many ways it's a baby Cadillac."

And a Colorado high school student: "My 258-c.i.d. Spirit is powerful and fun to drive. I think it's the best car AMC puts out."

Over 75 percent of the Spirit owners we questioned rated the car's workmanship good to excellent. That's a very solid endorsement. A Texas dental assistant praises, "Compared with other small cars, quality is the best I've seen, and I'm satisfied." And an Ohio gas-line operator adds, "So far everything is perfect."

Even so, about half our owners reported they'd run into mechanical problems that necessitated visits to the dealer soon after purchase. None was considered especially serious, however (see data panel, below). Dealer service got good grades generally, with 61.8 percent rating it good to excellent. However, in fairness, a vocal minority (13.1 percent) gave service a rating of poor. "The dealer

always seems too busy to bother with me," grumbles a California service clerk.

When we asked for specific praises of the Spirit, owners often waxed enthusiastic. "It's comfortable—nice and quiet," notes a Wisconsin retailer. A happy California painter adds: "My DL Spirit drives and handles extremely well. I love such interior features as the digital clock, hatch pushbutton latch, and comfortable velour seats; also the car's good looks."

An Ohio quality-control inspector says,



Seats fold, yet some owners grumbled that space-saver spare cuts into space.

"The Spirit is very well put together. Its size, performance, handling, and dependability are just fantastic!"

A North Carolina realty man: "I sold my 1974 Corvette and replaced it with this Spirit. It's a great car—drives beautifully, with an excellent ride. My biggest complaint is that it took eight weeks to deliver."

According to an Illinois machinist: "I like the Spirit's styling. It's a beautiful, sleek small car. It handles beautifully, is quiet, comfortable, and rides like a dream... like a small Cadillac. I couldn't ask for a

better car. Seriously, I love it."

We also asked owners to list suggestions for making the Spirit better—things they'd like to see changed. Here are some representative responses.

A Wisconsin teacher recommends, "They should definitely change the spare tire location. It takes up too much space in the cargo area." An Ohio retiree adds, "I had no use for that toy spare tire, so I bought a conventional full-sized wheel and tire. But the company won't take back the Mickey Mouse spare."

A Michigan health worker: "The rear side windows should be larger and should open outward for ventilation."

Summing up, the Spirit garnered much praise and high marks from most owners. Flaws tended to be minor, the most obvious being too little passenger space in the back seat. Many drivers didn't consider even that much of a drawback, and their complaints focused on other, more personal peevs.

For example, an Ohio factory worker wrote: "My Spirit is perfect so far. The only thing that irritates me is the glove box knob. Instead of popping open, you have to grip the knob, twist, and pull."

Since most owners were young and expected the size of their families to grow by the time they got ready to buy another car, some 33 percent said they probably wouldn't go for a Spirit again the next time. "But I intend to drive this one for about five years," announces a Michigan art instructor, "and if there's an AMC car out then that's comparable to the Spirit, but roomier, I'll certainly order one."

And finally, a North Carolina salesman sums up, "I'll certainly consider another Spirit, but I believe my next car will be a Concord for the additional room. In my opinion, the Spirit and Concord are the finest cars on the market that money can buy!"

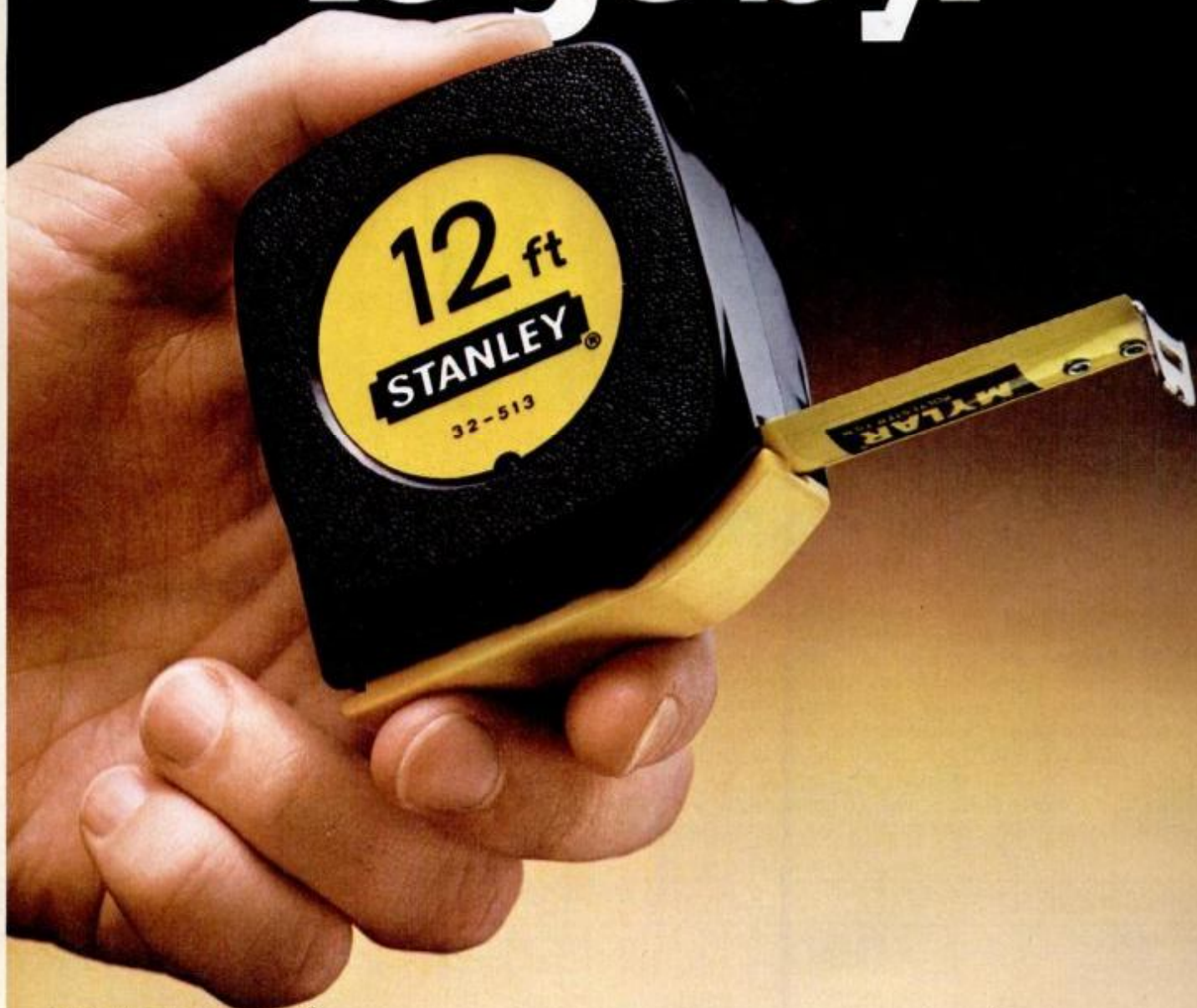
PM

SUMMARY OF 1979 AMC SPIRIT OWNERS REPORTS *

<p>Total miles driven 795,733</p> <p>Average miles per gallon: 121-cu.-in. Four (not EPA rated)</p> <p>In town 20.4 Long trips 25.7</p> <p>232-cu.-in. Six (EPA 18 manual; 19 auto)</p> <p>In town 17.9 Long trips 22.5</p> <p>258-cu.-in. Six (EPA 17 manual; 17 auto)</p> <p>In town 16.8 Long trips 21.9</p> <p>304-cu.-in. V8 (EPA 13 manual; 15 auto)</p> <p>In town 14.7 Long trips 20.0</p> <p>Engine choices:</p> <p>121-cu.-in. Four 18.5% 232-cu.-in. Six 31.2 258-cu.-in. Six 43.4 304-cu.-in. V8 6.8</p> <p>Transmission choices:</p> <p>Automatic 3-speed 68.4% Manual 4-speed 28.8 Manual 3-speed 2.8</p>	<p>Body style choices:</p> <p>3-door hatchback 98.1% 2-door sedan 1.9</p> <p>Series choices:</p> <p>Base Spirit 14.6% Spirit DL 66.0 Spirit Limited 19.3</p> <p>Why did you choose the Spirit?</p> <p>Styling 59.7% Economy of operation 20.4 Price 19.4 Size 17.1 Handling 14.8</p> <p>Specific likes:</p> <p>Styling 50.7% Handling 50.2 Economy 26.8 Comfort 25.9 Ride 19.0</p> <p>Specific dislikes:</p> <p>No complaints 14.9% Gas mileage lower than expected 13.4 Not enough room 10.4 Seat shape obstructs vision 9.4 Too little rear legroom 8.4</p>	<p>What changes would you like?</p> <p>No changes 14.6% Different seat shape/size 12.2 More rear legroom 11.2 More interior spaciousness 10.7 More headroom 9.8</p> <p>Workmanship opinion:</p> <p>Excellent 33.5% Good 41.7 Average 15.6 Fair 4.1 Poor 5.0</p> <p>Comfort opinion (front seats):</p> <p>Excellent 48.6% Very good 29.8 Good 17.4 Fair 2.8 Poor 1.4</p> <p>Comfort opinion (rear seats):</p> <p>Excellent 2.0% Very good 4.5 Good 17.2 Fair 28.3 Poor 48.0</p> <p>Had any mechanical trouble?</p> <p>Yes 50.2% No 49.8</p>	<p>What type of trouble?</p> <p>Electrical 16.7% Heater 13.9 Cold starts 13.0 Carburetor 12.0 Oil leaks 7.4</p> <p>Dealer repairs satisfactory?</p> <p>Yes 70.4% No 29.6</p> <p>Dealer service opinion:</p> <p>Excellent 36.1% Good 25.7 Average 15.2 Fair 9.9 Poor 13.1</p> <p>Number of vehicles owned:</p> <p>Spirit only 45.1% Two cars 40.5 Three cars 9.8 Four or more cars 4.7</p> <p>Age distribution of owners:</p> <p>15-29 years 53.5% 30-49 years 26.0 50-plus 20.4</p> <p>Would you buy another AMC Spirit?</p> <p>Yes 66.3% No 33.7</p>
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*Percentages might not equal 100% due to rounding or insufficient data.

Good rules to go by.



LEVERLOCK[®] The new easy-to-handle rule that locks in place wherever you set it. So measuring's easier than ever. Just release the lever to lock it. Squeeze again to release it. That's all it takes to zip the tape back into its case.

The 3/4" wide yellow blade, with easy to read numbers, is

protected with DuPont Mylar[®] for longer life. And the Tru-Zero end hook lets you measure accurately, plus draw circles and arcs. Stanley's new Leverlock. The lever-action rule in 12' and 16' lengths.



THE
TOOLS THAT
HELPED BUILD
THE OLYMPICS

STANLEY[®]
helps you do things right.[™]

PM WORKBENCH

PM EXAMINES PRODUCTS & SERVICES

Lightning book

Your youngsters will think it's magic—not a lesson about static electricity. Turn on a water tap so it makes a slow stream. Then rub a comb on your sleeve and hold it near the water. The water will "bend" toward the comb. If electricity is strong, and the gap isn't too wide between comb and water, a spark may jump between them. It's lightning on a small scale. To teach children about lightning, the National Weather Service offers a booklet that explains what thunder is and how lightning is formed and includes experiments that illustrate static electricity.

To obtain your copy of *Owlie Skywarn's Lightning Book*, send 80 cents to the Consumer Information Center, Dept. 196, Pueblo, Colo. 81009.—H.W.

Hooked on a hook

At last there is a coat hook for hollow doors and walls. This version, manufactured by Plasplugs Inc., 65 Montauk Hwy., Box 265, East Hampton, N.Y. 11937, comes with its own fastener built right in. It is a one-piece, all-nylon construction en-



Plug is pushed firmly into 5/16-in. hole.



As screw is turned, plug inside expands.

gineered to hold up to 50 lbs. Adhesives are eliminated; just bore a 5/16-in. hole where you want hook and turn the device home. Available in brown, white, black, yellow and red at hardware stores and home centers for the price of 79 cents per hook.—R. Capotosto

Porcelain touch-up kit

Now you can repair blemishes on any porcelain surface—bathtub, sink, range. With this easy-to-use kit, minor nicks and scratches are made almost invisible in minutes. Touch-Up Kit has 15 cc of specially formulated porcelain enamel in nine



Touch-Up kit is available in nine colors.

colors that closely match original shades—white, off-white, blue, pink, yellow, beige, gold, avocado and copper-tone. Each kit is \$3.33 postpaid from K.I.T. Industries, Dept. PM, Burlington Ave. and Cooper St., Delanco, N.J. 08075.—R. Capotosto

Coating inhibits rust

Cold Galvanizing Spray is a zinc-rich primer for iron and steel that inhibits rust and corrosion. It dries to the touch in half an hour, and a



New one from Krylon is a rust fighter.

top coating can be put on. It's sold in pint cans, 12 to the case. For nearest dealer, write Krylon Products, Consumer Products Div., Borden Chemical, 180 East Broad St., Columbus, Ohio 43215.—H.W.

Pen-point gluing

When the type font (ball) on the IBM Selectric Composer in PM's art department lost a tooth, we took the opportunity to test a new glue. The pen-shaped dispenser enabled us to place a small drop of glue exactly where we wanted it. The bond, which began to set after several sec-



Hold dispenser like a pen (above). Squeeze nipple to start glue flow. Keep glue off fingers. Use tweezer (below) to hold pieces for gluing.

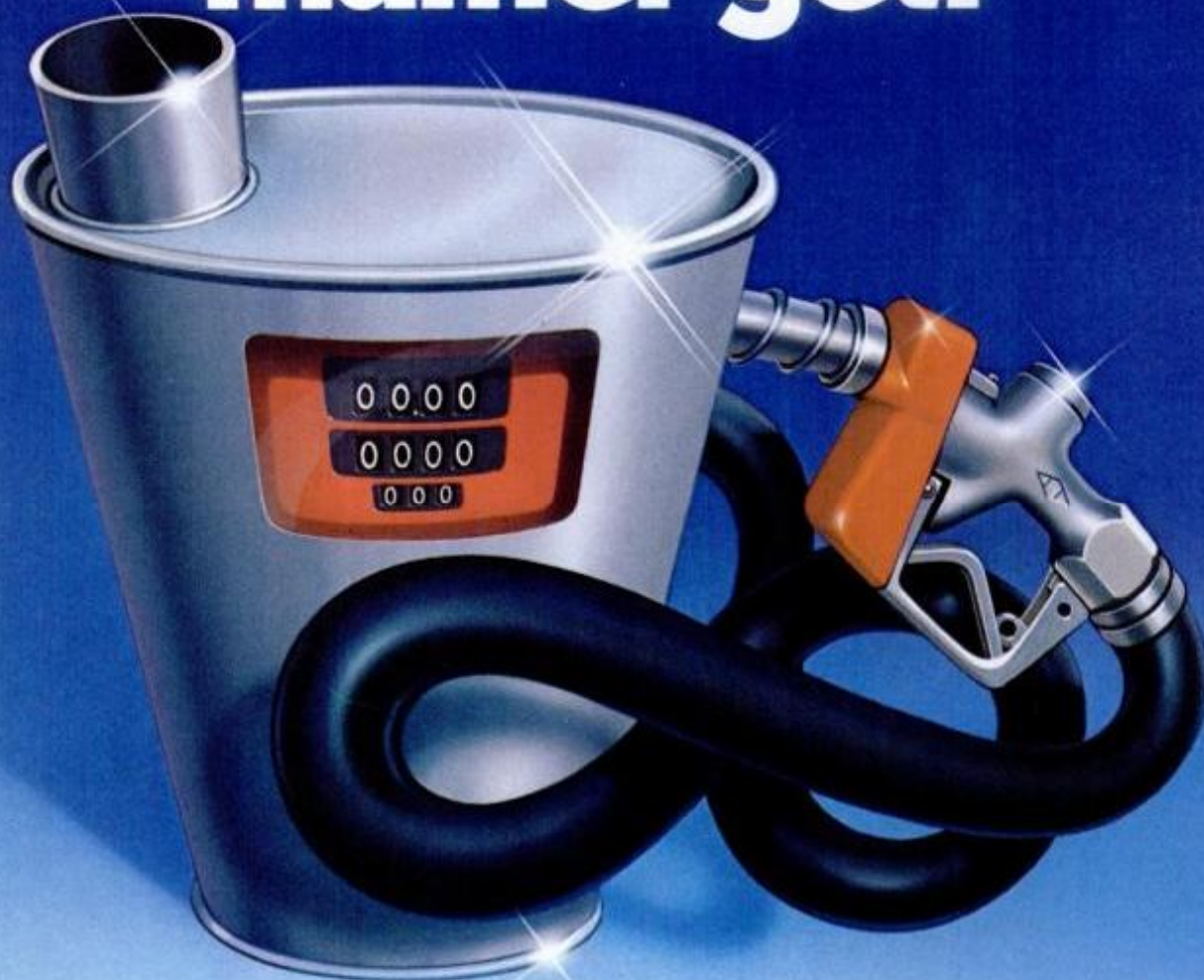


onds, has held for two months under daily use.

Gluematic Pen contains a cyanoacrylate glue and is recommended for nonporous surfaces—but not for glass, pottery or fingers. It's \$4.39 from Woodhill Permatex, a Loctite Corp. subsidiary, 18731 Cranwood Pkwy., Cleveland, Ohio 44128.—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.

How many mpg does your muffler get?

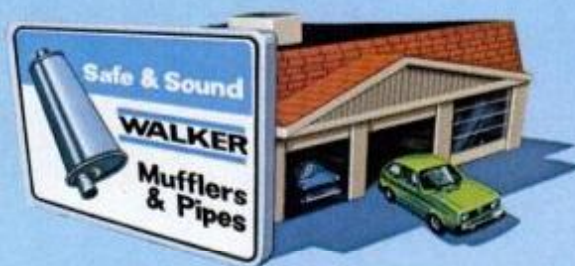


A strange question? Not at all. Because your muffler can have an effect on gas mileage.

Take a Walker muffler. Over the years, it helps your engine run efficiently ...which means you get the most for your gasoline dollars.

Why? Because Walker designs exhaust systems specifically for each individual car—over 2,300 different systems. A Walker system helps your car perform at its best. No wonder Walker is the world's best-selling muffler.

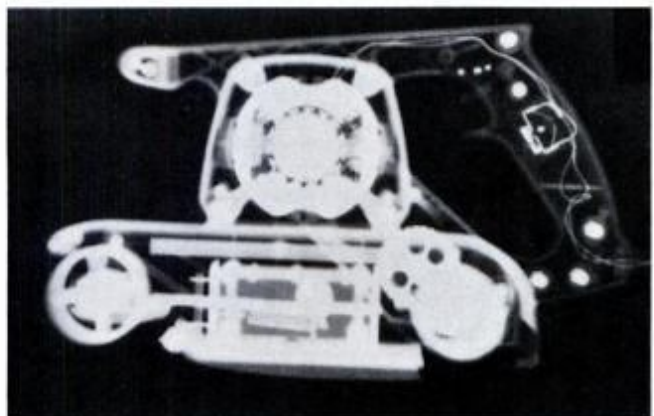
Just look for the Walker sign ...at service stations and garages everywhere. Or look in the Yellow Pages under "Mufflers!"



**Get a Walker muffler. A sound investment
for your gasoline dollars.**

WALKER
Walker Manufacturing
Division of Tenneco Automotive
1201 Michigan Blvd
Racine, Wis. 53402





PM's Whatsit

It took considerable equipment and expertise to produce the seemingly complicated graphic you see here. The moral: An inside look at something commonplace may be bewildering. If you still are—bewildered—turn to the next page.



Will Rogers.

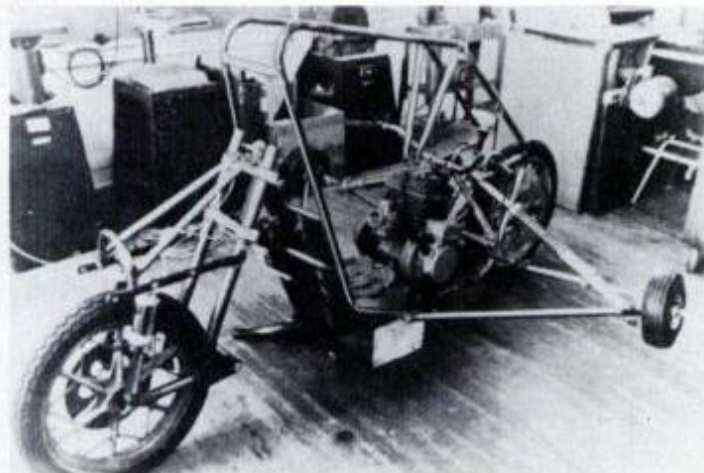
Native son's centennial

Much has already been made of centennial celebrations in 1979—the major honors going for the births, respectively, of Albert Einstein and Thomas Alva Edison's incandescent light bulb. We have a feeling that PM readers might also want to recall Will Rogers (born Nov. 4, 1879) who, as they say, "would have been 100 this year."

Our appreciation of Rogers covers too vast a territory for listing here, but includes his passion for and public endorsement of the machine in which he ultimately rode to his death—the airplane. He understood not only the pure thrill of flight but the follies to which it would be subject under the auspices of mankind.

"Claremore, Okla.," Rogers once noted of his hometown, "is just waiting for a high tension line so they can go ahead with locating an airport."

Going nowhere.



Sundance kid.



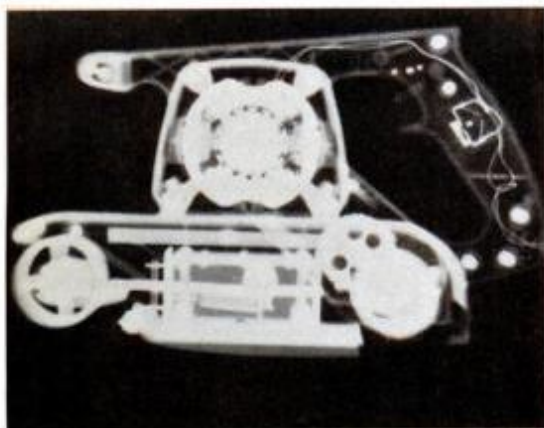
Motorcycles: from the sublime to the ridiculous

Evel Knievel may someday pass on into the stratosphere but man will never stop experimenting with two-wheeled vehicles. Here's this month's evidence: Californian Jeff Dunan took a moped frame, put a bucket seat on it and powers it by a 1.5-hp electric motor energized by batteries and a solar cell system; a production version may hit 55 mph, sell for \$2200. Your atypical English shepherd is Jimmy Ogston, who bounds over the Oxfordshire moors keeping track of 800 sheep and 1600 lambs by himself on a Suzuki. Finally, the "training wheel" apparatus shown here is an experimental bike with rear-wheel steering, developed (for over \$120,000) by the National Traffic Safety Administration. It is unrideable.



Wild and woolly.

IPM BRIEFS



Whatsit revealed

This X-ray picture—radiograph—of a common belt sander was considered such a pleasing example of the art that it was one of 12 comprising a calendar distributed to radiologists and industrial radiographers by Eastman Kodak Co. The faint trigger spring and copper core of wires leading up through the pistol grip should have tipped you that this was a power tool.

Helorigible? Blopter?

It may be with us before we know what to call it, but Goodyear Aerospace Corp. proposes that a lighter-than-air ship with helicopter propellers could lift as much as 160 tons of payload. The concept has been suggested for a variety of applications ranging from fighting forest fires to transporting heavy construction equipment. In keeping with the present employment of Goodyear airships, it has also been suggested that the new hybrid could make for more evenly matched World Series games by orbiting the stadium and turning on the rotors to shrink grand-slam homers back into infield pops up if the team at bat has too big a lead.



The nostalgia of 1919

In preparing the article in this issue on the epic transatlantic flights of 60 years ago, PM's editors made good use of one primary source: *Popular Mechanics* of 1919. Aside from the "live" coverage of the great aviation events, we were bemused and often distracted by the ads of the day. Flying schools and Marconi "wireless" training courses were the hot career paths then, as the article points out. But auto repair subjects, even "vulcanizing tires at home," didn't take a back seat.

Many concerns of Americans were the same as they are today. In the wake of a great war, getting the economy in order was paramount. The escalating cost of living drew attention from every quarter. Businessmen were fast learning how to turn a buck, though—the ad for scale-model plans of the NC-4 aircraft reproduced here was in print a scant two months after the original plane was commissioned. At only 50 cents, the plans probably sold out the first lot in no time. And if prices are the ultimate nostalgia item, try these from 60 years ago: All the precut lumber in a "kit" for building a five-room house—\$540. Or, our favorite, all-worsted blue serge pants, a "\$6.50 value," for \$1.65 postpaid from the reliable Tailoring Co. of Chicago. Those were the days . . .



Build and Fly a Model of the NC-4

This new "IDEAL" Model Aeroplane is a dandy—the celebrated Naval-Curtis Seaplane, first to cross the Atlantic Ocean—a strictly American plane every American boy will want to build. 4 1/2 feet across the planes and a true, scale-model duplicate of the real NC-4. Guaranteed to rise from the water and make a perfect flight under its own power. Get a set of "IDEAL" Accurate Scale Plans, including Building and Flying Instructions, and build this wonderful Model Aeroplane right away.

Plans and Instructions for Building
a 4 1/2 Foot Model NC-4 . . . 50c

Other Plans and Instructions at
following prices, all sent postpaid:

De Havilland Battle Plane, 35c

Curtis Military Tractor . . . 25c | Blériot Monoplane . . . 25c
Nieuport Monoplane . . . 25c | Taube Monoplane . . . 25c
Cecil Peuli Racer—Official Record Holder . . . 25c

IDEAL Model Aeroplane Construction Outfits containing all parts and materials needed to build these Model Aeroplanes, are sold by Leading Toy, Sporting Goods and Department Stores. Ask for them at your store.

"IDEAL" Model Aeroplane Catalog, 48 pages, 5c postpaid

Ideal Aeroplane & Supply Company
Established in 1911

159 Wooster St., Cor. W. Houston St., NEW YORK CITY

Relax, the government is doing its best to curb this creeping inflation

The new dollar coin bearing the likeness of Susan B. Anthony, due out next month, will cost only 3 cents to produce—as opposed to 8 cents for the Eisenhower dollar.

Don't forget to call the baton-twirler a 'majorist'

In describing its new dollar coin the Treasury Department refers to Susan B. Anthony, former suffragette, as a "suffragist"—another great step forward in desexualizing the English language.

Come fly with me.

In the 1979 Thunderbird T-Roof convertible.

Now when you fly your own Thunderbird, you can enjoy the open-air feeling of a convertible. It's the new Thunderbird T-Roof, the ultimate touch of sportiness in the legendary Thunderbird.

And you can add to your driving fun with a choice of over 70 options, including AM/FM stereo radio/cassette player, extended range fuel tank and new seatbelt warning chime. Test-fly the new Thunderbird T-Roof. It's a rarified experience.



THUNDERBIRD

FORD DIVISION



Come to Marlboro Country.

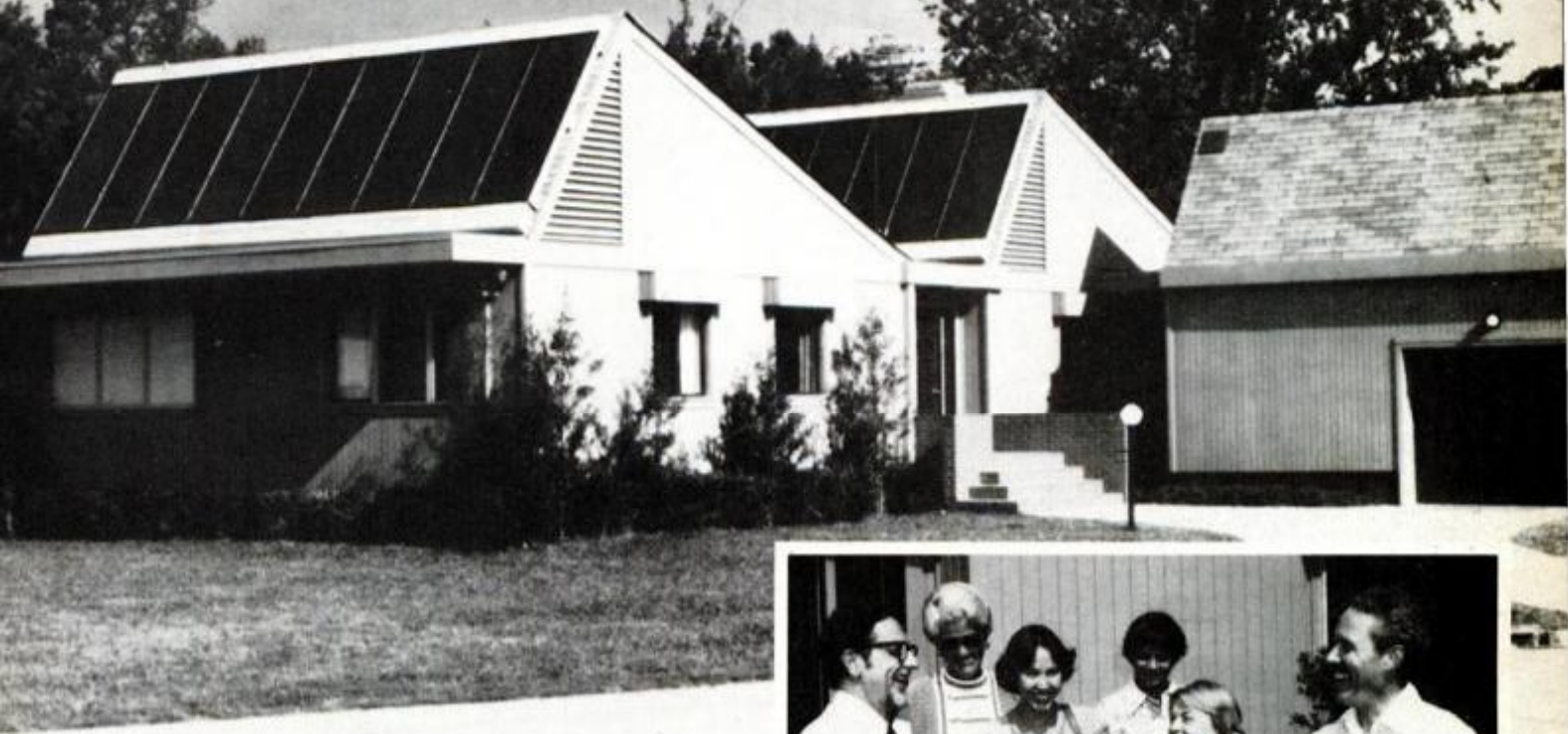
Famous Marlboro Red and Marlboro Lights—
either way you get a lot to like.



Lights: 12 mg "tar," 0.8 mg nicotine — Kings: 17 mg "tar,"
1.0 mg nicotine av. per cigarette, FTC Report May '78

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

'Our year in NASA's far-out house'



How one family saved \$100 a month in energy costs while living with a watchful computer.

by Hans Fantel

At first glance, the house seems out of place. It nestles into military rows of labs and offices, where researchers speak calculus and figure how technology can change your life. It's the only house at NASA's Langley Research Center in Hampton, Va. Its property borders a field sprouting solar collectors under test. Neil Armstrong, first man to walk on the moon a decade ago, practiced lunar module landings from a high structure nearby that is now used to drop airplanes to test them for crash-worthiness.

But on closer examination, the house fits. It's as much of an experiment as dozens of other NASA projects now underway in neighboring buildings, an experiment in energy

A NASA official hands Dr. Charles Swain the key to Tech House to begin year-long test. Hampton, Va., mayor (in sunglasses) was there to greet family.



conservation and the application of space technology to down-to-Earth needs.

The key experimenters, however, weren't NASA technicians. They were Dr. Charles W. Swain, a tall, tweedy professor of religion, and his family.

Soon after they had moved into the futuristic house that NASA built, Swain, his wife and two children found a few bugs—in the computer. But they stayed, as pioneers. They learned to like the sometimes confused computer. And they en-

joyed the energy-cost savings—between \$100 and \$125 a month—that more than paid their modest \$100-a-month rent. The Swains' stay at "Tech House" proved a point for the National Aeronautics and Space Administration: Putting space technology to work in home construction can save more than half the energy an average family uses in a conventional all-electric house.

I wondered out loud why NASA had picked a professor of religion rather than an engineer for its experiment. But Swain saw nothing

odd about that. "Religion—both western and eastern—deals with man's relation to the world," he said. "Naturally, this relates to one of the main aspects of ecology—man's depletion of our planet. Energy-efficient living has become a necessary condition of future survival. And that's a proper religious and philosophical concern."

Beyond the philosophy, the fact is NASA didn't want an engineer living in the house. "That was the

point of the experiment," Swain said, "to see if an average middle-class family—people who weren't scientific or technical—could live in this house and save energy."

The lure of 'space stuff'

Was it hard to persuade the family to join in the experiment?

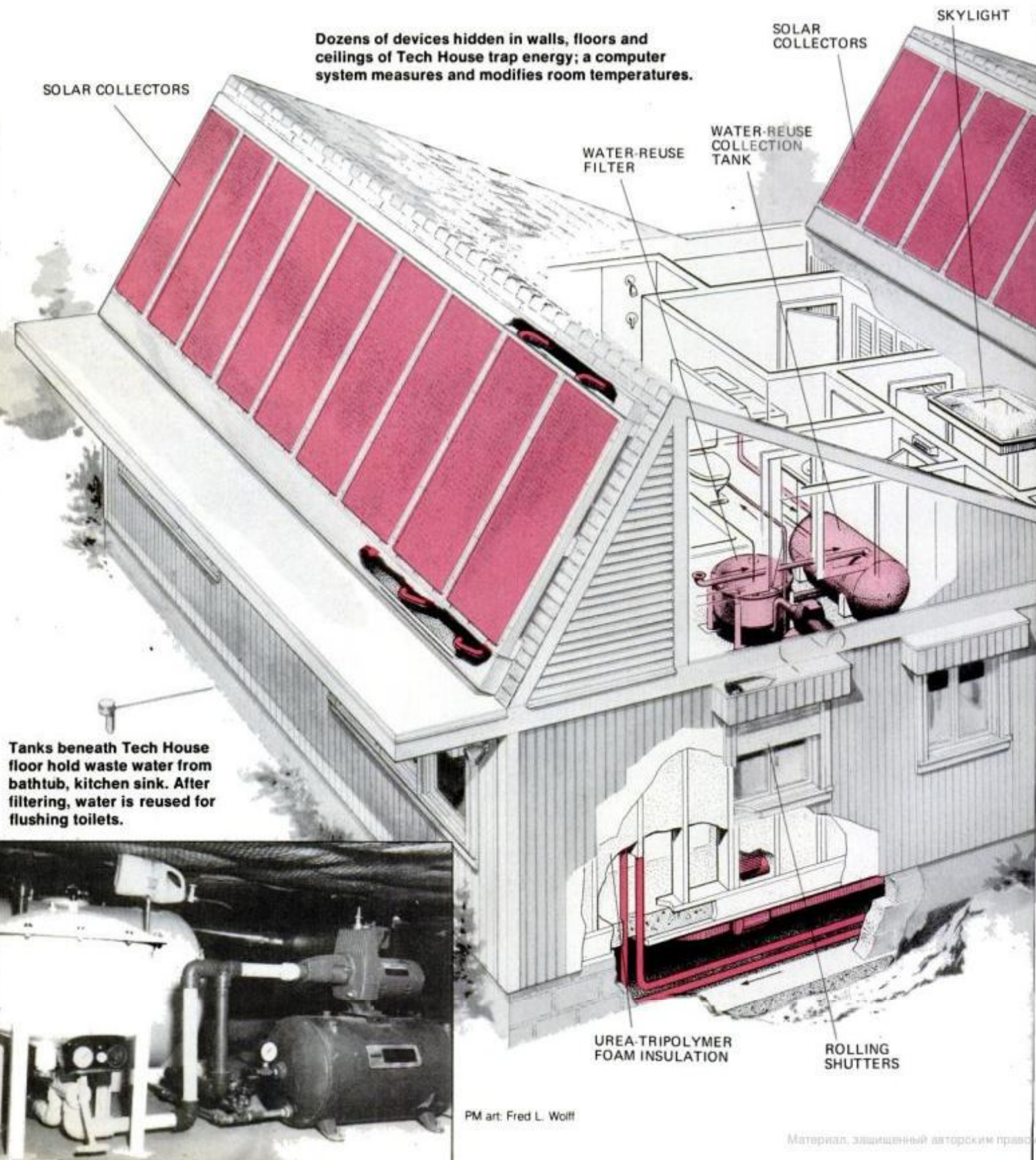
"Not really," says Swain. "My boy, Chuck, is 13, and he was all excited to be right in there with all that space stuff. It wasn't so easy for my

wife, Elaine, who had to switch jobs to make the move with me. But she and my daughter, Carol, feel the same way I do about the ecological problem. So they were proud to be part of our venture."

The family nearly lost its enthusiasm, however, after moving in.

"The first month was a disaster," Swain says.

Much of the trouble came from the elegant data-acquisition computer system based in the garage. The



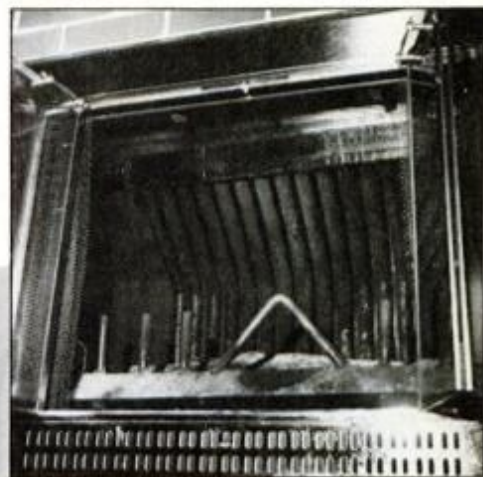
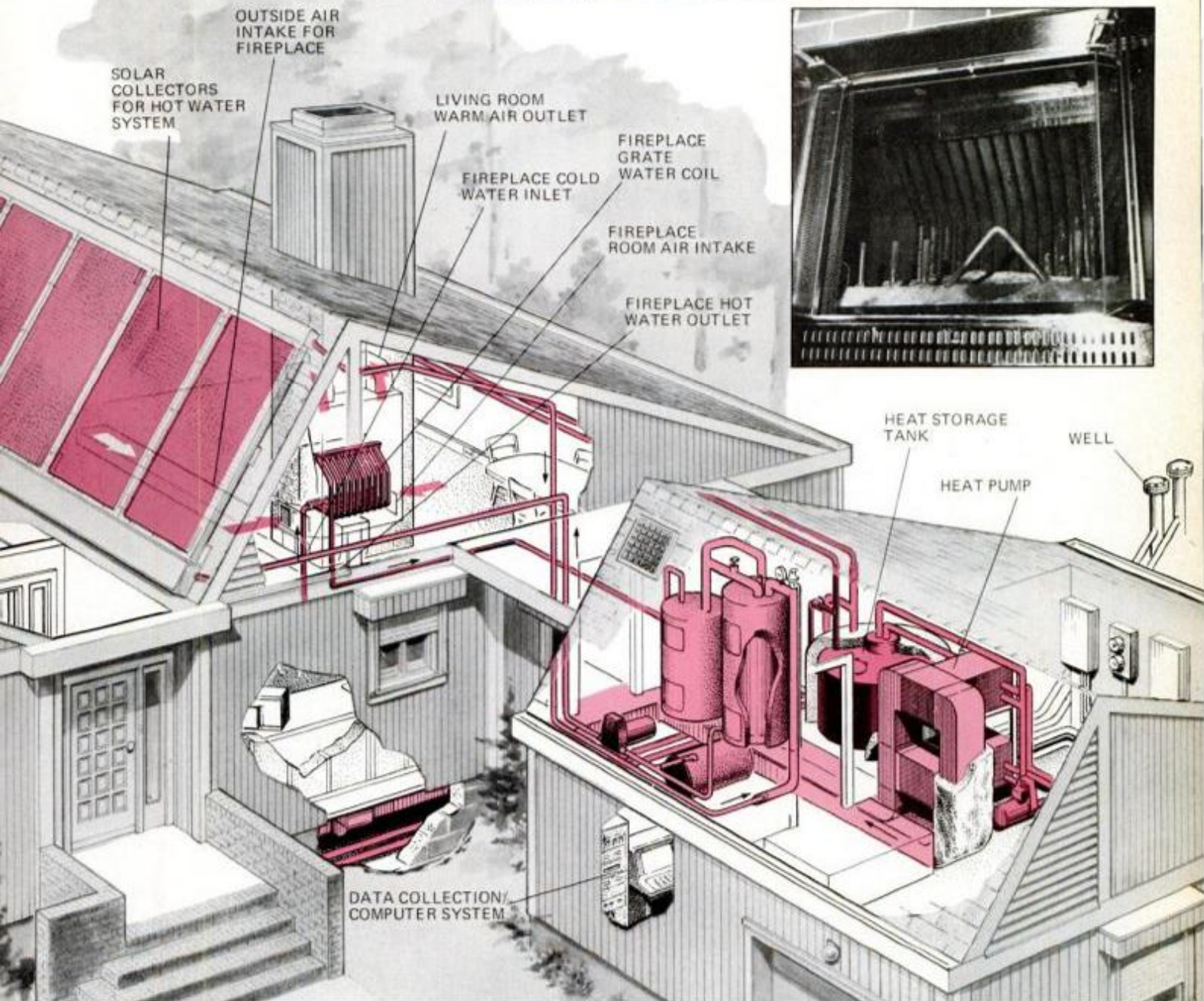
equipment, costing as much as several Cadillacs, monitored the house and issued electronic pulses to control heating, ventilating and air-conditioning. A hundred sensors fed data from all over the house—on wall temperatures, for instance—to a \$50,000 data-acquisition system. This was NASA's record keeper, sorting minute-by-minute information on system performance. The data, in turn, were fed to a \$10,000

(Please turn to page 126)



Workmen spray urea-tripolymer foam into Tech House walls. Foam fills cracks, hardens into effective cost-cutting insulation.

Fireplace draws much of its air from outside, reducing energy loss up chimney. Fire heats water in grate pipe connected to insulated heat-storage tank.



The price? \$45,000 . . . sort of NASA estimates that Tech House could be built commercially for about \$45,000, but there's a lot of fine print under the price.

The figure is based on 1976 dollars, and doesn't include land or landscaping costs. And in reaching that modest total, NASA assumed that all equipment would be mass-produced.

Some Tech House equipment is cur-

rently available from NASA contractors. The fireplace grate, for instance, is sold—at \$280—by Ridgeway Steel Fabricators Inc. (Box 382, Ridgeway, Pa. 15853). Urea-tripolymer foam insulation from C.P. Chemical Co. Inc. (39 Westmoreland Ave., White Plains, N.Y. 10606) costs 65 cents and up per square foot. Shutters start at about \$12 a square foot, from the Pease Co. (Ever-Strait Div., Box 510, New Castle, Ind. 47362). More information on Tech

House is available from NASA (Mail Stop 139A, Langley Research Center, Hampton, Va. 23665).

NASA's contractors, of course, aren't the only suppliers of alternate energy systems. Thomason Solar Homes Inc. (609 Cedar Ave., Oxon Hill, Fort Washington, Md. 20022) has been building solar devices for 20 years. Prices for the Thomason system vary by area; a full heating-cooling system installed in Atlanta costs about \$6600.

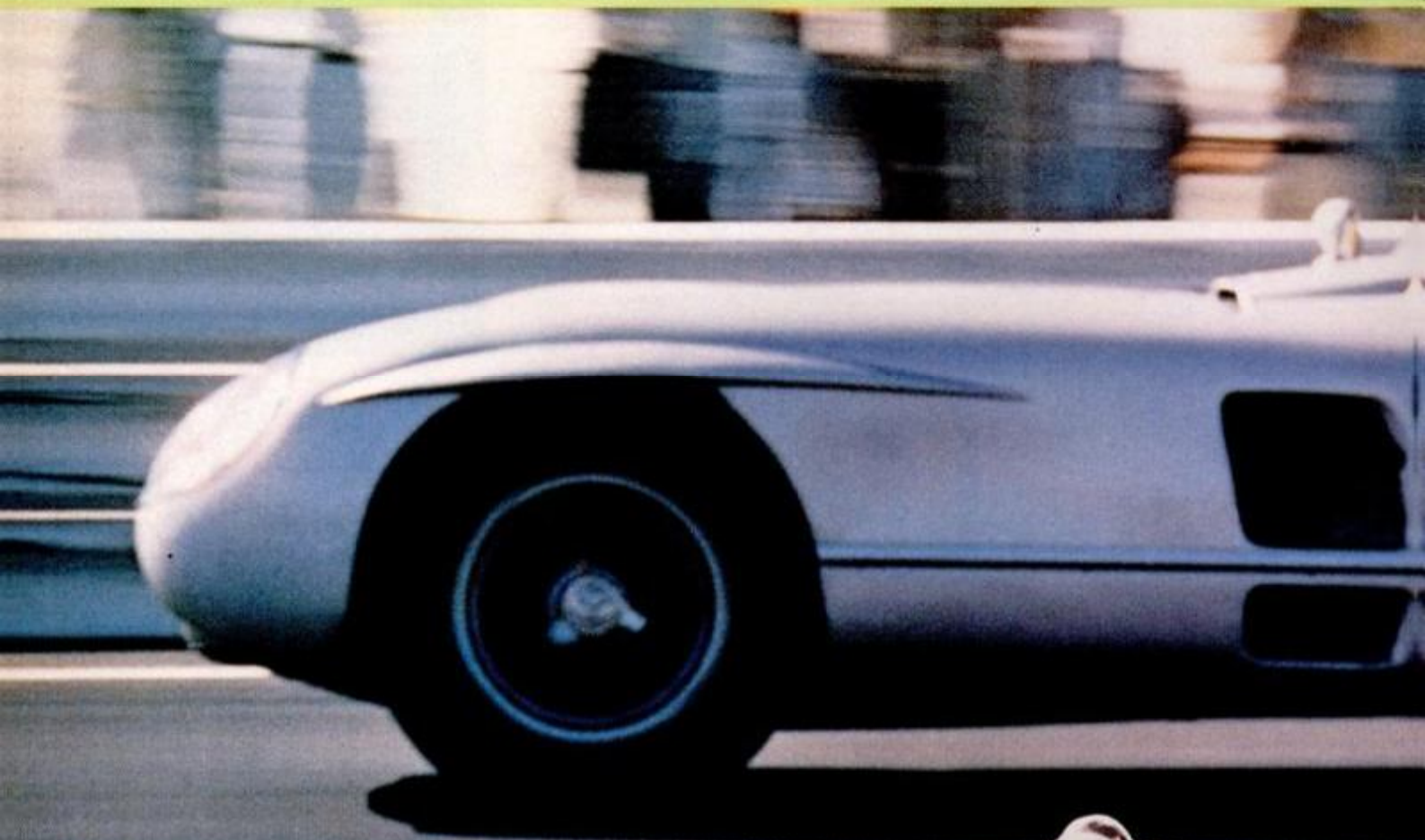
Vintage vroom!

Three cheers for the owners of these priceless, historic cars who rocket out of pit roads and actually race them!

by Peter and Susanne Stevenson

Going back to see your old high-school sweetheart after 25 years can be a chilling experience. But if one of your heartthrobs happened to be a blood-red Ferrari or a ground-shaking Cadillac-Allard bristling with pipes and spokes, then you're in for a treat.

Vintage car racing is bringing all the old snorting, fire-breathing legends of yesteryear back onto the track—and they're looking better than ever. What started out as a way to give owners of these classic thoroughbreds the opportunity to



Alfa Romeo has long been a competing marque on international race circuits (2300-cc, above left). Right-hand drive MGs (left) don't burn up the racetrack, but they're certainly a joy to behold.

Talbot-Lago Grand Prix car, vintage 1947, was the only representative of that marque at the Fifth Annual Monterey Historic Auto Races, where cars here were photographed by authors.



You may have missed the race in Sicily that year, but you can still cheer on the 1922 Mercedes-Benz Targa Florio (above). Roll bar is comfort to Genie driver (below).



The late 1960s saw fast, thigh-high racers like this Lola coupe.

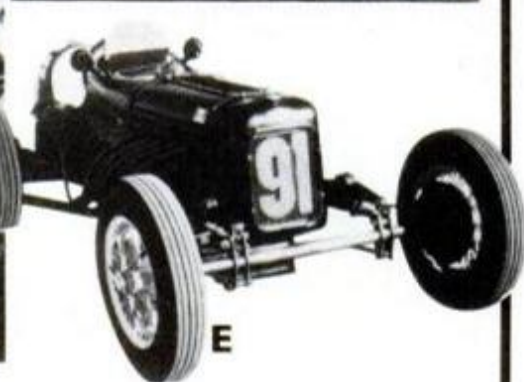
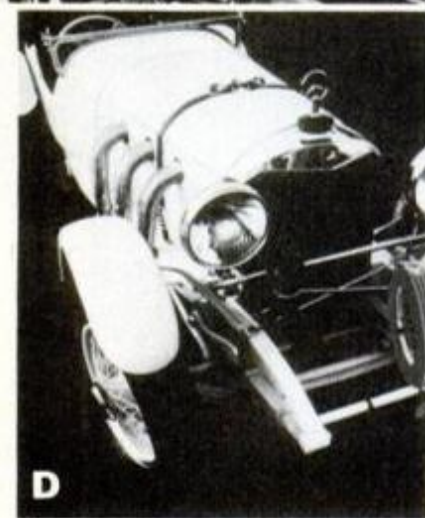
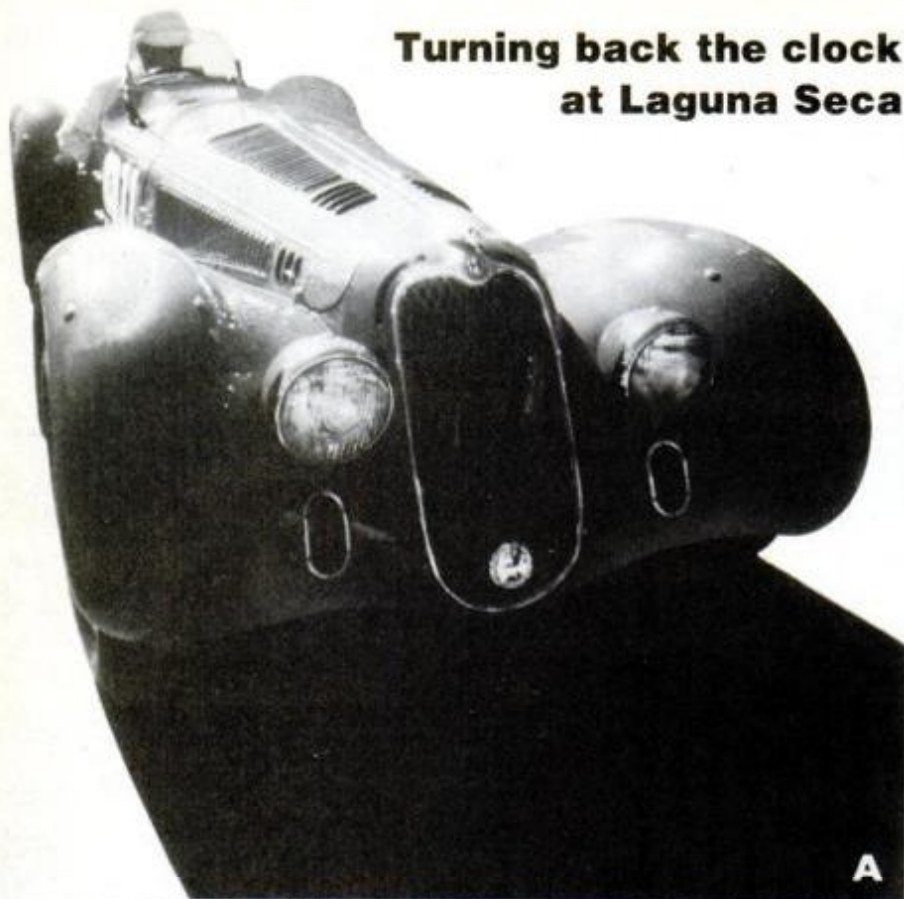


Mercedes-Benz 300SLR Sports Racing Car, with America's first world driving champion, Phil Hill, driving, featured fifth Monterey. Car 658 was flown here from Mercedes museum in Stuttgart, Germany, for the vintage races. The 1955 racer won World Championship of Makes that year.



Four vintage cars (right) race at the Laguna Seca Raceway near Monterey, Calif.

Turning back the clock at Laguna Seca



The grids for "geriatric Grands Prix" at more tracks around the country are packed with classic race cars from the world's greatest builders. Marques like Alfa Romeo (A; that's Phil Hill at the wheel), Bugatti (B), Jaguar (C),

Mercedes-Benz (D) and Frazer Nash (E) show up, with more exotic makes a possibility, too. If you're a motorsports fan, you'll appreciate the difference between seeing favorite racers in a museum and on the track.

exercise their cars on the track has turned out to be a booming spectator sport. The coast-to-coast revival of road racing in the grand old manner is winning a whole new generation of fans.

Fun and excitement

On the track the cars bring back an old excitement to some and introduce a new kind of fun to others. You can actually see the drivers up-close-and-personal as they struggle with an ornery transmission, or wrestle with the capricious handling of the thundering beasts. The old blood-stirring sounds are back, too, ranging from the insistent screams of the two-stage superchargers to the bellows of the heavy irons as they're flogged around the tracks in no uncertain fashion.

There's plenty to feast your eyes on, as well: sleek bits of four-wheeled sculpturing that aren't hidden under several layers of advertising signboards and speed-grabbing gadgetry; curvaceous Italian darlings, snarling and clearing their throats; old English verticals ticking over stolidly; and muscle-bound American brutes snorting away. All the old cars that the kids have only read about in auto history books are back. Now they can get to know them and pick their own favorites. The only difference is most of the cars are in better shape now.

Emphasis in vintage car racing is definitely on f-u-n. Drivers are admonished from the start to keep everyone's enjoyment in sight at all times and not to lose their cool trying to go all out for a win. And it works. The mood is mellow, the talk friendly, and the atmosphere is the same casual sort that made the sport such a hit in the early days after World War II. You're free to stroll through the pits and chat with the drivers, enjoying amateur sport at its friendliest.

Participation the key

The boom in vintage racing has sent the price of old competition cars skyrocketing, as everyone naturally wants to get in on the fun. Cars have to be bona fide old campaigners to qualify and a lot of old racers that were skipped over by the classic car boom because they were temperamental and didn't carry enough of the family are now at a premium. It doesn't matter, of course, that your 3-liter Tornax never made it through the first lap of an old race. The main thing is that at least it tried, and actually took part.

Interest in racing cars of museum quality on the tracks again first

(Please turn to page 125)

IT'S NEW NOW



Build a dock from a kit

You can build floating docks in almost any size and shape from these kits. Each contains materials for one 10-foot-long section in widths of 6, 8 and 10 feet. A section consists of 2 x 6 decking supported on low-cost floats made from old auto tires that are filled with foam flotation. Sections can be combined to form L-, T- or U-shaped docks. The cost ranges from \$369 for 6-foot width to \$519 for 10-foot width. Topper Ind., Box 1611, Vancouver, Wash. 18663.



Sharp practices

Electric-shaver blades become dull like any other blade and can be costly to replace. Shaver-Sharp is claimed to resharpen such blades and reduce the need for replacement. A 1/2-ounce tube is said to last years. It's \$4 from Shaver-Sharp Inc., 1615 James St., Merrick, N.Y. 11566.



Good to the last drop

Some adhesives are only good for a few drops before the tube clogs. The nonclogging, self-puncturing applicator tip for Permabond Super Glue is designed to allow every drop to be used. A 1/10th-ounce tube is under \$2 from Permabond International Corp., 480 South Dean St., Englewood, N.J. 07631.



Keep your bait alive

A portable ice chest or other watertight container can be transformed into a fish or live-bait tank with the Livewell Oxygenator System. The unit consists of a submersible pump, oxygenator valve with adjustable spray head, mounting bracket and 4 feet of flexible hose. Permanent or temporary installation takes only minutes, the maker says. The 12-volt d.c. system aerates about 400 gallons per hour, it's claimed. The Model 77 is priced at about \$33 from Rule Industries Inc., Cape Ann Industrial Park, Gloucester, Mass. 01930.

