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ON THE COVER

When Miami firemen rush to a fire, they may go by land or sea—whichever is the fastest way to get there. Read about their remarkable new amphibious fire engine that can go anywhere it's needed.

Story starts on page 93.

—PM painting by
Ed Valigursky

OCTOBER 1983

VOLUME 160 **NUMBER 4**

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EDITOR'S NOTES

Consider the year 2008. Seems awfully remote, doesn't it? Yet it's no further in the future than 1983 was when the National Aeronautics and Space Administration (NASA) was founded 25 years ago.

Who could have predicted then, with confidence, that America would have accomplished as much as it has in the ensuing 25 years . . . men on the moon . . . space shuttles . . . photos from the edge of our solar system?

It's not difficult, therefore, to believe James Beggs, NASA Administrator, when he writes on page 85: "By the year 2008, we'll have established a permanent space station orbiting the moon." And that's just one of the space spectaculars NASA has in mind. Mr. Beggs' predictions are part of our celebration of American space achievements that begins on page 81.... Speaking

of NASA, that amphibious firefighter in Miami (page 93 and the cover) owes much of its water-pumping ability to the space agency. The pumps in Miami's seagoing fire engine are based on the design of the fuel pumps in a Saturn V Rocket. . . You'll see two new names on this month's masthead. They're both in the Automotive Department, and they're both names you'll be seeing a lot of in the future. Wade A. Hoyt is heading up the Auto Department and will be based in New York. Daniel Charles Ross becomes our man in Detroit.

Wade, a member of the Society of Automotive Engineers, has been associated with magazines for many years. Most recently, he was senior editor of Reader's Digest General Books, where he directed publication of the Digest's Complete Car Care Manual. Daniel comes to us after staff duty with AutoWeek, preceded by a stint as a



Hoyt in the Big Apple . . .



... Ross in Motown.

freelancer. He replaces Gary Witzenburg, who's off to Los Angeles and freelancing. . . . "Go ahead and hit me," challenged Joe Klecko, 269-pound defensive end for the New York Jets. Dennis Eskow, our slightly smaller Science



"I'm only kidding, Joe."

Editor, obligingly (and somewhat rashly, we think) hit him. Dennis admits he would not do it without an invitation. The point of one-sided punching is simply that today's high-tech football armor really does offer the player a good defense against the thunderous collisions on a football field. You'll find a roundup of protective gear in Dressed To Kill (page 89).

Jan a. Sistella

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IT'S A GREAT PLACE TO START

LETTERS TO THE EDITOR



Flying saucers—old and new



PM's July '57 cover (left) and a new flying car prototype (right).

I was very interested in Dr. Moller's design for a flying saucer, the XM-5 Commuter (*Technology Update*, page 122, July '83). However, while the craft incorporates several novel features, its concept is definitely not new.

If you look back at your issue for July 1957, you'll find basically the same vehicle displayed on the cover (far left). Hiller's flying car used the same principle of ducted fans to provide lift and propulsion. So, you see, the idea is more than a quarter of a century old.

PAUL BAUGHMAN WATERFORD, PA

Thanks for the reminder. Unfortunately, the Hiller design was never built, but Dr. Moller already has an operational prototype and appears to be well on his way to producing a commercial version for sale as a kit.

Old Jeeps never die

In previewing the new Cherokee and Wagoneer 4wds (Detroit Listening Post. page 30. Aug. '83). Gary Witzenburg referred to earlier models as ''clunky old Jeep wagons.'' Them's fightin' words to us country folks.

Maybe he's never had to haul baby calves out of a freezing blizzard in the dead of night or he'd know better. Our "old clunker" has more than 110,000 miles on it and is still going strong. Keep those fancy new five-speed, independent-front-suspension tin cans out of my way, because old clunkers never die—they just pass you.

RUSS WEIDNER TRENTON, NEB.

Call us British, please

Your exciting story Falklands Diary Of A Harrier Pilot (page 59, June '83) was marred only by a small oversight in referring to our gallant fighting men as English, when you should have said British. As a United Kingdom, we're British first, then Scots, English, Welsh and Irish second.

HAMISH PROCTOR ELGIN, SCOTLAND

Tale of two cranks

When I was a boy 50-odd years ago. I learned many principles of mechanics and their proper terminology from PM. Your information was invariably accurate and provided a great education for young people like myself. This is why I

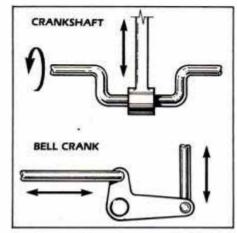
was appalled to see a crankshaft called a bell crank in your otherwise fascinating article Folk Art That Comes To Life (page 105, May '83).

A crankshaft converts rotary motion to reciprocating motion or vice versa. A bell crank, on the other hand, converts reciprocating motion in one direction to reciprocating motion in another direction, usually at 90°.

I wouldn't nit-pick this way except that PM is read by thousands of budding young mechanics, engineers and scientists. They shouldn't grow up with a misconception.

> ROY MOUNGOVAN SEBASTOPOL, CALIF.

We agree and apologize for the slipup. The two mechanical linkages, correctly identified, are shown below.



For the record, a rotary crankshaft (top) versus a right-angle bell crank (bottom).

Vintage Vettes are better

I've held my tongue long enough. As the owner of five vintage Corvettes from '63 to '70, I must comment on the latest edition that you praised so highly (*Corvette*, page 84, Mar. '83).

The new Vette is certainly a fine car mechanically, and I wish that some of its features were on my older models. But to call it a beautiful car is stretching wishful thinking just a little more than I can stand.

The '83 Corvette is the blandestlooking set of wheels I've ever seen. Not a single person in our 78-member Corvette Club has bought one. Does that tell you something?

> CARROLL SHELDON KEARNEY, NEB.

Make-believe mix-up

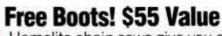
I agree wholeheartedly with Neil Shapiro's glowing praise for Microsoft's new Flight Simulator program for the IBM Personal Computer (PM Software Monitor, page 61, July '83). But how on earth did he manage to put the John Hancock building in Boston?

I have the same program and the building was in Chicago the last time I looked. Have they moved it?

> MATT SWAFFORD KANSAS CITY, MO.

No, it's still in Chicago. Neil Shapiro reports he was so shaken after crashing his Cessna into the John Hancock tower that he somehow must have thought he was in Boston.





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A harmony of sports cars



Isuzu

Who doesn't drool at the sight of a perfectly restored MG TD out for its Sunday drive? That's when you might be tempted to wonder. "Whatever happened to the sports car?" One theory is that sometime in the '60s it became a motorcycle: wind-in-theface fun, except on a bike your passenger sits behind you.

The ragtop roadster is gone—trusting that you don't confuse a K-car convertible (as nice as it is) with an Austin-Healy 3000 Mk III! - and side curtains have flapped their last. But the new sports cars do have a music

Toyota two-seater will become another link in sports car evolution next year.

We'll

The twin-cam Supra is the hot one

satellite control pod of the

have a full test next

month. It's available in

30 states from 200 deal-

ers and worth crossing

\$10,000, what a deal!

state lines for. And at

new Impulse.

Mitsubishi

The turbo Starion gets needed frontend cleanup. The smoother hood line will also be found at Chrysler dealers, who will soon be selling the Starion with a Conquest nameplate.

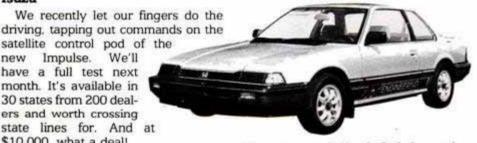
Honda

The second-generation Prelude, having grown a bit longer in its transformation into a totally integrated and great-looking design, leaves Honda with a slot for a small, sporty car. They'll be filling

it with a sports coupe variation of the Civic coded CR-X. Pics to come.

Nissan

The Pulsar sports coupe now has tur-



Hotter-than-stock Honda Prelude got the hop-up treatment at A/T Engineering.

step in the evolution of the Z-car. In the past dozen years it has undergone dramatic changes, but has always retained its identity. The 300ZX gets new skin and the powerplant will be an all-new 3.0-liter turbo V6. This is the top rung among these sports cars, most of which go home for closer to \$10,000 than 20. You can go \$25,000 and over, but

you'll pay dearly for every extra mph

in the quarter.

bo boost, but the big news is the next

right now, but Toyota's got a smallerscale, two-seater in the works. Security's tight, but our sneak shot is seen above.

Mazda

The RX-7's clean styling, excellent performance and reasonable price are still its strengths. Sheet metal is the same for '84, but more power will be on tap from its rotary engine.



isuzu impulse styling turns every head and satellite pod controls delight all fingers.

of their own. They reflect a harmony of influences: roadsters at heart (even though they're closed up into "sports coupes"), with back-seat passengers getting the squeeze, if there is a back seat; under-the-hood hop-up by turbos and hot-rod valves; suspensions and muscle-car bodywork from track and wind tunnel; and all the power options-even cruise control-formerly found only on "luxury" cars. They're almost exclusively from Japanese automakers.

Here's a look at the latest entries in the field.



Design study of the Nissan 300ZX: PM's road test of the luxury sports car is next month.



ALL OUTDOORS



Kevlar—canoes are made from it, too

Kevlar—that miracle material used in everything from bulletproof vests to motorcycle helmets—has now found its way into canoes. I had a chance recently to try out some of the new Kevlar canoes. Here's what I found:

A Kevlar canoe is much lighter than an aluminum one. A 17-foot aluminum canoe might weigh about 80 pounds. A 17-foot Kevlar canoe weighs 32 to 60 pounds, depending on its use. For racing it might be 32 pounds, for flatwater use, 40 to 50, and for whitewater running, 60.

Getting rid of those extra pounds isn't cheap, though. The price of a 17foot Kevlar canoe might be \$1,300. A

Mad River's 13-foot Compatriot is made of Kevlar and weighs in at 33 pounds. The craft is camouflaged, and it's a great solo flat-water canoe.

comparable aluminum canoe might cost only \$550.

Kevlar canoes are great when you have to do a lot of portaging. Of course, if Kevlar's high price tag discourages you, there are plenty of fiberglass canoes available. A fiberglass canoe is heavier than a Kevlar model, but might be lighter than a comparable aluminum canoe. A 17-foot canoe made of fiberglass might weigh 70 pounds and cost \$750.

Another advantage Kevlar and fiberglass canoes have over their aluminum brethren is that they can be repaired. Put a hole in an aluminum hull and you've got problems. Do the same

thing to a fiberglass or Kevlar job, and you just repair it using normal fiberglass repair techniques (with Kevlar you use Kevlar cloth instead of a fiberglass cloth).

How do canoes made of synthetic materials perform in the water? Very well. I paddled several new models and found them to be responsive, durable and lightweight.

Still, a canoe made of a hightech synthetic material may not be for you. The extra weight savings gained with a canoe made of Kevlar may not be important if you don't do any portaging. And a good aluminum canoe is durable. You have to whack it pretty good with a rock to put a hole in it.

But if light weight and ease of repair are important, then your choice is clear: Get a high-tech synthetic.

Air guns for better shooting



The CO₂ cartridge fits in the handle. Each cartridge is good for 60 shots. Gun breaks open so pellets can be reloaded quickly.

Shooting handguns is a great sport. It's also expensive. Forgetting the initial investment for a gun, the ammo'can cost several cents a round—even if you reload it yourself.

Another problem is flinching, something all of us either do or have done. Flinching, of course, is when you jerk the gun as you pull the trigger, in anticipation of the pistol's recoil.

An air pistol, particularly Crosman's six-shot .357 Colt Magnum replica, is a great way to eliminate both flinching and the high cost of ammo. I've shot several hundred rounds through one of these babies recently. My shooting has improved. And even more importantly, each round costs me only 1½ cents.

At 25 feet, the .357 replica fires its .177-caliber pellets accurately. An experienced shooter can produce very tight groups. The gun can be fired double or single action. The great thing about this pistol is that you can shoot it in your basement—something family, neighbors and your basement walls would object to with a real .357. A cardboard box filled with wood chips stops the pellets easily.



An air pistol has no recoll, which means that flinching is eliminated. Crosman's Colt .357 Magnum replica costs about \$50.

Camping is popular

Camping continues to be one of America's favorite sporting activities. Approximately 60 million Americans camped last year. By 1985, that number will increase to 61.6 million. And by 1990 it will swell to 64.4 million.

These are some of the interesting figures reported in a new study done by the A.C. Nielsen Co.

Camping exceeds these sports in

popularity: bowling, boating, jogging, softball, tennis, skiing, hunting, golf, soccer and billiards.

The study found that the campers break down this way: 44.6 percent are tent campers, 39.1 percent are RV campers and 11.1 percent are backpackers. Or, put another way, about 27 million persons are tent campers, 24 million RV campers and 7 million backpackers.

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DETROIT LISTENING POST



Special Fiero and Corvette

It was at Sears Point Raceway in California that we tested America's first mid-engine sports car, the Pontiac Fiero 2M4. Equipped with the highly recommended WS6 suspension option, it handled Sears Point's tricky hairpins and diving, climbing and flat-out turns with terrific agility. Its only real deficiencies, we found, were the low-revving 2.5-liter engine, one too few ratios (four) in the standard manual gearbox and fairly slow 19:1 steering, all of which are being attended to for future models. It's an impressive new car, but not as exciting as its nonproduction versions.

At the Sears Point introduction, division General Manager Bill Hoglund unveiled a serious-looking Fiero race car and a gorgeous open roadster version. The former is a 280-hp four-cylinder prototype built by Pontiac engineers and indicative of what they hope some independent teams will be racing next year; the latter is a concept car only, and not intended for production. But the roadster gives an idea of what aftermarket firms might do for the Fiero, thanks to its bolt-on body panels. It looked like a ¾-scale Lamborghini!

Another factory racer we saw re-



Recent sneak previews of a mid-engined Corvette prototype racer (top) and a Pontiac Fiero roadster show that Detroit carmakers have rediscovered automotive excitement.

cently is a mid-engined GTP Corvette aimed at IMSA's popular Camel GT series. This screamer combines a raceproven Lola chassis, a smooth-looking body by GM Design and PPG, plus a Ryan Falconer 3.4-liter turbocharged Chevy V6 that develops 720 hp at 8,500 rpm on gasoline.

Chrysler news bits

Chrysler is working on extendedwheelbase versions of its soon-to-beavailable fwd minivans. The change will provide more cargo room, plus a fold-down rear seat for sleeping and an electrically operated sliding side door.

Another program for '85 is an upmarket fwd luxury coupe, codenamed H-car. The vehicle is said to be rounded and highly aerodynamic, sporting Ford T-Bird/Cougar/Tempo/Topazstyle doors that wrap into the roof and an overall shape reminiscent of the beautiful new Audi 5000. (I recently asked a Ford executive whether he thought his company's new "aero" look was catching on with the public. "Yes," he replied with a grin, "and Chrysler's already copying us.")

On the engine front, Chrysler is tooling up a new V6 off its existing 5.2-liter (truck) V8. It's intended primarily for a new mid-size pickup truck, smaller than conventional pickups but larger than GM/Ford and Japanese minitrucks. Both vehicle and engine should debut sometime next year, and the engine may find its way into some fwd passenger-car applications in the more distant future.

GM news

Just when we thought we had GM's many code names down pat, they're going to change the system. The '85 N-body luxury coupes (Grand Prix, Cutlass Supreme, Regal) are now the GM-20; the '86 Eldorado/Riviera/Toronado replacement is GM-30; the '87 Buick and Olds fwd full-size B-body replacement is GM-70; and a combined X-car/A-car replacement program for '87 is GM-10. I give up.

Returning to the present, GM's

much-discussed fwd C-body luxury car replacements (Cadillac de Ville, Buick Park Avenue, Olds 98), originally scheduled for introduction about now, will likely hit the showrooms about four months late, or after the first of the year. "We will release no car before its time," said one GM official, indicating that some further development was necessary.

Oldsmobile Div. is awaiting corporate approval to tool up a new, high-tech double-overhead-cam four-cylinder engine for future small luxury and sporty cars. If it reaches production sometime in 1987, as hoped, it will be the first all-new homebuilt engine from General Motors since the late 1970s.

Finally, everyone knows whitewall tires are passé, old-fashioned and out of style, right? No European carmaker would be caught dead with glitzy

(Please turn to page 16)

PERFORMANCE.

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What do you call a spark plug that gives you all-out performance or your money back?

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Because when you install spark plugs embellished with the red letters of Champion, you get the advanced technology of the world's best seller. Plus a 60-day, money-back Performance Guarantee.*

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better with fresh Champions, just return the plugs to Champion with proof of purchase within 60 days, and we'll give you your money back. No ifs, ands or buts.

So tune up now, during National Car Care Month with performance guaranteed, Champion Copper Plus. It's the best spark plug we've ever made.

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DETROIT LISTENING POST

(Continued from page 14)

whitewalls, or even sporty white letters on its car's tires, right? Then why are American carmakers so reluctant to give them up? Because a lot of people still like them. But also because GM, for example, averages \$28 extra profit on each whitewall-shod car its dealers sell. That's about \$100 million a year.

Ford's refreshing spirit

Also at Sears Point was the West Coast press preview for Ford Motor Co.'s most exciting new '84 products: EXP Turbo, SVO Mustang and Mark VII LSC. President Donald E. Petersen was bubbling with enthusiasm and confidence at the track, where he and a growing number of his top lieutenants recently completed Bob Bondurant's high-performance driving school.

Instead of standing around uncomfortably and fielding occasional questions from the journalists, normally the case at such affairs, the Ford people— Petersen included—were lining up to wheel their cars around the track in between our own test drives. Like us, they couldn't get enough. At one point late in the day, Petersen asked for one more drive in one of the LSC Marks. The PR-types and engineers who were coordinating the ontrack activities said they could probably accommodate him in the next few minutes. "Why not?" one said to the other when the Ford president was out of earshot. "It's his company."

Earlier that day, Petersen had been expounding on his company's philosophy on designing and building its cars for the '80s. He said that from now on, Ford products will be "drivers cars" with outstanding seats and careful attention to seating position relative to the steering wheel and pedals, as well as instrumentation and controls. Interiors would be understated and functional, not "glitzy" as in the past, with large glass areas and an overall feeling of spaciousness.

The guiding emphasis will be on what he called "fundamental product integrity." When making product decisions, he said, "We will ask ourselves, 'Is this really the right way to do it?" "Safety, damageability and solidity of the body/chassis will be paramount, as well as serviceability. Petersen said. "We will have no 2½-mph bumpers," for example.

Transmission gearing will be properly matched to the engine. "the way the driver wants it. We're not going to fall back into the trap of extra-wide gearing just for higher EPA numbers." Another trap he said Ford will keep away from is the use of unnecessary electronic gimmickry. "There will be no more voices in Ford cars."

Petersen emphasized, too, that not all "driver's cars" are performance-oriented. "We will have purpose-developed cars for all types of drivers, not just high-performance enthusiast cars. We'll try to make each car a 'fully specified' product for its intended function."

Of course, he added, the bottom line for any company is to make a profit, "But we're not going to sacrifice quality or integrity to do it. If you put the product first, the profit will come."

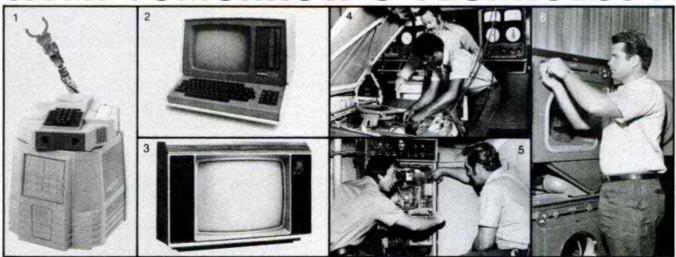
Above all, Ford wants a high-technology image and reputation. "We're going to be known as the company that's moving this whole industry the way cars are going to go," the Ford president concluded.

Sincere as all this sounds, can we write it off as more of the same old hype? I don't think so. The new '83 and '84 Ford products we've driven so far, as well as some major changes to existing older ones, definitely reflect this philosophy.

Finally—and I think this applies to most other carmakers as well, not just Ford—deeds are beginning to match words in Detroit.



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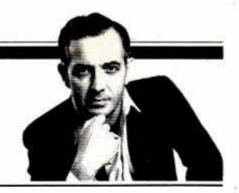
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CAR CLINIC



Needed: A nose job

Can you explain why the automatic transmission in my 1980 Pontiac Phoenix, which has a 2.5-liter engine, spits out fluid through the overflow when I start the car in my driveway? It loses about a guart a month.

The driveway is steeply sloped, and the loss occurs when the nose of the car faces up. If I park so the nose of the car faces down or on any level surface, it doesn't happen. The dealer and GM regional office offer no solution. Can you?—John Schoonhoven, Kentville, Nova Scotia

Sure can. Because of an incorrectly designed manual valve, some 1980-82 125C automatic transmissions have had a problem with fluid foaming. The condition usually manifests itself as an incorrect (high) indication on the transmission dipstick, but in a parking situation such as yours it may also result in fluid loss.

The solution to your car's problem is to replace the manual valve and auxiliary valve body cover with ones having GM part numbers 8643316 and 8643326, respectively.

Encore

My problem is with a 1980 Chevrolet Monza (2.5-liter engine). At 18,000 miles, the engine developed a loud tapping noise. My mechanic told me it was caused by carbon on the tops of the pistons. He was obviously correct, because adding a can of GM Top Engine Cleaner helped for six months. Now, the noise is back. I've talked to other GM owners who have the same problem with their 2.5s. Is there a cure?—Tony Wagoner, Gays, Ill.

I've gone over this before (see Car Clinic, page 23, July '83), but I'll repeat it because the trouble is widespread. This advice goes for every GM 2.5-liter engine experiencing engine knock: Replace the .040-inch-thick head gasket put in the engine on the production line with one that's .060 inch thick (part No. 10022914).

Feeling weigh down

In three years (30.000 miles), my 1980 Toyota Corolla station wagon has ruined three sets of front tires—that's a set every 10.000 miles. Only the insides of the tires wear away, but so badly that the belts show through. The outsides remain practically new.

The dealer has aligned the wheels at 10,000, 20,000 and 30,000 miles. He insists that the car is at factory specs, including the riding height, and can't find anything wrong. The wagon is used locally and is never overloaded.—John Guggino, Spring Valley, N.Y.

You say the wagon is "never over-

loaded," which suggests to me that some weight is put in it. When a load is carried in the Corolla wagon, even if it's not excessive, the front of the vehicle is raised and gives an increase in the front riding height. This leads to a toeout of the front wheels, which can result in severe inner tire wear.

Place a load in the wagon that approximates the weight you normally carry and then have front wheels aligned to the limits of the specification. By this I mean that with belted-bias tires, have toe-in set at 4 mm, since the spec calls for a toe-in of 3 ± 1 mm. With radial tires the spec is 1 ± 1 mm, so have toe-in set at 2mm.

Not so 'Vonderful'

My 1982 Ford LTD equipped with the 5.0-liter engine and three other LTDs (two '80s and an '81) I know about in this town have common problems no one has been able to solve. The most serious trouble is an almost-stall when slowing down. The other problems are black exhaust smoke and poor fuel mileage. So far, the dealer has blamed the exhaust-gas recirculation system, incorrect timing and low rpm. Now, he says nothing can be done, that this is the way the car works.—Clifford Grimes, Flushing, Ohio

Your car and those of the other LTD owners are equipped with variable venturi (VV) carburetors. The VV carburetor automatically varies the area of its venturi according to engine speed and load, which makes it a different animal from conventional venturi carburetors with fixed areas. The VV carburetor has a dual-element valve which moves in and out according to the amount of air flowing into the carburetor throat. This valve is controlled by engine vacuum and throttle position. It's connected to two metering rods which control fuel flow.

In theory, the VV carburetor is supposed to maintain a fairly constant air speed, keeping the air/fuel mixture more or less in balance at all throttle openings without the need for an idling

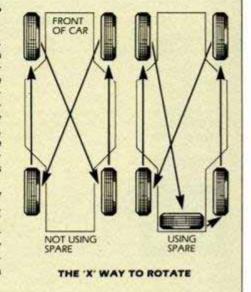
(Please turn to page 22)

PM CAR CARE Tread wear Uniroyal Tire Co.

has come out with some interesting observations concerning tire tread wear on frontwheel-drive cars. Al-

though front tires wear more quickly than rear tires, Uniroyal has found that, on average, there's no difference in the overall tread wear of fwd cars in comparison to rear-wheel-drive cars when tires are rotated on time and properly.

By "on time," Uniroyal means every 6,000 to 8,000 miles. "Properly" means, surprisingly enough, in the same "X" pattern you would use for rotating biasply tires. Uniroyal has found no basis for the widely accepted contention that radials should be rotated only front to rear on the same side of the car.



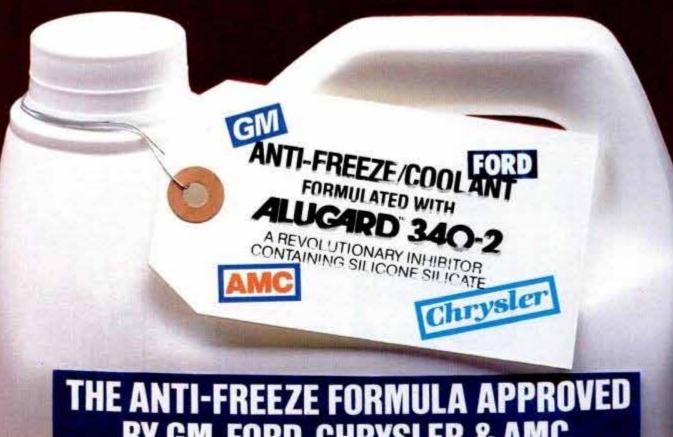
e anti-freeze

Only one anti-freeze formulation has met the tough standards of all four major car makers. Only one formulation has won their unqualified approval for safe and effective use in all their cars. That formulation contains a high performance corrosion inhibitor system called ALUGARD™ 340-2...and you'll find it in a number of major anti-freeze/coolant brands this year.

All the major car makers have raised their anti-freeze performance requirements significantly, because today's cars run hotter, and because of the potential serious engine and cooling system damage that can be caused by overheating. Anti-freeze/ coolants that you've used in the past, simply aren't good enough today.

If you care about your car and want to minimize costly problems, look for and use brands that contain ALUGARD™ 340-2. They're recommended for all new and older cars, including imports.

Look for the ALUGARD 340-2 Symbol on the jug label.



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NO OTHER ANTI-FREEZE GIVES YOUR ENGINE & COOLING SYSTEM MORE OVERALL PROTECTION.

(Continued from page 20)

system, enrichment-valve system and choke plate. The VV carburetor, which possesses none of these parts, is supposed to provide better fuel economy than fixed-venturi carbs in comparably sized engines. However, the VV has had its share of problems that have resulted in a number of service instructions from Ford to its dealers. Before I list the numbers of these service articles so you can advise your dealer, I want to make these other points:

First, the chief problem with the VV carburetor has been a tendency for the metering rods to get dirty and stick, which causes an overly rich fuel condition that results in the problems you mention. The only solution for this is to disassemble the carburetor and clean the rods, reassemble the carburetor and hope dirt doesn't again clog the works. This will have to be done if the procedures described in the service instructions don't work.

Second, there are two VV carbs—a Model 2700 and a Model 7200. The two are virtually the same, except that the 7200 has the feedback system tied into it—that is, the engine and carburetor are computer-controlled.

The service instructions are as fol-

lows (they apply to both the 2700 and 7200 unless noted otherwise): 80-12-23, 80-24-10 (7200 VV only), 81-9-10, 81-10-28, 81-11-8, 81-11-24 (7200 VV only), 81-15-16, 81-22-7 (7200 VV on the 5.8-liter engine) and 82-11-4 (7200 VV on the 5.8-liter engine).

Intoxicated

My car, a 1983 Plymouth Reliant with a 2.2-liter engine, has a bad hesitation

when the engine is hot, shut off for 15 minutes or so, then restarted. The car just doesn't go unless I let it idle for about 30 seconds. The dealer tells me all Chrysler cars with 2.2-liter engines are like this and the company is working on a solution. Is he giving me a load of baloney?—Steve Memmer, no address given

No baloney, Steve. A Chrysler engineer tells me this is a problem in cars that have confined engine compart-

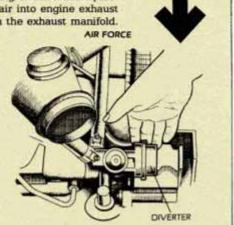
Trouble in the AIR

Remember AIR? It stands for Air Injection Reactor—a system used on many cars to reduce the outpouring of unburned hydrocarbons and carbon monoxide. It injects air into engine exhaust ports so oxidation of gases takes place in the exhaust manifold. AIR also helps catalytic converters to

function more effectively.

Well, a friend's car recently failed a New Jersey emissions inspection. He consequently spent \$65 for unnecessary service, because the car flunked reexamination. It turned out that the trouble was an inoperative AIR system.

How did I find out? Simply by letting the engine idle and feeling for air puffs at the diverter valve. Then, momentarily accelerating the engine and again feeling for air as it returned to idle. Air should be felt both times. If not, the AIR system needs fixing.



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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.

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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-yearold can do it.

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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?

- Decide if you like to work with your hands to create things and want to make money.
- Can you afford \$12.00 for my shop manual and six drawings.
- Send me your name and address along with your check for \$12.00 to:

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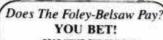


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This machine pays for itself making money out of scrap boards. It is a very well built machine and I confess it is more than I really expected for the price. It does everything you say it will.

Stephen Schultz - Orangeville, Penna.

"I've been a planer man for years and am now retired. The foley-Belsaw has earned me \$60,000 in eleven years... it's the best investment I ever made." Robert Sawyer — Roseburg, Oregon

"I recommend the Foley-Belsaw as the most useful shop tool any craftsman could own. We use one every day in the Workbench model shop couldn't get along without

Jay Hedden, Editor Workbench Magazine



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ments where air circulation is restricted. The trouble is caused by butane in gasoline foaming because of heat and pressure. Foam blocks the carburetor bowl vent, which causes an overpressure in the carburetor bowl. This, in turn, leads to an excessive amount of fuel flow into the engine and the problems associated with overrichness. Butane, incidentally, is an additive oil companies use to increase octane.

You and other owners of Chrysler Corp. cars and light trucks equipped with 2.2-liter engines are in luck, however. Chrysler has just issued an afterrun radiator fan system (part No. 4318148). The system allows the radiator fan to run for 10 minutes after the engine is shut off. The wave of cool air reduces engine compartment temperature and prevents fuel foaming.

On rye or white?

Since it was new, our 1982 Pontiac Grand Prix has had an odor inside the car. The dealer has tried several things to get rid of it, but nothing has worked. Can you help?-R.L. Becker, Boston

In a car, odors often are caused by mildew, which occurs because of a water leak. Washing the interior and spraying with a deodorizer may mask the smell, but won't get rid of it for long. Mildew is caused by bacteria that thrive in the soft, porous material. Bacteria have to be killed. Shampoo and air spray are ineffective.

The way to get rid of mildew is to first find and seal the water leak. Then, remove seats, carpet and carpet padding, wash the floor pan with a disinfectant and install new carpet padding. Before installing seats and carpet, hire a professional to steam clean all upholstery, including door panels, using industrial upholstery cleaner.

If the odor remains, it means there's still bacteria. At this point, assuming your problem is mildew, the cleaning company should fog the interior with a germicidal chemical.

Suppose the odor isn't mildew, but resembles garbage and is present with the air conditioner on or off. Then, it's possible that something was inadvertently left in an air conditioning duct during production. Maybe someone on the line put down a cheese sandwich and forgot to retrieve it. Whateverthe air conditioning ducts and module should be removed and inspected. 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

- A high-pitched whine noticeable only in PARK and NEUTRAL of a 1982-83 GM model with THM 125C automatic transmission may be caused by damaged or worn bearings. Have the following inspected and replaced, if necessary: drive sprocket roller cage bearing (part No. 8631186), driven sprocket roller cage bearing (No. 8631190), drive sprocket thrust bearing (No. 9436851).
- To check if pinion seals of a powersteering system in a front-wheel-drive model are leaking, Chrysler says to remove the air cleaner, wash down the pinion with carburetor cleaner and let it dry. Then, start the engine, turn the steering wheel from stop to stop two or three times and inspect the pinion for fluid. If there is fluid, a Chrysler Corp. shop can replace seals without removing the rack-and-pinion assembly. Relative data is in bulletin 19-01-83.
- Suspect carburetor icing if there's a loss of power and stalling in a 1978-80 Ford Fiesta while driving in wet, cold (about 32° F.) weather at highway speeds. The primary cause is an inoperative vacuum motor assembly (part No. D8RZ-9D612-A). Replace it.
- Is the manual transmission in your 1980-82 Honda Civic hard to shift? Honda has recently issued a new collar/bushing set with control No. 106877.

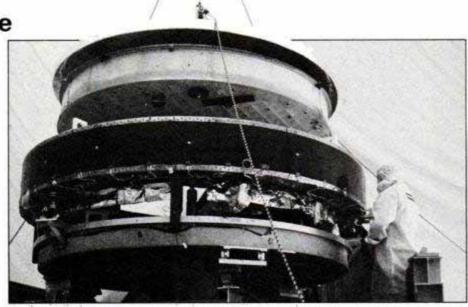
SCIENCE WORLDWIDE



Expanding its scope

America's Space Telescope has passed another construction milestone in preparation for its 1985 launch. The 8-foot-diameter mirror was finished a year ago. The latest landmark was achieved this past summer when the 1.800-pound mirror was mounted to its holding ring. The composite-metal ring has six mounting points for the mirror.

With the mirror in place, the ring will be mounted inside the telescope tube, probably early next year. The Space Telescope will orbit the Earth 320 miles up. Although we've had orbital infrared and X-ray scopes, science hasn't had an above-the-atmosphere view of the stars with a large optical mirror. With the space telescope, astronomers hope to discover new stars and perhaps see planets orbiting some distant stars.



Perkin-Elmer worker watches as Space Telescope mirror is lowered into mounting ring.

Goodbye, Columbus



Etchings found in West Virginia may have been made by Irish monks before 1492.

Back in the 1970s the discovery of an ancient Viking coin at an Indian campsite gave credence to the theory that Norsemen were on the New England shores centuries before Christopher Columbus "discovered" America.

Now, a Catholic University linguist has translated letters etched in stone inside a West Virginia cave. And Robert Meyers says the discovery may help prove that Irish Catholic monks were in the New World in about 500 A.D., perhaps earlier than the Vikings.

The cave inscription is an image of the sun followed by Celtic Ogam letters that spell out the message "Glad Tidings." The sun image apparently was set there to mark the beginning of the winter solstice.

Weeding out problems

Herbicides don't have much of an effect on weed populations because the chemicals don't deal with the unwanted plants' prolific seed production, according to a paper presented at a U.S. Department of Agriculture symposium.

To maintain populations, weeds can drop as many as 50 million seeds per acre. Usually, herbicides are applied when only about 10 percent of these seeds have germinated, so most of the seeds are still lying dormant. USDA scientists suggest gardeners let weeds grow wild for a year, allowing more seeds to germinate. That would greatly increase herbicide effectiveness.

Halley Watch

Amateur astronomers won't start seeing Halley's comet until next year. But the International Halley Watch at NASA's Jet Propulsion Labs wants help with early observational groundwork. This month, on the 21st and 22nd, the continental United States will experience the annual Orionid meteor shower. If you look toward Orion's Belt in the sky just after midnight, you should see meteors streaking to Earth. Dust left by Halley's comet at the turn of the century contributes to the shower.

By counting the number of meteors over a specified period and reporting it to the Halley Watch, you will help scientists determine the current mass of the comet. If you do take a count, send it to me and I'll pass it along to NASA. Also, those readers who want Issue No. 2 of the Halley Watch Amateur's Bulletin should send me a self-addressed, stamped envelope marked "Halley."

Chopping death rates

A report in the Journal Of The American Medical Assn. credits helicopters with cutting in half the rate of death due to accidents in Southern California. Citing a study of 300 accidents, the report says that rapid transit to the hospital was a major contributor to the high survival rate. But the study notes that trained physician-nurse teams are usually assigned to medical evacuation helicopters and can do more for a patient than an ambulance attendant.

Space Shuttle ride

I just received a note from NASA acknowledging my application to be the first journalist on the Space Shuttle in 1984 or '85. Next month, I'll share a list of duties the journalist will perform.

in ckęts the Pl He likes jeans made of tough, cotton denim. Jeans that fit right and look good, without frills or fancy stitching. He's the man who knows there's more to quality than an inflated price tag. The man in the Plain Pockets Jeans only at JCPenney 1500 Prices higher in Alaska, Haweii and Puerto Rico 1983, J. C. Penney Company, Inc.

APPLIANCE CLINIC



Overly hot dryer

My J.C. Penney dryer. Mod

My J.C. Penney dryer, Model 86147304080, serial No. ZD209560L, overheats when the clothes are almost dry. It overheats to the point that the dryer is too hot to touch. As a result, I've ruined two heating elements. I replaced the operating thermostat, but the problem persists.—K.A. Bernard, Carmichael, Calif.

The premature heating element failure and the high temperatures are probably due to insufficient air movement past the heating element, through the drum and out the exhaust. This usually is caused by either a build-up of lint or a restriction in the vent ductwork or in the vent hood.

My suggestion is to give your dryer ductwork a thorough cleaning. Disconnect the ductwork from the back of the dryer. Reach in and remove whatever buildup is visible. Thoroughly clean the inside of all the ductwork leading outdoors with a vacuum cleaner. When you get to the vent hood, pay particular attention to the flapper inside the hood. Make sure it moves freely.

Once the ductwork is cleaned and put back together, move to the front of the dryer. Open the door and remove the lint filter. Thoroughly vacuum the filter housing and ductwork to the blower assembly. The cleaning should remedy your problem.

Not defrosting

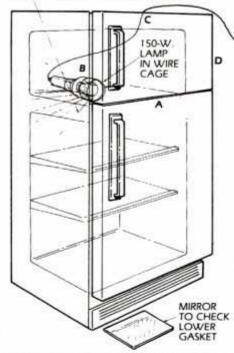
My 7-year-old General Electric cycle defrost TB-14S refrigerator-freezer hasn't been defrosting automatically for the past three years. Frost begins to collect the day after I remove it manually.—Frank Grayeske, Perkiomenville, Pa.

On your model refrigerator, the freezer should be defrosted manually when the frost buildup becomes 1/4 to 1/2 in. thick in any area of the freezer, or a minimum of once every six months. To defrost properly, keep the unit off a minimum of two hours for an average accumulation of frost.

If the freezer isn't defrosted, frost will build up in the hidden insulation and cause sweating on the outside of the refrigerator. There are only two ways to correct this problem: Either have a serviceman replace the insulation, or turn the refrigerator off for two to four days to let the ice melt. Defrost with the doors open. Use the family picnic cooler to store food while defrosting the refrigerator.

The rapid accumulation of frost in the freezer is due to a door gasket not sealing properly. Check the gasket with a 150-w., wire-caged lamp placed inside the freezer. Don't leave the light in too long, or its heat may damage the plastic freezer interior. Close the door with the light near one side (side B in the drawing) and the cord exiting from the opposite side. Or better yet, use a

LIGHT ESCAPING THROUGH GASKET



Place a 150-w., wire-caged lamp in the freezer. If you see light, there's a poor seal.

battery-powered, cordless light. Examine the door gasket, one side at a time. If the gasket is leaking, you will see light. If the gasket has any visible damage, it will need replacement. Often, incorrect door alignment can cause a poor seal. Releveling the cabinet or adjusting the hinges may help.

Automatic shutoff

Our Lady Kenmore gas dryer, model No. 110-6407922 and serial No. 01563M535, is equipped with an electronic sensor for automatic shutoff. This function has been inoperative for about five years. People at the parts store and I have looked at all of their product pamphlets with no luck in finding a repair. At this time we manually shut off the dryer. Can you help?—Drake Simoff. Southfield, Mich.

Consult a copy of the Sears Kenmore automatic dryer service manual. It's available at all Sears repair parts centers or can be ordered from any Sears store. The part number for the manual is 828693-E (approximate cost is \$6).

The manual will give you a basic knowledge of the operation of your dryer. It was not designed to cover a specific model dryer, but covers, in detail, the repair of most components used in any model. Check pages 30 to 36. I think this information will help you solve your mystery.

Frost collection

We had a serviceman work on our 7year-old Frigidaire Custom Imperial FPC1-170T refrigerator-freezer. I asked if he replaced the fan. He said no, adding that ice had collected on the unit until a screw broke, and he merely replaced the screw. The machine seems to be fine. What does the screw do?—Andrew Duchey, Chicago

The screw apparently holds the fan blade to the fan motor shaft.

SERVICE TIP

Whirlpool has come out with a do-it-yourself dryer repair manual to join the one on repairing Whirlpool automatic washers, which already is available. The new manual has step-by-step instructions and pictures to help you through each repair procedure. It costs \$7.50 through Whirlpool appliance dealers, parts distributors and Tech-Care service companies. Or, send \$8.25 postpaid to: Literature Dept., Whirlpool Parts Distribution Center, La Porte, Ind. 46350.

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.



There's a winning entry in every store display.



WIN 雜戶 PRIZES! SAVE # \$5.00!

10 1984 Pontiac TransAms,

TV not included.

1,000 ATARI Home Computers, or

a Gillette Travel Bag (\$15 value).



600 XL is a trademark of Atari, Inc.

In the Gillette World Series Bonanza, every store display has a winning entry. So go to your participating store, look for the display pictured opposite for details, and play! There's no purchase required. (Contest and Refund Offer expires January 31, 1984. Void where prohibited.)

If you cannot find an entry form for the Sweepstakes/S4 Refund Offer at the store, mail a self-addressed, stamped envelope by November 19, 1983 to: "Gillette World Series Sweepstakes/S4 Refund," P.O. Box 2236, Boston, MA 02277-2236.

You'll get \$4 back from us just for buying any four of the 11 participating Gillette products. And you'll get Another Dollar if you include the Bonus Dollar Certificate below. That's a total savings of \$5!





BONUS \$\$\$ CERTIFICATE

How to save even more in the Gillette World Series Bonanza: Take this certificate to your participating store, look for the display to the left and play according to the rules, you'll get \$4 refunded from Gillette. Then if you enclose this certificate with your store display refund certificate, we'll send you an additional Bonus Dollar!

Total Savings With This Certificate: \$5.00!



HOMEOWNERS CLINIC



Finish for concrete floors

My 20 × 24-ft. concrete garage floor is pockmarked from salts used in our area to combat ice and snow. I'd like to coat the surface with a paint to keep the dust down. How can I get the salt out of the pores, and what kind of paint should I use?-Richard M. Leicht. Rochester, N.Y.

A call to the Portland Cement Assn. (PCA) gave me the whys and hows. A trip to my Sears store gave me the what and how much.

You should first clean and etch the surface thoroughly. Sears has a cleaner-etcher that sells for about \$7 a quart and covers about 200 sq. ft. when diluted with three quarts of water. After applying with a sprinkling can, rinse completely with clear water and allow to dry. It's doubtful that any possible remaining salt will be harmful.

Next, you can finish the floor with an acrylic latex porch and floor paint for concrete. Sears' brand sells for about \$18 per gallon and covers up to 450 sq. ft. The directions caution that many tires contain compounds which in combination with the car's weight and the tires' heat may cause the paint to lift off. They suggest that you wait 24

hours before driving on the new paint, then use cardboard under the tire area for two more weeks.

For slightly better results (and more work), PCA suggests an epoxy or polyurethane paint. Once again, Sears sells its product in a pair of half-gallon cans. One is the catalyst, the other is the resin and solvent. This gives a harder finish. However, it also has a high gloss that may be slippery when wet. It sells for about \$32 per gallon. Most paint stores carry similar products. Sears' epoxy is available only through the catalog.

As you work, remember to follow the manufacturer's directions and cautions on the labels.

Deck moisture

I have a second-floor deck supported on each end by beams coming through the outside wall. In driving rain, water travels along the beam and leaks into the house.

Besides correcting this, how can I seal the top edge of the decking along the wall and expect it to last? Water stands and drips to the underside of the decking. Can I add plastic sheeting and carpet? How can I fasten the plastic and carpet without piercing them?-E.A. Ford, Santa Rosa, Calif.

You can thank your architect for building one of the greatest contributors to moisture penetration and wood rot. From your description, I assume you have a cantilevered balcony. Any movement or traffic on it causes a slight movement at the juncture of the beam entrance through the exterior wall. This can be corrected by caulking with a high-grade silicone caulking, such as that produced by General Electric. The sealant will allow some flexing or movement while still maintaining a watertight seal between the two surfaces.

Your next big problem is the decking itself, which will definitely rot if left as it is (see Protect Against Rot And Insects With Pressure-Treated Wood, page 162, Mar. '80). The nails holding the

> decking to the beams are a perfect "in" for water.



under the outside edge and under the flashing. Wrap the plastic and carpet over the plywood and deck edges and

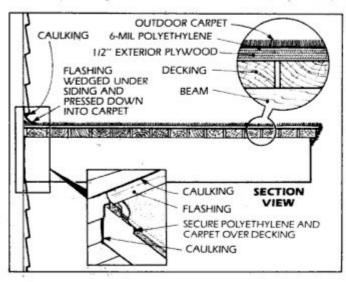
Sliding-door update

A strange thing happened between inception and delivery of the drawing in the July '83 Homeowners' Clinic ("Sliding Doors For Closet," page 20). We wanted to show how to frame a door that is located on a bearing wall. The framing process involved adding a header which would be supported at the ends by jack studs. The drawing shows the jack studs bearing directly on the flooring. These studs should bear on the sole plate for proper distribution of the imposed loads.

As shown, the supporting member could be resting on-and deflectingthe plywood subfloor. The nailing between the two studs would then be the only thing keeping the load off the flooring. From a construction standpoint, the sole plate is normally laid out first to assure continuity in the line of the wall. The plate is cut out after the wall and header are framed.

Some framing handbooks show the jack studs resting on the floor, as in our sketch. However, that's for rough openings for doors which are narrower. Most structural engineers and knowledgeable contractors will frame both studs on the sole plate.

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.



To seal a deck, cover it with exterior plywood, polyethylene sheet secure to the beams and outdoor carpet. Then flash and caulk at the house wall. (see drawing).

Fireside Accessories



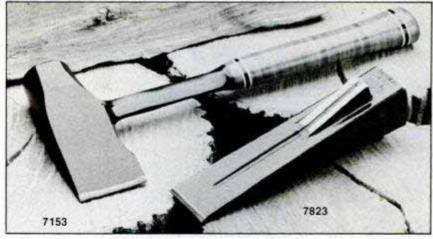
Fire Handler's Gloves

Believe it or not you can actually grab a burning log or rearrange white-hot charcoal with these gloves on and not burn your hands!

They have tough, fire resistant treated leather outers and an extra thick wool lining, yet the fingers are flexible enough to pick up a single briquette easily. The gauntlet cuffs go almost to the elbow so that even your forearms are fully protected. These have the longest cuffs of any gloves we've seen.

Our Fire Handlers have been tested at foundries and out-perform and out-last welding gloves. One size fits all.

5983 - Fire Handler Gloves\$29.95



Fireside Friend

If you split wood, you've gotta have a Fireside Friend. Where an axe or maul is often unwieldy, the Fireside Friend is just the right length (15") and weight (4 lb.) for most kindling work.

The handle can't break, the head won't fly off — they're one piece — forged from hardened steel.

Thick, sole-leather washers are pressed onto the handle, riveted and double lacquered . . . handsome and **very** durable.

7153 - Fireside Friend \$24.95

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Multiply your wood-splitting power. You can drive our new log blaster into the heartwood of a green log and it won't get stuck.

It's so effective that a few whacks with a maul explodes the log into quarters, just fireplace-right. Forged steel, 9" long with an ax sharp edge. 7823 - Log Blaster . . \$19.95

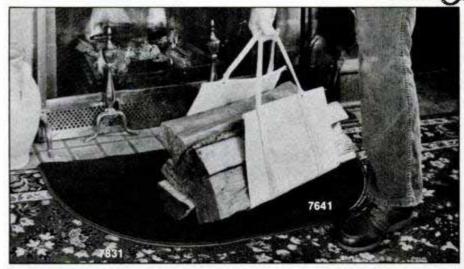
laster are naturals together

7971 - The Fireside Friend and Log Blaster are naturals together BUY BOTH AND SAVE \$5.00.....\$39.90

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Hearth Rug

Why risk ember burns on your expensive carpeting or wood floors when you can cover the danger area with an attractive non-flammable brown thermoglass protective mat? A big 40 x 20". Machine washable. 7831 - Non-Flammable

Hearth Rug \$22.95

Log Tote

Don't scratch your arms or tear your shirt carrying firewood. Use our big, 15 x 48", cowhide tote for lugging logs from the woodpile to the hearth. Stitched and riveted handles for good looks and long life. One trip to the woodpile should do it for the evening.

7641 - Cowhide Log Tote \$22.95

9928 - The Hearth Rug and Log Tote are naturals together.
BUY BOTH AND SAVE \$6.00 \$39.90



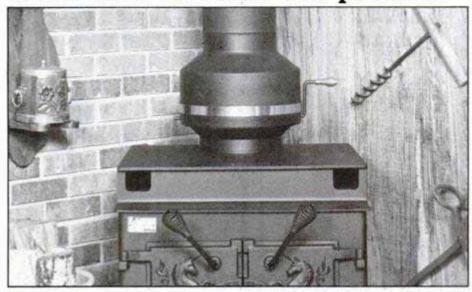
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HOME & SHOP

NEW

Wood stove converter cuts pollution



The manufacturers of the IN-TEN'SI-FIRE wood stove catalytic combustor (\$199.95) claim dramatically increased burn times, greater heat output and a reduction of creosote and other pollut-

ants to nearly zero. The IN-TEN'SI-FIRE installs directly into the flue of virtually all airtight wood stoves. For further information, contact Catalytic Damper Corp., Conway, Ark, 72032.



Quick faucet fix

NIBCO has developed a quick and inexpensive way to fix dripping faucets. Remove the old, damaged cartridge and drop in a replacement (\$1.95). The replacement cartridges repair any of NIBCO's two-handled faucets. They're at plumbing supply stores. By NIBCO Inc., Box 1167, Elkhart, Ind. 46515.



Bathroom phone ideas

A free bathroom decorating booklet, Beautiful Bathrooms/Fabulous Phones, is available from American Bell. Shown here is the Touch-a-matic S telephone with a TeleHelper Speakerphone. For a copy, contact Susan Ames, Bell Home Consultant, Box 2763, Grand Central Station, New York, N.Y. 10017.



European styling

Excel now offers European-style kitchen cabinets at an economical price. The cabinets, called Alpha, feature flushmounted melamine laminate doors, oak pulls, all-metal self-closing hinges and ball-bearing drawer slides. For local availability and price information, you should contact Excel Wood Products. One Excel Plaza, Lakewood, N.J. 08701.



Refillable spray can

Jenni Can is a refillable aerosol can. Add the desired liquid and pressurize, using a bicycle pump or gas station air line. Available in half-pint (\$15.95), pint (\$17.95) and 1½ pint (\$19.95), postpaid. From Unique World Enterprises, Dept. PM, 20 West 485 Ailsworth Ct., Downers Grove, Ill. 60516.



Earth anchor secures small trees

Protect small trees, bushes and trellises from strong winds and vandals with the Duckbill Hercules earth anchor. Each kit (\$9.97) contains three earth anchors, three tree collars, 24 ft. of wire and an 18-in. drive rod to hammer the anchors into the ground. Available at garden and home centers. Made by Foresight Industries Inc., Box 4067, 2114 Pioneer Ave., Cheyenne, Wyo. 82003.

Take the road to flavor.

PALE INGHIS

Raleigh

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

Filter Kings, 16 mg, "tar", 1, 0 mg, nicotine; Lights, 9 mg, "tar", 0, 7 mg, nicotine av, per cigatette, FTC Report Mar, '83.

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The Husqvarna 50 Rancher cuts weekends down to size.

No matter how often a saw is used, it should have the same high standards of quality and performance that professionals demand. That's why the Husqvarna 50 Rancher is built to the same professional standards as all our chain saws.

Besides its easy-to-handle design and excellent power-toweight ratio, the Husqvarna 50 Rancher features electronic ignition. An automatic oiler. An anti-vibration system. Plus a totally automatic, permanently adjusted inertia chain brake. Also, it's easy to start and restart.

The Husqvarna 50 Rancher. Designed to make the nonprofessional work like a pro.

Don't forget. Husqvarna prices have come down. Getting Husqvarna quality won't set you back as much as it used to. In fact, you can buy a tough, rugged Husqvarna for about the same cost as a chain saw of lesser quality. So if you've ever considered owning a Husqvarna, now is the time to get one.

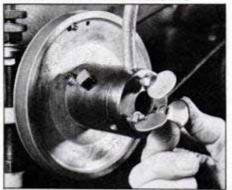
For the dealer nearest you, consult your Yellow Pages or write Husqvarna, 224 Thorndale Avenue, Bensenville, Illinois 60106.





HINTS FROM READERS

Thumbscrew setscrews



To loosen hollow-head setscrews easily when removing the spindle-control capstan arms on a drill press, replace the setscrews with thumbscrews. The 1/4-20 thumbscrews shown were made by brazing steel disks in the slots of hex washer-head bolts. Use thumbscrews for wrench-turned setscrews only when they can be tightened safely by hand.—Walter E. Burton

Soaking a paintbrush



Sometimes paintbrushes become so clogged with paint that they require overnight soaking in thinner to dislodge the deposit. To keep the bristles from curling under the weight of the handle as they rest on the bottom of the soaking container, clamp the brush handle to a scrap of wood that's long enough to bridge the sides of the container. Adjust the paintbrush so the bristles are suspended slightly off the bottom. Add enough thinner to cover the bristles.—Kenn Oberrecht

PM PHOTO HINTS

Darkroom help



Bumping the handle of a negative carrier can mean refocusing. Paint the handle white.—Kenneth Brooks

Jaws



Attach a machine screw to side of alligator-grip light. Then attach a swivelhead tilt-top for double-duty light that holds a camera.—Robert Hertzberg

Forget-me-not

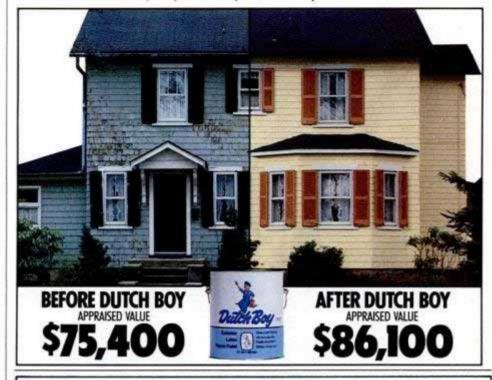


It's easy to forget what film you've loaded. Tape the end flap from film box onto camera.—Bob Brightman

WHEN DUTCH BOY GOES ON, THE VALUE GOES UP.

