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Popular Mechanics®

On the cover
This Navy F-14 Tomcat plunging off the deck of the carrier *Forrestal* set off a months-long nightmare adventure in recovering the top-secret jet and its missile in the violent waters of the North Atlantic. Those two ejecting crewmen? By a miracle, they both landed safely back on deck. It's an exciting saga of men and sea. —*Painting by Ed Valigursky.*

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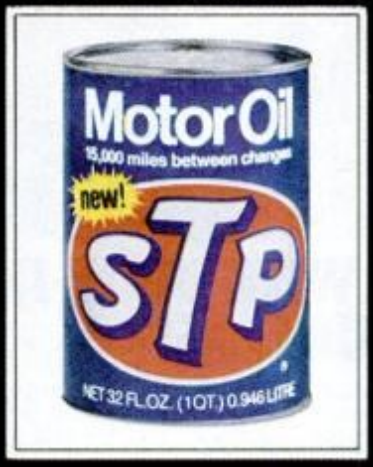
New STP Motor Oil.



Proven protection for 15,000 miles. Without an oil change.

Now, with this new advanced motor oil from STP, you don't have to change your oil every 3,000, 5,000 or 7,000 miles. This new oil protects against engine wear, sludge, varnish and rust for 15,000 miles, or one year under normal driving conditions.

And we proved this protection in a series of different tests.

Proof on the test site.

We ran cars on computer controlled test equipment which duplicated city driving. Stop and go traffic. Even highway conditions. These cars ran 15,000 miles on new STP Motor Oil.

When the engines were pulled, torn down and inspected, we found exceptionally clean parts and no noticeable wear. That's after 15,000 miles without changing the oil.

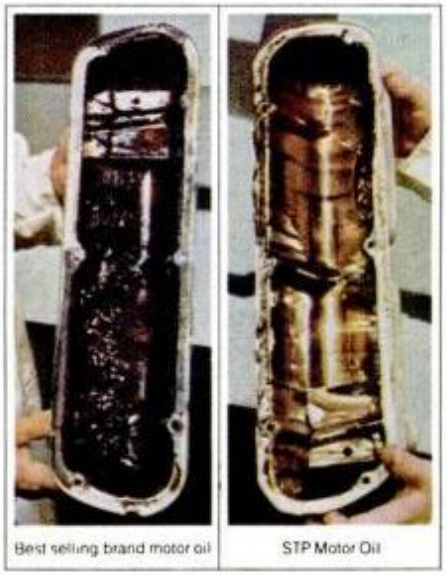
Proof on the road.

For on-the-road proof of protection, we put this new motor oil in taxi cabs and ran them for 15,000 miles. That's five times longer than major auto manufacturers recommend taxis go without an oil change.

When these engines were torn down, again we found exceptionally clean parts; virtually no sludge and varnish build-up. And when weighed and measured, the parts showed no noticeable wear...proof of new STP Motor Oil's 15,000 mile protection.

But how does STP Motor Oil stand up to sludge and varnish against the best selling brand?

An independent lab ran new STP Motor Oil and the best selling brand through the standard industry test for sludge and varnish. But they ran new STP Motor Oil twice as long.



Best selling brand motor oil | STP Motor Oil

Just look at these valve covers in the photos on the left. After the standard industry test, the best selling brand left sludge and varnish build-up. After double the test, new STP Motor Oil left the valve covers with virtually no sludge build-up and on average less varnish than the best selling brand.

But, those weren't the only tests. Initially, new STP Motor Oil was subjected to the tough SE Classification Test for corrosion, rust prevention, wear, sludge and varnish, and high-temperature performance capabilities. Any oil that meets these test requirements is a very good one, indeed. STP Motor Oil not only passed, but in almost every case, after doubling the test, it met the standard for a single test. So, after all these tests, new STP Motor Oil proved itself to be one of the most advanced automotive engine lubricant formulations on the market today.

Want more proof?

These tests proved for us that new STP Motor Oil gives protection for 15,000 miles. But, if this ad hasn't changed your mind about changing your brand of oil, this will: An informative booklet that documents the actual tests with pictures of the results. It's yours free. Just write to: 15,000 MILE PROTECTION, STP CORPORATION, BOX 9807, FT. LAUDERDALE, FLA. 33310.

New STP Motor Oil. Protection for 15,000 miles. That's Extra Protection.

STP Corp., Ft. Lauderdale, Fla. 33310

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KONICA C-35 EF. WITH BUILT-IN POP-UP FLASH.

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Twice!

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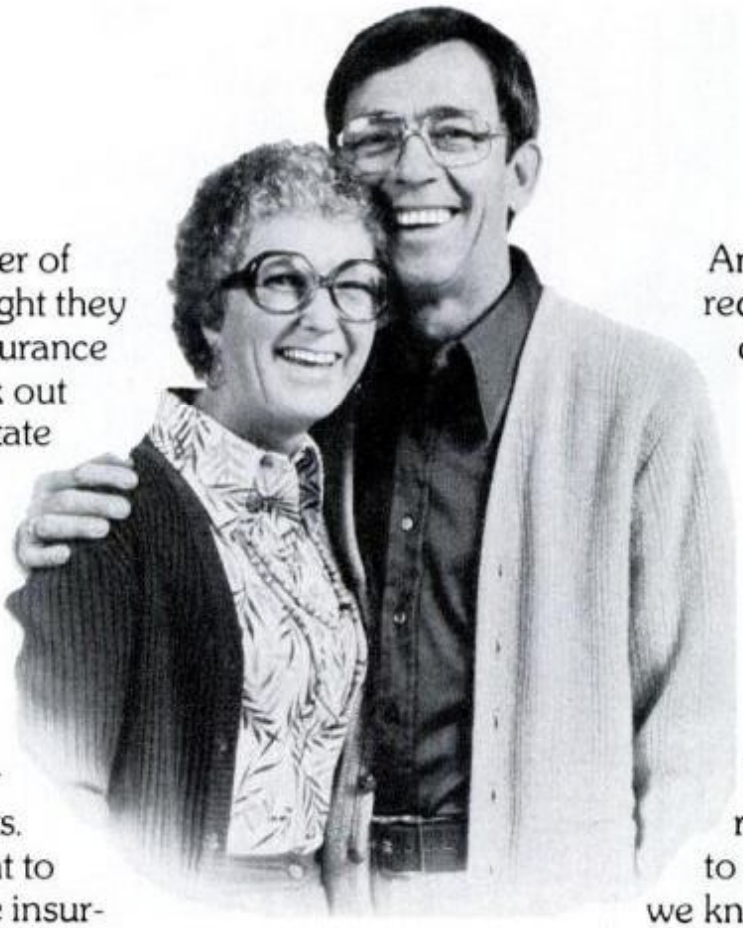
Deane Bradfield is four of the best insurance agents you'll ever find.



Ken and Wanda Meyer of Waterloo, Iowa, thought they had found a good insurance agent when they took out an auto policy with State Farm agent Deane Bradfield more than twenty years ago.

But over the years, they've changed their minds.

Today they know Deane is actually four good insurance agents.

"Since we first went to him, he's handled the insurance on all our cars–I couldn't even guess how many," Ken says.

"He helped us insure our homes while the kids were growing up. And after we moved to an apartment, Deane handled the renters insurance.

"He's also helped keep our life insurance program up-to-date."

And if they should ever require individual health coverage, Ken adds, "I'd certainly talk to Deane first."

"Whenever he thought we were underinsured or there were discounts we could take advantage of, he's pointed them out to us," Wanda says. "We've recommended Deane to many people because we know he'll treat them as well as he's treated us."

If you want to be as well treated as Ken and Wanda Meyer, just check the Yellow Pages for the State Farm agent in your neighborhood. And make it a point to get acquainted soon.

You'll find your State Farm agent is four good people to know.

STATE FARM INSURANCE

Like a good neighbor, State Farm is there.

STATE FARM INSURANCE COMPANIES Home Offices: Bloomington, Illinois

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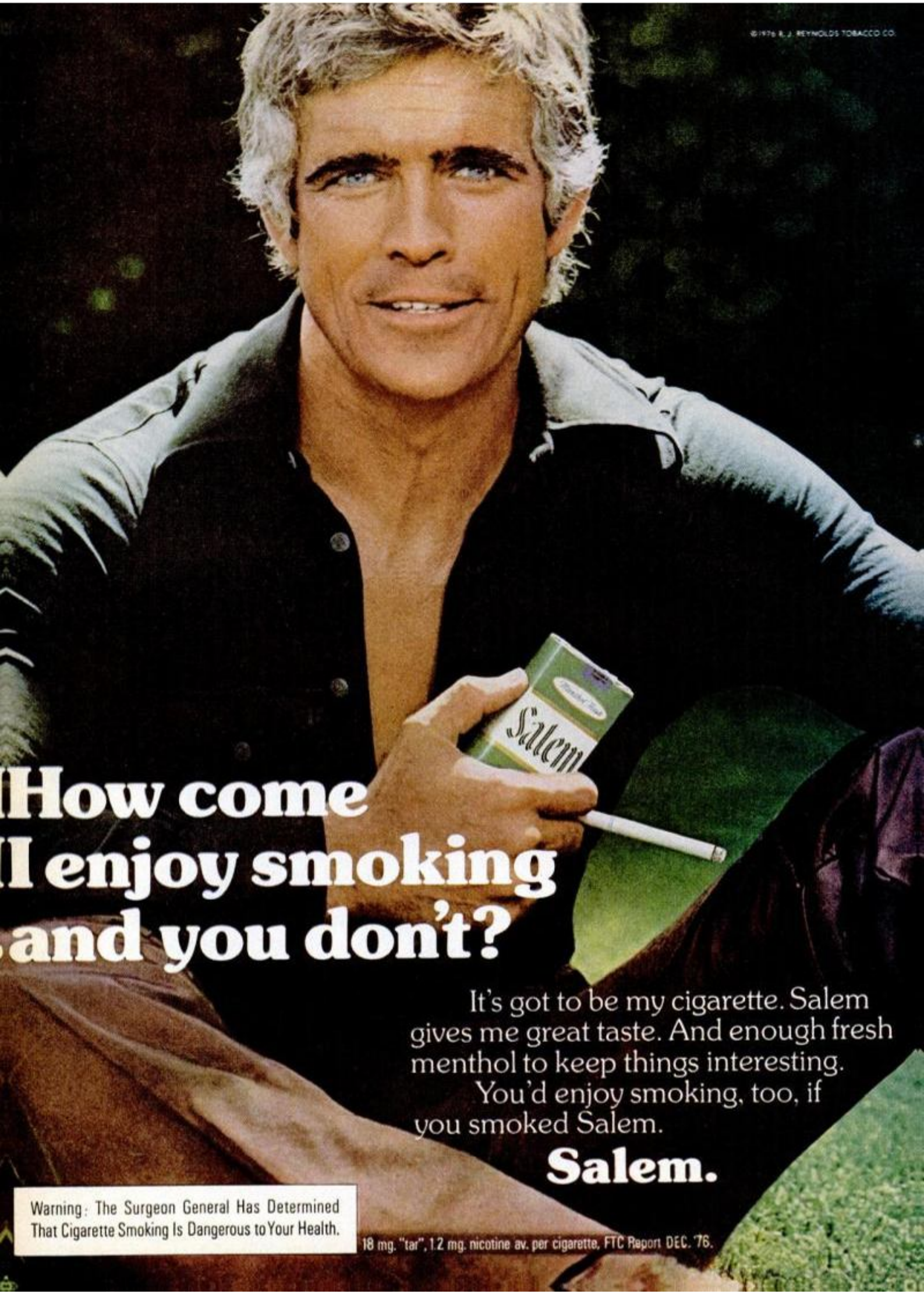
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Salem
How come
I enjoy smoking
and you don't?
It's got to be my cigarette. Salem gives me great taste. And enough fresh menthol to keep things interesting.
You'd enjoy smoking, too, if you smoked Salem.
Salem.
Warning: The Surgeon General Has Determined That Cigarette Smoking Is Dangerous to Your Health.
18 mg. "tar", 1.2 mg. nicotine av. per cigarette, FTC Report DEC. '76.

LETTERS TO THE EDITOR

On ending the world

I wish to respond to the article *20 Ways the World Could End* by Isaac Asimov (page 86, March '77). Mr. Asimov mentions two things which are not true. One, William Miller and his followers did not don white robes and wait for the Lord to come. The *Encyclopedia Britannica* in its 14th edition with a new biographical sketch of William Miller, states: "There is no historical foundation for stories that the Millerites engaged in such fanatical excesses as ascending hills, housetops and trees in ascension robes." In the 11th edition of 1910, they also had recorded the ascension robe hoax, but now they have retracted it.

The second error states that Jehovah's Witnesses "came into being as an offshoot of the Adventists. . ." Any look into the facts would reveal this is not the case.

Inasmuch as these inaccuracies have been passed along to the public by your journal, I think you have a responsibility to also publish a correction. LESTER J. JONES
WINTERSET, IOWA

If Isaac Asimov's predictions are no better researched than his statements of history, the matter of how the world will end is still pretty much an unknown.

If Asimov has any valid proof of his statement [Millerites, on housetops in ascension robes], there are many of us who would be glad to receive it.

There are numerous scholarly studies in the form of essays, pamphlets and substantial volumes that would have clarified the matter.
ROBERT FORMAN
MONMOUTH, ILL.

In your article *20 Ways the World Could End*, author Asimov presents no hope for indefinite existence of the earth. But the Bible does. Nor does he take into account the existence of the Creator. Asimov also overlooked another thing when he said the "black death" was the greatest catastrophe of recorded history. I submit that the distinction must go to the Noachian flood. The Bible is recorded history. The Old Testament records the flood as a fact. The New Testament speaks of the flood as an historical fact. An abundance of geological and paleontological evidence is ignored by the majority of scientists because of their prejudice against the biblical account and their blind faith in the theory of uniformity and evolution. WAYNE E. MOORE
JORDAN, MONT.

Another Daimler cycle

Why go to the Mercedes Benz Museum in Stuttgart, Germany, to see Gottlieb Daimler's first motorcycle (page 37, Feb. '77)? Right here in my Indian Motorcycle Museum Hall of Fame I have a Daimler in running condition. I understand the first one built was destroyed in a

fire; one is in Germany; I have one; two others made are either lost or destroyed.
CHARLES MANTHOS
SPRINGFIELD, MASS.

On reactivating windmills

Since the energy crunch began, hundreds of wind generators sold to farms and ranches in the western states from 1930 to 1960, are being reactivated. Starting in 1922, my company built thousands of Jacobs Wind Electric Plants and placed them in worldwide service, until the REA program ended rural plant sales in 1960.

Many "rebuilders" of these plants do not understand the need to keep both positive and negative circuits insulated. When you ground one side of a d.c. circuit, you create a possible damaging condition because the high voltage from lightning picked up in the insulated side of the circuit will surge through the generator or connected appliances and often destroy them in trying to get across to the grounded side. Once we had determined never to ground either side, and to use the proper high-voltage condensers, we were able to guarantee our generators for five years against damage by lightning. Thousands of our plants operating 40 years have proved this system.

Grounding also can destroy the anchor posts in a few months by electrolytic action from battery feedback into the generator (when not charging), putting a positive current flow from the anchors through the ground to a negative-grounded water pump motor or appliances. So don't ground any d.c. circuits connected to wind electric generators mounted on steel towers. Use 1000-volt oil-filled condensers. M.L. JACOBS
FORT MYERS, FLA.

Sure beats a full house

You describe the paint job on the van appearing on your March cover as "a full-house hand." What is depicted on the van are the first four cards leading to a royal flush, the highest possible hand in straight poker. ROBERT SCHIMMEL
COLTS NECK, N.J.

True, true. We should play the editor who wrote it—at a $10 ante.

Solar collectors

Your article, *"PM's Guide to Solar Energy Systems"* (page 80, April '77) incorrectly listed Ecosol as a flatplate collector manufacturer. Ecosol manufactures controls and mechanical equipment to use the heat generated by collectors in residential installations, but not the collectors. When installed with solar collectors, storage tank and an oversized domestic hot water heater, the Ecosol 101 provides solar space and domestic water heating as well as heat pump cooling. Inquiries we have received indicate great interest in solar energy systems and we hope future interested readers will write to collector companies for collector data, and to Ecosol about our Energy Recovery system. ECOSOL, LTD.
NEW YORK, N.Y.

It's Mobilfone Radio System

In Keep in Touch From Anywhere *(page 98, May '77), the Mobilfone Radio System, New York, N.Y., was referred to as the Mobilphone Corp. PM regrets the error.*

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'77 FORD COURIER
A tough new way to go truckin'...

Unbeatable gas mileage.

41/28 MPG
Based on EPA estimates, no other pickup in America gets better gas mileage ratings than Courier. With the 1.8 litre engine and optional 5-spd. trans., the EPA estimates 41 mpg hwy., 28 city. (Slightly lower in Calif.) Your mileage may vary due to how and where you drive, truck's condition, and optional equipment.

The all-new Courier is coming on strong. For '77, Courier gives you unbeatable gas mileage! The biggest engine in its class! More new options and new interiors! Plus the popular Soft Ride Package and 5-speed transmission options. And that's not all.

For '77, Ford offers an industry exclusive: The Free Wheeling Courier option. A tough machine that gives you the works: from Accent Tape Stripes, GT Bar, Push Bar, Fog Lamps to Wide-Oval Tires and Cast Styled Aluminum Wheels.

Free Wheeling Courier.

More new options.

Courier now offers a new 7-foot bed, sliding cab back window, radial tires, and more.

Biggest engine in its class.

Courier's optional 2.3 litre engine is the largest engine available in any compact pickup.

All new interiors.

Courier's new XLT option offers a stylish exterior plus a new level of interior comfort in a compact truck.

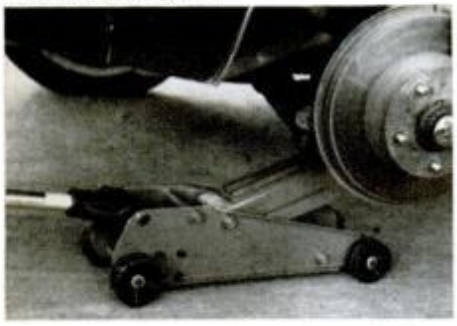
FORD

FORD DIVISION

THE PM GARAGE

CAPSULE REPORTS ON NEW AUTO PRODUCTS BY THE EDITORS

Home floor jack



There's a spate of new, small floor jacks currently being offered to the home mechanic. They're lightweight, easy to store and fairly inexpensive.

I bought one recently—a KeyBar 1½-ton Maxi-Brute—on sale at Grand Auto for $77.48. The regular price is between $80 and $90. I've found the jack very useful and handy.

It weighs only 36 pounds, and the handle disassembles with spring-loaded pins. The jack's 3000-pound rating lets it lift the front end of all but the heaviest cars, but as the cautionary note says, "After jacking, always use safety stands to support the load before making repairs."

The KeyBar Maxi-Brute raises to a maximum height of 14.50 inches, and the handle twists to let it down. It does everything—almost—that a big jack does. Now if the rear wheels only pivoted. . . .

Look for the Maxi-Brute at Grand Auto and other such stores, or write directly to Norco Industries, Inc., Box 2045, Gardena, Calif. 90247.—*M.L.*

Underhood oil gauge

An oil-pressure gauge that mounts directly into your engine is now available from Baker Precision Bearings. Called the Jammer, it screws directly into the block, but can also be mounted anywhere in the engine compartment with a little custom plumbing.

If you want to retain your dashboard warning lamp or gauge, you simply buy a standard pipe tee and hook in both the Jammer gauge and your pressure-sending unit at the same junction.

The Jammer lists for $10.95 plus shipping from Baker Precision Bearings, 2901 Cedar Ave., Long Beach, Calif. 90806. (California residents add 6 percent sales tax.) —*M.L.*

Custom license frames

Make up your own license-plate frames with this kit by A&P Sales. Express yourself. Serious or cute, you can list your CB handle, your car's pet name, or tell the world you bought "Another Lemon from Mickey Mouse Motors."

The kit, costing $4.95 plus 70 cents for mailing, consists of two plastic license frames in black or white, plus three very complete sets of stick-on vinyl letters, all water and detergent-resistant. Letters are available in a choice of five colors: blue, black, red, yellow and white. Order your kit from A&P Sales, Box 24, Placentia, Calif. 92670.—*M.L.*

Drywash your car

We'd been reading about KozaK Drywash cloths for over 50 years now, so we figured it's time to try one. And we found the KozaK great for quickly removing dirt and dust that's not actually stuck fast to a car's surface. You can save plenty of carwash cash with a KozaK.

The cloth's absorbent cotton fabric has a deep nap that captures dirt and grit without letting it

scratch the paint. And the KozaK's very light oiliness holds in the dust until you shake out the cloth. But be sure to read the KozaK instructions before you start dusting your car.

KozaK Auto Drywash cloths are available in regular and super sizes at $4.50 and $5 respectively. Order from KozaK, 6-10 Lyon St., Batavia, N.Y. 14020.—*M.L.*

Console for CB

If you're tired of locks, chains, slide mounts and other approaches to the CB installation and antitheft challenge, try a console. It'll work for you if you own a car with a large center tunnel on which you can mount the console.

This Jensen design is only $7 and uses a simple mounting plate for your rig: Just press your CB down on the adhesive strips on the plate. The plate itself snaps in and out of the console so you can take your rig along whenever you leave your car.

The console also has molded-in provision for beverage cups, toll change and so on. Jensen Auto Consoles, 300 Fay Ave., Addison, Ill. 60101.—*B.H.*

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The AC Spark Plug Dollar Sign.

We can help you save money the next time you buy spark plugs.

For a limited time, AC-Delco has made it possible for you to get one free AC Spark Plug when you buy seven — at participating AC-Delco outlets displaying this "Buy seven, get one FREE" sign.

If you need a tune-up, AC-Delco can help you save twice... once when you buy AC Spark Plugs, and again when you drive.

Look for this AC Spark Plug "Dollar Sign" wherever you go for parts or service.

While supply lasts. Void where prohibited.

AC GM Delco

AC-DELCO DIVISION OF GENERAL MOTORS CORPORATION

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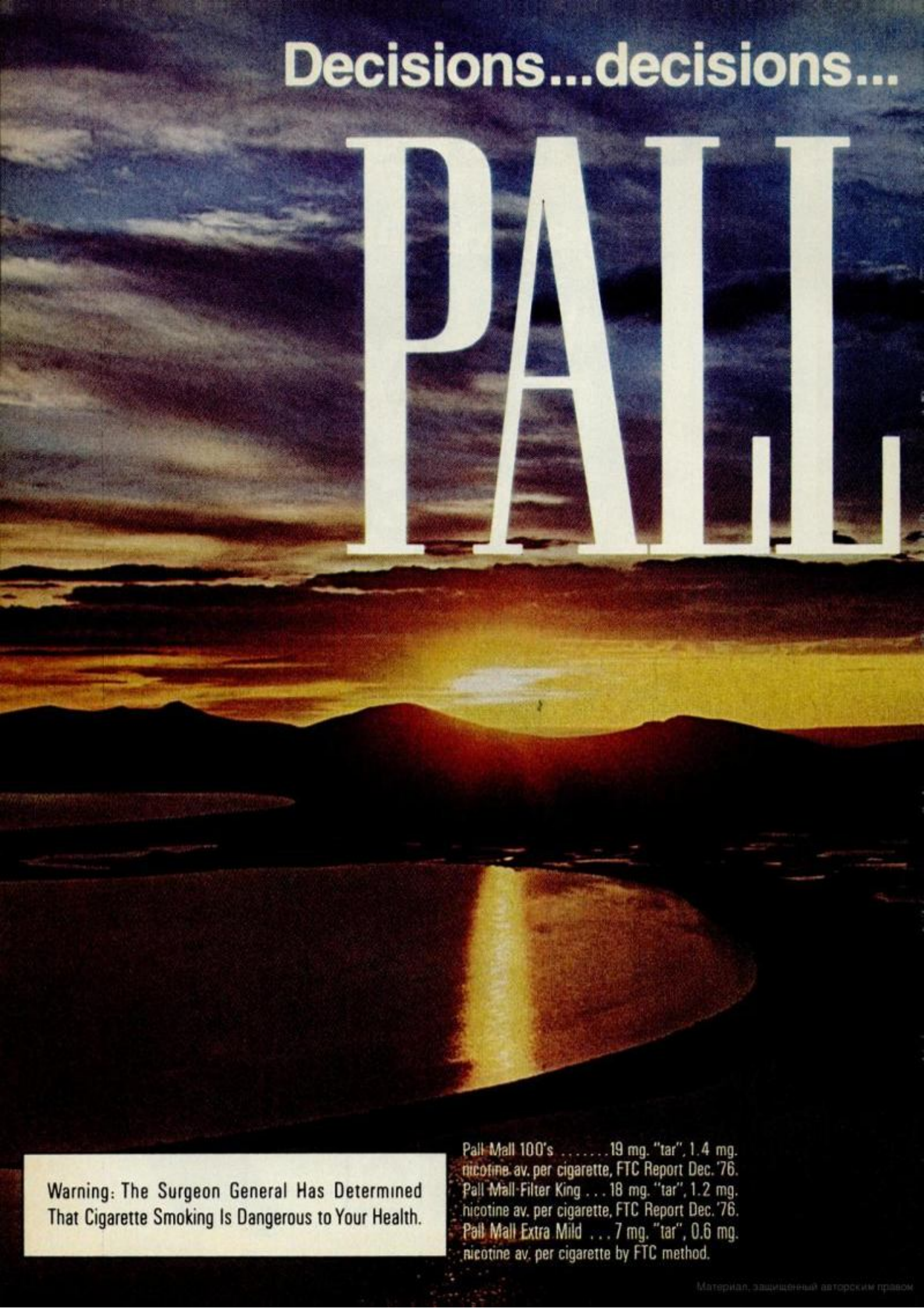

Warning: The Surgeon General Has Determined That Cigarette Smoking Is Dangerous to Your Health.

Pall Mall 100's .....19 mg. "tar", 1.4 mg. nicotine av. per cigarette, FTC Report Dec. '76.
Pall Mall-Filter King . . . 18 mg. "tar", 1.2 mg. nicotine av. per cigarette, FTC Report Dec. '76.
Pall Mall Extra Mild . . . 7 mg. "tar", 0.6 mg. nicotine av. per cigarette by FTC method.

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Make your decision

MALL

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Lower than all the Lights.

PALL MALL GOLD 100's
The great taste of fine Pall Mall tobaccos.
Not too strong, not too light.
Not too long. Tastes just right.

PALL MALL RED
with a filter.
America's best-tasting king-size cigarette... made to taste even milder with a filter.

PALL MALL EXTRA MILD
Lower in tar than 95% of all cigarettes sold. De-tarred but not de-tasted.

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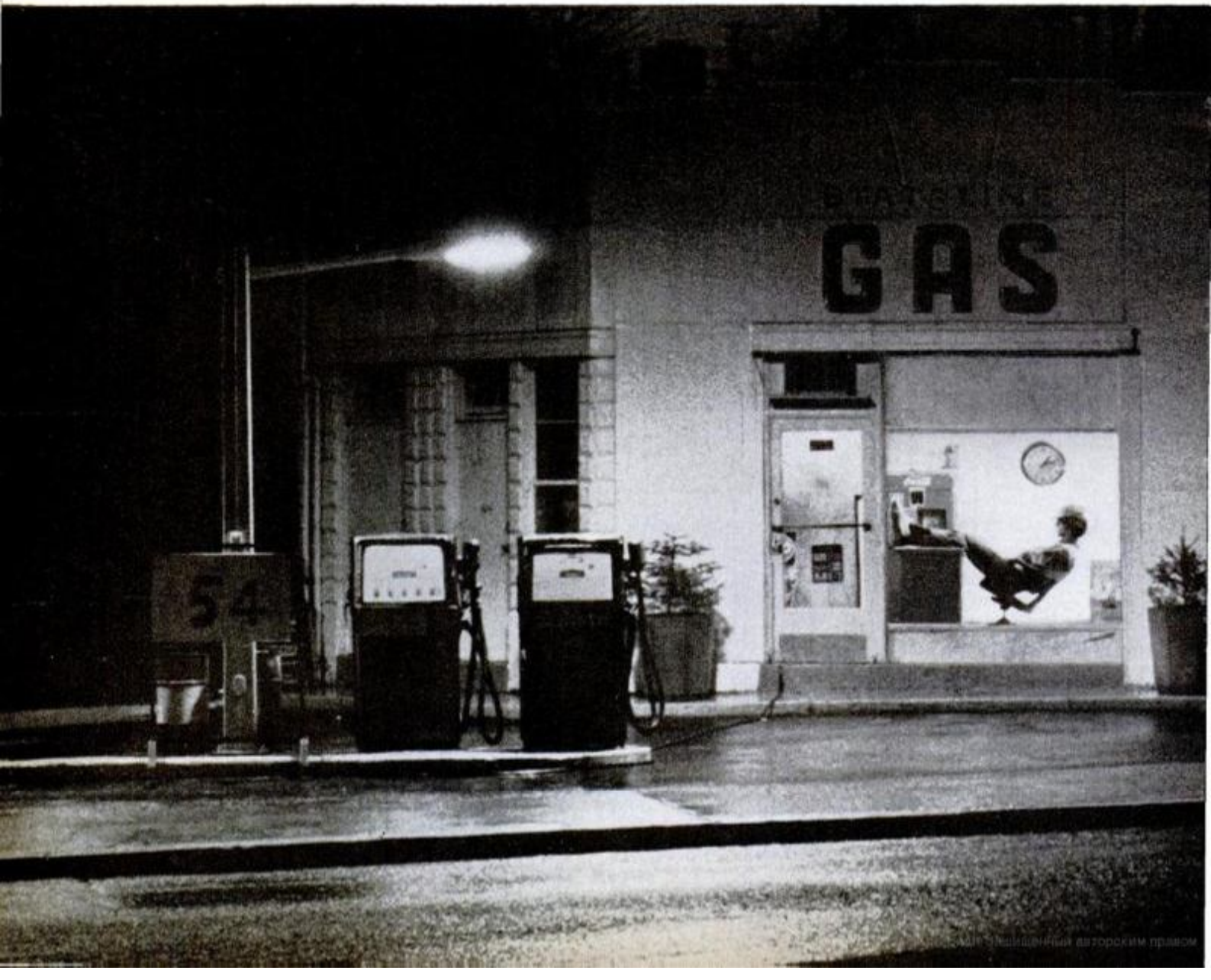
NOBODY SHOULD HAVE TO WORK 2 JOBS JUST TO MAKE ENDS MEET.



What would a second job mean to you? A few grubby dollars and a life that's an endless grind.

You'll hardly ever see your family. You won't have time for friends or fun. Your wife will wonder what happened to the husband she used to have. You'll spend your days off sleeping.

It just isn't worth it. And it doesn't have to be that way. Millions of men make a good living with one job. Millions of men actually like their jobs, because the job pays well, challenges them, and has a good future.

These are men who have had training. And now, so can you. That's where we come in. We're ICS, International Correspondence Schools. We specialize in training men and women for skilled careers.

And while we can't guarantee you a job—no school can do that—ICS *can* give you the first-rate training you need, especially if you're interested in one of the growing careers where ICS concentrates its training.

AN IDEAL WAY TO LEARN

It's not all fun and games. But you can do it in your own home. Without the hassle of a classroom. Without missing a paycheck. You get the texts and equipment it takes, and all the help you need. If you want to talk to an instructor, you can call ICS from anywhere in the continental United States and Canada, using our toll-free Dial-a-Question® service.

Since 1890, millions of men and women around the world have turned to ICS for career training.

More than 70 of America's largest 100 corporations use ICS training for their own employees.

And the ICS Center for Degree Studies is authorized by the Pennsylvania Department of Education to grant the Associate in Specialized Business degree in Accounting and Business Management, and the Associate in Specialized Technology degree in Civil, Mechanical, Electrical, and Chemical Engineering Technologies.

These degree programs are not mere stepping-stones to higher education nor are they primarily intended for transfer toward more advanced degrees. They are practical, career-oriented programs designed to help you reach your objectives without further academic training.

FREE DEMONSTRATION LESSON

No one can promise success, but if you *want* more—more money, more security, more day-to-day satisfaction and more future—our free Career Booklet and free Demonstration Lesson can help you get started in the right direction. Just check the box next to the field that interests you most and mail the postpaid card today. There's no obligation.

Remember, it's your life. You might as well make the most of it.

ICS

International Correspondence Schools
Scranton, Pa. 18515

(If card is missing, write ICS, Scranton, Pa. 18515)

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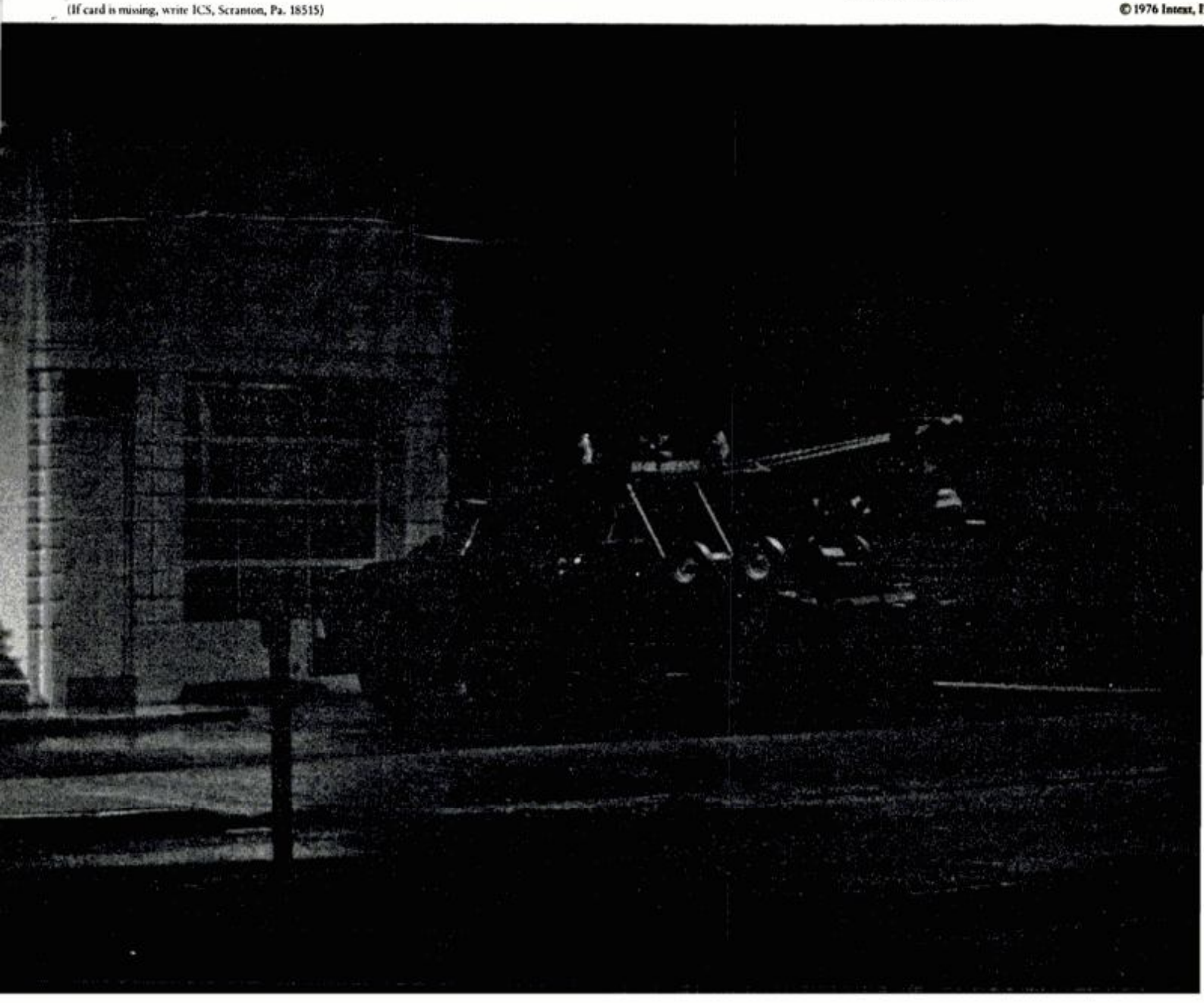


SCIENCE WORLDWIDE

Lightweight throwaways

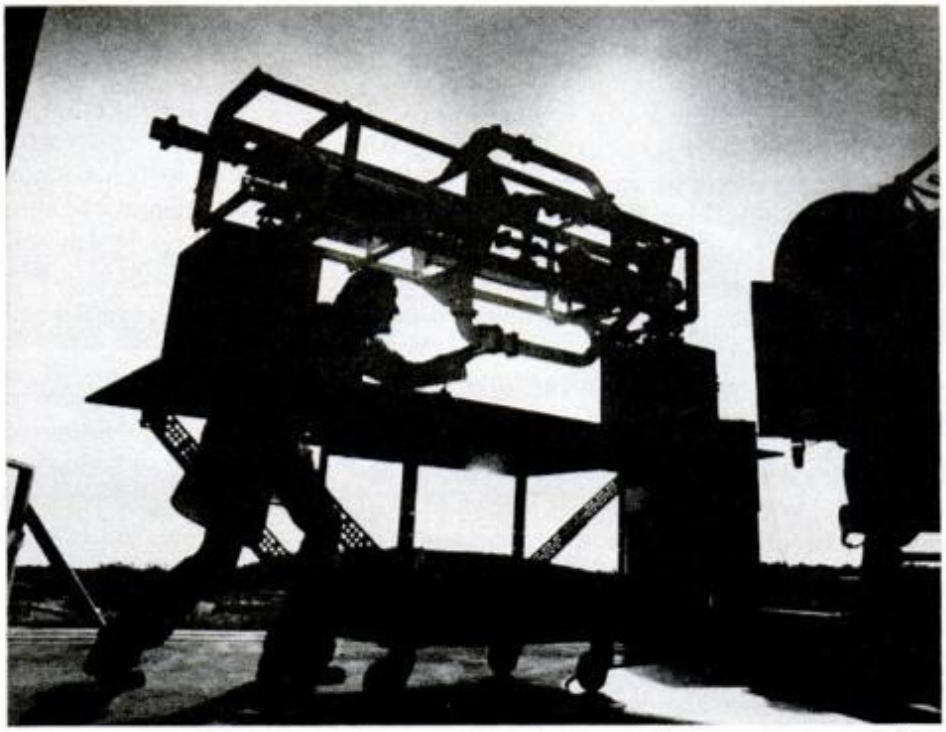
Nonreturnable soft-drink bottles soon may be replaced by new plastic containers (unlike earlier "toxic" ones) weighing less than a tenth as much as glass. One 64-ounce nonreturnable glass bottle weighs more than 13 new plastic bottles, as shown below. The new containers were made possible by Goodyear's development of a high-purity polyester resin it calls "Clear-tuf," inert enough to tolerate exposure to most soft drinks without affecting taste and strong enough to withstand carbonation pressures. The developers say the material has "the dimensional stability for long shelf life, and can solve a breakage factor that has been a problem for bottlers, store-keepers and consumers."

In tests, the polyester bottles have been dropped 40 feet without breaking. The plastic has a glass-like transparency and is basically similar to the material used to make pouches in which people have been boiling frozen vegetables and other convenience foods. Will we now substitute piles of grubby plastic bottles for indestructible glass shards in our parks? No, say the makers. The new resin has the same fuel value as low-grade coal and can be burned for energy or recycled.

New plastic bottles weigh less than glass.

Double talk for satellites

Although the backlog of data spewed into the computers from dozens of orbiting satellites already is such that armies of scientists will be busy for years deciphering all of it, electronics experts at GTE Sylvania's Eastern Division have developed something they call a "frequency re-use diplexer." What this gadget does is double the potential computer talk by permitting simultaneous transmission or reception of two signals at the same frequency. Ground stations already using the double-duty diplexer include two in Hawaii and others in Alaska, California and Florida. Photo above shows a GTE engineer aligning the equipment in a new station.



New gadget receives two radio signals on the same frequency at same time.

Porous pavement

For years, architects and engineers with a conscience have been troubled by an unhappy ecological fact: The more land they cover with buildings, highways and vast parking lots, the more they contribute to the nation's steadily dropping water table and to the devastating runoff of rain water that floods villages and tears up the countryside. Now the U.S. Department of Agriculture is testing a porous asphalt that allows rain to percolate through the paving and soak back into the soil beneath it. Test bed for the department's Agricultural Research Service is on the grounds of Willow Grove Naval Air Station, north of Philadelphia, where rural and urban areas merge and where runoff problems from impermeable surfaces have begun to show up.

Where have meteorites been?

Canadian sky-scanners recently caught a meteorite's arc to earth on two of their network's 12 cameras, providing enough data for astronomers to calculate the original orbit of the object. The Ottawa team, led by Dr. Ian Halliday, was able to calculate from the object's curving descent that it had been traveling from inside the orbit of Earth to the asteroid belt between Mars and Jupiter and back again every 2.3 years.

"The station closest to the impact got a good picture of the fireball," Halliday reported. "Another, 120 miles away, got a second picture." If two or more stations get a picture, direction and speed can be determined and—from that—the orbit. ★★★

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When a man's fancy turns to fancy.

There comes a time in every man's life when he outgrows the basic power tools. When his imagination calls for more.

That's the perfect time for a router. One of the few power tools around with hardly any limitation but your imagination.

Meaning you can make flutes, beads, reeds, rounded corners, or almost any other finishing touch under the sun. Plus a lot of really practical things, like dovetails for drawers, dadoes for shelves, rabbets for joints, etc., etc.

What's more, it's all possible for just $39.99,* the price of a Rockwell 4600 ½-hp Router. For some very good reasons.

Super high speed (28,000 rpm), to cut fast and smooth. Micrometer depth control, to make adjustments easy. Nonmarring base, to protect your wood. Double insulation, to protect you. 100% ball-bearing construction, to last and last.

*Manufacturer's suggested retail price

Not to mention more than 170 bits and cutters to pick from. Or a $49.99* toter kit complete with the 4600 router, wrenches, edge guide, the three bits you'll probably use the most, and a carrying case to hold everything.

All in all, it's one whale of a bargain. Especially when you consider the one feature you can't get anywhere else.

Rockwell engineering. The kind that only comes with half a century of industrial experience and on-the-job performance. It goes into every portable and stationary tool we make.

It's why they're all made tough, accurate and powerful.

So when you're ready to let your imagination go, they'll make the going good.

You can depend on it.

Rockwell. It's the same name industry's been depending on for 50 years.

Rockwell International

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Motorcraft Tune-Up Kits.

If they're tough enough for Alaska, they're tough enough for you.

Want a rugged place to test auto parts? Try Fairbanks. 120 miles below the Arctic circle. It dips below 0°F. for weeks on end.

Because of the intense cold, some of the vehicles had to be thawed before parts could be installed and readied for the test.

To avoid stalls, many cars are left to idle for hours, while drivers are occupied elsewhere. Idling is a major cause of plug fouling.

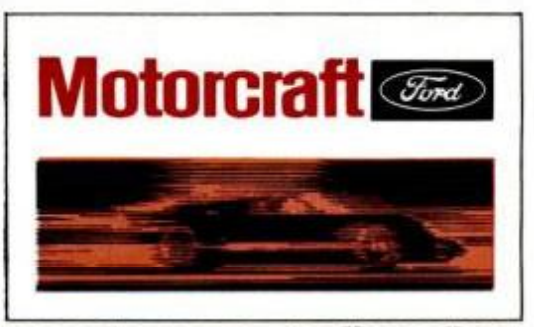
Motorcraft Tune-up Kit: Points, condenser, feeler gauge, cam lube, Autolite plugs, instructions. For most makes. And tough.

Alaska is tough on people, tough on auto parts. That's why we took Motorcraft tune-up kits to Alaska's rugged pipeline country. And had an independent testing company test them in 50 privately owned Ford, GM and Chrysler cars and light trucks.

The parts were changed at recommended intervals. But along the way they had to contend with punishing operating conditions, such as excessive fouling caused by long periods of idling in the winter. And in warmer weather, incomplete fuel combustion resulting from slow, off-the-road driving.

The test results? After six months of tough Alaska, only one spark plug couldn't take it and not one point or condenser failed.

No matter what you drive...wherever you drive, ask for Motorcraft tune-up kits...from Ford. They're tested tough in Alaska.



TESTED TOUGH

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FIRSTHAND REPORT

by Michael Lamm
WEST COAST EDITOR

Driving the new Datsun 200SX and 810

Datsun 200SX is a sporty two-door coupe but with big rear three-quarter blind spots.

Datsun's 810 family sedan and wagon replace the faithful 610 series, and the 200SX coupe comes in as a brand-new line.

What are these two cars like to drive? What's changed about their engineering?

The coupe

First the 200SX. SX, of course, is an adman's subliminal way of implying SEX, which is what Datsun is trying to blend into this car. I wonder, too, if the 810's designation has anything to do with the Cord 810—trying to play on Cord's glamor and performance image. Anyway. . . .

The 200SX comes only as a coupe and uses the Datsun 610/710 four-cylinder sohc engine. It's been slightly detuned, and the 200SX weighs just a tad more than the 710 coupe. Wheelbase happens to be the same as the 710's, but the car shares no other dimensions.

Instruments and controls are slick-looking and nicely arranged. The sohc Four displaces two liters; standard transmission is 5-speed.

Driving this 200SX again brought out my admiration for Datsun's ability to smooth out its cars. The Four comes amazingly close to the silky smoothness of the Six. Lacking fuel injection, though, the 200SX engine tends to stutter and balk when cold. This might be limited to the California version, but my test car hesitated even after the engine warmed up.

Engine power keeps climbing as you wind it out. Maximum torque comes in at a relatively high 3200 rpm, and the 200SX's willingness to rev seems limitless.

The standard five-speed gearbox tends toward the sticky side, and it's especially reluctant to go into low. Fifth is an overdrive ratio (0.854:1), and fourth winds out to an easy 80 mph (indicated)—great for highway passing and hill climbing.

The 200SX's cornering power is its strongest suit. It sticks to curves very well, yet rides as comfortably as many larger, heavier cars. Steering is quick and accurate, making the 200SX genuine fun to drive.

Then, too, the car's reclining front buckets feel comfortable, and there's fine drive visibility in all directions except to the three-quarter rear. Those big pillars get in the way. Rear-seat legroom is ample, but headroom in the back takes some jackknifing from tall riders.

The sedan

The 810 has an overhead-cam Six with fuel injection, same displacement and power as the 240-Z engine before the 260-Z came along for 1974. Here's an exceedingly smooth, tractable, willing powerplant—sort of the Japanese Jaguar minus one overhead cam. Lots of aluminum, very neat engine compartment, and it doesn't scare you half to death every time you lift the hood. It *looks* like the sort of engine any reasonably capable home mechanic can work on.

Only the California version of this engine needs the catalytic converter. The 49-state 810 doesn't. That means that, except in California, you can buy any grade and type of gasoline you want. Same goes for the 49-state 200SX.

With the 810's fuel injection,

(Please turn to page 24)

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$11.98 suggested user price

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This warranty gives you specific legal rights and you may also have other rights which vary from state to state.

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S-K DRESSER

the Great Ones

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DRIVING THE NEW DATSUNS

(Continued from page 23)

there's no "warm-up stumble"; in fact, you wouldn't really need to warm up the engine at all except that good sense demands it for the cylinder walls' sake.

And there's also never any hesitation when you really tromp the 810's accelerator. That's a nice change from so many late-model cars I've driven. In some, "smog-device stumble" becomes a real problem.

The 810 accelerates smoothly and with a crisp eagerness. I drove the four-speed version, which I suspect is peppier than the automatic, because both use the same 3.54:1 rear axle, yet the automatic starts out in what amounts to the manual's second gear.