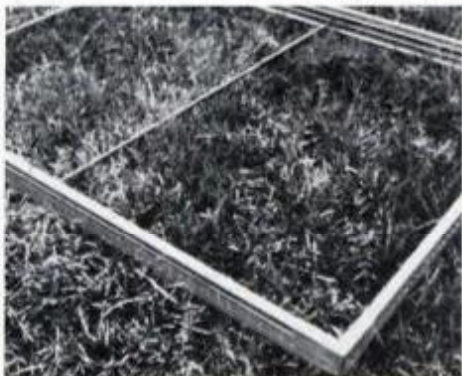
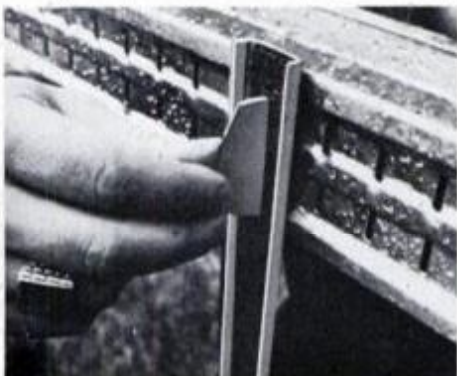


Forms for easier patio and sidewalk building

Leave-Er-Rite metal forms make it easier for a homeowner to build a sidewalk or patio, the maker says. The different pieces of the forms, like sidewalls and stakes (below, left),

angle spreaders and sidewall clips snap together to make a rigid framework (below, center) that can be left in place after the concrete has been poured (below, right). Pieces

for a 3 x 20-foot sidewalk, for example, cost approximately \$23. Leave-Er-Rite Manufacturing Co. Inc., Suite 400, Mill Plaza, Sheridan, Wyo. 82801.



No doubt about it: Looks sell cars. Both Firebird and Camaro owners listed styling as the main event in their purchase decision.

"Closest thing to a Corvette without the awesome price," comments an Illinois computer consultant about his 1979 Camaro. "I wanted a fun car with good looks."

And a South Carolina plant manager echoes that same feeling about his new Firebird. "I immediately liked the styling, and so did my teenaged daughter."

Styling swayed nearly 70 percent of our respondents, but it was far from the only reason they chose these ponycars. A Michigan draftsman and Trans Am owner noted: "It's the last year for the big engine

PM OWNERS REPORT: CHEVROLET CAMARO AND PONTIAC FIREBIRD



Camaro and Firebird offer wealth of engine choices, sell mostly mid-sized V8s.

and the first year for four-wheel disc brakes, and the T/A's handling is hard to beat."

A California technical writer: "Performance was my motive. I got tired of being gutter-shot from stoplights, so I bought this Z-28."

"Because the Trans Am with the 6.6-liter engine and four-speed is the last American-made muscle car," opines an Alabama steelworker. He goes on to say that, "... the performance is unreal for a 1979 car, and handling ranks second to none. Ride is firm, but exceptionally smooth, and it even gets fair gas mileage on the highway."

A Rhode Island grocery manager: "I guess I'm a diehard ponycar enthusiast. The Camaro has a clean, yet sporty appearance, no matter what angle you view it from."

A Michigan secretary: "I got a divorce, and the Camaro is the Number One car for single girls!"

The other point of view is from a West Virginia real estate broker: "This Camaro is absolutely fun to drive. Its sexy styling is great for a bachelor, because the car draws girls like a magnet!"

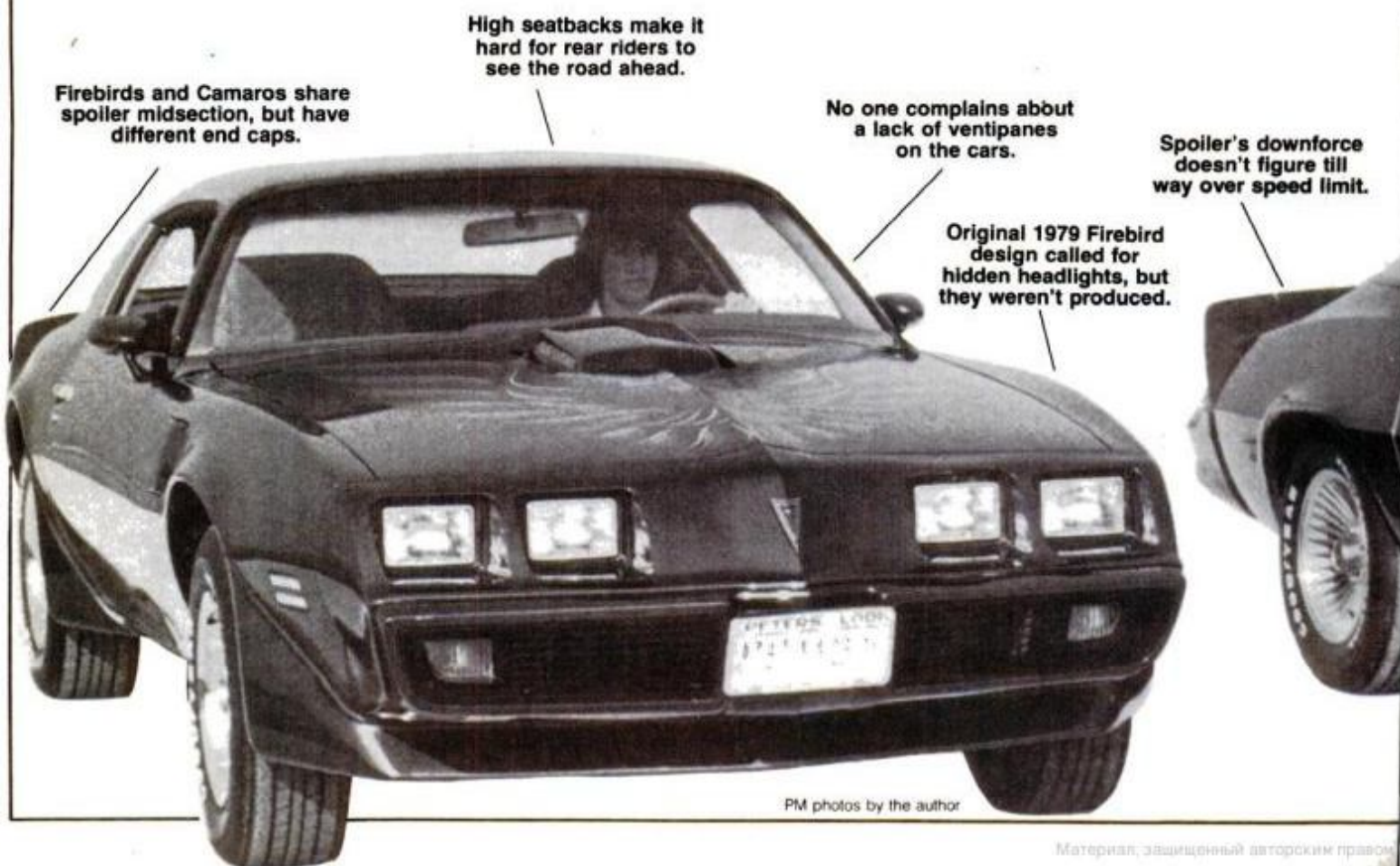
A Texas sales manager: "The Trans Am's resale value and performance sold me. This is my third T/A from the same dealer."



Both cars got their first instrument-panel redesign this year. Owners like the new look, but some still add custom touches.

And a California bookkeeper: "The Z-28 is the last of the factory hot rods. It's fun to drive, and I probably won't be able

BY MICHAEL LAMM WEST COAST EDITOR



Firebirds and Camaros share spoiler midsection, but have different end caps.

High seatbacks make it hard for rear riders to see the road ahead.

No one complains about a lack of ventipanes on the cars.

Spoiler's downforce doesn't figure till way over speed limit.

Original 1979 Firebird design called for hidden headlights, but they weren't produced.

PM photos by the author

Материал, защищенный авторским правом



Some owners suggest eliminating petite rear seat, expanding trunk for more cargo.

to get anything like it in a few years. By the way, what's a F-I-R-E-B-I-R-D?"

Camaro and Firebird handling also ranked high in our survey. An Alabama naval retiree remarks, "My Firebird's ability to stick to the road can't be beat. It's a pleasure to drive."

An Indiana security guard: "My Camaro with the 3.8 V6 handles very well on the curves because it's close to the ground; also, I find the engine responds well."

"Sports car handling," comments a Texas auto wholesaler about why he likes his Camaro. And a Michigan carburetor tester who works for Ford: "My Firebird's

radials really hug the curves, and the car handles extremely well—except in the snow."

In the workmanship department, the Camaro received slightly higher marks than the Firebird. Some 13 percent of Firebird owners, in fact, listed workmanship as one of their primary complaints.

"I like the car," affirms an Ohio accountant, "but I see that Firebirds from two or three years ago are made better, especially on the interior."

An Illinois truck driver and Camaro owner: "Too many plastic and rubber parts."

However, an Ohio receptionist says, "I'm very pleased with the quality and workmanship of my Camaro. The body structure is solid, and everything seems to work satisfactorily."

A number of owners pointed out prob-

(Please turn to page 166)



Sleek, powerful looks, excellent handling keep Firebirds, Camaros in short supply.

Last of the big ponycars

Camaros and Firebirds bowed initially in 1967 as GM's answers to Ford's best-selling Mustang. Chevy introduced the race-bred Z-28 with a 302 V8 that year, and Pontiac launched its first Trans Am in 1969.

Both were low-volume, high-performance cars, a situation that's greatly changed now. Today, Pontiac sells more Trans Ams than any other series of Firebird. And Z-28s now account for 20 percent of Camaro sales.

The second generation of both nameplates got their sendoff in 1970½. Camaro and Firebird bodies haven't changed basically since then. That means that, after nine years of production, GM long ago amortized these cars' tooling, so they're big moneymakers for the corporation. Current bodies are slated to stay in production until at least 1981—perhaps even 1982.

In 1972, as other carmakers phased out or downsized their ponycars, GM considered dropping the Firebird and Camaro. A 174-day strike cut production drastically that year. But key Chevrolet and Pontiac spokesmen pleaded with GM management to keep these two cars, and they were spared.

Firebird's 455-SD Trans Am, Camaro's early Zs, all convertibles, pace cars, and special editions like the 10th Anniversary T/A are fast becoming known as collectors' items.

A NATIONWIDE SURVEY BASED ON 479,394 OWNER-DRIVEN MILES

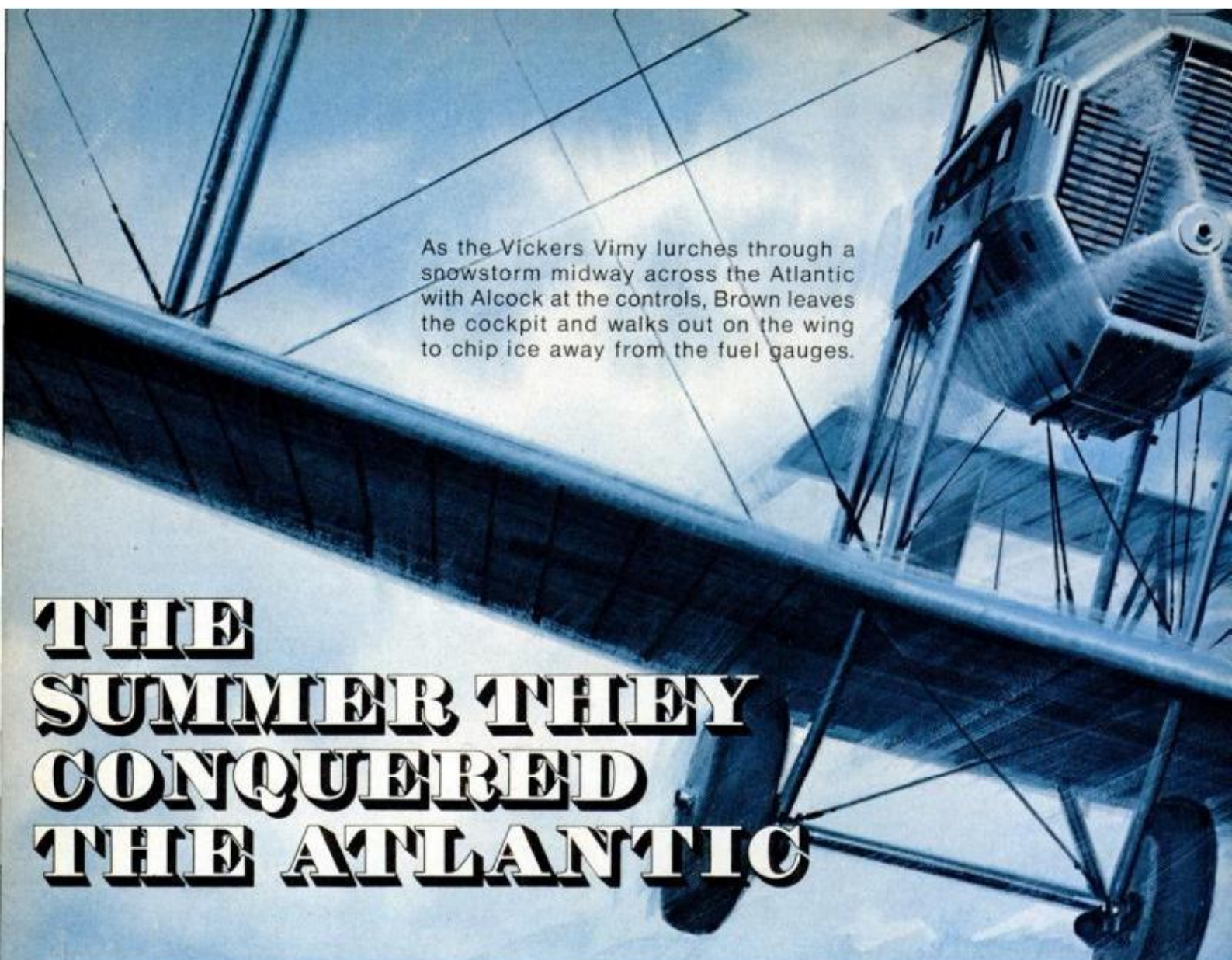
These two ponycars grow more popular with the years, but rear seats stay small

Double-insulated headliner silences body.



Camaro's "sugar-scoop" lamp nacelles collect snow, dim headlights.

Water, air from cowl flow through hollow rockers to flush them.



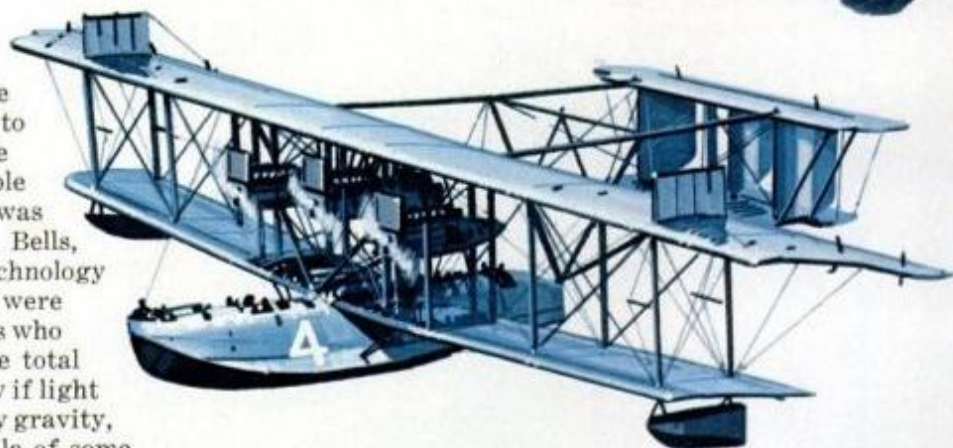
As the Vickers Vimy lurches through a snowstorm midway across the Atlantic with Alcock at the controls, Brown leaves the cockpit and walks out on the wing to chip ice away from the fuel gauges.

THE SUMMER THEY CONQUERED THE ATLANTIC

The year was 1919: The “war to end all wars” was over. President Woodrow Wilson was in Europe—first United States chief executive to visit there while in office—to make sure the peace would last. Some people thought the Great Age of Invention was over, too, that the Morses, Edisons, Bells, Faradays and Marconis had pushed technology as far as it would go. (Oh, sure, there were some harebrained British researchers who were going to try to photograph the total eclipse of the sun that autumn to show if light from nearby stars was actually bent by gravity, according to the preposterous formula of some obscure mathematician named Einstein.)

But lots of people figured there were still a few frontiers to be crossed. One was a 17-year-old boy in Little Falls, Minn., named Charles Lindbergh, who had decided, yessir, he’d be a mechanical engineer. Leafing through the *Popular Mechanics* of the day, a kid like Lindbergh could be endlessly fascinated...

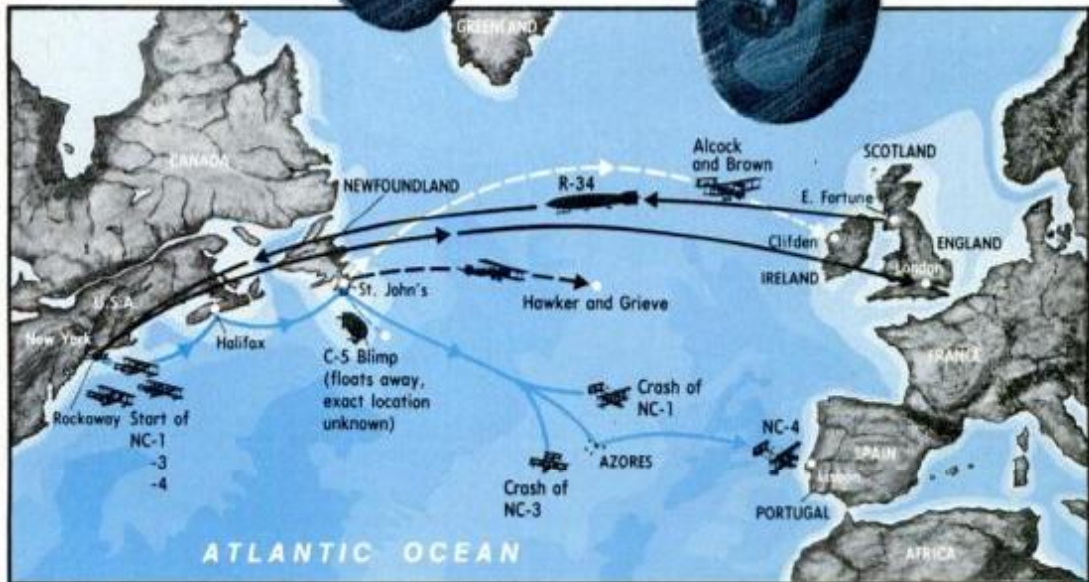
There were important issues: Editorials noted that unless the United States switched over to the





Map below traces extraordinary transatlantic happenings of the spring and summer of 1919: In May alone, the U.S. Navy's NC-4 succeeded in reaching Lisbon via the Azores, while the Navy's C-5 blimp blew away from Newfoundland in a storm and Harry Hawker crashed in mid-ocean. In June, Alcock and Brown nonstopped; in July, Britain's R-34 round-tripped.

Historic flight of NC-4 (left) began at Rockaway, N.Y., with sister ships NC-3 and NC-1 (an NC-2 was cannibalized for parts). The massive R-34 dirigible (below) was 665 feet long and 79 feet in maximum diameter. It took 108 hours to make the first east-to-west Atlantic hop.



metric system right away, we'd never do any business overseas. There was terrorism: "Of all the cowardly, unmanly, dastardly means of attack or revenge," *PM* declared, "the bomb in the hands of a civilian heads the list." And of course there were the endless photographs of what the ingenuity of man could now create. But a kid like Lindbergh, a dreamer, was also easy pickin's for the slick advertisers . . .

Along with ads for "a really comfortable artificial leg" (appealing to war casualties) were those promising, for example, "instant popularity" if you learned how to play the ukulele.

But sooner or later Lindbergh's restless eyes would fall on one flying school ad that noted: "The mail service will soon need pilots—a real he-man's job."

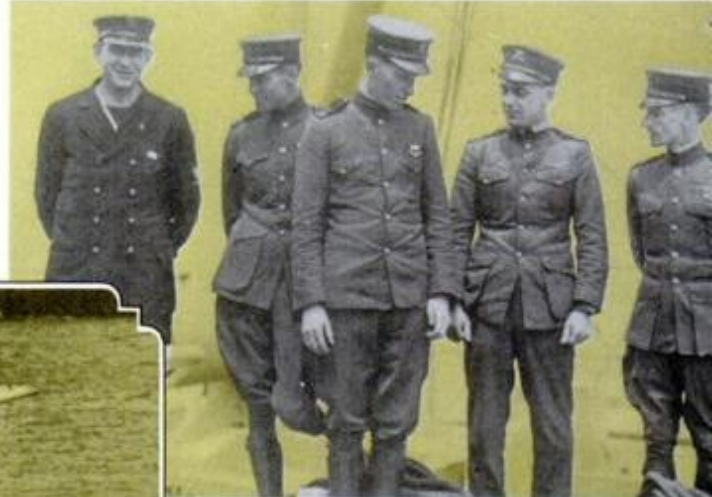
Because, 60 years ago, aviation was *the big* frontier.

By the end of April, it was obvious that somebody would soon make the first attempt to cross the Atlantic Ocean by air. Considerable prize money had been posted, since before the war, and now the race was on.

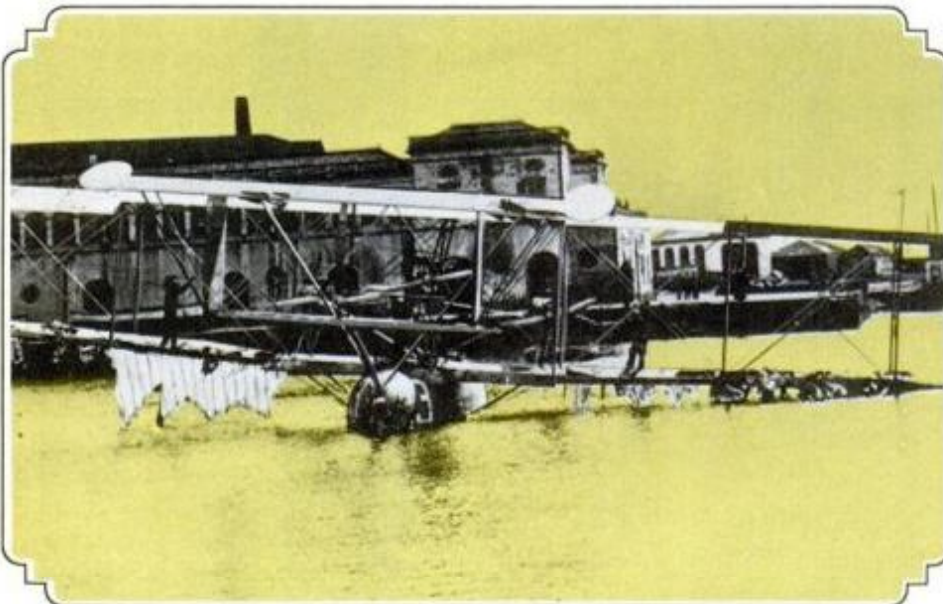
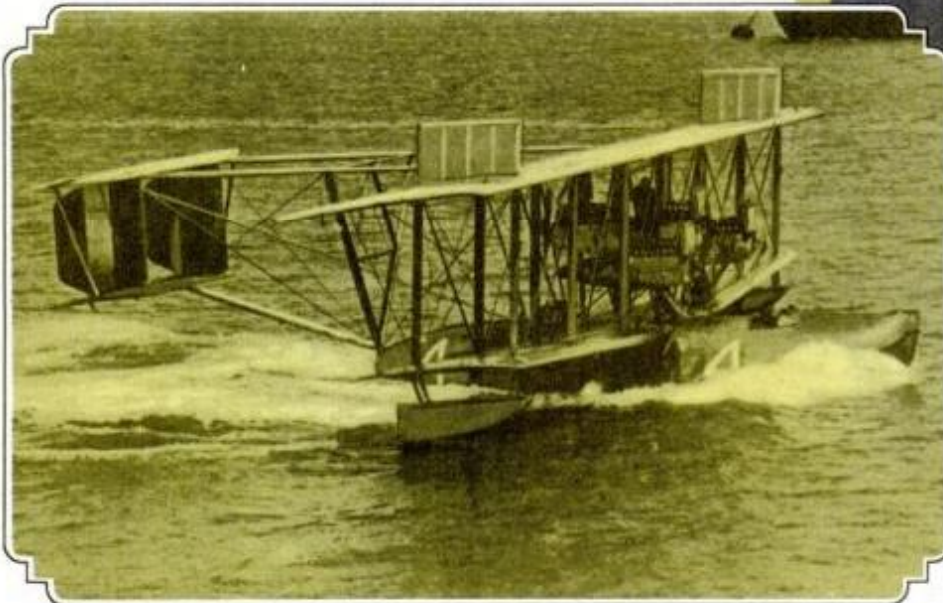
The U.S. Navy, which had been studying a possible transatlantic flight since 1917, commissioned a new series of seaplanes, the Curtiss-built NC type, on May 3. The aircraft's hull was 45 feet long, consisting of an oak and spruce frame covered with spruce or cedar planking and having places for a five-man crew. Its upper wingspan was, at 126 feet, some 32 feet longer than the lower span.

Between the wings were four 400-hp Liberty engines driving two-bladed Olmstead propellers (three puller, one pusher), all these powerplants being accessible *in flight* through hull hatches and ladders in the airplane's rigging.

The four NCs were part of an elaborate Navy plan. On May 5, it almost went awry when some gasoline caught fire and consumed most of a wing of the NC-1 and an elevator from the NC-4. Cmdr. John Towers, the Navy's "air admiral" in charge,



Cmdr. Albert C. Read, officer in charge and navigator of the NC-4, is in the center of the photo above with his crew, following their arrival at Lisbon (left); first over the Atlantic ocean by air.



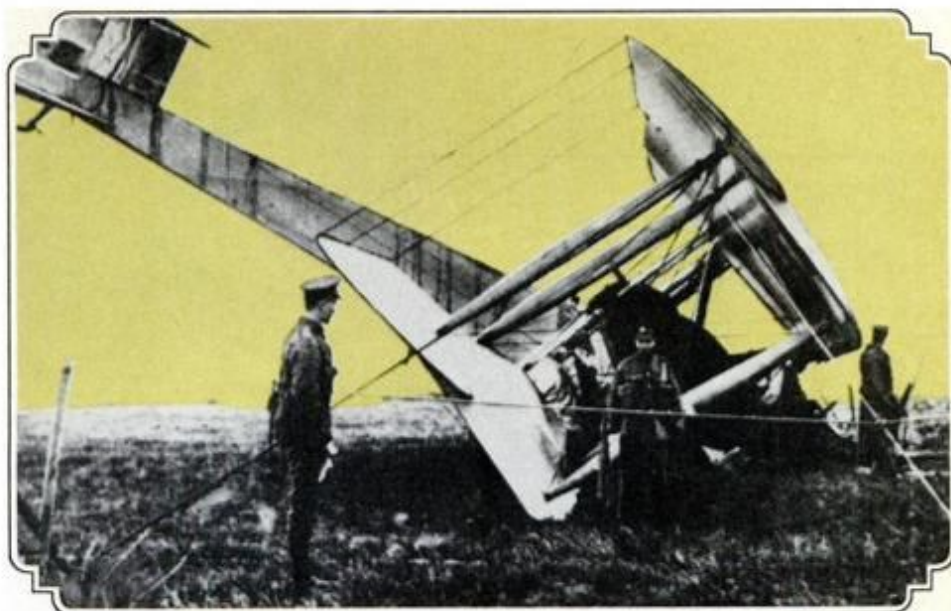
The NC-4 (top) almost didn't make the transatlantic attempt; having dropped out on the flight from Rockaway to Halifax to change two engines, she barely caught up

to her sister seaplanes for the departure from Newfoundland. NC-3 was forced down, damaged, and taxied 200 miles through gales to the Azores.

decided that the NC-2 should be cannibalized for parts to refit the others. On May 8, weather clearance was given and the NC-1, NC-3 and NC-4 took off from Rockaway Beach on the south shore of New York's Long Island. Destinations: Halifax, Nova Scotia; Trepassey Bay, Newfoundland; Horta in the Azores Islands, and, finally, Lisbon, Portugal, then on to London.

Leaving as little as possible to chance, the Navy was moving an incredible "picket line" of 30-odd ships, mostly destroyers, into positions at 50- to 80-mile intervals across the ocean along the projected flight route. To further aid NC-borne navigators, a special sextant had been devised in which a bubble centered in fluid served as an "artificial horizon" since the natural horizon might be obscured by cloud cover.

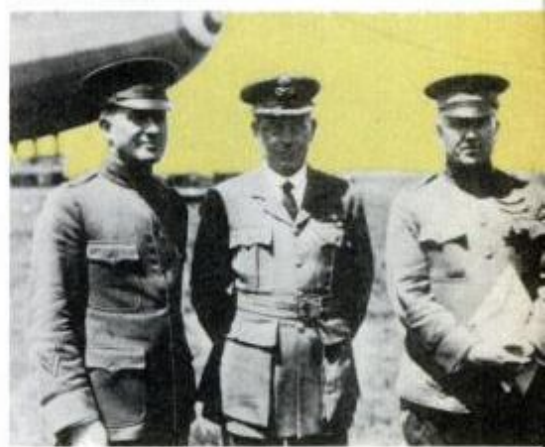
Aircraft 3 and 1 reached Halifax without incident. NC-4, however, had put into Chatham, Mass., where two Liberties were found faulty and engine changes necessary. The two other aircraft went on to Trepassey Bay, Newfoundland, on May 10. Five days later the weather broke clear—and still no NC-4. It looked like 1 and 3 would make the attempt



The old adage, "Any landing you can walk away from is a good one" certainly applied to Capt. Alcock (in civilian dress at left) and Lt. Brown, who ended the first nonstop in an Irish bog (above).

With 600 soldiers standing by her lines, Britain's R-34 completes the first east-west Atlantic crossing on July 6th.

R-34 skipper, Maj. G. H. Scott (center, below, with U.S. Army officers) dodged the 665-foot airship around thunderstorms, its fuel nearly gone.



without her. They tried, on the evening of the 15th, but excessive fuel loads prevented their takeoff. As they taxied back toward shore, the NC-4 was seen approaching. Commander Towers put off departure until the next day.

At sunset on the 16th, they lifted off minutes apart. At about midnight the May moon appeared in a cloudless sky, and the three seaplanes loosened formation, flying on independently. The ideal conditions were but brief; by 8:00 a.m. little lumps of fog began slipping by NC-4, with the navigator, Cmdr. Albert C. Read in charge. Read gained altitude, but was in and out of fog or cloud for the next five hours. A little after 1:00 p.m., the navigator saw rocky coastline through a rift in the clouds. The ship descended and put down at the island of Fayal; gaining his bearings, Read took off again and proceeded to Horta Bay.

NC-1 saw its last picket destroyer, "Number 18," around 11:00 a.m. and was off course shortly thereafter.

An emergency landing in the choppy sea tore away a pontoon and damaged the empennage. Fortunately, the Gibraltar-bound steamer *Ionian* happened by and got the crew off the NC-1 before it sank.

NC-3, with Towers as its navigator, lost its instrument lights during the night and climbed through the overcast to use the stars for reference. High altitude winds took it rapidly to the south of its course. The "wireless" also went out, and in later landing on the sea to permit accurate fixes, the plane was so damaged it would not fly again.

Determining himself to be 200 miles west of Ponta Delgada, Towers ordered the pilot to begin taxiing. After two days, with men alternately manning pumps and standing on the wings to balance the aircraft as it plodded through gales and seas, it pulled into Ponta Delgada.

On May 27, the NC-4 glided into Lisbon harbor after a 10-hour flight from the Azores. The historic first crossing had covered 3925 miles and

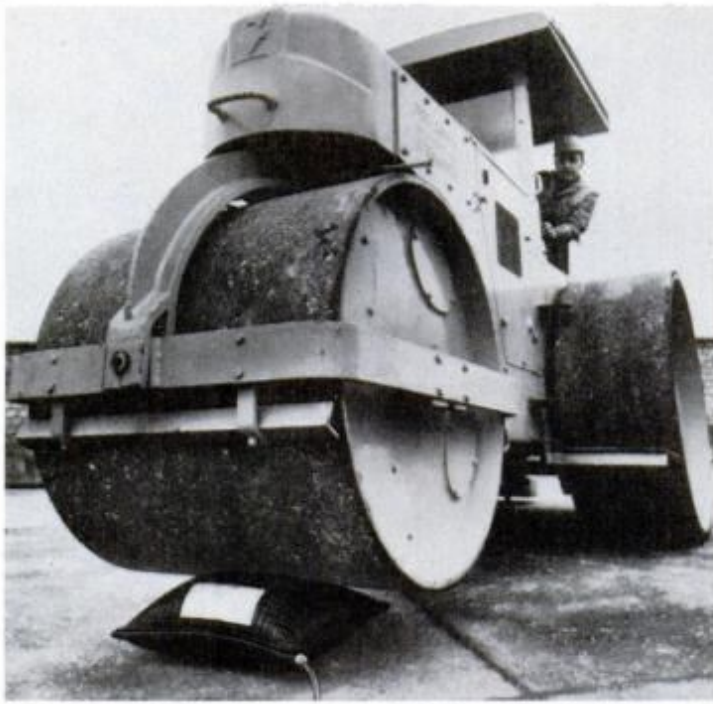
consumed 57 hours, 16 minutes of actual flying time—an average speed of 78.8 mph.

Meanwhile, the scene in Newfoundland following the departure of the Navy mission had become almost chaotic. On hand in early May were at least four different makes of British aircraft: Sopwith and Martinsyde single-engine biplanes, a twin-engine Vickers Vimy converted bomber and a huge Handley-Page aircraft. Back in Britain, two Boulton-and-Paul bombers, a Bristol triplane bomber and a Fairey single-engine seaplane were all regarded as possible contenders (the last of particular interest since it had been designed with innovative "variable-

(Please turn to page 160)

Pillow talk

This isn't the kind of pillow you'd want to sleep on, but it might give you a lift. The largest of these Mini-Bags, made by Vetter Systems of Pittsburgh, need an insertion space of only about an inch. Two bags inflated together can lift almost 90,000 pounds about three feet, according to the maker. Six layers of rubber reinforced with woven stainless-steel wire form a bag with a pressure of 87 p.s.i. Bags can free mired machinery, give lift on soft terrain, save trapped persons.

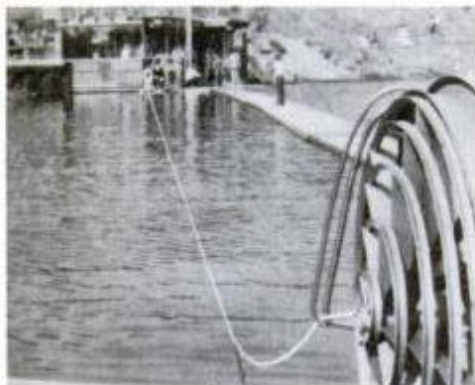
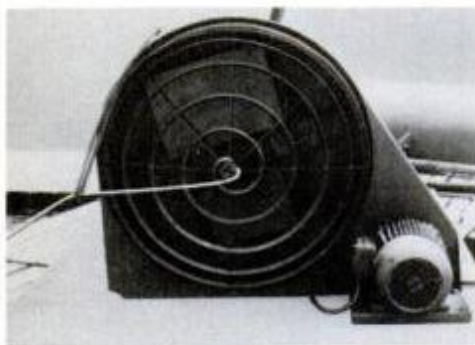


Talking with your hands



The average person doesn't know sign language, but with this British glove it's possible for almost anyone to communicate with the deaf, mute or blind-deaf. The user points to a letter, numeral or symbol to spell out words. At the left of each graphic is its representation in Braille. It's said that, with practice, 50 to 60 words per minute is possible.

Water skiing without boats



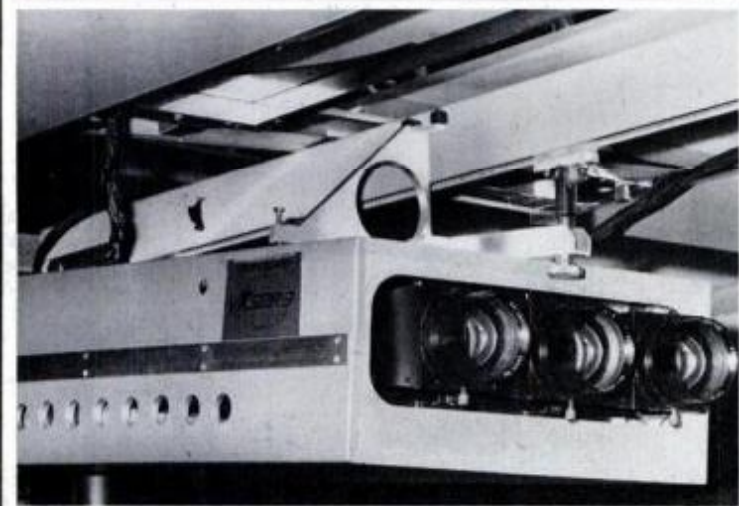
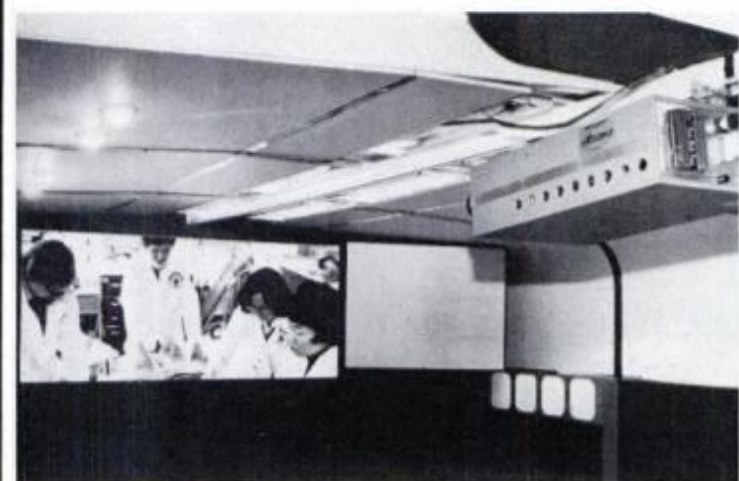
The toughest part of water skiing is the start. Ski Teach is designed to make the start easier to learn—and without a boat. An electric motor drives a self-winding machine (top) that pulls the skiers up to 18 mph. The unit comes with a 75-foot

rope and can be installed at the edge of most waterways (bottom left). The rope can be shortened for installation at Olympic-size pools. Once you've learned the start, you can ski boatlessly with another machine—the German SkiNau-

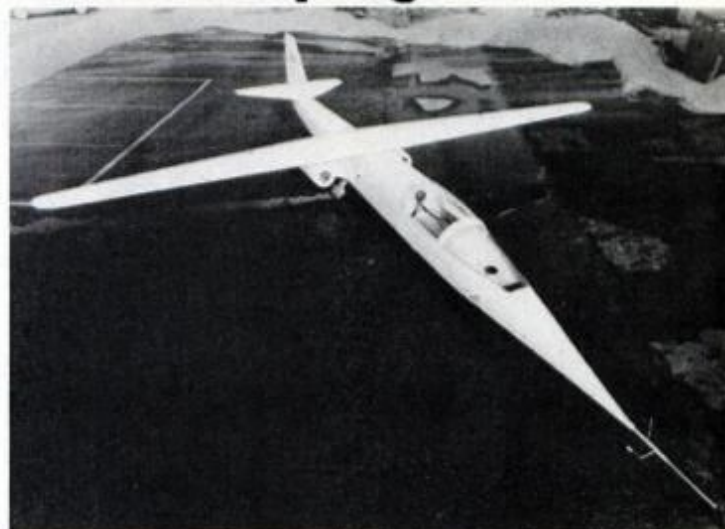
tica. It consists of a rectangular overhead cable structure supported by masts at the corners. Up to 12 skiers can hook up at a time; speed varies from 12 to 40 mph. The system, now being introduced here, is claimed safer than boat-pulled skiing.

Projection TV in the sky

You'll soon be able to watch big-screen TV aboard jetliners. The V Star 3 Video Projection System, from In-flight Services, shows wide-screen movies, as well as video games and flight information. On the ground, broadcast TV can be picked up. Bottom photo shows prototype projector.



Scissor-wing plane cuts a sharp figure



The strange-looking AD-1 oblique-wing aircraft is ready to perform aerial cutups. This 15-percent scale model of the so-called scissor-wing plane was built for testing by Ames Industrial Corp. of Bohemia, N.Y. The pivoting wing, which swivels up to 60°, is designed to reduce drag, cut sonic boom and be simpler and cheaper than dual swing-wing designs. The plane is being tested for possible SST applications.

Double-duty weapons chassis

Two battlefield vehicles scheduled for production in mid-1981 share the same chassis and running gear. The General Support Rocket System (GSRS) carrier (below, left) will be outfitted with a launcher-loader module. Highly mobile

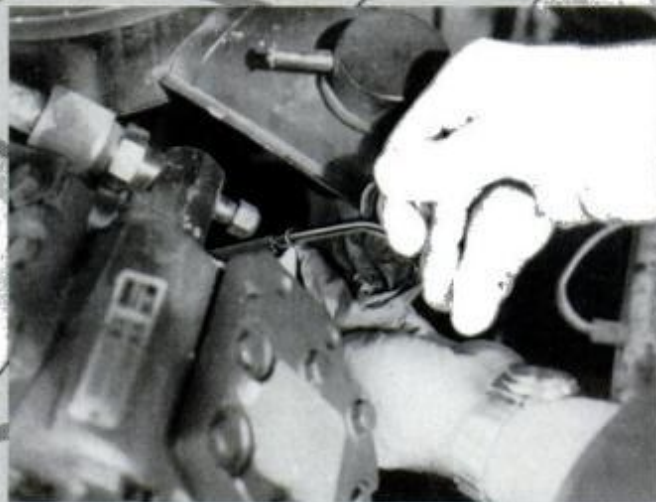
unit will carry 12 rockets that can be fired rapidly by its three-soldier crew. The Infantry Fighting Vehicle (IFV) carries nine soldiers and is armed with a 25-mm automatic cannon, 7.62-mm machine gun and TOW antitank missile launcher. Both

vehicles have a 500-hp diesel engine and top speed of about 40 mph on level ground. Both are designed for rough terrain at high speed. The carrier chassis and IFV will be built by FMC Corp.; the rocket-launcher loader, by Vought Corp.





Engine oil you don't really need or no oil at all is what you'll get if you don't get out of your car and keep your eyes open. This quart "can of oil" is empty to begin with.



By not fully seating the engine-oil dipstick an attendant can actually "show" that you're down a quart!

On this year's vacation travels... Don't get ripped off along the road!

by Mort Schultz

Interstate 75 is a heavily traveled route that runs from Sault Ste. Marie, Mich., to Tampa, Fla. In recent years it's acquired a nickname: Ripoff Road. The reference is to a type of highway thievery practiced by the kind of bandit whom you first spot leaning against a gas pump as you pull into his "service" station. He'll try to cheat you on gas or oil, or sell you tires you don't need. He might even inflict damage—or appearance of damage—on your car while your attention is diverted—so he can sock you for expensive parts. And the problem of service station rip-offs is growing far beyond the confines of a single highway.

"We get about 600 complaints a year from drivers who say they have been swindled at the pump," states John Whitton, head of Florida's Bureau of Petroleum Inspection.

For the most part, allegations contend that some service stations deliver less gas than customers pay for. According to Whitton, this oc-

curs when the customer previous to the one who is swindled buys \$2 or \$3 worth of gas.

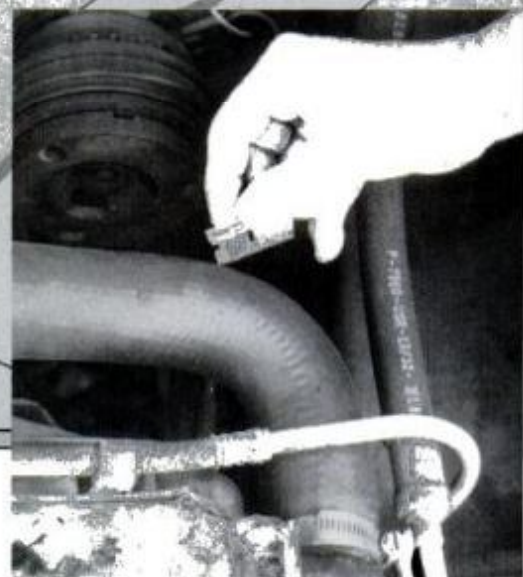
Instead of returning the nozzle to its boot, which automatically turns off the pump so the metering device has to be turned to zero before a new sale can take place, the attendant lays the nozzle on the ground. This keeps the pump activated. When a new customer asks to be filled up, his sale is added to the previous one.

"This trick succeeds, because drivers are not always attentive," Whitton warns.

Loss amounts to millions

According to a spokesman for the American Petroleum Institute, short-changing people at the gas pump and maliciously damaging car parts amount to a \$100-million-a-year racket. This estimate might be conservative in light of another issued by the National Highway Traffic Safety Administration.

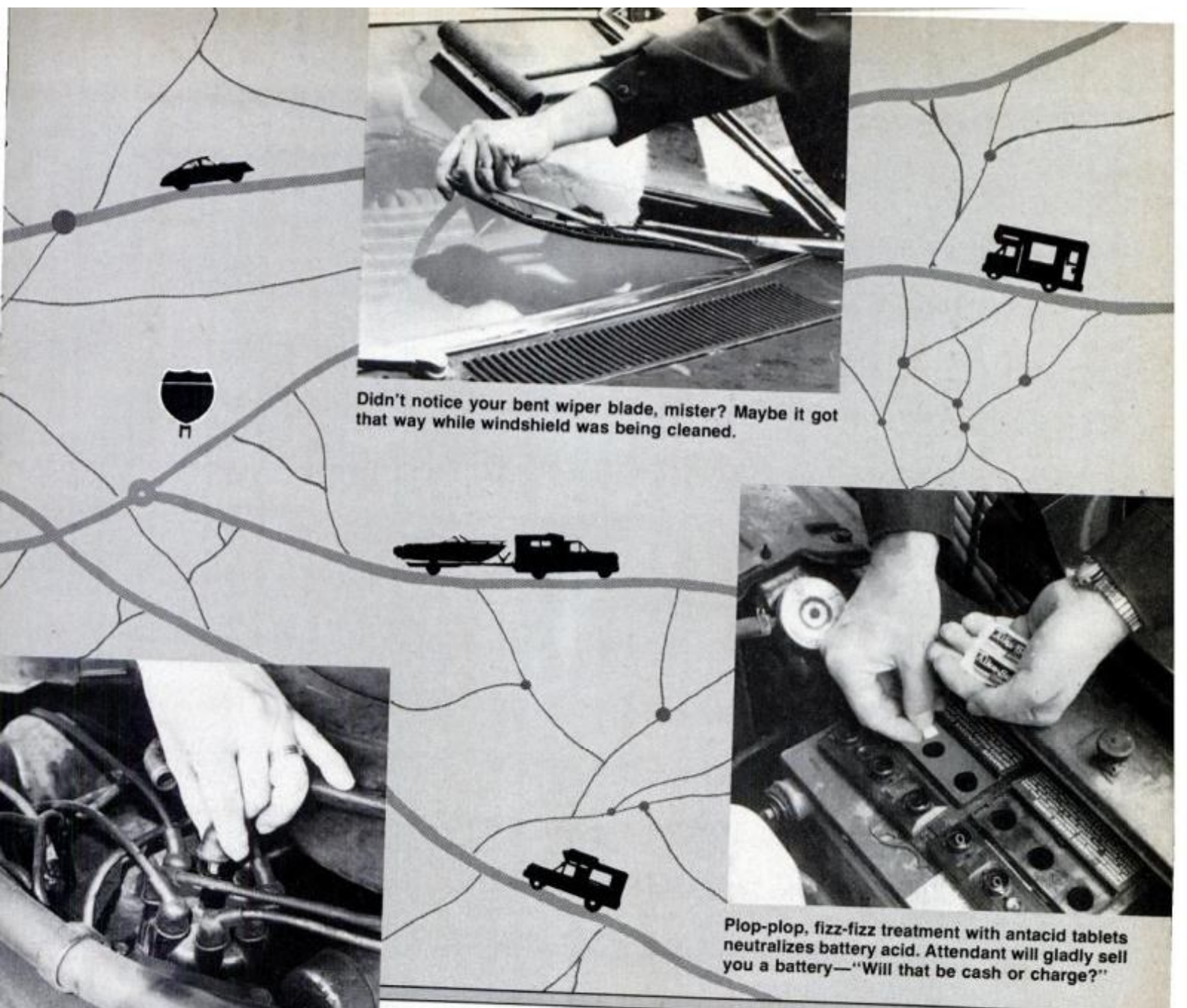
NHTSA says that American car



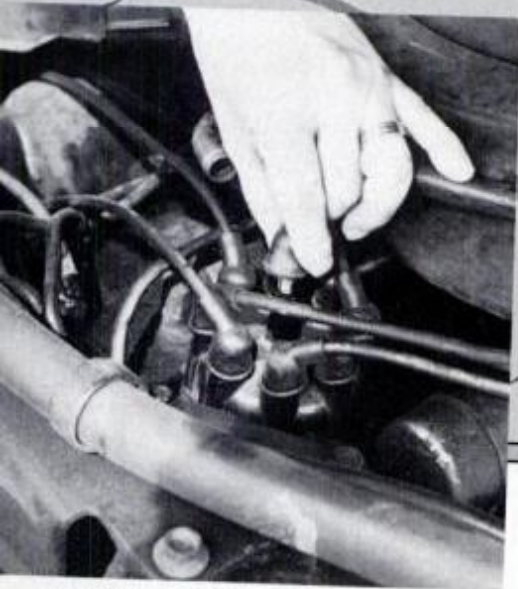
Cooling system hose is slit and "conscientious" attendant brings leak to your attention. You're stuck for new hose, a gallon or two of antifreeze and labor.

owners are sold, "with possible fraudulent intent," \$2 billion worth of unneeded repairs annually. The figure has been questioned by representatives of the automotive repair industry, but this does not deny the fact that dishonesty exists along highways. Why else did American Oil Co., for one, have to issue a bulletin to dealers several years ago that stated, in part:

"The high-pressure tactics used by a very few service station dealers and attendants to sell unneeded, unwanted merchandise constitute a serious threat to your reputation as an honest, ethical businessman . . . For our part, we will thoroughly in-



Didn't notice your bent wiper blade, mister? Maybe it got that way while windshield was being cleaned.



A no-start condition is easy to rig while an attendant is under your hood. If you're not aware of loosened ignition wire, you could be sold a complete tune-up.



Plop-plop, fizz-fizz treatment with antacid tablets neutralizes battery acid. Attendant will gladly sell you a battery—"Will that be cash or charge?"

investigate any complaints that our customers are not being fairly treated."

According to a Shell Oil Co. representative, oil companies often ask the assistance of police to investigate dealers accused by customers of racketeering. In one instance, police were effective in stopping highway robbery along Interstate 80 in Salt Lake City, Utah. Twelve service station attendants were caught red-handed.

A tactic used by police was to pose policewomen as tourists. One team, after visiting the restroom, was told by an attendant that their car needed new shock absorbers. He

drew their attention to puddles of oil under the front shocks, warning that the car could go out of control and result in a fatal accident if the old shocks were kept in use.

Of course, the man had spread the oil himself. This shock absorber ploy is a time-proven method used by crooks to frighten drivers who look uninformed, automotively speaking. Considered in this category, most often, are women and the elderly.

However, no driver—male or female, young or old—is immune to thievery if he or she is inattentive or leaves the car unattended.

"Service stations engaging in illegal acts will rip off anyone they think can be ripped off," says Alex Cortinas, consumer complaint analyst for the Florida Division of Consumer Services.

Protecting yourself

Oil companies are outspoken about action taken when there are complaints against a dealer.

"Exxon will not hesitate to terminate a franchise agreement should fraudulent retail practices or serious customer complaints warrant, as permitted by applicable franchise laws," states R.A. Pierpont Jr., retail business manager of Exxon USA.

Pierpont suggests that drivers who have repairs made at a strange service station get itemized bills and make sure they retain old parts. If the repair is questionable, this "evidence" can be turned over to trained company investigators who usually can determine if a part was purposely damaged.

There are several other common-sense precautions you can take to protect yourself at disreputable gas stations:

1. Before leaving on a trip, put your car in top shape. Inspect items that gas stations sell, including tires, windshield wipers, shock absorbers, hoses, belts, battery, bat-

(Please turn to page 132)

The roller renaissance

Forgiving, quiet urethane wheels and new suspension tricks have put a great sport back on its feet.

by Charlie Lehrs

For those people who have saved their skate keys, there is good and bad news: The good news is that roller skating—an activity once regarded as a cloddish version of ice skating—is bigger and better than ever. All the signs are there. In the last five years, the number of roller rinks in the United States has increased from 900 to 3000. A whole new phase of the sport—outdoor skating for adults—has come into being. And “roller disco,” after gestating for 30 years in a few isolated rinks, now looms as the 20th century’s answer to the waltz.

The bad news is that skates have changed, and those keys ain’t worth a darn.

In fact, the roller revival owes its existence to technological improvements in the equipment. Today’s skates are faster, quieter and more



Developed in Germany, two-wheeled skates called Rools approximate the feel of ice skates, support up to 175 pounds.

maneuverable than their forerunners. And, of course, they are more expensive: as much as \$1000 a pair for the ultimate in what can only be called “evening” skates.

A single magic ingredient—polyurethane—makes it all possible. The rubber-like plastic shows up in the new skates’ steering systems and brakes, where it performs creditably. When molded into wheels, however, it seems capable of almost anything; indeed, urethane has carried the sport into the 1979 Pan-American Games, an important stop on the way to the Olympics.

Students of the skateboard will find this tale familiar, for it was urethane that saved sidewalk surfing in the early 1970s. About 16 years ago, when they were introduced, skateboards were merely king-size clamps without the clamps. Below decks, four steel (or hard “composition”) wheels hung from cheap, crude trucks. The loose ball bearings wore out as fast as the novelty.

A Californian named Frank Nasworthy rescued skateboards from fad heaven. Urethane wheels, he noted, grip the sidewalk or road

while absorbing the shocks caused by cracks and pebbles. No more would skateboarders have to retrace their routes in search of lost fillings! That was great, because now they would be going all sorts of strange places, including up the wall. The idea was brilliant.

Not an instant success

It was also borrowed from, of all things, the roller skate. The Chicago Skate Co., long a leader in the field, marketed a urethane wheel at least a year before the skateboard was re-born. But the Sixties was not the sort of decade one roller-skated through, and, in the words of a Chicago sales executive, “The new wheel didn’t turn any heads.”

Instead of rubber-like plastic, the previous generation of skates used a

They look like fashionable clogs, but Pop Wheels are equipped with “retractable” urethane roller wheels; pin releases extend wheels from the thick-soled shoes.



plastic-like rubber that manufacturers loaded with powdered wood and whatever else was in their individual recipes. Composition wheels, as they are called, still are widely available and, for the once-a-month rink skater, probably perfectly adequate. Although very hard, they hold the floor better than wood, which is used now only by serious speed skaters. Their other plus is price. A good set of eight composition rollers runs about \$22, as compared with \$39.95 for an equal number of Beldaire Blazers, the urethane wheels used extensively in the last U.S. Amateur Roller Skating Championships at Lincoln, Neb.

