

JUNE 1983 \$1.50

Popular Mechanics



First Look!
We Test
Chrysler's New
Mini-Van

NOW: JUMP JETS THAT LEAP FROM CARGO SHIPS

1,500,000-MILE REPORT

AMC Renault Alliance
-Surprising Quality
-Eye-Opening Economy

QUICK REPAIRS FOR CRUMBLING CONCRETE AND MASONRY

PM Choice: Your 4 Best Bets In Portable Computers

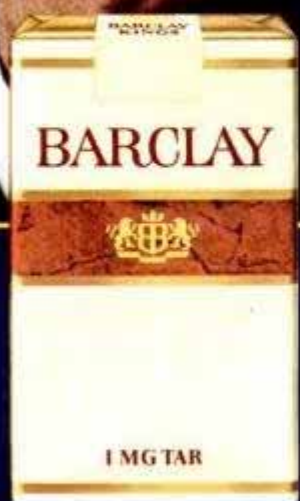
36 PAGES: LIVING OUTDOORS

- **PLANS: 5 Classic Country Fences & How To Make Them**
- **2 Home Playgrounds Climber Sets You Build**
- **Garden Workshop You Can Make—And More!**



Regular, 1 mg. "tar", 0.2 mg. nicotine
av. per cigarette, FTC Report Dec. '81.

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BARCLAY

Warning: The Surgeon General Has Determined
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Taste tests proved it.

Over 10,000 drinkers compared Imported Windsor Canadian to Seagram's V.O. in informal bar tests in selected markets. The majority chose the mild, smooth taste of Windsor over V.O.—57% to 43%.

If you're a Windsor drinker, that will come as no surprise. But if you're not, try the taste of Windsor and find out for yourself why it's the Canadian that stands alone.

You can't beat the taste of Windsor. And you certainly can't beat the price.

WINDSOR 
ONE CANADIAN STANDS ALONE



This One



YBFR-10J-731F

SPEED STICK® OUTLASTS MORE THAN 2 AEROSOLS* ...THAT'S VALUE.



*You'd use up two 3 oz. cans of the leading spray, start a third, before you'd use up one 2½ oz. Speed Stick Deodorant.

THE WIDE STICK™
FOR EFFECTIVE
DEODORANT PROTECTION



EDITOR'S NOTES

John A. Littleton

When most Navy jet fighters go screaming aboard an aircraft carrier, they are traveling at some 150 mph as they touch down. Even after the tailhook grabs the arresting cable, the plane continues a few hundred feet along the deck. A small deck on a small ship would never do for such a landing.



Harrier jet proves it can slip into a small parking space.

The ability to operate from a small space is one advantage of the British Harrier, shown here landing on a ship at anchor. The Harrier can also operate from a flight deck laid on top of a container ship (cover and page 144).

But it's not all that simple. There's a hazardous moment of truth for a Harrier pilot as he approaches his ship. The transition from the stability of forward motion to the tricky balancing act of hovering allows no error. Combat pilot Lt. David Smith of the Royal Navy graphically describes the special demands of flying the vertical-takeoff-and-landing jet in our article, *Falklands Diary Of A Harrier Pilot* (page 59).

The 1,000 owners of AMC Renault Alliance cars whom we surveyed for this month's *Owners Report* (page 74) agree on one thing. An American manufacturer and a foreign manufacturer can, in a combined effort, produce a very good car. High on the owners' praise list is the quality of workmanship. The old canard about shoddy American craftsmanship suffers a bit with that evaluation. The Alliance is assembled in Kenosha, Wis., by United Auto Workers **You've been hearing lots of music lately** by our favorite American composer, George Gershwin. The current revival of interest in his work includes the June 5 Tony Awards broadcast, with a Gershwin theme. We think he was both a great composer and a discriminating reader. As author Kay Halle wrote in *The Washington Post*, "George was fascinated by new inventions, and surprisingly knowledgeable about scientific matters. I remember one occasion when he asked his butler to go out and bring back six copies of *Popular Mechanics*, his favorite magazine—one for each guest." **Electronics Editor Neil Shapiro** seems to have put it all together this month. His department features Herb Friedman's *Four Ways To Portable Computing Power* (page 62). And, by coincidence, Neil's own book, *The Small Computer Connection* (Micro Text/McGraw-Hill), is making its appearance in bookstores. It deals with the use of modems to link small computers to the vast world of telecommunications **One of life's little vexations** is the promptness with which patching jobs on concrete often go their own way. A bad winter, and they unpatch. If you've had that experience, take a look at *Problem Concrete: Answers To The 17 Most-Asked Questions* (page 112). I found that the first thing to mend is technique; after that, the patches stick.

DO YOU HAVE WHAT IT TAKES TO START AT \$22,500⁰⁰

WITHOUT A COLLEGE DEGREE?

Most Tulsa Welding School Grads Do!

In fact, the first paychecks for students who graduated in the first four months of 1981 and went to work welding . . . ranged from a low of \$793 to a high of \$6,846. This is a yearly salary range from \$9,516 to \$82,152. Worldwide construction and pipeline firms compete for our graduates. Full course is only 16 weeks (others as little as 10 weeks). There are more jobs open throughout the U.S. — and the world — than there are qualified welders.

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PM/83

We'll send you a complete course catalog plus job list and pay at which recent grads have gone to work.

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PM

LETTERS TO THE EDITOR



Some still fly, some still sit

Your story *New Wings For Old Warbirds* (page 80, Dec. '82) was an eloquent lament on the sad passing of the mighty fighters and bombers of World War II. I thought you might like to know that at least one company is doing its bit to help keep some of these great, old warbirds in the air.

We recently formed two sky-writing squadrons of restored SNJs, the Navy version of the famous WWII AT-6 advanced trainer (photo, right). The five-plane teams perform at airshows, fairs and sporting events around the country, entertaining crowds, while spelling out the message for our Miller High Life beer.

RICHARD H. BURTON
MILLER BREWING CO.
MILWAUKEE

It was a nice, nostalgic story, but you didn't fully explain how a bunch of brand-new P-38 fighters came to be stranded on an icecap in Greenland. Your readers might be interested in knowing how they got there.



Keeping a legend alive: 40-year-old World War II SNJs revive the past for thirsty spectators.

The flight consisted of six P-38 Lightnings and one B-17 bomber on a ferrying mission to England during World War II. They encountered a severe storm over Greenland, couldn't find an open airfield and ran low on fuel. Eventually, the entire flight was forced to belly-land on the icecap. Most sustained little structural damage, and their crews were later rescued, but no one has been able to recover the planes. They're still sitting there.

DREW CAMPBELL
PAOLI, IND.

One man's Corvette . . .

Congratulations on your cover story on the Corvette cult (*Corvette*, page 84, Mar. '83). It had me practically hyperventilating, with sweating palms and racing pulse. I generally read the automotive specialty magazines for this kind of information, but your piece outdid them all!

J. BALIUS
RICHMOND CENTER, WIS.

As an avid Vette fan, I was disappointed. What have they done to the new model? It's lost all its distinctive lines and is just another car.

JOYCE A. VENIS
BRIDGEWATER, N.J.

Expensive thrills

After reading your glowing report on the free-fall Flyaway thrill ride at Las Vegas, Nev. (*Technology Update*, page

147, Feb. '83), I made a special trip there to try it. I was shocked to find that the prices were astronomical—as much as \$65 for a 10-minute ride. This is a lot more than the \$15 per hour you stated. How come?

RICHARD HAMMERSTRAND
DUBLIN, CALIF.

We were told the average cost is \$15, but it turns out this is for five minutes, not an hour. Prices vary with the number of people in a group and the length of the ride. In a group of three, it's \$15 per person for five minutes; in a group of five, it's \$11.

Help for bowhunters

Thank you for your excellent article on the current state of archery (*High Tech For Robin Hood*, page 82, Mar. '83). However, your statement that "most modern bowhunters prefer flat-flying

arrows to allow solid hits at unknown ranges" may be misleading.

Actually, most deer are taken at less than 20 yards. At this range, it makes little difference if an arrow is traveling at 200 feet per second or 170 f.p.s. What's more important is that it be of a heavy hunting weight to provide maximum penetration.

For readers wishing to get in on the exciting sport of bowhunting, I recommend they first enroll in the International Bowhunting Education Program to get a better understanding of safe and ethical bowhunting. This course is offered in all 50 states. Details can be obtained from local state wildlife officials.

WILLIAM F. STONE
STATE CHAIRMAN, MARYLAND
BOWHUNTER EDUCATION PROGRAM
BALTIMORE

Girl salts are okay, but . . .

Your December '82 *All Outdoors* column (page 22) has just come to our attention. You are correct in stating that U.S. Power Squadrons now allow memberships for women and families, but you go on to imply that all USPS boating courses are open to the public and that course graduates are eligible for USPS membership.

I must point out that this is not true. The only USPS course open to everyone is our public boating course, and graduates are not automatically eligible for USPS membership. We are a private organization, and membership is by invitation only.

WILLIAM W. FARRAR, REAR COMDR.
UNITED STATES POWER SQUADRONS
NORTH CALDWELL, N.J.

Wrong 'foamula'

On behalf of our client, Primex Plastics Corp., we were happy to see your story on the plastic-bodied Formula One racing car (*PM Briefs*, page 66, Jan. '83). Unfortunately, however, it contained an error. The material the car is made of is called Prime-Foam-X, not Foam-Core. Foam-Core is the name of a competitor's product.

PHYLLIS SPIEGEL
KEYES MARTIN
SPRINGFIELD, N.J.

Introducing Kawasaki's 1983 guide to Single-cylinder, Dual-mode, Three-wheel, Four-stroke, Five-speed, Six-pack, Seven-days-a-week Good Times.

How much you get out of something depends on how much has been put into it. Take the new '83 KLT250C Prairie,[™] for example.

We started with (1) a big, torquey, four-stroke engine, (2) tough manual clutch and (3) rugged five-speed transmission. They're all you need to get you through any sand-wash, snowbank or mudhole. To help smooth out engine vibration, we designed (4) a single counter-rotating balancer. For convenience, there's (5) electric starting. And for low-maintenance, (6) a hot-sparking Transistor Controlled Breakerless Ignition and (7) an automatic camchain tensioner.

Around this powerful engine we wrapped

(8) a strong, double-cradle, steel frame. Up front, we gave it (9) smooth-riding, leading-link suspension. And for longer chain life, the Prairie sports (10) a sealed, O-ring drive chain. (11) Durable, high-traction, ATV Radial tires are fitted front and rear while (12) powerful drum brakes at each end help make your stops quick and sure. And finally, for two-wheel-drive traction and tight-terrain maneuverability, there's (13) our exclusive Dual-Mode Differential.

Then, to complete the package, we added (14) a theft-resistant, key-switched ignition, (15) a bright 45-watt headlight for high visibility and (16) a special 3-amp accessory terminal. The KLT also features (17) a

speedometer with built-in odometer, (18) a standard trailer-hitch bracket, (19) an easy-access trunk, plus (20) front and rear cargo racks to help increase your KLT's carrying capacity.

And the Prairie is just one example. For 1983, there are eight new Kawasaki three-wheelers to choose from. Each equipped differently, yet all built with the same bullet-proof Kawasaki know-how. What all these numbers mean is that right now, at your Kawasaki dealer, you'll find there's more than one way to enjoy the Good Times.

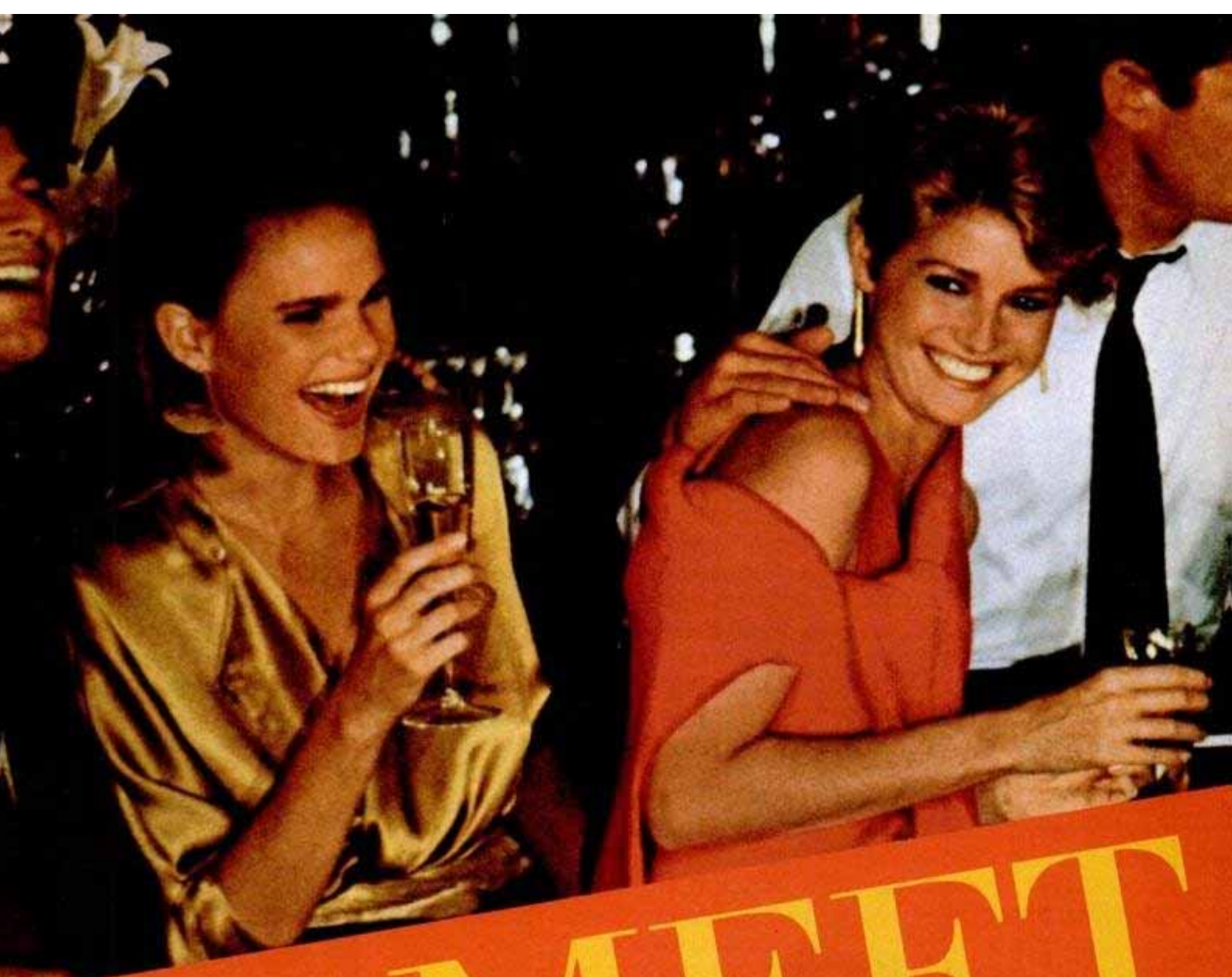
Kawasaki

Let the good times roll.



Prices and specifications are subject to change without notice. Availability may be limited. Kawasaki believes in riding safely. Always wear your seat belt. Member AMA and MSF. Accessories shown optional at extra cost.

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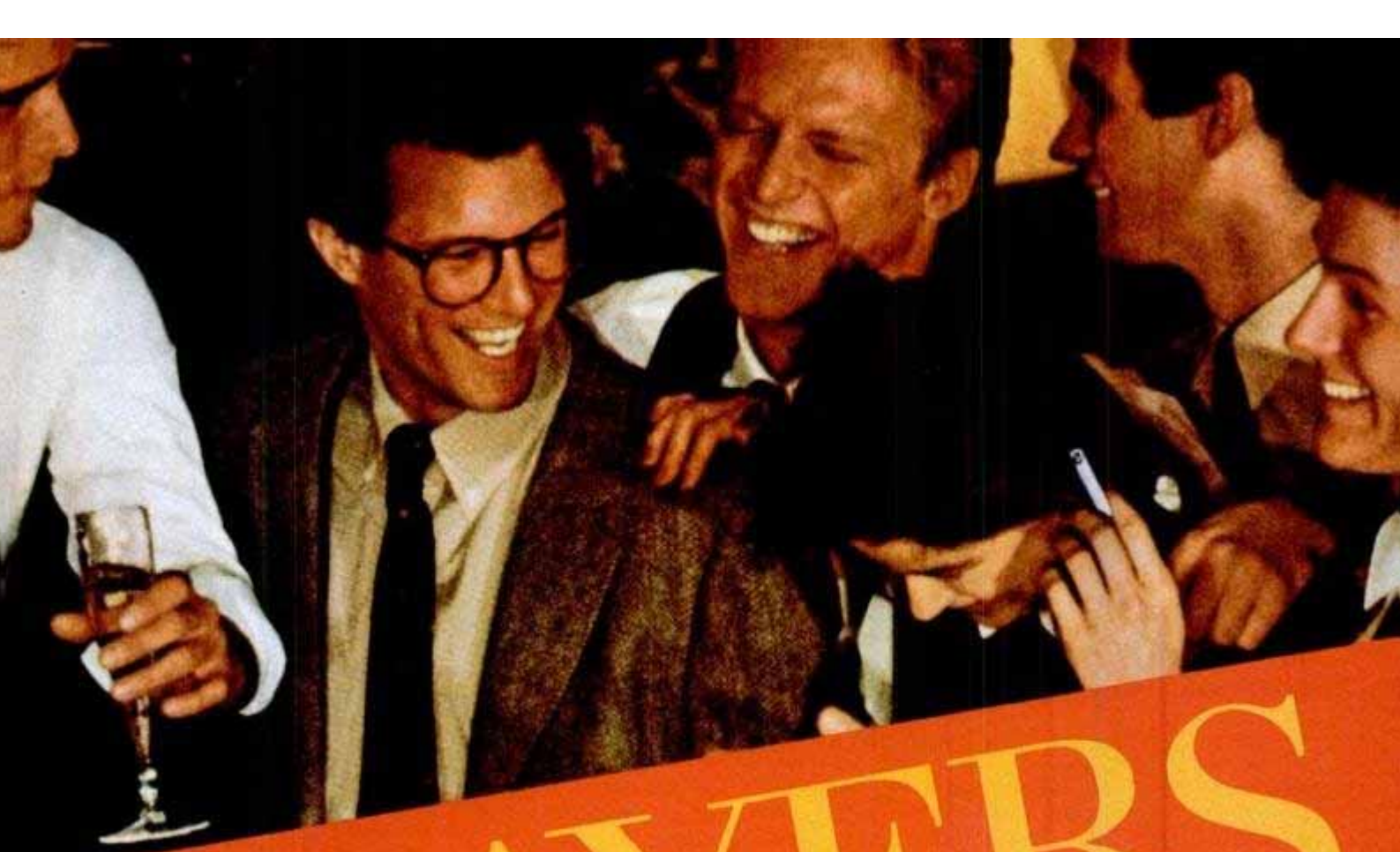
MEET

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

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

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PLAYERS

New
Players Kings.
Regular and Menthol



IMPORTS & MOTORSPORTS



Curves and crinkles

The most aerodynamic sedan in the world has just gone on sale, and first sight of it will take your breath away.

The 1984 Audi 5000S

with its drag coefficient of 0.33 gets its smooth shape from some all-new construction techniques. There are no protruding rain gutters (two grooves in the roof sheet metal carry water back and off the car); the curved side windows, windshield and back glass are designed flush with the body; the underbody is smoothed to speed airflow under the car and wheel arches are eliminated so



Design of Audi 5000S makes it the slipperiest sedan you can buy.

that Volvo expects to stick with right into the 1990s—and Volvo's a company, remember, that can keep refining one body style and keep it going strong for decades. A wedge like the 760 makes a very practical package, and keep in mind that a .07 difference in drag coefficient means only a few dollars a year in fuel for average driving.

Obviously, Audi and Volvo represent two schools of thought when it comes to designing today's—and tomorrow's—cars (we see it, also, when comparing Ford's curves, typified by the T-Bird, with GM's angles).

So, it'll be interesting to see how car buyers react to the brand-new 5000S compared to the already favorable reaction the 760 has received. It's been on sale here for a few months, after earlier availability in Europe (see *Driving The New Volvo 760 GLE*, page 112, Aug. '82). Right now, only several thousand 760s are available, whereas Audi is expecting a 30,000-car first year with the 5000S. Audi also has a slight price edge: a \$16,000 sticker vs. \$18,000 for the 760. We've just driven the 5000S and we'll have a report soon. As we wait to see just how aerodynamic future car design becomes, we know one thing for sure: Vent windows—those equivalents of a jet fighter's dive brakes—are gone forever.



Wedge-shaped Volvo 760 GLE has traditional styling and higher drag than Audi.

fender lines are in the same plane as the smooth disc wheel covers. Even tire valve stems are flush.

In contrast to the curves of the Audi are the crinkles of the new Volvo 760 GLE. The creases of the wedge-shaped GLE put it in the folded-paper school of design. Its drag coefficient is 0.40. That's appalling to some critics, but actually quite good for a car designed along traditional lines. It's a body style



Battle of imported family sedans: Volvo without curves (left), Audi with (right).

The two-wheel way

Anyone who has learned to twist a grip and lean into a fast curve knows the unparalleled joy of riding on two wheels. Even with all the forces conspiring against us—roads for cars only, killer potholes, rotten weather, licensing and insurance hurdles and often wives and girlfriends—we won't quit our "bikes" whatever their shape or form. This latest two-wheeler, from Yamaha, is a born-again motor scooter—and it's a design-award work of art



Yamaha Riva 180 is such a chic two-wheeler, it's hard to call it a scooter.

if ever I've seen one (it's also as user-friendly as a favorite pair of culottes, if you're looking to convince that reluctant wife or girlfriend). The Riva scooters come in three displacements: 50, 80 and 180 cc. The Riva 180, shown here, is freeway legal and a snap to ride. The four-stroke machine has electric start and automatic transmission, and terrific instrumentation: speedo,



Start button, front brake lever and slick instrumentation are on the handlebars.

odometer and trip odometer, fuel gauge, oil-level light, turn signals and high-beam indicator. Front brake is lever operated, the rear by foot. The 180 (\$1,399) is good for 85-mpg fuel economy and 65-mph top speed with passenger. The two-stroke, 50-cc (\$695) and 80-cc (\$899) scooters aren't as fast, but just as much fun. **PM**

1983 FORD LTD CROWN VICTORIA



**IT'S A COMFORT TO KNOW YOU CAN
STILL OWN THIS MUCH CAR.**



Crown Victoria for 1983. Quiet. Smooth riding. Full size. With comfort and luxury for six passengers. Standard this year is a 5.0 liter Electronic Fuel Injected engine with automatic overdrive transmission. Rich velour fabrics, thick carpeting and warm woodtones create a quiet

place for you to relax. While a solid steel frame and remarkable sound insulation make it clear you're riding in a truly fine automobile.

LTD Crown Victoria for 1983. In two- and four-door models. It's so rewarding to own one. Isn't it nice to know you still can?

Get it together — Buckle up.

HAVE YOU DRIVEN A FORD...LATELY?



FORD DIVISION

HOMEOWNERS' CLINIC



Cleaner for ceramic shower tiles

I read your suggestion on using an isopropyl cleaner for fiberglass showers. My problem is: What can I use to clean ceramic tiles on the floor and walls of my shower? I also have mineral deposits on my chocolate brown fixtures, especially the toilet bowl.—Mrs. Richard Marose, Lakeland, Fla.

Energized Ceramic Grout and Tile Cleaner, available at Color Tile stores, is your answer. Pour a little into a glass or ceramic dish and apply with a stiff brush. Allow a few minutes for the cleaner to act, then flush with clear water. Don't allow solution to dry on

the surface of the tile before rinsing. Mask bathtubs, sinks and other fixtures adjacent to the tiles being cleaned.

Follow directions, wear rubber gloves and goggles, and ventilate the work area. Test on tile in an inconspicuous area before proceeding. To locate the Color Tile store nearest to you, write: Color Tile Supermart Inc., Box 2475, Fort Worth, Tex. 76113.

To avoid build-up on your bathroom fixtures, keep them clean by using a general-purpose bathroom cleanser and stiff brush once a week, whether they need it or not.

inadequate for a complete flush. If the water level is not marked on the inside of the tank, it should be $\frac{3}{4}$ in. below the top of the overflow tube. (The drawings show how to raise and lower the water level.) Many people have tried to conserve water by lowering the level or by adding a brick inside the tank.

There is also a slight chance that the tank ball in the bottom may not rise enough. If that's the case, shorten and rehook the lift wire. Follow the directions for a pivoted-type valve.

Rust stains on siding

Several years ago I had white vinyl siding (Certainteed) put on my house. I now have rust stains creeping down, which I've traced to poorly galvanized nails used in the installation. Of course, the contractor has disappeared. Other than the stains, I'm very pleased. How can I remove the stains? I've tried vinegar, mineral spirits, household bleach, steel wool and TSP to no avail.—Ross Smith, Houston

A spokesperson at Certainteed's Vinyl Products Div. says that oxalic acid will remove rust stains. The company recommends aluminum nails to hang the product; but if a contractor has to hang it over a hard substrate, such as asbestos shingles, sometimes galvanized nails are used. If the nails aren't hot-dipped, they may rust.

If you can't locate oxalic acid, use DuPont's Heavy Duty Cooling System Cleanser for cars. It has oxalic acid.

Dissolve one tablespoon of crystals in one cup of warm water. Apply with a soft bristle brush. Clean with a damp cloth and rinse with water. Wear rubber gloves and goggles. Remember, this will not stop further rusting—it removes stains.

The color of Certainteed's siding runs throughout the product. For those who don't have Certainteed, test the acid in an inconspicuous spot. **PM**

Mildew on redwood

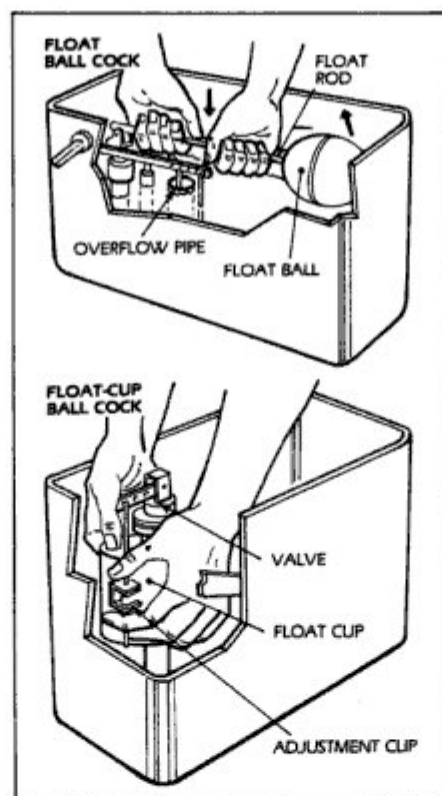
Our 16-year-old painted redwood house has a terrible mildew problem, even during periods of bright sunshine. The inside of the house seems to sweat and the inside surfaces of the window frames are peeling. We would eventually like to have aluminum siding, but first we must solve the mildew problem.—Vivienne Mazzatta, Belleville, Ill.

You've probably already checked the obvious causes of moisture: a lack of kitchen and bath fans, and poor exterior runoff of rainwater that allows excessive moisture to rise from trapped areas in the basement or crawl space.

If the above check out, you may have to introduce some dry, outside air. A "Service Tip," (Homeowners' Clinic, page 24, June '82) describes this problem and suggests installing an air exchanger such as E-Z Vent. It provides fresh, dry air (tempered by the air of the season) and exhausts the moist room air. E-Z Vent is made by Des Champs Laboratories Inc., Box 440, East Hanover, N.J. 07936. (Also see "Bring In Fresh Air Without Losing Heat," page 138, Sept. '82.)

Blocked toilet

When I flush my toilet, the solids in the bottom of the bowl go out, but the solids and tissue in the water remain in the bowl. The water never goes down to let the air in the bottom of the bowl. What could be the matter? I don't want



On a float-type ball cock (top), carefully bend the float ball upward to raise the water level; downward to lower the level. With a float-cup ball cock (above), merely squeeze the adjustment clip and then move the cup along the rod.

to take up the bowl if I don't have to.—William Dillason, Aledo, Ill.

It sounds as if the water level in your tank is too low. Therefore, the water is

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 the column. For more home-repair and maintenance help, get PM's Home Care Guide, \$4.95 postpaid. Send your order(s) to Popular Mechanics, Box 1014, Radio City Station, New York, N.Y. 10101.

Do low-flow showerheads remind you of ancient water torture?



Have you had it with water bills that soak you and showers that don't?

Would you like to stem the cost of showering by up to 70% without sacrificing a drop of the pleasure?

Introducing the Super Saver® showerhead. It turns a little water into a lot of shower.

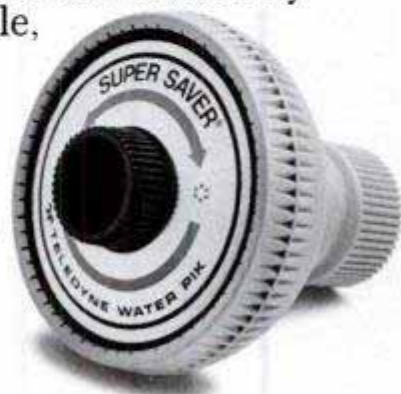
You're going to like the Super Saver low-flow showerhead. Unlike other water-savers, it's got two fully-adjustable sprays: a brisk inner jet and a full-coverage outer spray. So you



get a shower that's 100% invigorating—with up to 70% less water than a standard showerhead. And since it's made and backed by Teledyne Water Pik, the Shower Massage people, you can count on a lot of shower and a lot of savings (about \$175 a year)*.

Why not pick up a Super Saver showerhead? You'll say "aaah"... and your utility bills will say "uncle."

SUPER SAVER®
by TELEDYNE WATER PIK



*Water savings based on a comparison to standard showerheads, which use 5.5-8.0 gallons per minute, versus 2.0 gallons per minute for Super Saver at 45 P.S.I. and an average family of 2.75 persons, each taking daily ten-minute showers, with conventional electric water heater. Average water-heating bill would be reduced from \$294 to \$119 per year.

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T/A[®] HIGH TECH[®] RADIALS



Objective: Engineer a high-performance radial that achieves maximum ruggedness on-road and off.
Solution: The Radial All-Terrain T/A™

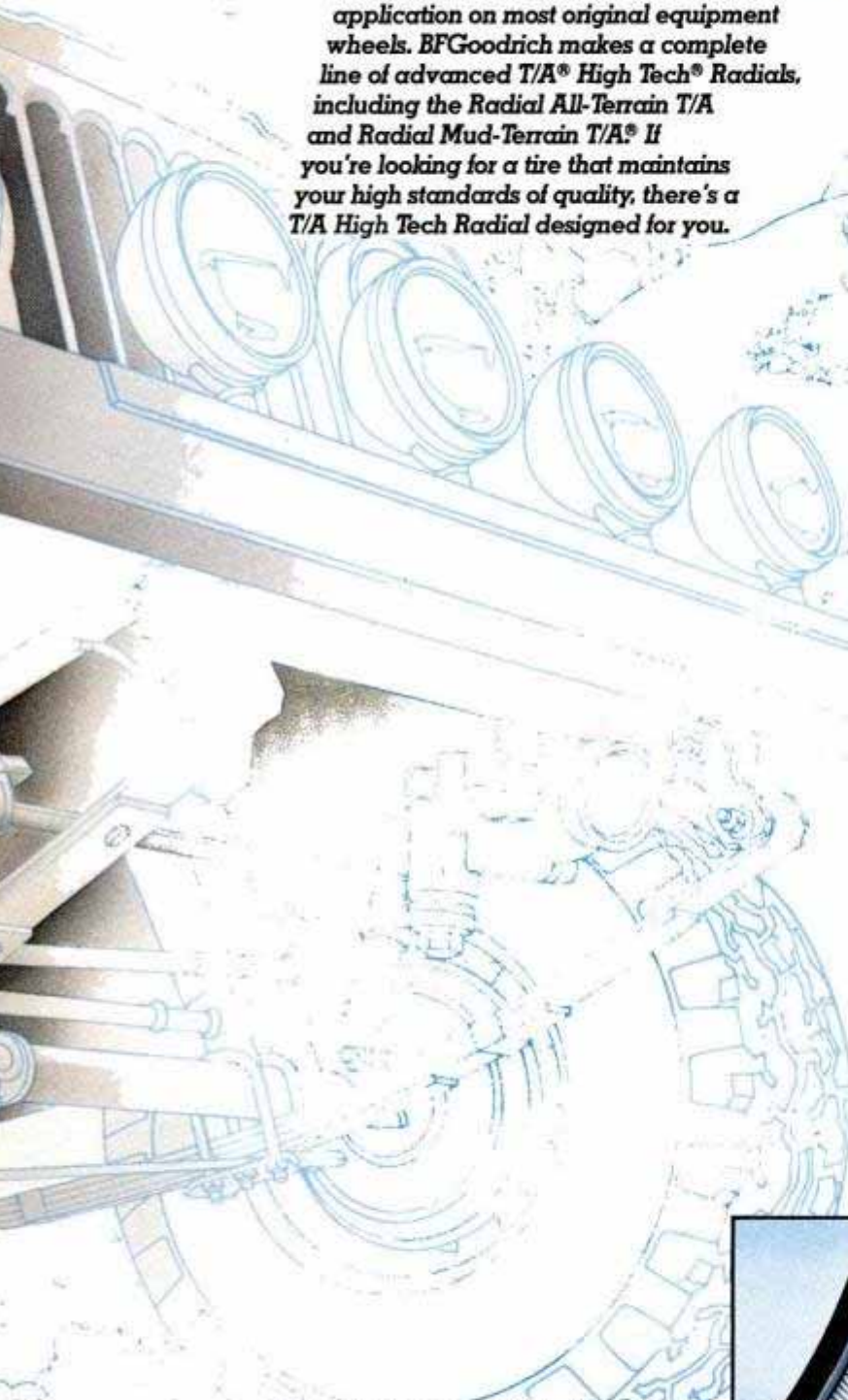
The Radial All-Terrain T/A™ was developed with one thing in mind—performance. Its race history includes outstanding victories at international off-road events like Riverside, the Mint 400, and the grueling Baja Internacional. The tires we race are the same tires you buy, so you get that same race-proven performance.





BFGoodrich

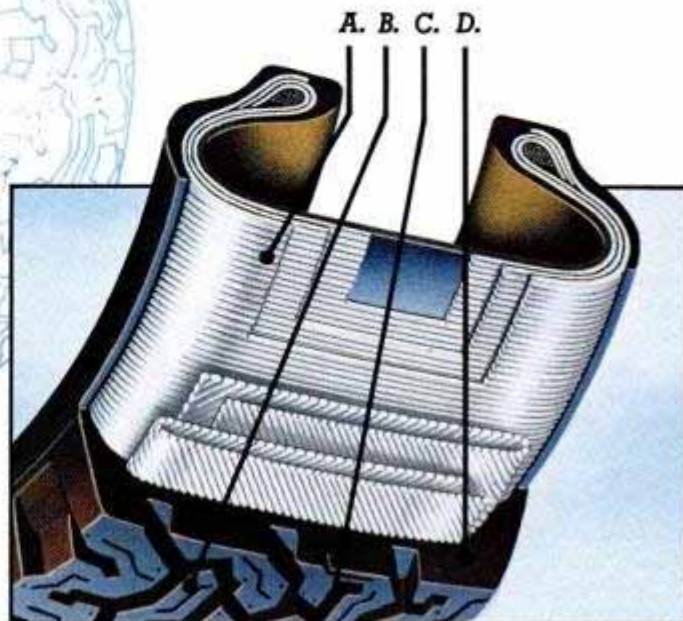
The Radial All-Terrain T/A tire is available in sizing suitable for direct application on most original equipment wheels. BFGoodrich makes a complete line of advanced T/A® High Tech® Radials, including the Radial All-Terrain T/A and Radial Mud-Terrain T/A®. If you're looking for a tire that maintains your high standards of quality, there's a T/A High Tech Radial designed for you.



The design of the Radial All-Terrain T/A tire includes this combination of advanced materials and technology:

- A. Three carcass plies help resist sidewall bruising.
- B. Tread pitch sequencing offers quiet ride.
- C. Deep self-cleaning grooves provide excellent traction.
- D. Dual compound tread ensures long wear and durability.

The Radial All-Terrain T/A offers maximum off-road ruggedness while maintaining the advantages of a street radial. Its advanced construction offers dependable and excellent handling. And the Radial All-Terrain T/A tire's aggressive tread design provides super off-road traction.



PM ELECTRONICS MONITOR



Now *this* is a portable TV

Our first reaction when we saw Seiko's television wristwatch was, "It's just a gimmick." But, after looking at it a while, we were impressed by its engineering and technological details. It's worn just like a wristwatch, but instead of a face it has a 1.2-inch TV screen



Seiko's TV wristwatch uses a liquid crystal display to form a screen that's 1.2 inches wide. Wire runs up sleeve to pocket-size power pack.

with the time displayed separately above the picture. A battery power supply can be carried in the shirt pocket, and headphones allow you to hear the audio.

The screen is a liquid crystal display (LCD). The crystals work by reflecting light back to your eye, so the picture quality is best in bright sunlight.

Seiko seems to have overcome the sluggishness of liquid crystal displays: This one definitely keeps up with the raster-tracking of the TV signal. And we saw no evidence of ghosting or "blinkiness," which characterized some other LCD video units we have seen. The watch can even be used to display videotapes. For the pickup, Seiko recommends wrapping a lead from the VCR output around the antenna, which is part of the headphone cord.

But, for all of its ingenuity and uniqueness of design (covered by more than 150 patents), we wonder if a wrist TV is the final application of this LCD screen. While the TV is exciting in

itself, is the wrist the best place, or even an acceptable place, for a video display? It would seem that an hour of viewing would lead to a crick in the neck, at least.

But we do think the Seiko watch is the most interesting application we have seen recently of LCD technology. For those who are waiting for a real wall-size and flat-screen TV, it's just come a step closer.

Seiko expects to market this watch late in the year for about \$500. Meanwhile, you'll get an in-depth look at not only the Seiko TV watch but the whole world of multifunction watches in next month's issue.

And big gets better

One of the biggest problems with designing a color picture tube is that of convergence. A color TV image is made up of three components: red, green and blue images. These images must be painted on the tube by three electron beams, and the images must be directly atop—converged on—one another.

Poor convergence results in such things as magenta shadows around an image or green lines outlining a person's hair. The more one of the three

images shifts, the worse the resulting picture.

As components "age," even the best TV tubes begin to lose convergence. The only way to bring the three images back into alignment is to adjust and readjust controls which are found on a "convergence board" inside the TV. This is difficult—almost an art—and requires a trained service technician.

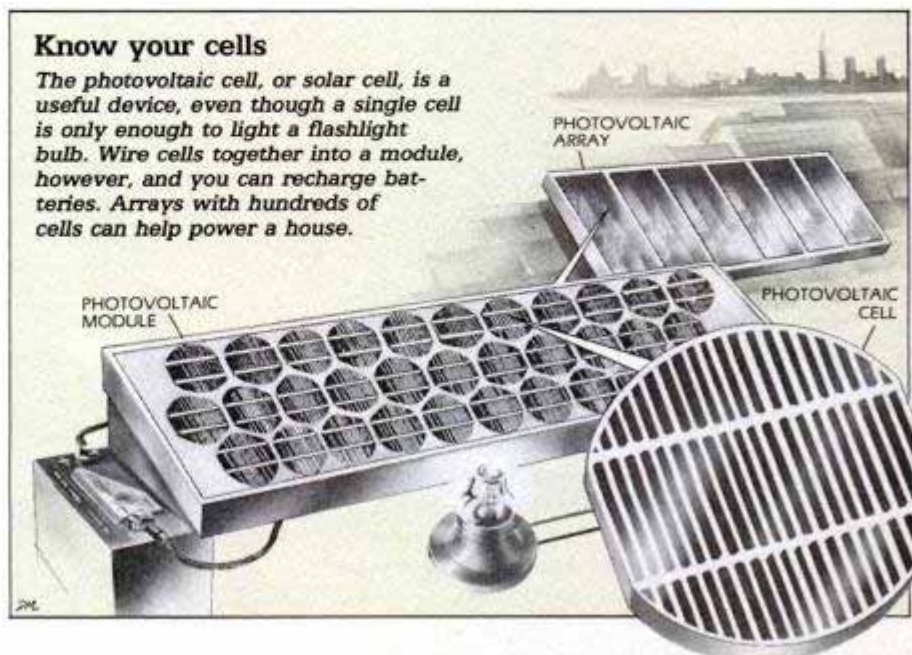
RCA has just announced its Coty-29 picture tube, to be manufactured by it and other TV companies, including Zenith and Sylvania. Industry sources expect the tube to literally light up the television industry because the Coty-29 automatically checks and rechecks the accuracy of the picture's convergence. And, instead of having to call a serviceman, the Coty-29 will converge itself.

The new tube will also reduce some production costs. This may not result instantly in lower prices, but it should enable, or at least help, beleaguered American TV manufacturers to hold the line against imports.

No one is saying exactly when you will be able to buy a TV with a Coty-29, although one source told us to expect it as a possible Christmas gift. We hope to have one of the first production models so that we'll be able to report on whether the Coty-29 lives up to its bright promise. **PM**

Know your cells

The photovoltaic cell, or solar cell, is a useful device, even though a single cell is only enough to light a flashlight bulb. Wire cells together into a module, however, and you can recharge batteries. Arrays with hundreds of cells can help power a house.



Home Gardening Breakthrough!

At Last! A Rear-Tine Tiller Especially for Small Gardens!

the 3¹/₂ HP TROY-BILT® "JUNIOR"

If your garden is 30'x50' or less, here's why it will pay you to get the full story about the Newest, Greatest Breakthrough in rear-tine tillers in over 50 years!...

- **SAVES YOU MONEY!** Goes for half the price of larger rear-tine tillers—which you don't need for your small-sized garden.
- **SAVES YOUR BACK!** Forget spading and raking! The "JUNIOR" prepares your garden in a fraction of the time!
- **SAVES HAND WEEDING!** It's adjustable to shallow depth perfect for chopping, uprooting and burying weed seeds—killing them. Simply guide the "JUNIOR" up and down each row.
- **SAVES GARDEN SPACE!** Narrow 14" tilling width allows you to plant your rows closer together. Grow more in less space!
- **EASY TO USE!** With its tines in the rear and engine out front, the "JUNIOR" is so well balanced you can handle it with **JUST ONE HAND**. Won't shake you to pieces like front-end tillers do!
- **EASY TO TURN & MANEUVER!** Because the "JUNIOR" is light and compact (but strong!) you can turn it and maneuver it in tight places with wonderful ease!

There's much more to know about this wonderfully different and better idea in small garden tillers...like how you can use it to build super rich soil, no matter what your soil conditions...or, how it can help you grow two, even three crops of vegetables where you could only grow one before!

So why not mail the coupon TODAY, and get all the exciting facts about the amazing new TROY-BILT "JUNIOR"...Plus our mid-sized PONY and large garden HORSE Models. We'll include prices, attachments and complete information about our special "OFF-SEASON" Savings discount now in effect!



WHY, for heaven's sake suffer any longer with a tines-in-front type of tiller that has no power to the wheels and shakes you to pieces? And why break your back with hoeing, raking and shovelling? The New TROY-BILT "JUNIOR" makes all your gardening chores faster and easier—increasing your gardening JOY! Send for full details TODAY!



Half The Price Of Bigger Tillers!

The BIG JOB tiller...for small, high yield gardens!



"Grow more in less space!"



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Mail this coupon today!

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YES! Please send me complete information on the new JUNIOR and all other TROY-BILT Tiller Models ranging from the 5 HP PONY to the 8 HP "PROFESSIONAL" including details on prices and big "OFF-SEASON" Savings now in effect!

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DETROIT LISTENING POST



Faster Cadillac Cimarron

GM's upcoming front-wheel-drive N-car will debut in coupe form for 1985 to replace the current rear-drive Pontiac Grand Prix, Olds Cutlass Supreme and Buick Regal coupes.

The line expands to include four-doors for '86, and that's when Cadillac plans to grab a version as its new Cimarron small luxury sedan.

The N-cars will be built on stretched and much-improved J-car platforms, which will be about 103 inches in wheelbase.

They'll offer Pontiac's 2.5-liter Four (port fuel-injected by then) as the base



The '85 N-cars will be built on a stretched J-car platform with 103-in. wheelbase.

engine and the Chevy-built, 2.8-liter V6 as an option. That will give Cadillac a slightly larger, more distinctive and

much better performing Cimarron with which to butt heads against BMW and the rest.

GM goes racing

While Ford public relations and racing reps have become pit rail fixtures at American races in the last couple of years, GM's newly liberated Chevrolet and Pontiac Divs. were very much in evidence for the first time in a long time at this year's Pepsi Challenge/Camel GT Daytona 24-Hour endurance test.

Chevy treated the press to breakfast race day morning to: 1) show off its 680-hp turbocharged 3.3-liter V6 racing engine; 2) announce that 70 jazzed-up USA-1 support trucks will be supplied to various race tracks and race sanctioning groups in 1983; and 3) introduce its new 190-hp, 5.0-liter HO Camaro Z28.

Pontiac had racing press kits in the press room and tower, plus its well-known Trans Am Territory tent in the infield for Firebird owners and enthusiasts.

Though both are powered by Chevrolet small block engines these days, the Camaro/Firebird rivalry on the track was intense. The very fast Billy Hagan Camaros qualified 9th and 10th overall behind five twin-turbo Porsche 935s and three exotic prototype racers. Gordy Oftedahl Firebirds placed 17th and 18th on the 79-car grid. Unfortunately, none of those were among the 30 finishers after 24 hours of racing, and the highest placed American car was a Chevy Monza in 15th.

My Daytona 24-hour driving debut, co-driving with '82 Trans Am series

champion Elliott Forbes-Robinson in Chuck Posey's Trans Am Specialties Bandit Trans Am, ended with terminal engine troubles less than eight hours into the race. Hats off to the hard-working, never-quit Bandit Racing crew for struggling mightily with their brand-new undeveloped car to make it run as well and as long as it did. Also to B.F. Goodrich, whose Comp T/A street radial tires, worked wonderfully, even at speeds of 170 mph on Daytona's high banks.

We started 66th and were classified



Author Witzenburg on the high banks of Daytona behind wheel of a Pontiac TA.

55th at the end with 121 laps of the 3.84-mile Daytona road course. For what it's worth, we tied the high-bucks, Pepsi-sponsored prototype of A.J. Foyt and Darrell Waltrip and beat 24 other cars. And it was great fun while it lasted.

DAWG talk

There's a small organization known as DAWG (Detroit Auto Writers Group) that once a month invites a key industry executive to lunch. The purpose? To get to know Detroit's movers and shakers and hear what's on their minds. Two recent DAWG meetings have had especially interesting guests of honor—AMC president Jose Dedeurwaerder and Buick Div. general manager Lloyd Reuss.

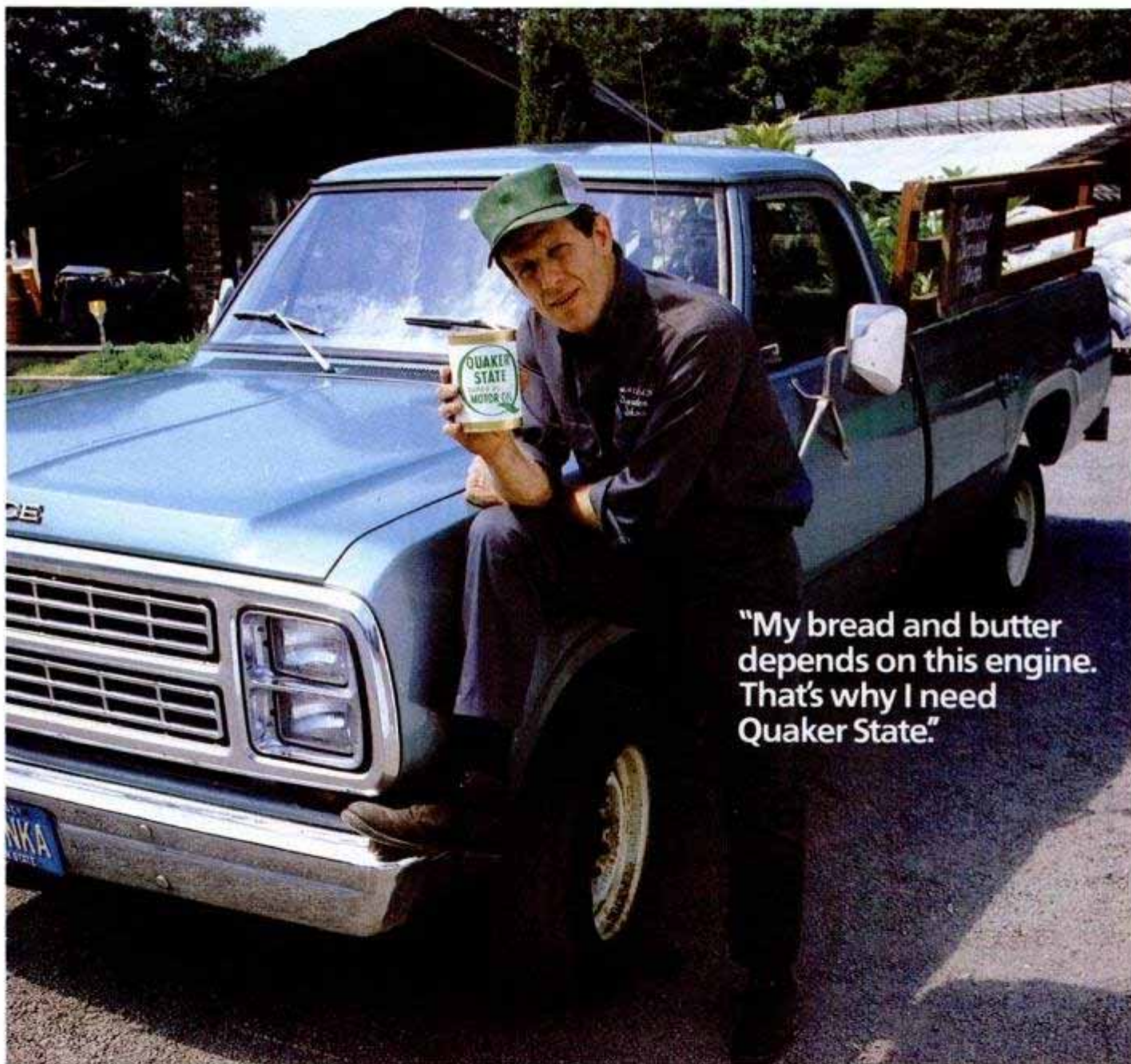
Dedeurwaerder, who came over from Renault to replace Paul Tippett when the latter moved up to take over as AMC chairman, discussed the advantages of international cooperation and joint ventures among automakers. In designing, developing and tooling up a new product, he asserted, "The investments are so big and the risks so high that working together worldwide is becoming a trend."

He explained the difference between AMC's relationship with Renault (a long-term, multiproduct partnership) and the recent General Motors/Toyota agreement (a one-time, one-product arrangement). On the subject of world trade, he characterized America's current trade imbalance with Japan as "very unfair." Asked whether a tariff or tax on Japanese imports keyed to the yen/dollar relationship might be the answer, Dedeurwaerder replied, "That may be a solution."

Reuss discussed his favorite subject and pet program: customer satisfac-

(Please turn to page 22)

"Today, you need an oil this good."



"My bread and butter depends on this engine. That's why I need Quaker State."

When you make a living with your vehicle, a costly breakdown can put you out of business. To keep your engine and business running smoothly, you need Quaker State quality. These Quaker State motor oils are made exclusively from Pennsylvania Grade Crude Oil. They offer quality protection for your vehicle. Quaker State: so good, it's America's best selling motor oil.

Quaker State



DETROIT LISTENING POST

(Continued from page 20)

tion. Buick has set up a new inspection and delivery procedure, for example, which involves the dealership general manager as well as the salesman. Together, they go over the car step-by-step with the buyer, give a demonstration drive and send the buyer off with a full tank of gas.

Buick dealers now have a toll-free number for technical assistance on service problems. This is computer-tied to a data base at the division's headquarters in Flint, Mich. and technicians can

use it to talk directly to the responsible engineers. Reuss says that 85 percent of the problems are solved on the first call. Also in the works is an 800 number for customers, which should be operational nationwide by the end of this year.

Ford's turbos

Introduction this spring of the 2.3-liter, port-injected turbo Four for Ford's T-Bird, Mustang and Mercury Capri is barely the tip of the proverbial Ford turbo iceberg.

Fall will see that engine made avail-

able in a performance version Mercury Cougar, an even hotter turbo 2.3 for the limited-production SVO Mustang and a new 1.6-liter turbo for the fwd Ford EXP and Mercury LN-7 two seaters—all with standard five-speed manual transmission.

The SVO (Special Vehicle Operations) engine will have forged aluminum pistons and an air-to-air intercooler to lower the temperature of its compressed intake charge. The engine should put out 20 to 25 more horses than the regular 145-hp turbo 2.3. The 8,000 or so special SVO Mustangs will offer racer-like suspensions with Koni gas-filled, adjustable shocks, a distinctive, aerodynamic and almost-grilleless front end, and a strange-looking, but effective, twin ducktail rear spoiler.

Turbocharging the port-injected CVH (compound valve hemispherical) Escort 1.6 should boost its output from the current 88 to about 115 hp, more than enough to make serious sports cars out of the EXP/LN-7s. By mid-'84, this engine will come in upgraded versions of the Escort GT and Lynx RS high-performance hatchback sedans.

GM/Toyota deal

Even while the dispute raged last winter over whether Nissan's new truck plant in Tennessee would be a union shop or not, laid-off autoworkers in California fired an opening salvo across the bow of their likely new boss, Toyota.

Seems Toyota and GM agreed that the Japanese automaker would have final say on who runs the Fremont, Calif., plant where the two companies plan joint manufacture of an '85 subcompact Chevrolet beginning late next year. United Auto Workers Union members, who lost their jobs when GM shut down the facility last year, quite understandably want them back. But quality-conscious Toyota, equally understandably, says it will hire the best people it can get—period.

So the unemployed workers got together and raised a fuss. They are miffed about the stated hiring policy, as well as the intrusion of Japanese control and work methods in general.

When will those guys figure out that such confrontational thinking has been a large part of the noncompetitiveness problem that got them, and a lot of others, laid off in the first place? Shouldn't they be happy that the plant is going to reopen at all, whoever runs it?

When Toyota gets threats instead of gratitude from those who stand to benefit, who would blame them and other foreign automakers for looking elsewhere for U.S. plant locations in hopes of avoiding the UAW entirely—as Nissan probably will in Tennessee? **PM**

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This PowerTip gives Autolite plugs what mechanics call a wide heat range.

That means Autolite actually works like two plugs. A hot plug and normal plug. So Autolite runs hot in

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In fact, you might call Autolite a plug for all reasons.

And for all cars, big and small.



Normal plug has normal heat range.

Autolite's longer Power Tip gives wide heat range.

Your little car is out there every day plugging for you.

So give it a break. Get the Power Tip spark plug: Autolite.

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If you want to see your kids do better in school, it's time they met PLATO™ from Texas Instruments. PLATO Basic Skills and High School Skills courseware is the most extensive computer teaching system ever developed for kindergarten through 12th grade. Until now, it was only used in schools to give children a special edge—but now they can use it at home—*exclusively* on the Texas Instruments 99/4A Home Computer.

The PLATO system, developed by Control Data, uses proven methods and techniques that make learning so interesting you may have a hard time getting the kids away from the computer. And they'll be learning at their own pace, from a machine that never criticizes; that builds on their newly acquired knowledge; that rewards them with a real sense of accomplishment.

PLATO Basic Skills and High School Skills courseware offers all the subjects a child needs. It teaches math, reading, social studies, grammar, science—more than 108 essential courses that build the foundation of a solid education.

Take PLATO home. And introduce your kids to the knowledge that lives in the Texas Instruments 99/4A Home Computer.

For more information, please call toll free (800) 858-4565.

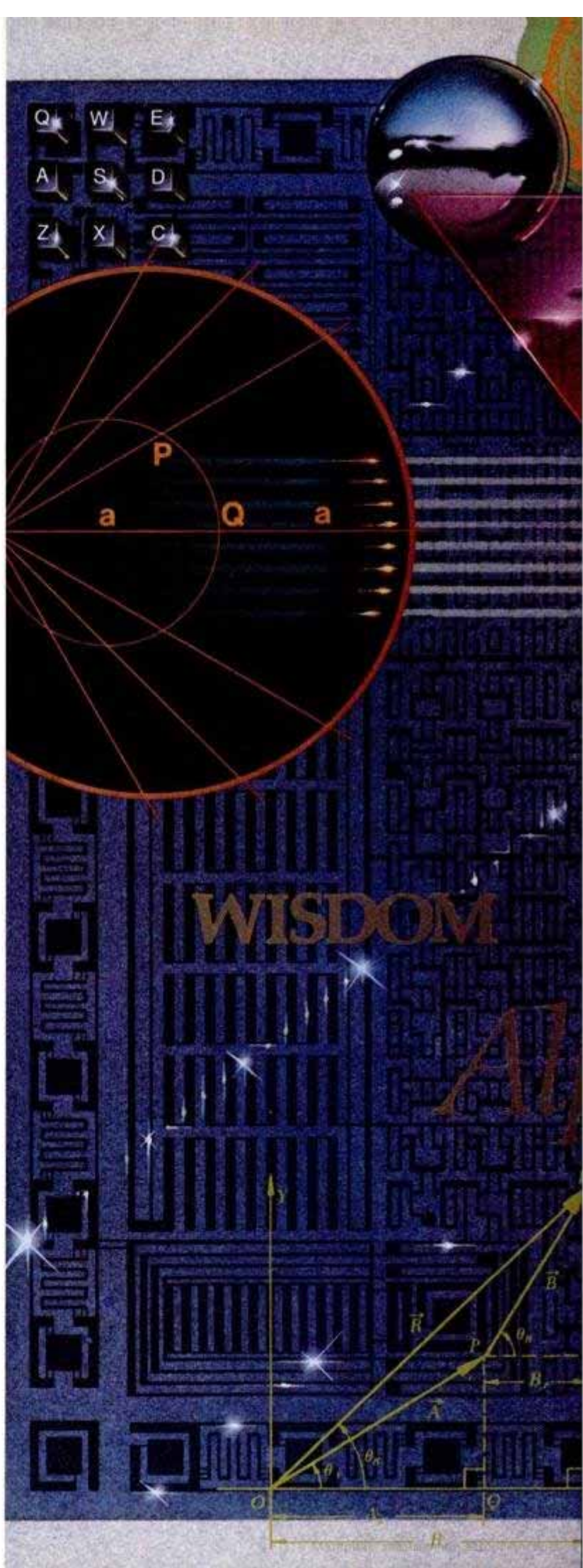
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APPLIANCE CLINIC



Washer hang-up on final spin

I have a Sears automatic washer Model 110-72884110, serial No. C80620890. It has a problem in the final spin dry. The motor continues to run but the motor pulley slips on the belt. When I pull the machine from the wall and give the belt a couple of tugs, it moves. The machine continues to operate for a couple of loads. Then it stops again. I would certainly appreciate any help or suggestions you could make.—Gordon Williams, Sebring, Fla.

It sounds as if it's time to adjust the tension on the drive belt or to have a service technician replace the belt, depending on its condition. To adjust

the belt, first unplug the washer. Next, remove the rear access panel (two screws at the bottom).

Use a $\frac{1}{16}$ -in. wrench to loosen the nut holding the motor mounting bracket to the base plate. Be sure the star washer is loose.

Grasp the motor mounting bracket with pliers or an adjustable wrench and pull the motor assembly against the belt to increase the tension. While holding the tension on the motor assembly, tighten the nut. Proper belt tension allows about a 1-in. deflection in the belt midway between the motor pulley and the drive pulley.

Pilot-light problems

I have a 1970 Norge gas dryer, Model DGK181A, serial No. 27859. The pilot light, which is supposed to be on all the time, keeps going out. I have to relight it before each load. I replaced the pilot assembly in 1976. What can the problem be?—K.W. Murcin, West Seneca, N.Y.

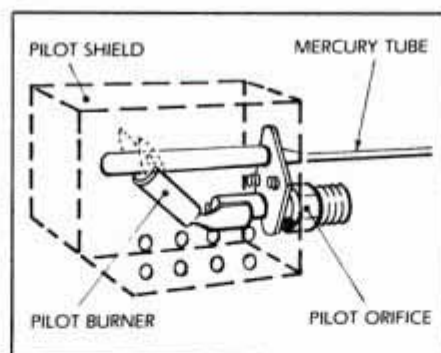
Sounds as if the pilot light could have a little dirt or lint around the pilot shield. This could cause the pilot flame to deflect away from the pilot mercury tube; or the pilot orifice may be partially clogged. To clean the pilot shield and orifice, first unplug the dryer and shut off the gas supply to it. Next, remove the pilot assembly from the burner. To do this you will have to disconnect the pilot tubing from the gas valve and the pilot orifice.

Remove the two screws which hold the pilot assembly to the pilot shield. Next, unscrew and remove the pilot orifice. Clean the orifice and the pilot shield with a cloth or a small paintbrush. Inspect the orifice and look for dirt or possibly a clogged hole.

Now that everything is clean, reassemble the pilot assembly. Make sure all pilot gas tubing connections are tight. Turn the gas back on and check for leaks using a soap and water solution on the connections. If you spot bubbles, there's a leak in the tubing connections.

Light the pilot. The flame should engulf the mercury tube and burn with

a sharp, blue flame. If you have cleaned and reassembled the unit and the dryer still doesn't work properly, you might try replacing the pilot assembly again.



A dirty pilot shield or clogged orifice on a gas dryer can smother a pilot flame.

(Note: Gas dryers are equipped with a safety mechanism—a mercury tube which acts as a sensor. If the pilot flame goes out, the sensor shuts off the gas supply to the pilot.)

Stingy ice maker

I have a General Electric side-by-side refrigerator Model TFF24RSE, serial No. FV 204221. The ice maker doesn't make ice cubes. If I connect the holes in the female outlet (test receptacle) with a wire, it will make only one container of ice cubes. Would you tell me how I can check and repair it? Is there a book that might teach me how to do it?—Akbar Vafaie, M.D., Fairborn, Ohio.

As far as checking the operation of the ice maker, you already did that when you jumped the test receptacle. It sounds as if the operating thermostat in the ice maker is not closing. Order operating thermostat No. WR5XSS; approximate cost is \$18. The part is available through any GE parts or service center. It is shipped with a good set of step-by-step instructions for installation.

Remove the ice maker by loosening the two screws at the top. Now remove the screw which goes through the bottom lower portion of the mold toward the rear, almost under the fill cup. This screw is used for shipping and doesn't have to be replaced.

Lift the ice maker up off the screws. Then reach down and unplug the ice maker power cord. Set the ice maker on a table and follow the instructions for installing the new operating thermostat.

For a book on your ice maker, write to General Electric, Box 111, New Concord, Ohio 43762. Ask for Technical Data Manual No. 30-85000-B. The cost is \$7.50 plus tax and shipping. The service center closest to you is in Dayton: (513) 898-7600.

SERVICE TIP

Now that summer weather is here, it's time to make sure your air conditioner is in working condition. It may take just a quick going over or a new filter. Summer weather is also hard on refrigerators and freezers. They run more frequently due to the opening and closing of the doors, as family members look for cool drinks or snacks. They also run more frequently in high humidity, such as when vegetables are steaming. Under this condition, moisture may form on the outside walls.

Moisture and frequent running are normal and need not be a signal to call a service technician. Whirlpool has published a brochure titled "Nice Things To Know About Preventing Appliance Service Calls." It could help you avoid unnecessary service calls. To receive your free copy, write to AIS, Whirlpool Corp., Administrative Center, Benton Harbor, Mich. 49022. **PM**

If you have a problem with any appliance, send your question, along with the model and serial numbers, 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.



Buick announces a little more wagon.