The four-speed shifts without a hitch, but the one thing that bothered me was what felt like a very loose U-joint. There was quite a bit of whip in the drive train. Whether

(Please turn to page 26)

SPECIFICATIONS

	Datsun 810	Datsun 200SX
Engine		
Type	In-line sohc 6	In-line sohc 4
Bore & stroke	3.27 x 2.90 in.	3.35 x 3.39 in.
Displ., c.i.d./cc	146/2393	119.1/1952
Gross bhp @ rpm	154 @ 5600	94 @ 5600
Gross torque @ rpm	155 @ 4400	102 @ 3200
Induction system	Electronic f.i.	2-bbl. carburetor
Compression ratio	8.6:1.	8.5:1.
Transmission		
Standard gearbox	4-speed manual	5-speed manual
Optional	3-speed automatic	3-speed automatic
Overdrive on high?	No	Yes—0.854:1
Differential		
Ratio, manual trans	3.545:1	3.889:1
Ratio, autom. trans	3.545:1	3.700:1
Brakes		
Front	10.7-in. disc	9.6-in. disc
Rear	9.0-in. drum	9.0-in. drum
Suspension		
Front	McPh. struts	McPh. struts, anti-roll bar
Rear	Ind., coil spgs. (sed.); solid axle (wagon)	Solid axle, semi-elliptic leaf spgs.
Steering		
Type	Var. ratio, recirc. ball, power opt.	Recirc. ball
Ratio	19.0-22.5:1	16.5:1
Tires	185/70 HR 14	175/70 HR 13
Body dimensions		
Wheelbase	104.3 in.	92.0 in.
Overall length	182.7 in.[1]	170.0 in.
Overall width	64.2 in.	63.0 in.
Track, fr./rear	53.1/52.7 in.[2]	50.4/49.8 in.
Curb weights	2738-2899 lbs.	2365-2415 lbs.
EPA mileage results, 49-state figures, city/hwy/combined		
Automatic trans	17/22/19	24/28/25
Manual trans	17/28/20	23/32/26[3]

[1]Wagon: 184.7 in.; [2]Wagon rear track: 53.2 in.; [3]California EPA figures.

The 810 sedan (and wagon) uses the fuel-injected Six of Z-car fame.

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WHY SEARS CENTRAL AIR CONDITIONING IS SO EASY TO INSTALL BY YOURSELF.

YOU'RE NOT BY YOURSELF.

The Sears Air Men (and women, too!), trained professionals, are with you every step of the way.

We'll start by doing a complete survey of your home's cooling requirements, just as if *we* were going to install the unit. We'll check, among other factors, the size of your home, type of construction and insulation, and your forced-air furnace into which the cooling system will be installed.

You can be certain that the Sears system we recommend will be *right* for your home.

Then you take over. All you'll need is a little muscle, some tools you may already have on hand, and the easy to follow, illustrated instructions. And you're sure to find the Sears Do-It-Yourself booklet on air conditioning most helpful. After you've installed the unit, and for a service charge, we'll come to your home to give the system a thorough check-out, before you turn it on.

Of course, we're always ready to answer your questions and make suggestions as you proceed with installation.

It's good to know you can save some money installing your Sears system by yourself. Even nicer when you know you're not by yourself.

Available at most larger Sears, Roebuck and Co. stores, and in the catalog.

Sears AIR MEN

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(Continued from page 24)

that happened to be in just my particular car, I don't know.

The 810 costs some $850 more than the discontinued 610, but it's also larger. Wheelbase is up 5.9 inches, overall length 8.5 inches, and width 1.2 inches. There might be slightly more passenger and trunk space, but some of the 810's newly created length accommodates the six-cylinder engine.

Normal cruising emphasizes the solidity of this unibodied 810. The sedan has all-independent, coil-spring suspension, with good road-noise insulation and a pleasant, yet not mushy, ride.

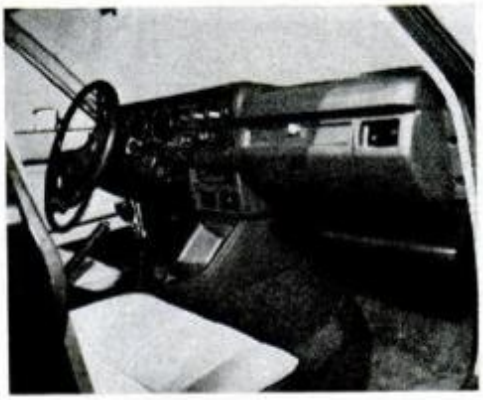
I'd be tempted to remove the factory radio antenna from the driver's windshield post because it creates a lot of wind roar. Also, the hood could use firmer anchorage—it bobbles slightly on rough roads. And while I'm at it, I wish Datsun would move the doorsill lock buttons somewhere where my elbow doesn't rest right on them. These are small gripes, but they're surprising since the 810 is so well thought out otherwise.

The 810 has a beautiful, highly legible, very complete instrument panel. Included are tach, voltmeter, all working gauges *plus* a central monitoring panel of warning lamps, a quartz digital clock, and an AM/FM stereo multiplex radio, all as standard equipment.

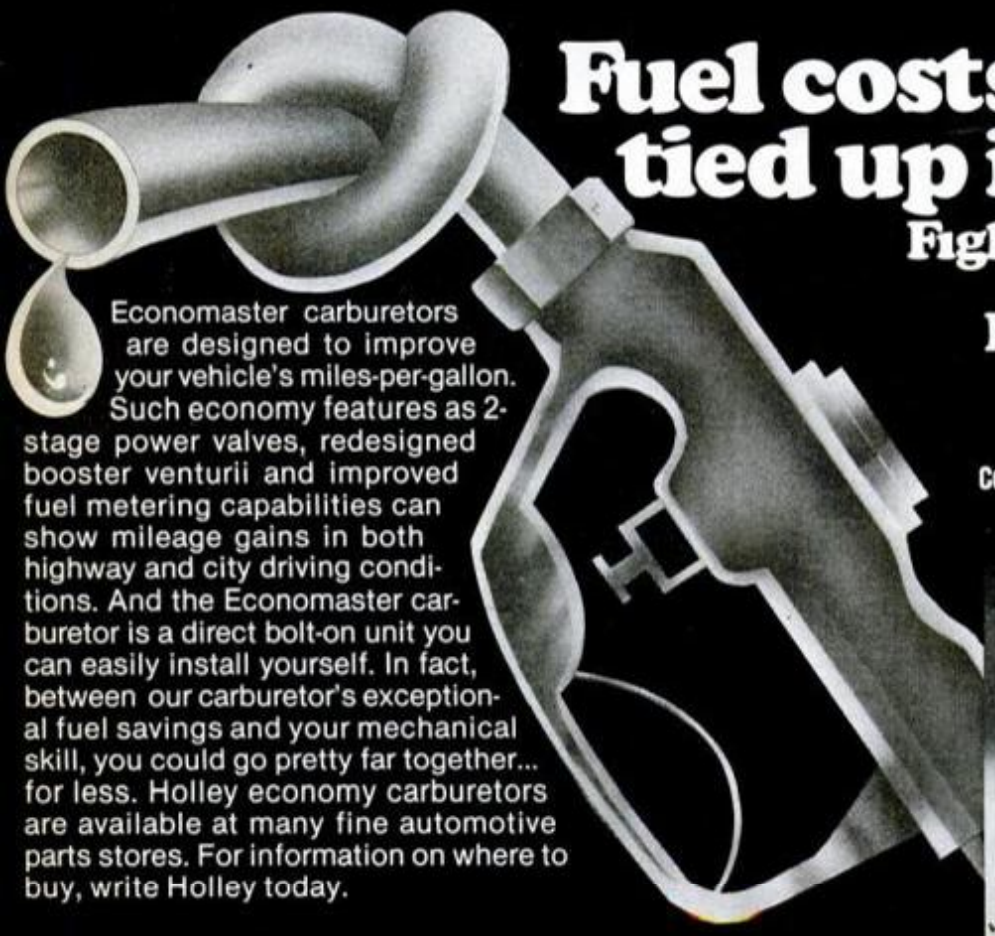
A voltmeter, unlike an ammeter, shows battery condition. During normal driving, it registers 14.3 volts, which means the alternator is charging. Even with the key off, the voltmeter tells you whether your battery is fully charged (12 volts), discharged, or discharging. Mercury, by the way, had a voltmeter in 1940 models.

The equipment list, in fact, runs on for about four pages, highlights of which include: steel-belted radial tires, power disc brakes, tilt steering wheel, rear center armrest, total carpeting, console box, and power steering when you order airconditioning.

In its price class, the 810—at $5099 list—bumps noses with Granada/Monarch and Aspen/Volare. The 200SX, listing at $4399, comes up against such price rivals as the Capri II, Toyota Celica, Honda Accord, and Triumph Spitfire convertible. All of which makes for some tough choices. ★★★



Rear-seat accommodations are comfortable but leave no room to spare. Instrument panel is well thought out and includes central monitoring panel with warning lamps. Many dash items are standard, like quartz digital clock, AM/FM radio and more.



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Economaster carburetors are designed to improve your vehicle's miles-per-gallon. Such economy features as 2-stage power valves, redesigned booster venturii and improved fuel metering capabilities can show mileage gains in both highway and city driving conditions. And the Economaster carburetor is a direct bolt-on unit you can easily install yourself. In fact, between our carburetor's exceptional fuel savings and your mechanical skill, you could go pretty far together... for less. Holley economy carburetors are available at many fine automotive parts stores. For information on where to buy, write Holley today.

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Actual economy gains may vary depending on individual application and condition of vehicle, driving conditions and driving habits.

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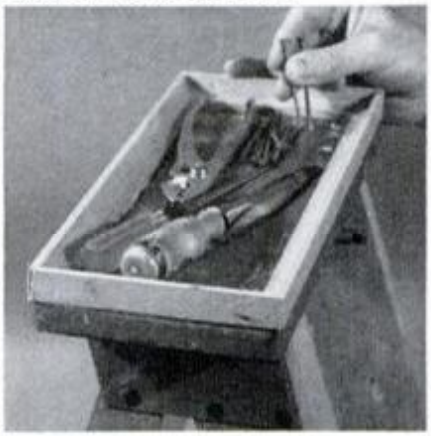
HINTS FROM READERS

Pliers secure nails

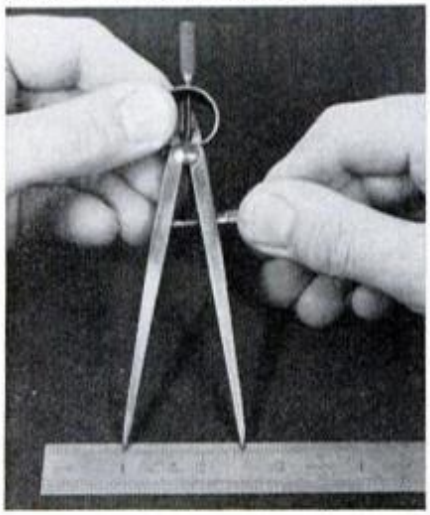
To insert nails in a light picture frame, spread pliers jaws over nail and frame, then squeeze with firm, steady pressure. Tape jaws to protect frame.—*William Swallow*

Ladder top holds tools



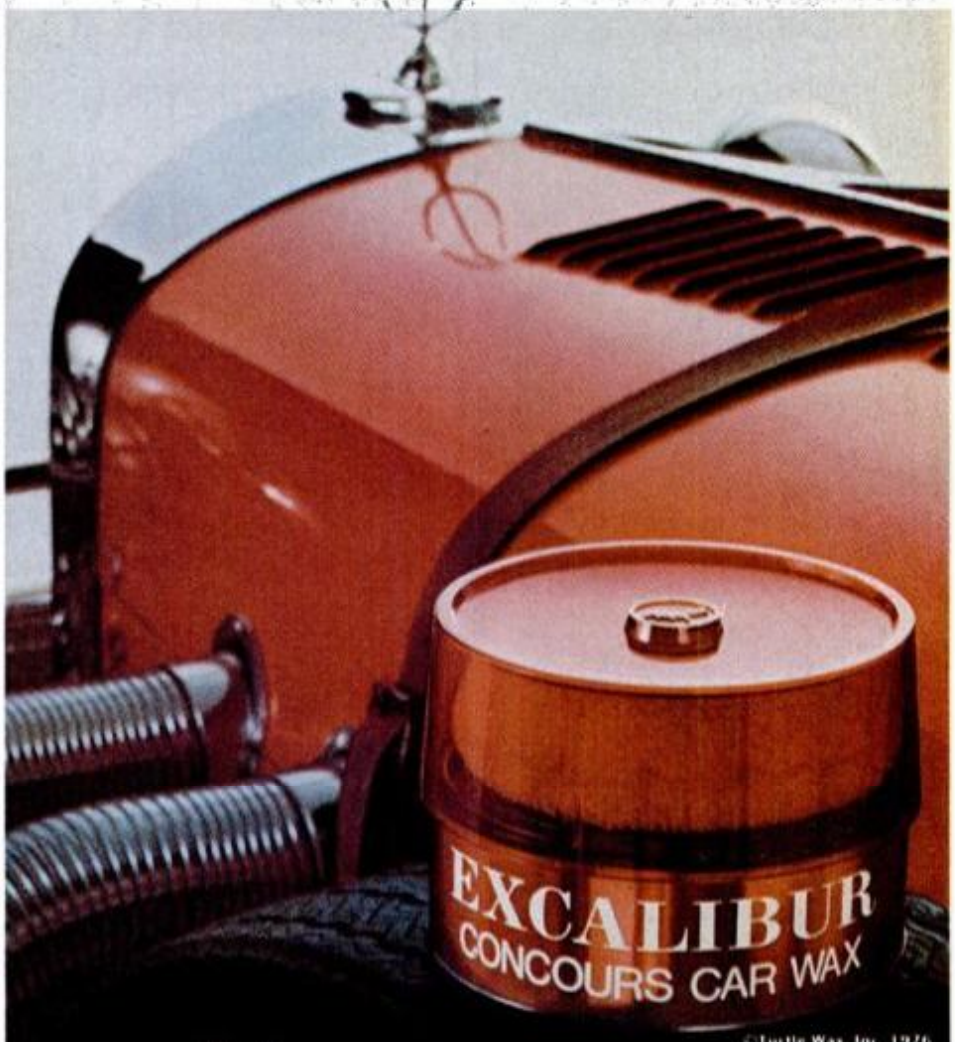
A stepladder's top shelf is a handy spot to hold tools if it is rigged to keep the tools in place. To do this, frame the ladder top with scrap cove stock.—*Ken Patterson*

Adjust compasses accurately



You can adjust dividers and compasses with accuracy by using a ruler's 1-inch mark as the "zero" position and adjusting second point or pencil.—*Ken Wells*

If you go first class...



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IT'S NEW NOW

Convertible leisure clothes—from long to short

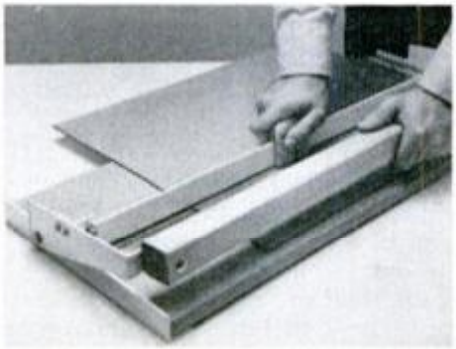
If it's chilly when you start out in the morning, climb into your long-sleeve, long-pants leisure suit. Then, when it warms up, turn it into a safari suit by unzipping the sleeves and trouser legs. The tricky garment was invented in mainland China where it is now manufactured. It's cotton and comes in tan, khaki or green. Most big sporting-goods stores carry the set at about $40 for the pants, $45 for the jacket. Or try Abacus Group, 154 West 57 St., New York, N.Y. 10019.

Nylon-tip setscrews

Nylon-tip setscrews ignore shaft flaws, self-lock by squeezing up around threads that range from 2-56 to ¼-20. Hex or slot heads. $3.98 a dozen. Metrifast, 51 South Denton, New Hyde Park, N.Y. 11040.

Precision trimmer-cutter

Plastic, fabrics or paper, from tissue to matboard, yield to a razor-blade cutter with a finger-safe hold bar to prevent stock from sliding. Units come in 24, 36 or 42-inch-cut sizes, with Plexiglas rule calibrated to the ¼ inch. All sizes cost $70 plus shipping. Stowe, 3553 South Urbana, Tulsa, Okla. 74135.



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Here's a new way to get authentic goods from the North Country... items that are not readily available in local stores.

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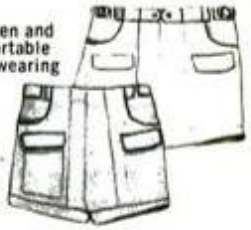

Allagash Hat. Australian-style bush hat for hunting or fishing. Deep crown contains mosquito net to cover face and neck. Adjustable chin strap. Olive Green. Men's sizes: 6¾ to 7¾. $15.00.

Checkered Sportshirts of polyester and combed cotton. Woven for cool comfort and nice appearance. Short-sleeved, squared tails and single breast pocket. Navy and White. Red and White. Brown and White. Men's sizes: S, M, L, XL. $12.50.

Special Offer: Include cap liner from Canadian Mist® (except ½-gallons) and deduct $1.00 from each order. (Offer valid only in states where legal —not Ca., Ky., Mo., N.J.)

☐ Please send the full Canadian Mist Trading Post Catalogue only. I have enclosed 25¢. (Catalogues sent free with every order.)

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PM WORKBENCH
PM EXAMINES PRODUCTS AND SERVICES

Housing dilemma

The American tradition of single-family home ownership is in peril. That's the view of the Harvard and MIT Joint Center for Urban Studies. Its new report shows a massive drop in the percentage of families able to buy a median-priced new home, warns that current housing starts are still far below need, and predicts that the average selling price of a typical home could hit a whopping $78,000 by early 1980s.

Meanwhile, the National Assn. of Home Builders blames tightening government regulation, as well as rising construction costs, for the upward price spiral. Besides periodic shortages of mortgage funds, it claims that regulatory controls are driving up land and development costs. Cost of a typical lot developed in 1970 was $5000 (20 percent of sale price); today that lot is $10,800 or 26 percent of new-home cost.

One-pass mowing, mulching

Should grass clippings be left on the lawn or removed? Michigan State University studies have shown that if they can be cut superfine and driven deep into turf, they can return valuable nutrients and reduce the need for fertilizers, without creating a layer of thatch that cuts growing grass off from sun.

The Twin Blade Mulcher Mower is said to meet those conditions, with multistage cutting and air pressure to blow mini-clippings down to the decomposition zone. Clippings are normally invisible after mowing. Several models from $220 are offered. Jacobsen Mfg. Co., 1721 Packard Ave., Racine, Wis. 53403.

Think texture

Samoa, Stauffer's new fiberglass shade cloth, introduces a hand-woven look in heavy grasscloth texture, yet the material is translucent for delicately lighted privacy control. The sturdy, washable shade is constructed to assure straight hanging; cloth is fire-retardant. Available in white, celery green, wheat, Sungold and toast; cost for a shade to suit a 36x72-in. window is about $26. The shade is made by Stauffer Chemical Co., Plastics Div., Westport, Conn. 06880.

New stain system

PPG Industries has introduced 96 new colors of Rez stain for exterior (and interior) use, with another 48 due out in the coordinated system by the time you read this. All colors are offered in latex and alkyd oil bases. Both the penetrating solid

and semitransparent stains provide durability, brushability and easy application. They're excellent for use on window boxes (above), decks, patio furniture and the like. Test application showed that uniform, even coverage was delivered in one coat as promised by the maker. PPG Industries, Inc., 1 Gateway Center, Pittsburgh, Pa. 15222.

Instant art—almost anywhere

In four easy steps, you can transfer photographs into decals for decorative use with this kit. Photique system enables you to transfer black-and-white or color Kodak or Polaroid (except XL70) instant prints onto glass, metal, wood, china—you name it. The kit also lets you make decals from images printed on paper.

Priced at $7.25 ppd., the kit contains materials to transfer 20 4x5-in. photos, instructions and finish. From The Artist Shack, Box 833, Bellmore, N.Y. 11710.—*H.W.*

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

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Ford LTD Country Squire

Ford LTD Wagon holds more and is rated to haul more than Chevy, but is priced about the same.*

Dual-facing rear seats, one of many popular Ford options

3-way Magic Doorgate, for convenient cargo access

Available lockable side storage compartment

Below deck lockable storage space

Again this year, The Wagonmaster—Ford—gives you more of what you buy a wagon for. Some wagon makers, like Chevrolet, have cut down their "full-size" wagons, making them narrower and shorter, so they hold less. But not Ford.

The 1977 Ford LTD is the full-size wagon that's kept its size. Compared with the "down-sized" Chevy, Ford LTD Wagon

- **has more room to hold things,**
- **more hip and shoulder room to carry 6 in comfort,**
- **an optional extra half ton rated towing capacity.**

**With optional heavy-duty trailer towing package, Ford LTD is rated to haul more than Chevy. Yet based on sticker price comparisons of comparably equipped vehicles, Ford LTD is priced about the same.*

If your family is growing bigger, why buy a wagon that's growing smaller?

Ford gives you more of what you buy a wagon for.

FORD

When America needs a better idea,
Ford puts it on wheels.

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DETROIT LISTENING POST

Follow-up car for Fiesta

In the February issue, I reported on a mystery mini that Ford is working up for 1980-81. I referred to it as a mystery car because I didn't know where it would fit in the Ford catalog. I have now nailed it down. The new car will be a replacement for Fiesta and Pinto. Fiesta is Ford's new import and it goes on sale June 24. At the time Fiesta was announced 18 months ago, Ford said if the car sold well it might transfer production to the United States—bring out an American version.

Well, there's been a change in plans. Ford isn't waiting for the sales reports to see how Fiesta scores with customers. It will begin building a Fiesta-derived car in the U.S. in 1980 for sale as an '81 model. It will be Ford's entry in the size and price class presently covered by Fiesta and Pinto. A new car usually calls for a new name, but in this instance Ford might continue one name or the other—Fiesta or Pinto—to give the new job a carryover identity.

Meanwhile, the U.S. version of the Fiesta (with 1600-cc engine) is arriving in dealer showrooms. And PM's July issue will have a driving report on the new small Ford.

New body for Mustang

Mustang II is heading for the last roundup. The '78 model will be the last run for the car using the present body. A new body is in the works for 1979. The mechanicals will be fairly standard—no front-wheel drive and a conventionally mounted engine—but the new version will be considerably lighter.

This will be the first Ford product manufactured in the U.S. in which all the technology to reduce weight has been pulled together in one package. So you can expect to see a major improvement in mileage. There may be two versions of the car, with the second copy sold through Lincoln-Mercury dealers. The Linc-Merc version would replace Capri, which Ford imports from Germany.

More mileage for GM makes

Preliminary reports out of GM indicate the new '78 intermediates will average around 22 miles to the gallon. GM still has to prove the figure to the government. Assuming the prelim tests hold up during the government certification tests, the smaller '78 cars will show an improvement of about three miles to the gallon over counterpart '77 cars.

Buying tip on big cars

If you're in the market for a big car, you might save yourself several hundred dollars by buying a '77,

(Please turn to page 34)

FIRST LOOK AT SOME '78 MODELS FROM GENERAL MOTORS

Photos: Automotive News

Buick Regal

Buick Century

Chevrolet Chevette

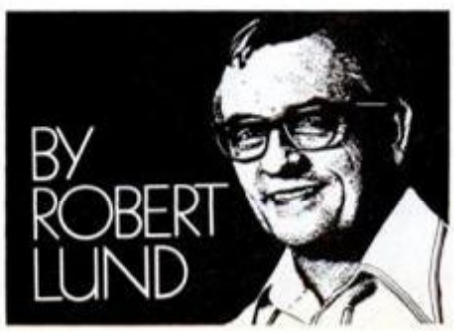
Pontiac Grand Prix

Chevrolet Monte Carlo

Chevrolet Chevelle

Chevrolet Camaro

Downsizing intermediates is GM's project for '78 model year, and success of the scaledown of the full-size cars in '77 bodes well for the middle range. Two-door specialty body will be shared by Buick Regal, Chevy Monte Carlo, Pontiac Grand Prix (all shown above) and the Olds Cutlass Supreme. Wheelbase will be 108 inches; weight will be down 400 to 600 pounds. Century is fastback and the Chevelle a notchback.



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

Treat yourself to light menthol Belair.

And, treat yourself to gifts twice as fast with new Belair Double Coupons.

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Kings, 15 mg. "tar," 1.0 mg. nicotine; Longs, 18 mg. "tar," 1.3 mg. nicotine, av. per cigarette, FTC Report Dec. '76

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Continued from page 32

instead of waiting for the '78s. I know you've heard that line before. It's a scare technique dealers use when they want to clean house before the new cars come out. The old "buy now and save a bundle" pitch. But there's more to it now.

Starting with the '78 models, the government says cars must average 18 miles to the gallon on a sales-weighted basis. The law doesn't say all cars have to give 18 to the gallon. Some can be above 18, some below, as long as all cars sold by a company during the model year average out to 18. To achieve that figure, the companies must sell more small cars.

The small cars aren't selling anywhere near the volume necessary to meet the regulation. Even with rebates, discounts, special deals and sales contests for dealers. The auto firms are worried. How can they turn buyers off on big cars, turn them on to small cars? One solution: Kick prices so high on the big jobs that people will be discouraged from buying them. If the small cars don't move in substantial volume in the next month or two, there are going to be some sock-it-to-'em price increases on the big-car '78 models.

Vette engine rumor revived

There's a rumor around Detroit that Corvette will go to a rear engine or mid-engine in 1981. But rumors about Corvette are a dime-a-dozen, even with inflation, and no refunds if the engine stays up front. The rumor about a mid-engine Vette has been batting around for something like 10 years. Chevrolet continues to sell all the copies of the car it can turn out or wants to turn out.

In the September issue we'll celebrate Corvette's 25 years and speculate on what's to come.

Chrysler cuts repair cost

When you take your car in to be repaired, you might have noticed the mechanic referring to a book before quoting a price for the job. The book is known as a flat rate. The flat rate tells the mechanic how much labor time to charge for a given job. So many minutes or hours are allowed for each operation. The companies compute the time by having a mechanic perform the work and clocking how long it takes. Up to now flat rates have always been figured using hand tools.

Chrysler has changed its method of figuring flat rate time and it has the other companies in a stew. In working up time allowances on its '77 cars, Chrysler did the time studies using an impact wrench, instead of hand tools. You can do the job a lot faster with a power tool than with a hand tool. The result is that a car owner pays less for labor—substantially less on major repair jobs—if he owns a Chrysler car than he would pay if he owned a GM, Ford or American Motors make. That puts the other companies on the spot. Nobody likes to pay the long dollar to have his car fixed.

I asked the other companies how they are going to handle this. They said they are studying the Chrysler change but have no plans to follow Chrysler's lead "at this time." The "at this time" could be significant. If the other companies were going to make a change, the time to do it would be when the new cars come out.

As Chrysler points out, the impact wrench isn't exactly a novelty. Most shops have been using it for at least 15 years and Chrysler is just recognizing that reality in using the tool to figure flat rates.

GM how-to book a winner

General Motors has come out with the best repair manual I've ever seen. I recommend it to anyone who works on cars, whether you're an old hand or a novice do-it-yourselfer. It's a step-by-step picture book—actually drawings, not photographs. GM has divided the car into nine categories: heating and airconditioning; body, frame and bumpers; steering, suspension, wheels and tires; rear axle and prop shaft; brakes; engine; transmission; chassis and body electrical; and accessories.

Depending on what the problem is, you refer to the appropriate section and find a description of the problem. Then you follow a series of drawings telling you the steps to take to correct the problem.

The only fault I find with the book is that on some of the more complicated procedures you still have to refer to the manufacturer's service manual after tracking down the problem. While the manual was written for GM cars, much of the how-to information can be applied to cars in general.

The book sells for $4.95. You can get a copy or additional information on it by writing GMDR Manual Headquarters, Box 1185, Southfield, Mich. 48075. ★★★

A SNEAK LOOK AT SOME '78 FORDS

Ford Granada

Mercury Zephyr

Ford Fairmont

Fairmont/Zephyr wagon

Ford Motor Company's one-two punch for '78 is the introduction of an all-new car that will be sold by Ford as the Fairmont and Linc-Merc as the Zephyr. All models—two-door, four-door, wagon and sporty two-door hardtop—will be on a 105-inch wheelbase. Maverick and Comet are dropped for '78 and Granada and Monarch get slight appearance changes.

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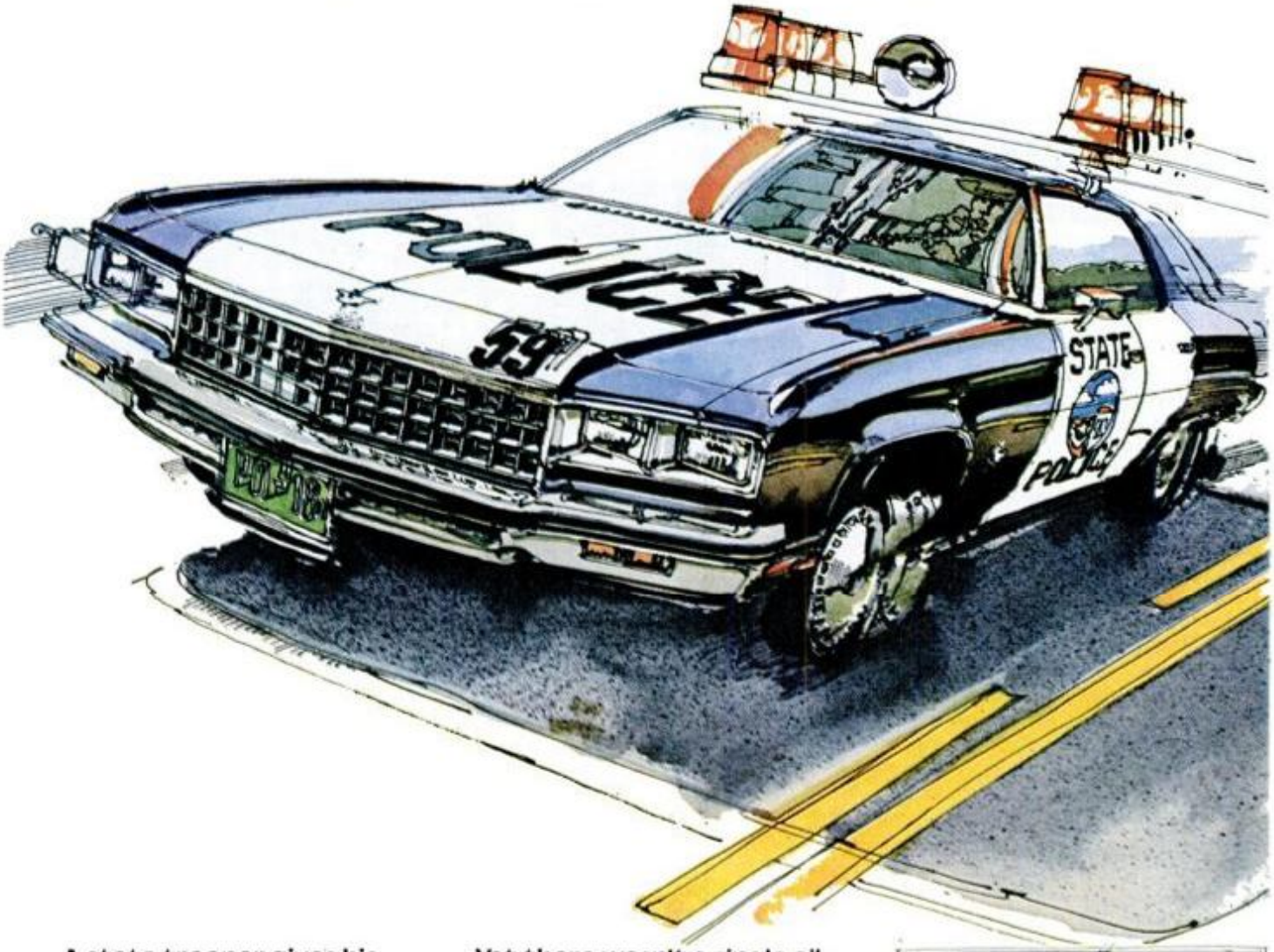
CHANGE YOUR OIL WITH HAVOLINE AND PROTECT YOUR CAR LIKE A TROOPER.



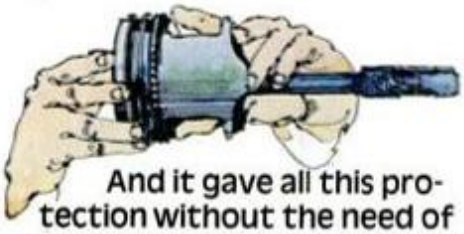
A state trooper gives his car a rough time.

Which is why we had more than 90 trooper cars with Havoline Super Premium All Temperature Motor Oil driven a total of over 4 million tough miles—4 million miles of all kinds of driving in all kinds of weather—from standing starts to high speeds in a matter of seconds.

And often, the same car was driven round the clock—24 hours a day.

These state trooper cars were driven almost as many miles in 6 months as the average car is driven in 3 years.

Yet there wasn't a single oil-related failure of Havoline-protected parts.



And it gave all this protection without the need of any extra motor oil additives.

So the next time you change your oil, protect your car like a trooper with competitively priced Havoline Super Premium. It provides all the protection your car needs.

Ask for Havoline wherever they sell motor oil.

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FIRSTHAND REPORT

by Michael Lamm
WEST COAST EDITOR

Driving the Terra diesel pickup

International Terra pickup averaged 26 mpg on the highway, 18.3 in town—not bad.

The diesel option is coming on strong. International announced one in its Scout series last year.

I got a chance to live with a brand-new, diesel-powered Scout Terra pickup recently and found it a fine vehicle in most ways and a trifle annoying in others.

First, you can't fault its mileage. On my longest highway trip—203 miles—I averaged 26.0 mpg. Diesel fuel, of course, usually retails for 5 to 10 cents a gallon less than gasoline, depending on what type you buy and where, so that's already a nice-sized saving. In town, I managed to average 18.3 mpg.

The six-cylinder diesel engine is made by Nissan (Datsun) in Japan under a sales agreement with Chrysler Corp. in this country. It's a lightweight (622 lbs.), high-revving powerplant that displaces 198 cu. in. and delivers 92 bhp at 4000 rpm.

Like most diesels, this is a fairly noisy engine, especially at lower speeds. The Terra itself tends to create wind noise, so starting around 40 mph, you don't so much hear the engine as the vehicle itself. And the removable fiberglass hardtop doesn't provide much sound insulation.

Starting's different

To start the engine cold, you first hold down a glowplug button under the instrument panel. After about 20 seconds, the "start" lamp lights, and you then crank the engine with the key. If you've floored the accelerator, the diesel catches right away, and while it's a little rough at first, it soon smooths out.

The engine needs no warmup. Throttle response is good, although acceleration tends to be a bit sluggish. Even so, it's nothing to worry about; I quickly got used to compensating when pulling onto, say, a freeway or into traffic from a side road.

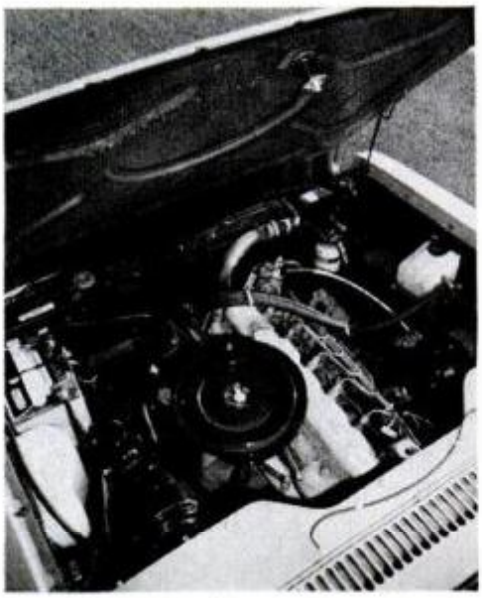
I-H offers an excellent floor-shift four-speed transmission. It's very tight and positive, snaps easily from gear to gear, and the ratios seem well suited to the engine (standard axle is 3.54:1, but there's also a 4.09:1 available—plus four-wheel drive for towing or off-road going).

One annoyance I found was the relationship of the gas pedal to the brake. They're too close together. The accelerator angles in toward the brake, and since they're at the same height, it's hard to hit the brake without hitting the gas, too.

Another annoyance—also potentially dangerous—is the placement of the inside rear-view mirror. It's at eye level, cemented to the windshield, and it blocks vision to the right. I finally ended up turning the mirror upside down to get a better view.

Other than that, though, the Terra diesel pickup has a lot going for it. Ride and handling feel good. And I found no flaws in workmanship.

But is it a good investment at $7200 base? (With accessories and so on, our test Terra came to a total of $8438.) Frankly, it depends on how far you drive per year. If you normally put 25,000 miles or more on your pickup, yes—the diesel will pay for itself in lower fuel costs, less maintenance, and longer distances between overhauls. ★★★



Six-cylinder diesel for the Terra is made by Nissan in Japan. It displaces 198 cu. in. and is rated at 92 hp at 4000 rpm.

Switches peculiar to diesel operation are under left side of dash: Glowplug switch is on left, engine stop on right.

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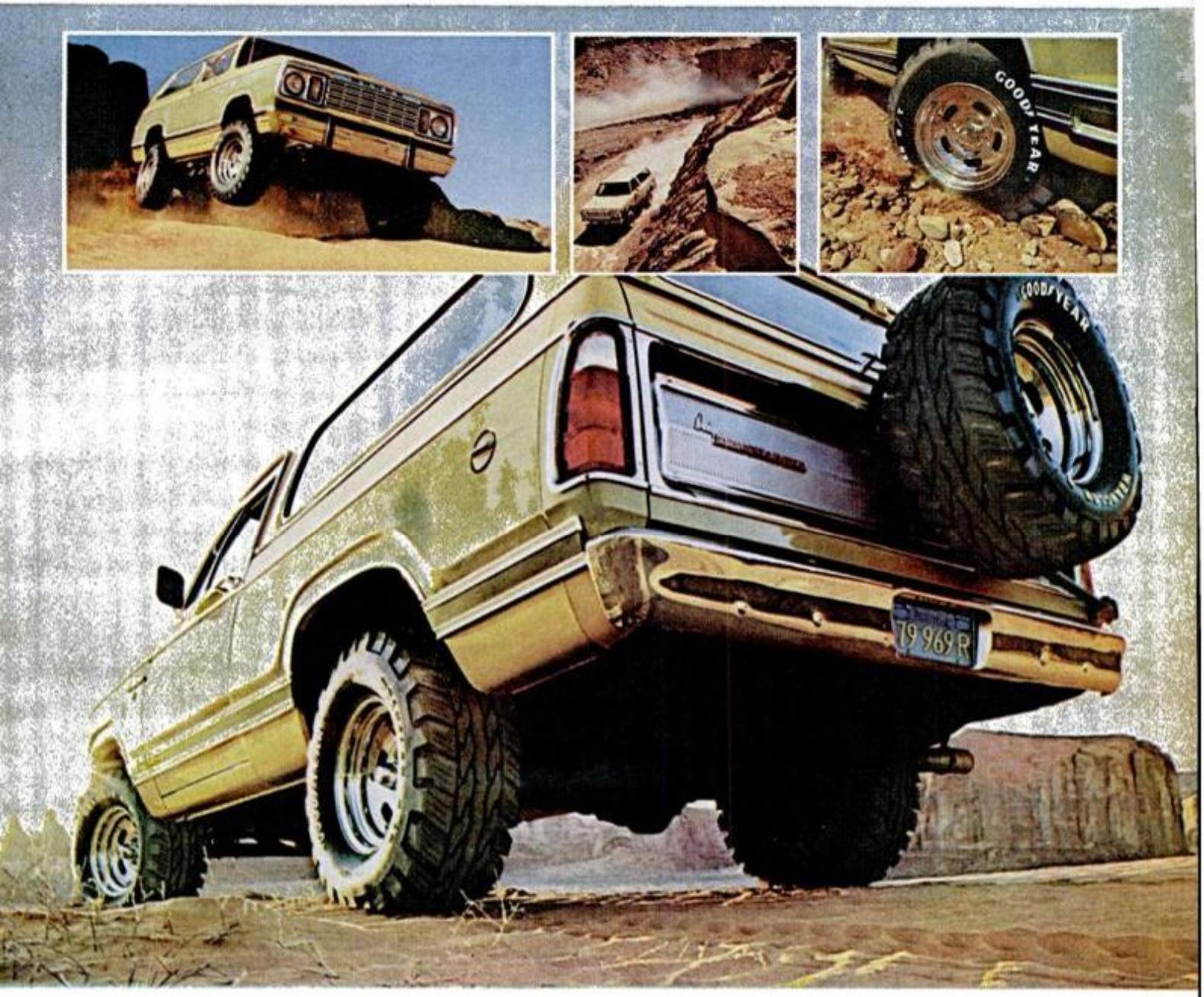
When the trail isn't there, Goodyear Wrangler R/T tires should be.



A tire has to do a lot of performing to get through terrain like this. Mostly, it has to keep a lot of rubber on the ground. And that's where the Wrangler R/T is in a class by itself.

The Wrangler R/T has "straight up and down design," so it has a wider footprint than any other tire in its size ranges. That makes for a lot of traction, whether you're going through mud, snow or soft sand.

Add to that a strong, yet smooth-riding polyester cord body, long-wearing tread compounds, fiberglass cord belts (except load range A), a center riding rib for smooth highway performance, and you get the kind of tire you can really depend on.

Those are just some of the reasons why more roads and trails get blazed on Goodyear's full line of tires than any other kind.

The Goodyear Wrangler R/T.

It's the tire to have if you don't have a trail. Or if you do.

GOODYEAR

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HOMEOWNERS' CLINIC
QUESTIONS ANSWERED

White spots in the attic

Should roof vents be left open in winter? I have three vents and usually keep them closed in winter. But now I notice a white spotting on rafters and roof boards.—L. R. Osgood, Scranton, Pa.

Chances are the white spots are caused by condensation—a sure sign of inadequate ventilation. It is essential to leave ventilators open all year round. In winter, when warm, humid air rises and enters the attic, it contacts the cold roof and deposits its moisture. This condensed water can ultimately rot the wood. Louvers, placed at gable ends, vent the attic without undue heat loss. The size of the area that the louvers take up should be equal to 1/300th of the attic floor area.

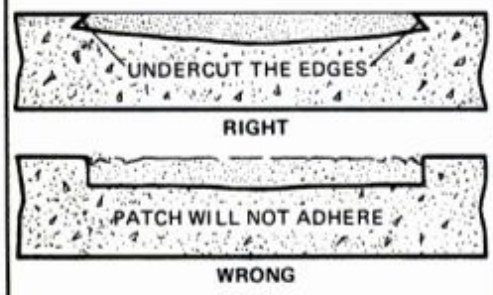
A damaged walk

My concrete walk has been damaged superficially and pieces have broken off. Is there a material that will fill these defects, even if only temporarily?—Paul C. Craig, Wyomissing, Pa.

Fix it for years! If the damage is not extensive, you can use any of the patching compounds—latex, vinyl, or epoxy—following instructions that come with them.

For badly damaged areas, however, use a readymade gravel-mix concrete, or make your own stiff mix of 1 part portland cement, 2 parts sand and 2 parts fine gravel.

PATCHING CONCRETE



Chisel out loose or broken fragments to a depth of at least 1 in., then use a cold chisel to roughen the base of the cavity. Undercut the edges of the damaged surface to lock in the patch as shown, because the patching mix will not adhere to smooth vertical edges.

The surface should also be damp, though not wet, before patching. Coat the area with a creamy mixture of portland cement and water, and then fill in the cavity with the patching mix. Tamp the mix in firmly, overfilling the cavity *slightly* to allow for shrinkage. Keep a piece of damp burlap over the repairs for six days to control hydration.

Warping wood

I'm an amateur woodworker. Recently I glued several narrow pieces of wood together, edge-to-edge, to make a table leaf. It warped rather badly. What did I do wrong?—Ray Archer, Long Beach, Calif.

Probably nothing. I'd guess that the wood you used wasn't properly seasoned. Use new kiln-dried wood or rip your table leaf into strips again, perhaps adding an extra piece to make up the width lost by sawing.

Make sure the boards meet squarely and alternate the annular rings to reduce warpage. If you use dowels, be sure to drill the holes straight or the dowels could cause cupping.

Place the boards flat on a bench, apply glue and tighten the clamps—but not excessively. Too much clamping pressure is sure to cause warping. If necessary, exert pressure from above.

A dirty job

What's the best method of removing smoke stains from the brick of my fireplace?—Charles W. Ledford, Colorado Springs, Colo.

A dirty job for sure! Get your rubber gloves and protective goggles out before you mix up a strong solution of trisodium phosphate (one cup will do for a gallon of water). Go to work on the smoke stains with a good stiff brush and plan to wash all of the visible brick for a neat job. After a clear water rinse, apply masonry sealer, following the maker's instructions to increase the intervals between cleaning and to make it easier next time.

Basement cracks and leaks

Water seeps into our basement through a tiny crack at the angle where the floor meets the wall. How can we seal this crack?—Marsha Sethman, Carmichals, Pa.

Cut the crack open with a cold chisel so it is about ¾-in. wide and deep. Try to undercut (as shown in the diagram for walks) for a strong patch. Sweep out all mortar dust, moisten with water, then trowel in a mixture of 1 part portland cement and 3 parts sand.

If that sounds like too big a job, buy some hydraulic cement. Open each crack wide enough to pack in an ample wedge of cement and clean it out well. Mix the cement in small quantities and mold it in your hand until it feels warm. Quickly cram it into the crack and support it in place until hard. Wash your hands immediately.

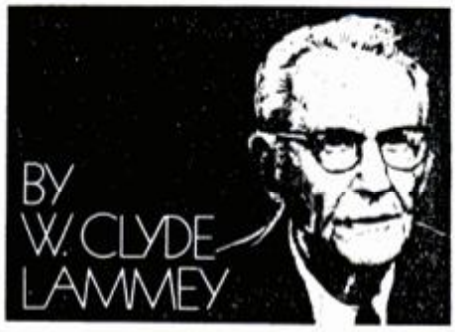
Stale water

What can I use in my portable humidifier to prevent the water from becoming stagnant? Is there something that will also act as an air freshener?—Richard Thorn, Oneonta, N.Y.

Something's wrong. If the water in the reservoir gets stagnant, either the machine isn't working efficiently or it's not used regularly. Depending on size, home humidifiers can put 2 to 15 gallons of water into the air every day, a rate that's hardly stagnant.

If there are long intervals between uses, drain after use, then refill with fresh water before next use. One of the many air fresheners now on the market, placed in front of the grille, can give a good scent. ★★★

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



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If you're comparing pickups, look at the bottom line.

DODGE. THE LOWEST PRICED PICKUPS BUILT IN AMERICA.

LOWEST PRICED SIX AND V8.

The manufacturer's suggested retail price for a stick shift, six-cylinder† Dodge D100 pickup is $3944*; with V8 engine, $4061.* That's lower than Chevy or Ford.

LOWEST PRICED WITH AUTOMATIC TRANSMISSION.

The price for a D100 with Six and automatic transmission△ is $4262*; with V8 and automatic transmission, $4379.* Lower than Chevy or Ford again.

LOWEST PRICED FOUR-WHEEL-DRIVE PICKUPS.

The Dodge W100 Power Wagon with six-cylinder engine† and four-wheel drive has a suggested retail price of $4985.* That's lower than Chevy, Ford, or Jeep.

LOWEST PRICED CLUB CAB PICKUPS.

The Dodge D100 Club Cab with six-cylinder engine and manual transmission† has a suggested retail price of $4241.* That's lower than Ford. (Chevy doesn't even make a Club Cab.)

'77 EPA ESTIMATES: 24 MPG, HWY. 18 MPG, CITY.

That's for Dodge D100 conventional cab pickups with a standard 225 Six engine and manual transmission.† Your actual mileage may differ, depending on how and where you drive, the condition of your vehicle and its optional equipment. Dodge's exclusive four-speed overdrive transmission† is also available as an option to help improve fuel economy.

TOUGH ENOUGH TO CARRY BIGGER PAYLOADS.

Dodge D100 is built tough enough to carry a bigger payload than comparable Chevys and Fords.

THE TRUCKS THAT LAST ARE THE DODGE TRUCKS.

96 out of every 100 Dodge trucks registered in the last ten years are still in use. (Source: R. L. Polk & Company, *Trucks in Operation*, 1975.) It all adds up to one heck of a tough pickup you can buy or lease... by the truck or by the fleet... at your Dodge Dealer's.

DODGE TRUCKS HAVE GOT IT WHERE IT (REALLY) COUNTS.

Dodge Trucks

*Price and price comparisons based on manufacturers' suggested retail prices, not including destination charges, taxes, and options. California prices slightly higher. †N/A in California or high altitude areas. △N/A in high altitude areas.