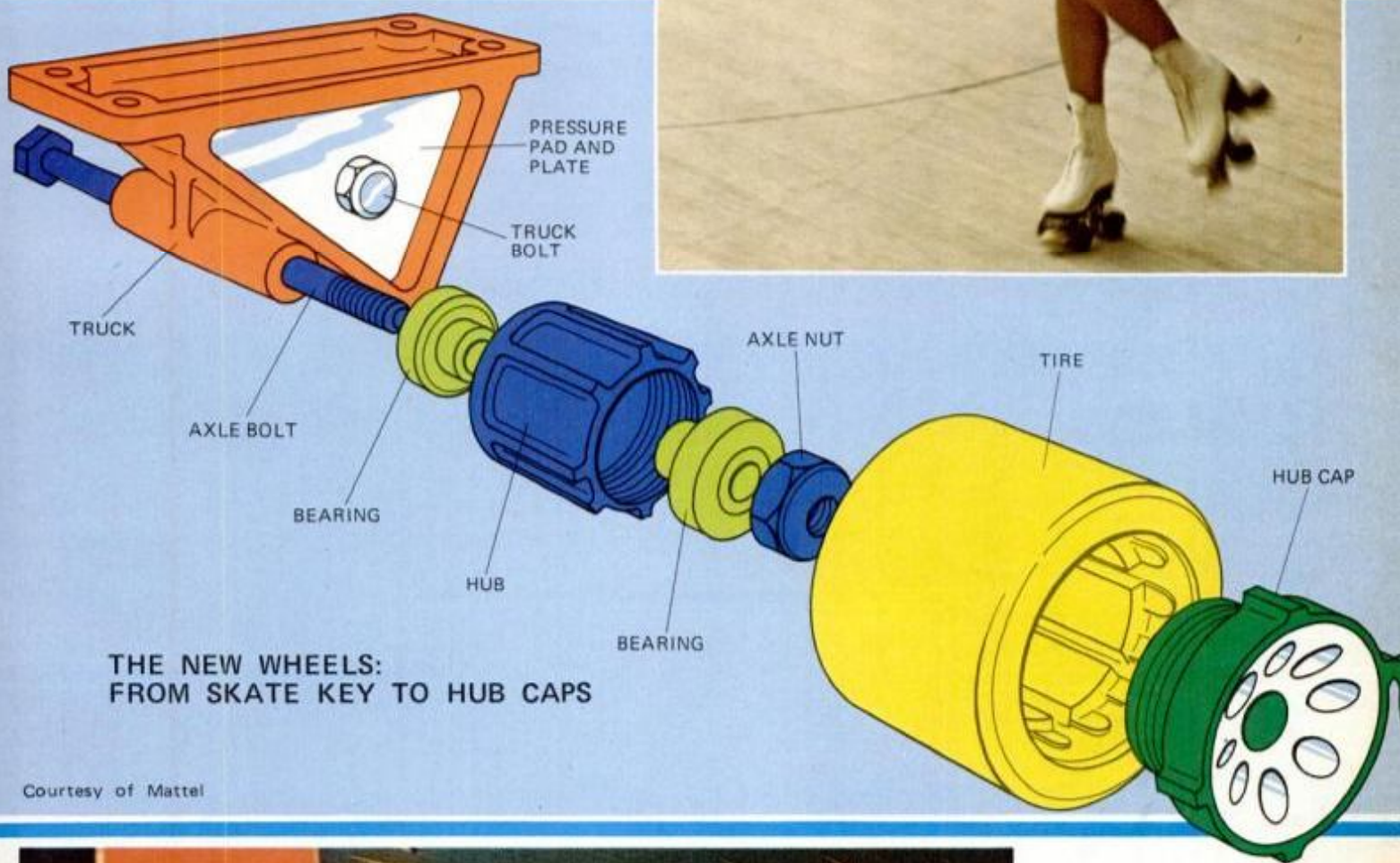
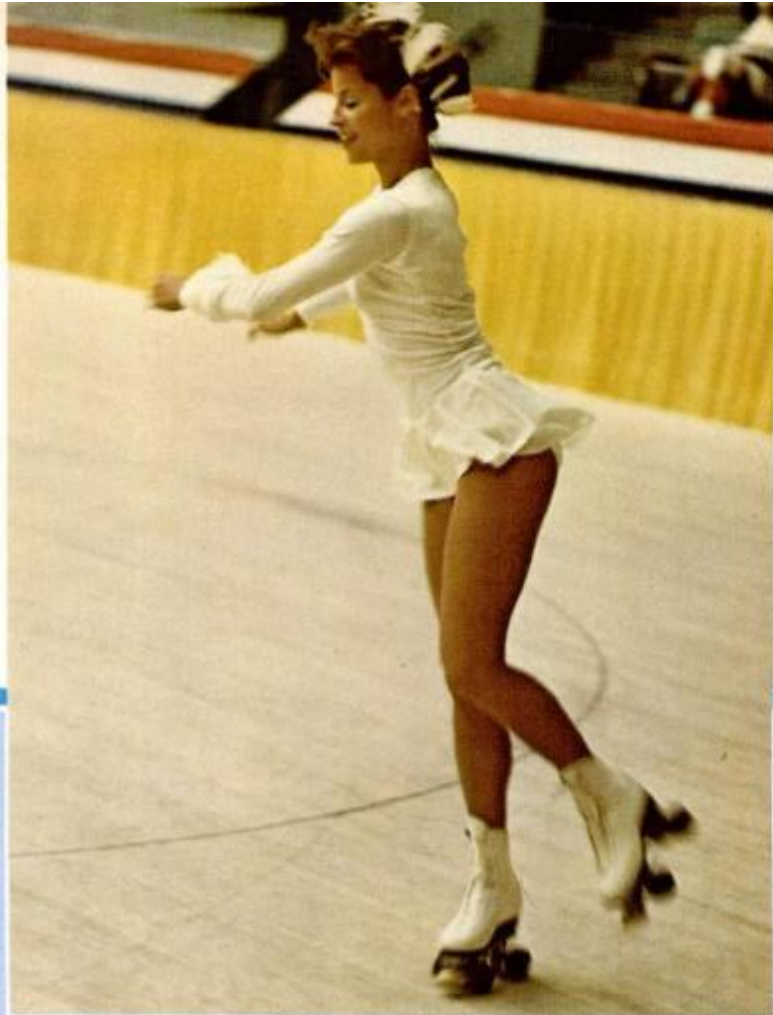
New sealed bearings

Still, if your plans include outdoor skating, composition wheels are no bargain; their tendency to chip, slip and transmit every vibration is what kept the sport inside all these years. Likewise, loose ball bearings may seem like a good buy until they are tested on the open road. In the long run, precision bearings, sealed against dirt and grime, usually are worth their higher price. (It’s easy to tell the difference between the basic types of bearings. Loose balls make noise and produce a long spin—an advantage if you’re a speed skater, but bad news for disco dancers and others interested in control. The spin of the precision bearing is short and silent.)

Having come this far, it should be noted that urethane is merely a direction one travels in, not an ultimate destination. Choose the wrong kind and you might as well be on Plimptons, the boxwood-wheeled wonders of the Gay ’90s.

If you’ll be skating to work, like a growing number of Californians, you’ll probably want wide, squeezably soft rollers that will envelope irregularities in your path—in other words, skateboard wheels. Careful, though. Urethane that is soft without being resilient doesn’t glide, it *schleps*. Unmounted rollers

(Please turn to page 134)



**THE NEW WHEELS:
FROM SKATE KEY TO HUB CAPS**

Courtesy of Mattel

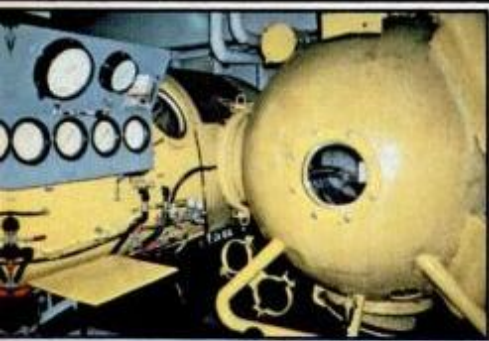
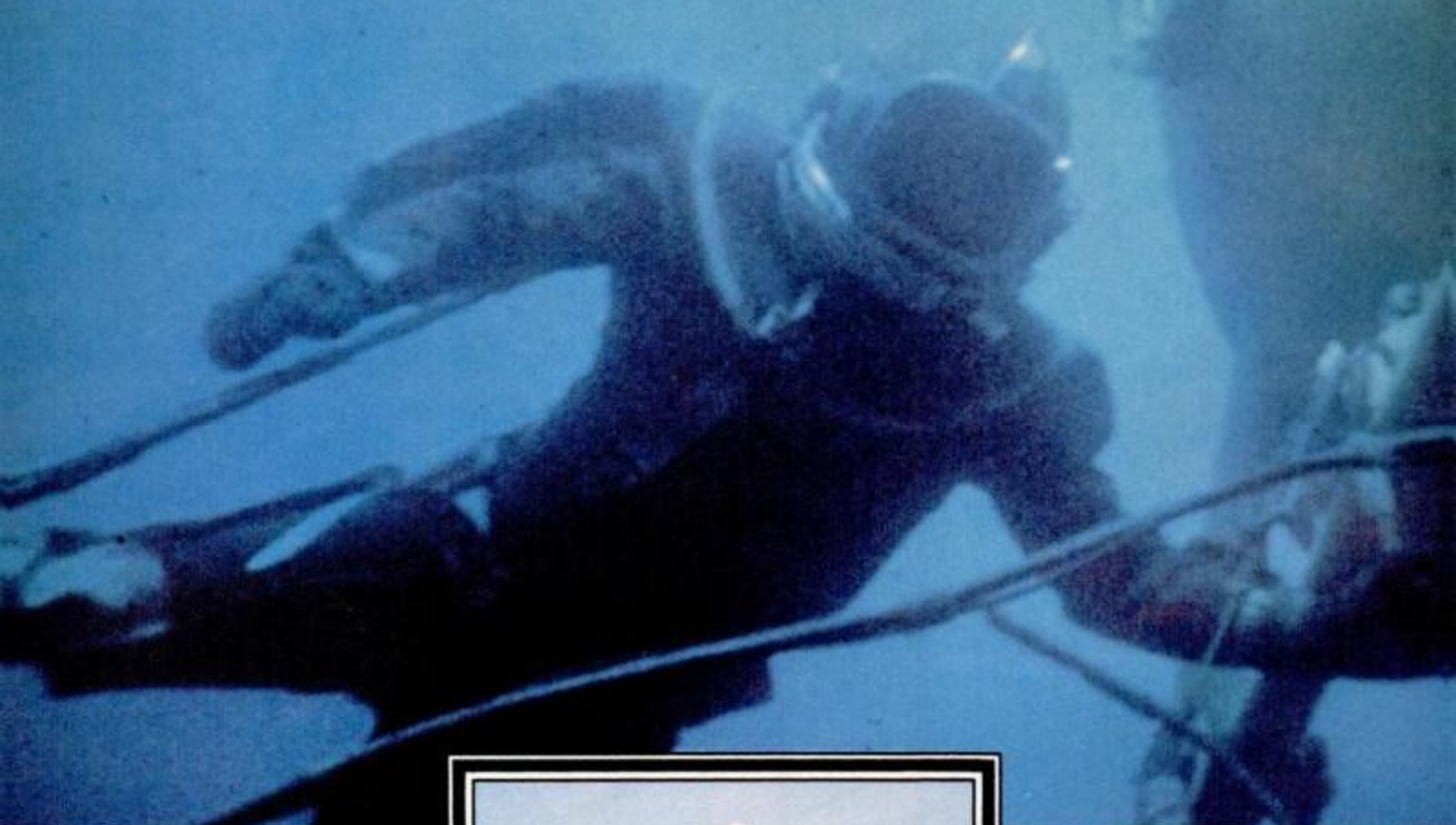


Innovations like Mattel's Sun-runner skates (photo at top; drawing above) result in both interchangeable "tires"—wider for outdoors; narrower, less resilient for indoor use—and a new mechanism for "steering" the skates. The truck bolt works against pressure pad as the skater leans, and is returned to center on straightaway. Bright colored jogging-shoe look is considered groovy, both in rinks and outdoors.

The most dangerous dives

Forget sharks—*Jaws* is a tea party compared to the kind of jobs industrial divers are now taking on.

by John Baldwin



Working with the latest hard-hat apparatus, oil-rig divers operate from diving bells, now work routinely at depths approaching 1000 feet. Often, they put in tours of up to 30 days at sea-floor pressure—the diving bell is brought up on completion of shift (photo above) and mated to a pressure chamber, where divers live during their tour. The photo at right shows North Sea weather—no time to be below.

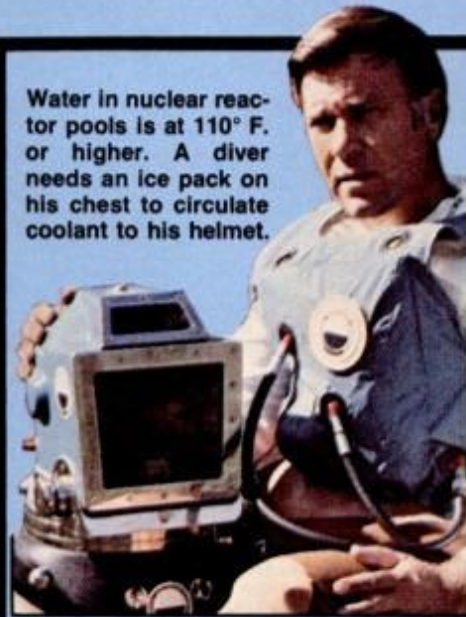


Color photos: Craig Jennings



We watched the surface of New York's icy East River for a moment, dark, muddy and brown as it swirled over the diver's dented copper helmet, and then he was gone. None of us took our eyes off the water where the man had stood waist-deep on an ice-covered ladder just moments before. Only the black rub-

ber air hose taped to the diver's speaker wires, and a three-quarter-inch manila line now linked the two tenders to the hard hat and diver's dress that kept Randall Peterson alive. Working totally by feel in the murky river, he carried down his pneumatic hammer, a pailful of concrete bolts and his welding



Water in nuclear reactor pools is at 110° F. or higher. A diver needs an ice pack on his chest to circulate coolant to his helmet.

By carefully limiting the amount of exposure to radiation, divers can work safely in nuclear reactor installations, performing inspections or mechanical jobs. Precautions against contamination must be thorough.





Headed down into the murky, 35° water of New York's East River, diver Randall Peterson descends into an exhaust tube serving "Big Allis"—world's largest turbine generator. Inset photo shows power plant with generator—left stack—shut down. Peterson had to install 750 pounds of sheet steel to support failing concrete casings, working with a pneumatic hammer. He called the job "routine."

torch. Soon, he began to install 750 pounds of prefabricated sheet steel—while fighting currents, the cold and the clock.

For years, three underwater exhaust tubes had emptied the hot water from the world's largest electrical generator directly into New York harbor. The concrete casings supporting the three-foot pipes had suffered with the load, and now steel collars were being installed by Peterson because the concrete was showing signs of failing.

"Big Allis," as this generator is affectionately called, is the pride of its owner, Consolidated Edison Co., as well as her builder, Allis-Chalmers. Servicing it takes months, requires teams of specialized workers, and follows a very tight schedule. The diving work had been scheduled for weeks, so there was no holding back for the weather.

That was Jan. 19, 1979, and diver Peterson had looked at his support team freezing in the shadow of the generating plant. The temperature trembled at 5°, gusts over 15 knots whistled between Manhattan skyscrapers and picked up velocity as they crossed the river, and the wind-chill factor was something the crew didn't have time to calculate and something the diver would soon be oblivious to. "You guys enjoy yourselves," he said before the 25-pound helmet was screwed in place, "I'm going down below and warm up. It's only 35° down there."

Soon the speaker box crackled to life and backup diver Richard Florio let a smile cross his serious face. Peterson was telling the surface crew that he had gotten the first heavy plate in position at last. The crew had been on-site at midnight the night before, but the tide had gone against them. Now they were back on schedule. Everyone topside was relieved. One down, two to go.

An involved job

After the collars would come the pneumatic tubes filled with heavy-duty industrial grout, which they would force behind the plate where the cracking concrete had been removed. Another precision job to be performed in total darkness. If the pressurized grout didn't force the water out properly as it filled the cavity, then the repairs would only last a short time. Otherwise?

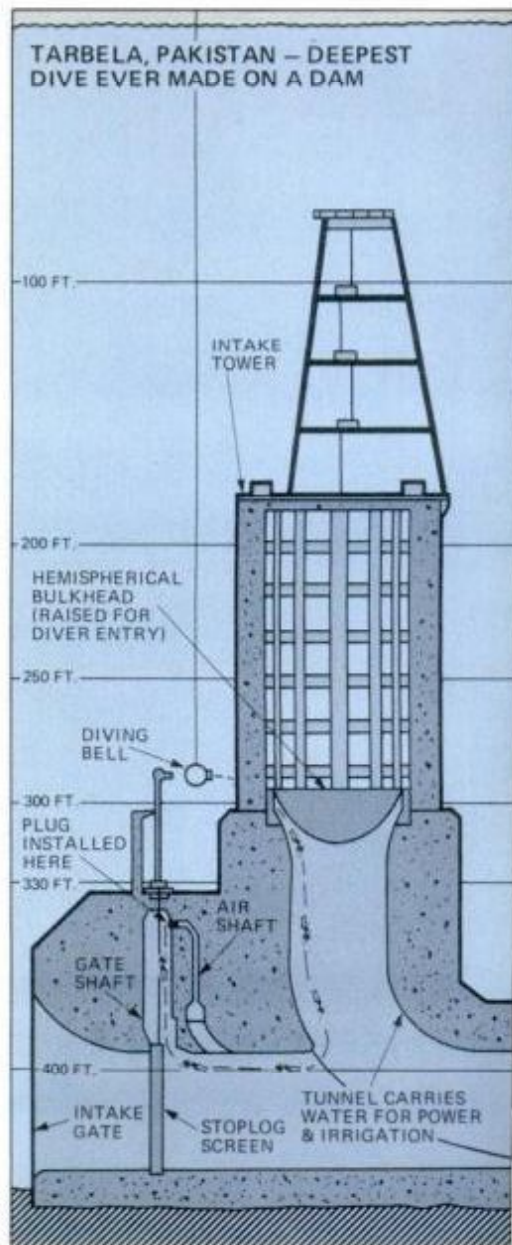
"We figure it should last 20 years," said Bob Henkin, a veteran of heavy construction diving and supervisor of the repairs. He is a man with a quiet pride in both his abilities and his divers—a professional. His company, New York Submarine Contracting, had been operating in these waters since 1897 and he raised his eyebrows at the mention of modern insurance rates.

Divers had to go 400 feet down, then 100 feet up again inside a submerged structure to plug a leaking air shaft at Tarbela Dam in Pakistan. Details in text on opposite page.

"Lloyds of London and about six other companies do most of the world's diving insurance. Sure there's risks; sometimes nobody will insure a job, not at any price." He pointed south along the East River to where, a few blocks away, the Queensborough Bridge reaches over Roosevelt Island to Long Island.

"We were laying cable on the river bottom a while back, and the trench being cut into the rock was only about six feet above the subway tunnel. There was no way you could blast. We had to chisel in by hand and use hydraulic rock crackers to make the holes."

Diver Florio recalled the job. He was unperturbed. "There wasn't any added danger; it was just another job, but it was strange with the trains right underneath you. You'd be down on the bottom and the subway would go through, and the rock would start to shake and rumble. Blasting would have been simpler. When we're blasting, the only real



danger is that a diver might have his helmet under water when the shock wave hits. That's not a good idea at all."

More hazards under water

Obviously, the hazards of any type of industrial accident are far greater for a man working under water; the cold, the currents, visibility problems, and communication difficulties all combine to increase the already severe risks anyone takes when he puts his head in a place where he can't breathe. Added to the special burden of the equipment he must wear are the bizarre, potentially deadly problems created by the effects of pressure. Compression changes the way the gases in our blood behave, nitrogen narcosis can make us drunk, euphoric and careless. If the pressure even from a long dive to 50 feet is released too quickly, gas bubbles will form in the blood to cause the bends, or rupture out through the lung tissues and create embolisms.

Today the scientific approaches taken toward diving have reduced these problems, but only if the rules are strictly followed, only if everything goes well. Divers aren't paid more money just because a job is risky; underwater, all jobs are risky. Divers are paid for time and depth. Danger, as Mike Weiley, a former Navy SEAL, puts it, is part of the job. "If you aren't careful, if you do something stupid, it's possible to drown in a bowl of vegetable soup. Fear and panic are a diver's worst enemies."

Claustrophobic fears

Industrial divers must regularly overcome a type of fear that recreational scuba divers gliding in clear blue water rarely face: claustrophobia, that grim belief that the space a man is in is closing in on him, the gut-wrenching fear of small places. It can lead to panic, and it can even happen to experienced divers.

Lost in a murky fresh-water cave in Florida several years ago, two divers barely managed to reach the surface after losing their bearings. The third diver didn't. When his body was found, he had adequate air in his tanks, his mask and equipment were all in working order, but he had panicked to the point where he could no longer breathe. He had died of panic, suffocating, not drowning, with air still in his tanks.

The closed chambers of an underwater cave can be frightening, even terrifying. But the inside of the Tarbela Dam in Pakistan, where over 50 dives were made several years ago, sets the record (see illustration at

Even godfathers get scared down there

Jacques Cousteau, coinventor of scuba-type breathing apparatus and, as such, the godfather of sport diving, has had a close call or two. But even though he's been eyeball-to-eyeball with nearly every known menace in oceans ranging from tropic to Arctic, the captain's closest brush with death underwater occurred miles from the sea. It was a situation having many elements in common with the kind of dangerous industrial dives professionals are paid to make every day.

In 1946, he was asked to investigate a subterranean flooding phenomenon at the headwaters of the Sorgue River, near Avignon, France. Cousteau and his codiver, Dumas, roped themselves together and waded into the 55° water of a large limestone cave. They sought an underground chamber system that would explain the violent upwelling following spring rains.

Feeling his way into an ever narrower limestone channel, Cousteau was aware of growing disorientation at about 90 feet down. The depth was not dangerous; he could think of nothing to explain the mysterious infirmity. At 100 feet, he lost track of the weighted lifeline and, to his horror, saw Dumas lose his mouthpiece as his eyes rolled back into his head. It was all Cousteau could do to



reach him and replace the mouthpiece.

He'd forgotten how many tugs on the line was the "up" signal. He pulled and it went slack. Wrong number. But they had sensed trouble on the surface and finally hauled the two nearly unconscious divers to safety, preventing certain tragedy.

Awake late that night with a splitting headache, Cousteau had a hunch. Tests proved him right—their portable diesel compressor had been efficiently pumping its own exhaust, as well as the clean air of France, into their tanks. Carbon monoxide almost killed the captain and his companion.—J.B.

left). The dam was nearing completion when a tunnel far inside the dam itself was found to be leaking. The tunnel had to be pumped dry to complete the mile-wide (world's largest) earth-filled dam, but water kept filling the shaft. The cause of the leak was unknown. Bulkheads at 290 feet were caulked by free divers working from a submersible bell. No luck. Next, a diver was sent deep inside the earthen dam through a 400-foot tunnel. He carried a 150-pound plug into the air shaft near the floodgate. When the plug was finally in place, the dam still leaked. Two types of diving bells had been used, and the divers on the 400-foot level required hours of decompression on the surface. Finally the stop-log (debris barrier) was caulked and the leak was plugged.

The divers, a team of Americans working for International Underwater Contractors, descended to 290 feet in a bell, got out of the bell, crawled through a tiny access hole, descended another 110 feet, swam down a pitch-black tunnel, and then up into a 90-foot blind shaft to do their work—all in total darkness, with no hope of reaching the surface

in an emergency. I.U.C's Bob Sikorski commented, "Sure it was a bad feeling, but the only apparent way to stop the leak involved this complicated dive. Oh, of course they could have torn down the dam. . . ."

I.U.C divers breathe an exotic mix of gases, including helium and oxygen, and have access to specialized decompression procedures, the sort of high-technology experts you call on in a must-do situation. They hold the records for the deepest dives ever performed in a dam.

New dangers for divers

Depth alone is no longer the exclusive measure of danger, for today the ocean's frontiers are constantly being pushed deeper and deeper, as the world's energy needs force man to the bottom of the continental shelf for oil.

New danger, of a vastly different type, is a direct result of our growing need for energy. Some industrial divers do their work indoors, in warm, clear water, well lighted, well equipped, and no more than 50 feet down. There are no strong currents where these divers are working;

(Please turn to page 141)

The Newport constitutes a case study in the problems Chrysler Corp. faces in today's marketplace. Here we have a car that most buyers bought because they'd bought one before. Over half (52.5 percent) had owned Chryslers previously. Equally significant: There were *no* owners in our survey under the age of 40. Our tabulator said he'd never seen anything like it before.

What it means is that the Newport isn't helping Chrysler make many conquest sales. And younger buyers apparently aren't interested in a car of this size and image.

So it appears from these statistics that the future of Chrysler Corp.'s full-sized models looks bleak. Meanwhile, the question is: Are the people who *aren't* buying Newports missing out on something? Is this the sleeper of the year?

We wish we could report that it is, but apparently the Newport has no secret,



It's still the good, basic six-seat car that Chrysler buyers have come to expect.

PM OWNERS REPORT: CHRYSLER NEWPORT

hidden virtues. Owners consider it a fine car, very pleasant to live with and pretty much what they'd expected through previous experience. But early teething problems on the 1979 assembly lines left Newports with a few minor annoyances, such as leaky side windows and balky carburetors.

An advertising specialty distributor from Ohio sums it up for many Newport owners when he writes, "I've driven Newports since 1959 and have dealt with the same dealer for 32 years. He's efficient in his service, and that's why I stick with him. I go back to him automatically every few years for a new car.

"This 1979 car has needed some minor adjustments because it was poorly inspected at the factory . . . a lot of little

things that should not be part of an expensive car. The doors don't really fit, and I wish they'd put frames back around the front door glass. And vent windows. There are air leaks at all four windows and the trunk leaks water. Very sloppy.

"But the car handles well, its size is good for city driving and parking, the heater and interior appointments are good."

An engineer from Tennessee reports: "I'm 6-foot-6 and after looking at most new cars, I discovered that only the Volare wagon and the Newport had adequate legroom. My wife didn't like the wagon, so we settled on the Newport.

"Compared with previous Chryslers, this '79 is substantially quieter, better handling, more comfortable, but it also costs a lot more. Considering it's just a dressed-up version of the old Plymouth



Instruments are hard to read because they're in recessed, poorly lit tunnels.

BY MICHAEL LAMM WEST COAST EDITOR

The Newport satisfies long-time Chrysler buyers, but can't grab new ones

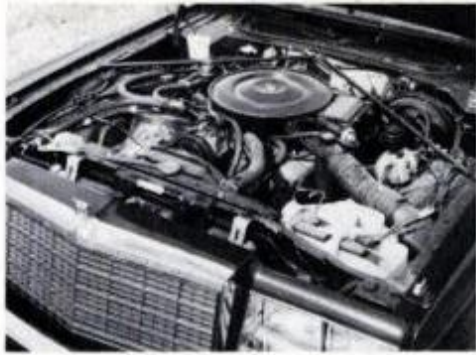
Chrysler lightened the Newport by 800 pounds, trimmed 9 inches off the car's length.

Semi-hidden windshield wipers tend to freeze in cold weather.

Newport sticks with torsion bars up front.



Photos by the author



Most owners opted for mid-size 318. Lean-Burn module rests at side of air cleaner.

[editor's note—it's not], \$8000 is a lot to pay for a car with an inaccessible, unusable jack. However, inside the car I find comfort very good in both the front and rear seats."

Here's a professional interstate truck driver from Michigan who owns the Newport with a 225-cu.-in. Slant Six (only 1.7 percent of our respondents opted for this engine). He reports 18-21 mpg overall. "Lots of room in my Newport to sit and stretch out, even with a hat on," he comments. "I find the car very comfortable throughout.

"The 225 Six is a fine, proven engine and gives perfectly adequate performance. I find the seats comfortable, the trunk roomy, the car handles well on ice and in snow, the styling is nice, and the colors are pleasing.

"I have no complaints with the car itself, but it was only half assembled when I got it. The dealer employs some nice fellows, but they are *not* good mechanics. What the factory assembled was fair, so far as workmanship goes, but there were too many things loose or slipshod. I've had to fix some of these defects myself. And every time I go back for service, I have to rent a car while they're fixing mine. So, while I basically like this Newport, I'm not quite sure I'll buy another."

A work-crew leader from Illinois: "I had had two Chryslers before and put be-

[\(Please turn to page 180\)](#)



Gas cylinders prop up decklid, which lifts slowly. High loading sill is irksome.

The smaller/bigger Newport

Chrysler downsized its full-sized cars for 1979, lopping 9 inches off the overall length and trimming weight by 800 pounds.

Yet, there's more room inside in all directions. And a bigger trunk, as well.

The Newport and its more expensive cousin, the New Yorker, share basic body shells, engines and running gear. Standard equipment in the Newport includes automatic transmission, power steering, power brakes, glass-belted radial tires, seatbelt chimes, full instrumentation, trip odometer and semi-hidden wipers.

There's an optional handling package that includes "Firm Feel" power steering, recalibrated shocks, torsion bars and rear springs. Also optional are stamped aluminum wheels, which result in a 32-pound weight saving per vehicle.

Three basic engines are offered: the 225-cu.-in. Slant Six, the 318 V8 and the 360 V8 in 2- and 4-barrel form. There's also a 4-barrel version of the 318 available in California, which doesn't allow the 360 4V.

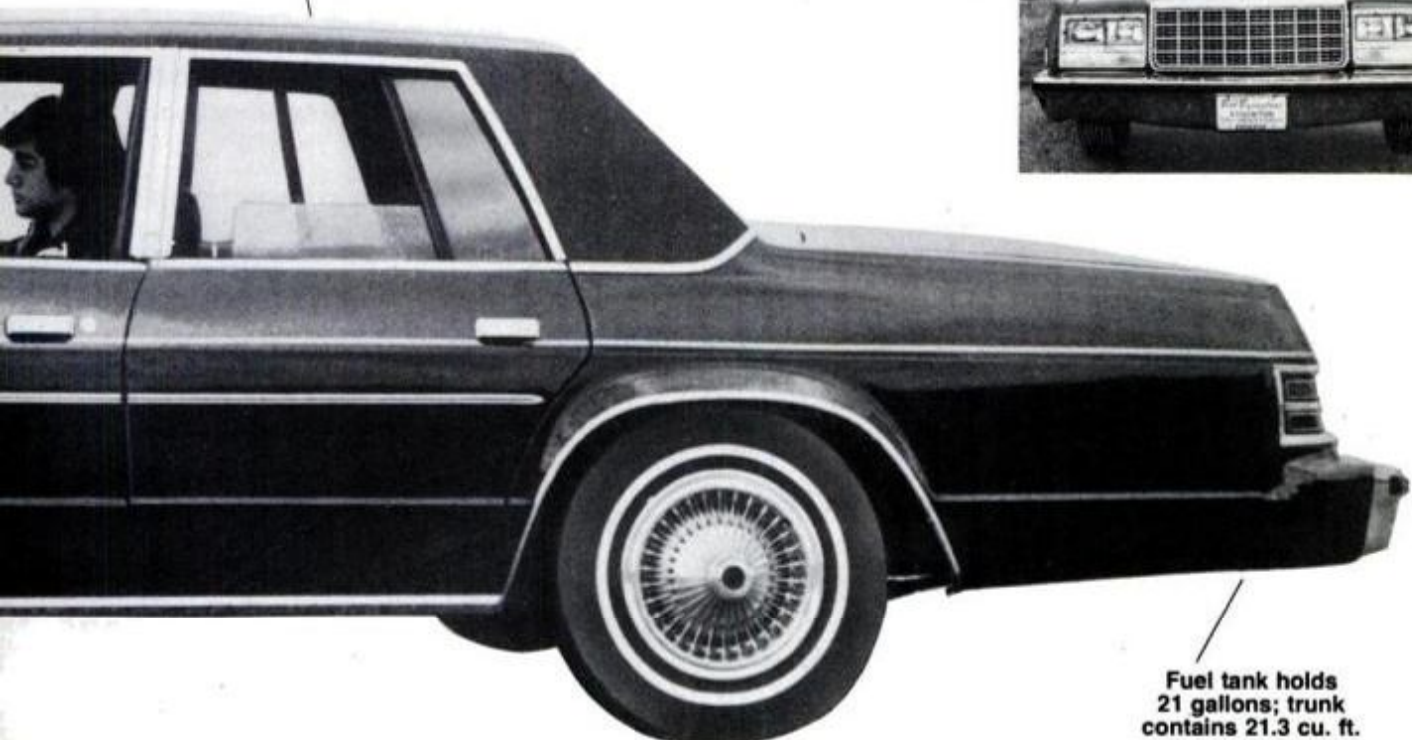
The Newport can be ordered with a great many options, including AM/FM stereo with electronic search tune, AM/FM multiplex 8-track and AM/FM stereo with integrated 40-channel CB.

Chrysler's electronic engine analyzer plugs right into the wiring harness and, in less than five minutes, can perform 50 tests of the starting, ignition and charging systems. The analyzer even prints out the results of its diagnoses.

A NATIONWIDE SURVEY BASED ON 265,380 OWNER-DRIVEN MILES

Frameless windows create wind noise and some leakage.

Newport has exposed headlamps, different grille texture than the New Yorker.



Fuel tank holds 21 gallons; trunk contains 21.3 cu. ft.

How to choose and install an outdoor TV antenna

Bring your TV reception up to movie house quality. It's easy; PM shows you how.

by Len Hilts

It's important to have the right color TV antenna. Without it, the fine performance you paid for in your set simply won't materialize.

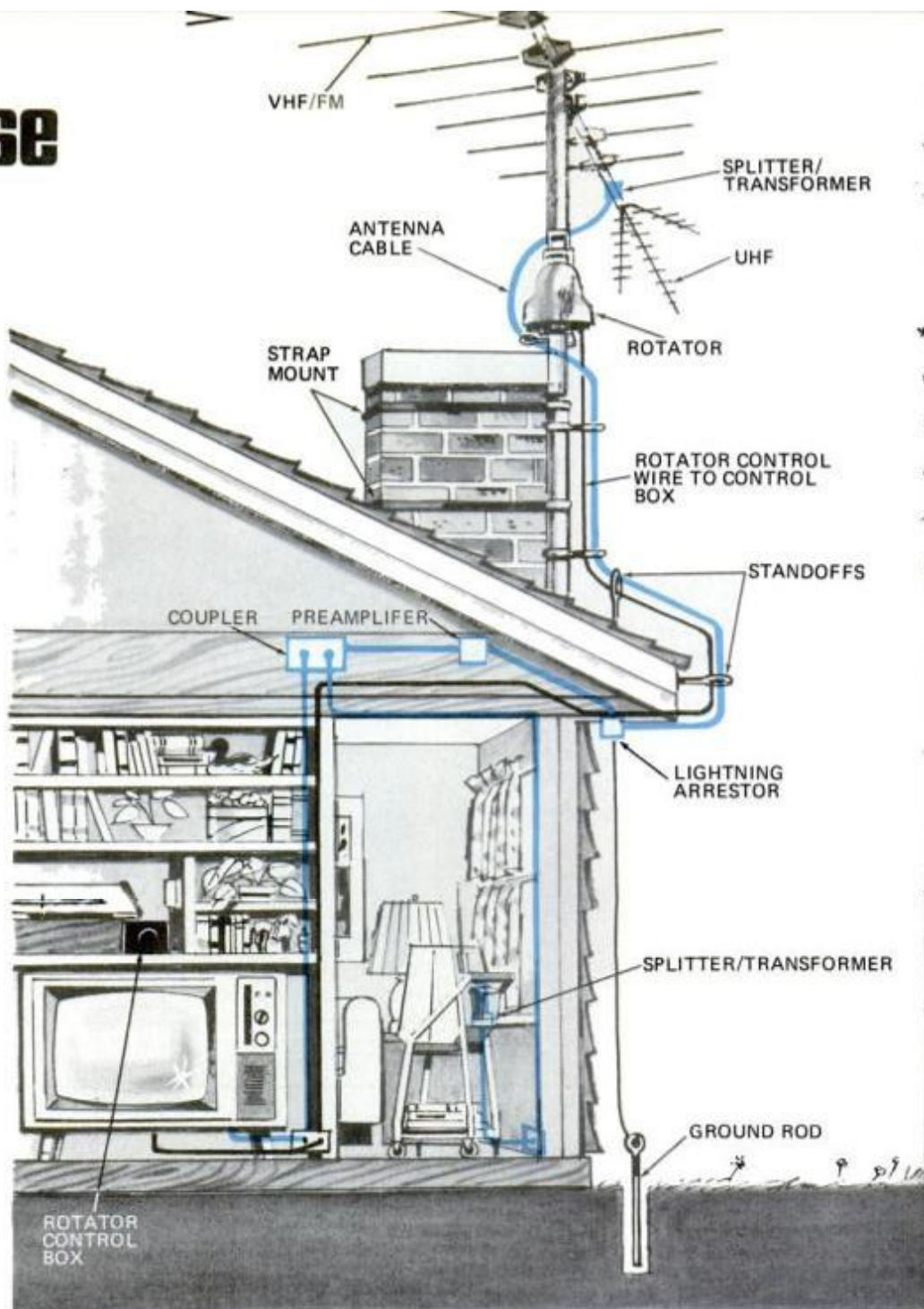
Actually, you need three antennas: one for the FM sound; another for channels 2 to 13 (VHF); and a third for channels 14 to 83 (UHF). You could buy them individually, but typically they're all on one boom.

How to buy an antenna

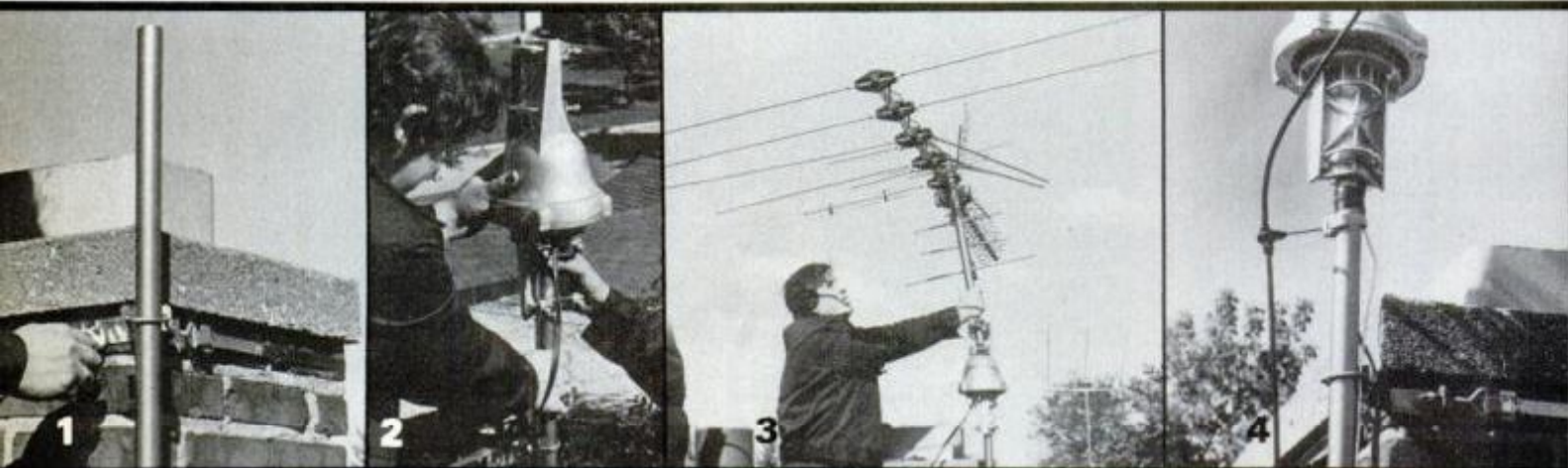
There are four questions to answer when buying an antenna:

1. *How far is my set from the transmitter?* Antennas are rated either in miles or by word descriptions. A typical rating might be 120 miles on VHF, 90 miles on UHF and 70 miles on FM. All are equally important.

Verbal ratings on a box may read: metro, near suburban, suburban, far suburban, near fringe, fringe, and deep fringe. Metro-rated units are for close-in reception—up to 50 miles for VHF, 30 miles for UHF and 25 miles for FM stereo. The deep fringe area rating is for about 180



When you install an antenna system, use a good ground and lightning arrester just as shown. Also, don't forget to loop the cable above and below the rotator!



1) When you install the chimney straps, make them as tight and as far apart as you can, and keep the turnbuckles near the corners. 2) Mount the rotator on the mast between the chimney and the an-

tenna. 3) The antenna should slip easily into the rotator. 4) Don't forget to run standoffs 180° from each other, above and below the rotator, to prevent cable binds.



Indoor/outdoor transformer (left) will match 75 ohms to 300 ohms. Use it at either the antenna or at the TV set.

Two-set coupler/combiner (right) allows download (75-ohm) to feed two sets, or combines signals from two antennas on one lead.



A preamplifier may be necessary if you live in a fringe area—or want to feed three TVs from same antenna's single download.



Transformer/splitter (right) will transform 75-ohm download to match a 300-ohm TV and split signals into UHF/VHF.

miles on VHF, 110 miles on UHF and 100 miles on FM.

2. *Do I need VHF only, UHF only, or both?* What service is available now in your area, or likely to be available in the future? Some places have only VHF stations, some only UHF. Most areas have both.

3. *How many sets will be run off this antenna?* If you have more than one TV set, you need a larger antenna. For two sets, jump one size in the antenna. For four sets, consider jumping two sizes, especially if you are near fringe areas. If you figure you need a far-suburban (70-80 miles) antenna for one set, go to a fringe-area type (110-120 miles).

4. *Do I want programs from different cities?* If so, you need a power rotator, controlled from a box on top of your TV set, to change antenna direction.

You have one other option, an antenna preamplifier which boosts the signal trapped by the antenna. These are good in fringe areas, and also when a large number of sets are used on a single antenna.

Mounting the antenna

Before buying your antenna, look at the roof and determine how you will mount it. Several types of mounts are available:

■ **The chimney mount** supports the antenna by metal straps wrapped around the chimney.

■ **The vent mount** is strapped to a vent pipe jutting from your roof.

■ **The tripod mount** has three legs attached to the roof with screws. It fits across the peak of a roof, and the feet are hinged to adjust to any roof slope.

■ **The mast anchor** is a simple bracket, screwed to the roof, into which the mast fits.

■ **Wall mounts** attach to the side of the house to hold the mast.

The best mounts are the chimney and tripod, which hold good-sized masts in rough weather. Instructions for mounting are packed with each unit, but here are some tips:

Chimney mounts: Locate the two straps as far apart as possible, at the bottom and top of the chimney. You should tuck-point (repair) any loose mortar before installation.

Tripod mounts: Where possible, drive the screws through the feet and the roof boards into the rafters beneath.

All mounts: For tall masts or small mounts, such as vent mounts or mast anchors, install guy wires. Run three wires from the top of the mast and tie them to large screw eyes in the roof.

Installing the antenna

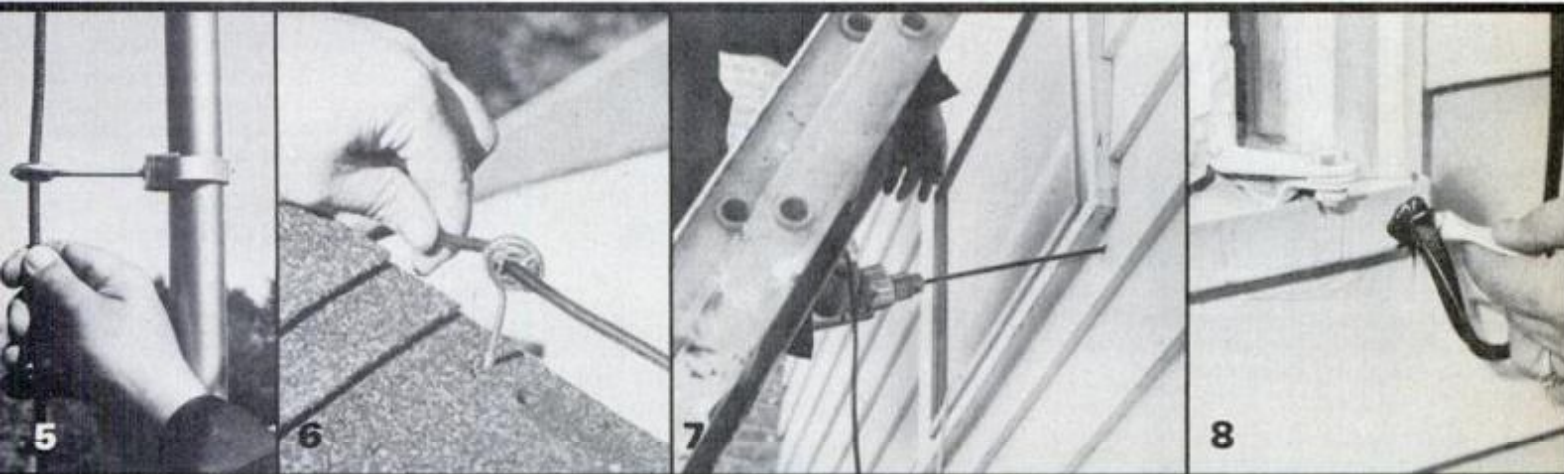
Working on a roof is always dangerous. The greater the pitch of the roof, the more treacherous it is. Wear nonslip (tennis) shoes and arrange tools and parts so they are convenient.

Installing an antenna, for safety reasons, is a two-man job. Some of the parts are cumbersome and there is less chance of tripping or stumbling when two people move these parts. If you have any doubts about your ability to work on the roof, don't go up. Have the antenna installed by professionals. Locate the antenna near the TV set, not at the other end of the roof. The antenna signal suffers a loss for each foot of cable it must travel, so short lead-in lines are best.

The antenna is already assembled in its box, with the dipoles hinged and folded back against the boom. You should receive a signal splitter with the antenna, but in case you don't, buy one. This is a small unit you attach to the lead-in wires of the antenna to combine the VHF, UHF and FM signals. With the signal splitter in place, you use a single lead-in wire. Without one, you need a separate lead-in for each signal.

If you are installing a rotator, you

(Please turn to page 182)



5) Run enough standoffs down the side of the mast to keep the cable straight. 6) Continue the standoffs along the eaves. 7) Drill up through the wall at an angle when you enter the wall. This will

help prevent leaks. 8) Once the cable is run into the house, fashion it into the drip loop, as shown. This is another way to insure that water will not seep indoors.

Restore your old antenna to like-new operation

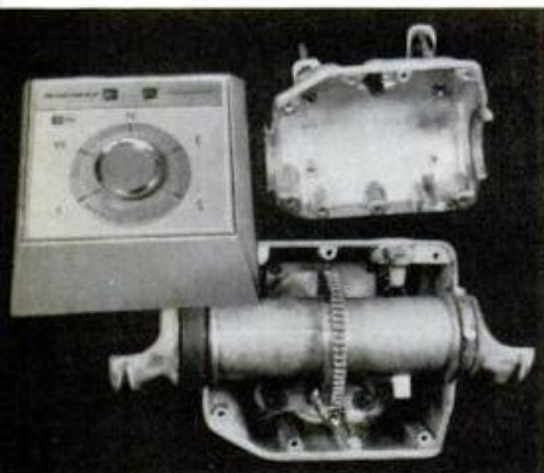
No matter what kind of antenna you own—TV, CB or ham—it can literally fall apart. Here's how to put it back together.

by George X. Sand

Frustrated TV viewers, CBers and ham operators often blame their receivers and transmitters when it's their antenna systems that are at fault. There is seldom a quick way for an owner to measure the efficiency of a faulty antenna. Thus, the difficulty may remain overlooked and steadily worsen.

Check for clues

Antennas suffer most from exposure to the elements. Close-up inspection is necessary. Antennas are usually located as high as possible.



Antenna rotators are often the cause of antenna woes, and most people think they are unfixable. Not true; follow these steps for successful salvage and repair.

So exercise caution against falling when making your inspection!

A poor connection is the most common antenna difficulty. When necessary, remove and clean (sandpaper or scrape) the connectors



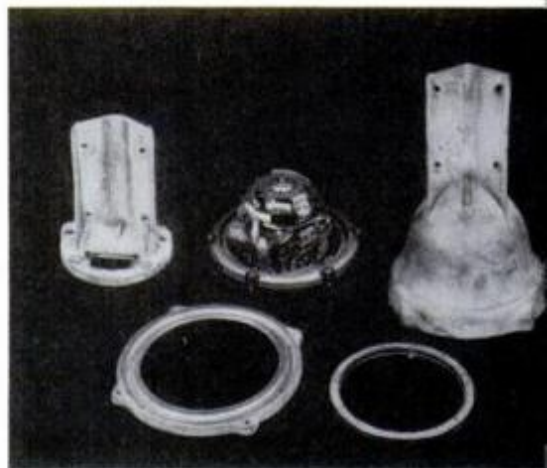
Whether your antenna is on a roof or tower, use proper safeguards such as straps and gin pole shown here. Even great reception isn't worth the risk of injury!

where the twin wire or the coaxial lead-in cable attaches the antenna to the TV or other set. Then restore the connectors and tighten each securely. Apply a weatherproof, non-hardening sealing compound over the cable terminals.

Inspect each element of an antenna array. Make certain that corrosion or rust has not formed to break the electrical contact at the supporting end of the element. In the case of TV beams, this contact is usually riveted fast. If necessary, grind or file off the head of the rivet. Clean the contact surfaces and use a small bolt and nut to restore the element to its original position. Apply weather seal compound over the new joint.

Replace *any* missing elements of a TV antenna. These elements are made of ultralight, thin-wall metal tubing, usually anodized. Make sure that each new element is the same length and approximately the same diameter as the old one (usually it will be identical to the one on the opposite side of a damaged array).

Light metal tubing suitable for TV element replacement can sometimes be purchased at hardware stores and lumberyards. Junk dealers frequently have available discarded TV beams from which some of the elements can be pirated as needed.



Once the housing of an antenna rotator is opened, it becomes clear that there really are many user-serviceable parts inside. Note ball bearings and races.

In some cases, a short length of metal rod or tubing of slightly smaller diameter can be used as a dowel to reattach a broken-off element to its original support.

Make an electrical check to see if a lead-in wire has broken somewhere along its length. This can be done by twisting together the two conductors *at the antenna*, then measuring for continuity at the two bottom wires of the lead-in. (If an ohmmeter is not available for this check, a battery and bulb connected together in

series with the lead-in wire can be used. The bulb will light if the wires are not broken.)

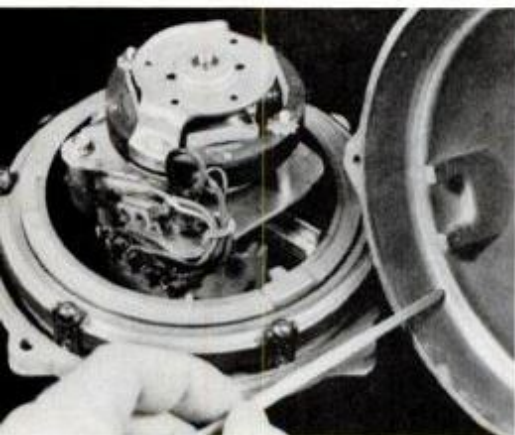
Restoring masts and towers

Rust is the tireless enemy of antenna masts and towers, as well as guy wires and other supporting fixtures used for roof, chimney, eave and wall-mounted antennas. Sometimes the offending rust can be cleaned away, down to the bare metal, after which the surface is painted. Often it is easier (and safer) to replace weather-weakened U-bolts, chimney straps or whatever.

Most telescoping antenna masts are made of galvanized steel that will eventually rust. Steel towers will do likewise, even though they may be made of hot-dipped galvanized metal. When this happens, you have no choice but to remove the rust and apply a good grade of rust-inhibiting paint. After that, a sprayed-on finish coat of chrome-aluminum paint will enhance the appearance of the reclaimed mast or tower.

Towers usually come in bolted-together sections, each about 10 feet long. Sometimes rust, corrosion, wind or other damage makes it necessary to replace one or more of these sections. This work can be facilitated by the use of a gin pole. Such a pole can be purchased.

It's always possible that the ball bearings and races may have become misaligned, especially if the case has been jarred or even previously opened.



The gin pole shown on page 104 is homemade from a 12-foot length of cast (for strength) square aluminum channel, 1½-inch outside measurement on each side. A metal pulley, secured with an eyebolt at the top of the pole, accommodates a ½-inch rope used to lift clear (for lowering) the mast sections, one at a time, if the tower is being disassembled. This is done while a helper pulls on the rope from below. The procedure is reversed to replace the sections.

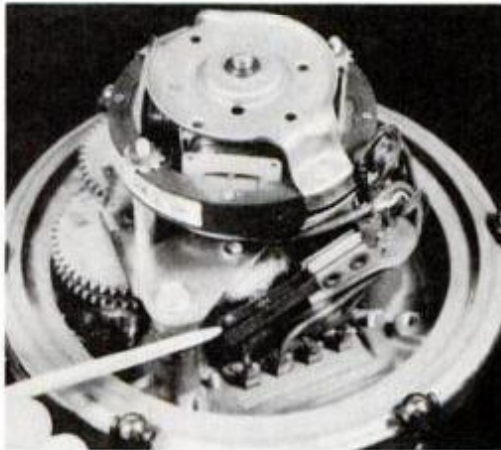
C-clamps can be used to hold a gin pole securely against a tower. To minimize weight and provide easier handling, the gin pole should have thin walls, be it made of metal pipe or channel. (Caution: crimped-together, screen-enclosure-type channel may lack the strength needed to erect a heavy tower section or antenna array.) Should you prefer, the control rope may be operated inside the hollow gin pole.

Antenna rotators

Movable antennas are driven by remote-control motors that vary considerably in size, shape and power. Some operate satisfactorily for long periods. Others become balky and even stop completely. The rotator must then be disassembled for inspection. If there are broken parts, these must be replaced. Often, all that is needed is a cleaning and lubrication.

Frequently, the motor will not op-

One of an antenna rotator's most frequently called-upon parts is the pulsing switch. Check carefully to be certain that the switch's contacts are clean.



Oxidized housing bolts can break right off. To remove the stub, weld on a nut. Apply heat from a torch. Then carefully turn the nut with a wrench.

erate because of a break somewhere in the multiwire cable connecting it to the directional control box below. So check these wires for continuity as explained previously.

When removing the protective

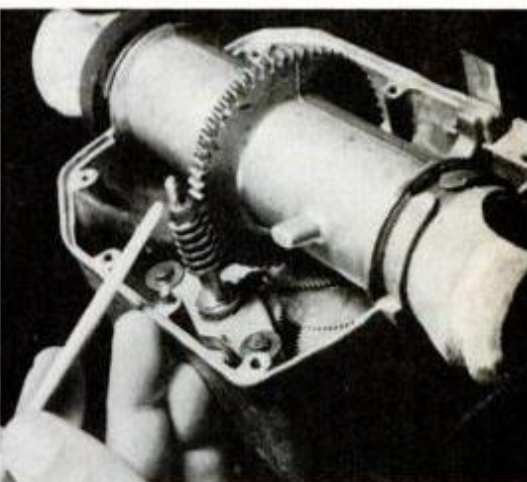
housing from the rotator, be careful not to break off the heads of the steel bolts that hold it together. The housing is nearly always made of aluminum, to make it lightweight, and this metal will oxidize to steel bolts, freezing them tight.

The rotator's moving parts and motor bearings are factory-lubricated. In time, however—especially if a faulty weather seal should develop—the rotator's ball bearings and associated race may become gummy from grit and hardened grease. Clean with mineral spirits and re-lubricate with good-quality, medium-weight bearing grease.

Check the rotator's interior for loose or broken wires. There will likely be a relay pulsing switch present. Make sure the contacts are clean.

Restore the rotor housing. *While the unit is still at ground level, operate the control box to check for proper forward and reverse rotation.* Should there still be problems, more extensive inspection will be necessary. Check for both continuity and unwanted grounding of the rotator's motor windings. Make a similar check of the transformer in the control box.