Three professional appraisers carefully inspected this house. Its average value: \$75,400. Then it was painted inside and out with quality Dutch Boy

paint. And it was appraised again. Average value: \$86,100. Increase the value of your home with long-lasting Dutch Boy Paint.



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known before. Whether you're a pipe smoker or merely wish to cut down on cigarettes, you're invited to take advantage of this unusual offer. After 30 days, if you don't agree that no other pipe gives you the full rich aroma, deep down smoking pleasure and peace of mind only a Carey pipe can give, smash it with a hammer. The trial has cost you nothing. Even the half-pound humidor of tobacco is yours to keep free.

Send for a free color brochure and select the style and shape pipe you want for your free 30 day trial. Mail coupon today or call toll-free.

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Along with a high-tech career comes the highest Navy pay ever. Starting pay is over \$550 a month plus housing, food, medical and dental care, special pay for sea duty, and 30 days' vacation earned each year.

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THE PM WORKBENCH



Steel bottle is super container

Since I'm back on the housebuilding scene (erecting a home that you'll see in PM next spring). I purchased an all-steel thermos that's claimed to be virtually indestructible.

Those who know me are aware that coffee is always nearby and this jug assures that, even during some pretty hectic construction sessions. If you're faced with conditions that might "put the boots" to your thermos, give strong consideration to buying this beauty. Though the thermos has been dropped from the roof more than once, it stays on the job keeping coffee hot for a full day.

The Aladdin Stanley one-quart thermos is \$32 at department stores, sporting goods outlets and hardware stores. Aladdin Ind. Inc., Box 100255, 703 Murfreesboro Rd., Nashville, Tenn. 37210 is the maker.—H.W.



All-steel construction and a five-year warranty makes this thermos suitable for jobsites, campsites and schoolyards.

You won't get bored with these bits

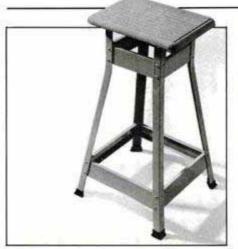
The folks at Omark, who have been making saw chains since your grand-dad was reading PM, are now in the drill bit business. And they picked a fine set of tools with which to make their entry.

The bits—dubbed the X-360—have points sharpened with a second bevel which the maker calls a split point. Result: You can start drilling in most hard materials without the bit drifting as the drill is started.

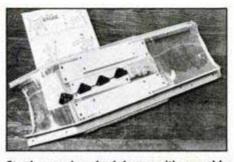
The bits are available individually and in sets (shown).

Write directly to Omark Ind., Credo Div., 2765 National Way, Woodburn, Ore. 97071 for details, including prices and the dealer nearest you.





This sturdy stool is quick and easy to assemble. Angled legs provide added stability.



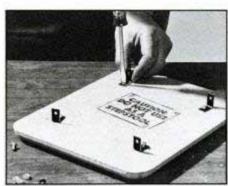
Stool comes knocked-down, with assembly instructions, in a factory-sealed bundle.

Sitting pretty

When I was in need of a lightweight, easy-to-park stool for use at the drawing board in my shop, I recently assembled the version shown here.

It's sturdy enough for a large-sized man to sit upon, yet still light enough for a youngster to handle. Available in five colors, the Work N'Hobby Stool is sold at discount department stores for \$9.95.

It is manufactured by Hirsh Co., 8051 Central Park Ave., Skokie, Ill. 60076.—H.W.



Attach the mounting clips to the seat underside with the screws provided. Then fasten the clips to the steel frame.



If you've come across a new product with some special features, let us know about it. Write to PM Workbench, Popular Mechanics, 224 West 57th St., New York, N.Y. 10019.

You know this girl. She's running for you. And after a lifetime of training all she needs is your support.

In the early hours of the morning you can see her running. She may run 80 to 90 miles a week, hold down a full-time job, carefully monitor her diet - and maintain her family life. Quite a feat!

She's doing it for the ultimate - the Olympics. And for the honor of representing the United States in the Games ...to represent you.

She needs your support.

Her training is costly. So are her expen-ses to travel to the 1984 Olympic Games

in Los Angeles.

The President and the Congress have aided the cause of our young Olympic athletes by passing the Olympic Commemorative Coin Act, designed to provide financial support through the sales of special Olympic commemorative coins.

You can help by acquiring these unique coins.

To celebrate our being the host nation in the 1984 Olympics, the United States Mint has issued for the first time in history three types of coins to commemorate the spirit and excitement of the Olympic Games. And it is the first time in some 50 years that the United States Government has minted a gold coin.

All profits from the coins will go toward our Olympic efforts.

All profits from the sale of these special coins will go toward the U.S. Olympic effort, for training expenses, the ever-rising costs of sending our team to the Olympic Games, and for the staging of the 1984 Games in Los Angeles.

The coins will preserve the memory of that moment.

These exceptionally beautiful silver and gold coins will bring you and your family great pleasure as a treasured heirloom of history and beauty.



Fine artistry of their designs.

The 1983 silver dollar coin (.77 troy oz. silver) has been designed by Elizabeth Jones, the chief engraver at the Mint. The obverse (or front) of the coin represents a dramatic engraving of the classic Greek discus thrower.



THE HOME TEAM

The 1984 silver dollar coin (.77 troy oz. silver) has been designed by Robert Graham, a renowned sculptor from Los Angeles. It will bear a representation of the Gateway to the Olympic Coliseum on the obverse of the coin.

The 1984 ten dollar gold coin (.484 troy oz. gold, 21.6 karats) was designed by John Mercanti, the youngest member of the U.S. Mint engraving staff, from a concept developed by James Peed, a U.S. Mint artist. He has captured the penetrating scene of the Olympic Torch bearers in delicate detail.

These magnificent Olympic coins are flawless gems

They are now being offered in "proof" condition, which involves specially prepared dies and planchets and special multiple striking, resulting in particular sharpness of detail and a flawless mirrorlike surface.

You have three options

You can buy the single 1983 silver coin: the two-coin set which includes the 1983 and 1984 silver coins; or the three-coin set which features the 1984 gold coin, the 1983 silver and the 1984 silver coin.

You can buy several sets. It has been apparent from the first that Olympic commemorative coins have struck a responsive chord among coin collectors, hobbyists, sport lovers and many people who are buying these special coins to give as a "gift of inspiration."

The more coins you purchase, the more you will be helping our fine Olympic athletes. And that feeling of helping and participating in this important Olympic event is a gift to yourself.

Order now!



Mail this form and your payment to: United States Mint, Olympic Coin Program, P.O. Box 6766, San Francisco, CA 94101

	One 1983 Silver Co		Mail coins t	10:			025110001B
Option #2	Two-Coin Set One 1983 and one Silver Coin \$64	1984	Name				
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	1984 Gold Coin \$4	16 1	City		State_	z	ip
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HOME WIRING FIXUPS: Do Them Right

Electrical repairs *must* be done by the book. But they can be easy and will save you money.

BY RICHARD NUNN

The secret of successful electrical work is to respect electricity. Always shut off the power before you start. Pull the fuse, flip the circuit breaker or open the master switch at the service entry panel where the current comes into your house.

Some older houses may have more than one service entry if circuits have been added, so double check to see that the power really is off. How? By using a circuit tester—insert its probes into the outlet—or by plugging in a table lamp. No light and you know the circuit is dead. Double check by touching the black (hot) and white (neutral) wires with a circuit tester after removing the wall plate. Many pros hang a sign on the main service entry warning not to turn on the power.

If you add a circuit or install new wiring, you may need a permit from the building inspector in your town. After the work is done, but before the walls are closed, you may have to get the job inspected. Common household tools can handle most wiring jobs, but a circuit tester and a wire stripper will help.

Replacing a plug

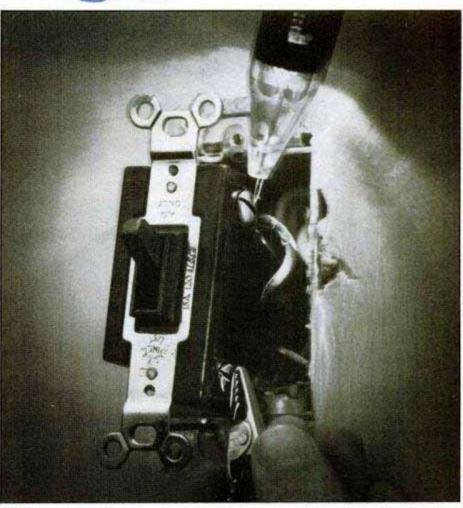
Even though the cord of a lamp or appliance lasts practically forever, rough handling can break the connections inside the plug. To repair it, you can either cut the plug off the cord and put on a new one or junk the old cord and make up a new one.

Always unplug any lamp or appliance before inspecting, cleaning or working on it. Tie an Underwriter's Lab (UL) knot, as shown on page 36, to keep the wires from pulling off screw terminals in plugs and lamps.

To rewire clamp plugs, raise the lever, insert the wires and lower the lever to lock them in place. Specialized plugs come with instructions. Appliance cords, like those on electric irons, often have welded connections and must be replaced.

Rewiring lamp sockets

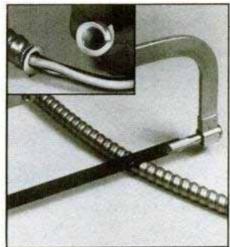
Changing a lamp socket with a failed switch or burned insulation is almost



Battery-powered continuity tester is used to check out a wall switch. With power shut off at the service entry, remove the switch plate and mounting screws so you can bring the switch out of its box with wires attached. With the switch turned on, the tester should light when you touch its leads to the brass (black wire) and silver (white wire) terminals. Tester should go out when the switch is turned off. If the tester does not light, the switch is bad.

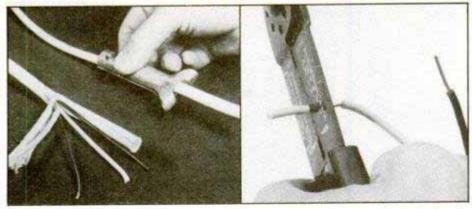


Junction boxes, also called GEM boxes, must enclose and protect all splices, connections, switches, outlets and other in-wall wiring flxtures. Surface wiring boxes are slightly different. This in-wall wiring junction box has removable ends so two or more boxes can be ganged to make one larger box.

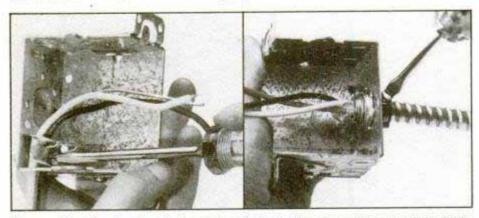


Cut metal-armored BX cable by hacksawing through the two coll wraps at an angle. Break the sawed cable to expose the wires, which are then cut with snips. Insulators protect conductors from sharp cable end.

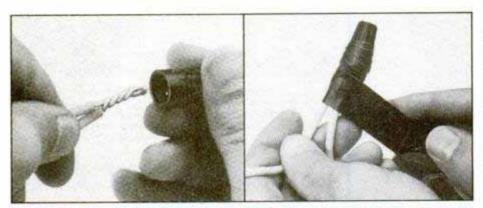
HOME WIRING FIXUPS:



Cut back BX or plastic sheathing about 6 inches with a utility knife or special plastic sheathing cutter (left, top). This will free the wires for stripping with a hand tool (right) that also cuts wires and screws, in addition to crimping solderless terminals.



The round junction-box knockouts can be pried out with a screwdriver to admit plasticsheathed cable (small size) or armored BX (large). Inside the box, clamp plastic cable (left) or secure BX with special fittings (right) over the red insulation protector.



A solderless connector joins two wires inside a GEM or other junction box. Twist the stripped wires together (left) and screw the connector down tightly to make the splice. Wrap the connector and wires with insulating tape (some codes require friction tape).

the same as rewiring the lamp. Take the lamp apart and run a new wire through it before connecting the socket. Replacing the socket is a straight swap.

If the insulation sleeve is the only defective part, check the terminals for tightness and replace the sleeve.

Two-socket lamps should have both sockets replaced even if only one is bad. Parts come as an assembly. But two-socket lamps wired independently so each bulb turns on and off with the same switch can have either socket replaced separately.

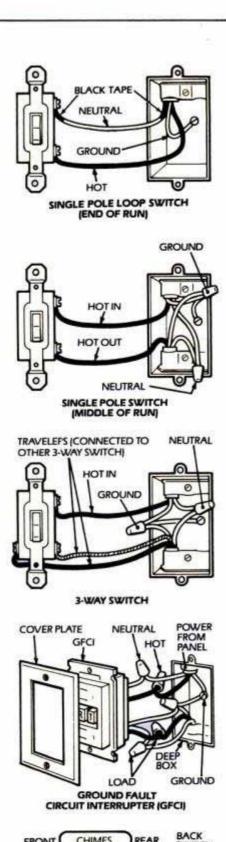
Three-socket lights can have their

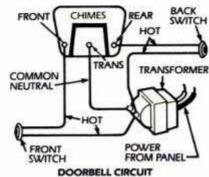
sockets replaced one at a time. Follow the wiring as installed originally. Lamp switches that are not part of a bulb socket come prewired. Install them by cutting out the bad switch and hooking up the new one with solderless connectors and tape.

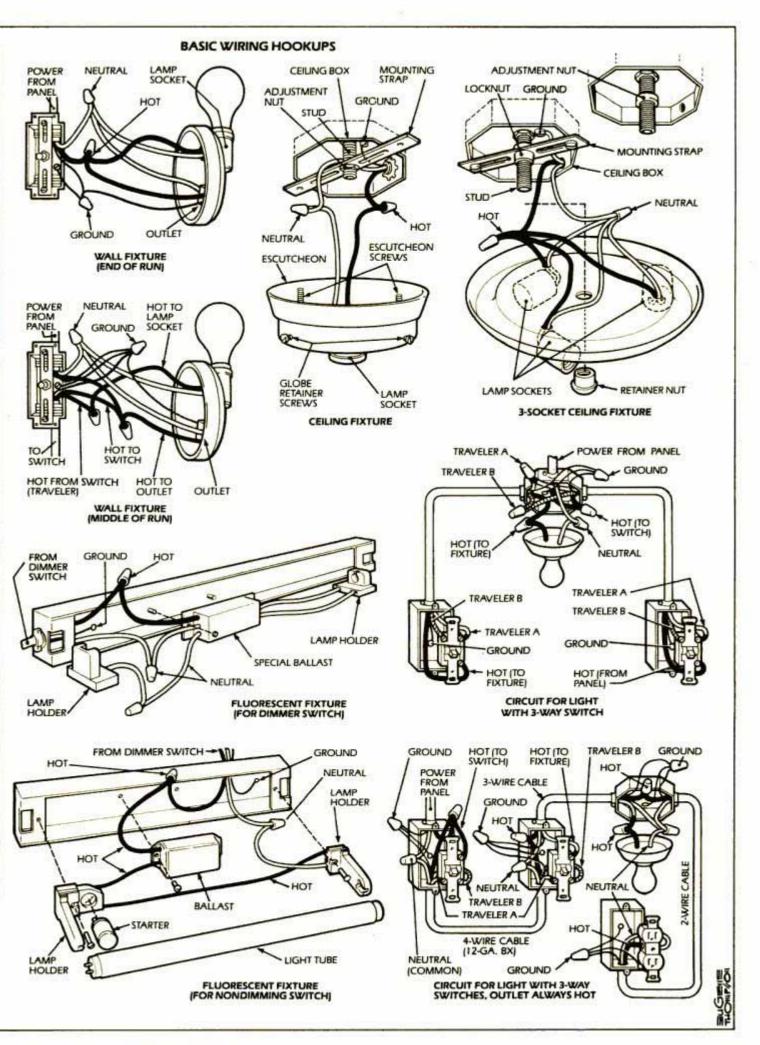
Changing wall switches

Wall switches, like all other house wiring junctions and controls, are mounted inside protective boxes. Before removing the switch cover plate, shut off power to the circuit.

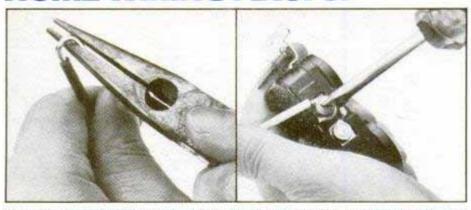
Get an identical switch for the one



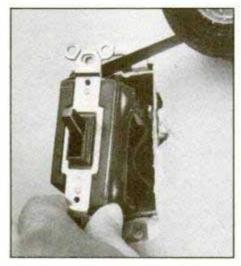




HOME WIRING FIXUPS:



Bend the stripped-wire end into a hook (left) by gripping it with long-nose pliers and twisting. Hook the wire around the terminal screw (right) so that as the screw is tightened in a clockwise direction, the wire will wrap tighter around the terminal.



Wrap the switch or other fixture in insulating tape after connecting the wires to prevent shorts when inserting in box.

you must replace. Single pole switches have only two terminals and control a light from one point.

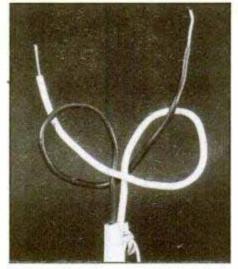
Three-way switches let you turn a light on or off from either of two points. They have four terminals: two for the switch, one for a traveler wire taking power to the other switch, and a metallic ground.

A four-way switch controls a light from a third location working with two three-way switches. It has four brass terminals, all of which accept traveler wires to the two three-way switches, and a ground.

Front-, side- and back-wired switches are the same except for terminal location. Some back-wired switches have spring slots (you poke the wire into the slot to make the connection) instead of screw terminals. These are only for use with copper wires. Do not use them with aluminum wires.

Changing receptacles

Like wall switches, outlets and receptacles are in wall boxes protected by cover plates. Replacing one is almost the same as replacing a switch.



Tie a UL knot in lamp and wall plug cords to keep the wires from pulling off terminals.

A single outlet usually has three terminals: brass (hot), silver-colored (neutral) and green (ground). A double outlet has five terminals: Four power the outlets and the fifth is a ground wire (green).

Changing a ceiling fixture

A ceiling fixture is simply an overhead wall box, except that it has a support bar. To work on the fixture, shut off the power, remove the decorative nut at the bottom of the escutcheon and lower the fixture from the ceiling. Support it on a wire hook made from a coat hanger to keep the strain off the wires. Disconnect the wires, remove the old fixture, connect the new one and remount it on the stud with the escutcheon nut.

Installing a dimmer switch

Procedures for putting in a dimmer switch vary for different kinds of lights. Special installation instructions come with the dimmers and should be followed exactly. Fluorescent dimmers replace the ballast resistor in the fixture as well as the switch.

Three-way switches

You can't simply replace two single pole switches with three-ways to get two control points for the same light. You need a third wire, called a traveler or messenger, to carry power between the switches. But, if the traveler is not in the wall cable, installing one can be more trouble than the job is worth.

Changing an existing three pole switch is a straight swap. If you put the hot lead on a traveler terminal, the switch won't turn off. Cure this by moving the hot wire to the hot terminal.

Ground fault interrupter

Many modern houses have ground fault circuit interrupters to reduce shock hazard in the kitchen and bathroom. A GFCI detects current leakage in a hot wire and instantly trips a circuit breaker to prevent electrical shock. Should an appliance short out and charge the housing, a GFCI protects you if you touch it.

Installation in an existing line should be made near the main service entry. The GFCI protects only downstream outlets. After killing the power, cut into the line and install a standard box. The GFCI has four wires which splice onto the conductors. Follow the instructions supplied with the unit. Push the RESET button to set the GFCI. Then hit the TEST button to make sure it's working. If the appliances on the line have no power, first reset the GFCI, then check the fuse or circuit breaker.

Fixing doorbells

Most doorbell or chime problems lurk in the outside pushbutton. It's exposed to the weather and is apt to corrode. Test the button by bypassing it. Kill the power, remove the button and disconnect one wire. Restore power and touch the loose wire to the other wire. If the bell rings, replace the pushbutton. Bells have low-voltage circuits powered by a transformer. Check for power to the transformer. If there is none, look for a fuse or resettable breaker. Replace a bad transformer.

If the bell won't stop ringing, there's a short in the wiring. It may be easier to run a duplicate line than to find and fix the short in the original.

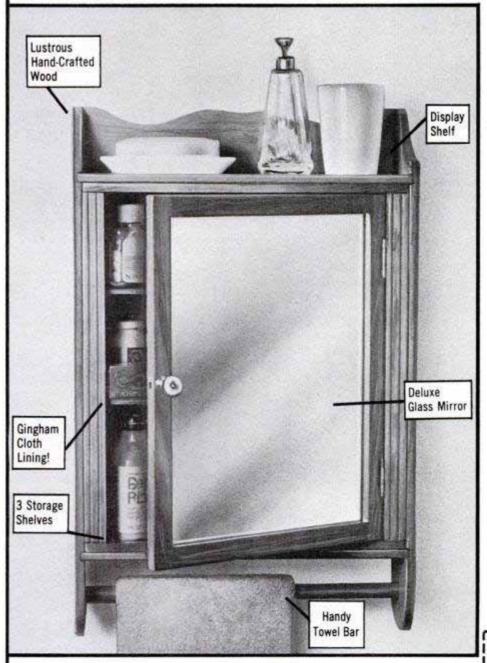
Outdoor outlets

Adding an outdoor outlet or replacing one is similar to indoor work. However, you must use special outdoor fixtures with rubber gaskets and waterproof cover plates that are shock-protected by a GFCI. Use UF sunlight-resistant Type TW outdoor cable buried at least 18 inches underground to power the outlet. It should be supported at least 18 inches above grade using metal conduit with a fiber bushing and a cement block set in concrete.

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THE PM GARAGE



Eliminating knocking problems

Engine knock is a problem that plagues many drivers. Knocking or pinging is not only annoying, but severe cases can cause engine damage. Knock is

Vara-Jection kit contains electronic module, tank, hoses and all of the necessary wiring.

most often caused by low-octane gasoline, road conditions (such as hills), combustion chamber deposits and turbocharging.

Edelbrock's Vara-Jection system is a method of monitoring an engine's vacuum pressure and rpm, then injecting a water mist directly into the carburetor. The water mixes with the gasoline to enhance fuel burning and reduce knocking.

Vara-Jection is a complete kit that's easy to install. We put it on a friend's van in a few hours one Saturday afternoon. He can now use regular gas with no pinging, and the van seems to have more power under load in hilly terrain, where he had had problems in the past. The kit retails for about \$90 at most speed shops. For information, contact Edelbrock, 411 Coral Circle, El Segundo, Calif. 90245.—Joel Breault

Truckbed liner

It's hard to keep the bed of your pickup from getting all beat up if you do any kind of serious cargo hauling. The Duraliner will protect your cargo box. sidewalls and tailgate from signs of abuse. The unit features one-piece seamless construction, and will withstand extreme impacts. It will not become brittle at -60° F. It's \$299.95 for domestic pickups, \$279.95 for imports, from Durakon Inc., Box 694, Grand Blanc, Mich. 48439.

—Mike Lamm



Dings look bad enough and also invite rust. Duraliner provides good impact protection.

Plug hole fixer

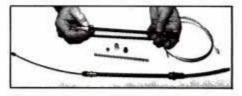


After reaming out damaged sparkplug hole threads, hammer in insert with special tool.

Heli-Coil, the company that pioneered coil spring thread repair inserts, now has a kit to repair stripped or damaged sparkplug threads on aluminum cylinder heads.

The kit works with both gasket and tapered-seat sparkplugs. First you screw the tap reamer into the damaged threads, which enlarges the hole for the insert. Then you hammer in the insert with an installation tool, as shown above. Teeth on the insert ensure a secure fit. Heli-Coil, Shelter Rock Lane, Danbury, Conn. 06810, sells the kit through auto parts stores for about \$25.—Paul Weissler

Brake cable kits



Adjustable brake cable kit allows you to tailor length and fittings for your car.

Ever try to order a parking brake cable? There are more than 1.300 of them! No store stocks them all. Canadian Jean-Paul Dussault has solved the problem with an adjustable replacement cable kit. Only 24 kits cover 1,300 car models. Tell the dealer the make and year of your car, cut the cable to the required length and screw on the selfthreading end fittings. Prices range from about \$15 to \$28. The kits, branded ABSCO, are marketed in the United States by Mercier Electronics Corp., 810 South Hampton Rd., Westfield, Mass. 01085. Write to Mercier for more information.-Paul Weissler

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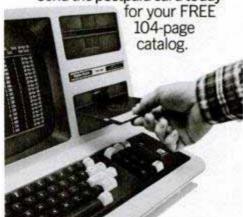
TRS-80 is a trademark of the Radio Shack division of Tandy Corp.

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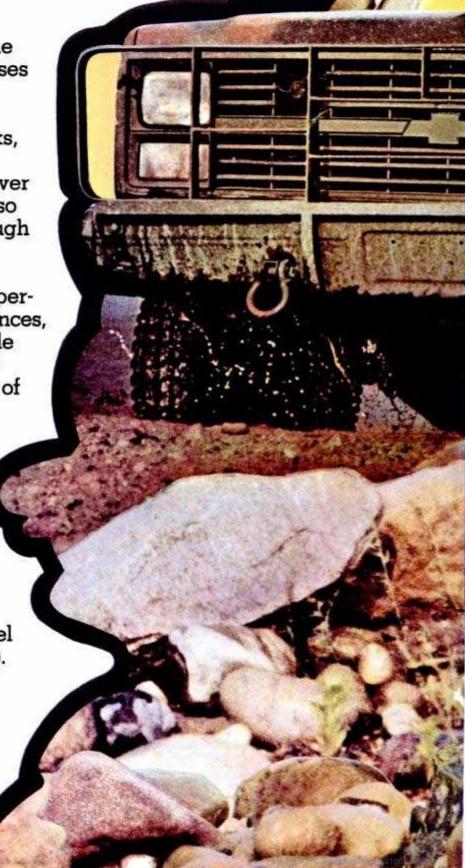
These vehicles will serve as personnel/cargo carriers, ambulances, command vehicles and mobile communication units. Before they were accepted, a group of vehicles was put through rigorous in-the-field endurance tests.

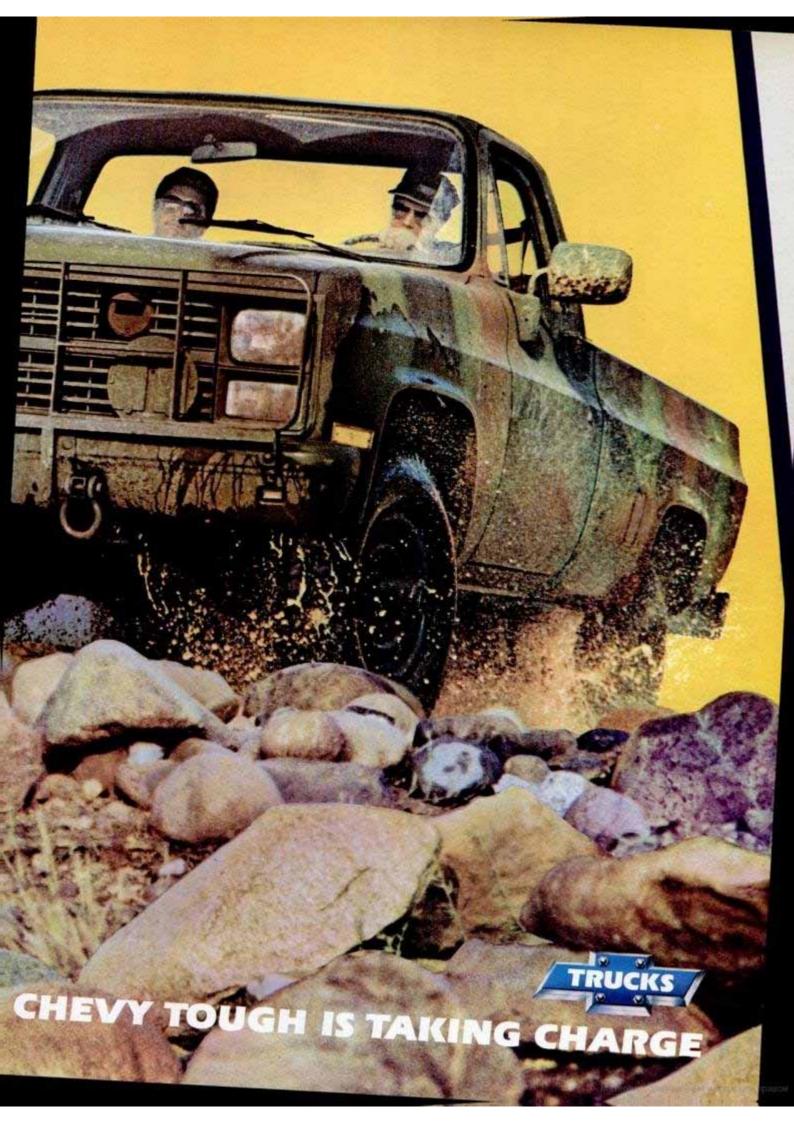
They're regular production Chevy trucks.

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PM ELECTRONICS MONITOR



Phone rates that are as high as an elephant's eye

Robert Braver, a 16-year-old in Norman, Okla., is, in his own way, a pioneer. In Norman they root for the Sooners—a football team named after the wagons that brought pioneer forefathers west. But while the original pioneers only had to worry about Indian attacks, sickness, and running out of food and water, Robert has been tromped on by a far mightier force—Oklahoma's Southwestern Bell.

Robert runs a popular electronic bulletin-board system on his TRS-80, Model 1 computer system. He even wrote his own software which enables other people to call his computer, leave messages and read messages from other people. To do this requires that Robert hook his computer to the phone line via a device called a modem.

Robert's problem arose when he called Southwestern Bell to ask for help in tracking down some annoyance calls that had been made to his system. Southwestern Bell couldn't help him there, but they did find a tariff regulation, passed in 1966, which enabled them to raise his phone bill from \$9 to \$45.90 a month.

The moral might seem to be never call the phone company—but this action is, we think, so threatening to the very fabric of this country's technological future that it hardly bears joking about.

Modems and the future

Modems are, now, one of the most popular accessories to buy for a personal computer. With a modem you have access to literally thousands of services. People with modems attached to their computers can call small systems such as Robert's or large networks such as Compuserve and The Source. Hundreds of thousands of computerists of all ages are using modems to do everything from electronic mail to shopping and banking at home, joining computer clubs and generally plugging into the most exciting new revolution in communications since Gutenberg.

As more and more computers become available, it is likely that almost every home in America will someday have a modem. And, according to Southwestern Bell, a phone company should be entitled to a tariff on these modems.

Should they be? We don't think so. According to Southwestern Bell, the 1966 tariff was originally passed to apply to businesses using the phone lines. Now, according to their spokesperson, the tariff may also be applied to computer enthusiasts. The rationale Southwestern Bell's Debbie Michaels gave is that modems "tie up lines."

Back in 1966, more than a decade before the personal computer, a modem required a special "data-grade" line. But today's personal computer modems operate just fine on normal 'voice-grade" lines. So, while back when the tariff was passed there was an expense the phone company had to recoup, there is no such expense today. And, while some computerists may indeed modem away for hour after hour, the majority do not. If you call a network, you are billed an hourly charge of from \$5 to well over \$100. If you call an out-of-town bulletin-board system, you must pay all long-distance rates.

The phone company may complain that Robert, for example, was "tying up" their phone lines. But then, how many people in Norman generate calls from as far away as Hull, England?

And, as Compuserve's Rich Baker pointed out, "It's not fair for the phone company to single out users of modems." In other words, there are probably more teen-agers tying up more phone lines than there are modems.

So the tariff seems to be asking people to pay more money for no additional services in order to offset arguably nonexistent, inapplicable or unfairly calculated expenses.

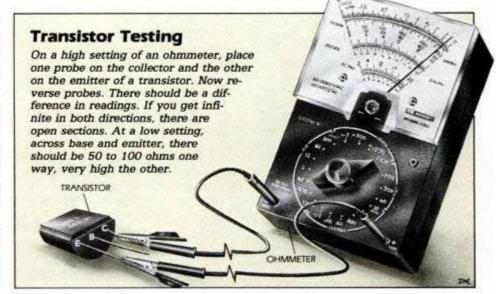
The coming fight

We talked with Pat Petree at Oklahoma's Corporations Commission, the regulatory body overseeing the phone company. He told us that, as things stand, Southwestern Bell is within their rights to apply the tariff.

Asked to comment on whether the tariff seemed fair, he replied the commission must have hearings to decide that, and that right now he didn't "know what a computer is, or a modem." He will likely find out soon.

Robert plans to appeal the decision but has decided for now to pay to keep his bulletin board running. (You can reach his system at (406) 360-3020). Meanwhile, he and other members of OMUG (Oklahoma Modem Users' Group at Box 5981, Norman, Okla. 73070) are attempting to raise a legal fund to fight Southwestern Bell.

The outcome of this fight will someday have a direct impact on just about everyone. At this point, the wagons are just beginning to form a circle.



PM SOFTWARE MONITOR



It's more than a nightmare



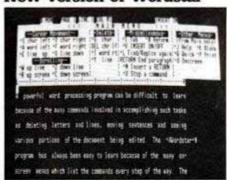
A map and counters are used to keep track of your robots when playing Suspended (above). In this text-style adventure, you must save the world by fixing its computers.

In the world of the future a sleeping man is king. The man who is chosen is stored, in cryogenic suspension or frozen sleep, deep in the underground vaults that house a Utopian society's complex computer systems. Should anything go wrong with these computers, which control everything from the weather to traffic patterns in the world above, then the frozen king will awaken—and it will be his job to find out what went wrong and learn how to fix it. Drafted into this somewhat less than enviable position, you one day awake to the clamor of loud alarms, and the coldness seeps gradually from your limbs. The computers are down. It is up to you to fix them. Should you fail, the police will arrive with your replacement, and they don't replace a live failure. So, even if you're less than thrilled with this society which condemned you, you will do your best to save it.

You cannot go physically into many of the areas in the complex. But you do have six robot servants, all with different personalities and powers that are yours to command. To keep track of the robots' locations you have a mapboard and counters. Your orders are input through the keyboard of what looks very much like an ancient personal computer (just about any of the ones popular in the old days of the mid-1980s). The screen shows you each robot's conversational response. But it's up to you to figure out how best to use the robots to solve the puzzle.

From Infocom at \$59.95 on disk, Suspended is one of the most extraordinary adventure games on the market.—N.S.

New version of Wordstar



Menus in Wordstar are helpful lists of commands. Main menu is on white background.

A powerful word processing program can be difficult to learn because of the many commands involved in accomplishing such things as deleting letters and lines, moving sentences and seeing various portions of the document being edited.

The Wordstar program from Micro

Pro has always been easy to learn because of the many on-screen menus which list commands at every step.

The newest version, the 3.3, continues the menus and adds function keys for the IBM PC and Apple IIe (with Z/80 CP/M card added).

These function keys allow you to define a command, which might take many keystrokes, as just one key. The IBM PC, of course, has its own separate function keys on the keyboard. The Apple IIe, on the other hand, has no function keys as such. So, on the Apple, the top keys (numbers) are treated as function keys if the Apple's special closed-apple or open-apple keys are held down. On both computers the function keys can be redefined. This new version may be available for other computers by the time you read this.

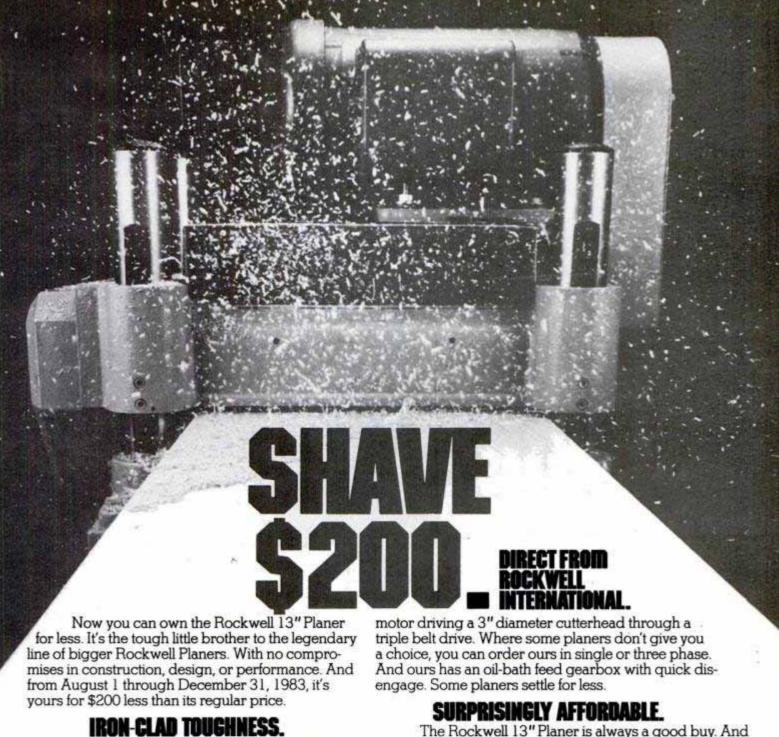
Wordstar is just about the most powerful word processor you can buy. Now, it's even easier to learn and to use.—N.S.

In the arena



Seen from directly overhead, two gladiators clash and fight in the game of *Bliestoad*.

Bilestoad from Datamost (\$39.95 for the Apple II) is an exciting new game of personal combat. Two futuristic gladiators, seen from directly overhead, may be manipulated by two humans, or one may fight the computer's champion. It's the best and most colorful such item that we've seen.—N.S.



Consider our construction. Where some planers use cast aluminum, we use high-tensile cast iron. So the Rockwell 13" is heavier. More stable. More accurate. And much more durable. Yet, at 290 pounds, it's still light enough to move to a job site.

A REALLY SMART HEAD.

Now consider design. Unlike some other planers, our table remains stationary while the head adjusts up or down. Faster and more sensible, especially when feeding long stock.

NON-STOP POWER.

Regarding performance, the Rockwell 13" has a constant-duty induction

CUTS STOCK UP TO 13" x 5.9" x 3/16".

FEED RATE: 13 ½ fpm.

CUTTERHEAD SPEED: 4500 rpm.

MOTORS: 2 hp, 16 or 3 hp, 36.

The Rockwell 13" Planer is always a good buy. And now through December 31, 1983, you can make a good buy even better with a \$200 rebate check direct from Rockwell International (good on Models 22-651 and 22-655).

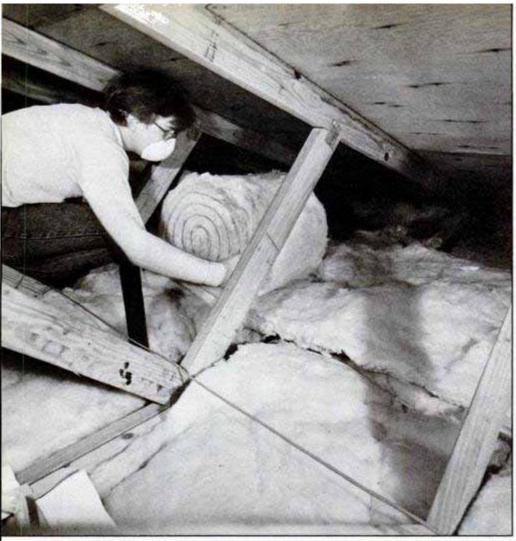
To find out how to get your rebate check, see your Rockwell distributor or call Rockwell Power Tool

Division toll-free 800-438-2486 (in PA 800-438-2487) for more details.





...where science gets down to business



The attic floor is one of the most important areas to insulate to retain rising heat. We put additional fiberglass insulation perpendicular to the trusses so there were no gaps.

Buttoning Up An Energy Sieve

We chart the progress of one do-it-yourselfer as he makes his home more energy efficient.

rom the standpoint of energy conservation, this sprawling 4,000-sq.ft. ranch house had little going for it. It was an all-electric house when electricity costs were at an all-time high. It had a 70-ft.-long hallway running its length which acted as a wind tunnel, and cathedral ceilings in the living room and master bedroom. The seven-bedroom house rested on a cement slab, except for a bedroom in the west corner built over a basement.

Your home may not be in such dire straits. However, some of the solutions for cutting this homeowner's astronomical heating bills may work for you.

The first step to conserving energy is to have an energy audit. This points out places where energy is lost, and ranks the practices and measures you should take in order of their cost effectiveness. We asked two energy auditors to look at the house and offer suggestions for saving energy. One is an auditor at Jersey Central Power and Light Co. (JCP&L) and the other is a construction consultant.

Inexpensive practices

The auditor from JCP&L went through a checklist of possible energy-wasting areas. The first part of the list involved energy-conservation practices—low-cost or no-cost steps you can take yourself to reduce energy use and costs immediately.

Practices that could be adopted by this homeowner were: reducing the water heater temperature to 120° F. (the dishwasher had a temperature booster to further heat water), install-

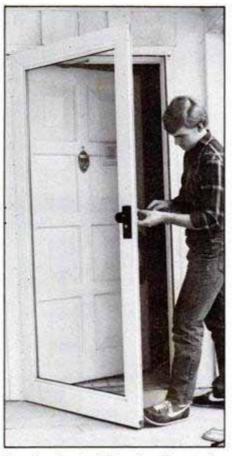
(Please turn to page 50)



To close gaping holes, foam sealant worked the best, but it was hard to control in narrow confines. To seal smaller leaks at windows and doors, we used caulk in a gun.



A magnetic strip on the frame of this interior storm window is attracted to a selfadhering steel strip around the primary frame. This keeps the storm in place.



To reduce heat-cold transfer, the exterior and interior surfaces of this storm door frame are separated by a polyurethane barrier. The glass panel is double-glazed.

Save Gas, Save Engine with 'POLY'

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

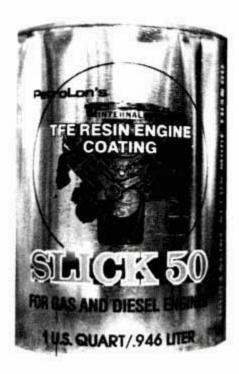
WHAT IS POLY? "Poly" is short for polytetrafluoroethylene (TFE). It is the slipperiest substance known to man (1981 Guiness Book of World Records, p. 188). The Petrolon Corporation, makers of Slick 50, has invented a way to permanently bind this slippery chemical to your engine with one treatment. All 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, lab tests at a leading university 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 tor-



ture test overseen by the Automotive Services 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? Your actual benefits in percentages may vary, depending on the kind of driving you do, vehicle condition, weather, and geographic area. By reducing friction, Slick 50 does all of the following: It increases gas mileage. 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.

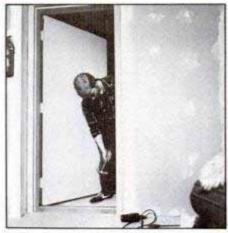
For purchase or further information, call toll-free 1-800-525-8624 (in Colorado call 1-303-762-1385) or send to SLICK 50, 3148 S. York St., Englewood, CO 80110.

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ENERGY SIEVE

(Continued from page 48)



Replacing a hollow-core door leading to the garage with this insulated steel door will help retain heat indoors. We also moved entry out to gain interior space.



Foundation insulation is applied to reduce heat loss through the block. Since the insulation was thicker than the siding, we added protective top trim.

ing water-flow restrictors on shower heads, installing insulation behind electrical outlets and switch plates, and adding an insulation cover over the attic stairs. A faucet leak, small as it may be, is an energy waster. A leak was repaired with a new washer. Dusty baseboard heaters which impede operating efficiency were vacuumed.

Other low-cost practices that didn't pertain to this household, but may to your family, include lowering the thermostat to 55° F. when your family is out of the house for four hours or more. Also, consider reducing the oil burner firing rate to the proper level after you've made your home more energy conservative by sealing the house shell.

Measures that pay off

A prepared list of energy measures to reduce heat loss and cold air infiltration through the roof, walls, floor, windows and doors was checked by the utility auditor. A chart showing the energy-saving steps we took is on page 52. It includes the approximate payback time of each step.

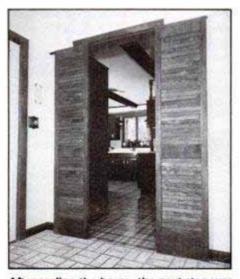
The addition of a solar water heater



An uninsulated north wall is protected easily with rigid insulation installed over the drywall. Gypsum wallboard at least ½ in. thick must cover the insulation.



This attic stairs cover (mounting frame included) zippers shut to seal off the attic opening. The cover prevents warm air from leaking out of the house into the attic.



After sealing the house, the next step was to divide it into three heat zones separated by doors. This pair, placed in a high-traffic area, slides open for safety. We also used swinging and bi-fold doors of the same type. Although the doors are solid wood and effectively seal off an area, the louvered look lightens their appearance.

at a contractor-installed cost of \$5,150 for a 9½-year payback was the only improvement suggested by the utility

(Please turn to page 52)



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2020.	MERCEDES-BENZ 25 MERCEDES-BENZ 68			A Company	\$12
308 1	MERCEDES-BENZ 35	0.450 7	1.80 to: 350%, 450	SE SE SE SE	\$121
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951	MUSTANG 79-82 co- NOVA, CHEVROLET 7	1-79 cow	ers all models		\$12
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				SC 4 911T	\$12.
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CORPORATION INTRODUCES...



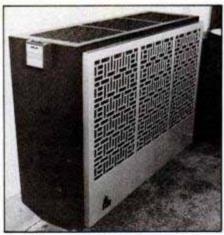
THE QUICKER UNSTICKER, THE BETTER PROTECTOR

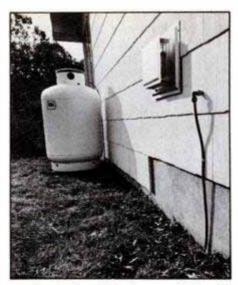
Endless uses for the home, auto, workshop, farm, boat and sports equipment.

- Frees sliding bolts.
- Turns keys in locks.
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- · Keeps mowers mowing.
- Keeps spreaders spreading.
- Keeps sprinklers turning.
- · Dries moist ignitions.
- Lubricates linkages, pedais & door handles.
- · Cleans and protects guns.
- Keeps ski bindings working.
- Unsticks lug nuts.
- Protects metal against

ENERGY SIEVE

(Continued from page 50)





At left is a vented LP-gas (propane) heater that works quietly and cleanly to provide heat in a corner bedroom of the west wing. The exterior setup at right shows the exhaust vent and the propane tank, which are positioned a specified distance from each other. The gas line goes through the house wall and is buried to avoid damage.

auditor that we didn't make. Due to budget limitations, this homeowner decided to concentrate first on tightening the shell of his home.

The construction consultant suggested sloping the earth away from the house on all sides. This would keep out water and moisture to help the heating equipment function properly. He also suggested adding foundation insulation to the north and east sides, and caulking, from inside the house, the joint between the top of the basement wall and the wood floor framing.

To better control heat, the consultant suggested zoning the home into three areas: the central living area including the kitchen, living, dining and family rooms; an east bedroom wing; and a west bedroom wing. These three zones were separated easily by adding doors at both ends of the long central hall.

We added a fireplace insert in the

central zone for its greatly increased wood-burning efficiency. A vented propane gas heater was installed in a bedroom of the west wing. The use of spot heating from portable heaters was another energy saver.

Now that the house shell has been made more energy conservative, ventilation must be introduced. In many homes, this can be done automatically with fresh air transported by a duct system. But this homeowner opens windows and doors for short periods on a regular basis each day.

At some point, the present water heater, located in the center of the house, will be replaced with two water heaters installed in the attic. One will be placed over each bedroom wing. The water heater nearest to the kitchen will service it. This will eliminate the inefficiency of heated water traveling long

(Please turn to page 190)

ENERGY CONSERVATION STEPS

	Approximate	First-Year	Time To
Measures	D-I-Y Cost (\$)	Savings (\$)	Payback
Caulking	50	262	2 mo.
Weatherstripping	20	35	7 mo.
Interior storm windows (north and east)	230	53	41/5 yrs.
Steel entry door	196	30	61/2 yrs.
Attic insulation (R-30)	600	149	4 yrs.
Wall insulation (interior north wall)	100	30	31/s yrs.
Basement ceiling insulation (200 sq. ft.)	60	40	11/2 yrs.
Foundation insulation	400	100	4 yrs.
Water heater insulation	15	30	6 mo.

Inexpensive Practices

Insulators on all outlets and switchplates located on exterior walls.

Attic stairs cover for attic opening.

Energy-Related Improvements

Storm doors (two) on front and back of house to reduce wind gusts entering the home. Three pairs of solid, louvered-look interior doors to zone the heating areas.

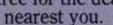
LP vented (propane) heater in heat zone 1. Fireplace insert in heat zone 3.

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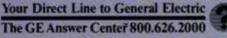
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For 1984, there's even more rust-fighting galvanized steel surface in a full-sized Dodge pickup than ever. 332 sq. ft. in all. 14% more than Chevy. And a full 53% more than Ford.

But as far as we're concerned, even that isn't protection enough.

So, we also wash our trucks in phosphate and rinse them in acid for additional corrosion resistance.

We're tough on rust. One reason why 92% of all Dodge trucks built in the last ten years are still on the road.

AND AMERICA'S LONGEST, NO-EXTRA-COST FACTORY RUST-THRU PROTECTION TRUCK WARRANTY.†

When you're this tough on rust, you can back your truck with this tough an outer body rust-through warranty:

Five years or 100,000 miles, whichever comes first.

Extensive use of galvanized steel in critical areas makes Dodge tough on rust.

There's 332 sq. ft. of galvanized steel surface in short-wheelbase Dodge pickups. And 362 sq. ft. in long-wheelbase trucks.



EPA EST MPG 18 HWY 26

Use EPA est, mpg to compare. Your mileage may vary with speed, distance, weather. Actual hwy, mpg & CA ests, less, 'R. L. Polk & Co. registrations through 7/182.

BUCKLE UP FOR SAFETY



Not I

Four Tool Kits That Work

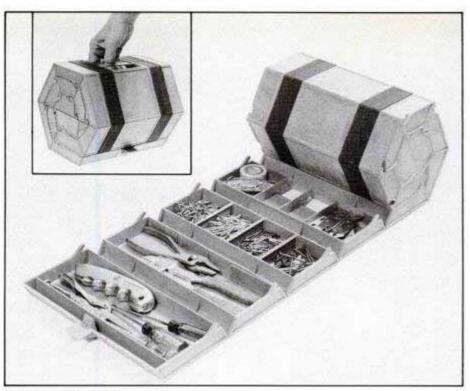


Tool roll and pouch

This 20-pocket canvas tool roll in a vinyl-lined zippered pouch is designed for storing wood chisels and other carving tools. One end of the tool roll is sewn into the pouch so the tools fold away safely. This prevents the cutting edges from becoming nicked or rusty. Excluding the tools shown, the roll and pouch sell for \$34.95 postpaid from Garrett Wade Co., 161 Avenue of the Americas, New York, N.Y. 10013.



This top-grain leather tool bag holds a small assortment of tools, such as those often kept in a car trunk or boat locker. The bag measures $5 \times 6 \times 15$ in. and features two all-leather handles and a shoe-sole leather bottom with four nick-le-plated feet. Two interior pockets can hold odds and ends. It's \$36.70 post-paid from Brookstone Co., 695 Vose Farm Rd., Peterborough, N.H. 03458.



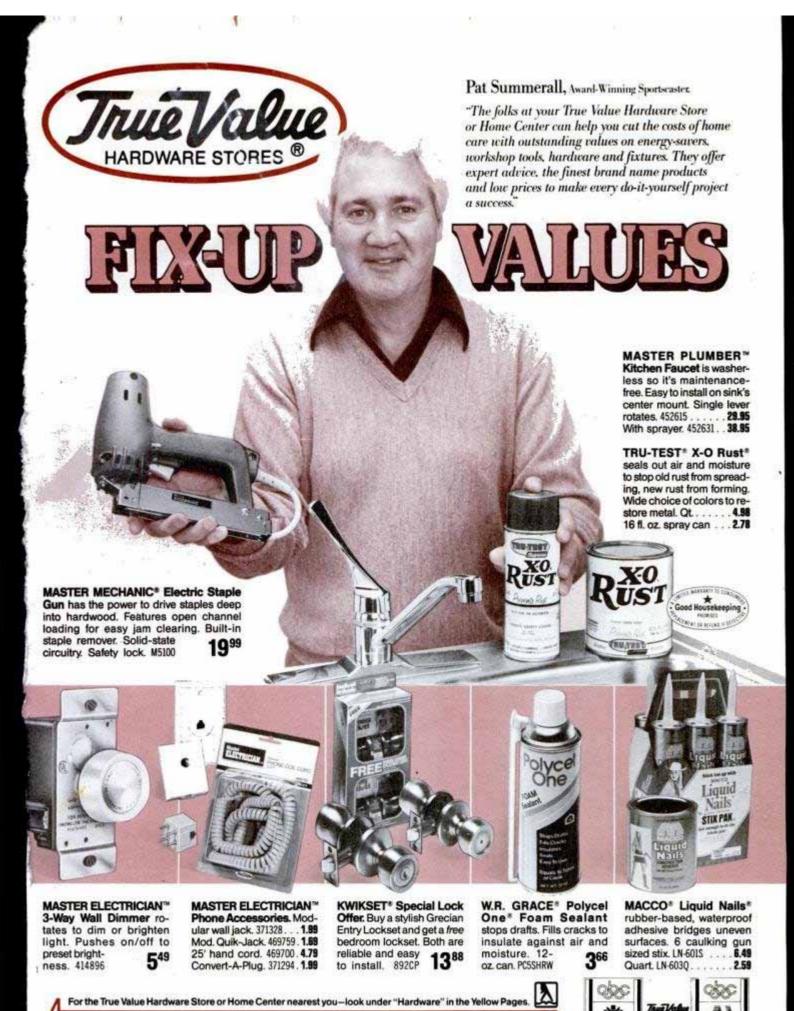
Roll-out tool kit

The Rolykit is a 14-compartment, polystyrene storage case made for holding hand tools, hardware and other small parts. Two permanently attached canvas straps and the clever interlocking case construction allow the kit to be rolled up to a compact $6\frac{1}{4} \times 11$ in. without the contents of one compartment spilling into another. It's from Specialty Items Distributing Inc., 1820 Jasper, North Kansas City, Mo. 64116, and is \$32.45 postpaid. An 11-compartment kit is \$27.45 postpaid.



Combination tool case and overnight bag

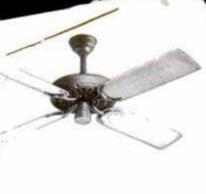
The Overnighter is a dual-purpose carrying case that has two separate locking compartments: one for tools, one for clothes. The case measures $12^34 \times 17^34$ in. and features a vinyl-covered hardwood frame and solid brass hinges and locks. The tool side is 4^14 in. deep and the clothing side is 2^5 % in. deep. Without the tools shown, the case sells for \$109 postpaid from Jensen Tools Inc., 7815 South 46th St., Phoenix, Ariz. 85040. With the tools, it's \$383 postpaid.