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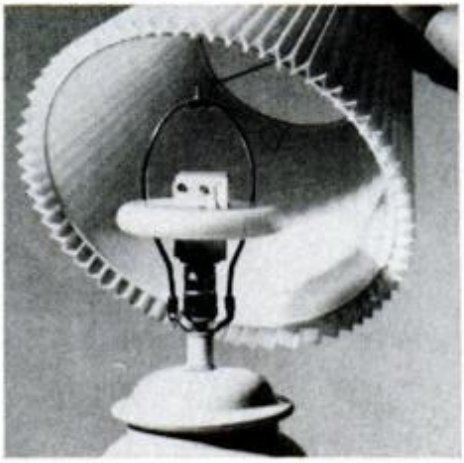
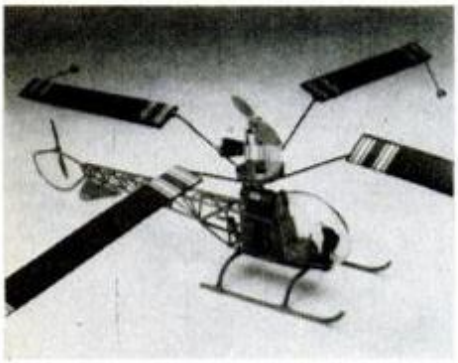
IT'S NEW NOW



Fluorescent light converter for table and floor lamps

Incandescent bulbs use more electricity than fluorescents that produce comparable light. But how do you rig a fluorescent tube in a floor or table lamp? Now there's an adapter that screws into a standard light socket so it will take circular fluorescents in many sizes, with a 12,000-hour life instead of an incandescent's 750. Single-socket converters are $15. A. Johnson Industries, Los Angeles, Calif.



High-rise toy copter

Mini-model of the Bell 47G whirlybird rises vertically under fuel-powered high-thrust rotors that promise stability and soft landings. L. Roller, 1320 Davies Dr., Beverly Hills, Calif. 90210.

'Toothpaste' solder

Solder in a squeeze tube contains solder, flux, solvent and gel for making firm joints. Heat can be applied from irons, ovens, lamps—name it. Alpha Metals, 56 Water St., Jersey City, N.J. 07304.

Postal put-on

Three-level mailbox arrangement puts incoming mail in proper order for a back-country Floridian who knows perfectly well that the local mail carrier can't possibly reach the box at the top.

There'll never be a better time to buy an RV!

Have you seen the latest line-up of RVs for 1977? If you haven't, you're missing out on a whole new world of traveling fun! You can have all the comforts of home...away from home. The 77's are better than ever and there's a style and model to fit everyone! The earlier you buy, the more time you'll have to enjoy summer. Find out more about the fascinating world of RVing by visiting your nearest dealer today!

Your participating Coleman RV dealer is just around the corner.

Only at your participating Coleman Dealer can you find this special offer at a time when you'd normally buy air conditioning anyway! Chances are he's just a few minutes drive away! And there will never be a better time to pay him a visit! Top RV dealers everywhere are making this great offer! Check your Yellow Pages. Don't let this opportunity pass you by! It's your chance to get a FREE Chill Chaser worth over $50 with the purchase of Coleman RV Air Conditioning.

Enroll in the sweepstakes while you are there. No purchase is necessary to become one of over 3,000 winners in Coleman's Summer Comfort Sweepstakes.

You'll find Coleman products in almost every RV you see!

The well-known Coleman logo is a familiar sight on most of the quality RVs manufactured today. Why? Because over 75 years of experience have proven that customers like you know and expect the top performance that only Coleman products provide. Check for these Coleman quality products in the next RV you see.

- Coleman air conditioners and evaporative air coolers
- Coleman furnaces
- Coleman water pumps and air compressors
- Coleman ovens and cooktop ranges

Enter the Sweepstakes each time you visit your participating Coleman Sweepstakes dealer on an official entry blank. Winners will be determined by a random drawing. Sweepstakes is open to all United States residents who are 18 years of age or older. Offer void in Missouri and wherever else prohibited or restricted by law. No purchase is necessary to win, and all prizes listed will be awarded. Contest begins April 1, 1977 and ends June 30, 1977. Entries must be postmarked prior to closing date. See official entry blank for complete details of Sweepstakes conditions.

Coleman makes Sense

Coleman Recreational Vehicle Products
Wichita, Kansas 67201

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"I'll give you a FREE Chill Chaser worth over $50 when you buy a new Coleman Deluxe RV Air Conditioner!"

A FREE built-in heater that takes the chill off!

Get the number one name in RV Air Conditioning, plus a FREE chill chasing electric heater! This 5,600 BTU heater is built right into the interior ceiling plate. Just a flick of the dial allows you to select heating or cooling to match the weather outside.

It's ideal for those mornings & evenings that are just cool enough to make you uncomfortable, but not cold enough to fire-up your LP furnace.

Only your participating Coleman dealer can make this fantastic offer right now! And Coleman quality air conditioners deliver unequaled efficiency, with super-quiet performance to give you cool, quiet comfort. Compare! Exclusive Dial-A-Comfort control lets you "fine-tune" your own personal comfort setting. All this plus a FREE built-in heater that takes the chill off without wasting precious LP gas. This limited-time offer is good on Deluxe ("A" Model) air conditioners purchased between April 1, 1977 and June 30, 1977 from participating RV dealers.

Over $100,000 in Prizes!

NO PURCHASE REQUIRED

Enter Coleman

NO PURCHASE REQUIRED

Summer Comfort Sweepstakes

GRAND PRIZE $10,000 CASH

OVER 3,000 CHANCES TO WIN AT YOUR PARTICIPATING RV DEALER!

Your chance to win a grand prize of $10,000 cash is as close as your nearest participating RV Dealer! It's Coleman's Summer Comfort Sweepstakes, designed to help spread the word about the new 1977 RVs and the cool comfort of Coleman RV Air Conditioning. Visit your dealer today and you could walk out a winner! This is a limited-time offer, so enter today!

1ST PRIZE... 5 Free Vacations for two to the fabulous French West Indies Islands of Martinique and Guadeloupe!

2ND PRIZE... 10 Fourteen-foot Hobie Cat® Catamaran Sail Boats!

3RD PRIZE... 25 Coleman Family Size Oasis® Tents!

4TH PRIZE... 50 Fifteen-foot Coleman Canoes!

5TH PRIZE... 100 Peak 1™ 4-man Lightweight Tents!

6TH PRIZE... 400 Coleman 12-volt Inflate-Alls™!

7TH PRIZE... 2,500 Coleman Roundabout® Cooler Jugs!

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FLAVOR TUBE IDEA REVOLUTIONIZES CIGARETTE SMOKING

NEW L&M LIGHTS FILTER ACHIEVES 8 MG. "TAR," DELIVERS 100% VIRGIN TOBACCO TASTE

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Filter Revolution!

The unique Flavor Tube™ channels a stream of undiluted, full-flavored smoke through most of the filter length. Fiber filter surrounding the Flavor Tube keeps "tar" at a low 8 mg.

Tobacco Revolution!

L&M Lights is the only cigarette made with just the tender "filet" of 100% virgin all-leaf tobacco. No tobacco by-products. No reconstituted tobacco. No added stems.

REAL TASTE. ONLY 8 MG. "TAR."

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

Flavor Lights; Long Lights; 8 mg. "tar", 0.7 mg. nicotine; av. per cigarette, by FTC Method.

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How to build a bicycle built for two out of two built for one

You can team up and build a tandem in 11 steps.

by Eugene A. Sloane

Until you ride a tandem you will never know the joy a bicycle can bring to the two of you. You can comment on the passing scene without having to shout or ride dangerously close together to be heard. Two-up riding is easier because two wheels instead of four offer less rolling resistance, and the tandem weighs less than two single bikes. When the wind is gusty a tandem is far steadier and easier to pedal than a single bike.

The trouble with tandems is their great expense. You can buy one that sells for as little as $150 but it weighs almost twice as much as the one you can build yourself, and looks, rides and feels like a truck. A really good ready-built tandem sells for upwards of $750. You should be able to build this lightweight, comfortable and responsive tandem for a maximum of $390 out-of-pocket and a minimum of $190 if you use less costly components. You can cut costs still further if you already have some of the parts such as saddles, wheels, tires, tubes, frames, derailleurs, brakes and handlebars from old bikes. The old frames you will need you can often scrounge from local bike shops which have no need for wrecked frames.

How to ride a tandem

If you follow all the build-it steps, you should have a high quality tandem with excellent shock-absorbing and steering qualities for long dis-

(Please turn to page 44)

TOOLS YOU WILL NEED

- Brazing outfit, with a dozen or so 1/16-inch bronze rods and brazing flux. I prefer the Tote-Weld Mapp gas outfit made by Airco which costs about $125 including tanks of Mapp gas and oxygen, rods, lighter, safety goggles and carrying case. The Mapp gas replacement cylinders are available from Sears, Roebuck and you can get oxygen from any welding supply house. A very adequate brazing and welding manual comes with the Tote-Weld setup, and you can learn to braze from it.
- Metal-cleaning equipment, including flat and rat-trail files, sandpaper and a ½-inch carbide burr bit.
- Hacksaw and blades.
- Frame alignment equipment. This includes a carpenter's level, 4-foot straightedge, ruler, roll of twine, I.D. and O.D. caliper rule.

PARTS YOU WILL NEED

- Two frames, preferably of high quality tubing such as Reynolds '531', Columbus, Super-Vitus or Vitus. Try to get a man's frame for the front and a woman's frame for the rear that fits your "stoker." If all you can get are two men's frames, steps here show you how to convert one to a woman's step-through frame. Rear frame can have a bent fork, since you need but one. Front frame fork must be straight, as should all main tubes. Prices vary according to how bad they are wrecked and the steel they are made of. Certainly $50 for a pair of old, beat-up frames should be reasonable.
- A pair of caliper brakes with levers and one short and one extra-long tandem length cable for the rear brake. Mafac brakes are very adequate, cost about $18 with levers. Extra long cable, about $2.
- Three seat-post lugs, about $2 each from Proteus Designs, Inc., 9225 Baltimore Blvd., College Park, Md. 20740. Give O.D. of old front frame seat tube and rear frame down tube to get fit—73° lugs are fine.
- Headset (if you need one for front frame). These are all cups, bearings and locknut. Measure I.D. of head tube to get set that fits. Strong-light headset is fine, for about $8.
- Pedals. Two pair of reasonably high-quality-alloy body pedals, such as KKT, with toe clips and straps. These must be threaded to fit your cranks. About $60 for two pairs.
- Wide gear-ratio rear derailleur and two front derailleurs (one for chain tensioner). Any Shimano GS rear derailleur will do. With dual down-tube levers, cables and stops, about $35. One extra rear derailleur wheel (for tensioner), $1.
- One front and one rear wheel with steel rims, bolt-on hubs, 1¼ x 27-inch tires and tubes. $50.
- Five-speed rear freewheel, 14-34 teeth preferred, such as made by Shimano. $11.
- Special Schwinn stem for rear handlebar; fastens on rear seat post. Schwinn Part No. 55-755. $8.50.
- Fork. This should come with one of the frames. If not, measure length of head tube, buy a fork about 1 inch longer and threaded same as headset threads. New forks come to fit largest frame, cost about $30. It is the practice to cut them to fit smaller frames.
- Chainwheels and bottom-bracket sets. You can use old chainwheels, *only* if the chainwheels to be used with the chain connecting front bottom bracket to rear bottom bracket have the *same number of teeth*. If not, rotation of each crank will be at different speeds and front and rear pedals will collide after one or two revolutions.

If you use old chainwheels, you can have only a five-speed tandem—okay with a wide gear-ratio freewheel. If you buy new bottom-bracket and chainwheel sets, use the T.A. special tandem set designed for tandems. It includes bottom-bracket sets (spindles, cups and cranks) front and rear, and gives you a 10-speed tandem. The T.A. set costs about $125. You provide bearings, 11 to a side (total 44 ¼-inch bearings). If you use old chainwheels designed for a one seater, you'll have to shim out the rear set to allow for chain clearance. Conventional chain ring sets were not designed to carry two chains at once, one chain on each ring. Longer washers or spacers and fixing bolts are available from good bike stores to fit most chainwheel makes.

- Two chains. This is the derailleur ½ x 3/32-in. chain with 122 links. Make sure the bike store has extra links to fit the same make of chain; you may need them. About $11 for both chains.
- Two saddles and seat posts. I prefer leather saddles with steel seat posts. About $30 with posts for both saddles.

You can spend much more than indicated here if you upgrade to the finest components. I have tried to compromise between price and quality.

Before listing tools you'll need to build a tandem, I want to make two assumptions. One is that you know how to disassemble, reassemble and adjust every part of a bicycle. If not, I suggest you read my book, *The New Complete Book of Bicycling*, $12.95, 550 pages, Simon & Schuster. The second assumption is that you know how to braze metal. If not, I suggest you stick to the Mapp gas outfit listed.

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Aftate for Athlete's Foot

better than Desenex. Much better.

Because the medication in Aftate is more effective in killing Athlete's Foot fungus (Tinea Pedis) than the medication in Desenex.

The medication in Aftate kills all major types of Athlete's Foot fungus. Aftate for Athlete's Foot relieves and soothes the itching, chafing, burning, and helps heal the irritation.

You can't buy a more effective Athlete's Foot medication without a prescription.

In four effective treatment forms: spray liquid or gel for even the most stubborn cases; and spray powder or sprinkle powder for daily foot care and to help prevent reinfection.

Aftate is odorless, too.

Read and follow label directions.

Aftate™
The Athlete's Foot Killer.
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BUILD A BICYCLE FOR TWO

(Continued from page 43)

tance touring comfort. Now, some advice about riding your new tandem. Learn to coordinate push-off from a standing start. Pedals on one side should be at two o'clock. Push down on that pedal and push up into the saddle and pedal a few strong strokes to get going. Stop for a second and get the other foot into the toe clips. Never stop pedaling without warning the other rider, never turn without letting the "stoker" at the rear know about it, never stop without informing the stoker. The stoker should never shift bodily weight because this can throw the front man off balance, especially during a turn. Some shifting about is okay, but don't overdo it. If you get along well in other departments, you should be a joy to each other and to watch you harmoniously pedal away!

Now here are the steps for building the tandem:

Step one

Remove all parts from both frames except fork from the front frame.

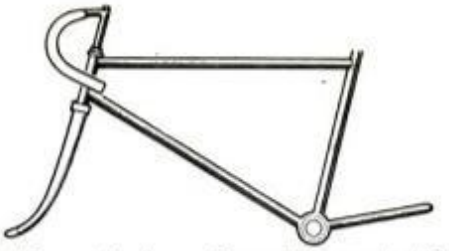
Step two

Prepare the rear frame section. Cut headtube in two places (dotted lines

on drawing) at Point 1. With torch, unbraze and remove headtube and top tube. Apply heat to Points 2, 3 and 4 as necessary. Do not overheat tube, use only enough heat to melt the bronze, *not* the steel. When through, the frame should look like the bottom drawing in this step.

Step three

Prepare the front frame section. Apply heat at Points 1 and 2, removing



both seat stays from the seat tube first, then removing the seat stays and rear dropouts. When you're through, the frame will look like the drawing above.

Step four

On the front frame section, clean off all paint, grease and dirt from the chain stays down to the bare metal, and for about one-third the length of each stay. Clean another pair of stays from another old frame or new from Proteus (see the parts section). Clean inside of the stays to shiny metal, as well as the outside at least to 3 inches inside of the stays. Braze on these extra stays right over the old stays on the frame, at F on drawing so that you will get extended-length stays.

Don't worry about the length or the spacing of the stays at this stage.

The front frame will now look like it appears in the drawing above.

Step five

This is an optional step to take if you wish to convert the rear frame to a shorter one. If the rear frame is a 24-inch size (measured from the top of the seat tube to the centerline of the bottom-bracket spindle) and your "stoker" gal is only 5 feet 2 inches, you should have a rear-frame size of around 18 inches for her.

To shorten the rear-frame section: Unbraze the rear-seat stays at the seat-tube lug, then cut off enough of the seat tube to shorten the frame to the size you need and braze on a new seat-post lug cluster. File off the top tube part of the lug; you won't need it. (Always clean lugs and tubes inside and out to the bare metal before brazing them.)

Fill the rear-seat stays with a fine white dry sand and cap them at the top with corks. Unbraze the rear-brake bridge. Carefully, with the torch always in motion and starting about 4 inches below the bridge, bend the stays—one at a time—until the ends come to just below the top of the seat tube. Remove the corks,

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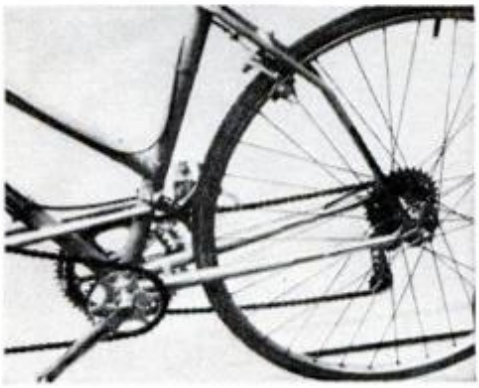
dump out the sand, wrap ends of the stays around the seat tube and braze them in place. Rebraze the bridge between stays. The bridge will be at a new angle, so you will have to use a side-pull brake and install it on the front of the bridge instead of the rear, as shown.

You could use an old section of a seat stay—miter it to fit the rear stays, drill it for the brake bolt and install it with the bolt hole parallel to the ground—but that's a lot of work. Bent and brazed stays are shown in the photo below.



Step six

Cut in half the three seat-post lugs noted in the parts section. Clean to bare metal inside and out. Slide one of the lugs upside down onto the rear-frame down tube. Clean ends of the down tube. Slide the other two lugs over the down tube you removed from the rear frame in Step 2. Clean all metal. Lugs should be upside down.

Place the rear frame's top tube alongside the front-frame seat tube with its other end on the rear-seat tube; check to make sure that this tube is mitered so both ends will fit snugly on both seat tubes. If not, re-miter. Now fill front frame chain stays for bending later as shown in Step 9.

Step seven

Align both frames as follows:

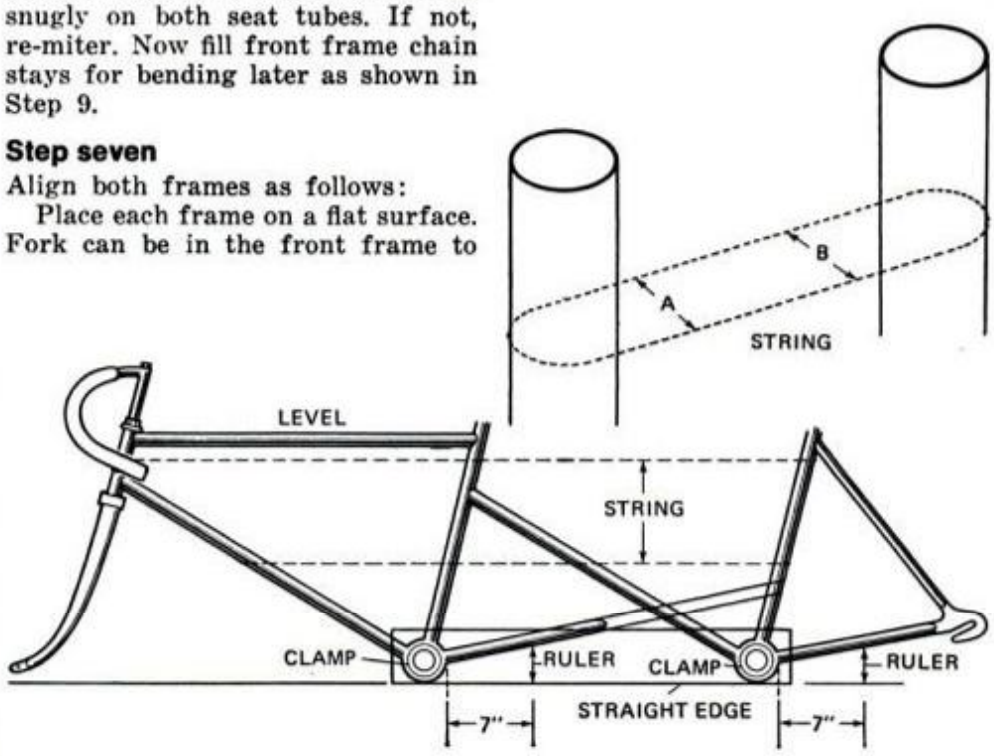
Place each frame on a flat surface. Fork can be in the front frame to help hold it. With level on the front frame top tube, level the front frame. Align both frame bottom-bracket hangars with straightedge on both sides, so hangars are exactly in line with each other. Lightly clamp frames through (or above) the bottom-bracket hangars (be careful not to mangle the bb threads).

Make sure that both sets of chainstays are at the same angle with respect to work surface by scribing a mark on all four stays exactly 7 inches from the bottom-bracket hangars; measure the distance that front frame stays are from the work surface and adjust the rear frame so its chainstays are the same distance from the work surface as the front stays (see drawing). Now when wheels are on the tandem their axles will be the same distance from the ground.

Final frame alignment is done with string. Wrap string at the top of the front frame-head tube so that it parallels and passes both frame seat tubes. Wrap another string about halfway down the front-frame down tube and back to the rear-frame seat tube. Adjust frames on the work surface so that the strings either touch all tubes or are at same distance from all tubes they pass (see drawings). Recheck all other alignments (bottom brackets, head-tube level and stay distance from work surface), make any necessary adjustments and firmly clamp both frames to the work surface. Again, recheck all alignments.

Step eight

Braze the rear-frame down tube to the front-frame seat tube (A on



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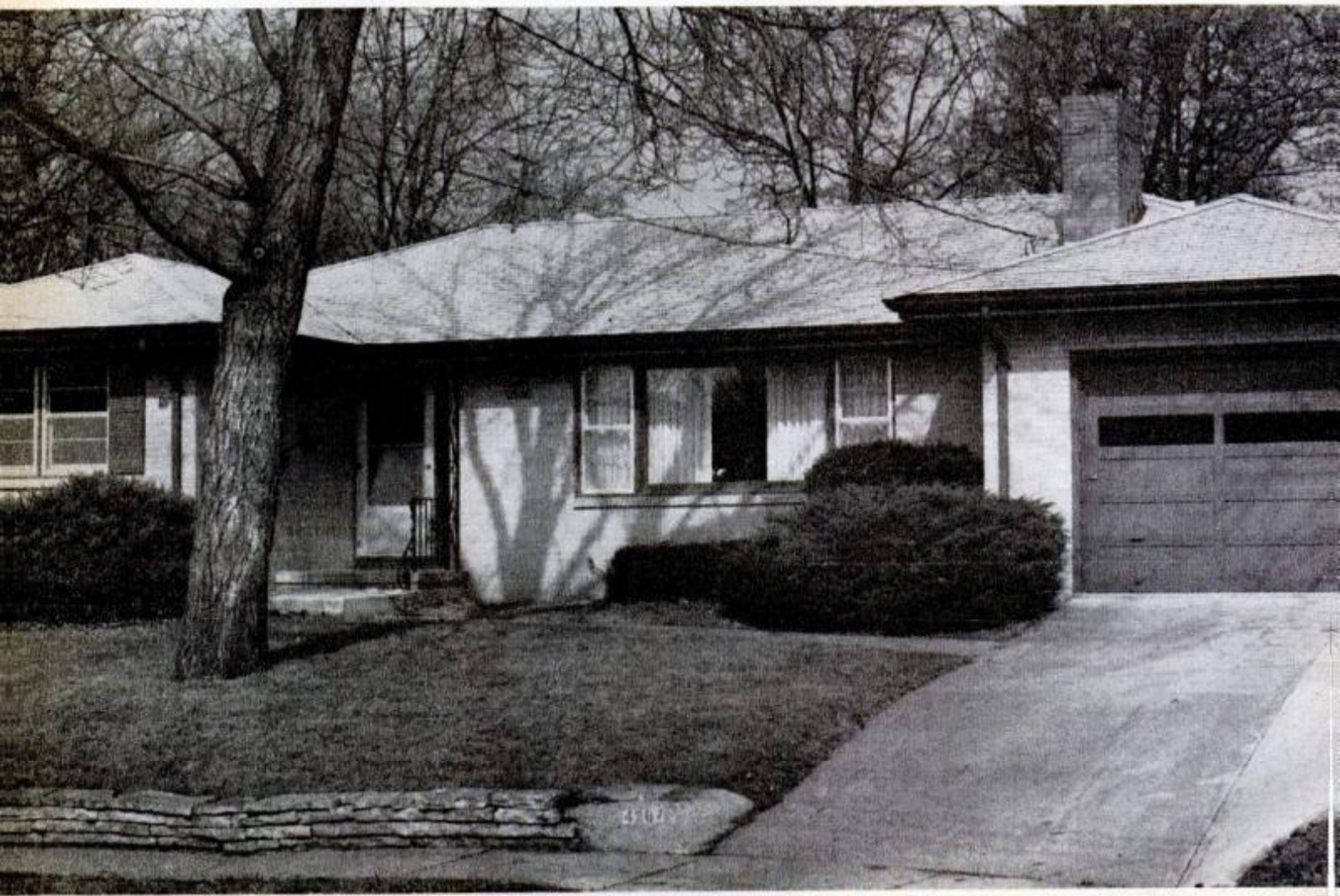
GOT THE COLD SHIVERS FROM HEATING BILLS?



OO COOLING COSTS MAKE YOU HOT UNDER THE COLLAR?

THE COST OF COMFORT IS GETTING MIGHTY UNCOMFORTABLE.

Homeowners everywhere are seriously concerned about rising costs and dwindling supplies of fuel. But now you needn't feel quite so powerless to fight those soaring home heating and air conditioning bills. Hold onto more of the power you pay for by having your exterior walls insulated with new Insulspray® foam insulation from Borden. It's a wise new way to help in the efforts to conserve energy, while holding down those uncomfortably high bills!

insulspray® THE WALL FILLING FOAM!

Costly energy losses can be occurring right through your outside walls. Insulspray foam is applied directly into wall cavities from the outside. Then it hardens to form a long-lasting barrier against winter cold and summer heat.

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By filling spaces between interior and exterior walls, Insulspray foam reduces energy loss. Your home stays warmer in winter, cooler in summer. You save precious energy. And you save on fuel bills.

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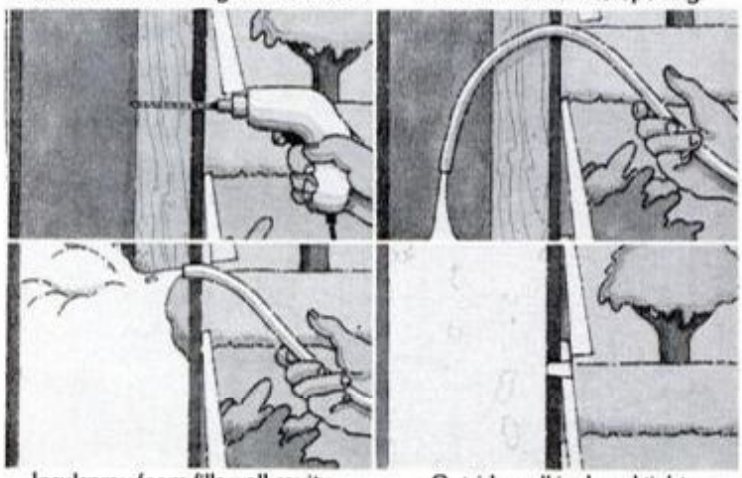
A hole is drilled through outside wall.

Hose is inserted into opening.



Insulspray foam fills wall cavity.

Outside wall is closed tight.

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GENTLEMEN: PLEASE RUSH THE FOLLOWING ITEMS:

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1	DISCOUNT CATALOG	FREE	FREE

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MDSE. TOTAL_____
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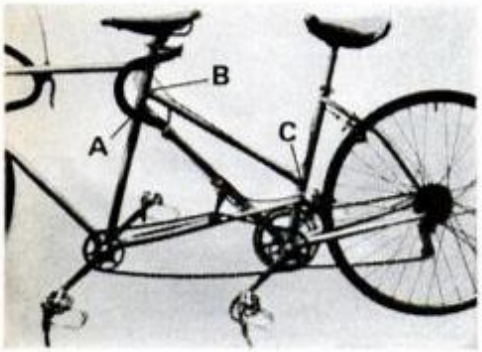
BUILD A BICYCLE FOR TWO

(Continued from page 45)

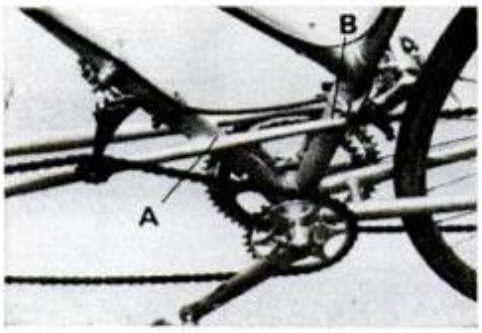
photo), first brazing the tube with a thin fillet, then a lug. After this and



each brazing operation below, recheck alignment at all points. Place the second down tube (formerly the rear-frame top tube) in place with lugs and braze at B and C as above. Be sure that the tube miters fit opposite the tubes snugly before you braze them.

Step nine

In Step six we said that the front chain stays, with brazed-on extensions, are filled with sand. Using a torch, you should carefully and slowly bend each stay, one at a time, until it meets the rear frame bottom-down tube and the seat tube as shown at A and B in the photo. Clamp the parts at both places and braze in position, building up generous fillets at each joint as shown.

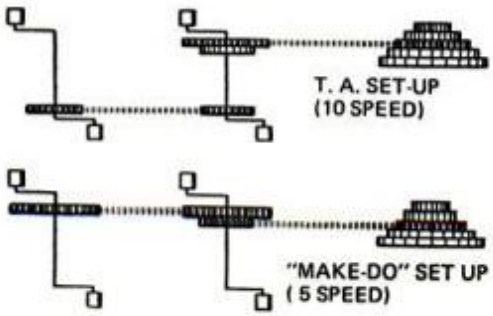


Step ten

Remove all old paint and repaint. See *The Bicycle Shop*, page 14, Feb. '76, for instructions.

Step eleven

Assemble the parts. Step 9 photo shows a chain tensioner, made from a front derailleur and one rear derailleur wheel, installed in place of a chain guide stop on the front derailleur. When the chain is mounted, both sets of pedals must face in opposite directions. The front chain should have about ½ inch of free play. The chain tensioner can be adjusted by sliding the converted front derailleur up and down the downtube. Lateral-chain tension is adjusted with the converted chain-tensioner adjusting screws. The drawing shows the correct chainline for both T.A. and conventional chainwheel sets. The chain line for T.A. is accurate when third rear gear is lined up between the double, rear chainwheel. Conventional chainwheel alignment is correct when rear third gear is in line with inner small chainwheel. Some chainline adjustment can be made by adding or removing thin spacing washers under the rear-wheel freewheel-side axle locknut, thus moving this gear cluster laterally. If you add or remove spacers, the rear wheel should be re-dished for accurate alignment. Assemble all other parts. ★★★



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Firestone announces the first Steeltex Radial. Especially for people like Steve Petrasek and you.

For years you've been hearing about the smooth ride and long mileage of radial tires... for cars.

Now Firestone's built a radial for you.

The first Steeltex Radial.™ A steel belted radial truck tire engineered especially for pickups, vans, RV's, and motorhomes. With the same steel cords we use in our heavy duty radial truck tire.

And Firestone's tire engineer and resident outdoorsman Steve Petrasek predicts you'll love it.

"My people needed a radial for all the reasons car people want radials. Mileage, steering control, fuel economy, traction, strength, smooth ride... and no 'flat spotting'.

"We've designed all that into the Steeltex Radial. So if your wheels are approved for radial tires... and any Firestone Dealer can answer that... it's a comfort to have these underneath you.

"And it's a good idea to order them when you're ordering a new vehicle."

Firestone STEELTEX® RADIAL

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Set yourself up for life with Lifetime®

STAINLESS STEEL COOKWARE

Here's what you need. Lifetime Stainless Steel Cookware is a product you can really believe in. And really sell. Fact of the matter is Lifetime almost sells itself. It's truly unique custom-designed 6-ply and 5-ply "minimum moisture" cookware, with exclusive "solar cap"™ construction.

All Lifetime cookware carries a full life-of-the-purchaser warranty from The West Bend Company. That's a real sales plus!

Why not get yourself a line with a future?

Get Lifetime and get going. Simply send the coupon for complete details. And, get a whole new lease on life today.

PATENTED 6-PLY CONSTRUCTION!

LIFETIME®

To: **The West Bend Company**
Lifetime Cookware Division
Dept. PM6-7
West Bend, Wisconsin 53095

I am interested in:
_____a Lifetime Distributorship
_____full-time sales for Lifetime
_____part-time sales for Lifetime

Name_____

Address_____

City_____ State_____ Zip_____

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HINTS FROM READERS

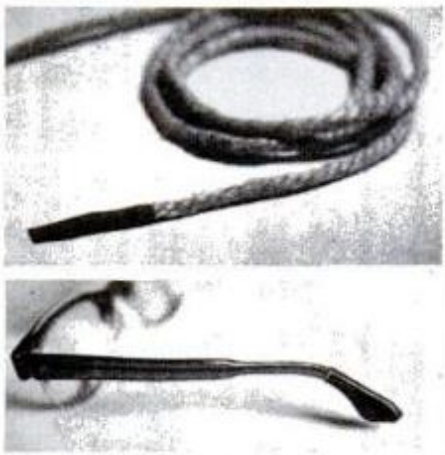
Paintbrush cleaner

A wire brush with paint solvent on it can penetrate deep into a paintbrush and clean it without causing damage to the bristles.
—Kenneth Wells

Taking mildew off rubber

Use denatured alcohol and rags to remove mildew from rubber. Or let full-strength household chlorine bleach stand on it for 60 seconds *only*, rinse and then dry thoroughly.*—W.E. Burton*

Versatile shrink tubing



Widely used in electronics, shrink tubing can also be used to prevent rope ends from fraying or to cushion the bows of eyeglasses.
—Albert Plavcan

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Pay & Benefits

If you enlist in the Army, you'll start with good pay; a long list of job-training courses to choose from; 30 days paid vacation each year; the opportunities to travel and to continue your education. For more information about all the opportunities in today's Army, send the postcard. Or call 800-431-1976 toll free. In NY call 800-243-5614.

Drive.

"An Armor crew has got to have it. The drive to work fast and hard. And work together. Everybody in the crew has got to want that. I could take these trails faster than I do, but I know the other guys would be bouncing so much they couldn't do their jobs. I'll tell you, it's more than being close, or being friends, that makes you give that little bit extra. It's sharing a common goal. Us four decided our goal was to be the best."

PFC Willard Jackson, Fort Carson, Colorado

Join the people who've joined the Army.

IMPORTS&MOTORSPORTS

Clean Swedes

Volvo and Saab have joined the growing number of auto manufacturers who are putting prototype electric cars on the road. One of Volvo's electrics (shown above) is a two-seater that uses 10 six-volt, traction-type batteries. With a weight of about 660 pounds, the batteries are about a third the weight of the car, which is a bit over 2000 pounds. Range is about 25 miles, top speed around 40 mph.

The Saab prototype (below) is being developed together with the Swedish Post Office, and it, too, is limited to a range of slightly more than 25 miles. Both manufacturers admit that electrics can't compete with gasoline-powered vehicles, but when that long-awaited breakthrough in battery technology comes, they want to be ready.

Almost ready for U.S. roads is Saab's turbocharged passenger car. PM expects to have one late this month for testing for a story that will appear this fall when the car goes on sale here. Saab works wonders with their two-liter Four. Now they're modifying it to run at high compression with low-octane fuel!

At Volvo, it's clean exhaust that's getting high marks. The company just won the National Environmental Industries Council "Award for Excellence" in air pollution control. The Lambda Sond system is used on California Volvos (and now Saabs have it, too) and will soon be in more widespread use and on other makers' cars as well. Next month we'll have a story on driving a Volvo with the Bosch-developed system.

Wonderful world of wheels

The Classic Motorbooks 1977 Catalog is billed as the "world's largest selection of automotive literature," and the folks at Motorbooks like to call themselves booksellers to the world's automobile enthusiasts. Well, they're that and more, because they also cover the world of trucks, buses, ambulances and—what?—*German Softskinned Vehicles of WWII?* Yes, those too. There are

listings for over 3000 items from over 400 publishers. It's a handsome, 116-page catalog that's only 50 cents from Classic Motorbooks, Box 1, Osceola, Wis. 54020.

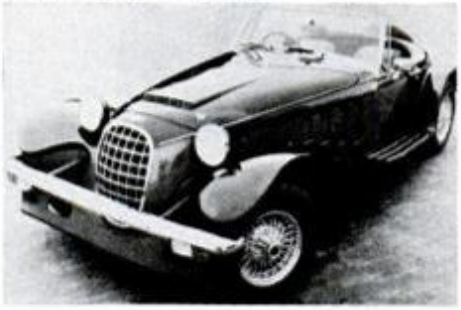
Sporty options

Here's a worthwhile do-it-yourself project for these warm, sunny days: Cut a hole in your pickup truck's roof. Before it rains, however, you'll want to cover it over, and for that job, Chrysler's Mopar people have just what you need—a Sky Lite Remov-A-Top. The removable glass top comes with all the required

hardware, a template and illustrated instructions. The $200 top can be ordered from any Chrysler, Plymouth or Dodge dealer.

Another do-it-yourself option—this one for the Arrow, Plymouth's captive import—is a sunshade for the large hatchback glass. It's a practical addition and looks good on the Arrow, which is one of the best-looking small cars on the road today. The sunshade is a well-made, $135 option that's easy to install.

1977 Panther Lima

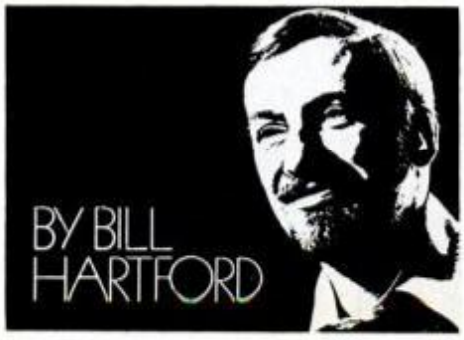


It's meant to resemble a Morgan or MG of bygone days, but the Lima is brand new. It was first shown here at Auto Expo in New York in April. Panther Motor Cars is the British-based company that specializes in nostalgic designs. Their J72 roadster ($30,000) and DeVille tourer ($70,000) were also at Auto Expo. Those big-buck machines make the Lima a bargain at only 10,000 beans. It's a practical two-seater sports car, too, since it's all GM under the skin.

Showing its stripes

Championship Edition Porsche 924 is recognized by its stripes on the outside, but it's even nicer inside with its sport seats with red corduroy inserts and blue piping. The special edition commemorates Porsche's 1976 Trans Am, Makes, and Sports Car championships.

Everyone should recognize the front-engine 924 by now, since it was introduced in mid-1976. But would you recognize its big brother, the V8-powered Porsche 928? It was unveiled at the Geneva Auto Show in March and we've got a test of the new supercoupe, starting on page 92. ★★★



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NOTHING IN LIFE IS FREE. EXCEPT WHEN HARLEY-DAVIDSON SETS OUT TO PROVE A POINT.

Then, you have a choice. A General Electric High Performance Portable Radio/Cassette Recorder worth $149.95 for free. Or, a Holsclaw trailer worth $247 for almost free. ($49.95).

Buy a new Harley-Davidson Street or On/Off Road 125, 175, or 250 cc motorcycle between April 15th and June 1st* and you can take your choice of either one.

The Cassette Recorder is a high-performance model that plays and records from AM, FM, Aircraft and Weather bands. And comes with both a built-in condenser mike and a high-sensitivity remote mike.

The trailer has a 700 pound capacity and is especially made for carrying lightweight motorcycles. It comes equipped with all lights and a double set of safety chains. Or, if you'd prefer, we'll give you a gift certificate worth $100 in Harley-Davidson rider accessories.

Why? Because we've grown tired of listening to guys who didn't know we made lightweights ride around explaining to their friends that someday they were going to "move up" to a Harley-Davidson super bike.

The point is, it's a nice idea, but you don't have to wait until "someday". On your way up to a Harley-Davidson, you could be riding one.

UNTIL YOU'VE BEEN ON A HARLEY-DAVIDSON YOU HAVEN'T BEEN ON A MOTORCYCLE.

*At participating Harley-Davidson dealers.

AMF Harley-Davidson

ALL OUTDOORS

Marine goes metric

The land is changing from yellow to gold and the water from light blue to blue green. Though that sounds poetic, it's the practical decision of the National Ocean Survey (NOS) in the National Oceanic and Atmospheric division (NOAA) of the U.S. Department of Commerce.

The NOS prepares our nautical charts, and the first prototype of charts for the future is now being released. It is of Lake Erie. It was prepared in cooperation with Canadian charting authorities, and uses new colors and metric units of measurement for the first time. That's one side. On the other, the customary feet and fathom measurements, the regular colors and the buoy symbols are retained for comparison.

The new colors have been selected to make chart reading easier at night under "red light" illumination. More depth contours, fewer soundings, international buoy symbols and a number of other changes recommended by various user groups have been incorporated. The new Lake Erie chart, No. 14820, is available for $3.25 from nautical chart sales agents and NOS Distribution (C44), Riverdale, Md. 20840.

High-performance plastic

Several offshore racing boats are being built of DuPont's new Kevlar 49 aramid fiber instead of fiberglass and should give the material a good test. Models we have tried out look and feel like any other hull, but builders claim they can make a stiffer, stronger hull with the material at a 20 to 25 percent cut in weight. Even inflatables are being tried.

Less poundage means more speed per horsepower, or the same speed with less gas consumption. Either way Kevlar boats, although they currently cost more, seem worth watching.

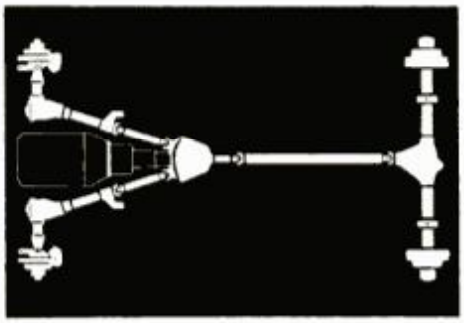
Bonus barrels

More options for less cost are among the advantages of interchangeable shotgun barrels, and Smith & Wesson has just announced a new Model 1000 12-gauge, 3-inch Magnum autoloader that provides a choice. For clean shots at extended range, the extra-strength steel receiver uses 3-inch shells and a 30-inch ventilated rib barrel with full or modified choke. Or pick interchange barrels for a 28-inch modified, 26-inch improved or skeet cylinder, or 22-inch slug barrel for any 2¾-inch shell. The 8-pound Smith & Wesson Magnum is just over $300 and barrels around $100 or less.

Ithaca is also introducing a new Standard Mag-10 semi-auto to supplement more deluxe models of its 10-gauge, 3½-inch magnum. All working parts are stainless steel, and the finish a vapor-blasted blue/black mat on the barrel and receiver to prevent rust and glare.

V-4WD

A new slant in driveshafts for four-wheel-drive vehicles—particularly vans, right now—is being manufactured by Vehicle Engineering & Manufacturing Co. (Vemco, for short) in Fort Wayne, Ind. Designed by the Spicer Axle division of Dana, the system is called V X 4 by Vemco, and at present it's an option for GMC and Chevy G-30 vans.



New power drive is feature of 4WD V X 4.

The arrangement replaces the usual front transfer case of 4WDs by putting the power from the transmission into an inter-axle differential in a transfer case behind the engine. Here the torque is divided between the driveshaft to the rear wheels and left and right front-wheel gear units. That makes possible independent front-wheel coil-spring suspension and improved ground clearance with no need to increase vehicle height. Weight on the front wheels improves traction, and better handling is reported as well.

The inter-axle differential is also claimed to sense which wheels have the best traction and to deliver to them the most torque from a biasing worm gear. If a wheel is spinning at higher rpm, it will receive less power than a driveshaft turning at lower speed because of a better grip on the ground.

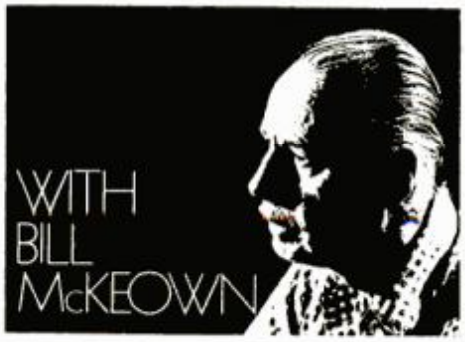
As more recreation-vehicle drivers look for go-anywhere rigs, the V X 4 may provide one of the new answers.

Water lessons ashore

Learning sailing, power boating and fishing will be easier this summer. Courses for instructors who will later tour boating centers have been organized by the U.S. Merchant Marine Academy and the Recreational Boating Institute. Lessons for sailors have been encouraged by the United States Yacht Racing Union to cover competition and safety techniques, small boat rescue and outboard handling. Information is available from the U.S. Merchant Marine Academy Sailing Center, Kings Point, N.Y. 11024.

School instruction, similar to driver education classes, is being sponsored by the Marine Retailers Assn. of America. Called a national Boating Performance Course, the series is being prepared by the Recreational Boating Institute, 10160 East 25th St., Tulsa, Okla. 74129. Hopefully, high schools around the country will soon be the sponsors of boat-handling courses.

Fishermen who would like to tackle that ultimate art called fly casting should make reservations right away. Fenwick Rods, Box 729, Westminster, Calif. 92683, has scheduled classes across the country. Classes will also be available in Alberta and Alaska this summer. And in the Green Mountains of New England, the noted sporting goods outfitters of Orvis, Manchester, Vt. 05254, will again instruct in the special art of wetting a fly twice a week. Even an expert fisherman can benefit from a review of easier and more relaxed technique, and can also get good hints from instructors about where the local lunkers hide. ★★★



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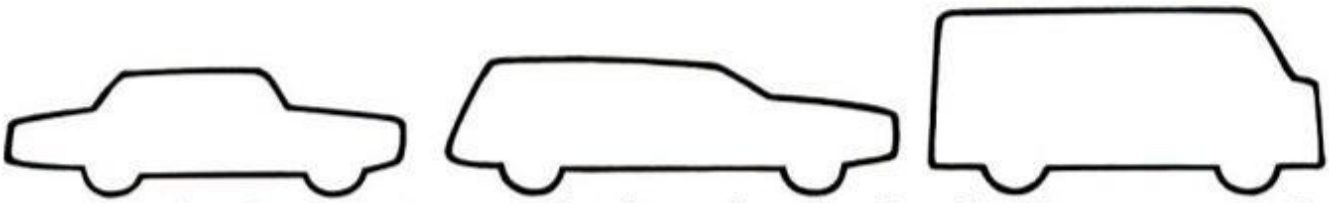

Do you make these common mistakes when buying family transportation?

Take the Bus.

Why spend all that money and wind up disappointed? Instead, you could have the most practical family wheels anywhere, the new 1977 Volkswagen Bus. The vehicle that carries the most for the least cost. The vehicle that AUTOWEEK says "might be the *real* best all-around car in the world." Just see how the Bus compares.

A sedan? No contest, of course. The VW Bus has yards more room inside. So how about a station wagon? Surprise: the Bus gives you almost 70% more interior space than a full-size domestic station wagon. In fact, the Bus is almost as big inside as a van. But the Bus is beautifully finished and a lot more comfortable. Comfort to us is not an option.

And here's the pay-off. According to the 1977 EPA tests, the VW Bus gets an estimated 28 mpg on the highway, and 20 mpg in the city with standard transmission. (Of course, your actual mileage may vary depending on your driving habits, your Bus' condition and optional equipment.) So when you consider that the VW Bus gives you that kind of economy along with its tremendous capacity, you realize why it's such a great choice for family transportation.

And that's not all. The VW Bus is very versatile. The rear seat folds down to provide extra carrying space, and that big sliding door lets you load all kinds of outsized cargo.

It's fun to drive, too. There's an optional automatic transmission, and independent torsion-bar suspension on all four wheels. And the powerful 2-liter engine has electronic fuel injection for super efficiency.

So to avoid making costly errors, visit your Volkswagen dealer. You'll love that low bus fare.

Introducing The '77 VW Bus.

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APPLIANCE CLINIC
QUESTIONS ANSWERED

On, off, on again

Is it a good idea during long periods of inactivity, such as from fall to summer, to turn on a home air-conditioner every couple of weeks and run it for a few hours? It sounds dumb to me, but a friend insists that it is good advice.—John Beecher, Boca Raton, Fla.

It's good advice, John, especially in the humid climate that prevails in southern Florida. Turning off a piece of mechanical equipment and leaving it off for a long time can cause it to corrode. Trouble can be avoided by turning on the air-conditioner once a month for an hour.