Depending on the type of rotator being serviced, you may find a faulty



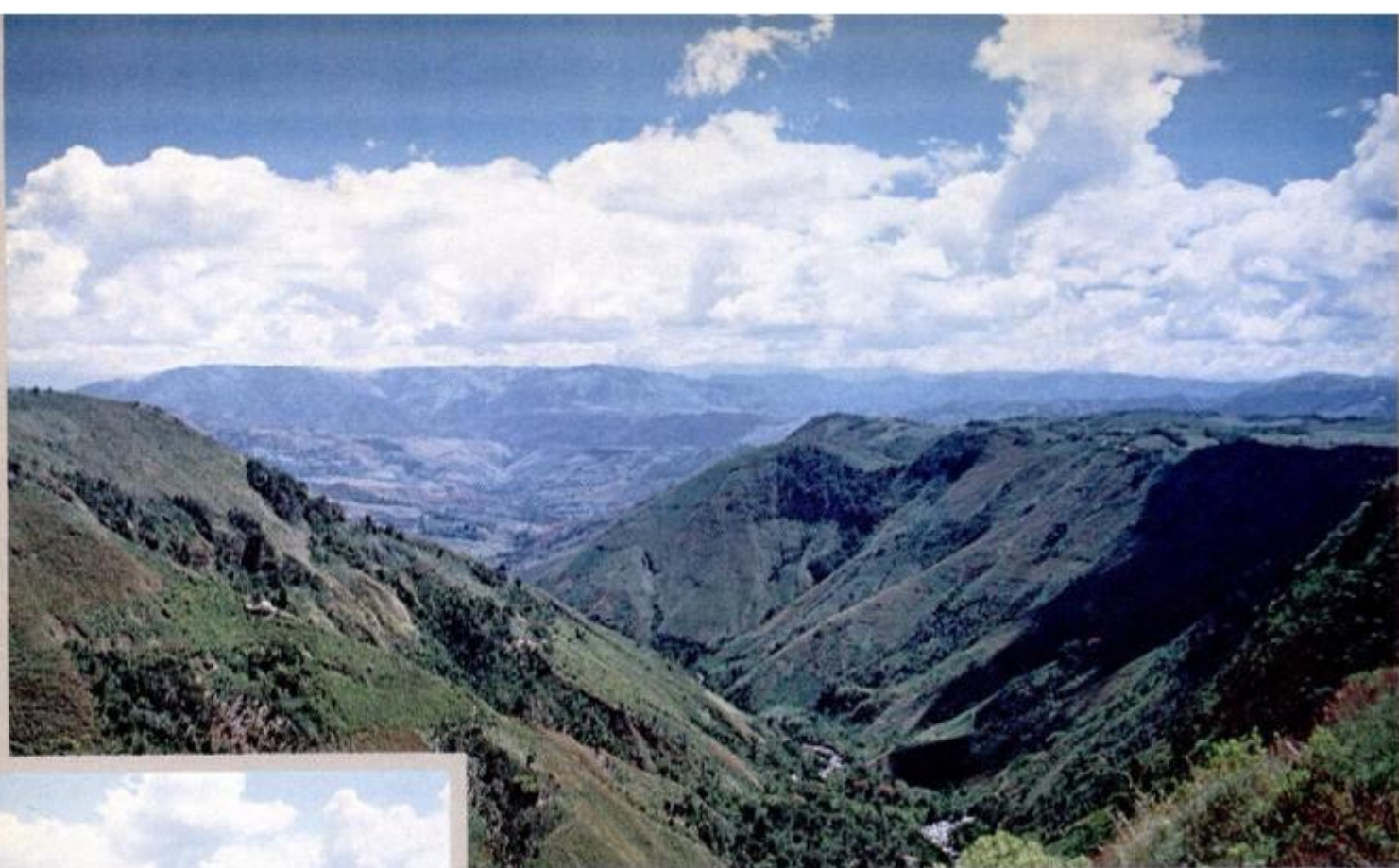
Once the rotator is open, clean all the gears thoroughly. Use a good grade of medium-weight grease to assure that operation will remain clean and smooth.

thermal overload switch, perhaps a faulty motor reversing switch, or a bad relay pulsing switch, solenoid or capacitor.

Replacement parts can sometimes be purchased from the manufacturer, perhaps even locally. If not, you will have to return the faulty rotator or control box to the manufacturer for repair.

Before returning a serviced rotator to the mast or tower, adjust the control box so the rotator moves to

(Please turn to page 139)



A polarizing filter renders washed-out colors (left) brighter with better saturation (above). The filter is especially useful on superbright days; intensity of the effect varies if polarized disc is rotated relative to the sun.



Better photos the easy way—with filters

Used with restraint, filters can aid creativity—with color *and* black and white films.

by Bill Wrenn



No color film is balanced for fluorescent illumination, so color rendition is inaccurate (lower photo). In this case (shooting Ektachrome 200 film), a 30M filter yields acceptable skin tones (top).



When shooting outdoor film indoors, an 80A filter can help restore color balance. But daylight coming in through a window may overpower indoor lighting (left). A filter then makes things worse (above).

Have the people in your photographs ever had green faces, even when they weren't ill? Do your pictures ever come back looking like they were shot underwater?

Sometimes the camera doesn't record exactly what the eye perceives. While it's impossible to reproduce on photographic paper the brightness range our eyes can handle, we should be able to capture color and detail accurately.

One way to do this is with photographic filters. They allow you to capture a scene the way you saw it. Or, if you want, to change it to suit your imagination.

Filters come in many different colors, shapes, sizes and prices. But they all alter the way in which a camera "sees" light.

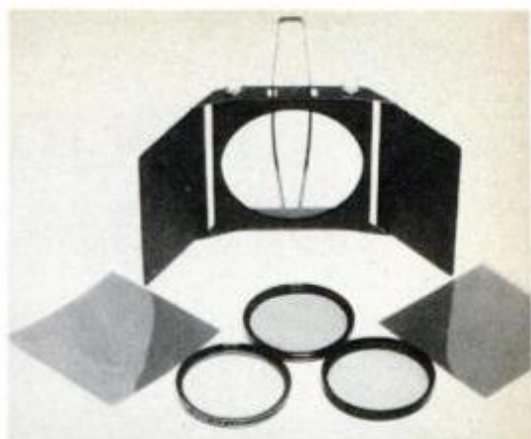
The most popular filters are glass discs with metal frames that screw onto the front of a lens housing. They are also found as square pieces of lacquered gelatin or glass. Gelatin filters are cheaper but more delicate and less durable. Squares of either material attach to a camera with an inexpensive holder. Filters and

lows only that part of the visible spectrum corresponding to its own color to reach the film and absorbs almost all of its complementary colors.

The three additive primary colors of light are green, blue and red. A yellow filter with b&w film causes blue areas to be darker because blue (which is the complement of yellow) has been absorbed. Thus, a blue sky is darkened by a yellow filter, giving greater contrast and more prominent clouds. A red filter, because it absorbs even more blue than a yellow filter does, goes reality one better to give sumptuous, sculptured clouds.

A green filter absorbs red and blue and is particularly useful for photographing foliage; green areas often come out darker in a picture than perceived by the eye. The filter, by passing more green light than yellow and blue, can lighten up grass and trees and improve their detail.

Remember when using filters for b&w, whatever is the same color as the filter you are using will come out lighter. Alternatively, a filter's com-



Glass disc filters (center) screw onto lens front. Gelatin squares (flanking discs) come in many sizes. Filter holder (rear) grips lens front, accepts gelatin squares.

pleted light, can be rescued by a polarizing filter. Like polarized sunglasses, it passes only light rays of a certain alignment, thus giving darker skies and richer colors. It can also be used for the same effect in b&w or in tandem with a colored filter. A polarizer can be rotated to vary its effect, and is also useful in penetrating atmospheric haze.



In black and white without a filter, clouds on a bright day are indistinct and sky is washed out. Shadow detail also suffers.



When same scene is photographed with the addition of a red No. 25 filter, sky darkens, clouds pop out and contrast improves.

holders are available for most types of cameras. In a pinch, gelatin filters can be cut to size and taped over a lens (make sure it covers the camera's electric eye, if there is one).

Black-and-white filters

Filters were a staple in black-and-white (b&w) photography for years, although they are less so today. Filters used in b&w don't do anything for colors, of course, but they can improve tonal rendition and image definition. Unless you have unusual needs, you will probably need only three: a yellow (No. 8 or 9), a green (No. 11, 13 or 15) and a red (No. 25 or 29). The higher the number, the darker the hue. Thus a red No. 29 is darker than a No. 25.

Each of these specific filters al-

plementary colors come out darker: blue with a yellow filter, green and blue with a red filter, and red and blue with a green filter.

Filters for color control

Under ideal conditions, color films should render an image close to what you see. But conditions are seldom ideal.

For instance, if a scene has a lot of reflected light, particularly near water, glass or concrete, the vibrant colors you remember will often appear washed out in a print or slide. Or perhaps shadow areas will look bluish. Even worse, you might have a set of pictures that all look as though they were shot through a fishbowl.

Such a scene, teeming with re-

Bluish shadows can be reduced with a skylight filter. It looks like a plain piece of glass, but it warms up shadow areas and the colors of a distant scene. Many people always keep a skylight filter on their lenses because it protects the lens from accidental damage and doesn't affect exposure settings.

If your photos are bluish all over and weren't taken under water, you were probably using indoor film outdoors. Different films are made to respond to different types of light. Outdoor (daylight) films respond accurately to sunlight and electronic flash. Indoor (tungsten) films respond to incandescent light. If you start shooting indoor film and move outdoors, an 85B filter will help re-

(Please turn to page 165)

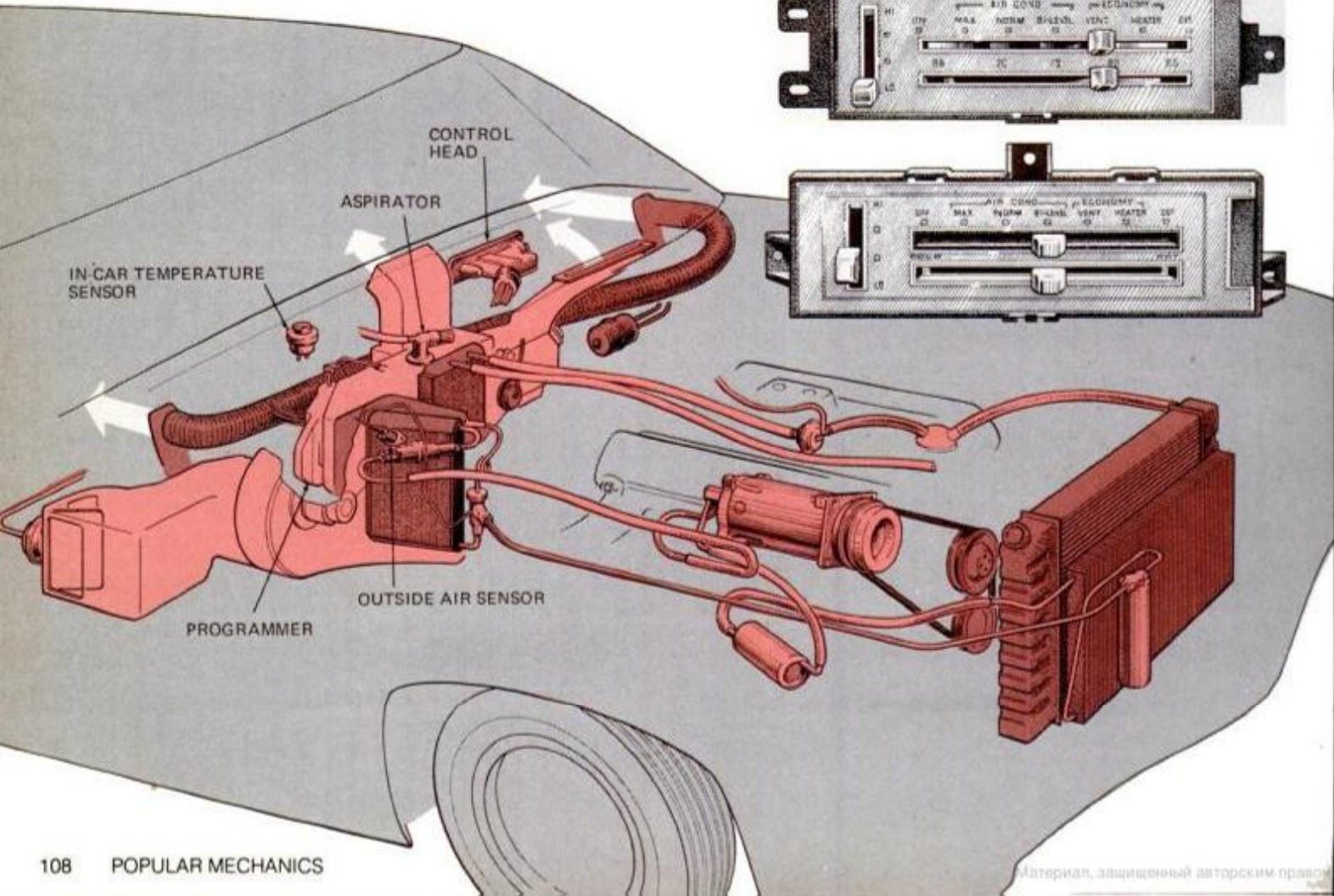
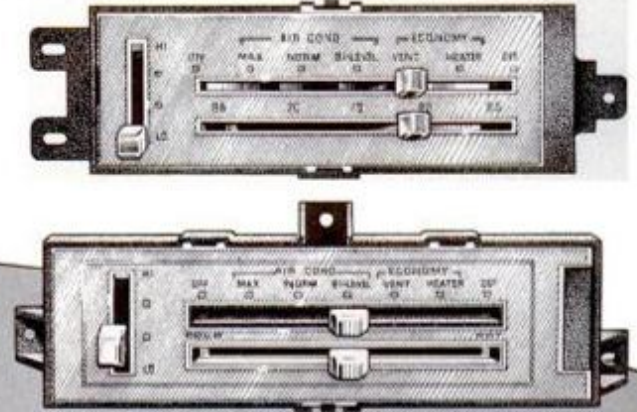
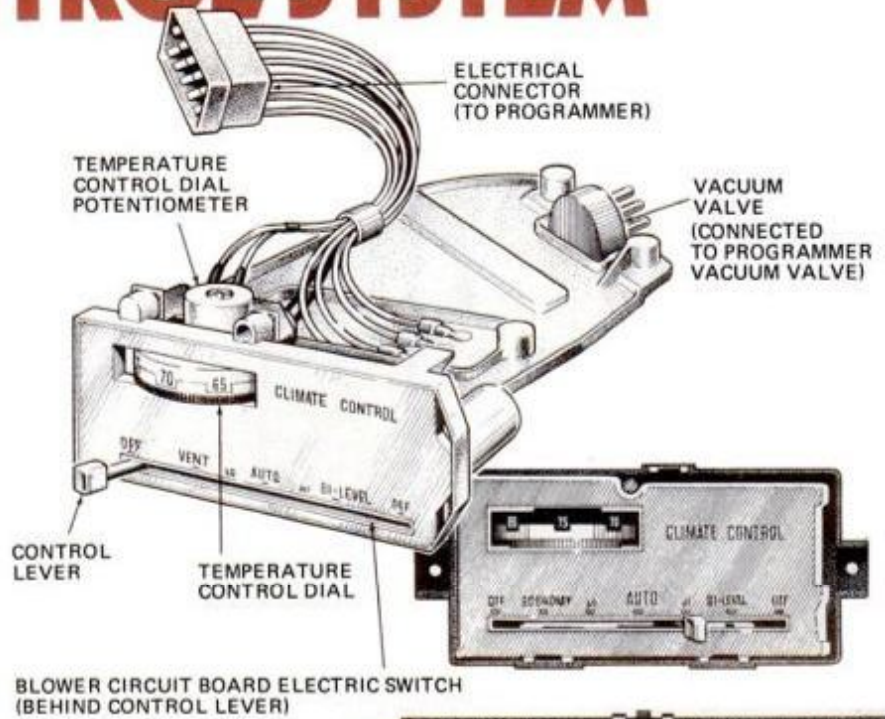
HOW TO KEEP THE CONTROL IN YOUR AUTOMATIC TEMPERATURE CONTROL SYSTEM

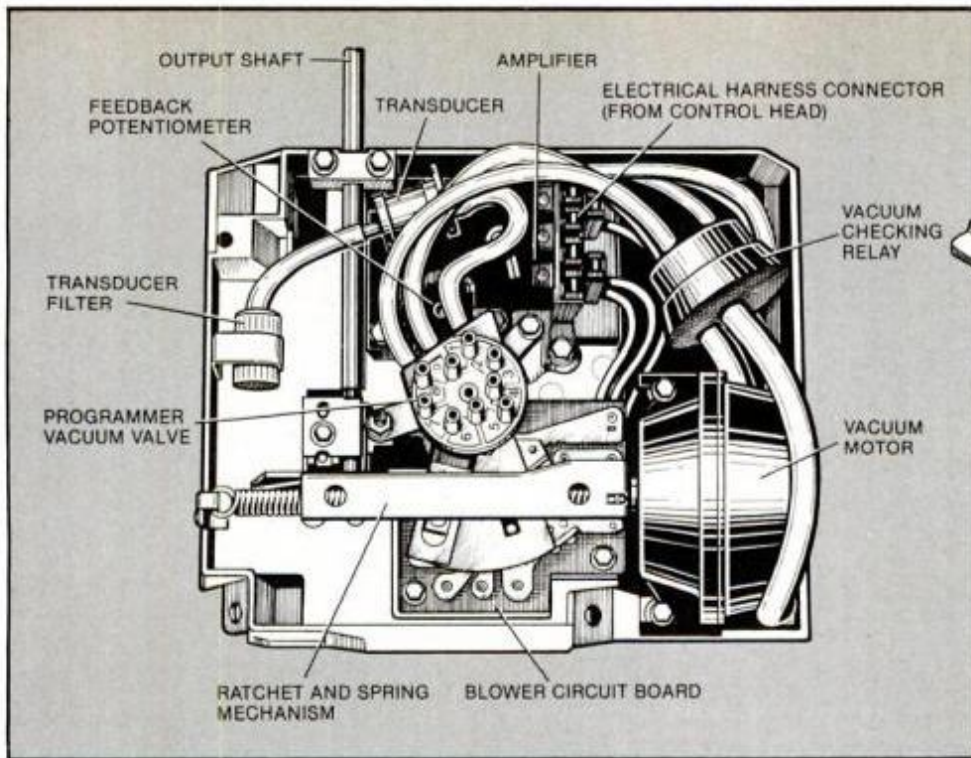
by Mort Schultz

Remember the used-car ads you used to read years ago? The cars that were well equipped had an "R/H" in the listing. Wow, a radio and heater! Over the years the number of options grew, and airconditioning was added to the list. Now, the old "H" and "AC" are often combined in a single sophisticated unit.

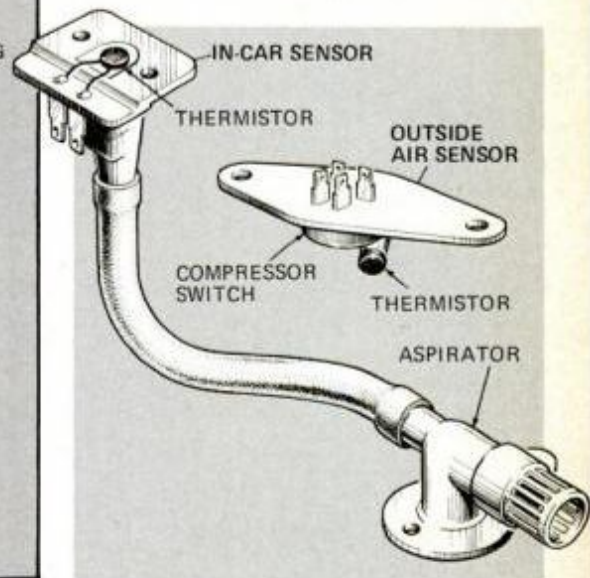
In place of a standard heater/air-conditioner, buyers of General Mo-

Overall view of ATC system components is shown below. At top right is a look behind an ATC control head, this one used by Chevrolet in its Comfortron system. Front panels shown at right, from top to bottom, are: ATC as used in Cadillac, Semiautomatic Temperature Control System (SATC) in Oldsmobile, and a standard, nonautomatic system panel from Chevrolet.





ATC programmer from Cadillac Seville (left) is opened to show parts layout. Below are in-car and outside sensors that monitor temperature and provide input for an automatic system.



PROGRAMMER OUTPUT		INPUT TO PROGRAMMER (SENSOR STRING + TEMP DIAL) — OHMS									
VACUUM VALVE FUNCTIONS	RECIRC DOOR	RECIRC.	OUTSIDE AIR								
	WATER VALVE	CLOSED	OPEN								
	MODE DOOR	A/C MODE		BI-LEVEL		HEATER MODE					
TEMP DOOR POSITION	MAX COLD		INTERMEDIATE TEMP POSITIONS			MAX HOT					
BLOWER SPEED	HIGH		M ₁	M ₂	M ₃	M ₄	M ₅				
		100	110	120	130	140	150	160	170	180	190

The ATC programmer input/output chart here shows the functioning of the system according to changes in circuit resistance as determined by sensors and temperature-control dial.

IN HOT WEATHER SENSOR RESISTANCE IS LOW CAUSING THE PROGRAMMER TO START AT THIS END OF THE CHART AND SEQUENCE TO THE RIGHT.

IN COLD WEATHER SENSOR RESISTANCE IS HIGH CAUSING THE PROGRAMMER TO START AT THIS END OF THE CHART AND SEQUENCE TO THE LEFT.

tors' models are able to order an Automatic Temperature Control (ATC) system, which has been available as an option for about 10 years. Oldsmobile also offers a Semiautomatic Temperature control system (SATC), called Tempmatic, as an option.

On 1979 models, ATC is limited to Buick Riviera, Century, Electra and LeSabre; Cadillac; Chevrolet Caprice and Impala; Oldsmobile Toronado; and Pontiac Bonneville, Catalina and LeMans. ATC costs about \$100, bringing the complete package (ATC and airconditioning/heating system) to over \$600. (ATC is not optional in a Cadillac. If you buy a Cadillac, you get ATC.)

ATC vs. SATC

When you set the temperature-control dial of an ATC system, tem-

perature in the car is automatically maintained regardless of changes in outside air temperature. The temperature dial is marked off in 5° increments from 65° to 85° F.

ATC provides warm or cool air. In aircondition, bilevel or heater mode, ATC automatically maintains in-car temperature at a preset level. This is accomplished by automatic control of the temperature door and blower-motor speed.

Note that the control panel of an ATC system doesn't have a setting for heater and airconditioner modes. Warm or cool air is delivered when the selector dial is placed on Auto (for automatic).

With the selector dial on Auto mode, air is discharged from the airconditioner outlets, heater outlet or both. Discharged air at 75° F. and below is delivered from the aircondi-

tioner outlets. Discharged air at 90° and above is delivered from the heater outlet. When air is between 75° and 90°, it is delivered simultaneously from heater and airconditioner outlets.

With the selector dial on Bi-Level, air is discharged from all outlets, including defroster outlets. Bi-Level mode is used when heated air is wanted at floor level and cool air is wanted at upper-body level. Turning the airconditioner's outboard instrument-panel outlets toward the side windows defogs the windows. At the same time, air from the defrost outlets clears the windshield.

You can override the ATC system's automatic blower by switching the selector dial to Lo or Hi for a fixed maximum low or high flow. The Economy mode is included to provide outside air ventilation when desired. In Def mode, the system delivers a large volume of defrost air from the heater outlet to the windshield, as well as to the interior of the car. Blower speed is on high.

The Oldsmobile SATC system has a mode control lever, temperature selection lever and blower selection switch. The control lever has to be finger-flipped from one mode to another to get normal aircondition, maximum aircondition, bi-level, ventilation, heat or defrost.

With ATC, you could drive from Alaska to Florida and the system would automatically switch from heat to airconditioning. With SATC, your finger would have to do the switching. And with SATC, you'd set blower speed manually.

So what's automatic about SATC? Look to the temperature selection

lever. Once this lever is set (between 65° and 85° F.), the temperature maintains itself by automatic control of the temperature door.

ATC's automatic controls

ATC is a basic air conditioner and heating system with a few parts added or changed to provide the automatic feature. These parts are a programmer, control head and two temperature sensors.

The programmer is mounted in the passenger compartment on the heater case. It contains an amplifier, transducer, feedback potentiometer, blower circuit board, and a vacuum system consisting of a vacuum valve, vacuum checking relay, vacuum motor, and ratchet and spring mechanism.

The control head is behind the control panel. It contains a temperature-control-dial potentiometer, blower circuit-board electric switch, in-car turn-on switch and vacuum valve. The programmer and control head are connected by electric wires and vacuum hoses. The role of programmer and control-head parts in providing ATC is as follows:

- *Amplifier* converts a weak electric signal from the temperature sensors and temperature-control-dial potentiometer into a strong electric signal that is transmitted to the transducer.

- *Transducer* transforms the electric signal to a vacuum signal transmitted to the vacuum motor.

- *Vacuum motor* works the ratchet and spring mechanism, which, in turn, does these things:

1. Moves blower circuit-board wiper across the blower circuit-board terminals.

2. Drives programmer vacuum valve, which, in turn, controls operation of air-circulation doors and the hot-water (heater) valve.

3. Drives rotary output shaft, which sets the position of the air-mix (temperature) door. The position of this door controls the warm/cool air mixture flowing into the car.

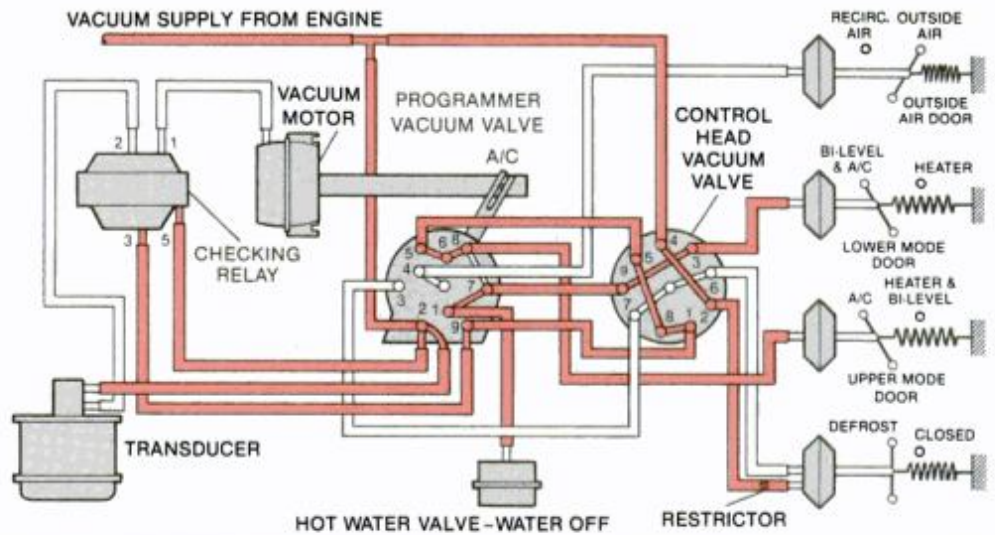
4. Works feedback potentiometer.

- *Blower circuit board* is turned on by the blower circuit electric switch in the control head when automatic blower operation is called for. The blower circuit-board wiper sets itself on one of the blower circuit-board terminals. This completes the circuit that starts at the blower circuit electric switch and terminals at the blower motor.

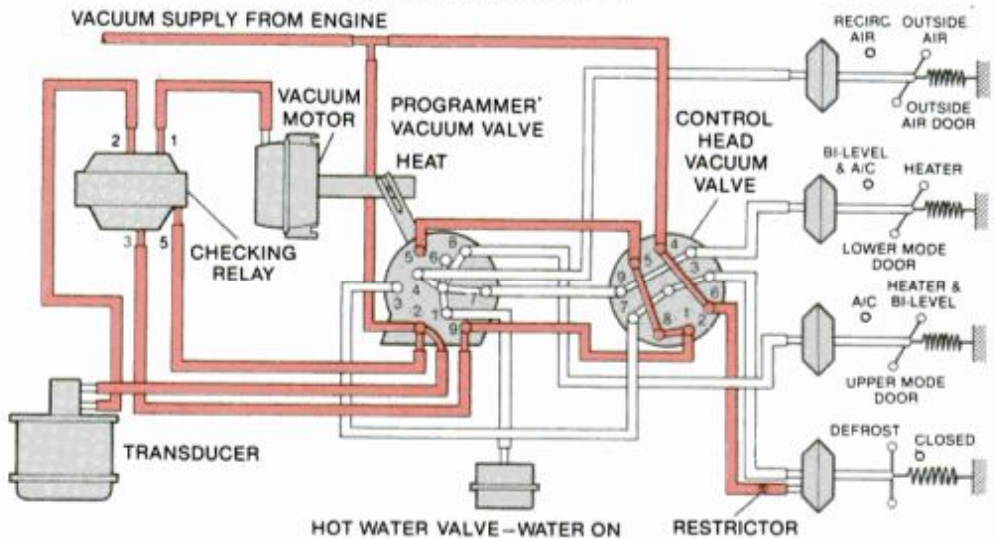
Each terminal has a different resistance that establishes which one of the four blower speeds will be in operation at any one time. It works like this:

As sensor temperature changes,

AUTO POSITION A/C



AUTO POSITION HEAT



Flow diagrams show operation of the vacuum system during automatic air conditioner-on position (top) and automatic heat-on position (above). Vacuum controls the automatic opening and closing of the mode doors and the hot-water valve.

the signal that sensors send to the vacuum motor, by way of the amplifier, varies. When the motor receives a signal different from the one it's been getting, it exerts either more or less pressure on the ratchet and spring mechanism. The mechanism moves, which moves the blower circuit-board wiper to a different blower circuit-board terminal, and the blower speed changes.

Incidentally, if the control lever is placed on Economy, Lo, Hi or Def, the blower circuit-board electric switch overrides the blower circuit board in the programmer.

- *Vacuum valve in the programmer* is connected to the *vacuum valve in the control head*. The two operate the air doors and hot-water (heater) valve. The various modes (aircondition, heat, ventilation and defrost) depend on the position of the air doors and whether the hot-water valve is open or closed. Each air door (there are four) and the hot-water

valve are controlled by a diaphragm working off the programmer vacuum valve or the control-head vacuum valve.

- *Feedback potentiometer* is a resistor that controls the movement of the vacuum motor by dampening the signal the motor receives from the transducer. This prevents the motor from moving the ratchet and spring mechanism too much.

- *Vacuum checking relay* allows the vacuum motor to maintain vacuum level when the engine is under load, such as during step-down acceleration and when climbing steep grades. The vacuum checking valve closes when there is a drop in engine vacuum to prevent vacuum being pulled from the vacuum motor by the engine. The motor is able to maintain vacuum to the various ATC components until engine vacuum returns to normal.

- *Temperature-control-dial poten-*

(Please turn to page 138)

NEW NOW for home and shop



A Power tilling and hoeing can be done by a single machine with the Auto Hoe. It's said to be lightweight and highly maneuverable, and thus easy to operate and control. Two heavy-duty V-belts transfer power from the engine to the tilling assemblies. The belt drive is quieter, longer-lasting and more efficient than gears or chains, the maker claims. The Auto Hoe is available for a 30-day home trial from Auto Hoe, Inc., Box W121NR, De Pere, Wis. 54115. Model 36, with 5-hp engine, is about \$300. Model 35, with 3-hp engine, is about \$270.

B Intricate woodcarving is made easier with this set of six tools. Hand-forged of high-carbon tool steel, the tools are said to be among the smallest made. Four of the tools have blades about $\frac{5}{32}$ -in. wide; the other two are about $\frac{5}{64}$ -in. wide. At that size, they are especially useful for fine detail work, modeling and miniatures. Set shown has half-round, palm-style hardwood handles; straight handles are also available. The set costs \$16 and is available from Harmen Co., Inc., 34 Parkway, Little Falls, N.J. 07424.



C The Energy Monitor supplies an instantaneous reading of electricity consumption in the home to aid in saving energy. It flashes a warning when power usage exceeds a preset monthly budget, and it can be used to monitor individual appliances as well. LED readout can show time of day, accumulated monthly bill, date, billing date, projected amount of next bill, amount of last bill, preset monthly budget and cost per kilowatt-hour. The a.c.-powered unit is wall-mounted; a sensor is clamped around the incoming service at the house entrance panel. Unit costs around \$300 from Dupont Energy Management Corp., 3301 Conflans, Suite 102, Irving, Tex. 75061.



D You can paint clean, straight lines or circles in one brush stroke with the Brush Control, according to the maker. The transparent plastic unit accepts different-size brushes and glides along a straightedge or around on its compass arm. The Brush Control costs \$12.50 and is available from IHMS Inc., 1569 West Hazelwood, Phoenix, Ariz. 85015.



1. Long entry hall is brightened and unified by American Olean's Primitive Birch floor tile. Natural textures such as the Townsend walnut wall planks give the area a warm, inviting look.

2. Attention to detail—hardware, art and greenery—produce a smashing view.

3, 4. The table/bench combo holds decorative items, stores scarves and makes a handy seat for pulling on boots, rubbers.



Color photos: Harry Hartman; stylist, Gabe Herrick

Here are some winning approaches to making over your front entry, including plans for a handsome foyer table/bench.

A NEW FRONT ENTRY WITH



by Fred Wolff and
Rosario Capotosto

For this project, PM's editors chose a hall entryway in dire need of revision with the hope that our ideas would ring a bell with our readers. Originally, the long, dark hall—it runs the length of the house—was a hodgepodge of styles, textures and colors. Entering guests had a clear view of the utility room at the end of the hall.

Our first change was to brighten the space with color and light, giving it a clean-line, contemporary look throughout. We also relocated the utility room entry to get it out of sight.

Windows are covered simply with blinds that bring maximum light into the area during the day, or can be closed during the warm months to reduce heat gain.

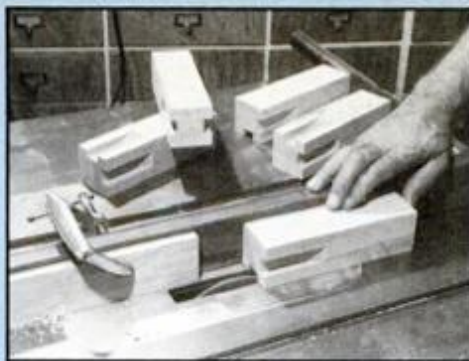
Choice of white on the window wall, floor and louvered door creates the illusion of greater space than actually exists. Greenery brings a fresh feeling to the long, narrow hall. Natural-looking materials such as ceramic tile and walnut wall planks help give the entry a contemporary look. Simple lighting designs and choice of accessories enhance the effect.

We also remodeled a small entry closet that contained a pump and water heater. By relocating the equipment, we made extra space for seasonal storage, and room for pull-down stairs leading to the attic.

Table/bench combo

Our multi-purpose foyer table adds to the overall look while storing outdoor needs. We built it of 4/4 pop-

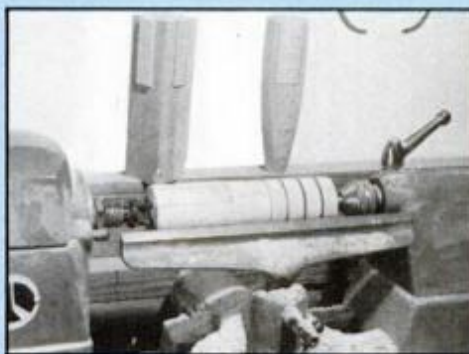
(Please turn to page 136)



1 Cut mortises in leg blocks before turning. Adjust the dado head, then clamp a stop block on the fence to limit groove.



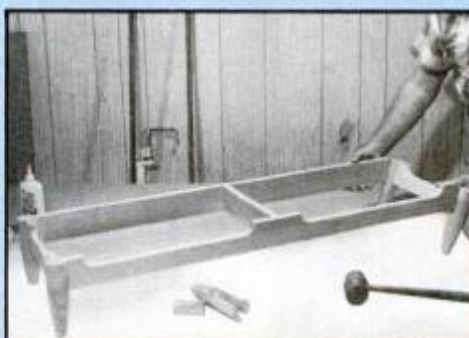
2 Clear out the curved portion of the leg groove with a sharp chisel. Clamp block firmly to the table for this step.



3 Temporarily glued filler blocks prevent splintering at mortise. Use parting tool and caliper to determine shape.



4 Glue paper scraps so filler blocks can be removed easily with a chisel. Fifth leg (center) has a slot cut through it.



5 Join legs to the ends, then to front and rear parts. Apply glue sparingly. Squeeze-out can result in a poor stain job.



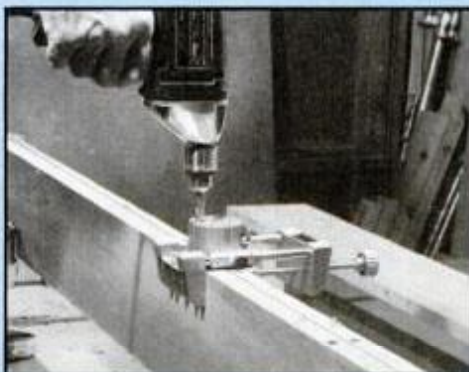
6 Unsurfaced lumber edges are rarely true. Tack-fasten a straightedge as shown to cut the first edge straight.

LOTS OF GOOD IDEAS

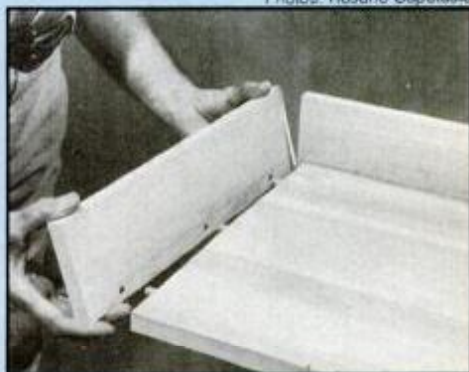
SHOPPING INFORMATION

Materials used in the PM front entry are available throughout the United States. For buying information, write to the manufacturer.

Ceramic tile, American Olean Tile Co., Lansdale, Pa. 19446; **switch plates, door and other hardware**, Amerock Corp., 4000 Auburn St., Rockford, Ill. 61101; **Flexaluminum blinds**, Hunter Douglas Inc., 20 Campus Rd., Totowa, N.J. 07512; **Durament grout**, C.E. Kaiser Co., Box 94169, Houston, Tex. 77018; **decorative lighting**, Lightcraft of California Div., 1600 West Stauson Ave., Los Angeles, Calif. 90047; **door speaker, chimes**, Nutone Housing Products, Madison and Red Bank Rds., Cincinnati, Ohio 45227; **plastic bifold doors**, Regency Door Co., 6720 N.E. Fourth Court, Miami, Fla. 33138; **recessed lights**, Sterling Div., Scovill, 1600 West Stauson Ave., Los Angeles, Calif. 90047; **Townsend wall planks**, Pottlatch Corp., Box 916, Stuttgart, Ark. 72160.



7 A doweling jig is invaluable when joining several boards on edge. Rotate the jig 180° to bore the mating hole. Mark each board for later matching.



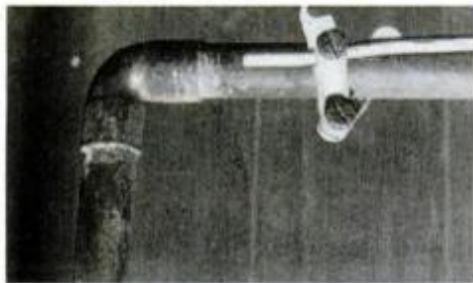
8 Spiral-grooved dowels allow excess glue to escape. To use plain dowels, plane a glue-escape flat on one side of each dowel. Trapped glue may split wood.

Photos: Rosario Capotosto

26 ways to beat rust and corrosion



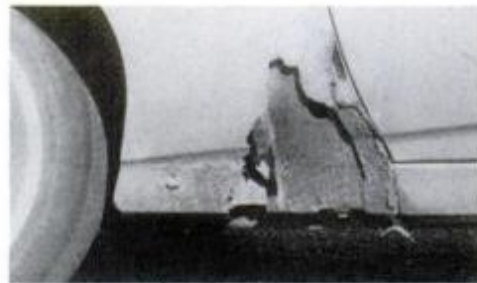
Where to check for rust



Failure of rust-rotted clamp screws on grounding wire will soon render protection ineffective and cause a potential hazard.



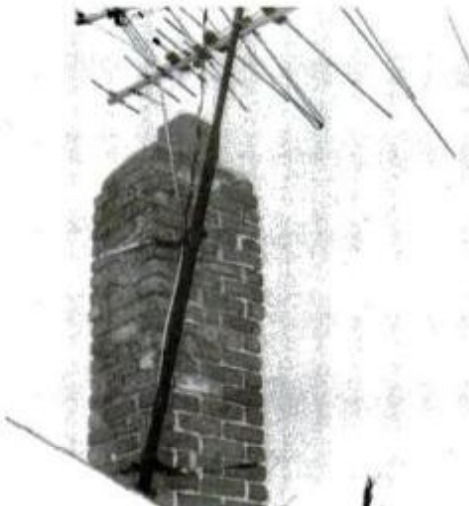
Replace rusted rivets in metal ladders with nonrusting kind. Use your drill and a twist bit to remove the old rivets.



A thorough undercoating when a car is new—plus periodic touchups—prevents body rust, which diminishes resale value.



Guard rail offers little protection because steel lagscrews which fasten it to wall have nearly rusted away (arrow). To solve problem, railing should be slightly relocated to provide sound holding for refastening with galvanized lagscrews.



Antenna masts and clamps will soon look like this if the components are poorly galvanized or made of plain steel.



Electrical conduit in condition shown is a menace. Check all fittings and replace any that show telltale signs of corrosion.

How to stay ahead of rust around the house.

by Rosario Capotosto

PM photos by the author

All common metals are derived from oxides which are processed to reduce them to a usable state. From that moment on, nature goes to work slowly and steadily converting some of the unprotected metals back to their original forms. This usually occurs through a complex electro-chemical reaction between the metal, water and air. The water and air begin the process; pollutant substances such as carbon, salt, sulphur dioxide and many others accelerate the action. The result is corrosion—which exacts a costly toll around every home.

In the early stages, corrosion may be only unsightly, but if allowed to continue unchecked, it can cause thinning, cracks, holes and general structural failure of metal, resulting in serious safety hazards. For example:

- A crack in an auto floor could lead to carbon monoxide poisoning.
- Failure of a ground-wire clamp in

Keeping down car rust



Wash car frequently to remove road grime, which contains rust-promoting agents.



Small hand grinder with conical stone is perfect for removing rust from nicks and chips prior to touchup painting.



Surface condition shown can be a result of infrequent washings and waxing, particularly in seacoast or industrialized areas.



Water trapped in car doors (arrow) rots metal. Remove plug to speed drying, check doors often for clogged weep holes.



Slipshod gas-meter installation joins galvanized and nongalvanized pipes. Eventually, galvanic action may create leaks.



Poorly maintained rain gutter will develop crevice corrosion and soon rot. Gutters should be dry when it's not raining.



Wheel wells, car underparts should be washed frequently, especially where snow-melting chemicals are used on roads.



Small cracks, peeling in undercoating cause crevice corrosion. To remedy, first cover wheel with plastic. Then patch affected areas with a spray undercoat.

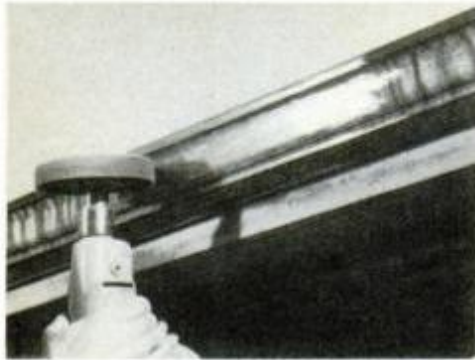


Heavy coat of grease or petroleum jelly on battery terminals resists corrosion.



Several thorough waxings per year will protect car finish against deterioration.

Quick rust cleanups around the house



Flexible sanding wheel in a drill quickly removes rust and gets down to bare metal of badly rusted steel gutters.



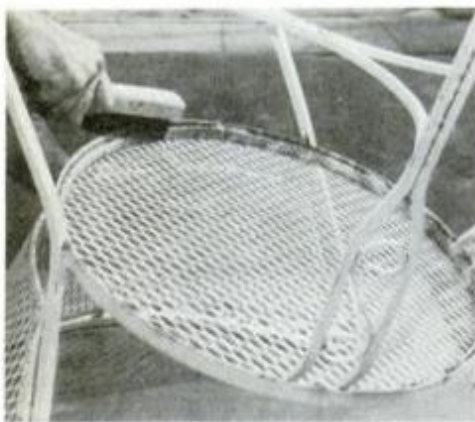
A coat of quality metal primer is a must for a job that will last. Or, use a new water-based primer to speed up the task.



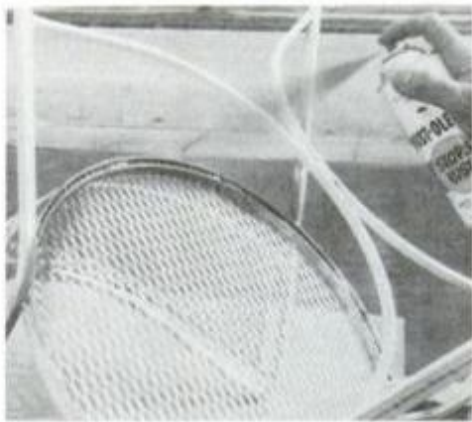
Sanded, primed and topcoated, the old gutter installation now looks like new.



To apply protective coating in hard-to-reach places (such as obstructed side of garage-door roller), use oil in spray can.



A stiff wire brush can't be beat for removing rust scale in small, tight areas.



Spray paints, better suited to painting intricate shapes, assure complete coverage.



Chipped enamel surface of barbecue will accelerate spread of rust if untreated.



Use high-temperature-resistant enamel to touch up damaged spot. Mask surrounding surface with newspaper.

a home's electrical system could cause a serious shock.

■ Steel fasteners in a step ladder could cause a fall if they have rotted after continuous exposure to the elements.

Other places to look for potential danger: pipes and fittings around a gas meter, guard railings, furnace exhaust ducts, TV antenna masts, outdoor electrical conduits, outdoor furniture and children's play equipment. And, of course, the bottom side of your car. You also need to fight corrosion to forestall costly replacement of your property.

All metals corrode to some degree. Silver turns dark, copper and its alloys turn bluish green, and aluminum forms white specks or powder. Zinc develops a white powdery substance, and iron and steel turn reddish brown. Normally, the corrosion of those metals which results in tarnish and discoloration presents no problems other than poor appearance. Corroded iron and steel decay more quickly, and thus will usually require more frequent attention.

Types of corrosion

There are four basic types of corrosion: galvanic, crevice, pit and stress.

Galvanic corrosion occurs when two different metals come in contact with each other. This sets up a weak electrical current flow that results in disintegration of the metals. When a bimetal combination cannot be avoided, a coat of paint between the two will restrain the formation of rust. Some common combinations which promote galvanic corrosion include the fastening of brass or copper items with steel bolts or screws, or the combination of copper rain gutters with aluminum or steel downspouts.

Crevice corrosion results when a portion of metal is covered by dirt, a gasket, bolt or screw heads and the like and exposed to a corrosive environment, like wet leaves piled up in a rain gutter, for example. Also, moisture-trapping cracks or peeling in the undercoating of a car quickly promote corrosion, particularly in areas where salt and calcium chloride are used on roads to melt ice and snow. Frequent hosing of the underside of the car will forestall rust. Drive slowly and repeatedly over a garden hose which has many small holes. If this is not feasible, try a professional car wash that has the equipment to wash the underside fully. Go there several times a year.

Pit corrosion results when small nicks and chips expose bare metal. This occurs most frequently in auto

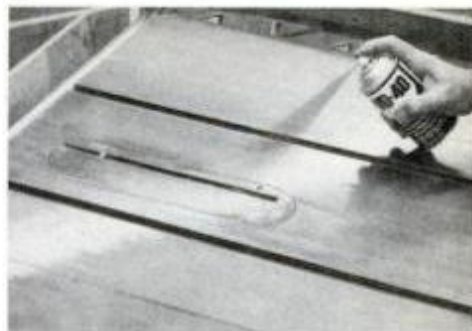
bodies, which are constantly struck by minute particles of debris. To prevent the corrosion from spreading, use a small grinder with a pointed stone to remove all traces of the rust. Then spot-finish with touchup paint or lacquer. Auto-body corrosion is particularly prevalent along seacoasts where the moist air is laden with salt. Frequent washing and waxing is the best protection.

Stress corrosion occurs when a
(Please turn to page 155)

Stopping rust in shop and yard



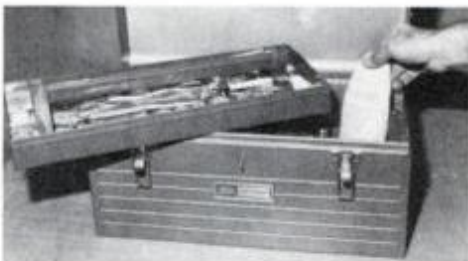
Use auto rubbing compound to remove rust, stains without marring saw table.



A moisture-displacing coating prevents rusting, provides friction-free surface.

Brush-on rust converter

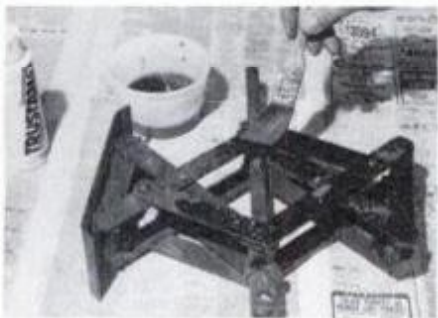
Several recently introduced rust treatments are not rust removers in the traditional sense. Instead, they "convert" rust to a protective shield. When applied to rusted steel from which loose scale has been removed, the chemical reacts with oxides to form a rust-inhibitive ferro-tannic complex that is extremely insoluble, provides an excellent base for paint, and protects against corrosion continuing under the film. The product we tried, called Trustran 7, costs \$4.99 postpaid for a 7-oz. bottle; from Trustran Co., 500 Highway 10, Ledgerwood, N.J. 07852.



Place a bag of desiccant in auto toolbox to keep tools dry and rust free. When desiccant is saturated, it can be reused if dried out in oven at low temperature.



Rusted shear was chosen as a good candidate for testing a rust remover.



To treat complex shapes, brush on converter and let it cure for 24 hours.



First, all grime and oily residue was removed using lacquer thinner and rags.



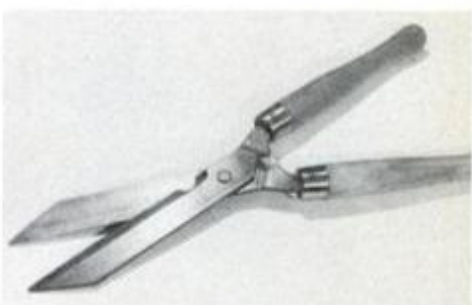
Brush was used to apply remover with disassembled tool held in plastic container.



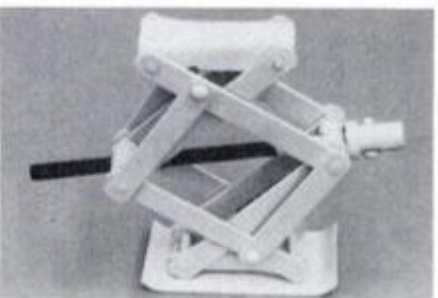
Remove all traces of chemical with thorough water hosing after curing.



Sanding helps acid solution penetrate into rust. Rubber gloves are a must.



Reassembled tool is like new. An occasional wipe of oil will keep it looking fit.



Treated metal takes paint nicely, guards against any further corrosion.



Renew corroded aluminum by applying Aluminum Jelly. The thick gel solution stays put, even on vertical surfaces.



Protect brass or copper surfaces from corrosion with clear polyurethane finish. Apply it until the metal tone suits you.

Organize your incoming mail with PM's letter locaters

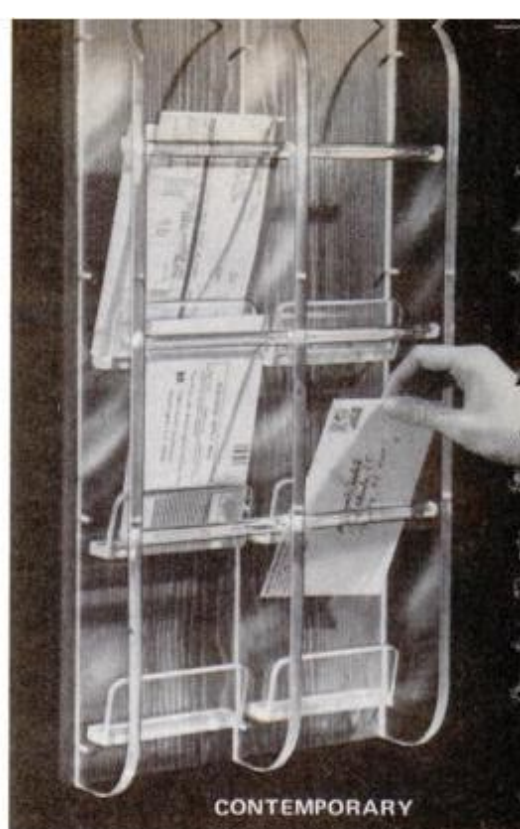
... and you won't lose those monthly bills in the stack on your dining-room table.

If your incoming mail gets tossed on the nearest counter or table when you walk in the door, build one of our handsome letter organizers. It will put an end to the clutter, confusion and annoyance of mislaid letters. The contemporary-styled organizer is made with clear-acrylic sheet dividers and retainers and a pine backboard. The colonial-styled

unit is made entirely of clear pine.

Making the colonial organizer

Start by cutting board A (see plans, page 119) from a piece of 1x12 clear pine and all other parts from 1/2-in. stock. Use a jig, coping or bandsaw with narrow blade to make the scroll cut at top. The shaped sides (D) can be ganged together and



CONTEMPORARY

PM photos and construction: Rosario Capotosto



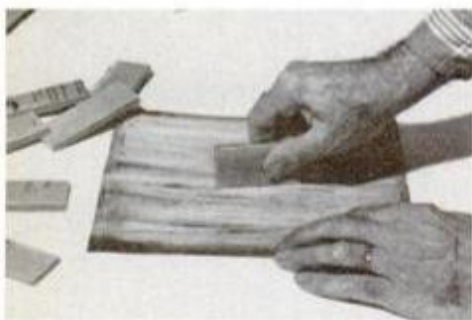
To cut parts from acrylic sheet, use a fine-tooth veneer blade elevated about 1/8 in. above the workpiece top surface.



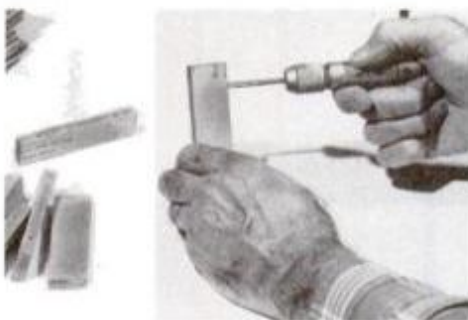
Use a cabinet scraper or a sharp chisel to remove saw ripples. Upright dividers are ganged to save time and effort.



For clean holes, run drill press at high speed. Set depth so bit stops 1/16 in. from bottom of B pieces (see plans).



Rub edges of parts to be glued against abrasive sheet to obtain a perfect flat; it's necessary for capillary cementing.



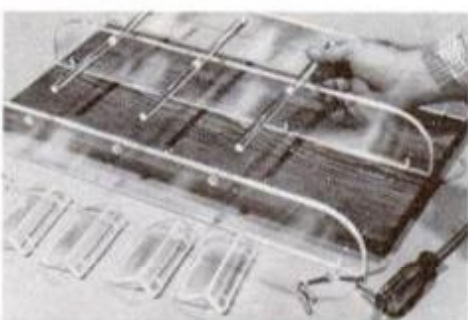
Use tap to cut threads in plastic as shown in plans. Stop twisting when tap meets resistance; use soap for lubrication.



Remove protective masking paper, tape parts together and apply solvent—with the joint line horizontal for best results.



After sanding edges of the plastic with 600-grit paper, polish on buffing wheel charged with auto-polishing compound.



Insert retaining rods (C) before screwing on the last divider. The pine backboard should be finished prior to final assembly.

cut and sanded in a single operation. The same goes for the compartment fronts (B).

All edges are rounded with a rounding-over router bit. The small pieces are best handled on a router accessory table, which lets the router function as a shaper. Parts are simply passed against the cutter. Lacking the table, clamp workpieces to your workbench and use the router in the usual manner.

Assembling compartment members to center board (E) is tricky be-



COLONIAL



Scroll patterns on colonial-style organizer can be cut with jigsaw, bandsaw having a narrow blade, or coping saw.