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TRUE VALUE® Quartz Electric Fan-Forced Heater has 2 reflectors for wide-angle heating, 1500/750W settings, auto. thermostat. HR80Q 4488 INTERTHERM* Portable Baseboard Heater safely circulates hot water heat. 750W unit warms at 2550 BTU/ hr. Thermostat. NP750 **79**99

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16⁹⁹ 2⁷⁹



ALADDIN* 9,600 BTU Kerosene Heater heats for 17-22 hours on 1.2-gal. fuel. Automatic ignition/extinguish. Almond finish. 03810 118

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ALADDIN* Heater Fan, 2 speeds, increases warm air circulation, mounts on most radiant heaters. Brown epoxy finish. HF183

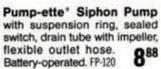
MET PRO® Breathe Easy™ Filter for radiant and convection kerosene heaters cleans and purifies air while reducing emissions. Installs in minutes. CF2001

CFP* Kero-Aid* Kerosene Treatment totally disperses water, reduces odor and carboning of wick for more complete, cleaner burn. 8 oz. treats 80 gallons. 7181-1

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DEFLECT-O* Air Deflector improves circulation from central forced air heating. Attaches with magnets. Adjusts 10-14*. 2-pack, 1022



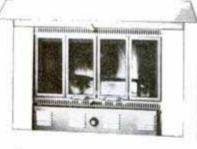
POLO* Electric Oil-Filled Radiator with air sensitive thermostat is safe for small children. 600/900/1500W, portable. 7815



NAUTILUS* Heater/Fan/Light
Unit for the bath has 2-motor
system, 1430W fan-forced heater.
Fits 4" rd. duct. Unbreakable grille. N655
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EMERSON* Ceiling Fan has 4-speed reversible motor, pullchain control. Real wood blades. Brn. or Antique White 14995 with brass. CF4152/W 14995 FIRST ALERT* Safety Kit includes smoke detector and 5 B.C. dry chemical extinguisher to fight grease, oil and electrical fires. SA67EXT 1999

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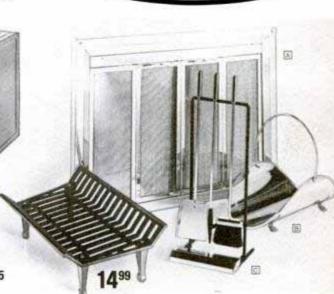
WESTBEND* 2-Speed Humidifier with refill light, water gauge. Lift-out power pak and removable water reservoir. Automatic shutoff. 2,500-sq. ft. capacity. 4022

WESTBEND* Humidifier with waterwheel moisturizing action, 2-speed fan, auto. humidistat. 2,500-sq. ft. capacity. Directional airflow, 9½-gal. reservoir. 3027 14999



MARTIN® Wood-Burning Heat Circulator has automatic thermostat, cast iron grates, rotating shaker, flue collar. Louvered top and stay-cool handles. 8802B 34995

MARTIN* Gas Heater with oxygen depletion sensing system provides clean, safe, efficient zone heating. Warms at 20,000 BTU/hr. Safety pilot. C1720 179⁹⁵



PORTLAND* Fireplace Accessories.



ENERGAIRE® Duct Booster forces more air into hard to heat or cool areas to lower utility bills. Fits 5" round, 314" flat ducts. EA-5



EMBERGLO® Gas Space Heater needs no flue installation. Oxygen depletion shutoff. 3 heat settings. 1575LP.... 168.95 Space heater. 1575NA.... 168.95



MAGIC HEAT™ Waste Heat Circulator installs in flue of any heating unit. Thermostatically controlled, built-in fan. 6" or 8" size. MH6R/8 8499









MASTER MECHANIC* Glue
Gun bonds permanently in 60
seconds...caulks and seals, too.
Has thermostat and
trigger control. 207MM 13*99



MASTER MECHANIC* 6-Pocket Tool Pouch has 2 plier pockets, 2 screwdriver slots, tape pocket. Fits belts up to 2" wide. MM3438 699



MASTER MECHANIC* Tape Holder with molded pocket for one-handed tape removal. For steel tape up to 25' long. Leather. MMLH463X 299



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MASTER MECHANIC* 3-Pc. Cold Chisel Set has %, ½" and ¾" chisels forged from heat-treated high-carbon steel. Head design reduces spalling. MM10

MASTER MECHANIC* Chisel Set shapes wood and composition. ½ % and 1" hardened steel blades are bevel ground to maintain their sharpness. 300MM



with die-cast bodies. Choose heavyduty non-retractable knife or midget retractable knife. Extra blades included. K118 Ea.

MASTER MECHANIC* 7" Block Plane has precision-ground cutters, cast-iron body, polished bottom and sides. Adjusts for thickness of cut. 15%" cutter, G2MM

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MASTER MECHANIC* Contour Gauge has 175 steel teeth to hold and match uneven surfaces of tile, linoleum perfectly. 6* long. MM4521

MASTER MECHANIC* 7" Home & Garden File is double cut on both sides for fast honing of mower blades, tools. Built-in handle. MM04116 279

MASTER MECHANIC* 25' Tape has easy-reading 1" wide blade, power lock-return switch, removable belt clip. End hook self-adjusts. MMP425



SKIL* 7¼" Circular Saw has 2¼-HP motor, ball-bearing construction, dependable helical gears. Carbidetipped blade. 55935 6999 SKIL* Sandcat™ Sander has the control of an orbital sander, the low vibration of a belt sander. Locking lever.
5 belts. 593
4599

DURACRAFT* 10" Table Saw rips and crosscuts to 35/16" deep, miters ± 60°. Hi-torque motor, carbide-tipped blade. UL listed. BTS10UL 11499 SERVESS* 16-oz. Nail Hammer has highly polished, heattreated steel head. Flame hardened shock absorbing wood handle. 3-16HFN 399



MASTER MECHANIC® Single Bit Axe is drop-forged from highquality tool steel & hand-ground to keep its keen edge. Hickory handle. 35\$BTT MASTER MECHANIC® 6-lb.
Splitting Maul has a dropforged, hand-ground steel head
fitted to a fire-hardened
hickory handle. MMS6MA
1199

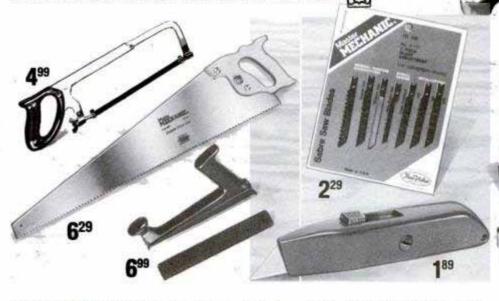
MASTER MECHANIC* Claw Bar, forged from hi-carbon steel with cat's paw, ripping bar, 3 nail pullers, cutting blade. MM132

529

MASTER MECHANIC* Staple

MASTER MECHANIC* Staple Gun shoots a staple where you'd drive a nail. Jam-proof mechanism, visual refill window. 1395 Steel/chrome. M5000

George Bignotti, master mechanic to a record number of 7 Indy 500 winners: "Professional-quality tools are essential to quality workmanship. That's why I rely of Master Mechanic* tools and accessories sold exclusively at True Value Hardware Stores and Home Centers."



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MASTER MECHANIC® Hack Saw Frame adjusts to fit blades from 8 to 12® long, cuts at 4 different angles. 3% deep. Blade incl. 125MM

and Home Centers. Look under "Hardware" in the Yellow Pages.

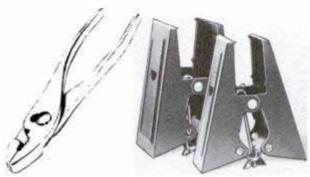
MASTER MECHANIC* 26" 8-Pt. Handsaw is hardworking. With highly polished precision ground blade secured to a hardwood handle. MM40080 629

MASTER MECHANIC* 2-In-1 Shaping Tool uses interchangeable blades to plane, shape, shave, file and sand wood, plastic and soft metal. 80570 MASTER MECHANIC* Sabre Saw Blades, 7-piece set includes highquality, precision-ground blades for wood and metal cutting. %* shank. 151506

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MASTER MECHANIC* 35-Pc. Socket Set has ¼ and ¾ drive sockets, 12 SAE and 16 metric, plus extension, ratchet, adapter, spinner and more, MM735



SERVESS* 6* Slip-Joint Pliers with smooth jaw action. Dropforged steel, nickel-plated against rust. Pick up a spare at savings. 247S MASTER MECHANIC* Sawhorse Brackets convert 5 pieces of lumber into a sawhorse without nails, bolts, miter cuts. Wingnut locks. 100



NATIONAL* ¼" and %"-Drive Sockets. 41-pc. set includes 33 sockets, SAE and metric, plus ratchet, extensions, more. Case. C8441AFM 1299



GEDORE* 11-Pc. Wrench Set has %" to 1" SAE sizes. Dropforged chrome vanadium steel, hardened and tempered, Pouch: 171/111A 1899



100' extension cord. 239327 . 9.99



MASTER ELECTRICIAN™
Crimp 'n Cut Kit has wire cutter, 48 most commonly used terminals, hang-up box. 479279 5.99
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EDISON LIGHTING® Lanterns. 60W with matte black finish. Choose from wall, semiceiling or post mounts. E3226/3626/3726-9 Each 1688



Special prices expire Oct. 29th.

MOHI-OUP



MASTER PLUMBER™ Washerless Faucet for the bath, single lever. Chrome-plated brass. 452649. 27.95
Washerless faucet with drain. 452656. 32.95

POLLENEX* Water Purifier 99™ has 4-stage filter to remove most chemicals and minerals that ruin water odor or taste. WP100 20°5

ZENITH* Mirrored Surface-Mount Cabinet has steel welded construction, white enamel finish, 3 safety-edge shelves. Installs easily. 14x22x41/2" overall size. 9

ALSON'S* Personal Shower replaces regular shower head with push-button convenience. Hang or hold. 59*hose. 410PB-PK 19.95
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MAYFAIR® Embroidered Soft Seat adds beauty and comfort to the bath. Installs without tools. Easy-clean vinyl in choice of colors, designs. 13-15/16D Ea. 1495



FULFLO* Water Purifier has carbon filter to remove odors, sand, rust, algae. Installs under sink, with installation kit. WT-6



G.E.* Silicone II* Sealants for all around the house: bathtub, concrete, windows, doors. Paintable & clear. 10.3-oz. cartridges. GE5000/1/2/7/90





PLOTEC* Drill-Powered Pump attaches to electric drill to remove water, drain oil. Port couplings for easy hose connection. DMP21SA 349



Pressure Sodium Light automatically turns on at dusk...off at dawn. Decorative bronze finish. DR70H 7888

AMERICAN FLUORESCENT*
Fixture has clear prismatic cover
to diffuse light, cut glare. 48' long.
Uses two 40W fluor.
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GE[®] Miser™ Bulbs give more light than the watts they use. 55, 70 or 95W incandescent. 55/70/95AW/M 4 for 1.99 40W fluorescent tube . . . 1.89

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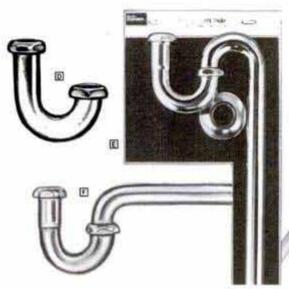
DUR-O-PEG* TV Antenna features 19-element VHF/UHF/ FM tuning for clear, sharp viewing on black & white, color sets. 8072



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 MASTER PLUMBER™ J-Bend for sink repair, remodeling or new installations. Chrome-plated. Easy to install. 1¼″ TVIPC3.49 1½″ TV2SN3.99

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MASTER PLUMBER™ Values. ½ x 36" strght. valve. 220608 . 3.69 ½ x 36" angle valve. 220582 . 3.29 12 x 36" toilet supply. 220442 . 1.68 12 x 36" corrugated. 219634 . 3.89



THOMPSON'S* Water Seal waterproofs wood, masonry, fabric, any porous surface. 101-0A/4/1 12-oz. spray. 2.99 Qt. 3.88 Gal. 8.88



ASTER* Laundry Tub of lightweight polypropylene is rustresistant. Features 2 soap rests and convenient splash guard. 725F 2095



SIMER* Geyser Pump for indoor and outdoor use. All metal construction is submersible. Anti-airlock valve. Portable. 115V. 2300





WAGNER® Heavy-Duty 10-pc. Power Painter is the airless electric sprayer for paints, stains, varnishes. 3058/200 99.99 14-pc. outfit 3070/300

TUCK* Duct Tape is a must for do-it-yourselfers. Now's the time to stock up on this energy saving cloth tape. 2" x 10 yds. C1245A

Emco® Water-Way™ Hinged Rain Diverter may prevent basement seepage and eliminate foundation repairs. 36" long vinyl.WW3624

GERBER® 7" Polystyrene Numbers have pre-primed, richly grained finish to paint or stain. Use indoors or out. Ready to mount. Ea.





△3M® Window Insulator Kit stops cold drafts. Clear plastic shrinks to fit in minutes with hair dryer heat. 42 x 62". 2140 2.66 62 x 210" window kit. 2141 8.99

■ 3M® V-Seal Weather Strip blocks drafts around doors and windows. Installs with scissors. 17 brown or white, 2100/1. 90', brown or white, 2102/3 . . . 14.44



of durable extruded aluminum protects while it weatherizes. Soft, flexible vinyl 17' vinyl/aluminum roll. 217V 2.99

FROST KING* Window Air Conditioner Cover fits snugly. AC-2 . . . 3.69 E Foam switch and outlet cover stops annoying drafts and heat loss. Invisible when installed, 0S12 99¢



M-D* Jamb-Up Door Weatherstrip nails in place in a jiffy. Fits doors 36 x 84". Without bottom . . ⊞ 36" Seal-O-Matic™ door bottom keeps cold air out, heat inside. . . . 8.88

 MORTELL[®] Winter Shield[™] for thru-wall air conditioners. Polystyrene cover beautifies while it blocks drafts. Reusable, installs easily. WS-1 45' weatherstrip roll. F-4.... 1.77

TRI-FLOW Lubricant with Teflon* pene-trates to free frozen mechanisms, reduce friction and wear, prevent rust. 3oz. spray. 199 13000



GENIE Garage Door Opener with Trac Drive" has 1/3-HP motor. Automatic light delay permits safe entry to home. GS810TT



K-V* Shelving. Pecan-look shelf. 1981SWP 8x24"..... 3.33 10x24". ... 3.83 Brass shelf bracket 1808R 8" . 1.44 10" . . 1.54 3' shelf standard, 80BR. . . . 2.74



GENOVA® Raingo™ Gutter System. No welding. PVC vinyl snaps together fast & easily. 4.69 10' gutter. RW100 . 10' downspout. RW200 5.99



MASTER LOCK® Bike Lock with 1/2 -inch thick hardened steel shackle is 812" long and virtually indestructible, 52-D

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page tear-out section.

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AUNTSTRIPP Eware The Hidden

ith a growing number of do-ityourselfers refinishing old furniture, paint stripping-the removal of old paint and varnish-has become common practice.

The most popular method of stripping an old finish is with chemical paint removers. These are economical, easy to use and highly effective, even on several layers of finish. But, when chemical strippers are used improperly or carelessly, they can be extremely dangerous.

Most paint and varnish removers

BY JOSEPH TRUINI ASSISTANT HOME AND SHOP EDITOR

contain methylene chloride (also known as dichloromethane) and methanol (methyl alcohol). According to the Occupational Health Guidelines of the National Institute for Occupational Safety and Health (NIOSH) and the Occupational Safety and Health Administration (OSHA), both chemicals are highly toxic when used in poorly ventilated areas.

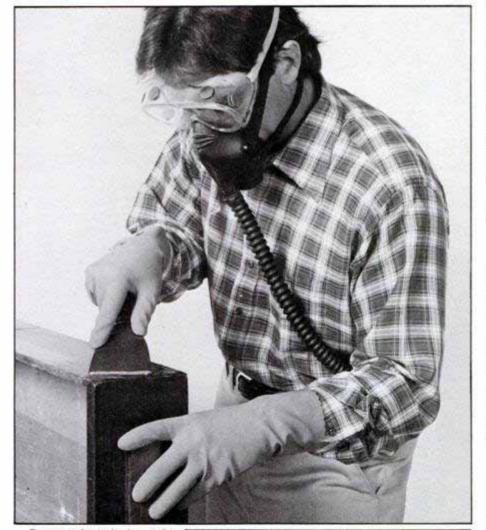
Short-term exposure to methylene chloride and methanol fumes causes light-headedness, nausea, mental confusion and irritation of the eyes and respiratory tract. Methylene chloride also has been known to contribute to heart attacks. The fumes metabolize to form carbon monoxide in the bloodstream and deprive the heart of sufficient oxygen. For this reason, heavy smokers and people having or suspected of having heart problems should be careful when using paint strippers.

For safe use, always apply refinishing products in well-ventilated areasnever in a basement or closed room. Do not use paint strippers near an open flame. This includes all pilot lights and hot surfaces such as gas stoves, kerosene heaters, water heaters and gas clothes dryers. Even nonflammable vapors may become toxic when exposed to high temperatures. For instance, methylene chloride vapors can convert to phosgene gas (a poisonous gas used during World War I) when used in the presence of an open flame.

The key to using chemical strippers safely is to work in well-ventilated areas and wear the right equipment.

Always wear a long-sleeve shirt and

(Please turn to page 186)



Proper paint-stripping attire includes long-sleeve shirt, chemical-resistant gloves, splashproof goggles and an air-supplied respirator when using products that contain methanol. The respirator receives constant airflow from a compact pump (right). Operate the pump from outside of the contaminated work area.



SAFETY GUIDELINES

Here are several safety points to keep in mind when using paint strippers and sol-

- Work in well-ventilated areas, never in a basement or closed room.
- Be sure to read all labels.
- Wear chemical-resistant gloves and splashproof goggles.
- Never apply strippers or solvents near an open flame or pilot light.
- Do not smoke while handling or applying chemical strippers.
- Use an exhaust fan motor with an explosion-proof rating.
- Store refinishing products out of the reach of children.
- Place stripper into metal or glass storage containers only.
- Do not store containers near heat or in direct sunlight.
- Keep a hose or bucket of water nearby for neutralizing chemical spills.
- Post local ambulance and poison control center telephone numbers nearby.
- People having or suspected of having heart trouble or any pulmonary disorder must consult their physician before using paint removers.

PM photos: Ray Solowinski Technical data: George Daniels Respirators and pump supplied by Eastco Industrial Safety Corp., Flushing, N.Y.

AWOOD-HEATED PRIZE WINNER

This two-bedroom home has a number of attractions: It's economical to build, space-saving and energy-efficient.

BY PENELOPE A. SPANGLER ASSISTANT HOME AND SHOP EDITOR



An overhang shelters firewood and serves as a sunshade (above). Windows wrapping around southwest corner (above and below) provide a view from dining room.



This elegant little house in central Vermont was a winner in a national design competition sponsored by Garden Way Publishing Co. The challenge was to design a compact home under 1,000 sq. ft.

Architect Thomas B. Leytham designed this one as an economical alternative to a mobile home. The house uses standard building materials and can be constructed in 30 days. In 1982, the house cost between \$35,000 and \$37,000 to build. Materials accounted for \$21,000 of the amount.

Leytham planned the house with

energy conservation in mind. The dining and living rooms share a south wall, which has banks of windows to take advantage of the view and to receive the sun's warmth. These windows continue on the west wall of the dining area to give it an open, airy feeling. In contrast, the utility room (which houses the electric hot-water heater, a washer and dryer), a half bath and the mainentry mud room are located along the north wall, which is windowless to keep out winter winds.

The house is heavily insulated in the walls, sloped ceiling, roof and at the perimeter of its concrete slab. The slab is a floating one poured directly on the prepared ground. The foam insulation at the slab perimeter is 2 in. thick at an 18-in. depth, extending horizontally 4 ft. from each side. The horizontal extension of the insulation keeps frost from getting under the slab. Together with the ceramic tile covering the first floor, the slab serves as a passive heat-storage system, absorbing heat during the day and releasing it within the house at night.

A wood stove in the living area heats the entire house. The two cords of wood needed to get through severe Vermont winters can be stacked right outside the door, under a protective overhang. Three 2-ft. sections of baseboard heating installed as a backup heat source (FHA requires conventional heating in homes it finances) have never been needed.

Besides being energy-efficient, the house is planned to make the most of its small space. The rooms on the first floor are laid out so they appear larger than they actually are. The openness of the space, where living room flows into dining room and dining room flows into kitchen, helps give this illusion. The expanses of windows with their views of rolling countryside also aid the effect. It comes as a surprise to note that the dining and living rooms together occupy a 12 × 21-ft. space—the size of some living rooms alone.

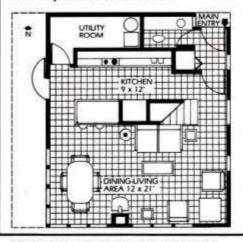
White walls lighten and open up the area. The dark-red laminate contrasted with light wood cabinets in the kitchen visually separate this area and add color to the first floor. The natural wood framing around the windows and on the stairway polishes off the space.

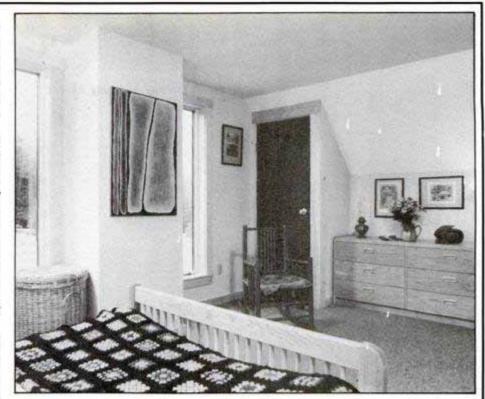
Upstairs, the two bedrooms are fully carpeted and roomy, with floor-to-ceiling windows and plenty of closet space. The slanted roof in the upstairs bathroom contains a skylight to give full light and to visually open up this small room.

The house exterior is sided with pine clapboard finished with Cabot's Bleaching Oil. A graveled area under the overhang on the west wall lends itself to outdoor fun.

Financing the home

Leytham planned the method of financing the house every bit as carefully as he tailored its design. Because the house can be built in 30 days, a construction loan with its relatively high interest rate and legal fees can be eliminated. Materials can be obtained on a contractor's standard 30-day credit line. Upon completion of the house, a permanent mortgage is financed. Mortgage financing must be arranged before day one of construction.









The master bedroom (top) has two floor-toceiling windows and is fully carpeted. The closet shown is one of a pair that flanks the bureau. A snack counter and the stainway separate the kitchen area from the dining room and the living room (above).

PM photos: Hanson Carroll

Stove: Vermont Castings, Randolph, Vt. 05060

Living room and dining room furniture: Pompanoosic Mills, East Thetford, Vt. 05074

Bedroom furniture: Work Space, South Washington, Vr 05675

For information on obtaining plans for the house shown, contact Thomas B. Leytham, Chelsea, Vt. 05038.

The Compact House Book, with 33 house designs, is \$12.50 postpaid from Garden Way Publishing Co., 3513 Ferry Rd., Charlotte, Vt. 05445.

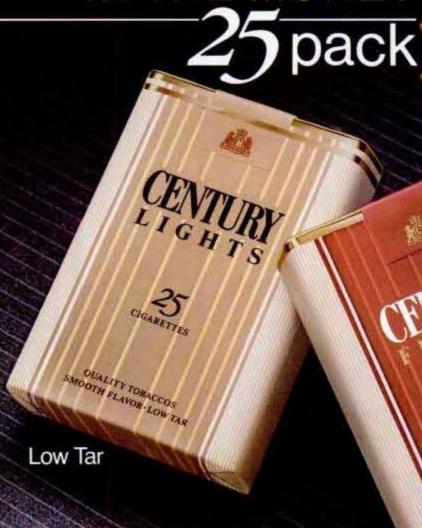
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Warning: The Surgeon General Has Determined That Cigarette Smoking Is Dangerous to Your Health.



Regular

LIGHTS: 10 mg "far", 0.9 mg nicotine. FILTER, 16 mg "tar", 1.1 mg nicotine, av per cigarette by FTC method

Build This Versatile Handcart

This attractive handcart is strong, simply designed and easy to wheel everything you'd want in a cart.

BY DAVID TRESEMER

ost people don't realize that twowheel handcarts have been used throughout the last 3,000 years for moving wood, weeds, rocks, compost and anything else that would fit in a cart. The failure of several modern handcarts is almost ludicrous in light of the fact that all design problems were solved hundreds of years ago.

The cart here optimizes strength and lightness, is easy to maneuver and uses accessories to adapt to many kinds of work. In the plan, the names of the cart parts come from the analogous structural members made by British cart-

The standard or crutch (see I on the materials list) is traditional in carts and wagons and is often quite ornate. It supports the cart sides when gates are installed at both ends of the cart body. Though missing in most modern carts,

the standard is extremely im-

portant for preventing the sides from

One of our tests was to haul a 55-gal. drum half full of sand. Since the drum didn't fit into the cart, it exerted terrific pressure against the sides. Yet, they held. The best test, however, is to transport green firewood, load after load. Modern carts, which have gates but no standards, flunk this test.

The bolster (H) is a support for the standard, a fender for the tire, a step for children getting in and out and a seat for a trailer hitch. Since it is a frequently encountered part of the cart, grind its outer edges round.

When I first started working with this design, I wrapped the ends of the bolster in cardboard to save my shins. I was accustomed to carts which didn't stick out as far.

The spar (C) and spar brace (C1) are one unit. But the spar brace does most of the work. The four spars from behind each panel may be omitted, since they strength. The soles (D), similar to the spars but in the bottom of the cart, shouldn't be omitted since they provide support for the floor.

The struts (J) are welded to the bottom rail just forward of the sole brace (D1) above the axle (M), and to the gate stop (F) at the front of the cart. The distance from the bottom rail to the ground is 13 in. You may prefer to have the struts shaped at a metalworking shop. If the struts are not perfectly matched, the cart will wobble a bit. However, it is very difficult to weld so that all four points, two tires and two struts, touch at the same time. Minor wobbles disappear when the cart is loaded.

The struts are the brakes of the cart. To slow down or stop, push down on the shafts (S) so the struts scrape along the ground. They should be of sturdy stuff, not flimsy tubular electrical conduit as in many modern carts. Use a 5/8in.-dia. reinforcement bar. These struts do not go across the direction of travel, as in other carts where they catch the heels of the carter.

Human harness

The trailer hitch tabs (Q) aren't only for small riding mowers. They can be used to attach a goat swingle and a human harness. The tabs must be notched before welding over the front sole brace.

The wheels (R) are placed to the rear of center because the most dangerous load is one that is placed too far back,

(Please turn to page 70)

Design and building information excerpted don't provide that much additional from Handcart Handbook by David Tresemer. Wooden flare boards increase cart's hauling capacity (left). To dump, remove rear gate and tip cart on dumping supports. Cart can be attached to riding mower (above) with trailer hitch.

(Continued from page 69)

tipping the cart up and perhaps hitting someone with the knobs of the shafts. The load should be centered just in front of the axle so most of the weight is borne by the wheels, but so that the cart rests firmly on the struts. When going up hills, the load should be even more forward. With the wheels placed to the rear, this cart feels heavier when empty than when loaded. With a load of hundreds of pounds balanced over the axle, the shaft can be lifted with one finger.

Construct a jig to hold the side parts at right angles to the bottom parts during welding. You can make the jig of 2×4s. Outside dimensions should be 12×24×48 in.

It is best to weld the cart upside down—first the bottom (bottom rails, soles and sole braces), then each side (spars, spar braces and top rail). When you're finished, tap or file away all excess spatters and grind down messy welds and sharp corners. Welding is best done with a wire-feed welder, since the more simple welders heat the metal so much that the pieces bend when cooling. If you use an arc welder, the top rails should be 3/18-in, stock, or as wide as the bottom rails.

Drill the following holes: 3/4-in.-dia. at

the end of the axle spar brace (L, see detail 2), \%-in.-dia. in shaft tabs (K, see detail 3 and standard detail) for the bolts (T) which hold the shafts in place; \%-in.-dia. in the trailer hitch tabs (Q) for a pin which holds the trailer hitch, if you plan on having a trailer hitch; \%-in.-dia. on the axle ends for the cotter pins which secure the wheels; \%-in.-dia. in the center of the bolster for a trailer hitch pin; and \%-in.-dia. holes in three places of each top and bottom rail for bolts (Y) to secure the side panels.

The wheels (R) slide on the axle and are held in place by one or more large washers (Z1). The washers are held by cotter pins (Z) set through the end of the axle.

Protecting the frame

Protecting the metal frame is best done in three steps. First, clean off the rust and dirt. Then etch the metal with an acid solution available at auto parts stores. Use extreme caution with these

(Please turn to page 72)

MATERIALS LIST—HANDCART

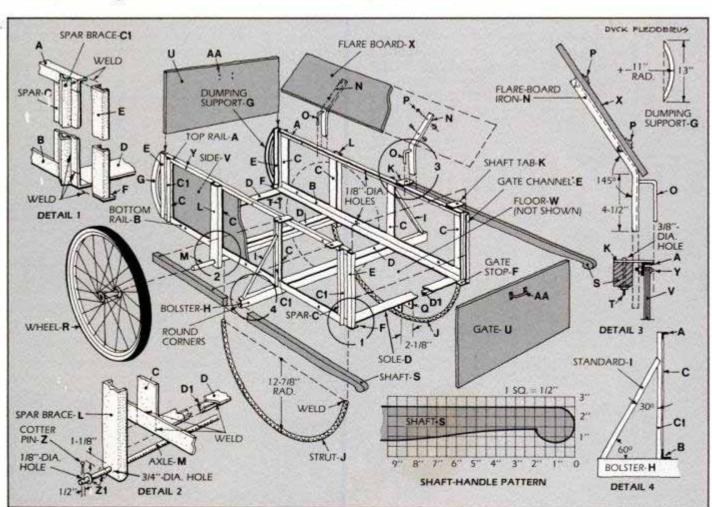
		MATERIALS
Key	No.	Size and description (use)
A	2	1/8 × 3/4 × 3/4 × 48" steel angle (top ra
В	2	1/6 × 5/4 × 5/4 × 48" steel angle (bottomail)
C	8	1/8 × 2 × 103/4" steel (spar)
C1	6	1/8 × 3/4 × 3/4 × 13" steel angle (spar brace)
D	4	1/a × 2 × 21 % steel (sole)
D1	3	1/4 × 3/4 × 3/4 × 24" steel angle (sole brace)
E	4	1/8 × 1/2 × 1 × 1/2 × 123/4" steel chan- nel (gate channel)
F	4	1/8 × 1 × 1" steel (gate stop)
G	2	½ × ½ × 1 × ½ × 13½" steel chan- nel (dumping support)
Н	1	3/16 × 1 × 2 × 1 × 371/2" steel channe (bolster)
1	2	1/4 × 3/4 × 3/4 × 13" steel angle (stan- dard)
J	2	%"-dia. × 44" steel reinforced (strut)
Ј К L	4	1/16 × 2 × 21/2" steel (shaft tab)
L	2	½ × ½ × 1½ × ½ × 15½" steel channel (axle spar brace)
M	1	3/4"-dia. × 37" steel rod (axle)
N	4	1/4 × 1/2 × 1 × 1/2 × 13" steel channel (flare board iron)
0	4	1/4 × 1 × 41/4" steel (flare board hook)

	TUTA	DUANI
P	8	%6"-dia. × 1½" bolts, washers, nuts
Q	2	(for flare boards) 3/16 × 2 × 2" steel (trailer hitch tabs,
33	100	optional)
R	2	26"-dia. × 2.125 spoked wheel and tire with extra-wide spindle
S	2	13/8 × 13/4 × 48" ash (shafts)
T	4	3/4"-dia. × 21/2" bolts, washers, nuts
U	2	1/2 × 121/4 × 24" plywood (gates)
STUVWXY	2	1/2 × 12 × 48" plywood (side panels)
W	1	1/2 × 24 × 48" plywood (floor)
X	2	1/2 × 12 × 48" pine (flare boards)
Y	12	1/s"-dia. × 1" bolts, with washers, nuts (for V)
Z	2	2" cotter pins
21	4	1/8 × 3/4"-i.d. × 2"-o.d. washers
AA	2	4" brass handles and eight 1/4"-dia. × 1

AA 2 4" brass handles and eight '%"-dia. × 1" bolts with T-nuts

Misc.: Redi-Metal or other acid-cleaning solution, 1 pint metal primer, 1 pint metal paint, paint thinner, exterior enamel, penetrating oil.

Note: The following items are available through 1983 in the continental United States from Hand & Foot Ltd., Box 611P, Brattleboro, Vt. 05301: 2.125 × 26-in.-dia. spoked wheel and tire (\$69/pair), axle (\$8.70), shafts (\$25/pair), struts (\$10/pair). Write for postage rates.



Wealthy Man Wants to Give You His Wealth Secret Before It's Too Late!

Dear Friend.

My name is John Wright. Not too long ago I was flat broke. I was \$30,000 in debt. The bank repossessed my car because I couldn't keep up with the payments. And ohe day the landlord gave me an eviction notice because I hadn't paid the rent for three months. So we had to move out. My family and I stayed at my cousin's place for the rest of that month before I could manage to get another apartment. That was very embarrassing.

Things have changed now. I own four homes in southern California. The one I'm living in now is worth more than half a million dollars. I own several cars, among them a brand new Mercedes and a brand new Cadillac. And as of now, I have \$178,000 cash in certificate of deposits in just one of my bank accounts in Beverly Hills.

I'm not really trying to impress you with my wealth. All I'm trying to do here is to prove to you that if it wasn't because of that money secret I was lucky enough to find that day, I still would have been poor or may be even bankrupt. It was only through this amazing money secret that I could pull myself out of debt and become wealthy. Who knows what would have happened to my family and me.

Knowing about this secret changed my life completely. It brought me wealth, happiness, and most important of all peace of mind. This secret will change your life, too! It will give you everything you need and will solve all your money problems. Of course you don't have to take my word for it. You can try it for yourself. To see that you try this secret, I'm willing to give you \$20.00 in cash, (I'm giving my address at the bottom of this page.) I figure, if I spend \$20.00, I get your attention. And you will prove it to yourself that this amazing money secret will work for you, too!

You probably are asking yourself, why is he sharing his secret with me? My response is, "why not". First, I've already made enough money to retire for the rest of my life. Second, my secret is so unique that we won't be competing with each other. Third, nothing is more satisfying to me than sharing my secret only with those who realize a golden opportunity and get on it quickly.

This secret is incredibly simple. Anyone can use it. You can get started with practically no money at all and the risk is almost zero. You don't need special training or even a high school education. It doesn't matter how young or old you are and it will work for you at home or even while you are on vacation.

Let me tell you more about this fascinating money making secret:

FAST MONEY

With this secret the money can roll in fast. In some cases you may be able to cash in literally overnight. If you can follow simple instructions you can get started in a single afternoon and it is possible to have spendable money in your hands the very next morning. In fact, this just might be the fastest legal way to make money that has ever been invented!

ALMOST NO-RISK

This is a very safe way to get extra cash. It is practically risk free. It is not a dangerous gamble. Everything you do has already been tested and you can get started for less money than most people spend for a night on the town.

"WORK" AT HOME

One of the nicest things about this whole idea is that you can do it at home in your spare time. You don't need equipment or an office. It doesn't matter where you live either. You can use this secret to make money if you live in a big city or on a farm or anywhere in between. A husband and wife team from New York used my secret, worked at home in their spare time, and made \$45,000 in one year.

SIMPLE

This secret is simple. It would be hard to make a

mistake if you tried. You don't need a college degree or even a high school education. All you need is a little common sense and the ability to follow simple, easy, step-by-step instructions. I personally know a man from New England who used this secret and made \$2 million in just 3 years.

AGE DOESN'T MATTER

You can use this secret to make money no matter how old or how young you may be. There is no physical labor involved and everything is so easy it can be done whether you're a teenager or 90 years old. I know one woman who is over 65 and is making all the money she needs with this secret.

NO PERSONAL SELLING

When you use this secret to make money you never have to try to convince anybody of anything. This has nothing to do with door-to-door selling, telephone solicitation, real estate or anything else that involves personal contact.

LEGAL AND HONEST

Everything about this idea is perfectly legal and honest. You will be proud of what you are doing and you will be providing a very valuable service.

NO LONG HOURS

It will only take you two hours to learn how to use this secret. After that everything is almost automatic. After you get started you can probably do everything that is necessary in three hours per week.

I know you are skeptical. That simply shows your good business sense. Well, here is proof from people who have put this amazing secret into use and have gotten all the money they ever desired. Their names are not mentioned here in order to protect their privacy but I have full information and the actual proof of their success in my office.

PROOF

- A woman from Oregon started out by using my secret method in its simplest form. She later reported that it had brought her \$14,000 in cash.
- A man from Rhode Island applied my secret and with the help of his family, made over \$40,000 in a year in his spare time.
- A man from California, who was broke at the time, tried my secret and made \$147,000.
- On the basis of my secret, a husband and wife team from Virginia grossed over \$100,000 cash in eleven months.
- A man from California made over \$265,000 in one year, with this incredible secret.
- I talked to a man from Ohio, who now lives in Santa Monica, CA. He said: "Thank you for sharing your secret... with this amazing, yet simple secret, I received \$220,000 in just two months."

As you can tell by now I have come across something pretty good. I believe I have discovered the sweetest little money-making secret you could ever imagine. Remember — I guarantee it.

Most of the time, it takes big money to make money. This is an exception. With this secret you can start in your spare time with almost nothing. But of course, you don't have to start small or stay small. You can go as fast and as far as you wish. The size of your profits is totally up to you. I can't guarantee how much you will make with this secret but I can tell you this — so far this amazing money producing secret makes the profits from most other ideas look like peanuts!

Now at last, I've completely explained this remarkable secret in a special money making plan. I call it "The Royal Road to Riches". Some call it a miracle. You'll probably call it "The Secret of Riches". You will learn everything you need to know step-by-step. So you too can put this amazing money

making secret to work for you and make all the money you need.

To prove that this secret will solve all your money problems, I'm not even asking you to send me money. Instead, postdate your check for a month and half from today. Obviously it is not actually money because it is not negotiable for 45 days. You can easily stop payment on it any time you want. I can't cash your check for 45 days before I know for sure that you are completely satisfied with my material.

IMAGINE HOW YOUR WHOLE LIFE WILL CHANGE IF YOU USE THIS SECRET TO GET ALL THE MONEY YOU NEED!

- · You won't have to worry about bills.
- You will be master of your own time and fate and nobody can boss you around.
- You will have more time to spend with your loved ones and you will be able to take care of them in emergencies.
- You can have the house you want, the car you want, the vacations you want.
- And most of all, you will finally have PEACE OF MIND!

If you need (or just want) more money, there are a lot of reasons why you should take advantage of this amazing secret. (And I can't think of a single reason why you shouldn't). It will probably solve all your money problems forever. In fact, I am so completely convinced that my powerful secret works money miracles, that I'm willing to give you the most unusual guarantee ever offered. That is, if it doesn't solve all your money problems, I'll return your original uncashed check, plus an extra twenty dollar cash bonus just for doing me (and yourself) the favor of giving the secret an honest try according to my simple instructions.

\$20.00 FREE!

There is no way you can lose. You either solve all your money problems with this secret (in just 30 days) or you get your money back plus \$20.00 in cash FRFE!

Do you realize what this means? You can put my simple secret into use. Be able to solve all your money problems. And if for any reason whatsoever you are not 100% satisfied after using the secret for 30 days, you may return my material. And then I will not only return your original UNCASHED CHECK, but I will also send you an extra \$20.00 cashiers check just for giving the secret an honest try according to the simple instructions.

I GUARANTEE IT! I have given references, therefore, there is absolutely NO RISK ON YOUR PART,

To order, simply write your name and address on a piece of paper. Enclose your postdated check or money order for \$12.95 and send it to:

WRIGHT PUBLISHING COMPANY Dept. 151 3340 Ocean Park Blvd., Suite 3065 Santa Monica, CA 90405

But the supply of my material is limited. So send in your order now while the supply lasts.

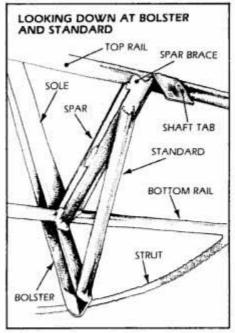
If you wish to charge it to your Visa or MasterCard
— be sure to include your account number and expiration date. That's all there is to it. I'll send you my
material right away by return mail, along with our unconditional guarantee.

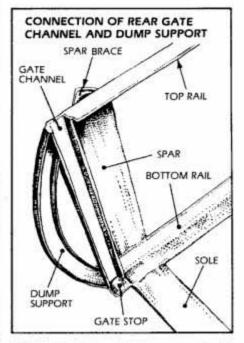
REFERENCES

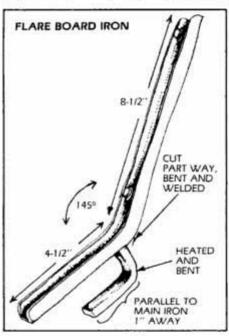
We belong to Los Angeles Chamber of Commerce, located at 404 South Bixel Street, Los Angeles, California 90017.

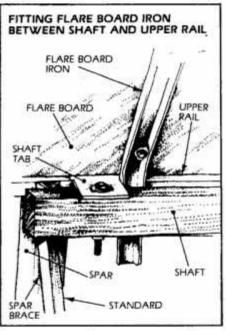
Our bank reference is: First Los Angeles Bank, Los Angeles, California 90067.

1981 Wright Publishing Company









HANDCART

(Continued from page 70)

chemicals. Wear a fume mask and handle them carefully. Second, prime the metal to protect it. Third, paint with at least two coats of paint for metal to protect the primer and give the desired color. Rustoleum primer and paint is a good choice.

You can expect to use about a pint of primer and a pint of paint plus thinner. Check the coat once a year. If a rust patch develops, sand and repaint the area.

Constructing the wood body

Although you can make beautiful cart bodies of hardwood, painted plywood is more practical. Bright colors and contrast between the plywood body and metal frame are traditional for country and city carts. Begin work by cutting the floor (W) and the two side panels (V). Cut the gates (U) to fit the gate channels after the frame is made, in case the frame warps during welding.

Measure the cart carefully before cutting the wood. Fill any holes or gaps in the wood with wood filler. Then paint the panels, floor and gates with two or more coats of an exterior-grade enamel.

Lay the floor in place and press the two side panels in place so they hold the floor. Bolt each panel in three spots through both the top and bottom rails. Attach brass handles (AA) to the gates with bolts and capnuts.

Shaping the shafts

It's more efficient to pull a cart with shafts (S) than to push it. Throughout history, two-wheel carts have been pulled, not pushed. Make the shaft of a straight piece of ash. Rough-cut the knob end with a handsaw. Finish the inside corner with files, rasps and sandpaper. The shaft is bolted from under the shaft tabs. It rests firmly against the front two spar braces. This leaves distance between the shaft and top rail for the flare board irons (N). The flare boards (X) increase the size of the load that the handcart can carry.

Oil the shaft with light penetrating oil. The area around the shaft tabs should be oiled once a year.

Wheels and flare boards

The wheel that I prefer is large (26in. dia.) and wide (2.125 in.), with thick spokes (.156 in. versus .080 in. found on most bicycles). The spokes should be welded to the hub and rim. Each of the wheels should have two sealed ball bearing units.

Heavy tread pneumatic tires smooth out the ride by flexing around small bumps. The tires should be inflated to at least 30 pounds per square inch and as high as 50 p.s.i. But the best guide is the shape of the tire when the cart is loaded.

Flare boards can be added when needed to extend the sides of the cart. Flare board irons attach the boards to the cart. Cut the main part of the iron (N) and bend it 35° to form a 145° angle. Cut and bend a hook (O) and weld it in place on the iron, so the space between them is 1 in. Then drill ⁵/16-in.-dia. bolt attachment holes in the iron and flare board.

The flare boards (X) are made of ³/₄in. pine. A 12-in. width is good for most
purposes, but you may prefer a different size. Paint the wood and metal as
described for the cart body, then bolt
the parts together.

Boards won't slide

Place the irons on the wood so they ride on the top rail. The front iron rests against the front of the second shaft tab (see fitting flare board detail). The rear iron rests against the rear end of the axle spar.

This iron placement ensures that the boards won't slide when the cart moves. However, it also means that the two boards aren't interchangeable. If the boards are mixed, one of the gates can't be removed.

Accessories you can build for the cart include a trailer hitch, human harness, sled, compost screen, farmer's market tray, taxi, goat harness, animal cage and winch.

There are also ways you can rebuild other two-wheel handcarts. Details are in the Handcart Handbook (\$6.95 postpaid) from Hand & Foot Ltd., Box 611P, Brattleboro, Vt. 05301, telephone (802) 254-2101.



Sotz Inc., 13643 Station Rd., Columbia Station, OH 44O28

DON'T GET STUCK!

You guys just saved me \$175. I had been convinced "The Stickler" was the fastest and best log splitter you could get. I was resigned to paying the \$200 for it when I saw your ad and thought, "What the heck, for \$25 I can't go wrong. "Well your Monster Maul worked faster than the Stickler and gives me some good exercise. Continue the good work. Enclosed is a check for your lift-n-saw. I'm looking forward to using it and I hope it will come in as handy as your Monster Maul.

Ernest A. Updike, Tonopah, NV

A GIFTED GAL!

I have just finished reading several Sotz letters from satisfied customers in Organic Gardening magazine. Most of the letters are about the 15# (total weight) splitting maul. As a petite woman I have a fairly difficult time with that maul. Last Christmas one of the best gifts I received was your 11# (total weight) maul from my husband. Surely there are many women out there who would love to know the lightweight version is available. Why don't you advertise it along with the other? I'm sure you would top quite a large consumer group. A Satisfied Mini-Monster-Maul owner.

Carolyn Hewes, Fort Jones, CA (Consider it advertised! The lady's maul may be purchased for just \$21.50 delivered, and \$18.50 factory pick up.)

NEVER TOO YOUNG!

I received my Monster Maul and proceeded to use it but I did not expect it to cut wood with the ease that it did. It works good for young man like me, I am nearing 77, an ex-logger. I have split cords of rick wood and cord wood but not with a good tool as that maul.

M.J. Powell, Battle Ground WA THAT GOOD FEELING

I'm retired from the Army after seventeen years over injuries I received in Vietnam, one being a back problem. My wife and I try to heat our home with wood. Up until last year we had to stick with smaller trees because there was no way I could split wood with an axe or wedges, without a lot of frustration and then spending the following couple of weeks in bed. Then we ordered your Monster Maul. I'm cutting larger trees, which is giving the smaller ones a chance to grow and our wood shed is full of split cherry, locust, and oak, with very little pain or problems. You make a very fine product. It does all if not more than you advertise. Now I have to try your Lift N Saw. Enclosed is an order for one, plus an order for two more Monster Mauls. Mine convinced a friend and a brother-in-law that they needed one ton

Donald E. Taylor, Grandview, IN

SUPERIOR

Just a note to let you know how pleased we are with the Monster Maul - it's GREAT! It's reassuring to receive an item by mail which lives up to (and actually surpasses) our initial expectations ... an additional "Thank You" for your quick delivery of the woodstove tools, wood carrier and "ears". As expected they represent a superior value at a most modest price. Good luck to your business.

Wm. Fish, Manchester, NH

CURE FOR THE COMMON COLD.



Bitter cold strikes young and old alike. And about all you could do before Thermolactyl was relieve the symptoms.

You could try to block the icy winds with layers of bulky clothing. Or wear old-fashioned long johns and perspire the moment you step indoors.

But now Damart is offering a cure you can live with (and afford!): Form-fitting underwear made of Thermolactyl, a manmade fiber much warmer than cotton or wool and also much lighter!

Damart Thermolactyl retains your body heat. And yet it b-re-a-t-h-e-s, allowing perspiration to evaporate. So you feel warm and dry, not cold and clammy. You're comfortable outdoors and indoors, too.

No wonder more than 1,000,000 Americans already wear Damart Thermolactyl for outdoor sports or to prevent nagging aches associated with cold and dampness. No wonder it's the choice of polar and Himalayan expeditions, the Ladies Professional Golf Association, and the Jets, Patriots, Bears, Bills, Steelers, Eagles and Packers football teams.

Damart's colorful catalog features form-fitting tops and bottoms in all sizes (including tall) for both men and women.

You'll also find caps, glove liners, socks, even thermal lingerie!

Send for your catalog right away. Not only will you survive the common cold; you'll thrive in it!

-⊠amarl

Mail to: DAMART, Dept. 34068 1811 Woodbury Avenue Portsmouth, N.H. 03805

FREE CATALOG Yes — rush your catalog of warm but lightweight Damart Thermolactyl. I understand there's no obligation at all.

Name		
	(please print)	
Address		
City	State	Zip



WARMTH WITHOUT WEIGHT OR WETNESS.



HINTS FROM READERS

Window cleaning easel



My annual storm window cleaning session often left me with pains in my lower back. Now, to eliminate unnecessary stooping, I position sawhorses at right angles to an exterior wall and place the windows on them at a convenient height for work.—A. Weber

Storing metal stock safely



To reduce shop injuries, "pull the teeth" of bars, rods and other metal stock stored for future use. Whenever a piece is sawed from some metal stock, file off the sharp edges and corners on the remaining portion before storing it. Later, you'll be less likely to cut yourself when searching through the assortment of stored items. Work gloves add protection, too.—W.E. Burton



THE RADAR DETECTOR GOOD ENOUGH FOR ONE OF THE WORLD'S FASTEST DRIVERS.

Bobby Unser. Three time Indy 500 winner. He's won enough races to have any radar detector. But he uses the new Regency.

What's the reason? We didn't know. So we called Bobby Unser. And got the straight story. Here's what he said.

"We tow race cars all over the country. Nearly all year long. It costs a lot of money. So we really don't appreciate those special tolls called speed traps. I needed a radar detector, and wanted the best. But I didn't know which one to buy.

So I checked with the guys at Regency. I've been using their two-way radios for years, and they work real well. It made sense that they'd know which detector to get

Only I never expected the answer I got. They told me not to buy a radar detector. Seems I called at the right time. They were working on one and wanted me to try it. OK, I said, but why is yours better than that famous brand everybody talks about? Well, they said with that one I'd be paying too much and wouldn't get any more.

Why's that? Well a detector is basically a radio. Those other guys were the first with a superhet design. And back then, they beat the pants off the older style radar detectors. But really, superhet designs have been around in the radio business since the twenties. So there was no new magic. The guys at Regency said they knew how to make a good radio, and the same stuff makes a good radar detector.

The main trick is to get it real sensitive to what you want to hear, and reject what you don't want. I got mine and found that the Regency did just exactly that. It picks up the speed traps over hills, around corners and far away. Yet it doesn't confuse you with any of the other microwave signals running around. And it does a super job on both X and K band from moving or stationary guns.

A couple of other features make my Regency radar detector special. It beeps and lights to let you know there's a radar gun around. When you're far away, it goes slowly. The closer you get, the faster it flashes and beeps. So it's like a distance meter, but easier to use. Plus you can set it for just the flasher, or just the beeper or both. It even tells you if there's radar coming up behind you, because the Regency is good enough to pick up deflected signals.



I like the fact that it has three types of mounting hardware. We Velcro® mount it to the semitruck. Use the bracket for the windshield of our pickup. Or we mount it on the sunvisor in the cars. It only takes a couple of seconds to put it on. So I just carry it with me, in my briefcase or my helmet bag, all the time.

Now I don't want you to get the idea I'm advocating speeding. I'm definitely not. A lot of people and cars just aren't good enough to be going fast. And those that are should be doing it on a race track. There are plenty, all over the country. But if those revenue speed traps where they write you for 56, 57 or 58 bother you like they do me, get the Regency radar detector. I know I definitely wouldn't be without mine."

Bobby Unser drives cars that cost \$300,000 and up. With engines that cost \$48,000 a crack. Which means he's a pretty good judge of equipment. So if he said the Regency radar detector was the one, it really meant something.

The other side of the equation was Regency. It turns out that they've been in the electronics business for over 35 years. And they sell nearly 100 million dollars worth of electronics equipment a year. Not bad. Must be doing something right.

So we had two sources. Both of them with good track records. And both of them saying that this new radar detector was something very special. That was all we needed. We got in touch with Regency and made a deal to handle only their new radar detector. Which puts us in a very unique position to make you a very unique deal.

Order the Regency RS Two and put it in your car or truck. There's even a hidden remote mount version if you're worried about the midnight auto supply. Then try out the Regency, just like Bobby Unser did.

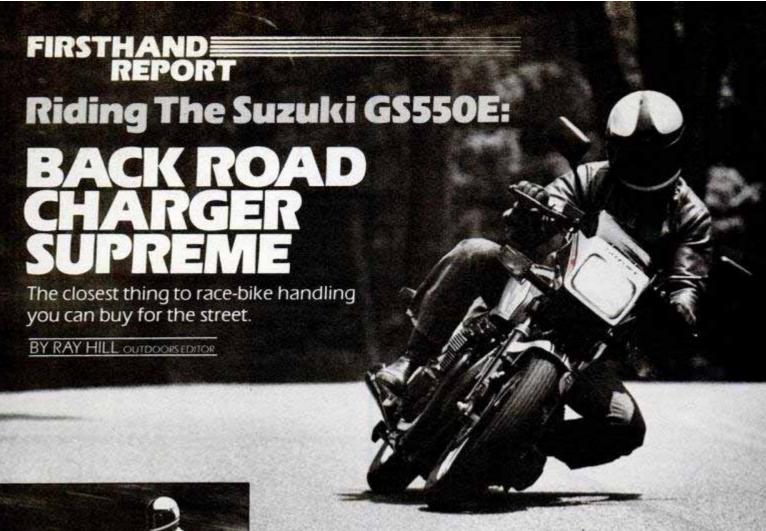
If you aren't 100% satisfied with its super long range sensitivity, compact easy-to-mount size or its interference free alerting system; simply return it to RCD within 25 days for a courteous refund. There'll be no hassles, no problems.

To order the Regency RS Two pictured above with your credit card, call toll free or send your check for just \$199.95 plus \$4.00 postage and handling. The hidden remote RS Three can be yours for only two hundred forty nine plus four dollars postage and handling.

The new Regency detector is backed by a one year limited warranty, a 100 million dollar manufacturer, and it's the choice of a guy who's as casual about doing over 200 mph as most people are about driving to the corner grocery store. Not a bad track record for such a new product. Get your own while our supply lasts.