Battle of the hexes

My wife is complaining that there is a hex sign on her GE self-cleaning iron. This is the one with the "surge of steam" feature. She says sometimes it leaks water—other times it doesn't. I contend that if the iron is leaking, it will leak all the time. Do you agree?—Fred Kurtz, San Diego, Calif.

Logically yes, but not necessarily so. If the iron is carelessly filled or if the steam button isn't properly positioned, the iron could release water. A leak, when one exists, will occur at any of several places—in the tank, at the gasket which seals the tank to the steam dome assembly, at the fill hole gasket, at the water-level tube elbows or at the "quick dump" valve in the steam dome.

You can determine whether your iron is hexed by carefully filling the tank. Ordinarily, the steam button should be in the *up* position. But for this test place it in the *down* position. Lay the *cold* iron (don't plug it in) on a paper towel. If moisture is on the towel after 15 minutes, the iron is leaking and must be disassembled for repair.

If there is no moisture on the towel, your wife should exercise care in filling the tank. She should make sure the steam button is *up* when filling the tank and she shouldn't have the steam button *up* when the iron's temperature is low, or water may be released.

Wire to wire

My Sears Kenmore clothes washer (model No. 6914800) blows a fuse when it is operated in any cycle except "normal." I'm worried that one day soon even the normal cycle won't work. Help.—Charles Snyder, Barrackville, W. Va.

If you will open up the control panel, you will find an orange wire and a blue wire extending from the timer, terminating at the motor.

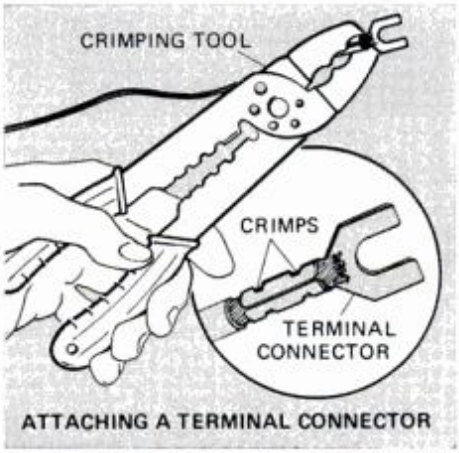
The blue wire is the high-speed wire. It controls all high-speed functions. The "normal" cycle is a "high-speed function" in both agitation and spin modes.

The orange wire is the slow-speed wire. It controls all slow-speed functions. Each one of the cycles other than "normal" has one or more slow-speed functions. For example, the "delicate" cycle involves slow agitation and slow speed. Your problem likely is that the orange wire may be shorting out between the timer and motor.

I would check the wire full length to make sure connections are tight and that no bare spot is grounding against the frame. If even replacing the wire results in no satisfaction, then you have motor trouble. Better have a pro check it.

SERVICE TIP

When you can use them, solderless terminal connectors make the most effective contact with terminal screws—more so than looping the wire around



ATTACHING A TERMINAL CONNECTOR

the screw. They come in two basic types—spade and ring—and in many sizes.

To put one on, strip the insulation from the end of the wire, insert the bare wire into the leg of the terminal connector and crimp the leg firmly against the wire as in the illustration.

In hot water

Your answer to William Carr of West Palm Beach, Fla. (Nov. '76 Appliance Clinic) concerning potential savings from disconnecting an electric water heater a portion of each day was misleading. A properly installed electric water heater uses little energy in maintaining a supply of hot water when there is no associated use. Studies have shown that a typical residential electric water heater (52-80 gallons capacity) will "come on" about once every three hours for seven minutes to maintain the desired water temperature (approximately 150° F. recommended setting for electric water heaters).

Assuming the water heater was left "disconnected" for a period of 10 hours per day, the energy savings would be approximately 5 cents per day. This assumes that the average residential water heater has two electric heating elements approximately 4500 watts each, but which are "interlocked," meaning only one element can be energized at a time.

The savings described were determined in this manner: During the 10-hour "disconnect" period the water heater is prevented from operating seven minutes every three hours, or 23 minutes each day. Energy consumed during this time would be:

$$\frac{4500 \text{ watts} \times 23 \text{ min.}}{1000 \text{ watts/kw.} \times 60 \text{ min./hr.}} = \frac{1.73}{\text{kwh/day}}$$

From a practical standpoint your readers should also be aware that the water temperature will drop during the "disconnect" period, and that as soon as it is reconnected, the heater will consume energy in raising the water temperature back to normal, virtually wiping out the savings described.

High costs associated with electric water heaters can *be traced to indiscriminate use of hot water, temperature settings which are too high, leaky hot water faucets and long runs of uninsulated hot-water piping. Attention to them will lead to greater savings than disconnecting the device.—George Kresina, The Cleveland Electric Illuminating Co., Cleveland, Ohio.*

Your criticism is clear, to the point and valid. Thanks. ★★★

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

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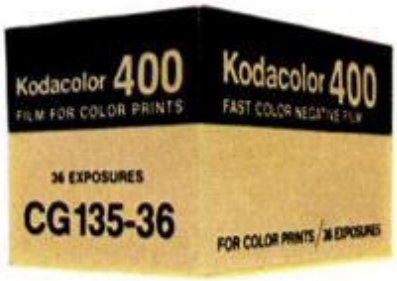
New from Kodak. A high-speed color print film.



For daylight, low-light, and fast-action pictures.

New Kodacolor 400 film is so fast, you can shoot in less light than you may ever have thought possible. Indoors and out, night or day. And you can get sharp, brilliant color prints where you couldn't before. Just how little light depends, of course, on the capabilities of your camera.

New Kodacolor 400 film has a speed of ASA 400, has fine grain and is color balanced for daylight, blue flash, and electronic flash. In fact, you can get pleasing pictures in almost any type of light without the need for filters.

New Kodacolor 400 film gives you more than just low-light and daylight versatility. It increases your distance range for flash pictures. You can also use higher shutter speeds to stop action...and to shoot hand-held telephoto pictures that are sharp.

Keep a roll or two of Kodacolor 400 film on hand and get great color prints in almost any light. Available in 135 and 110 sizes.

New KODACOLOR 400 Film

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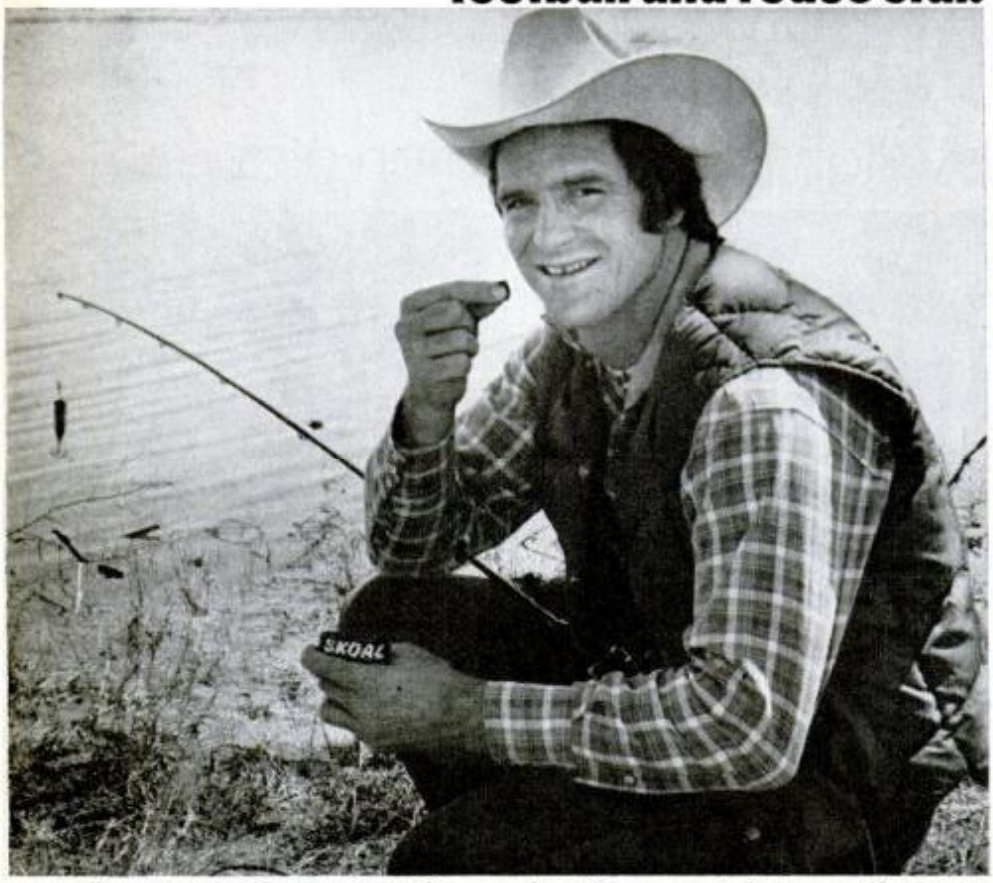
I love tobacco. I don't smoke.

Walt Garrison, football and rodeo star.



I'm a guy who loves tobacco, but I never take a puff. I use smokeless tobacco instead.

Just a pinch of smokeless in between my cheek and gum gives me full, rich tobacco pleasure. Feels real relaxing in there. And smokeless tobacco can't tie up my hands. So I can enjoy it no matter what I'm doing.

If you want to go smokeless, there are three brands to look for. Skoal, my favorite, with a wintergreen taste. Copenhagen, a straight tobacco. And Happy Days Mint.

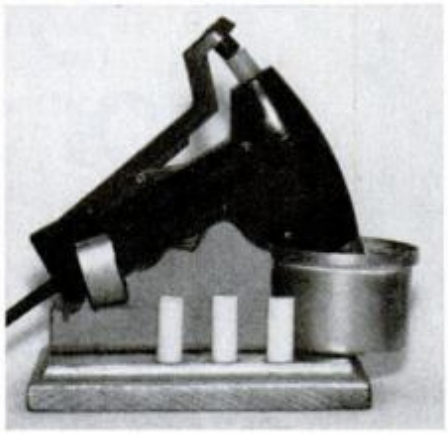
All three are dated for freshness. All three are tobaccos you enjoy without smoking.

Smokeless tobacco. A pinch is all it takes.

For a free booklet that explains how to get the full enjoyment of "smokeless tobacco" –as well as a few free pinches that you can try for yourself–write to "Smokeless Tobacco," United States Tobacco Company, Dept. PM067, Greenwich, Conn. 06830.

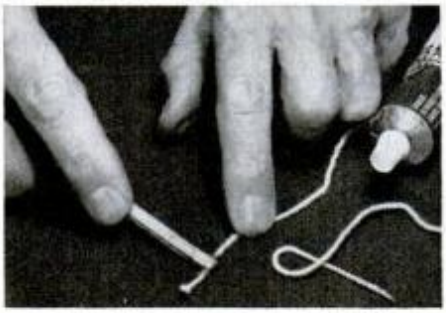
HINTS FROM READERS

Glue gun holder



To make a simple glue gun holder, duplicate the gun's curved part on paper and transfer it to ¾-in.-thick wood. Cut out the pattern. Nail it to a wood base so the gun will balance when in the holder. Attach a drip-catcher cap and drill holes for glue sticks.—*R.A. Scott*

Cord-tip stiffener



Stiffen the tip of a cord that has to be inserted repeatedly through small openings. Rub the tip with quick-set cement.—*W.E. Burton*

Distributor-cap toolholder

A discarded distributor cap cleaned with kerosene comes in handy as a place to park drill bits, screwdrivers, punches and other small tools.—*Ken Patterson*

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The Gabriel Shock Test Team.
They drive rough and tough, so you ride smooth and safe.

Four of the most respected men in auto racing have joined us at Gabriel. Their job—to help us make certain that Gabriel shock absorbers live up to every promise we make for them in performance, quality and value.

The Gabriel Shock Test Team works directly with Gabriel engineers and research personnel, testing the kinds of Gabriel shocks you buy, on the kinds of cars you drive. They test for control, handling and comfort . . . on the straightaway, on curves, during heavy braking, and on rough, bumpy surfaces.

The Gabriel Shock Test Team makes it tough for our shocks. And that'll help us make them better for you.

Gabriel®

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CAR CLINIC

SOLUTIONS FOR MECHANICAL HEADACHES

BY MORT SCHULTZ

Life saver

My 1976 Comet is equipped with a 302-cu.-in. engine and automatic transmission and I swear it's going to get me killed. The engine, only when cold, stalls on acceleration. There's this stop at a busy intersection near my house where my demise promises to take place unless you help. I've stalled out more than once trying to get across it quickly. My dealer has gone over the car—"with great care," he says—and has given it a clean bill of health. "Let it warm up," he tells me, but since when does a new car have to run at idle for five minutes before it can be driven? Can you give me any ideas?—Peter Sanford, Orlando, Fla.

There may be a simple, but little-known solution to your problem. It concerns the electrically operated choke, which may be opening too soon. I would disconnect the electric choke lead wire at the thermostatic choke cap, and fold and tape the connector back against the wiring harness.

This repair, which is authorized by FoMoCo, also applies to Monarch, Granadas and Mavericks equipped with 392-cu.-in. engines and shift-thyself gearboxes.

Out of the PM kitchen

Can the windshield washer reservoir in my 1974 Chevelle be repaired? It cracked last winter.—George Smythe, Burlington, Vt.

No, George, but you can insert an ordinary household plastic bag in the reservoir, fold the open end of the bag over the top, pour in solution and snap on the cover. This "repair" will work for damaged windshield washer reservoirs that have the outlet to the windshield nozzles through the cap—not through the base.

Uncivilized Civic

Can you tell me where the coolant is going in a 1973 Honda Civic I recently bought as a second car? After refilling the cooling system a couple of times, only to lose what I added, I checked thoroughly for leaks and found none. I came to the conclusion that the guy who dumped this car did so because it has a crack inside the engine, but examination of engine oil reveals no such thing. So where's the stuff going, Mort?—Tom Ludman, Grand Rapids, Mich.

Surprise! I bet it's going right out the overflow, Tom. Not once in your letter do you mention doing a necessary step that has to be done when adding coolant—bleeding the system. There is an air-bleed valve on the engine beneath the air cleaner that should be loosened when the coolant is added. If you don't do this, air will be trapped. This creates bubbles (aeration) that force coolant to be expelled.

Out for lunch

Got a story to tell, Mort. It concerns my 1975 Buick Skylark. I did the first tune-up ever on this car a few days ago, which consisted mainly of replacing plugs and timing the ignition. Was I in for a surprise when I road-tested. Did I say Skylark? The car acted more like a groundhog.

What a miss! I thought, "What did I do wrong?" I couldn't figure it out, so I took my tale of woe to my brother-in-law, who is a service manager at an Oldsmobile agency.

What I did wrong was use a puncture probe in hooking up my timing light. It tore the silicone sparkplug boot apart, so no juice was reaching No. 1 plug. Brother said that from now on I should use an adapter between the plug and terminal or a timing light with an induction pickup. How do you like them apples?—Fran Miller, Birmingham, Ala.

Delicious!

Hoppe's hopping mad

I've just spent money to have the front brake rotors in my 1976 Chrysler Cordoba resurfaced, but that's not what's bothering me. The car had to be stored for eight months while I was working overseas. When I returned and drove the car, there was a distinct pulsation effect when I braked. I was flabbergasted when my mechanic told me that rust had built up on rotors to a depth of several ten-thousandths of an inch. I claim the rotors were defective from the start and Chrysler is responsible. Do you think I'm right?—Lewis Hoppe, North Miami, Fla.

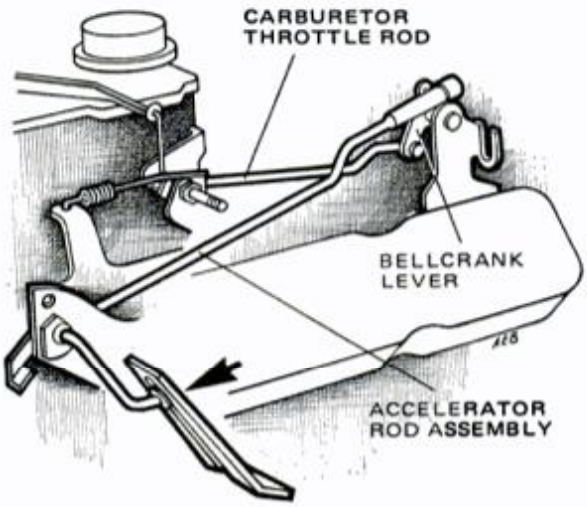
Right or wrong doesn't matter,

(Please turn to page 64)

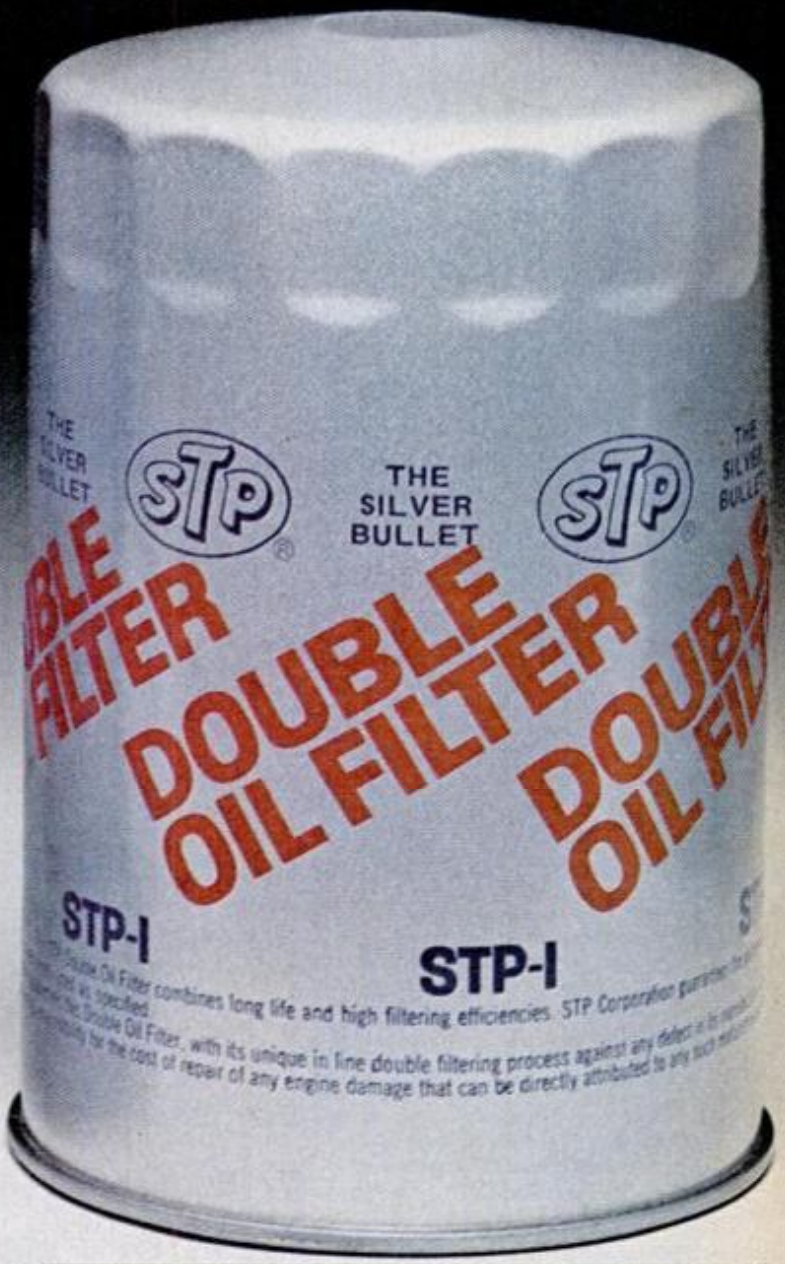
Poor little throttle linkage needs love, too

PM CAR CARE tip

The poor, forgotten throttle linkage—whoever gives it a thought? There it sits, moving back and forth hundreds of thousands of times in the life of a car. Usually, it doesn't utter a whimper. But sometimes the buildup of oil residue and dirt is too much and it can't bear it any longer. So it begins to bind. That's why it seems that the engine has suddenly lost power. Dollars later (spent for unnecessary repairs) the driver learns that a few cents spent for carburetor solvent and an old toothbrush to clean the linkage would have solved the problem. Incidentally, the "typical" linkage seen in the illustration is the one used in Dodge vans. Yours is similar.



In with the good. Out with the bad.



FORTIFIES MOTOR OIL AND HELPS REDUCE ENGINE WEAR.

Pour STP Oil Treatment into any car, new or old, and you're fortifying your oil. You're helping to reduce the wear rate of the lubricated parts in your engine. You're helping your engine fight friction. It's good stuff.

Here's how you use STP Oil Treatment. Pour it into the crankcase while your engine is running and warmed up. Do it when you change oil and the first time you need to add oil. Use one can of STP Oil Treatment to four or five U.S. quarts of oil (or 10% STP when the car's oil capacity is below four quarts or more than five).

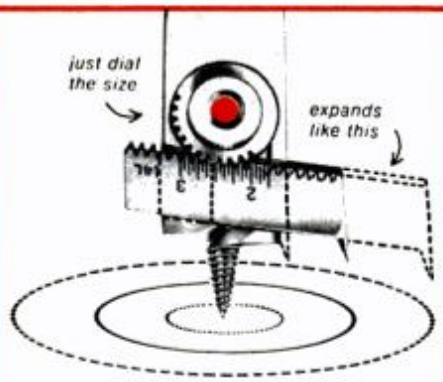
If you haven't used STP yet, ask a friend who does. Millions of people use it. Because they know that the more good they can do for their car, the better.

FILTER-IN-A-FILTER PROTECTION FOR LONG LIFE AND HIGH EFFICIENCY.

Grit, sludge and microscopic bits of metal are bad stuff for your engine. In fact, they can shorten its life. Getting them out is no easy matter for an oil filter either. In 7,500 miles of driving (at average speed of 40 mph) 28,000 gallons of oil pass through the oil filter. Good reason to use STP Double Oil Filter, The Silver Bullet.

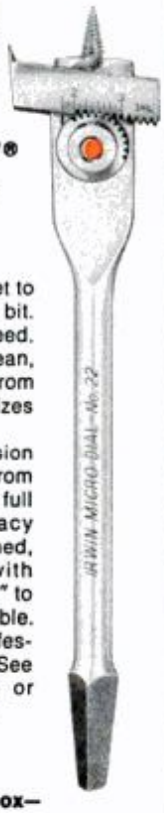
Here's how The Silver Bullet works. It contains two filter elements made of different filtering media. One filter nests inside the other so that all your oil goes through both filters on every pass through the cannister. That adds up to filter-in-a-filter protection for long filter life and high filtering efficiency.

The design is advanced. None of the five other best-selling filters are built this way. And that's one more good reason to go with the STP Silver Bullet.



No. 22 Micro Dial—⅞" to 3" boring range

Stop hunting for bit sizes!



Irwin's "Micro-Dial"® Expansive Bit bores 35 standard holes.

Just turn the dial and you're set to go with this Irwin Expansive bit. No hunting for the size you need. Fits all hand bit braces. Clean, fast, accurate boring action from ⅞" to 3"—35 standard hole sizes in all!

And what a really fine precision tool to own. It's drop-forged from special bit steel, heat treated full length, machined for accuracy and sharpness, highly polished, too. Two cutters supplied with each bit. Model No. 21 with ⅝" to 1¾" boring range also available. Ideal for home handyman, professional woodworker, or farm. See your independent hardware or building supply dealer soon.

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CAR CLINIC

(Continued from page 62)

Lewis. When a car has been kept in storage for an extended period, especially in areas subject to high humidity, disc-brake rotor corrosion is certain to occur.

The corrosion attacks those spots of the rotor which aren't protected from the elements. Ask your mechanic—I'll bet he'll tell you that areas in direct contact with pads were not affected. Anyway, the variation in thickness produces pulsation and brake roughness.

Rust might have worn away in about 100 miles of brake operation. However, in time, the once-rusted rotor surfaces would have tended to wear more rapidly than the areas which were protected from corrosion by pads. Eventually, this would have resulted in the rotor surfaces being thicker where they were protected by pads than in the once-rusted sections.

At this point, you would have had to have the rotors turned—brake pulsation would have been that bad. So it matters not that you had the rotors turned now. Sooner or later, you would have had to do it.

Elusive knock

I'm getting a pretty bad knock from the front end of my 1976 Capri when I travel the cold-heaved wavy roads in this area. There is no noise on smooth pavement. All elements of the suspension, exhaust and other underbody components are sound and tight. Do you have any idea what's causing the knock?—Bill Waterman, Oswego, N.Y.

Sure do. It's probably the less-than-adequate hydraulic valving inside the MacPherson strut (shock absorber unit). A new, stronger cartridge has been released. See your dealer about it under the terms of your warranty. Its part number is D6RY-18124-A.

Rodeo star

I own a 1972 Ford F100 pickup with standard steering system and drum brakes, which I purchased new. When the mileage hit 25,000 a serious problem began. Whenever the vehicle hits a bump, the front end starts shaking violently and the steering wheel vibrates from side to side.

I can't find evidence of wear or loose parts. My friend has the same problem with his '73 Ford truck. Any advice?—Thomas F. Jones, Jacksonville, Ariz.

The problem isn't uncommon with a Ford truck that has picked up mileage. There are four causes:

1. Steering gear out of adjustment. As time goes on, the manual steering box loses its proper mesh load and preload, thus requiring readjustment.

2. Worn-out strut-arm bushings. There is one set sandwiching each I-beam. As time goes on, these rubber pads get hard and can no longer dampen shock. The result could be uncontrollable shimmy.

3. Front end out of alignment. Reset toe-in to ⅛ inch.

4. Keeping worn-out tires in use or not equipping your truck with the right tire for the terrain. Read *Guide to Off-Road Rubber*, page 110, March 1977.

One of the biggest mistakes is trying to ride a truck over back alley roads on four-ply rated two-ply tires (load range A). Sidewall flexing can cause shake. In most cases, a *minimum* four-ply (load range B) tire is needed.

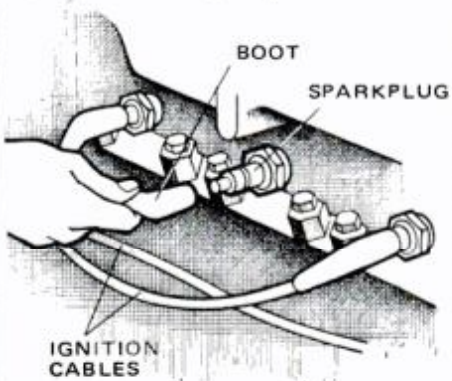
Pooped pump

I can't seem to keep accelerator pumps in the Holley four-barrel carburetor of my 1972 Chrysler, which has a 440-cu.-in. engine. Every 2000 miles, like clockwork, the engine redevelops a slight hesitation whenever demand is put on it. Only a new pump eliminates the lag for another 2000 miles. The pumps show no visible damage, and the carburetor is

They look tough, but . . .

PM CAR CARE tip

Here's a mistake made by those working on their cars that leads to an elusive engine miss. To get at sparkplugs, they grab high-tension cables and pull on them. This is enough to tear delicate wires inside the insulation apart. Next thing you know the engine is missing, and the driver wonders why. To properly remove a boot from a sparkplug, grab and twist the boot—never the wire. To be absolutely safe, buy sparkplug pliers for a couple of dollars. You just can't use them the wrong way.



clean and in good shape. No mechanic around here has a solution. Do you have one?—Edward Kennedy, Port Richey, Fla.

No. But neither does Chrysler. The company blames the "high percentage of aromatics in certain brands of gasoline" for causing the rubberized pump cups to swell. A new pump has not been developed for the Holley, although something may be in the works. Not long ago, a redesigned accelerator pump (part No. 4049179) was released for Carter two-barrel carburetors that are used on Chrysler Corp. 225 and 318-cu.-in. engines. They demonstrated a similar problem.

For the time being, the only advice a Chrysler spokesman could offer you is to "change your brand of gasoline."

SERVICE TIPS

■ Don't get confused concerning which sparkplug to install in your 1976-77 "small engine" GM car. The Oldsmobile Starfire, for example, can be equipped with the 231-cu.-in. V6 engine or a 140-cu.-in. two-barrel L4, which are the same engines used in Vega and Astre. The two engines take different plugs, and each has a different gap.

Plugs intended for the V6 are gapped at 0.060 in. Plugs for the L4 are gapped at 0.035 in. Woe is you if you mix them up. Check the emission decal in the engine compartment and, just to be safe, check the recommendations in the owners or service manual, too. Make sure the specs jibe.

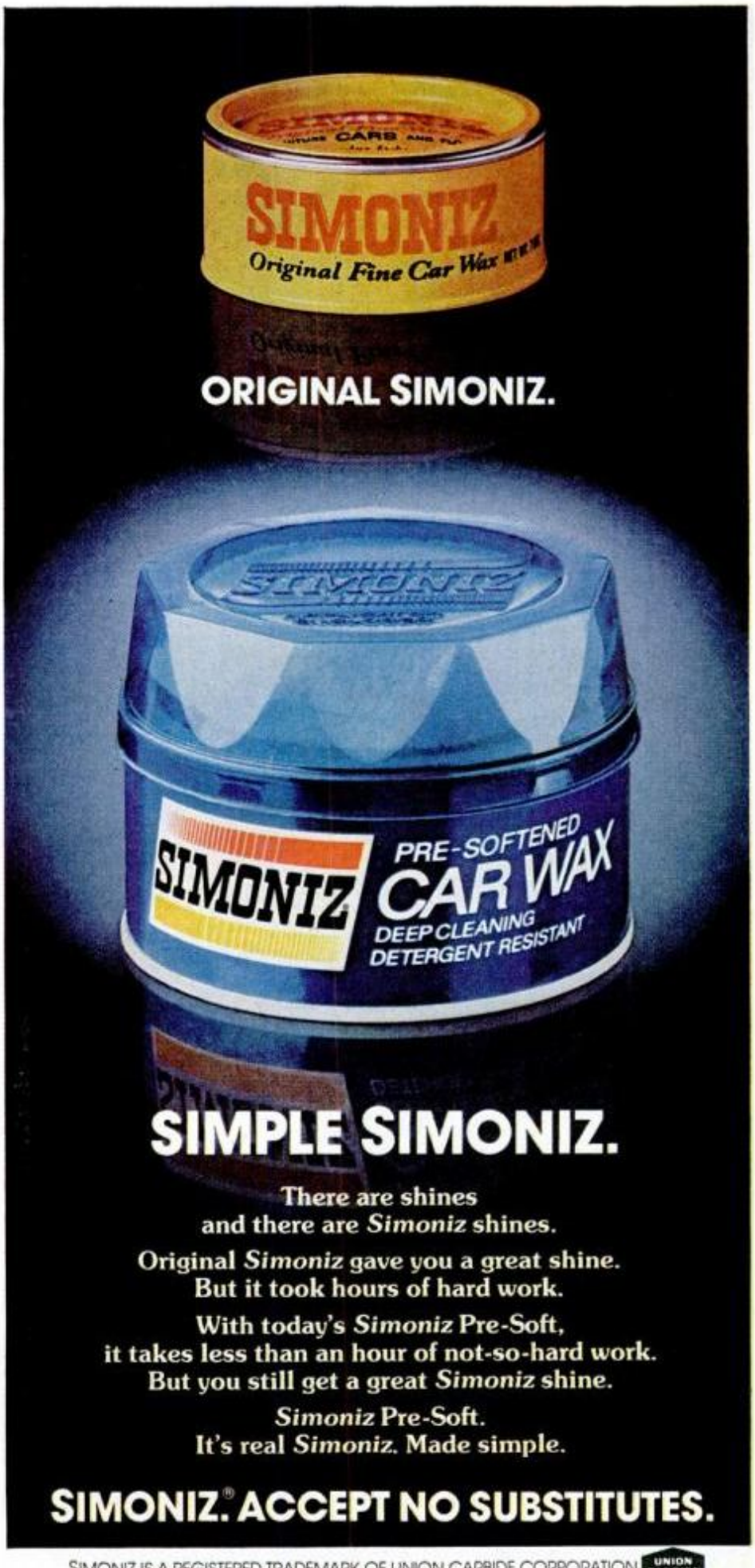
■ AMC wants you to cut out using greasy kid stuff (petroleum jelly, that is) on the wiring harness connectors of the BID ignition system. Only GE Silicone Di-electric Compound G623 is recommended. If you can't get it through your usual auto supply outlet, try an AMC dealer or GE service center.

■ If you are going to go from your place at sea level to a vacation spot at high altitude with your Ford, Mercury or Lincoln, the Ford Motor Co. recommends that once you get there you have the engine idle speed readjusted to specification. (That's good advice for any car owner.)

A car suddenly forced to operate at higher altitude with sea-level idle speed will be underpowered at idle, causing the engine to stall or lope. Resetting idle offsets the problem, but when you come back down to earth don't forget to adjust the idle speed again; otherwise, you'll be running too fast. ★★★

GOT A PROBLEM WITH YOUR CAR?

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



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*All exterior metal parts custom plated in 14k. Gold.

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Complete and give to your Yashica dealer.

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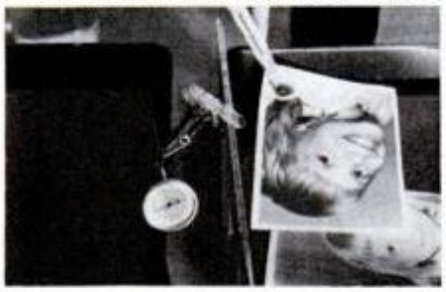
PHOTO HINTS

Clothespins tame thermometers



I find keeping tabs on the temperatures of photo solutions, especially developers, is necessary for top-notch prints. But a thermometer, loose in a tray, is a nuisance, especially when it takes a dunking and has to be fished out. Spring-type clothespins will keep either a glass or metal thermometer nestled snugly against the side of a tray. Because the solution temperature is only slightly different from room temperature, the immersion depth is not critical as long as the entire bulb of a glass thermometer or at least one inch of the stem of a dial thermometer is submerged.

—John F. Pilznienski

Tripod boom

My tripod boom simplifies two picture-taking situations: low-angle shots close to the ground and shooting straight down without including part of a tripod leg in the photo. The boom shown is 1x2 inch pine. The two camera mounts are 2-inch angle brackets covered with scrap leather to protect the finish on the camera base. The camera attaches to the brackets with a ¼x20 thumbscrew and wingnut. I used ¼x20 Teenuts for tripod sockets. Socket locations depend on the height and leg spread of your tripod. My boom has two sockets, one 11 inches and the other 20 inches from the camera-mounting end of the boom.

—Gary Cosand

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You like to get away from it all, right? To do your Truckin' far from interstates and expressways. Where you can exchange the trappings of civilization for trees and sand and water and sky.

Well, we're proposing a very special way to do that sort of thing. The K1500 4-wheel-drive Jimmy . . . a rather magic vehicle from GMC with a talent for taking on terrain that most things with wheels are hard-pressed to handle.

It starts out as a legitimate on/off road truck with an enclosed cargo area for stowing everything from pups to pup tents, kids to kayaks.

Where you take it from there is pretty much up to you.

The standard engine on Jimmy is a 250 CID in-line six. But there are other choices, all the way up to an available 400 CID 4-bbl. V-8.

Boondock Truckin'

The standard covering for Jimmy's cargo area is a removable fiberglass-reinforced roof section. But you can order an available soft top that quickly folds out of the way.

You can dress up your 4-wheel-drive Jimmy with a number of available wheels. Likewise, tires. Or with any of a number of available 2-tone paint schemes, complete with hood stripes and a stand-up hood ornament.

And if you want to take a little civilization with you when you leave it, you can order available amenities ranging from air conditioning to a stereo AM/FM radio and tape player.

GMC's 4-wheel-drive Jimmy. However you trick it up, it's a fundamentally tough and reliable vehicle. One built by people who've specialized in trucks for 75 years.

Here's what you should do. See a GMC dealer. He knows trucks the way we know trucks. Let him help you outfit a new Jimmy.

And then get Truckin'.

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GMC

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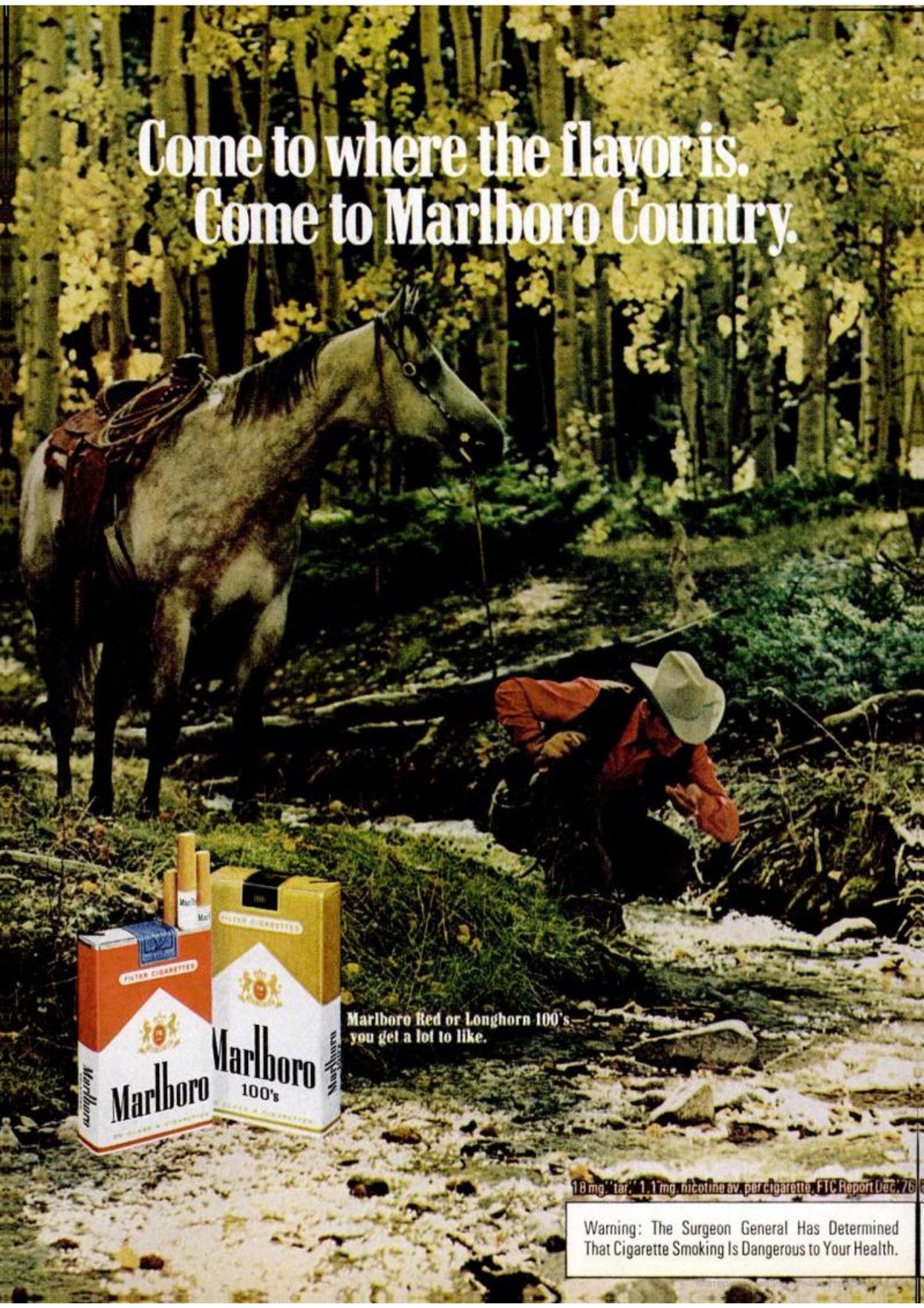
Come to where the flavor is. Come to Marlboro Country.



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18 mg. "tar," 1.1 mg. nicotine av. per cigarette, FTC Report Dec. '76

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

Popular Mechanics

The missing plane they had to find

When one of the Navy's new super-secret F-14 fighters plunged off the deck of a carrier last fall, a desperate salvage operation was launched to recover the sunken craft—before someone else did.

by Capt. Charles Barton, USN (Ret.)

It seemed like just another routine mission. The F-14 Tomcat fighter was taxiing slowly down the canted flight deck of the aircraft carrier *John F. Kennedy* toward takeoff position on the steam catapult. Suddenly there was a blast of jet power and the craft lurched forward out of control. Its canopy flew off and two seated figures

Badly battered, the errant F-14 is finally plucked from nearly 2000 feet of water after two months of search and recovery effort. At right is top-secret Phoenix missile, shown lying on sea floor after tearing loose from the aircraft. It was found by Navy's NR-1, first nuclear-powered deep-submergence vessel.

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The missing plane they had to find

Continued

Материал, защищенный авторск

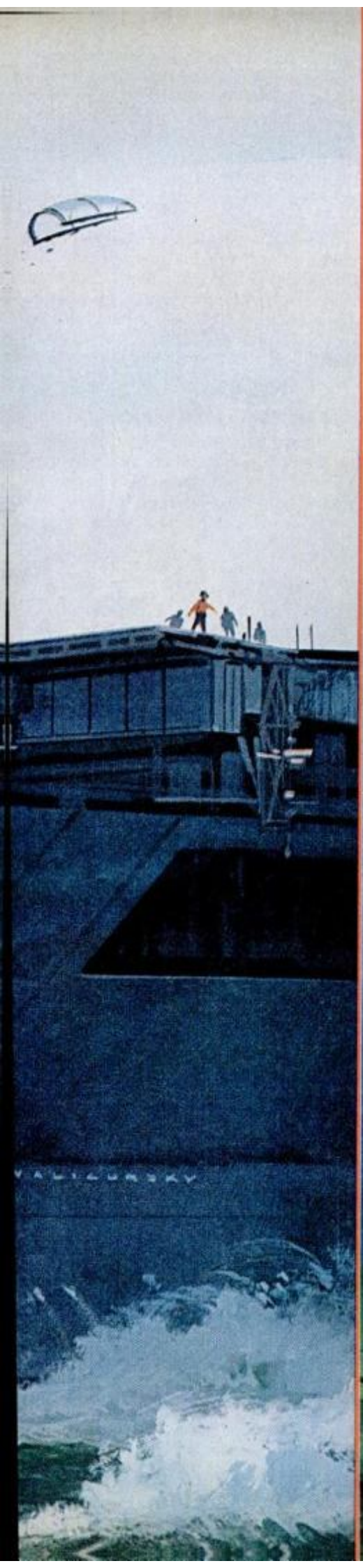
rocketed upward as the pilot and observer ejected. Then the aircraft plunged off the end of the deck into 1890 feet of water—in full view of nearby Soviet ships watching the naval exercises in the North Atlantic about 100 miles northwest of Scapa Flow, Scotland.

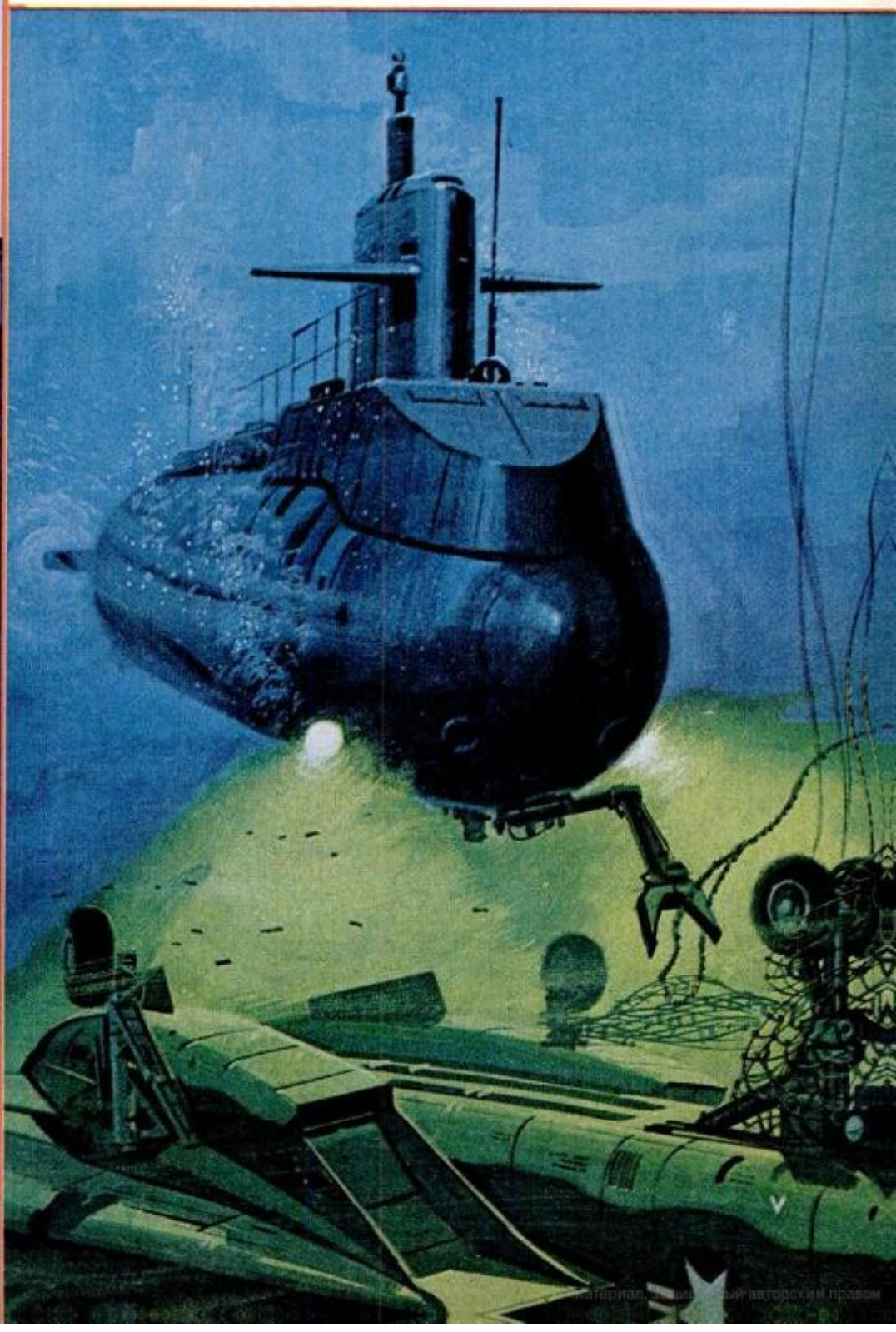
Two chutes blossomed and—miraculously—both crewmen landed back on the carrier deck, with some injuries, but alive.

The incident, last fall, instantly set off one of the most massive underwater search and recovery operations in history—an effort that was to take nearly two months, involve a task force of specialized salvage vessels, cost $2 million and produce a seemingly endless series of frustrations and failures.

Planes have rolled off carrier decks before, but this was a far more serious situation than any earlier

Crewmen eject safely just in time, in artist's rendering at left, as their F-14 jet hurtles off carrier flight deck in freak, still-unexplained accident. Below, Navy's nuclear-powered deep-submergence NR-1, first of its kind, uses a remotely controlled mechanical claw to put a lifting line around a main landing gear on the sunken F-14, found overturned in nearly 2000 feet of water. It took almost two months, working in savage North Atlantic weather, to raise the top-secret fighter and its Phoenix missile—a feat never before accomplished at such great depths and under such foul conditions.





The big drama was about to begin

mishap. There were vital reasons why the ill-fated F-14 *had* to be found.

As the Navy's newest, hottest supersonic jet interceptor, it was crammed with the latest in highly sophisticated, super-secret target-tracking and fire-control gear—just what any potential enemy would love to get his hands on. It was also carrying an equally top-secret Phoenix missile with advanced target-seeking guidance systems and the capability of being armed with a nuclear warhead. Moreover, with more and more of the new Grumman F-14s going into service—at $16 million apiece and with the lives of aircrews at stake—it was imperative that the malfunction causing the near-tragic accident be discovered and corrected before it could occur again.

With the *Kennedy* operating in international waters, the prize was up for grabs for anyone able to get to it first. Soviet ships were known to be in the area "shadowing" the fleet, and there was some speculation that the Russians might attempt to recover the sunken plane as a counter coup to the loss of one of their own Mig-25 Foxbat fighters that fell into U.S. hands after being flown to Japan by a defecting Russian pilot.