The stylish wagon you see sitting very smartly in front of its two big brothers is the new Skyhawk Limited Station Wagon.

It's the first front-wheel-drive Buick wagon. And though it's a small Buick, it's very big on traditional Buick qualities. Its seats, for example, are trimmed with the same quality cloth that adorns the Electra Park Avenue.

Due to its highly intelligent design,

the Skyhawk wagon is more spacious than you might expect. With the rear seat folded down, it can carry 64.5 cubic feet of whatever you wish to carry.

So everything fits beautifully. Including you. And your cargo.

Buckle yourself up and visit your Buick dealer soon.

And put yourself into a little more wagon.

*Official Car of the XXIIIrd Olympiad
Los Angeles 1984*



BUICK
Wouldn't you really rather have a Buick?

KING: 15 mg. "tar", 1.1 mg. nicotine, 100's: 16 mg. "tar", 1.4 mg. nicotine, av. per cigarette by FTC method.

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s Best.



Join the first team.
Reach for Winston.



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

CAR CLINIC



From one who's been there

I read with interest the Car Clinic letter from Richard Zinsky titled "Corseted Courier" (page 42, December '82). Mr. Zinsky complained of difficulty shifting the five-speed transmission of his 1979 Ford Courier in cold weather. I was in the same boat and was able to solve the problem.

Cold weather brought difficult shifting to the five-speed gearbox of my Subaru station wagon. For the first couple of miles, going from FIRST to SECOND was almost impossible, so I had to shift directly to THIRD. Subaru told me just about the same thing that Ford told Mr. Zinsky: "Live with it. There's no solution."

However, I followed a tip from a mechanic who had similar trouble with a five-speed in a Datsun. I drained the factory lubricant and replaced it with a synthetic gear oil, making sure that the

one I selected met Subaru standards—AMS/Oil SAE 80W-90 synthetic gear lube that claims to exceed automaker specifications GL-2 through GL-6 and military specifications MIL-L-2105-C. Since the lubricant meets Subaru requirements, I have not voided my warranty.

The shifting problem has disappeared, even down to temperatures of 20° below zero. —Dennis Barrone, Fort Wayne, Ind.

As long as the synthetic lubricant is of a quality that meets Ford specification ESP-M2C83-C, Ford says it's worth a try. AMS/Oil states that its SAE 80W-90 synthetic gear lubricant meets this standard.

Lubricants which do not conform to the Ford spec may break down, leaving the transmission wide open to damage.

Plugging a hole

There's no way to keep in the rear camshaft plug in my 2.6-liter Dodge Challenger engine.

As heat causes the engine to expand, this insecure fiber plug falls out and I lose oil. The dealer has tried several different repairs, but he tells me that nothing is really going to help. What do you think I can do to correct this problem?—J. Doering, Newport, Tenn.

By the time you read this, you may have received a letter from Chrysler Corp. announcing a manufacturer's recall to repair the problem. The fix is in the form of a two-part epoxy adhesive, which is capable of withstanding a temperature of as much as 400° F.

The epoxy will keep the plug permanently in place. The repair is done at no cost to customers. A new plug is inserted if the old one is missing. Then, the epoxy is mixed and a dam is built behind the plug to keep it from slipping out.

Be certain not to be too ambitious: Don't try doing this yourself with an off-the-shelf epoxy. An ordinary epoxy is not able to withstand the high temperature and consequently will disintegrate.

We learned that a new plug is being

designed for installation into production line engines.

If it's necessary for an engine in the field to be overhauled or if for some reason the epoxy repair doesn't work, a dealer can install the new plug, which should be available now.

Neighborly advice

My 1981 Chevrolet Impala (267-cu.-in. V8 engine) needs a new carburetor air filter once every few thousand miles—4,000 to be exact. The filter gets coated with oil and clogs badly enough to cause the engine to run poorly. The dealer says he can't find anything wrong. My neighbor has an '81 Monte Carlo with the same engine. He doesn't have the trouble. Why me?—Owen Dodds, Star City, Ariz.

The problem is probably because the positive crankcase ventilation (PCV) system in his Chevy is in better shape than the PCV system in your Chevy. A defective PCV valve or a kinked or clogged PCV hose can cause a back pressure that draws oil from the crankcase into the carburetor air cleaner, through the hose in which air is supposed to flow from the air cleaner to the crankcase. Replace the PCV valve and look for a restricted hose.

Remember, also, that there is a small fiber-type element in the air-cleaner housing that filters air being drawn from the air cleaner into the crankcase. This filter probably is coated with oil, so replace it, too. If you do these things, chances are you'll see the last of this trouble.

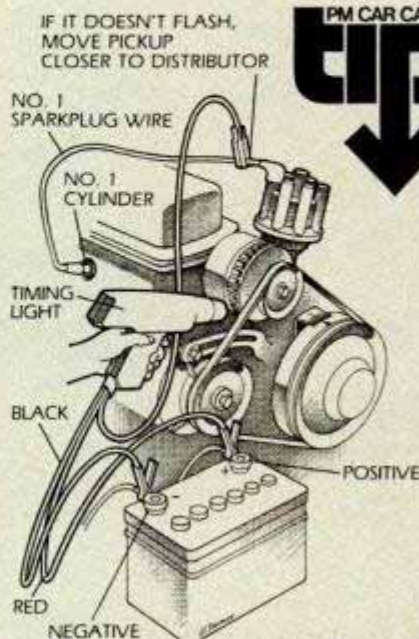
(Please turn to page 32)

Let there be light

Suppose you have your induction-type timing light connected to an engine in a new or used car you've purchased recently and the light doesn't flash. Where's the problem?

Before condemning the light or the distributor, reconnect the light's induction lead as close to the distributor as possible. This is the point at which the signal is strongest and resistance is at a minimum.

Conversely, maximum resistance is present near the sparkplug, and some timing lights aren't able to pick up the signal. If the timing light still doesn't flash, hook the induction lead to the coil wire near the coil to test the light. You should see many rapid flashes. If you don't, the light is bad.





It's worth its weight in tough protection.

If you're driving one of today's precision-engineered, high performance cars, you need tough engine protection. That's why Pennzoil GT Performance is specially formulated in an SAE 20W-50 weight to stand the strain high RPM's put on motor oil. GT Performance is also available in an SAE 20W-40 weight.

This extra weight oil has the

staying power to keep giving your engine the protection it needs—even under intense pressure. And GT Performance has built-in friction reducers to help high revving engines run easier, increasing their efficiency.

Pennzoil GT Performance

provides tough protection, too, for hard-working, load-carrying pick-ups, vans and RV's.

A top quality product of Pennzoil's long on-track experience...this is the oil with the extra weight to give tough engine protection for your high revving, high performance car.

Pennzoil GT Performance Motor Oil

Extra Weight for Tough Protection

CAR CLINIC

(Continued from page 30)

Engine blows its cork

The 2.2-liter engine of my 1981 Plymouth Reliant has had oil leaking past the head gasket on the driver side. The gasket has been replaced twice—the first time at 22,000 miles and then at 37,000. The service manager tells me it's a common problem and that if it keeps happening, the only solution is to keep replacing the gasket. Is he leveling with me?—Larry Lamore, Enosburg Falls, Vt.

A leak is common, but only because head bolts aren't being tightened correctly. The solution, therefore, is not to keep replacing the head gasket, but to tighten head bolts using the correct sequence. This sequence is described in technical service bulletin (TSB) 09-10-82 and on page 9-70 of the 1983 service manual. Despite the date, it applies to all 2.2-liter engines. Tightening should be done with the engine cold.

Nothing left to say

My 1982 Mercury Cougar Villager runs beautifully until the air conditioner is on; then the engine surges. The dealer tells me this is normal. I can't believe it.

Do you have any suggestions?—Ralph Morris, Wooster, Ohio

None, because the dealer is right—at this point in time, anyway. Ford engineers have yet to find a solution to this one. Your air-conditioning system employs a pressure switch that turns the compressor clutch on and off. When pressure in the system reaches

45 pounds, the pressure switch turns the compressor on to provide cooling. When the pressure in the system drops to 25 pounds, the switch turns the compressor off. What you call a surge is the reaction to the changing load on the engine by the compressor clutch as it turns on and off.

Ford says that the surging "should

A change in SOP

After years of saying no, some car and oil filter manufacturers are now saying maybe to a change in standard operating procedure. Should you use a filter wrench to tighten an oil filter? There had been fear that using a wrench might lead to overtightening a filter, making it difficult to remove the filter.

Well, you still have to be careful. However, to make sure you won't lose oil because the filter is too loose, it is now okay to use a wrench if you do it with finesse. First, tighten the filter as much as you can by hand. Then, start the engine and let it idle a couple of minutes. Turn it off and run your finger around the seam between the filter and its mounting surface. If your finger comes away with oil on it, attach the wrench to the filter and turn clockwise one-half turn more. Repeat the test. You can tighten most filters with a wrench one full turn.

TIGHTEN,
BUT DON'T
EXCEED ONE
FULL TURN



There are two rechargeable lights in this picture.



The one that's still shining is Ready-Lite.

There are two well-known brands of rechargeable light. But the difference between them is like night and day.

Ready-Lite shines more than 2½ hours on a single charge. The other light can't.

Ready-Lite stands on its own and swivels its beam to put light where you want it, and to leave your hands free. The other light doesn't.

Ready-Lite can switch from a wide beam to a narrow, focused beam. The other light can't.

And Ready-Lite will hang on to its power, ready for emergencies, even if you don't turn it on for months. The other light may not.

The other light can't match Ready-Lite.



READY-LITE™
From the makers of **First Alert®**

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Yes, you can make \$1000 a month and more with just a hack saw in your spare time.

Will I Get Rich?

No, you will not get rich, but you can make over \$1000 a month in your spare time and have a ball doing it.

I tried all those "Get Rich" gimmicks that are advertised, that never tell you anything until you've sent them your \$25, and then you find out their gimmicks were not for you. Well, I've tried them all and I'm still not rich.

All I ever wanted was something I could do in my spare time with my hands, make a little money and enjoy myself and not have to buy \$3000 worth of tools or merchandise to do it.

Believe It Or Not

I found the most enjoyable and profitable business working with my hands and the only tools I use are a hack saw and measuring tape. The really nice thing about it is any man, woman or ten-year-old can do it.

What Do I Do?

I make beautiful indoor/outdoor P.V.C. pipe furniture. Such as chairs, lounges, tables, swings, and all kinds of baby furniture out of P.V.C. pipe; even birdhouses and feeders. P.V.C. pipe furniture is the hottest selling furniture on the market today, because it is unique and beautiful and will not rot or rust and it will virtually last a life time.

Profit Unbelievable!

The fantastic part of this business is the profit.



Just go look at some of this furniture in the stores and see some of the unbelievable prices it is selling for.

A chaise lounge that costs \$62.25 in material and three

hours of work is selling for over \$228 in the stores. I can sell my chaise lounge for anything I think my labor is worth. For once, the big manufacturing companies cannot compete with me or you on prices. You will find you will have more orders than you want!

Where can you buy the P.V.C. Pipe?

You can buy the P.V.C. pipe from any local hardware store to start. Plus I will supply you with the names and addresses of cushions and pipe manufacturers who will sell to you wholesale, plus I will supply you with my shop manual and six detailed shop drawings with pictures and measurements of six different designs.

Do you need my shop drawings?

No, you don't need my shop drawings unless you want to save hundreds of hours of trial and error work and thousands of dollars that I had to spend before I finally

found the right design and measurements and tricks to the manufacturing of P.V.C. pipe furniture. I only wish that when I started, I could have bought these shop drawings and I would have gladly paid \$100 for just one of them.

I will pay you!

Yes, I will pay you \$25 for any unique design shop drawing that I can use in my collection and workshop manual.

How do you start?

1) Decide if you like to work with your hands to create things and want to make money.

2) Can you afford \$12.00 for my shop manual and six drawings.

3) Send me your name and address along with your check for \$12.00 to:

Philip E. Brancato Sr.
P. O. Box 237 P4
Riverview, Florida 33569
(813) 677-6948

Please allow about two weeks for delivery.

not be objectionable," unless the cycling occurs frequently and causes an almost constant surge. Frequent cycling results if the air-conditioning system is low on Freon. If the dealer has charged the system, well, live with it or trade.

Shock treatment

The water-pump bolts of my 1980 Plymouth Horizon keep loosening. The result is an antifreeze leak until I can get around to tightening the bolts again. Isn't there any way to tighten them permanently?—Don Schadow, Rapid City, S.D.

Nuts and bolts that loosen are common to cars with four-cylinder engines, since four-bangers have a greater tendency to vibrate.

Try what I did on a K-car that's still holding up after 20,000 miles: Buy some lock washers and a tube of anaerobic, thread-sealing compound.

Smear the threads with the anaerobic adhesive, install the washers and tighten the bolts to the specification given in the service manual, which for your water pump is 250 in.-lbs.

Don't exceed this specification, since you can distort the water-pump housing.

A helping hand

I have trouble changing the oil filter of my 1981 Chevrolet LUV truck with diesel engine. The problem is caused by a rubber ring that fits between the oil filter mount on the engine and the oil filter gasket. If this ring, which is the same size as the oil filter gasket, isn't held in position just right, the two assemblies don't come together properly. I've already lost 10 quarts of oil, but what do you do if you don't have three hands?

A mechanic at a dealership told me he coats the ring with glue to keep it properly positioned as he installs the filter. But I'm wondering if this is wise. Won't glue flake off as it dries and contaminate the oil?—William C. Lamirande, Bay City, Mich.

It may. On the other hand, coating the ring with a lithium-base grease or a pipe sealer containing Teflon will not foul the oil, since both substances are compatible with oil. Use either of these instead of glue. **PM**

DO YOU HAVE A CAR PROBLEM?

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 discussed in the column.

SERVICE TIPS

■ Pontiac advises that some 6000 and Phoenix models with 2.8-liter V6 engines built early in the 1983 model year may exhibit "engine roughness," which is most evident at idle, but also during acceleration and at steady driving speeds. The condition is caused by stray electronic signals received by the distributor module. The solution is to reorient the distributor module and reroute wires as explained in TSB 83-T-5.

■ Some 1983 Mustangs, LTDs, Capris and Marquis with 3.8-liter engines were sent out into the world with oil dipsticks belonging to 2.3-liter engines. That's why the one in your car may be showing an overfilled crankcase although the specified five quarts of oil are in the engine. The correct dipstick (part No. E2DE-6750-AA) for the 3.8-liter engine measures 23.7 in. from the tip of the stick to the top of the cap. If the dipstick you have measures 26.1 in., return it to the dealer and get the right one. The stick may also have a part number embossed on it, so you can tell at a glance if it's the right one.

■ The correct toe-in for your 1982 Chevy Citation or Celebrity is not the one shown in the service manual. Remind whoever is doing front-end alignment that Chevy now says the correct spec is $0^\circ \pm .50^\circ$ (0 mm \pm 0.5 mm).

MORE THAN TWICE THE TOWING POWER OF ANY IMPORT PICKUP.

CHEVY S-10 MAXI-CAB.

An available V6 and a heavy-duty trawling package let a Chevy S-10 Maxi-Cab haul up to 5000 lbs., including trailer and cargo. That's more than twice as much as Datsun or Toyota pickups offer.

Coupled with a heavy-duty payload option, the V6 Maxi-Cab's payload rating is 1500 lbs., including people and cargo. That's even bigger than payload

ratings for some *full-size* pickups.

S-10 Maxi-Cab has a roomy 14.6-inch cab extension on an extra-long 123-inch wheelbase. A Maxi-Cab with standard bench seat gives you up to 40% more behind-the-seat load space than Datsun's extended cab.

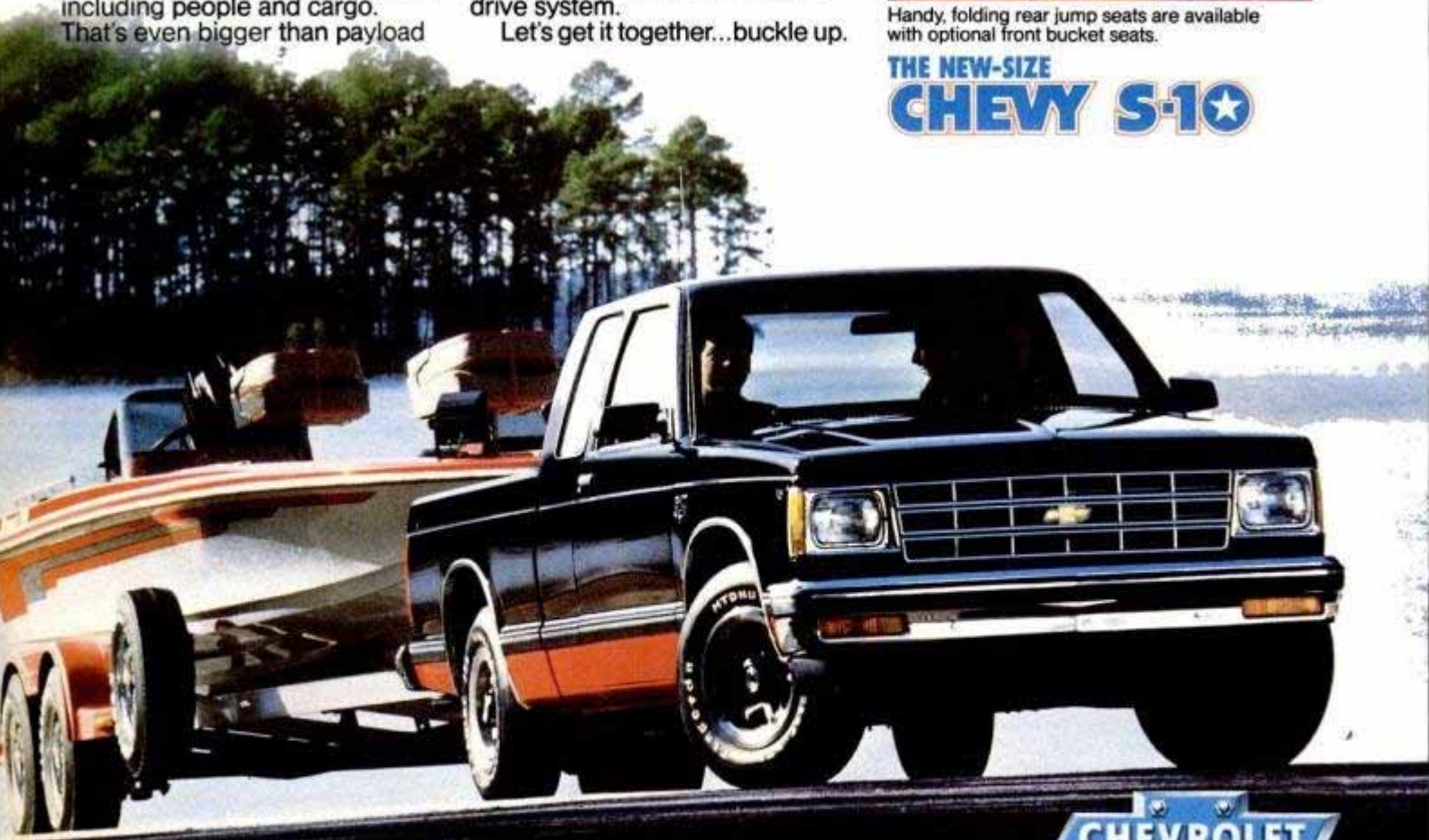
New-size Chevy S-10 Maxi-Cab is also available with the revolutionary Insta-Trac 4-wheel-drive system.

Let's get it together...buckle up.



Handy, folding rear jump seats are available with optional front bucket seats.

THE NEW-SIZE
CHEVY S-10 ★



CHEVY S-10 MAXI-CAB



TOUGH CHEVY TRUCKS ARE TAKING CHARGE

SCIENCE WORLDWIDE

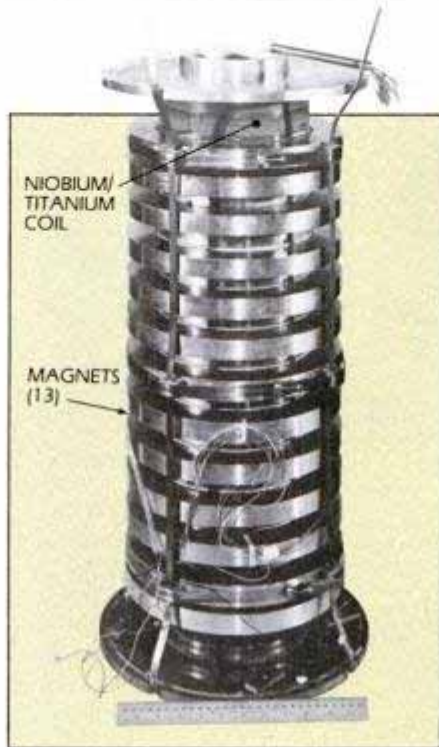


Strong attractions

Most of us live far away from the generating stations that supply our electricity, so utilities send it to us on long lines. But that's costly, since much of the electricity is lost through electrical resistance. Soon, however, there may be a way to decrease the loss.

Argonne National Laboratory has developed a superconducting magnet—similar to, but more powerful than, one developed at Brookhaven—that could cut resistance on a power line to near zero. Its first application, however, will be as a "lens" to guide an electron beam in an atom smasher.

At 5 tesla, the magnet is over 100,000 times more powerful than the Earth's magnetic field. To achieve near-zero resistance in a current-carrying wire running through it, the magnet's niobium-titanium coil contained inside 13 magnetic discs surrounds tubing filled with nitrogen gas that brings the wires' temperature to near absolute zero.



Special coil and 13 disc magnets give more pull than Earth's magnetic field.

time because the embryos die of various causes before implantation. Often, the embryos are weak because of damage done to the ova when it is frozen to await processing. Now, a report in the journal *Biotechnology* says several researchers have increased the embryo survival rate by removing the ova at specific hours after it's produced in a cow ovary. Well-selected ova, the article says, go on to become healthy embryos in over half the cases.

Arctic haze has red tint

The phenomenon called "arctic haze" has caused some climatic changes in the Great North. The haze is believed to be a combination of acid rain and other pollutants that have increased cloud densities and warmed the arctic air. University of Rhode Island oceanographer Kenneth Rahn, working for the U.S. Office of Naval Research, says his work in the arctic with University of Alaska researcher Glenn Shaw indicates the haze is coming from central Russia, probably in a highly industrialized area. Using satellite photos, they're trying to find the source. **PM**

The sun skips another beat

The biggest scientific disappointment of 1979 was the lack of sunspot activity. It was supposed to be a peak year in the theoretical 11-year sunspot cycle. Now it turns out that 1982 was just as disappointing, but for the opposite reason: Last year, sunspot activity was supposed to be very low. But Stanford researcher John Katsufakis, who was trying to measure the Earth's magnetic field from an Antarctic station, says there was so much sunspot activity that the planet's magnetic field was seriously disturbed. He says he has no explanation.

Run to catch the Shuttle

Have you entered PM's Space Shuttle Contest yet? Final entries are due by the end of July (see rules on page 102, Apr. '83).

First prize—supplied by the Bushnell Div. of Bausch & Lomb—is a trip for two to the Shuttle launching and a Criterion 4000 telescope with a 4-in. aperture. Second prize is a Celestron C-90 spotter scope. And we've added a

third prize—Edmund Scientific's 2001 Astroscan telescope.

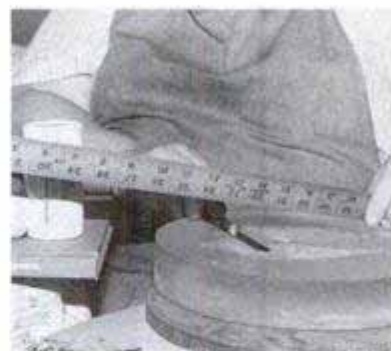
New arthritis drug: aspirin

Aspirin periodically makes an appearance in a new role, and it's happening again. University of Vermont researcher John Bland—in an article in the medical journal *Therapaeia*—goes so far as to call the old standby "a wonder drug." Osteoarthritis, which keeps more than 150,000 Americans in wheelchairs, is little understood. But Bland reports in working with patients he found that aspirin, exercise and bed rest got many of those whose cases were diagnosed as "irreversible" out of their wheelchairs and walking. In recent years, aspirin also has been used to treat blood disorders.

Frigid embryos last longer

In developing new cattle for important traits, scientists have to remove ova from cows, fertilize the ova and implant the embryo that comes of that fertilization. This procedure fails about half the

Mirror on the bench



PM photo: Steven Eskow

With a feeler gauge and yardstick, I'm taking a rough measure (above) of the curvature of an Edmund Scientific mirror blank. Under the blank is a glass disc-grinding tool. By pouring aluminum grit on the tool and turning the blank against that rough surface for about 60 hours, I will have the mirror for a telescope we'll use to photograph Halley's Comet in 1984. Virtually all the observations of the comet will be made by amateurs.

Free.

Up to \$120 worth of free merchandise with every new 8" Black & Decker Professional Bench Grinder.
Up to \$56 worth with each 6"/7" model.

Get the new Professional B&D 8" or 6"/7" Bench Grinder with the industry's highest HP, and get a bonus. Up to \$120 worth of accessories of your choice. Free. Including goose neck lamps, wire-wheel brushes, powerful Spotlitter™ lights, even a heavy-duty bench grinder pedestal.

Both new bench grinders have the wide wheel clearance for easier grinding, and wide wheel guards for wide wire-wheel brushes. And both have integral exhaust chutes, 3-way tool rests, sealed motors, and $\frac{1}{4}$ approval.

Your nearest participating Black & Decker Distributor or Dealer has all the details. See him before this offer ends.



B-D Black & Decker

Industrial/Construction Division, Hampstead, MD 21074

KA-BAR WAS THERE!

The legendary Ka-bar quality and performance that the U.S. Marines relied on and fought with during World War II is built into today's full line of Ka-bar knives.

Forged by Marine tradition, Ka-bar knives offer outdoorsmen unsurpassed craftsmanship for long life in the most demanding applications.

Built to rigid specifications, these dependable knives combine the finest honed stainless and carbon steel blades with handsome, functionally designed handles. Continuing in the proud tradition of the past, Ka-bar remains the standard by which all other knives are compared.

KA-BAR®
by
COLE

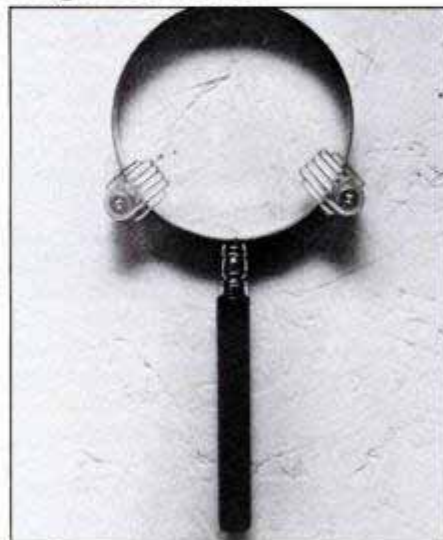
March 14, 1945. The raising of the U.S. flag by Marines on the island of Iwo Jima in the Pacific marks the end of 3½ weeks of fighting.



(For a framable print of this finely rendered flag raising scene at Iwo Jima and a coupon worth \$1 off the purchase of any Ka-bar knife, send \$1.50 to: Ka-bar Print Offer, P.O. Box 6983, Cleveland, Ohio, 44101.)

PM PHOTO HINTS

Magnifier holder



Every photographer knows how handy a magnifying glass can be to examine slides and negatives. Make a wall holder from two plastic, wall-mirror brackets as shown.—A. Weber

Diffusion screens



To make your own diffusion screens, cut the upper lip from a plastic food container and slice out inner surface. On the resulting frame, stretch material such as panty hose.—A. Weber

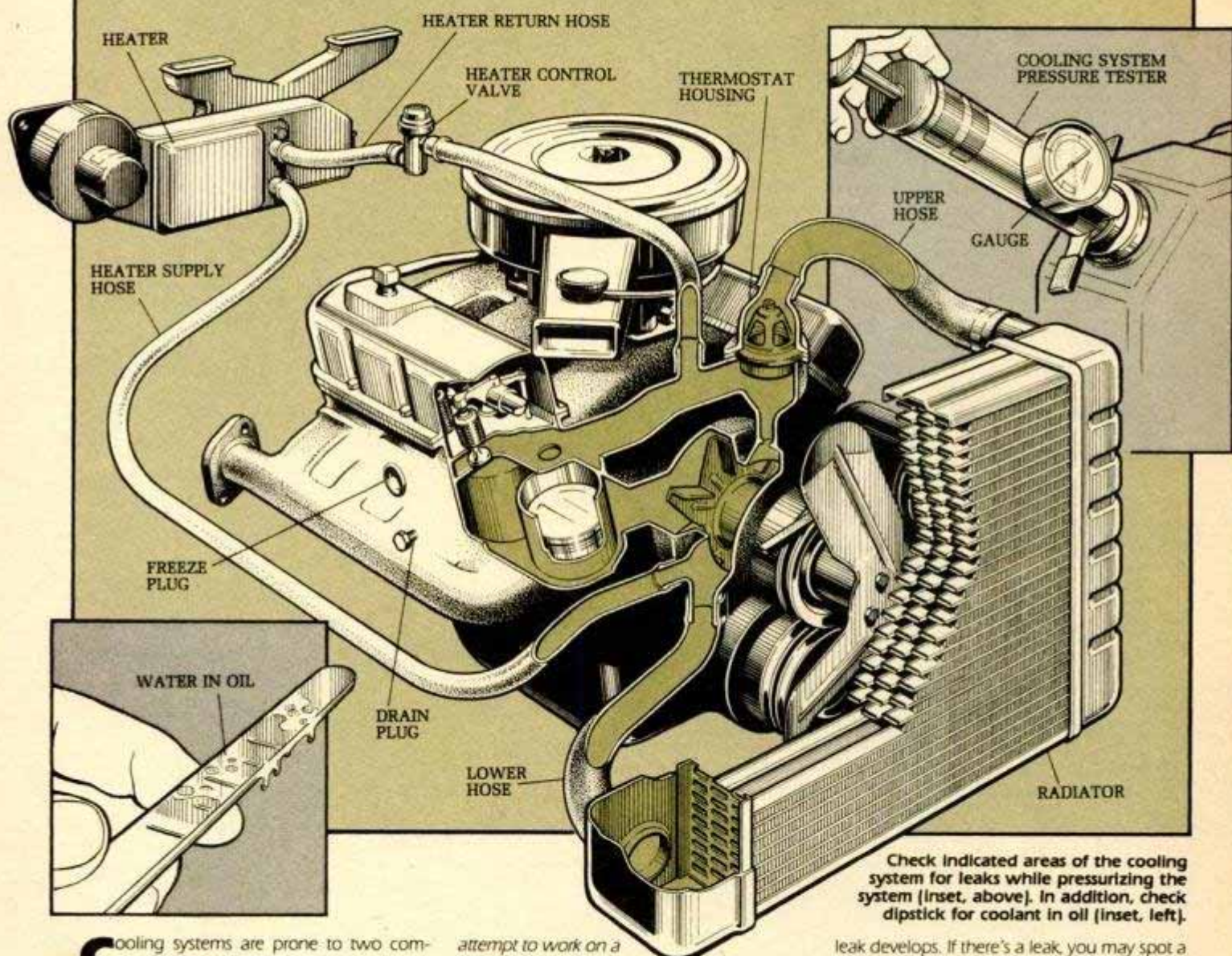
Locket-sized images



Trial and error with a Polaroid camera produces locket-sized images. Adjust distance to subject to get larger images (left) or smaller images (right) to be centered.—Jose Corté

Troubleshooting Your Cooling System

BY MORT SCHULTZ *Part 2*



Check indicated areas of the cooling system for leaks while pressurizing the system (inset, above). In addition, check dipstick for coolant in oil (inset, left).

Cooling systems are prone to two common types of maladies: leaks and clogging. Both problems can result in an overheated engine and possible terminal engine damage. But both can be prevented, in most cases, if you take the time to understand how your cooling system works, then take proper preventive steps. Repairs are another matter we'll discuss later.

But first, remember this caution: *Never*

attempt to work on a hot cooling system. And never open a radiator cap on a hot system. The coolant is under pressure and is hotter than boiling water. Make sure the system is well cooled down.

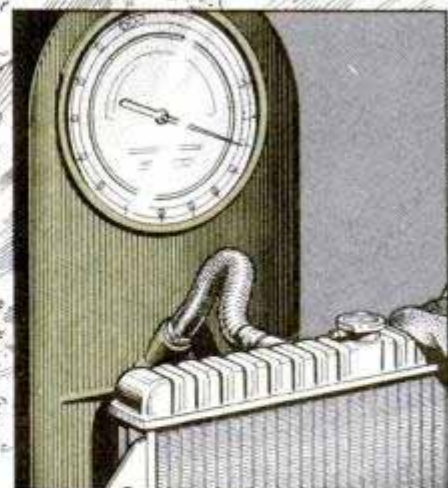
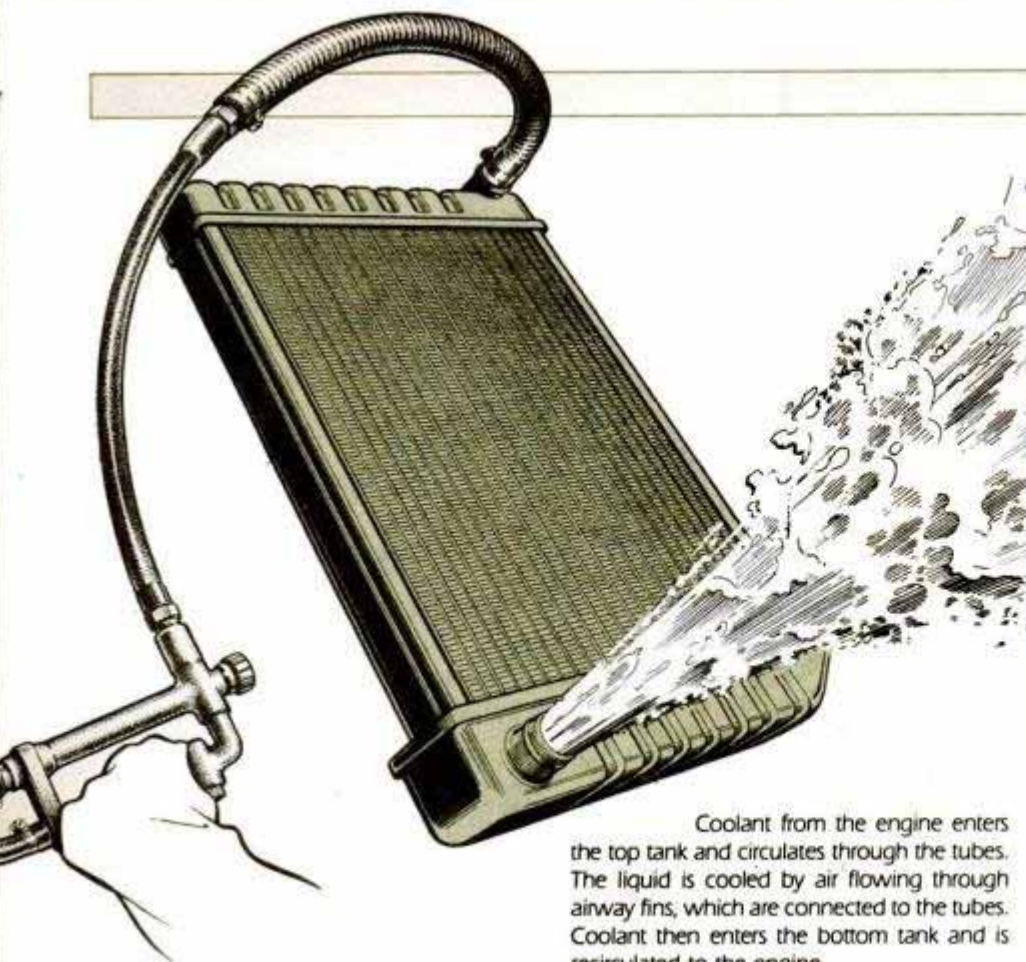
Now, let's take a look at the problems.

Leaks

A cooling system is a sealed system. Coolant is lost only if it boils and evaporates, or if a

leak develops. If there's a leak, you may spot a puddle under the car. If there's no puddle, the leak may be internal. So how do you know if your cooling system is sound? You can make an accurate evaluation by using a cooling system pressure tester, as we described in Part 1 in April (page 39).

Leaks often occur around the top hose connector. This is a weak-link point. Cooling system pressure is greatest here, and the connec-



A good radiator shop will blast out blockages (left) and flow-test a radiator (above) before attempting any repairs. If it fails the flow test, it's dismantled and fixed.

tors put a tug on the hose. Another place where leaks occur is the seam between the top tank and top header plate. The header plates (there's also a bottom header plate) are those parts of the radiator core to which the top and bottom tanks are soldered. Leaks happen when solder falls apart due to excessive pressure, heat and/or corrosion.

Leaks are also common at the corners where top and bottom tanks join the header plates. Corners flex as they alternately heat and cool off. This expansion and contraction may cause corner seams to open.

Less common are leaks from a split tank and from radiator tubes. There are a bunch of these tubes running from the top to the bottom header plates.

Clogs

Tubes clog more often than they spring leaks. To prevent clogging, which keeps hot coolant trapped in the radiator, the cooling system has to be kept clean. This means draining and flushing the entire system, and then refilling it with new ethylene glycol anti-freeze.

An annual treatment is recommended for newer radiators with $\frac{3}{8} \times \frac{3}{32}$ -in. tubes. With older radiators, which have tubes that are $\frac{1}{2} \times \frac{3}{32}$ in., you can get by with a 24-month cleaning.

Identify your radiator

There are two types of radiators: downflow and crossflow. Downflow radiators have tanks on the top and bottom of the core. Crossflow radiators have tanks on the sides of the core. The core is that portion of the radiator consisting of tubes and airway fins.

Coolant from the engine enters the top tank and circulates through the tubes. The liquid is cooled by air flowing through airway fins, which are connected to the tubes. Coolant then enters the bottom tank and is recirculated to the engine.

Radiators may also be classified according to the materials from which they're made—all metal or a combination of plastic and metal. The majority of cars have all-metal radiators. For the most part, tanks, header plates and tubes are brass, and airway fins are made of copper.

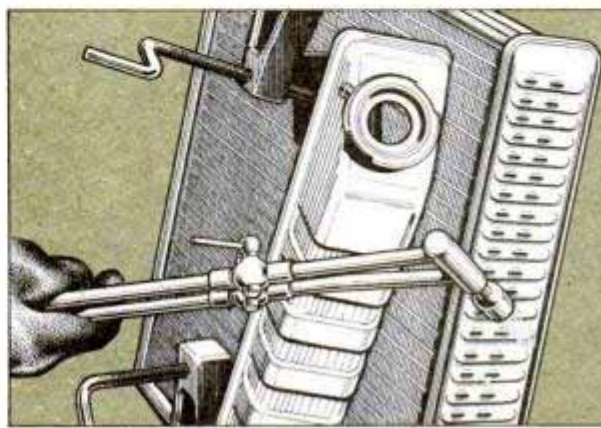
In recent years, car manufacturers—Ford, GM, VW and most Europeans—have used radiators with plastic tanks and aluminum or copper cores.

If a plastic tank should spring a leak, a special welding unit is needed to seal it. This unit consists of an electric blow-type gun, similar to a hair dryer, for applying a glass-impregnated sealing material. Plastic radiator tanks are made of glass-impregnated nylon that resists high temperature and pressure.

If the radiator in your car springs a leak, you're going to face these choices:

- Should you try to repair it yourself?
- Should you take it to a radiator repair shop?

Part of the repair procedure for your car's cooling system is to remove all rust, scale and deposits from the core and the tube with a torch. The header tanks are removed for this operation and cleaned.



- Should you buy a new radiator from a dealer parts department?

Chemical sealing agents

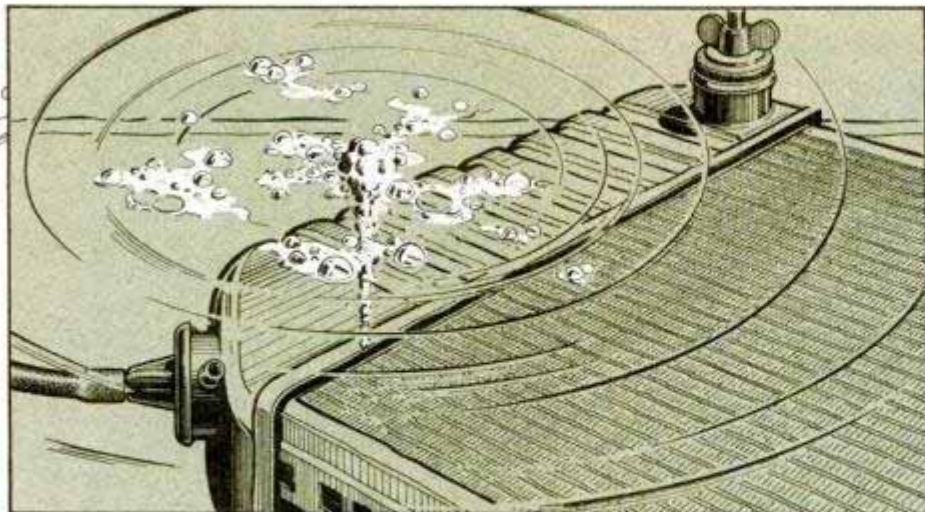
The first inclination probably is to try to repair it yourself, using one of the many chemical sealing agents on the market. Can a chemical sealer stop a radiator leak?

"Only if the leak is not a structural leak," Frank Finger of Finger's Radiator Hospital in North Brunswick, N.J., points out. "Chemical sealers are only effective for stopping champagne leaks." A champagne leak is a small leak from a porous area, usually a tube. But a chemical sealer may clog narrow tube passages, especially if they're already partially restricted.

Use a professional

Should you try to repair a leaking radiator yourself? No. It's a waste of time and effort. Chances are slim that your repair will be effective. Even if you have experience in soldering and have the necessary equipment, you can't just lay a bead of solder on top of a leaking area. It won't work. Here's why.

Suppose there's a leak from a top tank-header plate seam. This area accumulates a thick coating of corrosion between the under-



After sealing all the openings, the initial leak test is performed by pressurizing the radiator with compressed air and immersing the unit in water. Bubbles rising to the surface will pinpoint leaks immediately and will provide an indication of their seriousness.

side of the tank and along the inside of the header plate. To close this leak, solder has to flow—by capillary action—under the seam to seal the opening from the backside. Solder won't flow and take hold in areas where corrosion exists. In other words, the tank has to be removed and cleaned thoroughly. So does the header plate. Are you equipped to do this?

If the leak is from a connector, the connector has to be cut away and the area cleaned. A new connector then has to be soldered to the tank. Again, simply laying solder along the joint usually doesn't work.

How about a pro?

Yes, there are fly-by-night radiator shops. So how can you be sure the one you go to is reputable? Other than the obvious—talking to friends and relatives who have been in your boat—one way is to find out if the shop is a member of the National Radiator Service Association. About 30 percent of the radiator shops in the country belong to this group. Generally, members are competent and familiar with modern repair techniques. However, if a shop isn't a member, it may not be inferior.

So another way of trying to determine if a shop is competent is to find out its procedure for repairing radiators. A shop man-

ager should be willing to give you, as a potential customer, a tour to see firsthand how the facility refurbishes radiators.

Here's the procedure used by a good radiator shop to get a radiator back into shape:

1. The radiator is put into a tank of caustic solution for cleaning. Then, it's sprayed outside and inside with water under high pressure. It's important that radiators be cleaned before they are leak-tested, since foreign matter inside the radiator may block the leak and make it appear as if there's nothing wrong.

2. Next, the radiator is put on a

Core tubes are reamed clean with a wire rod (below, left). A badly corroded header tank is sandblasted to expose bare metal (below). The solder brazing won't hold if there is any dirt or impurity on the metal. Once the tank is clean, flux is brushed on the surfaces to be brazed (right). The flux will allow the solder to flow.

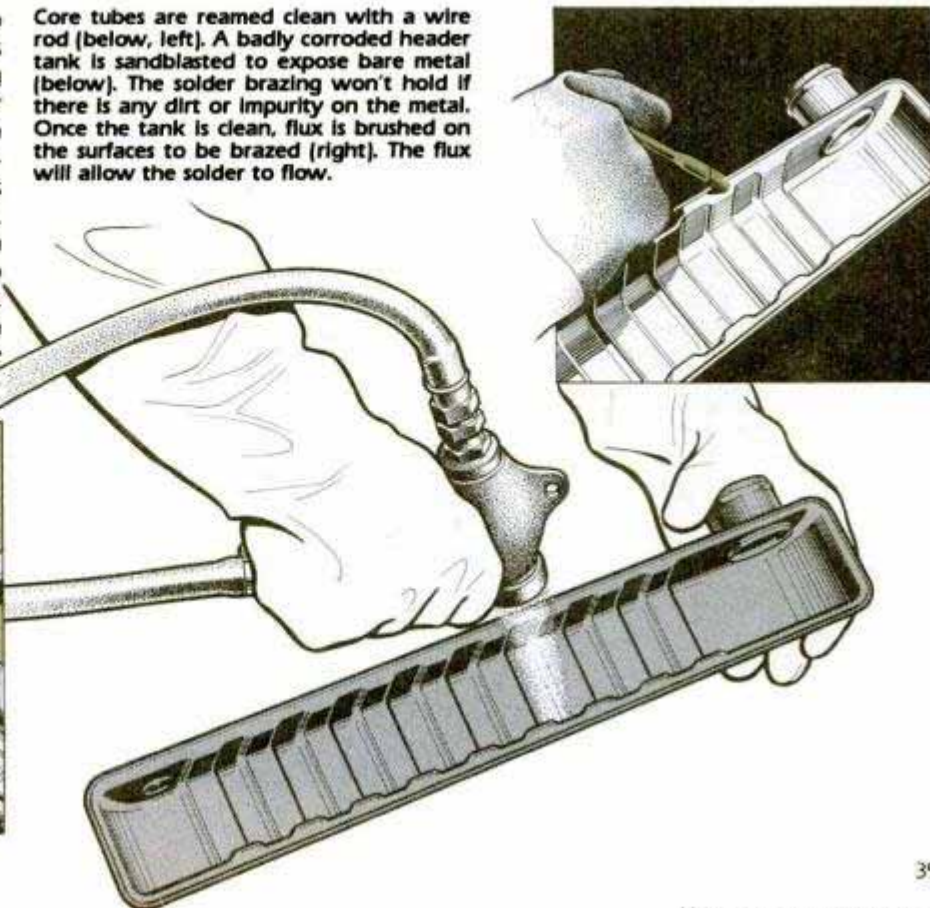
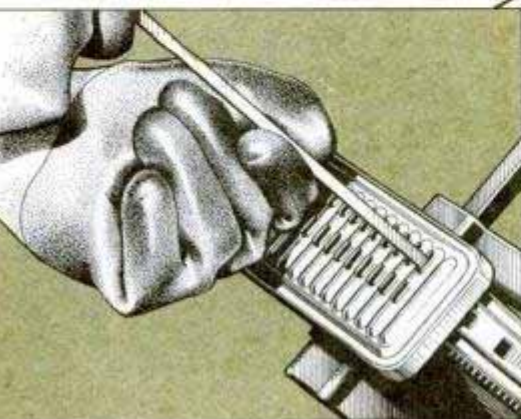
flow tester and water is fed through it, by gravity, to determine if tubes are clogged. The mechanic compares the flow rate to the manufacturer's specification. If the radiator doesn't meet the flow-rate specification, the next step is to remove the tanks and clean the tubes by pushing a rod through them.

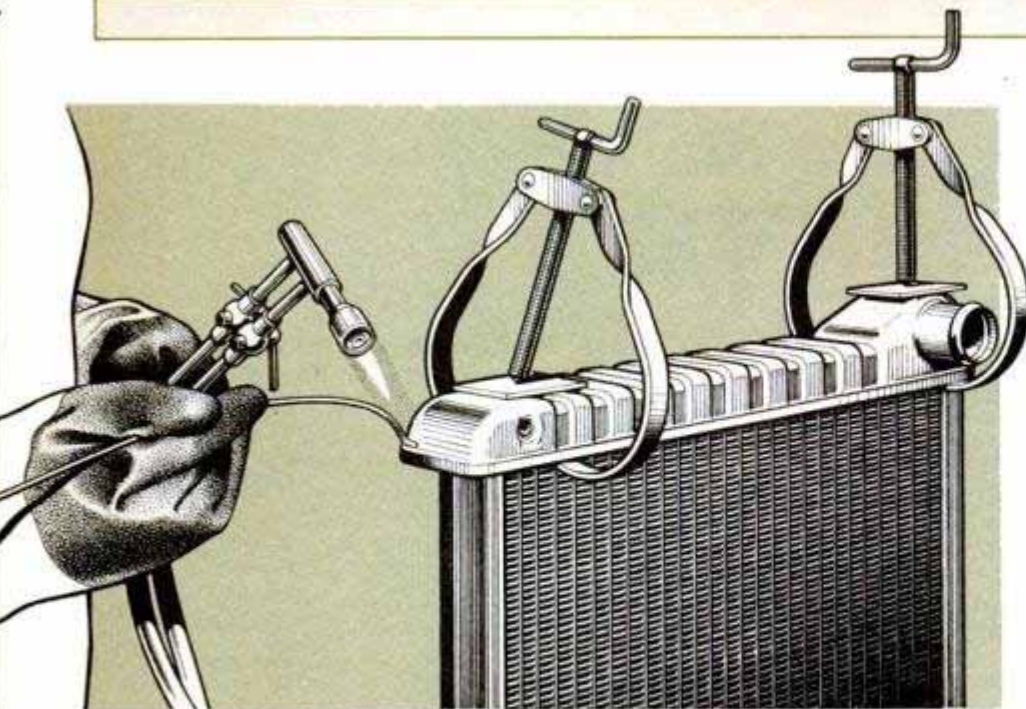
3. Assuming the radiator meets the flow-rate specifications and doesn't need rodding, all openings are sealed, and an air hose is connected to the filler neck. Then, the radiator is dunked into a vat of water, and air at 15 to 18 p.s.i. is shot through it. Bubbling water reveals leaks and indicates their seriousness.

Suppose a tube leaks? If a chemical stop leak won't seal it, there is a way of salvaging the radiator by cutting out the tube and soldering the openings that are left in the header plates. This shouldn't cause any cooling problems unless a car is used for towing a trailer or city driving. Even so, it's worth a try. A new radiator for a subcompact costs about \$90; for a full-sized car, as much as \$200.

4. If the leak or leaks can be repaired, top and bottom tanks are removed from the core and cleaned in a machine that blasts them with abrasive glass beads. Header plates are wire-brushed. If a core is leaking and it can't be salvaged, top and bottom tanks usually can be removed from the old radiator, cleaned and soldered onto a new core. This saves the cost of new tanks.

5. Before tanks are soldered back





To repair a leaky header tank, you should have a professional clean the unit thoroughly, then braze it. Remove dirt and corrosion before brazing so solder can take hold.

onto an old core that can be salvaged, airway fins are examined and bent fins are straightened.

Remove the radiator yourself

How much do radiator shops charge? Finger's, which has been in business since 1929, charges \$40 if a customer brings in the radiator and adds another \$27 if they must remove and reinstall the radiator.

It isn't particularly difficult to remove and reinstall a radiator. First, drain the cooling system, remove hoses and disconnect any automatic transmission oil cooler lines. Be careful with those oil-cooler fittings. They're brass and delicate. Many do-it-yourselfers damage them when they take off or reinstall cooler lines. If fittings are damaged, coolant will leak and new fittings will have to be installed, adding to the cost.

Remove parts blocking the radiator, such as the fan shroud and fan. The radiator is held by bolts that attach the radiator mounting brackets to the vehicle. Remove them and draw the radiator out of the car.

Buying a new radiator

If your radiator is shot and you have to buy a new one, get the exact one for your car. By exact we mean one with the correct dimensions.

The best way to order a radiator is to use the original equipment manufacturer number, which is found on the radiator. The number may be on the top tank, on the mounting brackets or on the filler neck. If you can't find the number or if it's been obliterated, determine the radiator you need by measuring the height, width and thickness of the old radiator. Only the core is used for measuring, not the tanks.

Make sure the radiator is in an upright posi-

tion; that is, with the filler neck opening facing up. Measure thickness by inserting a length of wire or a thin rod through an airway fin until its end is flush with the other side. Mark the wire or rod and then measure the amount that penetrated the fin.

Don't be fooled into thinking that height is an up-and-down measurement and width is a side-to-side measurement with a crossflow radiator. Height is between the tanks; width is between the mounting brackets.

The ethylene glycol story

One thing's for sure. If you practice sound maintenance, the chances of getting a radiator leak during the life of your car is minimized. Good maintenance involves flushing the cooling system once a year and refilling it with a fresh mixture of ethylene glycol antifreeze, which leads us to another subject—ethylene glycol.

You shouldn't use just any antifreeze. There

are superior and inferior products. The inferior ones don't contain ample additives to protect the cooling system against corrosion. How can you tell which antifreeze is better? Sticking to a brand-name product is your best assurance.

Aluminum parts

If you don't have aluminum components in the cooling system—radiator core, water pump and/or cylinder head—you can use any ethylene glycol antifreeze. However, if your engine contains aluminum parts, a special formulation is needed to resist corrosion better. Aluminum is more susceptible to corrosion than other metals used in automobile cooling systems.

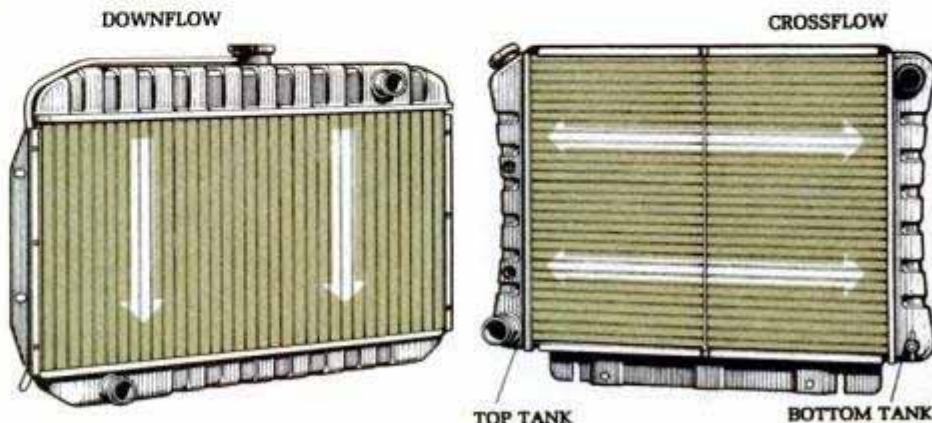
How do you know whether the ethylene glycol you buy is suitable for aluminum? It will say so on the label. If it doesn't say so, don't buy it.

Once you've got your antifreeze, don't try improving it with additives. You may upset the chemical balance. Remember: Your name's not, for example, BASF Wyandotte, which makes Alugard; Dow, which makes Dowlgard; DuPont, which manufactures Zerec; Northern Petrochemicals, which makes Peak; or Union Carbide, which manufactures Prestone.

Caustic solutions

Aluminum radiators and engine components can also be destroyed by caustic solutions found in some cleaners. To avoid damage, make sure the cleaner you buy says it's recommended specifically for aluminum components.

In fact, to avoid complications, GM recommends that you never use any chemicals to clean an aluminized cooling system. Instead, reverse flush with plain water. Remember, too, that an aluminum pressure cap and an aluminum petcock or drain plug has to be used with an aluminum radiator. Using parts made of another metal causes galvanic action that leads to corrosion. Stay cool. **PM**



Whether your automobile has a crossflow radiator or a downflow radiator, the basic operating principles are the same. Water flows from the top header tank to the bottom header tank through the cooling fins. Heat is carried off by the rushing air.

Save Gas, Save Engine with 'POLY'

The following introduces one of the most fully tested and credentialed gas-saving, friction-reducing engine treatments ever to reach the market!

WHAT IS POLY? "Poly" is short for polytetrafluoroethylene (TFE). It is the slipperiest substance known to man (1981 Guinness Book of World Records, p. 188). The Petrolon Corporation, makers of Slick 50, has invented a way to permanently bind this slippery chemical to your engine with one treatment. All you do is add one quart of Slick 50 to your oil during oil and filter change. By reducing engine friction, Slick 50 increases gas mileage and horsepower and reduces engine operating temperature, thus causing your oil and engine to last longer. Just as important, it reduces metal wear, defraying costly overhauls.

HOW DO I KNOW THIS ISN'T A FRAUD? Slick 50 has some very impressive credentials. The "Consumers Digest" magazine (March/April, 1982, p. 35) states "Slick 50 does reduce engine heat and ordinary wear, and our informal tests indicate that it will improve gas mileage by about 2 or 3 miles per gallon." Researchers at the Franklin Institute Research Laboratory, after applying a powerful ultrasonic cleaning process to a Slick 50 treated engine, were surprised at its permanence. They stated, "We actually expected the Petrolon Slick-50 TFE Resin coating to also be removed, but later found it was still there."

The FAA (Federal Aviation Administration) has fully accepted Slick 50 Aircraft Piston Engine Treatment (F.A.R. #33.49). An FAA test simulating 1400 hours of engine use (equivalent to about 70,000 miles on a car) showed almost zero engine wear!

2500 miles after removing Slick 50 from the crankcase, tests done at the University of Utah Engineering Experiment Station showed that the benefits of Slick 50 were still there. They reported a horsepower increase of 16.9% and 9.9% for light and heavy loading respectively. The senior engineering researcher at the University of Southern California in San Diego stated this, "Slick 50 does increase horsepower and decreases fuel consumption in tests done at the university." The Space Shuttle Columbia uses the chemical "poly" in its gears and bearings because it is the only chemical lubricant which can withstand the heat and corrosive elements of space.

Perhaps most dramatic of all is a torture test overseen by the Automotive Ser-



vices Council for Pennsylvania and shown on television station WTVE. Three cars with between 75,000 and 129,000 miles on them were treated with Slick 50. Six months later the oil was drained from each vehicle, and the cars were driven without the oil plugs for about a half hour. The water temperature never rose, and the engines sustained no apparent damage. There are many more tests available. If you are still skeptical, send \$2.00 to defray printing and postage costs, and we will send you additional, more detailed test information, etc.

HOW DO YOU TREAT AN ENGINE? Very simply. A few minutes before oil and filter change, add engine flush (sent free with each order) to clean out the engine. Let the engine idle for 10 minutes. Then drain the oil, change the filter, and add the proper amount of oil less one quart. Add one quart Slick 50, drive for 30 minutes, and leave it in the crankcase for 3,000 miles. As the engine operates, the oil carries the polytetrafluoroethylene between the parts where it is burnished into the pores of the metal. Once impregnated, it is permanent, so you do it only once, not each time you change oil. One quart of Slick 50 will treat all standard 4-, 6-, and 8-cylinder gasoline and diesel engines.

WILL IT WORK WITH MOST OILS? Yes, Slick 50 will work with all

petroleum-based oils and all synthetics that are compatible with petroleum-based oils. An exception is graphite oils. However, once an engine is treated, you can go back to a graphite type if desired.

WHAT ARE THE BENEFITS OF SLICK 50? Just about all the benefits you could want for your engine. By reducing friction, Slick 50 does all of the following: It increases gas mileage (mileage improvement may vary due to vehicle, driving habits, geographical area, and weather conditions). It increases horsepower—small economy cars and large RV's really need this! It reduces operating temperatures, thus increasing the lubrication and life of the oil and the engine. Last but not least, the drastic reduction in engine wear defrays or eliminates costly overhauls which could save you up to \$1,000. Slick 50 eliminates the "lubrication starvation" that all cars experience when first started before the oil has a chance to circulate. Up to 90% of the engine wear on a car can be caused by this lubrication starvation. You receive all of these benefits for \$33.95, less than the cost of two tanks of gas.

WILL SLICK 50 HARM MY ENGINE OR AFFECT MY WARRANTY? No! Slick 50 is suspended in an excellent grade of petroleum oil which meets or exceeds every manufacturer's engine warranty requirements. In addition, Slick 50 is the only product of its kind to have both an API (American Petroleum Institute) and an SAE (Society of Automotive Engineers) rating imprinted on the package. It also has a SF-CC-CD service classification.

ARE DEALERSHIPS AVAILABLE? Yes. Here's an opportunity to make handsome profits. Having such solid test results from major institutions makes Slick 50 easier to sell than many other products. Free dealership information is sent upon request.

Free engine flush sent with each order. Free shipping with orders of 2 or more.

For purchase or further information, call toll-free 1-800-525-8624 (in Colorado call 1-303-762-1385) or send to SLICK 50, 3148 S. York St., Englewood, CO 80110.

I enclose \$33.95 + \$3.00 shipping and handling.

I want 2 or more (free shipping and handling).

Check C.O.D. Visa MasterCard

Card No. _____ Exp. Date _____

Name _____

Address _____

(Give street address if possible for UPS delivery)

THE PM GARAGE



Compressed air to go

A small, portable air compressor is the kind of tool you never appreciate until you really need it. One of the best we've ever come across is the Handycraft Super Pump. It operates on 12-v.d.c. power systems and plugs into



The Super Pump compressor will inflate a flat to 32 p.s.i. in about 5 minutes. Built-in gauge is included.

your car's cigaret lighter. Also available is a 25-ft. extension power cord with clips that allows you to hook up directly to the car battery.

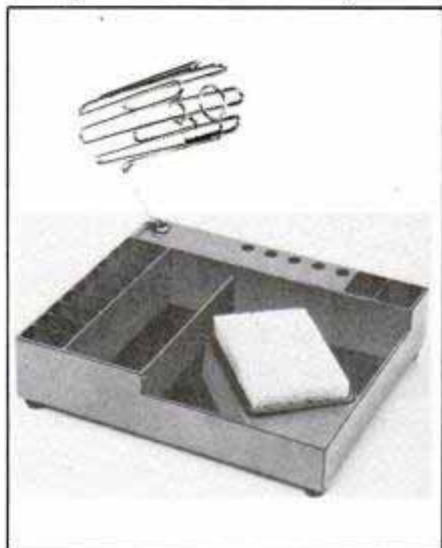
The whole package is high quality, and the working end uses an oilless piston to provide the compressed air. The castings of the compressor are thick and all air fittings are of solid brass. Just below the handle is a 0 to 100-p.s.i. pressure gauge which was 99 percent accurate when we tested it.

The unit comes with extra fittings to inflate footballs, air mattresses and an adapter for a spray gun. It's \$49.95 plus \$3.50 for shipping from I.D. Ratherby, 18480 Bandilier Circle, Fountain Valley, Calif. 92708.—T.A.

minutes. After curing, the material can be sanded and painted with standard touch-up paint. While it won't work for really large holes, it will fix most of those half-dollar-sized craters.

With the kit, you get an excellent 64-page booklet, *The Car Builder's Catalog*, which covers products for repairing, maintaining or restoring a car. The kit is \$18.95 from H.C. Fastener Co., Box P, Alvarado, Tex. 76009.—T.A.

Keep solder stationary



Solder station is made of tough plastic, includes a sponge pad, lots of handy bins.

The next time your soldering iron rolls off your workbench and onto your lap, jump up and remember O.K. Machine's solder and tool station. The small platform is constructed of heat-resistant thermoplastic, which won't melt even if you lay a hot iron directly on the surface.

It also features a sponge pad for tip cleaning. There are lots of small, handy compartments for organizing as many as 15 accessory tools. The tools, however, are not included with the solder station.

The Model SK-25 that I tested is available from electronics stores. You can also order direct from the O.K. Machine and Tool Co., 3455 Conner St., Bronx, N.Y. 10475. Each solder and tool station retails for \$15.07.

—Joel Breault

Super scanner

It's easy to eavesdrop with a Fox BMP 10/60 base, mobile and portable scanner. The scanner has 60 preprogrammed frequencies spread over the popular police, fire, mobile telephone, marine and weather bands. The Fox BMP 10/60 scans 10 channels every two seconds, locking onto any signal. I monitored the Space Shuttle conversations with Houston control.