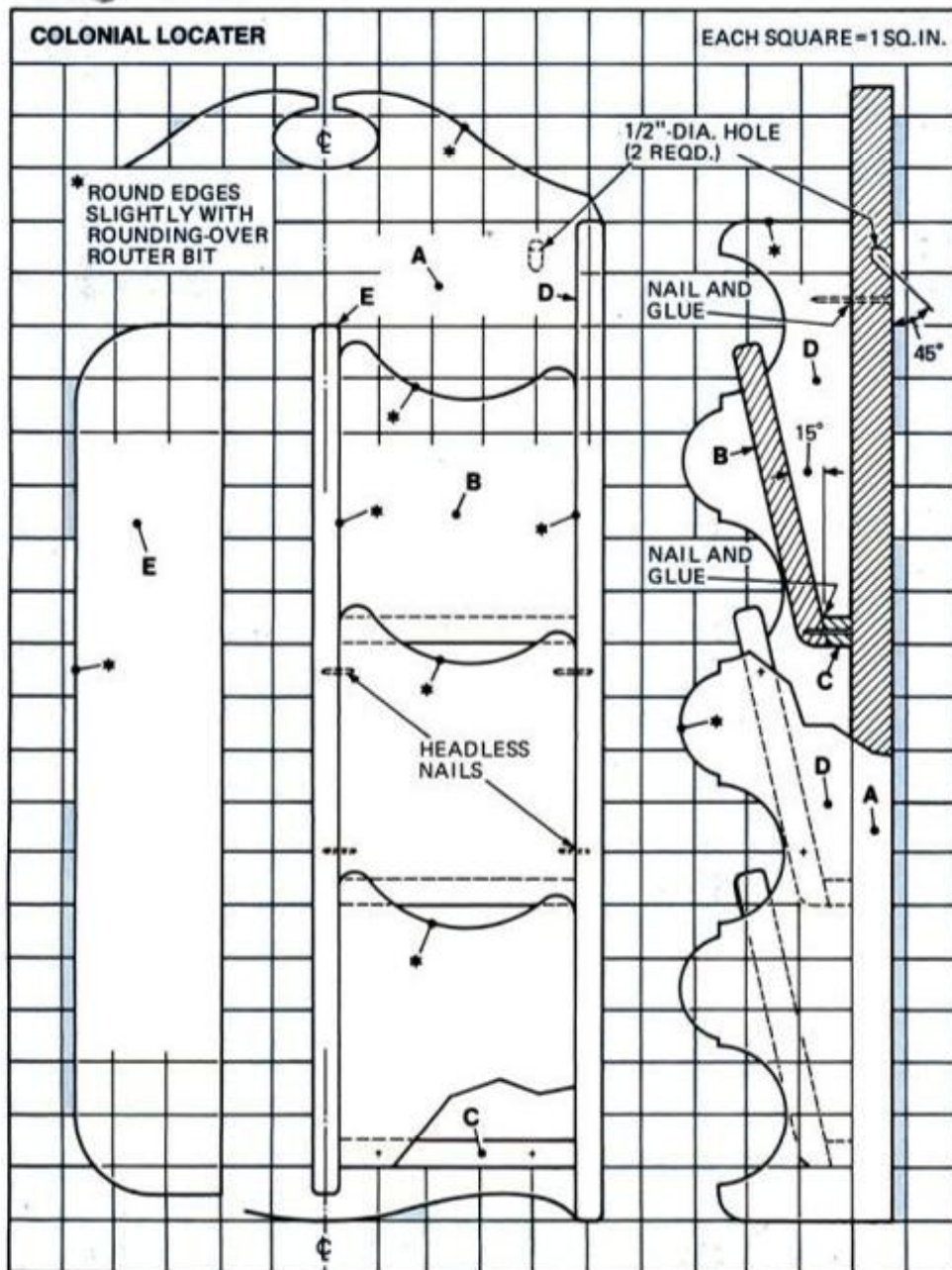
To save time, side members (D) are taped together before cutting scroll. Use a sharp blade, slow feed to assure accuracy.



Sand convex curves, sharp corners with a sander/grinder. Use drum sander, drill or drill press to smooth concave curves.



A router table simplifies rounding-over of edges; use a piloted bit to make a pass on both sides of the workpiece.



Before gluing, use the protruding-nail trick to align the halves of the organizer with the central divider (see text).



Since unit should be stained before final assembly, trace joint locations and mask them with tape. Apply stain to pieces; when dry, reassemble with glue.

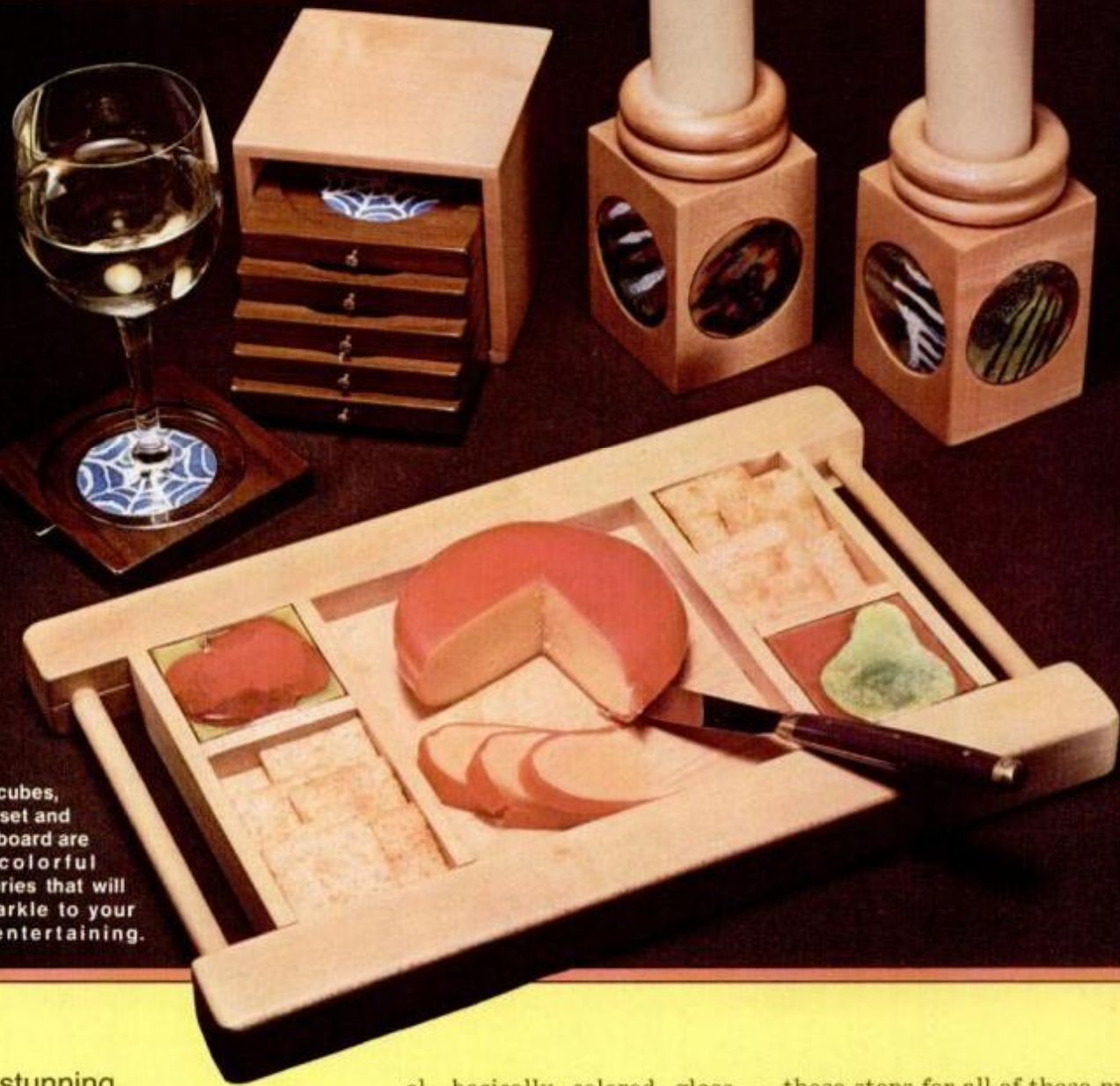
MATERIALS LIST—COLONIAL LOCATER

Key	Pcs.	Size and description
A	1	3/4 x 10 1/2" clear pine
B	6	1/2 x 4 1/2 x 5 1/4" clear pine
C	6	1/2 x 3/4 x 4 1/2" clear pine
D	2	1/2 x 3 1/4 x 19" clear pine
E	1	1/2 x 2 3/4 x 16 1/2" clear pine
Misc:		White glue, nails to suit.

cause nails can't be driven through from both sides. However, protruding nails can be used to assure alignment for gluing. Clip heads from

(Please turn to page 150)

Enameling— a colorful craft anyone can master



Candle cubes, coaster set and cheese board are three colorful accessories that will add sparkle to your home entertaining.

These stunning projects combine the brilliant hues of fired enamels with the warm, rich tones of wood.

by Penelope Angell
ASSISTANT HOME AND SHOP EDITOR

Although advanced enameling requires finely honed skills, you'll be amazed at your success with these introductory enameling projects. The glitter of baked enam-

el—basically colored glass—catches the eye, particularly when contrasted with wood.

To get you started in this colorful craft, we've designed three simple wood items with enamel insets. Each enamel design requires different basic techniques to produce. By the time you've completed all of the projects, you'll have a good understanding of the craft.

Enamels for candle cubes

Before you begin work, see *Basic enamel preparations and finishing processes* on page 122. Then follow

those steps for all of these projects.

Making the free-form designs for the candle cube enamels gives you an opportunity to experiment with design. It's fun to overlay transparent enamels and see the effect of color on color. Each copper circle in the cubes is made with a somewhat different design.

Prepare and counterenamel the back of a 2-in.-dia. circle C (see drawing, page 121) as explained in the *Basic enamel preparations*. Then begin work on the enamel face.

Sift on a layer of clear flux enamel as the base coat to brighten the color



1 After sifting clear flux on face of a candle cube disc, put it on stilt; use spatula and tweezers to put in kiln.



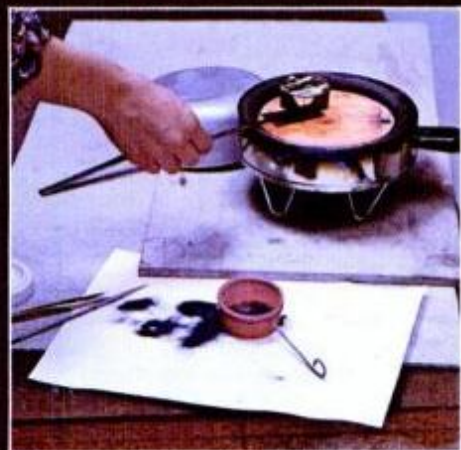
2 Each time you fire an enamel, cool 15 seconds on the stilt then flatten with a steel block or other weight for 10 seconds.



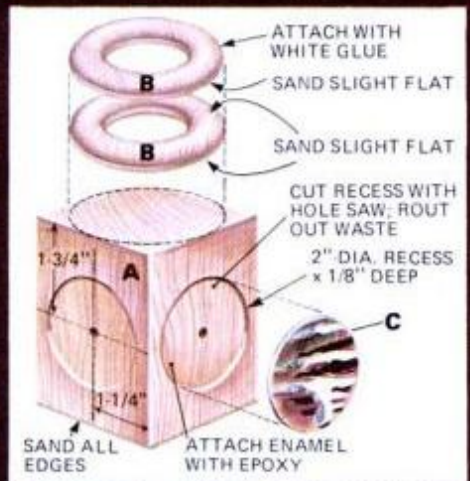
3 Brush on design with adhesive gum binder. Sift bluebell enamel on disc; tap disc on table to remove loose grains.



4 Dip brush in gum binder and remove enamel dust. Repeat step 3 with raspberry and white enamels, firing each one.



5 Sift a final overlay of black enamel onto the disc over gum binder. Remove excess enamel with binder and fire.



Candle cubes are simply made of maple blocks topped with wooden drapery rings.

enamel overlays. Flux must be fired for a longer time than other enamels to achieve full transparency. Heat the kiln to bright red before you add the enamel (Photo 1). Flux will look golden and glossy when it's ready to be removed from the kiln.

Each time you fire a layer of enamel, remove the piece from the kiln and let it cool on the stilt 15 to 20 seconds. Then remove it and gently rest a flatiron or other weight on it for 10 seconds to prevent warpage (Photo 2).

Sift and fire a layer of hazel enamel in the same manner as you fired

the counterenamel. Whatever color you use here, sift it over the entire copper, let cool, then flatten after firing.

Brush on a free-form design with Klyr Fyre gum binder. Sift bluebell enamel over the piece, then tap it on the table to remove excess enamel (Photo 3). You can remove color or change the design by scratching with a brush handle. Dry, then fire the piece. Don't worry if the first enamel layer appears to be cracking in the fire; it will fuse.

After you paint on gum binder and sift enamel, tap off the excess. Particles of enamel dust may remain. Remove this dust with a brush dipped in gum binder (Photo 4).

Make layers of raspberry and white enamels similar to the bluebell layer. First paint a design with gum binder, sift enamel, tap off excess and wipe off dust with gum binder. Dry, then fire the enamel.

As you overlay colors, you'll see how they blend with the ones beneath them and change in value. For example, when you add a layer of palm enamel, it will look much lighter in those areas where it overlaps white. Make and fire a design layer of black enamel (Photo 5). Experiment with varied brush strokes. File edges clean.

Making the candle cubes

Cut block A of maple for each candle base. You can mortise the recesses for the enamels with a router and mortising bit. To do so, after securing the cube with a clamp, bore a 3/16-in.-deep ring on each face with a 2-in.-dia. hole saw in a drill, then use the router freehand to cut away waste. The hole saw kerf is a buffer which allows you to keep the router bit away from the outside edge. Adjust the router to a depth equal to the thickness of the enamel. Then test the depth on scrap wood.

Sand slight flats on the attaching surfaces of the drapery rings B for good contact. Sand and apply finish, avoiding the recessed areas where the enameled pieces will be placed. Use epoxy to attach the enamels.

Coaster set enamels

The spider-web design on the coasters is made by scratching through an unfired layer of enamel to reveal a fired layer underneath it. This technique is called sgraffito.

First prepare the copper D (see drawing, page 123) by cleaning it and counterenameling as described on page 122.

Begin work on the face of the copper by spraying gum binder, then sifting on an undercoat of white enamel. Dry it on the kiln, then fire

MATERIALS LIST—2 CANDLE CUBES

Key	Pcs.	Size and description
A	2	2½ x 2½ x 3½" hard maple
B	4	1½" i.d., 2½" o.d. wood rings
C	8	2"-dia. copper circles

Misc.: Quick-set epoxy glue, white glue, satin polyurethane finish; Klyr Fyre gum binder; Sparex cleaning solution; flux, hazel, bluebell, raspberry, and palm transparent enamels; white undercoat and black medium fusing enamels.

Note: 3x3" maple stock is available from: Albert Constantine, 2050 Eastchester Rd., Bronx, N.Y. 10461. Wood drapery rings are available at craft stores or can be obtained from Woodring Craft, 35 West 44th St., New York, N.Y. 10036.

CREDITS

Woodwork by Rosario Capotosto; PM photos, color photo on opposite page by George Ratkai; color photos above and black-and-white how-to photos by George Smol.

and flatten. Add more white and re-fire if it looks burned out around the edges. If there are air bubbles, punch them out with a pin, add

enamel and re-fire the copper face.

To make the spider-web design, spray gum binder and sift a thin coat of bluebell enamel. In sgraffito

it is especially important to make this coat thin and even.

Again lightly spray with binder. Then scratch the web design with

Basic enamel preparations and finishing processes



Clean the metal piece under running water using steel wool that doesn't contain soap. Grease may remain on the metal.



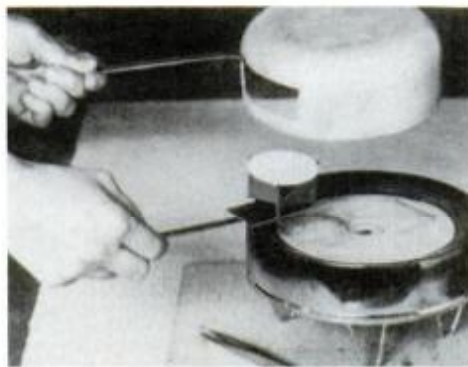
To remove grease, immerse the metal in a solution of Sparex and water. When grease is removed, water won't bead on the metal.



Spray gum binder on the metal to hold the enamel. To get a fine, even coat, hold the sprayer about a foot from the piece.



Sift a thin, even coat of any color enamel (it won't show) over the back of the metal. Make sure the metal is entirely covered.



When the kiln is heated to 1500° F., lift the lid, put the enamel and stilt inside and immediately replace the lid.



Hold the finished piece under running water and file firescale off the edges. Stroke file away from the top side of the piece.

Follow these steps for all projects:

1 Clean the copper. Use 3/0 steel wool and scrub the copper under cool running water. In a Pyrex container mix a solution of Sparex cleaner and water as directed. Immerse the copper in the solution for two or three minutes to remove grease so the enamel will adhere. Heating the solution slightly on a stove speeds up its cleaning action. Use copper tongs to remove the piece and dry it with a cloth towel. Rinse your hands if they touch the solution.

2 Counterenamel the copper. To keep the enamel from warping and cracking as the metal expands and contracts, you must counterenamel the back of the copper. This is called counterenaming. First spray gum binder on the back so the enamel will adhere, using a solution of 1 part Klyr Fyre to 2 parts water. Hold the sprayer about a foot away from the work to get a fine, even mist.

Partially fill the sifter with any color enamel (the back won't show) and sift a thin, even coat over the copper until it is completely covered. Sift more enamel on the edges as it tends to burn away when fired.

Dry the piece for several minutes on a stilt trivet near or on top of a heated kiln to keep enamel from popping off during firing.

3 Fire the enamel. As you heat the kiln the element passes through several color changes, from dark red, to dull red, to cherry

red at the 1500°F., firing temperature. As it gets hotter, the element will turn bright red, red orange, then yellow white. The kiln shown takes about 20 minutes to heat to 1500°F. (Other kilns may take longer to heat. It's best to check temperature by the color of the element.)

Place the copper on the stilt—enamel side up. Lift off the kiln top and with a spatula place stilt in the center of the kiln. Grasp the stilt with tongs as you remove the spatula, and immediately replace the lid.

After two or three minutes heating, the enamel becomes pebbly and has a texture similar to orange peel. Check this by removing the lid. **Don't look through the air hole in the lid; that can damage your eyes.** Make sure the enamel completely covers the copper. If not, remove the copper from the kiln, spray on binder, sift enamel where needed, then replace.

When the piece is ready for removal, the enamel will look dark but glossy. Remove the piece and stilt with a spatula and place on an asbestos sheet. Allow the piece to cool 30 seconds, then remove it from the stilt with tongs. (If it sticks to the stilt, grasp the piece and tap the stilt sharply on the table.) Immediately press the piece flat with a flatiron. The colors will look dark or dull red when the piece is hot. As it cools the true colors appear.

4 Clean off firescale. The copper will have

dark firescale (oxide deposit) on it. Remove this by placing the piece in Sparex for several minutes. Then scrub with fine steel wool. If some firescale remains, reapply Sparex. With firescale removed, the piece is ready for the enamel design.

5 After the last firing, clean copper edges with a carborundum file to expose a smooth edge. Do this under running water, gently stroking away from the enamel.

Getting started in enameling

Materials. You can buy 2-oz. jars of the nine enamels and all copper pieces used in the projects shown by clipping out and sending this box, and a check for \$15.95, to Allcraft Tool and Supply Co., Inc., 100 Frank Rd., Hicksville, N.Y. 11801. Included are medium-fusing flux, white undercoat, lemon, geranium and black medium-fusing opaque enamels and bluebell, raspberry, palm and hazel transparent enamels. Also included are the copper pieces: 14, 2-in.-dia. circles and two, 2-in. squares.

Equipment. Also used in these projects and available from Allcraft are an enamel kiln with spatula, binder sprayer, 2-in.-dia. sifter, Klyr Fyre gum binder, Sparex cleaner, three-point stilt. To purchase these items, send this box with a check for \$30.85 to Allcraft. For both materials and equipment, send one check for \$46.80.

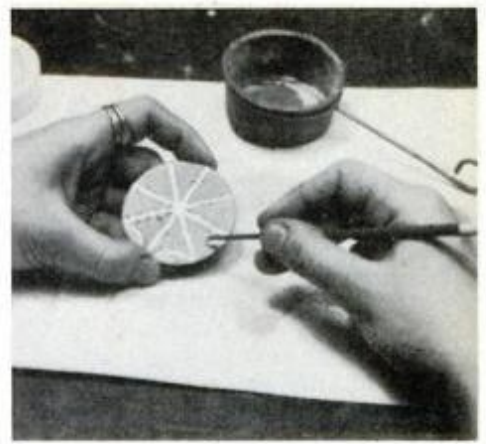
Additional equipment. Wood and nontoxic bowl seal finish for the projects is available from Albert Constantine, 2050 Eastchester Rd., Bronx, N.Y. 10461. You will also need small and medium camel-hair brushes, flatiron or steel weight, copper tongs, carborundum file, asbestos pad, 3/0 steel wool and white and quick-set epoxy glues.

the end of a small brush handle until the white lines show. First halve, quarter and divide the circle into eight sections. Then scratch the scalloped edge and curved lines in each section. If the blue becomes lumpy, flatten it with a brush dipped in gum binder. (Some irregularities will smooth when fired.) It is important to clean out the scratched areas with a wet brush. Experiment until the web is easy to see. Then dry and fire the piece.

To add the spider, mix black enamel with water so it can be picked up with a brush. Paint on the spider, dry the piece, fire and flatten it. Finally, file the edges clean.



Sift bluebell over the fired white after spraying binder. In sgraffito it is very important to sift a thin, even layer.



Using the end of a small brush, scratch the web design through the enamel so the under layer of white enamel is visible.

Making the coaster set

Cut the wood parts A and B to make the box. Attach the top and



Paint the spider using black enamel moistened with water so it is easy to pick up on a brush. Dry, then fire the piece.



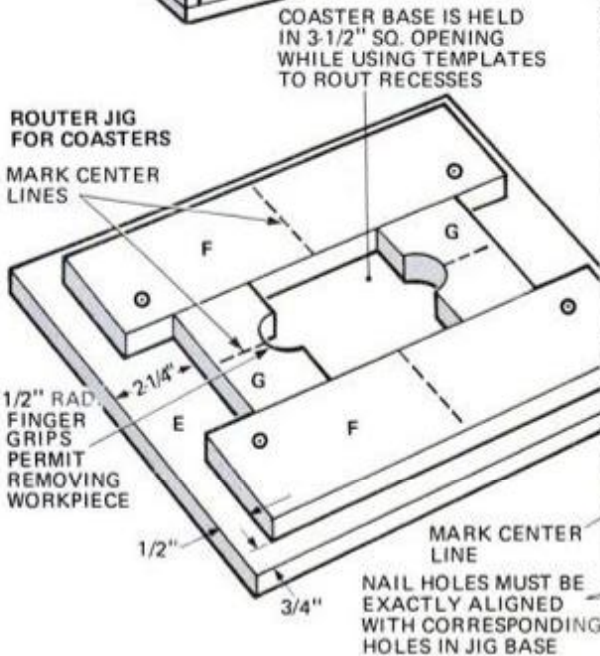
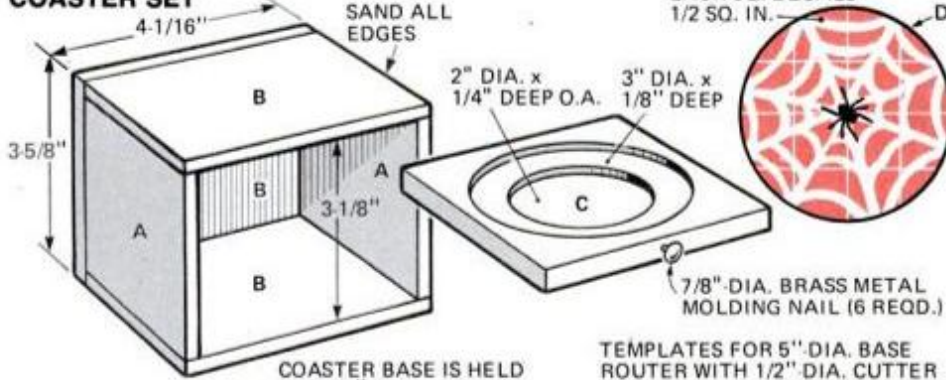
A jig holds the coaster blocks for routing. Each block gets a router pass using template X and a pass using template Y.

MATERIALS LIST—COASTER SET

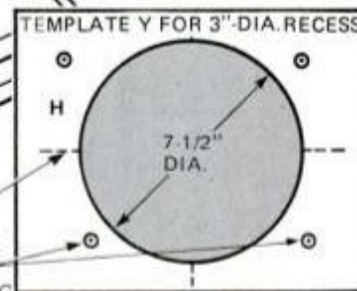
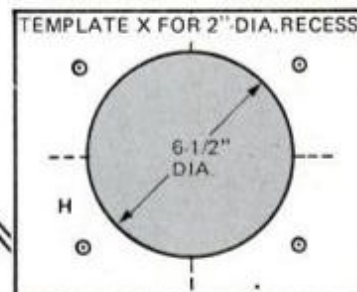
Key	Pcs.	Size and description
A	2	1/4 x 3 1/2 x 3 1/2" maple
B	3	1/4 x 3 1/2 x 4 1/16" maple
C	6	1/2 x 3 1/2 x 3 1/2" walnut
D	6	2"-dia. copper circles
E	1	1/2 x 12 x 14" plywood
F	2	1/2 x 3 1/2 x 13" plywood
G	2	1/2 x 2 x 3 1/2" plywood
H	2	1/2 x 8 1/2 x 12" plywood

Misc.: 6, 1/8"-dia. brass metal molding nails; 1/2" x 20-ga. wire brads; white glue; epoxy glue; clear satin polyurethane finish; Klyr Fyre binder; Sparex cleaner; white, bluebell, black enamels. Hardwood is available from Constantine, 2050 Eastchester Rd., Bronx, N.Y. 10461

COASTER SET



TEMPLATES FOR 5"-DIA. BASE ROUTER WITH 1/2"-DIA. CUTTER



bottom to the sides, then add the back using white glue and wire brads.

Cut six coaster squares C. To rout the recesses in the coasters, make the jig shown in the plans.

Make templates X and Y for use with the jig by cutting holes in two pieces of 1/8-in. plywood or scrap wall paneling H. Use a sabre saw with a circle guide to cut the openings. These templates are sized for use with a router with a 5-in.-dia. base and a 1/2-in. mortising bit. Alter these dimensions to suit your router and bit.

Tack-nail template Y centered over a coaster in the jig. Adjust the bit for a 1/8-in.-deep cut and rout the 3-in.-dia. recess on all coasters. Then use template X with the router bit set for a 1/4-in. cut to rout 2-in.-dia. recess.

Sand off all sharp corners. Use 7/8-in. metal molding brass nails for knobs. Bore pilot holes, then drive them in so the heads project about 3/16 in. Apply finish, avoiding the enamel recesses. When dry, attach enamels with epoxy.

Enamels for cheese board

The pear and apple enamels for the cheese board are made of 2-in.

(Please turn to page 131)

WORKSHOP MINICOURSE

ABOUT CLAMPS AND CLAMPING

Sooner or later, every woodworker has a need for clamps and the know-how to use them. Since all joints—even sophisticated ones such as the dovetail—require glue, it follows that you must have clamps on hand to hold a workpiece securely while the glue dries.

There are a number of styles of clamps available, each designed for a specific gluing problem. (There are also basic clamps you can fashion yourself; we will get into these in a future *Minicourse* article.) Basically, there are five woodworker's clamps you should know about and have on hand. Your best bet is to buy clamps as needed and then erect wall racks to keep them organized and safe from damage.

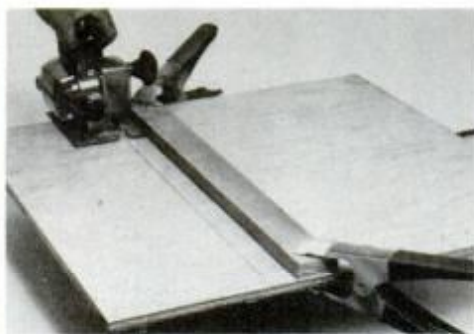
Here's a rundown on clamps you should be familiar with, and the order in which I recommend buying them. If you proceed into serious woodworking, you will buy many more of each type as time progresses.

■ **C-clamp (also a carriagemaker's clamp):** You will probably use this more often than any other type. Buy these by the pair (same size) because, more often than not, that's the way you will use them. A C-clamp, as the name implies, has a C-shaped body with a bolt through its base. Since bare metal against wood can leave undesirable marks, use scrap wood beneath jaw pads as shown.

■ **Spring clamps:** These are intended for lightweight tasks, holding small glued-up parts and the



Spring clamps come in a variety of sizes and are perfect for light clamping tasks. You squeeze handles to open jaws.



You can use spring clamps to hold straight-edge for light cuts with sabre saw, but clamps will not resist heavy pressure of circular saw cutting or router grooving.

like. I find that I use these almost as often as C-clamps. Buy at least one pair of two or three sizes and carry them in your house-carpentry toolbox. You'll use them often.

■ **Hand (wood) screws:** As can be seen in the photos, a hand screw consists of two blocks of wood connected by two parallel bolts. In order for a hand screw to be effective, its jaws



Spring-tensioned jaws are fine for holding small parts until glue dries. Pair here has plastic on jaws to prevent marring work.



C-clamps are probably the most-used type in the home workshop. Here a pair holds glued-up stock for a lathe turning. Note protective wood strips under jaw pads.

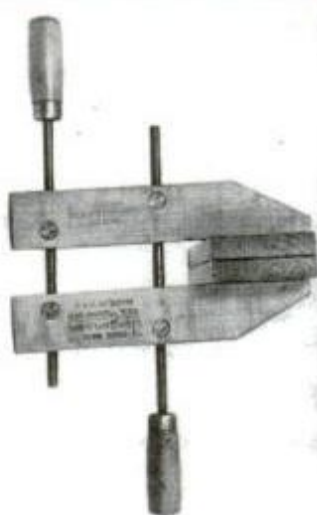
must be parallel when a workpiece is clamped.

■ **Bar (or pipe) clamps:** These come in a wide selection of clamping sizes. Bar clamps come with the vise jaws already mounted on flat steel stock. Pipe clamp fixtures should be mounted on black pipe, which you supply. These work using the same principle as bar clamps.

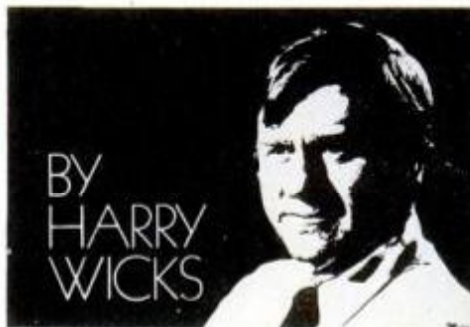
■ **Web clamp:** This consists of a tough webbed belt having a steel fastener with ratchet action at one end. A web clamp is used for encircling pieces and irregular shapes such as a chair. You will need at least two of these if you plan to renovate and restore furniture. In a future *Minicourse* we will show bar, web and pipe clamps in action. **PM**



Wrong way to grip work with hand screws—nonparallel jaws mean work will dry as shown (in this exaggerated view).



When hand-screw jaws are parallel, the entire surfaces of pieces being joined are in full contact with each other, as above.



7 non-shocking reasons to buy the Echo gas Trimmer.

(Instead of an electric)

1 Heavy-duty construction. In the engine, the flex shaft, the head. And the engine body is metal, not plastic.

2 Balance. The engine's at the top, so the weight's not all at the bottom. You have more control for cutting ease.

3 Power. From the powerful 14 c.c. Kioritz gas engine. Kioritz is the first name in two-cycle engines.

4 No cord. No outlet. No straining at the end of an electric tether. So you get go-anywhere, cut-anywhere mobility.

5 Edging. The Echo Trimmer has the versatility to trim and edge with the same ease and power. And a diaphragm carburetor to work at any angle.

6 Dependability. To start when you want to work...

7 ... And work till you want to stop. Now that you know the reasons, we'd be shocked if you bought anything but an Echo Trimmer.



ECHO.

The dependable Echo Trimmer

For more information, write Echo, Inc., Dept. A, 3150 MacArthur Blvd., Northbrook, IL 60062.
Call Toll Free 800-447-4700 for your nearest Echo Dealer.
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When Should YOU Change Engine Oil?

How you drive determines how far and how often you should change your crankcase oil. It is nearly impossible to drive a car properly so that yearly changes of oil would be safe for your engine.

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NASA'S FAR-OUT HOUSE

(Continued from page 79)

Tektronix 4051 "desktop" computer. This could be programmed to match family living habits and save energy. By day, for instance, the computer could be told to close off heat ducts to the bedrooms. At night, ducts to the living room would close.

The Tektronix also displayed information. Push one button and all water flow rates appeared. Push another for air flows. With each display there was a definition, from the 32,000-bit memory, identifying what the numbers meant.

Choking on data

The high-class system sometimes choked on the raw data flowing from the middle-class house. Occasionally, for instance, a sensor would feed in a higher reading than the computer could handle. At other times, an errant thermometer system would call on the computer to divide by zero. In either case, the computer in the garage would suffer a temporary breakdown, and start beeping loud enough to be heard throughout the house. The Swains sometimes woke up to a cold bedroom.

Another problem had nothing to do with electronic gadgetry. The toilet wouldn't flush properly. NASA had figured out that nearly half of a typical family's water use—about 10 gallons per occasion—is for waste disposal. So they designed a special toilet to cut water volume for each flushing. The trouble was that it failed to transport solids without more than one flush, "... so NASA finally gave us a conventional toilet while they recalculated the suction system," Swain said.

As an additional economy measure—which worked well—the flushing water wasn't fresh. The toilet tank was filled with water that had been previously used in bathtub, shower, kitchen sink or washing machine, and then was filtered and cleaned in a recirculating system. "It looked a bit off-color in the bowl," Swain said. "But we got used to that, especially when we saw how it shrank our water bill." Preliminary figures from NASA indicated a saving of 20,000 gallons a year, about a third less than average consumption. By cutting water use, the system also reduces the load on sewer systems and on sewage-processing plants.

Giant Thermos bottle

Other features, the Swains reported, paid off well. The main energy-saver in the NASA design is su-

per-efficient insulation. NASA conceived the house as a "thermal shell"—a sort of giant Thermos bottle inhabited by people—retarding heat exchange with the outer environment. The idea stems from NASA's interest in constructing habitats enabling astronauts to survive in space. Yet some of the principles apply on Earth to keep homes warm in winter and cool in summer, with minimum energy input.

Many design details keep Tech House tight. One is urea-tripolymer foam used as roof and wall insulation. It's nearly 45 percent more efficient than conventional fiberglass insulation. All windows are double-paned, each pane a half-inch thick. Vinyl weatherstripping in the frames reduces air infiltration. NASA designers called for horizontal sliding windows in preference to double-hung vertical-motion windows. The full weight of each window, made by Reynolds Metals Co. keeps a tight and constant seal at the bottom.

The Swains liked the horizontal windows so much that when they got home, they installed them on their Florida house, at a cost of about \$2000.

Exterior shutters on Tech House windows cut heat loss on cold nights by 65 percent and can also be used to block direct sunlight in summer. They can be opened to admit light and air.

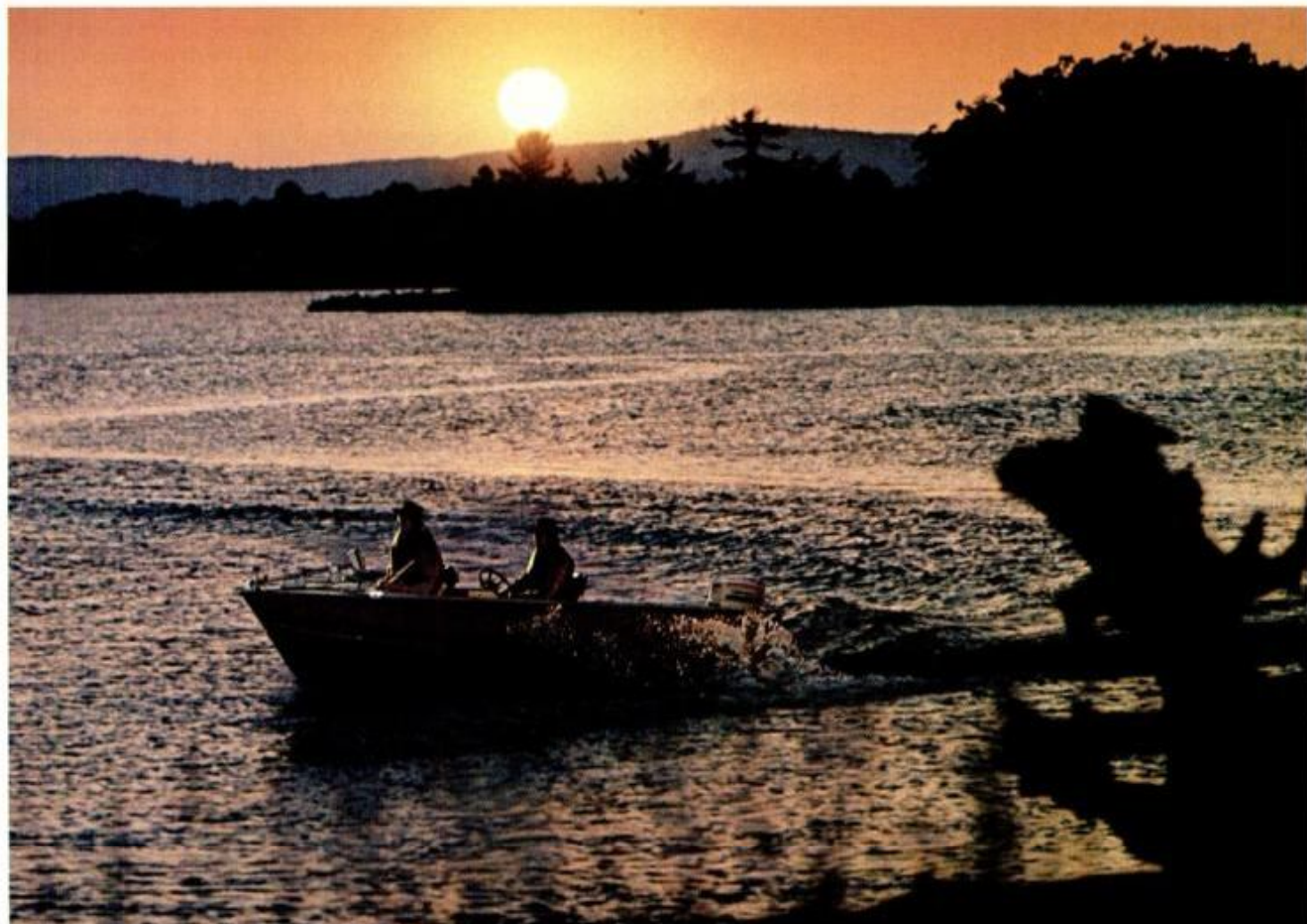
Front and rear entrances are through small vestibules acting as air locks to reduce the loss of warm or cool air when people enter or leave. A rubber lip extends from the bottom of the doors, fitting into a groove when the door is closed to restrict airflow. And the door panels themselves consist of heat-retarding polyurethane with metal facings, cutting heat loss by about 65 percent compared with conventional wooden doors.

Within this thermal shell, heating and cooling are provided by an ingenious combination of solar collectors on the roof, an electrically powered heat pump, and a wood-burning fireplace—all monitored by the watchful computer. "That computer got to be like a member of the family," Swain said. "But sometimes we felt like we were being watched. We had to get used to that." And the family had to adjust to the occasional computer failures.

Backup system: the fireplace

"When the first cold spell came, we had about a week's worth of solar energy stored in the form of hot water," Swain said. "But that was ex-

(Please turn to page 128)



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hausted after five cold, cloudy days. Then the computer bombed out and wouldn't switch on the alternative electrical heat source. Fortunately we had the fireplace."

Swain is particularly impressed by the fireplace, a unique NASA installation. The fire draws air from outside, so no heat from the room goes up the chimney. Water flows through the grate—a set of pipes—to the central storage tank. This extracts additional energy from the fire. Finally, room air circulates between the double walls of the firebox to maximize heat transfer by convection. While conventional fireplaces are only 10 percent efficient, NASA's design uses nearly 55 percent of the thermal energy of the wood.

"I believe we could have heated the house all winter with the fireplace alone," Swain said, "using about a cord and a half of wood."

The Swains' squabbles with their computer continued for the first few months of their stay. NASA engineers made an exhaustive check to try to stop the plaintive beeping from the garage.

Finally, they uncovered one of the basic problems. The agency that sent men to the moon and probes toward the stars had reversed the polarity in the power plug for the data-acquisition system. Once the plug was rewired, the Swains reported, the computer behaved admirably.

In fact, Swain would like to see the computer functions expanded in future versions of the house. In addition to monitor and control functions, he would like the computer to display instant status reports through the family's TV set, tuned to an unused channel.

"It might be something like the computer readout on the new Cadillac that tells you how many miles you can still go on your gas reserve," Swain said. "Similarly, I want the house computer to tell me at a glance how much energy was consumed since the beginning of the month; how much it cost; and I want it to spell out alternative energy use patterns that might further reduce consumption and cost."

NASA spokesmen point out that the computer system in Tech House was never designed for widespread use. If Tech House copies begin springing up, mass-produced, they'll probably call on a relatively simple computer, the size of a pocket calculator. The homeowner will punch in a program based on planned use of rooms; the computer will direct hot

or cold air wherever it's most needed.

The lifestyle factor

No matter what gadgets wind up in some future Tech House, Swain argues that the lifestyle of its inhabitants will largely determine energy-use levels. The family could have done better, Swain concluded: "We were given a Ferrari and drove it like a Model T."

For example, it would have been best to run the washing machine early in the morning. The hot water used would then be replaced by the solar heat of the day, so the whole tank would have been full of solar-heated water when everyone got home from work and wanted to wash up.

"But we were all out working," Swain said. "I had a job as personnel administrator for NASA for the duration of our stay. Elaine (a registered nurse) worked in a hospital, and the kids were in school. So we never did the laundry in the morning. We did it at the end of the day, along with everything else. The solar-heated water had to be augmented with electrically heated water." Swain's recommendation: Put the computer in charge of the laundry to switch on the preloaded washer at the most opportune time, even if nobody is home. Or increase the size of the hot-water storage tank and hope there's enough sun to heat it all.

Doubts about solar efficiency

Surprisingly, Swain retains doubts about solar heating, the most prominent feature of the NASA house. "Figuring in all the energy it takes to manufacture the solar collectors—all that glass and copper tubing—I wonder if you really come out ahead in the end. Partly, of course, it depends on climate—the yearly amount of available sunlight. But as far as I know, nobody has yet explored the question from a point of view that takes into account the energy requirements of equipment manufacture."

And overall, Swain said, Tech House gadgetry won't solve the energy crisis. For one thing, less than 20 percent of energy consumed in the United States is in the home, according to the Department of Energy. Only fundamental changes in the way we live will protect future generations, Swain said. "My kids aren't going to be up the wall, but their kids are. We've got a maximum of 25 to 30 years left in which to do something."

But in the meantime, Tech House technology could help by buying us a

few extra years before current fuel resources are exhausted, Swain told me. And he is aware that his sojourn has high public relations value, alerting people to dwindling resources, hyping the public conscience to act before it's too late.

And those worthy goals—to Swain, moral goals—helped the family adjust to their bouts with the computer, their occasional longing for more privacy, their sense—as Elaine Swain put it—"that it wasn't a real house, just a lab disguised as a house."

Susie calls the cops

Only one member of the Swain family never properly "interfaced"—as they say in space lingo—with some of the fancier features of the Tech House. Susie, a 3-year-old border collie, kept triggering the burglar alarm. NASA uses seismic detectors similar to those employed to register volcanic activity on the moon or Mars. The detector beams a microwave signal to the house to set off a warning if an intruder approaches within 80 yards. It also automatically calls the cops. Susie's 20 pounds were just enough to make those lunar earthquake detectors mistake her for a mugger lurking among the bushes. Once, during the Swains' absence, Susie summoned the police by padding around the property. They scoured the premises for the surmised intruder while petting Susie, who was delighted with all the attention. Sometimes, high technology really pays off—even for dogs. **PM**

PM'S AUTOTACH

(Continued from page 36)

ignition coil. The only off-board wiring is for one resistor and for connecting the LEDs through resistors to the board.

Adjustments are simple. Borrow a regular tach (you'll only need it this once). Set each rpm adjustment (R8, R9, R10) in the center of its range. Pick out the trip point (rpm) you want to use. Start the car, then rev the engine and watch until that point is reached. Adjust R11 until the LED just lights.

Now set the other two LEDs via their respective controls. There is no need to touch R11 again. Just rev up engine to the shift point you want and adjust that LED's trimpot.

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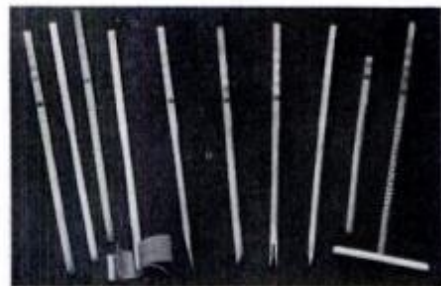
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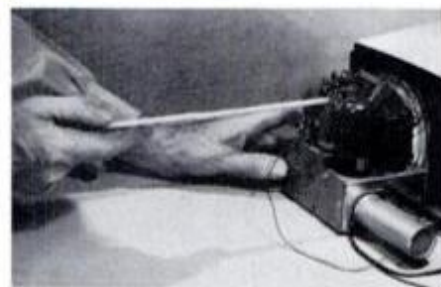
Think chopsticks are just for chop suey?

If you've ever toted a pair of chopsticks home from a Chinese restaurant, you'll appreciate some of these clever ways to put them to work again. With a little imagination you can shape chopsticks into small tools and novelties.

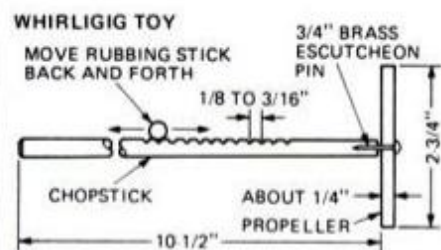
To make an internal sander,



From left are three unmodified chopsticks and items to make with them: internal sander, spatula, scraper, fork, screwdriver, rubbing stick with whirligig.



Nonconducting chopstick-screwdriver adjusts capacitor in receiver.



split the end of a chopstick with a fine saw blade and insert double strips of abrasive paper, rough side outward. Form a spatula by carving an inch-long blade on a chopstick. Make a diagonal cut near a tip to form a sharp edge and you have a scraper. A pickle fork is made of a chopstick slit at one tip, with the resultant segments rounded into prongs. A nonmetallic screwdriver can be shaped like a spatula, but with a thicker blade. Or, for the fun of it, make the whirligig toy shown in drawing.—Walter E. Burton



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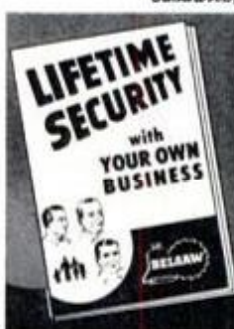
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DON'T GET RIPPED OFF ALONG THE ROAD!

(Continued from page 93)

tery cables, sparkplugs, sparkplug cables and air-cleaner filter. If one of these parts suddenly is "damaged" during a stop at a service station, making you suspicious, take evidence to the oil company.

2. When stopping for gas, *get out of the car* and watch what's going on. If you have the attendant check under the hood, look over his shoulder. Obviously, the task becomes more difficult if two attendants service the vehicle, one pumping gas, say, while one washes the windshield. This practice makes it easier for attendants to engage in unscrupulous acts. You can't be up front and in the rear at the same time.

3. If possible, patronize self-service stations. But whether you buy at a full-service or self-service installation, never leave your car unattended at the gas island to use the restroom or get something from a snack machine. Wait until the car is serviced. Then, park and lock it away from the gas island or wait until you stop at a restaurant.

4. Most breakdowns on the road involve simple repairs made with easy-to-install parts. If you are a Saturday mechanic, gather parts from your inventory before leaving on a trip. Include battery cables, drive belt, hoses, windshield wipers, plugs, points and condenser. Put them in the car along with your tool kit. Now, if something is needed, do it yourself.

5. If you need a mechanic in a strange town, you have a better chance finding one who is reliable by calling the Better Business Bureau, Chamber of Commerce or a local agent representing your insurance company.

You can also buy a copy of *Where to Find Certified Mechanics for Your Car*, which is a 198-page listing of mechanics certified for competency by the National Institute for Automotive Service Excellence. The book, which sells for \$1.98, can be ordered from NIASE, 1825 K St. N.W., Washington, D.C. 20006.

Tricks of the trade

To get a line on some deceptive practices, I consulted owners of several service stations. They are honest dealers, but they are aware of methods dishonest operators employ. In addition to practices previously mentioned, here are some others:

■ **Shortchanging on gas.** Credit-card users often make easy victims. Crooked operators run the credit card through the stamping machine

twice or use two tickets. The owner's signature is forged on the bogus ticket. This scheme is successful because many credit card users don't keep receipts to verify monthly bills.

Retain credit card receipts and check your monthly bill against them. Don't pay for gas you didn't receive. However, you may be asked to prove that you did not patronize the service station on the date in question.

If you use a credit card, make sure the imprinted amount shown in the upper right-hand corner coincides with the amount of the sale written on the statement. The oil company always bases its charge on the imprinted amount—not on the written amount.

■ **Shortchanging on oil.** Short-sticking is probably the oldest way of selling unneeded oil to a customer. When checking oil, the attendant simply does not seat the dipstick. The result is a low reading.

Some attendants sweeten the pot by adding inferior oil and charging the customer for a top-of-the-line grade. Other attendants may add *no* oil. They remove an empty can from the oil rack and insert an oil can dispenser in the old puncture. They then recheck the level, this time seating the dipstick and showing the customer a full crankcase. There's a nice profit to be made in selling oil from empty cans!

■ **Honk-honk.** Have you heard the one about the dishonest dealer who rigged a nail to his shoe and punctured tires as he pumped gas and cleaned windshields? Along with the shock absorber gimmick, it made him a bundle of money during the Salt Lake City caper by resulting in scores of new tire sales. The method is called "honking." It is as unscrupulous as the damage that's done by attendants to other good parts of a car.

The following are some other things that can be done to a customer's vehicle as he or she sits behind the wheel:

■ **Dropping antacid tablets inside a battery** to neutralize acid and prevent starting. Antacid kills a battery, leaving a customer little choice but to buy a new one.

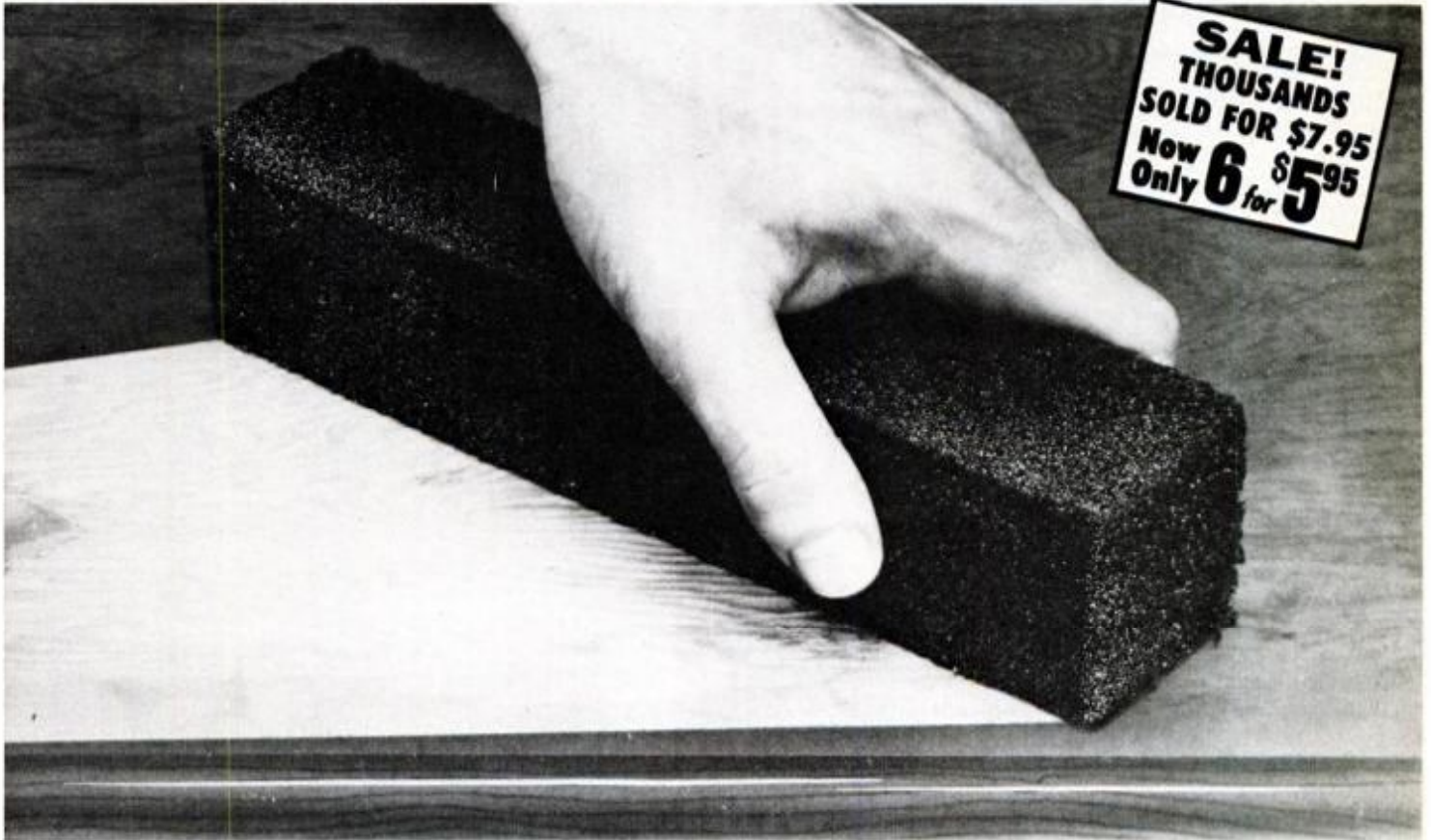
■ **Slitting drive belts and hoses** with a concealed knife or razor blade.

■ **Pouring a vial of milk in the power steering pump** or down the automatic-transmission filler tube to make fluid on a dipstick look con-

(Please turn to page 162)

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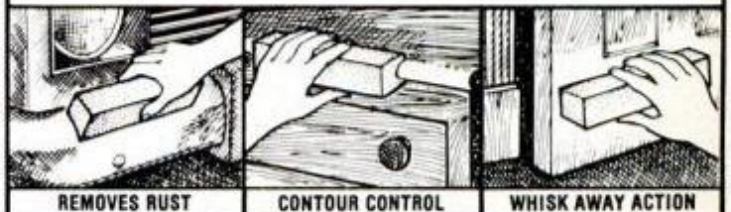
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This photographic accentuation helps depict the whisk-away action of the wonderful Space-Age Paint Stripper.

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THE ROLLER RENAISSANCE

(Continued from page 95)

should bounce like tennis balls; otherwise, you'll arrive late and leg-weary.

And now there are tires

At the other end of the spectrum is the rink wheel—harder and narrower (the better to boogie with) and perhaps one-third the cost. The choice is yours. Or, you may opt for **Mattel's new Sunrunner** (see photo, page 95), the first skate to offer "tires" that can be changed independently of the hubs—and cover all possibilities. Priced at \$20 to \$50, these lightweight jogging-shoes-on-wheels also feature radically designed trucks that represent a simplification of the conventional steering system that has been used for roller skates.

Roller buffs had trouble making smooth turns before James Plimpton invented the steerable skate in 1863. (For a while, in the early 19th century, the wheels rolled only straight forward. Presumably, some people skated off and were never seen again.) The steering action was provided by small rubber pads that reacted to the skater's shifting weight.

But today, a good pair of skates has two rubbers on each truck: double action. By adjusting the action bolt, you can get the amount of "lean" that suits your taste and purpose. With the niftier skates, you'll need an Allen wrench to make this adjustment.