The race is on

It was Sept. 14, 1976. Within minutes of the sinking, the airwaves buzzed with the alarming news in a frantic attempt to mobilize an immediate search and recovery force—before anyone else did. Things began to happen in a rapid succession of events:

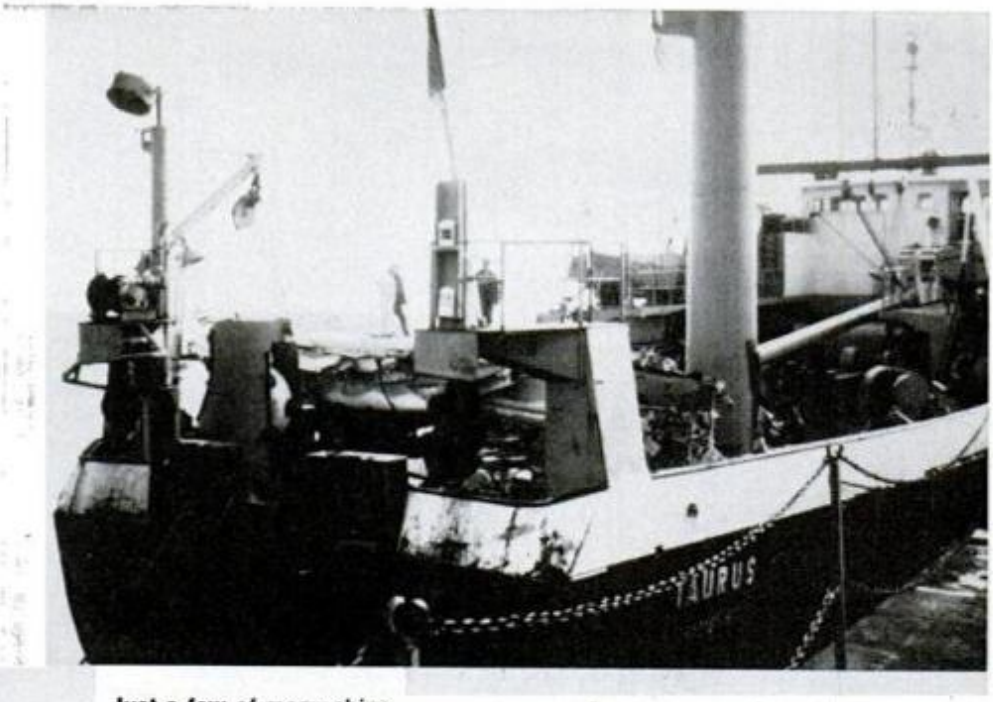
Capt. Robert B. Moss, USNR, director of Ocean Engineering and supervisor of salvage for the U.S. Navy, began assembling the necessary salvage crews and equipment. His deputy, Cmdr. William N. Klorig, USN, an engineer with diving and salvage experience, was designated project officer. The Navy's search contractor, Seaward, Inc. of Falls Church, Va., was alerted to prepare for the recovery job. Seaward, in turn, notified its subcontractor, Hydro Surveys of Fort Lauderdale, Fla., to get its side-scan sonar ready. Then Robert E. Kutzleb, vice-president of operations for Seaward, hopped a plane for London to help direct the recovery attempt—all within hours of the initial call for aid.

CURV III, an unmanned deep-water retrieval device, was airlifted from San Diego to be put aboard the *Constructor*, a Norwegian salvage vessel equipped with a center diving well or "moon pool" and controllable bow and side thrusters for maintaining a stationary position in heavy seas. The *Constructor* would later be joined by the *Oil Harrier*, a British work boat with exceptionally powerful winches and an unusual open stern well into which the aircraft could be pulled.

The USS *Shakori*, a rugged seagoing Navy tug skippered by Lt. Cmdr. David P. Sargent Jr., was loaded with sonar search gear and dispatched to the recovery area. It was Sept. 21—less than a week after the fateful plunge of the F-14. The big drama was about to begin.

Bad weather slows search

Aboard the *Shakori*, Kutzleb stood by the rail and noted the sky and sea. The weather was good. He hoped it would hold long enough to get the job done. It didn't. By the following day, the *Shakori* was running through rain and fog, winds of 15 to 20 knots and seas of 6 to 8 feet—



Just a few of many ships involved in the F-14 recovery are shown here. Above is West German salvage boat *Taurus* that made final, successful hoist after all other attempts failed. At left is heroic USS *Shakori*. First on the scene, she braved raging seas to spot the sunken aircraft, then stayed on to help throughout most of recovery job despite low supplies and exhausted crew. At right is *Oil Harrier*, British salvage ship with big winches, open stern well. Perhaps best fitted of all, she had to quit when lift lines broke.

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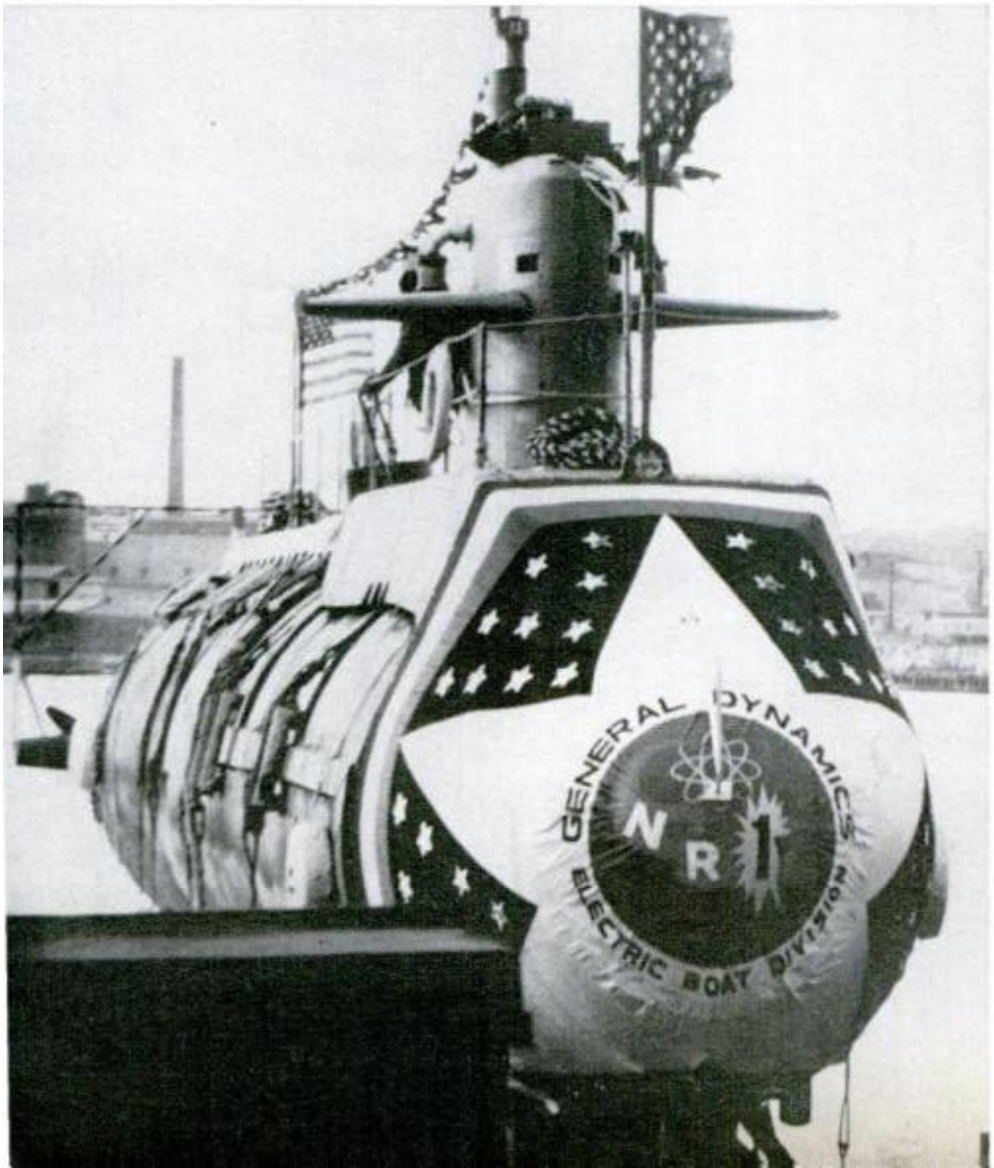
In dramatic mishap, somewhat similar to recent F-14 accident, an A-4E Skyhawk plunges off deck of carrier USS *Shangri-La* as brakes fail. Pilot (in circle) ejected safely.

First nuclear-powered deep-submergence research submarine, NR-1, is shown during 1969 launching at New London, Conn. Sub played big role in locating sunken F-14.



just a foretaste of what was to come.

Kutzleb was concerned: If the job didn't get done soon, it might not get done at all—winters in the North Atlantic are vicious. Arriving at the search area, the *Shakori* quickly marked off a four-mile-square grid centered on a navigational fix made by the *Kennedy* at the time of the sinking. Then she lowered her side-scanning sonar, a fish-shaped acoustic detection device towed close to the bottom on a long cable. The plan was to run back and forth across the grid in parallel tracks about 260 feet apart. The "fish" had a sounding range of 600 feet to either side so there would be plenty of overlap on each pass to avoid any chance of skips called "holidays." It seemed simple enough—the plane was down there and the fish would spot it.

Not simple at all

It was not simple. The weather was steadily worsening, with gale-force winds and pounding seas. Under such conditions, it was difficult to keep the *Shakori*, a single-screw, single-rudder ship, on a straight course. She sometimes had to "crab" into quartering winds to hold position, and there were problems of drift. In such deep waters, there was no assurance that the sonar fish strung out on 8000 to 9000 feet of line would follow the track. It might swing wildly from side to side, missing important search areas.

It took an hour and a half to complete a single pass across the grid, plus another hour to hour and a half at each end to turn the ship around in a long, wide arc to make sure the fish would be properly lined up astern for the next pass into the grid. To make matters worse, the navigational system went out several times at critical points, causing precious hours to be lost recalibrating instruments and attempting to get back on course. Kutzleb worried that holidays were getting in their sonar trace patterns.

Search crews, working 12-hour shifts and unable to eat and sleep properly because of the ship's violent pitching and rolling, were becoming sick and exhausted. A cook was severely burned when thrown against a steam kettle in a particularly savage lurch. Days passed slowly and painfully in deepening gloom.

Finally, a contact

It was now Oct. 2 and the *Shakori* had covered 90 percent of the supposed search area with no sign of the elusive F-14. People ashore were beginning to become restive, and

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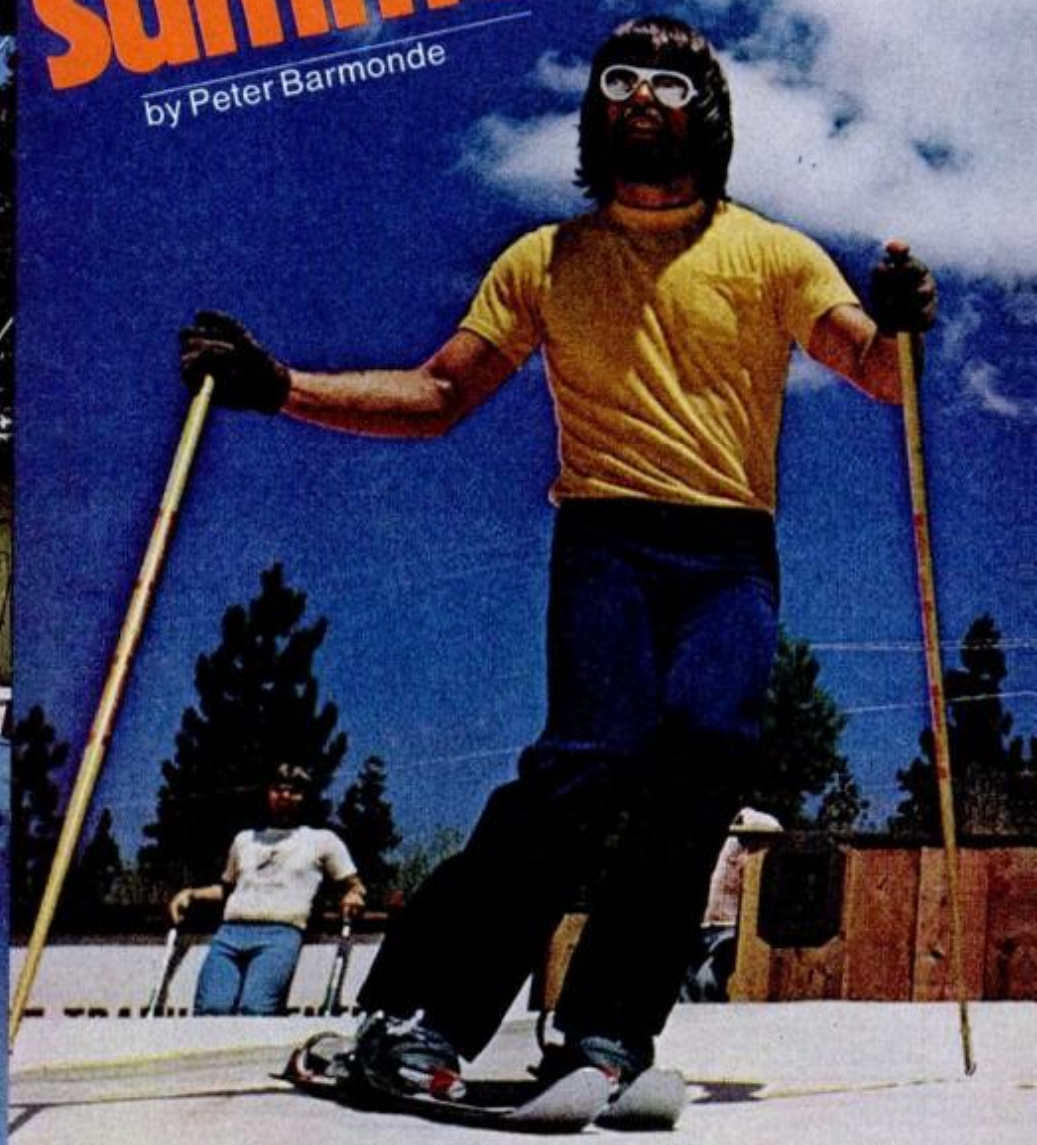
Материал, защищенный авторским правом

Spectacular midair action can be learned now in time for free-style acrobatics next winter.

Summer school

by Peter Barmonde



Professionals and purists insist the sport should be called freestyle skiing. But spectators call the game "hot-dogging."

Whatever it is—part downhill skiing, part ballet, part gymnastics—freestyle skiing is one of the newest, fastest-growing sports on the winter scene and is rapidly capturing the imagination of the skiing public.

The experts will even tell you that the activity is not a form of reckless endangerment, and that six months in traction is not a necessary part of learning mobius, lay-outs, helicopters, pikes and javelins.

Part of the game is staying in shape 12 months of the year—so it's off to summer school now for free-stylers. (Even nonhot-doggers and inexperienced skiers will gain by the summer training, its proponents claim.)

for hot-dog skiers

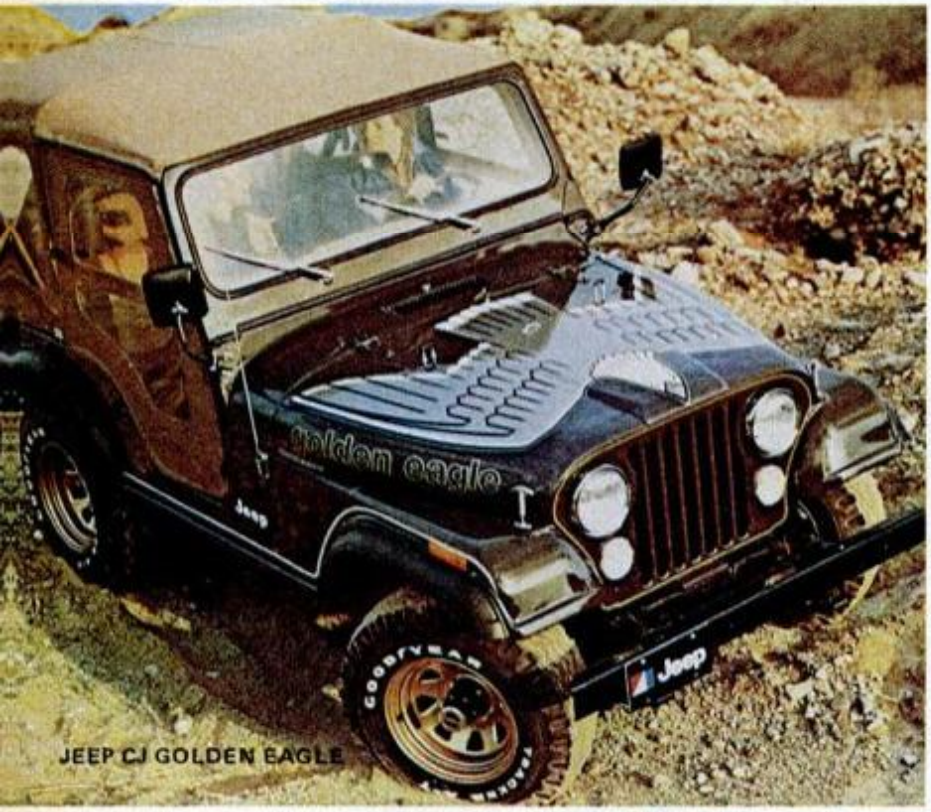
Bill O'Leary, founder of the World Freestyle Training Center at Heavenly Valley, South Lake Tahoe, Calif., also likes the term "creative" skiing, and views hot-dogging as a natural outgrowth for people who want more out of skiing than sliding downhill. Safety and control are the goals.

Ski decks and trampolines with safety belts are tools used in the training. George Hery, a former world trampoline champion, directs gymnastics. Students at the freestyle school practice tumbling and work out on trampolines while wearing skis. Each pupil must complete 50 tricks before he is allowed to attempt a flip. When he feels confident enough, he can progress into more complex maneuvers such as the mobius flip,

(Please turn to page 130)

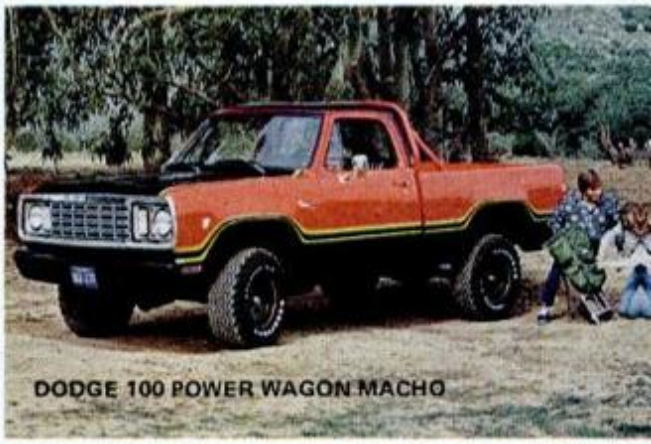
PM photos by the author

Flying high from a trampoline with or without a harness (far left) or skimming down a motorized ski deck to learn snow-slope ballet, you can start training right now to get into form for ski gymnastics next winter.



JEEP CJ GOLDEN EAGLE

FORD COURIER



DODGE 100 POWER WAGON MACHO

PLYMOUTH TRAIL DUSTER
4 x 4 MACHO

CHEVROLET BLAZER

New rigs for rough action

Now the off-roaders look as good at the country club as they do in the boondocks.

by Bill McKeown OUTDOORS EDITOR

Want a vehicle to handle big loads and chores during the week and then head for the hills for weekend fun? One with the looks to park in front of the country club and traction to tote you outback too?

The latest multiaction machines are at home on highways and have the optional inside padding, airconditioning and decor of standard passenger cars. Outside they can pass for a cross between a sports car and cargo wagon. And off-road, many now dig out on four-wheel drive and wide flotation tires. Owners claim they may be the best of both worlds on wheels.

The new RV truckers are a fussy crew. Corner a crowd of range men and ranchers, as we did recently, and you'll get wild arguments over an inch of added road clearance between transfer case and the crown of a rocky trail, or advantages of full-time four-wheeling versus getting out to engage front hubs. But there is no quarrel about the good looks and more comfortable cab arrangements of the latest models. Like driving with the top down? You can drive with it off in this league; convertibles have never threatened to fold up here and disappear.

More or less

Add-on accessories aren't necessary for the latest look this year, however. International Harvester has a new sports-utility Scout SS-II that comes without a top, side doors, passenger seats, carpeting, airconditioning or AM/FM stereo unless you want them. It does have a heavy-duty roll bar, front sway bar, power disc front brakes and skid plate for the 19-gallon fuel tank as standard equipment. Power steering, engine and axle-ratio choices, automatic transmission, front-mounted winch, six-way trailer wiring and white or black soft top and sides are among the options.

International also has a new "three-way convertible" pickup. (Who says convertibles are dead and pickups aren't hot?) Called the Suntanner and based on the Scout Terra, it's available with 4WD and a fiberglass hardtop, a soft vinyl top and matching tonneau to snap over the pickup bed—or drive with both off for really fresh-air trucking in an open-top runabout. Base prices for Scouts will start under $5000, and a couple thousand dollars' worth of options are available. For diesel models, you add about $2650 for the engine and its four-speed transmission, larger battery, two-speed transfer case and tilt steering wheel. You may also add

(Please turn to page 167)

A colorful collection of bodies is now mounted on four-wheel drives. In addition to models at left, an off-roader can pick the AMC Jeep Golden Eagle J-10 pickup (at top) with special hood decal, grille guard and roll bar. Only convertible pickup truck made, the IH Suntanner Scout Terra (center) can unsnap the tonneau that covers spare tire and pickup bed, remove the separate matching white vinyl top, and drive as a wide open rig. Or a fiberglass cab enclosure can make it a hardtop pickup. This year's Internationals have Family Cruiser, Street Machine and Off-Road Vehicle (ORV) options. Ford Bronco (at bottom above) offers special colors, styling and top options.

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All electronic roads lead to IC heart (upper center) of Texas Instruments module.

Get the beat from Timeband (left) five-function LED digital wristwatch with IC brain.

Throw-away digitals you'll want to keep

Priced under $20, mass-produced watches in plastic cases are here to stay.

by Gerald R. Patton

I spotted a sexy all-black digital wristwatch the other day and fell in love with it. It told time in red light-emitting diodes (LEDs): the hour, minutes, seconds, month and day. How much? $300? $75? No, a flat $15.95. And the deal was aboveboard, on the table in full view of other customers who were buying similar timepieces.

If you guessed $300, you're three years behind the times. And $75 was last year's price. The current crop of high-style men's, ladies' and kids' digital watches is on the market for under $20.

It's easy to get behind on watch prices the way they have been sliding down scale lately. It's only a few years since the first LED watches appeared in fine jewelry stores priced in the $300 range. You could push a button and get the time to the second with quartz-crystal accuracy. That price was too high for most of us, but it brought public attention to the advantages (and disadvantages) of digital watches.

Today's $20 watches tell you not only the time to the second, but also the date. Some even display the day of the week. What made it all possible? Vast public acceptance leading to mass production of integrated circuits (ICs), and the development of plastic cases account for most of the answer.

Command button

Some people used to be convinced that watches using LEDs and requiring the use of a "command" button to turn on the display would not sell to the general public. Who would want a watch that needed one of your hands to produce the time? As it turned out, many people wanted one.

Electronic digital watches have no moving parts to wear out or need adjustment. They are easy to set since the hour can be changed without affecting minutes and seconds. Accuracy is assured through the use of a quartz-crystal time-base, vibrating at the rate of 32,768 times per second. The LED display is ideal for viewing at night.

These are the practical reasons for the initial acceptance of such watches, but a big psychological factor is simply our never-ending fascination with electronic gadgets that do *something*, obediently, upon our command. They do *something* so well and so accurately that their success was inevitable.

Anyone who paid $150 a couple of years ago for a four-function calculator and now finds more capabilities nested in store calculator displays at $15 can see a parallel with digital watches. Some 50 million watches were sold in the United States during 1976. More than 20 percent of them were digital. Texas Instruments, a major producer, projects that 30 percent of the watches sold in 1977 will be digital. That will increase to 75 percent by 1980.

LED vs. LCD

There are two types of digital watches. The distinguishing feature is the display type used: LEDs and LCDs (liquid crystal display).

LEDs produce light and are

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Six functions, automatic brightness come with Avatar watch (below) by Litronix.

Standby current drain from batteries in TI watch (left) is only 5.5 millionths amp.

Time flies with Eagle for kids from Texas Instruments (left). Available with other patterns, too.

Ladies' choice from Texas Instruments (right) uses smaller batteries than men's.

Watch where you are going with Exelar (below) by National Semiconductor.

easily seen in the dark, but need so much power that using them for a constant display is impractical. Thus the command button that activates the display only when you want the time.

LCDs do not produce their own light. Instead they reflect ambient light. The digits aren't visible in darkness, but the display requires very little power and gives a constant readout. Microma, which makes the Synchroquartz LCD series of watches, says the power required to light a 100-watt bulb for one minute would power its IC chip and display for over 100 years. Such watches have a tiny built-in night light for use in the dark.

Texas Instruments, a maker of semiconductor IC chips for calculators, watches, computers and other solid-state products, is producing many styles of inexpensive watches for men and women. It even has a special youth model that comes with 24 self-stick decals to personalize the watch. Recent advances in IC technology have extended the battery life in the TI men's LED model from an average of nine months to nearly 15 months. A good feature of TI watches is that the display flashes if the watch is left inadvertently in the "set" mode. It can help avoid a dead battery.

Smaller batteries

Women's LED models are smaller, use batteries with about one-third the capacity of those in the men's versions. However, makers often include an extra set of batteries.

The Litronix Avatar digital watch series features automatic control of the brightness of its LED displays. This offers maximum brightness when needed for viewing in sunlight and reduces glare and power consumption when the display is turned on in a dark environment. The Avatar watches offer six functions by displaying hours, minutes, seconds, date (month and day), and day of the week. A commendable addition to the Avatar owner's manual is a list of radio frequencies and locations of time-broadcasting stations such as WWV in Colorado, WWVH in Hawaii, and CHU in Ottawa, Ont.

Battery hatch

A pop-out battery hatch that can be opened without tools to change the battery is a feature of the Timeband by Fairchild Camera and Instrument Corp. It also has an automatic calendar that remembers the number of days in each month and needs correction only in leap year.

The Exelar model by National

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HOW THEY STAGE THE SNEAKIEST OF THE SNEAK PREVIEWS

by Robert Lund
DETROIT AUTO EDITOR

It's six o'clock in the morning and a gang of guys obviously up to no good are stripping down a truck-trailer combination in an alley two blocks south of the General Motors Building in midtown Detroit. The truck was a Chevrolet or GMC when the strippers started. But all outward identification has been removed and it's tough to tell the make after the working over. The strippers have even switched license plates.

If your first reaction to this scene is to find a phone to call the cops, hold up for a minute. Watch the gang work and you'll realize there's something wrong with the setup.

While it's obvious the strippers are pros and they are trying to disguise the truck-trailer, there is something unthief-like in the way they go about it. No furtive glances over the shoulder, no panic to get the job done. They are casual, methodical, deliberate.

Car identities are shielded

So what's going on?

The hanky-panky in the alley is part of the preparation for the first public showing of a car Chevrolet will bring out three or four years from now.

Later in the day, the trailer—possibly more than one trailer—will be loaded with a fleet of cars, one of which will be the new car. The others—five, six, maybe as many as eight cars—will be current models, GM makes and cars of rival manufacturers. All will have gone through the same identification strip-down the truck-trailer was put through.

The cars will be transported to a secret location outside Detroit where they will be shown to a carefully screened audience of a few hundred motorists. The car owners will be asked to vote on what they like/dislike about the cars. Not just the new car, but the whole fleet. The new car will not be singled out in any way to distinguish it from the other vehicles and the "jury" will not know the name of the company sponsoring the showing.

So why the cloak-and-dagger with the transport truck? If you roll up to an auditorium with a moving van stacked with shiny automobiles and the truck or trailer has the name of a particular auto company written all over it, it's fair to assume that company is sponsoring the show. But the purpose of this particular show is to get an unbiased reaction to the new car. If some eagle-eye spots the company name on the truck and happens to be pro GM cars, he just might shade his opinion to favor GM. And vice versa.

In some situations the auto firms won't even use their own trucks to haul the cars; they contract the job out to a moving company. Or they will use their own trucks to get within 50 or 100 miles of the site of the showing and then arrange for a local mover to complete the trip.

Showings like spy thrillers

The cat-and-mouse game with the truck is only a footnote to an elaborately plotted script Detroit uses to pre-test public acceptance of new cars before putting them in production. The secret showings are known as product clinics. They take some curious twists and turns and have all the ingredients of a spy thriller.

Rule No. 1 in conducting a product clinic is that you never hold it in Detroit, or even Michigan. "Detroit is a biased town," says Leonard J. Piconke, director of marketing for Chrysler's North American Automotive Group. "You can't get an objective reading." If you dig deep enough, everybody in Car City knows somebody who has a connection with the auto industry: a brother, a cousin, a friend who works for an auto company, a dealership, a supplier, an ad agency handling an automotive account.

New York is another place to avoid. It's too crowded, many New Yorkers don't own cars and the logistics of setting up a show in New York involves too many outsiders who could let the cat out of the bag.

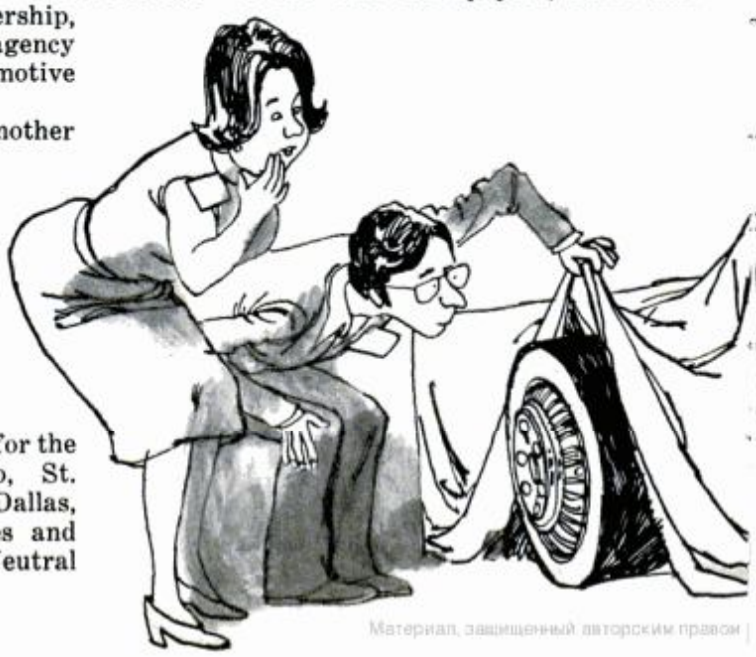
Favorite locations for the clinics are Chicago, St. Louis, Kansas City, Dallas, Atlanta, Los Angeles and San Francisco—"Neutral places," as Piconke describes them. Big cities are favored over small or medium towns because it's important to be in an area that has a large car population to get a wide cross section of car owners. Usually there's enough action going on so the shows don't attract the attention they would in a small town, and big cities have the necessary facilities—convention halls or sports arenas—to house an auto show.

The auto manufacturer decides where and when the clinic will be held, but the companies frequently hire outside firms to do the follow-up work and make the arrangements with the owner of the hall to protect the identity of the carmaker.

Chevrolet prefers to handle the whole operation with its own people. While it has one of the most experienced crews in the business for putting on a product clinic, the company still runs into situations that cause Chevy execs to splash tears on their custom-made double-knits.

The cars will be transported to a secret location outside Detroit where they will be shown to a carefully screened audience of a few hundred motorists.

Last fall, for example, after weeks of undercover work preparing for a show, the staff arrived at the show site to find a banner across the front of the building: "Welcome to the new car presentation." The owner of the building was so pleased at signing Chevrolet as a customer that he had the banner made at his own expense. To top it off, he sent out invitations to the local newspapers, radio and



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TV stations to cover the show as a news event.

Chevrolet bit the bullet, cancelling the show at that location, and scurried around to find another hall in the vicinity. The show came off as scheduled, but somewhat over budget.

Picking 'bait' cars is tricky

After a site has been picked, the next step is to work up a list of "bait" cars to show with the new car. This is a tricky proposition. The "old" cars have to be as close as possible to the new car in size, weight, body style, appearance and equipment. If the new car is too different, it stands out and gives the game away.

If the new car is a two-door coupe, for instance, the "old" cars should also be two-door coupes. Obviously, you don't sneak a Lincoln in with the bait cars if the prototype is a Pinto or Maverick. One way of disguising the new car is to paint all the cars the same color. Ford did this at a show a few years ago, painting each car an undistinguished brown.

If the new car is three or four years away from production, it will be in clay. This complicates matters. For one thing, car owners attending the showing can't touch the clay. So the cars have to be roped off—not just the clay, but all the cars.

In addition to having a different feel to it, a clay car has a different look from a production car in metal. A clay car can be made to look like a production car, but it's a long process and it's easier to work the other way around—make the production cars look like clay cars.

The competitor cars to be shown with the prototype are purchased through dealers, usually in Detroit, rather than in the city where the clinic is held. Automakers are always buying each other's cars for test purposes in Detroit and the purchases don't attract attention, as they would if GM or Ford bought a batch of Chrysler cars in St. Louis or Los Angeles.

If the new car is three or four years away from production, it will be in clay. This complicates matters. For one thing, car owners attending the showing can't touch the clay.

While the cars are being stripped down and worked over, another department prepares a list of car owners to invite to the showing. The auto firm usually leaves this job to an outside company.

The car manufacturer supplies a profile of the type of owner he wants —age, education, married or single, number of children, income bracket, type of car he/she drives, price of car, age of car, what it's used for and so on. The market research company then buys a list of names of owners fitting the general description and puts the list through a screening process. The original list can run to as many as 25,000 to 30,000 names. After the weeding out, the final list will narrow down to 500 to 700 names.

Screening names to get the right mix for an audience is no simple shuffle of cards. One factor must dovetail with many others. Let's say the concept car is a mini GM plans to bring out in 1981. This presents a problem right off the bat because there are no competing cars—at least none GM can get its hands on—to show for purposes of comparison. The invitation list will have to be made up of owners of small cars on the market now.

Through a process of elimination, the market researcher reduces the raw list of 25,000 names to 10,000. This process is repeated again and again and again, depending on the qualifiers stipulated by GM.

Qualifier: GM wants the final list to have 500 names. Breakdown: 100 owners of GM cars, 100 owners of Ford makes, 100 Chrysler makes, 100 from American Motors, 60 owners of Japanese makes, 40 owners of VWs.

Qualifier: GM views the concept car as a second car, so all persons listed must own at least two cars.

Qualifier: GM sees the concept car as having greater appeal to women than to men, so it wants to invite 60 women for every 40 men.

Qualifier: The women must be of child-bearing age (in 1981, when the car will come out), live at least three miles from a shopping center and can't have received a speeding ticket for three years.

The list of qualifiers goes on and on. No wives or husbands of reporters, no spouses of automobile dealers or people associated with the car business, no heavy boozers, nobody who owns a motorcycle, nobody who has had a relative killed in an automobile accident, nobody who works during the hours when the clinic will be held.

Some of this information can be obtained from public records, some

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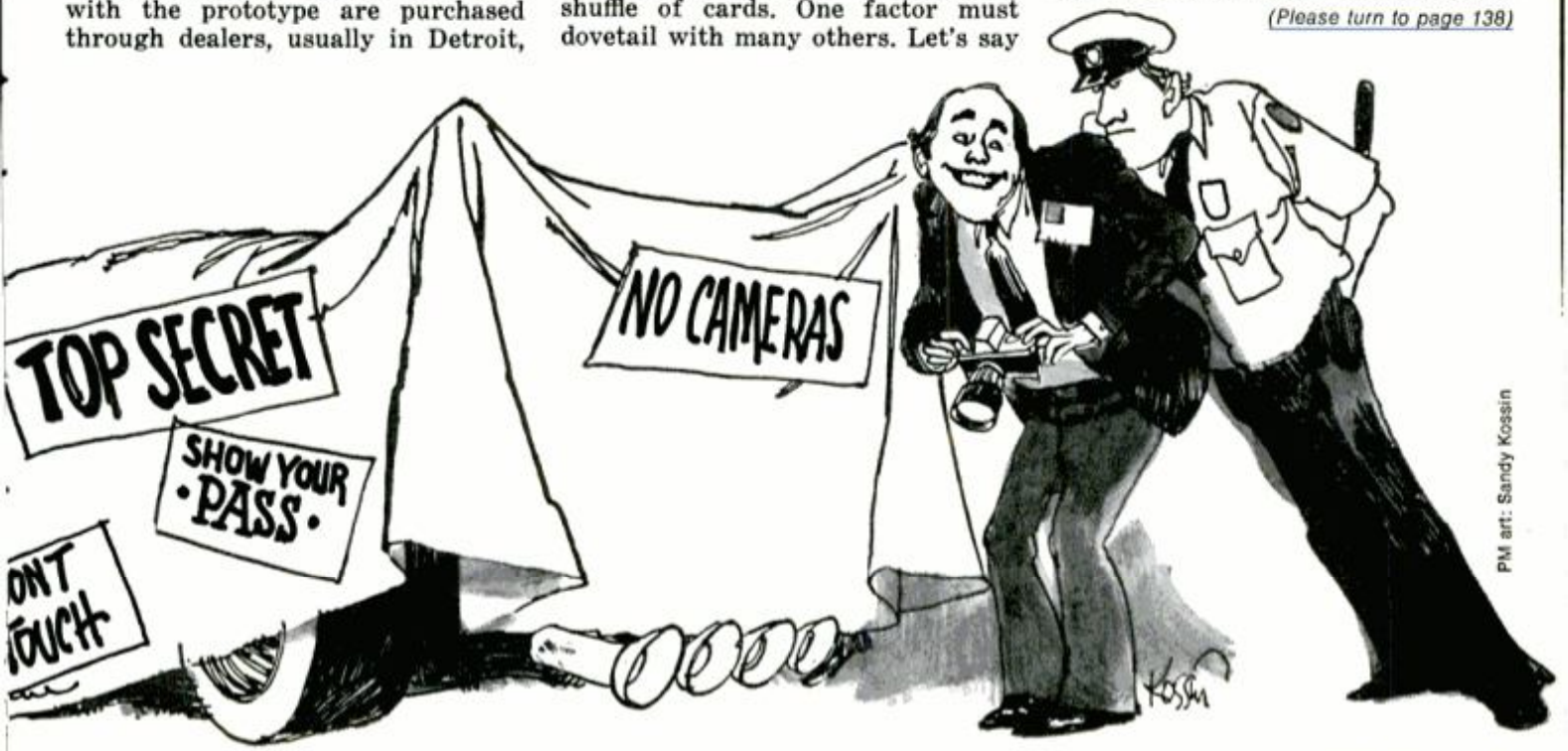

PM art: Sandy Kossin

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40-CHANNEL CB: PM TAKES A LOOK AT THE NEW SETS

Finally you can get on the Upper 17. Here's what we found after trying nine top-quality 40-channel rigs.

by Anthony R. Curtis
ELECTRONICS EDITOR

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PM photo: Benn Mitchell

If you're going nuts with the heavy radio traffic on the Lower 23, you'll be happy to know the big wave of 40-channel CBs has arrived. Now you can leave the madding crowd and scoot on up into the Upper 17 where peace and quiet will reign for at least a year or two.

The 40-channel radios don't look much different from 23s, but they sound a whale of a lot better. Uncle Charley forced manufacturers to design better receiver sections into their transceivers. New radios will not interfere with other radio services now, and they will not be interfered with as easily, either. Even down on the crowded Lower 23, bleed-over from sets operated by your neighbors won't be as bad. The sets are more selective and they let you hear weaker signals.

Transmitters in the new rigs will cause less television interference (TVI) and give your voice a better sound.

CB radios come in a wide range of prices. The more features built into a radio, the more it costs. Special sets—for in-dash mounting or base stations with SSB—cost more than underdash transceivers.

Here's a rundown on nine of the best sets available now. First, the conventional under-dash mobile rigs:

Motorola Mocat 40

The grand old pioneer of American two-way radio, Motorola, has updated its rugged Mocat to 40 channels. As in all the radios we tested, channels are controlled by a phase-lock-loop (PLL) synthesizer rather than individual crystals. The PLL is a tiny solid-state circuit to keep you locked exactly on channel at all times.

The Motorola Model 4005 ($209) has a sensitive receiver, power-microphone circuit built right into the radio, a lighted power meter, and two noise killers. It has both a noise limiter and a noise blanker to cut out static and other annoying radio sounds from nonhuman sources.

Radio Shack TRC-452

The Realistic TRC-452 should be one of the most popular 40-channel sets. It's readily available at more than 5000 Radio Shack stores in North America at an easy $139.

The TRC-452 has an RF gain control which usually would be cranked wide open, but can be used to cut back receiver sensitivity when your neighbor's CB transmitter overloads your set. Reducing RF gain can cut down unpleasant sounds from a nearby transmitter on an adjacent channel while permitting you to hear a distant station on your channel.

The Realistic will work in any 12-volt d.c. car or boat with either positive or negative ground.

Pearce-Simpson Lion 40

The Lion 40 from Gladding Corp. adds digital channel numbers in large red LED (light-emitting diode) readouts.

You'll be protected from older CB transmitters with the Lion. Old sets, controlled by crystals, can drift off channel and sound distorted to a listener. The Lion has a front-panel control so you can slide your receiver off channel to clarify a bad-sounding signal.

The Lion 40 ($249) has a receiver audio tone control so you can add bass or treble to your friends' voices.

Superscope CB-640

The sexiest rig of the lot, to my taste, is Superscope's CB-640, housed in an all-black cabinet which is offset nicely by a red digital-LED channel readout and a red-line LED power meter.

The LED meter display is a fas-

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cinating replacement for the old-style needle-pointer meter. Red LEDs light up from left to right like a bar graph, showing incoming signal strength, your power output, your modulation and the SWR of your antenna. The tiny lights are eye-catching as they race back and forth in a row across the front panel of the CB-640 ($229).

In addition, the CB-640 has a built-in scanner with beeping sounder which alerts, no matter what other channel you are using, when a signal comes in on emergency channel 9.

You can play music from your tape recorder through an auxiliary input jack on the CB-640, which also feeds a public-address (PA) speaker if you want.

Johnson Messenger 4175

E. F. Johnson has built a lot of goodies, such as LED bar-graph meter, digital channel readout, RF gain control, and noise limiter and noise blanker, into its 4175 ($249).

A photocell, hidden behind the LED channel readout, automatically dims the digital display for nighttime viewing.

A built-in speech compressor punches up your voice to extend transmitter range.

Panasonic CR-B4747

Underdash mobile radios such as those mentioned so far are most popular, but theft is a problem. More security comes with a rig hidden away inside your car's dashboard.

Pull the AM music radio out of the dash of your car and slide in the Panasonic CR-B4747 ($299). It is a direct replacement for your underdash set and includes all the best CB transceiver features like digital LED channel readout and a power meter. And it gives AM and FM-stereo music as well.

Along with hiding a radio inside the dashboard, a mobile CB can be tucked away in the trunk. Remote controls mounted inside the microphone allow you to operate the set from the car cockpit.

Clarion Mike System

Clarion Corp. puts all controls in your hand and the bulk of the transceiver in the car trunk. In-hand will be a one-finger channel changer, big LED channel readout, volume control, squelch control, power on-off switch as well as the usual push-to-talk button.

Besides being installed in the trunk, the Mike System ($229) can be bolted to the firewall or hidden under a car seat.

The Mike System has a standby control permitting you to listen to

Beeps from Superscope CB-640 tell of emergency signals coming in on channel 9 even as you use different channel. Row lights replace the meter.

Roar with Pearce-Simpson Lion 40 from Gladding Corp. Built-in SWR meter checks antenna system efficiency and power output.

Blank out extreme static with the topnotch noise killers in two big-name 40-channel CBs: Motorola Model 4005 (right) and E.F. Johnson Messenger 4175 (above).

Boatmen on channel 13, the favorite marine CB channel, can switch Radio Shack's Model TRC-452 easily from waterway to roadway.

Super secret CB is Panasonic Model CR-B4747 in-dash rig covering 40 channels plus AM and FM-stereo music with digital readout and built-in power meter.

Remote-control CBs have channel changer, readout, power switch, volume and squelch controls and push-to-talk button, all in microphone. SBE Touch-Com 40 (below) has attractive main radio to hang under dash. Clarion Mike System (left) uses utilitarian styling for hiding in automobile trunk.

Beautiful base station radio is Cobra Model 139 XLR with built-in meters, common AM modulation or SSB for long-range solid contacts. Base runs on 120-volt a.c. house current or 12-volt d.c. car system.

music from your AM-FM car radio. It automatically switches the loudspeakers to CB audio when a signal is on a channel you are monitoring.

SBE Touch-Com 40

SBE has all controls in the microphone of the Touch-Com 40, including LED channel readout. The set has an attractively styled cabinet around the main portion of the transceiver. Unlike the Clarion Mike System, which has utilitarian styling for the mount-in-the-trunk unit, Touch-Com 40 ($259) can be slung under your car dash just like a conventional mobile radio. It still gives ease of operation with all controls switched from the microphone.

Not all CBs have to be used in a car. Base-station units have all the conveniences of mobile radios and often more. They are designed to be powered from 120-volt a.c. house electricity.

Cobra 139 XLR

The Cobra 139 XLR is packaged for an active operator and for his family as well. The case has the first-class look of walnut with black front panel, two meters and LED channel readout.

While it is handsome enough to be set up as a base station in your family room, it is strong enough to work long distances. This 40-channel CB transmits single-sideband (SSB) as well as the AM kind of modulation found in more conventional CB rigs. SSB, which carries farther with less noise and interference, is the wave of the future in shortwave two-way radios like CB gear.

The 139 XLR ($449) contains a power mike, RF gain control, SWR meter and a control for tuning in other operators who may be transmitting off channel.

Since regular AM sets transmit on both sidebands of a CB channel while SSB rigs allow you to select use of either the upper or lower half of a channel, you get the effect of twice as many channels. Where an AM type of CB radio has 40 channels, an SSB set has 80 channels.

A Motorola base-station converter ($44) is a convenient means of turning your Mocat mobile radio into a home unit operating from 120-volt a.c. electricity. The Mocat 40 slips down into the converter providing a complete station not much larger than most mobile rigs alone.

Don't worry about 40 channels jacking up the cost of CB. Radio Shack and other manufacturers already are out with under-$100 sets. The Realistic TRC-468, at $99, covers all 40 channels with PLL and a noise limiter. ★★★

A PM reporter goes on a teeth-jarring ride in one of the strangest, quaintest car rallies ever held—England's annual Brighton Run. In the 58-mile "race" no entry can be newer than a 1904 model.

Sputtering run to

by J. A. Maxtone Graham

Prince of Wales (in cap at right), later to become King Edward VII of England, rides in 1899 Daimler in early 1900 Brighton Run. His driver, Hon. Scott-Montagu, was father of Edward Lord Montagu who drove PM's reporter in the *same car* in last year's rally. Typical entries in today's events are 1901 Locomobile Steamer Runabout (above) and 1902 Beaufort Phaeton (on facing page).

Putting on a quick burst of speed—all of maybe 12 mph—a 1903 Gladiator (right, below) passes a 1900 Cudell De Dion (left) on the road to Brighton. Leaning into it, the driver of a 1901 MORS (right) uses body English to urge his ancient steed up a challenging—almost flat—grade along the "treacherous" course.

Brighton

I treasure a stiffly posed photograph dated August 1900. It shows the Prince of Wales, aging a little at 58 and later to be King Edward VII, sitting, somewhat self-consciously, high up on the front passenger seat of a 12-hp Daimler motor car. His tweed-suited figure seems poised nervously atop the strange machine, as though this king-to-be, for all his royal eminence, is uncertain if the motor car (or horseless carriage) is a giant step forward for mankind—or just a passing fad.

The fad seems to have caught on, and 76 years later I was delighted to climb up into that very same seat, in tweeds, to set off on a journey from London all the 58 miles south to Brighton and the seaside. The 1899 Daimler, registration plate number AA 16, was as fit for the trip as it had ever been, and was driven by Edward Lord Montagu, son of the man who was photographed next to the Prince over three-quarters of a century before.

Bone-shaking adventure

We were taking part in the annual Brighton Veteran Car Run, and although no form of racing was involved, I found the day yielded by far the most exciting, rewarding and colorful trip I have ever taken.