RCO

806 CUSTER AVENUE P.O. BOX 1494 NORFOLK, NEBRASKA 68701 call TOLL FREE 800-228-8108





Whether you're straight-line cruising or back-road blasting, the GS550E is at home. Ground clearance in turns is excellent.

There are two kinds of motorcycles—those that are fun to ride and those that aren't. Suzuki's new GS550E definitely falls into the fun category. It's one of the best handling street motorcycles I've ever ridden. In the 550-cc class, it's the performance king.

From a standing start it can rip through the quarter-mile in less than 12.5 seconds at over 105 mph. Top speed is about 117 mph. A few years ago such performance couldn't be obtained from motorcycles that displaced 750 cc or more. Now it's available in a midsized 550.

Even more impressive are the bike's handling characteristics. So far, I've ridden the bike 2,500 miles over all types of roads: interstates, bumpy

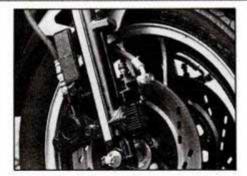


instrument panel is stylish and functional. A digital readout on the panel lets you know which gear the six-speed tranny is in.

paved roads filled with heavy city traffic and crooked back roads. It works well in all these situations.

The brakes are outstanding. The front brake lever feels a bit soft, but most street Suzukis I've ridden lately have a similar soft feel. And that doesn't lessen the twin front-calipers' stopping ability. You can lock up the front wheel with two fingers.

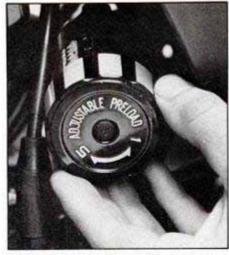
Another nice feature is the front brake antidive system. Some antidive units are more for marketing purposes than performance. A hard pull on the front brake lever by an experienced rider makes the front end dive as quickly and as far as if no antidive system is in place. But the antidive unit on the 550 Suzuki really does slow down the front



Antidive unit on the front of the fork leg above the axle does a good job of preventing the forks from diving rapidly.

fork's rate of dive—particularly useful if you're braking very hard and heading into a sharp turn.

Where this motorcycle really shines is on crooked back roads. Steering is more precise than any street motorcycle I've ridden, regardless of size. This is partly due to the motorcycle's 16inch front wheel. Until this year, most street bikes had 18- and 19-inch front wheels. Reducing the front wheel diameter to 16 inches makes for a quicker-steering motorcycle. And in the Suzuki's case, the overall steering geometry is such that you get quick steering along with precision steering-which in the real world means that you can change your line instantly in a corner, even if the pavement is



Rear spring-preload on the single rear shock can be adjusted with the turn of this wheel, which is located behind the engine.



The fuel tap is positioned behind this filmsy plastic door. On a cold day with thickly gloved hands, turning the tap isn't easy.

bumpy. The 16-inch wheels were first tried on GP racing bikes a couple of years ago. They worked so well there that they are now beginning to filter down to production street bikes.

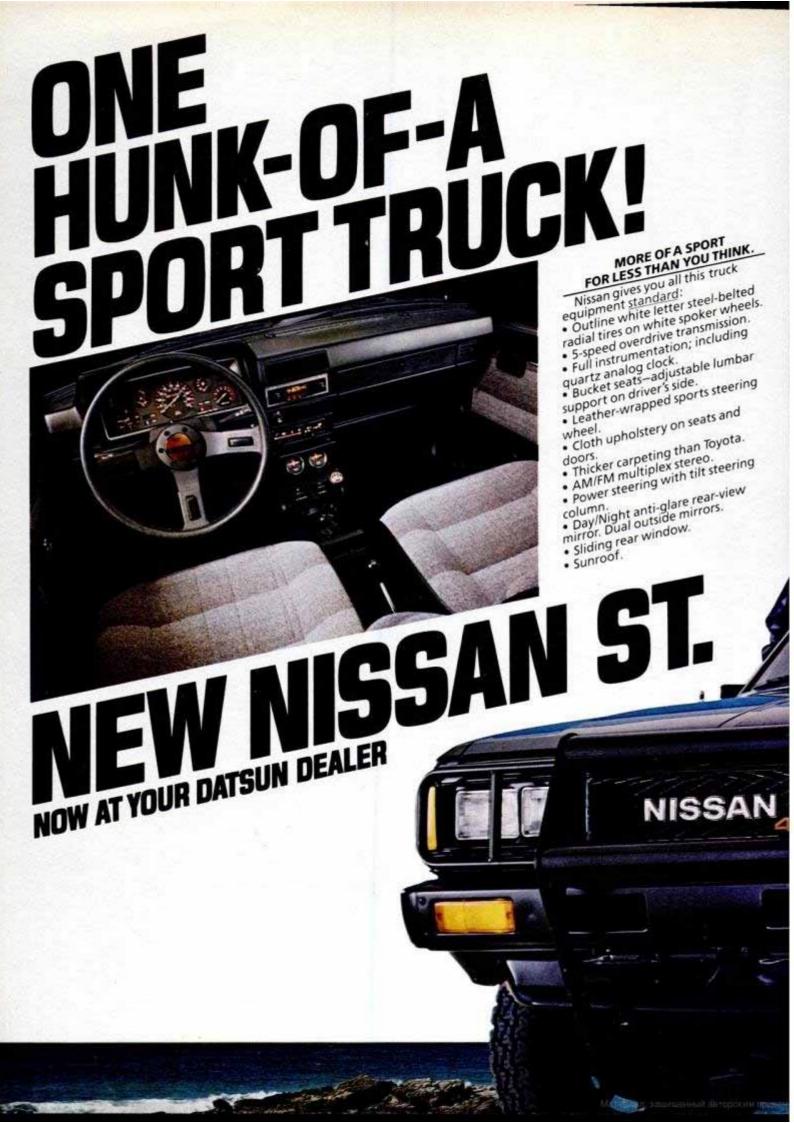
The four-cylinder dohc engine has four-valve cylinder heads and a pair of 30-mm, two-barrel Mikuni carburetors (one barrel per cylinder). An external oil cooler keeps the engine oil from getting too hot.

The only two drawbacks I found with the engine are these: It's cold-blooded—you can't put the choke in the off position for several minutes. And the engine doesn't have a lot of low-end or mid-range power. It doesn't start making neck-snapping power until about 7,000 rpm. But when it does, you had best be hanging on. From 7,000 rpm up to the engine's 10,000 rpm redline, this 550 accelerates with the surge and authority of a much larger motorcycle.

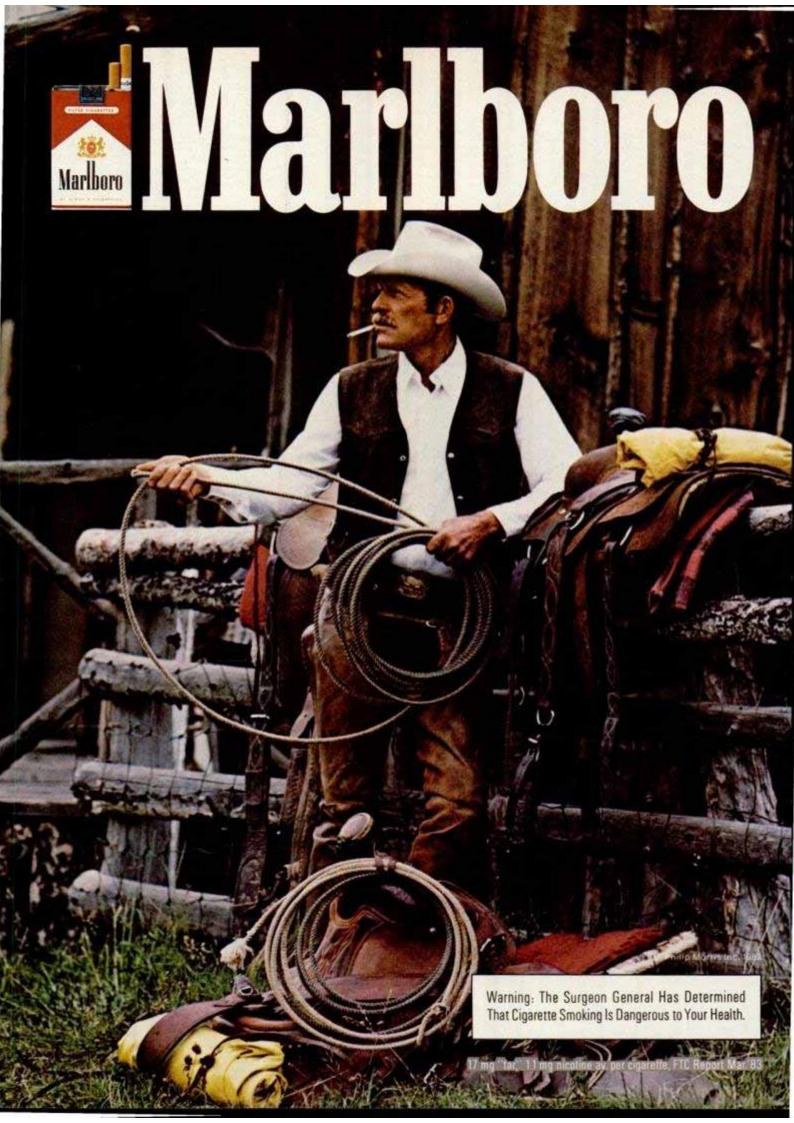
Fuel economy is good. The lowest mileage I recorded was 40 mpg, with the bike ridden very hard, and the highest was 56 mpg, with the machine ridden sedately.

Suggested retail of this little tiger is about \$3,000. That's not bad for the best 550 you can buy.







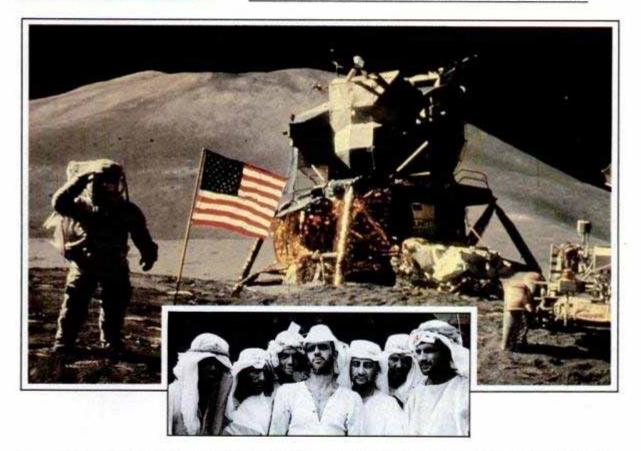




GREAT YEARS OF SPACE EXPLORATION

The National Aeronautics and Space Administration planned man's boldest quarter century.

BY DENNIS ESKOW AND TERENCE DICKINSON



Mercury, Thor and Apollo. And the men who rode them were bigger than life. Names like Neil Armstrong, Gus Grissom, Alan Shepard and John Glenn bring to mind the most earthshaking news of our lifetimes: Man had leaped out of his daydream into outer space. An American flag stood unfurled on the surface of the moon. We looked at snapshots from the surface of Mars. Russians and Americans shook hands in orbit high above the troubled Earth. The space age had exploded on the scene and we were launched into a new age.

It seems as though the National Aeronautics and Space Administration (NASA) has been around forever. But the agency was signed into existence by President Eisenhower just 25 years ago this month. Few men believed we'd be cruising routinely in space so quickly. Indeed, few enterprises have enjoyed so much success so quickly, despite natural obstacles and two major calamities that nearly brought the American space program to a precipitous end.

NASA was born a year after the Russians stunned the world with the launching of Sput-

Neil Armstrong's 1969 moonwalk was NASA's triumph. Original seven astronauts (inset) mug during survival mission.



nik I, the first artificial satellite to orbit the Earth. America itself had already begun planning some form of space exploration, but for much further into the future. With Sputnik came a whole new jargon, beginning with the phrase "space race." The Russians rubbed it in, making the race all the more crucial to the thinking of American scientists. One Pravda editorial said, "The so-called system of free enterprise is turning out to be powerless in competition with socialism."

For a while, it seemed, the Soviets were right. The American program got off to a wobbly start. In 1958, 10 of America's 17 space launches ended in failure, with the rockets destroyed on the launch pad or over the ocean tracking ranges. The Americans had used the Navy's Vanguard rockets, but they suffered from technical problems.

It was a Jupiter C rocket that carried America's first satellite into orbit on Feb. 7, 1958. The 31-pound Explorer satellite was launched under the aegis of NASA's predecessor agency, the National Advisory Committee on Aeronautics (NACA), under the supervision of rocket scientist Werner von Braun and astronomer James Van Allen. Sensors aboard the Explorer detected radiation in space, confirming the existence of the Van Allen radiation belts.

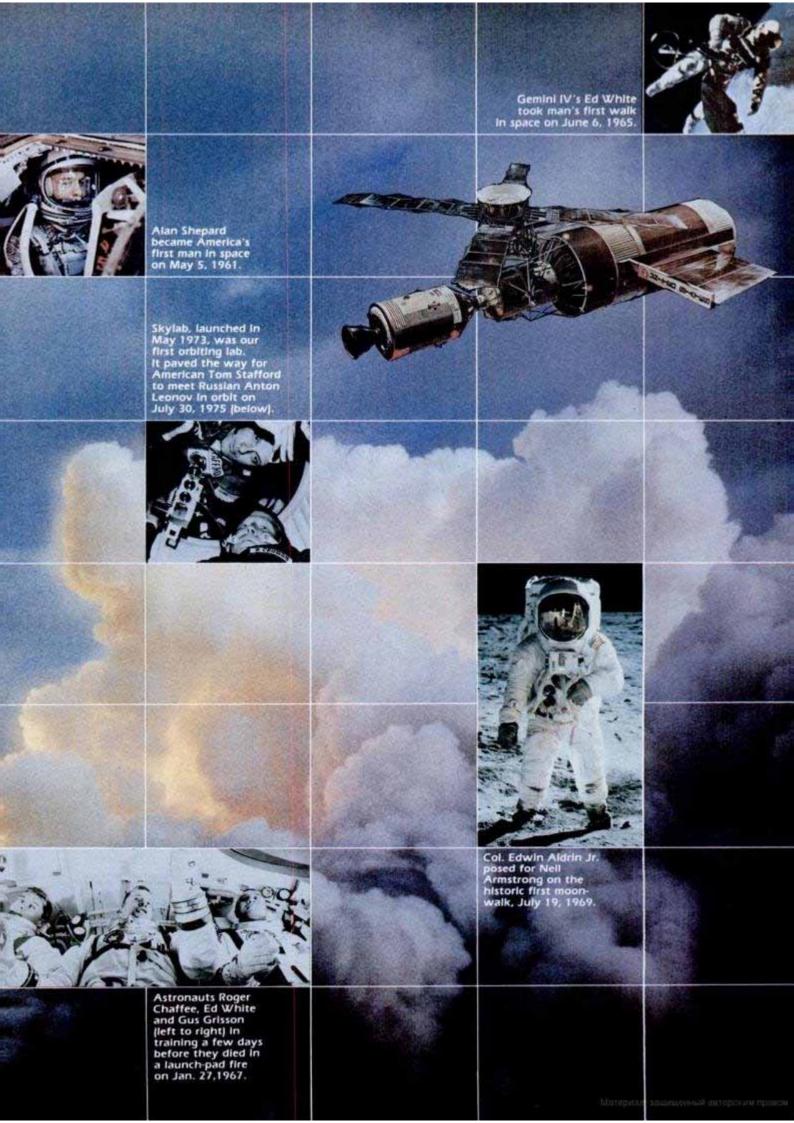
By 1961, NASA was hot on the heels of the Russians, using the highly successful Mercury-Redstone rockets developed by the Army. On Jan. 31, 1961, MR-2 launched a chimpanzee named Ham into Earth orbit. He spent a week in space and survived re-entry. Ham died earlier this year at age 26.

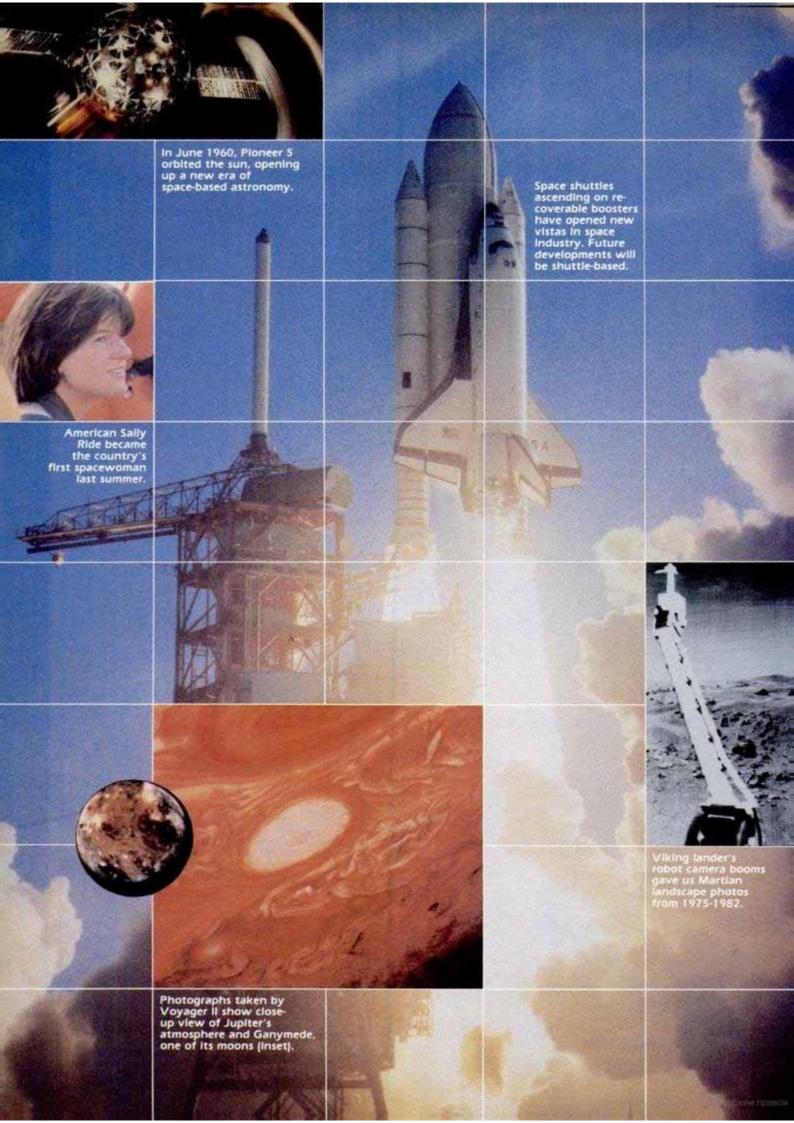
By 1960, the Thor-Able rocket series had put the Pioneer 5 satellite into solar orbit and put the first functioning communications satellite into Earth orbit. And the X-15 one-man vehicle, launched from the wing of an airborne B-52, helped train a new generation of subspace hypersonic pilots.

Watching over their shoulders now, the Soviets launched Yuri Gagarin for one Earth orbit on April 12, 1961. But in manned flight, NASA refused to be stampeded, opting for maximum safety for its astronauts.

The first seven astronauts, all military test pilots, were introduced to a somewhat skeptical public in early 1959. Hamming it up as nomads in the







desert training photo on page 81 are (left to right) Gordon Cooper, Scott Carpenter, John Glenn, Alan Shepard, Gus Grissom, Walter Schirra and Deke Slayton. A year after Gagarin completed his single orbit, Shepard became the first American in space, traveling 116 miles up and 303 miles over the Atlantic tracking station. On Feb. 20, 1962, Glenn orbited the Earth three times in the Friendship 7 capsule.

Meanwhile, the Americans were experimenting with what was to become their space forte—data-gathering satellites. Pioneer, Discoverer and Explorer satellites sent back radio and camera records of the surfaces of the Earth and moon. In the decades that followed, the NASA satellites would fly by Jupiter and Saturn, circle Venus and take scouting photographs of the Martian surface. America's Viking Lander, a robot camera operator that touched down on the surface of Mars in 1975, continued sending back photos of the Martian landscape until last year.

By 1967, the United States had captured the space race lead. That's when disaster struck. During a launch test at Cape Kennedy, an Apollo cabin caught fire and astronauts Gus Grissom, Ed White and Roger Chaffee were killed. Critics quickly called for NASA to hold back on the moon program. But there were more supporters than detractors as NASA plunged ahead, and by July 19, 1969, Neil Armstrong and Buzz Aldrin were descending the steps of Grumman's Lunar Landing Module in the Sea of Tranquility. It was the famous "giant leap for mankind."

The Apollo program brought the massive Saturn rockets that would launch America's first generation of moonwalkers and space lab scientists. In May 1973, the NASA Skylab was sent into Earth orbit. Less than two weeks later, Pete Conrad, Joe Kerwin and Paul Wietz boarded the lab for nearly one month of experiments.

In July 1975, two rockets left the Earth and rendezvoused in orbit—one a Soviet Soyuz vehicle, the other an American Apollo craft. The docking marked the first major joint venture of any kind apart from the military alliance of World War II. But Apollo-Soyuz didn't end the space race.

The U.S. program has shifted its emphasis from planetary exploration to the Space Shuttle. By the end of the decade, NASA expects to have five Shuttle craft flying about 20 missions a year, lofting satellites and containers into space and performing space-walking repairs.

With each passing Shuttle mission, a new record is set: first Shuttle-



launched satellites this year, first American woman in space, the first program that permits any private citizen to place a package in orbit. (*Popular Mechanics* will send an experimental package up as early as 1985.)

The French Arianne rocket and a planned Soviet space shuttle have threatened to bite into NASA's "space truck" business. But, for the present, satellite and other space users seem to prefer the NASA version.

At the recent Paris Air Show, the Russians were offering to undercut the cost of a NASA Shuttle ride by 5 percent for any nation that wanted to switch to the Soviet model. So far as anyone knows, there were no takers, but the Soviets are reported continuing their shuttle building program. And the space race that started 25 years ago promises to continue for many years to come.

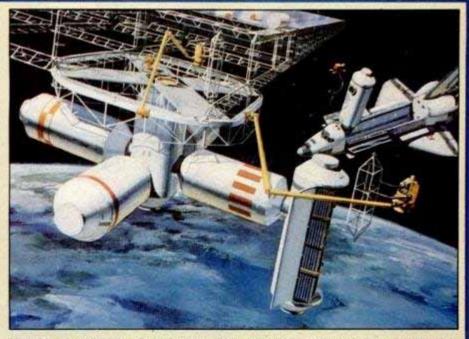
NASA 2008: The Next Generation

BY JAMES BEGGS, NASA

In just one lifetime, we've watched unfold perhaps the greatest era of technological achievement in the history of the world. We've moved from horse-drawn vehicles to an aerospace shuttle and the exploration of the outer planets. Voyager II brought us the vision of primordial planetary development which was unknown just a few years ago. Along the way, the technological fallout—new materials, machines and techniques—became part of our everyday lives.

As we stand on the threshold of a new era in space, the Shuttle era, we may now plan activities undreamed of a few decades ago. The rest of the world is very envious of the fact that we have a mechanism in place and they're trying to duplicate it. Meanwhile, we can look 25 years down the road and ask where we are headed. We will try taking some quantum jumps in space. We can work with 65,000-pound payloads, inserting them into orbit, picking them up again, repairing them in the weightlessness of space. We can take massive cargoes back and forth between Earth and space stations.

The Shuttle has been flying commercial payloads since last November. It's ready for major jobs. I just reread some thoughts of a previous NASA administrator, Tom



Modular space station of the future will be built with parts hauled by the Shuttle.

Paine, who in the 1960s envisioned a shuttle-based space station.

By the year 2008, we'll have established a permanent space station orbiting the moon. Within the next decade after that, we could establish a small research colony on the moon. By 2030, a robot-driven enterprise—mining and manufacturing—could be in place on our moon base.

Aboard the Shuttle-based space station, we could establish modules for in-orbit research and earth-to-space communications. Such stations may well signal the beginning of interplanetary travel, and maybe even interplanetary colonization.

Beggs, the NASA administrator, has headed the U.S. space program since 1982.

Camera Lenses THE LONG AND SHORT

ost single lens reflex (SLR) cameras are purchased with what is called a normal lens. "Normal" in photography means several things. First, the lens has an angle of view (how much it sees) similar to that of the sharp portion of our own vision, which is about 45° to 50°. Also, a normal lens sees objects in the same size relationship to one another as the eye. This makes it ideal for most photographic situations where an accurate representation of what one sees is needed.

Since the lens can be removed from the camera body with a snap or a twist, it's easy to change lenses. Op-



tional lenses are grouped in various categories, such as normal, wide-angle, telephoto, zoom and macro, and each is sold according to focal length. Focal length is the distance from the optical center of a lens to where the image appears to be in sharp focus if aimed at a subject at infinity. Just hold any magnifying glass in front of a piece of paper, aim it out the window and move it back and forth until the image on the paper looks sharp. Measuring the distance between the lens and the paper gives the approximate focal length of that lens.

Of course, modern camera lenses are complicated in design, often consisting of a dozen or more individual lenses to correct for all sorts of optical distortion. But the idea behind focal length remains the same.

Most normal lenses for 35-mm cameras have a focal length of about 50 mm. Anything less than 40 mm is considered a wide-angle, or short lens. If it's over 80 mm, it's a telephoto, or long lens.

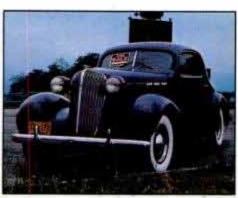
The wide-angle group probably contains the most interesting of the specialized lenses. Their shorter focal length focuses the image closer to the back of the lens. Focusing closer makes the subject image smaller, permitting more of it to occupy the same size film. Therefore, short-focal-length lenses have a wider angle of view as-

sociated with them. Another bonus is their greater depth of field.

The most popular wide-angle is the 28-mm lens. It has an angle of view of 75°, as compared to the 46° of a 50-mm lens. It's got plenty of coverage for most indoor photography and yet is great for scenic landscape shots.

It is the more extreme short-focallength lenses that bring out the most interesting characteristic of such optics: the exaggerated foregroundbackground relationship. Because we are able to see more of the background with these lenses, they appear to greatly distort the size relationship between what's up close and the sub-

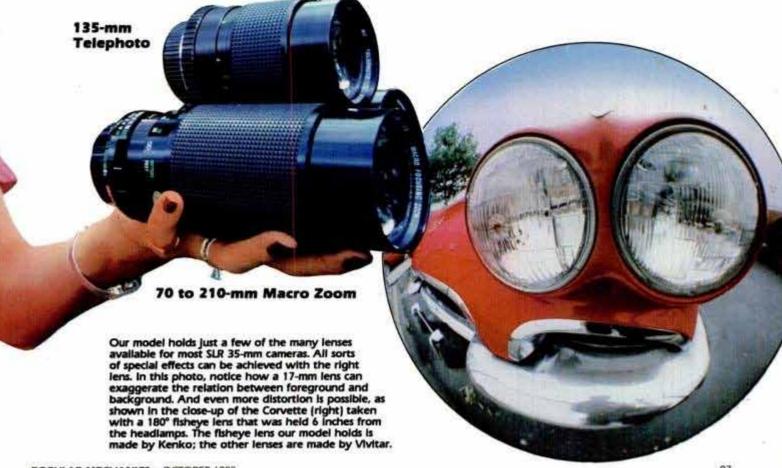


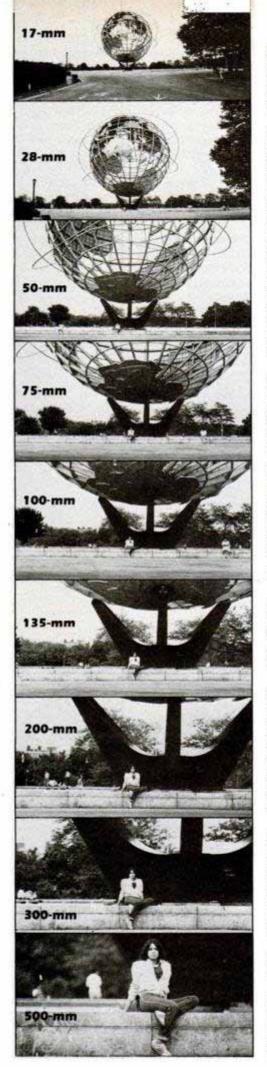


A 17-mm wide-angle shot (left) is contrasted with one taken with a normal 58-mm lens (right). Note how the wide-angle effect distorts the relationship of foreground and background size. By varying the position of the camera, many different special effects photographs can be taken of the same subject using the same lens. Because of this feature, short-focal-length lenses are among some of the most fun to experiment with.



Detailed close-up inside a pocket watch is the type of shot possible with a macro lens. This was taken with a macro adjusted to maximum extension for a 1:1 ratio. Images on film are the same size as the subject.





ject farther behind. Actually, no major changes in perspective occur with focal-length changes. They only happen when the position of the camera is moved.

A fisheye lens, so called because of its appearance, combines this trait of exaggeration with a 180° angle of view and very severe barrel distortion-a condition which makes the subject appear to bulge outward. This produces the most radical wide-angle pictures, regardless of the subject. A close-up of Aunt Martha's face with this 7-mm lens would make her nose look like a canoe. The lens is primarily used in situations needing the most coverage in the least amount of space. Several manufacturers offer less expensive add-on fisheyes which screw onto the front of the normal lens. They cost a little less than \$100.

A more practical lens is the 17-mm wide-angle. These computer-designed lenses fill the entire frame with a 104° angle of view and are nearly free of the fisheye's curvilinear distortion. Its wide view makes it ideal for photographing in limited spaces, such as airplane cockpits, without obtaining the confusing circular image of a fisheye. The lens is also very useful for dramatizing specific portions of a subject, such as automobile fenders. Low to the ground sports photos also seem to be favorites of 17-mm users.

Far brought near

Ask any SLR owner which is his or her second lens and the answer will probably be a telephoto. There is something exciting about being able to bring a subject closer. Maybe it's the peeping Tom instinct in all of us.

Telephoto lenses have a narrow angle of view and are longer in focal length. Being farther from the film allows the image coming through the lens to enlarge more. The most popular telephoto is the 135-mm with an 18° angle of view. It's a good lens for those across-the-street shots, but hardly compares to the power of a foot-long 300-mm.

Telephotos find their homes mostly with sports or wildlife photographers. Their narrow angle of view, 8° for a 300-mm, makes it difficult to follow subjects quickly. It's like looking through a paper tube. A steady hand or tripod is a must for keeping the image on the film sharp when using lenses that are 300 mm or longer.

Fixed-focal-length telephoto lenses have lost their popularity to another miracle of optical engineering, the zoom. Zoom lenses are variable-focallength lenses incorporating movable optics inside the lens barrel. The most popular zoom, 80-210 mm, has become a favorite of amateur photographers because of its versatility.

Computer-designed zooms

Recently, smaller zooms have been designed with the help of computers. Many photographers have retired their normal lenses in favor of such convenient focal-length ranges as 28-85 mm or the less expensive 35-105 mm. Telephoto buffs can appreciate the great zoom range of a 75-300 mm lens. It's a good choice on a camping trip or a day at the ball game.

All of these lenses are inherently a bit less sharp than many of their fixedfocal-length counterparts, but unless you are into photographing lens test charts, the difference is of little consequence.

There is one special feature of a zoom that many photographers overlook—zooming during an exposure. Night scenes of lighted buildings and cars work best. Mount the camera on a tripod, focus at the longest focal length and set the shutter to a one-second exposure with 100 ASA film. Set the aperture to about f/11 and release the shutter. Zoom slowly while the shutter remains open. On automatic cameras, change the aperture to f/16 or f/22 if need be to get the slower shutter speeds. Practice without film first.

Getting closer

SLR owners seldom stick with just one lens. The next logical choice is for a close-up or macro lens. Many zooms are called macro zooms, but are hardly suited for serious close-up photography. A true macro lens is designed to provide optimum performance at very close distances. These lenses have an expandable lens barrel which allows life-size (1:1) images on the film without the aid of other attachments. A typical macro zoom, for example, may have only a 1:4 reproduction ratio. Macrophotography can easily become a hobby that can last a lifetime. It seems that almost anything viewed up close looks interesting.

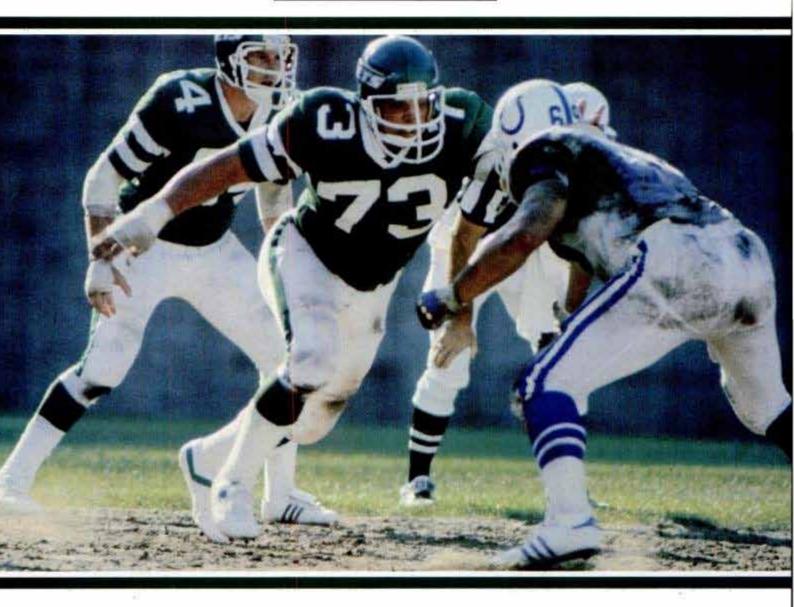
The complicated task of choosing a lens can be simplified greatly by asking yourself what it is that you most enjoy photographing. But remember to first become familiar with your normal lens and its capabilities. A new lens—long or short—doesn't have built into it your own special way of seeing photographic subjects.

The series of photographs at left were taken from the same position to illustrate how different lenses change the angle of view. Perspective and size relationships remain unchanged with the long-focal-length lenses. If you were using film with fine enough grain, much the same effect could be achieved by progressively enlarging the 17-mm photo. Telephotos, unlike wide-angles, do not introduce any distortion.

DRESSED TO KILL

Today's football player needs two hours to get into the plastic, high-tech armor that could save life and limb.

BY DENNIS ESKOW SCIENCE EDITOR

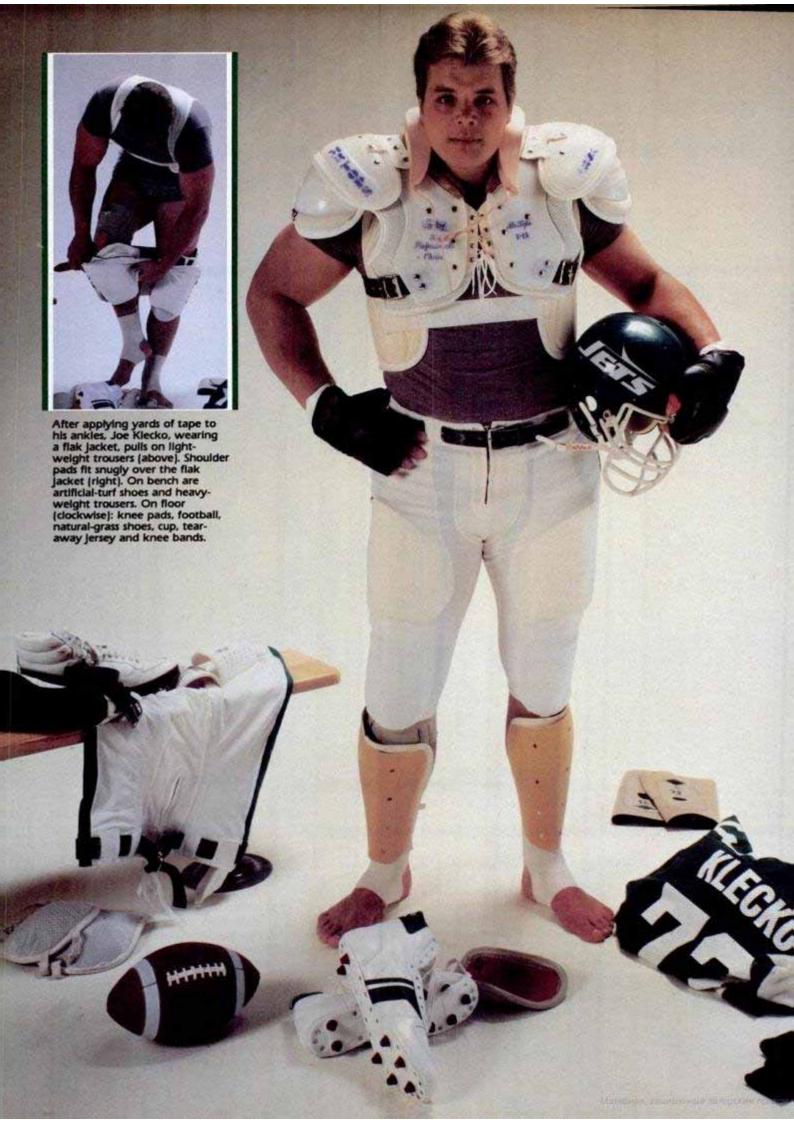


Defensive end Joe Klecko (73) of the New York Jets rushes at Baltimore Coits tackle Leo Wisniewski en route to knocking down quarterback Art Schlichter (out of view). Klecko's hightech armor includes a new composite bird cage face protector and reinforced shoes.

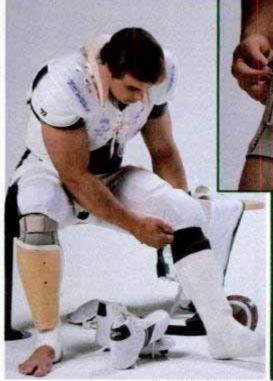
The half-ton machine rolls down the open field, tearing up the turf beneath it and pushing aside virtually anything that stands in its way. To football fans, it's the New York Sack Exchange, a well-oiled squad of defensive football players famous for getting quarterbacks to sit down—the hard way—right in the middle of a game. The New York Jets' defensive line, like its counterparts at 27 other National Football League franchises, specializes in body contact at the most intense and destructive levels. A Stanford University study estimates

that when any two professional football players collide at top speed, they release enough energy to move a 33ton object 1 inch.

"It could be worse," quips Joe Klecko, the 6-foot-3-inch, 269-pound Jet defensive end. "It could be 15 years ago." That was before the advent of synthetic materials like Plexon, closed-cell rubber and polyester-covered cushion foam. Back then, a football player carried up to 25 pounds of equipment. Today he wears about 12 pounds of protection. And the current gear does a far better job







Flak Jacket is cinched (top) with Veicro belt. A form-fit knee-to-ankie shin guard is strapped on (left). In detail photo above, Klecko hooks together springs that form a special shock absorber for knee. On average, more than 100 pro footballers undergo knee surgery each year.

PM photos: Bill Ashe

Klecko laces natura turf shoes (top right) for games at Shea Stadium. His made-toorder Keds are high-top for ankle protection and have a metal-reinforced toe to protect his feet. He has similar shoes with extra cleats on the bottom for road games on artificial turf. The Jets' supersacker dons a thumbknuckle protector (bottom right), one of 20 protective devices available for hands and feet.



of keeping football heroes out of hospitals. In the old days, players would collapse at half-time, suffocating from the heat and sweat beneath their armor. Nylon, urethane, vinyl and other lightweight materials have brought that to an end.

"We have a lot more to work with than we ever had before," says Jet trainer Bob Reese. In the Jet locker room he can point to several pieces of equipment developed out of special material for specific players. Sometimes the special pieces catch on and become standard gear. Sometimes they're destined to remain the hallmarks of a single player.

The best known specialized armor to catch on like wildfire was the flak jacket, first worn by Houston quarterback Dan Pastorini in 1978 to protect his broken ribs. The inflatable polyester and plastic vest invented by Byron Donzis was slipped on and laced up the front. Then it was inflated to fit snugly around the quarterback's ribs. Since Pastorini, most professional quarterbacks have worn a Donzis flak jacket at least once to protect bruised or broken ribs. Despite a price tag of \$310, the jacket is even worn by college and high school players.

Perhaps a bit more esoteric are the special shoes made by Pro Keds for Klecko. The shoes have a steel plate in the front of the sole to protect the hard-running defensive end's feet. The Klecko shoe is also a high-top instead of the more popular low-cut type to provide added support to his ankles, which have been injured in past seasons.

The uniform as a weapon

Conrad Dobler, listed in the 1982 official Datsun Football Guidebook as "Mr. Violence," has been quoted as calling the pregame suiting-up "dressing to kill." Dobler, a former St. Louis Cardinal offensive lineman, is a veteran of the era when a uniform was part of a player's ammunition.

Up until 1979, defensive players often speared opponents, lunging into them helmet-first. The practice was banned in college ball in 1970 and has been outlawed by the pros since 1979, the year after Oakland defenseman Jack Tatum helmeted New England receiver Darryl Stingley, leaving Stingley permanently paralyzed.

Suiting up for a football game is one of the most time-consuming things a player has to do. "You give yourself a good two hours," Klecko says. "You want everything to go on just right. This stuff is protecting your butt."

The dressing ceremony has been compared to the preparations made by a bullfighter. The player puts on his jockstrap, and he may also want to insert a cup to protect the genitals. Then a heavy elastic support for the back and abdomen is put on.

With the help of an assistant trainer, a plastic undercoat is sprayed on the skin and on goes the tape. The undercoat prevents itching and painful over-sticking. Up to 10 yards of tape are used to protect a player's ankles and wrists. For many players, the knees also have to be taped. The knee is the most often injured joint in pro football. Sports Medicine Associates of New York reports over 100 football players undergo some form of knee surgery each season. In 1980, the De-

troit Lions took on a dubious distinction when a record 21 players underwent knee surgery.

Many receivers and defensive backs also tape their forearms. It gives them a bit of stickiness to aid in catching or intercepting a pass. Players are not allowed to spray on any added stickum. Other players—guards and tackles in particular—tape their arms to make them somewhat rigid.

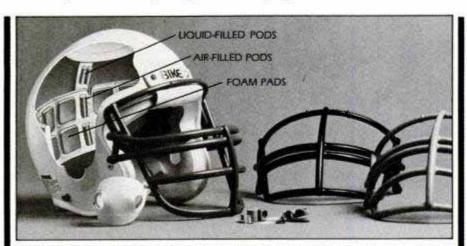
The taping exercise can take up to an hour, especially if the player wears elastic wraps or hand pads. Now the athlete is ready for the padding. Most players wear a set of knee-length nylon pants with snap-in thigh guards and knee insert pockets for the knee pads. The knee pads have been around for a long time, but many sprinting players of the past went without the protection rather than having the cumbersome pads flop around as they ran at top speed. Today's knee pads make it much easier. Made of half-inch-thick cushion foam with polyester backing, the new pads contract from body heat and form-fit the knee. Similar features are available in specialized shin guards.

Once the pants are cinched up, the player can put on his flak jacket and shoulder pads. The shoulder pads are the heaviest protective devices—up to 5½ pounds. They have to be cinched in tightly, and the banana flaps covering the shoulders must be pounded by the trainer or another player to make sure the pads are set perfectly in place. "That's the place where you get grabbed and shoved the most," Klecko notes. "You don't want the shoulder pads to slip at all."

Near the end of the dressing ritual, many players insert a leather neck-protector between the top of their shoulder pads and the skin of their neck. It makes the fit a bit uncomfortable, but any player who's been thrown down in the heat of combat will agree that the neck protection is vital.

In addition to the basics worn under his jersey, a player may have as many as 20 other local protective devices. There's the knee-cartilage shock absorber, which is a spring and hook device that fits onto the knee brace on the outside and helps lessen the shock to the knee from a sudden stop, as in a blind-side tackle. Soccertype shin guards molded from the ankle to the base of the knee have become popular in the training rooms of the Jets and their New Jersey rivals, the Giants. The shin protectors were developed by Joe Rosenstein, former trainer of the New York Cosmos soccer team.

Elbow braces, biceps pads, wrist (Please turn to page 175)



Helmet cutaway shows foam pads and filled pods used to absorb head blows. Helmet's face guard is a "cowcatcher," which gives full-face protection. To its right are ultralight, open-face guard and full-face "bird cage." Nose bumpers are in foreground.



Tough, lightweight body protectors made of plastics and composite include (left to right): knee guard with shock absorber (foreground), hip and thigh protector with spine support (foreground), hip guard with belt loops and contoured knee pad.





Composite flak jacket (left) hangs from shoulders by suspenders and is laced tight. This model protects a quarterback's rib cage. Forearm and elbow guard (right) keeps lineman's arm rigid, while wrist guards are kept rigid in an open-finger glove.



Seafaring Fire Engine

the firehouse of Miami's Special Tactics Team—less than a mile from the Miami River—a 13-ton machine lumbers out to the street just like a pumper truck. But the ungainly amphibian, 35 feet long, 10 feet wide and 11

feet high, draws stares as she rumbles along at a cool 35 mph.

GIs called them LARCS—those drab, round-bellied Light Amphibious Rescue Craft which braved 10-foot breakers to roll men and cargo on shore in Vietnam, and to patrol the Mekong River delta.

Now the old gray LARC just ain't what she used to be. Equipped with hoses and powerful pumps designed from NASA technology, the LARC has been transformed into a red and silver fire-quenching alligator that can eat



Miami's LARC fireboat marries a military hull to a NASA water pump.

It can take on any tough waterfront fire with its powerful space-age pump.

BY SOLANGE DE SANTIS

PM photos: Michael Delaney

fires just as easily on water as it does on

On land, the side visibility from the cramped cabin is poor, according to the firefighters who have operated the amphibian. In fact, it's as tight as a space capsule inside the LARC's control center. However, shifting couldn't be smoother. An automatic transmission easily handles the two forward and two reverse gears of the four-wheel-drive vehicle.

At the river launch site, which need not be a paved boat ramp, since this tough craft can handle a 60° grade on sand or coral beaches, she simply rolls into the water. Once afloat, the power-assisted steering system uses stern-rudder and front wheels simultaneously. At a top pace of about 10 knots, the amphibian is slow but steady, and her ability to shoot water is truly awesome. The stern water cannon fires 3,000 gallons per minute (gpm); the two bow guns put out 1,100 gpm each. The larg-

(Please turn to page 160)

Copy-Cat Tape Decks

These new cassette decks feature two tape transports that let you copy tapes with ease and dub like a professional.

BY ARTHUR J. ZUCKERMAN

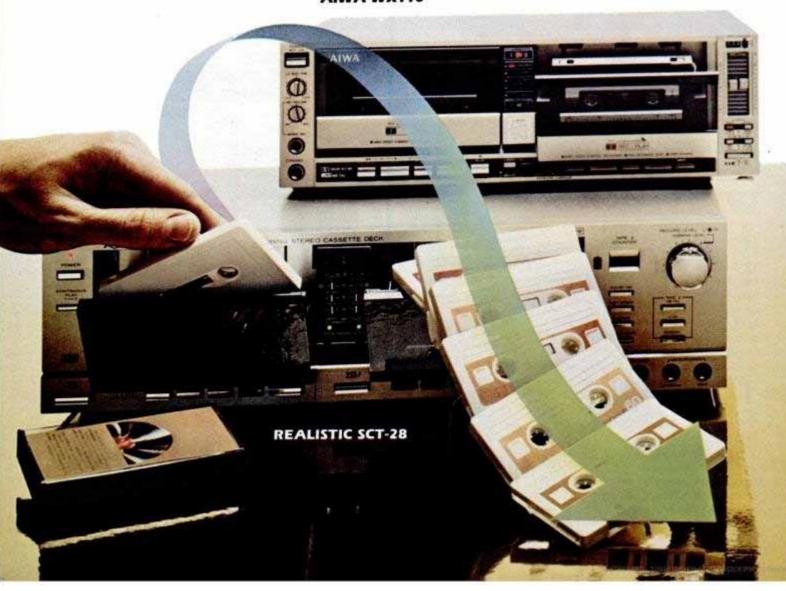
The arrow from the Realistic SCT-28 symbolizes the most popular use of all these dualtransport tape decks: One unit allows you to copy tapes as well as dub from one tape to another. The SCT-28 even copies tapes at high speed. The unit also has a continuous-play function. When the tape in the first bay finishes playing, the tape in the second bay starts automatically. Above the SCT-28 is Aiwa's entry, Model WX110. This deck not only copies at high speed, it can copy both sides of a cassette simultaneously, which means an entire C-90 cassette can be dubbed in 22½ minutes. The Aiwa unit also features extras, such as Dolby C. The dual-transport tape deck, considered a novelty when it came out about two years ago, is capturing the fancy of music lovers. It gives you the ability to copy, or dub, a cassette without borrowing another deck and hooking it up to yours. One-machine copying is great if you've got a cassette player in your car, or use a cassette portable.

Dual-transport decks list for as little as \$200, and the top price for a model loaded with special features is only about \$450. Currently, they all have one major characteristic in common: One transport both records and plays tapes, and one only plays them. So, you can copy from one tape to the other, but you can't record on both simultaneously from an outside source.

A less universal but widely shared feature is high-speed dubbing. It permits decks to make copies in half the normal playing time or less, in addition to dubbing tapes at the standard cassette speed of 1% inches per second (ips). Another common feature is continuous play. One cassette (usually the one in the play/record transport) starts playing when the other one stops.

We put six dual-cassette decks and one portable through their paces. The

AIWA WX110



decks were the Sanyo, RD W50 (\$199.50), the Realistic SCT-28 (\$339.95), the Sansui D-99D (\$350), the Onkyo TA-W88 (\$380), the Aiwa WX110 (\$395) and the Cybernet DD701 (\$425); the portable was Sharp's RD-688AV (\$650).

Sanyo RD W50

The modestly priced Sanyo is a nononsense, basic machine. It operates at only the standard speed, and it has no microphone inputs. Equalization and recording bias for normal (ferric oxide), chrome (chromium dioxide) or metal (metal-particle) tapes are set manually, as is the recording level for a line source such as an amplifier, receiver or recorder. But the recording level for tape dubbing is set automatically. Setting the deck for dubbing also automatically turns off its Dolby B noise-reduction system.

To copy a cassette, you load transport 1 with the tape to be dubbed and transport 2 with a blank tape, and you set the input-selector button to the "tape 1 to tape 2" position. Then you engage the pause controls for both tapes and set transport 1 in "play" mode and transport 2 in "record" mode. Release

the two pause controls simultaneously, and you're in business.

This no-frills Sanyo model does have a simple program-search system for transport 1. If you push in its rewind key while it's playing, the tape will wind back to the dead interval (which must last at least four seconds) between the beginning of the selection you were playing and the end of the one before it. It will then start playing the selection over again. Pushing the fastforward key during "play" mode makes the tape advance to the null at the beginning of the next selection. Holding in the rewind or fast-forward key when the tape reaches a null will make the tape continue to the next selection.

Realistic SCT-28

The Realistic deck copies tapes at either standard or high speed, and has more features. Equalization for the tape 1 (play-only) transport is set automatically, but equalization/bias settings for the tape 2 (record/play) transport are made manually. There is a manual fineadjust knob for setting the recording bias to match precisely the different kinds of normal tape.

Jacks for left- and right-channel microphones are provided. A single mike, if plugged into the left-channel jack, is fed to both channels. But a mike can't be mixed with any other source. Dubbing procedure is like the Sanyo's, except for the high-speed option. Tape search on the Realistic is also similar to Sanyo's.

This deck also has a continuous-play function that is actuated by pushing in the "play" buttons of both transports after the "continuous play" switch is set. Tape 1 starts, and when it ends, tape 2 starts automatically.

Sansui D-99D

Sansui's dual-cassette offering provides only standard speed for dubbing,

(Please turn to page 170)

Sansui's D-99D is one of the most automated units we sampled. It has two program-search systems. The tape transport on the left will search backward to the beginning of a song and play it again. The transport on the right is a more sophisticated searcher and will allow you to skip ahead up to nine selections. The RD W50 from Sanyo is a basic two-mouth tape deck. Many of its features, such as dubbing, tape copying and record-level metering, are now considered standard among these decks. The RD W50 is a good buy for beginners.

SANSUI D-99D

PM photo: Bill Ashe



Do Beautiful Work In Tight Places

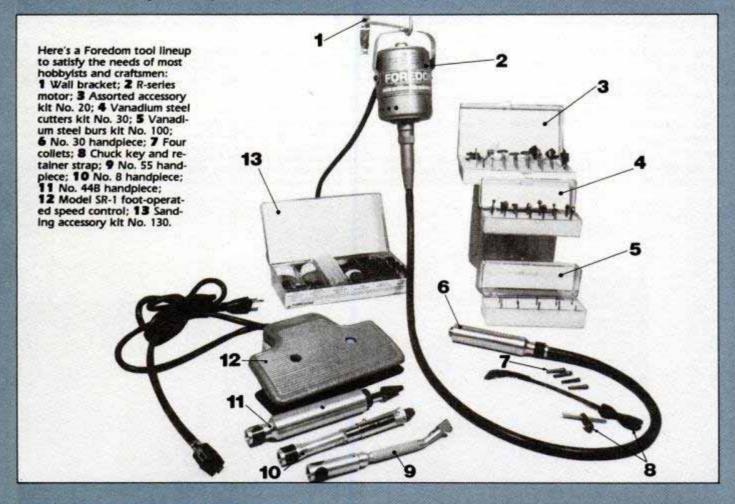
hether you're an enthusiastic weekend craftsman, a devoted hobbyist or a professional jeweler, owning a flexible-shaft miniature power tool is a pleasure.

The tool consists of a motor which drives a handpiece by means of a flexible shaft. An accessory is held by the

BY JOHN GAYNOR

PM color photo by Walter Jackson How-to photos by the author

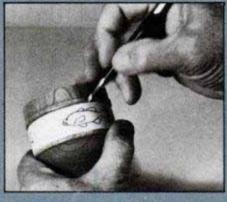
handpiece and used for stock removal and finishing operations. But, for tackling intricate, highly detailed work, this simple tool is in a class all by itself. The Foredom Electric Co. is the frontrunner in the production of flexibleshaft miniature power tools. Foredom offers 10 motor models, wall-hung and bench-mounted styles, 16 handpieces and hundreds of accessories. The accessories include points, burs, brushes, buffs, cutters and abrasives



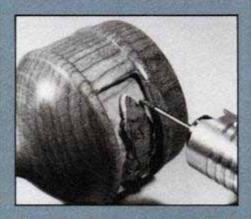
HOW TO CARVE THE GOBLET FISH



Wrap a paper strip around the gobiet to find its circumference. Then sketch the design, spaced equally, onto the paper.



Place carbon paper under the pattern. Next, use a sharp pencil to trace the design, transferring it onto the goblet.