The mobile mounting bracket fastens to the underside of your dash. Just slide the BMP 10/60 into place, plug the attached power cord into the cigaret

lighter and run a lead to the car's existing radio antenna. It costs \$349.95. Contact Fox, 4518 Taylorsville Rd., Dayton, Ohio 45424.—Joel Breault



Scanner lets you eavesdrop on fire, police and even NASA from car or home.

Rubber bumper saver



Urethane filler repair kit will mend a hole or a gouge in your rubber bumpers.

With the increase in rubber bumpers has come a rash of gouges, nicks and holes. You can fix them with Rapid Patch two-part urethane filler.

Mix equal parts of the filler, stir for one minute and apply with the wooden spatula. It cures, ready to sand, in 15

More horsepower and torque than Chevy S-10!

Ford's Ranger is already the best-selling 4-cylinder pickup built in America. Now it offers V-6 power and performance, too! Ranger's new 2.8L V-6 is available in 4x2 and 4x4 models.

More payload than Chevy S-10. Ranger's 1755-lb. payload option is the largest of any American-built small pickup.

R. L. Polk & Co. CYTD registrations for 4x2 models through October, 1982.

Ford's new Electronic Engine Control, EEC-IV, constantly monitors the Ranger V-6 for most effective performance. It can process a million commands a second!



Widest choice of engines. Only Ranger 4x2

offers two 4-cylinder gas engines and a V-6, plus a new diesel that the Chevy S-10 can't match.

FORD

FORD DIVISION



FORD **V-6** RANGER.

THE MOST POWERFUL V-6 IN ANY SMALL PICKUP!



Get it together—Buckle up.

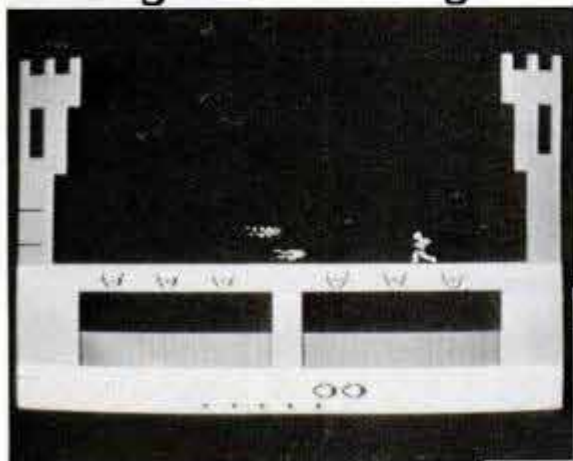
AMERICA'S TRUCK

**TOUGH
FORD
RANGER**

PM VIDEO MONITOR



New game cartridges



In first scene of *Dragonfire* from Imagic (above), you have to make your princely character dodge fireballs and run to tower. Once inside (right), you must pick up the treasure, yet be sure not to let the dragon burn you to a video crisp.

The Atari 2600 system has really caught on. And it seems that everyone is selling game cartridges for it. No longer is this inexpensive system considered to have coarse graphics. The latest programs for the 2600 offer a range of animation, color and downright artistry that the machine's own designers likely never even imagined.

Game play, too, has improved drastically. These new games are just about as wrist-twisting and eye-catching as their coin-op arcade cousins. As we show, many companies besides Atari offer these plug-in games. The competition is hot and furious as so many firms vie for your video dollar. Pictured here are what we consider some of the best game cartridges we've seen recently. All of them will run on the Atari 2600.

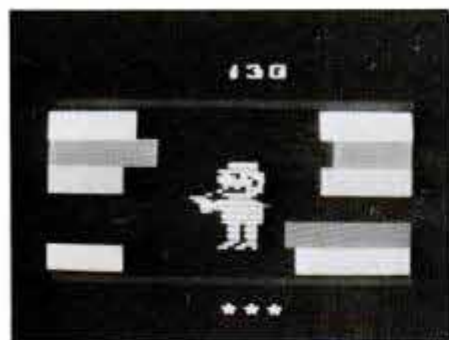
Imagic, with its *Dragonfire* cartridge, has achieved a surprisingly good game based around two scenes. This, we think, will become the wave of the video future and we should see an increase in games that incorporate more than one playing field.

Humor, as in US Games' *Picnic* and Telesys' *Coconuts*, is also on the rise. Violence and video mayhem, it seems, can only go so far before the gamer will sit back and plug in a cartridge with a programmed pratfall.

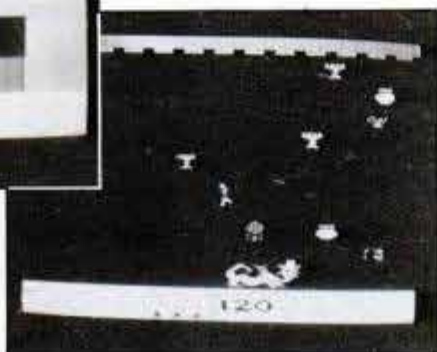
Maze games, such as *Wizard of Wor* from CBS Games, offer faster and harder-to-avoid opponents. Data Age gives us a whole new field of game, the videogame tie-in with rock music: *Journey—Escape* is based on helping the rock group "Journey" escape from a bevy of agents, groupies and undesirables.

By the way, we tried all games in Colecovision's Expansion Module and it does play all Atari 2600 cartridges.

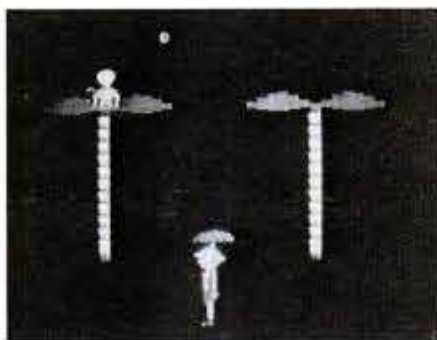
More than ever before, an inexpensive video game console can achieve results similar to the expensive spread.—N.S.



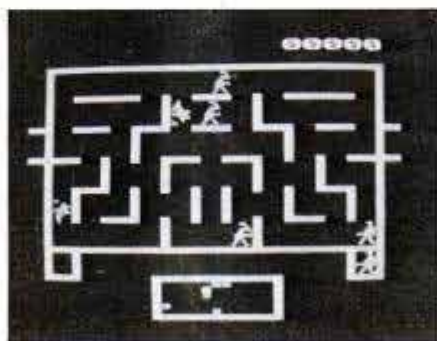
Shoot at and shorten the colorful bars that come at you in this game of *Squeezebox* from US Games. There's a different musical note each time you score.



Watch out for the monkey in this funny *Coconuts* game from Telesys. He wants nothing more than to bean you with a coconut dropped from his hiding place.



The ants are no problem but the flies will devour your sandwiches in *Picnic* from US Games. It's up to you to make the world safe for outdoor eating.



An action-packed maze game, *Wizard of Wor* (CBS Games), rewards not only quick reflexes but the ability to plan strategic movements and tactical plays.



In Data Age's *Journey—Escape*, you help the rock group break away from aggravating agents and greedy groupies. All five musicians must leave safely.



**There's only one way
to play it.**

No other ultra brings you
a sensation this refreshing.
Even at 2 mg., Kool Ultra has
taste that outplays them all.



KOOL ULTRA

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

Kings, 2 mg. "tar", 0.3 mg. nicotine; 100's, 5 mg. "tar",
0.6 mg. nicotine av. per cigarette by FTC method.

© 1982 B&W T Co.

PM LOOKS AT...



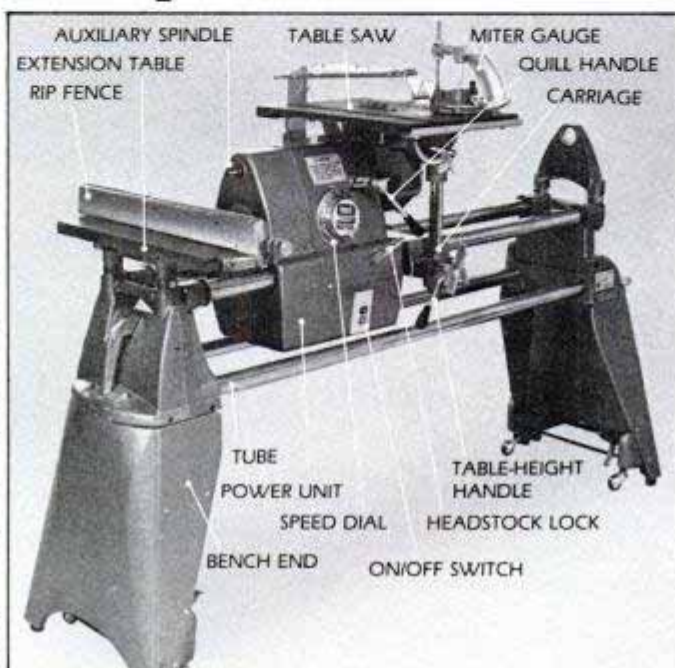
A One-Tool Workshop

Practically every woodworker goes through the same tool ownership evolution. In our early workshop years, being limited in both woodworking skills and funds, we buy tools at the low end of the quality/price scale.

The usual practice is to replace the cheap tools with quality pieces as skills blossom and budgets allow. That's the route I took. Now, after many years of project building, I'm spoiled. I work only with high-quality, professional woodworking tools.

That's why I was especially eager to try the new 5-In-One Tool offered by the Master Woodcraft Machine people.

I admit to being a bit skeptical of a \$1,000 tool that supposedly can perform five different functions satisfactorily. This unit can function as a 10-in. table saw, a 34-in. lathe, a



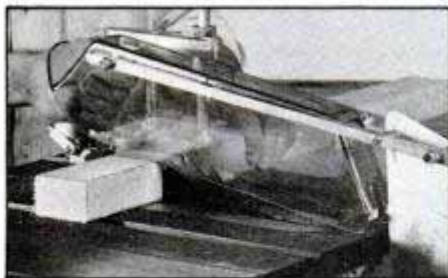
The multi-tool is a compact unit that provides a lot of shop action in very little space. It can be a table saw, lathe, drill press and sander. Author rates the tool as being a good one.

16½-in. vertical drill press, a horizontal drill press and an 11¾-in. disc sander. Discounting the horizontal drill press, which most woodworkers can live without, the other four functions give you the almost instant capability of doing serious woodworking.

Since this tool appeals, for the most part, to a beginning woodworker, I felt that my workshop experience and preferences might disqualify me as an impartial judge, so I asked my 21-year-old son, Jim, an enthusiastic tool user, to work with me on this project. He put the machine together following the manufacturer's instructions. He also ran each of the five tools through its paces, as I did, so we could compare impressions and results.

Setting up the multi-tool
(Please turn to page 48)

Five tools in one



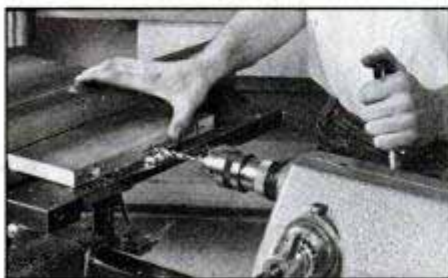
Most obvious use for the multi-tool is as a table saw. Tool comes with the necessary rip fence and miter gauge.



Getting into lathe work is a real woodworking plus. This machine boasts variable speeds and performs well.



After the table saw, the vertical drill press is the biggest shop need. The first chuck that we tried wobbled.



Horizontal drilling may be a luxury for most woodworkers, but it's good to have for use on long workpieces, special tasks.



As a disc sander the multi-tool excels. Here, a splayed leg is held against fence and in a jig, while control (arrow) advances the spinning disc. Such capability is handy for production-type work—like sanding four legs to the exact same length.



HANDLING HIGH-ENERGY EXPERIMENTS IS NO TASK FOR A WEAK SPARK PLUG.



Motorcraft

EXCEEDS THE NEED

Ironically, this experimental performance car uses a standard Motorcraft spark plug dedicated to fuel efficiency. But to remain frugal, these plugs must survive surges that could reach twice the voltage normally produced by conventional engines—including yours. Plugs capable of surviving surges to 38,000 volts: Motorcraft Extended Tip. As you drive, Motorcraft Extended Tip plugs relentlessly burn away power-blocking carbon deposits

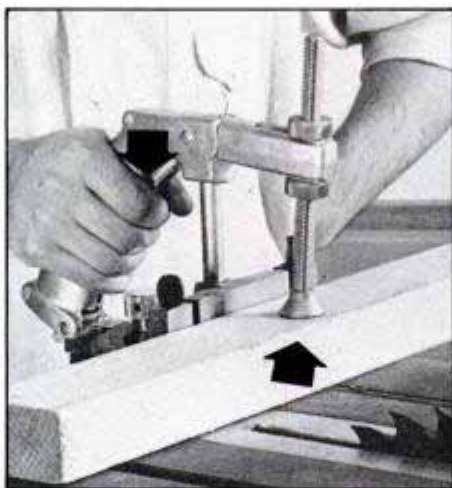
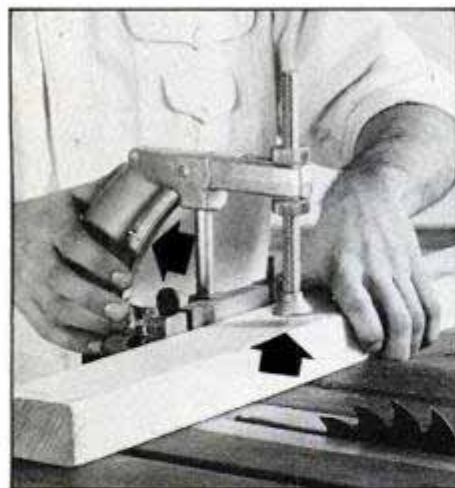


from their electrodes. Thus allowing a cleaner path for the spark to ignite precious fuel mixtures. That means less wasted gasoline in any properly tuned normally driven automobile — no matter how advanced. Motorcraft Extended Tip Spark Plugs. Engineered to eliminate fuel-thieving sooty carbon, without eliminating themselves in the process. Motorcraft. Quality parts for all makes of cars. *Get it together—buckle up.*



ONE-TOOL WORKSHOP

(Continued from page 46)



Well-engineered miter gauge features a handle that prevents workpiece drift. At left, the handle has not been grasped and clamp pad is in the air (arrow). At right, the pad bears down against the wood as the handle is grasped firmly.

requires just a couple of tools and very little time. You should read the brief instructions all the way through before starting. The same advice holds true for setting up the tool in any of its five operational modes. Once you have set up the tool a number of times for each function, you will find that changes are quick and easy to make.

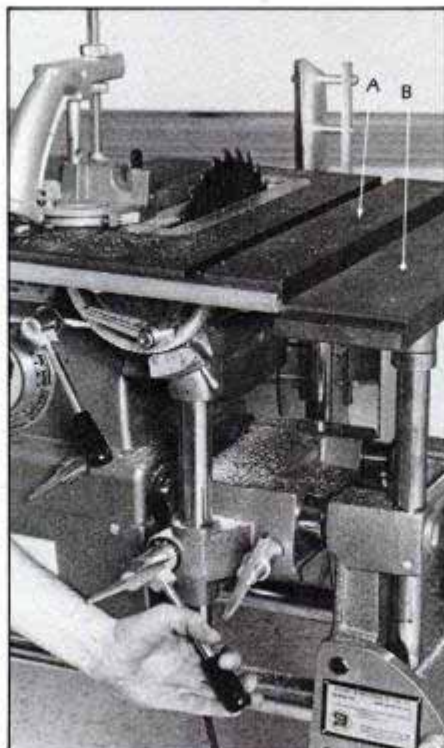
Our machine performed well in all modes, but we had one problem. In the drill press setup, we detected drill wobble, which prevented us from drilling perfectly round holes. After checking out the quill—we were able to do perfect spindle turnings—we deduced that the problem was in the chuck. We contacted the manufacturer, who quickly replaced the chuck. The replacement works fine.

The tool has some interesting design features, including a small table extension that elevates separately to support oversized workpieces (see photo), and a miter gauge that incorporates a work-grabbing shoe when its handle is squeezed.

My conclusion: The multi-tool is an

excellent investment for serious beginning woodworkers, and also for advanced craftsmen with limited workshop space. It moves you instantly from the portable tool class to a position where you can create professional-quality projects. And there's a bonus: You can get in on the great fun of woodturning.

In an era when American technology and production methods are routinely disparaged, it was, indeed, a happy surprise to come across a tool that is both well engineered and a real pleasure to use.—Harry Wicks, Editor, *Home and Shop*



To adjust saw blade for depth of cut, table is raised or lowered (A). Once set, the auxiliary table (B) is then adjusted.

SPECIFICATIONS— 5-IN-ONE TOOL

GENERAL—Speed: variable, from 900 to 5,400 rpm; Power: 1½ hp; Quill feed: 4¼ in.; Price: \$999.

TABLE SAW—Blade dia.: 10 in.; Maximum depth of cut: 3¼ in. at 0°, 2½ in. at 45°; Tilt table range: 0 to 45°.

LATHE—Distance between centers: 34 in.; Swing over ways: 16½ in.; Ways: chrome-plated tubular steel.

VERTICAL DRILL PRESS—Capacity: drill to center of 16½ in. circle; Chuck to table: 26 in.; Chuck to floor: 58 in.; Table tilt: 0 to 90°.

HORIZONTAL DRILL PRESS—Capacity: unlimited workpiece length; Table size: 14 × 16½ in.; With extension: 18½ to 37 in.; Bearing: steel ball permanently grease-sealed.

DISC SANDER—Disc size: 11¼ in.; see general specifications for other dimensions.

Manufacturer: Master Woodcraft Machine Co., 800 Spruce Lake Dr., Box 669-PM, Harbor City, Calif. 90710.

ESCORT:

By now, just about everyone knows a radar detector needs lots of warning distance to be truly effective. And ESCORT® delivers. Over hills, around corners, and from behind. *Car and Driver* magazine, in their 1982 test, went so far as to say: "The ESCORT, a perennial favorite of these black-box comparisons, is still the best radar detector money can buy." But there's more to the story.

The Plot Thickens

About a year ago, all radar detectors began picking up a new type of radar signal that was as strong as some police radars. The rest of the radar detector industry dismissed these signals as unmarked patrol cars, radar intrusion alarms, or even overactive imaginations.

But something didn't add up. There were just too many of these new signals. And we had another clue. ESCORT's audio warning distinguishes between the two police radar bands: it "beeps" for X band, and "braps" for K band. These new radar signals simultaneously triggered both warnings, and that told us the signals couldn't be police radar. Tracking down a car emitting this signal revealed the actual source—a new type of imported radar detector had the side-effect of transmitting radar signals in both police radar bands. Hard to believe, but true.



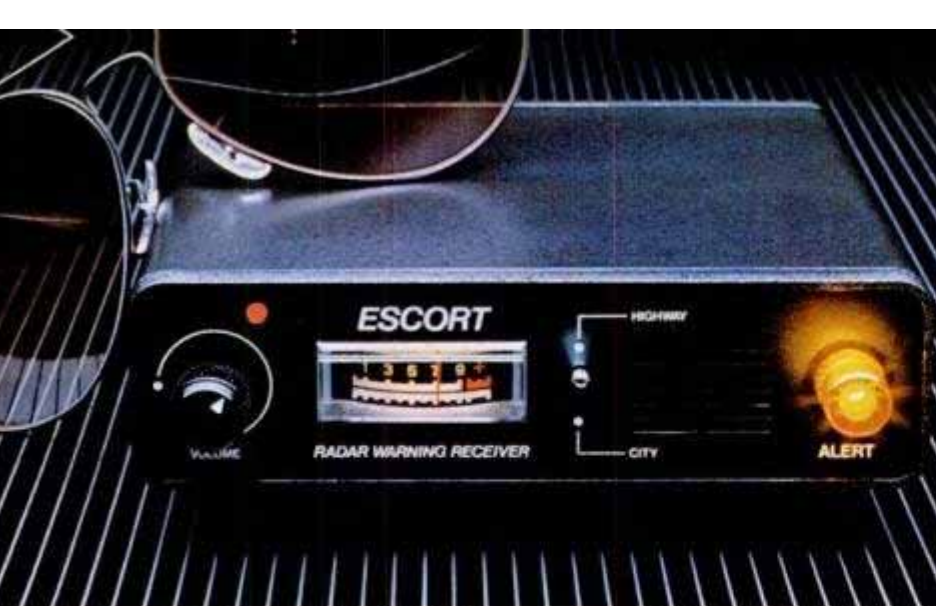
Our first step was to inform ESCORT owners of the situation. We composed a "Radar Bulletin" explaining the source of this new radar pollution and sent out 200,000 by first class mail. But this was only the beginning.

Mission Impossible?

On the surface, the problem seems unsolvable. The signals transmitted by these "radar polluters" are in the same bands as police radar, so it's impossible to detect one and ignore the other, right?

FOR ESCORT OWNERS ONLY:

As our ad above states, we've made another improvement. The new ST/O/P circuitry is a standard part of every ESCORT starting with serial number 400,000.



The Radar Defense Kit

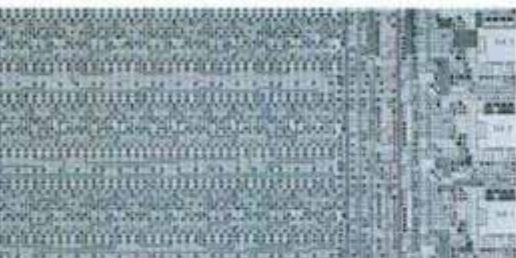
Radar Warning, No Riddles.

Not necessarily. Let's look at another type of technology to make a point. You can now buy an inexpensive device that will turn on the lights in your living room whenever you clap your hands. Or shout. Or drop a book. Or make any loud sound. At the other extreme, there are computerized devices available that don't merely sense sound, but can actually recognize sound patterns unique to specific spoken words. Some can even tell your voice from any other.

Why not apply this principle to radar detection? Instead of merely acknowledging the presence of any radar signal, a detector could look for a pattern in the signal and distinguish between "radar polluters" and actual police radar. And now ESCORT does just that.

Nothing But The Truth

The result of months of extensive engineering, ESCORT's new ST/O/P™ circuitry reduces alarms from "radar polluters" by over 95%. ST/O/P (Statistical Operations Processor) consists of a CMOS digital processor with built-in memory. When ESCORT receives an X or K band radar signal, ST/O/P recognizes patterns in the signal's amplitude/frequency/time characteristics, and uses these patterns to determine the signal's identity. All in 1/64 of a second.



If the signal is from a "polluting detector," ESCORT keeps quiet while maintaining its lookout for police radar. If the signal is police radar, ESCORT immediately alerts you. And unlike other detectors that keep you guessing, ESCORT's amber warning lamp, signal strength meter, and geiger-counter-like pulsing sounds ("beeps" or "braps") tell you everything you need to know. ESCORT has a lot to say, and we include a 33 1/3 RPM Radar Disc to make getting acquainted easier than ever. Play it on your stereo turntable and take a "test drive" with ESCORT as soon as you open the box.

Fully Equipped

ST/O/P digital circuitry is just the latest example of the continuous development of the ESCORT. We won't compromise on performance or features. Here's proof: **Performance:** • Double conversion Superheterodyne receiver circuitry with varactor-tuned Gunn oscillator • Patented digital signal processor (now with ST/O/P) • 1/64 second response time covers all police radar • City/Highway switch optimizes X band sensitivity • Sturdy construction of aluminum and polycarbonate **Alert System:** • Different tones for X and K band radar • Audio pulse rate accurately relates radar intensity • Illuminated signal strength meter • LED power-on indicator • Alert lamp automatically dimmed at night **Convenience:** • Inconspicuous size (1.5H x 5.25W x 5D) • Visor clip and hook and loop mounting supplied • Power cord plugs into cigar lighter and has quick-disconnect from ESCORT • Protective carrying case.



Take a stereo "test drive."

Critics' Corner

Car and Driver: "...All things considered, the ESCORT is the best piece of electronic protection on the market."

BMWCCA Roundel: "...The ESCORT is a highly sophisticated and sensitive detector that has been steadily improved over the years without changing those features that made it a success in the first place... In terms of what all it does, nothing else comes close."

Playboy: "...ESCORT radar detectors... (are) generally acknowledged to be the finest, most sensitive, most uncompromising effort at high technology in the field."

Autoweek: "...the consistent quality is remarkable."

Made In Cincinnati

If you want the best, there's no reason to look anywhere else. ESCORT is designed and manufactured under one roof, and sold to you factory direct.

Knowledgeable support and professional service are only a phone call or parcel delivery away. And you can try ESCORT at no risk. Open the box, play the Radar Disc, and install your ESCORT. Take 30 days to test it. If you're not absolutely satisfied, we'll refund your purchase and pay for the postage costs to return it. You can't lose. We also back ESCORT with a full one year limited warranty on both parts and labor. ESCORT will change radar for you forever. So order today.

Do It Today

Ordering an ESCORT is simple, by mail or by phone.

By Phone: Call us toll free. A member of our sales staff will be glad to answer any questions and take your order. (Please have your Visa or MasterCard at hand when you call).

CALL TOLL FREE... 800-543-1608
IN OHIO CALL... 800-582-2696

By Mail: We'll need to know your name and street address, daytime phone number, and how many ESCORTs you want. Please enclose a check, money order, or the card number and expiration date from your Visa or MasterCard.



ESCORT (Includes Everything)... \$245.00
Ohio residents add \$13.48 sales tax.

Speedy Delivery

If you order with a bank check, money order, credit card, or wire transfer, your order is processed for shipment immediately. Personal or company checks require an additional 18 days.

ESCORT

RADAR WARNING RECEIVER

Cincinnati Microwave
Department 668
One Microwave Plaza
Cincinnati, Ohio 45242

Is ST/O/P adaptable to your present ESCORT? Well, yes and no. At S.N. 200,000, there was an internal redesign of ESCORT incorporating custom integrated circuitry, a precision quartz timebase, and a new integrated microwave mixer/antenna/Gunn oscillator. The new ST/O/P technology builds on this by signifi-

cantly expanding the digital logic and adding memory. As a result, older units (serial numbers less than 200,000) cannot be modified to incorporate ST/O/P technology.

For those of you with ESCORTs from S.N. 200,000 to 399,999 we are presently developing procedures and

facilities to make adding the ST/O/P circuitry to your unit possible. The cost will be \$75, and details and special shipping instructions will be in our advertisement in the August '83 issue of this magazine. Sorry, but we won't be able to convert your unit until that announcement.

Water vacuum



Multipurpose water vacuum (left) is designed to clean spas, hot tubs, fountains and swimming pool steps. It connects to a garden hose and removes dirt, small rocks, leaves and other debris. Water from the hose passes through an inlet in the equipment; this creates a vacuum that forces debris up through the unit and into a removable bag. Water Vac is at hardware stores and pool centers, or post-paid (\$24.95) from its maker, Watkins Mfg. Corp., Box 39, San Marcos, Calif. 92069.



Electric string trimmer

Three new electric string trimmers are offered by McCulloch. Two of the models, Mac 30 and Mac 40, have a handle-mounted command feed system that advances up to 50 ft. of fresh line when a lever is touched. The Mac 20 releases up to 25 ft. of line when the string head is tapped on the ground. The Mac 20 (\$30) has a 9-in. cutting swath. The Mac 40 (\$65) cuts a 12-in.-wide swath. McCulloch, Div. Black & Decker, is located at 5400 Alla Rd., Los Angeles, Calif. 90066.

New roach killer

Mr. Cucaracha is a new roach killer by Ramick Chemicals, Box 19289, Washington, D.C. 20036. The odorless powder also kills ants, silverfish, and water bugs. A 4-oz. bottle is \$4.50, 10-oz., \$6.50 (postpaid).



Portable barbecue

This portable electric barbecue begins heating as soon as it's plugged in and turned on. It has 182 sq. in. of cooking area and a 130-sq.-in. griddle. The unit comes with 2½ lbs. of volcanic rock and a regulator plus connector for a standard 14- or 16-oz. LP tank (tank not included). The Grid'L Top is priced at \$120. Structo Div., Route 75, Freeport, Ill. 61032, is the manufacturer.

New bronze finish

The Aquarian-style centerset lavatory faucet by American Standard now comes in a new antique bronze finish. The faucet (\$73.10) has a crystalline knob handle. Also in the Aquarian-style is a bath/shower combination valve (\$109.40). Both fittings use a ceramic disc cartridge for water control, rather than washers. American Standard, Box 2003, New Brunswick, N.J. 08903.



Tri-square with retractable pin

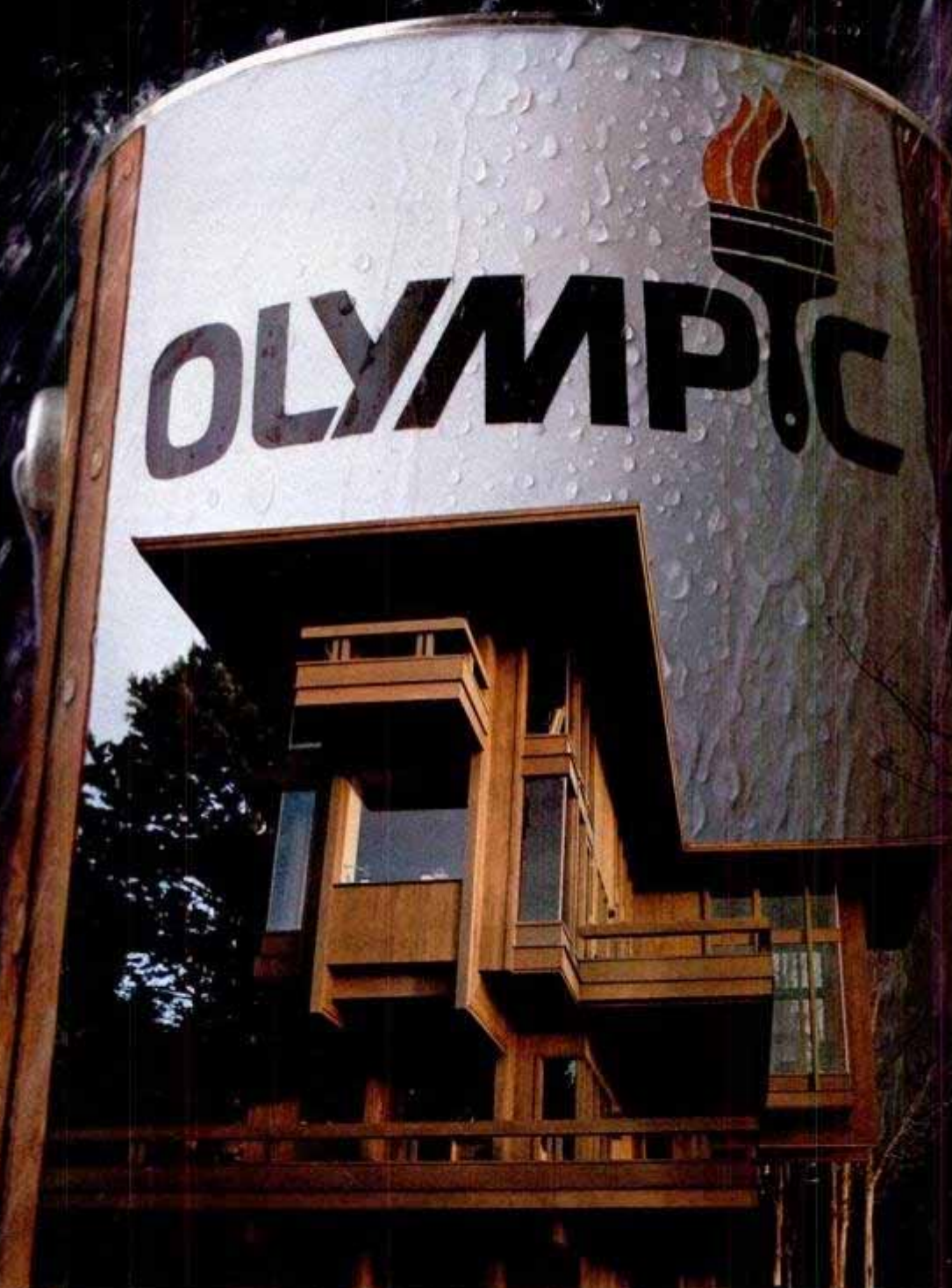
The Retracto Squeeze Pin Tri-Square helps home craftsmen and professionals measure, mark and cut material. The pin supports the tri-square on a working edge. On flat surfaces, the spring-loaded pin retracts, leaving a perfectly straight edge. The tri-square comes in 6-, 8-, 10- and 12-in. sizes; prices are \$4.50 to \$7.65. They're at office or art supply stores; or write to the maker, Fairgate Rule Co. Inc., 22 Adams Ave., Box 278, Cold Spring, N.Y. 10516.



CPVC plumbing supply valves

These new supply valves for straight runs (top photo) and angle configurations (bottom photo) are made of heat-resistant and corrosion-proof, chlorinated polyvinyl chloride (CPVC). They are designed to adapt to copper and plastic tubing, and can be used as replacement parts or in new installations. The valves cost \$4 to \$6 each and are easily installed without wrenches. From Genova, 7034 East Court St., Davison, Mich. 48423. **FM**

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on outside protection.*



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OLYMPIC



MOWER MAINTENANCE

Summer is back, and so is lawnmowing. With this maintenance guide, you can keep your mower purring all season.

BY MORT SCHULTZ

Suppose one afternoon while cutting the grass, your walk-behind rotary lawnmower drops dead. Would you:

1. Take it to a repair shop?
2. Junk it and buy a new mower?
3. Roll the thing into the garage, hoping that the first frost will hit soon and flatten those scraggly blades of grass?
4. Find out what's wrong and fix it yourself?

If you didn't choose No. 4 because you think you can't fix it, you're wrong. Many people can diagnose and repair lawnmower engines themselves.

Most mower problems involve an engine that won't start or one that stalls. Obviously, before you can make a repair, you have to find the source of the trouble. To do so, you must test to determine if the malfunction is a compression, ignition or fuel-delivery problem.

Compression test

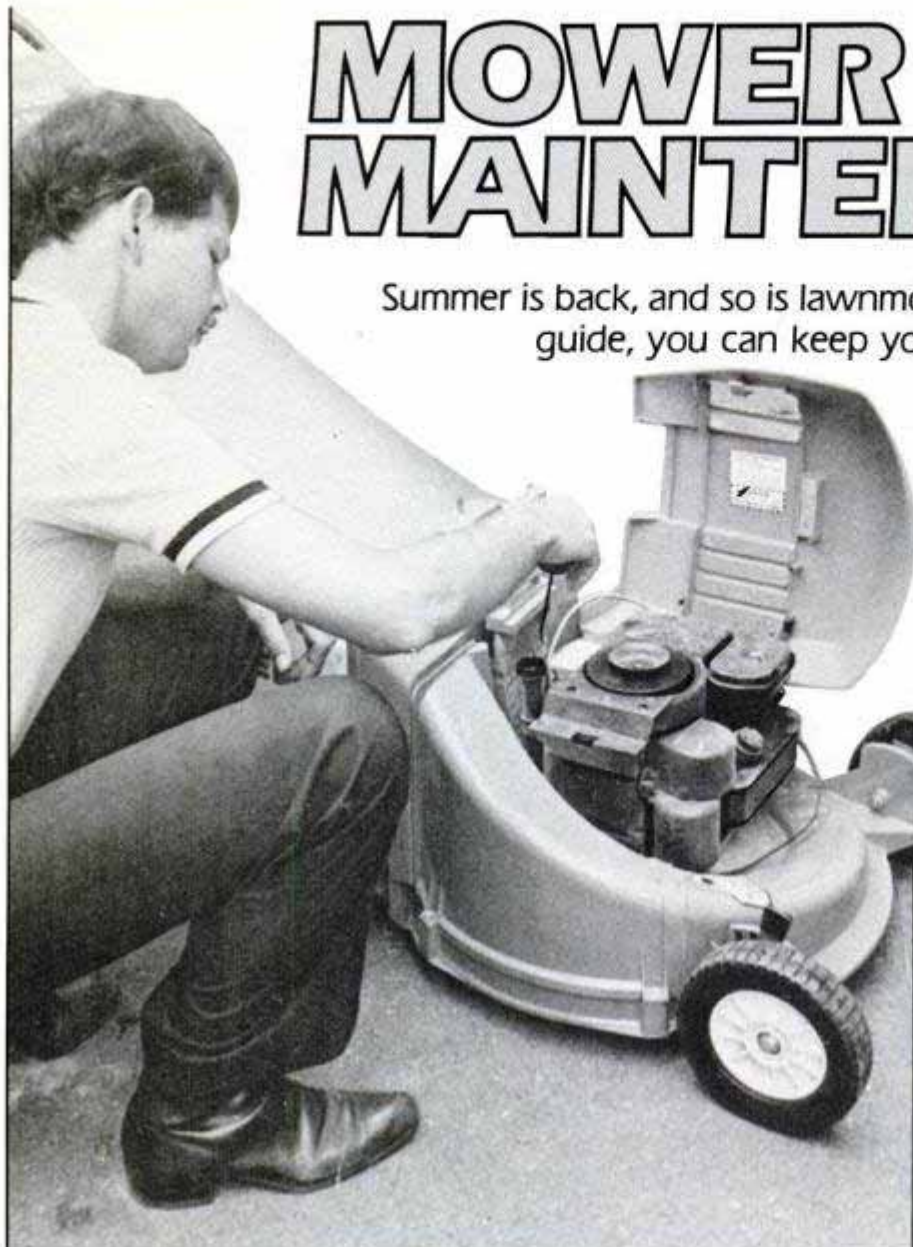
You can test an engine's compression using a compression tester or by hand. The first method is the most accurate.

It's possible to test a lawnmower's compression using an auto engine compression tester, if it has a tapered, cone-shaped end. Remove the sparkplug and push the cone-shaped end firmly into the sparkplug port during testing. An auto compression gauge with a screw-on swivel end gives the most accurate results, but you must replace the long hose adapter used for car engines with a shorter 14-mm-dia. adapter. Screw the adapter (available at auto parts stores) into the sparkplug port, then attach the compression gauge to the protruding adapter.

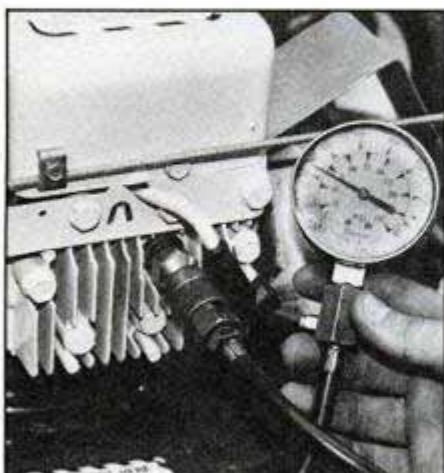
Regardless of the compression tester used, a tight fit into the sparkplug port is essential to prevent inaccurate readings due to compression loss. With the compression tester in place, give the starter cord three good pulls as if you were starting the engine. If your mower is equipped with an electric start, acti-

(Please turn to page 55)

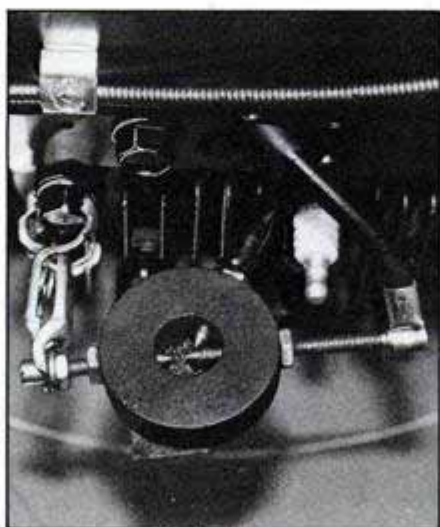
Technical consultant: Fords Lawn Mower Sales and Service, Fords, N.J.



With proper guidance, plus a few hints from the pros, anyone can diagnose and service an ailing lawnmower. An important first step is to check the oil level.



When testing with a compression gauge, screw a short adapter into the sparkplug port and then screw the tester into the adapter. Connections should be tight to prevent compression loss, which would result in erroneous readings.



Check the spark, using a spark intensity tester. Black tape placed on the back side of the tester helps highlight the spark, making it easier to see.

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Dunlop Radial Rovers . . . RV, Rib and Traction . . . let you tame the back roads with twin steel belts reinforced by belt guards for trailblazing strength and durability.

And whether you're clawing your way through the rough stuff, or breezing along the superhighway, Dunlop Radial Rovers deliver the smooth-rolling, sure-footed confidence that comes from riding on a legend.

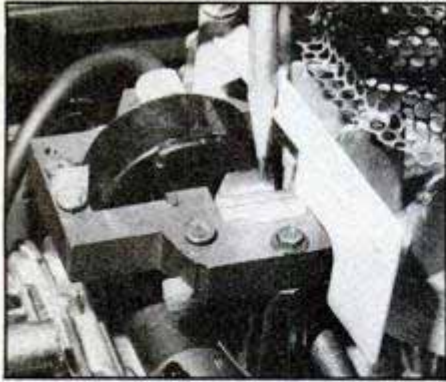
And they do it all with the rugged styling of raised outline white letter sidewalls.

Ask your Dunlop dealer which Radial Rover fits your driving needs.

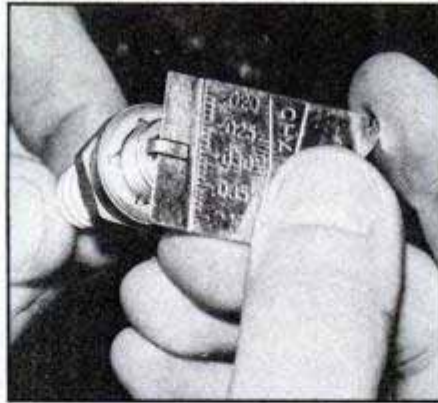
Backwoods, beach, or boulevard, live the legend with Dunlop Radial Rovers.

 **DUNLOP**
For the long run

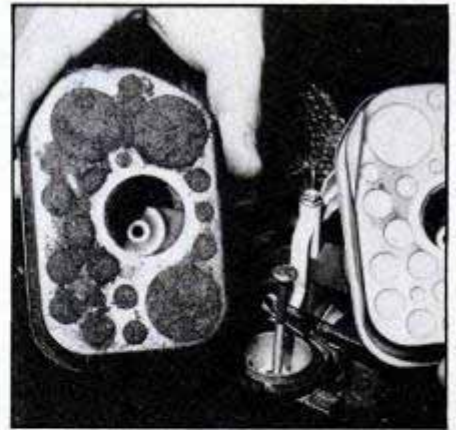
Dunlop Tire & Rubber Corp., Buffalo NY 14240



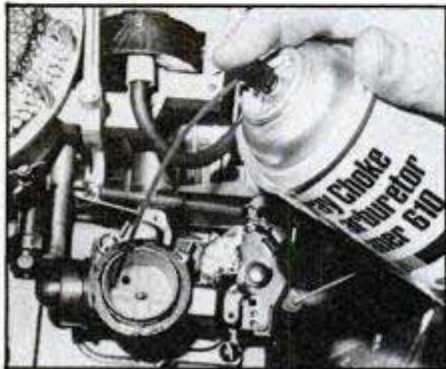
Pencil indicates the location of the Magnatron—the electronic capsule on Briggs & Stratton engines. The capsule replaces points and condensers in lawnmowers with electronic ignition systems.



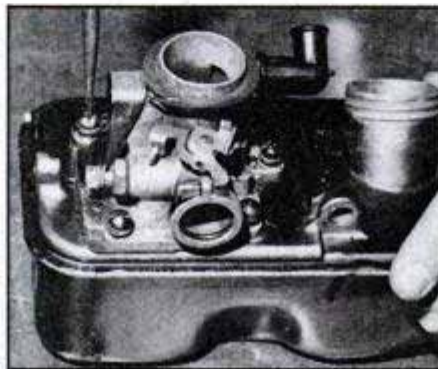
Worn, damaged or improperly gapped sparkplug will make an engine hard to start and cause it to stall. Here, a plug is correctly gapped to .030 in.



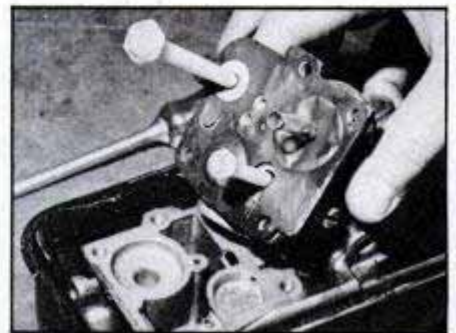
A clogged air filter (left) can stall an engine and possibly damage cylinder. New filter is shown at right.



You should use a carburetor cleaner to keep choke plates operating smoothly.



Unscrew the carburetor from the fuel tank to permit servicing and cleaning.



Soak the carburetor, minus rubber parts such as this gasket, in some carburetor cleaner for several hours. Then install new parts from a rebuild kit.

The 1983 Plymouth Reliant K Backed for 5 years, 50,000 miles.



41 est hwy. 29 EPA est. MPG*

MOWER MAINTENANCE

(Continued from page 52)

vate the start switch until the engine puffs three times. Each puff is a compression stroke. If the engine is producing adequate compression, the gauge will show at least 55 pounds of pressure per sq. in.

Testing by hand

To test compression by hand, disconnect the coil wire from the sparkplug and ground the wire terminal to a metal engine part. **Caution:** Be sure the coil wire is disconnected and properly grounded. If the ignition system is left active, the mower could start, causing the blade to rotate.

Tip the mower, muffler side up, until you can reach the blade. Keep an eye on the fuel tank. If fuel starts dripping out, siphon some from the tank. With the mower tipped, grab the blade and spin it against compression—that's away from the free-spinning direction. With most lawnmower engines, this is counterclockwise. If the blade bounces, then the engine compression is adequate. If the blade doesn't bounce, but stops dead as it meets resistance, then compression is low.

Low compression can simply be a case of loose cylinder-head bolts or a loose sparkplug. But an internally dam-

aged engine may also be the problem. If so, take the mower to a pro for evaluation.

There are two ways to check the mower's ignition system. One way is with a spark intensity tester. Connect the tester's ground clamp to a head bolt as shown. This grounded connection must be clean; scrape the bolt of any paint or dirt. Detach the coil wire from the sparkplug and connect the remaining side of the tester to the coil wire terminal. Now crank the engine. If the ignition system is functioning properly, a continuous blue spark will appear between the three screw points. If there's no spark or the spark appears weak, there's an ignition problem.

To test the ignition without a spark intensity tester, you'll need a new 14-mm sparkplug. Using a feeler gauge, gap the new plug to .030 in. Now, disconnect the coil wire from the mower's sparkplug and attach it to the test plug. Use locking pliers and clamp the test plug to a clean metal engine part. Position the plug so that its electrodes point away from the engine. Be sure there's metal-to-metal contact between the pliers, engine and metal hex nut of the test plug. Now, pull the starter while observing the test plug's electrodes. If the ignition system is okay, a blue spark will jump the plug's electrode gap.

If there's no spark or it's weak and

the engine doesn't have electronic ignition, then chances are that the points and/or condenser are bad. To gain access to the points and condenser, you'll need a flywheel puller. You should use the flywheel puller designated for your engine by the manufacturer.

After removing the flywheel, replace the points and condenser. Gap the new points to .020 in. Reinstall the flywheel and perform another spark intensity test. If there's still no spark, then the coil and armature assembly is defective. Replace it.

Testing electronic ignition

If your mower has electronic ignition and produces no spark, there are three parts to check: the coil and armature assembly, the coil wire, and the electronic capsule that replaces the points and condenser. (On Briggs & Stratton engines, this part is called the Magnatron.)

On most mowers, the coil and armature assembly and the electronic capsule are exposed and easy to replace. The electronic capsule often is guaranteed by the manufacturer, so check with a dealer before replacing it. If the electronic capsule is okay, check the coil wire. In some cases, this wire can be disconnected and a new one attached.

(Please turn to page 56)

Reliant SE interior not available on base model.



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MOWER MAINTENANCE

(Continued from page 55)

In other mowers, the wire is molded to the coil and armature assembly and it can't be detached. If this is the case, then the whole assembly must be replaced.

Finally, if the electronic capsule and the coil wire are not causing the ignition failure, install a new coil and armature assembly. The old assembly is probably defective.

Sparkplug check

When replacing your mower's sparkplug, don't assume that the new plug is gapped to specification at the factory—it isn't. The plug in the photo on page 54 was gapped to .020 in. The correct electrode gap for rotary mower sparkplugs is .030 in. Always examine the electrodes of the old plug. Their condition can tell you a great deal about what's going on inside the engine. For example, if electrodes are coated with dry, fluffy carbon, the engine is operating on an overly rich fuel mixture. This may be the reason it's stalling, so check for a clogged air filter or a choke that's not working properly.

Overchoking is only one result of a neglected air filter. Another could be a cylinder bore scored from dust drawn

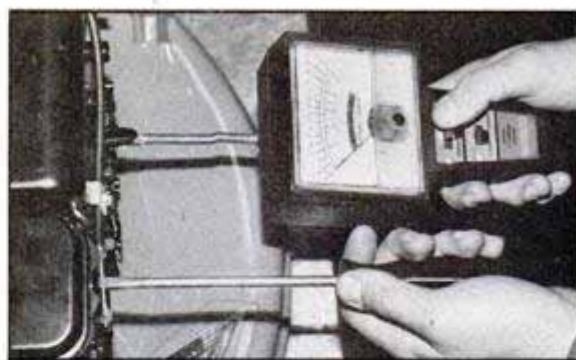
into the engine. After every 25 hours of operation, clean and oil the foam air filter. If the filter is made of another material, replace it.

If dirt gets around the choke plate pivot points, the plate may stick in the closed position. Spray carburetor and choke cleaner on the pivots, then work the plate open and closed by hand.

If you find the sparkplug electrodes are burned (eroded), the engine is overheating. The cooling fins under the blower housing are probably clogged. Clean out all dirt and grass. If sparkplug electrodes are coated with oil, you have serious engine trouble. Probable cause: worn piston rings or worn valve guides. In this case, it may be cheaper to buy a new mower than to overhaul the engine.

Testing fuel delivery

If you've gotten to this point without finding the trouble, it's time to check the mower's fuel-delivery system. Remove the sparkplug and shoot three squirts of fuel into the cylinder from a trigger-operated oilcan. If it's a two-



Use a tachometer for single-cylinder engines to adjust high and low speeds to the correct specifications.

cycle engine, use a gas/oil mixture. Use straight gas for four-cycle engines. Reinstall the plug and try starting the engine. If the mower starts, runs briefly, then stalls, you've found the problem.

One reason for fuel-delivery failure is that fuel pipe screens become clogged. Remove the fuel tank-carburetor assembly. Empty the fuel tank and unbolt it from the carburetor. Inspect the screens at the bottom of the carburetor's feed pipes. If they are dirty, soak them in carburetor cleaner.

A disruption in the flow of fuel may also be caused by dirt inside the carburetor. In this case, overhaul the carburetor by cleaning it with carburetor

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10 HP Tecumseh, cast iron sleeve, 1" shaft, #6010 . . . \$220
10 HP Tecumseh, cast iron sleeve, electric, #60101 . . . \$265
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3 1/2 HP Briggs, 1/2" x 2-7/16" long shaft, recoil, #7033 . . . \$98
4 HP Briggs, 1/2" x 1-13/16" long shaft, recoil, #7040 . . . \$114
5 HP Briggs, 1/2" x 1-13/16" long shaft, good tiller replacement . . . \$145
6 HP Tecumseh, 1" x 3-5/32" long shaft, recoil, #7060 . . . \$159
7 HP Tecumseh, 1/2" x 3-5/32" long, fits John Deere, #70708 . . . \$199
8 HP Briggs, recoil, 1" x 3 1/2" long shaft, #7080 . . . \$205
8 HP Briggs, electric, 1" x 3-5/32" long shaft, #7081 . . . \$255
8 HP Tecumseh, recoil, 1" x 3 1/2" long shaft, #7082 . . . \$195
10 HP Tecumseh, recoil, 1" x 3-5/32" long shaft, cast iron sleeve . . . \$210
10 HP Tecumseh, electric, 1" x 3 1/2" long shaft, #70101 . . . \$259
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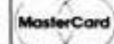
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cleaner and replacing it with parts from a rebuild kit.

The prime cause of dirty screens and dirty carburetors is old gasoline. After a few months gasoline forms varnish and

turns gummy. This gummy substance clogs up screens and prohibits the flow of fuel. Always use fresh *leaded* gas—not unleaded, which may burn the mower's valves.

Hard starting and stalling also can be attributed to an improperly adjusted carburetor. Most engines have two adjustments: fast speed, 2,800 to 3,000 rpm, used during grass cutting; and low speed, 1,800 to 2,000 rpm, used during idle running. To tune the engine to these speeds, you'll need a tachometer. However, you can come close to these marks with just a screwdriver and a good ear.

Start the mower and listen to the engine's reaction as you turn the two carburetor adjustment screws. Adjust each screw until the engine runs smoothly without vibrating excessively or stalling. Whenever making carburetor adjustments, keep either the air cleaner on the carburetor or the air cleaner hold-down bolt in place.

Electric-starting systems

If your mower has an electric-start system, it could be still another source of trouble. Electric-start systems consist of either a battery alone or a battery, starter motor and alternator.

The starter motor and alternator are reliable units that seldom require servicing. If there's a weak link in the system, it's the battery. To prolong battery life, clean the battery and its posts at the beginning, middle and end of the mowing season. **PM**

Safety Compliance Lawnmowers

There is a new phrase in the rotary lawnmower business these days—Compliance mowers. This refers to machines manufactured after June 30, 1982, which must comply with a safety requirement issued by the Consumer Product Safety Commission (CPSC) that requires a mower blade to stop rotating within three seconds after the operator releases a safety control lever. The purpose is to prevent the operator from coming into contact with a spinning blade. (Each year, over 57,000 people are treated for injuries caused by mowers.)

The safety control lever is built into the handle and it must be held back against the latter for the mower to run. When it is released, a brake band grasps the flywheel, and a device in the coil and armature assembly grounds the ignition system. This stalls the engine.

With manual-start Compliance mow-



ers, the operator must stand behind the mower in order to grasp the safety lever and yank on the pull cord. Similarly, with electric-start models, the key switch is located on the handlebars, again forcing the behind-the-machine position for the operator. There is a cost for this added safety; prices for power mowers have increased as much as \$40.



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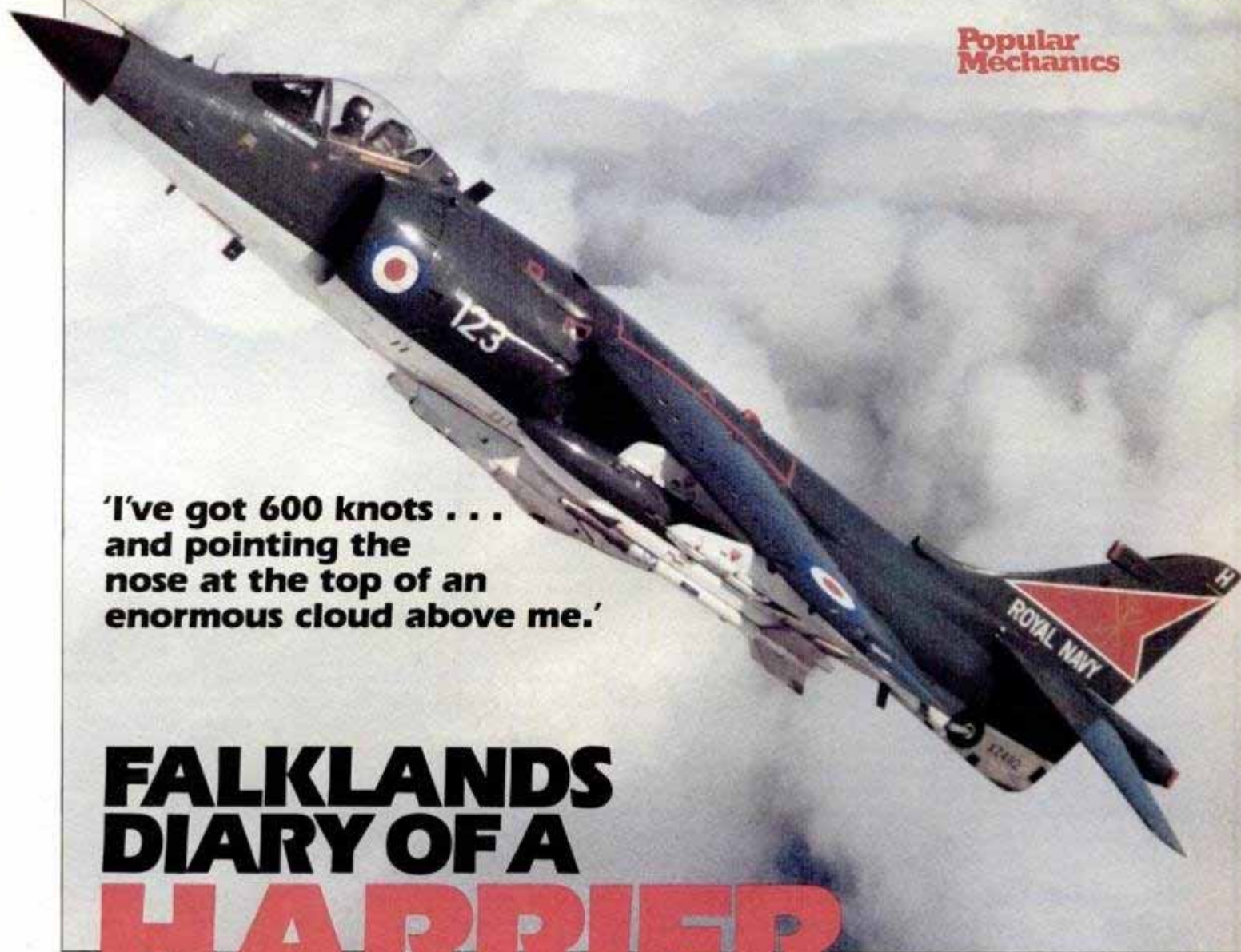


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'I've got 600 knots . . . and pointing the nose at the top of an enormous cloud above me.'

FALKLANDS DIARY OF A HARRIER PILOT

BY LT. DAVID SMITH
ROYAL NAVY

Last summer changed the lives of thousands of English military men, abruptly called into service to fight an abbreviated South Atlantic war with Argentina over the Falkland Islands. In the midst of the action, Royal Navy Lt. David Smith, 27, pilot of a Sea Harrier VSTOL jet stationed on the HMS *Hermes*, wrote a series of letters home describing some of the action and the jump jet he flew. He later assembled undated excerpts of those letters for publication as his Falklands diary.

I thought I would try to describe to you a typical sortie from the deck so as you can imagine "how it is." Normally, an hour before launch time, all the pilots involved crowd into Number One briefing room, where, along with the helicopter crews launching at the same time, we receive a brief on the ship's position, course and speed, and the various frequencies and call signs. . . . We are currently in company with a number of warships, and the disposition of these are given to avoid their firing-arcs.

After signing out and having

aircraft allocated, we go out onto the flight deck, which always seems to be absolute bedlam! Apart from the normal 30 knots of wind across the deck, there are helicopters landing and taking off, chiefs yelling and screaming at God knows who, aircraft being shuttled from one side of the deck to the other and back again (for no apparent reason). On top of all this, you are probably late because the engineers weren't ready and you've now got five minutes to start and get airborne.

Damn! They've decided to move my aircraft just as I am

LANDING A HARRIER

'I can see *Hermes* on my radar 60 miles away.'

Flaps normal, engines horizontal, landing gear in, the Harrier's speed is 540 knots at 30,000 feet.

doing my external checks. Never mind, I'll do them on the roll. Finally, my plane checked and lined up on the centre line, with four minutes to go, I leap into the cockpit, frantically struggling with the tangle of straps and umbilicals, and rush round the internal checks. I have to be especially careful now as it is when one is being hassled like this that one forgets something really important. Three minutes to go. I can see "Wings" (flight deck director—Ed.) looking at his watch—"why isn't R4 started yet?" I bet he is saying. . . . Well, here we go, checks complete, boosters on, start selected, master pressed, HP on—here she goes—jet pipe temperature rising—she's burning and turning. The navigation kit takes 2 minutes to align, so without further ado I initiate that process and sit it out. There are 1½ minutes to go, with the sweat pouring off me.

'I accept the launch'

Right, they are unlashing me now, let's check my ejection seat pins out, all takeoff checks complete and the navigation kit on line just in time with 15 seconds to go. The flight direction officer is giving me the wind-up signal—I slam the engine to half power

1
'With my speed decaying . . . I bang down full flap.'

Flaps down, engines 40° horizontal, speed is 300 knots 800 feet up.

in 3 to 4½ seconds—the nozzles checked and I accept the launch by showing the flat of my hand in the canopy. His hand drops and I smash the throttle to the firewall. Ten tons of angry power arrive in the small of my back in just under 2 seconds and the Harrier roars down the deck. A quick glance at the rpm and temperature—looking good—in less than 3 seconds my speed is around 90 knots and here comes the ramp—*whoosh*—we're off! Nozzles rotated smartly to 35 degrees and hold everything. Trying to resist the temptation to touch the controls—she's reaching the end of the trajectory and I'm gently easing the nozzles forward, landing gear and flaps up and the aircraft is accelerating through 400 knots before I know it. A quick frequency change to call "D" (the fighter direction officer—Ed.), holding her down at 200 feet until I've got 600 knots and now pulling back on the stick and pointing the nose at the top of an enormous cloud

2
'Halfway round the turn and descending . . .'

Engines 60° off horizontal, landing gear out, speed under 200 knots, the Harrier is at 400 feet.

above me. She passes through 15,000 feet effortlessly and I roll over on my back to bring my heaven-ward rate of ascent under control. "D" has given me a vector and off I go looking for the attacking aircraft.

Looking for the enemy is a "cat-and-mouse" game. Who can see the other on his radar first and turn it to his advantage. I can hear his radar sweep on my warning receiver—it's telling me he is off to the right slightly—and there he is—a tiny blip. Now we close each other with a closing speed of just under 1,000 knots. It is important that I see him by 10 miles, as I can then organise the fight to my advantage. Suddenly, through the radar lock cross in the head-up display, a tiny speck appears, initially stationary and then growing with incredible

Text: Münch Media



Harrier jet jumps off HMS Hermes (left) as pilots and crew gather on deck for combat sorties. Ammunition ranging from 1,000-pound bombs to AIM-9 missiles was delivered to British warships by Sea King helicopters, three of which are standing by with rotors folded.

PM art: Ed Valigursky

speed. He's obviously seen me, too, as I can see him turning towards. Seconds later there is a blue/grey blur less than 100 feet from my canopy as we cross and slam our aircraft into the first of a series of body-pounding combat turns. Every muscle and sinew straining as we endeavour to fly the aircraft to its very limits under the crushing effect of seven "Gs." The most important thing is not to lose sight of him, even if it requires moving your head and neck into positions you wouldn't believe possible.

'He suddenly turns'

After 15 minutes of hard manoeuvring, he suddenly turns for home,

probably short of fuel. I can see *Hermes* on my radar 60 miles away so I turn towards her and up the speed to 540 knots. A quick glance at the navigation computer confirms that it will take just over 6 minutes to reach her and use 1,000 pounds of fuel. That will get me off *Hermes* with 5 minutes to "slot," with 1,200 pounds of fuel remaining. That, in turn, should give me about 2 to 3 minutes of fuel in the hover to sort myself out and land before the beast runs out of fuel!

I see the ship a few minutes later and am cleared by the controller to the "low wait." This is an orbit off the ship's port quarter at 1,000 feet,

where I now fly at endurance speed until my "slot" time. At 2½ minutes to "Charlie" (land-on time) I "slot," which involves flying past the ship's bridge at 600 feet and break downwind to land.

It is from now on that the pilot of a Harrier has really to switch on and keep his act together. The flight profile has to change from being fully wingborne, as in a conventional aircraft, to fully jetborne in the hover, at the same time as flying a tight fuel critical circuit to land on a small, sometimes highly mobile deck.

So, with my speed decaying reluctantly through 300 knots, I bang

(Please turn to page 166)



3

'I am paying very careful attention ...'