The event is held each year on the first Sunday of November. From Hyde Park, there depart—with various amounts of chugging, spluttering, banging, smoking and steaming—nearly 300 veteran road vehicles: They must have been made no later than 1904 to qualify for entry. Some

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three hours later, the first cars will have crossed the finish line on the sea front at Brighton—with the late stragglers arriving around teatime with terrible tales of faulty magnetos and leaking radiators. What with the huge crowds at sunrise in the park, the thousands of cars following the procession nose-to-tail along the road, and the cheering spectators throughout Brighton, some two million people watch the Brighton Run each year, making it the most thoroughly observed of all one-day annual events in Britain—and possibly the world.

But why choose November, of all months? And why Brighton? Like many delightful old British customs, this is one that goes back longer than a lifetime.

Traveling almost as fast as a horse

The first two petrol cars ran on British roads in 1894. By the following year, there were perhaps 20, including a few powered by steam and electricity. By the end of the last century, the number might have risen to 800 or so—compared with about 5000 in neighboring France. The huge difference—which, incidentally, seriously hampered the birth of the British car industry—was caused by the infamous "Locomotives on Highways Act" of 1865, which laid down a 4-mph speed limit and stipulated that every such vehicle must be preceded by a man on foot carrying a red flag.

At least one motorist got around the law by employing a boy to ride ahead on a bicycle and signal the appearance of a policeman—at which point another boy would leap from the car and stroll the regulation 20 paces in front carrying a couple of square inches of red material on a pencil. While thousands of French, German and other drivers were whizzing along at unimaginable speeds—almost as fast as horses could go—resolute British enthusiasts were restricted to the speed of a fairly slow pedestrian. Then, in 1896, Parliament reluctantly passed the "Light (Road) Locomotives Act" that allowed self-propelled vehicles to go up to 12 mph and to dispense with the advance footman.

Chugging triumphantly across finish line are two 1903 De Dions (below), cheered on by hundreds of spectators in galleries along Brighton's seaside resort. Annual event draws entrants from all over the world, including elderly Cadillac from California (at top) and two Danish riders (lower right). Above is shown one of first "home-on-wheels"—father, mother and child contentedly riding in "family" car.

The new Act became law on Nov. 14, 1896, and England's few but enthusiastic motorists decided to celebrate the day. There was a ceremonial tearing up of a red flag, and of the 40 or so vehicles that turned out for the event about 14 actually chugged their way to Brighton to arrive that very same day. Unfortunately, the official timekeeper's vehicle broke down and exact details are not known, but at least one electric car, renowned for its short range, was alleged to have been carried much of the distance by rail, then camouflaged with road mud shortly before arrival.

Disqualified for going over 20 mph

The day saw the beginning of the healthy disregard for regulations that British drivers have followed ever since—for although the new Act forbade speeds over 12 mph, the first arrival at Brighton managed to *average* 15. But in the modern Veteran Car Run, a driver can be disqualified if he averages more than 20 mph—the maximum speed permitted under the "Motor Car Act" of 1903.

The next few years saw new reenactments of the "Emancipation Run," then the event fizzled out until it was revived in 1927 to become known familiarly as "The Old Crocks' Race." That was all a bit of a joke, with the cars painted garishly to

(Please turn to page 146)

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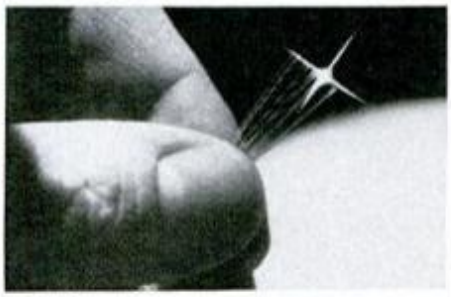
IT'S NEW NOW

Pushbutton phone for anyone

Anyone with phone service can convert to pushbutton from rotary dialing with a new button phone that works on any rotary or Touch-Tone line. Unit also remembers last number called and redials it automatically if switch is thrown. About $100. Communications Electronics, 2311 East South St., Orlando, Fla. 32803.

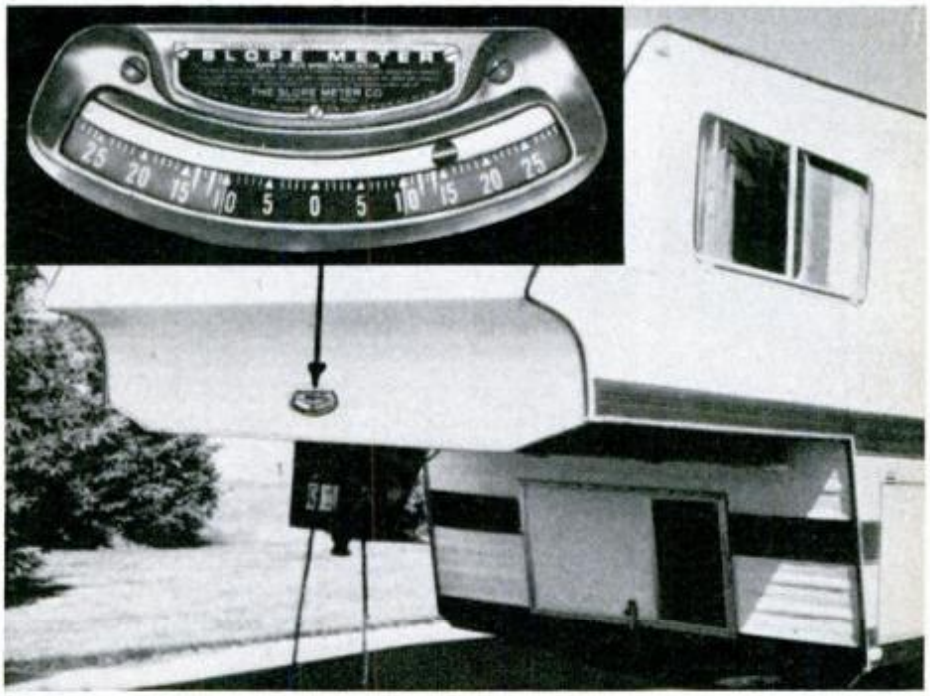
Eyeglass holster

Strap it to the steering column of your car and keep your glasses at the ready for a "fast draw" if you have to stop to read fine print on a road map. The "holster" is black vinyl with soft lining and adjustable strap. $2.98 postpaid. Stock Sales, Box 606, Mineola, N.Y. 11501.



Lightwave communications

Only 24 hair-thin glass-fiber lightguides will carry phone, TV and data signals on beams of light under Chicago streets this summer. Bell's 1½-mile installation is a test bed for a national network.



Park your trailer on an even keel

Using a principle similar to the turn-and-bank indicator that tells pilots how far they're leaning, a Slope Meter with a black ball afloat in clear liquid provides highway "pilots" with a level gauge for proper functioning of appliances in fifth-wheel trailers. Unit mounts on trailer front and is easily read through rear-view mirror. Slope-Meter, 15648 Tonkawood Dr., Minnetonka, Minn. 55343.

Photographers' vest

Fishermen and hunters carry their gear in multi-pocketed vests, so why not photographers? Now there's a vest to banish the gadget bag. It boasts 10 pockets in front for everything from filters to film and lenses. Large rear pocket holds an extra camera or tripod. Loops on front take snap-on hardware. $37.50. Abacus Group, 154 West 57 St., New York, N.Y. 10019.

Outback communications

One good learn deserves another. During a recent visit to the University of Kansas, Australian aborigines demonstrated and taught students at William Allen White Journalism School the art of boomerangs. In turn, they were shown and taught how to photograph events for television with a portable Sony Videocorder camera. The native Australians, who daubed on their gaudiest tribal decor, caught on quickly and managed to produce a series of memorable scenes for the monitors.

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First Belvedere, then Satellite, now Fury, but it's still Plymouth's intermediate.

People keep coming back to Plymouth, no matter what the image-makers **rename it.** Try as Chrysler's name-changers might, they can't confuse the loyal Plymouth buyer. And loyal customers are Plymouth's best friends.

Past experience, in fact, accounts for most Plymouth sales. They're repeat sales.

A New York glass repairman says, "I had a 1973 Fury II and liked it. My last car was a 1975 Valiant, but I didn't get the comfort and found it too small. I believe my gas mileage with this 1977 Fury is as good as with the 225-cu.-in. Slant Six."

"I've owned Chrysler products since 1936," confesses a Florida retiree.

"This is my seventh new Plymouth since 1941, and they've all given me good, economical service."—West Virginia instrument technician.

"I put over 250,000 miles on a 1965 Plymouth Satellite."—Kentucky farmer.

A relatively large number of owners reported mechanical troubles with their Furys—62.1 percent. That's high only, though, as compared with our 1976 Ford and Chevrolet Owners Reports, and it's actually lower than figures we got for the 1976 Volvo and the Fiat 131.

A major Fury complaint centered on the carburetor, specifically the two-barrel carburetor of the 318-cu.-in. V8. An Illinois railway carman opines: "The carburetion is all screwed

Photos by the author

Styling proved second-strongest buying lure. Fury coupe, on shorter wheelbase, still has ample legroom. Plaid upholstery, optional reclining 60-40 seat is liked for comfort and looks.

PM OWNERS REPORT: PLYMOUTH FURY

Beneath those enticing good looks— a thirsty powerplant

A nationwide survey based on 752,071 owner-driven miles

by Michael Lamm
WEST COAST EDITOR

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up. They don't know how to fix it. The car would be wonderful if they could get it to run right."

And a Michigan policeman: "The 318 two-barrel is an extremely rough-running engine. They finally corrected it after two months when **a kit for the carburetor** came in. I understand a lot of 318 engines have this problem."

In California, it's Kit No. 4049199; in other states it's Kit No. 4049186—available at dealers.

Nearly 27 percent of owners we polled weren't satisfied with their gas mileage. Most complainants had the big V8s. A retired New York detective, for example, wrote, "Very poor gas mileage. I had been told that the Lean Burn 400 engine was very economical. I'm getting 9 to 11 mpg." And from a California telephone installer: "Poor mileage; **not as advertised.**"

EPA figures are consistently 3 to 4 mpg higher than our owners reports.

On the other hand, owners of Furys with the 225-cu.-in. Slant Six seem more than pleased with both mileage and performance. Notes a Texas probation officer: "Very peppy six-cylinder engine, great pickup, reasonably quiet and 18 to 20 miles per gallon." And an Illinois data-processing manager: "Great performance from the 225-inch engine, plus 17 to 20 mpg."

Workmanship rated *good* to *average* with most owners. Comments an Indiana farmer, "It's put together okay, but Detroit keeps making cars cheaper all the time—not just Plymouth but all of them."

"The interior of my car still isn't right;" emphasizes a New York supervisor, "screws missing, rattles, and the doors and windows leak."

A Missouri truck driver: "It is a very solid auto, and well built."

A Virginia mechanical engineer: "Any machined or mechanically processed parts are excellently finished. Final assembly, though, is very poor."

Others judge comfort to be *good* to *excellent* by an overwhelming majority, tossing out the following comments. From a New York federal employee: "Fine rear-seat legroom and headroom in the four-door sedan." And a New York college professor: "Excellent seating with the 60-40 bench reclining seat."

As to specific qualities owners like about their Furys, we got this cross section:

"Just the right size—not too big, not too small."—New York accounting clerk. "The ride, the looks, the surprising amount of room for a mid-sized car."

A majority of owners rated service good to excellent.

"I especially appreciate the **good service,**" avers an Illinois dairyman. "We've had only Plymouths for 26 years, always buy from the same dealer, and our only bad car was the 1973 model."

"Large enough to be comfortable; small enough to be economical."—Texas grocery checker.

A Wisconsin researcher: "It's a beautiful

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FIRSTHAND REPORT

by Bill Hartford
AUTO EDITOR

At speed in the Porsche 928

It's every cubic inch a Porsche—even though it will first be scorned by rear-engine 911 nuts as a Stuttgart sellout—a crude Corvette with a fat V8 up front.

The 928 will go on sale in the fall and overnight the 911 driver will become legend: He'll be a barnstormer—a driver whose expert flicks on the steering wheel and sensitivity at the throttle are all that keep the twitchy rear end of his car from spinning him into oblivion.

No such degree of skill is necessary to guide the well-behaved 928 safely through the esses and even less to keep it on the straight and narrow. The devotee of the classic Porsche will miss the twitch and the sidewind sensitivity. And it'll take him some miles to get hooked on the new sounds and sensations peculiar to the 928. But when he does, there'll be no going back. Only the purest of the purists would prefer *the* original 356 Ferdinand-Porsche Porsche over a 911.

Preflight checkout

The 928 is an all-new car, but *sitting* at the wheel, any Porsche fan will feel right at home: The design of the sport steering wheel continues in the tradition of the marque, and, as with all Porsche models, it's a car that you "wear."

Before you move off the line there are a few things to do: First, there's a muscle-wrenching reach for the shoulder/lap belt (see below) which protrudes from the B-pillar panel far behind the front seat back. A small hook on the side of the seat back could be used to keep the belt within reach. Otherwise it's easy to settle in: Seats are fully adjustable, and so are the pedals and steering wheel.

Some of the controls, switches and instruments are familiar and in the usual places; others are not. The ignition, for example, is not on the steering column, but in the instrument cluster in front of the driver. The trickiest switch of all is on the carpeted rocker panel at the driver's left: It's the "fine tune" headlight aim to adjust for different loading conditions, of course. But it may be used by the overzealous to fry thoughtless drivers who don't dip their high beams.

The car is fitted with headlamp and windshield-washing systems, with the windshield getting a special squirt of cleaning solvent from a second reservoir.

In the center console is a 12-function warning system for malfunctions: Flashing lamps indicate loss of vital fluids like engine oil or brake fluid. Steady illumination of other lamps tip you off to low washer fluid, brake pads wearing thin and so on.

That innocent-looking glovebox—are you ready?—is not exactly a refrigerator, but it is cooled by a strategically placed airconditioner duct. And why not? Now on summer picnics you can double the range of your egg salad sandwiches with mayo.

Taxiing for takeoff

Turn the key on the 928 and let the Bosche K-Jetronic do all the thinking. No choke. No pumping. Just off or on. The lightweight aluminum V8 (572 pounds) cranks out its 215 hp (U.S. version) maximum at 5250 rpm more than 1000 rpm below red line. Maximum torque (37 mkp) is available at 3600 rpm and the 928 pulls up to speed smoothly without balking even from low speeds in fifth gear. For real lazy-man driving, there is the optional automatic transmission (that Porsche buys from Mercedes-Benz).

The choice of V8 engine and transaxle drive train layout was made in 1971 when the 928 project began (the 924, introduced here in 1976, was a spinoff). The decision to go to a front-engine, water-cooled V8 was made at a time when more and tighter restrictions were being placed on cars. The improved emissions characteristics possible with a water-cooled V8 was only one factor. Noise regulations are also more easily met with engine noise and exhaust noise separated by the length of the car. The transaxle gives good front/rear weight balance for handling, and the 4.5-liter displacement provides the performance that the driver of this type of car de-

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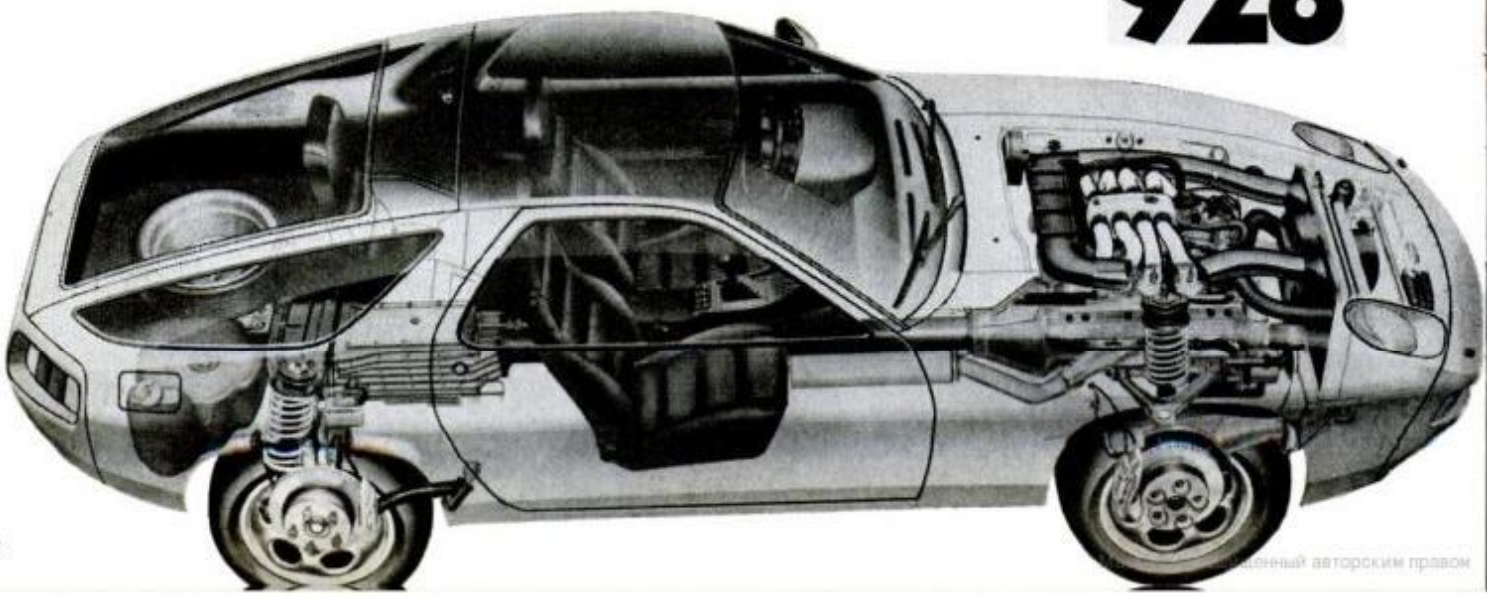

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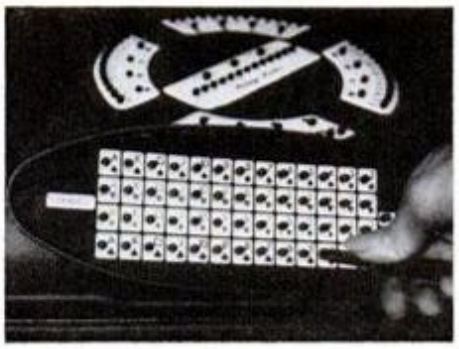
Quick, quiet and comfortable, the front-engine, V8-powered Porsche is as refined as a 2+2 production sports car can be. Large hatch and soft butt mark the rear, pivoting headlights identify all-new, 140-mph 928 from the front.

Balance and symmetry show through in layout of the transaxle and fuel-injection systems at left. The ohc, water-cooled, 90° V8 displaces 4.5 liters. Block and head are aluminum, as are hood, doors and front fenders.

IT'S NEW NOW

Roadside ramps for do-it-yourself underside work

Drivers with problems under their cars don't have to pull over and wait for help in Rumania. At regular intervals along major highways, the country's automobile club is erecting ramps for private cars and small vans. Nearby are boxes of tools free for the using and parts for many car makes. People pay later for parts used. So far, cheats are few. Problem is rule-breakers who change oil and dump dregs.

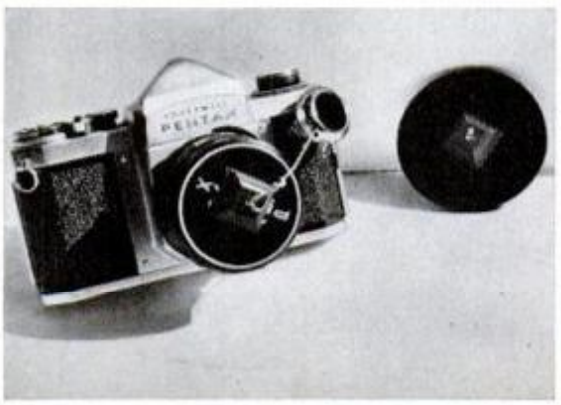


Computer bridge

For people who forget cards played and tricks taken, electronic bridge is the answer. A computer logs each play, keeps track of everything. Instead of playing cards, each player has a light-sensing pen he touches to light-emitting diodes on a display board representing cards in his hand. He has access to computer's memory. $350. Dynatronics, Inc., 1575 North Central Dr., Dayton, Ohio.

Loss-proof lens cap

Lens caps are great protectors of the delicate surface on expensive coated lenses. But they're a headache if you lay them down some place and forget to replace them. Now there's a cap you can't lose. It's on a leash held in a spring takeup reel that attaches to the camera body. The cap is held snugly against the camera when not in use. Reelsafe Lens Cap Retainer, Armond, 312A Plochman Lane, Woodstock, N.Y. 12498.



Rear-view wristband

A close call from an overtaking car sent an engineer cyclist to the drawing board. Result: a 3-inch-diameter wide-angle mirror, backed by a reflector, on a wristband. In normal cycling position, "See-Bak provides wide rear view. At night, oncoming beams hit reflector. $4. See-Bak, Box 118, New Britain, Conn. 06050.

Drive-in pickup truck

Snowmobiles, garden tractors and hand trucks can roll aboard a standard pickup truck equipped with these three-section foldaway ramps. Units come in pairs, with 1000-pound capacity. They stow flat on truck bed or fold to 2½-inches thick behind tailgate. Petersen Industries, 400 Wheeler, Fredonia, Wis. 53021.

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Bright new shapes for the campground

If you think tents still look like low brown pyramids for midgets—look again.

by Bill McKeown OUTDOORS EDITOR

Anyone who remembers crouching under leaky canvas in a back-yard pup tent, or who tripped over poles and tent pegs on a moonless night or who watched rain blow under the edges of an Army bivouac shelter and thinks that's like tenting today in the old campground —just hasn't been outdoors recently. True, the Persian models stitched up by Omar the Tent Maker centuries ago would have looked at home at campsites until the 1950s. But now you'll see tents that resemble doodles of a

Strength enough to support someone on top! This may be an unlikely campground test, but it shows the wind and snow-resistance power of alternate aluminum and glass poles in Clear Creek Ogive pack tent.

Unpack and throw down the FasTent, from Upland Enterprises, and a coiled loop of spring steel inside snaps it into shape. Setup time is 30 seconds.

Материал, защищ

geodesic dome designer, yet can be carried to a mountaintop without two camels and a faithful Sherpa guide and set up without aid from a big-top circus rigger. Living with only fabric between you and the stars can be colorful, comfortable, satisfying.

Today's tents

Though available in more sizes and designs than ever, most any good modern tent will have a ground cloth sewn in as a fabric floor. No more standing in the mud. Fabric will be fire-retardant and "breathable" so condensation can escape through it. The cloth will be canvas or a long-wearing synthetic, but will not require the doses of waterproofing that used to make tents heavy, stiff to fold and smelly. Instead of a treatment and tighter weave to keep out moisture, many tents now employ a second tent—a "fly." Acting as a tarpaulin over the first, this fly deflects a downpour but is rigged so it does not touch the inner tent and cause capillary action to start leaks. Many areas have little rain, however, and a tent fly may not be necessary, though it helps to reflect heat at an unshaded campsite.

Ventilation is provided by well-screened doors and windows. These must also keep out rain, and be covered with a mesh netting fine enough to stop tiny black flies, sand flies and no-see-ums. Camping took a giant step forward when tent design started to put insects in their place.

Invisible means of support

Mechanically, the cleverest development in outdoor shelter has been to make tent frames lose weight and disappear. Gone are the guy lines, the center poles inside and the pegs outside that always seemed to be in the way. A line can still support a tube tent between two trees, if two are handy, and pegs of special types to stick in soil, sand or snow are still the answer if there's a chance of a windy night. But even when vertical supports are needed, now they're engineered to fit in fabric slots to form a stressed-skin structure, and are made of aluminum, steel and flexible fiberglass. Many tents are now so light that, once erected, they can be picked up and moved to the most suitable site. I remember crawling out of my Pop Tent one windy night up near the Divide in the Rockies, moving it into the lee of a group of aspen and putting in three perimeter stakes for added security against gusts.

Streamlined specials

Perhaps best known of light, rounded, set-up-quick designs is the Pop Tent, originally developed for the Ford Motor Co. by C. William Moss. Fit-together fiberglass rods lock into a center fixture to make put-up and take-down rapid and simple. Eureka, Stag, North Face, Sunshine and other makers now have similar aerodynamically clean half-spheres. Bill Moss went on to design the O-Dome vacation house and now has his own Tent Works in Camden, Me., to turn out more advanced creations.

Europeans long have known the bargains of camping vacations and are ahead of us in cottage-type tents. Jack Kirkham of AAA Tent & Awning, Salt Lake City, has developed the Springbar Modular Tent system to fit tent units together for similar roomy results.

Large but light, the Trilium from Tent Works, Camden, Me., is a three-entrance 13-pounder that sleeps six, rolls into 20x9-inch size for easy carrying by one backpacker.

Eave Two-Man, another Bill Moss design from Tent Works, claims buffet-free shelter in gale-force gusts. The 5½-pound tent erects in two minutes. Fitted fly increases ventilation.

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And for backpackers, Coleman, Sears and many others have developed ultralight mini-models. Still not sure tenting is for you? Many trial types are available as rentals. Over 200 Kampgrounds of America units in the nation have roomy tents already set up. For about $11 a night, a family of four can try tent camping for themselves. ★★★

Freestanding two and four-man tents are new from Coleman's Peak 1 backpacking equipment division. A spreader bar extends the headroom and space inside light nylon enclosure.

Pac tents, by Sunshine Cover & Tarp, include Dome (top), Scout and Deluxe Mountain Pac, 3-Man Redwoods Pac & Fly. Sunshine 10-Second model of Dome claims 10-second setup.

Outside framing provides more inside living space for Heritage 8x10 and 9x12-foot four and five-sleepers from Outdoor Venture. Larger model offers screened-in patio.

Energy from outer space

Giant solar collectors nine miles long and three wide are under serious study. By 1995 they may be circling Earth, beaming wireless electricity to your home.

by Richard F. Dempewolff

The year is 1999. You stand on a hillside looking southward at the night sky. Another glittering "star" has just been added to a growing line of them that soon will reach from horizon to horizon like a super Orion's Belt.

Each of those "stars" is a man-made satellite occupying about 22 square miles of space, hovering motionless in "geosynchronous orbit" (an orbit above the equator in perfect time with Earth's rotation) and beaming to Earth power it collects from the sun. From each, some 10,000 megawatts of electricity (more than twice the output of the Grand Coulee Dam and enough to power a city the size of New York) are picked up by huge "rectennas" and fed into the nation's power grid.

Cloud nine dreams and schemes?

Not according to the people now involved in actual development of the mind-boggling concept.

Recently, Boeing Aerospace's vice president Richard W. Taylor told *Popular Mechanics*: "It is immense, but possible. . .well within our present technology."

At Grumman Aerospace, Saul Ferdman, director of space program

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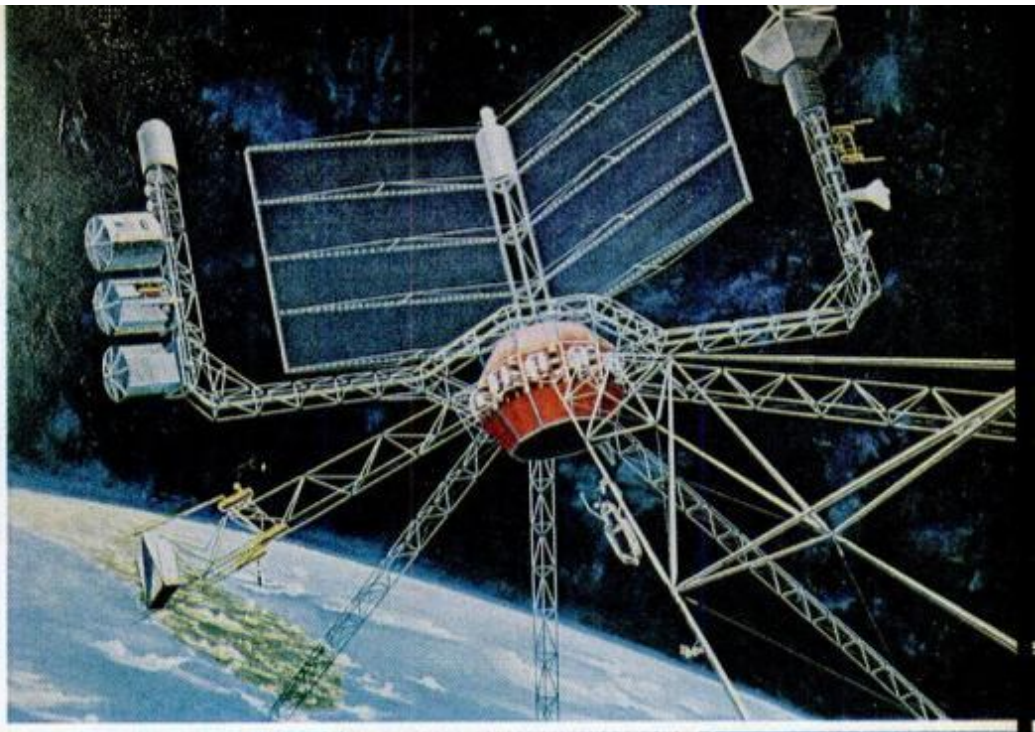
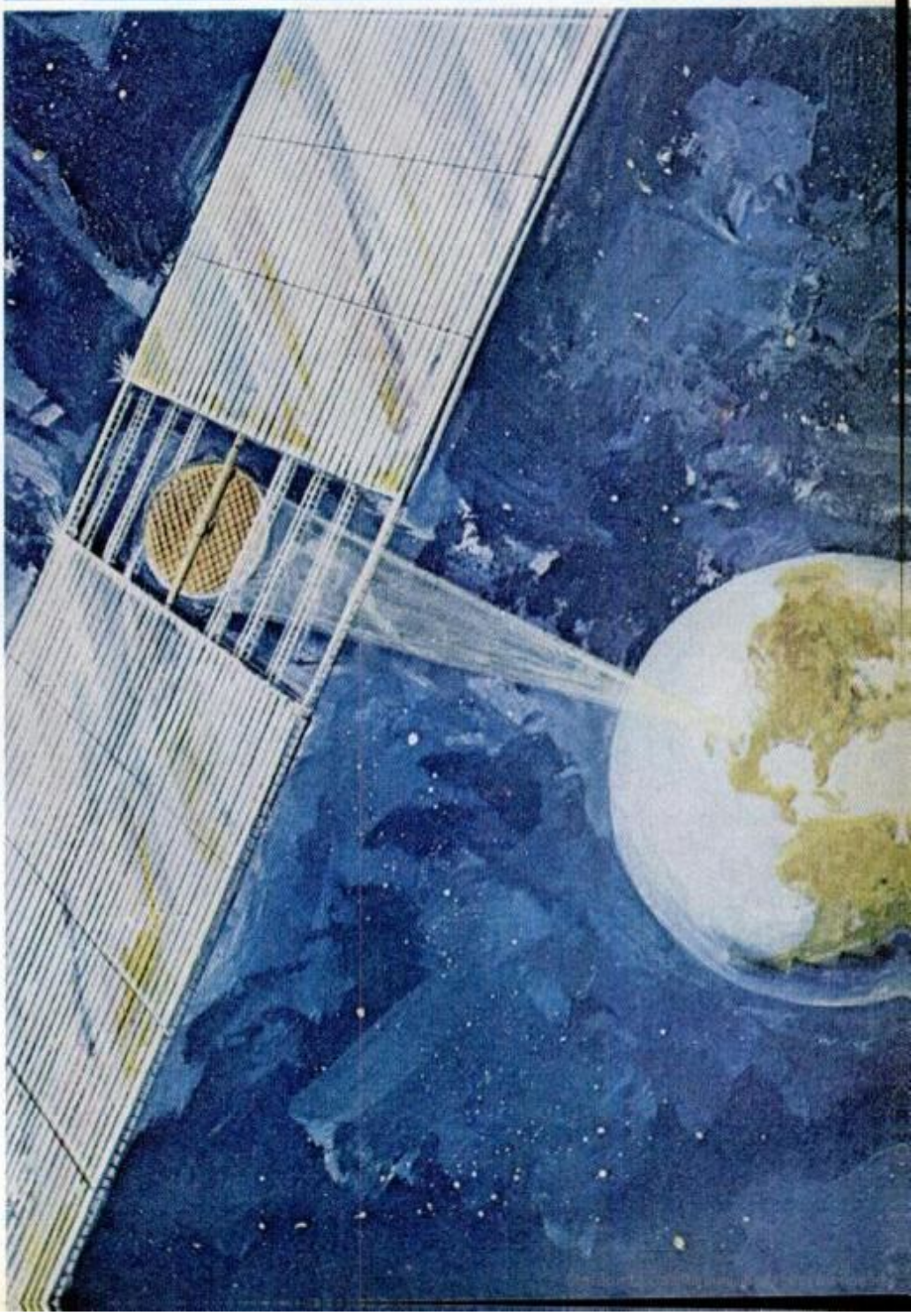
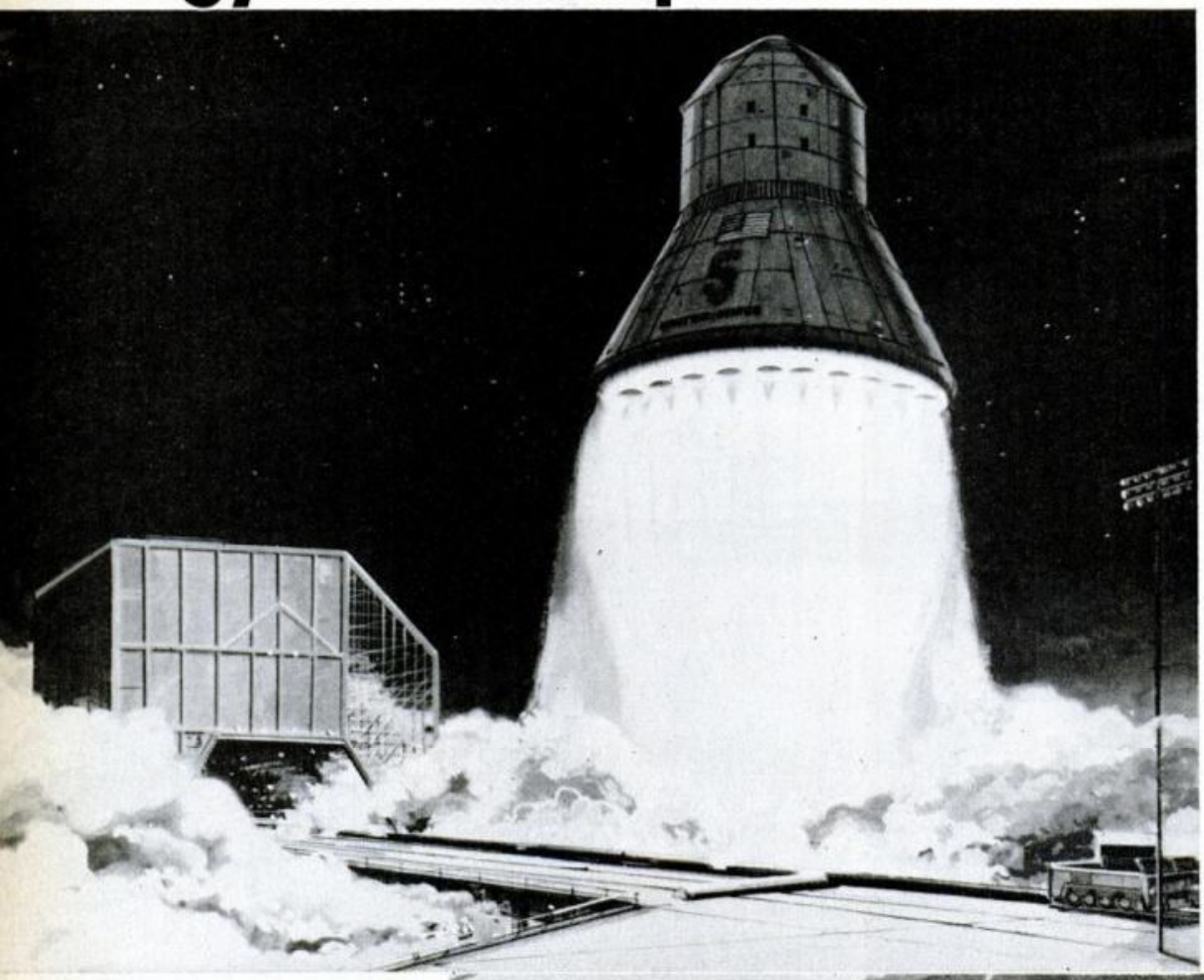




Four-module power satellite above is the Boeing concept for an orbiting monster nine miles long and three wide. Giant bowls lined with reflective plastic will focus sunlight to a white-hot pinpoint at a receiving cavity in apex of overhead girders. Heat creates steam in a closed-cycle system to drive a generator, and power is beamed to Earth by microwave antenna (far left). Generator unit detail (above, right) shows components under construction. Docked Shuttle shows scale. Girder arms sprout cylindrical "hotels" for crews. Using 22 square miles of solar cells, Grumman's power satellite (right) orbits at 22,300 miles, has no moving parts except adjustable antenna, which directs microwave beam to Earth target.

Energy from outer space

Continued



development, and Richard Kline, manager of space station programs, observed that, "While the Space Solar Power Satellite (SSPS) poses some significant technical challenges, our analyses show them to be less formidable than those we faced at the outset of Project Apollo. . . We might reasonably expect to have the first one in orbit and feeding the electric power grid by 1995."

Price would be right

NASA's manager of Satellite Power Systems, S.V. Manson, revealed that "Studies to date indicate that satellite power systems are potentially competitive economically with Earth-based systems." And at the Energy Research and Development Administration, a cautious Dr. Robert Summers told PM that ". . . the only solar electric approach which seems to offer a possibility of baseload power is the solar satellite power station concept."

The idea of orbiting great solar collectors 22,300 miles in space,

Reusable Heavy Lift Launch Vehicle (top) is Powersat's low Earth orbit freighter for transporting the satellite components to space. The single-stage rocket, with half-million-pound payload capacity, would weigh 22 million pounds at liftoff. Its flight mode would be a once-around orbit with payload deployed on the backside of the orbit. Payload would have its own propulsion unit for distribution and docking. Launch and landing complex at Kennedy Space Center (above) has a huge landing basin for soft powered landing using rockets for deceleration. Launch complexes are on basin's rim.

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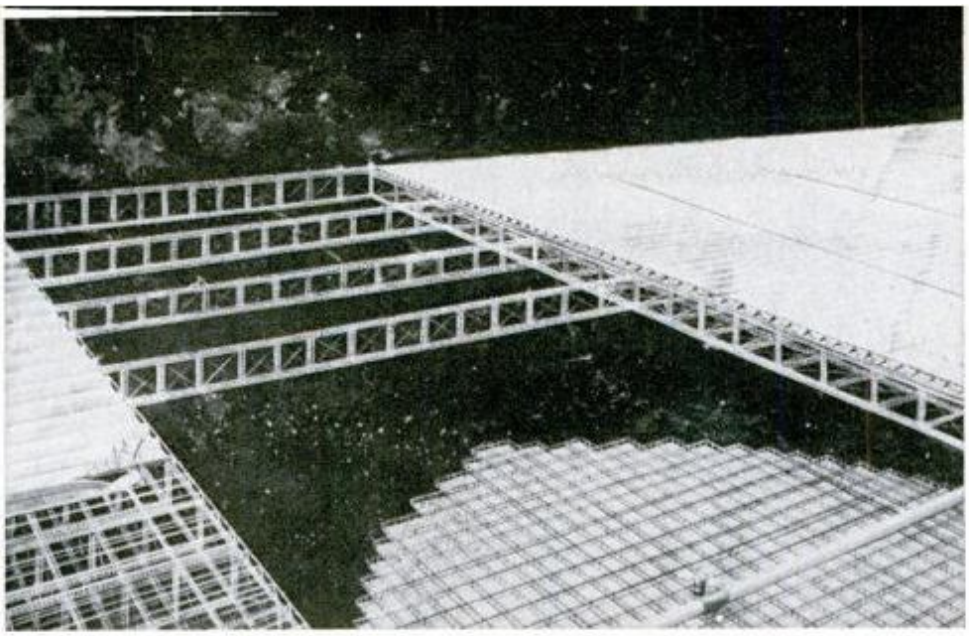


Antenna for Space Solar Power Satellite is located between two huge panels of solar cells. It tilts, so it always faces the Earth target, while satellite faces the sun.

converting their gathered energy into electricity and transmitting it earthward via microwave or laser, was suggested as early as 1968 by Dr. Peter Glaser of Arthur D. Little Co. in Cambridge, Mass. Reactions were instant and skeptical. Boeing engineers recall that Glaser's ideas were regarded as "something for the next century, if ever." Today, all that has changed. "We are reminded," say Boeing technologists G.R. Woodcock and D.L. Gregory, "of the widely expressed view, in 1960, that man would land on the moon some time after the year 2000."

Two approaches

Since Dr. Glaser first made his startling suggestion, design studies have been under way by a heavyweight federal and industrial team involving NASA, ERDA, Boeing, Grumman, Jet Propulsion Laboratory, Rockwell, Arthur D. Little, Raytheon, Spectrolab, Econ and others.

Details of two separate approaches have been worked out meticulously. One, developed by the Grumman-Arthur D. Little group, is the SSPS, using a photovoltaic process in which solar cells convert sunlight directly to usable electric power in the same way they've provided power for nearly every spacecraft and satellite to date. The other—"Powersat"—explored by the NASA-Boeing researchers, uses a thermal concentrator and heat engine system. This involves arrays of gigantic hexagonal bowl-shaped reflectors, each about three miles from rim to rim, focusing sunlight on a receiving cavity mounted high above the bowls where the intense heat turns a fluid to steam and drives a mechanical turbogenerating system.

Why bother putting all that stuff in space when solar powerplants could just as well be located on sun-drenched deserts? Boeing's Ralph Nansen explains that the output of a solar collector in space is about six times what it would be at the best location on Earth. Due to day and night cycles down here, huge storage capacities would be required, and the remotenes of deserts would mean extensive transmission lines.

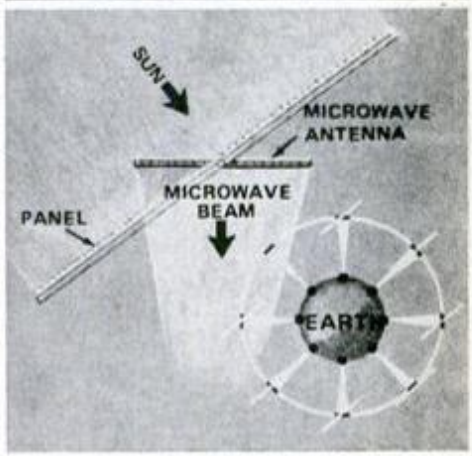
On the other hand, a satellite in geosynchronous orbit is exposed to continuous sunlight more than 99 percent of the time, and power could be beamed where needed. The only inactivity would involve minutes during solstice periods when the collectors would pass through Earth's shadow.

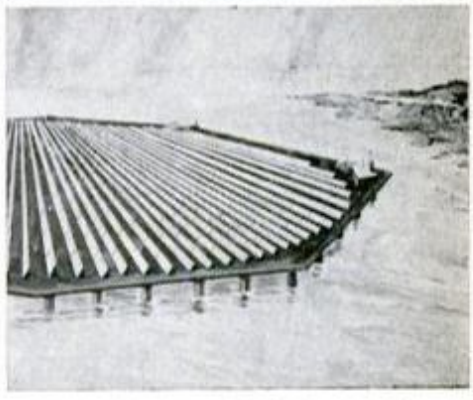
To comprehend even remotely the vastness of these gigantic space islands, you'd have to climb aboard one and look around. From one end of the SSPS, the view would reach out across seemingly endless miles of glaring reflective corrugations, diminishing into star-studded blackness. Out there, other islands in the great energy archipelago would shine like links in a golden chain, disappearing where it curled behind Earth's rim.

Two huge panels

Activate your jet backpack and levitate yourself a hundred or so feet above the surface of the vast solar panel, and you'll see that the station itself actually is made up of two rectangular panels, each about 3½ miles long by 3 wide, and 600 feet deep, connected by a few main girders and a great mast. Located between the panels is the half-mile-wide disc of the adjustable microwave transmitting antenna.

Satellite chain in operation (top) shows how SSPS system beams power directly to specific targets as units orbit in synch with Earth's rotation. Cross section of satellite (center) shows solar collectors at right angle to sun, while antenna tilts to hold beam on rectenna target. Proposed plan (bottom) is for offshore rectenna to convert microwave energy to a.c. electricity and feed it to power grid ashore.





Mounted on each huge panel, reflective ridges march away like waves, giving it the appearance of a shiny metal washboard. Oriented to face the sun in perpetuity, endless arrays of solar cells lie along the surface of each depression in the washboard. Slopes of the ridged corrugations are covered with reflectively coated sheet plastic. The solar cells are bathed in direct sunlight as well as the concentrated light that is focused on them by reflectors—which more than doubles the

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Материал, защищенный авторским правом

Speed dash in a homemade jet

PM photos by the author

by Ralph L. Emerson

It's a tiny speck in the distant sky one second, then a blurred streak an instant later as it flashes past you barely 50 feet off the ground. It's Darryl Greenamyer, in his blazing T-tailed F-104 Starfighter, setting a new low-altitude speed record for jet aircraft at 1010 mph—Mach 1.3—or nearly one-third faster than sound.

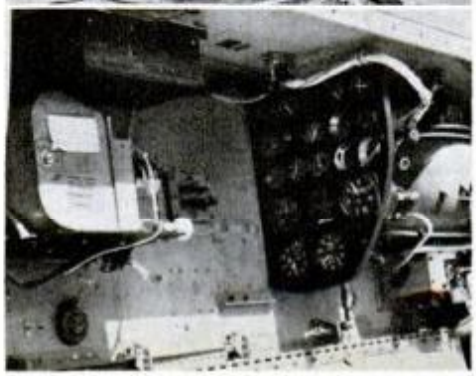
Except for a slight rustle of wind, there is a strange silence over the wilderness—the supersonic jet is completely soundless as it goes by. Then suddenly the sound waves catch up, shattering the desert stillness like rifle fire. Sonic booms resound off far-away mountain walls in a thundering rumble. It is an eerie, awesome experience.

Endless quest for speed

Greenamyer, a master test and race pilot, has been chasing after the elusive gods of speed for almost as long as he has been able to fly. During the last decade he has won or placed high in a number of closed-course, pylon-type air races demanding the ultimate in pilot skill and endurance. He has more than 300 hours flight-testing the Lockheed SR-71, a high-altitude reconnaissance spy plane that officially holds the absolute speed record for jets at 2070.-102 mph.

In 1969, Darryl set a new world speed record for piston-driven prop planes in a modified F8F-2 Bearcat, a souped-up descendant of the famed World War II Navy fighter. The record—482.562 mph—still stands, and the historic Bearcat, retired after last year's Reno event, is now on display at the Smithsonian Institution's Silver Hill Museum in Silver Spring, Md.

Greenamyer, an energetic, still-youthful-looking 41, has not been without his troubles, however. Because of a malfunction in the delicate photo-electronic timing equipment—not discovered until later—his recent speed dash in the F-104 could not be established as official. (Officially, the low-altitude speed record for jets is currently held by a Navy F-4 Phan-



Setting a new speed record in the low-altitude jet class, scratch-built F-104 is caught above as it streaks across Nevada desert range at over 1000 mph. (Author, shooting at 1/1000 second, still had to "pan" camera to get sharp image, accounting for blurred onlookers on ground.) At upper right, youthful 41-year-old Darryl Greenamyer, plane's builder and pilot, poses in cockpit. At center, a patchwork of scrounged pieces is hand-groomed into a sleek speedster—even rivet heads had to be set flush to reduce drag. Duplicate instrument panel (bottom) is installed behind cockpit with camera to record readings too fleeting for pilot to note.

Материал, защищенный авторским правом

How to fireproof your firearms

by Bill McKeown

It's no secret—a gun is safe only when it fires when you want it to. Recently inventors have developed several devices that should make it impossible for a child, an intruder, or even an angry friend or relative to grab your gun and fire it.

Locking all firearms in a closet or vault will prevent accidents, and many good gun cabinets are now available. But what if you're a homeowner or store owner who wants a firearm handy, or a law officer who wears a weapon? Some new devices developed prevent discharge of a gun by anyone except the owner.