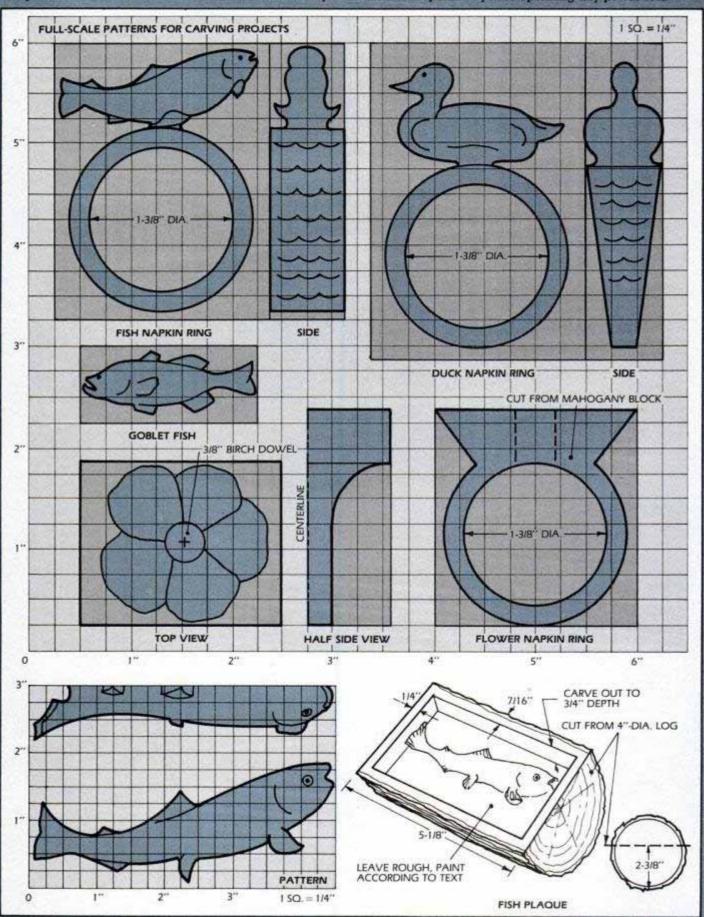
Use a small variadium steel cutter in a No. 30 handplece to carve out and smooth the background of design to a depth of 1/4 in.



for use with almost any material. By joining the appropriate handpiece with the desired accessory, you can grind, carve, drill, sand, deburr, engrave, polish, rout and brush with ease, speed and precision.

The machine shown is the Foredom Model R-30 (a series R motor with a No. 30 handpiece). The R-30 is a ½0-hp, wall-hung motor with a maximum speed rating of 14,000 rpm. The speed is controlled by a No. SR-1 foot-operat-

ed, variable-speed control. Manually operated controls are also available. Caution: Never operate any accessory above its maximum rated speed. And always wear eye protection whenever you're operating any power tool.





For fine detailing, switch to a No. 55 handpiece that is fitted with a steel bur. Use abrasive points to polish the rough spots.

Four of the 16 handpieces offered by Foredom were used to produce the projects shown. The first handpiece chosen was the No. 30 (\$48), a good all-around handpiece with a geared chuck. Next was the No. 44B (\$37), which is similar to the No. 30 except that it has a collet-type chuck for larger accessories. For lightweight, in-close work, the No. 8 handpiece (\$31) was used. Prelubricated ball bearings allow the No. 8 to operate at high speeds without overheating. The angled No. 55 handpiece (\$99)—an adaptation of a dental instrument-is designed for intricate, delicate work.

Let unit do work

Before starting any projects, read the owner's manual thoroughly. Then practice getting the feel of the tool on scrap wood

Be certain that you don't force the tool. Let the speed of the unit do the work. Generally, slower speeds are used for rougher, heavier work or when you feel that greater control over the accessory is required. Higher speeds are used for buffing, polishing and cutting.

Always disconnect the power cord before changing accessories. Inspect (Please turn to page 174)

Two Flexible-Shaft Tool Accessories That You Can Make

3/4 x 2-3/4 x 12-1/2"

The accessory rack evolved during the 40 years the author has worked with flexible-shaft tools.

The rack holds 62 accessories and three handpieces for quick selection and neat storage. Solid walnut was used for this

THIRD TIER

ACCESSORY RACK

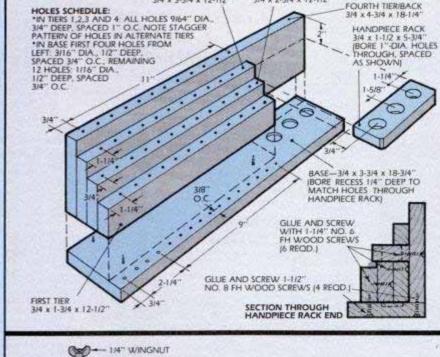
rack, but any other hardwood could be used as well. The surface is protected with three coats of clear finish.

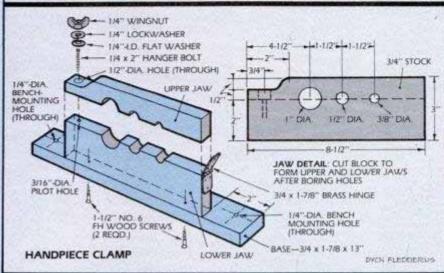
First, cut all the pieces as shown. Be sure to bore the holes before assembly (see the holes schedule in the drawing). Next, glue and screw the four tiers together. Then, screw the tiers to the base using four 1½-in. No. 8 fh screws. Finally, attach the handpiece rack to the fourth tier with two 1½-in. No. 6 fh screws. Hole diameters in the handpiece rack may have to be altered to accommodate certain handpieces.

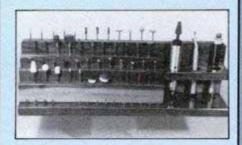
Handpiece clamp

This simple walnut clamp serves as your third hand when using a flexible-shaft tool. Fasten the clamp to a work-bench using screws or C-clamps. Then, place the handpiece between the jaws in the appropriate hole. Close the jaws and tighten the wingnut to securely grip the handpiece. This allows you two-handed control of the workpiece, which is helpful for polishing, buffing and brushing.

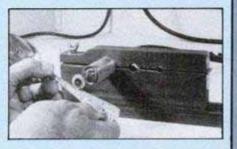
First, cut the piece that forms the clamping jaws. Bore the three holes, as shown, before ripping the block to form the upper and lower jaws. Certain handpieces may require different diameter holes. Next, join the two jaws with a brass hinge. Bore a hole to install the hanger bolt and wingnut. Then glue and screw the jaws to the base. Apply three coats of clear finish.







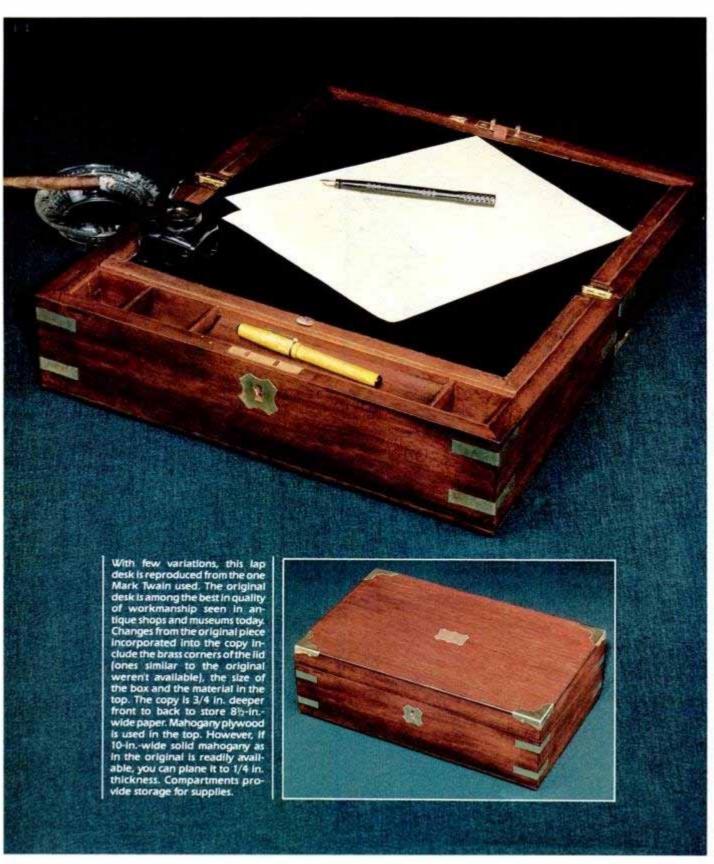
The rack provides neat storage and quick selection of accessories and handpieces.



When two hands are needed to hold the work, the handplece clamp is helpful.

PM Reproductions

A Classic Lap Desk You Can Build



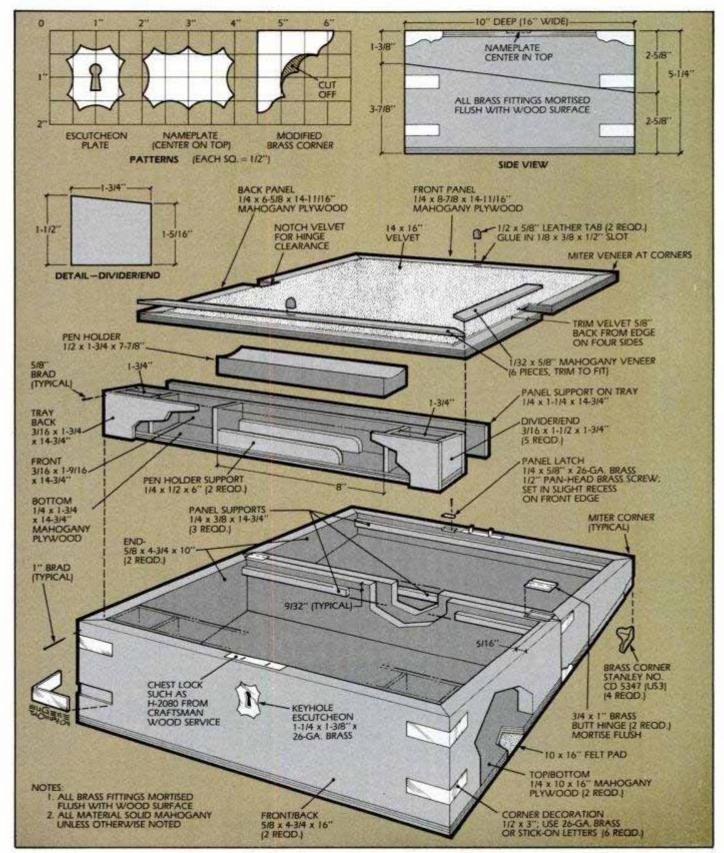
This is a reproduction of the desk that Mark Twain used. You can build one in two weekend sessions.

BY RALPH WILKES

PM photos: Color by Walter Jackson; black and white by the author This mahogany lap desk is a close reproduction of Mark Twain's desk, now in his collection at Elmira College, Elmira, N.Y. As I handled and measured the original, I thought how significant a role this little piece of furniture must have played in Twain's daily life. Perhaps on this velvet panel he wrote The Adventures of Tom Sawyer. The compartments may have held the notes for Life On The Mississippi.

Today, a lap desk is still a convenient box to store the essentials for writing. When opened, the slanted, velvet-covered panels provide a handy writing surface

The corners of the lap desk are mitered so they show no end grain. Glue and nail the front, back and ends; then add the top and bottom. Be careful to locate corner nails where they won't (Please turn to page 166)



(5) Tools That'll

What tools would an active homeowner or woodworking enthusiast select if he were turned loose in a well-stocked hardware store? We asked PM's home and shop editors that question and came up with the 12 tools shown. The favorites, we quickly discovered, either performed a specialized task, like cutting

glass disks or trimming
miters perfectly, or performed an ordinary task
particularly well, such as
smoothing wood or boring tapered screw holes. On these
pages you'll find our editors
picks. We think you'll agree
they are worth adding to
your basic tool collection.

MITER TRIMMER

> CIRCLE GLASS CUTTER

HOLD-DOWN

APANESE

SPOKESHAVE

CABINET SCRAPERS

BRAD DRIVE

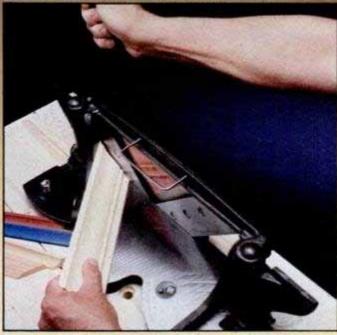
> TAPERED BITS

BRAD PUSH PLANE

HOLE CUTTER FENCEMAN'S

Surprise You

PICTURE-FRAMING TOOLS



After you make a cut with a saw and miterbox, the massive hollow ground blades of this miter trimmer cut like a razor to produce an accurate finish cut that is glass smooth and requires no sanding. A left and a right gauge lock into any angle you desire from 45° to 90° to guide an angled cut. You can use the trimmer on stock up to 4 in. wide when mitering. You can also use it to square ends on stock up to 6 in. wide. The miter trimmer sells for \$209.95 postpaid and is available from Woodcraft.

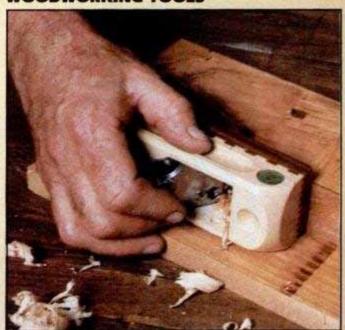


3 This lever-assisted brad pusher makes setting the smallest brads a fast, simple and accurate task. You can drive brads without bending them, damaging your fingers or marring the workpiece. It's especially handy for setting the small brads that hold the backing in a picture frame. One jaw padded with rubber protects the frame while the other jaw presses in the brad. The pusher works on molding up to 1½ in. deep × 3½ in. wide. It's priced at approximately \$18 from Constantine.



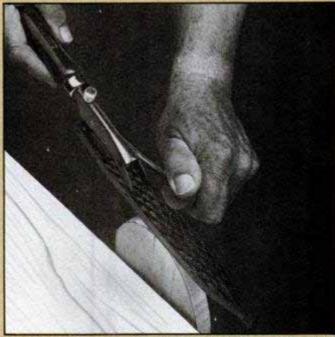
The circle glass cutter cuts up to 10%-in.-dia. disks for picture frames, mirrors, clocks and flashlights. Hold the rubber pivot firmly in the center of the glass and rotate the cutter head in a circle. Next, adjust the cutter head for straight cuts and make tangential cuts from the circle to the edge of the glass. Break off the pieces formed and you have a perfect glass disk. The cutter, which costs \$11.40 postpaid from Brookstone, comes with three spare cutting wheels and a screwdriver.

WOODWORKING TOOLS



This superb small plane by E.C. Emmerich, West Germany, is available for the first time in the United States. For the same price you'd expect to pay for a first-rate steel plane, you can now enjoy the feel of working with an all-wood one. Its 21/16 × 51/16 in. body is crafted of varnished-steamed beech and the bottom plate is of hornbeam. Surprisingly, the block plane features a depth adjustment knob—no more tapping the blade to depth with a hammer. It's \$33 postpaid from Hammermark Associates.

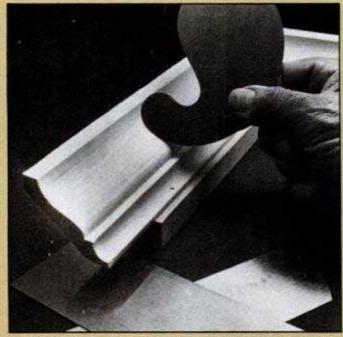
WOODWORKING TOOLS (Continued)



This Japanese saw rasp planes and shapes wood smoothly and quickly without clogging. It is comprised of 10 two-sided hacksaw blades assembled so that the fine teeth are on one side of the rasp and the coarse teeth are on the other. The overall cutting surface is $1\% \times 10\%$ in. To change sides for use, loosen the knurled nut on top and reposition the handle. The round knob gives you an extra hold for two-handed leverage. The saw rasp costs \$16.50 postpald from The Woodworkers' Store.



6 This round-face spokeshave works like a plane to smooth concave surfaces. Adjusting screws allow setting for thickness of shaving and provide lateral positioning. Normally, you would set the blade almost flush with the sole. Work with the grain to prevent tearing the wood on curves. The round-face spokeshave costs \$13.75 postpaid from Garrett Wade Co. A flat-face spokeshave which helps to chamfer or bevel edges and smoothes flat surfaces is also available from the company. surfaces is also available from the company.



With this set of cabinet scrapers, you'll be able to smooth hollows and convex shapes as well as flat surfaces—nearly every shape you'll encounter in the workshop. The set includes a gooseneck 2½ × 4½ in., a round-end 2 × 5½ in. and a straight scraper 2½ × 5½ in. Besides scraping paper-thin shavings to smooth wood, you can remove paint and fillers in hard-to-reach parts of moldings and in other irregular surfaces. The set is \$9.95 postpaid from The Woodworkers' Store.



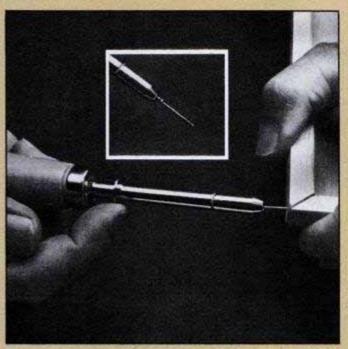
You can install this handy hold-down clamp anywhere on your bench by simply boring and counterboring a hole and installing a hold-down bolt. The clamp sildes onto the bolt head ready to secure work that's up to 3 in. thick. The clamp rotates 360° around the holding bolt to secure work at the right spot or easiest angle for the hobbyist. When it's no longer needed, remove the clamp and let the hold-down bolt drop down out of the way. The hold-down clamp is \$11.95 from Leichtung.

SUPPLIERS

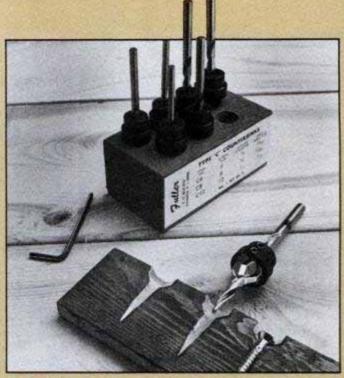
Brookstone Co., Dept. PM, 695 Vose Farm Rd., Peterborough, N.H.

Constantine and Son Inc., 2050 Eastchester Rd., Bronx, N.Y. 10461. Garrett Wade Co., 161 Ave. of the Americas, New York, N.Y. 10013.

Hammermark Associates, Box 201, Floral Park, N.Y. 11002. Hyde Tools, Southbridge, Mass. 01550; attn.: Marketing Dept.; send only certified check or money order. Leichtung Inc., 4944 Commerce Parkway, Cleveland, Ohio 44128; 1-800-

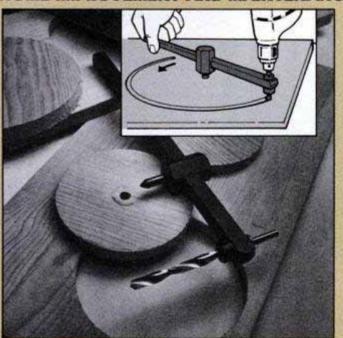


9 The wood-handled brad driver has a magnetic barrel that picks up a brad (inset photo), drives and sets it. The tool drives up to 1-in., 16- to 19-ga, brads. It is invaluable for paneling jobs, where one hand holds the panel while the other picks up and secures the brad. It's also handy when constructing picture frames, fastening window screen, applying decorative molding and working on miniatures and models. You can find many other uses. The brad driver is \$10 postpaid from Hyde Tools.

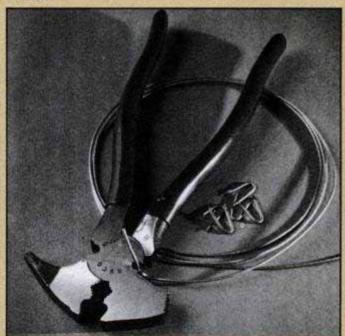


10 At last, there's a tapered bit for boring holes that conform to the shape of a screw. Each bit comes with a matched, fitted stop collar and countersink/counterbore. In one operation you can prepare the wood for the threads, the screwhead and a wood plug. A setscrew, adjusted with the included Allen wrench, secures the stop collar in position to counterbore for a plug or countersink for a screwhead. A set of seven bits for screw sizes Nos. 5 through 12 is \$59.25 postpaid from Garrett Wade Co.

HOME IMPROVEMENT AND MAINTENANCE TOOLS



1 Finally, there's a hole cutter claimed by its maker to work in a portable electric drill—and, by golly, it does. The cutter removes disks from 1½ to 18 in. In diameter in wood, plastic and soft metals. You can make portholes and speaker or basin cutouts in wood or plastic laminate, to name a few uses. Push the free end clockwise to achieve a clean hole (cutout); push it counterclockwise to cut a clean disk. Cutter costs about \$32, including a steel case, a bit and an Allen wrench from Constantine.



12 You'll find countless uses for this multipurpose fenceman's tool. For starters, it stretches and twists wire, pulls and drives staples, and cuts heavy-gauge wire. In other words, you can use it as a piler, a wrench and a hammer. The handles of the 10½-in.-long tool are clad in soft vinyl to give you a comfortable grip. The driver weighs a hefty 21 oz. and is made of high-tensile-strength alloy steel hot drop forged. The fenceman's tool is \$16.40 postpald from Brookstone Co.

CREDITS

Tool consultant and photo direction: John Gaynor
Color photos: page 102; Bill Ashe; other color and black and white photos:
Chuck Rogers, except block plane photo: Harry Wicks
Wood surfaces: Constantine; preparation: Rosario Capotosto







More versatlle and a little more luxurlous than the Alliance, the Encore (top) takes AMC upscale.Four-door Cherokee (left) can be rugged and luxo. New XJ (right) is at home offroad and on. XJ Interior (above) is well designed and attractive.

ALL-NEW JEEP AND RENAULT ENCORE

A new addition to its passenger cars and a whole new line of Jeeps put AMC right back into it.

BY DANIEL CHARLES ROSS DETROIT AUTO EDITOR AND RAY HILL OUTDOORS EDITOR



PM photo: Vic Huber

merican Motors/Renault scored decisively last year with the introduction of the Renault Alliance. Anyone who awarded "car of the year" laurels in 1983 gave them to the Alliance, aptly named for the cooperation between French Renault, which supplied the European R9 basic architecture, and AMC, which adapted and is building the little car at its highly robotized Kenosha, Wis., assembly plant.

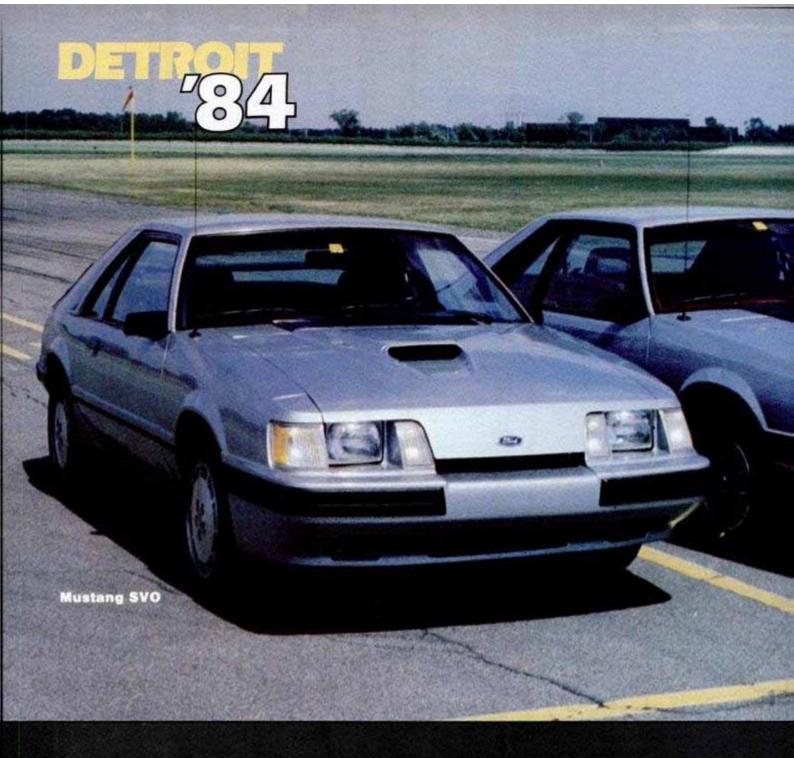
But the car which was to follow Alliance to this country from France had to attempt to duplicate the predecessor vehicle's success, with an appropriate new name AMC/Renault hopes will appeal to a slightly different buyer. Of course, there was but one truly suitable name for the new car. Encore.

The Encore is exactly that—a curtain call for a top performer who's had the opportunity for a costume change. The Encore is a bubble-back, three- or fivedoor hatchback which AMC/Renault insists boasts "sporty cues," intended to appeal to a more sportyoriented buyer audience than does Alliance.

The Encore is just what it appears to be: It's a hatchback version of the Alliance, a conclusion unmistakable from all angles of examination. While AMC/Renault insists the car is more appealing to the younger, "upscale" audience marketers all seem to covet, we think it will still appeal to the people who enjoyed the Alliance—since it's virtually the same automobile.

Encore has the same rack-and-pinion steering as Alliance, at 3.2 turns lock to lock for the power-assisted version and four turns for manual. Both cars have identical chassis, with a 97.8-in. wheelbase and overall width of 65 in., though the Encore shows up

(Please turn to page 158)



FOMOCO IS PACKAGING GET-UP-AND-GO!

Under the slippery sheet metal of Ford Motor Company's new models are neat tweaks for higher torque.

BY DANIEL CHARLES ROSS DETROIT AUTO EDITOR





The ultimate Mustang, the SVO, sits on the line ready to go head to head with the GT version. A driver's eye view of Mustang instruments and controls, including the leather-wrapped steering wheel, is seen above. Mercury's Cougar, sibling of Ford's T-Bird, mounts the 2.3-liter, fuel-injected turbo Four [above], while offering either five-speed manual or automatic transmission. Ford's EXP Turbo puts the blower on a 1.6-liter Four that's good for 110 hp at 5,000 rpm and 120 ft.-lb. of torque at 4,000 rpm.

rom screaming turbochargers to fourshock rear suspensions to ultrasleek new aerodynamic luxury tourers, Ford has had fun designing its '84s.

Just look at the new Mustang SVO. There's no mistaking this car for the Mustang GT, not in appearance or performance. The SVO is from Ford's Special Vehicle Operations group. SVO had primary responsibility for its version of the Mustang. Its performance, therefore, is what could be expected from the section of Ford which also goes out to the races in IMSA GTP Mustangs.

The Mustang SVO is powered by Ford's 2.3liter, air-to-air intercooled Four, turbocharged to a blistering 176 hp at 4,400 rpm. A hefty 210 ft.-lb. of torque spools up at 3,000 rpm, making the Mustang SVO a very willing, high-revving and quick-stepping car. The power is well put to the street through Ford's use of the Borg-Warner fivespeed transmission, providing gear ranges calculated to get maximum use of the available power under most circumstances.

The output of the turbo 2.3 and intercooler is remarkable. Last year's 5.0-liter eight-cylinder powerplant showed up with 175 hp at 4,000 rpm. The blown four-banger does feature a "big engine" feel, though it isn't nearly as effective in the power-on department right now as this year's Mustang GT V8.

In the looks end of it, the SVO Mustang is not like anything you've ever seen in an American car. Its nose is virtually grilleless, in an obvious but welcome nod to better airflow over the car. Aerody-

(Please turn to page 164)



GENERAL MOTORS LAYS ON THE LUXURY

The General is writing take-out orders for more convertibles, Eurosport models and station wagons with the works.

BY GARY WITZENBURG



PM photos: Vic Huber

ith gas plentiful and still fairly cheap, bigger cars selling like nickel beer and some smaller ones going begging, the underlying theme at GM once again is "give 'em more luxury."

Softer ride, more sophisticated stereo and electronics, gadgets and gimmicks, more vinyl roofs and wire wheel covers, more everything. You'd think there had never been a fuel shortage, let alone two in the last decade. And so long as peoples' memories are that short, General Motors aims to be there to help them forget.

When we journeyed to Detroit and endured five hot, muggy days of GM's '84-model previews to find out exactly what was up, we thought it was going to be a pretty dull session—especially since GM made the decision to delay introduction of the corporation's all-new fwd C-body luxury cars (Cadillac deVille, Buick Electra, Olds 98) until after the first of the year.

What we found, though, was interesting, occasionally

exciting and highly revealing of how each division sees itself and where it's going as the long-awaited auto sales recovery gains momentum.

You've seen Pontiac Div's lovely little two-seat Fiero (Detroit '84, page 68, Sept. '83) and now Cadillac's up with a new Eldorado convertible. New wagon versions of the excellent fwd A-cars (Chevrolet Celebrity, Pontiac 6000, Olds Cutlass Ciera and Buick Century) replace the old rear-drive G-body (Malibu, Bonneville, Cutlass, Regal) wagons and feature nearly three cubic feet more cargo room.

There are the usual "bold new grilles," minor styling and trim changes and upgraded features.

But there are substantive improvements as well: new GM-spec, all-weather radial tires (standard or available on most models) that offer far better mud, snow and wet-weather traction with the added benefits of lower rolling resistance and noise; a new cruise control sys-









Pontiac 2000 in its Turbo FI configuration, shown here, is a 150-hp screamer. The 1.8-liter, overhead-cam Four with turbo-charging and port fuel injection gets a big lift over its 82-hp output in stock form. The turbo on the 1.8-liter engine, like that on the Buick V6, is from Garrett AiResearch. Boost is limited to 9.4 p.s.i. on the Pontiac. Trans Am is seen in its birthday suit—diaper white with special wheels—for its 15th year as one of America's most coveted nameplates. The Chevy Celebrity wagon shown here is one of GM's Eurosport versions that's sure to create a stir in the showrooms this month. Cadillac Cimarron takes on a very smart appearance with its new grille and revised taillamps for '84.

tem with "resume" as well as "tap-up" and "tap-down" features to let you fine-tune your speed in one-mpg increments; and ride, handling and engineering improvements.

Cadillac kicked off the proceedings with introduction of its plush new Eldorado convertible.

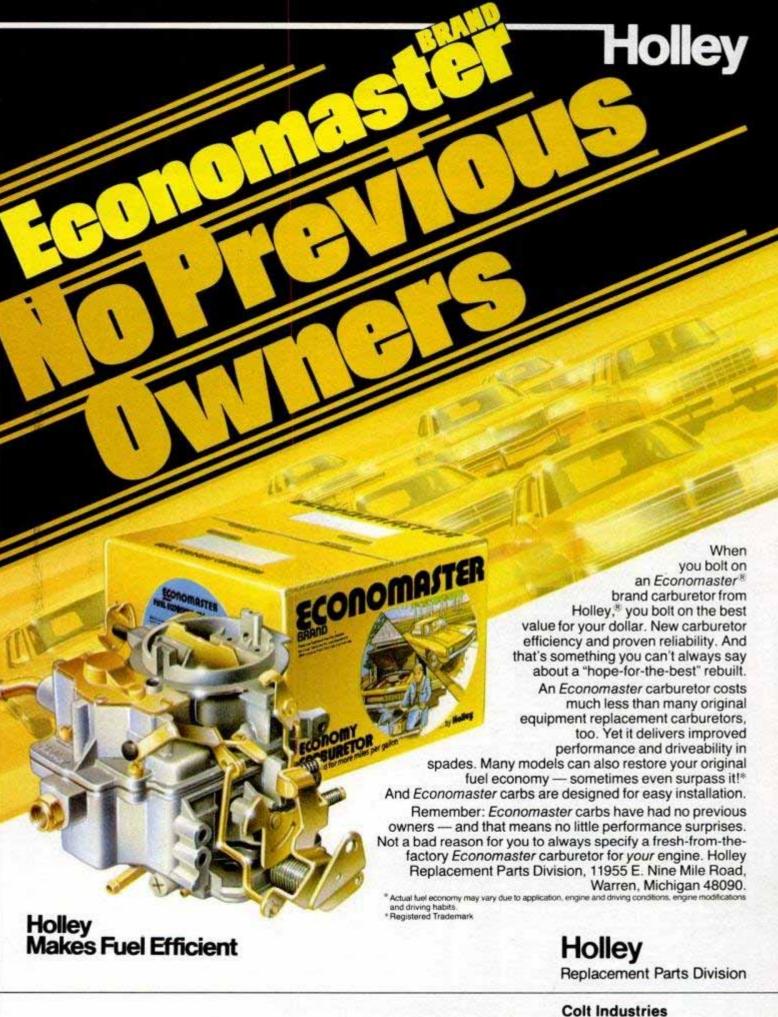
You may recall that "The Last American Convertible" was supposed to be the '76 soft-top Eldo, which quickly became a collector's item. Some 14,000 were sold, compared to 8,950 the year before. It was left to Chrysler to boldly resurrect the soft-top two seasons ago. Buick and Ford followed with ragtop Rivi-

eras and Mustangs, and both Chevy and Pontiac currently offer open-air J-cars.

Now the Eldo convertible is back. It's an American Sunroof Corp. conversion of the topline Biarritz. It comes in white, blue and Autumn Maple Firemist (red) with a white top; features a full cloth headliner, a glass rear window, power rear quarter windows that raise and lower automatically with the top, and extensive frame and body reinforcements. It will be (of course) very expensive—probably about \$30,000. Cadillac expects to sell 2,000 to 4,000 of them a year.

Interestingly, there's also a fake convertible top

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LOOKING UNDER THE HOOD

JEEP POWER FOR AMC

The new American Motors Eagle-Jeep 2.5-liter four-cylinder was developed by cutting down a larger engine, the old 4.2-liter Six. However, you don't just lop off cylinders at the front or rear of a block, put in a new crank and cam and presto—have an instant, new, small, fuel-efficient engine.

What AMC did to engineer its Four is a good example of how the cut-down process really works.

A brand-new engine

AMC actually designed a brand-new engine, just taking care to locate cylinder bores and other holes so it could use six-cylinder tooling already in place.

The boring machinery, for example, is rigidly mounted and there's no way to change spacing. So AMC kept the same spacing between cylinder bore centers for its Four, but changed the boring bit to increase cylinder diameter from 95.3 to 98.4 mm. It also kept the fuel pump in the same place relative to cylinder No. 1, distributor and oil filter relative to No. 3, and starter relative to Nos. 5 and 6. Block-machining tools for those parts, therefore, can also be reused.

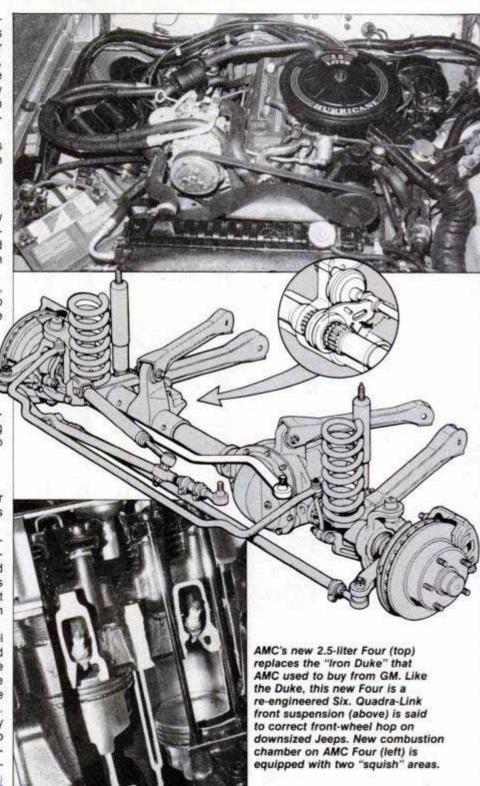
Engineering exercise

So the cut-down is really an on-paper engineering exercise, and the cylinders "chopped out" are Nos. 2 and 4.

The cylinder head is all-new, featuring a double-quench combustion chamber. This means that at the front and rear, the chamber is shaped so there is very little space above the piston as it rises to the top on its compression stroke.

The rising piston pushes the air-fuel mixture from the limited spaces toward the wide-open area in the center of the chamber. The push causes the mixture to become turbulent, promoting more uniform mixing of the air and fuel. Result: The mixture burns so quickly from the spark that it is less prone to produce knock, even with regular unleaded. This is called fast-burn and oth-

(Please turn to page 153)





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LOOKING UNDER THE HOOD

CHRYSLER GOES TURBO

When you've been pushing fuel economy and durability, it's tough to suddenly find the market is looking for power. Chrysler's '84 approach is to concede it isn't the fastest, but lots faster than before, and still fuel-efficient and

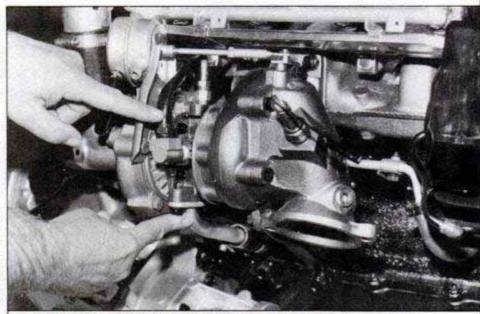
The Garrett AiResearch turbo is the big move. Bolted to the 2.2-liter fourcylinder and combined with individualcylinder fuel injection, it jacks horsepower from 98 to 142. Because turbocharging is power on demand, fuel economy numbers still are good.

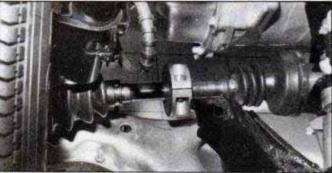
The engine has a beefier bottom end to take the extra power. The camshaft has less valve overlap and the piston rings are a tighter fit, both steps that hold in the fuel charge during turbo boost. The reduced valve overlap also improves low-end performance, before turbo boost comes in.

Most important for Chrysler's durability image, the turbo itself is watercooled, a first for a passenger car sold here. Water-cooling keeps the turbo bearing and oil from baking even when the engine is shut off. At that time, other turbos are in hot soak, which causes oil to coke and the turbo bearing to run with inadequate lubrication as it slows down.

The water-cooling continues (even though the pump has stopped) by a thermosiphon effect. Hot water rises and flows away from the turbo, and cooler water flows in, resulting in a modest circulation pattern. It's not as good as with the pump, but bearing and oil never go above 300° F., compared with 600-700° F. during engine-off hot-soak period of other turbos. A half-century ago, many engines didn't have water pumps; they were cooled by thermosiphon circulation.

With the sharp reduction in bearing and oil temperatures, Chrysler can easily go with a 7,500-mile oil and filter change. (Compare this with the 3,000-5,000 typical of many turbo-charged engines.) Chrysler also has incorporated an automatic fuel shutoff that cuts in at 6,800 rpm to prevent overreving. All this protection is needed because







Twin water hoses (above) cool the vital turbo bearing on 142-hp version of Chrysler Four. Circular dampers on the axle shafts (center) help to reduce vibrations on four-cylinder engines in '84. A 24-message vacuum fluorescent dash (bottom) lights up like the half-time show in Ms. Pac-Man when you trigger its test sequence.

Chrysler is including the turbo in its fivevear, 50,000-mile warranty, and obviously it doesn't want to take a financial

Reliability also is important because the turbo is going into Chrysler's Eseries sedans as well as the Daytona-Laser sports jobs. The only reason Esedan buyers will take the turbo is to get decent performance with a carful, not possible with the naturally aspirated engine in cars of that size. These buyers expect a really reliable engine.

The extra performance of the turbo created a problem for Chrysler engineers: very noticeable torque steer.

All cars in that category tend to steer toward the longer axle shaft when torque is applied, and the greater the

(Please turn to page 154)

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Mobil II The official oil of the 1984 Winter Olympics.





LOOKING UNDER THE HOOD

FORD REFINES TURBOS

ord's so-so record with the turbo should undergo a spectacular reversal in 1984. The company that could barely get a limited run under way in 1980 has 10 turbo models in '84, and one is right up there with the most

sophisticated designs.

Power boost on the 2.3-liter, fuel-injected Four in the Mustang SVO turbo will be torque-regulated by a computer wired to intake airflow and barometric sensors. With this setup, the computer can calculate the air mass that must flow into the engine at peak torque and rpm (210 ft.-lb. at 3,000). The computer locks in on that airflow and allows the engine to maintain it (and therefore peak torque, too) by increasing turbo boost pressure, typically up to 14 p.s.i.

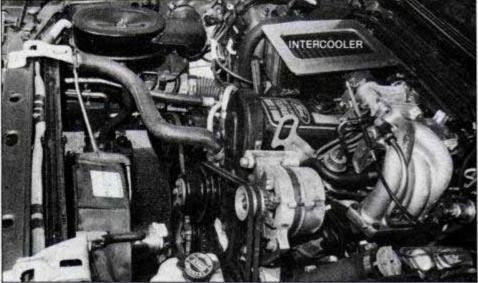
Boost pressure could be higher or lower, depending on air density. A solenoid valve is spliced into the pressure hose to the wastegate-controlling diaphragm unit, and the computer opens and closes the solenoid valve to regulate boost. Torque regulation of boost is in the 3,000 to 4,400-rpm range. Above 4,400, exhaust back pressure builds up, slowing exhaust gas flow, so boost drops. Peak horsepower of 174 comes in at 4,500 rpm. Also, there's a knock sensor on the intake manifold and if it hears knock, the computer retards spark timing.

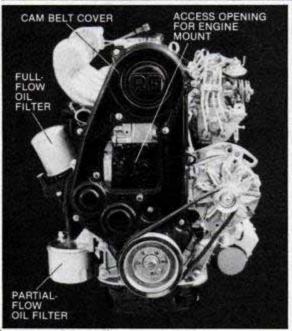
These design and operating features are similar to the Volvo GLT and the '84 Buick V6 turbo. But the SVO also has some unique features. One is a high-low octane switch, so the computer can pick the best spark advance curve for

the gasoline.

Another is the intercooler, a heat exchanger in the airflow circuit. As a turbo compresses intake air, the air gets hotter and thins out. Cold ram air from outside and the hot compressed intake air both flow through the intercooler. The intake air is cooled, so it becomes denser, for more power. In the 174-horse SVO, intercooling is worth about 35 of those horses.

The SVO engine also has an oil cooler, plus spark-advance curves that keep the exhaust relatively cool. So







Turbo intercooler (top) adds 35 hp to SVO Mustang. Dual oil filters on 2.0-liter diesel engine permit a 7,500-mile oil-change interval (above, left). Running the engine mount through the cam belt cover helps to squeeze the transverse diesel in place. The Lincoln air springs (above, right) are computer controlled.

when the engine is shut and oil circulation stops, Ford claims, oil in the turbo doesn't get so hot that it evaporates and leaves a coke residue that blocks lube passages (common on other turbos).

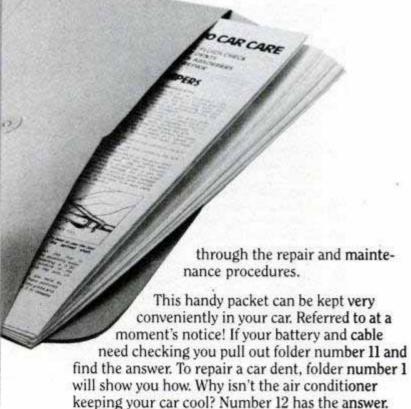
Ford also has a turbo for the 1.6-liter

Four in front-wheel-drive cars. Although smaller and simpler than the SVO, it has internal oil cooling. After some of the oil pumped into the turbo lubes the cool thrust bearing, it flows through a

(Please turn to page 155)

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LOOKING UNDER THE HOOD

GM DROPS DISTRIBUTOR

The '84 Buick turbo V6 is America's first gasoline engine without a distributor, and the first with port-type sequential electronic fuel injection.

The distributor and coil are replaced by a module containing three double-end coils with a plug wire connected to each end. A sensor at the crank pulley tells the module's electronic circuitry when No. 1 and its companion cylinder, No. 4, are at the top of their strokes, one on compression, one on exhaust. The module then signals the computer.

When the computer gets the signal, it triggers one of the coils, sending spark voltage out of each end to the plug wires. One spark ignites the fuel mixture, while the other fires harmlessly in the exhaust.

The module's electronic circuitry also can operate the ignition in case of some computer malfunction.

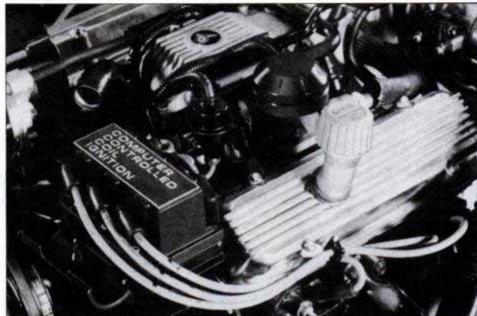
The hole that used to be for the distributor now has a sensor for camshaft position, so the computer can distinguish between cylinders 1 and 4. This isn't necessary for ignition, but for the fuel injection. With the sequential system, only the cylinder on compression gets the squirt, so a No. 1 signal is needed as a starting point.

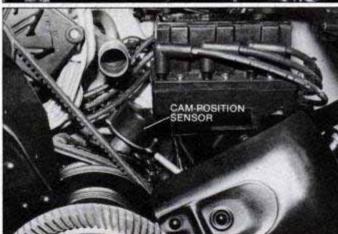
Another approach to port-type fuel injection (used on the naturally aspirated '84 V6) is to squirt into all intake ports simultaneously, twice per rpm, injecting half the fuel each time. Buick claims sequential squirting improves idle and performance.

Regal horsepower is up from 170 in '83 to 200, but most of that is from '84 improvements to the turbo system. Like the Mustang SVO, the '84 Buick turbo has an electronic boost control solenoid valve and an airflew sensor. The Buick computer also uses the airflow signal to calculate and maintain optimum boost for max torque, between 2,400 and 4,000 rpm. Peak boost pressure is around 14 p.s.i.

If the knock sensor is triggered, the computer not only retards spark, but also may cut boost pressure. If knock is severe, it may drop boost immediately. The Buick turbo doesn't have the

(Please turn to page 156)







Buick's turbo V6 engine has an allelectronic ignition that eliminates the distributor (top). A black box with three coils fires two sparkplugs at a time. one at the end of a piston's compression stroke (as usual) and the other at the end of the companion piston's exhaust stroke (which is harmless). A camshaftposition sensor replaces distributor (center) and provides information for the sequential fuelinjection system. Movable control pods (bottom) on the '84 Camaro Berlinetta bring the dashmounted pushbuttons to the driver whose reach falls short of Wilt the Stilt's.

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COOLING SYSTEM PRESSURE TESTER RADIATOR

To check for leaks, use a pressure tester connected to radiator in place of cap.

A clean, efficient cooling system, filled with the right proportion of the correct coolant, not only will protect your engine, but will help keep you warm, as well.

Most vehicle manufacturers recommend that the cooling system be inspected and tested yearly, and backflushed and refilled every two years. If you intend to do it yourself, without the help of a power backflushing machine, an annual change is probably best. Since a cooling system maintenance includes a check of antifreeze protection level, it's an obvious part of prewinter maintenance.

Begin with a check of the belts and hoses. You don't want to pour a lot of expensive new antifreeze into a cooling system that's on the verge of failure.

Examine the hoses carefully for signs of cracking, swelling or oil and grease contamination. Take a particularly good look at the area just behind the clamp. Sometimes you'll find that the clamp has started to work its way through the hose. A hose can look good on the outside and be seriously deteriorated on the inside. Black flecks in the coolant or in the top of the radiator may be a sign of hose deterioration.

Testing by aftermarket manufactur-

ers has shown that hoses last only about four years. It's a good idea to replace your hoses after four years even if they look good. This will protect you against unexpected failures.

Defective fan belts are not as easy to spot as they once were. Belts used to be covered with a fabric wrapper that would begin to come apart before the belt failed. However, as a result of changing original equipment specifications, most belts are now manufactured without the protective wrapper. These belts can snap without warning. Check for cracking on the bottom of the belt or glazing on the sides. Again, some man-



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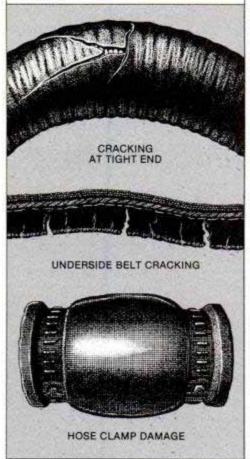
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ufacturers suggest that, regardless of how good they look, belts that are made without the fabric wrap should be replaced every four years.

While you're staring at those belts, don't forget to check tension.

It's best to use a tension gauge and check manufacturer's specs in a manual, but a little push with your thumb in the center of the belt's longest span is better than no check at all. If you detect more than about an inch of deflection under moderate pressure, you should tighten the belt.



Shown above are three problems common to any car. Makers suggest replacing hoses and belts every four years.

Once you've examined all the belts and hoses, make sure the engine is cold and remove the radiator cap. Run the engine with the cap off and the heater on until the upper radiator hose is hot. Then stop the engine and drain all the coolant. Remove and replace any defective or aging belts and hoses after allowing sufficient time for the engine to cool.

Testing the thermostat

If you have any doubts about your thermostat due to inefficient heater operation or engine overheating, now is the time to test it. To test, simply suspend the thermostat in a pan of water along with a thermometer. Heat the water and check to see when the thermostat opens. If it doesn't open at the specified temperature, you must replace it.

Once you have installed any necessary new components, fill the system with water, turn on the heater and pressure-test the cooling system. Install the pressure tester onto the filler neck of the radiator and pump up the specified amount of pressure. Then carefully check all connections, the heater control valve and the thermostat housing.

If these checks fail to uncover the source of pressure leakage, use a flash-light and mirror to check the vent hole and seal of the water pump. If further checks are necessary, support the front of the car on jackstands and check all the core plugs.

Flushing the system

Once you have determined that there are no leaks, remove the tester, add a cooling system flush treatment, run the engine until it's warm again, then shut it off and drain all the water. Repeat this step, using plain water three or four times until the drained water runs clear. Remove the recovery tank and clean it out.

Reinstall the recovery tank and fill the system with enough antifreeze to provide at least 50-percent antifreeze, but no more than 70 percent. (Freezing protection deteriorates as the antifreeze percentage exceeds 70.) Fill the recovery tank to the "full cold" level.

If your vehicle has an aluminum radiator or aluminum engine parts (cylinder head, water pump, and so on), you should use an antifreeze that's formulated especially for use with aluminum engine parts.

Some import manufacturers insist that their own antifreeze be used for refills. This is actually unnecessary, because any of the popular aftermarket labels that are formulated for aluminum will provide excellent corrosion, boilover and freeze protection in these vehicles.

If your cooling system has not been flushed on an annual basis and corrosion and dirt have accumulated, ask your neighborhood mechanic to do a power backflush, using chemical cleaners.

Check the radiator pressure cap with the pressure tester to make sure it will maintain cooling system pressure, then reinstall it.



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SECTION TWO

The single most common cause of winter no-starts is improper operator starting technique. The right method, as most vehicle manufacturers recommend, is that you push the throttle to the floor once or twice and release it. This sets the choke and provides a shot of fuel from the accelerator pump.

If the recommended procedure fails to start the car, don't keep trying to modify your method until you find a procedure that works. Instead, determine why the cold-start mechanism isn't working.

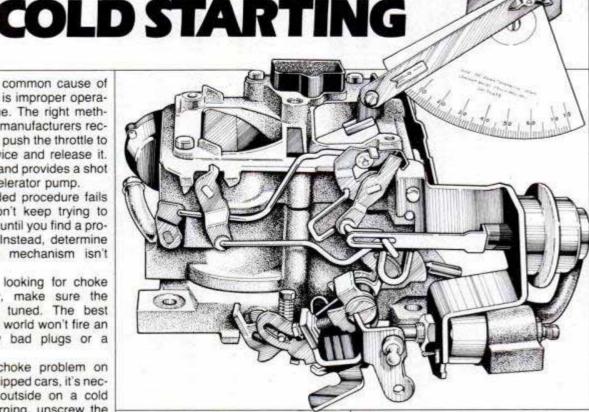
Before you start looking for choke problems, however, make sure the engine is properly tuned. The best choke system in the world won't fire an engine with a few bad plugs or a clogged fuel filter.

To diagnose a choke problem on most carburetor-equipped cars, it's necessary to leave it outside on a cold night. The next morning, unscrew the air cleaner before you even attempt to start it. While watching the choke valve, open the accelerator linkage. The choke valve should snap closed, and the fast idle cam, which holds the throttle open for cold starts to provide faster idling, should slip into position. There should be no drag or binding.

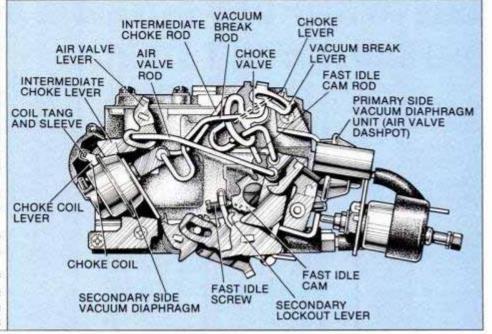
Prewinter maintenance should include the cleaning of the choke mechanism with carburetor cleaner. Don't lube the linkage. This will only attract dirt, causing premature failure.

Once you've determined that the choke valve isn't binding and is moving into position, hold it open and depress the throttle fully while watching the accelerator pump nozzles inside the throat of the carburetor. They should provide a stream of fuel. If they don't, you have a carburetor or fuel system problem that must be resolved before the cold-start system will function.

If both the accelerator pump and the choke valve are functioning, you can adjust the choke valve and the fast idle. On some cars this is just a matter of indexing the choke housing to a specific position and adjusting the fast idle cam linkage so the throttle screw falls on a



A choke valve angle gauge (above) is needed to adjust the choke on 1978 and newer GM cars with two-barrel or fourbarrel carburetors. Magnet holds the gauge to the choke plate. The built-in bubble level is used to set the precise angle of the choke plate. The angle can be changed by carefully bending the fast idle cam rod (below) with a special tool. The fast-idle screw must be on the second step of the fast idle cam when the adjustment is made (see details in text).



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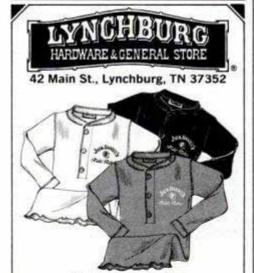
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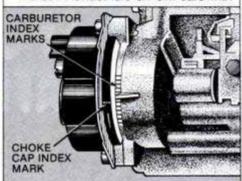
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COLD STARTING

specified step. On other vehicles with choke housings in the intake manifold, there are reference points that can help you determine if the choke is closing fully. In either case, you'll need a general auto repair manual or the specific factory service manual for your car.

A choke valve angle gauge is necessary for choke mechanism adjustments on 1978 and newer GM carbureted cars. The adjustment procedure on these cars begins with a check of choke valve closing. Specific size rod gauges (or drill bits) are used to check the choke valve closing. Once this adjustment is made, the fast idle cam relation is adjusted with a choke valve angle gauge. This gauge is available at auto parts stores.