Engines 90° off horizontal, speed barely perceptible, the craft lines up just off the carrier.



4
'Bang on the deck—throttle closed and nozzles fully forward....'

Engines 105° off center, craft hits deck very hard with a slight backward jerk. Line grabs wheel.

FOUR WAYS TO

Portable Computing Power

No matter where you go, your computer can be alongside. Here are four that make the computer revolution a movable feast.

BY HERB FRIEDMAN

KAYPRO II



RCA VP-3501



Virtually unknown just a few years ago, the portable computer is fast becoming a success story. Though relatively light and compact, various models offer many of the features and performance of "full-size" desktop computers, yet they are small enough to fit under airline seats, be carried in a shoulder bag, or even slip into a standard attaché case. You can take them along on business trips and vacations, or on the daily commuter train. They can be set up quickly on the kitchen table, in a motel room, or even on your lap.

Our four computers are the Osborne 1, the KayPro II, the Epson HX-20 and the RCA VP-3501. (The RCA VP-3501 isn't really a computer, it's actually a videotex

terminal which provides the user with computer and database services through information networks such as The Source and Dow Jones. But, in a sense, the RCA terminal serves as a "portable computer" because it can access computer and information services through the nearest telephone.)

The Osborne 1 is the model that introduced a wholly new concept in portable computing: that of a full-featured computer in a relatively light, easily carried cabinet. It is housed in a plastic cabinet that measures 5 in. wide x 13 in. deep x 9 in. high, and weighs under 24 pounds. Features include: 64K of RAM (memory), a built-in video monitor; an output for a dedicated communications modem (to send and receive data over a phone); an

Osborne 1 was the first of the portable computers and is still one of the top contenders. Complete with two disk drives and small screen, it arrives with a full software selection. KayPro II is similar in concept to the Osborne but has larger screen. It, too, comes with an impressive software collection. The Epson HX-20 can be carried in your attaché case. Its liquid-crystal display (LCD) makes the unit truly portable. The RCA VP-3501 isn't a computer—it's a terminal. Hooked up to a TV and phone, it accesses large computers.



OSBORNE 1



EPSON HX-20

PM photo: Leo Jowitz



KayPro II's keyboard features all the keys found on a full-sized computer, including a numeric keypad (above). It all folds together into a portable, easy-to-set-up package (right).

RS-232C serial I/O (input/output) for a printer or a communications modem; an IEEE I/O which also provides a Centronics-type printer output; an output for an optional, large, external video monitor; a connector for an optional, external battery power supply; two 5¼-in. floppy disk drives, each providing approximately 100K or 200K bytes of storage (depending on whether you purchase the single- or double-density computer model). The single-density model costs \$1,795 (and might no longer be in production although still available in stores). The double-density model is priced at \$1,995.

The Osborne 1 keyboard is part of the cabinet cover. It can be detached and placed about a foot from the computer. Just about everything else is on the main cabinet's front panel. A disk drive is positioned on each side of the panel and between the disk drives is a 2.6 in. × 3.5 in. video screen with a display 52 characters wide by 24 lines. Across the bottom of the panel are the battery power, external video, peripheral and accessory connectors, computer reset switch, and video brightness and contrast controls.

What really creates enthusiasm for the Osborne 1 is the supplied software package—its retail worth is almost equal to the cost of the computer. It consists of the CP/M disk operating system, MBASIC (MicroSoft BASIC), CBASIC (Compiler BASIC), *WordStar* (perhaps the most famous word processor), *MailMerge* (which does form letters) and *SuperCalc* (an electronic spreadsheet system). A special promotion deal also included *dBase II*, a rather expensive data management system.

In particular, the CP/M implementation for the double-density model is superb; it's many times more convenient than the standard CP/M implementation used in the old single-density model. The double-density CP/M is entry-level-user and applications-oriented—so simple even a child would have no difficulty—truly "user-friendly."

However,

Wordstar is almost a programming language in itself, with 149 individual command and formatting codes. While extremely powerful and flexible, it is somewhat difficult for the casual user to learn and use. The problem is compounded by the Osborne's 52-character video screen, which makes it extremely difficult to use the on-screen "help" menus that extend well beyond 52 characters, and which are important for the casual user. Also, since most business letters and documents are normally 60 to 64 characters wide, the user cannot see the actual document formatting on



RCA's VP-3501 is a videotex terminal which has no built-in computing power of its own. Instead, it connects via a telephone to computer networks or other computers and uses any television for display.

the Osborne's screen. While the Osborne's screen does a horizontal scroll if the user types beyond 52 characters, it's not the most convenient system to use if you want to search for something normally "off the screen."

But for those who want maximum convenience and flexibility in word processing, Osborne has an optional upgrade that provides an 80-character display. While 80 characters on the small, internal screen is almost illegible, it appears "normal" on a larger, plug-in monitor. The 80-character screen also makes *SuperCalc* (perhaps the most user-friendly Calc-type program there is) even better, as it adds at least three additional columns to the display.

A serious inconvenience that can affect the Osborne's use in an office or other "permanent" area is the location of the connections along the bottom of the front panel. The cables come out right on the keyboard, or they interfere with loading the left disk drive or viewing the screen. For those who have their printer or modem connected at all times, it's an important point to consider.

Big and bright

The KayPro II portable computer is similar in external appearance to the Osborne, and also comes with 64K of RAM. It is housed in a metal cabinet



Epson HX-20 is an attaché-case-sized computer with features such as a built-in LOD display, a printer and a row of user-defined function keys, all shown above.

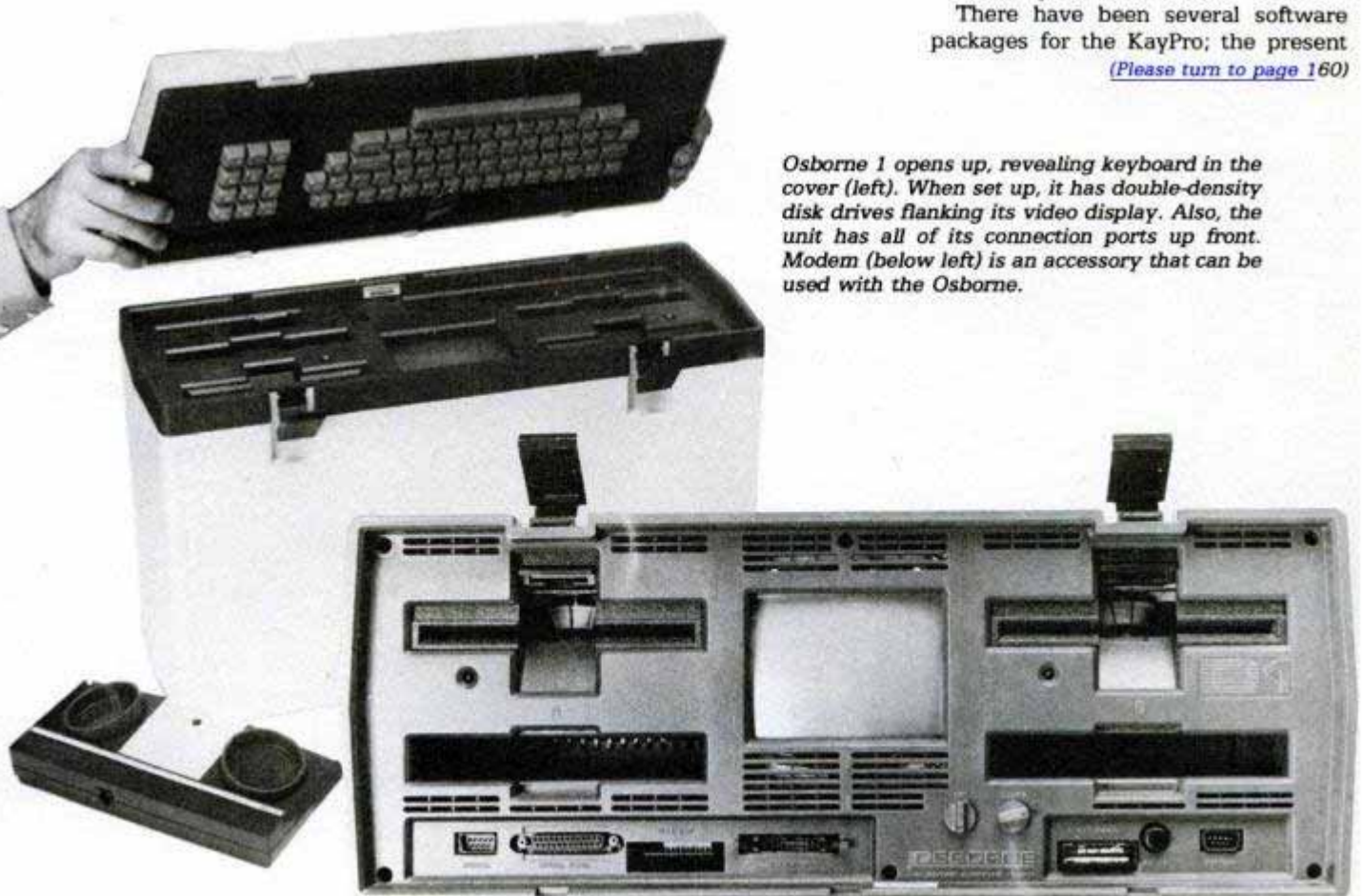
that weighs about 25 pounds. Overall, it's 18 in. wide × 16.3 in. deep × 8 in. high. The front cover is also the keyboard; it connects to the back of the main cabinet through the same type of coil cord used for modern modular telephones. On the back of the cabinet is the carrying handle, posts for wrapping the attached power cord, connectors for all standard printers, a video brightness control and the computer's reset switch.

Although externally similar to the Osborne, the KayPro II takes a somewhat different approach to portable computing. First, it is available only

in its latest version, which is double-density, providing approximately 200K bytes of storage on each of two 5¼-in. disk drives. The price is \$1,795. Second, and more important, it has a 9-inch, razor-sharp, 80-character, 24-line video display that takes up almost the entire left half of the main cabinet's front panel. (The two disk drives take up the entire right side.) Since 80 characters by 24 lines is considered "standard business" width for personal computers, all software provided with the computer—and virtually all you might purchase—will deliver optimum display on the KayPro.

There have been several software packages for the KayPro; the present [\(Please turn to page 160\)](#)

Osborne 1 opens up, revealing keyboard in the cover (left). When set up, it has double-density disk drives flanking its video display. Also, the unit has all of its connection ports up front. Modem (below left) is an accessory that can be used with the Osborne.





PM drives the Chrysler T-115, the first of the fuel-efficient minivans and looks at others on the way.

A Real Family Car: The Garageable G Van

BY MICHAEL LAMM
WEST COAST EDITOR



The Plymouth version of the front-wheel-drive minivan will be the Voyager (top, next to full-size van) and Dodge will be named the Caravan (right).

PM photos: Vic Huber

Chrysler's T-115 minivans are going to revolutionize family transportation. The T-115's importance as an idea and as a well-executed design will be felt by every automaker who sells cars in this country. When Chrysler introduces its '84 T-115s, Plymouth will market it as the Voyager, Dodge as the Caravan. You'll be able to buy these vehicles as five- and seven-passenger "family wagons," as two-seater vans without benches behind the front buckets and as a driver's-seat-only commercial van.

But before we go into the T-115's engineering features (T-115 was Chrysler's early code name during development), let's drive it.

First of all, it doesn't feel like you're piloting a big, conventional van. In most vans, you sit up high, and you're keenly aware that the only thing between you and the bugs is a pane of glass and some sheet metal. Each time I've driven a van—be it a Vanagon or an Econoline—I've felt more like a trucker than an automobile driver.

Chrysler's T-vans simply feel more like cars than vans. A lot has to do with the stubby hood out front. The seats don't hike you way up in the air, and the carlike steering wheel position doesn't leave you feeling you're driving a school bus.

The tall roof and slender pillars provide excellent vision in every

direction, and you're not left wondering when you're going to back into a lamp stanchion or parked car. (Dodge's commercial Caravan lacks rear side windows.)

Driving down the road, the fwd Voyager and Caravan ride, sound and handle essentially like cars. The two prototypes I drove were quiet and smooth-riding. There was no appreciable wind noise and none of the pitch that's so common in normal vans. The T-van positions the front seats several feet behind the front-axle centerline.

I found the automatic version more satisfying to drive than the five-speed transmission. Ordinarily I prefer vehicles with manual trans-





Because of its front-wheel-drive arrangement, Chrysler T-van has a flat cargo floor. The sliding side door makes entry and exit a good deal easier. The van will have a variety of seating arrangements and will be able to carry as many as seven people.

missions, but not this time. The automatic Voyager family wagon I drove used the 2.6-liter Four (made by Mitsubishi), which has 22 foot-pounds more torque at 1,200 fewer rpm than the standard 2.2.

This, plus the five-speed's higher differential ratio (2.56 versus 3.22), resulted in noticeably faster acceleration from the 2.6 automatic. Not that either engine leaves the T-115 feeling sluggish, but the 2.6 with automatic has a definite edge over the 2.2 five-speed. (By the way, the 2.2 with the four-speed, available in van and commercial applications only, would probably give a better compromise be-

tween acceleration and fuel economy than either of the two other engine/transmission combinations.)

In terms of handling, the 60/40 weight distribution again makes the T-115 feel like so many fwd sedans—fairly nose-heavy, with understeer in very hard cornering but no quirks or surprises in normal use. The only criticism I have of the T-van's steering is its fairly wide turning diameter—41 ft. curb to curb.

The relatively soft suspension isn't set up for hot-dog maneuvers. This is not a slalom car. If you drive the minivan as intended, you'll be more than satisfied.

Chrysler will make a heavy-duty GVW package plus wider tires optional. The GVW package raises payload capacity from 1,200 to 1,700 pounds through a change in springs and shock valving.

Space efficiency

What makes the T-115 attractive is its size. It's neither too big nor too small. Seen from above, the minivan covers roughly the same shadow area as the Aries/Reliant K-car.

Chrysler emphasizes that the T-115 is *not* a K-car derivative, but that's true only to an extent. It shares the K-car's engines and transaxles but not



sheet metal. Front suspension is similar. The T-115 has a flat floor and, since the van stands nearly a foot taller than the K-car wagon, it has a lot more room inside. Specifically, with both rear benches removed, the T-van boasts an interior volume of 125 cu. ft. And that's all usable space. Compare that with 201 cu. ft. in the VW Vanagon.

Chrysler engineer Bruce U. Benedict, the T-115's program manager, told me that his team started with the T-van's external dimensions and tried as hard as possible to incorporate maximum interior space. This meant keeping doors and walls thin, setting ground clearance at a low 5.4 in., and raising the roof a foot above the K-car's. He insisted that the T-van be able to carry a 4-ft.-wide sheet of plywood between its rear wheelhouses. The cargo floor measures 83.9 in. from the front seatbacks to the lift gate.

For family use, there are two seating plans. The five-passenger version has a three-place bench anchored 36.1 in. behind the front buckets. That configuration gives about 5 in. more legroom in the second bench than in the seven-passenger version.

In the seven-passenger, family wagon, the second bench provides



Toyota's aero-slick Model-F van is a one-box design that can hold eight people. The van went on sale in Europe last fall and might make it to the United States.

space for only two riders, with a walk-through aisle alongside the sliding door on the far right. The third bench is full width between the wheelhouses, again with seating for three.

Now here comes the intriguing part. If you want to convert the seven-passenger wagon to a five-seater, you take out the close-coupled, two-

place center bench, quick-release the three-place rear bench, and replant the rear bench in special floor fixtures that allow more legroom in the new position. In other words, there are two sets of seat-mounting fixtures in the van's floor, both for the second bench. Where you place the center bench depends on whether you in-

(Please turn to page 162)

NISSAN AMBIVAN



FORD M-VAN

GM MINIVAN (UNNAMED)



Nissan's '84½ Ambivan will carry six people and be powered by a 2.0-liter, four-cylinder engine. It has a unique sliding door without a B-pillar on the passenger side. Ford's M-van will be rear-drive and will carry up to eight people. It will supplement rather than replace the current full-sized Econoline vans. GM's eight-passenger van will use existing X-car powertrain. The GM van may also use a 2.5-liter V5 engine.

PM art: Mark Stehrenberger

Tone Arms In The Groove



The latest discs make tracking more critical than ever before. Our tests show that new pivoting arms and linear-tracking types can do the job.

BY HANS FANTEL

Tone arm of Denon DP-11F (above) features internal magnets and sensors. When the arm deviates from true tracking, it will automatically correct its own tracking forces.

MITSUBISHI LT-10V Linear Tracking

The Mitsubishi LT-10V uses linear tracking and is specifically designed to play standing up. Dual's CS505-1 has a special Ultra-Light-Mass (ULM) tone arm and a premounted cartridge. The Sansui P-M7 is a linear-tracking turntable which has programmability and, with a Sansui tape deck, automatic cueing. Denon's DP-11F uses special arm (see detail above) to cut down on mistracking. Kenwood P-9 is a linear-tracking model designed to stand up on a narrow shelf. Like the Sansui, it will offer automatic cueing with a Kenwood tape deck.

DUAL CS505-1 Pivoted Arm



Gearing up for the digital competition, conventional records and turntables are currently going through some significant changes. More sound is packed into record grooves by computer-guided record cutters. To track such records, with their potent bass and shattering loudness peaks, phono cartridges are now brought close to their theoretical limits. But these new high-performance cartridges can't live up to their promise if tone arms

that hold them won't "play along." So, with one development pushing the next, a lot of engineering attention now centers on tone-arm design.

The challenge is being met in two ways: first, by refining the conventional pivoted arm and, second, by use of the linear-tracking arm. PM checked out both approaches, testing five new turntables and their tone arms.

The most dramatic departure in

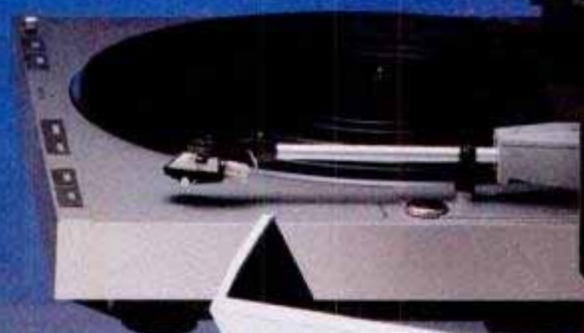
recent tone-arm design is the linear-tracking arm, sometimes also called a radial arm. Unlike conventional arms, these linear models do not swing across the record, swiveling on a pivot. Instead, the arm slowly crawls across the record in a straight radial line, inching its way from the outer grooves toward the label. This reshuffles the whole basic geometry of groove tracking, eliminating what is known as the

(Please turn to page 135)

SANSUI P-M7
Linear Tracking



DENON DP-11F
Pivoted Arm



KENWOOD P-9
Linear Tracking





Now Your Sailboard Can Fly!

When this hydrofoil attachment lifts your board out of the water, you'll outrun the wind.

A sailboard with a hydrofoil mounted underneath lifts out of the water and picks up speed.

Windsurfing, the most explosive sailing sport to hit the beaches, is about to experience a new lift. Already more than a million of these challenging watercraft are in use all over the world. Now there is a new hydrofoil accessory that will allow sailboards to travel literally faster than the wind.

The dramatic new hydrofoil appendage, which promises even more spectacular sailboard records, was developed by Prof. Sam Bradfield of the Dept. of Mechanical Engineering at the State University of New York at Stony Brook, N.Y., and an engineering student, Neocles Athanasiades, who is also an airplane pilot. The add-on looks like a miniature, canard-winged airplane attached to an underwater strut, and slips into the center daggerboard slot of the board. Bradfield reports that, as the board picks up speed, the underwater foils lift

(Please turn to page 161)



Group Surfing

What we have here is a windsurfer built for nine—yes, *nine*—using the modular Shark System Board and a few extra pieces.

The basic Shark System is a three-piece board held together by tierods and bolts. The board can be disassembled in about five minutes and fits inside your car. The basic board can also be assembled without the 4-foot center section for wave surfing. An optional 13½-foot-long section, with mounting points for two

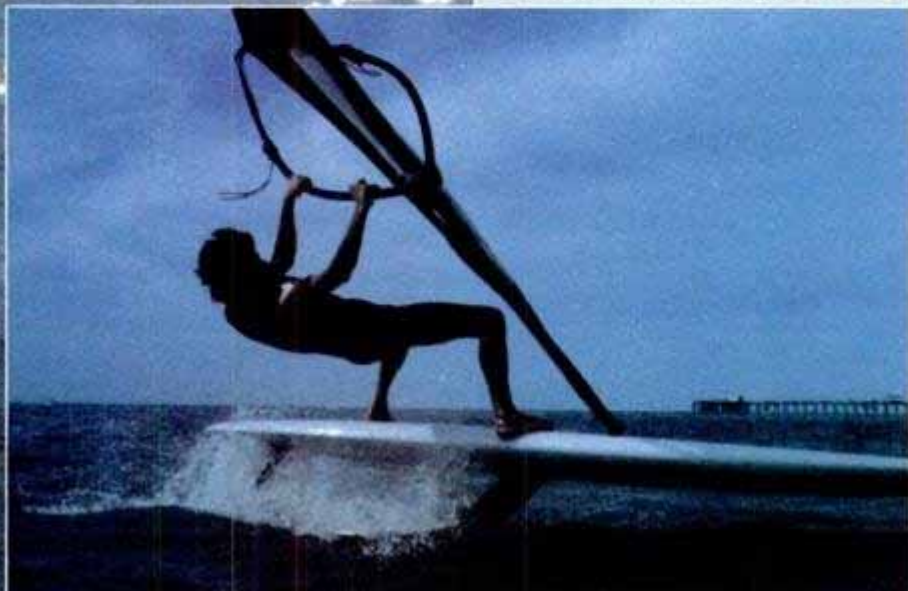
sails, is also available. This allows the basic board to be used in three different configurations—sailboard, tandem sailboard and surfboard. What you see above is a super stretch Shark with four tandem sections and the normal center section screwed between its prow and stern. The result: windsurfing fun for large families, choral groups, or baseball teams.

It's from Shark Wassersportgeräte, Bassum, West Germany.



When disassembled (left), Aquafoil is entirely portable and can be transported to the surf on a car roof. Assembly (right) can be completed in three minutes.

Sailing in small waves (below, right) can be a thrill, too. There's always an exhilarating rush of freedom as the sailboard lifts out of the water (below, left).



AMC RENAULT ALLIANCE

"It looks expensive, but it's not priced that way."

GEORGIA AIRLINE AGENT

"Everything fits perfectly."

ILLINOIS LINE OPERATOR

"It really rides well, soaks up highway bumps."

NEW YORK APPLIANCE TECHNICIAN

"I expected better gas mileage."

WISCONSIN NURSE



Half American and half French, the Alliance is one of the best built cars.

Thanks to the current low value of the French franc against the American dollar, the AMC/Renault Alliance enjoys a nice price advantage over a number of imports. Right now, the Alliance's \$5,595 sticker beats the Toyota Starlet by \$203, the Mitsubishi Tredia by \$944, and the Nissan Stanza by \$1,404.

Everything except the Alliance's engine and transaxle is made in Kenosha, Wis., in a plant that used to turn out

Nash Ramblers. American Motors and Renault spent \$100 million to modernize the Alliance plant, and the car is

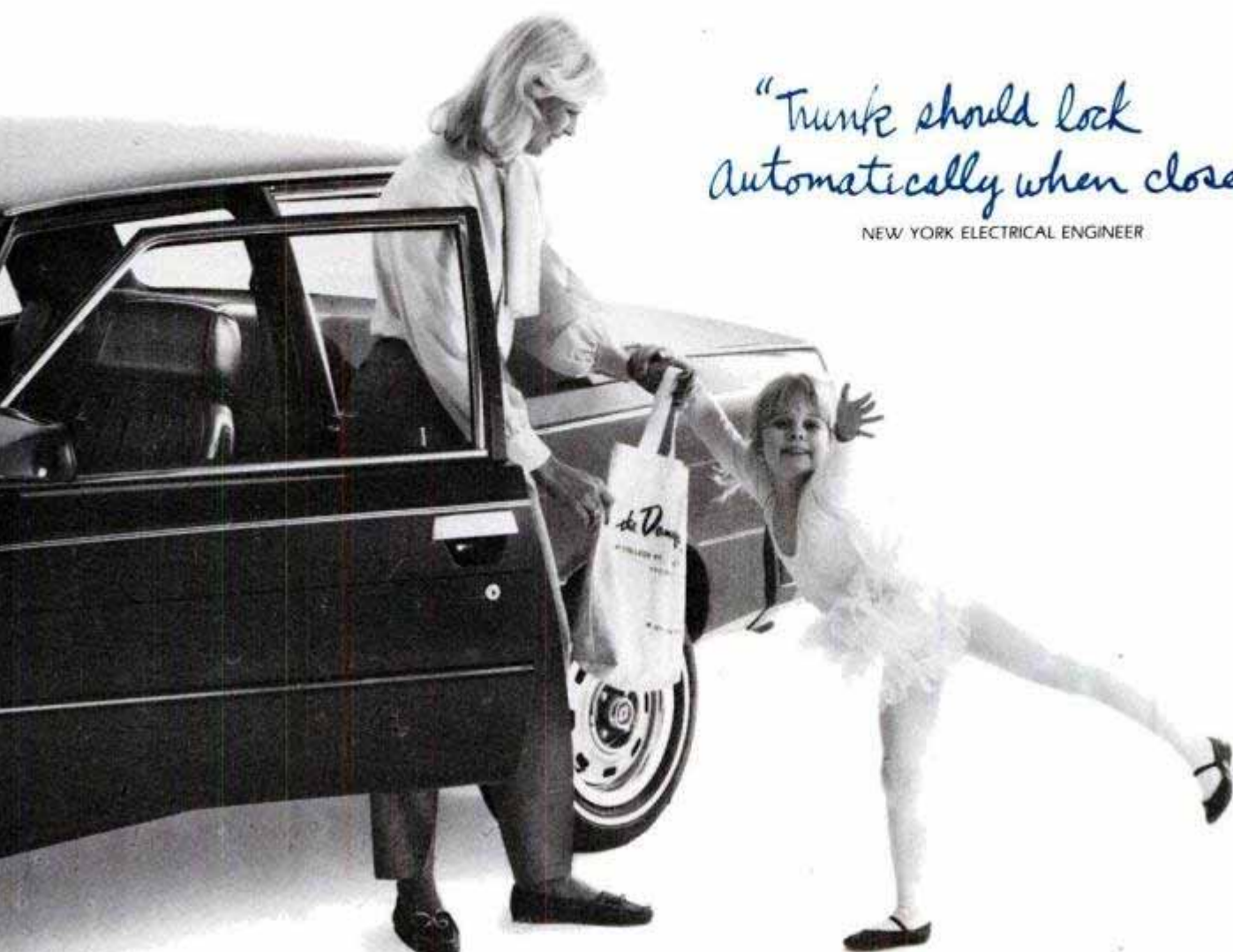


Hospitable cockpit comes with lots of gauges, console, thick steering wheel.

assembled by members of the United Auto Workers—so the Alliance is not quite an import and not quite a domestic.

Old prejudices die hard. Anyone old enough to remember the name Nash can recall that past Renaults haven't won plaudits for quality or service. However, when we surveyed owners of the Renault Fuego (page 153, January 1983), we found them impressed with that car's workmanship and reliability. The Fuego, though, is put together in France. What about the American-made Alliance? How well is this one built?

Very well, indeed, according to the owners we surveyed. "Everything



"Trunk should lock automatically when closed."

NEW YORK ELECTRICAL ENGINEER

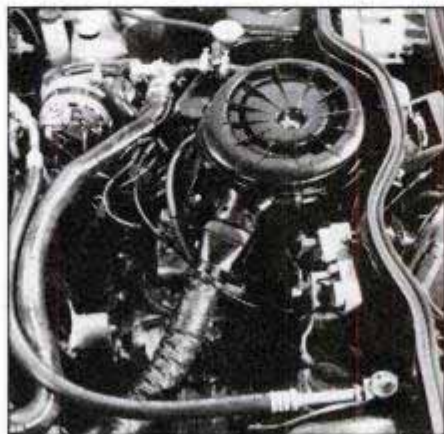
"Well built, comfortable, good on looks, handling and economy."

ARIZONA CIVIL ENGINEER

PM photos: Bill Ashe

works," said an Illinois bookkeeper, "and I've never had any problems at all." A Michigan transit supervisor seconded, "Very solid car; exceptional quality." An Ohio stationary engineer: "Doors shut tight, no wind noise, no orange peel, no rattles. The Alliance is what the VW Bug should have become!"

In all, nearly 60 percent of our respondents rated the Alliance's workmanship excellent. That's a high figure for any car and considerably above the norm for U.S.-built models. Actually, a whopping 93.4 percent rated workmanship good to excellent. That's 10 points above the Lincoln Continental and 23 points over the Trans Am. It's also



The 1.4-liter engine is rated 56 hp. Some owners thought the car needed more.

slightly higher than the Fuego's score.

Quality, though, wasn't the big reason people bought the Alliance. A Florida accountant hit the nail on the head when he wrote, "Great gas mileage from an attractive car." Economy and styling came in first and second as purchase motivators.

Interestingly, the four-speed manual gearbox seems to give better gas mileage than the five-speed (although not much), while drivers with the automatic grumbled a little that they weren't getting the mpg they'd expected. We can't explain the four- versus five-speed discrepancy, but it's common for micro-engined cars with automatics to

(Please turn to page 165)

With the Vivitar printer, you can make color prints without a darkroom. There is a size limitation, but you'll get high-quality prints without the need for an enlarger or additional equipment. The Kodak and Ilford printmakers require darkroom facilities including an enlarger such as the Omega C-700. To use the Omega for color work, you'll need the Color Print Outfit at right. Seen (from top to bottom) are compressed-air can for slide cleaning, color filters and color calculator.

OMEGA COLOR PRINT OUTFIT



OMEGA C-700 ENLARGER



KODAK EKTAFLEX MODEL 8 PRINTMAKER



VIVITAR INSTANT SLIDE PRINTER



Cibachrome MARK II COLOR PROCESSING DRUM



ILFORD PROCESSING DRUM WITH MOTOR BASE





HOW TO MAKE PRINTS FROM SLIDES

You don't need a professional darkroom to take colorful slides and turn them into beautiful, full-color prints.

BY FRANK LUSK PM photos by the author

If you shoot most of your pictures on color slide film, you probably have prints made of your favorite slides. That used to be costly and time-consuming, but new processes and materials have made it possible for photographers to produce their own quality color prints economically and quickly.

No darkroom needed

The Vivitar Slide Printer produces a high-quality color or black-and-white print from a 35-mm slide in a matter of minutes. With most or all of the features found on units costing far more, the Vivitar is a real value.

The unit contains a small automatic flash with manual adjustments of up to one f-stop under and one-and-a-half stops over for greater control of exposure. The flash exposes Polaroid color film held on a carrier atop the unit. The Polaroid pack film accepted by this unit yields prints $3\frac{1}{4} \times \frac{1}{4}$ in.

The copied image must be cropped slightly to fit this format. An illuminated window is provided to preview the slide so you can decide which end to crop. A built-in timer beeps at 35 seconds and again at 70 seconds, the times required to process black-and-white and color films.

You can make a printable b & w negative using Polaroid's Type 665 Positive-Negative pack film by simply rinsing the goo off the negative in a stream of 70° F. water. For color copies, Polaroid's new extended range (ER) Type 669 color film is recom-

mended, but Types 108, 109 and 668 color-pack films will also work. A 2×2-in. color-compensating (CC) filter may be sandwiched with your slide using a filter holder.

Color printing from slides

If you have tried your hand at b & w printing, you need only a small additional investment to get started in color printing. Most enlargers suitable for b & w work, such as the Omega C-700, may be upgraded for color work by purchasing a set of color-printing filters.

An enlarger equipped with a dichroic lamp house is a good investment and offers built-in filtration, greater light output and ease of operation.

Depending on your choice of printing materials, you'll need a printmaker such as Kodak's Ektaflex or Ilford's processing drum. The timer, graduated and thermometer used in b & w work also are needed. A can of compressed air for slide cleaning is a must.

How to make a print

The first step in producing a color enlargement is to select a colorful, sharp and well-exposed color slide. Place your slide in the enlarger and adjust the enlarger's height to produce an 8×10 print.

Next, following the paper manufacturer's recommendations, insert (or dial in, if your enlarger has a dichroic lamp house) color filters into the en-

larger. Make a test print by gradually uncovering the projected image while the paper is being exposed. This will produce a print exposed in steps of 60, 50, 40, 30 and 20 seconds, for example.

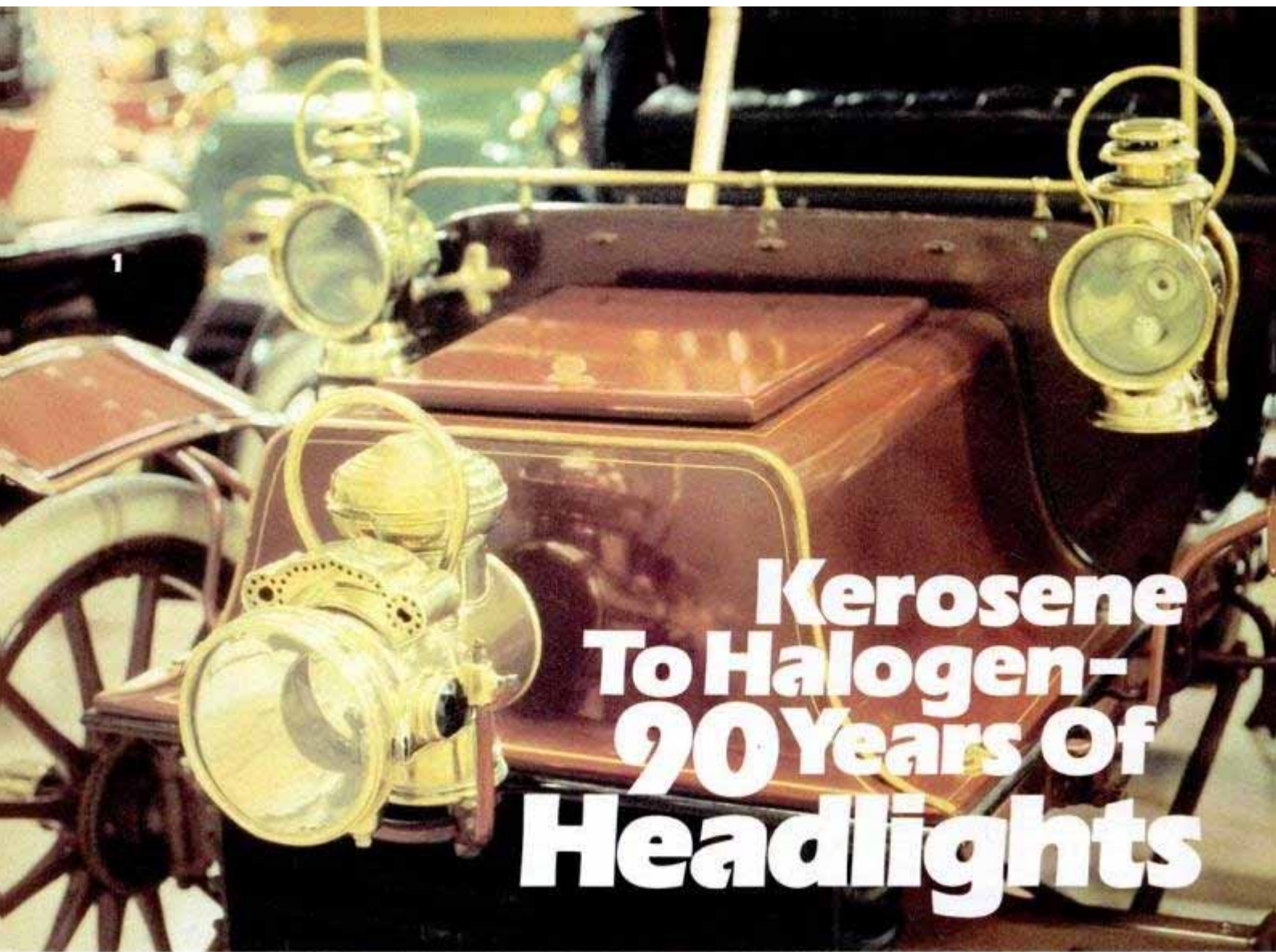
Process the print in its appropriate chemistry. The color will probably be awful, but you should at least know the basic exposure needed to produce an 8×10 print. The changes needed in your basic filter pack may be estimated by viewing the correctly exposed portion of the test print through whatever color or combination of filters it takes to make the color of the print look right.

Make another print using the adjusted filter pack, keeping in mind that an adjustment in exposure may be necessary to compensate for changes in your filter pack's density. This second print should be in the ballpark, but a few more attempts probably will be necessary to fine tune your basic exposure/filtration combination.

Color print calculators can be costly. However, an inexpensive exposure-filter calculator, such as the one shown (by Omega), can pay for itself quickly in time and material savings. They generally cost under \$20 and are compatible with all popular print processes.

Since every slide is different, making a contact print of all possible printing candidates will provide you with lots of useful information. Simply

(Please turn to page 137)



Kerosene To Halogen- 90 Years of Headlights



From dim coach lights to the 150,000-candlepower flamethrowers of today, headlights have stopped us from going bump in the night for 90 years.

BY MICHAEL LAMM
WEST COAST EDITOR

Automobiles before about 1902 usually came without any lamps at all. Lamps were accessories, and owners paid extra for them. From 1892 to 1902, cars that did have lamps carried either the one-candlepower variety (actually powered by one candle) or used kerosene, oil or carbide fuel.

From 1902 through the early teens, big carbide brass headlights

(Please turn to page 152)

PM photos by the author
All photos taken at Harrah's Automobile Museum,
Reno, Nev

1 The 1904 Cadillac sported kerosene sidelamps and acetylene headlamp.

2 This 1892 Phillion lamp was carried over from horse-drawn carriages.

3 Dietz made this kerosene headlamp for curved-dash 1904 Oldsmobile.

4 Solid-brass acetylene lamp by Phare was on 1901 Panhard-Levassor.

5 The 1912 Speedwell was one of first cars to have electric headlight.

6 In 1914, Pierce-Arrow integrated light into fenders and set a trend.

7 No-dazzle lens by Macbeth-Evans of Pittsburgh was on 1920 Argonne.

8 Always at the forefront of technology, Duesenberg fitted a flat Ryan-Lite with two bulbs in 1927.

9 Packard repeated the theme of the grille in the headlights in 1932.

10 In 1933, faired-in headlight was still a styling cue of Pierce-Arrow.

11 The milestone 1934 Chrysler Air-flow faired headlights into fenders for better aerodynamics.

12 The '36 Cord 810 had first pop-up headlight worked by crank on dash.

13 The 1937 Ford pushed the headlight back into the car's fender and continued the body line at bottom.

14 Center lamp on the 1948 Tucker turned with wheels to light corners.

15 The fencing-mask stone guard on 1953 Corvette gave the car the rakish, sporty image Chevrolet wanted.

16 In 1954, the Hudson Italia featured fake scoops above the headlights.

17 Packard used five-pound bezel in '57, when excessive chrome was standard.

18 In 1963, Chrysler tried to make turbine car look futuristic and surrounded lights with something that looked like a jet's exhaust tube.

19 Buick Riviera stacked lights in '65 and used a flip-open, clamshell cover.



Build Your Kids This Pop-Top Desk

Flip the top up to any one of the angled positions and your youngster has a tilted drawing board. When the top is flat, it's a table. Bonus: Plans for building the chair.

BY ROSARIO CAPOTOSTO



Design includes a swing-out tray, two drawers and pencil-stop to keep supplies from rolling or sliding off the desk top when tilted.

Here is a sure way to involve youngsters from 3 to 10 in crafts and hobbies. The PM Pop-Top Desk boasts a tilting top that can be positioned to suit the activity at hand—from flat for jigsaw puzzles and games to a steep pitch for working on paintings.

Though we sized the original desk to suit the above ages, you can increase

the dimensions proportionately to meet the needs of teen-agers or adults, if desired. All will delight in using this functional piece with its generous storage for supplies used in crafts and hobbies.

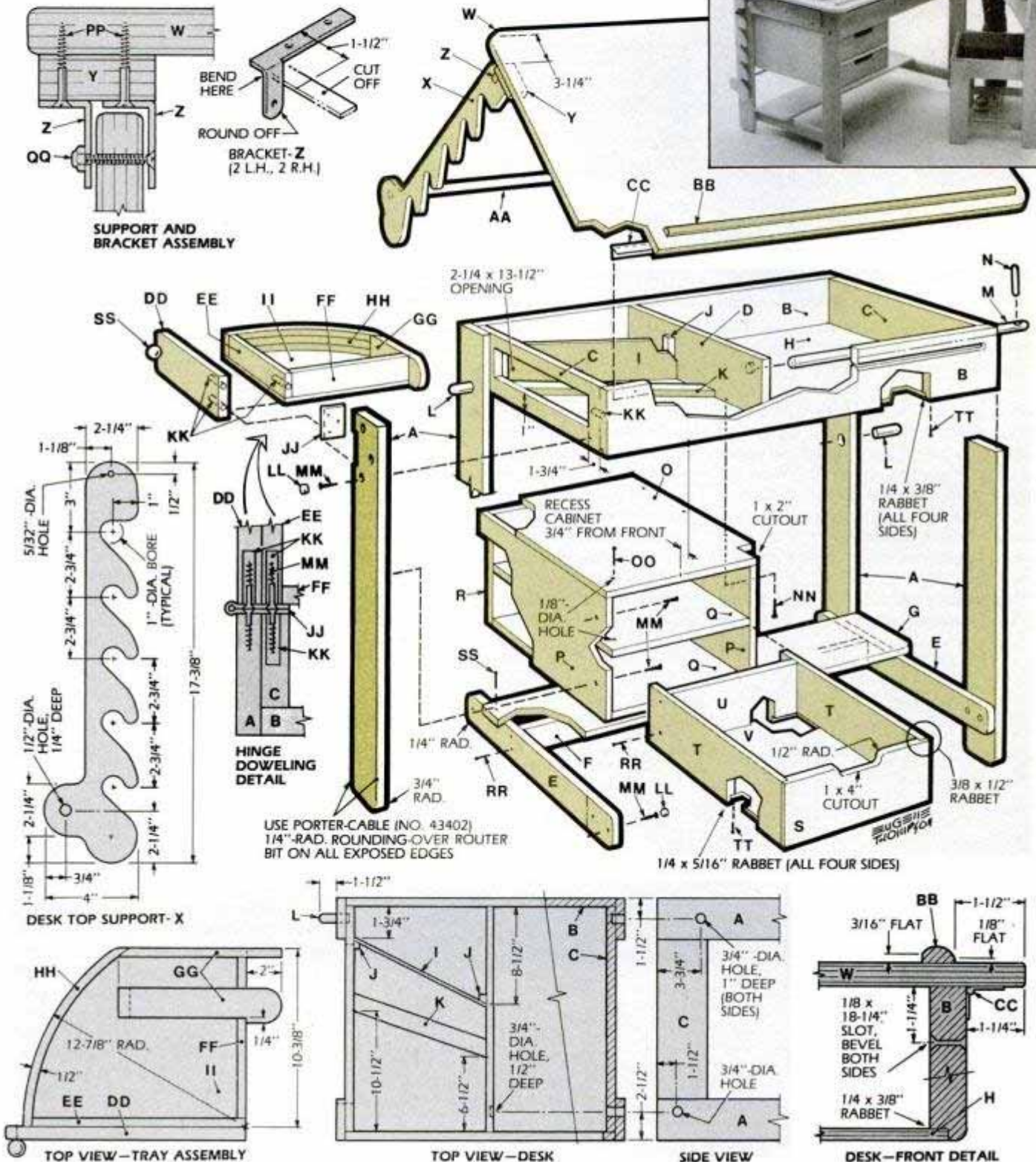
A neat swing-out tray on the left provides easy access to small items which must be kept handy. Two roomy drawers and the storage compartments

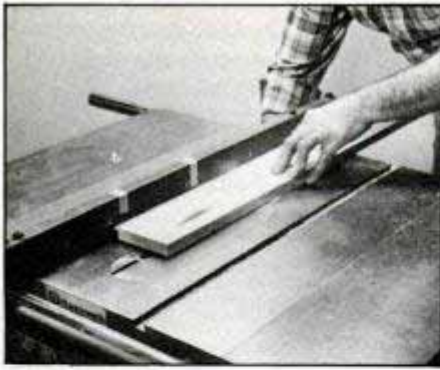
under the tilting tabletop will hold a fair amount of art supplies, games and other things. The compartment under the hinged seat adds even more storage space.

A roll of 18-in.-wide sketching or

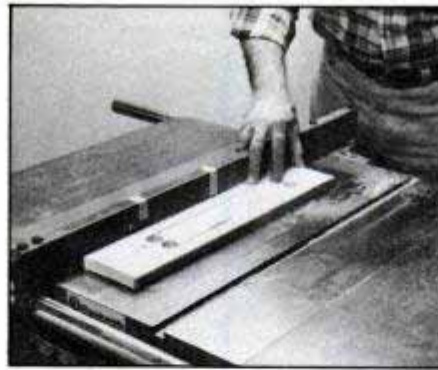
Concept: Bob Pfreundschuh
 Construction and design: Rosario Capotosto
 PM color photo: Harry Hartman; black and white photos by the author
 Finish: Krylon Paints

Though small in size, PM's Pop Top Desk has storage space galore. We even utilized area beneath chair seat.





Cut the drawing paper access slot by slowly raising the blade into the work. Tape on fence shows cutting limits.



Use the same blind cut procedure to cut the opening for the swing-out tray. Use a sabre saw for the short end cuts.



Use a V-groove router bit to bevel paper slot edges. A wood block clamped to base accurately guides the router.

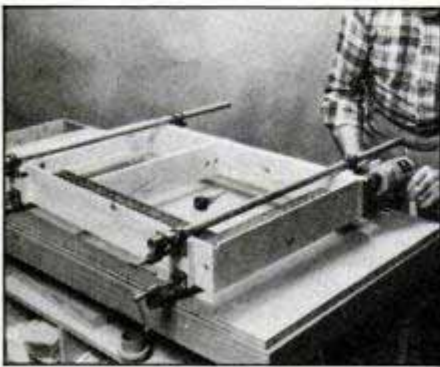
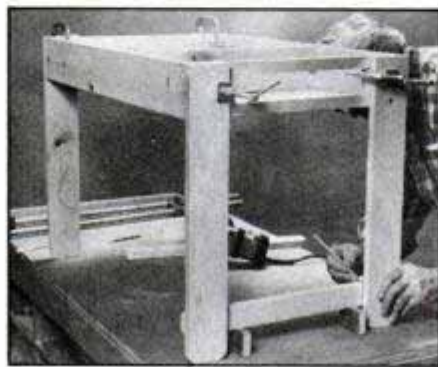
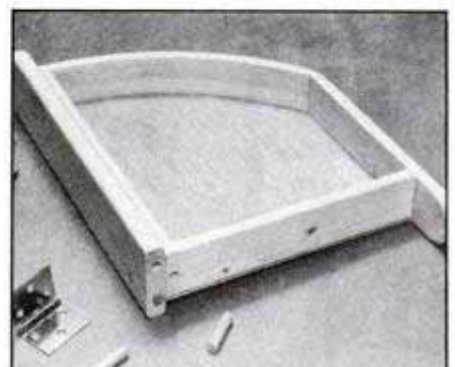


Table frame is dry-assembled and then clamped for boring screw pilot holes. Square is positioned to ensure accuracy.



Reassemble table and bore screw holes in legs and stretchers. Mark the pieces to be shaped with corner-round bit.



Insert hardwood dowels in end grain to give hinge screws better holding power.

newsprint paper conveniently feeds out of a slot in the front apron. It should be noted that 18-in.-wide sketching paper in rolls is commonly available at art supply stores. Newsprint is usually sold in 36-in.-wide rolls. If you opt for the less expensive newsprint, you can buy the wide roll and cut it in half on your band saw.

The prime consideration in designing this desk was making certain the tilting

top was safe. Folding metal brackets and adjustable lid supports which require forceful tightening were ruled out because of the possibility of accidental slipping which could crush a tiny finger or hand. The novel and positive-holding four-position, tilting-top supports contrived for this table do the job nicely and safely.

The top is elevated by lifting it at back center with one hand until the

desired notches in the supports flop into place. The crossbar between the supports facilitates lowering the top: One hand can pull out on the bar to disengage the supports, while the other hand holds and lowers the top.

Another safety feature is found in the drawers: They can't be pulled out of their compartments accidentally. The drawer stops consist of two 1½-in. common nails with the points blunted. They're dropped through holes above each drawer. The drawer backs strike these projecting nails and effectively stop when contact is made.

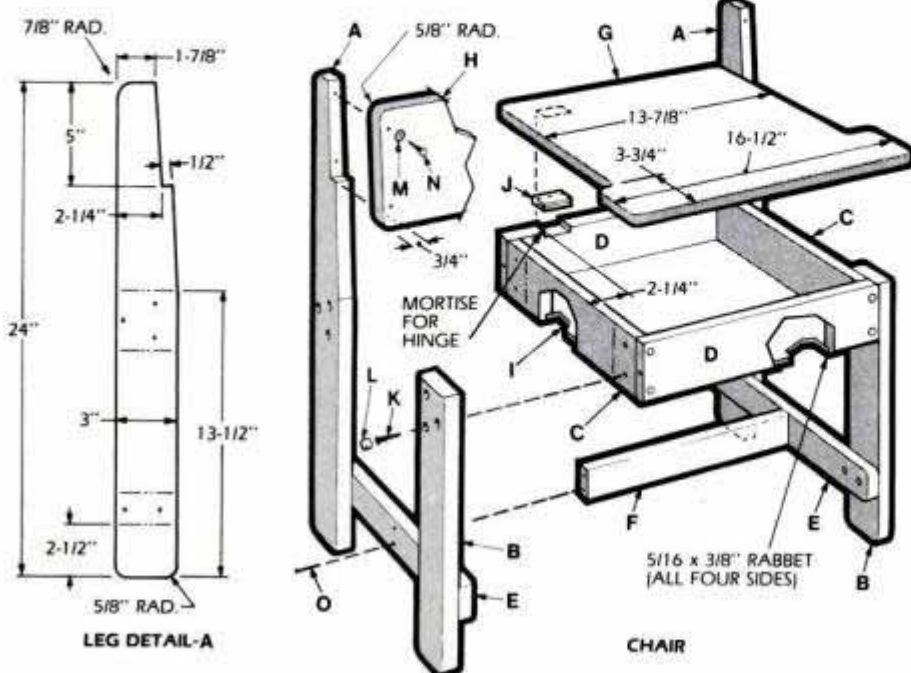
Construction

Common No. 2 grade pine carefully selected for small tight knots and ½-in. MDO plywood as well as ¼-in. lauan plywood are used for this project.

MDO is Medium Density Overlaid fir plywood. It has a tough, smooth, resin-coated surface which can be cut without splintering; it is especially well suited for painting. In addition, this material has better quality inner plies so you won't have the usual problem of large voids, which are common in ordinary fir plywood. It's a bit more expensive, but well worth the difference. Be sure to order S/2/S—surfaced two sides.

Cut 1×6 boards to size for the front and side aprons, then cut ¼×5½-in. rabbets on the inside bottoms. Lay out

[\(Please turn to page 153\)](#)



WORKSHOP MINICOURSE



More about dowel joinery

Last month and in April, we listed the basics for working with dowels. The point I like to impress on beginning woodworkers is that the best way to gain experience with dowels is to work with them. This means that you should spend a couple of bucks on a few lengths of dowel and common pine for testing and practice.

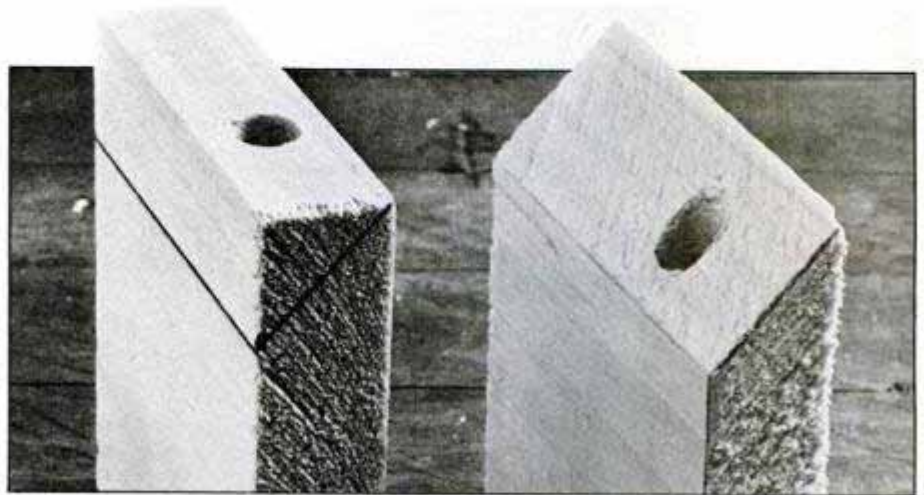
The easiest way to explain about working with dowels is to take the exercise step by step, recipe fashion. What follows is condensed, of course, because of space limitations. But good shop habits are spelled out.

1. Invest in a quality doweling jig. Don't be tempted by economy models or so-called new and better versions. Every woodworker I've ever worked with uses a quality doweling jig. Once you buy the jig, take time to read instructions and practice.

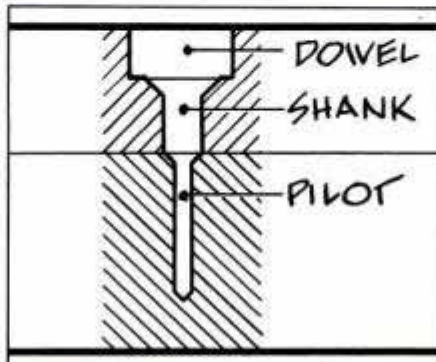
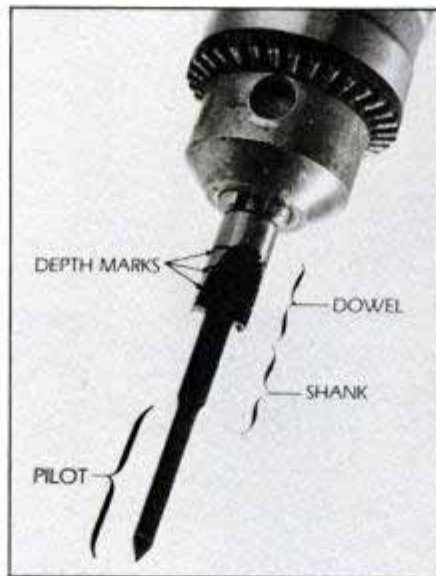
2. When laying out for and boring dowel holes, always clamp the workpiece in a vise and use a square and very sharp pencil, or an awl, for marking the points to be bored.

3. Always use a depth stop of some sort on your bit if you intend to bore the various holes with different bits (instead of using a combination bit like the one shown at right). If you do use several bits, start boring with the counterbore (the largest) hole first. Then, follow with the shank bit and, finally, the pilot bit. If you bore the holes starting with the smallest diameter, you'll lose center and it will be impossible to drill an accurate counterbore hole.

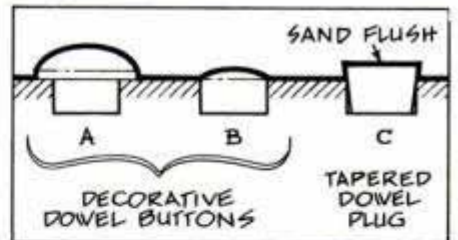
4. After boring holes in both edges to be joined, make certain you clear all shavings from holes. Apply a scant amount of glue to one half of all dowels and insert them into the holes in the edge of one board. *Before* applying any glue to the board edges, line up the two boards to make certain the dowels will enter their mating holes. Occasionally, one of the holes can be off a slight amount—even $\frac{1}{64}$ in. can stop that dowel from entering its hole. When this happens, use a sharp knife to trim the offending dowel. This is a professional stunt that saves aggravation and wasted materials.



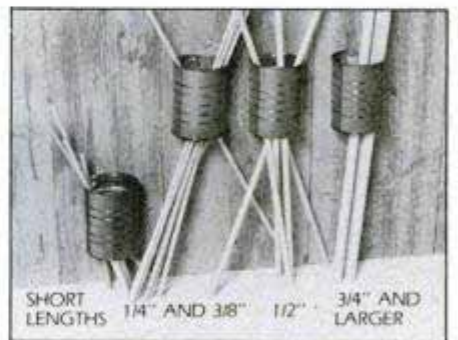
Work sequence is frequently important in shop work. For example, when you have to bore straight holes in a beveled edge, bore the holes first and then cut the angle.



Combination bit (top) lets you bore a hole exactly to suit the screw and task. Various parts of the bit—and the function each performs—are shown in drawing.



These are the types of dowel plugs that you are most likely to use: A and B are decorative; C, the tapered plug, is tapped in tightly, and then sanded flush.



Author's method for keeping his dowel inventory organized: Remove both ends from coffee can and drill a hole on side of the can to permit fastening it to wall with a screw. Paint finish is optional.

20 Expert Answers To TOUGH PAINT PROBLEMS

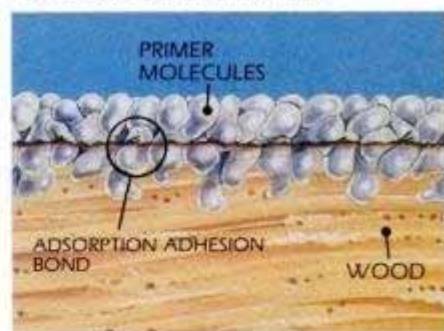
Here's a guide that helps you analyze the symptoms of paint failure and tells you what to do about them.

BY JOHN H. INGERSOLL

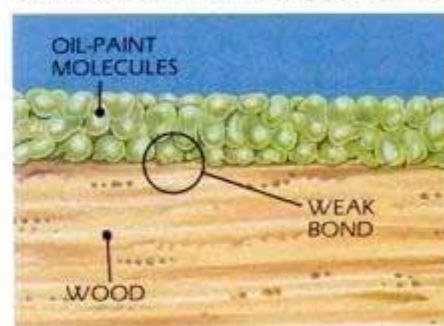


The majority of paint problems are caused by moisture. Originating inside the house, moisture absorbed by this window frame has lifted the paint. To correct the problem and save hours of scraping and repainting, venting is needed.

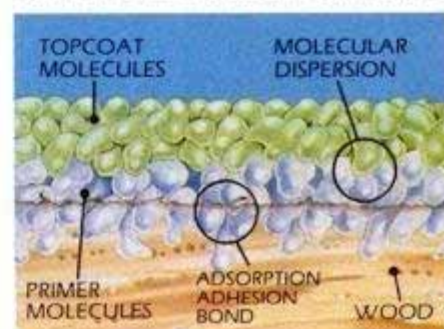
OIL-BASE PRIMER



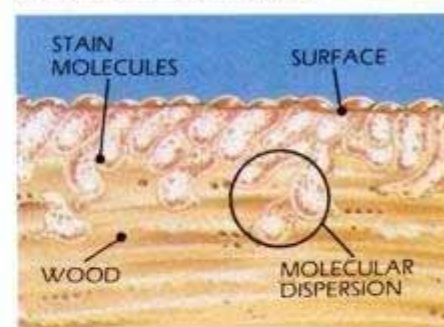
OIL-BASE PAINT WITHOUT



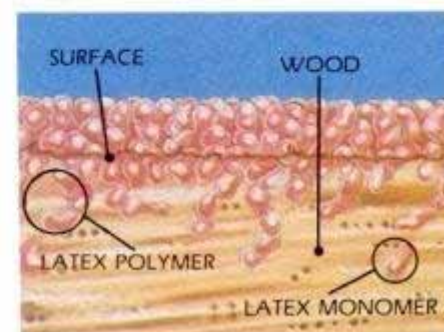
OIL-BASE PAINT OVER OIL-

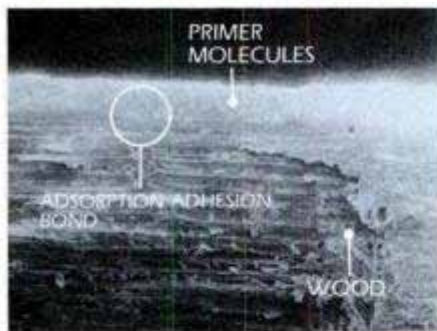


OIL-BASE STAIN



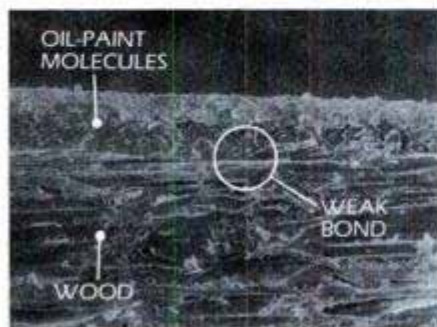
LATEX PAINT





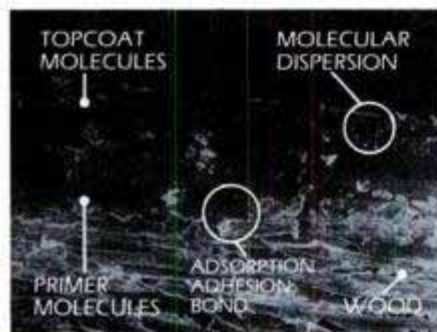
Electron micrograph (left) shows oil-base primer applied to wood at a magnification of 120x. Illustration (far left) clarifies data shown in photo. Contrary to popular belief, oil-base paints do not penetrate wood deeply, except when surface is highly porous. Instead, primer molecules virtually fuse with wood molecules at lumber surfaces, a process called "adsorption adhesion." The wood surface must be clean.

PRIMER COAT

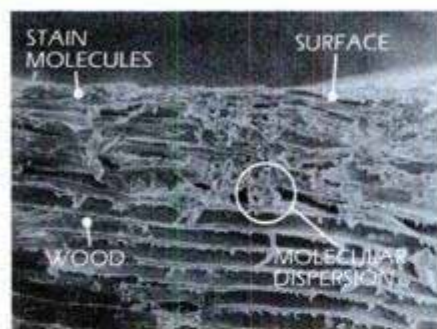


Oil-base topcoats contain more pigment and less oil per unit of volume. Because of the reduced level of oil molecules, adsorption adhesion bonds occur less frequently—the consequence being that finish paints, when applied to bare wood, form a brittle coat that cracks and peels easily. A topcoat by itself, lying on surface, is held together by forces similar to magnetic forces that bind molecules rather weakly.

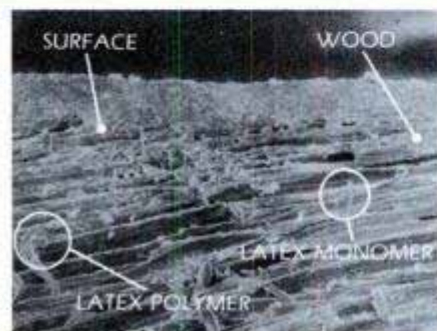
BASE PRIMER



When you apply an oil-base topcoat over an oil primer, the extra pigment in the topcoat becomes strongly bound to the primer coat, as shown. The two paints "mix" by a process called "molecular dispersion," in which rows of surface-paint molecules move through groups of primer molecules, interlocking with them. Primer gives topcoat tight grip on wood surface by means of the adsorption adhesion bond.



Pigments are soluble in wood, so wood stain—which is largely pigment—goes deeply into wood. The same is not true with oil topcoats because oil dominates the molecular interactions. Micrograph (left) and illustration (far left) show almost total penetration by stain. The stain molecules do not bond with wood molecules; they intermix through molecular dispersion. Topcoat's dispersion is with primer—not wood.



The latex paint molecules are "monomers" that become "polymers" as evaporation occurs. A monomer is a one-molecule unit; a polymer is a many-molecule chain. Contrary to common belief, when latex is in the monomer state (wet), it penetrates relatively deep into wood pores. In polymer state (dry), its chemical nature does not change. Latex does not break down; weathering appears as slight peeling.