Three useful models are the locking type. Michaels of Oregon, in Portland, maker of the Uncle Mike's line, has a Cease-Fire unit that fits into the action of a bolt-operated rifle. It's about $10 at sporting goods outlets. Trico Security Products, Willow Grove, Pa., makes the Security Gun Keeper with a pin that ratchets into the bore of a rifle or shotgun and holds it against the wall in a cabinet or case. A key is needed to unlock and slide out the muzzle plug. Guns can be mounted horizontally or vertically for $30. For .38 and .357-cal. revolvers, the Guardian Co., Lincoln, Neb., has a plastic Safe-T-Key and No-Shoot Rod for $4. It is trimmed to barrel and chamber length, inserted through the muzzle, and then the Safe-T-Key is unscrewed. Until the rod is removed, the gun is completely inoperable.

Two ingenious inventions

Statistics show that about one quarter of all shootings of policemen are committed with the officer's gun. Most murders are crimes of passion that might be reduced if there were a delay in seizing a gun. Joseph Smith, of Sunnyvale, Calif., has patented the Magna-Trigger. To fire your revolver with Smith's system installed, you must wear a special ring with built-in magnet to unlock a safety mechanism. Children can't discharge the gun without the ring; a police officer couldn't be shot with his own gun by another person; remove the ring and gun-cleaning accidents could be halted.

The Magna-Trigger Safety ring contains a very powerful samarium-cobalt rare-earth magnet that will not demagnetize. A wafer of the magnet material is epoxied into a sterling silver ring worn on the middle finger of your gun hand for best contact with the pistol grip, although the ring can trip the safety mechanism from an inch away. Police and civilian rings have different polarity to reduce the chance that a civilian could discharge a police pistol. Police are also issued two rings, one for each hand, to permit firing with either hand.

Trigger pull, weight and balance of the gun are unaffected by the installation. Only a bare metal strip on the grip frame indicates the special safety is present. While the device could also be installed as original equipment by rifle, shotgun and semiautomatic pistol manufacturers, it currently is available only for Smith & Wesson revolvers modified by Magna-Trigger Safety, 1114 West McKinley, Sunnyvale, Calif. 94086. It has already been adopted by the 35-man Foster City, Calif., police force, and other police units are interested. Cost per weapon is under $100.

Puzzle safety

More simple and inexpensive is a patented modification worked out by Frank Murabito, R.F. Sporting Goods, 64-14 Myrtle Ave., Glendale, N.Y. 11227. So a revolver won't fire if grabbed by someone unfamiliar with it, an extra directional movement is built into the thumbpiece to release the cylinder for loading. The safety can be installed four ways so only the owner will be familiar with it. Only a flick will set the gun for firing, and the installation is under $20. Some police have been reluctant to install it for fear it would delay an officer in a quick-draw situation. But bank guards and civilians welcome it, the inventor reports. Safety is always worthwhile. ★★★

Magnet-actuated safety set into the metal frame of the grip releases the action only when the shooter is wearing the special Magna-Trigger Safety finger ring.

Материал, защищенный авторским правом

PM OWNERS REPORT: 1977 FORD THUNDERBIRD

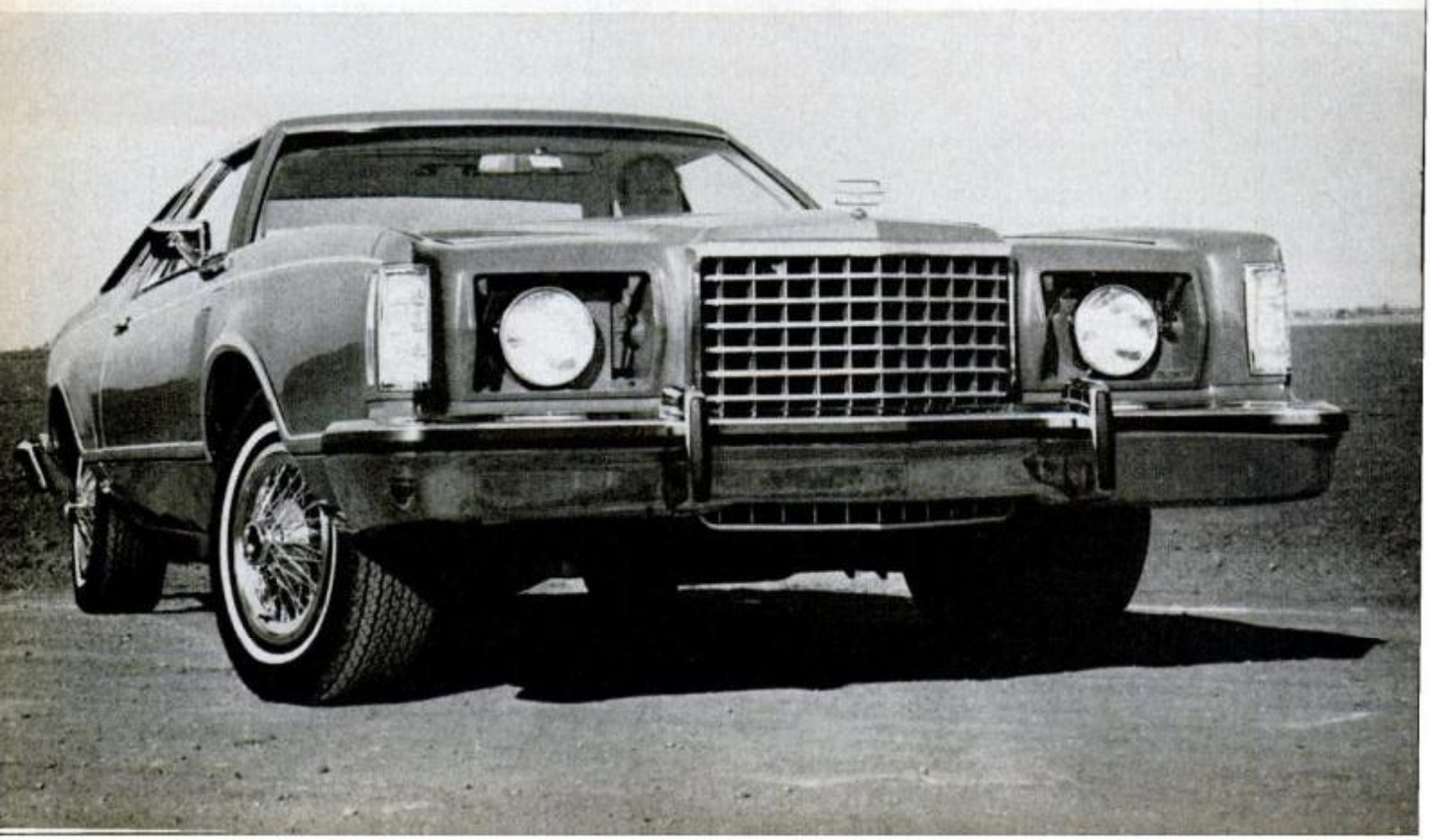
New Thunderbird costs almost $3000 less and seems to please most owners even more

A nationwide survey based on 839,084 owner-driven miles

by Michael Lamm WEST COAST EDITOR

Thunderbird's front-seat comfort is praised by owners, but many object to shoulder harness interfering with rear-seat entry and exit. T-bird's length has been trimmed 10.3 inches; weight's down 630 pounds; price down $2725.

Photos by the author



This year's Thunderbird bucks the traditional Detroit cost spiral by chipping $2725 off its 1976 price tag.

The car is now a variant of the 1977 Ford LTD II, formerly called the Ford Torino. Still, it has a unique look and an aura all its own. Front-end styling, roof theme and rear treatment make it a Thunderbird, unmistakably.

As before, the T-Bird's main appeal comes from its styling. Appearance prompted 55.7 percent of owners' buying decisions. The lowered price attracted another 28 percent.

A number of owners confessed long-standing covetous feelings for Thunderbirds.

A Virginia finance manager reports: "**Ever since I was 15,** I desired and craved a new Thunderbird. The 1976 model was too expensive, but the reduced base price on the 1977s made the purchase possible, although I probably would have bought one anyway." When asked for specific praises, he said: "It satisfies my ego; is also prestigious, comfortable, silent and responsive."

"I bought it because I liked the styling and the more reasonable price," agrees a Michigan carpenter. A Mississippi attorney: "Thunderbird rides superior to other autos costing $2000 to $3000 more. I also liked the body style, size and cost."

"When you compare the lower price of this year's Thunderbird to the 1976s," reasons a Texas hairstylist, "and then compare its cost with the 1977 LTD II and LTD Landau, then figure in the T-Bird's resale value—well, what would you buy?"

A Texas college student writes: "I like the looks of the T-Bird inside and out, and I did get a good price on a big, nice car."

What do owners think about the way their Thunderbirds have been put together?

"No gripes so far," comments an Alabama rural mail carrier. Retired Michigan printer: "I went over the whole car very carefully and cannot find a thing wrong." Illinois research executive: "All minor defects were completely corrected by my dealer prior to delivery." In all, over 75 percent of T-Bird owners rated workmanship *good* to *excellent*.

When we asked owners what they'd like to see changed, 14.7 percent would leave it the way it is; 11.1 percent wanted more trunk space, and 8.4 percent, greater rear legroom.

But with larger wheel housings, trunk space would be even smaller.

A Michigan quality controller suggests: "Ford ought to make the **rear wheel wells bigger.** Ice and snow build up inside them, and you can hear the tires rubbing."

An Illinois social worker: "Legroom in the rear should be greater, and the shoulder belts hamper persons getting in and out of the rear." Minnesota tire-store manager: "They ought to paint the car with tougher paint. The finish on the quarter panels gets eaten away by sand and rocks tossed up by the tires in highway cruising. It's distressing"; Colorado shop foreman: "Seems like too much use of **plastic for moldings,** front grille and so on. Metal wouldn't squeak so much."

Plastic, though, helps keep weight down. The T-Bird's front ensemble is largely fiberglass.

When we asked owners to rate Thunderbird comfort, the front seat got top marks, the rear seat a distant second. Here are typical comments: "I have the split front bench, which is very nice, but the back is very bad," opines an Indiana sales manager.

A Michigan hydraulics engineer: "The Thunderbird, although lighter than before, rides and handles very well, but there ought to be more front headroom and more rear legroom." Illinois mechanical designer: "The car is just plain small. Seat belts get in the way during rear entry, and the moon roof lessens what little headroom there is in the rear-seat area." Illinois dry cleaner: "This is

(Please turn to page 182)

Styling of the Thunderbird reminds some owners of the Mark V. "Crown Victoria" roof gives good visibility plus distinction, say owners.

Summary of 1977 Thunderbird Owners Reports*

Total miles driven	**839,084**
Average miles per gallon	
302-cu.-in. V8	
In town (EPA 15)	14.3
Long trips (EPA 19)	18.8
351-cu.-in. V8	
In town (EPA 14)	13.3
Long trips (EPA 20)	16.9
400-cu.-in. V8	
In town (EPA 13)	11.9
Long trips (EPA 18)	15.6
Engine choices:	
302-cu.-in. V8	7.1%
351-cu.-in. V8	50.4
400-cu.-in. V8	42.4
Why did you choose Thunderbird?	
Styling	55.7%
Price	27.9
Previous ownership	13.5
Size	11.5
Specific likes:	
Styling	63.3%
Handling	43.3
Ride	31.7
Comfort	26.3
Economy	17.9
Specific dislikes:	
Gas mileage lower than expected	10.5%
Rear legroom	8.9
Poor-quality materials	5.9
Trunk too small	5.5
Catalytic converter odor	5.5
What changes would you like?	
More trunk space	11.1%
More rear legroom	8.4
Clear away seatbelts for getting into rear compartment	6.7
Change styling	5.8
Better-quality materials	5.8
Workmanship opinion:	
Excellent	38.8%
Good	37.3
Average	11.8
Fair	7.5
Poor	4.7
Comfort opinion (front seat):	
Excellent	58.8%
Very good	23.5
Good	12.5
Fair	2.7
Poor	2.4
Comfort opinion (rear seat):	
Excellent	15.7%
Very good	18.6
Good	25.2
Fair	19.8
Poor	20.7
Had any mechanical trouble?	
No	55.2%
Yes	44.8
What type of trouble?	
Electrical	17.0%
Carburetor	16.1
Transmission	8.9
Front-end alignment	6.3
Oil leaks	5.4
Did you repair it yourself?	
No	95.5%
Yes	4.5
Dealer repairs satisfactory?	
Yes	65.6%
No	34.4
Dealer service opinion:	
Excellent	34.1%
Good	29.1
Average	16.4
Fair	7.3
Poor	13.2
Number of vehicles owned:	
Thunderbird only	44.1%
Two cars	42.9
Three cars	9.1
Four cars	2.8
Five or more cars	1.2
Makes of other cars owned:	
Ford	31.0%
Chevrolet	21.1
Mustang	12.0
Mercury	9.9
Oldsmobile	7.0
Age distribution of owners:	
15-29 years	25.3%
30-49 years	42.8
50-plus	32.0
Would you buy another T-Bird?	
Yes	81.6%
No	18.4

*Percentages might not equal 100% due to rounding or insufficient data.

Boat you build with 'plastic planking'

Constructing this slick little sloop is simplified with remarkable new C-Flex.

by Bill McKeown
BOATING EDITOR

Feather, a new boat-plans project from Glen-L for home building, uses fiberglass C-Flex as planking to make a "one-off" hull for an 11-foot daggerboard sloop that performs well with a crew of one or two.

There are some outstanding new ways to build yourself a boat these days. Quicker, easier and better than many methods of the past, they are particularly suitable for constructing one boat at home. True, you can make a mold and pop out faster, cheaper hulls, perhaps. But complications and government requirements of building boats for sale are best left to the professionals. A "one-off" method like that described here is preferable for a handyman. (Coast Guard booklet 466, *Safety Standards for Backyard Boat Builders*, is also worth getting from the U.S. Coast Guard, Washington, D.C. 20590. It covers hull identification number and safety requirements.)

The neat little Glen-L Marine Feather shown here is a fiberglass 11-footer designed to take advantage of the new fiberglass planking called C-Flex. Made in rolls by Seemann Plastics, Box 51647, New Orleans, La. 70151, the "planking," in foot-wide lengths of 100 to 250 feet, is composed of fish-pole-size fiberglass roving held between two layers of fiberglass cloth.

A lightweight grade (CF-39) is available for small boats and a heavier type (CF-65) for larger craft and other uses. The material can be rolled out over a male mold or framing kit, held in place with ice picks or staples, treated with resin, and given more fiberglass coverings as required; all without making the elaborate female mold needed to build a conventional fiberglass hull.

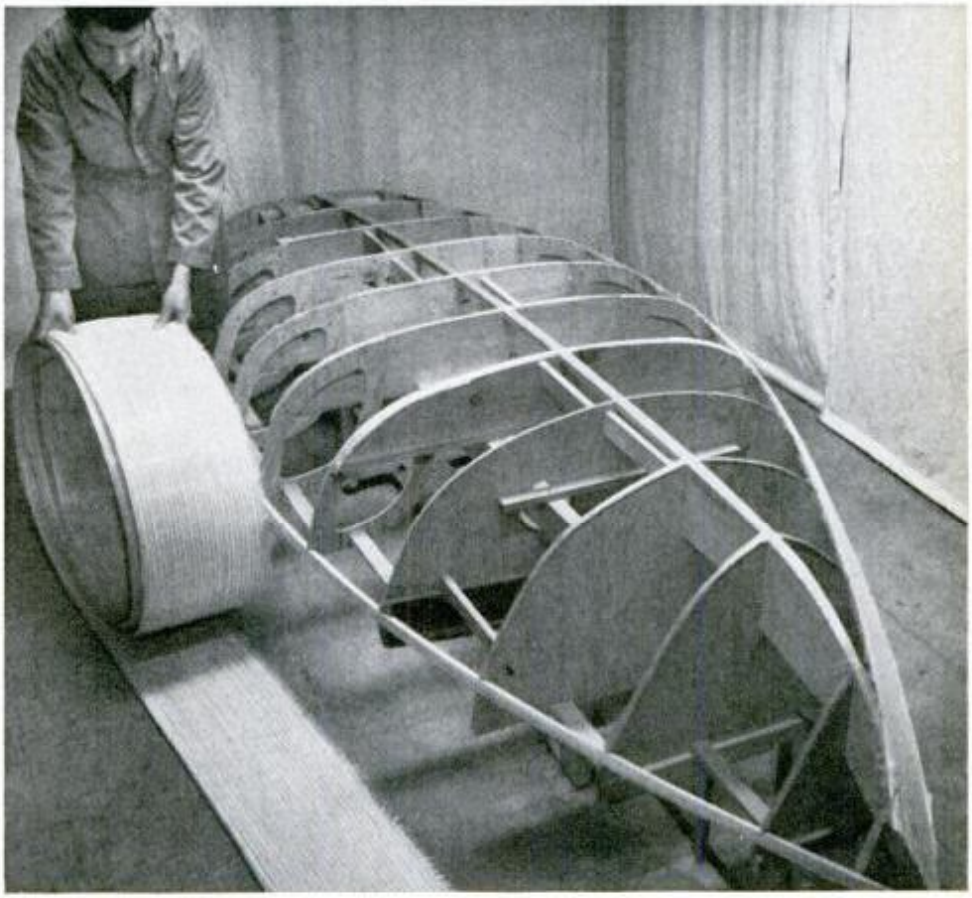
Prefab forms

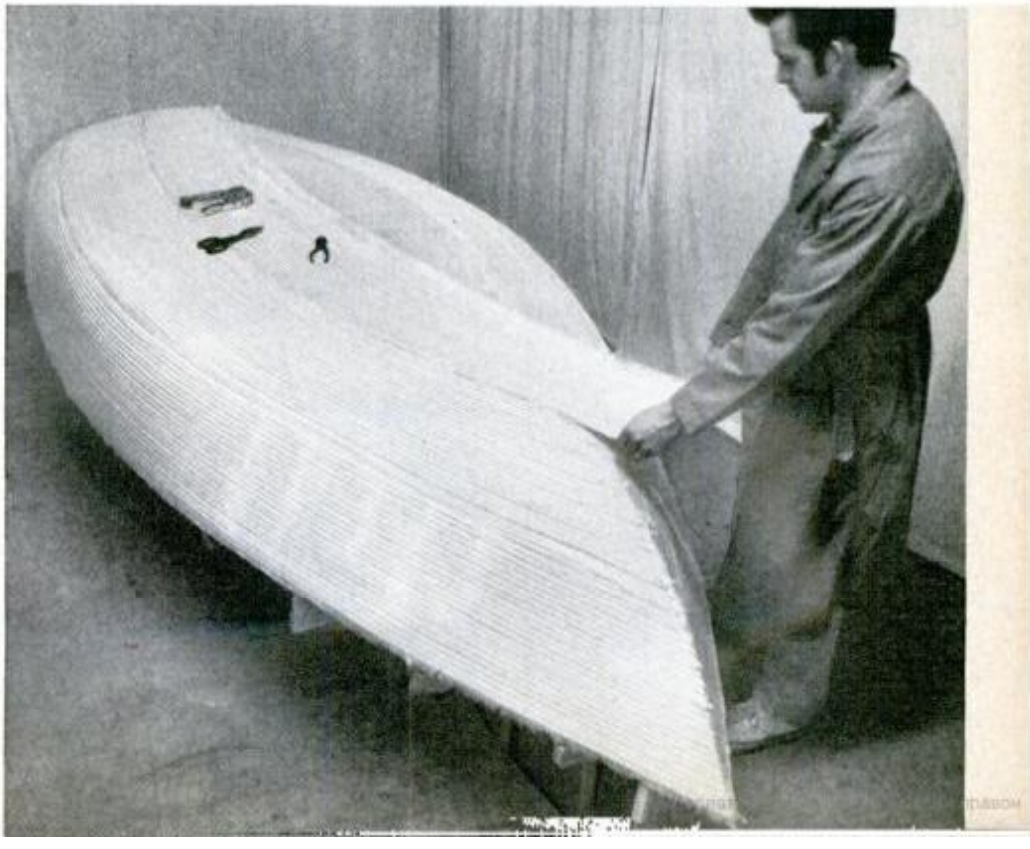
Sections of the form constructed to support the C-Flex hull can even be prefabricated to become part of the finished hull as bulkheads and stringers. Extensive instruction for building hulls of C-Flex is given in the book *How to Fiberglass Boats*, by naval architect Ken Hankinson, $5.95 from Glen-L Marine.

Whether you want a light, fast cartop sailboat or a way to practice fiberglassing technique for a bigger project, the Feather makes a good starting point. Both plans, in three sheets of details and 39 step-by-step photos, are provided. Complete plans and full-size patterns for the stem and transom forms, building forms, daggerboard-case form, daggerboard and rudder, with bill of materials and equipment lists, are an $18 package from Glen-L.

In addition, a form frame kit for the Feather is available with plans and precut parts for $99. A fiberglass building kit for $254 f.o.b. supplies the C-Flex required plus mat, cloth, resins, brushes and squeegees. A hardware kit is $64.50 postpaid; a

Roll out the topsides from a continuous length of C-Flex plastic and you'll be ready to start planking a hull. The material alternates rods of solid fiberglass-reinforced polyester resin with bundles of fiberglass rovings held together between two layers of lightweight open-weave fiberglass cloth. About one foot in width, the material comes in up to 100 or 250-foot lengths and in lightweight grade for smaller boats like the Feather or a standard grade for heavier applications. Simple framing constructed from plans or available in a kit is set up as shown below, and lengths of C-Flex are mounted over it and positioned. Ice picks or heavy-duty staples can be used to hold each plank in place as the lengths are butted and adjusted for a smooth surface. Feather's hull, when fully covered (bottom), takes three widths of the C-Flex material to plank each side. Once adjusting for a completely fair surface is finished, ends of the C-Flex can be trimmed more exactly at bow and transom with a portable power saw using an abrasive cutoff disc. A light coat of resin is applied next, but it does not need to saturate the C-Flex since more will be used inside when the hull is upright.





Smoothing the hardened resin coat is done with disc or belt sander, while wearing a protective mask. Two pieces of glass mat and cloth are next cut to rough shape for each side. Mat is overlapped at keel line, resined and unfolded onto the hull.

Draped in place over the wet mat, the final cloth layer of the laminate is positioned, smoothed and resined. Once it hardens, a resin filler coat is spread on and sanded when dry. Boat can then be turned upright for completion.

deluxe kit is more. Rigging for the Feather is $53; necessary aluminum spars are $52 with the hardware kit, $68 without, and the sails are $125 postpaid. The boat can be built just from the plans if all materials are available locally, but even if you buy all the kits, the price is well below that of a prefinished boat.

Home boat building costs less because you usually don't put a price on your time—which can be considerable, particularly for the amateur boatwright. With the faster C-Flex method, however, once the frames and form members have been set up and faired, "planking" can start.

Oversize lengths of the material are positioned, secured over the forms, and cut with an abrasive cut-off disc on a portable power saw. Heavy-duty staples or icepicks holding the C-Flex sheets in place may need to be lifted and adjusted until the surface is smooth with no buckled or bulging areas. For this sailboat, three widths of the material will cover each half of the hull. Adjoining edges are merely butted together rather than overlapped.

The next step

Next the entire outer surface of C-Flex is coated with resin, allowed to dry and lightly sanded. Pieces of mat, then cut oversize to cover each side of the hull, are first used as templates to cut the final layer of fiberglass cloth. Folded mat is coated with resin on the underside as it is unfolded onto the hull. Once the hull is covered, more resin is applied to the mat and along the generous overlap of the two sections along the center keel line. Now the precut cloth is draped over the wet mat and given an additional resin coat.

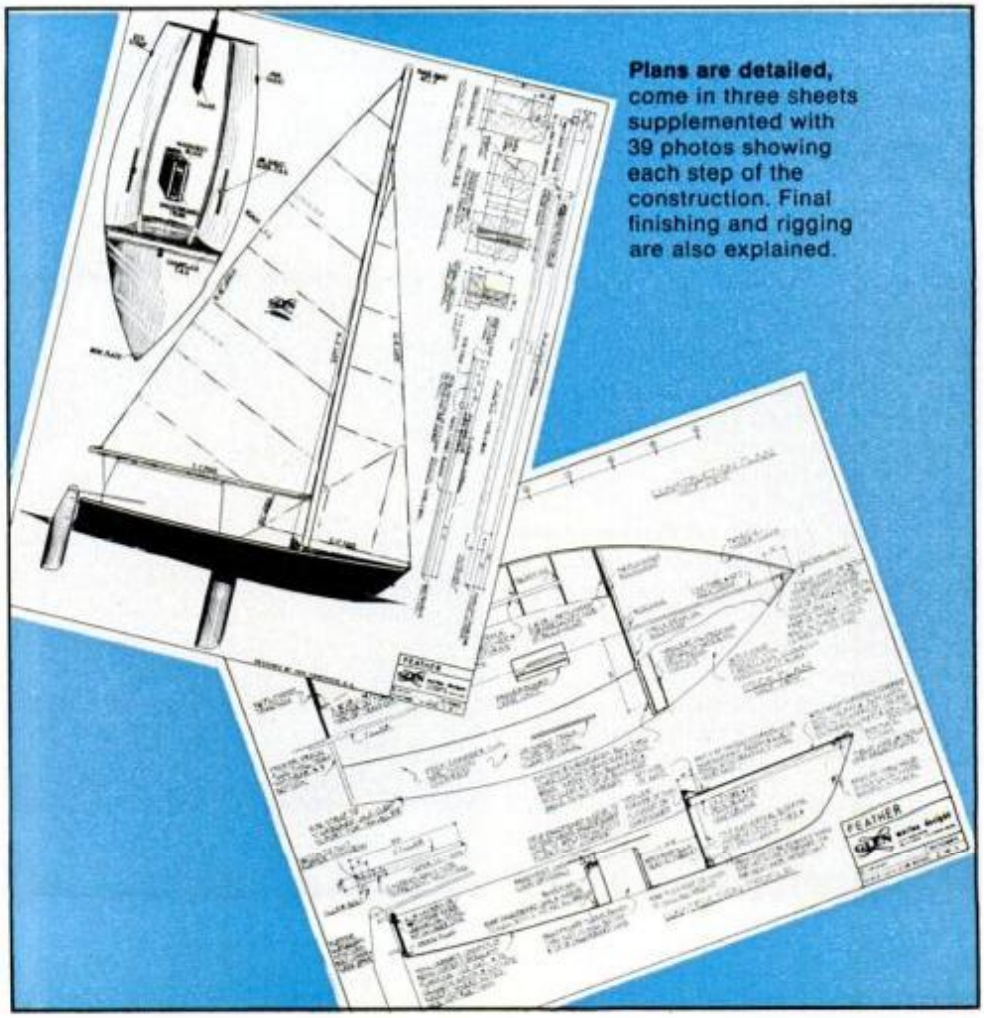
With the laminate completed and cured, the hull is lightly sanded smooth and a coat of resin filler is applied with a wide putty knife to form a filler layer that will be sanded and finished. This coat, when hard, is largely removed by sanding with a disc or belt sander so the surface is very smooth and fair. Now the hull can be turned upright, form members which will be a permanent part of the hull bonded in place with resined pieces of mat, and the interior is coated with resin to complete the saturation of the C-Flex.

Final operations

The Feather has rounded deck chambers in the cockpit, and these are sealed the same as the hull construction. Fitted mat is used as a template for cutting the cloth surface layer, resined and unfolded into place; then covered with the finishing cloth. The laminate is also used to cover the plywood foredeck. Resin filler is again used as a covering coat that will be sanded for a completely fair surface.

Thin cardboard spacers are wrapped around the daggerboard to make it a mold for the daggerboard sleeve. This fits in a case molded to the hull. You are now ready to paint, step the mast, install hardware, standing and running rigging and get ready to sail.

The 150-pound sloop can handle a crew of two or three, take a 3-hp outboard. Plans and kits are available from Glen-L Marine Designs, 9152 Rosecrans, Bellflower, Calif. 90706. ★★★



Plans are detailed, come in three sheets supplemented with 39 photos showing each step of the construction. Final finishing and rigging are also explained.

Материал, защищенный авторским правом

Two hot ham radios you'll want when you step up from CB

by Anthony R. Curtis, K3RXK
ELECTRONICS EDITOR

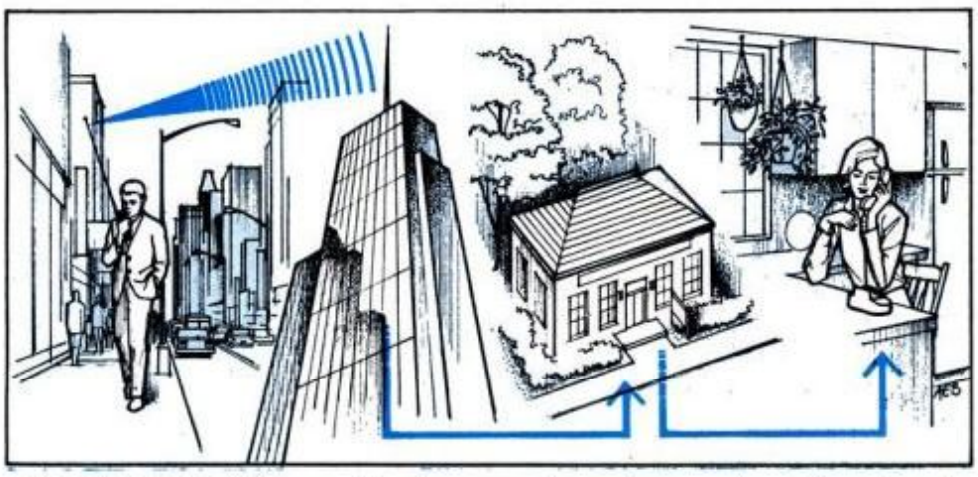
Bleep! Squawk! Breaker! Every channel in your CB radio is filled to overflowing with signals from other operators. You wish for someplace to go to get away from the crowd.

Rather than sell the CB rig and switch hobbies, you can move up to *amateur radio* along with thousands of other CBers.

One of the best reasons to go *ham* is the quiet hi-fi sound of radios used in the two-meter ham band. They have static-free FM rather than the old-fashioned AM kind of modulation in CB sets. And these radios offer greater power, longer range, lots of channels and even telephone calls from the field.

Two of the most popular of this new breed of radio are the Heathkit HW-2036 mobile rig and the battery-portable Wilson 1405-SM.

Heathkit gives you 400 channels. Compare that with 23 or 40 in your CB transceiver. The Heath is FM sound, puts out more than 10 watts from its transmitter, and is easy to build. We put it together in about 40 evening and weekend hours. The rig, at $269, is designed for use in your car, powered by the 12-volt auto electrical system. You can use it at home as a base station with Heath's Model HWA-2036-A inside-the-house power supply ($32).



Autopatch phone call from walking ham goes to amateur repeater station atop skyscraper where it is switched into telephone line and through to home telephone.

Where's the Wilson?

The Wilson is so popular that hams have adopted the word *Wilson* to replace the designation walkie-talkie. "Where's the Wilson?" is a common question around my house since the *XYL* (ham lingo for wife) also is a licensed amateur radio operator.

Even though hundreds of thousands of amateurs have traditional ham shacks for talking around the world from their homes, it's not necessary to have even a tiny corner of an apartment or house to get into the fun of ham radio. Keep a Wilson handy or Heath mobile rig under your car's dash and you can be on the air at any time.

Many times I have enjoyed a *rag-chew* (ham talk for what CBers call ratchet jawing) with ham friends 100 miles from my home as I relax in the den, chatting through the hand-held Wilson.

Wilsons come in several models for use in different ham bands. The 1402-SM ($179) and 1405-SM ($249) two-meter-band models are most popular.

Autopatch calls

Hams often equip their Wilsons with telephone-type tone-dialing pads

(Please turn to page 140)

Материал, защищенный авторским правом

How to do that engine overhaul yourself!

Burning oil? Need a valve job? Need a ring job? Here's what you should know to do the job in your own garage.

by Mort Schultz

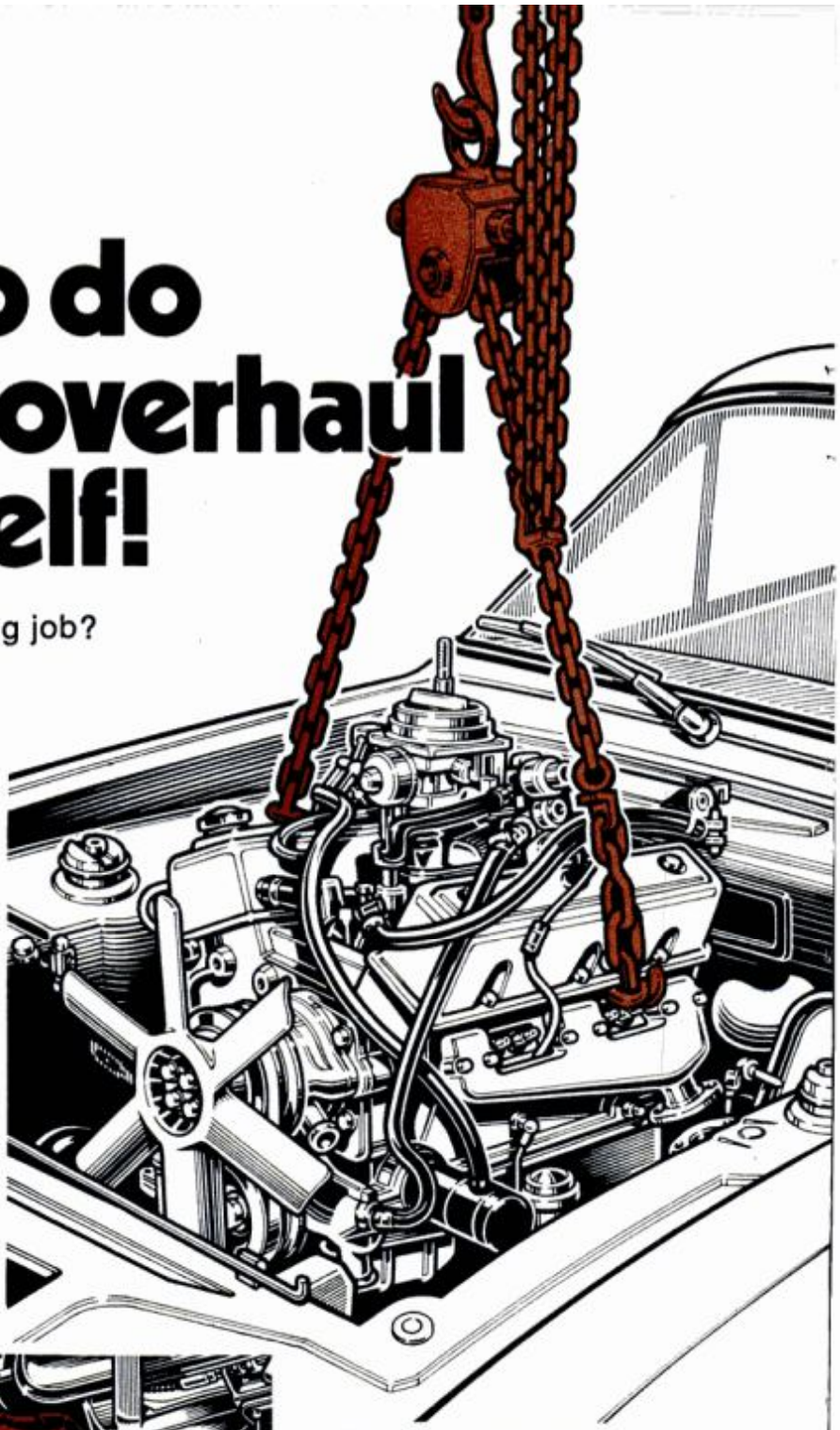
You have a car in the 75,000 to 100,000-mile range that has started drinking oil. You know that oil is not leaking from the engine, but hoping against hope, you check anyway.

You spread some old newspapers on the floor under the engine and flywheel housing, and run the engine with the transmission in neutral or park at about 1000 to 1250 rpm, which is equivalent to 20 to 25 mph. When the heat gauge shows that the engine has reached normal operating temperature, you race the engine for a moment and then let it slacken back down to the 1000-1250-rpm range.

You continue this procedure for at least for five minutes after the engine has warmed up; that is, racing the engine to high acceleration for two or three seconds at 30-second intervals. At the end of five minutes, you drive the car carefully off the newsprint so that the tires don't make confetti, shut off the engine and examine the newspaper.

Oil appearing on the newspaper means that there's a leak. A leak that isn't too severe may not make droppings on the paper, but there should be oil wetness on the underside of the engine or flywheel housing. (You'll be able to tell better if you clean the engine with solvent before making this test.)

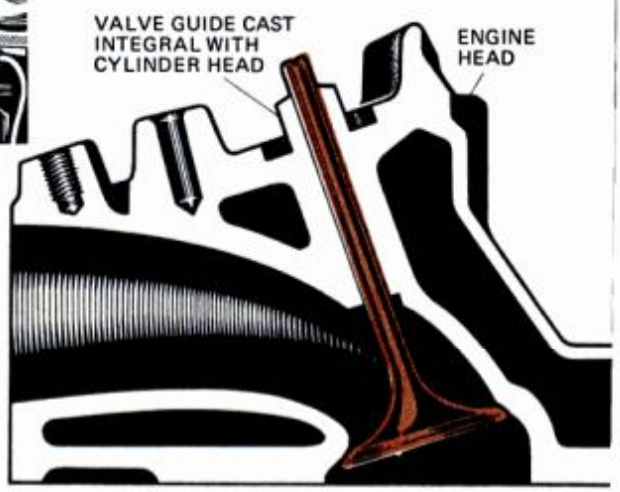
However, the chances are that you will not find a leak when an engine has reached the mileage plateau



Removing your engine for overhaul may be necessary with some cars. You'll need a block and tackle.

Removing oil pan is always necessary for engine overhaul. Clean it thoroughly and, after overhaul, reinstall with new gasket and tighten it to specification.

PM Illustrations: Peter Trojan



Valve guide bores in cylinder head require reaming to accommodate new valves with stems of larger diameter.

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yours has. If not, then the high oil consumption is undoubtedly being caused by oil that is getting past worn parts of your engine into the combustion chambers where it's being burned.

PCV system to blame?

On a hunch, though, let's not overlook one other "minor" possibility that even sharp professional mechanics forget—the chance that a clogged positive crankcase ventilation (PCV) system is responsible for oil consumption.

If your PCV valve is clogged, excessive pressure builds up in the crankcase and forces oil through the valve cover-to-carburetor hose into the carburetor air cleaner housing. Obviously, then, if you find oil inside the air cleaner housing and on the air cleaner filter element you should replace the PCV valve, clean out the PCV system hoses, replace the carburetor air cleaner element and give thanks that you're so lucky. Because if you aren't, engine work looms.

The usual reason for loss of oil because of internal damage is worn piston rings. However, worn or scored cylinders, worn ring grooves in pistons and/or clogged oil-return slots or ring grooves that prevent oil from returning to the crankcase could also be responsible.

Leakage past bearings

Another internal cause of oil consumption is excessively worn engine bearings. This condition is often easy to distinguish because too much bearing clearance, which allows oil to escape past bearings into cylinders, usually provides low or no oil pressure with the engine warm and idling.

Suppose that in your engine the allowable bearing clearance is .0015 inch. Leakage, if any, is at a minimum.

In time, the bearings wear and clearance works its way to .003 inch. Suddenly, oil leakage becomes five times greater than it was. If clearance eventually should attain .006 inch, the leakage will be 25 times greater than it was originally when that bearing clearance was only .0015 inch.

If your automobile is equipped with dash-mounted gauges, you can get a pretty good idea of engine bearing condition by observing the oil pressure.

If the car is really losing oil and the oil pressure is low, worn bearings are probably the cause. However, a bearing oil-leak detector may be used to definitely establish bearing condition before the job of installing the new bearings is undertaken.

Remove the oil pan and connect the oil-leak detector, which is a pumping instrument, into the engine's lubricating system. With pressure applied, count the drops of oil per minute that each bearing allows to pass.

Generally, if more than 120 drops pass per minute, it means that the bearing is excessively worn.

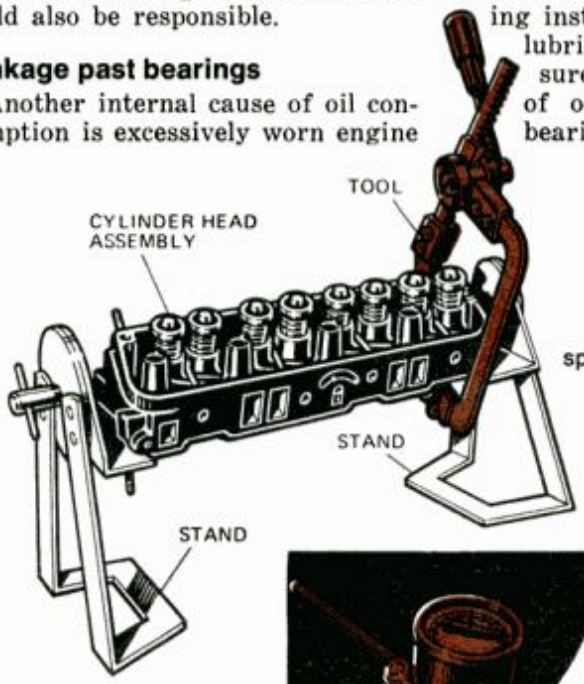
Do a complete job

If any one of the engine problems just mentioned should prevail and problems just mentioned prevails and work is going to be done by a professional mechanic, he will probably advise that you allow him to do a complete overhaul although some of the parts may not have to be replaced now. Listen to him. If parts in one area of the engine are worn—rings, for example—parts in another area (bearings, for instance) will probably wear out soon.

In order to do any one of these jobs, you may have to remove the engine from the car and you will have to take off the head(s) and oil pan. It would be a shame to put only new rings into the engine, button everything up and then discover that you'll have to take it all apart once more some 5000 miles later to replace the bearings when they have reached their wear limit.

The same advice holds if you're going to tackle this work yourself—it is practical to do a complete overhaul job when work in one area is required.

However, you still may have an "out" that will permit you to postpone overhaul. There is always the chance that your old engine has worn valve guides. Repairing worn valve guides, although not a snap job, isn't



Removing valves requires that valve spring be compressed to get off retainers and locks. Special tool shown here costs about $20.

Measure valve-guide wear with dial indicator. Reading should be within manufacturer's tolerance. If there's too much play, valves must be replaced and valve guide bores must be reamed.

Valve guide bores are reamed with special tool costing under $10.

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in the same class with doing a ring job.

Tests tell

You can get a good idea what your course of action will have to be by noticing a few things. First of all, pull the sparkplugs after running the engine at idle for about 10 minutes.

If plugs are oily, there is no longer any doubt that oil is getting into the combustion chambers. You can discount external leaks and the PCV system.

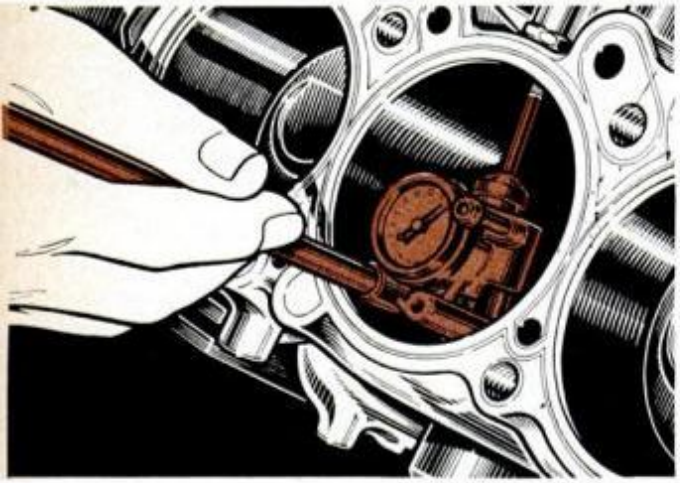
But is oil getting into the chambers because of worn valve guides? To find out, reinstall the plugs and drive the car about 10 miles. Pull the plugs again. If they are now dry, you can proceed with valve guide repair. If sparkplugs are still wet with oil, an engine overhaul is needed.

If you need more evidence, test engine compression. Warm the engine to operating temperature, shut it off, and remove all sparkplugs.

Take off the carburetor air cleaner and block the carburetor throttle linkage in full open position. Insert the compression gauge in a cylinder and crank the engine until the gauge's pointer no longer rises. About six or seven compression strokes are needed. Record the reading and proceed to take readings for each of the other cylinders.

You will probably find readings below normal in several or all cylinders (check the service manual for the engine's "normal" compression reading). Inject about two tablespoons of SAE 30 or 40 motor oil in each low-reading cylinder in turn and test again. An increase in the reading means that loss of compression (and oil) is past worn piston rings.

Keep in mind that a compression test will not tell you if oil loss is the result of deeply scored cylinder bores. Injection of oil into a cylinder with a damaged bore will not seal the cylinder. Thus the compression gauge reading will remain the same as it was before you injected oil. In this case, you don't know if your problem is damaged bores or worn valve guides. But it's logical to assume that valve guides are to blame and proceed to tackle them first.



Cylinder bores must be measured before piston-ring size can be determined.

To check ring set size, position a ring in a cylinder bore by pushing it down carefully with the head of a piston. Measure gap between ends of ring. If ring gap is greater or less than specified limits, get new rings.

Check ring groove condition by inserting feeler gauge between ring and land. Gauge should slide freely when moved. Do this around piston's entire circumference and for all ring grooves. Binding means land has developed high spot. Piston should then be replaced since high spots will damage new rings.

A ring compressor will be necessary to reinstall the piston back in the cylinder, as shown here.

Decision time

Your options are clear if a complete engine overhaul is indicated. You can get rid of your clunker and buy another car.

Or you can turn the car over to a pro. His price for overhaul will probably be $400 to $600.

Or you can do the work yourself. But before you embark on this course (you may figure you have nothing to lose but time and sweat) let me fill you in on a few details.

First, you can lose money if you get discouraged and give up halfway through the job. Engine work requires special tools. Special tools can cost you over $100, and most of them will not be used again unless you do another engine job.

Second, ask yourself whether you have the facilities to take an engine apart, especially if it has to be removed from the car. How are you going to do this if, say, you live in midtown Manhattan? Think about it.

I'm the last guy to discourage any-

(Please turn to page 158)

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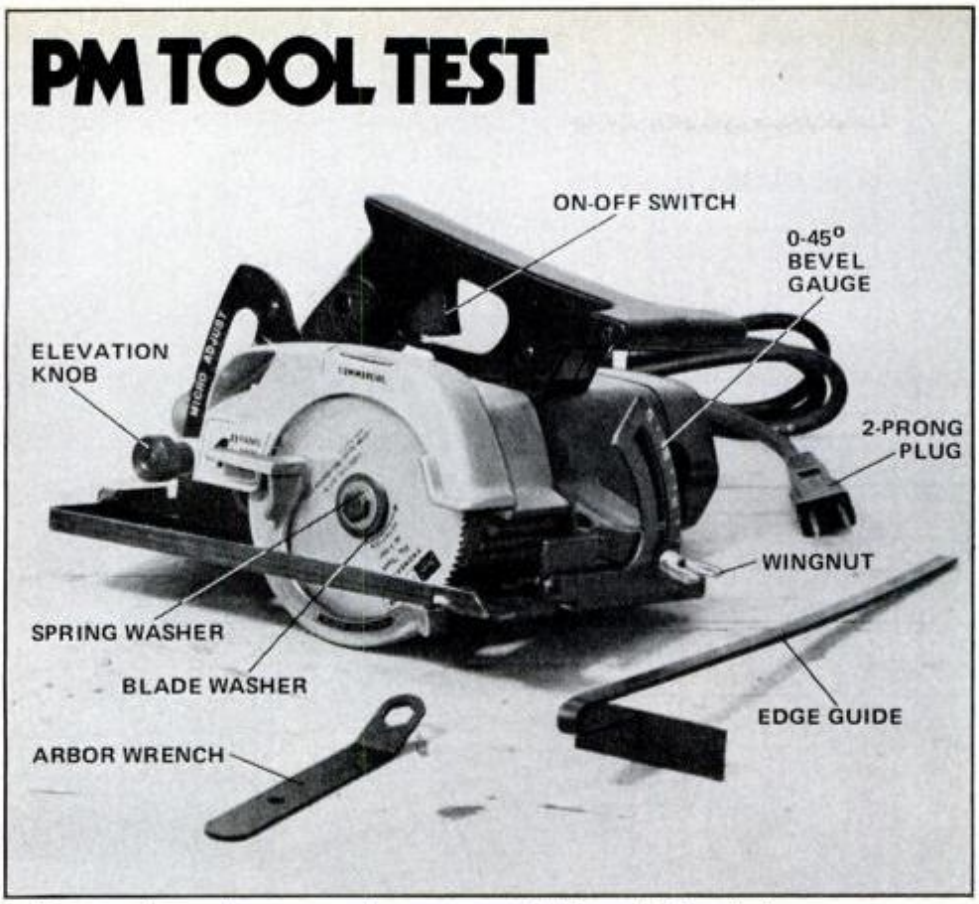
PM TOOL TEST



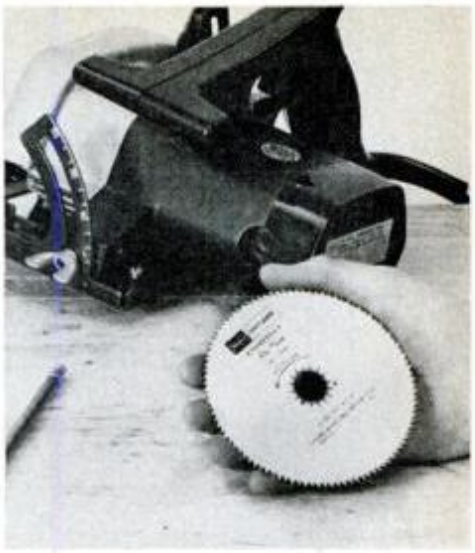
Pint-sized panel saw with a big bite

When you first open the package, you suspect that you've been shipped a toy by mistake—like the miniature tools that are sold for youngsters. But after your very first pass with this saw, you're sure to agree that looks can be deceiving.