Steering innovation

Mattel Co. has eliminated the shish kebab of rubbers, nuts and washers which, the firm claims, renders a flawed interpretation of the "messages" sent from above. Sunrunner trucks are solid triangles filled in with rubber pads; the action bolt, in this case, is parallel to the axle.

"Steering is everything," reports Mattel designer Steve Kimmell, "and ours is more precise, more consistent. Because there are no gaps, the axle gets popped back to dead center every time."

Perhaps. But the World's Largest Toymaker must prove it to the Godfather of Roller Disco. Detroit native Bill Butler holds that title, as well as the more financially rewarding position of skating director at The Good Skates, an outdoor roller concession in New York City's Central Park. A skater for 38 of his 45 years, he has gone so far as to develop "a whole philosophy of life" based on the sport.

"I stay in shape for skating physically, mentally and morally," Butler says. "I eat only those foods which help me to skate better." (Red meat is for ice skaters and other lesser mortals.)

Recently, Bill Butler and freelance writer-photographer Elin Schoen completed a book—*Jamin': Roller Skating Now!*—that promises to be at least the most sincere treatise in the impending glut of roller literature.

Butler laughs at the notion of the \$1000 skate with its precision-tooled magnesium-alloy plate, kangaroo-skin boot, working electric lights and diamond-studded heel. In his opinion, the classic skate can be constructed for \$150. "It'll have some features the beginner won't need," he notes, "but if he wants them eventually, they'll be there."

The ultimate skate

When a customer gives him carte blanche, Butler reaches first for Kryptonite blue urethane wheels. ("The top of the line," he says, "but you can use 'em indoors or out.") Into these he inserts Fafnir precision bearings (two per wheel) and the slightly larger (5/16-inch) axles that came along with the road-skating craze.

His favorite plate is made of drop-forged steel by the Snyder Skate Co.; it features a jump bar that keeps the double-action trucks from spreading, and adjustable locking toe-stop (brake), and an "elevator" in the heel that allows the foot to be raked forward, to allow for greater maneuverability. But the real maraschino cherry, so to speak, is a Reidell leather boot.

That, at any rate, is Butler's dream skate of the month. By the time he begins holding court at the Roller Ballroom, a chic nightspot set to open soon in New York, his opinions may change. New products come on the market so fast nowadays that even the Godfather of Roller Disco has trouble keeping up with them.

Skating at 40 mph

Consider, for example, the two-cycle, 1.2-hp engine that Motoboard International of Sunnyvale, Calif., suggests you slip on the back of one skate. For \$289 you can zip down the highway at 40 mph with the wind blowing through your hair and your whole life passing before your eyes.

"Oh my," you'll say. "How this sport has changed!" **PM**



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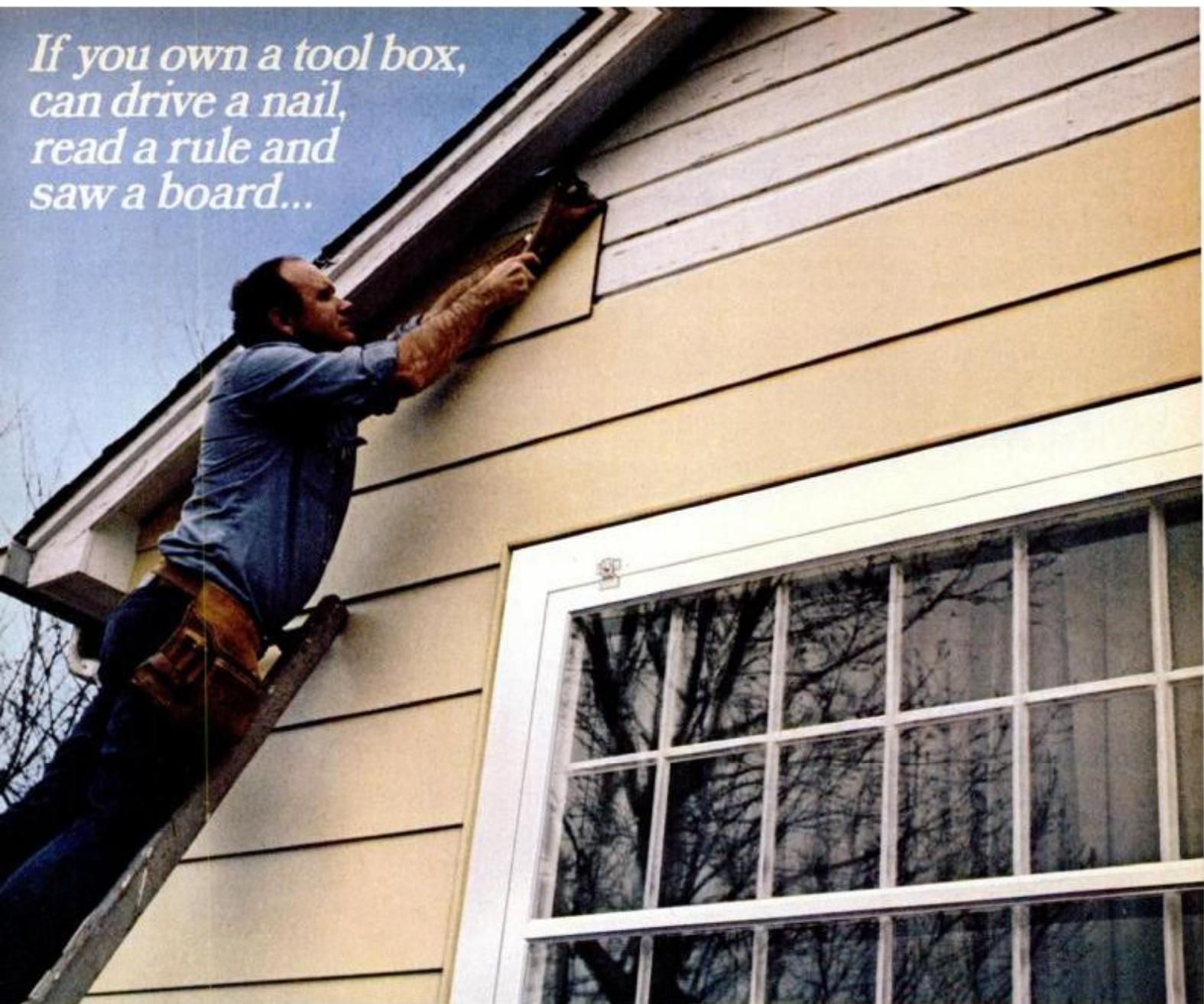
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PM'S NEW FRONT ENTRY

(Continued from page 113)

lar (which measured $1\frac{3}{16}$ in.), and stained it walnut.

To join the round legs to the square base, square-up turning blocks Q and R (see below), and adjust dado head to make cuts. Note cuts on the fifth leg are different from the first four. Glue filler blocks into the grooves before turning. For easier removal later, insert paper, with a small amount of glue on both sides, between leg and filler block.

Use the gouge to rough-turn the blocks to cylindrical shape. Then make parting cuts to desired depths. Shape with a spear point and skew. Sand the legs, remove filler blocks with a chisel and scrape out the remaining paper.

Cut base members E, F, G and H to size. Then run a rounding-over router bit to shape the top edges of F and G. To assemble, first glue two legs into each F piece. Join G and E to H and add the F pieces. Hold the assembly with bar clamps cushioned with softwood blocks to prevent

marring of the workpieces. Add the fifth leg after you've positioned the bench where it will be used so you can adjust for an out-of-level floor.

Building the tabletop/seat

Using dowels, edge-glue boards to create A and C. First rip the boards to size; identify them and clamp adjoining pieces together. Use a square to draw centerlines at dowel locations. Bore holes accurately using a doweling jig. Glue panels and sand smooth with a belt sander.

Cut and attach D to C. Cut and add ends B and drawer dividers S. Attach A after C is screwed and glued to legs and drawers are fitted.

Cut front, sides and back for large drawer J, M, N; medium drawer J, K, O; and small drawer J, L and P. Cut grooves for the drawer bottoms in all parts. Assemble sides and back with glue and 4d finishing nails. Cut bottoms T, U and V about $\frac{1}{16}$ in. scant in both directions to avoid expansion problems. Slide bottoms in place and attach drawer fronts N, O and P with glue and 3d finishing nails. Attach drawer-slide hardware

MATERIALS LIST—TABLE/BENCH

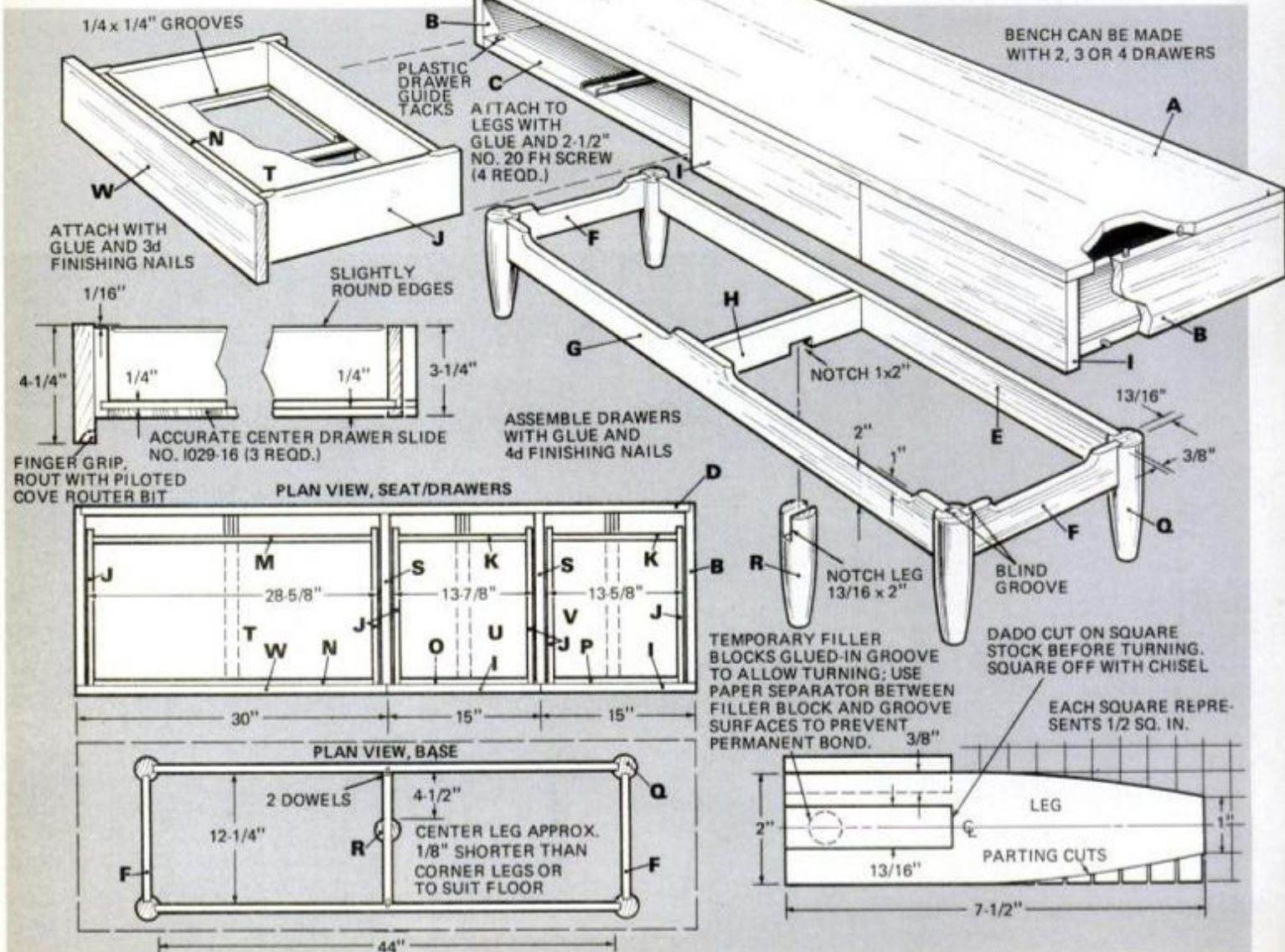
Key	Pcs.	Size and description
A	1	$1\frac{3}{16}$ x 18 x 60" poplar
B	2	$1\frac{3}{16}$ x $4\frac{1}{2}$ x $17\frac{7}{16}$ " poplar
C	1	$1\frac{3}{16}$ x $16\frac{1}{2}$ x $58\frac{1}{2}$ " poplar
D	1	$1\frac{3}{16}$ x $4\frac{1}{2}$ x $59\frac{1}{2}$ " poplar
E	1	$1\frac{3}{16}$ x 3 x $44\frac{1}{2}$ " poplar
F	2	$1\frac{3}{16}$ x 3 x $11\frac{1}{2}$ " poplar
G	1	$1\frac{3}{16}$ x 3 x $44\frac{1}{2}$ " poplar
H	1	$1\frac{3}{16}$ x $3\frac{1}{2}$ x $12\frac{1}{2}$ " poplar
I	2	$1\frac{3}{16}$ x $4\frac{1}{4}$ x 15" poplar
J	6	$\frac{1}{2}$ x $3\frac{1}{4}$ x 15" pine
K	1	$\frac{1}{2}$ x $3\frac{1}{4}$ x $12\frac{1}{2}$ " pine
L	1	$\frac{1}{2}$ x $3\frac{1}{4}$ x $12\frac{1}{2}$ " pine
M	1	$\frac{1}{2}$ x $3\frac{1}{4}$ x $27\frac{1}{2}$ " pine
N	1	$\frac{1}{2}$ x $3\frac{1}{4}$ x $27\frac{1}{2}$ " pine
O	1	$\frac{1}{2}$ x $3\frac{1}{4}$ x $12\frac{1}{2}$ " pine
P	1	$\frac{1}{2}$ x $3\frac{1}{4}$ x $12\frac{1}{2}$ " pine
Q	4	2 x 2 x $7\frac{1}{2}$ " poplar
R	1	2 x 2 x $7\frac{1}{2}$ " poplar
S	2	$1\frac{3}{16}$ x $3\frac{1}{4}$ x $16\frac{1}{2}$ " poplar
T	1	$\frac{1}{4}$ x $13\frac{15}{16}$ x $28\frac{1}{16}$ " hardboard
U	1	$\frac{1}{4}$ x $13\frac{15}{16}$ x $13\frac{1}{16}$ " hardboard
V	1	$\frac{1}{4}$ x $13\frac{15}{16}$ x $13\frac{1}{16}$ " hardboard
W	1	$1\frac{3}{16}$ x $4\frac{1}{4}$ x 30" poplar

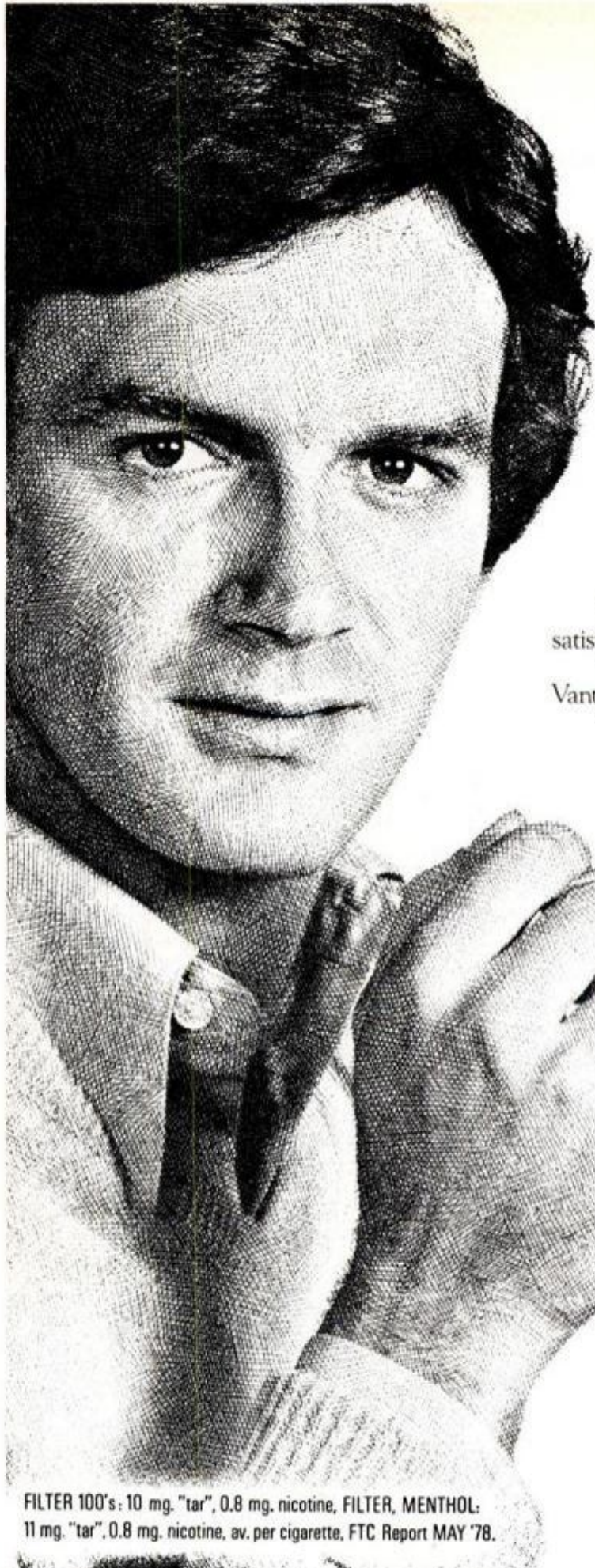
Misc.: White glue; $\frac{1}{8}$ -in.-dia. dowel; 4 No. 20 x $2\frac{1}{2}$ " screws; 3d and 4d finishing nails; 3 No. 1029-16 Accuride center drawer slides complete with plastic drawer-guide tacks; sealer; stain; satin polyurethane finish.

and position drawers. Cut faces I and W from the same board for best match of grain. Align them, mark, glue and nail drawers to faces.

Apply a thin coat of sealer to all inside areas and inside and outside of drawers. Stain and finish. **PM**

TABLE/BENCH





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CONTROL YOUR ATC SYSTEM

(Continued from page 110)

tiometer is a wire-wound resistor that emits a signal. As the dial is moved, potentiometer resistance is changed. This signal is transmitted to the programmer amplifier.

The control-dial potentiometer and the two temperature sensors are wired together in series. Their signals, combined into one and sent to the vacuum motor by the amplifier, keep the vacuum motor working at a level that holds temperatures in the car within narrow limits.

■ *In-car turn-on switch* is a thermostatic switch that senses temperature inside the car. When the ignition is turned on, the in-car turn-on switch automatically closes and activates the ATC system if temperature is above 80° F.

Making sense of the sensors

One sensor used in the ATC system senses outside air temperature; the other sensor senses in-car temperature. Both sensors are thermistors—resistors whose resistance decreases as temperature rises.

The in-car sensor is located under a grille in the instrument panel. A rubber hose connects it to a part (aspirator) mounted on the heater assembly. Then the aspirator discharges a sample of passenger-compartment air across the thermistor for an accurate temperature signal.

The outside air sensor is usually mounted on the evaporator inlet case. In addition to sensing outside air temperature, it possesses an ambient switch that turns the air conditioner compressor off when temperature goes below 32° F. At 32° F. and above, the compressor stays on to

dehumidify air in the car, lessening the chance of window fogging.

To get an idea of how the sensors and temperature-control-dial potentiometer operate the ATC system, suppose it's a warm day. Temperature at the outside sensor is 80° F. Temperature at the in-car sensor is 75°. The setting on the temperature control dial is 75°.

In a typical ATC system, at 80° F., the resistance of the outside air sensor is 32 ohms. At 75°, the resistance of the in-car sensor is 68 ohms. The resistance of the temperature-dial potentiometer is 36 ohms. Total resistance is 136 ohms.

In a typical system, a resistance of 136 ohms maintains the blower on low speed, keeps the heater water valve open, keeps the outside air door open, and allows the air conditioner to operate. Air coming from air conditioner outlets is about 60° F. Suppose the outside temperature increases to 90°. This causes a decrease in outside air sensor resistance to 26 ohms. Total resistance, therefore, decreases to 130 ohms.

The change in total resistance changes amplifier output current, which causes a change in transducer output vacuum to the vacuum motor. The motor alters the position of the ratchet and spring mechanism, which moves the blower circuit-board wiper to a new position. Blower speed steps up to Medium Low to keep in-car heat at 75° F.

A programmer input/output chart for a typical ATC (page 109) shows the function of the system according to changes in the combined sensor-and-temperature-control dial resistance. With the chart below you can determine if an ATC system is functioning properly. **FM**

ACTION IN TYPICAL AUTOMATIC TEMPERATURE CONTROL SYSTEM	
(Engine warmed up and running)	
CONTROL LEVER POSITION	WHAT SHOULD HAPPEN
Off	Air discharges from heater outlet. Moving of temperature dial from 65° to 85° should cause discharging air to get warm, but no change in blower speed; air should continue coming from the heater outlet only.
Economy	Air discharges from airconditioning (a/c) outlets. Moving temperature dial should not change the discharged air temperature or blower speed.
Lo	Moving the temperature dial from 65° to 85° causes the discharged cool air to heat. Air should switch from a/c outlets to heater and defrost (small flow) outlets. The blower maintains itself at a fixed speed.
Auto	Moving temperature dial from 65° to 85° causes discharged cool air to heat. Air should switch from a/c outlets to heater and defrost (small flow) outlets. Blower speed drops, then increases.
Hi	Moving temperature dial from 65° to 85° causes discharged cool air to heat. Air should switch from a/c outlets to heater and defrost (small flow) outlets. The blower maintains itself at a fixed speed.
Bi-Level	Moving temperature dial from 65° to 85° causes discharged cool air to heat. Air is discharged from a/c heat and defrost (small flow) outlets at all times. Blower speed drops.
Def	Moving temperature dial from 65° to 85° causes discharging air to go from cool to hot. Airflow comes from heat and defrost (large flow) outlets at a fixed speed.

RESTORE YOUR OLD ANTENNA

(Continued from page 105)

its "end" position. (It is assumed that the rotator has been properly synchronized with its control box according to the manufacturer's instruction sheet.) Install the rotator while it is still in this position, making sure that two antenna down-lead stand-off insulators are properly positioned 180° apart, one immediately above the rotator, the other immediately below. Such positioning provides for sufficient slack in the down-lead to prevent binding during maximum rotation.

Lightning protection

Since antennas are customarily mounted higher than surrounding objects, they become prime targets for lightning bolts. A lightning arrestor should always be used between the antenna and the equipment it feeds! (It should be mounted outdoors, with a sturdy wire running directly from it to earth, instead of to a cold-water pipe, wherever possible.) Some manufacturers claim their products will function repeatedly, but if it is suspected a hit has occurred, it's a good idea to replace the arrestor.

You can make your own lightning arrestors from discarded sparkplugs. These will operate repeatedly. And since the plug's electrodes are left uncovered, damage inspection is easy.

The sparkplug lightning arrestor is installed outdoors, near the antenna lead-in. It is supported at the base by a small right-angle metal bracket that in turn is secured against the building. The "hot" (ungrounded) side of the lead-in cable or twin-lead makes contact with the terminal at the top of the plug. (Note that this wire is not broken. After making contact with the sparkplug, it continues on its way.) The metal body of the plug is connected to ground, preferably by means of a heavy wire running directly to the earth.

Incidentally, as a further safeguard against lightning damage, all equipment should be unplugged during an electrical storm.

Power-line protection

When restoring antennas, it is most important to make sure that a snapped guy wire, falling mast or damaged antenna element has not made contact with adjacent power lines. Workers have been electrocuted when this happened. So plan your antenna restoration work carefully beforehand. Always remember—safety first, even before good reception!

PM

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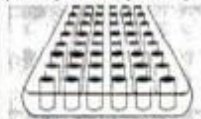
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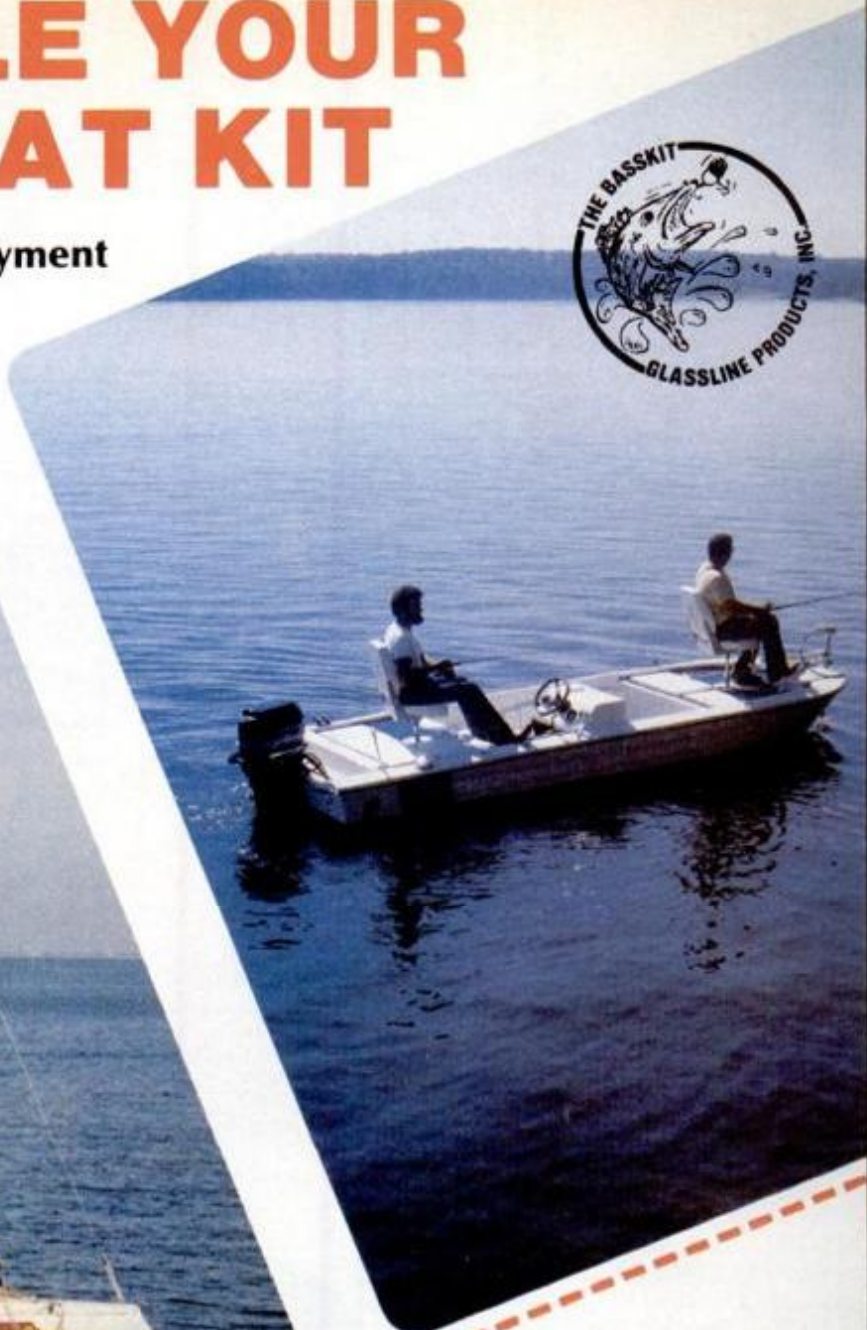
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CHECK ONE: SAILBOAT BASSBOAT

PM-6

there are no sharks. A medical team stands by and the divers' work is monitored by remote cameras, so the surface team can watch their every move. Sounds like soft duty, doesn't it? Don't believe it. The divers in question are part of an exclusive group of men working for a small handful of ultraspecialized underwater engineering concerns. These are the men who actually dive into the radioactive fuel assemblies of the nation's nuclear reactors. They don't even have a union.

Several years ago, Rochester Gas & Electric, operator of a nuclear generating station on Lake Ontario, found itself between a rock and a hard place. The spent-fuel reprocessing plant where the nuclear reactor's used fuel, still highly radioactive, is usually sent had been shut down. Like other nuclear operators, RG&E found itself forced to store unanticipated numbers of spent fuel rods in its own 20 by 40-foot storage pool. On a temporary basis there was no problem; the 14-foot fuel rods would not accumulate rapidly enough to fill the existing storage pool, which was, at that time, only half full.

However, the reactor was scheduled to be shut down and inspected in 1979 after its 10th year of service. The entire reactor would have to be defueled and all 121 fuel assemblies would be unloaded from the reactor's core. The inspection was mandatory, but there was no possible way to store the highly radioactive fuel elements unless new storage became available.

Courses of action limited

The choices were limited. They could build a new storage pool, by no means cheap; they could hope that the reprocessing plant would reopen and take the fuel assemblies off their hands, by no means prudent; or they could take out the existing storage racks and put in more compact underwater storage shelves so they could use their existing pool. The decision was made to replace the storage racks with new high-density racks and the Underwater Construction Corp of Essex, Conn., got the assignment.

After the government's Nuclear Regulatory Commission's safety questions had been answered, the plant's health physicists set up radiation monitors and helped plan the divers' work times to keep radiation exposures within safe limits. Then the hard work began.

The racks, made of two by two by 1/4-inch structural stainless-steel an-

gle stock, looked just like a series of interlocking picket fences welded together in cage-like arrays. They clearly had not been designed to be removed. The entire assembly that RG&E wanted replaced had been carefully welded in on all sides (as well as along the bottom) to the walls, floors and adjoining racks. Scores of pieces of stainless angle stock would have to be cut free, and all the work would have to be performed under 40 feet of contaminated, radioactive water.

Cutting stainless steel, even in a welding shop, is not one of life's simpler chores. But when the nuclear engineers ruled out the use of oxy-arc cutters because of the risk of combustion byproducts contaminating the fuel, the job got tougher. Electrical bandsaws were also ruled out because of shock hazard, so U.C.C. came up with the idea of converting them to pneumatic drive. Then the air supply had to be beefed up to overcome the additional pressure of 40 feet of water.

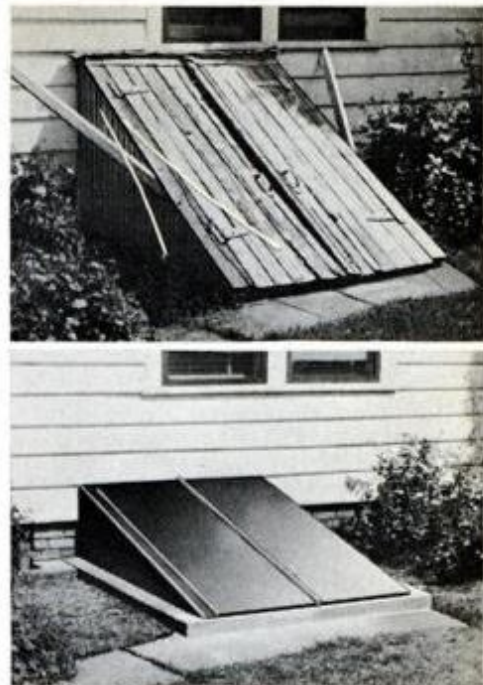
Along with the tool problems the question of the diver's outfit was confronted. Conventional wet suits, despite their freedom of movement, were ruled out, since free-floating radioactive debris in the tank could immediately work its way inside the mechanism of the scuba regulator. It was the tried and true hard-hat rig, unchanged in principle, but greatly updated since its introduction a century ago, that was finally chosen. An additional advantage to the rubber-suited dress was the diver's ability to precisely control his own buoyancy by adding air to the suit from the surface pumps. There was always a standby diver, fully dressed and ready to enter the water whenever another man was in the tank, as well as radio for diver communication and television for job supervision.

Progress is tedious

Work periods in the tank were limited to 190 minutes, not for reasons of pressure, but radioactivity. A decompression chamber was on site. The cutting began. Working back into the maze of stainless angle stock, the divers had to cover jagged ends above and below as they inched forward, lest a snag tear the suit.

After three and a half weeks of 10-hour day and night shifts, using two crews of five men—the two divers, their two tenders and a communications man—the first welded storage section was removed. The remaining racks went more rapidly, and a

(Please turn to page 142)



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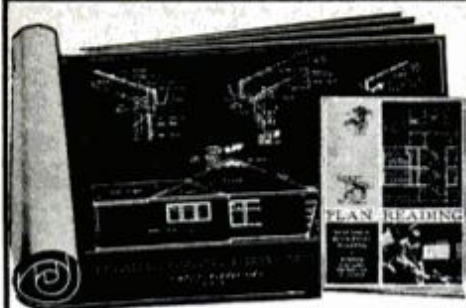
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simpler method of installation for the new storage racks allowed the job to be finished in plenty of time for the inspection. In addition, the divers performed the unplanned removal of a damaged control-rod assembly, a task that would have been far more complex and costly if it had been performed by workers on the surface. There were risks—the consequences of an accident in the contaminated pit could have been gruesome—but the work was performed without injury.

Out in the open ocean, however, the hazards of industrial diving take on undeniably frightening proportions. Scores of divers have been lost in the North Sea since the deep-water oil rigs started appearing there, though nobody claims to have an accurate count of the casualties. Nevertheless, the work goes on. Working divers in the North Sea off Norway recently broke the 1025-foot depth record that was set in the Gulf of Mexico in 1977, if only by a few feet.

Dangerous winds, currents

Killer winds sweep in at well over 100 mph, and when one oil tower was designed to withstand seas of 90 feet, the North Sea promptly sent in monsters of 110, a phenomenon supposed to happen theoretically only about once every century.

Building an immovable object to withstand these irresistible forces takes the best that man can devise, and it's the divers who get to check the foundations and see that the plumbing has all been installed properly. Currents running seven knots and more are known to have swept several men away into open ocean before anyone even knew they were in trouble. Mismatching the pressure in a diving bell during a recent decompression mishap turned the divers in a transfer chamber into what was grimly described as "strawberry jam."

The risks have grown so great that an entire hospital section specializing in diving medicine has been established in Aberdeen, Scotland. One drilling firm has equipped a helicopter with a decompression chamber for transferring injured divers without risking the bends.

Swift, risky currents are not limited to North Sea work. Divers in San Francisco Bay tell of working under the Golden Gate Bridge when tides ripping out on the surface were masking currents near the bottom that were simultaneously running in from the Pacific. Orville Hanners, a hard-hatter who has worked in the

Bay for 35 years, described the sensation in *Oceans* magazine. He had checked the tide tables and was 200 feet down. Said Hanners, "The tide may be still running out on the surface two hours after low water, while at the same time it is flooding underneath. So when you go down, the hose goes out like an "S" and you get completely turned around."

In Alaska, on several of the oil drilling platforms, the currents have been so rough that the divers are sent down inside the tubular steel legs of the drilling rig. It keeps them from being swept away while they install the cross supports.

Jaws notwithstanding, there are lots of ways to die in the ocean, but the rewards are right there, along with the risk. Nobody knows that better than a man named Luck.

Shades of Jonah

John Luck is his name, and it took a while to track down his story. He was working as an oil rig diver in the Gulf of Mexico, the year was 1968, and the story is true.

Earlier in the year a grouper, a large, but slow-moving and nonaggressive fish, had actually bitten off the flippers of a diver working near the bottom of the rig. The story went around, but everyone knew groupers were above suspicion. Big they are—some weighing in at well over 1000 pounds—but invariably harmless, and even affectionate.

When Luck entered the water, his mind was far from the grouper story, and he was hard at work. Tethered to another diver by a safety umbilical, he never saw the fish until it *swallowed him*. It didn't bite him, it didn't even hurt him, but if the other tethered diver hadn't been there to pull him back out of the fish, Luck would certainly have run out.

The dangers of the ocean are primarily the risks that men choose to take for themselves, for pleasure or profit. A diver working in the icy depths of the North Sea at 1030 feet earns as much as \$1000 per day. The Colombian divers who swim out into the water of New York harbor to smuggle in their kilos of cocaine can earn \$2000 in an evening (if their partners don't cut their throats after the dropoff; *it has happened*). The risks are balanced by the rewards.

If there are dangers, if the work is hazardous, there is still the thrill that comes when a risk has been undertaken willingly, and successfully overcome. The pride and self-confidence that come from a challenge like diving is what makes these people take the risks they do. **PM**

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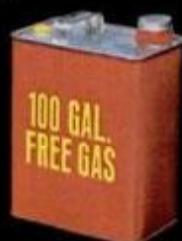
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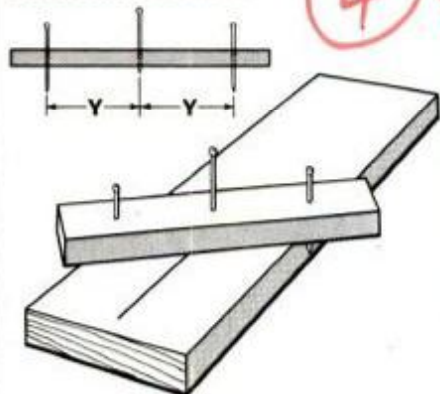
Mixing epoxy



When you mix small amounts of epoxy, use the bottom of an empty can as a container. Hammer a concave curve in the bottom. A ball peen hammer works especially well to form a depression.

—Bernard Fritch

Centerline scriber



Find the center of boards quickly with this simple scriber. It's made of a piece of wood and three nails. Nails must be in line, the middle one centered between the outer two and extending enough to scribe (be sure distances indicated at "Y" above are equal). Hold the scriber flat on the board being marked, with outside nails touching its edges.—Bob Tom

Making neat stripes



Make neat, decorative stripes on a wood dowel. Form very shallow grooves around the dowel with a tubing cutter. The grooves are boundaries that make coloring stripes easier.—Walter E. Burton

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The interior shown is called the Rally STX. Notice that the upholstery is a snappy Glen Plaid. The front seats are the available reclining and swivelling bucket type; each one having two, large retractable armrests.

The instrument panel houses all the usual gages, dials, and indicators. And, of course, you can equip any Rally Wagon model with all sorts of carlike extras: air, stereo, Cruise Control, tilt steering wheel.

But a few things you'll always find on a GMC Rally Wagon that you would never find on the station wagons of yesteryear, or any year for that matter, are: A huge 44-inch sliding side door to welcome you all aboard. A great, "over-the-car-tops" view of the road from behind the large windshield. And available rear seats which are completely removable for added cargo room.

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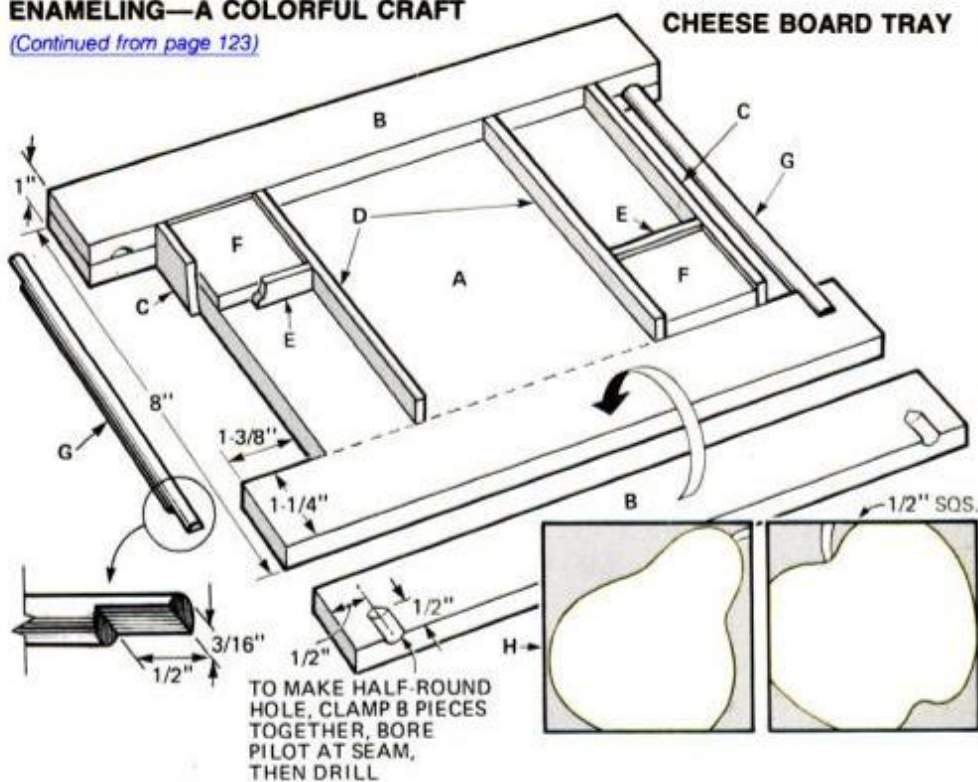


GMC is a division of General Motors.



ENAMELING—A COLORFUL CRAFT

(Continued from page 123)



To make notch cuts, place piece A over depressed blade, start power, slowly raise blade; then cut notch at other end.

MATERIALS LIST—BOARD TRAY

Key	Pcs.	Size and description
A	1	1/2 x 8 x 12 3/4" maple
B	2	1/2 x 1 1/4 x 12 3/4" maple
C	2	1/4 x 1 x 5 1/2" maple
D	2	1/4 x 1/2 x 5 1/2" maple
E	2	1/4 x 1/2 x 2" maple
F	2	3/8 x 2 x 2" plywood
G	2	3/8"-dia. x 6 1/2" hardwood dowels
H	2	2" copper squares

Misc.: White glue; epoxy glue; Hardwood and bowl seal finish; Klyr Fyre binder; Sparex cleaner; flux, raspberry, lemon, palm, hazel transparent enamels; geranium and lemon opaque enamels.

Note: Hardwood and nontoxic bowl seal finish is available from Albert Constantine, 2050 Eastchester Rd., Bronx, N.Y. 10461.

copper squares H (drawing, above).

Pear: Prepare the copper by cleaning and counterenameling it. To begin work on the face, spray gum binder and sift on a layer of flux. Dry, fire, cool and flatten copper.

Spray with gum binder, sift a layer of raspberry enamel, fire, cool and flatten the enamel.

Using a brush dipped in gum binder, loosely paint the shape of a pear on the enamel (see plan). Sift lemon opaque enamel onto the piece and tap off the excess. Add binder and enamel until you've made the desired shape. Clear away dust with a brush dipped in binder. Then dry, fire and flatten the piece. Check that the yellow is evenly coated and fill in any uneven spots with gum binder and enamel. Refire until the pear has an even layer of yellow. Otherwise, unfilled spots will appear dark later when the shading is sifted.

Spray binder and lightly sift palm transparent enamel over the entire pear. Then sift hazel transparent enamel over the bottom and sides of the pear to give it shading and a dimensional look. Clean the back-

ground and define the pear shape. Dry and fire the enamels in one firing to get a subtle color gradation. Add a stem with a brush dipped in hazel enamel moistened with water. Dry, fire and flatten; file edges.

Apple: Prepare the copper and fire a coat of flux as with the pear.

Spray binder and sift a layer of palm enamel over the flux, then fire. Spray binder and paint the apple using the same technique as the pear with geranium opaque enamel. Shade the apple with raspberry enamel and fire. Add a stem of moistened hazel enamel and fire.

Making the cheese board tray

Cut base A using a sabre saw or table saw as shown above. Cut pieces B, clamp together and bore a 3/8-in. hole on the joint line to form the half holes required for installing handles G. Cut strips C, D, E and blocks F.

Sand and assemble in this order: Glue strips C to A. Lay handles G in place and glue on B parts. Glue in F, then parts D and E. Apply finish. When dry, add enamels. **FM**

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Safe, easy to use.

The V-shaped base on the brad nailer lets you reach into wall panel grooves and also permits you to work in corners. A plastic guard on



This electric brad nailer can be loaded with special strips of 1 or 1¼-in. brads.

the unit prevents scratches on finished surfaces.

The 1- and 1¼-in. brads which fit this nailer are packaged in convenient 50-brad strips sold in packages of 10 strips (500 brads). Loading the brad nailer is as simple as filling a stapler.

The brads are available in a choice of four colors to blend with a variety of wood finishes.—R. Capotosto



To load strip of nails, withdraw spring-loaded push bar (foreground), insert the nail strip and reassemble.

SPECIFICATIONS—DUO-FAST BRAD NAILER

Tool construction: High-impact plastic housing; nickel-plated steel base; solid-state circuitry; 15-ft., three-conductor power cord.

Power requirement: 115-volt, 60-cycle a.c.

UL listed: Yes.

Price: suggested retail, \$77.99.

Brad price: \$1.49 for package of 500.

Manufacturer: Duo-Fast Corp., Consumer Products Div., 3702 River Rd., Franklin Park, Ill. 60131.



Nailer is especially suitable for installing sheets of wall paneling. V-shaped base fits into panel grooves for easy alignment.



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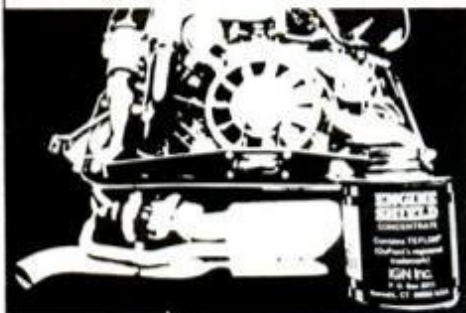


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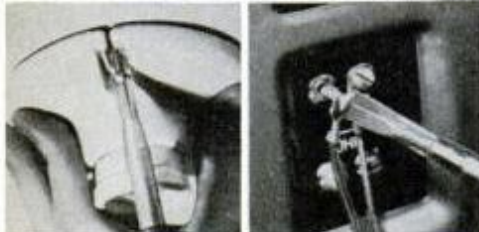
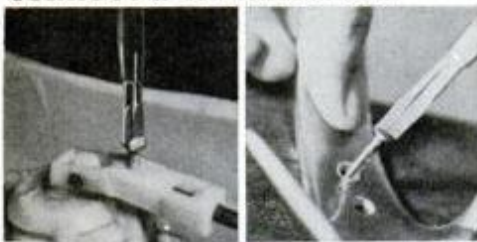
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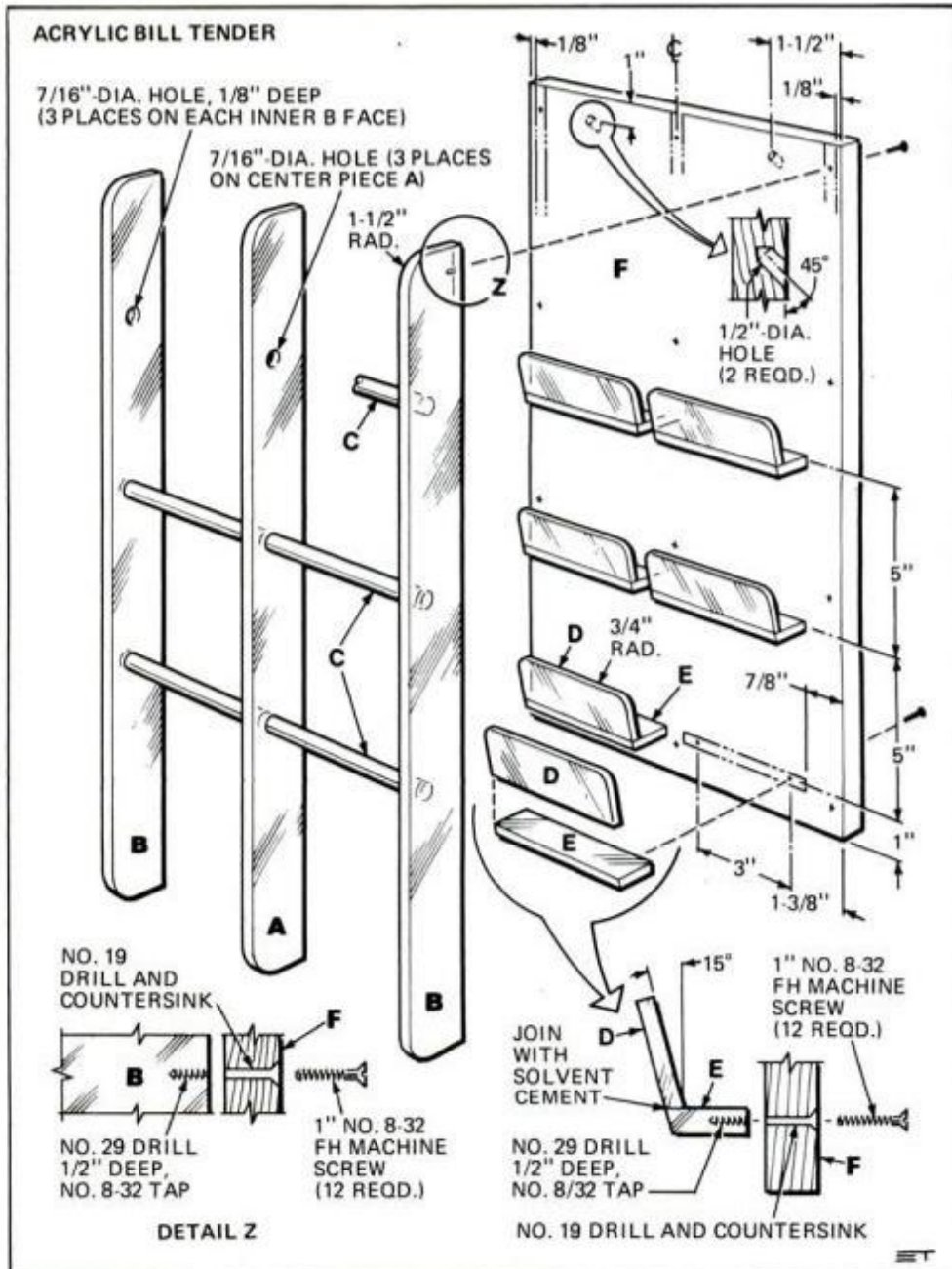
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BUILD PM'S LETTER LOCATERS

(Continued from page 119)



nails and bore pilot holes for nails on inner edges (those that abut E) of six compartment fronts (B). Push nails into holes with points protruding about 1/4 in. Tack-nail side pieces (D) to the compartment sections. Then press parts together against center dividing strip (E). Do this step on a flat surface.

Since the shape of this rack is too confining to permit successful application of stain, it is important to stain *before* assembly. While the unit is temporarily assembled with nails, mark outlines of all butt joints

with a pencil. Then disassemble. Apply masking tape to all outlined surfaces. This keeps stain from areas to be glued.

After staining all parts except the outsides of the side members (D), remove the tape and reassemble the rack with glue. Outsides are stained later because they must be sanded flush with the back after gluing. Apply a varnish spray coat to completed assembly.

The contemporary organizer

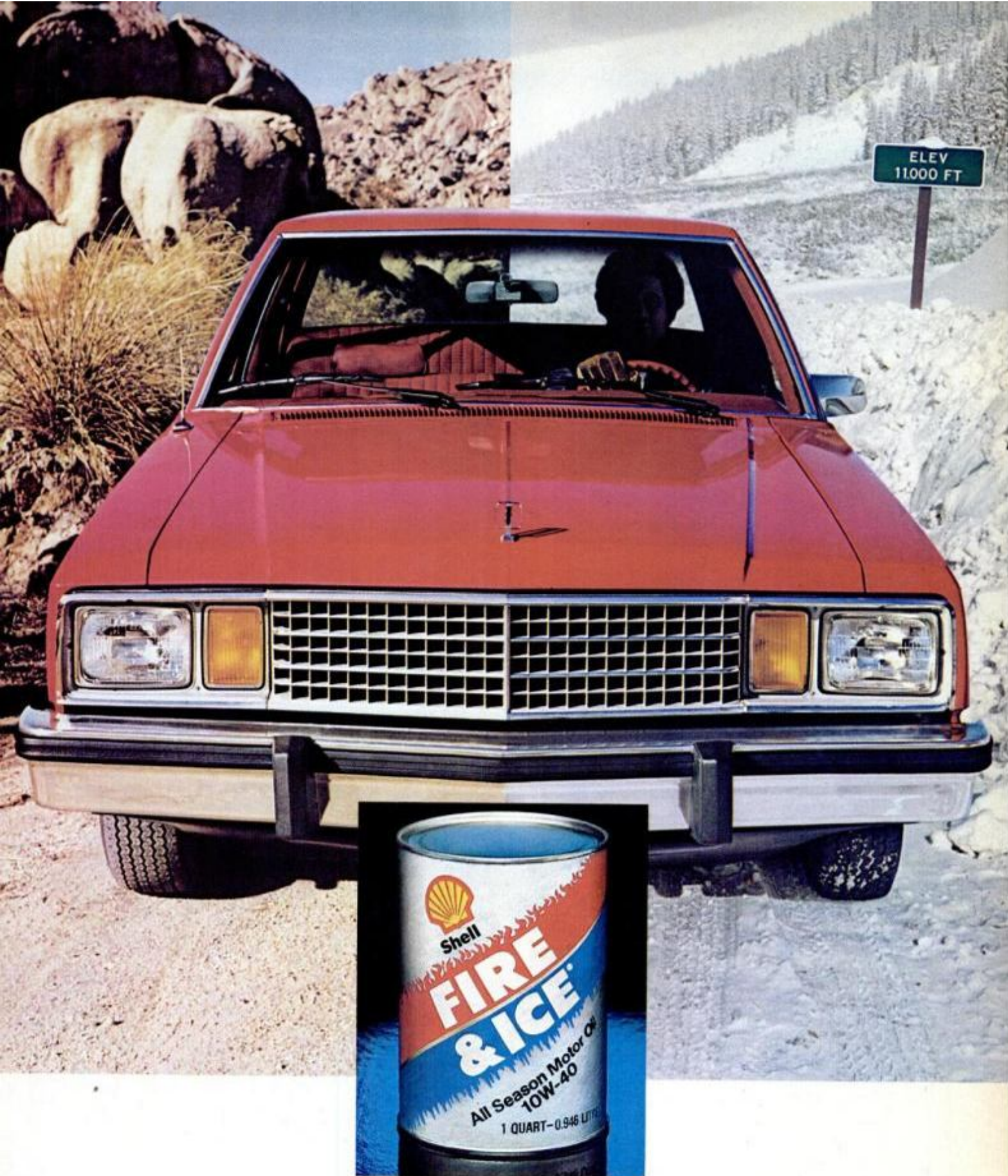
Start by cutting the verticals (A,B) using a fine-tooth plywood blade (see drawing above). Gang the three pieces together with masking tape and cut the round corners at the same time using a bandsaw, if available, or cut the corners individually with a sabre or coping saw. Be

(Please turn to page 152)

MATERIALS LIST—MODERN LOCATER

Key	Pcs.	Size and description
A	1	3/8 x 3 x 21" clear acrylic plastic
B	2	3/8 x 3 x 21" clear acrylic plastic
C	3	3/8"-dia. x 9 3/4" clear acrylic plastic
D	6	1/4 x 1 1/2 x 4" clear acrylic plastic
E	6	3/8 x 1 1/4 x 4" clear acrylic plastic
F	1	3/4 x 10 1/2 x 21" clear pine

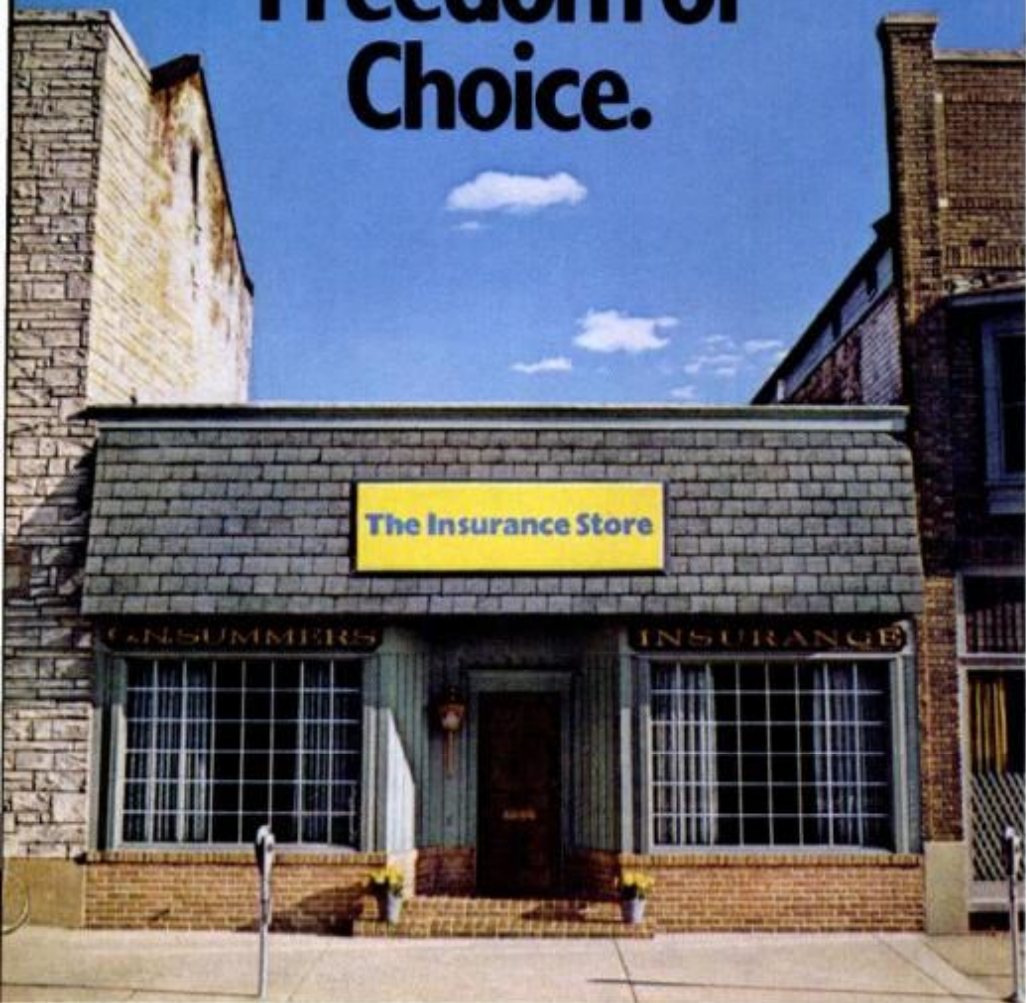
Misc: Solvent cement, screws to suit.