Things are rarely as simple as they seem, and exterior house painting is no exception. Most nettling is when you have a problem that apparently can't be solved by ordinary means. It's frustrating because what seems to work for others won't work for you.

We've compiled questions and answers about the most frequent house-painting problems so that you can learn about the methods that work best.

Q. Last spring, I scraped every speck of defective paint from the siding on our house, then primed and painted with a high-quality topcoat. By November, the new paint had blistered. My neighbor painted two years earlier and his house remains in pristine condition. Why?

A. Cut open some of the paint blisters. If bare wood shows beneath, it's almost certain that you have a moisture problem. Check the venting on your neighbor's house and compare it with your own. Does he have a stationary attic vent? Has he installed vents in the siding? Good venting allows moisture to pass to the outdoors from inside a house before it can penetrate the siding and lift the paint. As a further precaution, use paint on interior walls that is rated as a vapor barrier. Also, make sure caulking and flashing are sealing out leaks.

Q. Why is it that paint sticks to every surface on our house except underneath the eaves?

A. There is probably no vapor barrier behind the eaves sheathing. Installing one or venting the eaves will preserve future paint jobs. Another possible trouble source is airborne dirt and dust particles carrying natural and industrial salts which lodge behind the sheathing and affect the paint bond. After scraping and sanding the eaves, scrub them with detergent and let them dry thoroughly, then prime and paint.

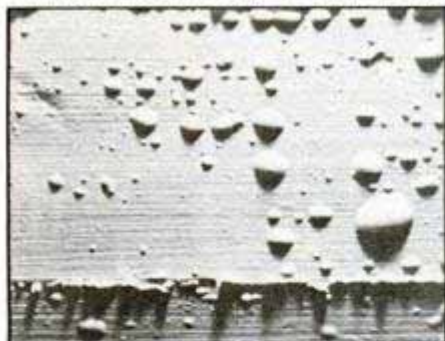
Q. We can't keep paint on our seaside home. What's the reason?

A. Salt trapped beneath a new coat of paint attracts moisture from the inside of the house, which, in forcing its way out, takes the paint off the siding. An effective way to dislodge salt is "water blasting"—using a high-pressure sprayer to hose down the house. The equipment can be rented. After allowing surfaces to dry, apply an oil-base primer thinned by 25 percent to give it a chance to soak in deeper.

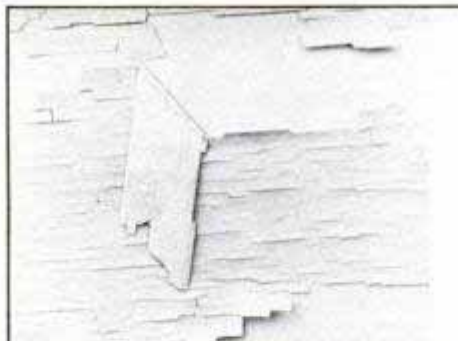
Q. While washing down my house to prepare for painting, I found the dirt came off but the mildew didn't. I know this will destroy the new paint soon. What should I do?

Micrograph photos: Monroe Yoder
Lead photo: Red Devil
Black and white photos: Benjamin Moore Paints
Photo of stone house by the author
Consultant: S.I. Cheng

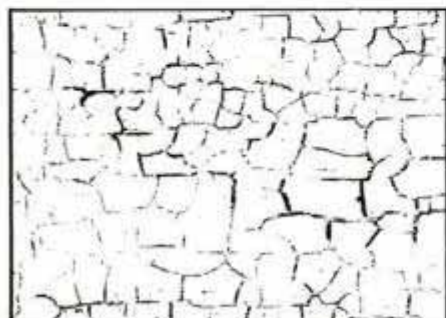
PAINT SURFACE DEFECTS



Blisters, such as these shown at close range, are usually caused by moisture originating inside house. As moisture evaporates, it lifts off paint.



While flaking and peeling like that shown above may be caused by moisture, there are other symptoms to look for. Highly resinous wood will shed paint like water. If some paint remains beneath a peeled layer, the topcoat may have been incompatible with the primer or the remaining layer may have been too glossy or dirty.



Alligatoring, shown above, is a defect caused by building up too many layers of paint. Oil paint is particularly susceptible to alligatoring because it oxidizes continually and eventually grows brittle. Take the time to remove paint down to the substrate (bare surface) by scraping, sanding or chemical means.

A. It's often hard to distinguish mildew from ordinary dirt—both appear as dark stains. To test a spot, dab at it with a bleach-soaked rag. If it's mildew, it will fall off. The best all-purpose washing solution for paint preparation is made with $\frac{2}{3}$ -cup trisodium phosphate, $\frac{1}{2}$ -cup household detergent, 1 quart bleach and 3 quarts of warm water.

Be particularly careful in choosing your detergent—those with ammonia can produce a toxic gas when combined with bleach.

Q. Chalking from white window trim is ruining the appearance of the brick veneer on our home. How can the stains be cleaned off and how can we prevent them from recurring?

A. Start by scrubbing with detergent and water. Then use a muriatic acid solution to get at the tenacious chalk. If this doesn't work, ask a pro to try a light sandblasting. To prevent the condition from recurring, use an oil-base enamel or a latex on the window trim.

Q. We've scraped, wire-brushed and power-sanded flaking paint from our garage in preparation for painting, and still, in some spots, we can't get the paint off. What do you recommend?

A. If paint is hanging on that tightly, don't remove it. Sound paint will not interfere with the bond of the new paint. If your idea is to remove all the

(Please turn to page 140)

A Master Craftsman's Method For Dealing With Peeling Paint

High levels of resin frequently present in wood siding will prevent paint from adhering to the surface. The resin often acts as a solvent for the paint.

The pine siding shown in the photos below peeled every year or so, no matter what kind of paint or undercoat were used. The problem is due, at least in part, to high-resin content. The dark streaks in the bare spots are a sure indication of the presence of resin.

Recently, I learned of a method for dealing with this problem that I think will lick it. The technique is interesting because it

uses glue in a way not many of us have considered.

First, scrape off all loose paint. For a really smooth finish, feather the edges of the remaining paint with sandpaper.

Next, coat the bare spots with a solvent- or lacquer-base glue. Apply a smooth, thin coat. Extend the coat a half-inch or so over the edges of the remaining paint.

Allow the glue to dry for at least 24 hours. You may notice some softening of the existing paint, but it will reharder when the glue is dry.

After the glue has cured, apply a primer, either oil base or latex, then a compatible topcoat.

Using glue as a sealer works well, not only for resin problems, but for moisture-related and staining problems. Most solvent- and lacquer-base cements are virtually clear and leave only a slight amber tinge. They're also good for putting protective coatings on canvas, metal and leather. White wood glues cannot be used as sealers because they have a water base.

If there are only a few peeled spots to seal, a half pint of glue should be sufficient. For about \$3, the half pint will cover roughly the same area as a quart of ordinary primer, since the glue is applied in a thin coat.—Walter Burton

PM photos: Walter Burton



Step 1: Scrape off all the peeling paint; feather the remaining edges smooth.



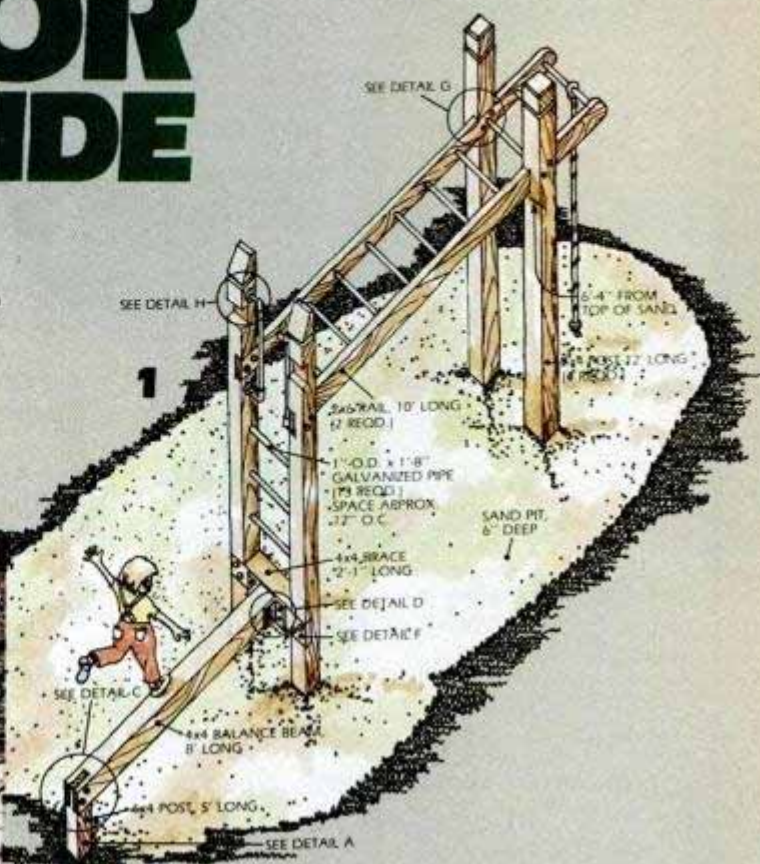
Step 2: Use thin, even coat of glue on any bare spots. Overlap the paint edges.



Step 3: Allow glue to dry 24 hours, and then apply primer suited to topcoat.

OUTDOOR LIVING GUIDE

You can make your home and yard the most appealing in the neighborhood with our great ideas for the summer season.



- 1** Original plans make our yard games better than the playground.
- 2** Fences—the sure way to gain privacy, while adding charm.
- 3** PM answers 17 tough homeowner questions on masonry problems.
- 4** Easy-to-build furniture makes your patio a vacation retreat.



John Deere owners last longer.

Once a John Deere owner, always a John Deere owner. Or so it seems.

Bill Hendrickson, for instance, has been riding his 110 Tractor since 1965. And when he does eventually replace it, he, like most John Deere tractor owners, will probably stay with John Deere.

But that's not surprising when you know how they're built.

Even the smallest John Deere lawn and garden tractors have features like solid steel frames and cast-iron axles with heavy-duty spindles and bearings. Their dependable 4-cycle engines, ranging in size from 10 to 16 hp, are enclosed and isolated for a smoother, quieter ride. And John Deere offers dozens of durable power-matched attachments including center-mounted rotary mowers with 38- or 46-inch cutting widths.

John Deere lawn tractors also have a loyal following. With five models to choose from, you can select mowing width, drive system and power size from 8 to 16 hp. All feature electric start, smooth 4-cycle engines and efficient deep-tunnel mowers. And all offer year-round performance with optional front blades, snow throwers, dump-carts and rear baggers.

John Deere also builds top-quality riding mowers. The 5-speed 68 has an 8-hp synchro-balanced engine; a 30- or 34-inch rotary mower; and a shift-on-the-go, gear-drive transmission for greater durability.

In fact, the John Deere 68 may be the finest rider you can own. Just ask any of the folks who do.

For more information or the name of your nearest dealer, call 800-447-9126 toll free (800-322-6796 in Illinois) or write John Deere, Dept. 50/59, Moline, Illinois 61265.



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A fence makes a statement about you and about how you see your home. Today, the variety of fence treatments offers you a vast range of attractive expressions.

Essentially, fences are protective. They define boundaries and set aside areas for special uses. How strong a statement you make depends on several design features, including the material you choose, fence height, the openness of the fencing, and the gate and gate hardware.

A low split-rail fence is informal, defining an area more than protecting it. A 4-ft. fence with pickets spaced 3 in. apart and fitted with a decorative gate says "look but don't touch; you are welcome to walk on the path." An 8-ft. stockade fence with a solid gate and heavy hardware says "no trespassing."

Other aspects of fence design offer further ways of expressing how the fence is meant to function and what the builder cares about. Painting a fence white makes it stand out, accentuating its protective presence. Natural wood fences recede visually. Setting plants in front of a white fence highlights the plants in a dramatic way. Plants set against natural color fences have a more casual presence. Use of shaped pickets and turned finials on fence posts creates a more formal atmosphere, while simpler elements have the opposite effect.

Your range of design possibilities may be limited by the local building code and property laws. Building codes usually set limits on how close you may build a fence to streets and intersections, how high fences may be, the per-

centage of fence surface that may be solid, the type of security devices allowed (that is, barbed wire, electrification) and, in some cases, the style.

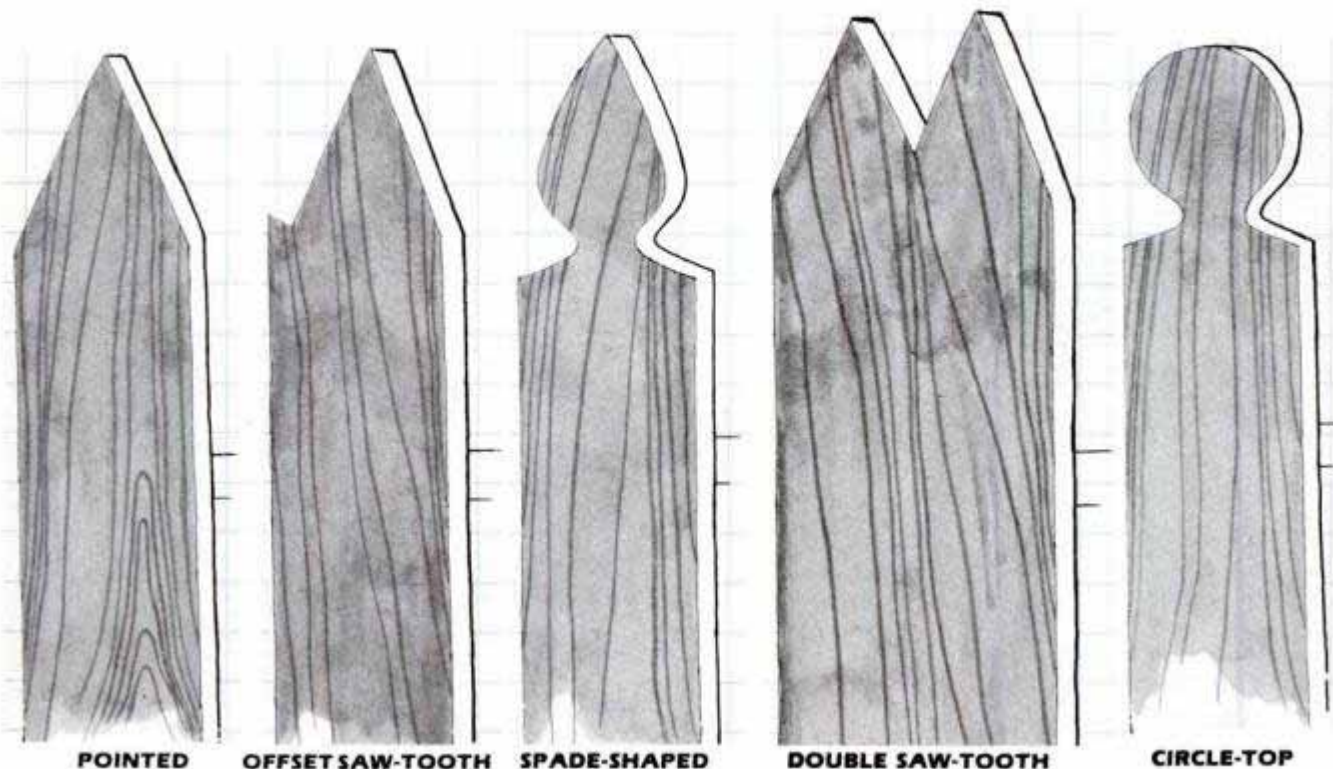
If you plan to erect a fence along your property line and cannot find the lot markers, have a new survey made by a professional. Consult a lawyer about codes and ordinances affecting ownership, maintenance responsibilities and other possible disputes that a fence can cause between neighbors. If your neighbors are erecting fences along your property lines, it may be in your interest to contribute half the cost in order to have some say about design and maintenance.

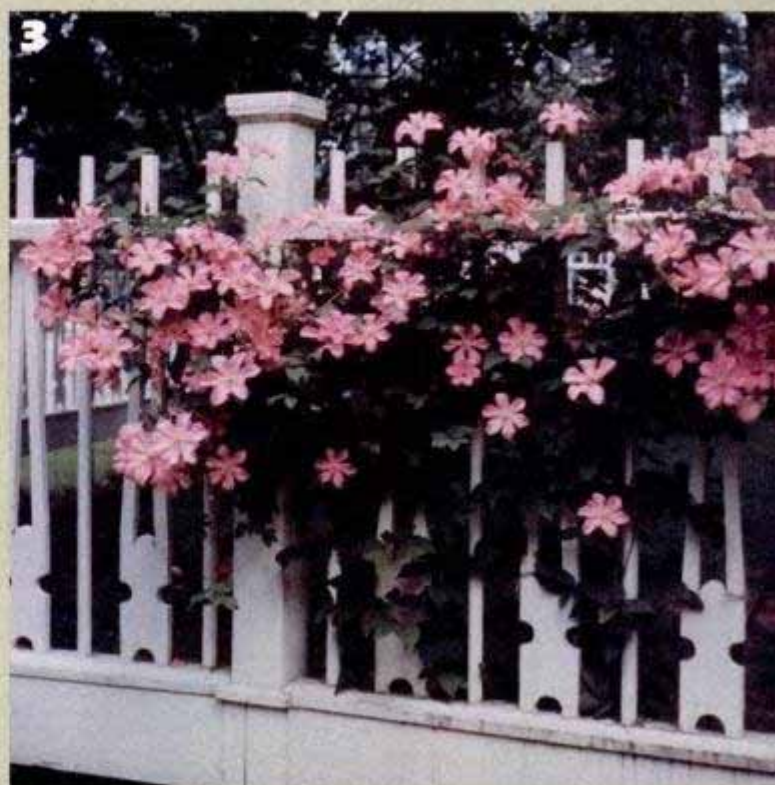
Preparations for building

Once the design and legal questions have been resolved, draw a site plan

TYPICAL PICKET FENCE SHAPES

(1 SQ. = 1")





1 Trellis arches can be cut from 2-in.-thick lumber and glued up in sections. Closely spaced pickets provide privacy.

2 Mortised into posts, 4x4s set corner-up serve as fence rails. The double gate opens onto a wide garden path.

3 Ornate pickets can be cut from 1x4s with sabre saw, nailed to back edge of top rail and toenailed at the base.

4 Rough-sawn pickets are staggered on opposite sides of the stringers in order to give privacy with an open feeling.

5 The center panel of this gate could be made from tongue-and-groove V-joint millwork and framed with 3/4 stock.



OUTDOOR
83
LIVING GUIDE

and plot your fence on it. Also draw an elevation view (as if looking at the fence from straight on) of a typical section of the fence and a detail view of the gate. These drawings will help you to estimate the required materials with greater accuracy.

PM photos: Nos. 1, 3, 5: George Taloumis;
No. 2: Molly Adams; No. 4: Derek Fell

Lumber selection is an important consideration. To decide on the best lumber for a particular fence, weigh the durability of the various types and their compatibility with the desired finish. If you plan to have a fence installed by a contractor, agree on lumber species and grade beforehand.

Pressure-treated lumber and all-heart redwood will prove most resistant to damage from moisture and are recommended, especially for posts. Cedar and cypress are also widely used. If the final finish will be paint, however, none of these may be suitable, since the salts in pressure-treated lumber impair paint adhesion, and resins in the others tend

(Please turn to page 93)

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to bleed through paint. If you aren't using pressure-treated or naturally moisture-resistant lumber, use a wood preservative. The most effective method for application is soaking; that is, immersing lumber in a container filled with preservative.

Creosote is a good preservative, especially for parts of fence posts that will be below ground, but it's oily and bleeds through paint. A five-percent solution of pentachlorophenol is recommended for maximum protection. Penta is paintable, but it's toxic to plants. Copper naphthanate is favored for garden fences because it's safe for plants, but it stains wood green, so it's not suitable for fences where a natural color is desired.

Any part of the fence that will be below ground or within 1 ft. of the ground should be treated with preservative, no matter what type of lumber is used. End grain and any parts used to form joints should also be treated.

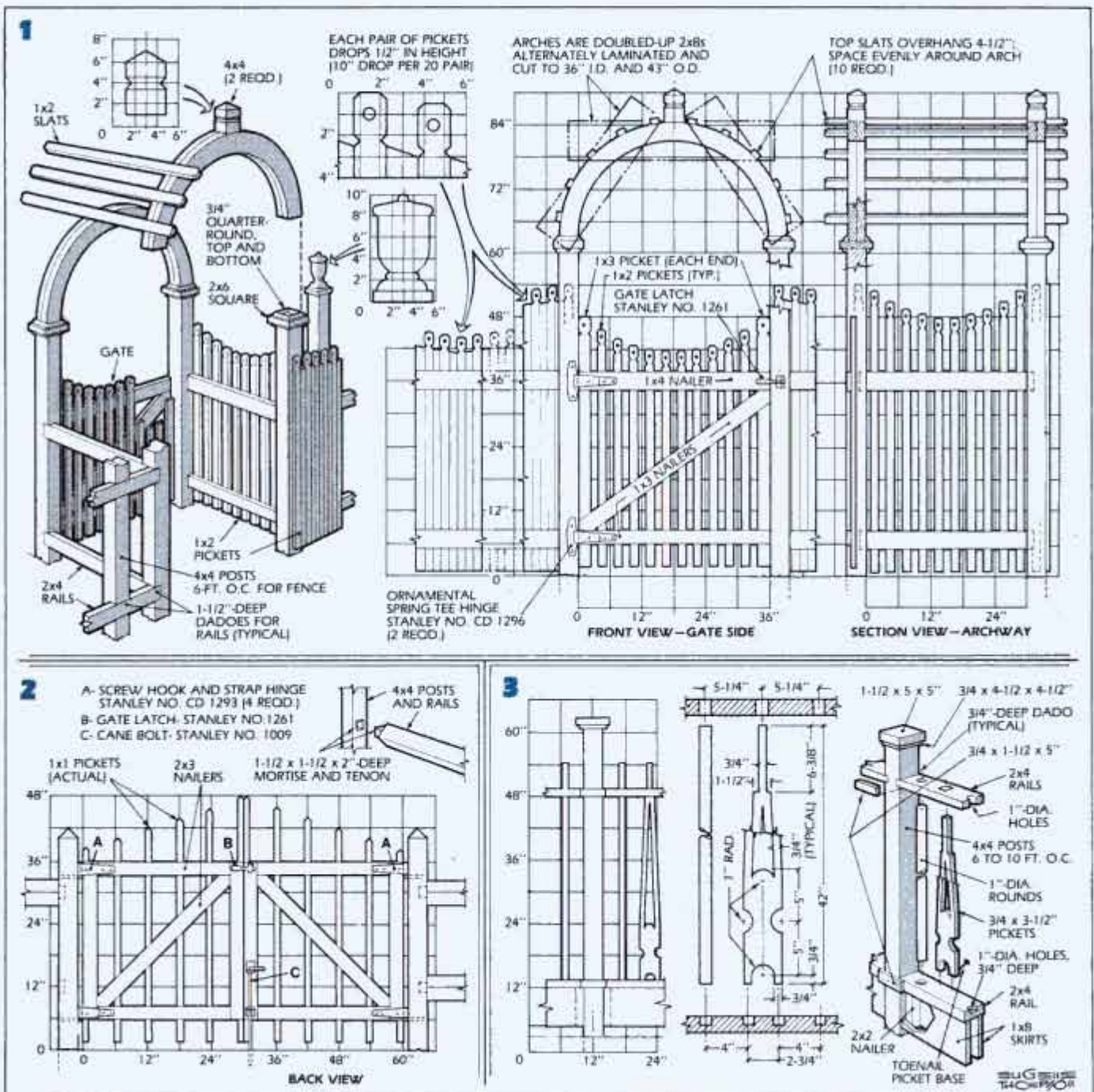
Recommended soaking times for different lumber species vary. Pine can absorb an effective amount of preservative in 12 to 24 hours. Douglas fir and others may need to soak as long as a week. The easiest way to soak long pieces of lumber is to create a trough using 4-mil polyethylene stapled to a 2x4 frame. Build the framework deep enough to soak several boards at once.

If soaking is impractical, apply liberal amounts of preservative to fence parts with a brush, paying particular attention to joints and end grain. Wear rubber gloves, goggles and a respirator when working with preservatives, and don't smoke when using petroleum-base products.

Paints and stains can be applied after the fence is up. Casein paints are economical and hold up better than whitewash. Oil paints are suitable, though some finishes may be damaged by insecticides. Use a stain that contains oil, varnish or creosote for protection.

Construction procedure

Lay out your fence lines on the actual site by driving in stakes just beyond



where the corners are to be and stretching mason's lines between them. Make sure corners are square by laying out a 6-8-10 (or equivalent) right triangle.

Once your layout lines are established, dig holes for setting the fence posts. For this, use either a clamshell posthole digger or an earth auger. Posts are usually set 6 to 8 ft. apart. As a rule of thumb, posts are set with at least one-third of their total height below grade. Corner posts are often set somewhat deeper for extra rigidity. Dig post-holes about 6 in. deeper than necessary to allow for gravel fill to aid drainage.

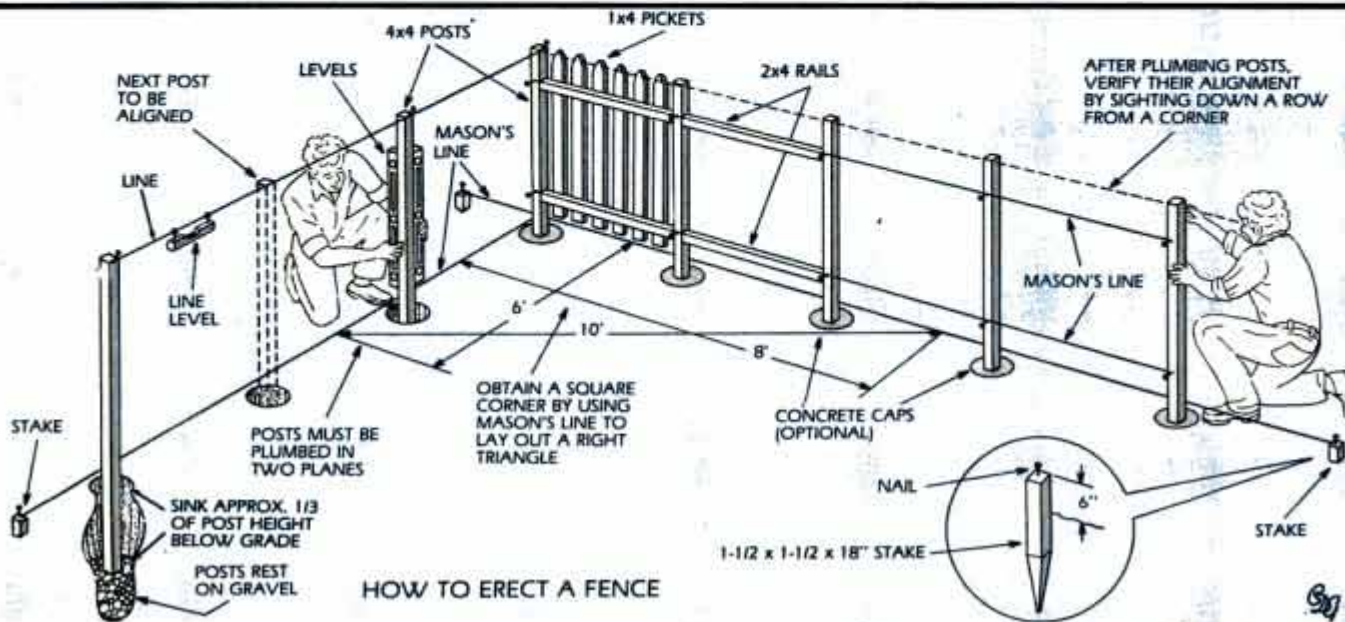
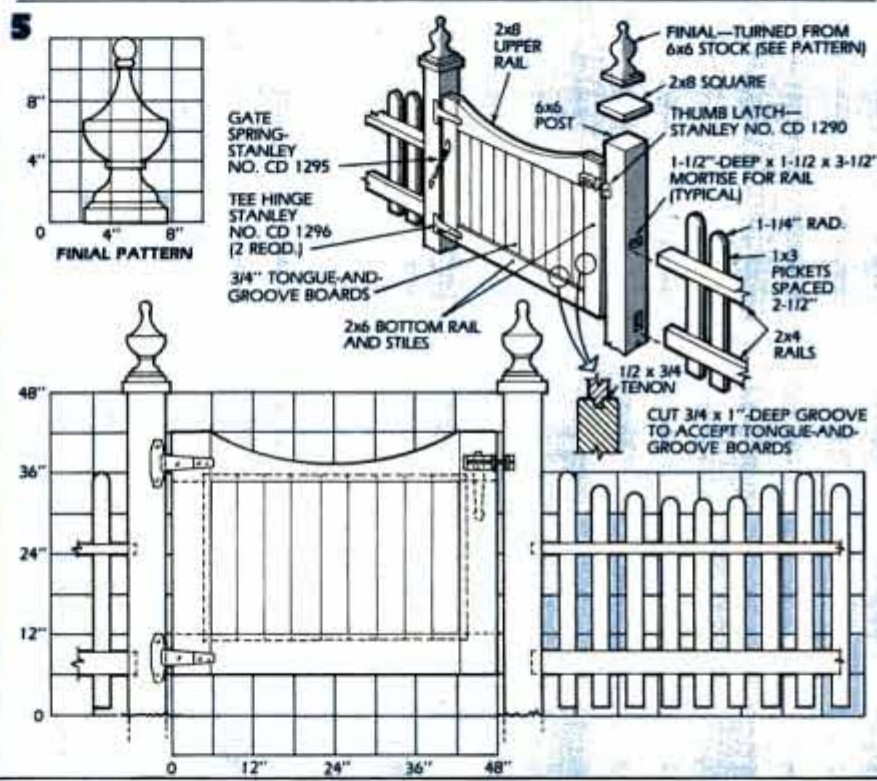
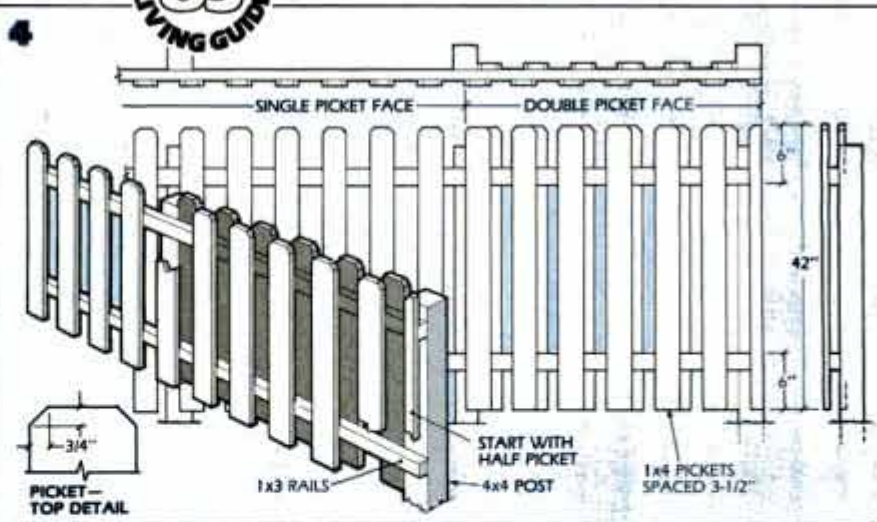
If posts are to be set in concrete collars (the strongest way to anchor them), the holes should be three times wider than the posts. Concrete should not be allowed to get underneath the posts because it will trap water and rot out the post bases. Tops of concrete collars should be pitched away from the posts to achieve positive water runoff.

Posts may be cut to the proper length beforehand, but many professionals simply leave the posts longer than necessary and cut them to the proper height after they are plumbed and anchored.

Posts must be plumbed in both planes. One method is to use two spirit levels on adjacent post faces. Another method would be to drive nails partway into two adjacent faces of each post and suspend a plumb line from each. When plumb lines are both parallel to the faces they're suspended from, the post is plumb.

To support the posts during the plumbing operation, tack two diagonal supports (1x4 stock) on adjacent faces near the top and long enough to reach the ground. Supports should be able to pivot to adjust the post position. When the correct post position is established,

(Please turn to page 97)



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COUNTRY FENCES

(Continued from page 94)

secure braces with stakes, then backfill the hole (you can adjust posts set in fresh concrete for up to 20 minutes). Tamp the earth, if backfilling with soil only. A 3-ft. length of pipe with a cap threaded onto one end and a tee on the other is an ideal homemade tamping tool.

When all posts are set, sight along each row from a corner to doublecheck their alignment. Attach lines from the corners to set the overall height of the fence and the positions of the rails to which the pickets will be nailed. Use a line level to make sure that each of these guidelines is true.

Attaching rails

If your posts are set in concrete, you should wait at least three days before assembling remaining fence members (longer if it has rained recently). Impact from hammering may crack "green" concrete (that is, concrete that has not cured sufficiently).

Rails may be attached to posts in any of a number of ways. The fastest, but also the weakest, is to toenail the ends into the posts. Rails may also be nailed to cleats mounted on the posts. Other alternatives are to let in rails into da-does crosscut into posts or to use mortise-and-tenon joints.

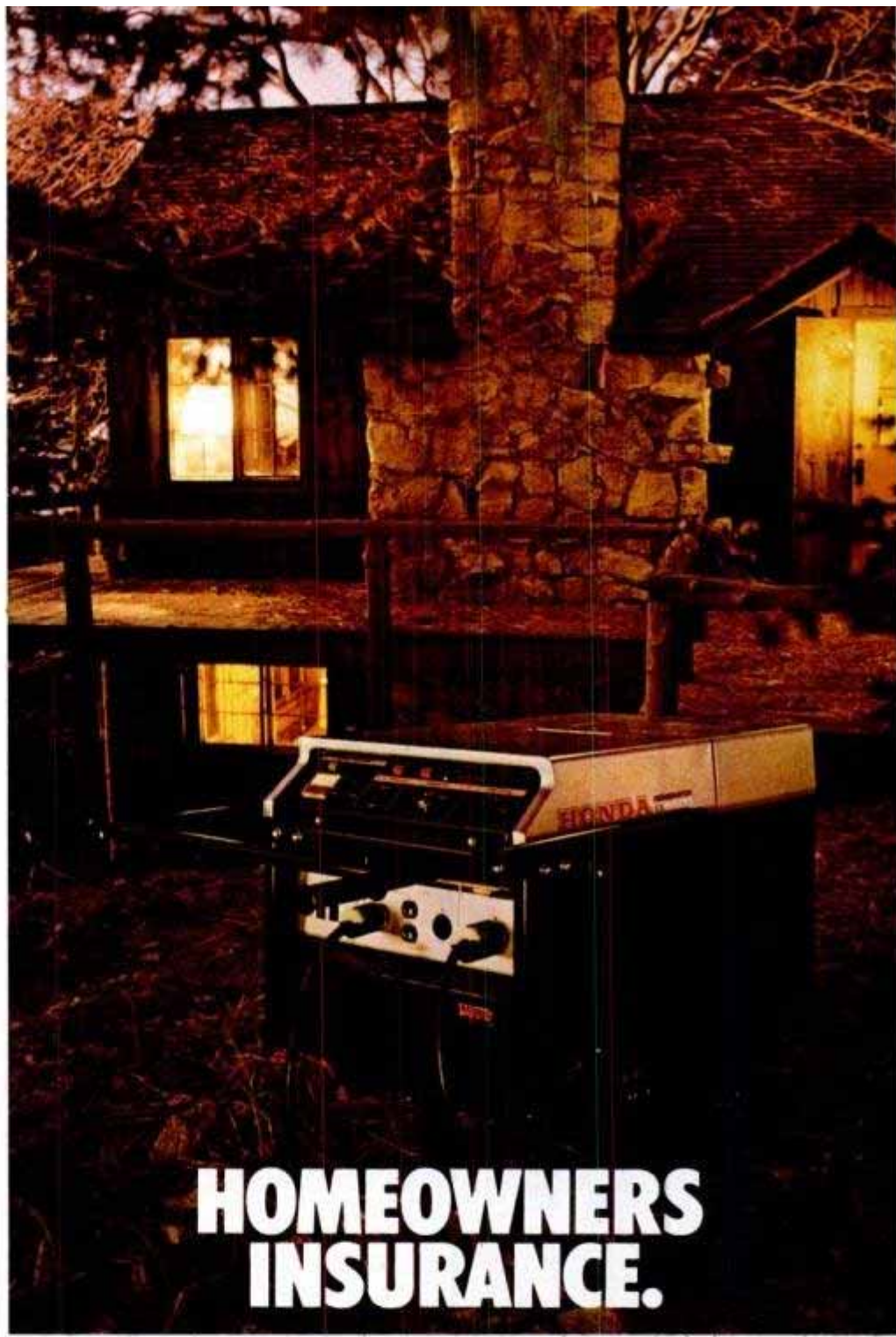
Applying pickets

Pickets are generally face-nailed to the rails. Galvanized or aluminum nails should be used to prevent corrosion and staining. An easy way to assure even spacing between pickets is to rip a guide board to the width of the desired spacing and tack or hold it to the rails in between the pickets as you are nailing the latter in place. A line stretched across the posts will serve as a guideline for the picket tops.

Gates and hardware

Consider several factors when planning gates. Varying the gate design either slightly or radically from the design of the rest of the fence will call attention to it to a lesser or greater extent. Obviously, when privacy is your aim, it is preferable to have a gate be indistinguishable from the rest of the fence.

Gate hardware must be selected with both security and durability in mind. A gate gets more wear than any other part of the fence, and hinges and latches must be able to support both the weight and the frequency of operation. Strap hinges are often selected both for their strength and decorative appeal. Self-latching catches are the norm for garden gates, and they are often fitted with self-closing devices. **PM**



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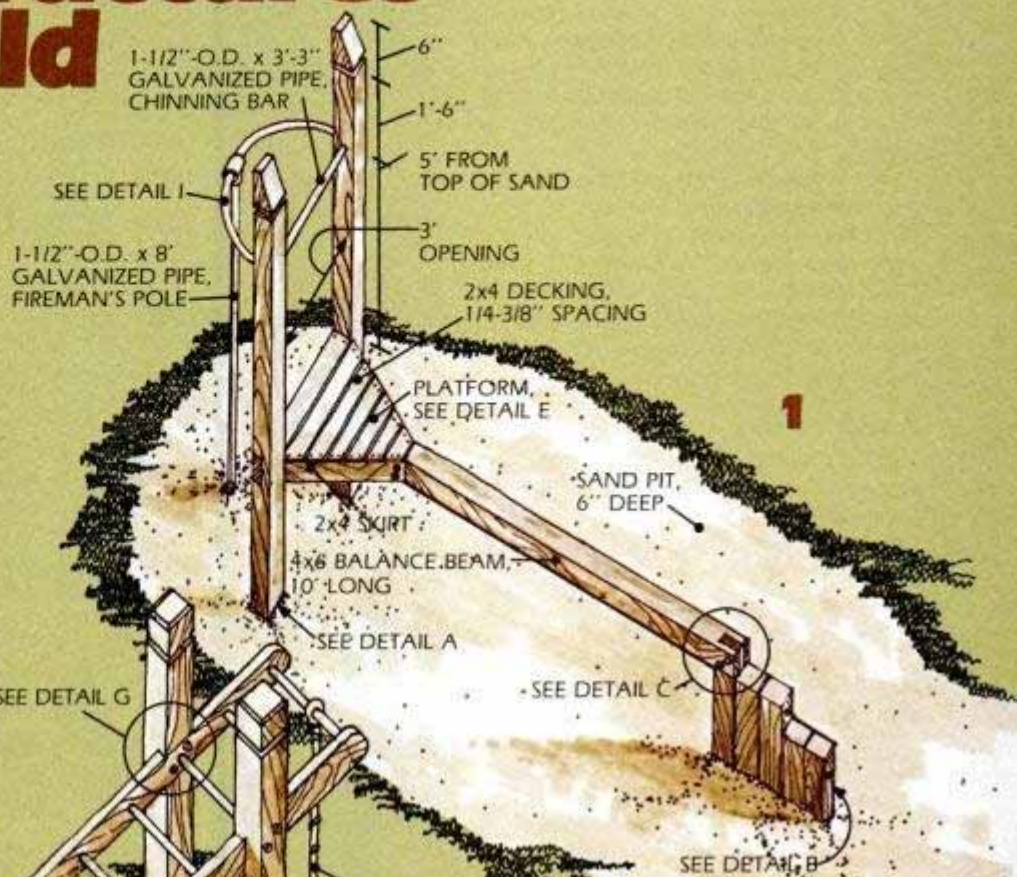
KID PLEASERS:

2 Play Structures To Build

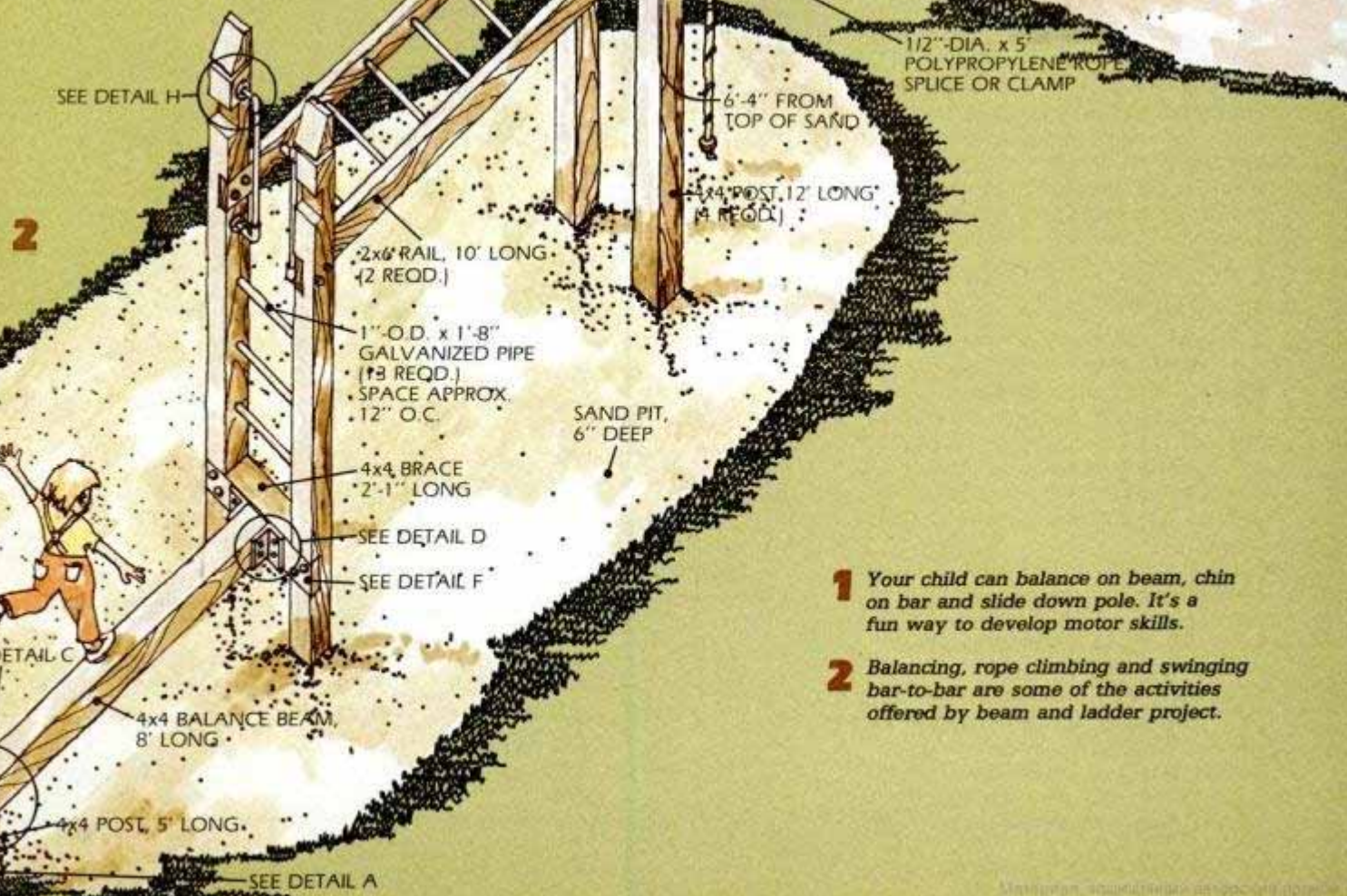
Here are two wood designs, plus tips on planning, installing and maintaining them.

Design outdoor play equipment that's fun for kids, yet visually appealing to adults. That was the challenge we gave Ira Grandberg, an architect with The American Institute of Architects and father of three. Ira returned with several ingenious creations. Two with modifications are shown here for you to duplicate.

For durability, we recommend using pressure-treated lumber. Select wood that carries the American Wood Preservers Bureau (AWPB) quality seal, is labeled "CCA" (chromated copper arsenate) or with another waterborne preservative, and is dry after treatment so the preservative won't leach out of the wood. Posts and lumber that contact the soil should be labeled "LP-22 ground contact .40." Se-



1



2

1 Your child can balance on beam, chin on bar and slide down pole. It's a fun way to develop motor skills.

2 Balancing, rope climbing and swinging bar-to-bar are some of the activities offered by beam and ladder project.

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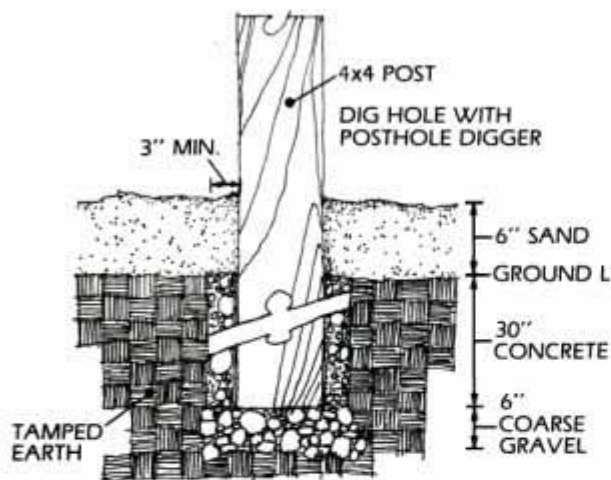
The six Weed Eater gasoline powered trimmers have top-mounted engines from 26.2cc to 28.0cc. They provide precise balance and have solid state ignition for quick starts. Adjustable assist handles and Tap-N-Go® automatic line advance are standard. Some models convert to a Power Edger and Power Hoe with optional attachments.

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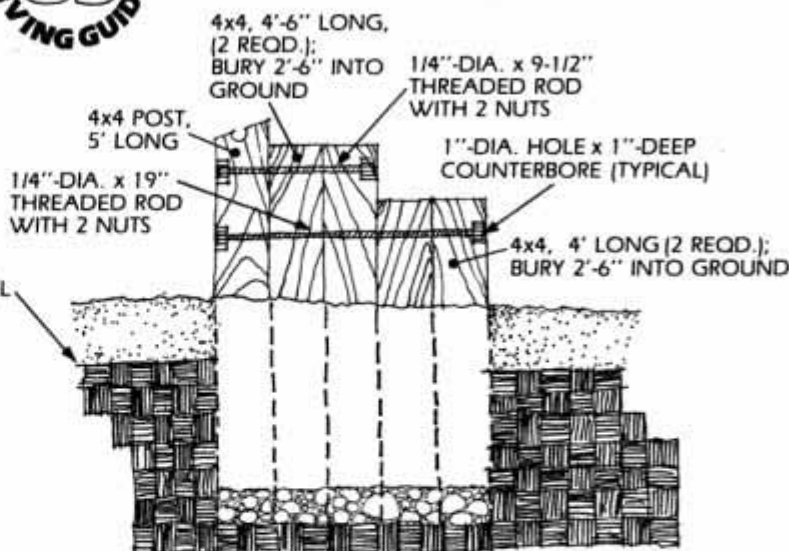
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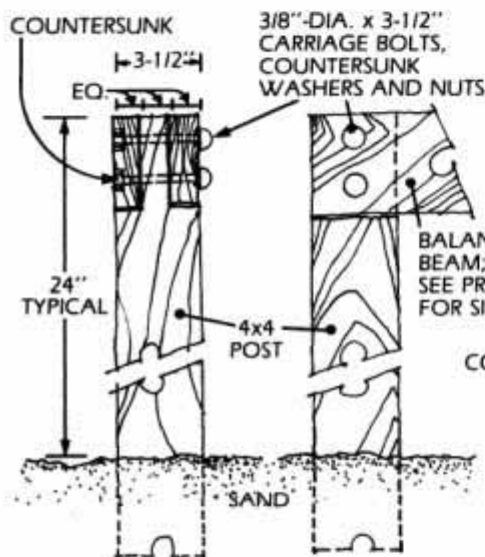
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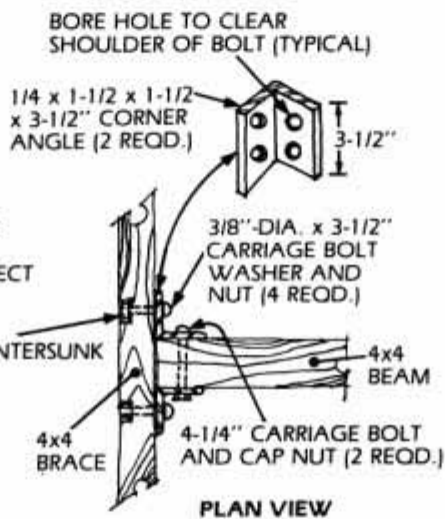
DETAIL A: TYPICAL POSTHOLE



DETAIL B: BALANCE STEPS

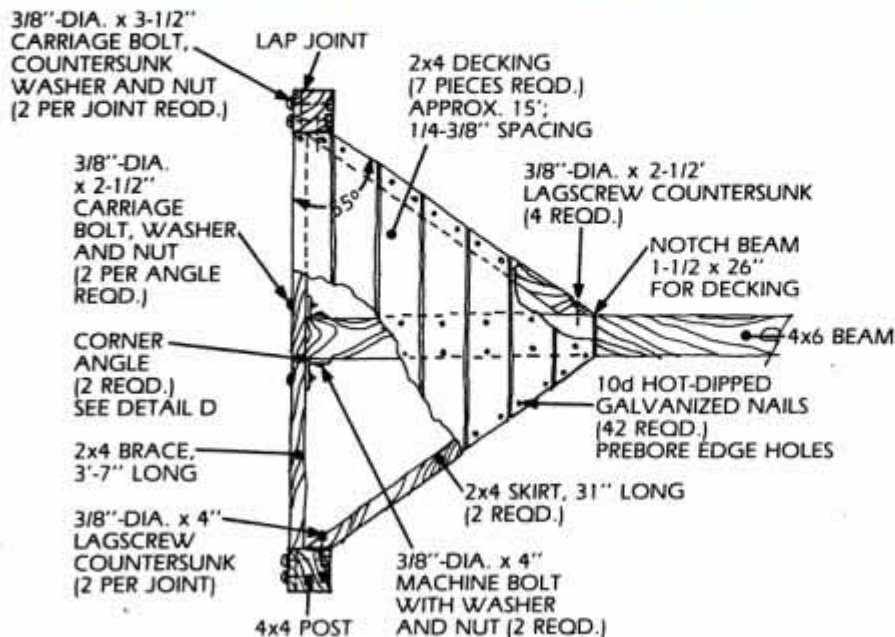


DETAIL C: BEAM-POST CONNECTION



PLAN VIEW

DETAIL D: BEAM-BRACE CONNECTION



DETAIL E: PLATFORM, PLAN VIEW

lect No. 1 grade wood to minimize splintering. In addition, ease all edges and chamfer or round ends.

Use hot-dipped, galvanized or cadmium-plated hardware. In most situations, we suggest using carriage bolts pounded into prebored holes to admit the shoulders, secured with countersunk washers and nuts tightened from the back.

First, counterbore the nut hole, then clamp the two members together and bore through them. If the bolt ends should protrude, mark, remove and cut them flush with a hacksaw.

Planning the play site

Carefully planning your child's outdoor play site will greatly reduce the possibility of accidents. Bruce Chivington of Site Specialties, Lithonia, Ga., planner of outdoor play areas, suggests the following:

Select a level space. Consider the location of underground power lines, sprinkler systems, water and telephone lines. To avoid placing a slide or swing too near a tree, for example, it helps to make a scaled diagram of the area with the proposed equipment. You'll also be able to plan an adequate safety apron, the ground around the equipment which should be topped with semisoft material.

Chivington borders play areas with sunken railroad ties "a safe distance" from the equipment. On equipment 4 ft. high, this means 4 to 5 ft. in all directions. The border for a swing suspended from a 10-ft.-high bar should be 10 ft. in front and back. After installation, he fills the play area with bark or pine straw to a 6-in. depth. Sand is also good. Trees and bushes should be left nearby for shade.

All outdoor play equipment should
(Please turn to page 102)



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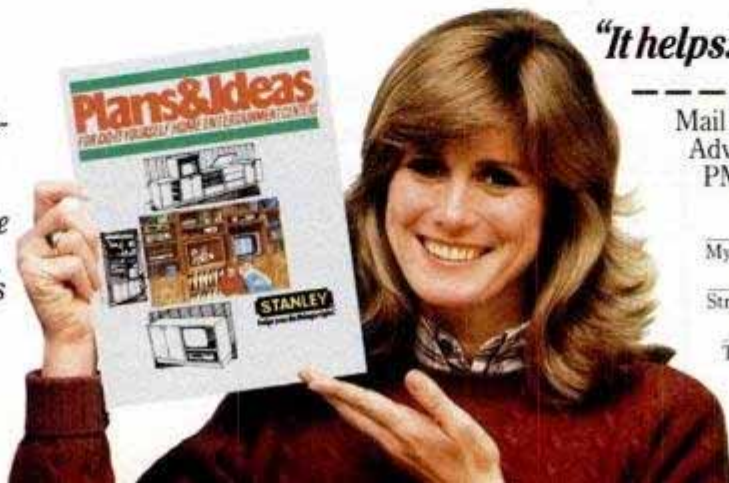
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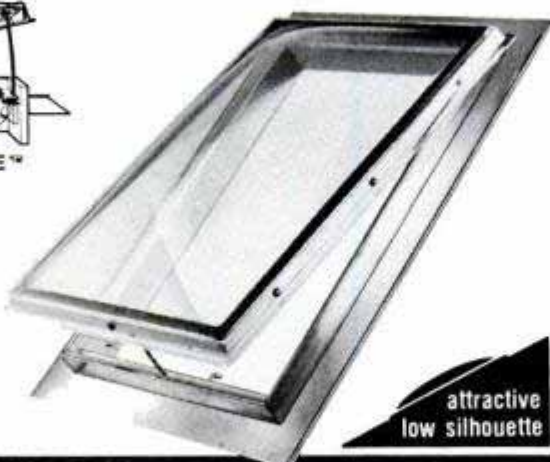
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PLAY STRUCTURES

(Continued from page 100)

have installation instructions made specifically for the equipment. It is important to follow these instructions.

Installing outdoor equipment

Heavy wood equipment requires solid anchoring. There are three major concerns in determining adequate anchors: the *stress* to the equipment, the *soil* in which the equipment (posts) is installed and the *frost line* in the specific area.

A swing set that undergoes torque movement, for example, should be anchored deeper than a slide which doesn't receive this type of stress. A concrete collar in sandy soil should be deeper and wider than a collar in clay soil. Generally, wooden posts for home play equipment are installed 18 to 24 in. deep or to the frost line. Your local building department can tell you the depth of the area frost line.

Project 1: Beam and pole

This project incorporates a fireman's pole. The pole top is held in a tee-fitting, to which two sections of pipe curved 90° are also fastened (see detail I).

An electrical contractor with an electric or a hydraulic bender can curve sections of pipe cut to size and threaded at the ends. Although we haven't tested the procedure, you might create the curved top of the pole with sections of straight pipe and cast 90° elbows.

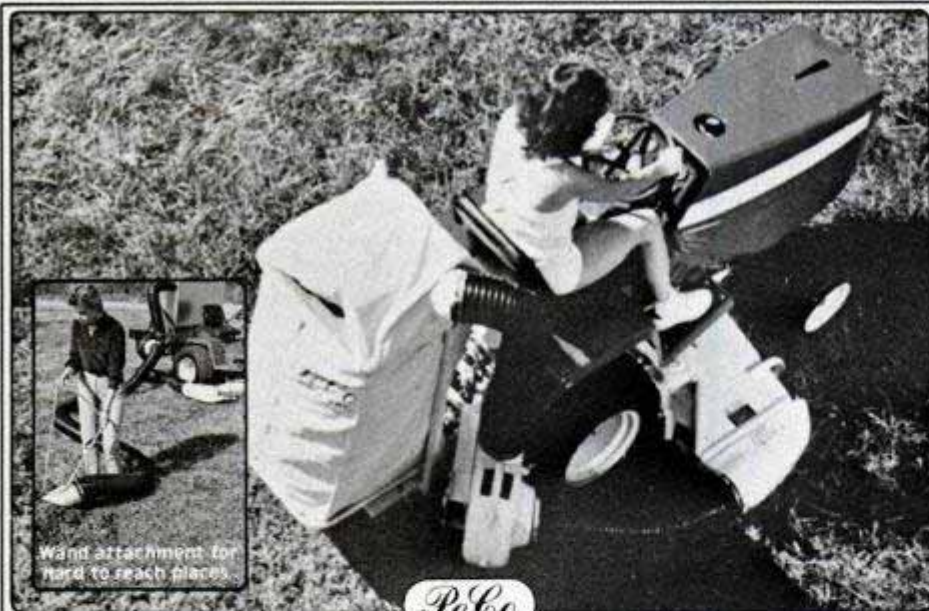
The drawing on page 98 gives dimensions of the wood parts. Details A, B, C, E and I give fastener tips.

Begin cutting the steps (detail B) and posts (detail A) of 4x4. Cut the 2x4 brace. Ease all edges, including those on the beam, and make decorative cuts and kerfs. Bore 1½-in.-deep holes for the chinning bar and cut notches for the brace connection on the two major posts. Notch the beam for the decking.

Mark and cut the post that connects to the beam (detail C) with a dado blade on a radial-arm saw. Set the blade to cut a 1½-in. depth and cut the post on both sides. Mark the notch to be cut on the beam and bore out both corners of the notch. Cut out the notch with a hand saw and use a sharp chisel to clear out waste.

Set the beam on the post and clamp or tack nail it; counterbore for the washers and nuts. Then bore through-holes for the carriage bolts. Don't assemble the parts yet.

Counterbore holes in the short post (at the other end) and steps for nuts that hold connecting rods (detail B). Bore holes for the attachment rods. Join the steps with the rods and nuts. Secure the beam to the short post.



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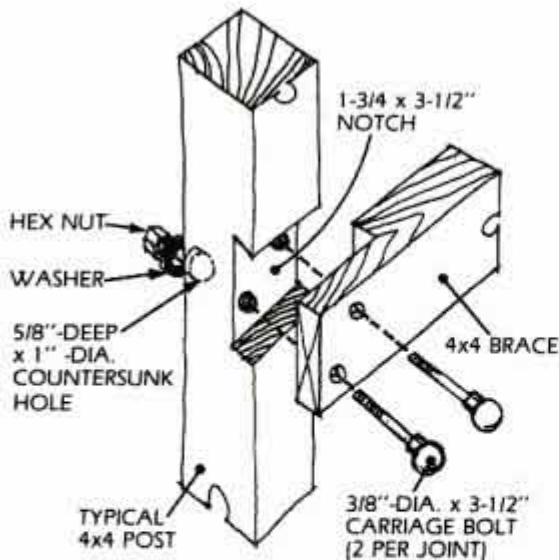
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DETAIL F: POST-BRACE CONNECTION

Install the chinning bar and platform brace (detail E) on the major posts. Secure the beam to the brace with a corner angle cut to size.

At this point, test-position the assembly. Then dig postholes (detail A) with a clamshell posthole digger. You can use a shovel to dig holes for the steps. Pour gravel into the holes. Position the structure and rock it slightly to "set" it on the gravel. Plumb and level, brace if needed and pour concrete collars.

Next, install the deck skirts and the rough-cut deck members with 1/4- to 3/8-in. spaces between them. After installation, snap a chalkline and trim with a combination blade in a circular saw, so it just cuts through the decking.

Thread the tee-fitting onto the fireman's pole (detail I). Thread both pipe quadrants onto the tee and into flanges on the other ends. Test-position the pole and dig its hole with a clamshell posthole digger. Install the pole; tamp the backfilled earth. Secure the flanges to the posts. Finally, add 6 in. of sand around the area.

Project 2: Beam and ladder

A number of children can enjoy this design at the same time. The drawing on page 98 gives dimensions of the wood parts. Details A, C, D, F, G and H give fastening information.

Cut the posts, balance beam, rails and brace to size if needed. Ease the edges and round or chamfer the ends. Make decorative kerfs and cuts in the posts. Cut notches in the posts for the rails (detail G) and brace (detail F). Carefully mark aligned holes for the pipe bars in the rails and posts; bore holes 1 in. deep.

Mark and cut the post that connects to the beam (detail C) and notch the beam (see explanation for making this

joint in project No. 1). Secure members.

Install the pipe bars in the rails and temporarily tack crossbraces on both ends to keep the rails together. Next, install pipe bars in the posts. Temporarily tack a crossbrace near the top pipe and secure the brace that connects to the beam (detail F).

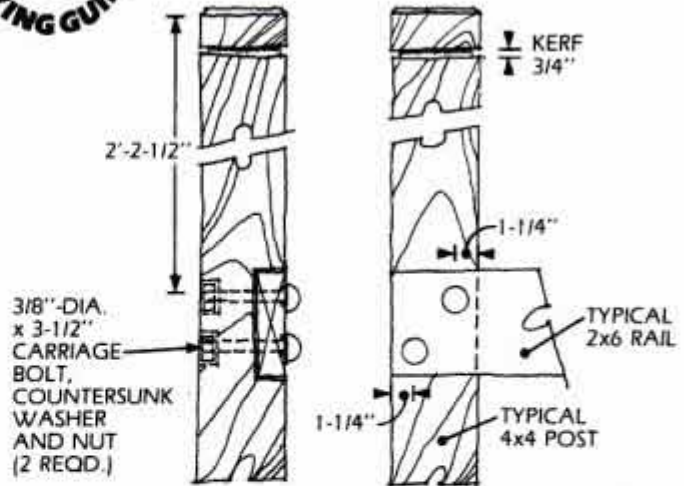
Install the rail assembly onto the posts (detail G), leaving a 7-ft., 8 1/2-in. space between posts. The rail assembly will extend 1 ft., 8 1/2 in. beyond the posts at one end. Join the balance beam to its brace with two corner angles (detail D).

Dig postholes for the footings with a clamshell posthole digger (detail A). Pour gravel into the holes and position the unit, rocking the posts to seat them on the gravel. Plumb and level; brace if needed. Pour in concrete.

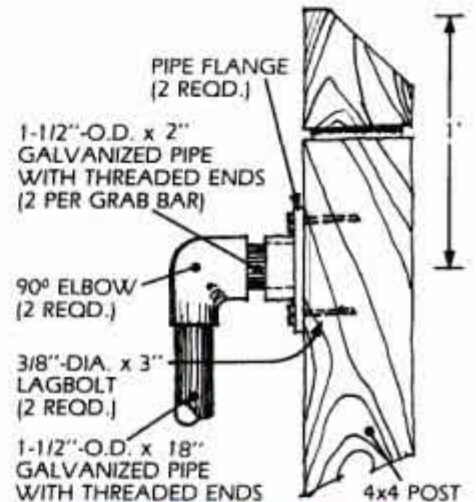
Install grab bars (detail H) and secure the polypropylene rope. The rope, which is meant for climbing, can be anchored at the free end or omitted for safety if the play area isn't supervised. Fill the area with 6 in. of sand. If you are unable to locate 1/2-in.-dia. hollow braided polypropylene rope in your area, write to Berkley and Co., Trilene Dr., Spirit Lake, Iowa 51360 for the nearest distributor.