To set the fast idle on GM cars with



On many cars, the choke is adjusted by aligning the index mark on the choke cap with the specified mark on the carb.

two- or four-barrel carbs, rotate the gauge scale until the zero is opposite the pointer. Then position the magnetic base of the gauge on the choke valve with the choke closed. Turn the bubble level until the bubble is centered. Next, rotate the scale to the degree specified in the owner's manual. Then position the fast idle cam so the throttle screw sits on the second step. Close the choke and push the vacuum break lever toward the tang on the choke linkage. The angle gauge's bubble should center. If it doesn't, bend the fast idle cam rod until it does.

The angle gauge is also used to adjust the vacuum breaks that help control choke position during warmup.

If you want to have a professional mechanic do the job for you, ask him if he has an angle gauge for GM choke adjustments. If he doesn't know what you're talking about or tells you he doesn't need one, find a new mechanic. A mechanic who is NIASE-certified in engine tuneup should be familiar with this procedure.

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SECTION THREE

ENGINE TUNEUP

he term tuneup is a confusing one. That's because the whole concept of what a tuneup should be is changing. We like to divide tuneups into two categories: maintenance service tuneups and diagnostic tuneups. A maintenance tuneup is the kind you can do in your driveway. It involves replacement of various components-like sparkplugs. filters and ignition parts-at regular intervals. A diagnostic tuneup, on the other hand, is the procedure that must be performed when regularly scheduled replacement of parts that wear out fails to remedy an engine fault. Due to the complexity of modern engine control systems, sophisticated and expensive test equipment is needed to perform a diagnostic tuneup properly. If you complete necessary maintenance procedures and find that your engine

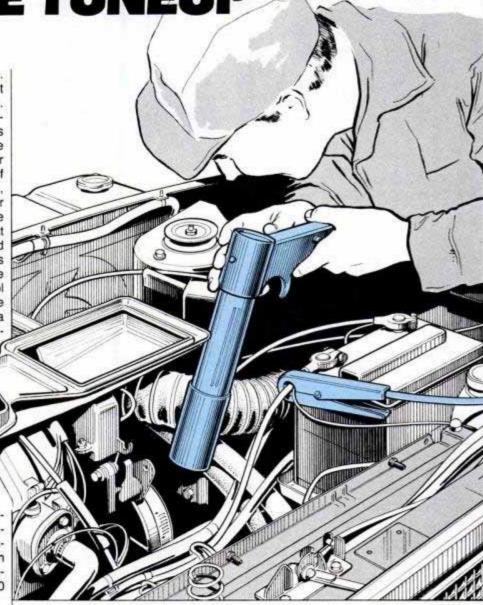
still won't run right, professional attention is usually called for. However, you can

However, you can still do a maintenance service tuneup. The most obvious part of this procedure is sparkplug replacement. While some vehicle manufacturers suggest that 30,000-mile replacement is adequate, most mechanics and some other manufacturers recommend 20,000-mile replacement. On vehicles with electronic ignition, we prefer to clean and gap plugs at 15,000 miles, then replace them at 30,000.

If you do clean and gap your plugs, file the top of the electrode slightly to sharpen the edges. Do the same with the ground electrode's front edge and lower surface. Discard plugs with more than a slight amount of electrode erosion.

Don't reinstall a plug that you've dropped on the ground; its insulator may be fractured internally. Gap plugs to the recommended setting.

Don't juggle sparkplug heat ranges in an effort to compensate for other engine problems. Today's plugs, with their wide heat ranges, are generally satis-



Check ignition timing by following steps described on the tuneup data decal under the hood. When timing at idle is correct, check the vacuum and centrifugal advance.

factory for all types of driving in the recommended heat range.

Replace all filters at least at the recommended intervals. In high dirt or pollution areas, replace air filters more frequently.

Clean your plug cables and remove corrosion from terminals. Check cables for burns, cracks or other damage. Check for boot fit. Replace any defective cables. If the cables are in generally poor condition, replace the whole set.

Inspect the inside of your distributor cap and the ignition rotor for cracks, carbon tracking, erosion and corrosion. Some ignition parts are coated with dielectric compounds to prevent corrosion and arcing. Make sure you use the manufacturer's recommended compound to coat new parts in a similar manner. On most engines the centrifugal advance weights are under the

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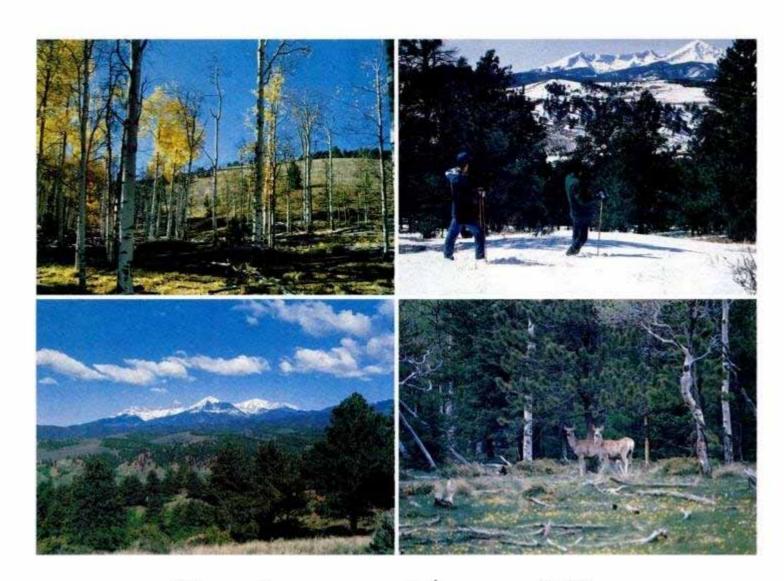
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ACTUATOR ROD VALVE ASSEMBLY EXHAUST

Heat riser and EFE valves on some engines are vacuum operated. If valve does not open as the engine warms up, check valve and rods for binding, and vacuum hoses for leaks.

rotor. Check them for binding and corrosion. Clean them if necessary.

Check and clean the PCV valve, filter and hoses every 15,000 miles. Replace the valve and filter (and any deteriorating hoses) every 30,000 miles. Replace the vehicle's oxygen sensor at recommended intervals. Check the heat riser or EFE valve in the exhaust pipe for binding. Make sure it closes when the engine is cold. Check the carburetor mounting bolts for tightness.

Check the air cleaner hot air system for proper operation. Make sure the door closes when the engine is cold and opens when it's warm. If the door doesn't close when the cold engine is started, check to see that vacuum is reaching the valve's vacuum motor in the air cleaner housing. If it is, replace the vacuum motor. If it isn't, check to see if vacuum is reaching the thermal vacuum switch in the air cleaner housing. If it is, replace the switch. If it isn't, check for incorrect hose routing or a damaged hose.

Of course, you'll want to make an oil and filter change a part of your prewinter tuneup. But don't neglect to maintain intelligent change intervals the rest of the year. Remember that the inexpensive maintenance intervals the carmakers advertise are for "normal" usage as opposed to "severe" usage. And their definition of normal usage is usually long trips, driven on highways at moderate speed. In other words, almost everyone fits into the "severe" usage category. We change our oil and filter every 3,000 or 4,000 miles, and use a premium-grade, conventional motor oil, usually a 10W-40.

Check the engine's idling speed as part of your maintenance tuneup, and adjust it to specification if necessary. Check ignition timing in the manner described on your vehicle information label. Adjust if necessary. Then, disconnect the vacuum advance, accelerate the engine to 1,500 rpm and reconnect it. You should see timing advance. If you don't, make further tests of the vacuum advance mechanism by checking the input vacuum with a gauge and vacuum diaphragm operation with a hand vacuum pump. Replace the vacuum diaphragm if it is nonfunctional. (Consult a shop manual: On some cars this may require more distributor disassembly than you're willing to attempt.) To check centrifugal advance operation, accelerate the engine to relatively high speed while watching your timing light and timing marks or timing meter.

Again, if normal maintenance tuneup procedures fail to solve a performance problem, a diagnostic routine will be necessary. To perform this routine properly, a shop should be equipped with an emissions analyzer, an oscilloscope and an engine analyzer that can perform a power balance test. In addition, the mechanic should make tests of engine compression, system voltage and computer controls.

Don't be afraid to ask a mechanic what his fault-finding diagnostic routine includes. If he doesn't seem to know what you're talking about, find a new mechanic. Again, a mechanic who is NIASE-certified in engine tuneup (and who is equipped with the proper tools), should be able to perform a fault-finding or diagnostic tuneup.

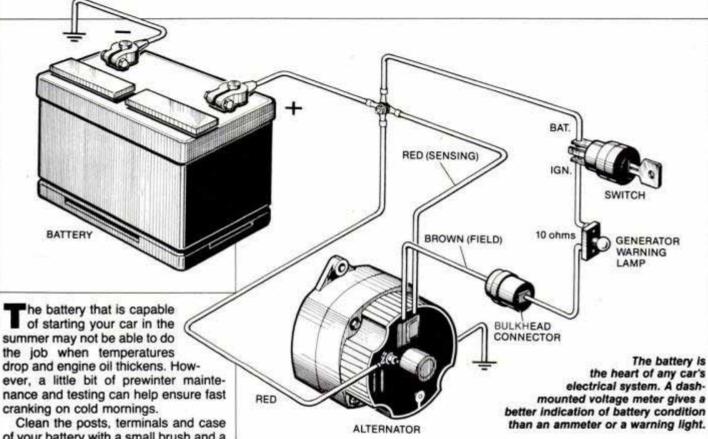






SECTION FOUR

BATTERY MAINTENANCE



of your battery with a small brush and a paste made with baking soda. If corrosion is allowed to build up on electrical connections, the resistance created will limit the amount of juice available for cranking the engine and firing the plugs.

If your battery cables are equipped with bolt-on replacement terminals, disassemble and clean these, at the very least. It would be better if you replaced any such cable with one that has a terminal molded onto the cable. The clamp-on terminals allow moisture to get into the connection, quickly creating corrosion and resistance.

With conventional batteries (as opposed to maintenance-free), check the fluid level. If it's not as high as it should be, add distilled water to the proper level. If the temperature is below freezing, drive the car for at least 20 minutes so the water will be fully mixed into the battery solution. The battery could freeze and crack if you don't.

If you have a maintenance-free battery, you may be able to check the battery's state of charge. On many of these batteries, you'll find a hydrometer eye on the top of the case. This gives an indication of the battery's specific gravity, which varies in respect to state of charge.

Usually, a dark or black eye means that the battery is in need of a recharge. A green eye means the battery is at least at 75 percent of full charge (see illustration on following page). A clear or yellow indicator means that the battery is defective and must be discarded. Don't try to jump such a battery. It cannot be recharged or refilled; it must be discarded. But don't be fooled by sunlight shining through the case of a battery. This may cause a false reading on cars with clear battery cases.

With a conventional or maintenance-

free battery, you can get a good idea of state of charge and the battery's ability to hold a charge by checking battery voltage.

First, measure voltage at the battery with all accessories turned off and the engine not running. It should be more than 12 volts. Then disconnect the coil wire from the distributor cap and attach it to ground. Or, on cars with GM HEI ignition, disconnect the wire that is attached to the distributor connector labeled "BAT." Have a helper crank the engine for at least 15 seconds while you watch the voltmeter. The cranking voltage of a fully charged battery should be at least 9.6 volts, and a battery that is in good condition and fully charged should be able to sustain that voltage for at least 15 seconds.

If your battery is not capable of pass-(Please turn to page 138)

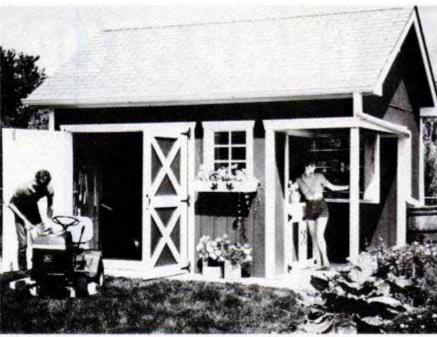


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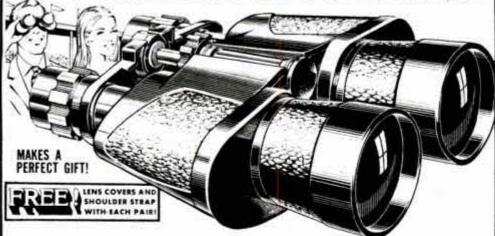
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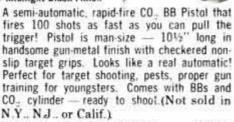
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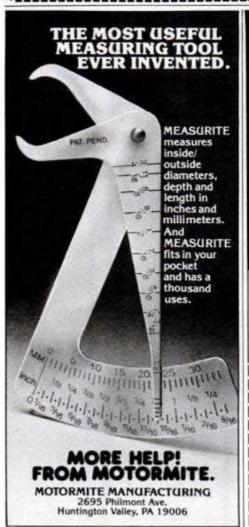
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BATTERY

(Continued from page 134)

ing the voltage test, bring it to full charge with a trickle charger and try it again. You may not be able to bring a maintenance-free battery to full charge with a trickle charger. Some maintenance-free batteries require a sustained, high amperage charge that can only be done on professional charging equipment.

Once your battery is fully charged and passes the voltage test, drive the vehicle for a few days and repeat the voltage test. If the battery won't hold the charge under normal operating condi-





INDICATES AT LEAST 75% CHARGE



DARKENED INDICATOR (NO GREEN DOT)

IN NEED OF RECHARGE

Hydrometer "eye" on some batteries shows state of charge. A color dot (usually green) indicates an adequate charge. No dot means that a recharge is needed. A light-colored eye means battery is shot.

tions, but passes the cranking voltage test once it is fully recharged, either your charging system is defective or there is an accessory current drain sapping battery power. A battery that passes the voltage test should be okay.

A hydrometer test can help confirm that a conventional battery is okay. Inexpensive battery hydrometers that indicate approximate state of charge are available at auto parts stores. But don't rely on a hydrometer reading without a cranking voltage test.

If you suspect that your battery is defective, make sure that a charging system problem hasn't contributed to its demise. If testing suggests that the battery is incapable of holding a charge, but you don't want to attempt a test of alternator and regulator condition, you may want to purchase a battery from a mass merchandiser or independent mechanic who offers free amp and fulfield testing of the alternator with every purchase. Ask. You might be surprised to find that your mechanic routinely performs this service with the purchase of a battery.

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The Rokon Ranger is an all terrain vehicle with both front and rear wheel drive. Features a weather-proof Chrysler 10-hp engine and automatic transmission. These vehicles can haul 600 lbs. and range up to 500 miles on one fuel loading. Free brochure.

772 Radiator Repair

The Barbee Company offers a 32-page catalog covering radiator repair equipment, supplies, tools and chemicals, plus information on their training school. Free

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Handy pocket measuring guide to solve all those everyday measuring problems. Includes decimals, drill sizes, metric conversion, liquids, troy weight and much more. R&B, Inc. 75¢

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24-page illustrated booklet gives helpful advice on shopping for modern vinyl floors. Information on no-wax surfaces, cushioning, installation and upkeep. Plus, how to decorate and important questions to ask the salesperson. From Armstrong. Free

775 Insulation Information

John-Manville's 12-page, color booklet can help you make the job of insulating your home an easy one. Includes information on choosing, measuring and installing fiberglass insulation. Also explains importance of R-values. Free

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777 Facts About Faucets

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Mist-Mizer is a product that can help minimize your air-conditioning costs. Works on a thermostatically controlled water "misting" system. Reduces condenser temperature producing colder air and less humidity. Brochure from Faxon Research and Mfg. Free

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SECTION FIVE

SUSPENSION

any motorists tend to ignore the parts of their cars that they can't see and those for which there are no specific service intervals, such as steering and suspension components. This is unfortunate, because a car with worn chassis components is dangerous. An annual examination of these parts is absolutely necessary. And, because wet, icy roads can aggravate handling problems, the last days of autumn are a perfect time for a checkup.

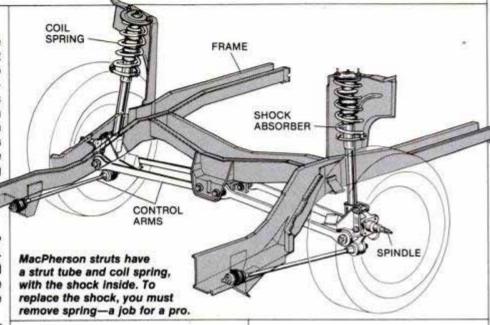
Begin the chassis inspection of any car with a road test. Does the car dive excessively on braking? Does it bounce uncontrollably after hitting a bump in the road? It should rebound firmly and smoothly and the suspension oscillations should be damped by the shocks or struts.

If you suspect that the shocks or struts are not damping wheel movement, follow up your road test with a bounce test. Simply push down firmly and quickly on each corner of the car and watch how it rebounds. It should return to the original position without bouncing back down repeatedly. If it bounces up and down, the shocks or strut cartridges are not providing enough suspension damping and should be replaced.

If your car is equipped with conventional springs and shocks (as opposed to struts), you should check ride height. This will tell you how much your springs have sagged. You can find ride-height specs in an auto repair manual.

Consider the ride-height checking procedure for a mid-sized GM car, as an example. The manual explains that the front ride height is checked by measuring the distance from the center of the lower control arm bushing to the ground and from the lower inboard edge of the ball joint seat to the ground. The second measurement is subtracted from the first, leaving you with a number that is indicative of how far the car has sunk on its springs. If the number is less than the specification, the springs have sagged and should be replaced.

The rear ride height of this particular

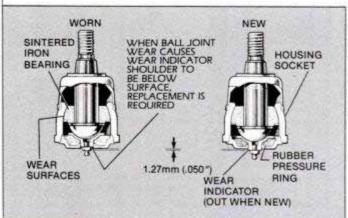


car is checked by measuring from the jounce-bumper's upper attaching bolt to the top of the axle housing. (As the springs sag, the rear axle housing is pushed up closer and closer to the jounce bumper.) Again, if the measurement is less than specified, the springs are worn and should be replaced. Leaf springs can be re-arced by a spring specialty shop, but sagging coil springs cannot be repaired.

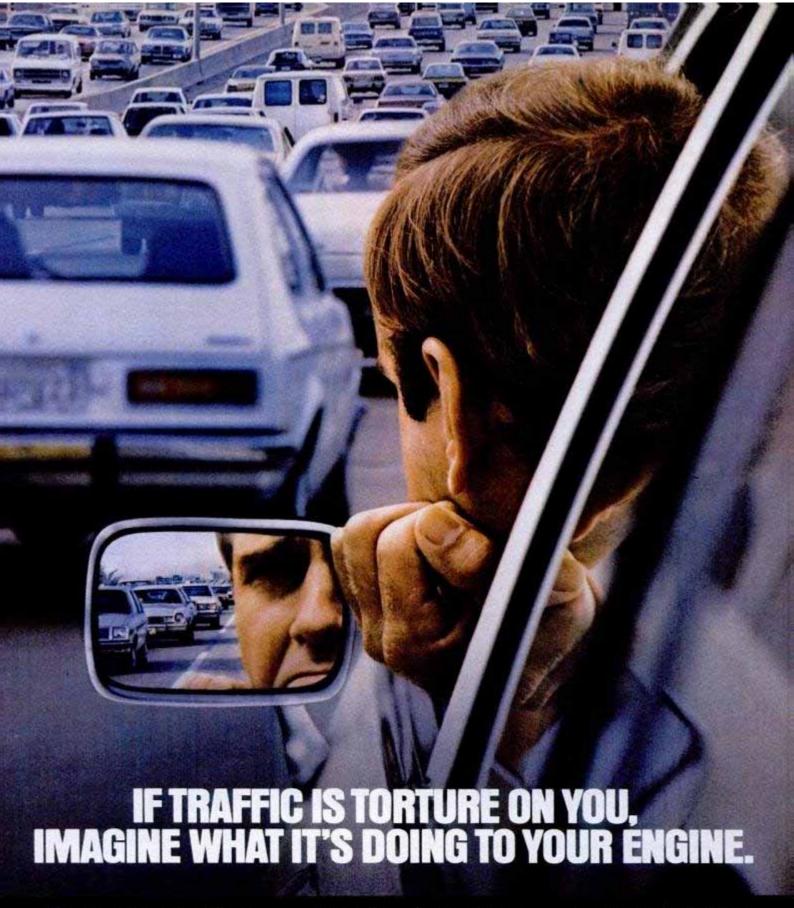
On cars with MacPherson struts, examine each strut for signs of leakage. Some struts may weep a slight amount

of oil over a period of time. This would be evidenced by an accumulation of dirt and a slight oiliness under the dirt. However, if the strut is wet with oil or completely coated with oil, the strut must be replaced. Check also for loose or damaged struts. If the tube is seriously dented or the strut rod bent, the strut must be replaced.

Check the tires for uneven or excessive tire wear. If the tires are not wearing properly, the strut or strut tower may have bent or shifted in some way. Have the wheel alignment checked. On some



Some post-'73 cars have a wear indicator on the ball joints. These cars have a collar or shoulder around the grease fitting. When the joint is new, the shoulder sticks out below the bottom of the socket housing. As the joint wears, the shoulder retreats into the housing.



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can take a lot of torture.

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Today's Gulfpride. It's tough in traffic.

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SUSPENSION

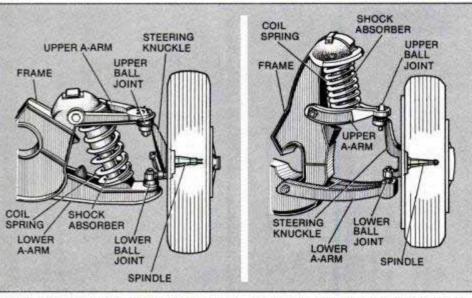
cars, the strut mount can be adjusted to change alignment angles. On other cars, the strut tower must be pushed back to its original location with frame-straightening equipment.

Jack up the front of your car and secure it on jack stands to check tie rod ends, steering arms and ball joints. Make sure the car is in PARK with the emergency brake set and the rear wheels chocked. On cars with coil springs, check the ball joint on the control arm (A-arm) where the spring is mounted. This is the load-carrying joint, and, unless it was replaced previously without replacing the other joint, it should be the first one to wear out.

If the load-carrying joint is on the lower control arm, lift the control arm with a jack until the wheel is in its normal position. Insert a pry bar under the wheel and attempt to move it up and down. There should be virtually no visible movement. One chassis parts manuSome cars produced after 1973 are equipped with wear indicator ball joints as standard equipment. Wear indicator joints have a shoulder around the grease fitting that protrudes from the lower surface of the joint. As the joint wears, this shoulder sinks below the surface of the joint, indicating that replacement is necessary.

The checking of tie-rod ends, Pitman arms and idler arms is pretty much a judgment call. You can check steering components by blocking the front wheels in such a way that they can't move from side to side. Then have an assistant turn the steering wheel while you watch the steering linkage for movement at each joint. Or you can just grab the tie rods and shake them vigorously.

If you push hard enough, you can induce movement in any tie-rod end. However, all tie-rod ends should be preloaded. The stud should not move freely in the socket. Look for damaged



On conventional coil spring suspensions, the shock absorber can be removed easily from within the coil spring by taking out a few mounting nuts or bolts.

facturer suggests that there should be less than 0.050-inch of movement. Replace both load-carrying joints if either is loose. Check the unloaded joints if the loaded joints were worn. There should be no visible movement.

If the load-carrying joint is on the upper control arm, relieve the load by wedging a block of wood between the control arm and the frame before jacking the car. Lift the car just to the point where the wheels leave the ground. Check for ball-joint movement without crawling under the car. Noticeable movement is reason for replacement.

or missing rubber boots on tie rod ends.

Inspect control arm bushings for signs of rubber deterioration. Check that the rubber has not ripped away from the center or outside of the bushing. Any sloppiness or excess play in the bushings means replacement.

Most cars have a sway bar to prevent body roll. Some cars have them both in front and at the rear. The bar will be mounted to two of the front control arms or to the ends of the rear axle on support links, and will be mounted in bushings on the frame. Check the bushings and support links for deterioration.



ESCORT WINS AGAIN! JULY 1983 BMWCCA ROUNDEL TEST

"... the filter (ST/O/P) ESCORT is simply outstanding... unit decreased non-police alerts by over 90%... a price far below that of many other detector units. The ESCORT simply keeps getting better."

ESCORT WINS

MAY 1983 CAR and DRIVER TEST

"The Escort looks so comfortable, contented, and familiar at the top of the heap that it's hard to see that something new and special has been added... live with a new Escort for a while and you'll realize it has advanced new circuitry that should go down as a genuine breakthrough."

ESCORT WINS

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"The Escort, a perennial favorite of these black-box comparisons, is still the best radar detector money can buy. The Escort is a quality piece of hardware."

ESCORT WINS

DEC 1981 BMWCCA ROUNDEL TEST

"The Escort is a highly sophisticated and sensitive detector that has been steadily improved over the years... In terms of what all it does, nothing else comes close.

ESCORT WINS

SEPT 1980 CAR and DRIVER TEST

"Ranked according to performance, the Escort is first choice... The Escort boasts the most careful and clever planning, the most pleasing packaging, and the most solid construction of the lot."

ESCORT WINS

MAY 1980 BMWCCA ROUNDEL TEST

"This unit... consistantly outperformed the other products and is the standard to which the others are compared. If you want the best, this is it. There is nothing else like it."

ESCORT WINS

FEB 1979 CAR and DRIVER TEST

"Only one model, the Escort, truly stood out from the rest...once you try the Escort, all the rest seem a bit primitive. In no test did any of the other detectors even come close."

Talkback with Jerry Galvin

Tune

America's New Weekly Satellite Call-In Comedy Talk Show, "Mr. Galvin is a master... bis show is so unusual that people actually set aside time to listen..." (The Wall Street Journal) Sunday evenings on public radio stations. Check local listings.



ESCORT: "A GENUINE BREAKTHROUGH"

If you keep up with magazine tests, you know that ESCORT does more than just outperform other radar detectors. In its most recent evaluation, Car and Driver concluded: "The Escort radar detector is clearly the leader in the field in value, customer service, and performance..." But performance, as measured by warning distance, is not the new breakthrough. After all, ESCORT has been beating all comers since its introduction in 1978.

Now There's More To It

While long detection range is obviously essential it does nothing to solve a problem that has cropped up in the last year. In fact, increasing range by itself just makes the problem worse. If you already have a good superheterodyne unit, you know what we mean. A new generation of imported detector transmits radar signals, and can set off your unit as far as a mile away. The longer the range of your unit, the farther away you find them. As Car and Driver pointed out last November: "Since there are far more detectors on the road than police radar units, interference.....could become a genuine nuisance."

Low Level Contamination

At first it was just an irritation. At least ESCORT owners had a way of distinguishing the polluters from the real thing. Our unique audio warning differentiates between the two police radar bands: it "beeps" for X band and "braps" for K band. The polluters' trashy signals triggered both warnings at once, and made a new sound—different than the sounds for police radar. (The rest of the industry didn't even know there was a new problem. Their detectors were making the same sounds as always, just more often.)

Radar Epidemic

As more and more of the "polluting detectors" hit the streets, the problem became more serious. If one of the "polluters" is approaching in an oncoming lane, the alarm from your detector is brief. But if it's traveling the same direction as you, your alarm can go on for miles. And the offending detector doesn't have to be in the car right next to yours. It can be ahead or behind, and up to a mile away. A very serious problem indeed.

Pollution Clean-Up

The problem required an entirely new approach. Examining the interference from these imports, our engineers discovered a subtle difference between their signals and those of police radar, even though they were on the same frequency. The solution, then, was to design new circuitry that would reject the pollution while — and this was the hard part — maintaining ESCORT's industry-leading response to pulsed and instant-on radar. We named it ST/O/P™ (STatistical Operations Processor), and it consists of a CMOS digital processor with built-in memory, ST/O/P is not simple, and it's not cheap. But it is, in our opinion, the most important breakthrough in radar detection since superheterodyne. Car and Driver would seem to agree: "Now, all the world's Radio Shack detectors can hum right by your car in full



Peace of Mind

With ST/O/P, we've put the complications necessary to cope with today's radar problems inside—where they work automatically. Just install ESCORT, plug it into your cigar lighter, and turn it on. ESCORT does the rest. If you encounter a signal from a "polluting detector," ESCORT keeps quiet while maintaining its lookout for police radar. If the signal is the real thing, ESCORT immediately alerts you both audibly and visually. And, unlike other detectors that keep you guessing about the radar's location, ESCORT's signal-strength meter moves upscale as you approach and its variable-rate beeper/brapper pulses faster. You get the full story.

FOR ESCORT OWNERS ONLY

The new ST/O/P technology incorporated in all new ESCORTs is adaptable to all ESCORTs from serial number 200,000 to 399,999. The "ST/O/P Retrotif" costs \$75, and includes adding the ST/O/P digital circuitry with memory and totally retuning and realigning the unit. The ESCORT's one year limited warranty will also be extended to a date one year after the conversion, and of course the shipping costs to return the unit to you are included.

To insure efficient and prompt service, we will use a special reservation system for scheduling the "ST/O/P Retrofit" service. DO NOT SEND YOUR ESCORT, but please send a card or letter (no phone calls, please) with your name, address, and serial number to the following special processing address:

to the following special processing address: ST/O/P Reservations, P.O. Box 228, Mason, Ohio 45040. We will then send you a special shipping label and details on how and when you can send us your ESCORT.

It's Simple

If you want the best, there's no reason to look anywhere else. But don't take our word for it. Try ESCORT at no risk. Open the box, install ESCORT on your dash or visor, and 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. ESCORT is sold factory direct, so knowledgeable support and professional service are only a phone call or parcel delivery away. And we back ESCORT with a full one year limited warranty. Order today and let ESCORT change radar for you forever.

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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.





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SECTION SIX

TIRES AND WHEELS

agood set of tires is obviously essential to safe winter driving. The driving wheels, front or rear, must provide adequate traction to keep you going on slippery or snow-packed surfaces, but don't neglect to check the other two tires, as well.

On a front-wheel-drive car, worn rear tires can contribute greatly to oversteer on turns (the rear slides out). On rear-drive cars, worn front tires can contribute to understeer (the car forges ahead rather than responding to steering control). Both can lead to serious handling problems.

For the driving wheels, there is the problem of choosing between snow tires and all-season radials. And within these categories there are a multitude of types available.

All-season radials, with their aggressive tread patterns, should suffice in areas where snow accumulation doesn't exceed a few inches and where roads remain dry much of the time. Some all-season radials are much more effective than others, so stick with a top-line tire maker.

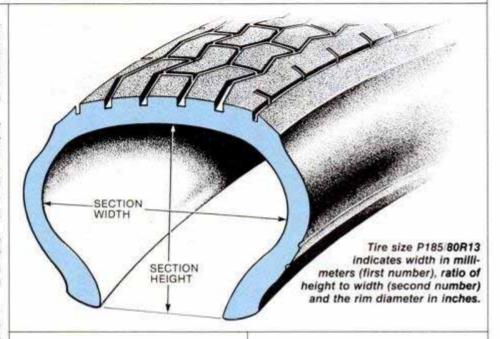
If you live in a heavy snow area, you may opt for snow tires on the driven wheels. Some makers of front-drive cars recommend mounting snow tires on all four wheels; check your owner's manual for advice.

The main rule in choosing snow tires is to avoid mixing bias-ply tires with radial tires. This can cause unusual handling characteristics.

If road-icing or snow-packing is a particular problem, you may want studded snow tires, providing, of course, that they're legal in your area.

Replacement tires should be of the same size, load range and construction as those originally on the car. Once you start swapping sizes or types, the vehicle's handling, speedometer calibration, ground clearance, or tire/body clearance may change. Tires should always be replaced in pairs.

When new tires are mounted, the wheels should always be checked for damage. Make sure none of them are



bent or dented, and examine the lug nut holes for elongation. Check the wheel carefully for corrosion, particularly where the wheel center and rim join.

Most vehicle manufacturers recommend that wheels be checked for runout when new tires are mounted. GM indicates that wheel runout should not exceed 0.045-inch, when measured near the edge of the wheel with the dial indicator parallel to the vehicle's spindle or axle and perpendicular to the wheel. (Obviously, you can't get an accurate reading unless the wheel is clean and smooth.) Runout should not exceed 0.025-inch when measured on the surface of the wheel that is parallel to the ground, with the indicator mounted parallel to the wheel and perpendicular to the axle or spindle.

Mounting and demounting snow tires twice a year is not only expensive, but it can chew up the beads and ruin a tire before its time. An extra set of wheels for your snow tires can pay for themselves in a few seasons. You can often buy sound wheels from wrecking yards for half the price of new ones—just make sure you inspect them carefully for rust or damage.

You can do a lot to improve the way your car handles on dry, snowy or wet pavement if you check tire pressures once a month and adjust them to the level recommended by the vehicle manufacturer. Check the tires cold, unless the manufacturer indicates otherwise. Pressure will increase as much as 6 p.s.i. as the tires heat up.

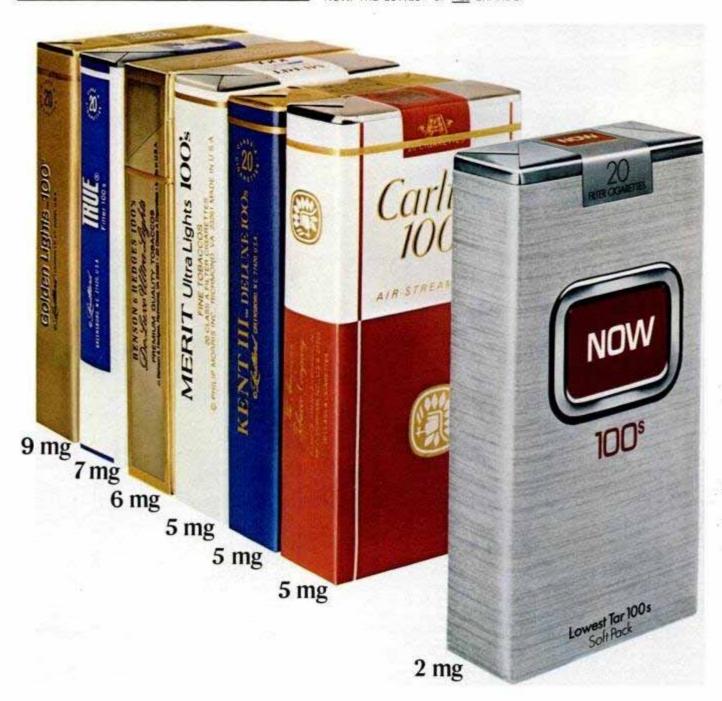
Most experts feel that underinflating tires will do little to improve traction, even in deep snow. And, when you cross from snowy roads to dry, the loss of handling and dangerous heat buildup will more than offset any return you may gain in traction.

Both full and partial chains are extreme measures and should only be installed when a car has to be moved through extremely deep snow. Don't drive on dry roads with chains; you'll beat your car to death.

Plain steel-link chains are cheap, but they wear through quickly. Lug-reinforced chains have cleats welded to the links that meet the road. These lugs provide better traction and longer wear. European-style chains have a crisscross pattern that provides excellent traction, but they are expensive.

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SECTION SEVEN

BODYAND PAINT

Preparing your car's exterior for winter is particularly important if you plan on keeping the car for more than just a couple of years. Moisture is the enemy. When the weather gets wetter, the danger of metal corrosion and paint damage increases substantially. But you can take steps to reduce the chances of harm.

You'll want to begin by treating any rust areas or paint chips. The trick is to remove the rust and coat the bare metal to prevent more rust from developing. We're not going to go into the procedures for repairing rust holes or refinishing panels at this point, and you may not be ready for that much of an investment in time or cash. But you can do a lot to keep the situation from worsening.

On rusted areas of more than 1inch diameter, where paint has
peeled off completely, you'll
have to settle for a mismatched
repair unless you're prepared to
refinish a whole panel or the
whole car.

On the other hand, small areas of less than an inch in diameter, such as chips or popped paint blisters, can be touched up fairly well. And, if they're not in conspicuous places, they'll be barely noticeable.

Just take a penknife and carefully scrape any rust from the damaged area. Make sure you get all of the rust, even if you create a depression by doing so. Then purchase a bottle of touch-up paint-if you can find touch-up paint for your car in a bottle. Spray touch-ups are commonly available in auto parts stores and from new car dealers. But the bottled paint is much harder to find. Settle for the spray paint if you can't find the other, but don't attempt to spray it on. It'll stick out like a sore thumb. Instead, after shaking the can very well, spray a little of the paint into the large cap or a paper cup. Allow it to sit for about five minutes or as long as it takes for the paint to thicken a bit, until it's more like the paint that is meant to be applied by brush.

Once the spray paint has thickened,



To buff out faded old paint and minor scratches, you can rent a polishing machine. But be extremely careful how you use it—any mistakes can burn right through the paint.

take an ordinary cardboard safety match and dip the torn end in the paint. Dab the paint on the bare spot, taking care not to exceed the boundaries of the damaged area. Lay the paint on fairly thick, but don't keep fooling with it. Do it and leave it alone. Once the paint is dry, the area will be protected, and the edges of the remaining paint will be sealed, preventing additional damage. The car can be waxed or polished after a couple of days, but take it a little easy on repaired areas with abrasive cleaners or polishes.

If your car is coated with road tar or other foreign material that normal cleaning with soap and water won't remove, you can purchase a solvent cleaner from an auto parts store that handles automotive paints. Ask the counterman for a solvent that is compatible with the finish on your car. Read the instructions that are provided with the product.

Polishing is important both in terms of protecting your car and beautifying it, and the right product will do both.

If your car has only slight scratches and discoloration, you can use a two-part car polish. The first part of this type of product is a blend of solvent and abrasive material that will remove the outer surface of the paint, restoring its color and smoothness. Part two is a sealing wax that will produce a gloss and protect the paint surface from weather and salt. However, these polishes do remove paint and you might rub all the way through to primer if you're not careful.

BODY AND PAINT

You should use an abrasive polish only if it's needed to remove faded paint, scratches or spots. If scratches are too deep for the abrasive polish, you might try a light sanding with No. 600 wet paper followed up by rubbing compound. However, the danger of rubthrough is, of course, even greater with rubbing compound and sandpaper.

A one-component liquid or paste wax with abrasive is designed to do the job of the two-component polish, but, again, rub-through can be a problem. Because these polishes are designed to be fast acting, they may be even more prone to rub-through than the two-part polishes, especially when used with a power buffer.

Finally, there are polishes without abrasive. Many of these are advertised as "cleaner polishes." They contain some type of solvent that will help remove surface film but will not remove a lot of paint. You can tell if a polish contains abrasive material by rubbing some of it between your fingers.

If you want your polishing job to protect the car all winter, rent a polishing machine that runs at 2,000 rpm or faster under load. Polishing with a machine heats the paint and causes a burnishing action. This makes the polish last much longer than a hand-applied coating. However, it's also easier to rub through the finish with a machine. Be careful.

See the label directions on the product you're using to determine what type of polishing pad to use. The most common types are the lamb's wool pad and the carpet-type pad.

While you're polishing the car's finish, don't neglect the brightwork. Check all the chrome and metal-appearing parts to determine if they're chrome-plated steel, anodized aluminum or bright plastic. Check with a magnet if you're in doubt. Wax aluminum and plastic parts with a nonabrasive car polish. To protect steel bumpers or other conventional chrome-plated steel parts, apply motor oil to the parts, wiping off the excess. Oil will reportedly protect chrome perfectly if applied three or four times a year.

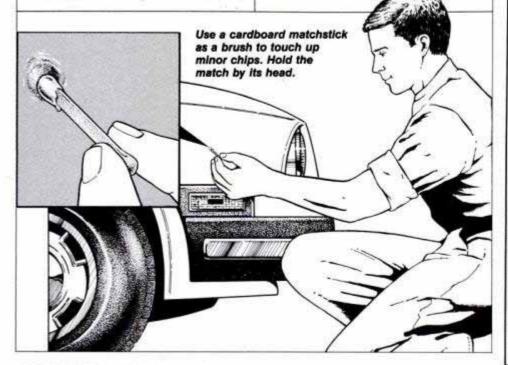
Don't neglect the greasy side of the car either. Check all the undercoating for bare spots. If you find any, clean off the dirt and corrosion and apply new undercoating material. Undercoating is available in spray cans from auto parts stores.

In general, remember that no metal or painted parts of your car should be exposed to bad weather without protection. And don't make the mistake of parking a wet car in a garage. It only speeds up the corrosion process.

Drain holes or tubes are often found on the bottom edges of doors, rocker panels and quarter panels. Some cars have drains on the undersides of the heater housing, cowl, air intake at the base of the windshield and trunk. If the drains are clogged, water will build up and rust will set in.

Use a pipe cleaner or soft wire to gently probe the drains to remove dirt, debris and slush. You must be careful not to scratch the paint.

With a little bit of care, your car can look as nice next spring as it did last summer.



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s yours one of the millions of vehicles called back by manufacturers to rectify safety-related problems? If you're not sure, the information in this section could literally be a life saver.

If you find your vehicle listed, call 1-800-424-9393. That's the hot-line number of the National Highway Traffic Safety Administration. Tell them that you think your vehicle may have been recalled. They will send you a card. Answer the questions on it, making sure to supply the vehicle identification number (VIN). Then, mail the card to the manufacturer, who will let you know if the recall applies to your vehicle. If you bought the vehicle used, the manufacturer will also tell you if it was brought back to the dealer by a previous owner to have the repair made.

There is, by, law, an eight-year statute of limitations on recalls. In other words, once a recall is announced, the vehicle owner has eight years in which to get repairs made at the expense of the manufacturer. Thereafter, the owner has to pay for them.

AMC

Year/Units	Description of Defect	
Models Involved	Corrective Action	
1982: 23,232 Concord, Eagle, Spirit, Jeep Wag- oneer & Cherokee	Incorrect lubrication of T4 and T manual transmission. Install cor- rect EP (extreme pressure) lube	
1982: 15,500 Concord, Eagle, Spirit	Wiring harness may develop short circuit; PCV hose may lie too close to engine hot spot. In stall new electric parts; reroute PCV hose.	
1981; 1,724	Improperly installed automatic	
Jeep CJ, Wagon-	transmission control rod spring	
eer, Truck	(6-cylinder engine). Repair.	
1981: 11,162	Cruise command servo chain	
Concord, Eagle,	may keep throttle activated. In-	
Spirit	stall new chain.	
1980: 6,000	Incorrect taillamp sockets in-	
Concord, Eagle	stalled. Replace.	
1980: 3,310	Front-wheel-drive half-shaft as-	
Eagle	semblies may fracture. Replace	
1979-80: 10,891	Damaged wheel bearings may	
Jeep Wagoneer,	exist. Replace left and right	
Cherokee, J10	bearing assemblies.	

CHRYSLER CORP.

ard. Replace.

joint. Replace.

Replace.

Incorrect tire air pressure plac-

Incorrect gasket between manual

transmission and transfer case

Defective lower control arm ball

Additional accelerator control

system spring needed. Install.

Year/Units	Description of Defect
Models Involved	Corrective Action
1983: 5,234	Electric arc at electric fuel filler
600, 600ES,	door may ignite fuel vapors. In-
Chrysler E-class	stall solenoid-to-ground wire.
1983: 1,725	Vehicle with manual transmission
Dodge Van, wag-	may start with ignition switch in
on, pickup, Ram-	accessory position because of
charger; Plym-	damaged switch. Replace
outh Voyager	switch.
1983: 50,000 Reliant, 400, 600, Aries, LeBaron, Chrysler E-class	Interference with rear brake tubes. Reroute tubes.

1982: 4,000 Ball joint-to-steering knuckle LeBaron, Town & Country, Reliant, bolts may fail. Replace. Horizon, 400, Aries, Omni, Ramcharger 1981: 30,000 Defective bowl vent solenoid may cause flooding and loss of power. Modify solenoid. LeBaron, Cordoba. Newport. Gran Fury, Diplomat, Mirada, St. Regis 1981: 110,000 Defective stop lamp switch may Aries, Reliant cause inoperative stoplights. Replace switch. 1981: 150,000 Automatic speed control may not deactivate on brake application. Replace speed control switch. LeBaron, Cordoba. Newport. New Yorker, Horizon. Reliant. Gran Fury, Omni, Aries, Diplomat, Mirada, St. Regis, Imperial 1980: 14,500 Ball joint-to-control arm bolts may fail. Replace. 1980: 25,004 Overheating ashtray bulb socket Champ, Sapporo, Colt, Challenger may cause fire. Replace socket and wire 1980: 3.000 Side door hinges may fail. Re-B100, B200. place. B300 1980: 235,000 Hood secondary catch may fail. Omni, Horizon Modify. 1980: 6,617 Interference with front tires may Volare, Aspen, cause damaged brake hoses. LeBaron Reposition hoses. 1980: 4,000 Exhaust gas may enter car Cordoba, Mirada through defective rear fende panel sealing plugs. Install different plugs. 1980: 7,000 Defective throttle linkage may Cordoba, Mirada cause throttle to stay open. Replace throttle return springs.

FORD MOTOR CO.

Description of Defect

Year/Units

Models involved	Corrective Action	
1983: 2,673 Thunderbird, Cougar	Inadequately welded fuel-tank seams. Replace fuel tank.	
1983: 36,000 LTD, Fairmont, Ford, Marquis, Zephyr, Grand Marquis, Lincoln Town Car, Conti- nental, Mark VI	Defective transmission control selector-tube retaining clips. Re- place clips.	
1983: 98,162 Thunderbird, Crown Victoria, LTD, Grand Marquis, Marquis, Cougar, Lincoln Town Car, Conti- nental, Mark VI, Ford light trucks, vans	Defective transmission parking pawl actuating rod cam retainer pins. Replace parking pawl as- sembly.	
1983: 1,102 Ranger 4 × 4	Defective front coil spring assem- bly studs. Replace.	
1983: 2,800 Escort, Lynx	Detective fuel system. Shield and reinforce fuel tank and fuel filler.	
1982-83: 2,089 Fairmont, Zephyr	Defective park actuating lever rod springs may exist in C3 auto- matic transmission. Install new springs.	

1982-83: 74,985 Ford	On light trucks and vans, rear axle may disengage. Install le- ver-locking wedges.	
1982: 15,988 Lincoln Continen- tal	Defective fuel filler housing as- sembly may result in fuel leak. Modify.	
1982: 113,000 Escort, EXP, Lynx, LN7	Air conditioning blower motor re- sistor may overheat and cause fire. Install new resistor.	
1982: 4,967 LTD	Incorrect steering column shift ver insulator. Install correct insulator.	
1982: 5,200 EXP, LN7	Failure to meet fuel spillage stan- dards. Install new fuel filter and vent pipe.	
1982: 3,010 Granada, Cougar	Incorrect tire placard data. Get revised placard from dealer.	
1961-82: 245,000 Escort, Lynx sta- tion wagons	Weak front upper torso restraint anchorages. Reinforce area.	
1961-82: 4,330 Escort, EXP, Lynx, LN7	Improperly assembled power brake booster. Replace booster.	
1981-82: 16,500 F-250	Incorrect wheel-lug torque speci- fication given in owner's manual. Get revised page from dealer.	
1981: 1,650 Econoline	Incorrect gear position indicator. Install correct indicator.	
1981: 21,000 Escort, Lyrx	Speed control may activate with- out warning. Modify.	
1961: 112,000 Escort, Lynx	Fuel inlet may not be grounded. Repair.	
1981: 6,500 Mustang, Capri	Driver seat back latch may fail. Replace latch/recliner assembly.	
981: 14,000 LTD, Marquis, Mark VI, Lincoln	Malfunctioning neutral start switch. Replace.	
1961: 7,000 Escort, Lynx	Misrouted engine compartment wire harness may be damaged and cause fire. Rerouté.	
1981: 27,000 Escort, Lynx	Improperly tightened rear brake backing plates. Tighten to speci- fication; check rear brake tubes.	
1981: 314,000 Ford	Cooling fan blades of 351W-cu in, engine with air conditioning may come loose. Replace fan.	
1981: 11,500 Escort, Lynx	Metal carpeting fasteners may have penetrated fuel tank. Re- place tank.	
1981: 6,260 F-100, F-350	Defective fuel tank straps. Relo- cate and/or tighten.	
1981: 18,154 Mercury, Mark VI	Defective electric relay may ove heat and cause fire. Replace re lay.	
1981: 1,500 Fairmont, Zephyr	Missing brake pushrod-to-brake pedal retaining pins. Install pins.	
1980-81: 12,500 Ford	On light trucks, spare-tire carrie reinforcement may damage spare tire. Modify.	
1980: 8,000 F-series light trucks	Missing exhaust-system heat shields. Install shields.	
1980: 13,332 F-series light trucks	Intermediate steering shaft-to- steering column bolt missing or damaged. Install bolt.	
1980: 14,500 Mark VI	Damaged accessory feed wire insulation could overheat and cause fire. Repair.	
1980: 14,500 F-150 4 × 4	Missing fuel-tank shield. Install shield.	
1980: 52,053 Lincoln, Mark VI	Damaged stop lamp switches. Replace.	
1980: 8,000 E-, F-series light trucks, Econoline,	Cracked wheels. Replace.	

1979: 7,700

1979: 1,170

1978: 9,650

1979: 1,995

Jeep Cherokee,

Concord Wagon

Jeep CJ-5, CJ-7

Club Wagon

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1980: 24,400 F-series light trucks	Failure to meet fuel spillage star dard. Install fuel-tank shield.	
1980: 10,000 Econoline, Club Wagon	Improperly made brake hoses. Replace.	
1980: 80,000 Bronco, Econo- line, Club Wagon, F-series trucks	Defective C6 transmission pai ing pswl actuating rod. Replace actuating rod.	
1980: 3,000 Fairmont, Thun- derbird, XR-7, Zephyr	Wrong rear-brake assemblies. Replace.	
GEN	ERAL MOTORS	
Year/Units	Description of Defect	

GENERAL MOTORS	
Year/Units Models Involved	Description of Defect Corrective Action
1983: 12,721 Cavalier, 2000, Skyhawk, Firen- za, Cimarron	On 2-liter fuel-injected engine, fuel system may leak at throttle body injection fuel-feed connec- tion. Install new fitting.
1983: 5,316 Toronado, Rivi- era, Eldorado, Seville	Capacitor in windshield wiper system may overheat and cause fire. Remove capacitor.
1982: 15,400 Citation, Celebri- ty, Phoenix, 6000, Skylark, Century	Rear brake hoses fail to conform to standard. Replace.
1982: 79,686 Cutlass, Delta 88, 98, Toronado, Seville, Eidorado, DeVille, Regal, LeSabre, Electra, Riviera, Bonne- ville, Grand Prix, Monte Carlo, Im-	In vehicles with 5.8-liter V8 die- sel engines, governor weight re- tainer in fuel injection pump mai fall, causing throttle to stick open. Replace governor weight retainer.

pela, Caprice,

1982: 4,987 Omega, Citation, Phoenix, Skylark	Interference by clutch pedal wit master cylinder brake pipe on cars with manual transmission and power brakes. Modify. Fuel tank filler pipe hose clamp may fracture. Replace clamps.	
1982: \$19,329 Celebrity, Cita- tion, Cavalier, 6000, Phoenix, J- 2000, Cutlass, Ciera, Firenza, Century, Skylark, Skyhawk, Cimar- ron		
1982: 24,455 Camaro, Z-28, Firebird, Trans Am	Fuel tank of fuel injection engine may spew gas. Replace vent and pressure valves.	
1982: 1,167 Regal	Fuel-inlet pipe may crack. Re- place pipe.	
1982: 1,633 Chevrolet C10, GMC C15	Rear brake drum balance weights may interfere with alu num wheels. Modify.	
1981: 2,440 Century, Regal, El Carnino, Caballero, Cut- lass	Weak wheels may fracture. Re- place wheels.	
1981: 105,130 Citation, Phoenix, Skylark, Omega	Engine-to-body electric ground cable may be damaged. Install new cable.	
1981: 9,070 Toronado, Rivi- era, Eldorado, Seville	Improperly torqued front left up- per control arm nuts. Tighten to specification.	
1981: 4,615 Imapala, Caprice, Electra, LeSabre	Wrong brake pedal support bracket installed. Replace.	
1981: 25,463 Citation, Omega, Skylark, Phoenix	On V6 engine, incorrectly routed power steering hoses. Replace hoses; reroute.	

1980-82: 598,387 Chevette, T-1000	Carburetor fuel inlet housing plu of 1.6-liter engine may come out allowing a fuel leak. Install retain ing clip. Seat belt retractors don't meet standard. Replace.	
980-81: 55,238 Monza, Chevette, Camaro, Sunbird, Firebird		
1980: 287,170 Skylark, Citation, Omega, Phoenix	Rear brakes lock under moder- ate to hard braking. Replace brake proportioning valve.	
1980: 18,881 Eldorado, Seville	Screws holding shift linkage may fall out. Tighten.	
1980: 85,325 Camaro, Firebird	Loose lower control arm ball joint-to-steering knuckle attachinut. Tighten to specification.	
1980: 12,362 Toronado	EGR wiring harness on diesel engine may become pinched, causing short circuit. Reroute harness.	
1980: 24,719 Impala, Caprice Classic	Front brake pipe may chafe and spring leak. Reposition pipe.	
1980: 2,343 Chevrolet P30, GMC P35	Rear brake hose may chale and spring leak. Reposition hose.	
1980: 4,382 Omega, Citation, Skylark, Phoenix	Brake pipe may chafe against clutch control cable and spring leak. Reroute cable.	
1980: 4,626 Omega, Citation, Skylark, Phoenix	Incorrectly positioned fuel hose may rub against front drive axle. Provide clearance.	
1980: 10,751 Citation, Phoenix	Inadequate welding of rear con- trol arm longitudinal body bars. Weld and bolt bars.	
1980: 23,725 Omega, Citation, Skylark, Phoenix	Incorrect front coil springs. Re- place.	