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BUILD PM'S LETTER LOCATERS

(Continued from page 150)

certain to leave the protective masking paper intact during all machining and finishing operations.

Use a scraper or sharp chisel with a pulling stroke to smooth out all saw marks. Follow up by sanding all edges with silicon carbide paper, working up from 220 to 600 grit.

Next, bore all holes and tap where necessary. Be particularly careful when drilling blind holes in (B) pieces. Since masking paper conceals view, make test borings in scrap to get it right. Cut shelf pieces with appropriate bevels. Then cement front pieces (D) to bases (E) with solvent cement.

The solvent works by capillary action, which requires that surfaces to be joined be in close contact. To obtain the necessary smooth, flat surface on the beveled edges of the fronts, do this: After smoothing edges with a chisel or scraper, lay a sheet of abrasive paper face up on a flat surface. Stroke workpiece firmly back and forth, making sure not to rock it. Work with progressively finer grits of silicon carbide paper. After sanding the beveled edges of the fronts, do the same to the beveled edges of base pieces. Sand remainder after cementing.

Remove the protective masking paper before cementing. Use masking tape to hold parts together. A fine-nozzle, squeeze-bottle cement applicator, available where you buy the acrylic, is used to apply cement. Lay assemblies down so the joint is horizontal. Apply a thin line of cement on joint line. If pieces are in good contact, cement will be sucked in and quickly weld the joint. Don't touch parts for five minutes.

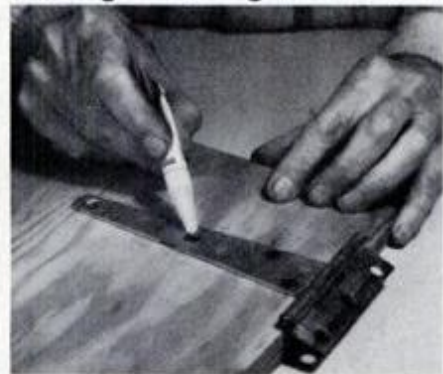
Sand all the flat edges of the shelves and slightly round the front bottom corners. Also cut and sand the rounds on the upper corners.

All edges which do not contact wood backboard are polished to a high gloss by buffing with polishing compound such as Du Pont Auto-Polishing compound or the Plexiglas brand. Use a buffing wheel, or a soft cloth shoeshine fashion.

If the screws meet resistance during assembly, rub a bit of soap on them. Attach two of the uprights; then insert the $\frac{3}{8}$ -in. rods before adding the third upright. The backboard is given a finish of walnut stain and satin topcoat varnish. (Do this before attaching the acrylic parts.) Plexiglas or similar acrylic sheet and rod are available at some home centers and at plastics supply houses. Look in Yellow Pages under "Plastics - Sheets & Rods." **PM**

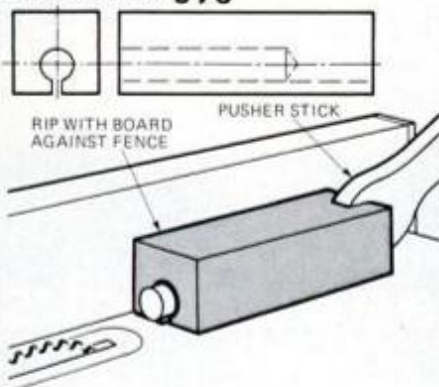
HINTS FROM READERS

Glue tightens hinge screws



Epoxy and quick-set glues keep loose screws in hinges. Lightly oiling the screwhead and slot before covering with glue makes it easier to pry or scrape out the glue if the screw must eventually be removed.—*Walter E. Burton*

Dowel venting jig



You can easily cut a glue groove in a wooden dowel by using this jig on a saw table. Make a jig for each dowel diameter you use. Use a pusher stick to protect your fingers.—*Judd H. Black*

Emergency guitar pick



Plastic tabs used to seal bread wrappers are easily cut to shape for use as improvised guitar picks. To achieve the best sound, smooth the cut edges with an emery board.—*Frank E. Dean*

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VINTAGE VROOM!

(Continued from page 82)

cropped up in Europe, before gaining a real toehold in the United States. Vintage racing has been strong in England all along, while retrospective events and tours at LeMans, and around the open road circuits of the Mille Miglia and Targa Florio, have enjoyed tremendous popularity, creating enthusiasm in those who never heard of the cars before.

Here in the United States, between-the-races exhibitions of the old cars in action became so popular that events for them were organized at Watkins Glen and Lime Rock in the East, and at the Laguna Seca and Willow Springs road courses in the West. New events are cropping up all the time to make a full racing calendar for anyone with an old campaigner. Full-on racing licenses aren't always needed and, in many cases, a simple driver's school stint at the event will qualify you. Tech inspections are detailed, however, and you can't just drag out your old Jowett Jupiter and threaten everybody's good time on 20-year-old tires or a worn-out brake system.

The vintage races are getting

more international as drivers bring cars from halfway around the world to get in on the fun. But they're not *all* millionaires. The little guy is still there, with his obscure Italian special that he just couldn't part with when it started to fade.

Well-known drivers, cars

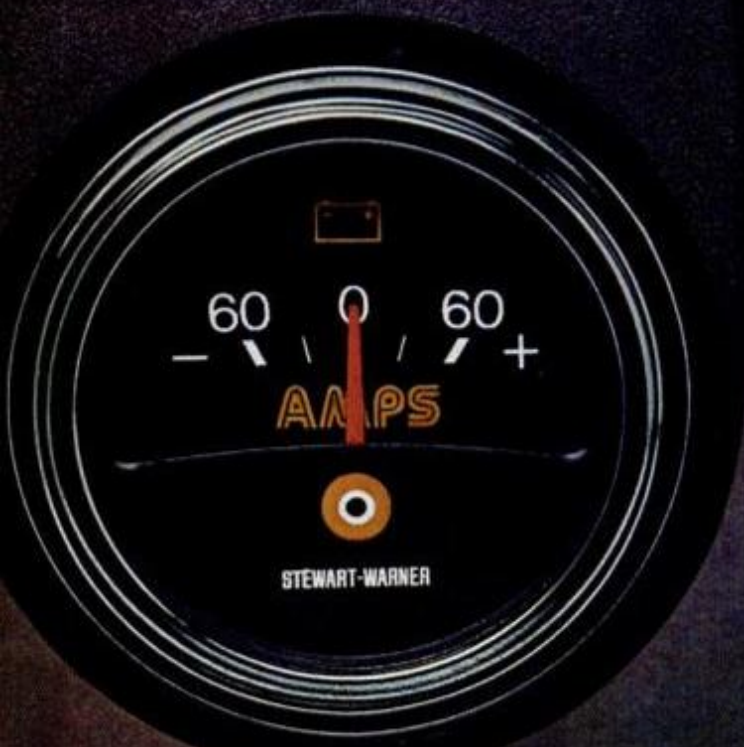
Some familiar faces have reappeared, and seem to be having more fun than ever. Five-time world champion Juan Fangio, Louis Chiron and French champion Rene Dreyfus showed up at the Long Beach Grand Prix to take part in the retrospective event. Museum owner Briggs Cunningham, builder of the first American sports car to race seriously after the War and winner of the America's Cup sailing challenge, has been a welcome supporter of many West Coast events with his amazing array of competition machinery.

America's first world champion driver, Phil Hill, has the enviable position of having entrants from one end of the pits to the other asking him to drive their cars in various events. An avid restorer from the

first, Hill has found himself racing everything from a Talbot-Lago coupe (great for riding to the opera), to the impressive 300 SLR Mercedes, the latest Mercedes to dominate world competition. By the end of the day, it's a good bet he's covered more miles than most other drivers, but he doesn't seem to mind at all.

The Big Boys are back, too; Jaguar, Mercedes, Alfa Romeo—all have sent team cars to show their stuff at vintage race meets. But unlike the old days, when they had a way of wiping out the smaller competitors, now they're icing on the cake and provide a lot of traditional background to the action of the day.

"You *will* have fun," says the instruction sheet for entrants in Steve Earle's Monterey Historic Automobile Races. "If you don't, then you are having a particular problem and aren't in step with the rest of us. Fun is the object, not winning anything." Fun's the object all right—and everyone seems to be coming away winners, judging by all the smiling faces. **PM**



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26 WAYS TO BEAT RUST AND CORROSION

(Continued from page 117)

metal that was bent or stretched in manufacture is exposed to a corrosive environment. A crack at the point of stress usually occurs. Certain combinations of metal and environment are especially susceptible. Whenever possible, avoid the following: aluminum alloys with salt water; copper, brass and bronze with ammonia; plain steel with ammonium nitrate fertilizers; stainless steel with salt water.

Preventive measures

The best precaution is to seal out the corrosive environment with paints, lacquers or varnishes, inhibitors, greases, oils and waxes. There are many good paints available, some of which contain special rust inhibitors, that give excellent corrosion resistance when used properly. The most important parts of any paint job are surface preparation and the application of a suitable primer. Painting over loose rust won't work.

To prepare the surface for painting, scrape and wire-brush or sand to remove any loose scale and rust, as well as loose paint, until the surface is sound. Then apply a primer which is specifically designed for the surface to be painted. For example: a primer such as Rust-Oleum 769 Damp Proof Red Primer is recommended for rusted metal. For clean or slightly rusted metal, Rust-Oleum's 960 Rust-Inhibitive primer does the trick. While some products claim one-coat rust prevention, one coat of paint over a rusted surface gives only a short-term solution. For lasting results, you need three steps: surface prep, primer and the topcoat.

Clear lacquers and varnishes protect metal without hiding the original finish. Copper and brass can be polished to like-new condition and kept that way by spraying on a clear finish. Or, if the object has tarnished to a stage that is desirable, a clear coating will keep it that way. Aluminum that corrodes into a dull, whitish film that dulls its surface can be cleaned and then coated with clear lacquer or varnish.

Inhibitors are chemicals which are added to an environment to make it less corrosive, or applied to a metal to protect it from the environment. Moisture-displacing sprays such as WD-40 are useful for protecting bare metal objects which cannot be painted, such as tools and machine surfaces. The most familiar use of inhibitors is in the cooling system of a car. Most antifreeze and

coolant preparations contain inhibitors to protect the engine cooling system from corrosion, but, in time, replenishment is necessary. A product such as Du Pont's Anti Rust is available for this purpose.

Another type of inhibitor consists of a bag of silica gel pellets. Placed in a toolbox, drawer or the like, this substance absorbs moisture to protect the contents from corrosion. It's especially useful in a toolbox kept in your car trunk.

Ways to remove corrosion

Rust, tarnish, and other corrosion can be removed with chemical preparations, providing the object is still sound. There are a number of corrosion removers on the market that will do a good job if used properly. Usually consisting of an acid solution suspended in a thick jelly-like liquid, the material dissolves corrosion. Upon testing several rust removers, it was found that in order to get really good results on badly rusted steel, it was necessary to go a bit beyond the printed instructions.

Simply brushing the material onto the rust in a thin coat didn't do much. Instead, we fashioned a shallow wood trough and lined it with plastic sheeting to keep the solution in constant contact with the rust. Occasional sanding with wet-or-dry abrasive paper during the soaking also proved effective.

Other cleaners remove corrosion or tarnish on aluminum, copper, brass, silver and other metals. They require less effort because they corrode less than iron or steel.

Homemade rust remover recipes

There are homemade preparations for removing corrosion. The following are from the U.S. Department of Commerce, National Bureau of Standards' Consumer's Guide on corrosion:

■ **For rusted iron or steel:** Dissolve four teaspoons of citric acid (or sour salt) in one quart of water. Carefully add small amounts of household ammonia to this solution, mixing thoroughly. *Very carefully* sniff the mixture after each addition. After the first few additions of the ammonia, you will not smell an ammonia-like odor from the mixture. Keep adding small amounts of ammonia and mixing until the mixture just starts to smell of ammonia again. Add more water to bring the volume of the mixture up to two quarts.

Put the solution in a fire-safe glass

(Please turn to page 156)

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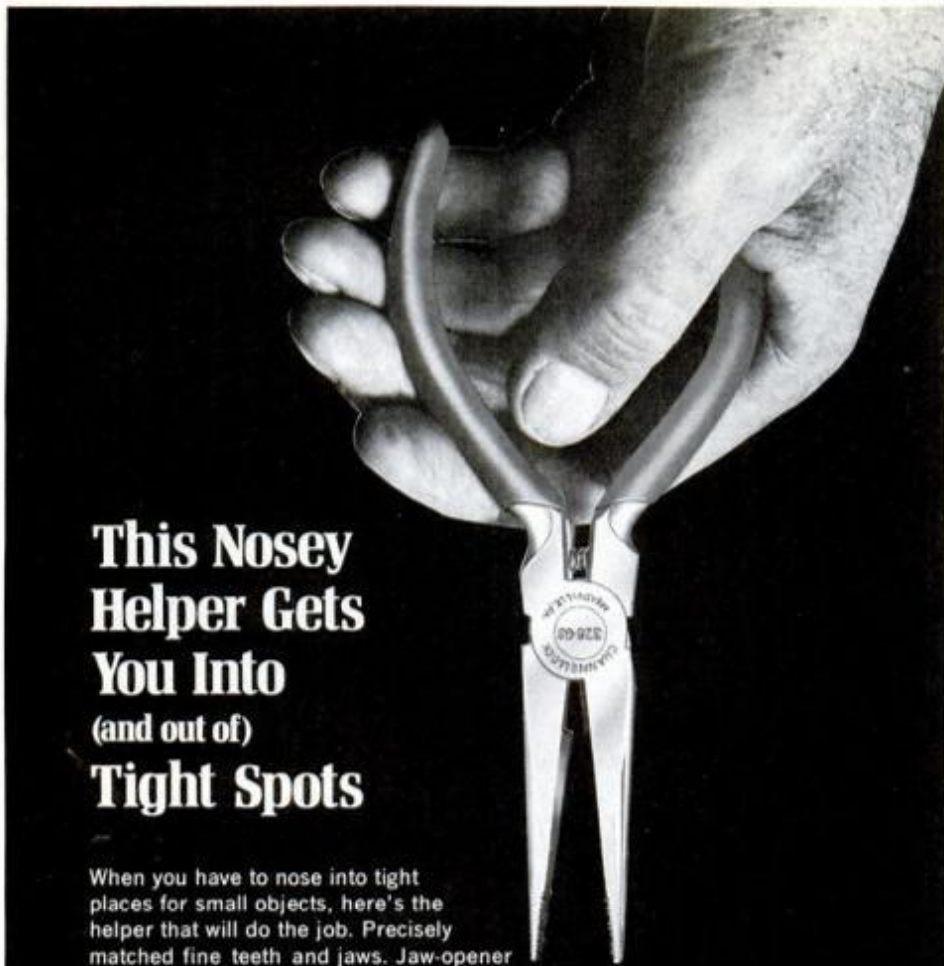
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BEATING RUST AND CORROSION

(Continued from page 155)

or enameled container. Place it on the burner of the kitchen range and heat the liquid to a temperature of about 150 to 160° F. Maintain that temperature and soak the rusted object. Check from time to time by removing and rinsing with clear water. For heavy rust, the procedure may take several hours.

For small spots: combine 2 oz. of cream of tartar and 1 oz. of oxalic acid (caution: poisonous). Moisten the rust spot, apply the powder and leave on for 10 minutes. Rinse thoroughly with water; then dry it quickly.

■ **For aluminum:** The black or dark brown that occurs in aluminum pots used to cook eggs or to heat certain types of tap water can be removed easily by cooking sour foods such as tart apples, sauerkraut, or tomatoes in the pot.

■ **For copper, brass and bronze:** Before attempting to clean copper, brass or bronze, remove any lacquer with a lacquer thinner and wash with warm water and detergent. After rinsing and drying, try one of these methods to remove the tarnish: Mix equal parts of salt, flour, and vinegar and apply the mixture to the metal with a dry cloth. Or, moisten the tarnished area with water, cover with salt and rub vigorously with a lemon slice. After removing the tarnish, wash the metal with warm water and detergent; rinse and dry. To preserve the gleaming finish, apply a coat of lacquer. Do not lacquer copper-clad cooking utensils.

■ **For silver:** As with other metals, silver can be cleaned with commercially available preparations. However, if you have a silver item which has an intricately inscribed design, the following procedure is suggested: Wrap the entire object in aluminum foil, making a few cuts in the foil to allow liquid to flow in. Place the wrapped object in a large glass, enameled or stainless steel pot that can be safely placed on the stove. Fill the container with a solution of water and bicarbonate of soda (4 to 5 tablespoons per quart of water) and simmer for 30 minutes. Remove the foil, and rinse and dry the silver thoroughly.

The information in this article should help you to avoid much of the damage caused by corrosion. With proper care, you can prevent it, slow it, or stop it before it becomes costly or hazardous.

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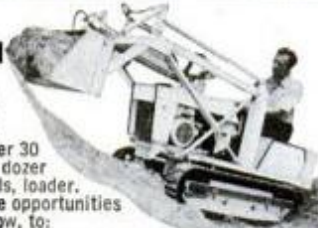
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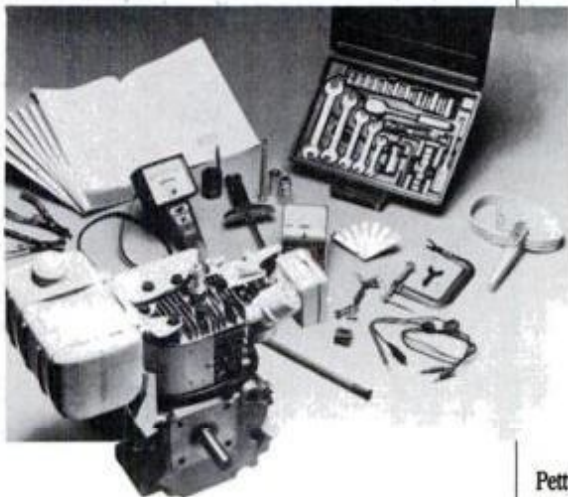
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THEY CONQUERED THE ATLANTIC

(Continued from page 89)

camber trailing edges" on its wings—later to be called "flaps").

The Navy itself had both good and bad news: On May 15th, the day before the NC-4 and its sisters had set out, another Naval aircraft, the C-5, a 192-foot nonrigid dirigible, was on the ground at Quidi Vidi, Newfoundland, when a 40-mph gale came up. The C-5 was also to have attempted an ocean crossing (special charts for it had been drawn with the assistance of Adm. Richard Byrd), but that wasn't in the cards. A land crew of 100 men couldn't hold it in the wind. That night, its anchor ropes snapped and the C-5 blew out to sea, never to be seen again.

At noon on May 18, aware that NCs might be two-thirds of the way across, an Englishman named Harry Hawker, who had vowed to "beat the Yanks across," decided to leap off in an attempt to at least make the first nonstop flight. Hawker and his navigator, Mackenzie Grieve, pulled on inflatable rubber suits over their woolen flying clothes and fired up the 375-hp Sopwith biplane.

Six days later Hawker and Grieve were being mourned for dead when word came that they'd been picked from the ocean, 1000 miles east of Newfoundland, by a Danish tramp steamer that had no radio. Defective circulation in the engine's cooling system had brought them down 950 miles short of Ireland.

Hawker's takeoff had an immediate impulsive effect on one rival Briton, Frederick Raynham, who, with his one-legged navigator, William Morgan, was running up their Martinsyde only one hour after Hawker's departure. The aircraft started its takeoff roll and seemed about to become airborne when the landing gear hit a ridge in the bumpy Newfoundland field and threw the Martinsyde on its nose—ending Raynham's and Morgan's chances without seriously injuring either.

Far less impulsive, but just as eager, were the British team of Capt. John Alcock and Lieut. Arthur Whitten-Brown. Alcock had the more extensive flying experience—he was downed by the Turks on a bombing raid over Constantinople in 1917 and made prisoner for the rest of the war—although Brown had made a name for himself as an aerial observer before crashing behind German lines. But neither had extensive navigational background.

Advised of the success of the NC-4, they spent several weeks near St.

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John's wedging extra fuel tanks into every possible corner of their stock Vickers Vimy bomber (Alcock was employed by Vickers as a test pilot). Every drop of 865 gallons of fuel was filtered through wire screen and chamois cloth.

Close calls for Alcock-Brown

Early on the morning of June 14, Alcock and Brown noticed that a rival team was on a test flight with the 130-foot, four-engine Handley Page entry, and they decided not to wait any longer, even though the weather was threatening a gale. At 12:13 p.m. Alcock threw both throttles wide open and the twin 350-hp Rolls-Royce engines roared against the wind. The Vickers' wingspan was only 67 feet, but its ease of control had made it a favorite of pilots. Even so, spectators thought the overloaded bomber would surely crash as it clawed over hedges and trees to gain altitude.

The great weight of the added fuel continued to tax both pilot and plane at flying altitude. Several hours out, in dense clouds, Alcock simply lost control. The Vickers shuddered and fell off into a spin. By the time he had the ship back again, Alcock could see the waves just below him. Past midnight, fog thickened to snow and hail. By morning, ice was forming over the aircraft. Brown was forced to climb out on the wings to chip ice from fuel indicators and engine air intakes with a penknife. He repeated this several times.

In improving weather, they sighted the Irish coast and decided to land as soon as possible to assure themselves of the nonstop prize money—about \$75,000 in 1919 dollars—rather than press on to England and chance failure in the Irish Sea. There was a wireless station in Clifden, Galway; the Vickers made a pass over it, circled, and settled into a likely looking field nearby—which turned out to be a bog.

The plane nosed over. Unhurt, Alcock and Brown were also rich and famous. The epic flight had covered 1890 miles in 16 hours, 28 minutes—about two hours less, *PM* pointed out, than "the fastest railroad time between New York and Chicago."

First dirigible crossing

There was yet more to come in that fabulous summer of 60 years ago. On July 2, the R-34, a 665-foot rigid airship filled with two million cubic feet of hydrogen in 18 separate "ballonettes," rose from a field at

(Please turn to page 162)

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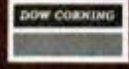
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THEY CONQUERED THE ATLANTIC

(Continued from page 161)

East Fortune, Scotland. Under the command of Maj. G. H. Scott, the R-34 was powered by five 275-hp engines driving pusher propellers; she had a large gondola forward, two amidships and one (housing two engines) astern. Eleven officers and 19 men were aboard—plus a teenage rigger hidden in the envelope who was to become the first aerial transatlantic stowaway—standing regular four-hour watches, and enjoying hot drinks and phonograph music when not on duty.

Four days later, on July 6, the R-34 appeared over Mineola, N.Y., on Long Island. A certain Major Pritchard parachuted from the forward gondola—as if it were routine—to “make landing arrangements.” The ship was tethered by 600 U.S. Army infantrymen and the first east-west aerial crossing of the Atlantic was completed. To prove her point, the R-34 flew routinely back to England two days later.

It was a time to fire the imagination, a time when young men could look skyward with a gleam in their eyes. And one of them, 17-year-old Charles Lindbergh from Little Falls, Minn., would one day make people forget all about the summer of 1919. **PM**

DON'T GET RIPPED OFF!

(Continued from page 132)

taminated. There is good profit in draining and adding new fluid.

■ **Cutting or disconnecting the coil-to-distributor cable** so an engine will crank, but won't start, then selling the customer a tune-up or installing a new gas filter.

■ **Pouring gas over a fuel pump** to convince a customer that the “leaking” part should be replaced.

■ **Bending a windshield wiper** as the windshield is being cleaned and then asking the customer, “Did you know this old wiper is shot?”

Isolated cases

In defense of themselves, service station people who are readers of PM will probably write and take us to task for this article. Before you do, let me emphasize that Exxon's Pierpont says: “Complaints involve a relatively small number of thousands of dealers servicing the motoring public.”

However, in patronizing a strange gas station, how do you know if an attendant is honest? The value of this article, we feel, is that it gives our readers a fighting chance—just in case. **PM**

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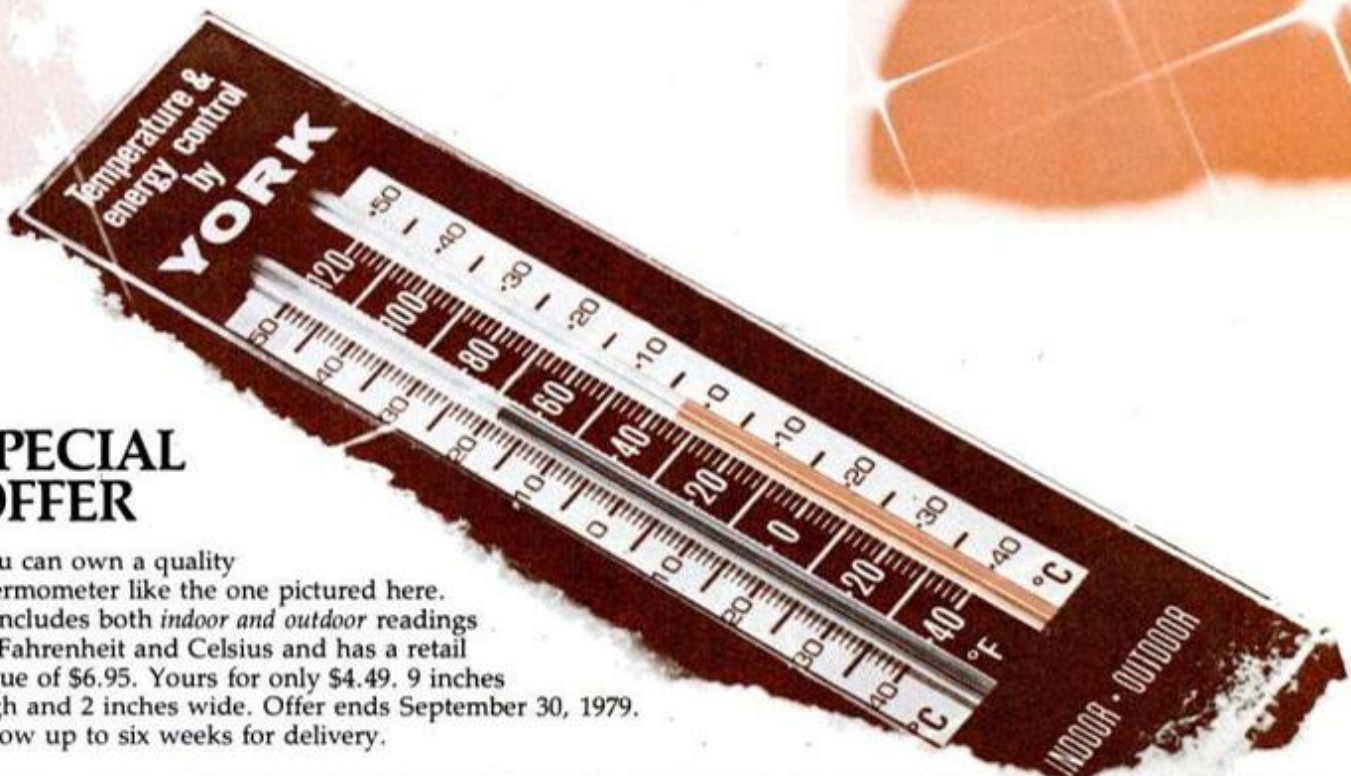
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Although truss systems have been around for years, they're now being used in a new, advantageous way—in lightweight truss-frame houses.

The lightweight truss-frame system was developed at the U.S. Forest Products Laboratory in Madison, Wis. Engineer-inventor Roger L. Tuomi describes it as "an open-web floor system, trussed rafters and wall studs all tied together in a unitized structural frame."

All framing components are joined by metal truss plates (gusset plates) that help distribute stress so the frame is a single, interconnected unit. Any part of the house supporting a load (such as the roof) shares it with the rest of the structure (floor and walls).

Truss framing has several advantages. Although exceptionally sturdy, the system is composed only of 2x4s. It can be erected and enclosed in less than a day, and the system requires no internal load-bearing walls. Most important, it reduces construction costs.

The lightweight truss-frame system is born of extensive investigation into how wood buildings are affected by natural disasters such as tornados and hurricanes. Studies show that in disasters, *wood structures tend to come apart at the seams*. Joints where floor, walls and roof meet are consistent weak links. The solution: Engineer the frame into a single unit using metal truss plates instead of nails at joints.

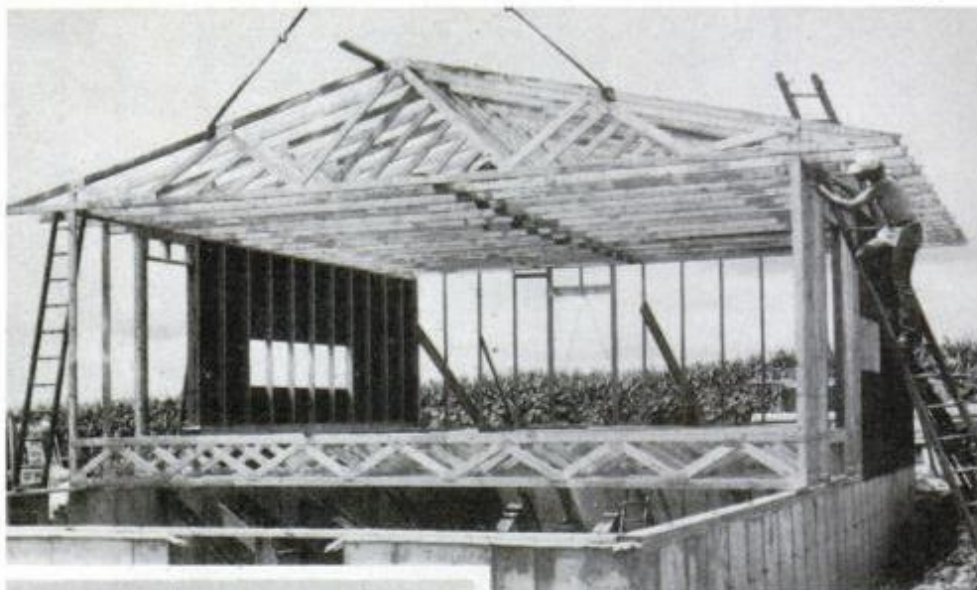
Prototype house

Last summer a 26x48-ft., three-bedroom, ranch-style truss-frame house was built jointly by the Forest Products Laboratory and the University of Wisconsin-Madison, at a site near Arlington, Wis. Besides the *strength* of a truss frame, the prototype disclosed other advantages:

- A savings of \$2300 on materials and labor when compared with a similar house of conventional framing.
- Only 70 percent of the framing lumber needed for conventional framing was used.
- Since truss frames span 24 to 30 ft. by themselves, no internal supports or load-bearing interior walls were needed. This also permits more creative room layout.
- Framing members were placed on 24-in. centers instead of 16.

The truss-frame prototype went up like clockwork. A three-man crew with a crane and operator swung the 22 250-lb. frames into place in eight-minute cycles. Precut spacer blocks, which also served as nailers for the

Lightweight truss framing: Quicker, easier, less costly



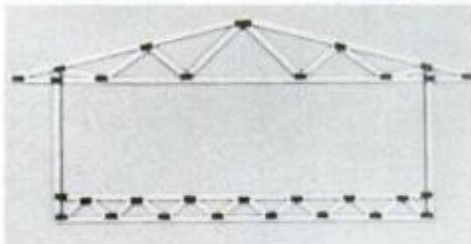
House viewed from end shows truss roof fully in position on wall plates.

With prefab end wall up, carpenters nail spacers between first two truss-frames.



House is quickly framed and sheathed so crew can use interior for work area.

All joints in lightweight truss frame are strengthened by metal truss plates.



top edges of exterior sheathing and interior drywall, were attached after each frame was seated. With sheathing commercially available in 4-ft. modules and frames 24 in. apart, little material was wasted.

In six hours, all was erected, complete with side wall sheathing. Later, utilities were run through open webs in the floor truss.

Besides time and money savings, such rapid erection means that workmen can get out of the weather sooner and the house stays drier. Builders can also avoid the stocking

of large inventories of lumber.

A potential disadvantage of truss-framed house is that picture windows can't be installed. An alternative that gives a similar effect is the use of several casement windows in a row. The windows open for ventilation, less heat loss occurs when it's cold, and breakage doesn't require replacing a large pane.

The Department of Agriculture has patented the lightweight truss-frame design and assigned it for unrestricted use. For information, write: Forest Products Laboratory, Box 5130, Madison, Wis. 53705. **PM**

The author is with the Forest Products Laboratory, Forest Service, U.S. Department of Agriculture.

BETTER PHOTOS WITH FILTERS

(Continued from page 107)

store color balance. If you shoot outdoor film indoors without flash, use an 80A filter.

What about fluorescent light? No film currently made is balanced for it. Besides, there are many different types of fluorescent light. When shooting under "cool white" fluorescent light, a 30M filter will bring you reasonably close to natural light. For other types, more than one filter is generally required, so you're probably better off using flash. Consult Kodak's *Filters for Black & White and Color Pictures* for other fluorescent-light filter combinations.

Two other kinds of filter bear mention: neutral density and ultraviolet. Neutral density filters reduce

the light coming through a lens, but do not affect color rendition. Useful in both b&w and color work, they permit wider apertures or slower shutter speeds on brilliantly sunny days, especially with high-speed film (ASA 400).

Some people use an ultraviolet filter like a skylight filter to reduce haze and lighten bluish shadows (the filter doesn't affect b&w film).

Filters for creative color

Filters can be used creatively as well as correctively. Experimentation with colored filters can result in exciting and highly original images from ordinary subjects.

For example, with color film, a blue filter (with slight underexposure) will make a daylight scene look like it was shot under moonlight.

That's how night scenes are shot in many movies. A red filter will add a warm glow to a sunset.

You can make your own filters with clear acetate and colored marking pens or various pieces of colored gelatin. Try making a filter that is half one color and half another. Also available are a number of gimmick filters with wild effects such as varied density or multiple images.

If filters absorb light, they must affect exposure settings. With a camera that has through-the-lens metering or an electric eye that's covered by the filter, the proper adjustment is automatic. Otherwise, exposure must be adjusted according to what is called the filter factor. For a filter factor of one, increase exposure one stop; for a factor of two, two stops, and so on. **PM**



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(Continued from page 85)

lems with the paint jobs and general finish of their cars—both Camaros and Firebirds. It seems that color matching between metal panels and fiberglass or plastic components such as spoilers, the soft nose assembly, and certain hoods could be better. Some people noted, too, that decals and taped pinstriping were beginning to peel off and that runs through carwashes aggravated the problem.

As for dealer service, Camaro owners again expressed slightly greater satisfaction than their Firebird brethren. A California quality-control inspector: "My Camaro's engine dinged. The dealer fixed it right away and the car was returned to me clean."

An Illinois cement worker: "This Pontiac dealer is good, but slow. When the wiring harness on my Trans Am burned, he had it in the shop for five days."

An Arizona legal secretary: "The Chevy dealer can usually get me in quickly for repairs, and his people are always courteous."

On the topic of comfort, the consensus on both cars was that the front compartment was terrific and the rear compartment was not so terrific. Opinions were divided on front-seat shape, and a significant

number of respondents would like reclining seats.

"The 1979 Trans Am is the best so far," limns a Michigan production person. "The contoured T/A seats are very sharp and very comfortable."

A California machinist: "There's no room for anyone over the age of seven in the back seat of my Camaro, but we have two babies, and it's fine for them."

We always ask owners what they'd



Space-Saver spare helps, but there's still little room for luggage in either ponycar.

change about their cars, given the opportunity. This time the Firebird took the honors, with 21.3 percent from that camp saying, "Leave it alone!" Among Camaro owners, 14.6 percent recommended no changes. Of the rest, here are some typical suggestions:

An Ohio office worker: "The Camaro's headlights accumulate snow, which makes them dim in the weather that demands the most from them."

An Ohio police detective: "Better gasoline mileage would be nice, but with the 6.6 V8, what can you expect?"

A Michigan design sculptor: "I'm not sure I'm crazy about the stowaway spare tire. The CO₂ cans are very expensive to replace, and most dealers can't refill them."

An Ohio school principal: "The air dam at the front of the car is too low and tends to break off easily if you park against a high curb (or not even too high a curb)."

"The ashtray location in the front of my Camaro is the pits," opines a Florida veterinarian. "Passengers can't reach it, and I burn the dashboard when I try to put out my cigarets."

A Michigan medical technician: "They

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ought to get rid of the nominal back seat and combine that area with the trunk; maybe make it a hatchback."

And a Texas radio station executive: "Couldn't they add mudguards to make the car easier to keep clean?"

When all's said and done, though, the

Firebird and Camaro are two cars owners can still fall in love with.

An Illinois stenographer, aged 19, writes: "I really enjoy the performance of my Trans Am—it really runs. I get a lot of pleasure from this car. All my friends like it, too. It's beautiful and lots of fun."

And a Michigan superintendent: "The Camaro has character. It's not like every other car you see on the road. Combine that with excellent roadability, handling, styling, response, value, and dependability and you've got one of the best designed U.S.-made cars today." **PM**

SUMMARY OF 1979 CAMARO-FIREBIRD OWNERS REPORTS*

Camaro		Firebird		Camaro		Firebird		Camaro		Firebird	
Total miles driven		266,668	212,726	Performance		---	22.4	Average		16.7	20.0
Average miles per gallon:		5.0-liter V8 (EPA 15 mpg manual, 16 mpg auto.)		Handling		15.1	16.3	Fair		9.3	16.0
In town		14.0	---	Past experience		11.3	---	Poor		7.4	6.0
Long trips		17.6	---	Specific likes:				Comfort opinion (front seats):			
5.7-liter V8 (EPA 16 mpg manual)				Handling		71.7%	64.6%	Excellent		37.0%	34.0%
In town		13.1	---	Styling		64.2	72.9	Very good		42.6	38.0
Long trips		16.8	---	Performance		28.3	29.2	Good		16.7	20.0
6.6-liter V8 (EPA 12 mpg manual, 14 mpg auto.)				Comfort		20.8	14.6	Fair		3.7	8.0
In town		---	11.7	Ride		17.0	14.6	Poor		0.0	0.0
Long trips		---	15.1	Specific dislikes:				Comfort opinion (rear seats):			
Engine choices:				No complaints		20.4%	18.2%	Excellent		3.9%	2.2%
3.8-liter V6		2.2%	8.3%	Low gas mileage		16.3	15.9	Very good		3.9	4.4
4.1-liter in-line Six		8.7	0.0	Paint and finish		14.3	15.9	Good		15.7	13.3
4.9-liter V8		13.0	22.9	Ashtray location		10.2	---	Fair		35.3	31.1
5.0-liter V8		34.8	16.7	Workmanship		---	13.6	Poor		41.2	48.9
5.7-liter V8		39.1	0.0	What changes would you like?				Had any mechanical problems?			
6.6-liter V8		2.2	52.1	No changes		14.6%	21.3%	No		59.3%	54.0%
Transmission choices:				Reclining seat (shape)		---	12.8	Yes		40.7	46.0
Automatic		92.5%	85.7%	Ashtray location		12.5	---	What type of trouble?			
Four-speed manual		5.7	12.2	Better gas mileage		---	10.6	Carburetor		31.8%	22.7%
Three-speed manual		1.9	2.0	Better surface finish		10.4	---	Transmission		---	22.7
Why did you choose this car?				More trunk space		10.4	---	Oil leaks		---	22.7
Styling		71.7%	67.3%	Workmanship opinion:				Dealer repairs satisfactory?			
				Excellent		18.5%	20.0%	Yes		50.0%	60.0%
				Good		48.1	38.0	No		22.9	39.1

*Percentages might not equal 100% due to rounding or insufficient data.

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hape up your mower now for summer cutting

If you failed to bed down your mower correctly last fall, it might not start. Here's what to do when it won't operate.

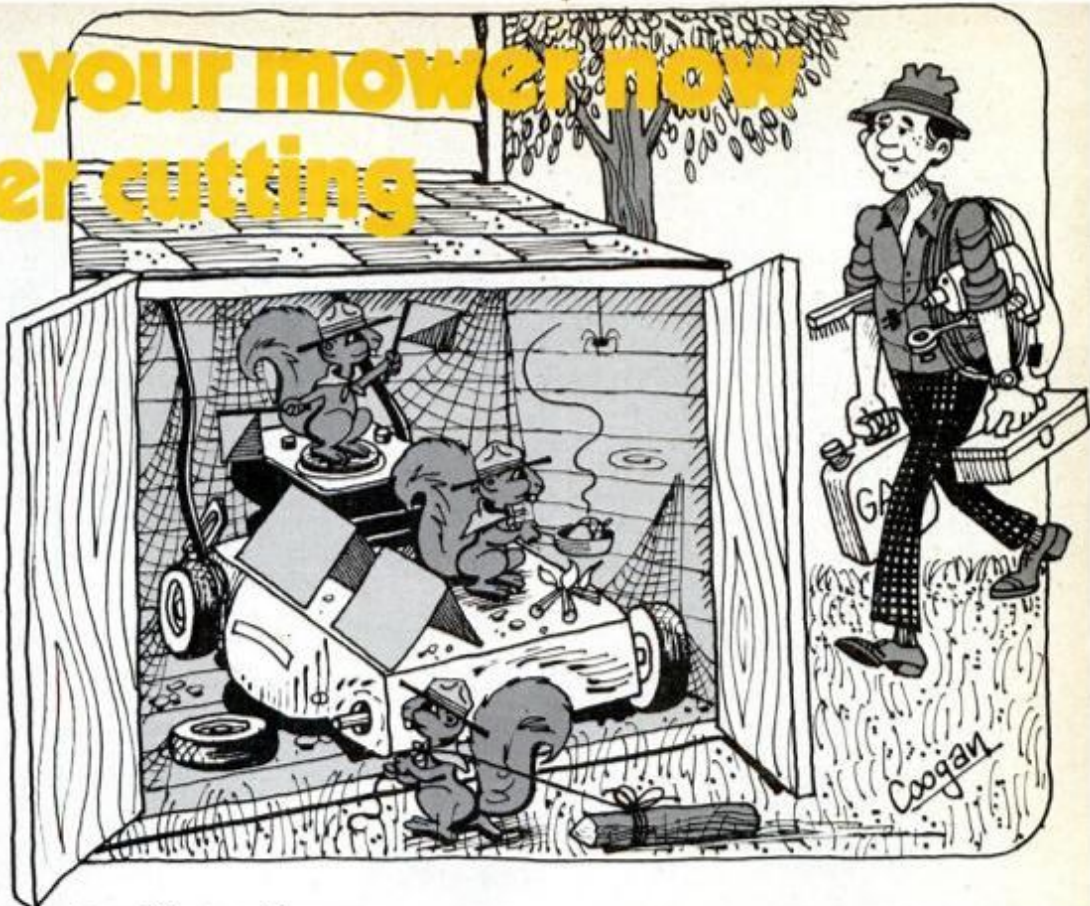
By Glenn S. Hensley

Let's face it: Last fall was the best time to prepare your lawnmower for duty this spring. The owner's manual details the steps to take to assure its starting when the grass begins to grow again.

That owner's manual, however, can become low-priority reading amid fall's crisp, blue days and autumn entertainment. Compared with servicing lawnmowers, hunting, golfing and watching football and the World's Series offer strong competition for your spare time. Result: You probably simply parked your mower after its last fall use. It will sulk there until it's time to work again. That's when you may learn that you've created a problem for yourself. That mower may get its revenge—when you attempt to start it, all you may hear is a sullen grunt or two.

Lawnmower service shops can come to the rescue when your machine won't start. They can fix it, for a price, providing you can wait until they've fixed the flood of no-start machines that swamps them at this time of year. But there is much that you can do yourself, even if you've waited until now to do it.

The author is the editor of *Farm and Power Equipment*, a publication serving farm and power equipment dealers.



Possible trouble areas

If your mower was working well last fall but just won't start now, here's a checklist that may help you locate the trouble. Chances are that on completing a run-through of the list, you'll be out cutting the grass in a short time.

■ Before you begin any service on your mower, disconnect the spark-plug wire. Make certain the wire is well away from the plug to prevent any possibility of the balky machine accidentally "changing its mind" and starting. Results could be unhealthy.

■ Give the mower a good scrub-down to eliminate the cobwebs and accumulated dirt. Follow directions on the container and flood an engine cleaner onto the greasy spots. Scrape away leaves, dried grass and accumulated trash from under the housing. A wire brush and a knife-type scraper make fast work of re-

moving under-housing debris. Sand and scrub away loose rust, too.

Inspect the engine

Next, tackle the stubborn engine.

■ Old gas left in the tank last fall may form "varnish" and gum residues that can foul a carburetor on the first pull of the starter rope. Drain that old gas out of the tank, carburetor and sediment bowl (if your mower engine has one).

■ You need not adjust the carburetor unless you're going to do a complete tune-up job. Do replace the gasket on the sediment bowl if you have to take the bowl apart. Gaskets on mowers often take a "set" which is destroyed when the seal is broken.

■ You can clean the foam air filter if you wish, but you might as well install a new one—they're quite

(Please turn to page 170)



Before you begin any work on your mower, disconnect the sparkplug wire so the engine can't accidentally kick over.



Use an engine cleaner to help cut loose accumulated grease and grime. For best results, follow package directions.



An old paintbrush helps to remove solvent-softened crud before you flush the unit with a full-force hose stream.

SHAPE UP YOUR MOWER NOW

(Continued from page 169)

inexpensive. Know the make, model and serial number of the engine, though, before you go to a parts supply house for the new filter element. Without that information it is difficult for the parts man to determine exactly the filter you need. Your small lawnmower engine uses a great volume of air as it works for you, so let it breath easily through a clean filter.

■ Squirt oil onto the filter element and squeeze it to distribute oil evenly. Wipe out the interior of the filter housing and follow the instructions for installation that come with your new filter element.

■ Drain the old oil and save it. You can make a container to catch the draining oil by cutting off and saving the lower portion of a plastic milk carton. Slice it so it slides under

the machine to collect the oil with a minimum of mess. That drained oil makes a great rust preventive for garden tools. You can also smear some of it under the mower blade housing to retard rust which tries to form there.

■ Refill the crankcase with oil according to the directions in your owner's manual.

Inspect the electrical system

You can also look over your electrical system by following these tips.

■ Check the wire you disconnected from the plug for cracks in the insulation.

■ Inspect the plug: If it's burned or otherwise fouled, it's better to toss it away and gap and install a new plug. No way to check the gap? Use a dime. It'll get you close enough to do the job.

■ If you're a mechanic and have the

tools, see that the points come up to manufacturer specifications.

When you try the engine again, if it still won't fire, remove the new or cleaned sparkplug and hold it against the engine. Crank the engine to see if a spark jumps the gap between the plug's electrodes.

■ If no spark or only a weak spark occurs, your problem is in the ignition system. You would be wise to have the system checked by a service shop.

■ Should you get a strong spark, squirt a spoonful of gas through the sparkplug hole and reinstall the plug. Put the high tension lead onto the plug and crank the engine again. If it won't start with fuel known to be in the cylinder, the problem could be low compression. This can be caused by a faulty head gasket, a stuck or broken valve or incorrect valve timing. Correcting these diffi-

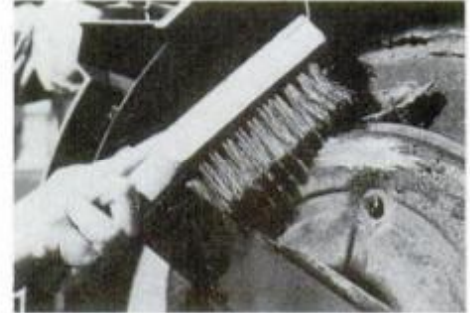
(Please turn to page 173)



Lift out the air filter element and wash it in low-suds detergent or in kerosene. Squeeze it dry and re-oil it.



Remove this under-deck muffler to expose exhaust ports. Scrape away carbon deposits you find accumulating there.



Your mower will operate more efficiently if you scrape away caked, dried grass trimmings from the deck underside.



To help retard rust, smear some of the drained oil over the exposed metal on the underside of the mower deck.



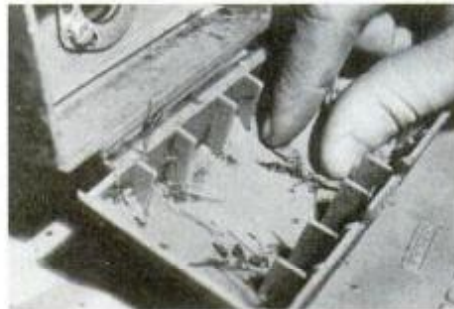
Remove and replace or clean engine's sparkplug. In an emergency use a dime to gap it (left); otherwise use a gauge.



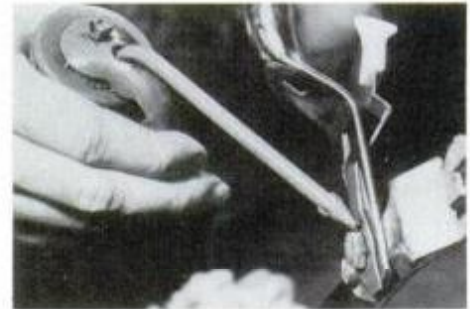
If the sparkplug is burned or otherwise damaged, it is best to gap and install a new plug at the season's start.



To check spark strength, grip plug rubber cap and hold plug in contact with engine while pulling on starter rope.



Swab debris from the air filter holder before replacing the element. Clean after 25 hours of use; more often in dusty areas.



Controls will operate easier if you remember to put a drop of oil on their pivot points. Wipe off any excess lubricant.

What's your best chance to make money in real estate?

The answer below may surprise you.

My name is Charles Edwards. I'm a licensed real estate broker—not an advertising writer.

There is a unique new way to make a substantial second income in real estate and it's just beginning to surface among brokers. I'm not speaking of buying apartments or flats. The business I'm referring to is PMC—Property Market Control.

The reason it's becoming so popular so rapidly is that it gives the middle-income investor an opportunity to make excellent profits—**without actually buying property**. No mortgage obligations. No large investments.

CONSIDER THESE FACTS:

- You don't have to buy so called "rental properties" to make money. Rental properties create some real headaches. First you have repair costs . . . a leaky roof, a new furnace, and heavy tenant liability costs. Then there are the personal interruptions . . . complaints, evictions to serve and telephone calls at 1:00 a.m. about a clogged drain. PMC eliminates these problems entirely.

- You can begin with only \$50.00-\$100.00 out-of-pocket investment yet control the sale and earn the profits from real property in the \$45,000-\$75,000 range.

- As a result of holding property in control (rather than outright purchase) you can reduce or eliminate the yoke of mortgage indebtedness altogether. This feature alone makes this a very attractive program for almost everyone on a fixed income.

- You eliminate the responsibility for building maintenance.

- You eliminate all utility indebtedness.

In sum, it's an ideal method for anyone who seeks high profit potential but a hassle-free income from real estate.

To illustrate how this method works, here are some actual cases of average people—not professional businessmen—who have profited from it, just as I did.

- Jennie Lashin, a housewife living in Western Tennessee, used only \$500.00 and PMC to obtain income property—no mortgage, no complications. But, a few years later, she sold this and several other properties for a net profit of \$40,000.00.

- Matthew Sutherland from Georgia did even better. A few years ago he was up to his neck in debt. He and his wife scraped together \$300.00. Using PMC

they made a net profit of \$50,000.00 and still maintain current holdings to reduce tax liability. But, most importantly, Mr. and Mrs. Sutherland never borrowed a single penny to finance their property. They did it all using Property Market Control.

- Jerry Doyle, a gas station operator from Arkansas, began using PMC in 1971. A few years later he sold the gas station and "retired." He and his wife, Tina, now enjoy life in a beautiful home overlooking their 100 acre estate. What's more, they still control property in Arkansas, Florida, Missouri and Minnesota and are planning a second home in Florida—all by using the leverage of PMC.

\$700,000.00 WITH PMC

- I must emphasize that this is not some kind of get rich quick scheme. It's a business and as such, it's speculative. But the profit potential is staggering. Consider my friend B. L. Tulley. He quit school at the end of the fifth grade, and was blinded in an accident in 1965. He had no special knowledge or influence—not even a trade to ply. But, by using PMC (and only \$500.00) he made over \$700,000.00 and still "controls" over more than 3,000 acres of property in the U.S. and Canada.

Obviously, I can't guarantee you'll make as much money as these folks. Then again, you might make more. It depends upon your initiative, and current market conditions.

EASY TO BEGIN

One of the best features of PMC is that you won't need a lot of starting capital. You can begin with as little as fifty dollars. In just one series of transactions I used only \$500.00 to make a clear profit of \$19,000.00

You can do this quietly—discreetly—without quitting your present job. It may require 30-60 minutes a day—occasionally a weekend afternoon.

You don't need a degree in business administration. PMC is a relatively uncomplicated business that can be mastered by following a few simple rules.

Best of all, you don't need to wait for months to begin. You can actively begin within 30 days.

In practice, this is a fairly localized business. I won't be competing with you nor you with me.

My materials will show you step-by-step how to begin. For example:

- How to "market control" and sell

\$50,000.00 properties for only \$50.00 with no mortgage commitment on your part.

- How and where to get special FREE BOOKS with current listings of top investment properties from Newfoundland to Baja. All details are included—asking price, description, and terms of sale.

- How to avoid the problems of tenants, vacancies, high insurance costs, and all the other grief of so-called "rental properties".

- How to actually buy properties (when it's advantageous) with as little as 2% down—only \$1,000 on a \$50,000.00 property.

- How it's possible to double the profit on your out-of-pocket dollars within 90 days.

- How to retain 60% of your profit on properties you actually purchase—not just tax sheltered profit—but totally free of State and Federal Income Tax.

MONEY-BACK GUARANTEE

I'll send you a copy of my book, **Property Market Control**, for 90 days without obligation. A full three months.

This way you have sufficient time to read it . . . and actually try it. If you're not satisfied, simply return the materials and I'll send you a full refund within 3 working days—no nonsense, no delays.

Our publishing offices are located in Dunkirk, New York. We belong to the Dunkirk Chamber of Commerce. Our telephone number is 716-366-8300. We're there from 9 to 5 on week days.

If you have any concern about sending money, please feel free to charge this tax deductible purchase to your VISA or MasterCard account. Simply send us your account number and expiration date.

To receive your copy, just write the words **Property Market Control** on a piece of paper and send it to Green Tree Press, 10576 Temple Road, Dept. 132Dunkirk, New York 14048, together with your check or money order or charge card instructions for \$12.95. If you wish AIR MAIL delivery, please add one dollar.

For EXTRA FAST service, CALL US. Our office number is 1-716-366-8300. We'll process your credit card order by phone and ship the same day.

You'll receive **Property Market Control** for three months at absolutely no risk to you. That is our unconditional guarantee.

Show Dad you really care this Father's Day.