Maintaining play equipment

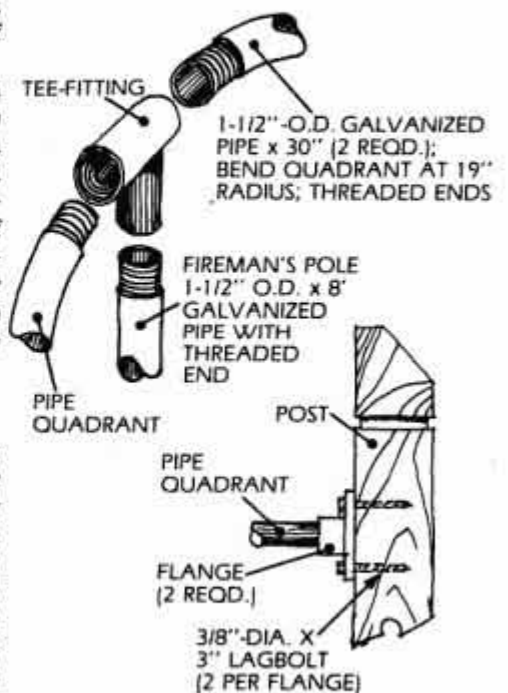
Following is a checklist of spring maintenance tips from the Consumer Product Safety Commission: Clear away debris, roots and rocks; tighten loose nuts, bolts and clamps; oil moving metal parts; sand rusted areas and paint with unleaded paint; replace rusted chains; cap or plug exposed ends of tubing; close S-hooks, rings and links; refill landing pits with sand or bark; and sand splintered areas. **PM**



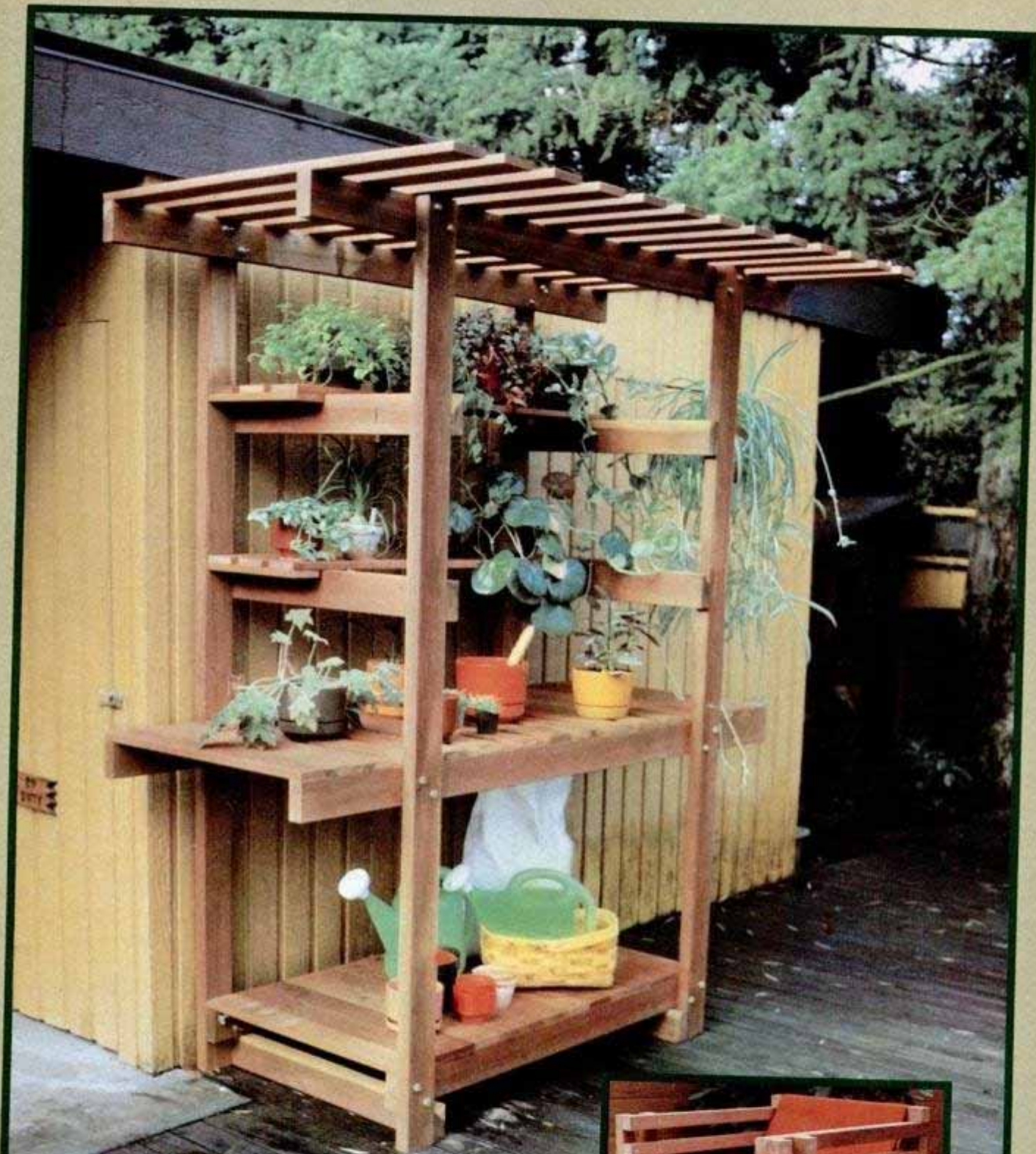
DETAIL G: POST-RAIL CONNECTION



DETAIL H: GRAB BAR



DETAIL I: FIREMAN'S POLE



1 Potting Bench Plant Stand

Redwood plant stand provides space for work, display and storage. It can be disassembled easily and moved for indoor use.



2 Sling Chair

Attractive yet simple-to-build summertime seat is made of redwood, heavy-duty canvas.

5 Handsome Yard Improvements

You can build these projects in very little time and enjoy them the rest of the summer.

Our summer roundup of yard projects is geared to get you out of the shop in record time and out-of-doors, where you can enjoy your handiwork. In one weekend, you can build any one or several of these projects, to enhance your property, or to aid in relaxing and entertaining.

Selecting the right materials for your projects will keep them attractive longer. Use pressure-treated wood or wood that has a natural resistance to infestation, such as redwood. To keep fastenings from corroding and discoloring the wood (i.e., rust stains), use hot-dipped galvanized nails and screws, or stainless-steel and aluminum alloy fastenings. Use resorcinol glue to provide a strong, waterproof bond in all weather conditions. For tight-fitting joints, measure and fit the wood as you build, rather than precutting material before you begin work. Gather all materials for your project before you begin, so you can work without interruptions.

1. Potting Bench/Stand

This redwood plant stand is constructed in sections and fastened together with removable bolts and wingnuts.

You can easily take it apart and reposition it indoors or outdoors. For economical, yet long-lasting, results, use



3 Garden Trellis

This lovely garden trellis can serve as a passageway, or, against a fence with an added bench, it's a resting spot.

garden-grade redwood for the 2x4 components and clear-grade redwood 1x4s.

Begin work by cutting the posts and three pairs of braces. Join these parts with 10d finishing nails. Set these and

all other nailheads and cover them with wood filler. To prevent splitting when nailing near the end of a board, pre-bore holes.

Use a table, radial arm or sabre saw to cut the roof supports and slats. Assemble with 6d finishing nails, spacing the slats the length of the supports. Cut the slats and slat braces of the two upper shelves; fasten with 6d finishing nails.

Next, cut the counter supports and counter slats. Assemble with 6d finishing nails, spacing the 10 center slats about 1 1/4 in. apart. Cut the bottom shelf supports and slats. Using 6d finishing nails, secure the slats to the bottom supports, leaving no gaps.

After the modules have been assembled, they can be joined to the posts. Measure and mark attachment points for the bottom shelf, counter and roof supports on the posts. Position the supports, one at a time, and bore 7/64-in.-dia. holes for the attachment bolts. Assemble with hex bolts, washers and wingnuts.

If you do not apply paint to the stand, the wood will eventually weather to a silver-gray. You

(Please turn to page 107)

Project designs 1 and 2, Simpson Timber Co.; photo 3, Pamela Harper; photo 4, Molly Adams; project design and photo 5, David Roberts; technical art, J. Dyck Fledderus



4 Log Bench

This bench was made of a single log which was split in half. Its rough-hewn look will blend with most yard settings.



5 Rain Gutter Flower Box

A length of aluminum rain gutter with gutter caps at the ends is an easily made container for flowers and plants.

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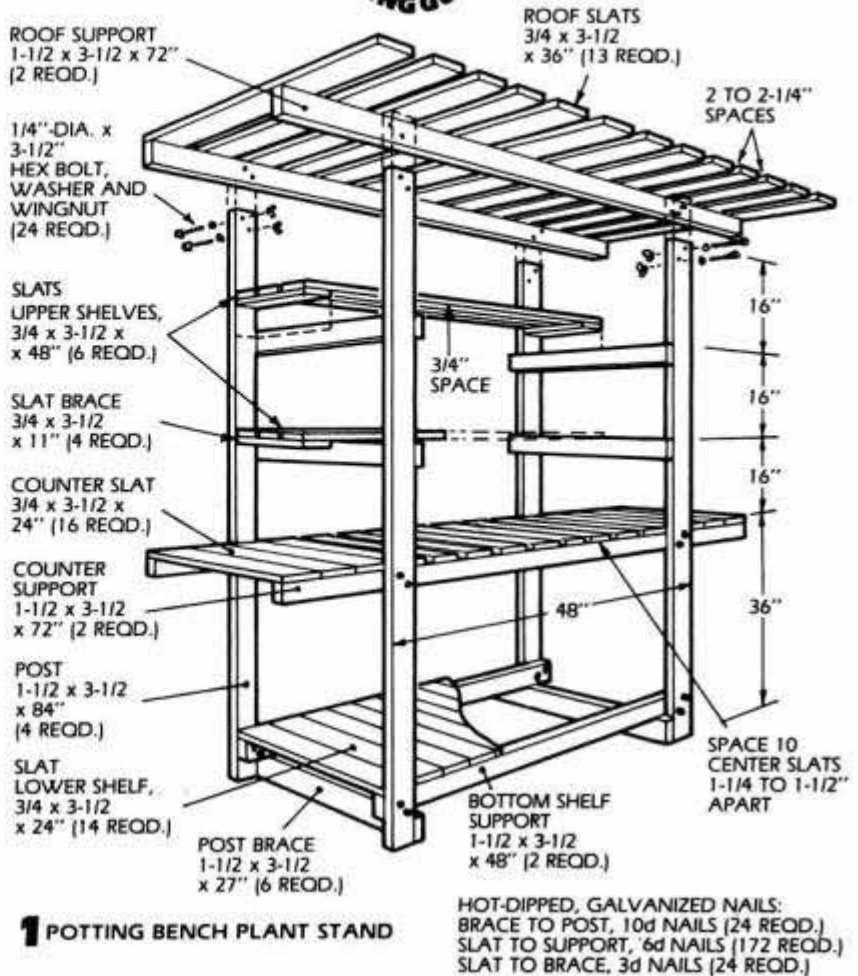
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THE BITE STOPS HERE



(Continued from page 105)



should apply a clear water repellent with mildewcide, such as Woodlife or Cuprinol No. 20. To retain the cinnamon color, apply a redwood-toned, oil-based stain.

2. Sling Chair

This comfortable sling chair is made of clear-grade redwood with a canvas seat. If you purchase 1 1/2 yds. of 36-in.-wide, heavy-duty material, you'll have enough fabric to make two chairs.

First, cut to size the four front leg members, two front crosspieces and leg adjuster blocks. Put the adjuster blocks aside for later use. Counterbore for the attachment screws. Assemble parts leaving a 1 1/2-in. space between cross-braces. Use resorcinol glue and countersunk screws. You can plug the screw holes later.

Cut the four arm pieces. Counterbore and install them inside the front legs using glue and screws. Check with a carpenter's square to make sure all angles are at 90°. Next, cut the back legs and back members. Round the tops of the legs with a rasp and 80-grit sandpaper. Counterbore, glue and countersink screws to secure the back pieces to the arms. Attach the back legs to the back members.

Test the chair on the ground to make

certain there is no wobble. Install leg adjuster blocks between pairs of front-leg members as needed to level the chair. Screw-hole plugs add decorative detail to the chair; thus, you might want to counterbore inside the arms for the plugs. Then use a plug cutter in a portable drill to cut all needed plugs from a scrap piece of redwood. Remove plugs with a sharp chisel. Glue them in as needed and trim flush, then sand the surface smooth.

Apply finish, if desired, before you install the hemmed canvas sling.

3. Garden Trellis

This graceful yet sturdy trellis is an attractive support for roses or climbing vines. For durability, we suggest building it of pressure-treated wood. Buy posts that are labeled for ground contact use.

Make the arches by edge-joining two boards for each arch using resorcinol glue and 1/4-in.-dia. x 1-in. dowels (see drawing). However, first draw the arch pattern on the boards, then use a doweling jig to bore the holes accurately within the arch pattern.

Line the three doweled glue-ups together, sandwiched between two pairs of wax-paper-lined cross-supports

(Please turn to page 108)

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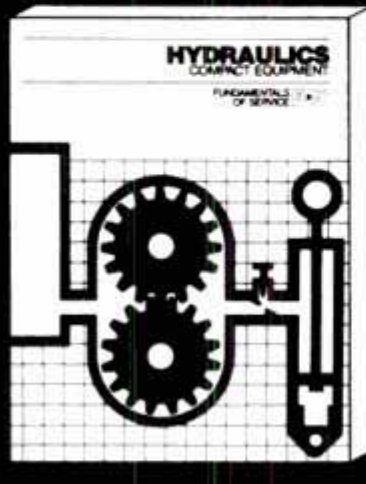
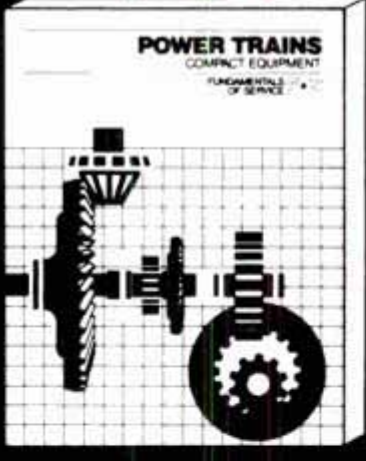
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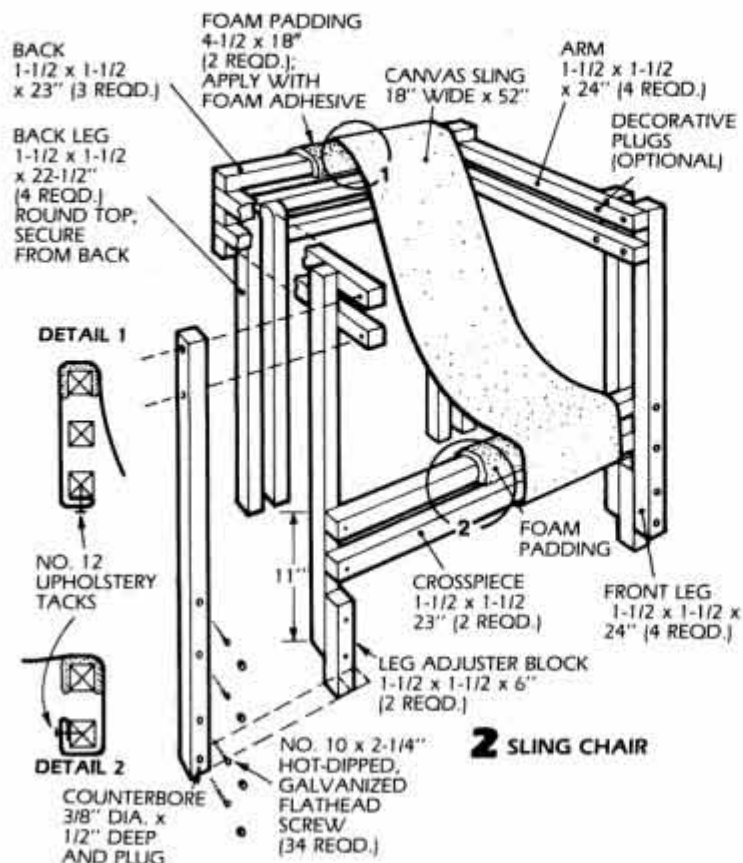
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(Continued from page 106)

clamped to the glue-ups with C-clamps to ensure a flat plane. Then clamp the arch joints closed with bar clamps. When the glue is dry, cut out the arches with a sabre saw. Sand with a belt sander and 100-grit paper.

Cut the 24 same-length slats with a radial-arm saw using a stop clamped to the fence, or use a sabre saw or hand-saw if working outdoors. You can notch the posts by making repeat overlapping passes with a dado head in a radial-arm saw, or with repeat parallel cuts with a portable handsaw. Either way, first test for proper blade depth on scrap wood.

Secure the slats to the posts with 6d finishing nails. Set these and all other nails, and cover with wood putty. Install the fascia, securing it to all three arches with 6d finishing nails. Make sure the arches are spaced so they can be secured to their mating posts. Nail the arch slats in place. Secure the arches to their posts.

Test-position the trellis and mark post-hole location. Use a post-hole digger to make the holes. You may want to pour in 6 in. of gravel below the posts for drainage. Set the posts and tamp the backfill earth.

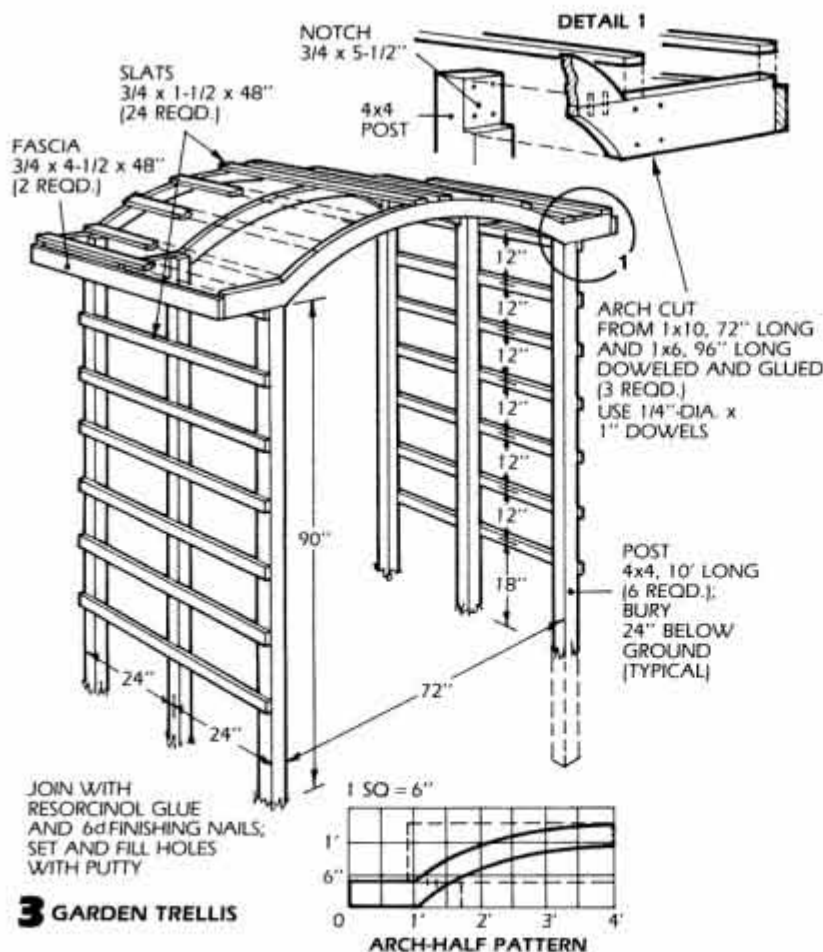
You don't have to apply finish to pressure-treated wood. However, if you paint the trellis, it's a good idea to wait at least six months.

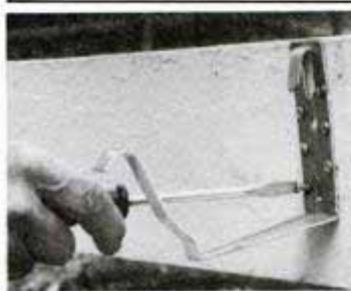
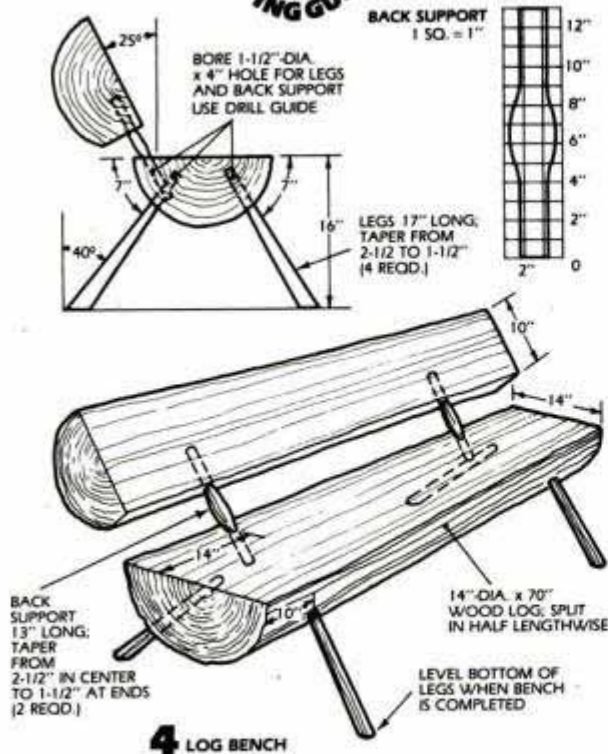
4. Log Bench

A sound, fairly straight log of any type wood may be used to make this bench. To make the legs and back supports (see drawing) use a 2x6, 8 ft. long, ripped in two equal parts and glued together with resorcinol. Trim it to 2 1/2 x 2 1/2 in. sq. and cut the parts to length. Shape on a lathe, or with a spokeshave or Surform rasp, then finish with a sanding attachment in a portable drill. Sand the wood smooth.

Mark the split line on both sides the length of the log. A temporary V-block made of two 2x6s fastened at both ends by crossbraces and held in position with cement blocks will make the log more manageable. You can split the log in several ways, or have it split and a portion of the back cut off at a mill in your area. To split it by hand, position the log with the cutline on top. Use a heavy (12-pound) maul and wedges. Then shred the rough surfaces, striking horizontally with a broad ax. Finally, slice off the splintered areas with vertical strokes. Sand smooth with a belt sander that is fitted with a coarse-grit belt.

It's easier to do the job with a chainsaw, if you own one with a long-enough bar. A chainsaw milling accessory (i.e., Alaskan MKIII saw mill from Grand-





5 Hang the rain gutter flower box on gutter hangers. They are sturdy and let you remove the box for planting or storage. A metal strap (not shown) locks the box to the hanger after drain holes have been punched and box planted.

berg Industries, Richmond, Calif.) makes slicing the log even easier. Many rental outlets carry such saw mills.

Next, mark and cut off the bottom part of the back where the supports attach. Use a 1 1/2-in.-dia. power wood boring bit in a portable drill and a drill guide to bore leg holes. Measure from the ends and top edge of the log to find each leg. Check the alignment of front and back legs. Leg holes must be bored at the same angle so the seat will be parallel to the ground. Bore holes for the supports in the back and the seat. Test assemble the bench.

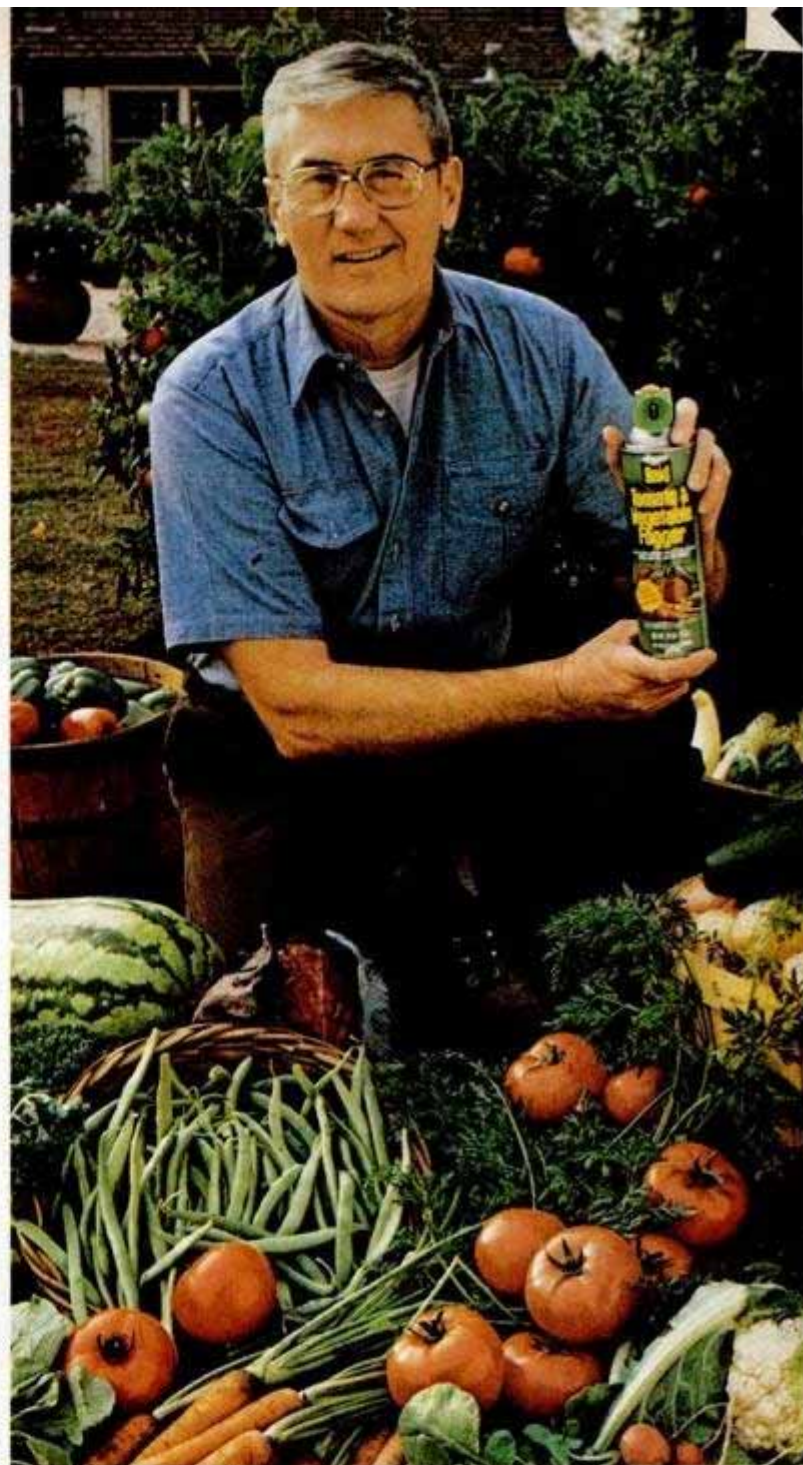
Install legs on the bench with resorcinol glue; install back supports and let dry. Next, install the back. Finally, apply a wood preservative such as Cuprinol.

5. Rain Gutter Flower Box

In less than 15 minutes, you can turn a length of ready-painted aluminum rain gutter, capped with standard right and left gutter ends, into an appealing flower box. Standard gutter hangers secure the box to a fence, wall or railing. Gutter material in 10 ft. lengths, caps and gutter hangers are sold at most hardware and building supply stores.

Turn the gutter upside down over two 2x4s and cut it to length with a hacksaw. Gutter caps snap onto the ends, or you can secure them with Pop Rivets. Punch drainage holes in the bottom, lay in drain stones, cover with burlap, then add soil mix. Use at least two hangers for each 5-ft. length.

Fill the box with plants that have small root systems. Some that thrive in a flower box are achimenes, coleus, impatiens, nasturtium, pansies, petunias and alyssum. Hang box on the sunny side of the fence or wall. **PM**



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In the case of painting, consider a Wagner Power Painter, instead of a brush.

A Wagner Power Painter's speed should quickly make a believer out of you. Just among the examples we've shown, the time saved is astonishing.

And a Wagner Power Painter is ideal for dozens of other painting chores around the house.

Professional-looking results made easier

Of course, speed isn't a Wagner Power Painter's only long suit.

A Wagner Power Painter also makes it remarkably easy to achieve professional-looking results—the spray lays down a smooth, even finish with no brush marks.

And when it comes to intricate painting jobs like wrought iron railings, louvered doors and bicycles, it's amazing the way a Wagner Power Painter reaches into crevices and applies paint.

That's also why a Wagner Power Painter is so effective on rough, textured surfaces like shake shingles.

Spray paints, lacquers, stains, varnishes, and more

Virtually any kind of latex or oil-based paint is compatible with a Wagner Power Painter.

It can also apply stains, varnishes and lacquers. Or spray almost any other liquid, even pesticides.

So a Wagner Power Painter is a lot more than just a "one project" tool.

And cleanup is simple—just run the appropriate solvent through until it's clean.

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The secret to a Wagner Power Painter is a precision electric, piston-driven pump.

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A variety of helpful attachments make Wagner Power Painters even more versatile.

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You can even get an optional spray tip that narrows the spray for precision painting.

But rather than simply reading about a Wagner Power Painter, we suggest you visit your local hardware store, paint store, home center or wherever quality paints are sold.



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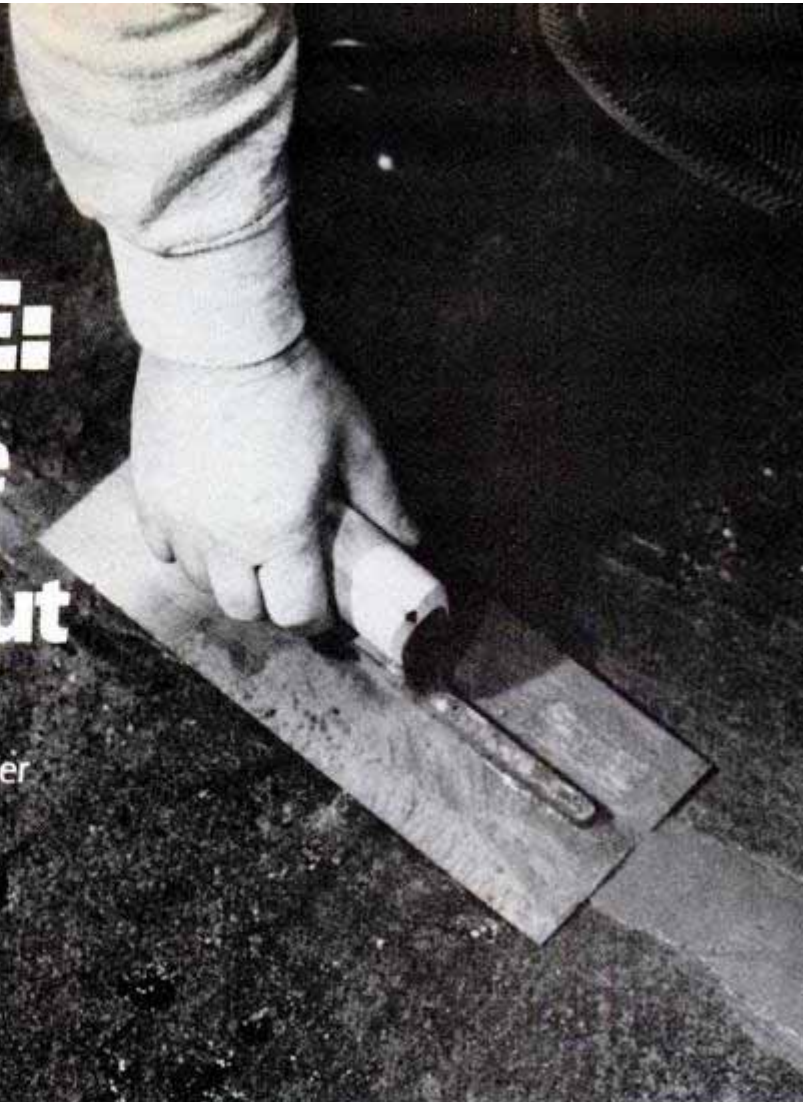


PROBLEM CONCRETE:

Answers To The 17 Most-Asked Questions About Patching

New materials plus know-how may offer quick fixes for damaged masonry you thought you had to replace.

BY WILLIAM BEYER



Narrow cracks, like this one in a concrete garage floor, can be patched with a vinyl polymer compound available in tubes.



Run a bed of patching material over crack, using a caulking gun. Press compound into crack with a moistened putty knife and let it set about 15 minutes.



Remove excess patching material with a putty knife or trowel for a neat finish.



Pitting and spalling shown here were caused by de-icing salts. To prepare for patching, clean away residue and dirt by brushing and flushing with water.



We applied a liquid bonding agent to the floor for good adhesion of our sand-cement patching mix. Vinyl patching materials don't need bonding agent.



The patching mix used consists of 1 part portland cement, 2½ parts sand and enough water to allow paste to hold its shape. Apply with a smooth trowel.

Many PM readers have written to ask a variety of questions about masonry repairs—ranging from patching various defects to cleaning and sealing masonry surfaces. We took those queries to the Portland Cement Assn. and to a professional mason and have assembled answers to 17 of the most frequently asked questions.

Q. There's a long, narrow crack running across my driveway. What's the best way to patch the crack and keep it from getting worse?

A. There's really no way you can keep the crack from getting worse. However, there are several ways to patch it. If the crack is 1/8 in. or less, fill it with a paste made from portland cement and potable water. Vinyl patching compounds are also suitable. Brush out loose particles and dirt. Soak the cracked area with water and cover it with plastic for at least 24 hours.

You can mix your own patching paste from 1 part portland cement, 2 1/2 parts sand and enough water to make a stiff paste. Vinyl patching compounds used for patching cracks are applied with a caulking gun. Lay the patching compound on the crack and press it in. Allow the material to set for about 15 minutes and then scrape off the excess.

PM photos by the author

Q. There's a wide stress crack running diagonally across my patio. Can I patch it or must I replace the concrete?

A. For cracks larger than 1/8 in. wide, undercut the sides with a cold chisel. Clean out and soak the crack. Use a cement-sand patching mix like Sakrete or a vinyl polymer patching compound. Fill the crack and allow the material to set about 15 minutes, then smooth with a trowel, feathering the edges. If the patching material is a cement-sand mix, keep it covered with plastic for about five days, moistening it occasionally.

Q. What can I do to prevent water from coming in through cracks in my concrete basement walls and floor?

A. If cracks are very narrow, epoxy resin paint applied to the inside of the basement wall may solve the problem. Fill wide cracks with trowel-grade epoxy mortar (two-part epoxy system with sand filler).

If filling a crack from the inside doesn't stop the leak, dig a trench around the outside to make repairs. When the crack is uncovered, chip it out with a mallet and cold chisel until it is about 3/4 in. wide and 1/2 in. deep. Then line the chipped-out area with aluminum foil or wax paper. Fill the lined crack with polyurethane or silicone masonry sealer.

Q. How do I repair pitting and scaling caused by de-icing salts on my concrete garage floor?

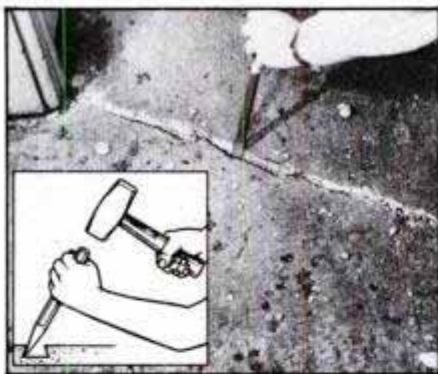
A. There are two methods: Trowel a vinyl mix or a mix made from portland cement, sand and bonding agent onto the damaged area, or pour a fully bonded concrete overlay at least 1 in. thick over the entire slab.

If you plan to fill the damaged areas only, clean them thoroughly to remove dirt and salt residue. Break away any unsound concrete in and around spalled areas. If you wish to overlay a new surface, first etch the old surface with a solution of 1 part muriatic acid to 4 parts water. Or you can create a suitable bonding texture by using a scarifier, grit blaster, scabblor, planer or flame cleaner. These tools usually can be rented.

Soak the old surface overnight. When you are ready to pour the overlay, broom on a bonding grout—a creamy mixture of portland cement, fine sand and water. Follow the grout immediately with concrete mixed in proportions of 1 part portland cement, 1 part sand, 1 1/2 to 2 parts 3/8-in. aggregate and no more than 5 1/2 gal. water per bag of cement. Cure the new overlay by keeping it damp and covering it with plastic or burlap for seven days.

Q. The concrete basement walls in our home are disfigured by

(Please turn to page 114)



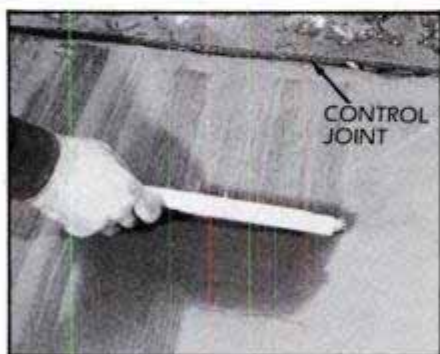
The sides of a wide crack should be undercut with a cold chisel and mallet. Wear eye protection when chiseling.



Clean the crack thoroughly to remove any particles that can weaken the bond.



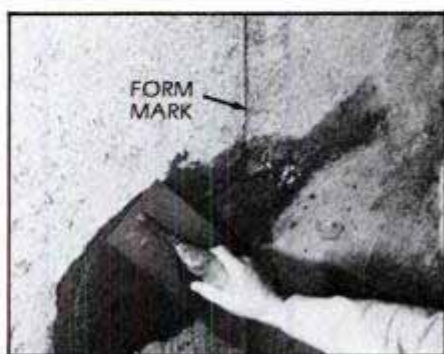
Fill the crack with a patching mixture of portland cement and sand or vinyl patching compound. Poke material deep into the crack with the trowel point.



When the wet surface began to look dull, we smoothed it with a trowel and brushed it for a nonslip finish. Note that control joint was left unfilled.



This air pocket, or honeycomb, was formed at the time the basement wall was poured. Structurally weak, honeycombing may be source of water leaks.



In cases where a hole is deep, prevent the patch from sagging by partially filling the hole, allowing material to harden, then applying a final coat to the area.

(Continued from page 113)

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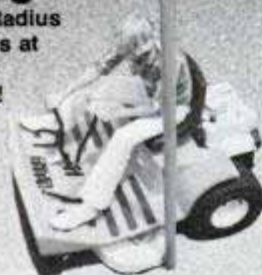


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large, rough pores, form marks and tie-rod holes. How can I smooth them?

A. First, remove all loose particles from honeycomb pockets and strike off projections with a cold chisel and mallet. Snap off form ties left in the wall. Be sure to wear eye protection.

Next, smooth rough areas with a wire brush or carborundum stone. Then use a trowel to apply a thin coat of vinyl cement mix. After applying the trowel coat, float the surface with a square mason's trowel.

Q. In one area of my concrete basement wall, there's a large depression and chunks of gravel are exposed. What's the best way to repair the depression?

A. The condition you describe is called "honeycombing" and can be patched with vinyl polymer patching compound. If the cavity is deep, it may be best to fill it in two stages—first with a thin coat and then with a finish coat—to prevent the patching material from sagging.

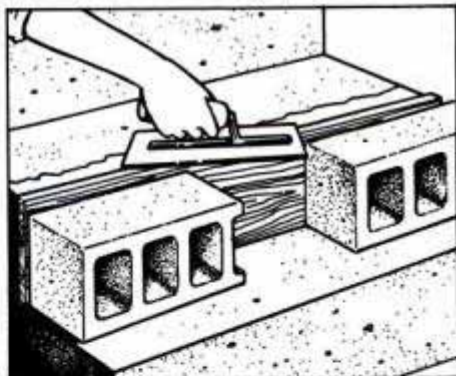
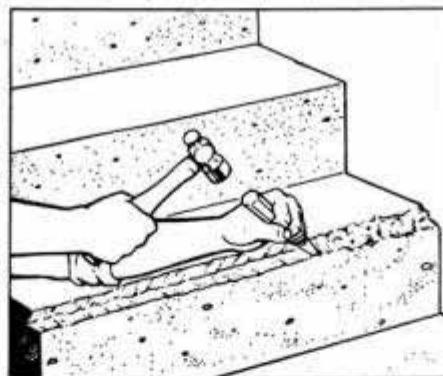
Q. The edges of the concrete steps leading up to my back door are worn and, in some places, cracked. Can I repair the damaged part of the stoop without repouring the whole thing?

A. You can repair the steps by chipping out the front edge of each stair. Be sure to undercut the back of the channels so that the patches key into the existing concrete for a strong bond. If you plan to use a sand mix for the repair, soak the existing concrete overnight, and apply a liquid bonding agent to the channel just before filling it with patching mix. Finish the corners neatly with a steel trowel and keep traffic off the stairs for about five days.

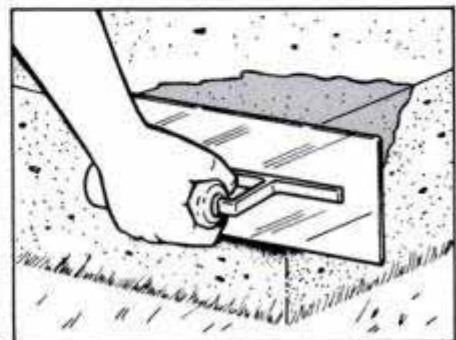
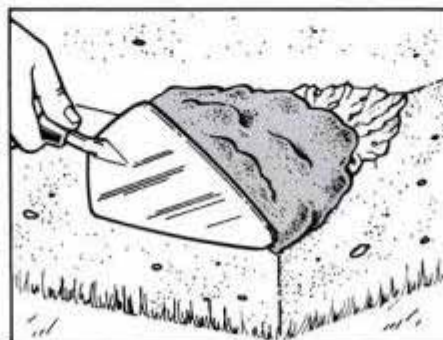
Q. The concrete steps leading to our front door have settled so that the threshold is now dangerously high. What are the alternatives for resolving this problem?

A. You have two: You can resurface the existing steps, or you can jack them up. If you plan to resurface, the overlay on each tread must be at least 1 in. thick. Build a form so that riser heights will all be equal and so there's a slight but uniform tilt toward the front to provide proper drainage. Sand the bonding surfaces with coarse emery cloth to create a "tooth" for the new material. Use sand-cement mix with a liquid bonding agent or an epoxy patching mix.

To raise the present stair system



To repair front edge of a concrete step, first break off defective material with a cold chisel, undercutting vertical surface as shown so that the patches form a strong bond with existing concrete. Improvise a form by ripping a board to the riser height and supporting it with heavy blocks. Pack notch with patching mix and finish with square trowel.



To repair a damaged corner, apply patching mix, allow it to set for about 15 minutes and then finish with a steel trowel. Moisten patch occasionally as it cures.

back to its original position, dig down underneath it and use hydraulic jacks to lift the steps. Once the steps have been raised, pour a new footing in the cavity below using a concrete mix with coarse aggregate. The base of the footing must extend at least 6 in. below the frost line.

Q. Whole sections of my concrete sidewalk have heaved because of tree roots. Do I have to tear out the old walk and pour new concrete?

A. Pouring a new walk would solve your problems only temporarily. The real problem is the tree roots. Since your concrete is in good condition, it should be a relatively easy matter to pry up the sidewalk in sections. Use a pry bar to move slabs out of the way.

Chop out the tree roots. You may need to dig the subgrade deeper if the level has shifted. Tamp the earth firmly. For good drainage, put in 6 in. of gravel. Replace the sidewalk slabs on the gravel bed.

Q. I recently poured a concrete driveway, and a few hours after it was poured, surface cracks appeared. What caused the cracks and can they be repaired?

A. The problem sounds like plastic shrinkage cracking, which can occur under hot, dry or windy conditions. Evaporation from the surface causes it to dry out before the concrete can develop tensile strength.

In all likelihood, these cracks do not run the entire depth of the slab and will not grow. They should be sealed to keep out water. A sealing mix can be made from 1 part portland cement, 2½ parts sand and only enough water to allow the paste to hold shape. Epoxy resin squeegeed over the slab will also make an excellent sealer.

Q. I want to make the correct mix of concrete for replacing a sidewalk section, but am confused by instructions that say "mix so many parts of cement with so many parts of sand," ... and so on. Are the parts determined by weight or volume?

A. The correct ratio of sand, cement and aggregate differs according to the way the concrete is to be used. For a sidewalk slab, the classic 1:2:3 mix is best. Ingredients are measured by volume. One bag of cement equals 1 cu. ft. Add 2 cu. ft. of sand and 3 cu. ft. of coarse aggregate to one bag of cement to make 4 cu. ft. of concrete. Use 5 to 6 gallons of water in the mixture. Add water slowly, however, since the sand may already be wet. The consistency is right when a handful can be compacted into a ball.

Q. My existing concrete patio is cracked badly and I plan to replace it. How far apart should control joints be spaced?

(Please turn to page 116)



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A. Control joints—that is, spaces between one section of concrete and the adjacent sections—relieve stresses in concrete that result from expansion and contraction with changing temperature. They should be spaced a maximum of 10 ft. apart.

You can make control joints in three ways: 1. Cut them into partially set concrete with a hand groover masonry tool. 2. Cut them into concrete after it has hardened with a concrete saw. 3. Build forms with 1×4 or 2×4 strips at joint locations. Strips can be left in for decoration.

Q. What's the best way to clean oil and grease from a concrete floor?

A. If oil has been freshly spilled onto a concrete surface, blot up as much as you can, then cover the spot with one of the following: powdered calcium carbonate, hydrated lime, talc or fuller's earth. Portland cement can also be used. Let the powder stand for 24 hours and then scrape it off.

If oil has penetrated into the con-

crete, scrape off whatever remains on the surface with a putty knife and then cover the stain with a stiff poultice made from one of the powdered substances above combined with a solution of 1 part trisodium phosphate and 6 parts water. Let the poultice stand at least 24 hours, then scrape it off. Scrub the surface with clean water.

Grease is easier to remove than oil. If scraping and scrubbing don't work, use a poultice made from benzene, naphtha or trichloroethane and an inert powder. Allow it to stand 24 hours, then scrape the surface clean.

Q. Dark brown spots are appearing in areas of my concrete deck. They don't wash away with soap and water. What causes these spots?

A. The type of discoloration you describe occurs when tricalcium alumino-ferride—the agent that gives portland cement its gray color—has not reacted thoroughly with other chemicals in concrete. To remove the dark spots, try pouring on undiluted household vinegar. If that doesn't work, try a

(Please turn to page 118)

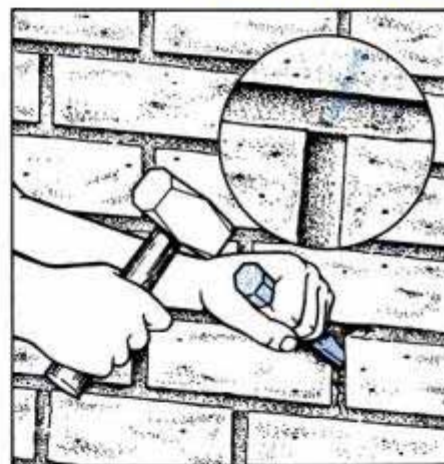
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solution of 1 part muriatic acid to 30 parts water.

Q. A fine layer of dust continually forms on my basement floor. How can I arrest this condition?

A. "Dusting"—erosion of the concrete surface—can be attributed to several causes. Improper curing is one, low cement content is another and freezing of fresh concrete is a third. When slabs are poured during cold weather, contractors often use fossil-fuel heaters to keep the area warm, and the carbon dioxide exhaust, reacting with the fresh concrete, causes calcium

carbonate to form on the surface. Still another cause may be that the concrete dried too quickly, allowing a mixture of water and fine cement particles called the "laitance" to form a thin layer.

Laitance can be ground off with coarse emery cloth, a carborundum wheel, a grit blaster or a scabber. To eliminate dusting from other causes, apply a chemical hardening agent that contains magnesium fluosilicate or zinc fluosilicate compounds.

Q. How can I get paint to stick to the high-traffic areas on our concrete front porch?

A. Today's epoxy, polyurethane and acrylic paints wear much better than oil and alkyd paints on concrete. Before applying a wear-resistant paint, clean and roughen the surface. Use a trisodium phosphate solution or strong detergent to scrub the floor. Sanding with coarse emery paper may be required to give the old surface a rough texture for good paint bonding. Test-paint a small area to be sure the new paint will adhere.

Q. The mortar joints on the brick walls of my house are dried and crumbling. How can I repair this?

A. The repair procedure for mortar joints on brick is known as "tuck pointing." Start by chipping out all loose mortar from the joints with a cold chisel and hammer to a depth of at least 1 in. Clean away dust and chips with a water jet and wire brush. In areas where failing mortar is causing leaks, remove the bricks and clean mortar from remaining bricks in the surrounding area.

Mix mortar from 1 part portland cement, 1/2 part hydrated lime, 4 1/2 parts sand and enough water so that the mixture can be compacted into a ball. Let it stand for one hour, then add enough water to make a stiff but workable paste. Dampen joints with clean water. Use a jointing tool to force the mortar into joints. As you compress the mortar and strike off the joints with the jointing tool, work in one direction only to avoid forming air pockets. **PM**



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- Burke BondCrete-S Bonding Agent, The Burke Co., San Mateo, Calif. 94403.
- Camp's Latex Concrete, Camp Co., 900 Sangamon, Chicago, Ill. 60620.
- Deep-Rock, Dependable Chemical Co. Inc., Rocky River, Ohio 44116.
- Duro E-Pox-E Cement & Filler, Loctite Corp., Cleveland, Ohio 44128.
- Far-Go Vinyl Cement Mix, Genstar Stone Products, Franklin Park, Ill. 60130.
- Fix-Crete Bonding Mixture, Mainstreet Enterprises, Lebanon, Ind. 46052.
- Polymer Plastics Corp., 65 Davids Dr., Hauppauge, N.Y. 11788.
- Quikrete, Worthington, Ohio 43229.
- Red Devil Silicate Cement, Red Devil Inc., Union, N.J. 07083.
- Roxium Mortar, Marlite Div., Masonite Corp., Dover, Ohio 44622.
- Sakrete, Box 17087, St. Bernard, Cincinnati, Ohio 45217.
- Southern Protective Products, Box 10888, Atlanta, Ga. 30310.
- Stay-Tite Products Co. Inc., 14701 Industrial Ave., Cleveland, Ohio 44137.
- Thoro System Products, 7800 Northwest 38th St., Miami, Fla. 33166.
- United Resin Corp., 14570 Barber, Warren, Mich. 48093.

Concrete sealers:

- GE Silicone Masonry Seal, General Electric Co., Waterford, N.Y. 12188.
- Sunnyside Silicone Sealer, Sunnyside Corp., Wheeling, Ill. 60040.
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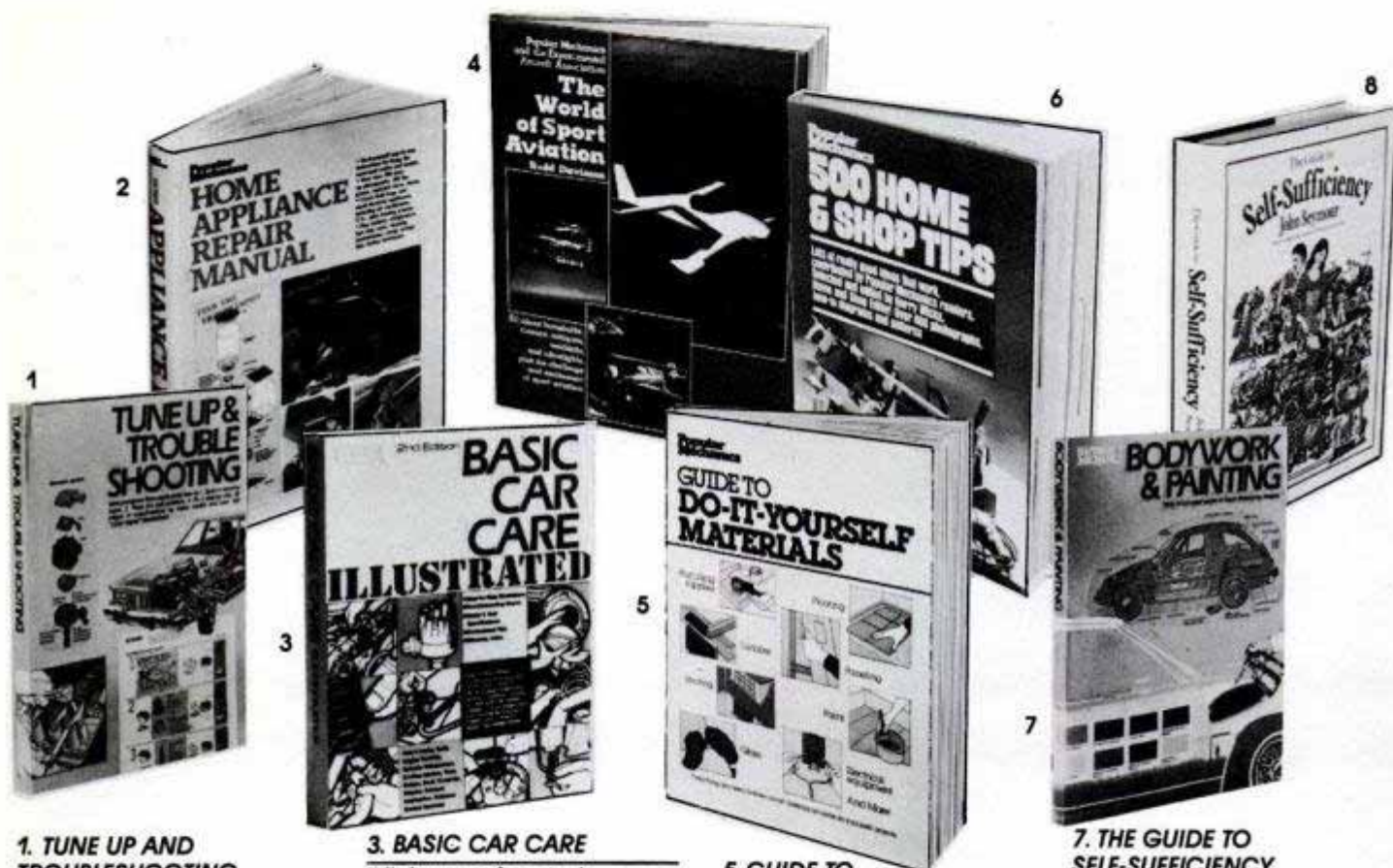
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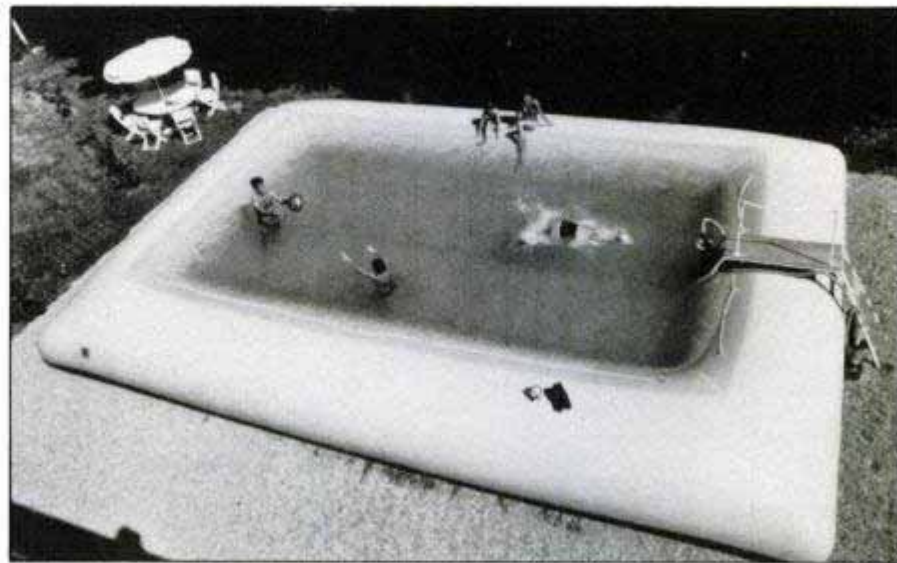
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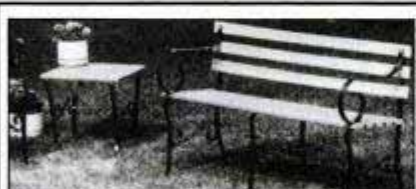
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A revolutionary new swimming pool has been introduced by Zodiac. Called the Hippo, it's a do-it-yourself, inflatable pool. Simply inflate the side walls with air, replace the air with water, then fill the interior swimming basin. Hippo's five models range from 12 x 17 x 2 ft. deep, which sells for \$1,800, to 31 x 43 x 4 1/4 ft. deep, which costs \$7,000. For more information, contact the Pool Div., Zodiac of North America, Box 400, Stevensville, Md. 21666.

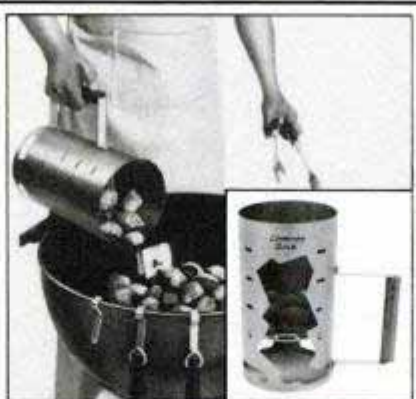
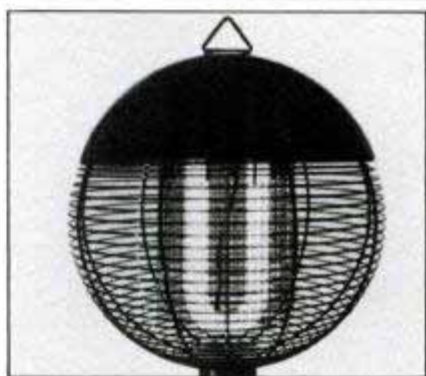


Adelphian Mill presents do-it-yourself gazebo packages. The manufacturer claims that two people can erect the prefabricated gazebos within four hours, using ordinary hand tools. Made completely of California redwood, the gazebos are available in both 9-ft.-dia. (\$1,096) and 12-ft.-dia. (\$1,680) models. For further details, you should contact Vandy Craft, Sales Office, 350 East Dundee Rd., Suite 205, Wheeling, Ill. 60090.



A close look at Algoma's new line of lawn furniture reveals "wooden" slats made of polyethylene. The line consists of nine pieces, including the two shown: a 4-ft. terrace bench (\$99) and a 16 1/2 x 18-in. end table (\$40). The furniture is available in green, white, redwood and gray and is manufactured by the Algoma Net Co., 1525 Mueller St., Algoma, Wis. 54201.

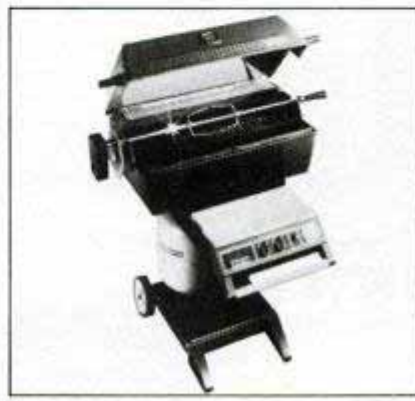
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A quick and safe way to light charcoal briquets is the idea behind the Christen SuperFast charcoal starter. The 6 1/2-in.-dia. x 12-in. steel cylinder is divided by a wire grate—the upper half holds charcoal and the lower portion is for crumpled newspaper. Lighting the paper will start from one to four pounds of charcoal in 6 to 15 minutes according to the manufacturer. It retails nationally for \$11.95 and is produced by Christen Inc., 59 Branch St., St. Louis, Mo. 63147.

Structo's Golden Classics gas grills are led by the top-of-the-line Model 97401B. This model's full range of convenience features include: stainless steel double burners, battery-powered rotisserie, pushbutton igniter, separate heat controls, a 20-pound LP fuel tank with regulator, steel base with 6-in.-dia. wheels, hardwood cutting board and volcanic rock. It's \$454.95 from Structo Div., Route 75, Freeport, Ill. 61032.

(Please turn to page 126)



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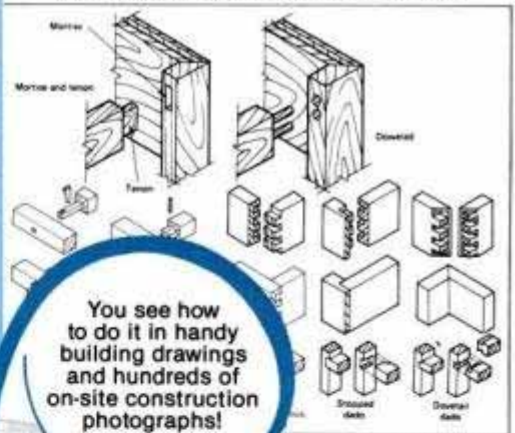
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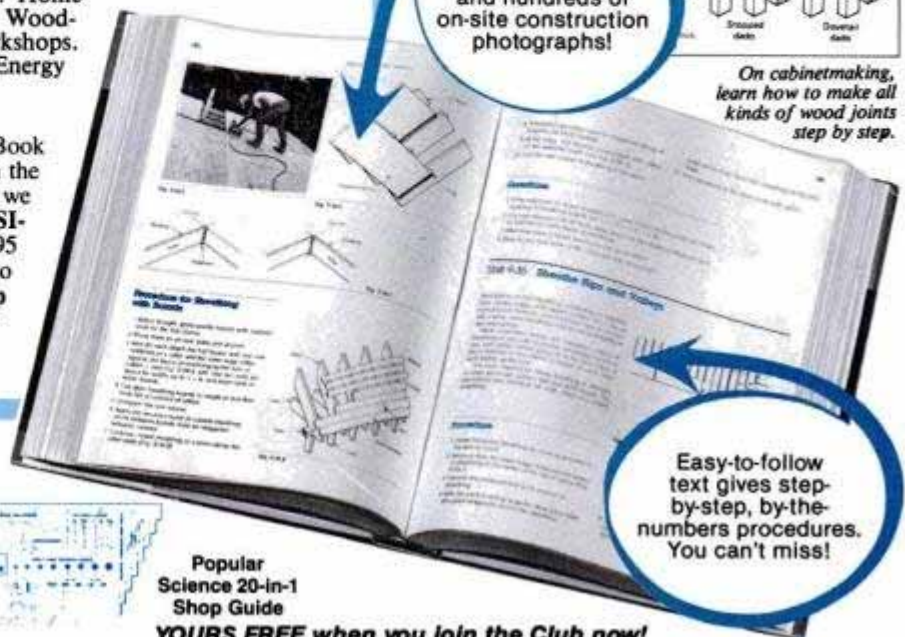


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What a great way to build a valuable library of the best new, hard-to-find handyman books on: house building, home repair and improvement, wiring, electronics, plumbing, wood-working, furniture building, appliance repair, cars and car repair, home insulation, energy savers, and many other do-it-yourself subjects. It's always your choice!