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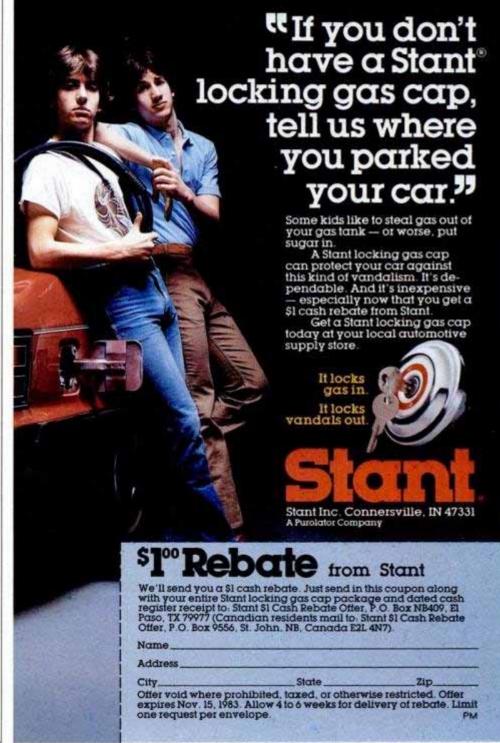
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1980: 161,225 Omega, Citation,	Steering gear mounting plate may crack and affect steering re-	
Skylark, Phoenix	sponse. Install new mounting bracket.	
1980: 224,892 Omega, Citation, Skylark, Phoenix	Automatic transmission fluid may leak through defective cooler hoses and ignite. Replace hos- es.	
1980: 3,170 88, 98, Toronado	Incorrect data on tire placard. In- stall new placard.	
1979-80: 320,677 Chevrolet, GMC light trucks	Crack may develop in brake booster housing and affect brak- ing. Replace brake booster.	
1979-80: 67,350 Century Wagon, Malibu Wagon, Cutlass Wagon, LeMans Wagon	Backlites having defoggers may shatter and scatter hot glass. Modify.	
1979: 8,534 Riviera	Marker lamps may not meet standard. Replace.	
1979: 4,208 Skylark, Starfire, Monza (H-Spe- cial), Sunbird	Engine oil switch may develop short circuit that could result in engine self-starting. Replace switch.	
1979: 15,328 Century, Regal, LeSabre, Electra, Monte Carlo, Impala, Caprice, Camaro, Firebird, Cutlass, Chevro- let & GMC light trucks	Rear brake stoplights may be- come inoperative and Cruise Control may stay engaged. Re- place applicable switches.	
1979: 42,977 Skyhawk, Star- fire, Sunbird, Monza	Fuel hose near EGR valve on 231-cuin. V6 engine may chafe and rupture. Reposition hose.	
1979: 1,326,404 Impala, Caprice, Catalina, Bonne- ville, 88, 96, Le- Sabre, Electra, Deville, Fleet- wood (also, 1960 88, 98)	Defective front seat belt anchor bolts. Replace.	
1979: 15,981 LUV 4 × 4 truck	Front suspension upper control arm shaft attaching boilts may loosen, affecting steering and front wheel alignment. Replace boilts.	
1978-81: 5,821,160 Malibu, Monte Carlo, El Camino. Century, Regal, Cutlass, LeMans, Grand Prix, Ca- ballero (all se- dans and wag- ons)	Lower rear control arm-to-frame bolts may fracture, causing rear control arm to fall. <i>Install new re</i> tainers.	
1978: 1,896,222 Malibu, Monte Carlo, El Camino, LeMans, Grand Prix, Cutlass, Century, Regal, Cabellero	High temperature may cause loss of front wheel bearing lubri- cant, leading to bearing failure. Install new bearings and seals that are lubricated with high temperature grease.	
1978: 41,508 Seville	Fuel hose connection may deter- orate and leak. Install new hose and clamp.	
1978: 22,268 Monza, Sunbird, Starfire, Skyhawk, P30 Motor Home	Detective steering intermediate shaft coupling. Replace.	
1978: 1,643 Malibu, Monte Carlo, LeMans, Grand LeMans, Grand Prix	Head restraints fail to meet stan- dard. Replace.	
1978: 333,619 Malibu, Monte Carlo, Catalina, Bonneville, Le- Mans, Firebird, Phoenix, 88, Cut- lass, Omega, Le- Sabre, Electra, Century, Regal, Skyhawk, Sprint	Fan blade spider may fail, caus- ing blades to fly off. Replace fan	

1978: 1,400 Impala, Caprice Classic	Front bench seats may fail to lock during an accident. Install new lock.	V	
1978: 5,146 DeVille	Windshield washer reservoir may crack and lose fluid. Replace.	Year/Units Models Involved	
1978: 4,504 Buick, Cadillac, Chevrolet, Olds- mobile, Pontiac	Defective rear wheel mounting boits may break and lead to loss of wheel. Replace.	1977-79: 936,774 Civic, CVCC and station wagon, Accord, Prelude	
1977-78: 172,000 Monza, Sunbird, Starlire	Left engine mount support may deform and lead to difficult steer- ing. Reinforce mount bracket.	(also 1973-76) 1977: 132,573 Civic 1200 (also	
1977-78: 372,466 DeVille, Brough- am	Accelerator pedal extension may wedge and increase engine	1975-76)	
	speed unexpectedly. Remove ex- tension.	1977: 33,552 Civic	

	HONDA	
Year/Units Models Involved	Description of Defect Corrective Action	
1977-79: 936,774 Civic, CVCC and station wagon, Accord, Prelude (also 1973-75)	Exposure to road salt may even- tually cause undercarriage struc- tural failure. Treat undercarriage with rust preventive.	
1977: 132,573 Civic 1200 (also 1975-76)	Heat emitted from split in muffler may lead to fire. Install shield.	
1977: 33,552 Civic	Short circuit may cause choke cable to ignite. Modify.	



NISSAN (DATSUN)			
Year/Units Models Involved	Description of Defect Corrective Action		
1982: 18,082 Stanza	Brake pedal height fails to meet standard. Adjust to correct height.		
1980-81: 42,735 Pickup truck (4WD)	Mud and water penetrating whee hubs may cause wheel bearing failure. Install new seals.		
1980: 15,019 310	Loose transmission main shaft lock nut may cause difficult shift- ing. Tighten lock nut to specifi- cation.		
1979-81: 118,747 510	Defective seat belt assembly. Replace.		

1979-80: 72,754 Hatchback	Defective taillight sockets. Re- place.		
1977-79: 295, 710 280Z, 280ZX, 810 (also 1975- 76)	Blowby gas may leak and cause electronic fuel injection components to affect engine idling speed. Install new PCV valve.		
	SUBARU		
Year/Units	Description of Defect		

Models Involved

1981-82: 43,300

All models

electronic fuel injection compo- nents to affect engine idling speed. Install new PCV valve.			
BUBARU	19 All		
Description of Defect Corrective Action	19 All		
Loose steering wheel nut may cause wheel to separate from steering shaft. Tighten to specification.			
	- cei		

	Stanley when	gives yo you nee	ou a har ed it mos	nd it.	
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helps you do things right.

1981-82: 94,564 All models	Main wiring harness in models with manual transmission may chafe, short and cause fire. Mod- ity harness.
1981: 32,000 All models	On vehicles equipped with San- kyo fast-idle control device, throt- tle lever may bind. Install new throttle lever.
1980-81 230,041 All models, ex- cept Brat	Headlight fuse holder may fall and cause loss of head lamps. Replace holder.
1980: 84,253 All models, ex- cept Brat	Driver's seatback frame may break. Install new frame.
1980: 71,683 All models, ex- cept Brat	Defective drive link may lead to loss of windshield wipers. Install new link.
1977-79: 106,000 Station Wagon (also 1978 Brat)	Fuel tank may crack because of insufficient venting, Install new orifice and valve assembly.
1977-78: 170,000 All models	Engine may stall in cold weather because of carburetor icing caused by moisture being drawn into the carburetor through the PCV system. Install new PCV system.
1977: 42,256 Station wagons (also 1976)	Defective tailgate latch assembly may allow tailgate to fly open. In- stall new latch assembly.
	TOYOTA
Year Units Models Involved	Description of Defect Corrective Action
1981: 9,171 Cressida	Misrouted wiring harness may not allow seat belt engagement. Reroute and clamp harness.
1980: 98,493 Celica, Corona, Corolla	Alternator pulley may break apart and parts may scatter. Install new pulley.
1979: 85,695 Pickup truck	Vibration at 40-50 mph may cause loss of control. Install steering damper.
1978: 5,700 Corona sedans.	Defective fuel system pressure relief valve may lead to stalling

relief valve may lead to stalling and hard restarting. Replace station wagons Fails to meet standard for welds 1978: 5.317 along side panels. Modify with Hilux VOLKSWAGEN

Year/Units Description of Defect **Models Involved Corrective Action** 1982: 1,770 Cotter pin to hold rear axle shaft Pickup truck lock nut omitted. Tighten lock nut to specification; install cotter pin. 1981: 5,200 Loose ball joint lock nuts. Tight-Rabbit, pickup en nuts to specification. 1981: 7,400 On cars equipped with diesel en-Jetta gines, incorrect data on certifica-tion labels. Install new labels. 1981: 4,800 Cracked tie rod ends. Replace. Rabbit, pickup truck 1981: 3,200 Incorrect data on tire placard. 1980-81: 133,000 High fuel tank pressure may al-low fuel to spill. Modify fuel filler. Rabbit, pickup truck 1980-81: 3,200 Defective brake calipers may cause loss of brake fluid. Repair. Dasher 1980: 2,287 Defective heater exhaust pipe Vanagon may cause dry material und vehicle to ignite. Modify. Improperly tightened front ball 1980: 2,572 Vanagon joints. Torque to specification. 1978: 3,000 Vacuum hose between carbure Rabbit tor and thermo valve may prevent throttle return to idle. Replace and clamp vacuum hose 1978: 18.500 Rubber elbows on pipe from throttle valve to brake power booster may fail, causing loss of Rabbit, Scirroco

brake assist. Replace and clamp elbows.

JEEP POWER FOR AMC

(Continued from page 114)

er auto manufacturers obtain similar results primarily with complex intake port designs.

Something old, something new

The AMC Four does keep the water pump and front housing from the 4.2liter Six, plus connecting rods from the old 232-cu.-in. Six. The rod bearings are an upgrade, and can go on all three

The timing chain is brand new. Sixes are easy on chains, but Fours produce forces that will tear apart anything ordinary. AMC went to England for a super-duty double-roller design, and added an automatic tensioner to provide belt-and-suspenders security.

The AMC Four has a distributor with conventional mechanical and vacuum advance, plus a computer and knock sensor to compensate for borderline

Unlike most knock-sensor systems, which just retard spark timing when the engine knocks, this one adds up to 6° advance when the engine is running knock-free. If it hears knock, it starts canceling out the spark advance in 2° steps, and if necessary can plug in up to 12° of spark retard.

Fast reactions

The computer is wired so it knows which cylinder is firing and can react so quickly it can change timing from one cylinder to the next.

The rear face of the 2.5 block is exactly the same as that on the optional 2.8-liter V6 AMC buys from GM. So if ever you're inclined, a swap is simple.

However, the Four should be adequate for most people. AMC doesn't announce horsepower figures, but torque is 132 ft.-lb., same as the GM

Iron Duke the engine replaces. More important, the torque curve is almost flat, so acceleration should be adequate with the 3,000-lb. vehicle.

Jeep front end

Four-wheel drives used off-road are prone to wheel hop on sand and gravel. The smaller 1984 Jeep Cherokee and Wagoneer have a new suspension called Quadra-Link to correct this prob-

There are two rear-facing links (from axle to chassis) on each side, and each pair has a theoretical intersecting point at the rear of the vehicle, to provide counteracting leverage against the

The front suspension also has a fifth link, hinged to the front of the axle on the right side and bolted to the chassis on the left. It restrains the axle and wheels to minimize any tendency of the axle to roll from side to side.

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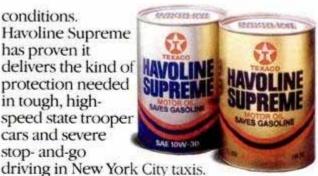
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Recoil start. Manual choke.

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CHRYSLER GOES TURBO

(Continued from page 116)

torque, the more noticeable it is. The driver can compensate easily in straight-ahead driving, but in turns the cars oversteer toward the longer shaft (in Chrysler's case, to the right) and understeer toward the shorter one.

Chrysler disposed of the problem completely (as did some Japanese cars) by making both axle shafts the same length and installing a stub shaft (bolted to the engine) between the transaxle and the shaft on the right (long) side. The stub has a U-joint to compensate for any variation in mounting.

Chrysler also took further steps in its ongoing effort to reduce transverse power train vibration. It installed circular dampers on each axle shaft, to tune out a frequency that was creating a gear rattle. On turbos it installed a shock absorber-type damper between engine and chassis to stop engine hop on heavy acceleration.

There's also more poop for the reardrives. That symbol of unexciting durability-the slant-Six-is gone from the passenger car line. All '84s will have two or four-barrel 318 V8s as standard equipment.

Electronics

Chrysler's electonics crew has a new dashboard for the Laser XE, featuring the same kind of bold color graphics as the '84 Corvette, plus 24 written and synthetic voice messages. Instead of the pompous "A door is ajar" that annoyed so many on the 11-message unit introduced in '83, this one says, "Please close the (location given) door."

The new dash, which is computercontrolled, has an ingenious method of automatically checking all exterior lights, even during daylight when they're turned off.

Wiring from the light switch runs through a tiny transformer to a set of bulbs. A second wire runs from the dash computer through the transformer. The computer feeds current to the transformer and this current is induced in the switch wiring.' If the induced current finds an incomplete circuit, perhaps because of a dead bulb or wiring problem, the computer reads this and alerts the driver.

The 24-message dash also has builtin self-diagnosis that should appeal to those who like video games. Just press the TRIP and RESET buttons with the ignition off and the dash will go ablaze with color as all vacuum fluorescent segments light up. Press the U.S./Metric button and the computer will start a sequence of pulsing individual segments one at a time to make sure all segments are working.

FORD REFINES TURBOS

(Continued from page 118)

large passage and absorbs heat from around the hot turbine bearing, then flows down and travels back to the engine.

Borg-Warner, co-designer with a Japanese company, offered precise numbers: The design cuts peak oil temperature during an engine-off hot soak period from 590°, at which oil will coke, to 482°, at which it shouldn't.

The 1.6 turbo produces 115 hp, enough to cause noticeable torque steer with fwd. Ford installed shorter coil springs to lower the front end of the cars 0.6 inch. This cuts the difference in angles between long and short axle shafts, reducing torque steer. This step is similar to one Chrysler took on its turbo. Ford also stiffened the front suspension, the approach GM took on its fwd turbos.

Ford hedges its performance bet with two '84 diesels, a two-liter Japanese Four for fwd cars and a BMW 2.4-liter in-line Six (coming in the spring) for Continental and Mark VII. A turbo is standard on the BMW.

Air suspension

The '84 Continental and Mark will have air-spring suspension. That promises a level car under all loads, less vibration and a more precisely tailored ride because the spring rate can be far more variable than with a conventional metal spring.

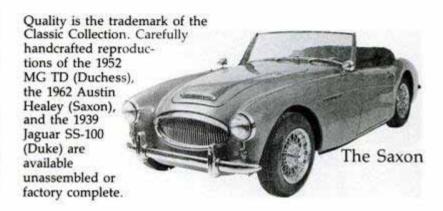
The computer turns on an air compressor to inflate, or opens a solenoid valve to deflate, the air spring-a neoprene rubber bag. It does this only when there is a load change, such as an additional passenger. Other changes in spring rate, as when the car is moving, are made by the air spring compressing on a specially shaped piston called a rolling lobe. If the lobe tapers inward, the bag can compress more easily over it (lower spring rate). If it tapers outward, it's harder (higher spring rate). On base models, the lobe has an hourglass shape for a soft ride under most conditions, then progressively stiffer. On the handling version, the lobe tapers outward only, for a gradually stiffer ride.

The computer has a car-parked strategy that lowers the car after a delay of up to one hour, so before you jack up the car to do something like change a flat, you must flip a switch in the trunk to turn off the system.

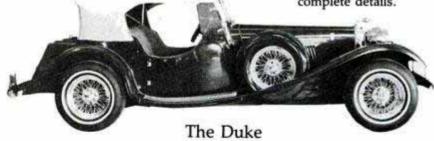
Will the '84 Continental and Mark with high-tech air suspension have enough to turn on prospective buyers in the lux-ury-car class? Well, Ford also is offering a European winter accessory—heated front seats—that they hope will clinch the deal.

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GM DROPS DISTRIBUTOR

(Continued from page 120)

intercooler of the SVO, but its turbo has a lightweight, resized turbine that responds faster to cut acceleration lag.

A second GM turbo debuts in '84 on the 1.8-liter overhead cam Four that Pontiac imports for the 2000 J-car. Along with port fuel injection, the turbo turns the 82-horse stock engine into a 150-hp screamer.

The engine has no exhaust gas recirculation valve (the camshaft was designed so valve operation traps enough exhaust gas for emissions control). Without EGR, information from a barometric sensor enables the computer to do a pretty good job of regulating a boost control solenoid, so the more sophisticated airflow sensor isn't used.

Limited boost

Boost is limited to 9.4 p.s.i., and is lowered to 3 p.s.i. with the engine cold or near overheating. Boost also is controlled according to throttle position, so the driver gets a smooth increase in performance as he steps harder on the gas pedal.

If the engine knock sensor is triggered, boost and spark timing can both be set back, as on the V6.

Both '84 GM turbos are Garrett AiRe-

search units and have been modified to dissipate heat better. Also, they're in the airstream from the radiator fan, which keeps them cooler. As a result, both reportedly stay under 500° F. in an engine-off hot soak condition so that the oil doesn't coke.

Because the 1.8 turbo is in a frontwheel-drive car, it gets a stiff front suspension, GM's approach to reducing torque steer.

GM cars across the board should have somewhat better performance in '84, thanks to a change made to meet high-altitude emission specs. Except on Pontiac four-bangers, GM will change from the pellet-type catalyst to a monolith (single structure), which makes the exhaust less restrictive.

Although the primary '84 GM emphasis is on engine performance, the Olds diesel isn't a dead issue. In fact, Olds has a 100-horse version of the 85-hp, 4.3-liter, V6 diesel under development. A Cutlass Ciera with the 4.3 runs 0-to-60 in just 10 seconds. There's a good chance Olds will soon make a diesel equivalent of the Wankel-engine Mazda RX-7; that is, a high-output sporty car that people will buy without much caring what's under the hood.

Olds also is continuing general development work on the diesel, in case the fuel situation changes. The '84 glow-plug system is almost immune to burnout. New glow plugs contain two coils in series, the first to provide heat, the second a special design that limits current to the first, to prevent burnout.

Electronic cruise control

All GM divisions have a new electronic cruise control with vacuum solenoid valves operated by a computer. This system needs less vacuum than the previous electromechanical one with its variable vacuum bleed, so there's less chance of running out of vacuum on long hills. It should reduce the many complaints from GM customers.

Chevy's '84 Camaro Berlinetta will feature an answer to the problem of the driver with short arms reaching instrument panel controls. The controls are on a pair of pods that slide fore and aft over an inch. Buttons are the touch type, so the pod itself won't move when you operate them. The radio is on a pivot mount on the console, so it can be canted toward the driver or passenger for easier operation.

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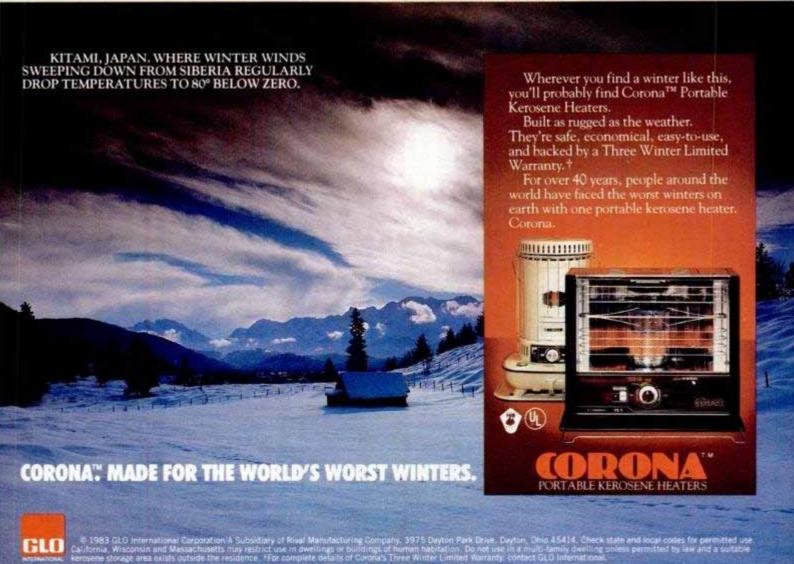
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AMC'S DOUBLE THRUST

(Continued from page 107)

3.2 in. longer overall than the Alliance's length of 160.6 in.

Nine out of 10 Alliance owners surveyed in PM's Owners Report (page 74, June '83) said they'd buy the car again, which probably means these folks are going to be real happy with Encore. Both cars share four- and five-speed transmissions in all their models.

Both the 1984 Encore and the Alliance share engines, Renault's 1.4-liter, 56-hp four-cylinder with a compression ratio of 8.8:1 and bore and stroke of 2.99 in. by 3.03 in. The 49-state engine delivers fuel through a Bendix single-point injection system. The Left Coast gets a Bosch LU multi-point unit.

Encore has a few new toys in the bells-and-whistles department, just to demonstrate that the electronic circus isn't passing by AMC/Renault. New in both Encore and Alliance is an electronically tuned digital radio/tape stereo unit. It's much more efficient and certainly better looking than the AMC radios we're used to.

Still in the electronic vein, Encore will have AMC/Renault's new "Systems Sentry," a device which automatically samples vehicle fluid levels when the engine is switched off, checking

them off individually in a dashmounted display pod and flashing a red or green light to announce fluid status.

In a second bow to gimmickry, albeit a more sensible one, Encore has an infrared door locking/unlocking device built in. The beam is generated by an emitter in the key chain, and the receiver is pod-mounted above the windshield on the headliner.

We previewed the new AMC/Renault cars in upstate New York at a time when rain was frequent, and we can attest to the real effectiveness of the infrared unlocking device in a downpour. The beam generator enjoys only spotty success, however, at ranges greater than about 25 feet or at oblique angles. It would probably be more efficient if the receiving unit were repositioned at or near the top of the dash.

It was a little sad that AMC's own vehicles got very small play during the company's new-car preview, though Eagle 4wd cars continue to soldier bravely onward. This year, the Eagle shucks its Pontiac-built Four in favor of AMC's own 2.5-liter, ohv four-cylinder engine. This is the same fine motivator going into the very competent new downsized Jeep XJs, and has the power band and driving feel of some six-cylinder motors.

Much of this year's AMC news is obituary. Neither the Renault Le Car nor the Renault 18i are going to be available here henceforth, though the 18i SportWagon (whose name is shared with the Jeep XJ utility vehicles) will remain on sale in the United States. Also biting the dust have been previously announced and new candidates: Concord, Spirit and SX-4 are all dropped from AMC's dance card.

California NOx standards tightened up right around Le Car's little intake manifold, choking off that model when it was felt the investment to make it comply with the West Coast requirement wouldn't be justified by future sales. The 18i was killed off by being too close to the market segment coveted by Alliance and Alliance-like cars. but at too steep a price in comparison. And the American Motors SX-4, its scrappy four-wheel drive churning gravel to the last, was shunted to oblivion when AMC decided its production complexities were too great to continue manufacture of a car which amounted to barely 10 percent of the entire Eagle line of four-wheel-drive cars.

Most noteworthy of all the AMC products we previewed were the remarkable downsized Jeep XJ-series utility vehicles. Here are transporters worthy of the Jeep imprint. They are

indicators of the future, and valiant enough to put the pride back into the AMC half of the Franco-American partnership.

Stylish Jeeps

Weighing nearly 1,000 pounds less than the Jeep Cherokee and Wagoneer SportWagons which they replace, these stylish little dual-purpose vehicles are at home on the highway or on the trail. We had a chance to put the new XJs through their paces recently for two days and walked away very impressed. The on-road portion of our testing varied from smooth interstate highways to crooked mountain roads. Off-road, we encountered everything from even fire roads to terrain so severe it could only be negotiated at a crawl. Through it all, the little XJs performed flawlessly.

Ride comfort on the highway is good, yet the suspension is versatile enough to handle rugged off-road obstacles without undue bottoming. Handling is excellent. On the pavement you can indulge in controlled drifts if you're experienced and so inclined. The same holds true with fire roads—you can slide around turns like a dirt tracker at the county fair.

With any dual-purpose vehicle you never get the best of both worlds. You can't have a machine that can win an off-road race and give a Mercedes-quality ride. But you can't drive that off-road racer to the office or haul the family inside, either.

As compromise vehicles—which the XJs and any dual-purpose vehicle are—the XJs work extremely well.

One of the things that really impressed us about the XJs is their cooling system. During the off-road portion of our testing, temperatures were in the 80s and high 90s. Often, the vehicles were running at crawling speeds.

Naturally, being the rugged outdoor types that we are, we had the windows rolled up and the air-conditioning on. The XJs never came close to overheating. Anytime we looked at a temperature gauge, the needle was around 200°—well below the boiling point.

The downsized XJs come in two versions—Cherokee and Wagoneer. Both have the same wheelbase (101.4 in.) and the same overall length (165.3 in.). The Cherokee is available in both two-and four-door models. It is aimed at the more adventurous driver who may be equally at home in on-road or off-road environments. The Wagoneer comes in a four-door body style, and is aimed at the buyer who wants the added security of four-wheel-drive in a luxury wagon.

Although the new XJs are 21 in. shorter in overall length, 6 in. narrower in width, and 4 in. lower than the former Cherokee and Wagoneer, they still have 90 percent of the earlier models' interior space. And they offer more cargo room.

Both come with AMC's newly designed 2.5-liter, four-cylinder engine as standard equipment. A 2.8-liter Chevrolet V6 is optional. We tried both engines. There's more than enough power for tackling any off-road obstacle with the inline Four. Our personal preference is the V6, simply because it accelerates a little faster.

A variety of transmissions is available, including a three-, four-, or fivespeed manual, and a three-speed automatic. A 13.5-gallon fuel tank is stan-

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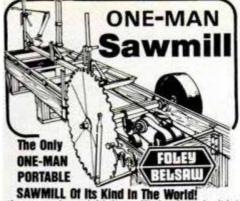
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dard, but an optional 20-gallon tank is available.

The owner of an XJ has one of the most versatile vehicles available: a recreational off-road vehicle, a utility vehicle, and a car for taking the family on a picnic or going to work.

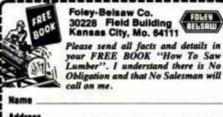
AMC's president and chief operating officer, José J. Dedeurwaerder, told us more than a year ago that AMC 4wd technology was one of the reasons Renault decided to invest in the beleaguered American car builder. And if the Jeep XJ "Utes" are any bellwether, Renault's corporate interest is most well-founded.





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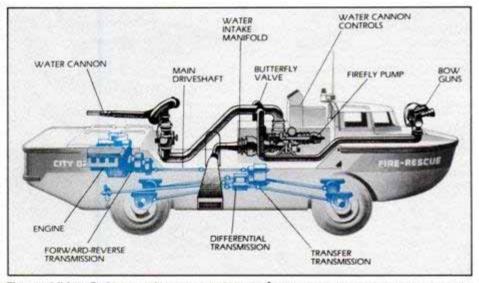
The amphibian was born when the city of Miami allocated \$400,000 for a new fireboat. Former Fire Chief Louis DeChime believed Miami could get the most splash for the cash by mounting a new, lightweight (21/2-ton) Firefly pump on a LARC. To get about the same amount of pumping power in a conventional fireboat, the city would have had to spend about \$1 million.

The Firefly, manufactured by Kinetic Technology International of Santa Ana, Calif., is twice as efficient as a conventional pump. It uses the system NASA developed to send fuel to a Saturn V rocket from the vessel's fuel tank. The Firefly is powered by a jet-fuel-burning, 370-hp Detroit Diesel Allison-gasturbine engine, a type commonly used on helicopters. However, the Firefly's design differs from a conventional pump in the design of its impellers, the

ing hits from explosions at a fire scene. The 350-pound pump may eventually be available in an all-titanium casing to maintain the protection while reducing its weight for efficiency.

Steering the Firefly is an adventure: The skipper must learn how to compensate for the powerful streams of water shooting from the hoses. The stern cannon could propel the amphibian, so the operator must power the boat to maintain position against the reactive thrust of the cannons. Recently, a firefighter overcompensated for the rear hose and rammed the stern up the bank of a freshwater lake near Miami International Airport, according to the former chief.

Miami is the logical place for the amphibious fireboat's "baptism by fire." The city has the largest passenger seaport in the nation in addition to 21 miles of shoreline on Biscayne Bay and other small waterways. The prob-



The amphiblous fireboat used by the city of Miami has two forward and two reverse modes for smooth shifting. The Firefly pump's butterfly valve allows for several water cannons.

propeller-like devices which help pull water into the pump and spin at terrific force. In a conventional pump, the two impellers resemble ordinary propellers, but the Firefly's impellers are shaped like screws or washing-machine agitators.

The first, or inducer, impeller spins at about 3,000 rpm. But in the Firefly, the second, or main, impeller spins at 6,000 rpm. It fires 3,000 gpm at 150 p.s.i. into the hoses. In addition, the impellers are closer to the intake suction piping on the Firefly.

KTI is developing a new pump called the Firefly IV. The latest model will pump 10,000 gpm at 70 p.s.i. The new pump's casing, made of hard anodized aluminum and stainless steel, is designed to ensure longer life for the pump parts by improving heat flow and preventing the working parts from taklems facing firefighters in Miami are going to put the fireboat through a wide range of very tough testing.

In service since last December, the amphibious fireboat hasn't yet had a chance to stretch its limits. It quenched a couple of brush fires on uninhabited islands in Biscayne Bay and was called into service as a fire was winding down in an abandoned bayside rooming house. For about a month last summer, its pump was in California being repaired.

Some day, firefighters hope to use the amphibian for fires on ships, in high-rise condominums along the shore, at shipyards, on islands, even in hurricane-flooded areas. DeChime believes so strongly in its worth he has retired early and formed a company, with a partner, to market the firefighting amphibian.

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(Continued from page 109)

namic aids are also applied to the rocker panels, wheel openings and twopart, two-level rear air spoiler. It's said by Ford to manage airflow better, and once you overcome an initial strange feeling about its looks, the thing really begins to grow on you. The total effect of the SVO reworking of the Mustang is a successful one, in looks and equipment. Our drive in the SVO Mustang supports this assessment.

The interior of the SVO car is virtually standard-issue Mustang, except for the placement of a few switches on the floor console. One of these is a premium/regular switch that instructs the engine electronic control system to recalibrate for both types of unleaded fuel.

Gear changes are done with the great-feeling Hurst shifter, a movement of grace under pressure in this case for positive throws with easy, fluid motion. There are other smaller, mostly subtle touches which make the SVO car different from its GT brother. But there is so much stuff standard on the new Mustang that only six major options exist: air conditioning, tape player for the radio, power door locks and windows, flip-up sun roof and leather seat trim.

Working up a sweat

The new turbocar runs off from a dead stop like a scalded dog, with turbo and engine working up a sweat to the redline in each gear almost as quickly as one can accelerate. There remains some of the 2.3-liter engine's buzziness under load, but unlike other Ford applications, this means much horsepower is being transferred to forward motion quickly.

Our preview of the car was on Ford's Dearborn test circuit, in traffic and under conditions that precluded our own 0-to-60 mph clockings. But Ford claims it can be done in less than 7.5 seconds. This would be consistent with the car's power and weight. We look forward to doing a full test report on the turbocar.

However, the SVO Mustang does exceptionally well on the fast course, something we did play with at length. The Mustang's prowess can be attributed to its unique suspension, utilizing gas-pressurized, Koni adjustable shocks. These are pretty interesting items. They can be set for "cross country" (front and rear), "GT" (front only) or "competition" (front and rear). Unique spring rates, special-sized stabilizer bars and traction bars assist in getting the ponies to the pavement. And best of all, the hardware works. The vehicle's race car-like handling characteristics allow very little roll in hard cornering, permitting the driver to toss the SVO Mustang into turns with the confidence born of directional stability. It's definitely a nice piece of work.

At Lincoln-Mercury

The Cougar XR-7 returns from obscurity to get back into the performance picture. For 1984, XR-7 comes back with its standard 2.3-liter turbocharged engine, and with both the three-speed automatic or five-speed manual transmissions standard. I also drove this car around the Dearborn loop. It's a striking black-on-black model that performed as well as its looks promised.

Cougars of every stripe get fuelinjected engines this year, meaning the 5.0-liter HO V8 can have a three-speed automatic transmission. The heavyduty suspension netted wider wheels, too, up a half inch to 14×5.5 inches.

Mercury's Topaz adds a 2.0-liter diesel engine this year, courtesy of Ford's Japanese brothers at Toyo Kogyo. It's an engine which won't see service in California. Because of its efficiency and its displacement near the gasoline engine, the diesel has decent performance, almost up to that of the Topaz standard 2.3-liter HSC (High-Swirl Combustion) engine.

Topaz's unitized body sits astride four-wheel independent suspension components, with rack-and-pinion steering and front power-disc brakes backed up with drums in the rear. Handling upgrades call for the TR-handling package, consisting of Michelin TRX rubber, stiffer suspension bits and cast aluminum wheels with locking lugs.

The Mercury LN7 has been discontinued for 1984, so Ford took its bubble-back rear window and put it on the new EXP, then added aero body pieces, blackout paint and a tiny turbocharger to EXP's 1.6-liter, four-cylinder engine. The EXP Turbo, Ford expects, will achieve 1.2 hp per cubic inch with its standard five-speed gearbox. And a rear spoiler and front air dam were attached. Power is an estimated 110 hp at 5,000 rpm, with 120 ft.-lb. of torque at 4,000 rpm.

EXP suspension

Suspension revisions include lowering the front ride height by ¾ inch to help eliminate torque-steer characteristics, increasing spring rates and using Koni shocks with special valving. All EXPs get revised interior treatments.

Even though the EXP Turbo suspension is revised, it's still unable to handle the turbo power at its fullest extent. New seats help keep the driver in position, but EXP is still subject to wander in turns where one is right up upon the turbo boost. Boost can go up to 8 p.s.i., and comes on quickly.

Efficiency has been on Ford minds

for some time. Ford Concept 90 and Continental Concept 100 experimental vehicles have resulted in the sleekest luxury car yet built on these shores the Continental Mark VII.

Mark VII is 350 pounds lighter, 13 inches shorter and 1.5 inches lower than the Mark VI it replaces, yet it retains the interior dimensions associated with the big car. In addition to its slippery styling (which Ford says results in a 0.38 drag coefficient), the Mark gets a new air-spring suspension system, developed jointly by Ford and Goodyear. The Electronic Air Suspension (EAS) accommodates continuous, three-way leveling operations, using a microprocessor to oversee ride height.

Standard engine is Ford's injected 5.0-liter V8, coupled to a four-speed automatic overdrive transmission. Later in the season, Ford will offer the car with a 2.4-liter turbocharged diesel engine supplied by BMW.

An LSC version (for luxury sport coupe) will lean in the direction of better performance. It will have stiffer-rate suspension components, including special EAS air springs, a handling suspension, fog lamps and quicker-ratio power steering than the basic Mark or several designer editions. And though the sexy new face comes standard with the raft of equipment this class of car normally features, the really hard of core will want the digital compass/outside temperature/ice alert warning.

Mustang GT and Capri RS

The Mustang GT/Capri RS duo won't be hurting in the performance area, either. Both get fuel-injected, 5.0-liter engines coupled to automatic OD transmissions, or new HO versions of the pavement-wrinkling 5.0-liter that pump out 205 hp at 4,600 rpm, with 245 ft.-lb. of torque at a low 3,000 rpm. The macho motor is only available with four-barrel carbureted fuel delivery and five-speed manual overdrive gearbox.

A running change to the engine will result in magical things: tubular headers, dual exhausts, higher-lift camshaft, forged pistons and full-throttle alternator cutout. In the same brush strokes, the Handling Suspension will be transformed into the Quadrashock Suspension. This will incorporate front and rear gas-pressurized shock absorbers and a neat arrangement at the rear wheels. The vertical shocks will be supplemented by horizontal, double-acting hydraulic shocks, acting as axle rotation dampers to cure the classic Mustang GT/Capri RS axle wind-up troubles. This will allow much more efficient use of all that horsepower.

Another running alteration will relocate the brake and accelerator pedals to facilitate heel-and-toe gear changing for lots of get up and go. **NEWEST RELEASE!**

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U.S. Gov't Report:

Carlton Box-Lowest Tar King. No Brand Listed Lower

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Carlton-Lowest Tar Menthol

Less than 0.5 mg. tar, 0.1 mg. nicotine

Carlton-Lowest Tar 120's

Regular & Menthol-6 mg. tar, 0.6 mg. nicotine

Carlton 100's Regular & Menthol

Less tar than over 160 brands-4 mg. tar, 0.4 mg. nicotine



19th Consecutive Report: No Brand Listed Lower Than Carlton.



Box King-lowest of all brands-less than 0.01 mg. tar, 0.002 mg. nic.

Carlton is lowest.



Box: Less than 0.5 mg. "tar", 0.05 mg. nicotine; Menthol: Less than 0.5 mg. "tar", 0.1 mg. nicotine; Soft Pack and 100's Box: 1 mg. "tar", 0.1 mg. nicotine; 100's Soft Pack and 100's Menthol: 4 mg. "tar", 0.4 mg. nicotine; 120's: 6 mg. "tar", 0.6 mg. nicotine av. per cigarette, FTC Report Mar. '83.

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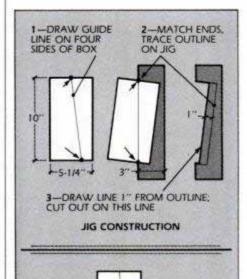
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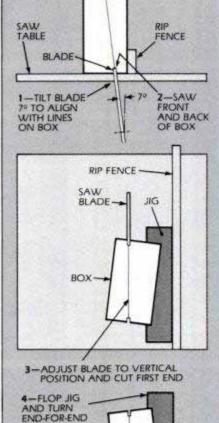
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interfere with sawing the box into two parts. On the hinged side keep nails far enough from the sawed edges so they won't touch the hinge screws.

After the glue dries, sand with 150and 220-grit abrasive in a portable or a stationary belt sander, or with an orbital sander. Using fine 220-grit sandpaper on a block, ease all corners. Then sand the top edges a little more. It's important to shape the wood to the slightly rounded brass corners.

Mark lines on the front, back and ends for separating the box into two parts (see drawings at left). You'll need to remove the guard from the table saw for this job. Tilt the blade about 7° from vertical, lower the blade so only 3/4 in. extends above the table, and make the front and back cuts, using the rip fence.





CUTTING PROCEDURE

-CUT

END WITH

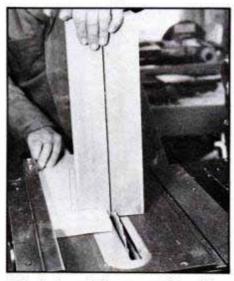
BLADE IN VERTICAL

POSITION

SECOND



To prevent the glued surfaces from sliding out of position, you should prebore holes before nailing. Take care not to use any nails near the diagonal cutline which divides the box into top and bottom.



Make the lengthwise cuts at a 7° angle (see the drawings at left). Then return the blade to the vertical position and use a jig in order to make the two end cuts.

Make a simple jig to hold the box at the proper angle to the rip fence while making the diagonal end cuts. Move the blade back to the vertical position and use the jig against the rip fence to make these cuts. A finetooth plywood blade works well for this

Install the lock before gluing and nailing the tray in place. Lock No. H-2080 from Craftsman Wood Service Co. (1735 West Cortland Ct., Addison, Ill.

60101) can be used. Chisel away the wood and shape the keyhole, following instructions supplied by the maker. A high-speed hand grinder with a flat end burr is helpful in doing the final smoothing.

Building the accessory tray

Rip 3/16-in.-thick strips of mahogany on the table or radial-arm saw for the accessory tray. Sand both sides. Cut pieces to the dimensions shown and assemble, checking the fit inside the box.

Make a concave insert to hold pens and pencils. Apply glue to the ends and to the side that's adjacent to the box and nail in place with a wire brad at each end.

Attach the other three panel support strips %2 in. from the edge. Cut two 1/4-in. mahogany panels to fit. Stain and apply satin finish polyurethane to the backs of both panels and to the entire assembly.

I duplicated the original's slightly brownish mahogany stain by mixing ²/₃ Minwax red mahogany to ¹/₃ special walnut. After the stain dries, fill nail holes with matching color. Weldwood blend stick works well for this.

Since mahogany is open-grained wood, you'll get a smoother surface if you next apply paste wood filler which has been tinted with the same stain used for the first coat. Follow instructions on the can, rubbing across the grain.

Follow up by using two or three coats of satin finish polyurethane. Do not



Fit the lock into the front of the box. I removed most of the wood with a chisel, then used a high-speed hand grinder in the finishing stages. You may prefer to do this job before you start assembling the desk.

apply stain or finish to the hinged edges because velvet will be glued to them later.

Installing the hinges

Using a sharp wood chisel to mark the locations and to pare away the wood, set the 3/4 × 1-in. brass hinges in 5/16 in. from the ends and flush with the surface. This allows for two thicknesses of velvet when the lap desk is closed. Bore the holes and then screw the hinges in place.

On the upper or unfinished side of the two panels, draw lines 5% in. in from the edge, parallel to the ends and outsides of the opened box. With the panels in place, apply to the larger one a thin, smooth coating of glue, extending it just to the outside of the line you have drawn.

Lay the velvet in place, brushing out wrinkles. Coat the smaller panel with glue in the same way, draw the velvet fairly tightly across the center, lay it on the glued surface of the smaller panel and brush out any wrinkles that have been made.

After the glue has dried, remove the panels from the box and use a steel (Please turn to page 168)





NEW DISCOVERY Reduces Chain Saw Kickback Up To 83%

Kickback has always been one of the greatest causes of chain saw accidents... but now that threat is greatly reduced*, thanks to a new discovery by SABRE. It's the new SABRE TRIRAKER™ SAW CHAIN — a patented triple depth gauge 3/8" cutter that gives additional protection without giving up any cutting ability. Ready to go to work for you today. Get yours and see!

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There are more than 5,000 True Value Hardware Stores in 50 states. Look under "Hardware" in the Yellow Pages.



*Kickback is reduced but not eliminated. You should continue to use any safety or protective devices... chain brakes, nose guards, etc... provided by the saw manufacturer.

A CLASSIC LAP DESK YOU CAN BUILD

(Continued from page 167)

straightedge and razor blade or utility knife to remove excess cloth.

Cut mahogany veneer to shape with sharp household shears and glue it to the ½-in. margin around three sides of each panel. If you use Elmer's glue or something similar, you'll have to clamp wood over each strip until it dries. Follow the maker's directions for contact cement. Stain and varnish the veneer trim and edges. Cut the slot and install leather tabs.

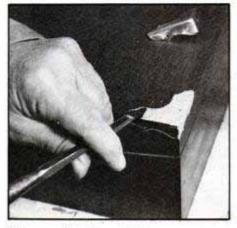
Trim the velvet to fit between the two hinges, apply glue to the box edges between the hinges and set the two panels in place. Press the velvet down on the glued edges and leave the box open until the glue is dry. Install the catch to hold the large panel when the box is opened. Glue a piece of felt or corduroy to the bottom of the lap desk so it cannot scratch any surface.

If you attach an escutcheon around the keyhole and stop right there, you will have a nice-looking lap desk. However, if you want a really beautiful one—a reasonably true reproduction of the Mark Twain lap desk—you'll need to add some brass trimming: a name or initial plate, decorative escutcheon, brass corners and brass corner straps.

Installing the brass trim

The corners and corner straps cannot be surface mounted, as this would interfere with opening the lap desk to its fullest extent. A raised nameplate could scratch a tabletop. All brass should be flush mounted.

Before you begin chiseling for the brass mountings, it's a good idea to practice on scrap wood. Use a sharp 1/4- and a 1/4-in. wood chisel. Keep a cloth under the box to protect the finish and



Using a mailet, 1/8- and 1/4-in. wood chisels, remove the wood to a 1/32-in. depth. Fit the brass frequently to check depth.

anchor the box with some blocking. As you work, keep both hands behind the sharp chisel edge.

Lay the brass corner (or other brass trim) in the proper location and outline it with an awl. Using the ½-in. wood chisel, bevel toward the part to be removed, cut straight down around the outline to establish the edge. Then remove enough wood within the boundary to permit the brass to fit evenly, flush with the wood surface.

On the corners, you'll find it necessary to make a new perimeter line just outside the original as you remove a layer of wood. After you fit each piece, remove it and apply a thin line of stain around the edge of the cut.

Secure all brass parts with contact cement. Apply it to the wood and to the back of the brass, wait for the period of time recommended by the maker and press the brass in place.

To make the ½ × 3-in. straps around each corner, you can use the same 26-ga. brass or you can purchase 3-in.-high brass stick-on sign letters. The latter save time and are difficult to differentiate from thicker brass. Cut portions of the letters to give you the dimensions you need and stick them in place.

With the last piece of brass trim in place, you are ready to use the hand-some lap desk.



MAKE YOUR STEREO SOUND SUPER FOR ONLY \$4.50

THE SOUND RIVALS THE MOST EXPENSIVE SPEAKERS

IT'S A GREAT DEAL BUT THERE'S A CATCH

Only \$4.50? It's true. Sound that rivals the most expensive speakers? That's also true. But there is a catch to this deal. Not number 22. Actually, our first. Read on.

We're a new company. We need customers. So we're offering this special deal, on a very special product. The headphones are very new on the market. You'll see similar models just beginning to appear in hifi stores bearing respected names like Sony and Toshiba.

Actually they're miniature versions of the famous new technology headphones that wrap around your head with a steel band. The mylar diaphragms are exactly the same. So the tight crisp response is unbelievable, over the entire 20-20,000 Hz frequency range. And as you probably know mylar domes simply don't work with normal speaker magnets. So the miniatures have the same

powerful rare earth Samarium magnets as the ones you've seen.

But here's where the similarities end. There is no steel band to fit around your head and press against your ears. They simply slip into your ears. That makes them more comfortable, but what's more important something really amazing happens to the sound. You're closer to the music, it almost seems to envelope you. The sound truly is all encompassing. If you ever try the older style headphones again, you'll think you're missing half the sound you've

come to expect. You get these remarkable little speakers with a standard phone plug adaptor plus an extra set of foam covers.

Now you're saying you never bought a Walkman. Glad you thought of that. Because we also have this neat little radio. Take seven normal filter cigarettes. Line 'em up in a row. That's the size of it. Really, it's that small. Plus it comes with its own headphone set, and it's powered for up to 24 hours straight by two normal AAA batteries. Get the FM stereo version for \$22.50 or the slightly larger AM/FM model for \$27.50. Both include headphones exactly like the ones we've described.

RED

Now if you like that idea, you don't mind the catch. Painless and easy, here it is: Try the radio and we'll throw in the extra headphones, adaptor and foam covers for only \$4.50 more.

So why do we do it? We're losing our shirts on the earphone, but we need to build our sales, and find people who like neat deals on neat electronics. We're a brand new division of a very large electronics company. And we want to show those guys at headquarters what we can do. The best way is very special deals like this. So you benefit.

To try this deal with your credit card call the RCD toll free hotline or send your check plus \$2.00 postage and handling. Specify group 1900 on FM or AM/FM on the radio. If you aren't 100% satisfied return it in the original carton within 25 days for a courteous refund. No hassles, no problems.

Be prepared to get an explosion of sound, at home or anywhere you go.



COPY-CAT TAPE DECKS

(Continued from page 95)

and it has no mike inputs. But it's one of the most automated units in this sampling. Bias and equalization are set automatically, but not in the extremely compressed manner of the conventional "ALC" type of automatic level control found in portable recorders.

The Sansui deck has two programsearch systems. The tape-2 transport has one that's much like the Sanyo and Realistic units. But the tape 1 transport has a system that permits you to skip ahead or back up to nine selections. This multiselection search aspect can be used with a special Sansui "computer-editing" feature. A "Compu Edit" key and the dubbing key are pushed in, and the pause and record controls for tape 2 are set. Then the tape 1 search function is actuated. When the search is completed and the selected tape 1 portion begins to play, tape 2 starts recording automatically.

The Compu Edit feature can also be used with certain Sansui turntables to interrupt recording when the tone arm lifts off the record and resume it when the arm returns.

Dolby noise reduction can be used

while dubbing a tape to correct for a non-Dolbyized original.

Onkyo TA-W88

In contrast to the Sansui machine, the only automatic features on Onkyo's twin-transport deck are dubbing-level set and the standard auto stop at the end of the tape. Bias and equalization are set manually, and there is no program-search feature.

But the Onkyo does have high-speed dubbing and continuous playback. It also has stereo mike inputs, and it permits mixing the microphones with the tape being dubbed. The mikes can't be mixed with a line input, however.

To copy a tape, you push buttons to select the dubbing function and normal or high speed. Then the pause controls are engaged. Tape 1 is set for "play" and tape 2 for "record," and the pause controls are released simultaneously.

Continuous playback is selected by a pushbutton. Then both "play" buttons are depressed together. This sets up tape 2 to start as soon as tape 1 ends.

Aiwa AD-WX110

The most striking feature of the Aiwa AD-WX110 is that, during high-speed dubbing, the unit can be set to copy both sides of a cassette simultaneously. An entire C-90 cassette can be dubbed in 22½ minutes.

The Aiwa also has continuous play. Unlike most decks with this feature, tape 2 always precedes tape 1. Operation in this mode, too, is simple. After the "continuous play" button is depressed, you merely push the tape 2 "play" button. Once tape 2 is finished, tape 1 starts.

Both transports have "cue-andreview." Tape 1 also has "program search." It's actuated by pushing in the "play" button at the same time as the "rewind" or "fast-forward."

Bias and equalization are set automatically for normal, chrome or metal tape, and there is a special knob for fine tuning the recording bias to match the various brands of normal tapes.

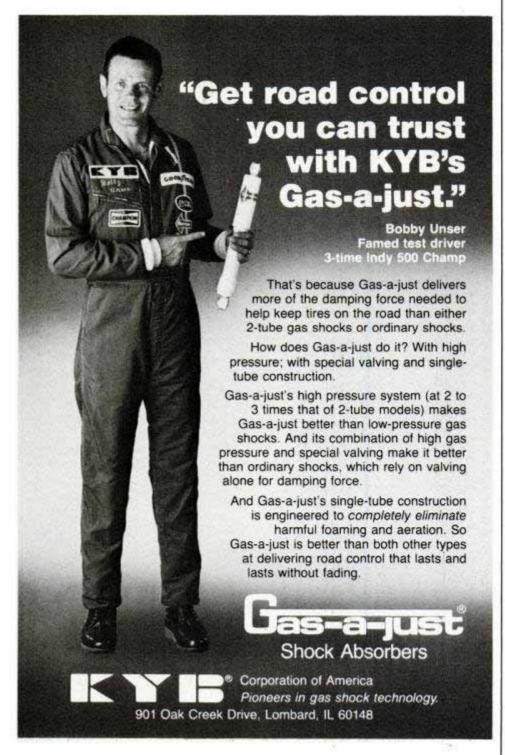
Cybernet DD701

The Cybernet deck, the most expensive in the sampling, is one of the more versatile units. It has high-speed dubbing and it also has a simplified extended-play feature.

There are left- and right-channel mike jacks and separate, slider-type controls for line-recording level, tape-copy level and mike-mixing balance. The line and tape-copy level controls have companion stereo balance controls. The mike-mixing control is teamed with a reverberation control.

As in the Realistic deck, the dubbing level is completely adjustable to cover

(Please turn to page 172)



The Amazing **FUELTRON** Gasoline Vaporizer

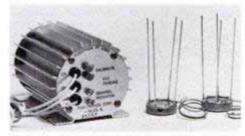
Gives your car more power, better acceleration, easier starts



Fueltron's vibrating crystal oscillates 1.3 million times a second to instantaneously vaporize gasoline into a high density, cold vapor. Read about its benefits below.

WHAT FUELTRON DOES

Fueltron has only one purpose—to vaporize gasoline in the intake manifold of a car engine. Every one of its benefits results from its superb ability to do just that. Here's a fast way to visualize how Fueltron works: Imagine you're sitting in front of a roaring fire with a fistful of wood chips in one hand and a handful of sawdust in the other. Throw the sawdust into the fire, and it will flare up and burn while it's still in the air...almost instantaneously. Throw the wood chips into the fire, and first their edges will begin to glow. After a while the chips will ignite, and eventually burn away. Droplets of gasoline from your car-buretor behave like the wood chips. Pulled into the cumbustion chamber, their outside surfaces will start to burn right away. Many will burn completely, but some will be swept, unburned, out of the cylinder with the ex-haust stroke, or will trickle down the cylinder walls, washing away vital engine lubricants.



Model 7000 (2 or 4 Barrel) Fueltron Kit consists of Dual Channel Amplifier, two crystal transducers.

Vapor from Fueltron behaves exactly like the sawdust, igniting completely and burning with high energy before it can be exhausted. Fueltron is the most effective gasoline vaporizer we've ever seen. Its vibrating crystal rips apart the molecules in a drop of gasoline, turning it into an easy-to-ignite vapor in mil-lionths of a second! The photo, above, shows gasoline being vaporized by a Fueltron crystal.

WHAT FUELTRON ISN'T

Fueltron is not one of those miraculous, gassaving horsepower boosters you're always reading about. It won't eliminate the need for tuneups (though you'll probably need fewer), it's not a substitute for properly firing spark plugs, and it won't breathe life into a neglected engine.

YOU NEED FUELTRON...

... if you're sensitive to the way your car's en-gine operates ... if you know it should be capable of faster throttle response, smoother idle and quieter running ... if the waste of gasoline caused by hard starts, stalls and engine flooding concerns you...if you want to use lower octane fuel with reduced engine knock. Nothing else you can do will increase your car's performance more, or is as eco-nomical and easy to install as Fueltron.

HOW YOUR ENGINE WASTES FUEL

Every fuel intake system on every carbureted or throttle-body injected engine performs the same tasks. The carburetor atomizes gasoline into droplets which are carried into the manifold by the inrushing stream of air. The manifold's job is to vaporize as many droplets as possible on hot manifold surfaces, mix them uniformly with air and carry an equal charge to each of the cylinders. When everything is warmed up, the system works pretty well. But cold-engine starts waste fuel, because the cold manifold can't vaporize the droplets of gasoline before they're swept into the cylinders, so they don't all burn. Low speed operation can be a problem, because air isn't flowing rapidly enough through the manifold to mix the fuel droplets evenly, resulting in an uneven mixture and ragged running. Acceleration causes two problems:
First, the stream of gasoline from the accelerator pump can't be vaporized quickly enough by the manifold, so it tends to "flood" the nearest cylinders. Second, as acceleration continues, partially atomized fuel from the carburetor goes through the manifold so fast it can't mix evenly with air, so cylinders nearest the carburetor get a too-rich mixture, while those farthest away are starved for gas, and can suffer from lean-mixture knock.