Socks, ties and pajamas. They're the gifts that make Dad always say, "Just what I needed!"

Dads are great that way.

This year show Dad you really care. Give him a copy of Saturday Mechanic Basic Car Care Illustrated. Over 500 pages and 800 illustrations that will take him step-by-step through most car repairs. With the way repair bills keep going up, it's a gift he needs now more than ever.

It's the first completely-illustrated guide for the beginning do-it-yourselfer.

Basic Car Care Illustrated is written so it's understood. It has illustrations with captions rather than a lot of dense text. It'll show Dad how, every step of the way.

Plus Basic Car Care Illustrated has all these features:

- "Quick Fix" tips for emergency repairs
- "Pro Shop" tricks of the trade

- Complete specifications
- Trouble shooting for every system
- Lists of parts and tools for every job.

And because we recognize that Dad has limited tools, time



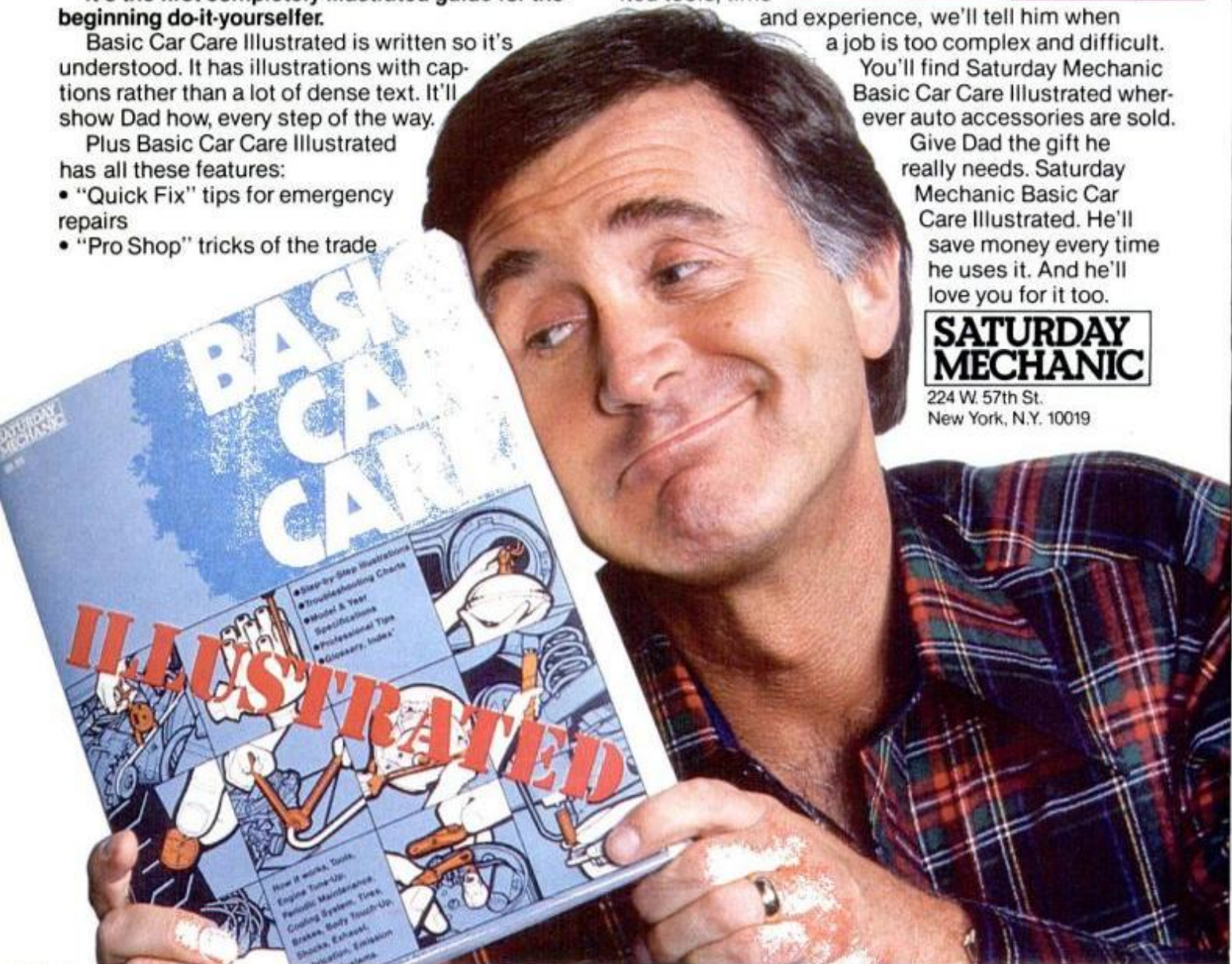
and experience, we'll tell him when a job is too complex and difficult.

You'll find Saturday Mechanic Basic Car Care Illustrated wherever auto accessories are sold.

Give Dad the gift he really needs. Saturday Mechanic Basic Car Care Illustrated. He'll save money every time he uses it. And he'll love you for it too.

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SHAPE UP YOUR MOWER NOW

(Continued from page 170)

culties is usually best left to a shop, too.

■ Is there a battery on your machine? If so, check fluid level and fill, if necessary, with distilled water. Clean off the terminals by scrubbing them with a mild solution of baking soda and water to eliminate corrosion. After cleaning the battery posts, reinstall terminals and torque down snugly.

Inspecting the exhaust system

Next check the exhaust system.

■ Is rust all over it? Are pieces of the old muffler falling off in your hand? Better just take it off and consign it to the junk box, then install a new one. Again, tell your parts supplier the exact make, model and serial number so he can give you a proper-fitting replacement.

■ If you have a two-cycle engine, cleaning the exhaust system is a bit more complicated. Carbon deposits can build up in the exhaust ports in the side of the cylinder where the muffler is located, so cleaning requires you to take the muffler off.

■ With sparkplug removed, crank the engine until the piston is below the ports so it won't be damaged in cleaning. Then, scrape the ports with a small knife. Be careful not to score them so they mar the piston. Crank the engine a few times to blow loose carbon from the combustion chamber. Then replace the plug and the new or cleaned muffler.

Adjusting mower controls

Before making adjustments, read your owner's manual.

■ Check and lubricate the recoil

start mechanism and install a new pull cord if necessary.

■ As a part of your spring start-up, lubricate all pivot points, linkages, idler pulleys, rollers and axle bearings. It's also a good time to examine brakes, clutch and transmission on larger mowers to see if they need to go to a dealer's service department for more extensive repairs.

■ Control cables will work more smoothly if you'll rub them well with an oil-dampened rag. After the oil has soaked into the cable, wipe the excess away so it won't catch dust.

■ Check the tension and condition of all belts and replace them if necessary. Better hang onto the old belt and take it with you when shopping for a new one. You'll avoid guessing about the proper size.

Inspect mower blade

Caution: Your mower blade is a deadly projectile just waiting to launch out into space. A gouge, bend or crack can be serious business. At high speeds and sudden shock loads, that blade may shatter, exploding in all directions at once.

■ Replace damaged blades. Don't take a chance. If the blade shows

(Please turn to page 174)



Sharpen the blade's cutting edge with a file or emery wheel. Inspect for signs of danger, such as cracks or severe bends.



It's important to check the configuration of your mower blade. A good blade will have its outer tips at least 1/2 in. lower than the center mounting hole.



After sharpening the blade, balance it by grinding the blade until it levels itself on a screwdriver that's been inserted into the mounting hole.

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SHAPE UP YOUR MOWER NOW

(Continued from page 173)

only evidence of normal dulling and a few small nicks, you can put an edge back on it with a file or emery wheel.

Sharpening is easy, but take the same amount of metal off both ends of the blade so it balances. You can buy a blade balancing kit, but a screwdriver inserted through the

blade mounting hole works satisfactorily. A blade that rests parallel to the ground is balanced. Grind off the low end until the blade rests horizontally.

■ Sand off some of the rust and perhaps spray on a coat of paint. Fill the tank with gasoline, recheck the starting sequence as outlined in the manual and we'll bet our last used sparkplug that she starts on the first pull of the rope. **PM**



Fill the fuel tank with fresh gasoline or oil/gasoline mix, replace the sparkplug wire and test-pull the starter cord.



Finally, wipe the machine with an old towel and it's ready to take on another season of grasscutting chores.

How to clean a foam filter

That plastic, sponge-type air filter fitted to the carburetor on your mower engine is an important component, one worthy of more than your passing attention. In fact, if you don't keep it clean, you might be courting an expensive engine overhaul bill.

Fine dust, drawn through a faulty filter into the engine, can wear out the piston rings and cause valve problems. Both could lead to poor starting and loss of power.

For it to be effective, you should clean the filter after every 25 operating hours. Do it more often if you run the engine in dusty conditions. The filter must be clean in order to remove abrasive dirt from the air while providing as little restriction to air flow as possible. If the filter is jammed with junk it can neither let air through nor capture drawn-in debris.

Most mower filters receive inadequate care.

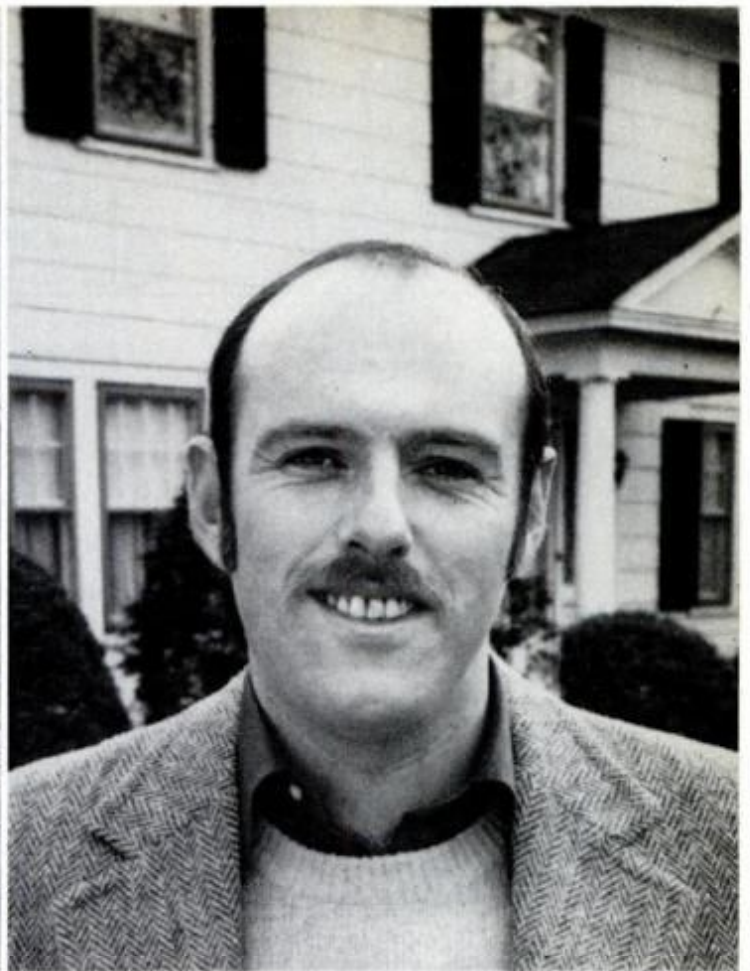
The average homeowner cleans the mower filter only twice a season. Many clean the filters far less. Even if he cleans the filter as often as suggested, a homeowner can defeat the purpose of the project by using an improper cleaning agent. Manufacturers recommend cleaning filters in kerosene or a low-suds detergent such as dishwashing liquid.

You may know someone who cleans filters in gasoline because it is handy and seems to dissolve the gummy goo out of the filter better. What he doesn't realize is that there is usually enough gasoline left in the cleaned filter to dilute the oil which is added later to provide a wet surface for capturing dirt. This gasoline-diluted oil is usually sucked from the freshly cleaned filter during the first few minutes of mower operation. The result? The filter's wetting capability, and thus its capacity to trap dirt, is quickly lost.

If, however, you use the recommended low-suds detergent, there will be no dilution of the oil. Follow the steps shown to insure a thorough cleaning. When you clean the plastic sponge filter, squeeze it dry in an old towel to get rid of the solution. Oil, reassemble and install the filter back in your mower. Then you're on your way to many hours of grasscutting with a healthy, efficient machine.—G.H.



1. Remove the mower's filter container and take out the dirty, plastic sponge element contained within. 2. Wash it vigorously in a solution of low-sudsing detergent. Dishwashing liquid works well. Scrape off the debris. 3. Press the scrubbed and soaked filter element on an old towel to dry it, giving filter and towel a hard squeeze to force the last bit of solution out of the element. 4. When it's as dry as you can possibly get it, re-oil the element and squeeze it in order to distribute the oil thoroughly over the plastic.



One of these homeowners is thrifty, safety conscious, and a sitting duck for financial disaster.

He doesn't even know it. He thinks he's done his best to protect his home and his possessions. He hasn't.

Many people, like the man on the left, believe they have adequate homeowners insurance. But inflation has been pushing up the value of their homes. They don't update their coverage every year. So when disaster strikes, they are unable to fully recover their losses.

Rising replacement costs are one reason. In the last 10 years the cost of re-siding a home jumped 132%, re-shingling a roof 155%; and repainting a living room 142%.¹ In the last five years alone, the cost of building a new home has increased 63%.²

As a group of property and casualty insurance companies, we don't want you to be a sitting duck by not having your insurance provide full protection for your home. Check with your agent to be sure your homeowners policy reflects the amount of additional coverage inflation has made necessary.

Here's what we're doing to help protect you:

- Offering policies with a built-in inflation clause.
- Supporting strict building codes to reduce fire risk.

- Designing new coverages to meet the special insurance needs of older homes.

- Helping to develop safety standards which protect life and property.

- Operating special claims assistance and damage repair programs in times of catastrophe.

- Conducting fire prevention and arson control programs.

Here's what you can do to protect yourself:

- Re-evaluate your home insurance needs annually with your agent.

- Take a higher deductible if you can. It lowers your premiums.

- Install a smoke detector or burglar alarm. Many companies offer premium discounts for such devices.

- Get a receipt or appraisal for all major household items (furniture, antiques, jewelry, art). Duplicate it and keep it and all such records in a safety deposit box away from your home.

- Inventory all your possessions and take photos of each room to document what you have.

1 Source: U.S. Dept. of Labor 2 Cost does not include land Source: U.S. Dept. of Commerce

This message is presented by: The American Insurance Association, 85 John Street, New York, NY 10038.

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Another Tidy Car Success Story...

'With twin babies, you'd think I'd want to hang on to a \$30,000 a year job, but I wanted to make real money.'

Marty Brown, Nebraska



An accountant turned salesman, Marty started looking around for something that could make "real money." But that meant taking some risks.

"I didn't have a lot to invest and I also didn't want to be taken in by the usual 'get rich quick' schemes. Then I read an article by Gary Goranson, president of Tidy Car, that offered a chance to get into the car appearance maintenance business. The article said you could earn \$30 an hour giving your neighbor's cars showroom shines. It sounded great but I was skeptical.

Your own business for under \$900.

"When I read you could get into business for under \$900, it seemed too good to be true. Another benefit was that you could start part-time to try out the business before you had to quit that \$30,000/year job.

"Having been an accountant I got busy figuring out the 'numbers.' And, it seemed clear that the Tidy Car business had the potential to grow into the 'real money' I was looking for. And, now I'm sorry I hesitated at all."

200 jobs in one month.

Within six months, Marty's business was up to 200 Tidy Car jobs in a single month ranging from \$45 to \$135 each.

How our exclusive process earns big profits.

Preserv-A-Shine™ is Tidy Car's exclusive surface protection treatment that goes far beyond waxing. It is a restoring and preserving process that puts an astounding hard-glass finish on cars, trucks, vans, boats and aircraft.

Guaranteed performance.

Our exclusive Preserv-A-Shine process protects against the ravages of weather, salt, sun, oxidation and pollution. With an inexpensive annual resealant, the shine lasts for as long as the customer owns the car. And we guarantee that in writing.

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Tidy Car Inc., Dept. PM6
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(716) 856-2826

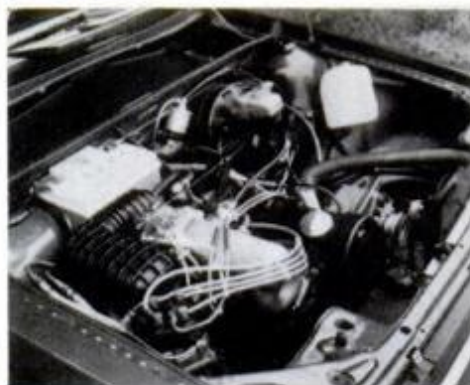


I'm interested in Tidy Car! Please send me a free 14-page brochure on how to become a Tidy Car dealer.

Name _____
Address _____
City _____ State _____ Zip _____

DRIVING THE AUDI 4000

(Continued from page 34)



In-line Four displaces 1.6 liters with its 78 horses going to the front-drive wheels.

ducted into the passenger compartment. Airconditioning is optional.

According to factory data, the 4000 accelerates from standstill to 60 mph in just under 10 seconds. Top speed is said to be 164 kilometers per hour, or 102 mph. The car reportedly will burn regular (leaded) fuel in all states except California and average about 27 mpg overall. **PM**

SPECIFICATIONS—AUDI FOX

Vehicle type

2/4 door, 4-passenger sedan; front engine placement; front-wheel drive.

Price, U.S. port of entry

Base: \$7000 (estimate).

Engine

Type: In-line, sohc Four, water cooled, 5 main bearings.
Bore and stroke: 3.13 x 3.15 in. (79.5 x 80.0 cc).
Displacement: 96.9 cu. in. (1588 cc).
Compression ratio: 8.0:1.
Induction system: Bosch J-Jetronic fuel injection.
Max. bhp @ rpm (DIN): 82 @ 5500.
Max. torque, lb. ft. @ rpm: 84.1 @ 5000.

Drive train

Clutch: Single dry plate
Transmission: 4-speed transaxle, fully synchronized, manual shift (automatic 3-speed optional).
Brakes: Front discs, rear drums, servo assist, self-adjusting.

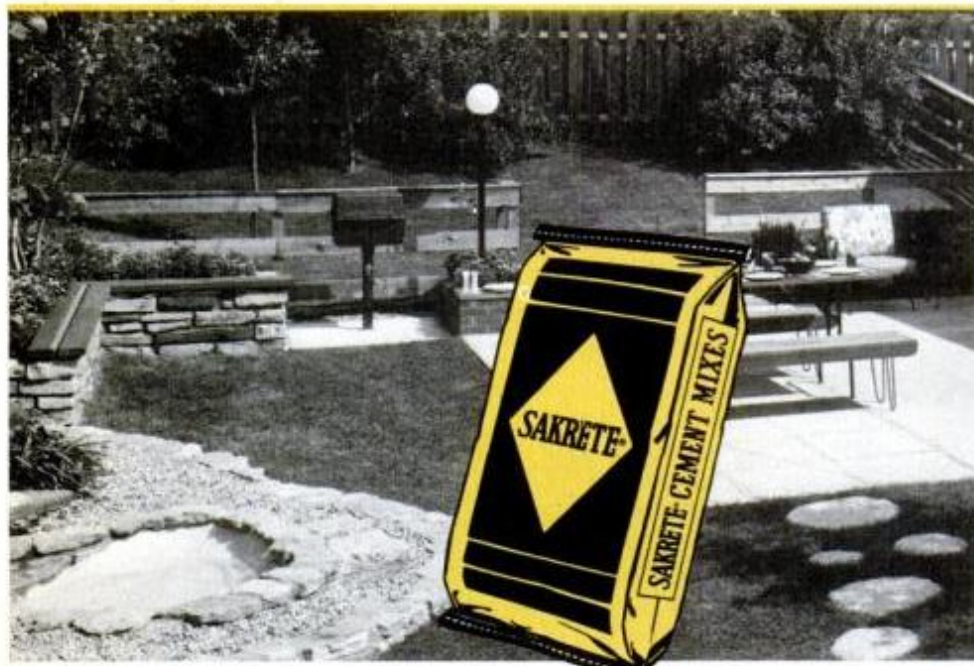
Suspension and steering

Front suspension: MacPherson struts, independent wishbones, antiroll bar.
Rear suspension: Torsion-beam dead axle, torsion rods, Panhard rod, coil-spring struts.
Steering: Rack and pinion.
Wheels: 5J x 13.
Tires: 175/70 HR 13.

Body and dimensions

Bodywork: Unitized steel construction, 2 or 4-door sedan.
Wheelbase: 100.1 in.
Overall length/width/height: 176.6/66.2/53.7 in.
Track, front/rear: 55.1/55.9 in.
Curb weight: 2165 lbs.

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patio or home • Handy tool pouch to keep accessories with the vacuum cleaner • UL listed.

The Wet/Dry Shop Vac is available in two models: an eight-gallon dual deluxe with ten standard attachments (Model 600-14); and a five-gallon deluxe with six standard attachments (Model 600-07).

Both models include a four-wheel dolly with swivel casters for ease of maneuvering. On sale through June 30 at over 1,400 K mart stores across the U.S.A.



\$39⁹⁷
(Model 600-14)



\$32⁹⁷
(Model 600-07)



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Most of us simply don't understand just how wasteful—and costly an ordinary, tank-type hot water heater really is. But, if you will just think about it for a moment you will immediately realize that much of the energy used to heat your basement tank of water is dissipated right through the walls of the tank itself and into your storage or crawl space area.

The Perfect Answer—The New Thorn Instant Tankless Hot Water Heater!

The answer is simplicity itself—if losses are created by the need to keep large volumes of water standing in a tank, why not eliminate the tank? And, that's just what Thorn has done. We have eliminated the tank—and in its place we have developed a tiny, super powerful, instantaneous heating unit which ACTUALLY CREATES HOT WATER AS YOU USE IT. A microswitch on the Thorn unit automatically turns on the moment a faucet is opened—then a continuous stream of delightful, sparkling hot water flows from the tap for shower or wash basin. IMAGINE—as much hot water as you want—produced in a never-ending stream as long as you need it. And, the Thorn unit is fully adjustable too—temperatures from cool to steaming hot can be obtained at the turn of a dial. Models for LP (Bottled) Gas, Natural Gas or Electric Power.

The Ordinary Tank-Type Hot Water Heater Is The Most Energy And Cost Wasteful Appliance In Your Home.

Did you know that an average tank-type heater will use as much as 4800 KWH of power in a year. Nothing in your home even compares to that for wastefulness and operating cost. By comparison, your refrigerator—usually opened several dozen times a day and placed in a hot kitchen, uses only 1/3 as much energy. In this day of rising costs and energy consciousness, a new THORN INSTANT TANKLESS HEATER should be considered for every home.

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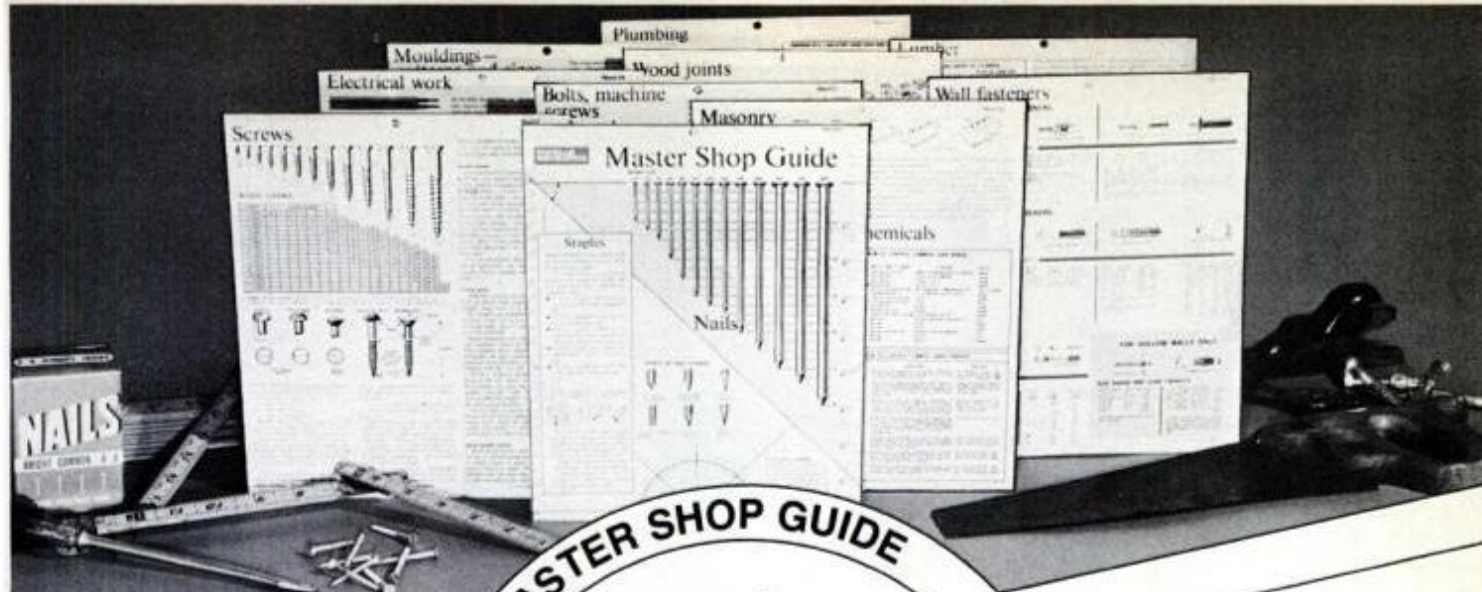
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(Continued from page 101)

tween 100,000 and 150,000 miles on each. No mechanical problems whatever. All I ever did to them was reline the brakes, install points and plugs occasionally, but they both had lower maintenance costs than any cars I'd ever owned.

"This 1979 Newport seems just as good so far. The workmanship on mine is excellent—the best I've seen these past few years. I've got absolutely no complaints except perhaps to ask for a little better fuel mileage. But the car looks good, there's lots of room in the front and back seats and trunk. If they still make a Newport this size in two years, I'll definitely get another one."

An Iowa retiree praises, "We liked the styling and wanted a four-door, full-sized car at a reasonable price. I'd judge workmanship as excellent, and the car has been well received by our friends, judging by their compliments.

"The dealer is satisfactory—very eager to please, and work is always done on time. His people have a never-failing courtesy, and he gives a fair deal and stands behind his agreement.

"Complaints? The trunk lid comes up too slowly, so there's the temptation to reach in too soon and bump your head.



Plenty of hip- and legroom back here, but wide C-pillar makes a bit of a blind spot.

As for comfort, we had a 6-foot-5 passenger, and he remarked on the roominess. It's a car that I'm proud to drive."

A Kentucky rural mail carrier: "Problems have been minor—rough carburetor idle, headlamps needed refocusing. All

were corrected. He's a small dealer, so can see to service quickly and correctly.

"I've driven Chrysler cars for 20 years and have been satisfied all the way around. If I could change anything on this Newport, it would be the gas mileage. I'm getting 12-16 mpg right now, but it should be better once the engine loosens up. This is the 360 V8."

An Illinois chiropractor says, "Very good comfort, very easy handling, and I like all the controls except the dimmer switch on the steering column. My dealer is excellent—he doesn't keep putting me off. I can't complain, as I've bought a new car from him every other year since 1957. Annoyances tend to be minor—the directional stalk has too many controls on it. Anyway, cars seem to be getting cheaper—not in price, but in materials. They keep adding plastic and fiberglass."

A Michigan real estate agent: "I bought this Newport because the 1979 LeBaron was too small and the New Yorker was too expensive."

"Quality tends to be good, although all new cars lack the personal touch. Something needs to be done about the wind noise of the rimless windows. They just don't seal right, and even when they're

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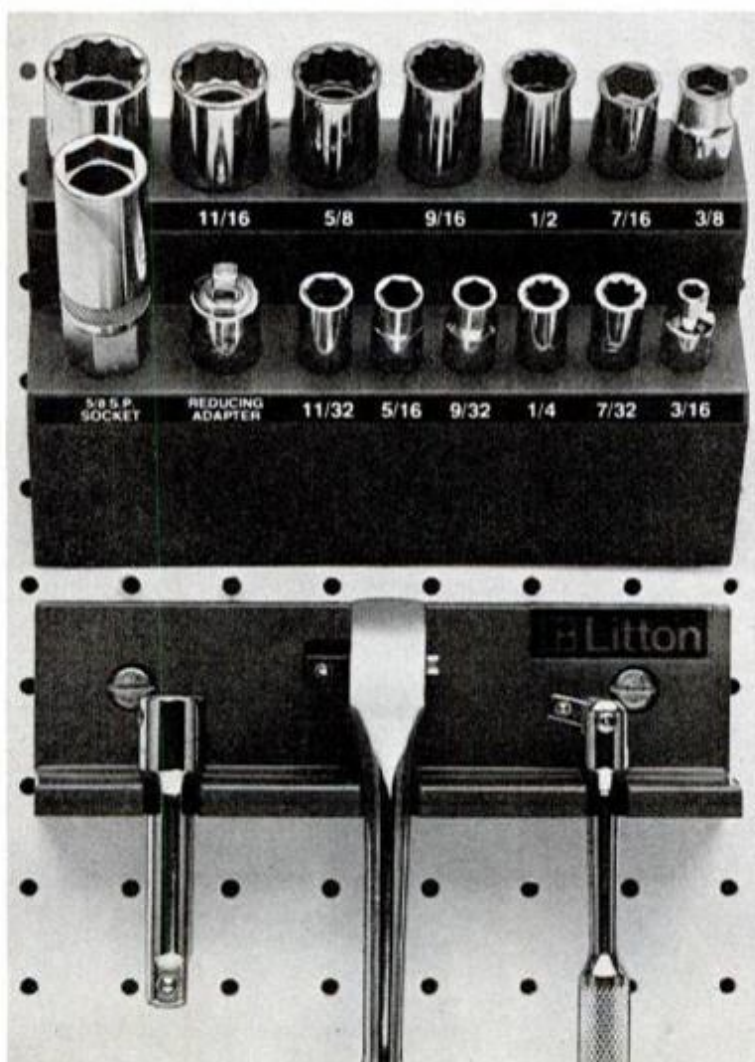
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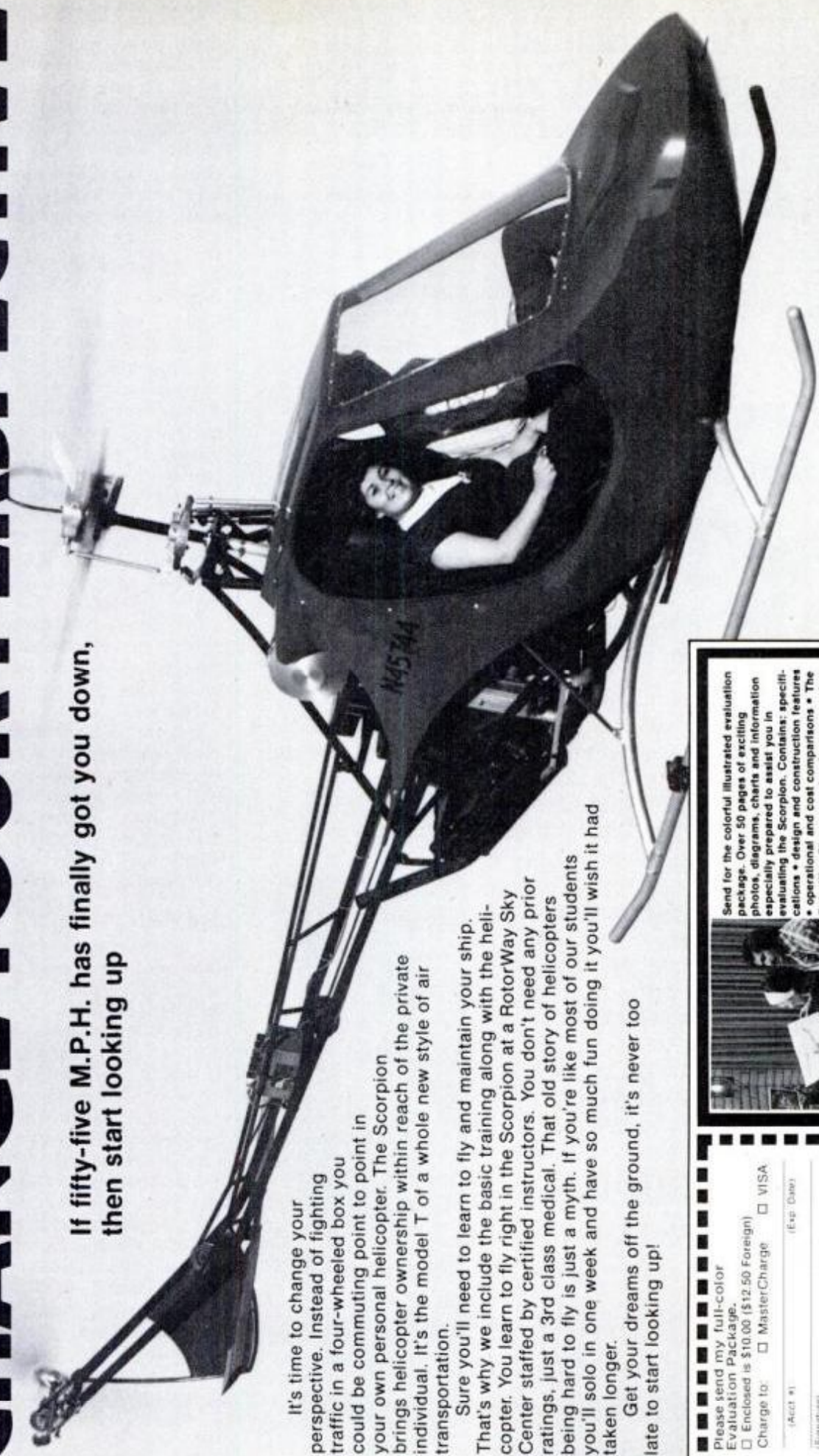
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NEW SCOPES

(Continued from page 188)

rifle and works very well. I've used a 2x Leupold on several shotguns when testing for slug accuracy, and it makes a very quick-handling setup. Such a barrel-mount system should work on the Model 94 Winchester which, because of its top ejection, cannot be used with most standard scope mounts. Offset side mounts, such as the high quality Williams unit, are available for it.

Sighting in

Most efficient use of any scope comes when it is sighted in for a yardage that takes best advantage of projectile trajectory. I sight in a shotgun at 75 yards and most rifle cartridges two inches high at 100 yards. Why two inches high? Because this angles the bullet up enough so that it will drop into the target at 200 yards or more. At 50 yards, the bullet will only be one inch high. If the rifle were sighted dead on at 100 yards, it could drop for a complete miss at 250. How much the bullet drops depends on cartridge velocity and design, but two inches high comes pretty close to working out with most hunting cartridges.

Beyond 300 yards, bullet drop becomes so increasingly great that the shooter must either carefully memorize trajectory and know where to "hold over," or else pass up the shot. The most powerful magnum, held dead-on at 500 yards, will only bite the dust somewhere short.

Eye relief


Too often the shooter throws rifle to shoulder and sees only a little ball of light, instead of the scope's full field of view. This usually means the scope is mounted too far forward. If it's too far rearward, recoil can throw it upward into the shooter's brow. You or your gunsmith should first slide the scope forward and backward until you effortlessly obtain a perfect view. Make sure the crosshairs are vertical as *you* hold the gun; they may be straight for the gunsmith but crooked for you.

Final stage with any scope is continual practice looking through it, and you don't even have to shoot the gun. Do this in and out of season, any time of year. Pick a stump, bush or whatever and look at it with your naked eye. Then quickly bring the gun up to see through the scope. Soon you'll be seeing the target through the scope the instant the butt reaches your shoulder. You'll find you have become a surer shot, and a safer one, as well.

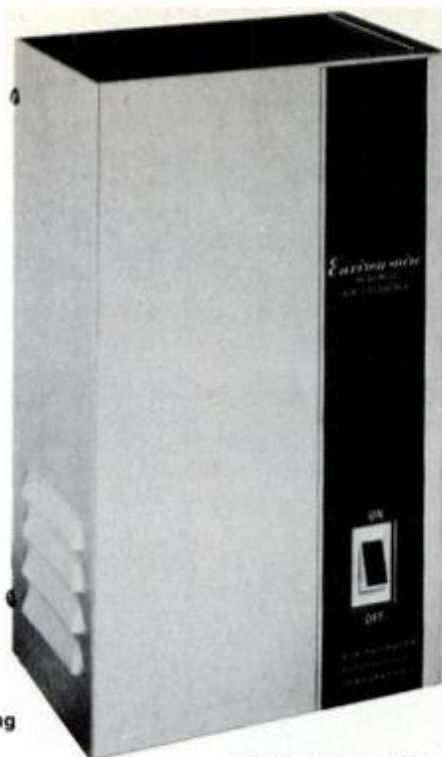
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Now, through this exclusive scientific breakthrough, indoor air can be purified in exactly the same way outdoor air is purified by lightning during a thunderstorm.



U.S. Government Patent No. 3,925,673

Think of that sweet "country fresh air" smell following a thunderstorm. That's actually the absence of odor. The electrical activity in the air created by lightning adds a small negatively-charged electron to each oxygen molecule in the air. Science has long recognized the miracle of this phenomenon known as ionization. Amazingly, these ionized molecules combine with any odor-bearing molecules in the air—destroying them.

The Environ-air unit's patented process electrostatically creates these same negatively-charged oxygen molecules that permeate any enclosed space and attract odor molecules like a magnet until they're totally "neutralized."

BEFORE ENVIRON-AIRE

There were two ways to control odors: Dilute—constantly recycle fresh air to dilute odor molecules or deodorize—constantly mask odor with a heavy perfumy scent. Now, with Environ-air, there's a third, more effective and highly scientific way. And that's to destroy all organic odor molecules electronically.

WHAT THE ENVIRON-AIRE IS NOT

It's not a one-shot cover-up. It doesn't mask odors—it destroys them electronically. And it kills tough odors continuously—not temporarily like sprays, wicks, stick-ons, etc. There are never any chemicals to buy, bulbs to burn out or filters to replace. The unit uses only as much electricity as a 25-watt light bulb.

WHAT IT IS

The Environ-air is a continuous air-cleansing process so unique it's patented. It uses the latest in space-age electronic technology to create the first energy and cost-efficient air purification system for the home. Even in a

smoke-filled room, you will be breathing only clean, fresh air all day long.

FORCED AIR—THE MOST IMPORTANT NEW FEATURE INNOVATION

One of the secrets of this new system is that it keeps the ionized air in constant motion. The Environ-air is the only electronic air freshener that continuously "pumps out" ionized oxygen molecules into the air, permeating every square inch of space—ready to attack and deactivate any odor-causing molecules instantaneously. Keeping the ionized air circulating is such an important factor that so-called "space age" air fresheners without it are truly outdated. Without it, odor-killing molecules simply fall to the ground near the unit, rendering them useless against odors.

A DUST-FREE ENVIRONMENT: AN UNEXPECTED BONUS

The Environ-air also de-activates dust particles suspended in the air. The ionized oxygen pumped into your room will attach itself to any impurities in the air, causing them to fall to the ground. Ahhhh... what's left is pure, clean air.

PROVEN EFFECTIVE IN HOSPITALS, FISH MARKETS, PET SHOPS & MORE

Prior to this special introduction to consumers, hundreds of Environ-air units were used by businesses with their own peculiar odor problems. After using it for over 8 months they found it to be the only answer to annoying, persistent odors. Why? Because it outperforms other systems in what it does and how it does it.

TO USE IT IS TO LOVE IT

You will feel the difference immediately. The Environ-air will cleanse any 20' x 20' room of odor-causing molecules within just 5 minutes!

Imagine how exhilarated you'll feel with a fresh supply of ionized oxygen surrounding you day and night!

CLEAR THE AIR ONCE AND FOR ALL

In the kitchen... bathroom... basement... nursery... pet areas... smoke-filled offices. Use it anywhere stale, musty, offensive or pungent odors are a problem. The attractive wood-grain unit is compact—10" x 6" x 4" deep—and lightweight—only 8 pounds. It can be wall mounted as an inconspicuous permanent fixture where annoying odors tend to accumulate. Or, it can be moved from place to place as needed, taking up little space on a shelf or floor. And installing it is simple—just plug it in. It uses regular household current.

LET YOUR NOSE PROVE ITS EFFECTIVENESS IN YOUR HOME OR OFFICE

The Environ-air may sound too good to be true. That's why we offer a 30-day trial period and ask you to really give it a workout. For starters, simply turn the unit on, then cut up a big, juicy onion. No tears. No smell.

SOLIDLY BACKED

If anything goes wrong with your unit during the first year Environmental Electronics Corporation will repair it—without charge. Although the Environ-air is built to last and be virtually maintenance free, it's still nice to know the manufacturer is service conscious.

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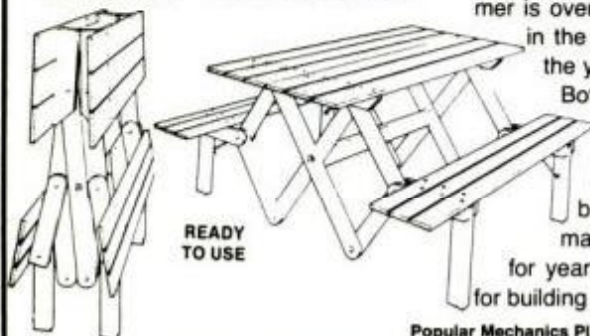
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EASE THE SQUEEZE

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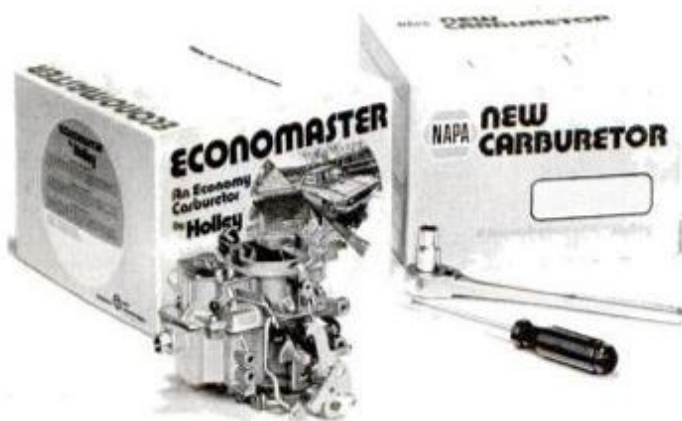
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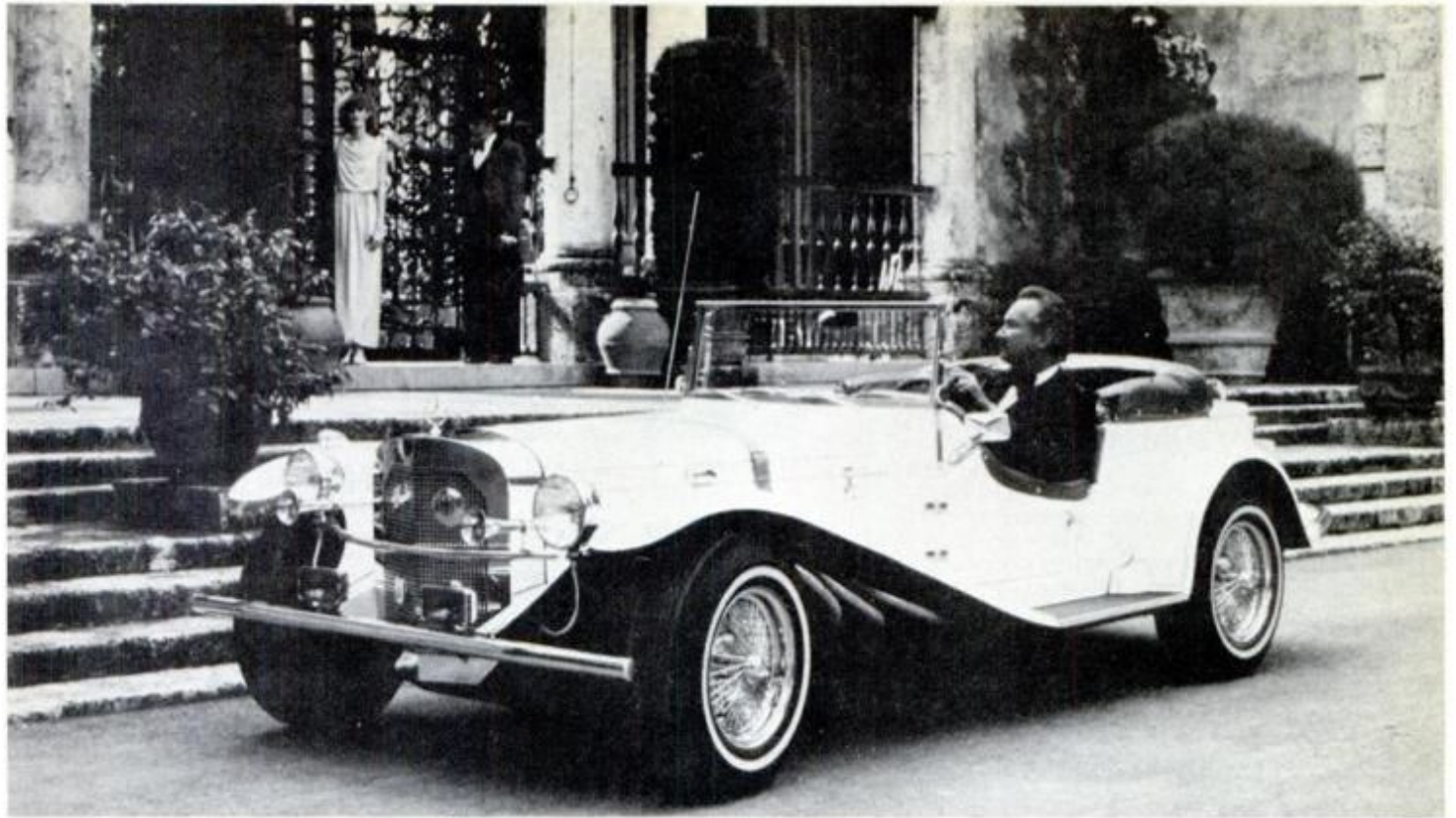
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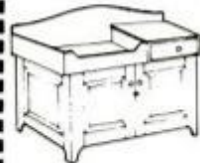
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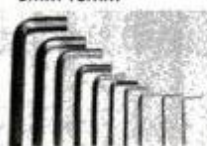
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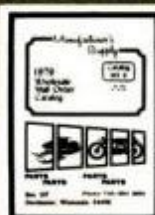
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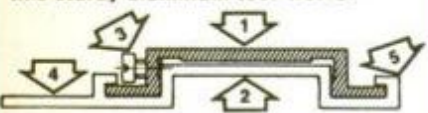
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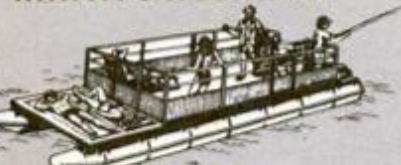
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(Continued from preceding page)

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Portable refrigeration breakthrough makes ice chests obsolete!

New Solid State Refrigeration Modules no bigger than your watch, have More Cooling Power than a 10lb. Block of Ice.

Your ice chest is bulky, awkward to carry, messy and inefficient at keeping its contents cold. You have to buy ice every day, if you can find it, throw away the spoiled soggy food and drain off the water repeatedly.

Conventional portable refrigerators are either too heavy, too noisy, drain your battery too quickly or need to be kept level.

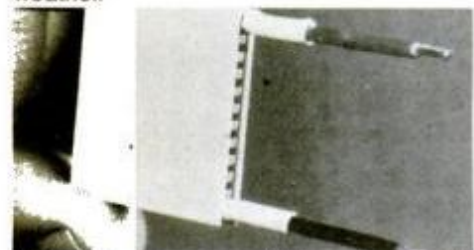
These problems and inconveniences have finally been resolved in one totally new product - the Koolatron 12 volt portable electronic refrigerator. We believe the Koolatron portable represents such a dramatic advance in refrigeration for recreational use that all existing methods are now outmoded.

USES AEROSPACE REFRIGERATION MODULES

The Koolatron portable cools your food electronically with solid state thermoelectric refrigeration modules. These same powerful modules are used by military and aerospace scientists to cool critical components in rockets and satellites. They use thermoelectric cooling because of its absolute reliability, insensitivity to motion or level, small size & weight and minimal battery drain.

WHY IS THE KOOLATRON PORTABLE SO MUCH BETTER THAN AN ICE CHEST?

An ice chest maintains an air temperature of 50-60 deg. F. Meat and milk spoil rapidly at temperatures above 50 deg. F. which is why the top of your meat will go bad even when it is sitting on ice. Koolatron portables maintain normal home refrigeration temperatures of 40-45 deg. F. even in 95 deg. F. weather.



Two of these miniaturized thermoelectric modules replace all the bulky complex piping coils, compressors and motors in conventional portable refrigerators. The modules pump heat from your food into efficient heat sinks where it is dissipated by a quiet fan. They operate on a principle called the "Peltier Effect" - passing electricity through the junction of dissimilar metals causes heat to flow away from the junction.

BOATING, FISHING, CAMPING, HUNTING

Fits into virtually any boat, van or camper. Carry it on the back seat during car trips. Ideal for fishing and hunting - bring your catch back home fresh (a few loads of fish fillets could pay for your portable). Use it for grocery shopping, medicines, carrying film, salesman's samples. Take it to the drive-in movies, auto races and other sporting events. With an inexpensive battery charger

you can use your Koolatron as a bar fridge all winter and a patio fridge in the summer. Run it in your motel room at night and enjoy a midnight snack whenever you feel like it. We have customers using our portables on construction sites, in workboats, laboratories and even in locker rooms for a "cold one" after the game.

THE ULTIMATE PORTABLE REFRIGERATOR

It weighs less than most coolers with a block of ice but holds over 40 pop cans or 40 lbs. of food in its large 36 qt. capacity. Plug it in a lighter socket in your car, boat or van or operate it from a 12 volt battery charger plugged into 110 volts. Cold contents will stay cold overnight with unit off. Draws a maximum of 4 amps., averages about 2 amps. at 70 deg. F. with the thermostat on. Keeps your food cold and dry. Exterior dimensions are 21" L x 16" W x 16" H. Interior dimensions are 16" L x 11-1/2" W x 12" H.

BUILT-IN QUALITY AND DURABILITY

The rugged "ABS" case is filled with the best insulation available - rigid urethane foam. It has a "150 lb. test" handle and non-rusting polypropylene hinge and latches, with stainless steel fasteners. The exterior is harvest gold with a white interior and has 4 non-slip rubber feet. Your portable comes with a 9 ft. detachable cord which plugs into your cigarette lighter. It also has terminals for attaching wires directly from a battery or fuse panel. The same terminals are used for your battery charger clips when operating from a charger. A reverse polarity warning light & buzzer are included. The Koolatron was designed so that the fan motor can be replaced by you with only a screwdriver. No other service should ever be required except for physical damage which can be repaired at our depots in Batavia, N.Y., or Barrie, Ontario.

GUARANTEE. 21-DAY MONEY-BACK TRIAL PERIOD

Your Koolatron comes with a written 1 year guarantee plus complete instructions and helpful information about batteries and chargers. If for any reason you are not totally satisfied, return it for a prompt refund in full.



BUY NOW AT OUR NEW LOW PRICE

Good news. Our increased sales have overcome mounting material costs. So for now we can pass on a



AT A NEW LOW PRICE!

The Koolatron portable keeps 40 lbs. of food at household refrigeration temperature but weighs only 15 lbs. Only 21" x 16" x 16" ext. Model F1A shown.

saving of \$10.00 per unit. Formerly \$169.00. Now \$159.00 + \$7.00 handling and shipping (\$179.00 in Canada).

ADJUSTABLE THERMOSTAT OPTION

For an additional \$10.00 you can order the Koolatron portable with an adjustable thermostat in place of the standard fixed temperature thermostat - order Model F1A.

PAYS FOR ITSELF

If you are regularly using ice, your Koolatron portable will pay for itself with the money you save on ice, spoiled food, restaurant bills and the gasoline used looking for ice.

Don't Waste Another Dollar on Ice!

Phone your order in collect to

705-737-0842

Koolatron Industries Limited,
56 Harvester Ave., Batavia, New York 14020
230 Bayview Drive, Barrie, Ontario, Canada
Or use this handy order coupon.

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Dept. 572

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Ontario L4N 4Y8

Send me ___ Koolatron F1 @ \$159.00 (\$179.00 in Canada) + \$7.00 each for handling and delivery in USA or Canada. (N.Y., Ont. and Que. residents add sales tax.)

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Acct. No. _____

Expiry Date _____ Send brochure only

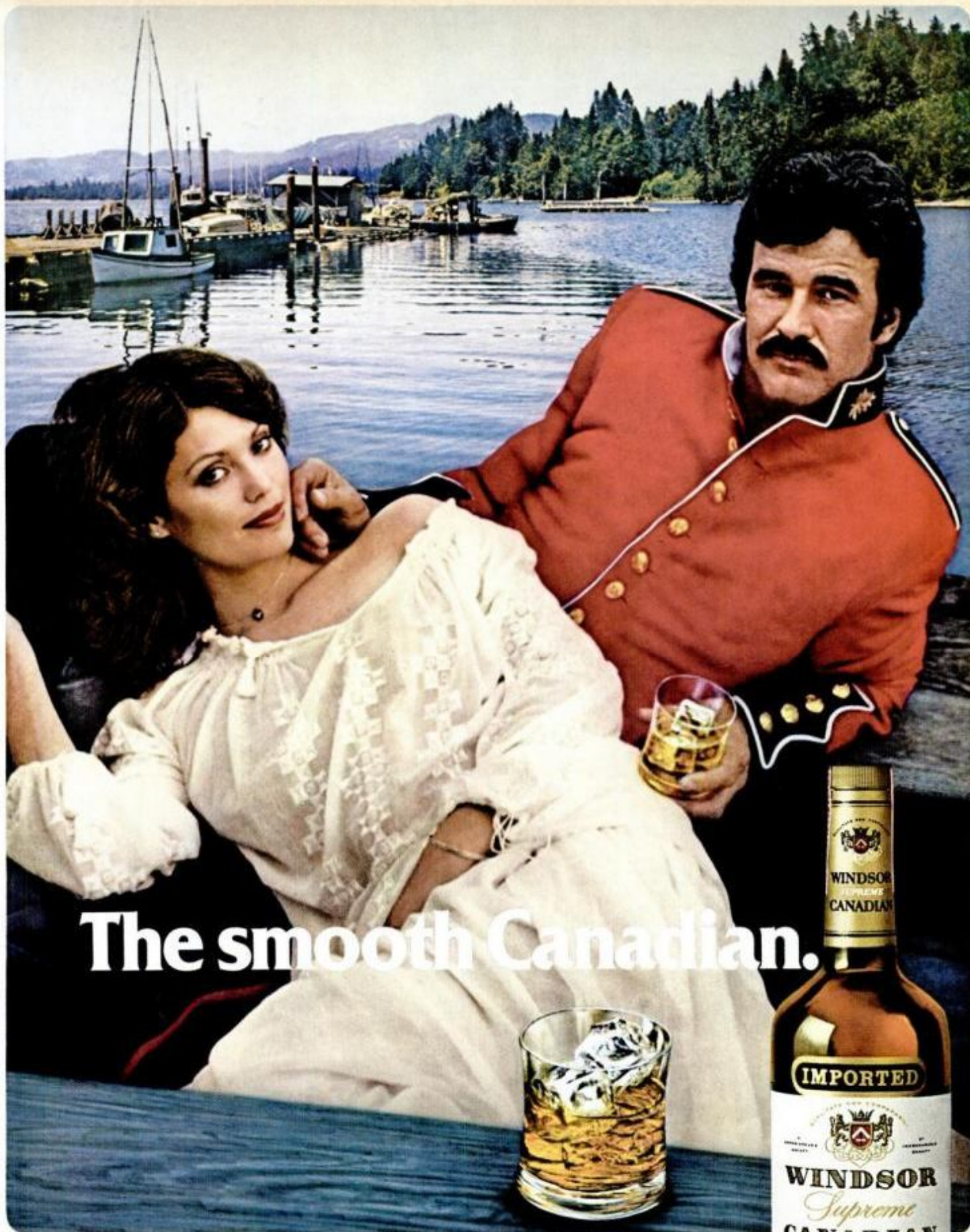
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**Best taste.
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13 mg. "tar", 0.9 mg. nicotine av. per cigarette, FTC Report MAY '78.

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