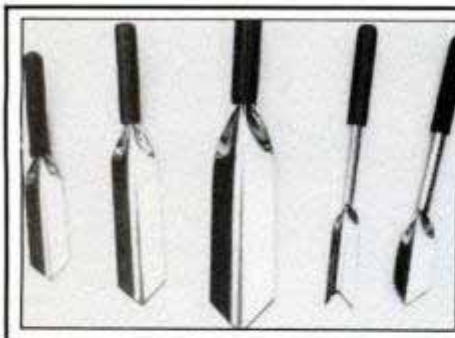
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NEW PRODUCTS

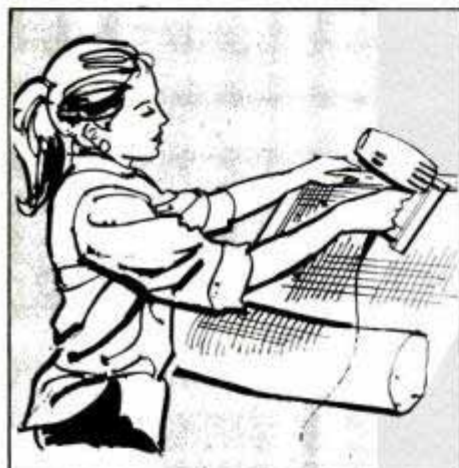
(Continued from page 121)



Polar Products offers stainless-steel garden tools featuring solid, one-piece construction. The tool line (left to right) includes a 10-in. potting trowel (\$3.50), 12-in. garden trowel (\$4), 14-in. utility trowel (\$6), 12-in. weeder (\$3.50) and a 12-in. long-handled trowel (\$4). All of the tools are guaranteed not to rust or break for seven years or they can be returned for a free replacement. For details, contact Peter Woolf Ltd., Box 186, Sparta, N.J. 07871.

A trigger-squeeze breeze in the hands of the handy homemaker!

A powerful, useful tool in the hands of the home handyman!



ARROW
ELECTRO-MATIC

Model ET-50 ELECTRIC STAPLE GUN

**It's TRIGGER-FAST!
Just plug in... and SHOOT!**

Just plug it into standard house current... and you're ready to fire staples as fast as you can squeeze its feathertouch trigger!

With her lightweight, trigger-fast Arrow ET-50 Electro-Matic, the handy homemaker will breeze effortlessly through scores of light decorating and repair chores... trimming a kitchen shelf, lining a closet, mending a torn screen or covering a headboard

And, the Arrow ET-50 Electro-Matic is a fastening tool with the heavy duty staple-driving power the home handyman needs for putting up ceiling tile, installing insulation, applying weatherstripping, etc.

Uses Arrow No. T-50 staples exclusively, in 6 sizes: 1/4", 5/16", 3/8", 1/2", 9/16" and Ceiltite.

Available at all leading Hardware, Home Center & Discount Department Stores everywhere.

ARROW FASTENER COMPANY, INC.
271 Mayhill Street, Saddle Brook, N. J. 07662

Operates on any 110 Volt AC-60 Cycle Outlet.



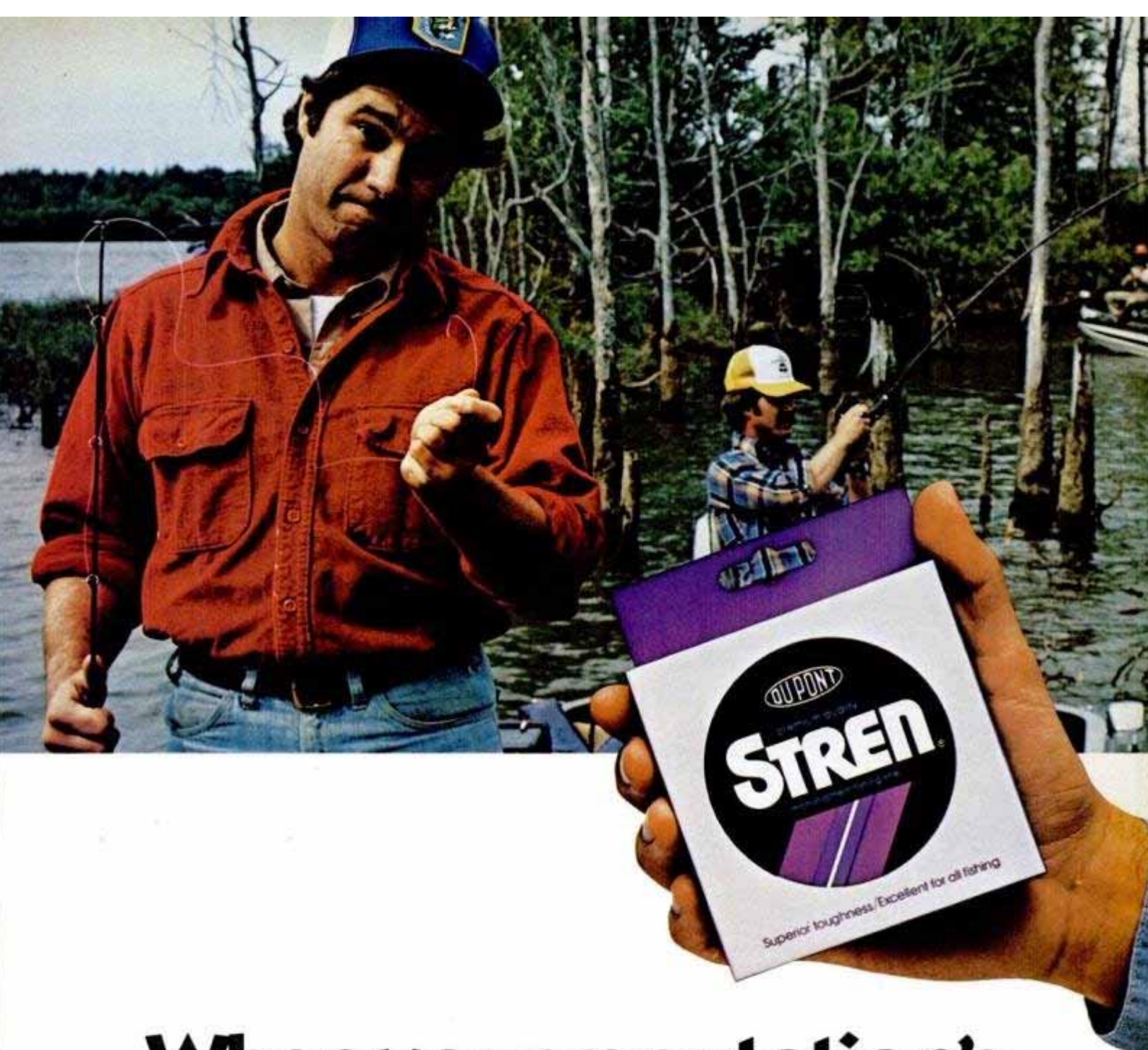
The Easi-Kneeler enables gardeners to work comfortably in either a kneeling or, when turned over, a sitting position. A foam pad covers the pine platform for additional comfort. It's \$47.75 postpaid and is available from Gardens For All, Dept. PM, 180 Flynn Ave., Burlington, Vt. 05401.



The PeCo garden sprayer (\$189.95) is powered by a rechargeable 12-v. battery. PeCo claims it can deliver 5 hours of spraying on one 13-hour charge. Write directly to PeCo Inc., 2750 Sweeten Creek Rd., Box 5415, Asheville, N.C. 28813.



The Power-Til (\$200) is an electric tiller which is claimed to perform like a 3-hp gasoline tiller. Its 9-in.-dia. tines are able to till a full 17-in.-wide swath. Contact Boyd Jefferies, DESA Industries, Box 719, Bowling Green, Ky. 42101. **PM**



When your reputation's on the line, better fish Stren.[®]

Your favorite lure did the trick. The fish took it, all right. But how will you explain that he took your line, too? Next time, rely on tough, all-purpose Stren, the premium fishing line from DuPont.

It's the professional angler's top choice. Because Stren has a unique balance of properties. To let you set the hook—hard. Play for keeps in rugged cover. And know that your best knots will hold up. Cast after easy cast, fish after fighting fish. So tie your lure to high-quality Stren, available in clear/blue, golden, and new clear.

Great fishing starts with Stren.



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Now your car can sound as sporty as it looks — with a Maremont Cherry Bomb performance muffler. Especially now that it's at this low sale price. In addition to mellow sound, Cherry Bomb delivers reduced back pressure, which can improve gas mileage.

*Sale price may vary at participating outlets. Offer ends July 31, 1983. Certain applications not certified in California and Florida.

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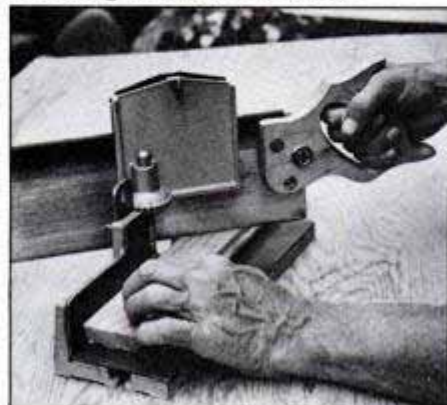
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HINTS FROM READERS

Nonslip miterbox liner



A nonslip rubber pad keeps the molding in place with very little hand pressure.



To secure pad, apply rubber cement to mating areas of miterbox and rubber. Position rubber after cement is tacky.

Holding a piece of work in a miterbox while sawing it can be awkward, depending upon molding shape. I've solved this by gluing sections of gasket rubber to the floor and side of the miterbox. Cut the rubber to size and apply rubber cement to both bonding surfaces. Set them aside for 10 to 15 minutes until the cement is tacky and the surfaces will bond firmly on contact. Now you can hold work with relatively little hand pressure.

—David W. Roberts

Silver-lead pencil is aid

A pencil having silver lead is a great aid in a home or farm workshop. Used on metal, the silver markings are easy to follow when cutting or welding.

—Howard E. Moody

For 1983, Chrysler increases its warranty protection to two years.

Only one major outboard manufacturer has enough confidence in its product quality and reliability to offer a limited warranty for not one, but two years. That's Chrysler Marine.

For 1983, all domestic outboards, purchased from authorized U.S. Chrysler Marine dealers, will carry a 2-year limited warranty against defects in materials and workmanship on the entire product. Both parts and labor.*

America's longest warranty. America's lowest dealer prices. It's not surprising that

Chrysler Marine leads the industry in warranty protection. Chrysler is a leader in bringing design simplicity/easy maintenance to outboard engines. And model for model, Chrysler offers its dealers the lowest wholesale prices of any major manufacturer. So, our dealers can pass along important outboard savings to you.

Exciting new graphics . . . new models highlight Chrysler's '83 lineup. Chrysler Marine outboards feature attractive new graphics, designed to complement any craft. Choose from a complete lineup of 1983 performers from the 3.5 to the 140 HP, including three of the highest-thrust sailor engines designed for displacement hulls:

And introducing the Charger 90. A real high-torque powerhouse with stainless steel prop, standard.

Our 1983 outboard lineup is the product of over 50 years of engineering innovation, testing and in-use proving.

Compare. Nobody pulls it all together like Chrysler Marine to give you price, warranty, quality and serviceability.

See your Chrysler Marine dealer now.

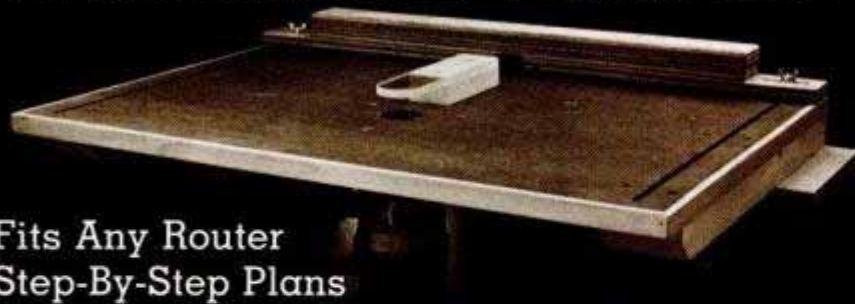
*Excludes normal maintenance service and parts, and outboards that are part of boat builder packages. \$25 deductible required in second year. See dealer for details.

NOW FROM CHRYSLER MARINE: THE INDUSTRY'S LONGEST OUTBOARD WARRANTY.



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Fits Any Router Step-By-Step Plans

Get the most out of your router by mounting it to this shop-tested router table. The extra-large work surface and fully adjustable fence beat the pre-fab metal tables hands down! And all at a fraction of the cost.

• With this router table you can make molding cuts on narrow boards. Cut rabbets or grooves exactly where you want them. Rout decorative patterns on curved edges. Even make multiple cuts for special effects. And get professional results every time!

• The complete plans for this easy-to-build router table include step-by-step directions for a bench-top model plus a full-size floor model.

• These exclusive plans are now available in a six-page Plan Booklet. The cost? For a limited time the Router Table Plan Booklet is only \$1.

• To get your Router Table Plans, send only \$1 to: Woodsmith, Dept. 40, Box 842, Des Moines, Iowa 50304

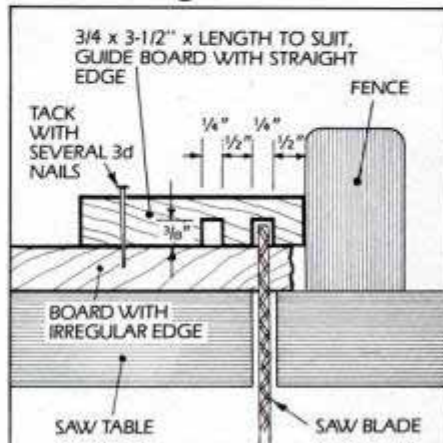
Woodsmith PLAN BOOKLET

Name: _____

Address: _____ City: _____ State: _____ ZIP: _____

HINTS FROM READERS

Uneven edges

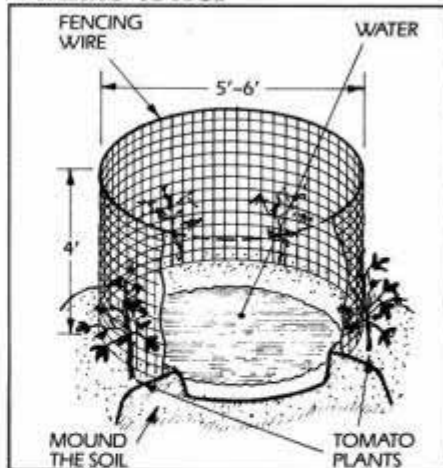


Here's an easy-to-make guide for cutting a straightedge on a board with an uneven edge. The guide is made from a straight piece of stock $\frac{3}{4} \times 3\frac{1}{2} \times 48$ in. (or any suitable length). The $\frac{1}{4}$ -in.-wide dados are used to align the guide with the desired cut.

Tack-nail the guide so it overhangs the workpiece's uneven edge and it rides against the rip fence.

—George Obradovich

Tomato tower



You can make this inexpensive tomato trellis in just a few minutes by rolling a 4-ft. \times 20- to 28-ft. piece of turkey wire into a cylinder. When you have the diameter you desire, secure the trellis by building a mound of dirt around its base. Plant four evenly spaced tomato plants close to the trellis. Use the interior for watering.

—Dorothy S. Garland

POPULAR MECHANICS • JUNE 1983

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Automatic Self-Adjusting Ratchet Design Wrench Loosens or Tightens Every Nut and Bolt From $\frac{3}{8}$ " to $1\frac{3}{16}$ " and From 9mm to 22mm

ONLY \$5.99



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Now there's an amazing, virtually automatic wrench that almost makes all those closed wrenches in your tool box obsolete! No more hunting through the tool box for the right size wrench for the job, because *this one tool fits almost everywhere that a closed wrench is needed!*

BREEZE THROUGH THE TOUGHEST TIGHTENING AND LOOSENING JOBS

This ingenious but simple ratchet action wrench takes on even the toughest, rustiest most stubborn nuts. *Loosens even rounded bolts!* To tighten, simply place wrench over bolt or nut, apply pressure and turn. *The grip increases as the turning gets tougher.* And at the remarkably low price of only \$5.99, you'll want several.

AMERICAN FAMILY, Dept. 234-KK Box 21, Kensington Station Brooklyn, N.Y. 11218

Please send me the amazing Multi-Purpose Wrench for only \$5.99 plus \$1.50 postage and handling. (Send check or money order in U.S. Currency only.) NY, PA, CA, MI and IL residents add appropriate sales tax.

SAVE! Order two Automatic Wrenches for only \$9.99 plus \$1.95 postage and handling.

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This talking phone TELLS you in clear English what numbers you're dialing.

We'll Try to Describe Everything This Space-Age Phone Does In One Page of Small Type. It Won't Be Easy.



The Everything Phone is a handsome, contemporary ivory phone with a standard modular plug, ready to go.

It's as though someone said—
"Let's think of *everything* any telephone can do, and combine them into one fantastic instrument."

Someone did say that. This is it. We call it THE EVERYTHING PHONE because it does everything. It advances the science of phone communications by ten years, even in this age of wild changes and improvements.

For example—
This Phone Actually TALKS To You
The Everything Phone speaks to you in a warm, gentle voice. It never tells you wrong. Touch the "Voice" switch and when you push a button, the phone tells you the number you've pushed. If you're working in dim light, you won't dial a wrong number, because your friendly phone voice repeats each digit immediately, as you dial it.

A Complete Phone Answering System
If you press the "Prefix" key, the "Clear" key, the Direct Memory Keys, or any of the other special function keys (more about these later), your Phone Voice tells you what you've pushed. If you get tired of company, you can shut off the voice; but it's like having a friend right inside your phone.

This feature takes some explaining. In the bank of keys to the right of the dial pad are three marked M1, M2, and M3. M1 and M2 will tell a caller, when you're out, either when to call back or another number where you can be reached.

What about M3?
M3 makes *any* cassette recorder an answering device. Using the connector (supplied), your recorder can take messages up to the total length of any tape cassette. The Everything Phone turns the recorder on and off automatically when a call comes in.

So—you have your voice of 1) a message, in the phone's own voice, to call back at whatever hour you designate; 2) a message that you're out and can be reached at whatever number you designate; 3) an invitation to leave a message after the tone, with a capacity as long as the cassette—an hour or more.

Memory Keys Galore for Automatic Dialing

At the left of the numeric keypad are ten Direct Memory Keys. The key at the upper left is for MCI, Sprint, or other computer-code dialings. It holds the access number and your personal code number.

The other nine let you dial stored numbers, including long distance numbers, by pressing one key. You can inset a tab showing whose number is stored.

But you ain't see nothin' yet!
You actually can store up to 50 numbers of 20 digits each, using a two-number code. Example: if you already have 30 numbers in memory and you want to store 1-305-473-2044, punch in that number, use the "Store" key and "31", and you'll be able to dial that number in the future just by pressing "31".

Quality Speaker-Phone

Of Course The Everything Phone has one-way speaker-phone capability. Of course it's high quality sound.

Just press the "Speaker" button and you have a hands-free phone. A volume control gives you just the right amount of amplification.

Music on Hold; "Mute" Switch

You can put a caller on hold just by pressing the "Hold" key. What a pleasant surprise! Instead of dead sound, the person on hold hears a pleasant melody. (You'll hear it too, so you won't forget he's on hold.)

You have a "Mute" privacy button, and it couldn't be more convenient—it's right in the center of the modern hand-phone. Press that button, and although the other party won't be able to hear you, you'll still be able to hear him or her. Release the button and communications are normal again. (No tell-tale "click" when you press the Mute button.)

Here's a List of Other Built-in Benefits
Your Everything Phone is an electronic butler. It has—

— Automatic redial. Press this key and your phone will redial the last number you called either once (if the phone is off the cradle) or four times (if the phone is in the cradle).

Each key has a separate function. Each one talks to you, if you want it to. What a conversation piece The Everything Phone is!

- Pulse/Tone selector switch. In areas with rotary dialing only, slide the switch to "P". In areas with touch-tone, slide it to "T".
- Ringer off switch. You can turn off the pleasant "chirper" (it isn't a bell) when you don't want to be disturbed. A separate ringer i.e.d. light will alert you, if you're interested.
- Access pause key. For Sprint, MCI, and other code numbers, the Pause button gives you the proper gap between the original dialing and the time the system takes to answer with a tone. The Pause has other uses, too, but we just can't list all of them here.
- Secretarial aids. Open a little door and you have a memo pad to jot notes. For the numbers stored in automatic dialing memory, slide out the Directory Card, concealed under the phone unit.
- Battery backup. Two tiny, easily replaceable batteries keep your memory intact. A power failure, even one that lasts for months, won't wipe out what's stored in the memory.

Anything Else?

Probably. We ourselves haven't figured out all the phone assistance The Everything Phone can give you. But we do know this:
No other phone ever made has all the benefits and comforts this one has for you.

**CAN YOU BELIEVE IT?
THE EVERYTHING PHONE
IS YOURS FOR JUST**

\$199.95

**two for only \$189.95
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by lifting your old-fashioned phone
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Have your VISA or MasterCard handy.
Phones are manned seven days a week,
24 hours a day.

We Absolutely Guarantee!

The Everything Phone is a lot of fun, and it's the darnedest electronic instrument you ever owned. But if at any time during the first full month you own it you decide not to keep it, send it back and we'll refund every cent you paid.

Send check or money order, or charge card information (\$199.95 + \$4.50 shipping—
Total, \$204.45) to New Horizons, or call the toll-free number above.

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MUST LIQUIDATE FAR BELOW DISTRIBUTOR COST! GENUINE TORO ELECTRIC POWER MOWER

Factory new! Factory perfect!

A genuine TORO lawn mower! With TORO's one year warranty! Priced at FAR below distributor cost! WHAT'S THE CATCH? Just this:

TORO over-engineered this lawn mower! They put so much money into its advanced technology, superior construction and sleek styling that it required a high price tag. Higher than many competitive models. This (plus the fact its unique concept was ahead of its time) met with resistance in the marketplace. At model year's end, TORO decided to "shelve" the program and liquidate the remaining inventory.

Because of the extremely short selling season for lawn mowers, we must move these out FAST! We SLASHED the price incredibly low. So low, you can consider buying one as a "spare" ... in case your present mower is getting old and "conks out" ... or if you want two people mowing at the same time.

Just roll out this TORO. Press a button and away you go with the greatest of ease! Mowing AND EDGE TRIMMING at the same time. What a timesaver! And what a neater, trimmer looking yard, too! Order a TORO now.



FOLDS DOWN COMPACTLY for transport in trunk of car or for hanging on garage wall.

TORO

TORO One Year Limited Warranty!

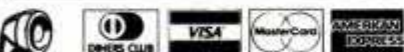
120 VOLTS A.C. DOUBLE INSULATED

Compare our low price with other electric mowers. (Source: 1982 Fall & Winter catalogs.)

Sears 19" w/bagger .. \$229.99
Wards 20" .. \$159.97
Penneys 19" w/bagger \$219.99

And remember, Ours is a **TORO!**

- Mows AND trims flush up to walls, trees, fences, etc.
- Cuts and recuts finely for mulch. No need to bag.
- Neatly mows a 20-inch wide swath of grass.
- 2 ultra-quiet 10 amp. Bosch motors for twin power.
- Adjustable cutting heights without use of tools.
- Unique, lightweight design. Less than 35 pounds.
- Easy for senior citizens, women, young teens to use.
- Electrically operated. Easy pushbutton starting.
- No gas to buy. No oil changes. No engine tuneups.
- Safer, BY FAR, than any other power lawn mower.
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- Low profile housing gets under bushes, shrubs, etc.
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If you know of any company with surplus inventories that must be quickly liquidated for cash, phone us Toll-Free: 1-800-328-0609. Only products in perfect operating condition will be considered. We'll pay you a finder's fee based on a percentage of the total value of the sales contract. (Officers and sales reps of mfg. are ineligible for fee.)

Safety bar under handle. Release grip, engine stops.

For upright grasses. Not for creeping grasses such as Bermuda.

AUTOMATIC LINE FEED! Fingertip control for automatic feed of line. No bending or stooping



120 VOLTS A.C. DOUBLE INSULATED



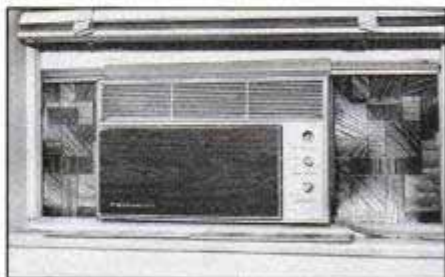
EASY START! Plug in cord and press a button. Simple, fast, sure starts every time.



2 CUTTING HEADS with 4 flexible lines revolving at 7500 rpm. to slice cleanly through grass.

HINTS FROM READERS

Air conditioner fins



Worn out air conditioner fins can be replaced inexpensively with vinyl floor tiles. For a tight fit, set the air conditioner in the window. Remove the original fins and measure the height and width of the openings on both sides. Cut the tiles to size with a utility knife.

For strength and neat looks, use a double thickness of tiles mounted back to back. Make certain that the joints (seams) are staggered. The adhesive forms an ideal bond and allows for resiliency when installing.

—Shannon Keith Kelley

Barbeque grill clean-up



Periodically cleaning your barbecue grill is the best way to keep it operating efficiently and looking good. First, clean the grill body, supports and base with a solution of hot water and detergent. Soften burned-on food by spraying with an oven cleaner and soaking the removable grating in hot, soapy water. After the crust has softened, Chore Boy recommends using a stainless steel scouring pad to remove residue on the grate. Charmglow suggests using a straight pin or a fine wire to keep gas burner openings clean. To clean reusable briquettes on a gas grill, turn them over and light the grill. Follow the manufacturer's use and care instructions.—George Jachens

C.O.M.B. Co. / Liquidators Dept. F-19-4209
6850 Wayzata Boulevard / Minneapolis, Minn. 55426

Send _____ Toro Power Mower(s) at \$88.00 each plus \$18.75 each for shipping and handling. (Mowers are in stock, ready for prompt shipment. Sorry, no C.O.D. orders.)
Minnesota residents add 6% state sales tax.

My check or money order is enclosed.
Charge: MasterCard® VISA Am. Exp. Diners Club

Acct. No. _____ Exp. _____

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Sign here _____

TONE ARMS IN THE GROOVE

(Continued from page 71)

tracking error, which is caused by the curved swing of conventional tone arms.

Ideally, the tone arm should hold the cartridge so that it remains tangent to the record groove all the way from the beginning to the end of the record. Yet, because of its curved path, a conventional arm changes the cartridge angle with respect to the groove as the arm travels from the edge of the disc toward the center.

The number of degrees by which the cartridge angle differs from true tangent at any particular moment is called the tracking error. It makes the stylus ride askew in the groove, causing distortion. You might compare the problem to the sideways drag caused by improper wheel alignment in a car.

Angle remains constant

Linear-tracking arms bypass this problem. Traveling across the disc in a straight line, the angle stays constant and remains true tangent (at least in theory, as will be explained later).

That's not the only benefit. Linear tracking also eliminates the side thrust or "skating force" which makes conventional arms lean harder against one side of the groove than the other. This side thrust—normally compensated for by special antiskating adjustments on the turntable—is caused by the offset angle in conventional arms. Linear arms have no offset angle for the car-

tridge holder, so the problem never arises.

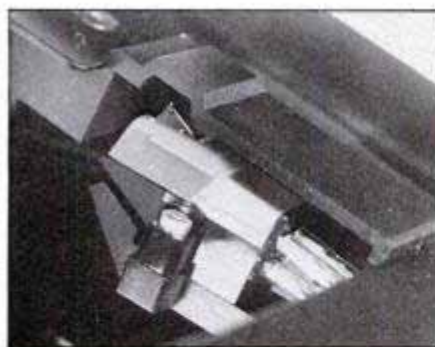
On top of all that, linear arms can be a lot shorter than the pivoted kind. This makes them lighter and less likely to get all jumpy and stirred up by powerful, low-bass vibrations or the up-and-down swings of warped records. Their lightness simply puts them out of the resonant range for such disturbances. The shorter arms also take up less space, so the entire turntable can be more compact. Finally, since linear-track arms don't depend on gravity or a counterweight to provide the correct stylus pressure, they can play in any

position—even standing up vertically.

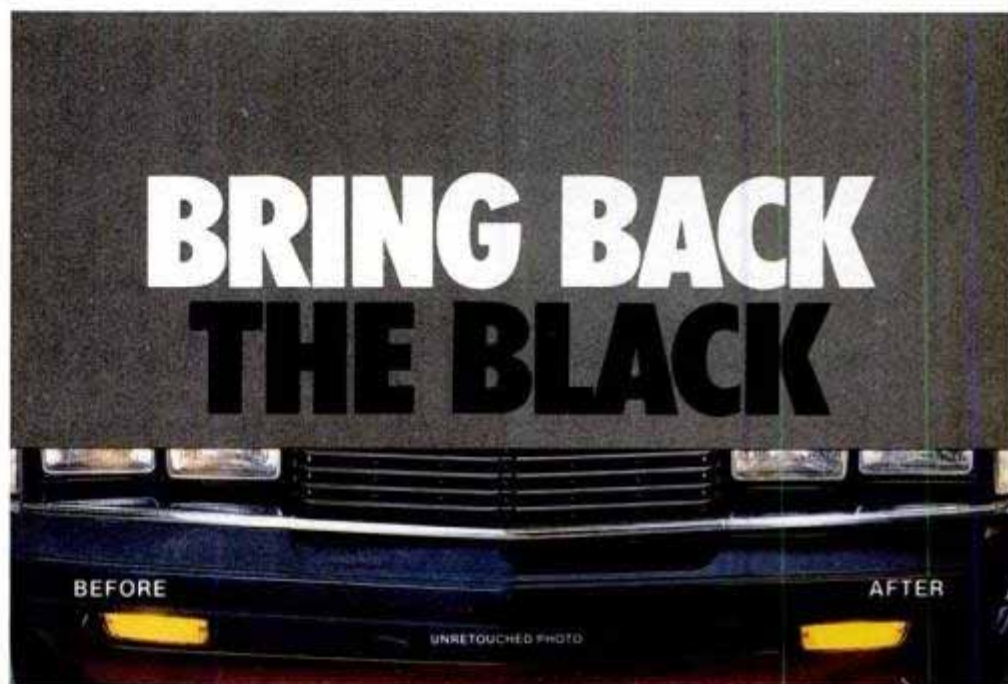
With all this going for them, you'd think that linear-tracking arms win hands down. Yet some engineers are having second thoughts about this approach. The advantages of linear tracking, they say, must be balanced against certain drawbacks.

For one thing, it takes complex circuitry to guide these arms across a record. They don't just get pushed along by the record groove, like conventional arms. Rather, linear-track arms are propelled by a mechanism similar in principle to the autopilot which

(Please turn to page 136)



Interior view of Mitsubishi's LT-10V (top) shows linear-tracking stylus nestled in turntable's "jaws." Control panel of Kenwood P-9 (bottom) has touch-sensitive switches for all functions.



There's nothing sleeker than the black look on today's cars. But how do you keep that black rich and lustrous? Well, now there's a one-of-a-kind product that cleans and seals black bumpers, trim and molding: Black Chrome™ cleaner & sealant from Turtle Wax®.

Black Chrome's creamy white lotion instantly gives black rubber and vinyl that deep, satiny look. Two cleaning solvents, plus emulsifiers, loosen, lift and suspend dirt and grime. But more than cleaning, Black Chrome's unique formula actually seals in that look for months of protection. Plus, Black Chrome works just as well on soiled bumper guards, textured plastic surfaces, simulated wood grain, tires and other vinyl and rubber colors.

Bring back the black today.

NEW BLACK CHROME™ CLEANER & SEALANT FROM TURTLE WAX.

SAVE 50¢
on Black Chrome™ or
Silver Chrome™

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TONE ARMS IN THE GROOVE

(Continued from page 135)

keeps airplanes on course. The autopilot senses deviations from the charted course and then takes corrective action. Exactly the same happens with these tone arms. Whenever a sensor in the linear-track arm registers a misalignment (deviation from true tangent) between the arm and the groove, it activates a servomotor which then pushes the arm the tiny distance needed to bring it into line with the groove. This process is repeated again and again as the cartridge moves from one groove to the next. Thus, in a series of small, corrective steps, the arm moves across the record.

Granted, the misalignment needed to trigger this movement is minimal. Even so, critics say these arms still fall short of the theoretical optimum because it takes a definite misalignment to get the servos going in the first place. As a result, some audio engineers argue that there is little or no difference between linear-track arms and conventional arms as far as sound quality is concerned. What's more, the servo drives are expensive. So, instead of opting for the linear-track approach, some designers are trying to improve conventional arms.



Well-designed and balanced gimbal joint gives Dual pivot arm excellent tracking.

Among top-rank turntable makers, Dual loyally sticks to the traditional swivel arm. By careful calculation of the offset angle and the arced path across the disc, the tracking error is kept to less than 2° . Dual engineers believe this causes no more distortion than the misalignment needed to activate a linear-tracking arm.

An ingenious refinement of the pivot principle is offered by Denon, with its electronically controlled tone arm Servo Tracer, which is part of the DP-11F turntable. Outwardly, it looks like a conventional arm, yet at its base, sensing coils read the velocity of the arm in both the horizontal and vertical directions. If unwanted resonances occur—or if the arm is thrown off course by record warp or side thrust—another magnet applies an equal and opposite

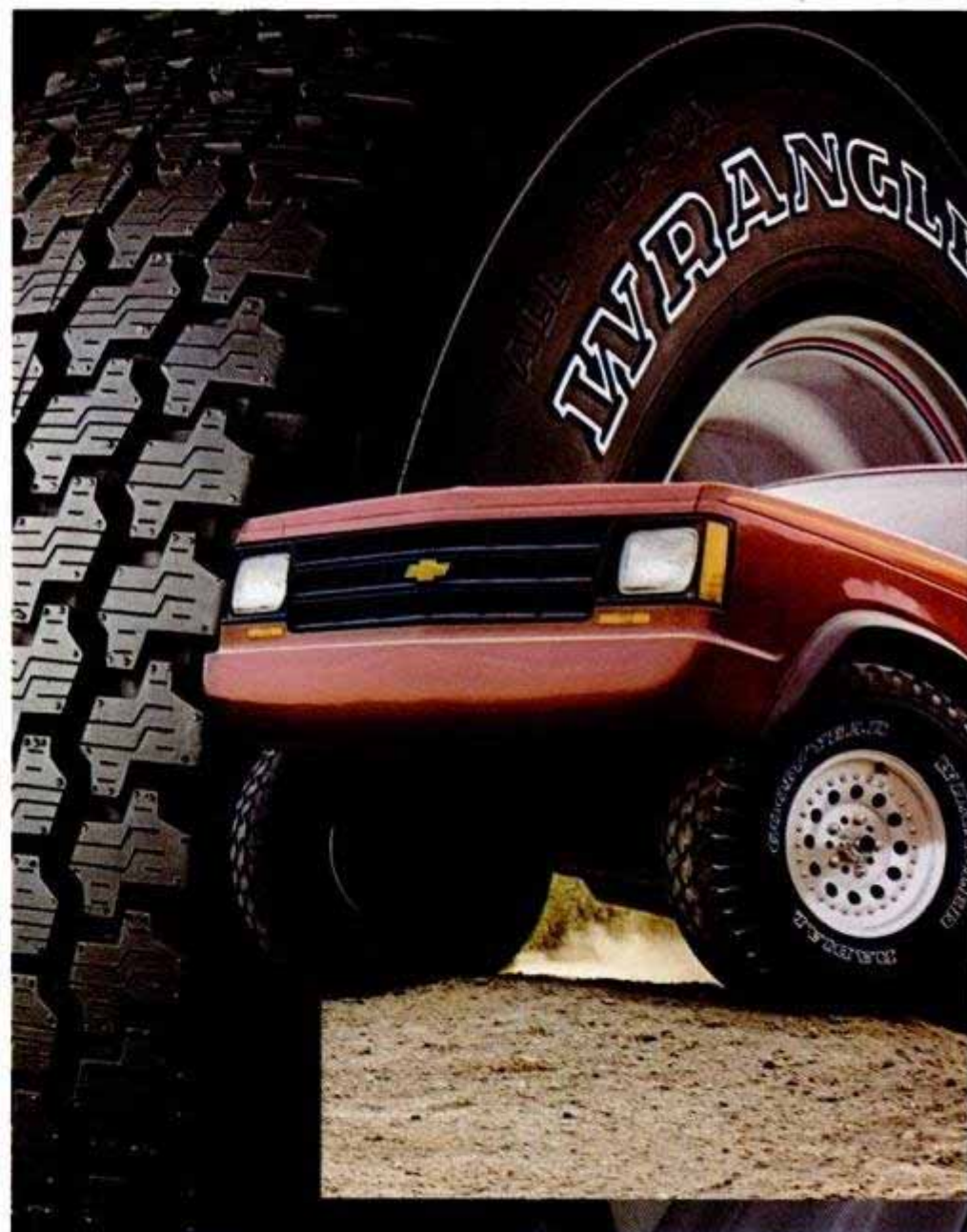
force. That way, stylus pressure is kept constant despite the roller-coaster motion of record warp. Side thrust is neutralized the same way.

Design details

Three turntables in our test group use linear-tracking arms: Sansui P-M7 (\$370), Mitsubishi LT-10V (\$250) and Kenwood P-9 (\$329). The Dual CS505-1 (\$130) and the Denon DP-11F (\$200) opt for pivoted arms, the latter with Servo Tracer. Each model has a number of distinctive features. For example, both the Kenwood and the Mitsubishi are specifically designed for vertical

operation: They play standing up instead of lying down. This is handy if the turntable must fit on a narrow shelf and makes it possible to place an entire sound system on normal-width bookshelves. While playing in an upright position, the Mitsubishi holds the record against the vertical platter by means of a clamp. On the Kenwood, you just drop the record into what looks like the maw of a hungry animal and then shut the lid.

Thanks to a built-in microcomputer, you can play—skip or repeat—up to seven tracks on a record in any preprogrammed sequence on Sansui's P-M7.



WRANGLER RULES THE ROAD.

You just punch in your choice on a row of seven selector buttons on the front edge of the turntable. If you use the P-M7 with a Sansui tape deck, it also provides automatic cueing for the deck when you dub a disc. It starts the cassette recorder the moment the stylus hits the groove and stops the recorder as the tone arm lifts off the record. (Kenwood has a similar feature, assuming the Kenwood turntable is used with a Kenwood tape deck.)

Among the turntables with pivot arms, Dual uses its renowned ULM (Ultra-Light-Mass) arm—a conventional arm of uncommonly light construction

with precision bearings that allow it to move with minimal drag. Equipped with a special premounted phono cartridge (made by the Danish firm Ortofon) the Dual ULM design reduces the mass of the arm/cartridge combination to 8 grams, a significant drop from the 18 to 20 grams typical of most other tone arm/cartridge assemblies. The result is excellent tracking without the need of any servo mechanisms and therefore at a bargain price.

There is no clear-cut winner in the ongoing contest between pivoted and linear-tracking arms. You can't pick and choose by numbers because nobody

has come up with an exact and reliable method to compare the tracking performance of these two basic arm types.

I sharpened my ears and (using Shure's top-rank V-15 Type IV cartridge where no cartridge came with the turntable) I played the Telarc version of Tchaikovsky's *1812 Overture* on all the turntables. I picked this particular record because it contains a passage where cannon shots thunder and church bells clang on top of a symphony orchestra fiddling away at full blast. That passage has been known to knock lesser tone arms into the bleachers. But each of the five models tracked it without a hop, skip or jump.

Still, there seemed to be a slight difference at the innermost grooves of the record, where the musical waveforms are most tightly packed together in the groove and accurate tracking becomes both more difficult and more important. At these inner grooves, the linear-track arms seemed to have a slight edge in tonal clarity, but the difference was merely marginal. On the whole, we found it's pretty much of a draw between the two design approaches.

In any event, the tested models left no doubt that the latest tone arms—both linear and pivoted—can clear the hurdles presented by today's most demanding discs. They're proof that analog technology is alive and well, ready to take on whatever challenge the digital future may bring. **PM**

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PRINTS FROM SLIDES

(Continued from page 77)

place the slides on the paper and print through them, using your basic exposure-filter values. The contact images are small, but the necessary exposure or filter corrections should be obvious enough to make your first print a good one and your second even better.

Exposure for print sizes other than 8×10 can be calculated using tables found in most color printing guides. The print manuals put out by Kodak and Ilford for their Ektaflex and Cibachrome processes are very well done.

The Ektaflex and Cibachrome processes are two of the best ways of producing prints from slides—Ektaflex for its convenience and the Cibachrome method for its image quality. Both offer image permanence, not found in most other printing materials.

At the core of the Ektaflex processing system is the Model 8 processor and the new Ektaflex PCT reversal film. The same paper and activator solution is used with the ordinary Ektaflex film used to make prints from negatives.

To make a print, place a slide in the

(Please turn to page 138)

PRINTS FROM SLIDES

(Continued from page 137)

enlarger upside down (emulsion side up) and expose the reversal film that is placed on your enlarger's easel. The exposed reversal film is placed in the processor, where it is soaked in the activator solution for about 20 seconds. Turning the handle of the printmaker laminates the film to the waiting paper. After 9 to 12 minutes in normal room light, the light-tight sandwich is peeled apart. There's no mixing, or washing, and no other complex processing steps are needed.

The print quality is comparable to that of other processes and offers a repeatability that the occasional printer should find attractive.

The new Cibachrome A11 paper and its compatible P30 chemistry are improved versions of an already proven paper/developer combo. The new material is every bit as sharp and much less contrasty. After exposure, the paper is placed in an Ilford or similar processing drum. The drum permits the paper to be processed in as little as 2½ ounces of chemistry. The solutions are kept in contact with the print's surface by rotating the drum back and forth on a

level surface. A motor base can make this job less tedious. At the end of each processing step the old solution is poured out and the new one is poured into the drum's light-tight trap. After three chemical and two washing steps, the paper is removed for drying. The total wet time is about 12 minutes at processing temperatures of 75°F.

Working at or near room temperature, rather than at the elevated temperatures (such as 100°F.) required for some other processes, makes Cibachrome and Ektaflex easy to manage.

Ektaflex and Cibachrome papers are available in both glossy and matte/pearl surfaces. Cibachrome's pearl-surfaced paper, while cheaper, does not possess the image-keeping qualities of the glossy paper—which is said to rival expensive dye transfer prints in image permanence. You can, of course, process other papers in the same drum used to process Cibachrome prints.

Soon, the Agfa Corp. will introduce a single-solution printmaking process similar to the Ektaflex process. The beauty of Agfa's Colorspeed process is that it may be tray processed, thus eliminating the need to buy additional equipment. It should be available later this year.

Simple, reliable printmaking processes free the printer to be more creative and enjoy high-quality results with less fuss. If you haven't tried printing yet, now may be the time. **PM**

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TOUGH PAINT PROBLEMS

(Continued from page 86)



Paint may fail under eaves and porch roofs earlier than on siding due to a lack of venting and because harmful salts are not washed off by the rain.



Paint chalking that washes onto brick is tough to remove. If wire-brushing with muriatic acid fails to solve problem, light sandblasting may be needed.

paint so that the finished surface will be really smooth, feather the edges of the remaining paint with medium sandpaper.

Q. I'd like to change the color of my vinyl siding, but I'm afraid the new finish may not be as long-lasting as the existing finish. What do I do?

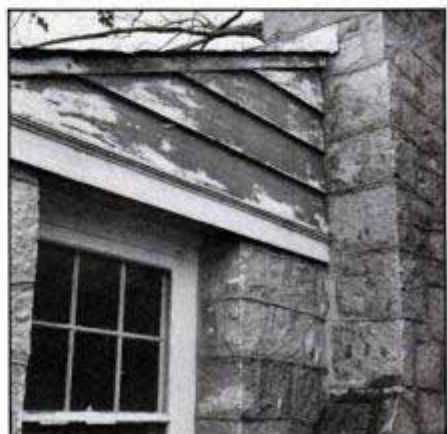
A. While the new finish on vinyl may not be as durable as the factory finish, there's no reason it shouldn't last as long as a fresh coat of paint on wood siding. Wash the siding thoroughly with naphtha, then again with soap and water. When it is dry, apply a good-quality acrylic latex.

Q. Confused by reading about different ways to prepare new galvanized iron gutters for painting, I've left mine unpainted for a year. But the time has come. What's the best preparation method?

A. Galvanized iron gutters must be degreased before you do any painting. Naphtha and trichloroethylene both work well. After degreasing, rinse with water and dry gutters immediately. Paint with an acrylic latex.

Inspect previously painted iron gutters carefully for rust. Remove any you find with emery cloth and steel wool. Apply a metal primer to bare spots before painting.

Q. The fiberglass privacy panels at one end of our patio are stained



Here is a clear case of paint failure caused by lack of stationary venting. Warm, moisture-laden air rises to attic and can escape only through the siding. Small holes could be bored in siding and fitted with circular metal vents. A vapor barrier inside the attic would also help.

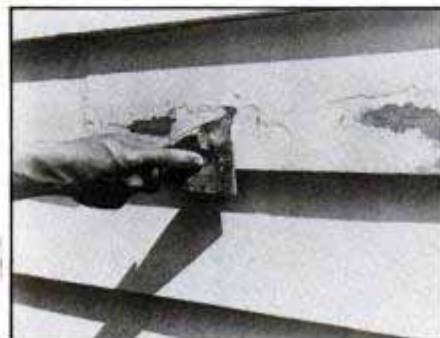
badly and would look better with fresh paint. What is the correct way to prepare and paint them?

A. Try cleaning the panels with isopropyl alcohol, then buffing them with white buffing compound and a polishing disk mounted on a portable drill.

The result may cause you to think twice about the need for painting. If you still wish to paint, wipe the panels

(Please turn to page 148)

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The sharp corner of a stiff putty knife can probe and scrape any areas where you suspect that the paint is unsound.



For maximum leverage, use a pull-type scraper. You can exert pressure directly over blade by scraping two-handed.

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Users report 1800 and 2000 feet. That's nearly half a mile. SuperFone 650 is a radiophone, not a toy, and that's why its signal doesn't break up or start hissing or crackling when you get half a block away.

You can tell when you heft it. It's a Little Giant. You can feel the power inside. What a marvel of electronic engineering it is! And it's tough, too. It fits into your shirt pocket, and you can bounce it around all day without damaging it.

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TECHNOLOGY UPDATE

AVIATION

'Copper' chopper crime stopper

The scene: Los Angeles. The time: just before the 1984 Olympics. The challenge: develop a police weapon that can perform mob control and counterinsurgency from the air. Put it all together and you have *Blue Thunder*, Columbia Pictures' new film named after the superhelicopter that performs all the miracles. The basic chopper is a French Aerospatiale Gazelle equipped with a 592-hp Astazou III engine. Composite metal plating keeps it safe from all sorts of weapons—even an AIM-9 missile.

Everything put on this chopper for the film was taken from existing technology, according to director John Badham. The 20-mm cannon comes off a Bell Cobra. And its avionics were cannibalized with technical assistance from Hughes Aviation. A visionics system, for instance, lets the gunner stand out of the range of most weapons while lining up on the enemy. *Blue Thunder* can see through walls with thermographic sensors available with most of today's military choppers. It has two 30-million candlepower night lights. And its powerful computer is like those operative on many of today's rescue craft. The film, which PM saw in a March preview, is witty and exciting. In one fantastic sequence, filmed along the Los Angeles River, standard police choppers and *Blue Thunder* fly under bridges and around obstacles with *Blue Thunder*, of course, ultimately outflying all the others.

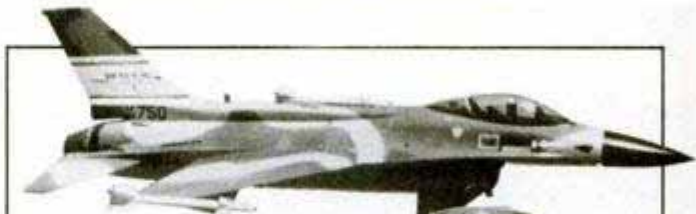


Blue Thunder (above) is a French Aerospatiale Gazelle with composite metal plating, a 20-mm cannon and sensors that see through walls. It was built for a new Columbia film and is seen in low-level flight (left).



ECOLOGICAL RAMJET

Even the military looks for alternative fuels these days, so we weren't too surprised at Lockheed's latest design concept. The sleek craft (above) would cruise at 3,350 mph, or Mach 5, at 100,000 feet. Lockheed says the reconnaissance craft's four turbo-ramjets would run on liquid methane fuel. The body would be made of titanium with a stainless-steel finish that is designed to ward off high-speed body heat.



FLIGHT TALK

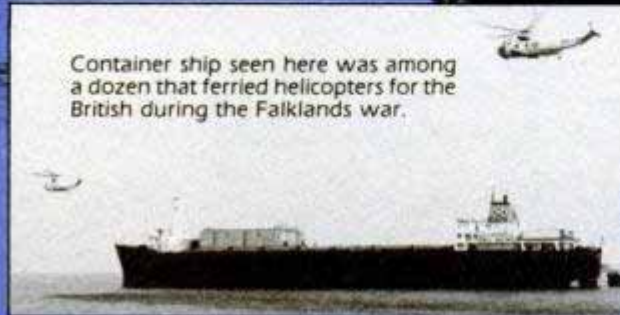
A U.S. Air Force F-16 Jet (above) has been equipped with a computer that translates voice commands like "strafe" and "turn" into action. The jet's computerized cockpit (right) can also "voice-print" a pilot so only his voice can give orders to the plane.



MILITARY



Container ship seen here was among a dozen that ferried helicopters for the British during the Falklands war.



Good aircraft carriers are hard to find

They move quickly and carry big flying arsenals on their broad backs. But today's aircraft carriers are too easy to spot by spy satellites. Getting a carrier out of port in an emergency might, therefore, pose big problems. Of course, today's navies have Harrier jump jets that can take off from decks much smaller than carriers (see *Falklands Diary Of A Harrier Pilot*, page 59). That's exactly the kind of thinking that has inspired the design of two systems—one British and the other Ameri-

can—to convert container ships into carrier vessels.

The British—whose Harriers controlled the South Atlantic in last summer's war for the Falklands—are developing SCADS, or Shipborne Containerized Air Defense Systems. British Aerospace, Plessey and Fairey Engineering have collaborated on the project, which so far is mostly on paper. With a specialized radar system, an electronic decoy system and an antimissile system, the SCADS

deck can transform a container ship into a unique carrier as the civilian vessel steams out of port. The entire change would take 48 hours.

The American system, developed by the Navy under orders from Congress, is called Arapaho, for the American Indian tribe.

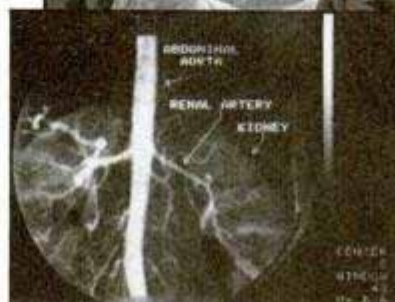
Both changeover systems depend on fast, 30-knot-plus container ships; standard-size containers that can be moved easily on trucks and trains; and production aircraft such as the

MEDICINE

Body pictures by the numbers

Basic arithmetic and computer and X-ray technologies are the seeds of a new diagnostic technique that gives the closest look yet inside the body's circulatory system. The University of Michigan Hospital and several other institutions say they are making early and accurate diagnoses of a wide range of ailments using "digital subtraction angiography" (DSA).

In a radiological version of paint by numbers, X-rays are transmitted through a patient's body forming both the usual internal image and a computer image. Each of the images' 250,000 pixels is assigned a number based on the density of the organ through which the X-ray penetrated. A first X-ray shows everything but the blood vessels of an organ. A second X-ray, taken after the patient is injected with a dye, shows only the shadows of veins and arteries. The computer subtracts dense tissue from less-dense tissue, forming an enhanced image.



To get a clear picture of kidney veins and arteries, (left) the Michigan system combines two X-ray images. Then, technician uses "digital subtraction," forming enhanced image.

Editor: Dennis Eskow
Contributor: Charles Reina

TECHNOLOGY UPDATE



American container ship converted to Arapaho helicopter carrier for military missions is seen here in artist's concept. Off the port bow is a British SCADS container ship with ramp for Harrier launching.

PM art: Dean Ellis

Harrier. Both SCADS and Arapaho are pre-packaged and stored with all radar, electronics and ammunition inside. The SCADS containers would support a bridge-type ski jump for Harrier takeoff.

The British couldn't get a SCADS into production for the Falklands combat, but they were able to convert a dozen container ships. These carriers transported Harriers and Sea King helicopters from England. Had they been able to use SCADS, they would have had extra takeoff area. The flexible ski jump is strong, supported by standard bridge cribs, special

jacks and towers or scissors jacks. A runway as small as 200 feet can be assembled to accommodate the jumping jets. For a vertical landing, a Harrier needs no more space than a helicopter.

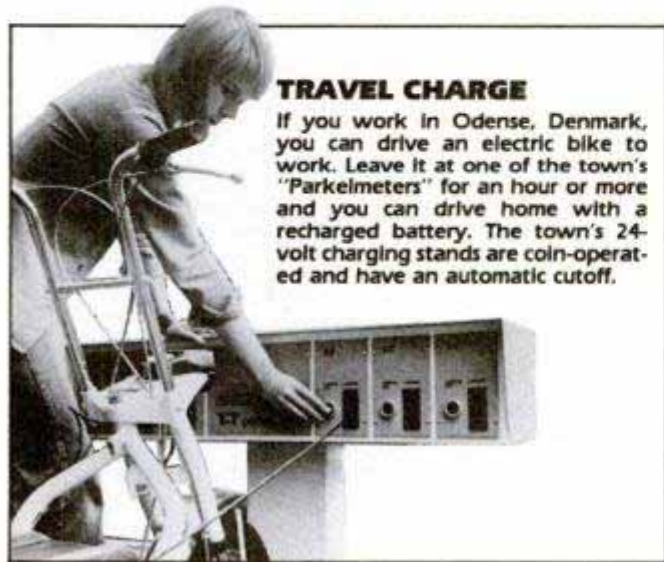
The ski jump is based on the kind of takeoff platform already used on small British carriers. That jump, which is built into the ship's deck, makes it possible to keep a large number of aircraft topside during actual combat flight operations.

The implications for both SCADS and Arapaho are mind boggling. Today's supercarriers

cost \$2.5 billion to complete. A container ship, notes Arapaho project director James Mulquin, costs \$50 million to \$75 million. Conversion to either system would cost about another \$20 million.

"The Arapaho program could extend the U.S. Navy's at-sea aviation bases from the present 150 to 160 vessels (including patrol boats that carry single helicopters) by about 60 to 80 container ships," Mulquin says. That kind of figuring promises to make Arapaho an American mainstay, and SCADS a British standard, for some time to come.

RECREATION



TRAVEL CHARGE

If you work in Odense, Denmark, you can drive an electric bike to work. Leave it at one of the town's "Parkelmeters" for an hour or more and you can drive home with a recharged battery. The town's 24-volt charging stands are coin-operated and have an automatic cutoff.



ISLAND IN THE SKY

Picture-snapping tourists at Cypress Gardens, Fla., next month will ride Kodak's hydraulic platform 150 feet in the air. The tower will carry about 100 people per trip.

ENERGY


Drill deeper, cheaper

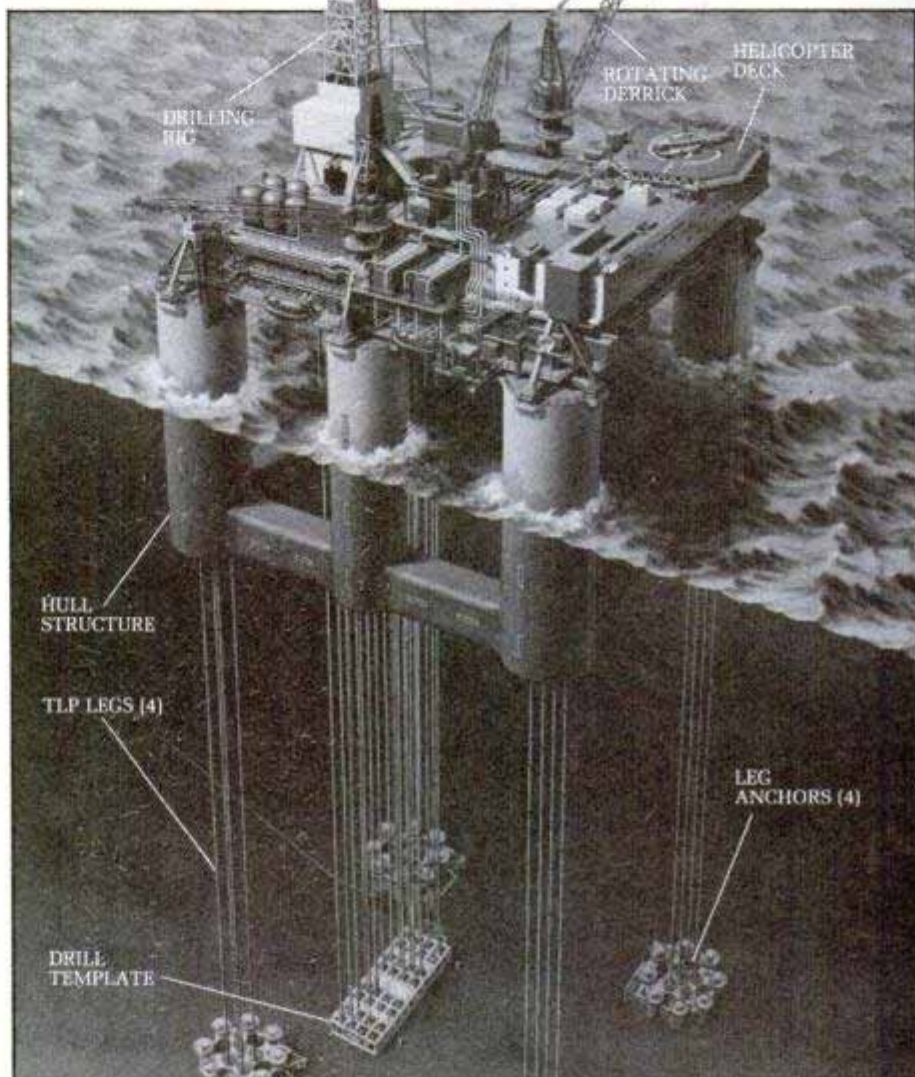
A new kind of oil rig platform will be floating in the Hutton field on the North Sea next summer. Conoco's Tension-Leg Platform, with its 243- by 268-foot upper deck, is built to handle the most difficult parts of oil exploration.

For one thing, it is designed to work in water even deeper than Hutton's average 485 feet. And, since a TLP floats, one platform can work in several areas without the high costs of foundation-building that permanent platforms require. The TLP's "legs" are steel tubes held down by weights. Beneath the center of the 61,000-ton platform are the well templates. In the drawing at right, well holes have been drilled through the heavy steel templates. The drill is lowered into the ocean in 25-foot lengths.

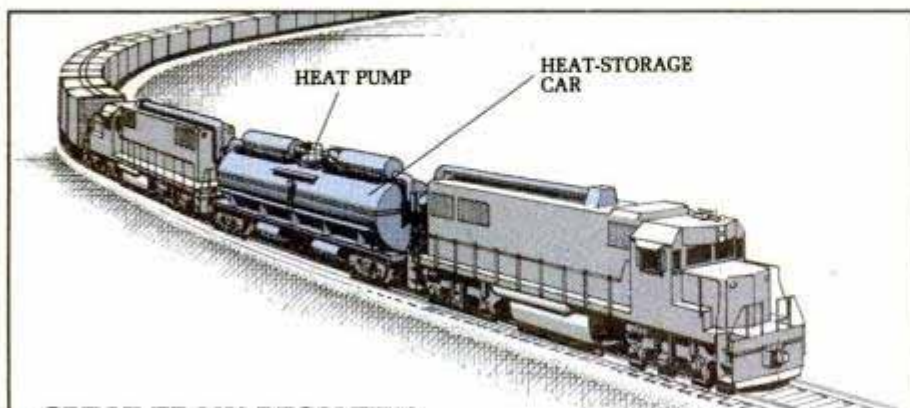
The all-steel hull is semisubmersible. It carries a three-level deck, the top of which includes a helicopter landing pad, drilling rigs, rotating derricks and other equipment. The second and third levels house the crew, equipment and generating station. All this sits atop six steel columns that hold the mooring legs in tension with upward buoyant forces against the columns and against the pontoons that stretch between them.

The 100-ton crane would move on a rail. One advantage to this floating island would be its ability to handle a fire. Pumps just below decks could provide an immediate and steady stream of water.

The hull structure contains water ballast to help keep the platform righted in high seas. Gulf Oil, Amoco and Brit Oil went into this venture with Conoco, which expects TLP rigs to be operated by most oil companies by the end of the this decade. 



Conoco's floating Tension-Leg Platform oil rig is expected to be operating next summer.



GREAT TRAIN RECOVERY

A diesel-electric locomotive vents a lot of heat into the atmosphere, which is why Thomas Williams has patented his Locomotive Energy Recovery System [U.S. Patent 4,342,921, issued last summer]. A heat pump carries exhaust heat

from the locomotive to a tanker car filled with a storage fluid. The heat can be used to warm railroad cars or conduct industrial processes, such as alcohol production, in another rail car. Williams says the car could uncouple for factory use.



ENERGY PROGRAM

Small supermarkets and restaurants this summer will be able to monitor and control as many as 20 temperature and humidity sensors from different areas with one microprocessor-based control system. Honeywell's W7000 interfaces with a personal computer.

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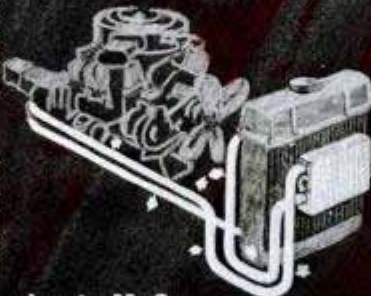
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TOUGH PAINT PROBLEMS

(Continued from page 140)



When painting over glossy enamel trim, you must remove the sheen by sanding lightly. A sanding block or other accessory will make the job easier.

down with naphtha, rinse with water and then apply an acrylic latex.

Q. I have a chronic problem with stains bleeding through the paint on redwood siding. Nothing seems to help. What do you suggest?

A. The resins in the redwood are being brought to the surface by moisture escaping from the inside of the house. Use a paint on interior walls that's rated as a vapor barrier. Use an oil-base, stain-blocking primer on the siding.

Q. I've tried to seal knots on the exterior wood trim of my house with shellac, but they bleed right up through the latex topcoat. Got another suggestion?

A. Yes, spot-prime knots with an oil-base, stain-blocking primer. The water in the latex paint dissolves some of the tannin in the knot and draws it toward the surface. You may use latex over the oil-base primer.

Q. Nails in the siding on my house keep popping through the paint and leaving rusty stains. How do I cope with the nails and the stains?

A. Either reset the old nails well below the surface or replace them with galvanized nails. In both cases, fill the nail holes with acrylic or copolymer caulking. Remove as much of the staining as you can by washing and sanding, then spot-prime stained areas with stain-blocking primer before applying the topcoat.

Q. Even though I use a high-quality brush and a good latex, I can't seem to paint without leaving brush marks. What do you suggest?

A. You're probably painting a surface that's too hot, which causes the latex to dry too quickly. Never paint when the temperature is above 90°F. or when the siding is in direct sunlight.

Q. My prefab sheet-metal toolshed with factory-applied enamel is

(Please turn to page 150)



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TOUGH PAINT PROBLEMS

(Continued from page 148)

rusting badly and in need of repainting. What method should I use to do the job right?

A. To start, remove all rust with emery cloth and steel wool. Pay close attention to holes in the sheet-metal base for hold-down bolts, since those are the spots where the rust probably started. Spot-prime all bare metal with metal primer or Rustoleum. Finish with acrylic latex.

Q. I want to paint the aluminum siding on my house, but it is

chalking and I am afraid that will cause the new paint to bond improperly. What approach will ensure a lasting job?

A. You should wash off the chalk with the standard trisodium phosphate-bleach-detergent-water solution. The next step in the process is to use latex paint or PPG's Metal Siding Refinish paint.

Q. In recent years, I've noticed white and green stains around the masonry foundation of my house,

and although I've washed them off before repainting, they recur very soon, causing new paint to peel. How can I arrest the staining and save the paint job?

A. The problem is called "efflorescence." Natural salts in the masonry are brought to the outside surface by moisture as it evaporates. First, you have to find the source of the moisture and block it. This may mean setting up a vapor barrier on the interior or repairing a leaky gutter or downspout that's draining into the wall. Once the moisture is stopped, clean away the efflorescence stains and apply two coats of latex.

Q. I cannot get paint to hold on the surface of my wood deck. Despite careful preparation and use of high-quality paint, flaking and peeling recur after about six months. Do you have any ideas about what my problem might be and how I can correct the job?