HOW FUELTRON CUTS FUEL WASTE

Because Fueltron vaporizes gasoline instantaneously, it fools the engine into thinking it's hot even when it's cold, thus giving fast starts. Because vaporized gasoline mixes more quickly and uniformly with air you get many benefits: Your engine runs smoother because the fuel mixture is evenly distributed among the cylinders, giving quieter operation, better driveability and increased low end torque. (In certified tests Fueltron increased engine response by 34%, with no increase in

fuel consumption)." The uniform fuel/air mixture virtually eliminates lean-cylinder knock, hesitation, stalls and flooding. Fueltron makes gasoline burn more completely, providing a boost in energy while reducing waste and pollution. Speaking of pollution, this is a good time to mention that Fueltron meets the requirements for sale in California.48

THE DETAILS

A complete Fueltron system consists of an amplifier which provides an ultrasonic signal, and either one or two vibrating crystals called "transducers". Two and four-barrel car-buretors require two transducers (photo at left); single barrel carburetors require only one. In the unlikely event that Fueltron fails, failure will not affect normal engine performance. Installation is simple; if you know how to remove your carburetor, the rest is easy. Simply insert transducers into the manifold, where they're held securely by retaining spring supports. Mount amplifier anywhere under the hood and make the simple electrical connections. No modificiations to carburetor or manifold required. Complete instructions and warranty come with kit.

(1) Certified by Coordinated Research Council Driveability Test: Conducted by the Ethyl Corporation Laboratory, Detroit, Michigan. (2) State of California Air Resources Board Executive Order No. D-132

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COPY-CAT TAPE DECKS

(Continued from page 170)

special needs. But for most dubbing situations, a detented center position is provided on the control.

The Cybernet deck's most unusual feature is an extra set of input and output jacks on the rear panel. These connect to a graphic equalizer so that frequency imbalances in a tape being dubbed can be corrected on the copy.

The Cybernet unit has a special, dual-purpose feature called "Quick Start and Recording Stop" (QSARS). When this is engaged while dubbing, both transports stop if a blank stretch longer than six seconds is detected at the end of a program segment on tape 1. When QSARS is used with the deck set for extended playback, the same kind of six-second null on tape 1 will stop that transport and start playback on tape 2.

Sharp RD-688AV

Unlike the decks discussed above, Sharp's RD-688AV Professional Stereo Double Cassette Tape Recorder (\$650) is a self-contained machine that can play through its own built-in audio system. It's sold as professional equipment for use by industrial and school audio/ visual departments.

This Sharp unit has a flip-up carrying bar to simplify hefting its almost 21pound bulk. It superficially resembles the "boom box" variety of stereo portables.

Its dual tape compartments are side by side, and its two pause controls are separated only by a record-muting key, an arrangement that makes precise editing easier. Another editing aid is an extended automatic program locating device (APLD).

A series of pushbuttons selects up to 11 four-second nulls between programs to search out on tape 1. Special forward and reverse keys activate the search. Both transports have regular fast-forward and reverse keys, which incorporate cue-and-review operation.

Apparently on the theory that tape hiss isn't noticeable in audio/visual operations, there is no noise-reduction system. But there are a number of recording, playback and mixing options. Mike and line recording can be performed either with automatic level control or with manual level set. This applies to dubbing, too.

In addition to two built-in microphones and a pair of stereo mike jacks, there's a jack for a single mixing mike, which feeds both channels. There are also echo and mixer/fader controls for this mike, which can be mixed with either a line source or a cassette during "play" mode, dubbing or regular recording.

There's a two-way, extended-play system. One transport is set in "play" mode with pause control engaged. The other is actually played. When the tape being played is finished, the pause control on the standby unit releases automatically. While the second tape is playing, the first tape can be flipped over, or it can be replaced with a new tape.

The Sharp recorder has a totally separate section, with its own inputs and outputs, for recording and playing back a projector-synchronizing signal on one of the two "flip-side" tracks.

Choosing the right deck

So, which deck is right for you?

If you only need to dub an occasional tape, a simple, single-speed deck can prove perfectly adequate. However, if you want to copy a lot of tapes, and do a number of them in a single session, you will be better off purchasing a tape deck that provides high-speed dubbing.

Should you be planning to do a fair amount of tape editing, you'll want to consider a machine with facilities that make the job easier. The level of editing sophistication you want will determine the kind of features you need.



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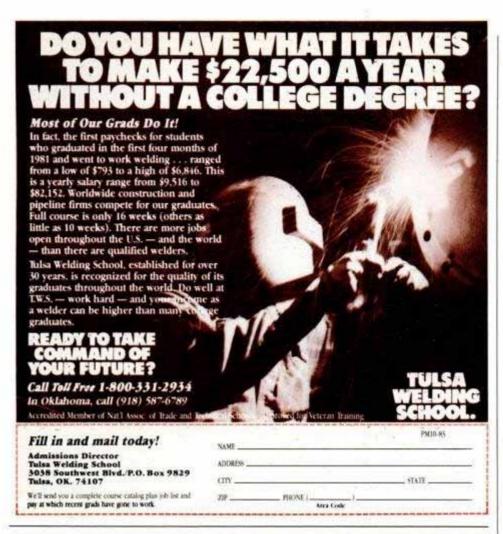
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washer for clear view.

WORK IN TIGHT PLACES

(Continued from page 99)

each accessory carefully for cracks and flaws. And remember never to use an accessory that is loose, damaged or out of balance.

With a little patience and practice, you'll be able to produce the carving projects shown here.

MANUFACTURERS LIST-FLEXIBLE-SHAFT TOOLS

Black & Decker, Consumer Power Tool Div., 3012 Highwood Blvd., Raleigh, N.C. 27625 (Rotary Hobby Shop; two models available, \$59 and \$79).

Dremel Mfg., 4915 21st St., Racine, Wis. 53406 (Moto-Flex Tool; constant speed Model No. 232, \$99; variable speed Model No. 332, \$110).

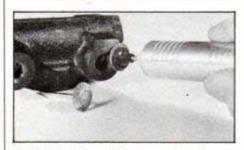
Foredom Electric Co., Route 6, Bethel, Conn. 06801 (R-series motor with flexible shaft and SR-1 foot-

operated, variable-speed control, \$185).
Wen Products, 5810 Northwest Highway, Chicago,
Ill. 60631 (Hobby Kit Center; two models available, \$100 and \$110).

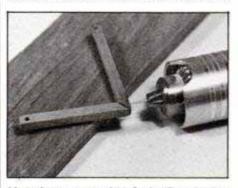
Other Uses For The Flexible-Shaft Tool



If you want to sculpture porous limestone, do so by using a large vanadium steel bur.



Refurbish old machine parts by using an abrasive disc and wire brush accessories.



Here is an example of ultrafine boring, using a common straight pin as the bit.

DRESSED TO KILL

(Continued from page 92)

protectors and other protection may also be added before the final stage of dressing. The next step is a two-man job: pulling the jersey over the shoulder pads. Today's nylon jerseys are of fishnet fabric for better ventilation. Most have tearaway stitching. Down below, the player slips into his uniform trousers and again gets help when putting on his shoes.

Personal foot flair

"The shoes are part of your personality," Joe Namath once said. The retired Jets super quarterback is the one who introduced pantyhose and "funky spats" into the game back in the '60s. The pantyhose kept Namath warm in the icy end-run of the long football season. Everyone laughed, but pantyhose are now standard equipment in a pro football locker room. The spats were special low-cut white shoes. After Namath introduced the personal foot flair, Baltimore Colts player Alvin Haymond followed suit, and within two seasons half the quarterbacks in the NFL were wearing special-order shoes to enhance their personal image.

Of course, football shoe design is a far more serious business. In the old days, players dragged their feet in hightops with metal spikes. The heavy leather shoe made feet sweat and never provided as much traction as a player needed. But in the past 10 years, football shoes have undergone a revolution, even as football fields underwent revolutionary changes.

Grass shoes are lightweight running shoes with seven rubberized cleats on each sole. They're made for the basic natural-turf field. Artificial-turf shoes have 75 to 100 cleats and special composite tongues and soles to reduce heat buildup in the shoes. Artificial turf can retain heat so well that an early autumn game in the South might be played in field-level temperatures near 100° F.

Canadian broomball shoes have about 15 suction cups on the soles and have become popular where natural grass has been planted in place of artificial turf. (The Orange Bowl in Miami switched in 1976.)

Protecting the head

The football armor piece de resistance is the helmet, the second weightiest item in the player's wardrobe. The average pro football helmet weighs 3 pounds. The outer shell is a layer of shiny polycarbonate followed by a layer of aluminum lined with vinyl foam, styrene plastic and a thin sheath of leather. The inside of the helmet is lined with foam squares and plastic pods filled with an antifreeze or pure alcohol. The pods absorb shocks and carry heat to the vinyl foam layer.

One of the most popular helmets on the market today-the Bike Air Power-uses an inflated inside liner to absorb shocks. After the player puts on his helmet, a bicycle pump tube is inserted in the helmet's ear hole and into an intake valve. The liner is then pumped up.

"Believe it or not, you really want the helmet to fit as tightly as possible without breaking your skull," Klecko says. "A loose helmet can do you a lot of harm by moving around when you get hit." The air-filled model gives the

tightest possible fit. The helmet itself is just the base of operations for a whole range of defensive devices for the player's head. A nose bumper of vinyl or other soft material sits at the center of the helmet above the bridge of the player's nose. A chinstrap keeps the helmet from moving sideways. Face guards and cages of various shapes and sizes complete the set of above-the-shoulder protection.

Paul Brown forced his Cleveland Brown players to be the first to wear face guards back in the 1950s. Players took to the devices grudgingly, com-

(Please turn to page 176)

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DRESSED TO KILL (Continued from page 175)

plaining that face guards made them anonymous to the fans. By the 1960s, most teams issued face guards to all players. Many variations have come onto the scene since then. There's the single or double bar that covers the lower nose, mouth and jaw. The elongated double bar covers the upper nose down to the chin and has become popular with defensive players.

With the advent of composite materials, helmet manufacturers have been able to make elaborate cages, such as the bird-cage or the cowcatcher types, which place a grid of protective material over the entire face while leaving wide slits so the player can see who he's up against.

he's up against.

The boxing world has contributed mouth guards to the supposedly more docile sport of football. The trainer takes a wax impression of a player's mouth and sends it to the mouth-guard manufacturer for a device that fits the individual perfectly, protecting his teeth. In an age of toothpaste ads and other commercials emphasizing good looks, no player wants to risk a broken tooth.

Bigger and faster

Space-age plastics have transformed the pro football player from a heavily laden behemoth to the modern meanand-lean image. And the equipment promises to keep getting leaner. The players are getting bigger and faster with each passing decade. In the 1950s, the average NFL player weighed 210 pounds. Today's average player, according to figures published in Pro Football magazine, is over 230 pounds. The speeds at which they move are dazzling. Linemen who weigh 270 pounds have been timed in the 40yard dash at 4.9 seconds. The greater bulk and higher collision speeds call for improvements in the armor, and football insiders say they're coming.

The biggest breakthrough will probably be in attachment of face protectors to helmets. Some experimental helmets being tried on the field this year come with face cages that break off with some ease but can be reattached right on the field.

"I've seen players tear off an opponent's face mask," Klecko says. Such violence often results in neck and shoulder injuries. The easy-off, easy-on cages will reduce those injuries.

The one thing science hasn't been able to provide football players with is a sure way to go through a whole season without a major injury. Klecko, who sat out most of 1982 after knee surgery, says "I'd give the Nobel Prize to the guy who came up with that."

Safe

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· Easy to Build

GENERAL MOTORS

(Continued from page 112)

available on the Eldorado. You can tell the real one by its less vertical rear roofline, smaller back window and chrome snaps on the molding where the top meets the body. The nifty-looking, nimble-handling (but underpowered) Eldorado Touring Coupe continues into '84 despite the fact that only a few hundred '83s have been sold.

Otherwise, Cadillac's engineering and styling changes include both the significant (standard electronic level control for deVilles and Fleetwoods, structural improvements for Eldorados with touring suspension, better glow plugs for the optional 5.7-liter V8 diesel) and the trivial (new front park/turn signal and taillamp lenses with "gold vertically winged crests," reduced door unlatching effort). The compact Cimarron sedan gets its third new grille (a finer cross-hatch design), revised taillamps and a softer ride for '84, with optional gold-on-black D'Oro trim.

On to Buick

Aside from the new fwd Century Estate wagon (with a standard hinged rear window that swings up separately from the big back hatch); new graphic electronic tachometers for the sporty Skylark and Century T-Types (plus beefier suspension and tires for the latter); a sinister-looking, all-black "NAS-CAR" turbo Regal coupe; and an all-white Century Olympia Limited sedan (official car for next summer's 23rd Olympiad in Los Angeles), Buick's major thrust for '84 is engines.

Biggest news is a multiport, sequential, fuel-injected (SFI), turbocharged 4.8-liter V6 engine with electronic wastegate control and a maintenance-free, computer-controlled coil ignition system that completely replaces the previous conventional distributor and coil. Standard on the Century and Riviera T-Types, it develops a very healthy 200 hp and 300 ft.-lb. of torque.

A couple of steps down on the evolutionary ladder is a nonturbo version with nonsequential (each injector fires twice per crankshaft revolution) multipoint injection. Available later in the year in Buick's Century, as well as certain other A-cars and the coming fwd C-cars, this "MFI" engine should deliver between 125 and 130 hp.

At Oldsmobile

In contrast to Buick's very youthful T-Type models, performance V6 engines and heavy emphasis on customer satisfaction, rival Oldsmobile is GM's "business as usual" division.

Though lip service is paid to attracting younger buyers with the compact Firenza and sporty-looking ES models, the real emphasis here seems to be on selling the same old stuff to the same old buyers. Thus the suspensions are soft, the wagons woodgrained, the tires whitewalled, the wheel covers wired, the roofs padded and almost everything heavily chromed—leading one autowriter wag to comment that the division seems to be in a coma.

Still, the same old "luxury" formula still plays in Peoria—if not in more progressive locales: Perennial third-placeseller Oldsmobile is doing very, very well these days for a seemingly comatose carmaker. The fwd Toronado gets another new face (probably its ugliest ever) and a new ultralux version called Caliente. The mid-size fwd Cutlass Ciera (GM's best-selling A-car), besides its new wagon version, gets a wider center pillar roofline for the coupe and a vinyl-capped Holiday Coupe model for the opera window set. Meanwhile, the 180-hp Hurst Olds, is carried over with its Hurst "Lightening Rod" triple-stick (automatic) shifter.

Visiting Pontiac

Even Pontiac, which has been steering a steady course toward the serious enthusiast (usually import) buyer and

(Please turn to page 178)

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GENERAL MOTORS

(Continued from page 177)

away from the hardcore chrome and woodgrain types, is starting to backslide into its old unsuccessful ways.

The division said it would never bring back its full-size car, but it did a half-year ago (the Canadian-built, Chevy-bodied Parisienne). It promised no tacky vinyl roofs and such on the cleanly-chiseled 6000 A-car, but breaks that promise for '84.

It was criticized for having no tachometer in the otherwise near-perfect (and highly successful) 6000 STE performance sedan, yet comes back for '84 with a Japanese-style, full digitalgraphic dash for '84-thereby moving the STE further away from the serious enthusiast for whom it's intended. Even the much-improved 2000 J-car is now the "2000 Sunbird." (Next year, it'll probably be just Sunbird.) All this is probably due to pressure from the dealer salespeople, who apparently have never understood the division's longterm program or the "new-values" buyer Pontiac has been courting.

On the positive side, Pontiac has one of the industry's hottest new engines for '84-a turbocharged, port-injected version of the 2000's 1.8 liter overhead-cam Four that's rated at 150 hp.

It's standard in new performance-version SEs and optional across the 2000 Sunbird line (including the convertible), as well as in Buick Skyhawk T-Types. Curiously, the sexy STE-like SE front end also graces the luxury-version LE Sunbirds, which seems to me to dilute its performance-image impact. The super-sleek Firebird line gets a new 190-hp optional Trans Am engine.

Last stop: Chevy

Chevrolet Div. finally seems to be revving its creative engines after years of self-imposed lethargy. Among other evidence, the J-car Cavalier sports a handsome new face and a sporty Type 10 coupe version, while the A-car Celebrity line adds very handsome, cleanly trimmed Eurosport models.

Significantly, Chevy's beautiful Eurosport wagon is the only sexy version of the new A-car wagon in the whole corporation. The NASCAR homologation-special Monte Carlo SS, with its aerodynamic nose, 190-hp V8 engine and new front bucket seats, returns for '84, the full-size Caprice coupe is revived by popular demand and the marvelous Corvette now has a cut-out switch for its manual-gearbox overdrive system.

Finally, do yourself a favor and check out an '84 Camaro Berlinetta next time

you're in your local Chevy store. You don't have to drive it; just sit in it and play with its fascinating instrument and control panel. Flanking its digital/ graphic instruments and electronic systems monitor are twin pods housing finger-reach pushbuttons for everything from lights to wipers to heater/ AC adjustments, similar to those in Isuzu's Impulse. There's also a remote, swiveling-head, pushbutton stereo radio with graphic indicators for bass, treble, balance and fade, plus an overhead console with a map light, a storage pouch and a removable battery-powered flashlight. Significantly, spaceship-like Camaro cockpit debuts in the high-lux Berlinetta, not in the high-performance Z28.

If GM '84 is notable for what it offers-a hearty course of Americanstyle steak-and-potatoes luxury, comfort and convenience served up with tantalizing side dishes of '60s-style performance and '80s-style Eurofashionit's notable, too, for what it doesn't offer-a low-calorie dessert of modern, high-tech, high-efficiency power train. Where are the state-of-the-art, domestically produced new engines and transaxles GM's new-generation fwd fleet still needs so badly to remain competitive through the '80s and '90s? Maybe next year?

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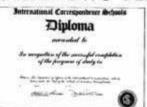
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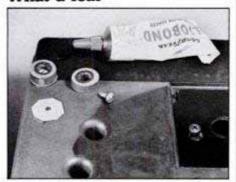
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What a feat



When I couldn't find replacements to match the rubber feet that were missing from a slide viewer. I made substitutes using a length of discarded 1/4-in. outside dia, garden hose. First, I cut 1-in. squares of sheet aluminum and drilled holes in the centers for mounting screws. Next, I cut 1/4-in.-thick rings from the garden hose. Then I fastened them to the sheet aluminum with Goodyear Pliobond cement. After the cement had set. I trimmed off the excess metal with tin snips and attached the feet. The substitute feet worked as well as the two remaining original feet. - Walter E. Burton

Paste brush storage



Make a storage container for soldering, paste, and other small brushes to keep them clean and to protect the bristles. A plastic 35-mm film container can serve the purpose. Cut a small X in the top of the container with a razor knife. Push the paste brush handle through the X. leaving the bristles and 1/2 in. of the handle exposed through the bottom of the lid. Snap the lid on the container and you'll be assured that the residue on the bristles won't end up on the tools in your toolbox, or on anything else.—Richard M. Haag

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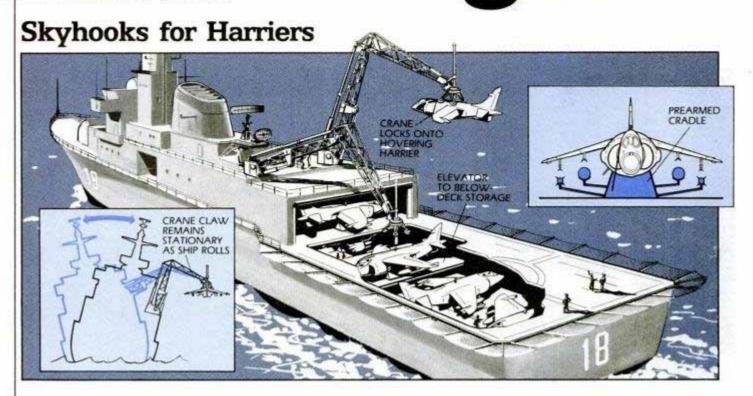
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TECHNOLOGY I IPDATE

AVIATION



The British love to think up new tricks for their beloved Sea Harrier V/STOL jump jet, hero of the Falklands. Their latest idea is a lulu. Picture a small patrol vessel with virtually no deck space but two large, articulated cranes. A crane reaches out, plucks a hovering Harrier from the sky and pulls it neatly on board. To launch a Harrier, the procedure is simply reversed.

Despite the scheme's quixotic daring, it has intriguing possibilities. A large amount of a Harrier's fuel supply is used up in the hover mode during vertical landings and takeoffs when the downward-pointing thrust jets require full power. The aerial snatch is designed to save precious fuel by reducing hover time. Also, small vessels with unreinforced decks could be used to launch and recover Harriers in place of big, expensive carriers.

Still more importantly, Harriers could be launched and retrieved in seas too rough for conventional landings and takeoffs on a heaving carrier deck. The double-jointed cranes, controlled by computers, can be programmed to flex their "elbows" in exact time with the rolling motion of a storm-tossed ship. Thus, the cranes' claws remain stationary in midair, making it easy for a hovering Harrier to hook on.

But the British don't stop there. As

each plane is lowered into the ship's hold, it's placed on a special prearmed cradle fitted with replacement bombs and missiles already in position for quick attachment. The weapons are fastened on and the plane is whisked up again to fly another mission. This way, say the British, a Harrier can be recovered, rearmed and relaunched in half the time it would normally take on a fully equipped carrier.

Called SkyHook, the system is being developed jointly by British Aerospace and Dowty Boulton Paul of England. If anyone can pull off such a caper, the British probably have just the right amount of audacity to do it.



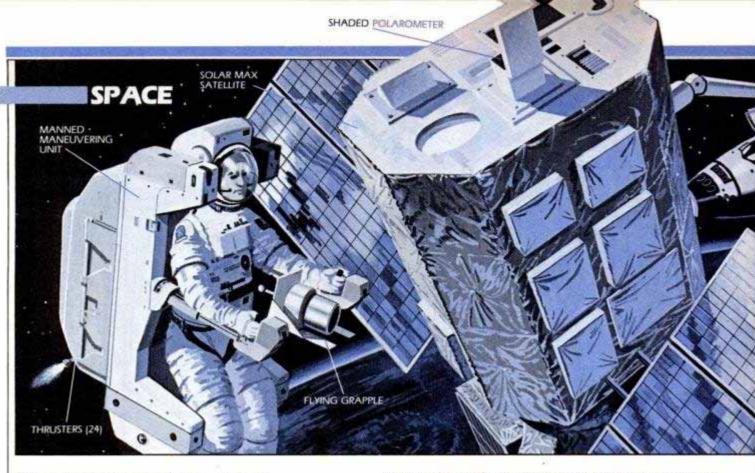
EYES FOR THE DARKNESS

The infrared Maverick air-to-surface missile, troubled by guidance-system problems in its earliest tests, now appears ready for regular service on American attack aircraft. The Maverick reportedly destroyed over 90 percent of its targets in the latest tests out of Nellis Air Force Base in Nevada. In earlier testing, the Hughes Aircraft missile scored only 77 percent. The missile is designed to seek out targets in darkness.



SUPER BLIMP IS COMING

Construction will begin soon on Goodyear Aerospace Corp.'s high-tech entry in the airship market. Using plastic and composite materials, the GZ-22 bilmp will carry nine passengers instead of the current six. A ducted, tiltable fan—in place of propellers—will allow near-vertical takeoffs and landings. The bilmp is scheduled to fly late in 1985 or early in '86.



'Roadside' repair in space

n April 1984, astronaut George Nelson will thrust up and out of the Space Shuttle cargo bay 286 miles above the Earth. He'll be strapped into a Manned Maneuvering Unit (MMU), and the 24 tiny thruster rockets will send him zooming 100 yards above the shuttle à la James Bond. By

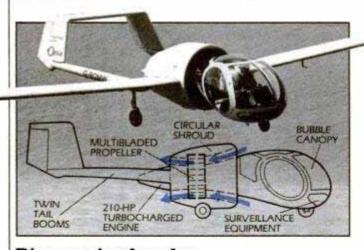
firing specific thrusters at different intervals, he'll steer the MMU around a sun-orbiting satellite being held in place by the Shuttle's robot arm. Thus, the Space Shuttle Challenger will enter the history books as the first vehicle to perform in-orbit service on a broken-down satellite.

The Solar Max satellite was launched in 1980 to study the sun's 11-year sunspot cycle. A few months after launch,

PROCESSING PACK

STRIP-SHEET ROLL

INVENTIONS



Big eye in the sky

t looks like a monster bee from a horror flick. Actually, it's a British prototype for a new high-stealth photo/ reconnaissance plane designed to offer the slow flight of a helicopter without the noise. Called the Optica, its waspwaisted shape allows air to be drawn into a large, shrouded pusher propeller. Although it can't quite hover, it can sneak along at 50 mph and operate from short fields. It's made by

Edgley Aircraft of Wiltshire, England.

Slides while you wait

STRIP SHEET

Fith Polaroid's new CS 35-mm color transparency film or Polapan CT 35-mm black and white film, you can shoot 36 frames in your SLR camera and have the slides mounted within the hour. It's done with the Polaroid 35mm AutoProcessor (\$83.25) and the chemicals that come with every \$14.85 package of 36-exposure film. Slip the exposed roll into the AutoProcessor, then insert a box of dry processing chemicals. Close the box, turn a crank and a strip sheet is laminated to the exposed film. Remove the film and the exposures are ready for mounting.

CHEMICALS

Editor: Dennis Eskow Contributors: Sheldon M. Gallager, Robert Little, David M. Stewart **PROCESSING**

COATED STRIP SHEET

LAMINATED TO

EXPOSED FILM

EXPOSED ROLL

Astronaut strapped to the Manned Maneuvering Unit (MMU) aims Flying Grapple as he rockets MMU into position prior to docking with the Solar Max satellite. Once docked, astronaut uses MMU's 24 thrusters to help the Space Shuttle's robot arm pull in the damaged satellite. Repairs will be made at flight support system. Then Solar Max will be reinserted in orbit.

PM art: Dean Ellis

Solar Max's roll, yaw and pitch fuses burned out, making it impossible to point the satellite at specific parts of the solar disk. Astronaut Nelson, when he reaches the steadied satellite, will use a handheld grapple to grab Solar Max and help the robot arm lower it into the cargo bay. Repairs will be made inside the bay and then the satellite will be reinserted into orbit by the Shuttle arm.

TECHNOLOGY UPDATE

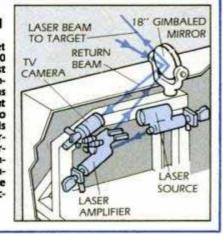
AIR BRAKES IN SPACE

A future Shuttle may use an inflatable outer jacket instead of retro rockets to slow down for a landing. The NASA concept would save fuel. The outer bag would inflate as the craft skims the upper atmosphere. Friction would slow the craft.



TARGET IS ON THE BEAM

To follow a target moving about 13,000 mph, you need a fast tracking device. Sandia National Labs has created a tracker that sends a laser signal to a mirror. The beam is reflected to the target, back to the mirror, then to a TV camera hooked to computers. They calculate the speed and direction of the rocket.



Seeing without looking: New 'eyes' for pilots

with these new eyeglasses, a pilot can "see" his instruments without looking at them. Superimposed on his view are such vital instrument readings as airspeed, altitude, compass heading and artificial horizon, enabling him to concentrate on his flying without having to look down into the cockpit.

The Micro-HUD system, invented by Hubert Upton of Bell Helicopter Textron, works like the fixed head-up dis-

SPEED, ALTITUDE,
HEADING
AND AIRCRAFT'S
ATTITUDE APPEAR
IN PILOT'S VIEW

TINY MIRROR
INVISIBLE TO EYE

Wearing new glasses, pilot sees instrument readings without taking his eyes off of the sky.

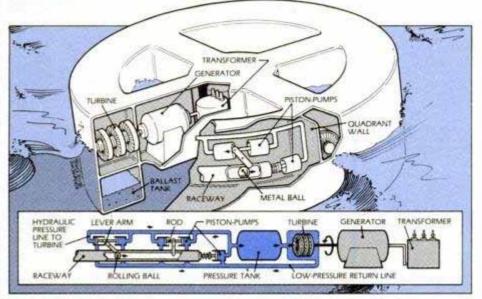
play (HUD) in modern jet fighters. The advantage of the eyeglasses, however, is that the image appears wherever the pilot looks. The glasses are also lighter and less costly than a fixed HUD, making them practical for civilian use.

The information to be displayed is transmitted by a fiber-optic ribbon to a tiny mirror at the center of one eyeglass lens. The mirror, only 1 mm in diameter, is too small to be seen, but reflects the image into the pilot's eye, creating the illusion that the readings are projected out in space.

The Micro-HUD glasses were originally developed for helicopter pilots, but have many other ingenious applications. A surgeon could watch his patient's vital signs without moving his head. An engineer or lab technician could check on instrument readouts without taking his eyes off his work. A sound-sensitive version, converting speech to symbols, could enable a deaf person to "read" another's lips without even looking at them. And you thought glasses were for poor eyesight.

TECHNOLOGY UPDATE

ALTERNATIVES



The Raft Energy Generator uses sea motion to move 100-pound steel balls along track.

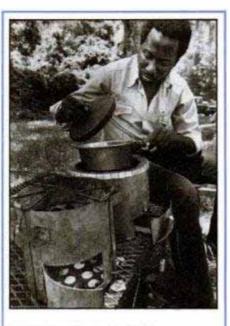
Sea power is patented

cean waves would be harnessed to generate electricity in a Raft Energy Generator patented earlier this year by Byrl and Betty Williamson of Agoura, Calif.

The huge raft would contain a series of "raceways" through which 100-pound metal balls roll back and forth with the pitch and roll of the sea. As a ball rolls down a raceway, it moves a

lever arm that pushes a rod, which, in turn, moves a piston back and forth. That motion pressurizes fluid running into a tank that turns a turbine. The turbine powers the generator itself.

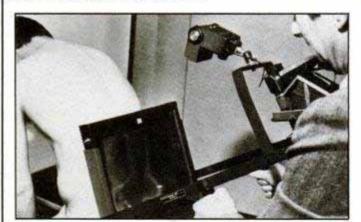
Fluid returns to the mechanical energy system through a low-pressure line. Each raceway system is contained in a quadrant of the raft to prevent balls from collecting in one place.



THIRD-WORLD STOVE

African families frequently rely on alternative fuels, such as charcoal and dung, for cooking. But even those fuels are in short supply. At the University of Florida, Tanzanian engineer Francis Mkwawa has invented a stove that can provide a normal fire with half the fuel. A metal collander holds hot coals under a metal plate recessed inside a ring of metal or ceramics. The cooking pot is then placed on top of the ring.

MEDICINE



Hot shots

The use of thermography to detect a range of diseases in their early stages is increasing. Thermography uses a chemically treated flexible plate that changes colors with changing temperatures. The latest use was demonstrated by Flexi-Therm at a New York symposium. The thermographic plate is placed against the back. A color photo shows spots where blood may be flowing too quickly or too slowly. It should help in finding the cause of back pain.

MARINE



TV cameras going under

video cameras aren't easy to protect underwater. The problem has been to keep their protection watertight and lightweight without getting any water near the optics or electronics. Westape, a Washington video development company, and Sony will introduce later this year a housing for video cameras. The solid-aluminum unit is good down to 500 feet. The news will be encouraging to researchers who would prefer video to more expensive film processing.



e wa

Imagine it's 2 a.m. An intruder is prying open a window in your house. In the dark he feels safe, secure. Suddenly a bright light comes on. He doesn't want trouble. So he runs.

Did you catch the burglar in the act? No. You weren't home. The light was turned on by an ingenious sound-activated device called the AudioLite Plug. And it may be your best bargain in home security.

It's also brilliantly simple. Plug a lamp or other appliance into the AudioLite Plug. Then set the precise sound level you want to trigger the unit-from a whisper to a

countdown. So if you remain in a room, there's no interruption of light. If you leave, you don't pay for light you're not using.

No engineering degrees necessary.

Simply plug an AudioLite Plug into any conventional AC outlet, from your cellar to your attic-anywhere at all. Then plug a lamp or other device (up to 300 watts) into the top socket. That's it. The bottom socket remains a conventional outlet. Removing the plugs is just as fast, so you can move them around the house or take one with you when traveling.

Plug in a lamp near the stairs, and walk safely day or night. And the children can fall asleep with a comforting light that will turn itself off when they're safely

Light without guilt.

AudioLite Plug works both ways, turning lights on—and off. So you save energy and money. Families with children can put a plug in every room, and in a few months the plugs will pay for themselves. During quiet activities like reading, use the manual On-Off switch. The dimmer switch on the AudioLite Plug is ideal for hallway lamps, and helps you save even more.

Order one—or save with four.

AudioLite Plug is UL approved, with solid-state reliability. One year warranty from AudioLite, pioneers in sound-activated switches and plugs for the home.

To see how handy AudioLite Plug is at your house, order #MSM752 for \$34. And if you've thought of several places where you'll use them, order a set of four (#MSM753) for only \$99. Use them for 30 days. If you're not delighted, simply return your order for a full refund.

Call today. Experience the magic and security of a home that responds to

sound-with light.

ORDER TOLL FREE.

For fastest delivery, credit card holders may call toll free. Please have the product number ready. Or send your check, adding delivery charge (2.50 for one, 4.50 for four). Calif. residents, add 6% tax.

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Light sensor reduces sensitivity during daytime when condi-No wiring necessary. Just plug the unit into any regular outlet. socket operates lights or other electrical de-vices up to 300 watts. High-Low dimmer switch for energy savings and convenience Bottom socket re-mains a conventional Time control (7 sec-onds to 7 minutes) is recessed to prevent tampering and acci-dental setting On Off switch lets you operate lamps and appliances manually. Recessed sensitivity control. You set the sound level you want quickly and easily

Light flashes when unit 'hears' sound, so you can check and adjust

ns are noisier

Sound-activated

shout. A built-in indicator light flashes when AudioLite Plug 'hears' a sound, making it easy to adjust the exact sensitivity level you desire. During noisier daytime hours, a special light sensor automatically reduces sensitivity.

Also adjustable is the number of minutes you can make lamps stay on-from 7 seconds up to 7 minutes. Each new sound triggers the internal timer, beginning a new

Setting sensitivity and time interval is easy, too. A quick turn with a screwdriver, and you're done.

Fun replaces fumbling.

Home security is only the start of AudioLite Plug's services. If you've ever tripped while groping for a lightswitch in a dark room, you can see how useful a sound-activated lamp will be. Your footsteps alone can turn on the lights.

PAINT STRIPPERS

(Continued from page 65)

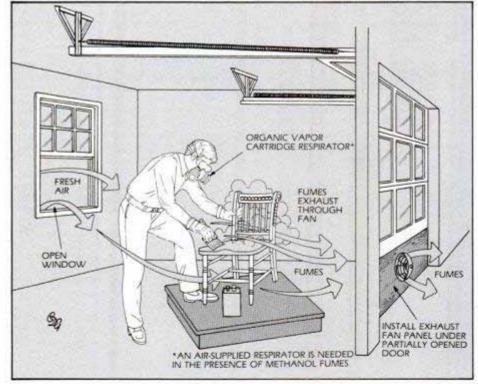
pants, not shorts, when handling or using chemical strippers. Wear chemical-resistant gloves made of a neo-

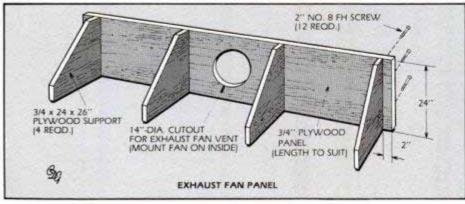
Wear an organic vapor cartridge respirator when you use products that don't contain methanol. Screw-on, disposable replacement filters are available.

prene/latex blend and splashproof goggles, not just eyeglasses. If you're going to use steel wool, wear cotton gloves over the chemical-resistant gloves to protect them from abrasion so they'll last longer.



Use an exhaust fan that's mounted in a metal frame. Secure the fan to the inside of the plywood exhaust fan panel by screwing through the metal frame.





Keep a hose or bucket of water nearby. Water will neutralize a water-based stripper's chemical action in the event of a spill. If the stripper comes in contact with your skin, wash the area immediately with soap and cool water.

Wearing a respirator is necessary when using toxic chemicals inside a ventilated workshop. Fumes from lacquers, enamels, thinners and other solvents not containing methanol are filtered safely through an organic vapor cartridge respirator. But, when using paint strippers, most of which contain methanol, you must wear an air-supplied respirator. Methanol vapors cannot be filtered through a cartridge-type respirator.

The only place you can use strippers safely without wearing a respirator is outdoors. And then, only under certain conditions.

Proper ventilation

In recent years, the safety warnings on paint stripper containers have improved greatly, reflecting the industry's concern for consumer safety. But even the improved warnings advise only that the contents be used in adequate ventilation. What is "adequate" ventilation?

To many people it means simply opening a window or door. But adequate ventilation really means continuously replacing exhausted air with fresh air. The recommended rate of air flow is 10 to 15 complete room exchanges per hour.

Using paint removers indoors—To safely refinish furniture indoors, set up a ventilated workshop as illustrated. Build the exhaust fan panel to obtain the recommended air exchange rate. A fan with an air delivery rating of at least 500 cu. ft. per minute will provide safe working conditions in the average-size one-car garage.

Raise the garage door and position the exhaust fan panel in the doorway. Then, close the garage door until it rests on top of the panel. Some strippers and solvents produce flammable vapors, so be sure to use a fan motor with an explosion-proof rating. This rating doesn't mean that an explosion can't occur, only that the motor housing will contain the blast and not blow apart.

Before applying the stripper, open a window or door in the back of the garage to admit fresh air. Then, turn on the exhaust fan at least 15 minutes ahead of time to start the air circulating. Always work directly in the path of the circulating air. Stand "upwind" from the project when applying the stripper, and wear a respirator.

Stripping paint outdoors—Whenever possible, use paint removers and other

(Please turn to page 188)

SOTZ GARAGE SHOP HEATER

Burns over 24 hours TRY A SOTZ HEATER FOR ONE YEAR AT OUR RISK!

- Produces more heat than 2 or 3 high priced woodstoves.
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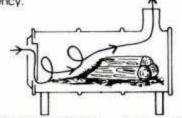
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Patented INTERNAL DRAFT CHANNEL-Air entering top draft control is preheated as it is drawn down inside of door and is sucked into bottom of heater with a turbulent action, mixing with the wood gases. This makes the Sotz stove tops in efficiency.



SPARK-PROOF DESIGN . . . Because of our internal draft channel, hot sparks cannot jump out of heater as in others with draft straight open to fire.

\$34.92 St-Gal. bottom kit factory pick-up

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30 Gal. bottom kit factory pick-up

Kit converts 55 gal., or 30 to 15 gal., drum (not supplied) into high capacity stoves.

You've seen our ads and read unsolicited testimonials from folks just like you for many years. Before you spend \$400 to \$500 on a wood heater, try a **SOTZ HEATER** kit. If (within one year) you don't agree it outperforms any wood heater money can buy or (within 10 years), if the kit cracks, warps or burns up, your money will be refunded, including shipping charges.

Use of draft control allows you to heat large or small areas. Basement installation heats your entire home. Great for your garage, workshop, or cabin. Top drum squeezes 60% more BTU's from heat normally lost up the chimney. Heavy steel kit bolts together quick and easy.

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THE ONLY KIT SOLD

- With enough nuts and bolts to complete stove.
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- •55 Gal. Stove has king size 15½" diagonal fuel door. Less wood splitting, easier fire tending.
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STARVING TERMITES

As an attorney I am a natural skeptic. While building my own passive solar house in La Grange, Kentucky, I did considerable research concerning wood stoves. After reading and studying all the information I could get my hands on, I determined that the Vermont Castings Defiant and the Franklin Scandia stove of the same design were the most efficient wood heaters on the market. I purchased a Scandia. I installed it, fired it up, and continued to shiver. It ate wood like a swarm of starving termites, and the only heat it seemed to generate was ... from my constant trips to the woodpile. After this \$441.00 mistake, I decided to risk \$50 on your double drum kit. The results are nothing short of amazing. Our ownerbuilt house is 3700 square feet, and the Sotz stove in the basement, centrally located, easily heats the entire three story house using only about one-third of the wood previously used! The stove may not

be esthetically beautiful (according to my wife), but this is a case of "pretty is as pretty does". I also find that because of the double-drum configuration the flue temperature is considerably lower. About a month ago, faced with the necessity of splitting several cords of wood for the coming winter, and having had poor success with a regular maul and wedge, and preferring the easy way of doing things, I seriously considered a hydraulic splitter but decided to rely on your Monster maul advertisement, the truth of your advertising having been previously proven by your drum stove ads. I ordered the Monster Maul. You saved me several hundred dollars. I actually ENJOY using the monster Maul. You may now send me a set of your stove tools, poker, rake, etc. Konrad Poth, LaGrange KY

CONVERSATION PIECE

I operate an automobile repair shop consisting of a 2-story masonry building with a concrete floor and tin walls and ceilings. To make matters a little damper and colder, a good sized river flows next to my back parking lot. Last year I purchased a double drum heater kit (55 gal.) I have been using it for my only source of heat and am very satisfied with it. It is very economical with its consumption of wood and a constant topic of conversation with friends and customers. I am now ordering another stove kit, a Monster Maul, a Lift-N-Saw and a set of Woodstove Tools. Thank you for your quality products and reasonable prices.

Mike Danco, Long Island, NJ WHY BOTHER?

Please send me the Sotz wood stove as shown in the Mother Earth News Magazine. My parents have one in their house and it works great. It heats their 7 room house easily. My uncle has one in his house also. I don't know why you bother giving a guarantee on such an indestructable product.

David Mundy, St. Ann, MO





compact design. Wheels fold in.



Fold to 40" x 22" x 515". Weighs only 57 lbs. Accessories (41 lbs.) are carried separately.



Includes special metal racks for haul-ing TWO bikes, safely and securely

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PAINT STRIPPERS

(Continued from page 186)

strong solvents outdoors. But simply being outside doesn't guarantee proper ventilation. Certain precautions must be followed here, too.

Wait for a day that's cool and breezy. Using toxic chemicals on hot, humid, windless days can be as dangerous as working in a closed room. Always work in an open, windswept, area-ideally between 65° and 75° F. Never work in an area that's closed in by fences, buildings and other obstructions. Stand upwind to avoid breathing the vapors.

After applying the paint remover, place the piece in a shaded area. Direct sunlight will speed the evaporation of the stripper and reduce its effective-

To avoid the possibility of spontaneous combustion, spread out all work rags containing paint remover until they're dry. Then, dispose of the rags into a fireproof, airtight container.

The methods described here are intended for the occasional user exposed to low levels of paint-remover fumes. For industrial and professional safety standards, consult NIOSH and OSHA guidelines.

MANUFACTURERS LIST

W.M. Barr & Co., Box 1879, Memphis, Tenn. 38101;

Klean-Strip paint removers.

Formby Inc., Box 667, Olive Branch, Miss. 38654;

Homer Formby paint remover.

Master Products Inc., Box 274, Orange City, Iowa 51041; TM-4 paint, varnish and stain remover McCloskey Varnish Co., 7600 State Rd., Philadelphia,

Pa. 19136; spray-on paint remover. M & M Chemical Sales Corp. and Tru-Marine Div., 515 Providence Hwy., Dedham, Mass. 02026. Mohawk Refinishing Products, Rte. 30 N., Amster-

dam, N.Y. 12010. yrock Chemical Corp., 5-40 45th Ave., Long Island

City, N.Y. 11101; Rock Miracle paint remover. Red Devil Paints and Chemicals, 30 North West St., Mount Vernon, N.Y. 10550.

Star Bronze Co., Box 568, Alliance, Ohio 44601; Zip-Strip paint and varnish remover.

UGL, Box 70, Dept. PM, Scranton, Pa. 18501; ZAR paint and varnish remover.

Exhaust fans

Greenheck Fan Corp., Box 128, Schofield, Wis. 54476.

Kord Manufacturing Co. Inc., 4510 White Plains Rd., New York, N.Y. 10470. Patton Electric Co. Inc., Industrial Fan Div., 15012

Edgerton Rd., Box 128, New Haven, Ind. 46774. H.K. Porter, 1401 West Market St., Warren, Ohio

The Silentaire Co., Box 2468-T, Baton Rouge, La.

70721 United Blower Co. Inc., 334 Canal St., Box 271-A,

New York, N.Y. 10013.

Respirators Amfak Safety Inc., 3160 Southwest 22nd St., Miami, Fla. 33145.

Belmar Safety Equipment Inc., 212 Clements Bridge

Rd., Barrington, N.J. 08007. Direct Safety Co., 7815 South 46th St., Phoenix, Ariz.

Eastco Industrial Safety Corp., 26-15A 123rd St., Flushing, N.Y. 11354.

Eastern Safety Equipment Co. Inc., 45-17 Pearson St., Long Island City, N.Y. 11101.

Lab Safety Supply, Box 1368, Janesville, Wis. 53547. Major Safety Services Inc., 4500 Patent Rd., Norfolk,

Va. 23502 Siebe Norton Inc., 2000 Plainfield Pike, Cranston, R.I.

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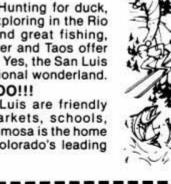
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THIS OFFER IS SUBJECT TO ALL LOCAL, STATE AND FEDERAL REGULATIONS.

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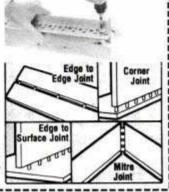
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ENERGY SIEVE

(Continued from page 52)



A fireplace insert turned the fireplace in the family room from an energy waster into an effective heat source. It can contribute up to 50,000 B.T.U.s of heat an hour.

distances. The heat system is the focus of another possible future project that calls for using the present electric baseboard heaters as supplemental heat and installing a heat pump in the attic over the central living area. Ductwork would run through the attic. The heat pump might also hook up to the water supply for hot water.

However, before this homeowner plans more projects, he wants to compare energy usage from the winter of 81 (before buttoning up this energy sieve) and the winter to come. We'll report back next spring.

SUPPLIERS

Fireplace insert: Ironwood from CWC Textron Inc.,

Box 4347, Muskegon Heights, Mich. 49444. Vented propane heater: Empire Stove Co., 918 Freeburg Ave., Belleville, Ill. 62222; tank and installation: Utility Propane, 1 Elizabethtown Plaza, Elizabeth, N.J. 07207.

Attic insulation: Knauf Fiberglass, 240 Elizabeth St., Shelbyville, Ind. 46176, unfaced fiberglass. Foundation insulation panels: Thermboard from

Omni Energy Products Inc., Box 220, Albuquerque, N.M. 87103.

Wall insulation panels: Thermax from Celotex Corp., Box 22602, Tampa, Fla. 33622. Basement ceiling insulation: Johns-Manville, Box 5108, Denver, Colo. 80217, fiberglass batt with vapor barrier.

Napor Darrier.

Interior louver-look doors: Model M1511 from CE Morgan Co., Box 2446, Oshkosh, Wis. 54903.

Storm doors: J.C. Penney, 1301 Avenue of the Americas, New York, N.Y. 10019, Model

R904C4751B shown.

Steel replacement entry door: Stanley Door Sys-tems, 1225 East Maple St., Troy, Mich. 48084. Interior storm windows: Plaskolite Inc., Box 1497,

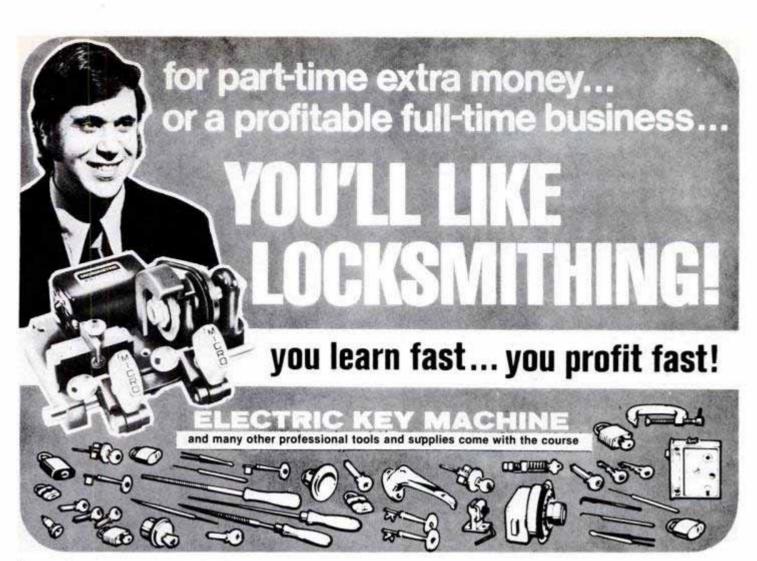
Columbus, Ohio 43216. Outlet and switch plate insulators: Snapit, Cable Electric Products Inc., Box 6767, Providence, R.I.

Attic stairs cover: Energy King., Box 1037, Wappingers Falls, N.Y. 12590.

ater heater jacket: S & S Industries Inc., Box

17087, Nashville, Tenn. 37217, Thermo Saver. Weatherstrip: Frost-King casement window weatherstrip, Thermwell Products Co. Inc., 150 East Seventh St., Patterson, N.J. 07524; 3M reusable tubular weather strip (for patio doors) and 3M garage door bottom seal, 3M Household and Hardware Products Div., 223-1N, 3M Center, St. Paul, Minn. 55144.

Caulk: Convenience Products Inc., 4205 Forest Park Blvd., St. Louis, Mo. 63108 (Touch 'N Foam and Touch 'N Caulk); Dap Inc., Box 277, Dayton, Ohio 45401; Darworth Co., Box K, Avon, Conn. 06001; Geocel Corp., Box 398, Elkhart, Ind., 46515; General Electric Co., Silicone Products Div., 7540 LBJ Freeway, Suite 515, Dallas, Tex. 75251; Insta-Foam Products, 1500 Cedarwood Dr., Joliet, Ill.



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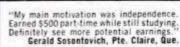
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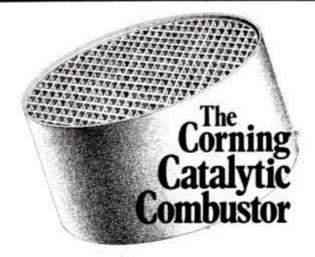
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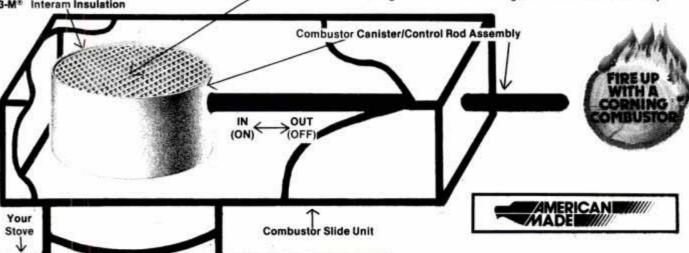
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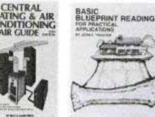


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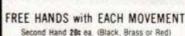
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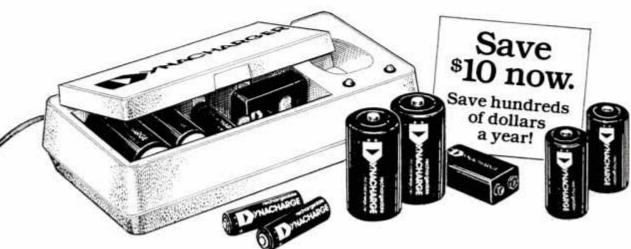
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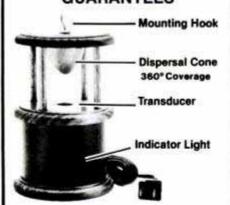
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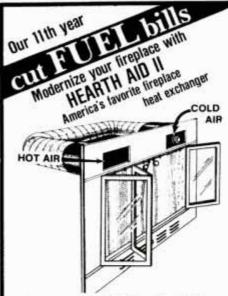






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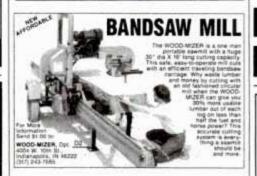
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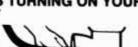
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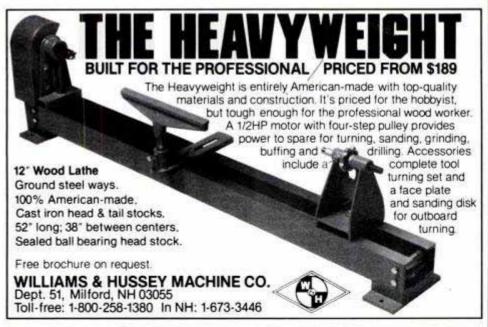


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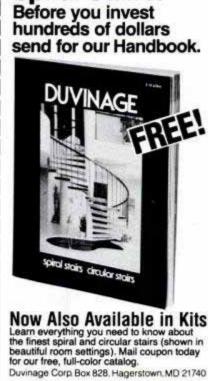
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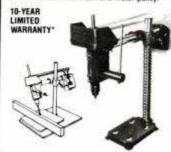
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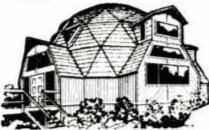
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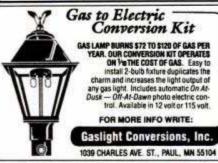
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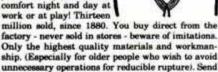


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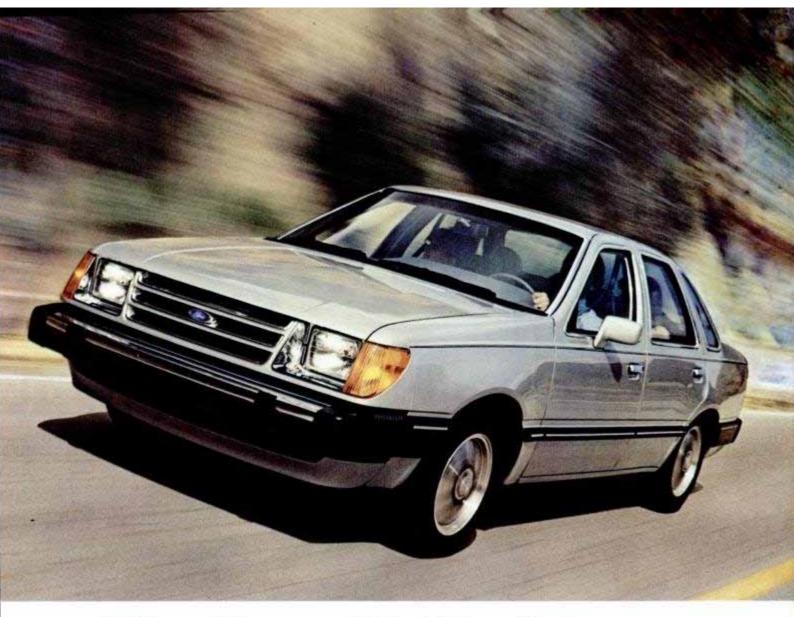
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