A. It may be that you're painting the surface and leaving the decking edges and underside unpainted. If that's the case, the untreated surfaces allow the decking to absorb water, which evaporates through the top and peels off your paint. Prime and paint all the surfaces, not just the top part of the deck.

Q. I like cedar shingles with the "natural look," but you see so many cases where, after a couple of years, untreated shingles blacken. Before re-siding my house, I'd like to know how I can prevent this from happening.

A. So that they retain a clear and natural look, cedar shakes should be dipped in a pentachlorophenol preservative such as Woodlife before they're installed. Another preservative, Cuprinol, manufactured by the Darworth Co. of Avon, Conn., is formulated with zinc naphthenate and has a mildewcide to prevent the blackening you're worried about.

Q. I stained and varnished a newly installed oak entrance door. After six months, the protective coating is failing. Is there something that will last longer?

A. Polyurethane varnish resists breakdown caused by the sun's ultraviolet rays and other weather conditions better than oil varnishes. Remove all the old varnish with a chemical paint remover, then use bleach to get out the stain.

Restain the door and allow it to dry for at least 48 hours. The next step is to apply at least three coats of polyurethane varnish, allowing at least 24 hours between coats.

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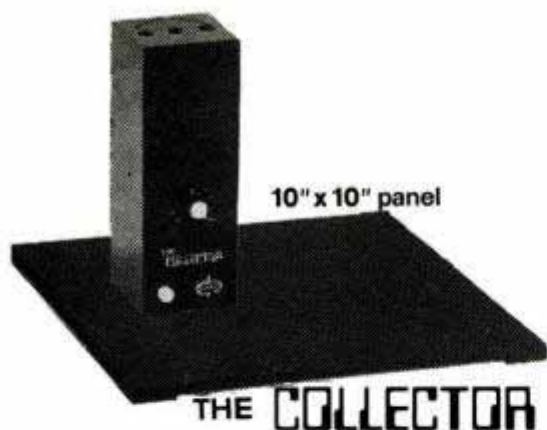


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AirCarell	236,000	YES
Ion Fountain	540,000	NO
Ion Cloud	350,000	NO
Ionosphere	350,000	NO
Modulian	75,000	NO
Ion Breeze	not stated	NO

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90 YEARS OF HEADLIGHTS

(Continued from page 78)

were often teamed with smaller brass kerosene sidelamps and taillights. Carbide lamps, made by such companies as Solar, Heineman & Pearson, Dietz, and others, generated acetylene gas by dripping water over calcium carbide. The acetylene produced a bright, white flame for about four hours, after which the lamp had to be opened, cleaned and refueled. Some acetylene lamps had movable reflectors, which let them "dip" or dim to keep from "blinding" oncoming traffic.

In 1908, electric headlamps were introduced to the American motorist. Early ones used single vacuum bulbs, and some again had movable silvered reflectors. They weren't very bright—21 candlepower—but they didn't hiss, didn't blow out in the wind and didn't need cleaning. Electric lights really

became popular after Kettering developed the self-starter and incorporated electric lights into his Cadillac system in 1912.

Dimming mechanisms now included movable bulbs, movable reflectors, louvers, blinds and shades. But there wasn't much call for antidazzle in electric headlights until 1915, when gas-filled electric bulbs replaced vacuum bulbs.

Faired-in headlights

In 1914, Pierce-Arrow introduced lamps faired into the front fenders—a practice that became a Pierce hallmark and was universally copied 25 years later. Ford changed to electric headlights in 1915. Lenses were prisms or "jeweled" around 1916 to deflect the light. Two-filament bulbs arrived in 1924, with prefocused bulbs after 1934.

Throughout the 1930's, headlights became more integrated into the car

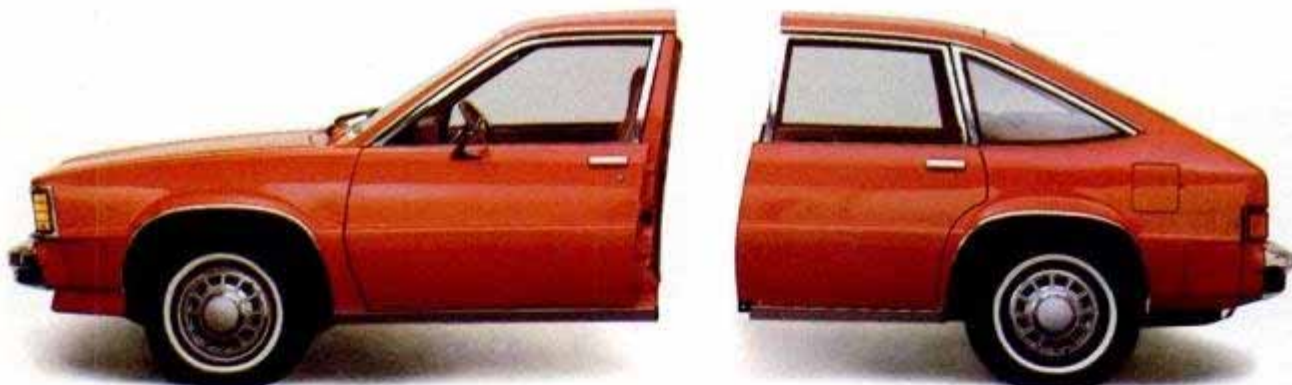
itself, especially with the advent of "streamlining."

In 1940, the 75,000-candlepower Sealed Beam headlamp arrived. It was adopted that year by all Detroit automakers. Two filaments were sealed in a bulbless, gas-filled, hermetic, mirror-reflector glass unit.

The original Sealed Beam remained America's standard auto headlighting system until 1957, when quad lamps came out on the Cadillac Eldorado Brougham. Quads separated low and high beams.

Rectangular headlamps were introduced in the United States for the 1975 model year, still at 75,000 candlepower by law. But in July 1978, the limit was lifted to 150,000 candlepower for high beams, bringing the halogen headlamp to America. Today's halogen lamps can be made of lightweight polymers, reducing their weight to a third of their glass predecessors. **FM**

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POP-TOP DESK

(Continued from page 82)

the rectangle for the swing-out tray opening on the left side apron. Bore corner holes, then use the table saw to make two parallel cuts in line with the holes.

To do this, depress the blade, set the fence and position the work. Hold down the work with one hand, turn on the power and then slowly elevate the blade until it cuts through the top surface. Advance the piece as required. Use a sabre or jigsaw to make the end cuts to drop out the waste. Next, cut the slot for the roll paper in the front apron, following the same table-saw technique.

Use the router with a V-cutter to bevel the edges of the slot on both sides. A block of wood clamped to the router base as shown will guide it properly.

Assembly is with glue and screws. All screwheads are recessed (counter-bored) and concealed with plugs cut from the same stock. Here's the best way to go about boring the screw holes: Use a 1/16-in.-dia. bit on the drill press to make straight holes in the front and rear aprons. Dry-assemble the ends and divider with bar clamps, then use the 1/16-in. bit with a portable drill to



Use a flexible drill-shaft accessory in order to bore pilot holes in tight spots.

continue the holes into the mating pieces. Disassemble, then use the drill press to counterbore for the wood plugs and finally bore the screw shank holes. Before assembly, be sure to bore the holes for the roll paper dowel.

Glue-assemble the aprons and add the bottom panel, then clamp the legs and stretchers in place to repeat the screw-hole drilling operation. Also mark the locations where stopped corner rounds must be made on the legs, aprons and stretchers. These cuts must be made with the router before final assembly, otherwise the router won't have full access to inside corners. The same procedure is followed for the chair.

The swing-out tray is made up of 1/2-in. stock and attached to a piece of 3/4-in. facing. The curved section is made by band-sawing a glued-up block, or it can be cut from a piece of 8/4 stock. Note that hardwood dowels are inserted in the hinge-screw locations where end grain is involved because end grain has poor screw-holding power. Also notice that the short screws that come with the hinge are replaced by 1 1/2-in. screws.

In order to bore the screw holes for this hinge in the table, you must use a chuck mounted on a flexible shaft due to the confined space.

The drawer case is assembled with butt joints, glue and 1 1/2-in. finishing nails which are sunk and filled. Be sure to make the attaching ledge at the top overhang sufficiently so it locates under the divider piece in the table to facilitate solid screw attachment. When making the drawers, be sure to cut the finger cutouts before assembly.

The brackets for the tilting supports are homemade with four 3-in. flat corner plates. Note that two are bent to the right and two to the left. Use a dab of quick-setting epoxy to position the brackets on the blocks as this will keep them in position for accurately boring the screw holes in the blocks. It most

(Please turn to page 154)

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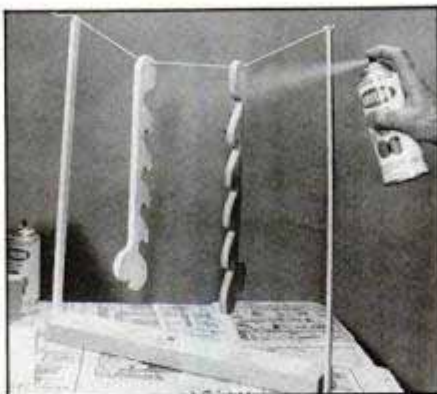
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POP-TOP DESK

(Continued from page 153)



Apply primer and finish coats over the course of several light applications. Hang up the pieces to avoid messy handling.



View of assembled table shows interior details prior to the tabletop installation.

MATERIALS LIST—KIDS' DESK

Key	No.	Size and description (use)		
TABLE				
A	4	3/4 x 3 1/2 x 23 1/2" pine (leg)	X	2
B	2	3/4 x 4 1/4 x 32 1/2" pine (apron)	Y	2
C	2	3/4 x 4 1/4 x 19 1/2" pine (apron)	Z	4
D	1	3/4 x 4 x 19 1/2" pine (partition)	AA	1
E	2	3/4 x 2 x 21" pine (stretcher)	BB	1
F	1	3/4 x 2 x 31" pine (stretcher)		
G	1	1/2 x 7 x 34" MDO plywood (shelf)	CC	1
H	1	1/4 x 20 1/4 x 31 3/4" lauan plywood (bottom)	SWING-OUT TRAY	
I	1	1/4 x 3 x 13" lauan plywood (partition)	DD	1
J	2	1/2 x 3/4 x 3" pine (cleat)	EE	1
K	1	3/4 x 1 1/2 x 13" pine (tray support)	FF	1
L	2	3/4"-dia. x 2 1/2" hardwood dowel (pin)	GG	1
M	1	3/4"-dia. x 22 1/2" hardwood dowel (paper roller)	HH	1
N	1	3/8"-dia. x 2" hardwood dowel (handle)	II	1
DRAWER CABINET				
O	1	1/2 x 13 x 18 1/2" MDO plywood (top)	JJ	1
P	2	1/2 x 8 x 18 1/2" MDO plywood (side)	KK	4
Q	2	1/2 x 11 x 18" MDO plywood (shelf)	LL	*
R	1	1/2 x 8 x 11" MDO plywood (back)	MM	*
DRAWERS (2 REQD.)				
S	2	3/4 x 3 1/8 x 10 7/8" pine (front)	NN	3
T	4	1/2 x 3 1/8 x 17 3/4" MDO plywood (side)	OO	2
U	2	1/2 x 3 1/8 x 9 7/8" MDO plywood (back)	PP	4
V	2	1/4 x 10 3/8 x 16 3/8" lauan plywood (bottom)	QQ	2
TABLETOP				
W	1	1/2 x 24 x 37" MDO plywood (top)	RR	*
			SS	1
			TT	*

Misc.: Carpenter's glue, Krylon spray paint: white primer No. 1315, flat white No. 1502, clear satin No. 7002. *As required.

likely will be necessary to countersink the holes in the metal deeper to seat No. 8 flathead screws.

A note on hinging the seat: A double depth mortise is cut into the apron only—the seat bottom is not mortised. These hinges must be attached before installing the seatback or access to the screws will be impossible. The seatback needs no glue. It is secured with oval-head screws seated in finish (cup) washers.

Applying the finish

For an easy-to-apply durable finish, we used Krylon spray products as follows: white primer 1315 followed with several coats of flat white 1502. This was then top coated with satin finish varnish 7002. If you prefer, you can use glossy white 1501 and omit the clear satin.

The natural wood was given three light coats of the clear satin finish var-

MATERIALS LIST—KIDS' CHAIR

Key	No.	Size and description (use)
A	2	3/4 x 3 x 24" pine (leg)
B	2	3/4 x 3 x 13 1/2" pine (leg)
C	2	3/4 x 3 x 12 1/2" pine (side)
D	2	3/4 x 3 x 14" pine (end)
E	2	3/4 x 1 1/2 x 14" pine (stretcher)
F	1	3/4 x 1 1/2 x 12 1/2" pine (stretcher)
G	1	1/2 x 14 1/2 x 16 1/2" MDO plywood (seat)
H	1	1/2 x 5 1/2 x 17" MDO plywood (back)
I	1	1/4 x 13 1/4 x 13 1/4" lauan plywood (bottom)
J	2	1 1/4 x 1 1/2" butt hinge
K	20	1 1/4" No. 8 fh screws
L	20	3/8"-dia. wood plugs
M	4	No. 8 finish washers
N	4	1 1/4" No. 8 oval-head screws
O	*	1 1/2" finishing nails
P	*	3/8" brads

Misc.: Carpenter's glue, Krylon spray paint: white primer No. 1315, flat white No. 1502, clear satin No. 7002. *As required.

nish 7002. Important: The second coat of 7002 should be applied within one hour of the first; if the second coat is not completed in the first hour, wait at least 48 hours or wrinkling of the first coat may occur. For best results, you should work at 70° to 80° F.

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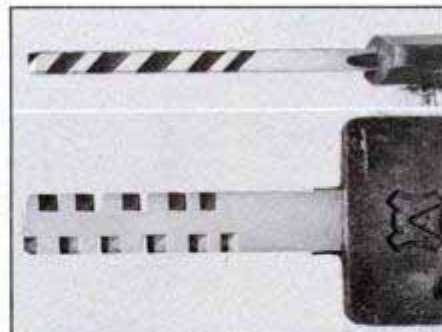
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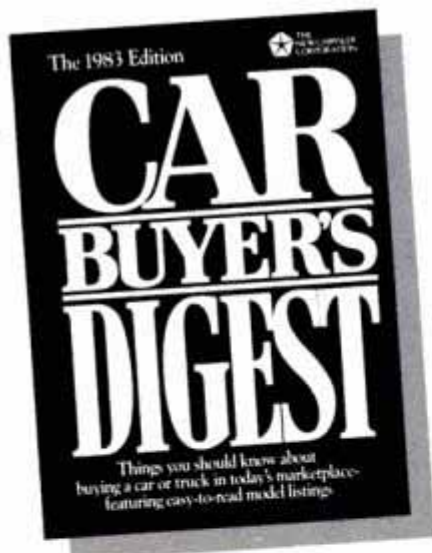
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PORTABLE COMPUTERS

(Continued from page 65)

package was upgraded even as this article was prepared. It includes CP/M in a more or less standard configuration, a version of BASIC called SBASIC, and MBASIC (from MicroSoft) and a software package from Perfect Software Inc. The package includes an excellent word processor that is not as extensive as *WordStar* but which is much easier for the casual user, a user-friendly spelling checker, *Perfect Plan* (an electronic spreadsheet), and an effective database program that is also user-friendly for the casual user.

In addition, KayPro has added *The Word Plus*, a spelling checker and dictionary that many software reviewers consider the finest there is because it will change the document to the correct spelling as the user makes the corrections, and it will supply the correct spelling if necessary (not every word is there unless you add it to the dictionary). Another recent addition is *Profit Plan*, a somewhat different electronic spreadsheet than *Perfect Plan*.

With cables where they won't get tangled in the keyboard, and the video display of a substantial size, the KayPro lends itself just as well to "permanent" use in the home or office as it does to portable computing.

Attaché case computing

The Epson HX-20, which is about \$800, is a grownup, powerhouse version of the pocket computer; it is the heart of what will eventually be a somewhat extensive applications-oriented computer system.

The HX-20 is slightly larger than an 8½ × 11 sheet of paper and stands about 1¼ in. high. Weight is about 3.5 pounds. It is powered by self-contained batteries that can be recharged in eight hours from a fully discharged condition by a plug-in charger that's supplied with the computer. The charger cannot be used to power the computer. The batteries provide about 50 hours of operation before needing a recharge.

Similar to the pocket computers, the HX-20 has a built-in BASIC, but not a stripped down version: its MICROSOFT BASIC (MBASIC) is specifically enhanced to utilize some of the special features built into the computer. If the user writes a program without using the special features, it is "transportable," meaning it will run on any other MICROSOFT BASIC computer with little or no modifications to the program.

The HX-20 has many interesting and exciting features. To start with, though the built-in screen is a liquid crystal display (LCD) four lines high and 20 characters wide, there is an output for an optional accessory that permits a black

and white or color TV set or monitor to be used as the video display.

The HX-20 has not only color, but graphics. While a TV is needed for the color display, the graphics can be displayed on the LCD screen. A built-in, four-octave sound generator can be programmed for musical effects.

Built-in printer

For more excitement, there's a built-in, 24-column-wide printer that prints upper- and lower-case alphanumerics and graphics. The printer uses roll paper 55 mm wide. While data can be stored to, or retrieved from, an external cassette recorder, it's the ROM cartridge for which the HX-20 appears to be designed.

The minimum package comes with 16K of RAM memory. An expansion unit provides 32K of add-on memory, of which only 16K can be RAM; the remainder must be ROM. Thus, 32K is the maximum RAM limit for the complete computer system. However, the computer is intended for use with ROM program cartridges, and up to 40K of ROM can eventually be used. A plug-in program ROM cartridge might contain, say, word processing or communications software, or an electronic spreadsheet, or a database. Eventually, Epson plans to have all major types of software available in ROM.

Connections are provided around the sides of the computer for many different peripherals, among them a standard cassette recorder, a barcode reader (such as that for the Universal Product Code used by your local computerized supermarket), a full-size serial printer, a floppy disk system, a display controller for feeding a TV set or monitor and the memory expansion unit. These are in addition to the microcassette recorder and ROM cartridges which install integral with the computer. Presently, the optional accessories are few: the memory expansion, the microcassette and a modem.

Out of the office

The Epson HX-20 is an interesting concept. Conceivably, one would carry it in an attaché case, work out programs during the day while away from the office, then go back to the home or office and dump the day's computer activity to a disk or a full-size printer, or transmit it via modem and telephone to another computer or terminal.

While the HX-20 has obvious inconveniences—the total cost being one—there are advantages, particularly for the user who needs a high-power portable with a high-power BASIC for writing his or her own programs. Bear in mind, however, that the HX-20 is presently not a substitute for a standard portable or office-size computer.

The RCA VP-3501 Videotex Data Terminal is a communications terminal designed so a remote computer—accessed through the nearest telephone—can provide computer, data and information-processing services equal to, or approaching, what might be attained from a portable computer. (A "dumb" terminal has no computing power on its own.)

The VP-3501 measures 17 in. wide × 7 in. deep × 2 in. high. Weight is approximately 6 pounds. The price of \$399 includes an hour of connect time from CompuServe, The Source and the Dow Jones News/Retrieval Service.

The terminal has a *membrane* keyboard, which is essentially a sandwich consisting of two plastic sheets with switches between the sheets. An internal sound generator provides a 14-octave range from 14Hz to 230 kHz at 16 volume levels. A white-noise generator, used for unusual musical or sound effects, has eight user-selected cut-off frequencies. Special features not usually common to communications terminals are software selectable reverse video, blinking reverse video, and color graphics of eight colors or eight levels of brightness for both the characters and the background.

Plugs into phone jack

The terminal has a built-in, 300-band, direct-connect modem that can be plugged directly into a modular-type telephone jack. If the location does not have modular telephone connectors available, an optional, matching, acoustic modem can be plugged into the terminal. The power for the acoustic modem is supplied by the terminal.

A standard color or black and white TV set tuned to channel 3 or 4 serves as a sound monitor and video display of 24 lines of 40 characters, or 12 lines of 20 characters. Both an audio output for separate amplification and an NTSC compatible TV signal for a standard video monitor are provided.

An optional accessory cassette recorder interface allows downloaded (incoming) data, programs and text to be recorded so it can be reviewed off-line at the user's convenience.

A built-in interface is provided for a printer, which can make hard copy while the terminal is in use, or later, from a cassette playback.

The RCA Videotex Terminal can provide many of the functions of a portable desk-top computer. To access portable computing power, the user plugs the terminal into the nearest telephone jack and dials or keys the telephone number of the computer service. When the computer "answers," the user is "up and running," with a computer 10 or a thousand miles away that provides the C.P.U., memory, disk storage, software

and even programming languages such as BASIC, FORTRAN and PASCAL, which the user can use to write custom programs.

While the VP-3501 is not as convenient as owning your own portable computer, it is a lot less expensive. If you have only occasional need for portable computing power, and you already have access to a dial-up computer, or you need the data that's available through the information services, a Videotex terminal might prove an effective means to portable power. **FM**

SAILBOARD

(Continued from page 73)

sailor and board up and out of the surf. The sound of waves slapping against the hull disappears. Instead, there is a barely discernible whisper of water turbulence around the dagger-board.

Prof. Bradfield has spent much of the past decade developing projects involving foil-equipped sailing vehicles. And, as for Neocles Athanasiades, he set speed records with a sailing rig he called (*nf*)2, which stands for "neither fish nor fowl." That was a 150-pound, aluminum-tube hydroframe that served as the test bed for different combina-

tions of foils, control systems, flotation and sail rigs.

The hydrofoil challenge was to design a simple accessory that would make a standard sailboard flyable by a sailor who has intermediate-to-expert skills. This unit is now being built by the Aquafoil Corp., 26 Southern Blvd., Nesconset, N.Y. 11767, and is available through Windsurfer dealers or directly from the manufacturer. List price is \$399.

The foils will fit in any sailboard that has a centerboard well about 10 in. long and 3/4 in. wide. For smaller wells, the foil can be cut down to fit. Athanasiades says the unit was not designed for high speed, but for a high lift-to-drag ratio at low speeds.

"I get foilborne at a minimum boat speed of about 4 1/2 knots, with the wind at 7 to 8 knots. The sailboard then goes faster than the true windspeed and gets going about 10 knots. I think the maximum speed with these particular foils would be about 21 knots in a true windspeed of 16 to 19 knots.

"To do this, you must have sheltered water, although there would be no problem with waves of 20 to 30 feet. The problem comes with waves that are the same length as the board. Under such conditions, the foils breach out of the water and you lose lift." **FM**

Foils can be designed for higher speeds. "We could design some that would be thinner and go faster," Bradfield says, "but they would need more speed to get the hull out of the water. These would be more like supercritical foils developed for airplanes."

Once the board comes up on the foils, drag seems to diminish about 50 percent. "There is a definite sense of surge," Athanasiades says.

The fuselage and strut centerboard of the Aquafoil are aluminum, wings and rudder epoxy glass composite. Sailing against other conventional boards is revealing. "I've gone about 25 percent faster under the identical conditions," Athanasiades says. "The greatest shock is when casual observers don't see the underwater foils. They think I'm flying on just the centerboard."

There are advantages even when the board is not foilborne. For instance, in rough water, the underwater foils act as a damper to reduce rolling motion.

How about racing with them? "That's inevitable," says Bradfield. "Theoretically, I think we could get up to 32 knots by using foils with a 10 percent chord. That's about the cavitation limit, where the water flow would separate and destroy lift."

That also happens to be world record territory. **FM**



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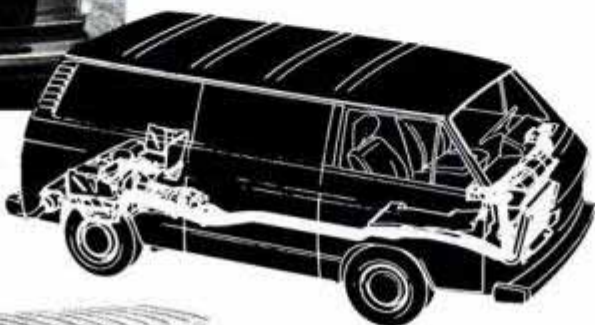
GARAGEABLE VAN

(Continued from page 69)

clude the rear bench. Meanwhile, the third-bench seatback folds flat, and there's a roller-type security screen for the rear cargo compartment. With all three tiers of seats set up, you have space behind the rear bench for 150 pounds of luggage. Grocery bags, naturally, will stand upright back there, too.



Volkswagen's Vanagon has been updated this year with a water-cooled, flat Four motor. Engine remains in the rear with radiator and plumbing forward (right).



Little-known in the U.S., Iveco is entering the mini-van wars with its S-class commercial vehicle (left). The van will be available with a diesel engine.

Up front, the driver and passenger sit in the low-back buckets. You can order cloth or vinyl upholstery, all very luxurious, plus the usual power seat, electric windows, air, rear wiper, cruise control and various passenger-car sound systems. Standard instruments stand in a pod ahead of the driver, but the van lacks full gauges. You can order an optional gauge pack.

On the front passenger's side, the dashboard sweeps far forward for a feeling of spaciousness. There's no

glove box in the normal sense. Instead, Chrysler has provided a good-sized drawer that slides in and out underneath the passenger's seat. This allows more storage than any standard glove compartment. It's also lockable and has a divider. The rear wheelhouses incorporate small, coverless storage compartments, plus indentations for cups or glasses.

Under the hood, you have your choice of Chrysler's ohc 2.2 or the aforementioned optional Mitsubishi 2.6-liter powerplant. The 2.2 has more horsepower than the 2.6, but less torque, making the 2.6 the engine of choice for automatic applications. Transaxles include four- and five-speed manuals plus a three-speed automatic. The five-speed transaxle is identical to the

Dodge Charger 2.2, fourth and fifth being overdrive ratios. Projected EPA fuel mileage for the 2.2 with five-speed are 24.4 mpg city, 39.2 mpg highway, giving a combined estimate of 29.4 mpg.

The T-115's body is unitized, meaning there's no separate frame. This helps keep the floor low and flat, as does fwd. Chrysler has done yeoman work on corrosion protection. Nearly every metal surface is galvanized either on both sides or on the inside. The lower body gets a coat of urethane primer for chip resistance. Transparent tape on

glass edges prevents paint cracking around windows. And painted surfaces are sealed with clearcoats to add protection and visual depth.

The front doors use flex-drive window regulators, with swing-out panes aft. Tinted glass all around is standard. The large, one-piece lift gate raises on twin gas-filled prop rods and has provisions for rear speakers. And the rear opening gives a very low lift-over sill.

New for the T-115, the air conditioner places the condenser side by side with the radiator, rather than ahead of it. This gives better cooling and less weight. There are five instrument-panel air outlets plus side-window demisters at both ends.

You can get cast alloy wheels, but the standard ones are styled steel, 14 x 5.5, mounting 185/R75-14 tires. Available optionally are 195/R75-14s and 205/R70-14s. T-115s come with temporary spares, but you can order a conventional spare at modest cost.

The Voyager and Caravan will cost about \$8,000 base. Fully equipped, they should sell for around \$12,500. If Chrysler's Windsor, Ont., plant does as good a job with quality as I found on the hand-built prototypes, these spacious, versatile vehicles should be well worth those figures.

A cresting wave

Chrysler will not be alone in the market with a minivan. The T-115 is only the first splash from a cresting wave of minis that will soon be flooding the showrooms.

Ironically, Chrysler will start marketing a fwd Mitsubishi van even before it introduces its own T-115 next January. The garageable Mitsubishi minivan should arrive around October.

Mitsubishi's 1½-box mini will be similar in size to Chrysler's T-115, and in Japan it's called the SSW (for Super Station Wagon). It stands on a 103.3-in. wheelbase, with a 177.8-in. overall length—1.8 in. longer than the T-van. But the SSW has 4.5 in. less headroom than the T-115, and it'll be imported only with a full seven-passenger complement of seats.

Mitsubishi's SSW has a short hood up front, like the T-115, and sideways under the hood is an ohc four-cylinder engine of about 2.0-liter capacity. The 2.0, coupled with either a standard five-speed transaxle or the overdrive automatic, should get outstanding fuel economy. Mitsubishi will sell the SSW through its own dealer network as well as through Chrysler's.

An unusual feature of the SSW is its center bench seat. This split bench has movable, divided backs. The seat backs can travel fore and aft, upright, as in old Pullman coaches. This lets riders face either forward or backward. None of



The Isuzu Fargo currently is sold only in Japan and some Asian countries. It is rear-wheel drive and powered by a 2.0-liter diesel or a gasoline engine.

the SSW's seats come out easily, but the third seat folds relatively flat, giving a high, but ample, cargo deck.

Ford plans to introduce a minivan for 1985½ that's currently code-named either Aerovan or Sierra, depending on whose rumors you listen to. This vehicle will use components from Ford's larger Club Wagons and Econolines and will be front-engined, with rear-wheel drive. Ford's van will have the same Four and V6 engines now offered in the Ranger and Bronco II.

General Motors seems to be working on what it calls the M-van, scheduled for 1985, again rear drive, and perhaps available with four-wheel drive, also. There are no details other than word that it'll be about the same size as Chrysler's T-115. I suspect that, because of the necessary driveshaft tunnel, both GM's and Ford's minivans will have to stand taller than Chrysler's fwd T-vans and might not have the load or seating versatility.

Toyota's giving serious thought to exporting an Americanized version of its Japanese Town Ace in the T-115-size class. This is a garageable, rear-drive van. Last fall, a version of the Town Ace, dubbed the Model F, went on sale in Europe. Toyota also builds several other Ace-series vans that could, but probably won't, induct for

U.S. service, among them the fwd Lite Ace four-seater micro.

Several other Japanese firms make small vans for use in that country, and while they're interesting, it's doubtful that they'll be imported into the United States soon. Subaru, for example, offers a four-passenger, rear-engined, one-box, 4wd microvan called the Sambar. The Sambar's water-cooled, two-cylinder engine displaces 544 cc and produces 28 JIS hp. Isuzu makes the rear-drive Fargo—a van similar in overall dimensions to the T-115 (171-in. length, 66.5-in. width). I'm told that Isuzu has no plans to bring the Fargo to the United States before 1986.

In Europe, Ital Design recently unveiled a modular concept vehicle called the Capsula—a four-place, fwd, 1½-box microvan that can take on several different body configurations. The Capsula in some ways represents a sophistication of the Fiat Panda.

There's an entirely different range of vehicles that's a cross between a conventional station wagon and a minivan. These are two-box designs with taller-than-normal roofs and great space maximization. The Toyota Tercel 4wd wagon is one, and another is the Nissan Prairie. The Prairie might soon be imported, and it could conceivably compete in the minivan field.

Based on the fwd Nissan Stanza, the two-box, six-passenger Prairie does wonders with its high-roofed interior. It has twin sliding rear side doors, no central body pillar, and movable seats. One of the split center seats can be turned backward to face the rear. And while it's 15 in. shorter than the T-115, the Prairie also has what amounts to a hood and fenders up front—like the Tercel 4wd wagon and Fiat Panda—so it doesn't really look like a minivan.

As if these entries weren't enough, even Iveco, a little-known name in the United States but the second-largest commercial truck manufacturer in Europe, is introducing a noncommercial version of its S-class van. This minivan with a 110-in. wheelbase is identical in almost every dimension to the T-115. It will be powered by a Sofim water-cooled diesel engine producing 72 hp. The expected availability is January 1984 at Iveco commercial truck dealers. Iveco expects 90 percent of these vehicles will be purchased for personal transportation and dual-role utility/recreation purposes.

With so many entries in this market segment, it should prove to be the hottest class of the decade.

No discussion of garageable vans would be complete without including

(Please turn to page 164)

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GARAGEABLE VAN

(Continued from page 163)

Volkswagen's Vanagon, the original garageable compact van. Volkswagen led the way in 1952 with a compact van and, while everyone was laughing at it, the vehicle started a whole new market segment that is only now being addressed by U.S. automakers.

Over the years, VW has modified and improved its small van to reflect the changing tastes of consumers. This year is no exception, as Volkswagen has finally acknowledged the fact that its Vanagon has been too slow.

Answer? A more powerful, water-cooled engine with 22 percent better city fuel mileage and 23 percent better highway fuel mileage. Not a bad improvement.

VW's Waterboxer

The Vanagon's new gasoline Four, like the Porsche 911 engine, is a flat, or pancake, engine. VW calls it the Waterboxer because it's liquid cooled and has horizontally opposed pistons arranged in a box formation. The engine is still rear mounted over the driving wheels. But the Waterboxer engine is rated 82 hp at 4,800 rpm as opposed to the old, air-cooled engine's 67 at 4,200 rpm.

Cylinder heads with redesigned high-compression combustion chambers and larger ports and valves, as well as a new Digi-Jet fuel injection system, which digitally programs the air-fuel mixture, all contribute to the Waterboxer's increased power output.

To handle the increased load of the more powerful engine, the standard four-speed transmission has been totally re-engineered. In addition to strengthening internal components, VW engineers also redesigned the shift forks and rods for easier shifting and changed the final drive ratio from 4.86:1 to 4.57:1—which also helps fuel economy.

All Vanagon Waterboxers have a new heating system which includes a standard equipment a second heater under the seat for optimum passenger compartment heating—long a Vanagon shortcoming with the air-cooled engine.

Other than a different front end treatment, which includes a second grille for air intake to the front-mounted radiator, the new Vanagon is identical externally to older models.

Another thing that's unchanged: VW's fanatical attention to fit and finish. The vehicles we inspected at the press preview all looked very German, which is to say, everything looked engineered to perfection. Even the seats looked like something out of a Porsche.

VW's U.S. competitors will have to go a ways to top the Vanagon. **PM**

DIARY OF A HARRIER PILOT

(Continued from page 61)

down full flap, steadying the jet downwind at 800 feet. Speed below 250 knots—landing gear going down and 40 degrees of nozzle selected. Turning finals now, checking "four greens" to indicate landing gear down and locked, hydraulics okay and duct pressure reading to my roll reaction controls. Halfway round the turn and descending; glide path looks good; angle of attack pegged at 8 units and power coming on as I take 60-degree nozzle. Speed decaying through 200 knots, water injection coming on and rolling out on the final approach. Nozzles to the hover stop and the speed now rap-



Harrier pilot David Smith (above) wrote the letters on which this article is based.

Several vessels in his task force were sunk during the Falklands fighting. HMS Sheffield (right) was hit by a missile and sunk early in conflict.



idly decaying and power coming on to replace that wing lift with power. I am paying very careful attention to the angle of attack and the sideslip indicator now, as this is the most dangerous phase of flight in the Harrier. Coming up alongside the ship and stabilizing in the hover.

I glance in to check the engine and fuel. The latter is rushing down now at about 200 pounds a minute as I hold nearly full power to hold the hover. Once steady, I move sideways until over the deck, and once established over my landing spot, quickly down. Bang on the deck—throttle slammed closed and nozzles fully forward—taxi into a clear area where I am once again lashed to the deck and I can shut down.

The air raids on the Fleet supporting the troops in the Islands have been

coming thick and fast, and it has been our continuous task to provide a combat air patrol to get these guys. I simply cannot describe the moments of sheer, angry frustration when the raids slip our grasp and get through to do such dreadful damage to our brave ships. We are having to transit such long distances to reach the Islands that we frequently have to depart just as a raid is coming in, in order to have sufficient fuel to get back to the ship. As it is, we are all recovering well below minimum, and landing only with fuel for another few minutes of hover.

The other day I flew on a combat sortie with the "Boss" Lt. Cmdr. "Andy" Auld, the C.O. of 800 Squadron, and on this occasion we won.

The Boss and I were launched on one of these sorties and arrived in the zone just as an air raid warning "Red" was called. This is the call put across all radio nets when either radar or elec-

tronic surveillance has picked up the enemy inbound. You can imagine how the adrenalin starts to flow, as to date we have always been outnumbered two to one by the Argies. Suddenly, HMS Broadsword called us and vectored us hard toward the west at full speed. They had detected a low-level raid of unknown strength at very high speed 30 miles away.

By now my heart was beating away at full speed and my breathing almost to hyperventilation. I slammed the throttle to keep tucked in about 100 yards on the Boss' wing as he hauled round in a high "G" turn and accelerated toward the threat. As we passed through about 550 knots we descended to about 50 feet above the sea and started a hard turn toward the now rapidly closing enemy. Suddenly the Boss

(Please turn to page 166)

OWNERS REPORT: ALLIANCE

(Continued from page 75)

suffer depressed mileage ratings. The petite 1.4-liter Four has to hustle to keep the automatic churning.

In the Alliance, the four-speed beats the automatic by some 7 mpg. Even so, no one managed to match the EPA's

ambitious 37/52 mpg figures. And that's why some owners complained.

Economy, naturally, includes the Alliance's attractive price plus freedom from repairs. Nearly 57 percent of the owners we surveyed hadn't had to take their cars back for service. Those who did spoke of fairly minor ills. The trans-axle shift linkage came in for the most

criticism, primarily because the lever was judged difficult to get into reverse.

The Alliance shares the Fuego's unusual pedestal front bucket seats. Most owners praised seating comfort and were pleased with rear legroom.

"I rode in back and was surprised at
(Please turn to page 168)

SUMMARY OF 1983 AMC/RENAULT ALLIANCE OWNERS REPORTS*

Total miles driven 1,511,970	Made in America 10.8	Good 34.1	Dealer service opinion:
Average miles per gallon	Specific likes:	Average 4.0	Excellent 33.1%
Four-speed manual	Economy 57.8%	Poor 2.6	Good 46.2
In town 34.3	Handling 47.4	Comfort opinion (front seats):	Average 10.6
On the highway 41.8	Styling 39.9	Excellent 64.0%	Poor 10.2
Five-speed manual	Comfort 32.1	Good 33.8	Number of vehicles owned:
In town 32.4	Riding qualities 21.3	Average 1.8	This car only 38.5%
On the highway 41.5	Specific dislikes:	Poor 0.4	Two cars 48.0
Three-speed automatic	No complaints 24.4%	Comfort opinion (rear seats):	Three cars 9.8
In town 27.7	Needs more horsepower 11.4	Excellent 35.4%	Four or more cars 3.7
On the highway 34.1	Disappointing fuel mileage 10.2	Good 53.7	Makes of other cars owned:
Transmission choices:	Hard shifting 8.3	Fair 9.7	Chevrolet 17.8%
Five-speed manual 45.4%	Door-locking system 6.3	Poor 1.2	American Motors 12.4
Three-speed automatic 36.5	What changes would you like?	Had any mechanical trouble?	Buick 10.7
Four-speed manual 18.1	No changes 11.8%	No 56.8%	Pontiac 8.9
Body style choices:	Different-shaped seats 8.4	Yes 43.2	Plymouth 8.9
Four-door sedan 74.1%	More horsepower 6.8	What type of trouble?	Age distribution of owners:
Two-door sedan 25.9	Relocate wiper switch 5.5	Transmission 18.8%	15-29 years 20.4%
Why did you choose this car?	How much did you pay?	Electrical 8.5	30-49 years 46.3
Economy 47.6%	Average \$7,406	Shift mechanism 8.5	50-plus 33.3
Styling 37.2	Range \$5,595-	Fuel gauge 6.8	Would you buy another Alliance?
Price 24.5	\$9,850	Clutch 6.8	Yes 91.5%
Handling 12.6	Workmanship opinion:	Dealer repairs satisfactory?	No 8.5
	Excellent 59.3%	Yes 72.1%	
		No 27.9	

*Percentages might not equal 100% due to rounding or insufficient data.

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РАСПРОСЯНІТ, ЭКСПЛУАТАЦЫЯ І АРТАСЦЫЯМ ПРЫВОМ

DIARY OF A HARRIER PILOT

(Continued from page 164)

called "visual" with four Mirages very fast, very low. As I picked them up, the Boss fired his first missile, followed quickly by his second.

Two Mirages erupted into enormous fireballs. No time to gawk—the second pair were breaking hard right, and I was the only one with missiles to fire. I picked up the number three and pulled hard into his turns. As my missile "cross" flashed across his tail, the angry growl of "acquisition" pounded my ears. A quick press of the lock but-

ton, and the missile locked and tracked—safety catch up and—fire. A great flash and the Sidewinder leapt off the rails, homing straight onto the target. Another flash and fireball. The Mirage broke up and impacted the ground in a huge burning inferno.

The fourth was still about somewhere, and as neither of us could see him, he was a threat. Then suddenly I saw him under the Boss, heading west at high speed. I turned hard, calling the Boss to break with me to cover my tail. We followed him flat out for several minutes, just out of missile range, until, short of fuel, we had to pull out.

I returned to the ship with extraordinary mixed feelings. Delighted at having prevented the raid from getting through, and at getting my first "kill," but saddened and horrified at witnessing the savage, quick death of a fast jet combat at low level. There's no doubt—no one wins a war. Wasn't it the Duke of Wellington who said, "The one thing more tragic than defeat is victory"?

Later that afternoon, as I flew patrol overhead at 10,000 feet, I once again witnessed the awful sight of the *Sir Galahad* fiercely ablaze, pouring out masses of thick, oily smoke. It was a quite incredible sight, one etched with so many others on my mind forever. The whole of the aftersection was literally glowing red with the intense heat.

"The Mirages disintegrated"

As the sun set in the northwest with angry colours, we noticed a small landing craft heading toward the disaster area from Goose Green. Just as we were carrying out a combat turn over it, Moggy (Flight Lieutenant Dave Morgan) shouted over the R.T., "Good God! It's being attacked—three—no, four—Mirages. Follow me down, Dave." With that, he rolled upside down and pulled hard for the surface, almost disappearing in the rapidly gathering gloom. I slammed the throttle to full power and dived down after him in a desperate attempt to stay visual with his aircraft. As we leveled out at wave-top height, with the Harrier shrieking loudly as my airspeed topped 600 knots, I saw two bright flashes as Moggy fired his missiles. I followed the two white smoke trails and saw two huge fireballs as the Mirages disintegrated and impacted the sea.

I was now in the quite dreadful situation of seeing several aircraft ahead of me but not being able positively to identify Moggy and get a clear shot. Mog then suddenly opened up on the two retreating Mirages with his cannons, and from the water kicked up by his bullets, I was able to pick out one of the "bogeys." I pointed the missile at him and there was the usual growl in my ears as it acquired him. A quick press of the "accept" button on the stick and a green circle appeared in the head-up display, accompanied by a chirp noise in my headset. The circle followed the Mirage despite his speed and incredibly low altitude and, rolling back the safety flap, I fired.

There was a bright flash and a roar as the missile launched, fairly rocking the aircraft in its wake. Surely the Mirage was too low, too fast, too far away. . . . I watched with a sort of helpless fascination. At that moment everything seemed to stay quite still,

(Please turn to page 168)

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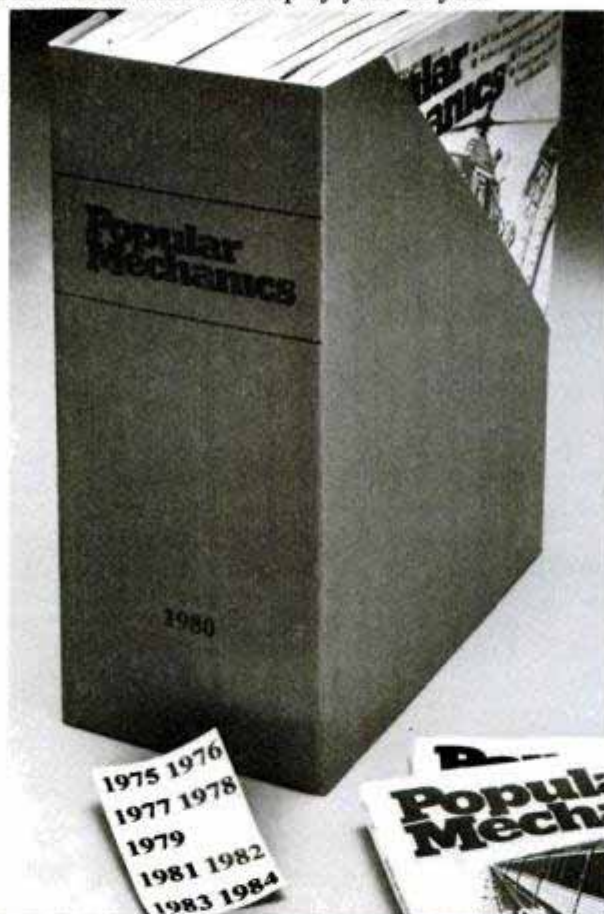
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DIARY OF A HARRIER PILOT

(Continued from page 166)

although in the real world my Sea Harrier was belting along at more than 10 miles a minute, a few feet above the waves.

Then the darkness was lit up by another fierce flash and fireball. He must have been flying so low that the missile impact and ground impact seemed almost simultaneous. Then, as the reality of the situation returned, a quick glance at my fuel gauges showed I was already on dangerous ground and I pulled the aircraft up to the vertical to attain the sanctity of high altitude. There was still the long return to the ship to fly, with a difficult night recovery at the end of it.

Lt. David Smith returned to England after the Argentine conflict. Early last winter, he went back to the Falklands to help train replacement fighter pilots assigned to beef up British defenses in the South Atlantic. **PM**

OWNERS REPORT: ALLIANCE

(Continued from page 165)

how much more room there was than in our Chevette," said an Ohio student.

As for handling, a New York university professor wrote, "Handling must rate as exceptional. The car tracks perfectly on the highway at cruising speeds, and steering is excellent—very responsive and accurate." A California engineer: "Excellent roadholding and driveability." A Tennessee telephone operator: "Great maneuverability."

A few owners questioned the Alliance engine's power output. "Needs more power for uphill climbs," observed a Virginia loan officer. A Michigan RN: "Not enough acceleration."

Miscellaneous minor complaints and suggestions for improvements included: "The wiper control is too near the steering wheel. I often hit the wiper accidentally while reaching for other controls."—California officer. "I wish the rear windows rolled down in my two-door."—Georgia state employee.

However, the owners commented on the Alliance's good qualities and features more than on the relatively trifling flaws.

An Illinois USAF technical instructor summed up the comments: "Friends and relatives who have ridden in and looked over my Alliance have guessed it to be in the \$8,000-\$10,000 price range. When I tell them I paid less than \$6,000, they're amazed. One passenger compared it to a friend's Audi in style, and I certainly consider it a better value for the money." **PM**

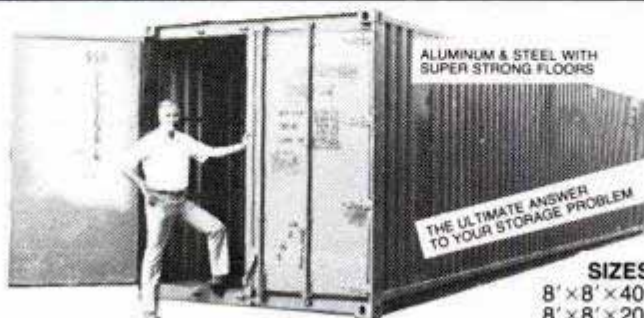
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***Adjustable, sturdy shell in cabinet.** Handy hanger holes and hooks on inside of door.

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The Z28's handling and performance are outstanding, but all's not well with the car's transmission and electrical system.

The past few months, we've been sampling a big sedan, a small sedan, a four-wheel-drive wagon and a muscular, sporty car. Being able to go from one to the other certainly brings a car's weak and strong points into focus, and gives us a perspective unavailable to most people. Our long-term tests also give us a chance to explore the answers to some questions you've been asking. For instance, is a sporty coupe also a practical commuter car? Can I live with a four-wheel-drive vehicle if I spend most of my time on the pavement? Is a small sedan practical for a large family? And can a big sedan give me room and decent gas mileage? We don't have all the answers yet, but we have been logging the data that can help with your car-buying decision.

Chevrolet Camaro

Since we did our long-term test on a Toyota Celica Supra last year, we've received a bunch of letters from readers asking us to evaluate a comparable American car. Okay, gang, here it is—the Chevrolet Camaro Z28. It's about the same size, also has four seats, costs about the same (our test car lists for \$14,707.47, but you can get a discount

off that at any Chevy dealer), and has sporty, rakish good looks that appeal to the same sporty-car buyer.

So how does the Camaro rate? Our test car was delivered to us with 1,134 miles on the clock. Since delivery, we've put an additional 1,890 miles on the car. In that time, the Camaro Z28 proved to be somewhat paradoxical, doing some things better than any car we've ever driven, but faring as badly as the worst cars we've driven in other areas.

Let's hit the good points first. The Z28 is just about the best handling car built except for the new Corvette. The car will run rings around such stellar handlers as the Porsche 944, Ferrari 308GTB and other cars of that ilk. The Celica Supra isn't even in the same league.

The Z28, especially with the twin crossram fuel-injected engine that we ordered (\$450 additional), is also one of the fastest cars sold in America. Lighting up and smoking the rear tires was no problem any time we felt like putting on our drive-in, macho-man act. Zero-to-60 times were never more than 8.5 seconds with our test car. And if that's not enough for you, Chevrolet has just announced a new L69 engine

option that has about 40 more hp than our test car.

Besides the ability to smoke tires, the Z28 has other good features. For instance, we've been averaging over 16 mpg with the car, which is incredibly good in light of the powerful V8 engine, automatic transmission and a very heavy right foot. We even had one tankful at 17 mpg. A lighter right foot could move this figure up to 20 mpg. That's almost as good as we averaged with the six-cylinder Toyota Celica Supra.

Interior comfort is excellent. We ordered the car with the custom vinyl interior, power bucket seat and tilt wheel. So the Camaro's already excellent driving position was enhanced further with the special equipment. We've taken several long trips with the Camaro and always have been comfortable. The back seat is another story.

The Camaro has done yeoman duty as a commuter car in the New York City area and has been excellent in that role, its sporty nature making the commute fun, our comfort aided by the \$4,000 worth of optional equipment we tacked onto the \$10,336 base price.

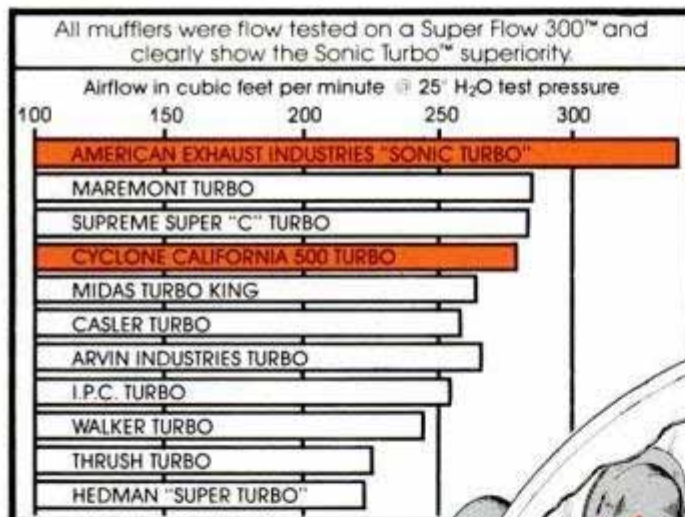
However, there's a dark side to this Camaro story. For one thing, the auto-

(Please turn to page 174)

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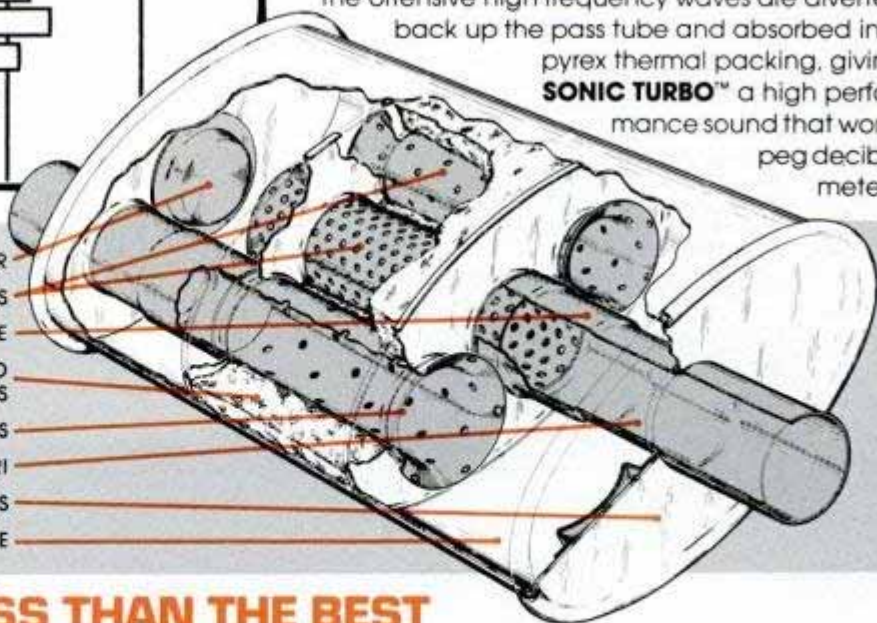
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LONG-TERM CAR TESTS

(Continued from page 170)

matic overdrive transmission in this car is about the worst we've experienced in years. For a company that used to build the excellent Turbo Hydra-Matic 400, which is still purchased and used by Rolls-Royce, we must say that the automatic in our test Camaro is an embarrassment for General Motors. The transmission slips and lurches, can never decide what gear it wants to be in and doesn't respond well to manual control. When the throttle is floored on

drive sedan market is expanding with new entries all the time (Subaru, Audi and Toyota now have four-wheel-drive sedans in their line-ups), we thought it would be a good idea to take a long look at the car that started it all.

Our Eagle wagon is equipped with power steering, brakes, automatic transmission, deluxe interior appointments and other comfort and convenience items. The four-wheel-drive Select-Drive System was revolutionary when introduced two years ago in that it allowed the driver to choose between two-wheel drive and full-time four-



The AMC four-wheel-drive Eagle wagon is at its best when it's working hard.

the highway, instead of downshifting smartly and moving the car out, the transmission hesitates for a few moments while the engine speeds up helplessly, then sometimes downshifts. Sometimes it doesn't. Chevy must know about it, too. You can't order the automatic with the new performance engine option.

The transmission isn't the only weak link on this car. The gauges sometimes quit altogether, the needles just lying limp against their stops. The left side of the stereo doesn't always feel like functioning. And most exasperating, the car's battery has gone completely dead twice since our tests began. And we mean completely dead. In fact, as we write this, the Chevy man has taken away the car to try to find the reason for the battery drains.

We'll have the Camaro long enough to let you know whether the transmission performance improves with age and whether the car's electrical problems are peculiar to this car, or whether they're caused by some sort of design or manufacturing defect.—J.O.

American Motors Eagle

The newest addition to our long-term test fleet is an American Motors Eagle wagon. While not a new design, the Eagle was a trendsetter when first introduced. Now that the four-wheel-

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Although we've only had the Eagle in our test fleet a short time, we've already had a couple of opportunities to use four-wheel drive. During a week straight of hard, driving rain, the four-wheel-drive system proved its mettle on slippery roads, both paved and gravel. Flip the switch into four-wheel drive and you can feel the tremendous traction of the big, all-weather tires take over. It's a great feeling of security.

Our test car has the optional six-cylinder, 258-cu.-in. (4.2-liter) engine. It's been improved in several areas this year for better performance. The compression ratio has been upped to 9.2

(Please turn to page 176)



Cimarron smile is marred by broken chin spoiler, only casualty in 3,545 miles.

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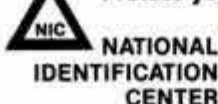
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LONG-TERM CAR TESTS

(Continued from page 174)

1 from 8.2 to 1, and a fuel feedback system and knock sensor have been added so that unleaded regular fuel can still be used despite the higher compression ratio. Our car also has the optional 2.73 axle ratio, which gives it a lot more pep than would the standard 2.35-to-1 ratio.

For '83, AMC offers the Eagle in four-door sedan and two-door hatchback besides the wagon. But we felt the wagon was the most versatile and most attractive, so we requested that body.

In future reports, we'll let you know if our choice was a good one. Also, we're eager to compare gas mileage figures with the Eagle in two- and four-wheel-drive modes. We'll let you know how it stacks up.—J.A.L.

Cadillac Cimarron

Frankly, we didn't care much for General Motors' front-wheel-drive J-cars (Chevrolet Cavalier, Pontiac J2000, Oldsmobile Firenza, Buick Skyhawk, Cadillac Cimarron) when they were first introduced last year. They were all dogs. They couldn't get out of

their own way. And they seemed cramped and didn't give very good fuel mileage. So who needed them?

Then, in January, we drove our test Cadillac Cimarron (with 2,641 miles on the clock) from its home base in Detroit back to our offices in New York. That drive, about 700 miles, took exactly 10 hours. When you're averaging 70 mph for 10 hours, a car's good points and deficiencies leap out at you. So we got to know the four-door baby Cadillac very quickly and very intimately. And we admit to having a new respect for the car.

A drive like that, with gas stops only, makes you aware of interior comfort, or lack of same. The Cimarron's six-way adjustable power seat plus tilt steering wheel should allow anyone to find a perfect driving position immediately. The leather upholstery was beautiful and comfortable, too, even after all those hours. The standard power windows would have made even the minor annoyance of toll stops disappear, but the switches to operate them are flush on the door panel and not easy to use.

Accolades go to the suspension and drive train. The new 2.0-liter Four has enough guts for high-speed cruising—something you often don't find in small sedans. And the five-speed transmission is smooth and a pleasure to use. The standard handling suspension with fat tires on aluminum wheels really gave us maneuverability when we needed it. And on Interstate 80 eastbound, you need it constantly.

The next day, we tallied up the gas slips. Even our leadfooting couldn't drop the average below 25.3 mpg. Most of this driving was, of course, at pretty constant speeds, which is in contrast to the city and suburban driving we've been doing since then. Even so, our overall average for 3,545 miles is 23.5 mpg, and that's all winter mileage, remember. Between January and April we added two quarts of oil and that's it; the Cimarron hasn't missed a beat since.

We did lose a piece of the chin spoiler somewhere, somehow. We don't remember any curbs jumping out to break it off, and suspect that it happened while muscling through some deep snow during the Blizzard of '83 in the New York area. We'll have the spoiler replaced at the same time that we pull in for a 7,500-mile maintenance check.

They're no dummies at Cadillac Div. advertising and if we were selling Cimarrons we, too, would compare them to BMWs. The Cadillac does stack up nicely against the 318i when you consider that German fit and finish is costing you a few thousand dollars more.

It is price that's the sticky issue here.

(Please turn to page 179)

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LONG-TERM CAR TESTS

(Continued from page 176)

The demographic Cadillac family might not think twice about buying a compact, around-town Cimarron to have in the multicar garage, but to most people this is a very high-priced J-car that doesn't look much different from the Chevy version. And, at this point, we won't get into a comparison with a car we regard as lower-priced competition for the Cimarron, a car that is currently being made in Ohio—Honda's four-door Accord.—*J.O. and B.H.*

Buick LeSabre

As we get ready to wrap up our test on the 1983 Buick LeSabre four-door sedan and return the car to Buick, one thing is crystal clear: This is one of the great bargains in today's automotive marketplace and, incidentally, may be one of the best American cars ever built.

Strong opinions? Yes, but we think they're justified. Look at the facts. First, this car has enormous amounts of room and comfort, a fact we stressed in our last report. Second, the car has been consistent in its delivery of over 17 mpg, with a few tankfuls over 18 mpg. Third, the car as we equipped it lists for \$13,982, which means you could walk into just about any Buick dealer in the country and buy the same vehicle for about \$12,000.

When you look around at what you can buy these days for \$12,000, the Buick LeSabre begins to look better and better. True, it's not a super-economy car delivering 50 mpg. But no economy car can match the LeSabre for room and comfort for six real adults.

With 6,974 miles on the clock, the car continues to deliver smooth, responsive handling and more than enough power out of the 307-cu.-in. V8 to provide brisk performance. Still, no car is perfect and our test LeSabre is no exception.

At 4,502 miles, we took the car to Straub Buick in Keyport, N.J., to have some items corrected. The shift lever indicator was out of whack and it was hard to tell what gear we were in. The car pulled to the left at highway speeds. We didn't think the rear defogger was working properly and we thought there was excessive wind noise around the driver's door.

Straub Buick's excellent service department fixed the shift indicator and aligned the front wheels. They verified that all the grids were working properly in the rear defogger and that the driver's door and window were properly sealed and aligned. They also replaced a plastic grille piece that had broken off in a parking lot. The total charge for

everything was \$45.15. Since then, the car has driven perfectly.

In our last report, we told you that the car had not been delivered as we ordered it, and we wanted to find out why.

We had ordered it with vinyl upholstery and received cloth, had ordered 70-series radial tires and received 75-series tires, and had ordered a 3.23 final drive ratio and received a 2.73. Here's why.

For the '83 model year, Buick dropped certain models and options. For instance, they dropped the base LeSabre model, which was available

with vinyl upholstery. Now the plainest LeSabre you can get is a Custom, which comes with cloth. Also, the 70-series tire option was dropped for '83. The axle-ratio goof was Buick's.

Frankly, we're going to hate giving this one back. The LeSabre and its sister GM cars—Chevrolet Caprice, Pontiac Parisienne and Oldsmobile 88—are fine American automobiles. They're built well, finished well and have room and comfort unmatched by any comparably priced car in the world. All that, plus decent fuel mileage and good handling and performance. What more do you want from a car?—*J.O.*

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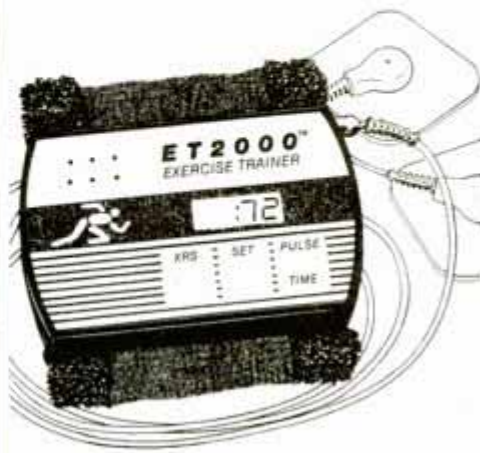
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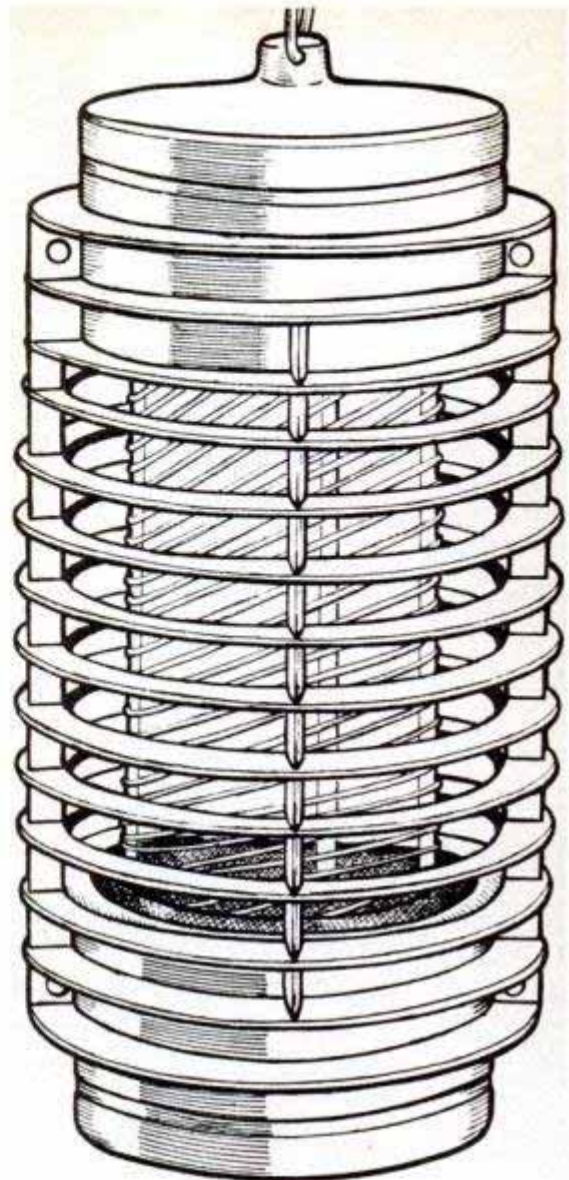
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