Since I didn't have a paneling job at hand, I ran this saw through its paces in the workshop using various pieces of material. When used with steady pressure and the proper feed rate, the tool cut ¾-in. plywood almost effortlessly. This indicates the motor is sized to suit those jobs that you are most likely to use this tool on—¼, ½ and ¾-in. plywood and particleboard.

Rated for commercial duty by Sears, the saw is sure to attract professional carpenters as well as homeowners. Though not intended to replace its more versatile cousin, the 7-in. circular saw, this imp will, in fact, let you handle many cutting chores with less back-breaking effort. That's the biggest plus that this tool has going for it. As many professionals will agree, a wearying aspect of any paneling job is the frequent picking up and putting down of the circular saw while working hunched over a sawhorse worktable. Since this tool weighs in at about half the poundage of a typical 7-in. circular saw, you will actually heft hundreds of pounds less during the course of a normal all-day paneling session.

For safety, the saw sports an external blade clutch—a spring washer. When installed properly—as directed in the owner's manual—this permits the correct amount of slippage during normal use. Conclusion: a desirable saw for professional and amateur carpenters alike.—*Harry Wicks, Home and Shop Editor*

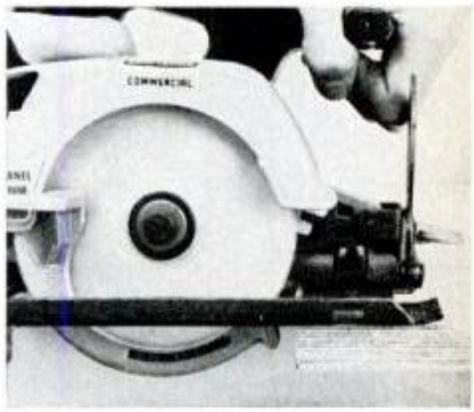


Don't let saw's size fool you; 4-in. blade shown zipped through paneling.

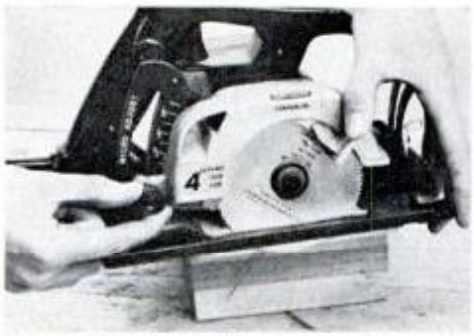
SPECIFICATIONS
Model 315.11890 4-in. circular saw

Bearings: Ball and roller
Gears: Helical
Motor: ⅜ hp, no-load speed 7000 rpm
Housing: Die-cast aluminum gear housing, thermoset polymer motor housing and handles
Electricals: Double-insulated, 110-120 v., 60 Hz, a.c., UL listed
Price: $39.99

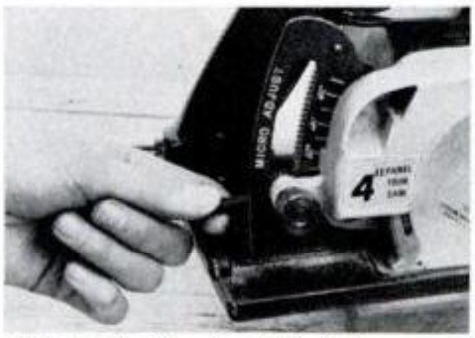
Manufacturer: Sears, Roebuck and Co., Sears Tower, Chicago, Ill. 60684. Available through catalog or at local Sears stores.



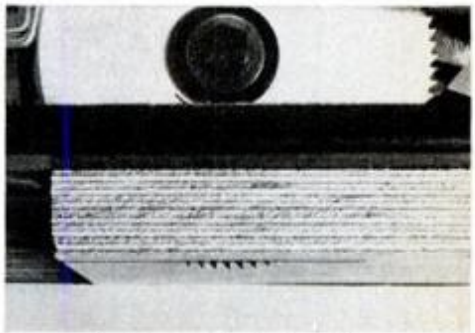
For best cutting: Rest shoe on work, get blade to full speed, enter board.



Micrometer-knob allows accurate depth-of-cut adjustment, is fast and easy.



With height determined, blade is secured by pushing down lock lever.



Proper depth for blade is with one *full* tooth below work bottom as here.

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Dehumidifiers: The low-cost way to take the sweat out of summer

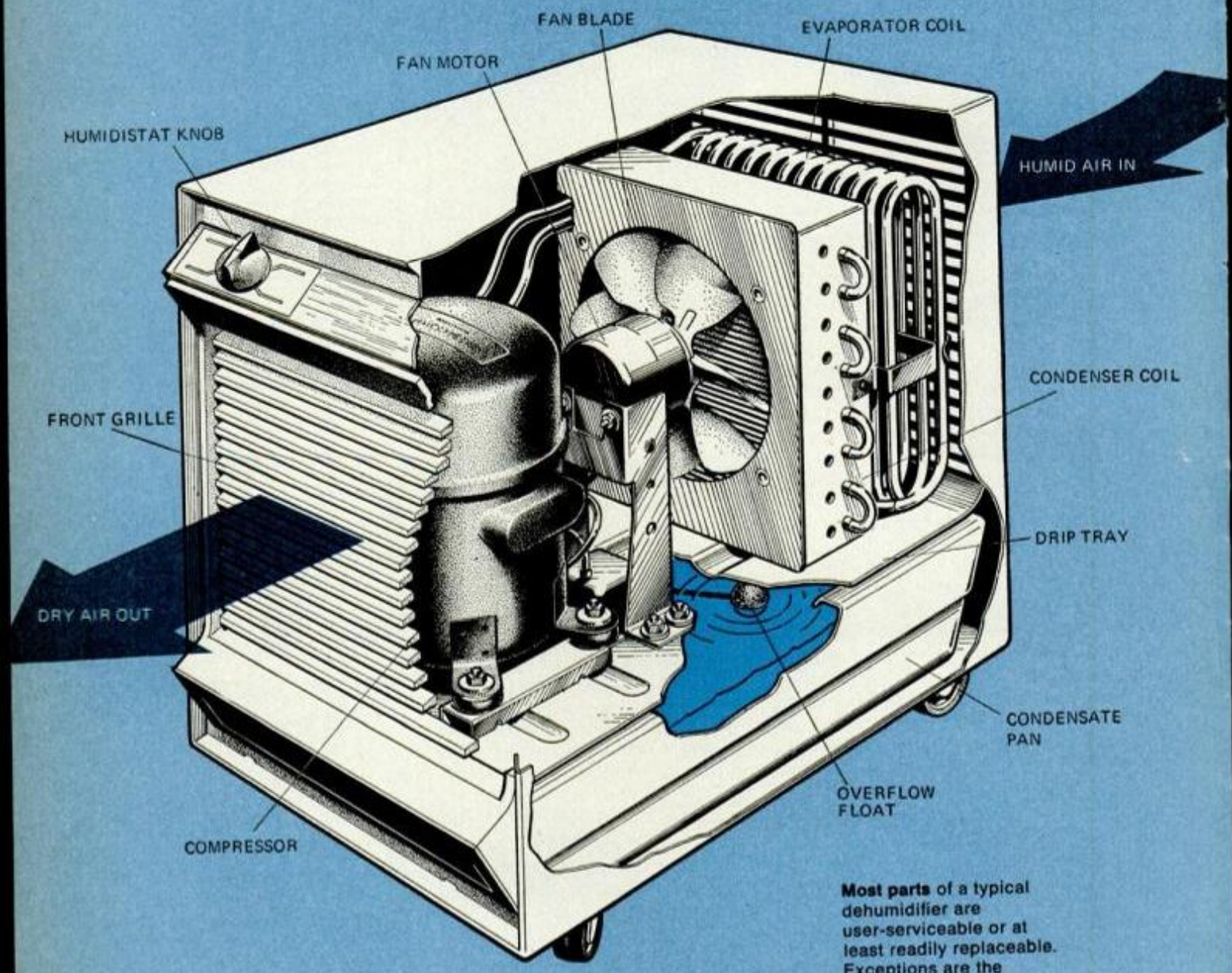
Here's a guide to the appliances that make damp spaces livable.

by Mort Schultz

You don't need test equipment to tell whether your home can use a dehumidifier. If the house, particularly the basement, shows any of the following symptoms, it's a candidate:

- Black, moldy-looking blotches—mildew—on insulation batts between basement or crawl-space joists.
- Wetness on insulation batts.
- Mildew on stored luggage, books, clothing or furniture.
- Rust on workshop tools and metal accessories.
- A musty, moldy odor.
- Sticking drawers and doors.
- "Sweat" on cold-water pipes or dripping from them.

Basements and crawlspaces are



Most parts of a typical dehumidifier are user-serviceable or at least readily replaceable. Exceptions are the components of the refrigeration system.

usually the only places where humidity goes high enough to cause damage. But some closed off, non-airconditioned rooms can benefit from dehumidification. Living spaces above ground level are likely to be okay, because they're airconditioned or their windows are kept open. Airconditioning does provide a measure of dehumidification—but watch out for humidity problems in some spaces where airconditioning is not run full-time (an airconditioned workshop, for example).

How humidity happens

How do high-humidity conditions come about? Air normally circulates through the house, especially to and from un-airconditioned spaces. Warm air has a greater moisture-holding capacity than cool air. Consequently, warm air entering a cool basement (relatively cool because it's shielded from sun) condenses some of the moisture it carries on surfaces inside the basement—and that's the moisture that shows up as "sweat" on pipes and promotes rust, mildew and odors.

In a basement, it may be practical to leave windows open most of the time during warm weather, making indoor and outdoor temperature closer and, perhaps, obviating the need for a dehumidifier. Try this before buying the appliance, unless conditions are severe.

If the open-window method is inadequate or impractical (if, for instance, the house is unoccupied most of the day), you can gauge the dehumidifier capacity you need by referring to the chart on this page.

You should be aware that a dehumidifier is no answer to a seepage problem—when moisture is entering from the ground through the basement's walls or floor.

How can you tell whether condensation or seepage is to blame for your basement's dampness? There are several possible clues. First, seepage will tend to be confined to one part of the space, a single damp wall, for instance—and any visible trickle of water is a dead giveaway. Second, condensation will be greatest during periods of high outdoor humidity—see if dampness is greater then. Third, seepage will be greatest after heavy rains—see if that's the time when dampness increases.

Curing a seepage problem can be a laborious or expensive process. For pointers on dealing with seepage, see *How to Waterproof a Basement* (page 92, Oct. '73).

Capacities and prices

Dehumidifiers are rated by the number of pints of water they draw from the air in 24 hours (under standard conditions of 80° F. temperature and 60-percent relative humidity). Each manufacturer makes several models with different capacities, and capacity is the major factor governing price.

For example, Ebco Manufacturing Co.'s line of Oasis dehumidifiers for 1977 consists of four models. The 15-pint unit sells for $178; 24-pint for $196; 28-pint for $205; and 35-pint for $228.

White-Westinghouse Corp. makes five models. The 14-pint unit is priced at $149; 20-pint at $169; 25-pint at $189; 30-pint at $209; and 35-pint at about $230.

Most (if not all) nationally known manufacturers of dehumidifiers are members of the Association of Home Appliance Manufacturers, and their products display the AHAM seal. The group rates dehumidifier capacities and twice a year publishes a complete listing, with capacities, of members' models. You can get a copy by writing to AHAM at 20 North Wacker Dr., Chicago, Ill. 60606.

In determining the unit you need, go up one size if the chart seems to indicate that your conditions are on the borderline between two capacities. Also remember that factors other than area of the space can come into play. These include use of laundry equipment in the space, number of family members using the space and the amount and intensity of their activity and the number of doors and windows.

How they work

There are dehumidifiers that pass air through a moisture-absorbing chemical like silica gel, but the refrigeration type is more convenient for homeowners, more reasonably priced and more common.

A typical dehumidifier has the same

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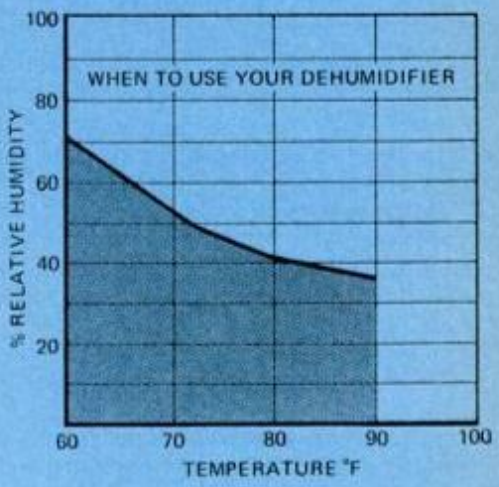


High-style dehumidifiers with attractive cabinets fit neatly into finished rooms.

ESTIMATING DEHUMIDIFIER CAPACITY NEEDED
(Pints per 24 hours)

Interior condition (summer)	Area in square feet 500	1000	1500	2000
Moderately damp: Space feels damp, has musty odor (during most humid weather only).	10	14	18	22
Very damp: Space always feels damp, smells musty; damp spots show on walls and floor.	12	17	22	27
Wet: Space feels and smells wet; walls or floor sweats.	14	20	26	32

Saw sharpening tricks and techniques

by Rosario Capotosto

Obviously, a sharp handsaw makes cutting easier and gives cleaner cuts. Besides making good cuts, a sharp power saw blade is a must for maximum safety. Feeding a board into a dull table-saw blade can cause kickback, and cutting with a dull blade can burn out a saw's motor.

Saw sharpening is an inexpensive and money-saving do-it-yourself operation that requires some basic knowledge and a little practice. Here's how you can keep your saw blades in top shape.

Basic steps

Before you begin to sharpen any saw, you must remove all accumulated resin, pitch and gum. Use kerosene or a commercial solvent sold for the purpose.

The essential steps in sharpening both handsaws and power-saw blades are: *jointing* to standardize teeth height; *shaping* to restore correct tooth shapes; *setting* to prevent binding (so the saw kerf will be greater than blade thickness); and *filing*, the actual sharpening of the edges or points of teeth.

Not every operation will be necessary every time you sharpen a saw blade. For touch-ups, a thorough cleaning and filing may be enough.

Mill files (single cut) should be used for sharpening because they leave smooth, finished surfaces. Keep file strokes level, and always lift the file off the tooth before drawing it back for the next stroke.

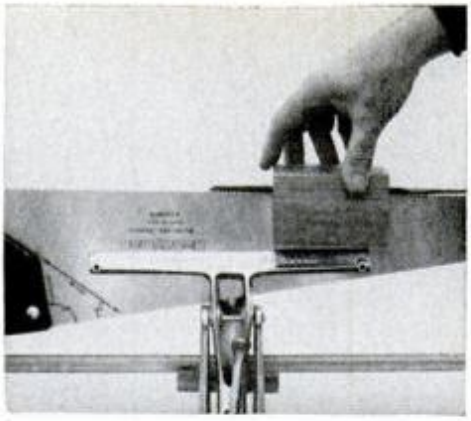
Sharpening handsaws

The file used on a handsaw depends on the fineness of the saw, as measured by its "points" or teeth per inch. This information, usually stamped on the blade, can be readily checked with a ruler. Use the chart on the facing page to find the file of the right size and taper for the saw you're working on.

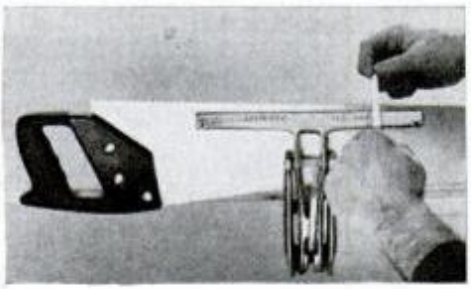
A simple-to-make plywood clamp (next page) will hold the blade while you work on it. Or you may be able to locate one of the old commercial clamps, like that shown.

If the saw teeth have been worn unevenly, joint by stroking an 8-in. mill bastard (single-cut, medium-coarse) file over their tips. A file-holding jig or easy-to-make jointing block will assure even, square filing. Don't overdo it. Check your work frequently and stop when a spot of bright metal shows on each tooth.

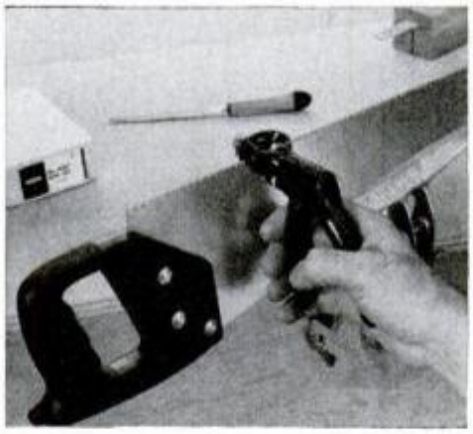
For shaping, clamp the saw so the gullets are not more than ⅛ in. from clamp jaws. Hold the file level at 90° to the blade and all the way down into the gullet. File the forward slope of each tooth until exactly half the flat spot left by jointing has disappeared. Then file the rear slope of each tooth until the rest of the flat has disappeared. The result is sharply pointed teeth.



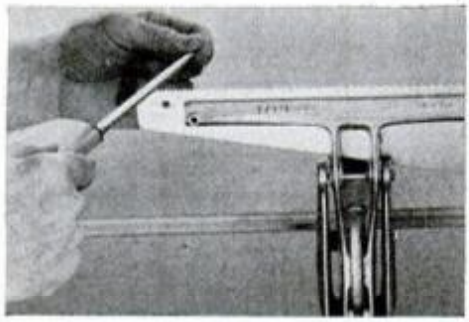
Jointing to reduce all teeth to uniform height is the first step. It's done by passing a file several times lightly but squarely over the top of the teeth. The jointing block assures a level pass.



Shaping is done with a taper file in the gullet used at 90° to the blade. File forward tooth slope until half the jointing flat disappears; then file rear slope.



Setting or bending the saw teeth is done here with a Stanley pistol-grip saw set. You can adjust it to give the amount of tooth set you want (see text).



Filing a crosscut saw begins at the saw toe. Hold file at a 65° angle to blade and file the teeth that are set toward you on the push stroke. File both gullet slopes. Reverse saw, file alternate teeth.

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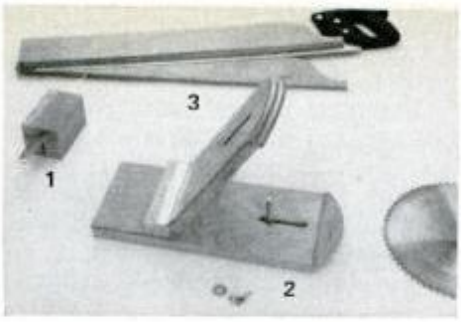
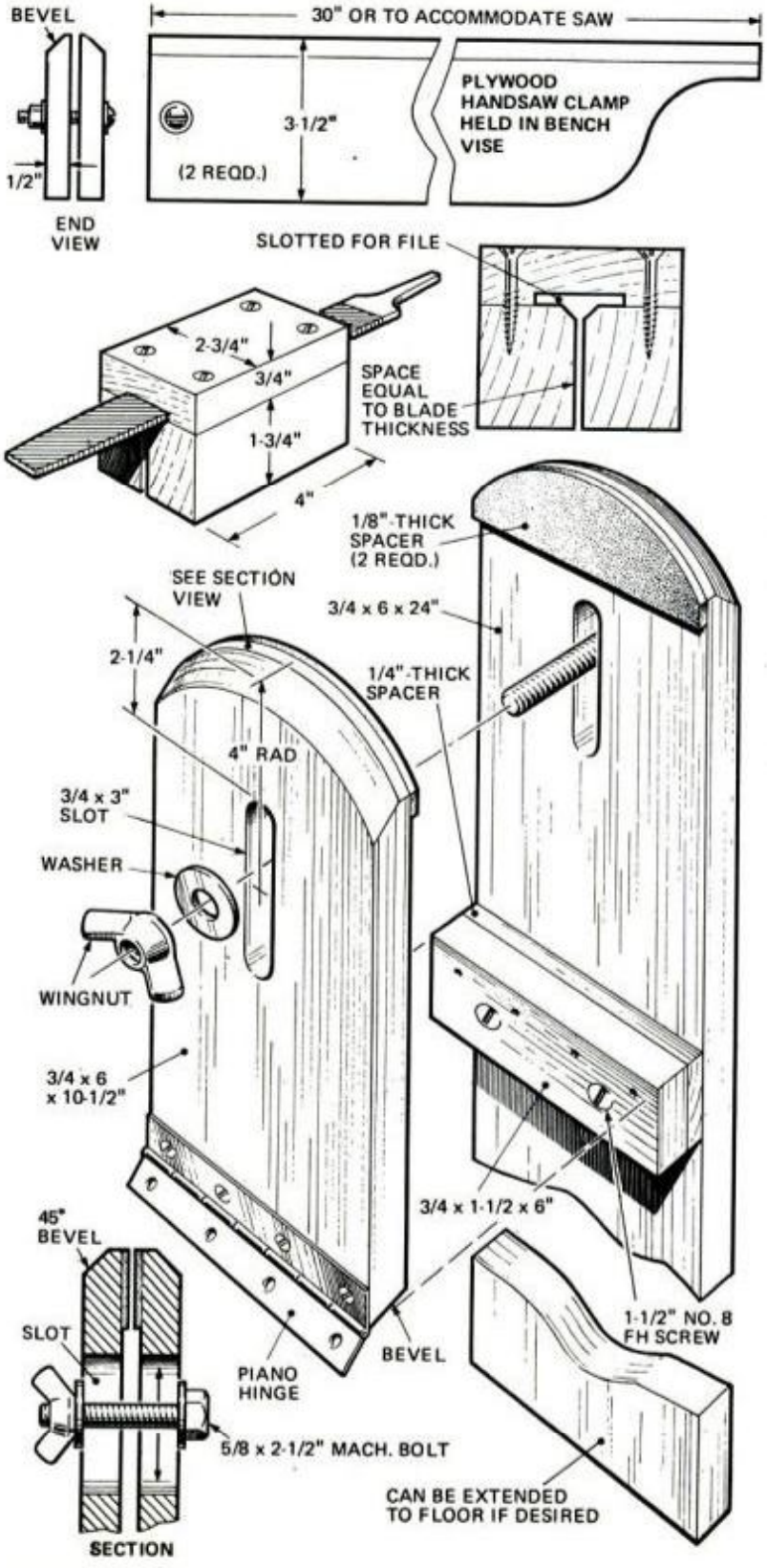


Easily made sharpening aids are: 1. jointing block; 2. circular-blade clamp; 3. handsaw clamp. Plans are shown below.

File guide for sharpening handsaws

Blade points per inch	Taper (triangular) files recommended
5, 5½	7″ taper regular
6	7″ or 8″ slim
7	6″ or 7″ slim
8	6″ slim 7″ extra slim 8″ double extra slim
9	6″ extra slim 7″ extra double slim
10	5″ or 6″ extra slim
11	5″ extra slim 6″ extra double slim
12	5″ extra slim
13, 15, 16	5″ double extra slim



To set the teeth, raise the saw in the clamp. The tool, called a saw set, is adjustable. You want a set of about one-third blade thickness on rip saws, one-fourth on crosscut saws and even less on hollow-ground handsaws.

First set every other tooth—those set toward you—then reverse the blade in the clamp and set alternate teeth. To set evenly, use the same pressure for each tooth.

Filing crosscut saws

To file a crosscut saw, clamp the blade with the saw toe pointing left, handle to the right (reverse if you're left-handed). Start at the toe and file the teeth that are set toward you. Place the file into the left side of the first tooth's gullet, holding it horizontally and at the same side angle as the original bevel (usually about 65°). The file should touch both sides of the gullet with each stroke (remember to file with forward strokes only). When every other tooth has been filed, reverse the saw in the clamp, start at the toe again, and file the alternate teeth.

To file a rip saw (jointing, shaping and setting are the same), stand directly in front of the clamp and hold the file straight across the saw at a right angle to the blade. File so that tooth points, not edges, are sharpened. After every other tooth is brought sharp and square, with the file to the left of the tooth set toward you, reverse the saw and file the remaining teeth.

For a finishing touch, many craftsmen like to add an operation known as side-jointing. It's performed by stroking each side of the blade two or three times—*lightly*—with the fine side of an oilstone. (Wrap cloth or thin cardboard around one side of the stone to keep from scratching the blade.) Side-jointing removes filing burr and dresses tooth alignment to uniform set. It will help you get the smoothest cuts your saw can make.

Circular-saw blades

The principles of sharpening circular-saw blades are the same as those of sharpening handsaws, but the techniques are different. Proper set and tooth uniformity are particularly important to assure a smooth-running blade. Extra strain on a tooth left larger than its fellow teeth can lead to breakage or a cracked gullet.

You can restore steel saw blades, but for carbide-tipped blades, see a professional saw sharpener.

The first step in keeping a blade sharp is taken when it's brand new: Make a close tracing of its outline

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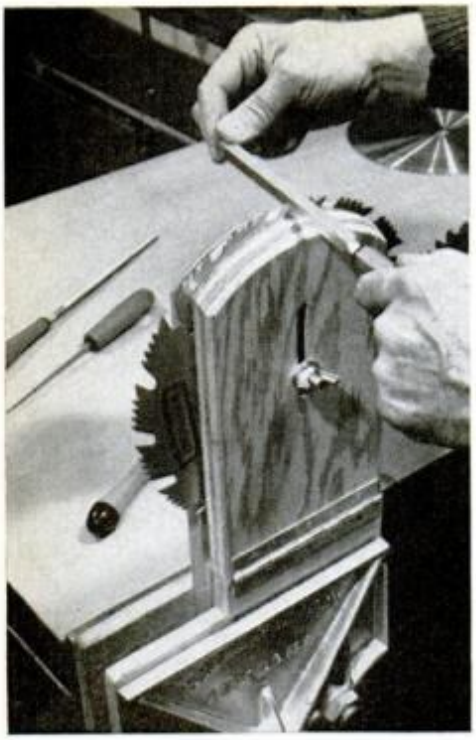
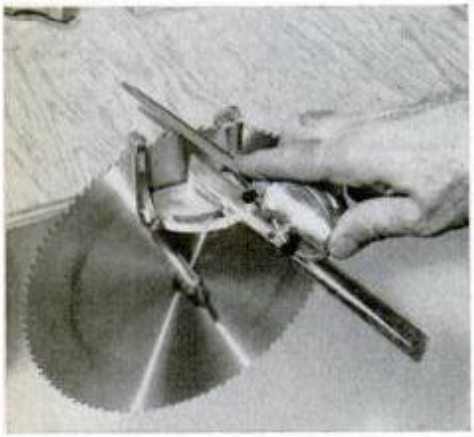


A cantsaw file bevels the teeth of this combination blade, while blade is held securely by the circular blade clamp. The file is available with a "safe back"—a smooth side. Narrowness of the file allows it to fit in angles less than 60°.



This circular saw sharpener lets you sharpen blades by hand with almost foolproof accuracy. You just set the scales to the pitch and angle you want and file. It handles 6 to 12-in.-dia. blades and is about $17.25 from Brookstone, 350 Vose Farm Rd., Peterborough, N.H. 03458.

Some saw-sharpening aids: attachment (left) to use with a bench grinder, $59.99; blade-setting tool designed for circular blades (right foreground), $59.99, and blade sharpener attachment for radial or table saws (right background), $29.99. All are from Sears.

on paper. This pattern will be a vital reference after several sharpenings.

A blade should be sharpened as soon as it shows symptoms of dullness—increased feed effort, rougher cuts and burning (the last of which you'll smell before you can see it). Start by jointing, with the blade in place on the arbor of the table or radial-arm saw, and the saw *unplugged*.

Place an oilstone on blocks so it straddles the blade. (Since the blade will groove the stone, don't use an expensive oilstone for this.) Adjust the blade so the teeth just barely scrape the stone. Then slowly rotate the blade backward by hand until every tooth has contacted the stone. To joint on a radial-arm saw, rest the stone on the table and bring the blade down to it. *Never joint with the saw under power.* For a portable circular saw, you'll have to jury-rig a way to hold the stone in a fixed position in contact with the blade.

Combination and planer blades with rakers—teeth that don't cut but clear chips—present a special problem. These teeth must be filed individually about 1/64 in. below the cutting teeth. Block the blade so it remains stationary and file squarely across the top of each raker with a 6 or 8-in. mill bastard file. With a table saw, you can block up the file for uniform height, sliding the block to cut. It's good practice to count strokes, too, and give each raker the same number.

Use a wooden clamp like the one on page 117 to hold the blade firmly for shaping and filing. To shape crosscut and combination blades, file

(Please turn to page 132)

FILING CHAIN-SAW TEETH

Your chain saw needs sharpening when the sawdust turns from chips to fine powder. The best way to file teeth is with the chain locked in a chain filing vise, but you can do a satisfactory job "on the bar" if the chain is tensioned so that it doesn't wobble.

Be sure to maintain the correct filing angle and height relative to each cutter's top plate (tooth's top surface). Bevel angles and the proper file are usually specified by the manufacturer. Round-hooded, chipper-type chains are simplest to sharpen—the right file and good technique will give the proper angles. Get a file holder if available for the chain—it will insure accuracy.

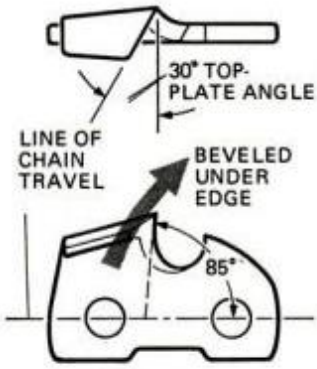
Strictly as an example, here are filing data for a 37 Series Chain according to Homelite:

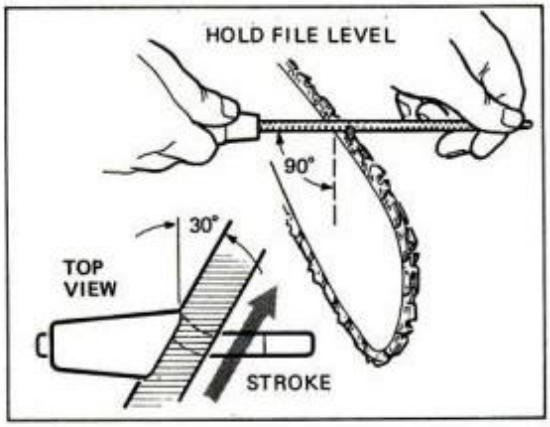
Use a 5/32-in.-dia. round file held 30° from a line straight across the chain. Hold the file level and stroke toward the front corner of the tooth. Keep 1/10th of the file diameter above the top plate.

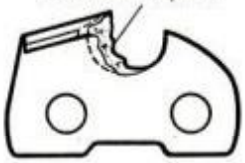
Use light pressure and press more toward the back of the tooth. Lift the file away for the return stroke. Avoid a rocking motion.

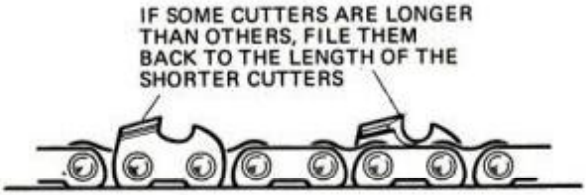
The result should be proper top and side plate angles and a 60° hollow-ground under-edge. Now file the depth gauges (forward points of cutters) to specified level below top plates—use a gauge-jointing guide for this.

Teeth damaged by nails must be filed down—and then all other teeth must be filed back to the lengths of the shorter ones. Have this done commercially.









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WORKSHOP MINI-COURSE
USING A CLAW HAMMER

If the students in my woodworking class are typical—and it's a pretty safe bet they are—there is little doubt that the ordinary "nail hammer" is the most frequently used tool in the home. Yet I find many persons are completely in the dark about the basics of hammer use.

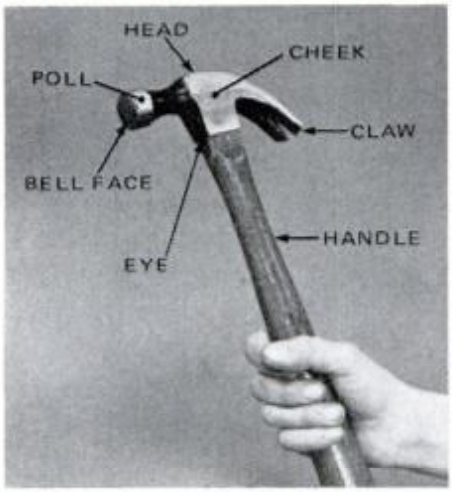
The information contained in the photos here covers the most-often-asked questions about hammers. Some other basic facts to consider:

■ Always use the right-size hammer for the job. For most chores, a 16-ouncer is perfect. A 13-oz. hammer is fine for bench work, cabinet-making and the like. For house framing, use a 20-oz. hammer.

■ Never use one hammer to strike another because there is a high risk of breakage and possible injury.

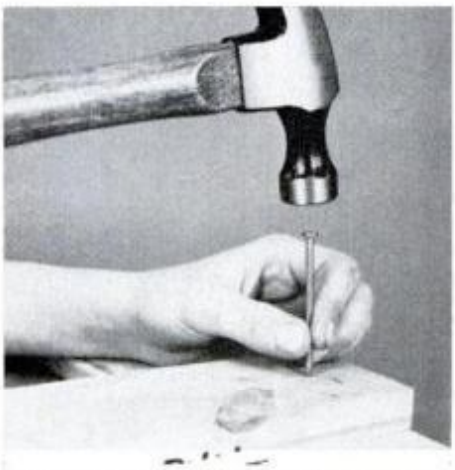
■ If a hammer shows excessive wear or mushrooming (misshapen head), toss it out.

■ Your best choice for a first-hammer purchase is a curved claw, 16-oz. hammer with bell face. The latter means there is a slight convex surface on the hammer face that makes contact with the workpiece. The result is that dents and marks are less likely to occur.—*Harry Wicks, Home and Shop Editor*

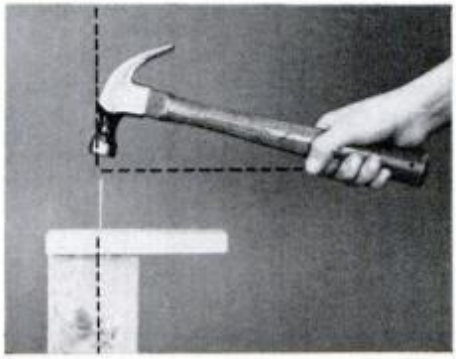


Nomenclature for a nail hammer.

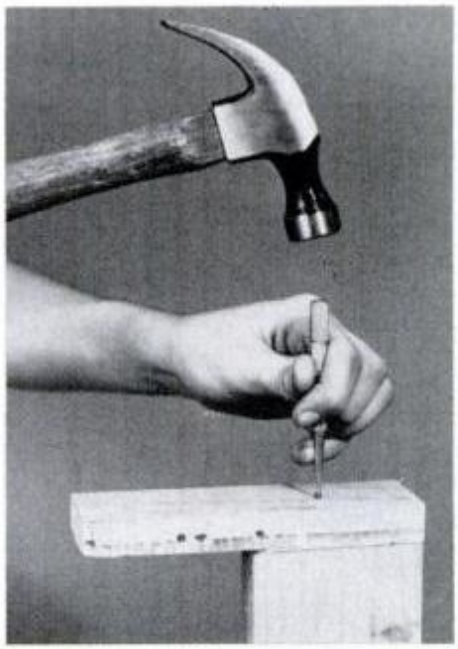
Nail hammer heads come in two patterns —curved claw (left) and ripping claw.



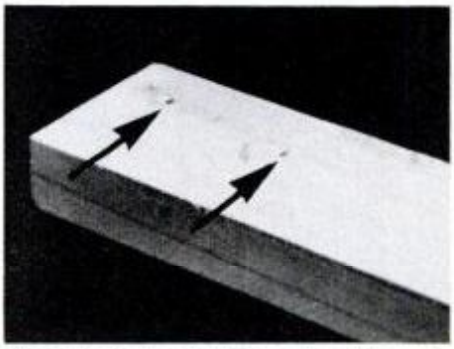
To start a nail, hold it between thumb and forefinger, apply several light taps.



Note nail axis when driving; hold handle near end on same plane as the nailhead.



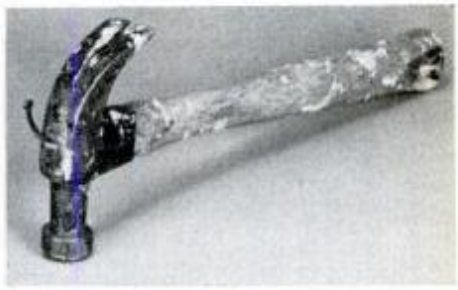
Stop driving finishing nail when head is slightly above surface; then use nailset.



Properly used nailset countersinks nails (arrows) without marring the workpiece.

To gain leverage when pulling nails and to protect work surface, use scrap block.

Never use hammer's cheek to drive a nail; you run a risk of chipping cheek.



Unhandyman's special—a misused hammer with loose head; it's hazardous.

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Build a redwood chaise

This redwood chaise will help you enjoy your outdoor leisure hours this summer. The lift-up section pivots to four different angles or lowers to a full horizontal position.

You can make the chaise with clear heart redwood—good for outdoor furniture—resorcinol or other waterproof glue and the minimal hardware noted in the materials list. You'll need about 68 ft. of ¾ x 3½-in. wood, 20 ft. of 1½ x 3½-in. wood and 10 ft. of ¾ x 1½-in. wood. This includes allowance for waste. Wood cost is under $50.

The chaise is made up of four parts: the lounge section, the side (arms and legs) section, the lift-up section and the ratchet section.

Begin by cutting the lumber to size. Label the pieces and separate them into their individual sections as you work.

Mortise-and-tenon joints

The legs and arms are joined by mortise-and-tenon joints. Carefully lay out the tenons in the legs and score the shoulder line with a sharp knife. Then secure the work in a vise, repositioning the wood for each cut so it can be made square with the face of the work. Cut the tenons with a backsaw. Then use a ripsaw to make the four cuts parallel to the tenon to remove waste.

Next lay out the mortises in the arms and use a 3/16-in. auger bit to bore out the mortises. Bore each hole ⅛ in. deeper than its mating tenon (to allow space for glue). Secure the wood and clean out all waste with a sharp chisel.

Use a router or table saw to cut the notches in the legs where the side rails attach.

The slats in the lounge and lift-up sections rest in grooves in the side rails. Rout the grooves for the slats on the side pieces using a straightedge guide.

Make the dado cuts for the end piece of the lift-up section. Also cut notches in the lift-up section to accommodate the ratchet when in the horizontal position. Drill and chisel out the first slat of the lift-up section where the pivot bolts will be attached.

Next, make the rabbet cuts on the lounge side rail ends.

Mark and cut the dadoes and the slots in the ratchet support section and the notches for the ratchet stops. Assemble.

You can use a compass set at 1¾-in. to mark the circle design on the leg bottom. Draw the circle, then measure ⅝ in. down from the circle top. Make a freehand cut inward from the outside of the wood around the mark. Also cut the other rounded corners on the arms, lift-up section and ratchet.

Join individual sections

Join all sections with glue. You may need to clamp the sections overnight; check manufacturer's directions on the glue can.

Begin with the lounge section. Spread the glue evenly in the grooves of the side rails and space the slats 1 in. apart. Glue and screw the end pieces and adjust bar clamps.

Glue and clamp the lift-up section in the same manner. Then glue and clamp the two side sections and the ratchet support.

Relax in the sun. Your comfort is assured in this reclining chaise. Its back can be lowered to the horizontal position so you can get an even tan.

PM photo: Harry Hartman

PM design: Ed Krales

Chaise slats are spaced 1 in. apart. To maintain even spacing, you can make a jig by gluing ¼-in. plywood to 1-in. stock.

Assemble the chaise

Join the lounge section to the side sections with glue and screws. Fit and bolt the lift-up section into the chaise. Then attach the ratchet support section to the lift-up section and bolt them together.

Attach the lower ratchet pieces by gluing and screwing them to the chaise leg. Then glue and clamp on the ratchet stop covers. Sand any rough edges.

Lounge pads are available in department and home center stores. The one shown is from Crawford Mfg. Co., Inc., Third Ave. and Decatur St., Richmond, Va. 23224. ★★★

MATERIALS LIST—CHAISE

No.	Size and description (use)
2	¾ x 3½ x 78" redwood (side rails)
10	¾ x 3½ x 26¼" redwood (slats, ends)
2	¾ x 3½ x 39" redwood (lift-up sides)
9	¾ x 3½ x 24¾" redwood (lift-up slats)
2	¾ x 3½ x 11" redwood (ratchet cover)
4	1½ x 3½ x 20⅜" redwood (legs)
2	1½ x 3½ x 44" redwood (arms)
2	1½ x 3½ x 20" redwood (ratchet)
1	¾ x 1½ x 27" redwood (endpiece)
2	¾ x 1½ x 17" redwood (ratchet sides)
1	¾ x 1½ x 25½" redwood (ratchet piece)
1	¾ x 1½ x 23¼" redwood (ratchet piece)
2	¼-20 x 1¼" fh galv. bolt, acorn nut
2	¼-20 x 1¾" fh galv. bolt, acorn nut
16	No. 8 x 1¼" brass fh screws
6	No. 8 x 2½" brass fh screws
	Resorcinol or other waterproof glue

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Caning a chair in 7 easy steps

by Penelope Angell
ASSISTANT HOME AND SHOP EDITOR

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By using some inexpensive materials and following the basic steps of caning, you can give a chair an attractive, long-wearing seat. The intricate pattern of natural woven cane is at home in almost any room —you can use a caned chair in traditional or contemporary, formal or informal rooms.

A chair that has small holes bored around its seat opening should be caned. You can restore an old family piece or sometimes you can buy a chair—in need of caning—rather inexpensively. Before you cane the chair, make any needed repairs, and be sure the finish is in good shape and one that will resist water.

Cane used for chair seating is the outer bark of the rattan palm cut into narrow strips. The chart on this page tells you the cane size for your chair, depending on the size and spacing of the holes in the seat. Binding cane used on the seat perimeter is one size larger than the weaving cane. You can buy cane at chair-seating and craft supply houses.

As you work, weave with the shiny side up and pull the cane through in a direction that will prevent the "eyes"—the bumps where leaves once grew—from becoming damaged. To determine in which direction each strand will slide smoothly, run the strand through your fingers.

Note: The longer the cane lengths, the less you'll have to tie and begin new strands of cane.

Tools: You'll need 12 wooden pegs (whittled or purchased), awl, pail of water, several clothespins, sponge and scissors.

The caning operation

Begin by soaking several strands of cane in warm water about 20 minutes, or until the cane is pliable. As you take a strand from the water, add another to the pail from the hank of cane.

Step 1: Count the holes in the back of the seat frame. Find the center hole (or the hole just left of center if there are an even number of holes) and insert a peg marker. Find and mark the center hole (or left center hole) in the front of the frame. Remove the back peg. From the top, push the first moistened strand of cane down through the hole and extend it about 3 in.; repeg the hole to keep the cane in place. Remove the peg from the front hole, pull the cane strand across the chair seat through the hole and repeg it. Keep the cane somewhat slack. It will tighten as weaving continues.

Working under the chair frame, pass the free cane end up through the next front hole to the left. Pull it across the seat and down through the opposite hole at the back (to the left of the pegged hole).

Continue working to the left in the same manner, keeping the weaving slightly slack. If your seat is curved so a front hole doesn't have a back hole opposite it, fill the front hole and pass the strand through a side hole so it is parallel to the others. Clamp the remainder of the strand with a clothespin for later use.

Weave the right side of the seat the same way, starting from the center and working toward the right.

Step 2: Begin on the right side of the chair frame as you face it. Place a strand of cane 3 in. into the rearmost side hole and peg it. Pull the cane across the strands placed in Step 1 down through the opposite hole on the left side of the frame and peg it. Bring the cane under the frame and up through the hole next to the left-hand pegged hole. Pass the cane across to the opposite hole on the right. Continue working side to side, moving to the front.

Test for moderate tension with the palm of your hand. If the seat front is curved, peg individual strands into holes in the frame front so the strands are parallel with the others to complete the pattern in Step 2.

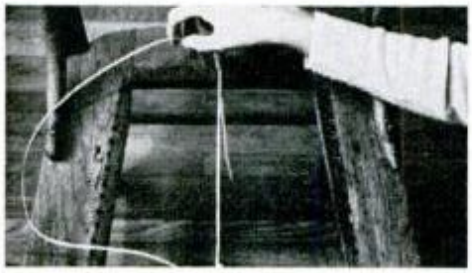
Joining cane strips

When you must add new cane, tie it to existing strands under the chair, using a square knot, or tie the end of each strand to a loop of cane with a half hitch. Make sure both pieces of cane are moist before tying.

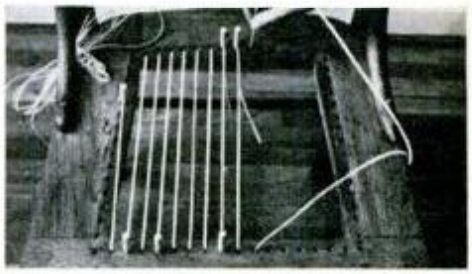
Step 3: Repeat the procedure used in Step 1. Work from back to front on the left side, then the right side, going over the strands in Steps 1

To find the cane size you need, measure the diameter of a hole in the chair seat. Next, measure the spacing between two holes from *center to center*. Then refer to chart at right for the answer.

Cane size	Hole size	Hole Spacing
Carriagefine	1/8"	3/8"
Superfine	1/8"	3/8"
Fine fine	3/16"	1/2"
Fine	3/16"	5/8"
Medium	1/4"	3/4"
Common	5/16"	7/8"

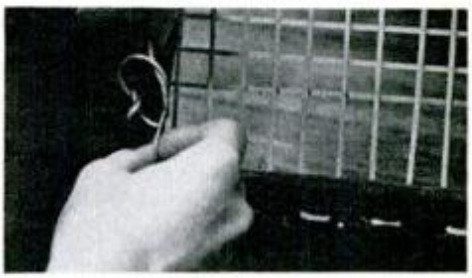


Step 1: Caning begins at center hole of the back rail or at first hole left of center if there is an even number of holes.

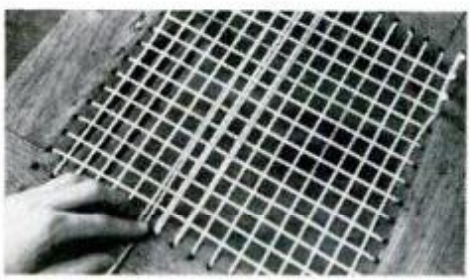


Pass the cane from back to front on the left half of the seat, then do the same on the right side. Cane should be slack.

Step 2: Begin in the back hole of the chair's right side as you face it. Pass cane from side to side to opposite holes.



Tie end of a new strand to the completed one on the underside of the chair with a square knot. Moisten ends before tying.



Step 3: Similar to Step 1. Strands go back to front. However, these strands must be to the right of those in Step 1.

Another way to secure a finished strand on the underside of the chair is to tie it to a loop of cane with a half hitch.

PM color photos: Bob Golden

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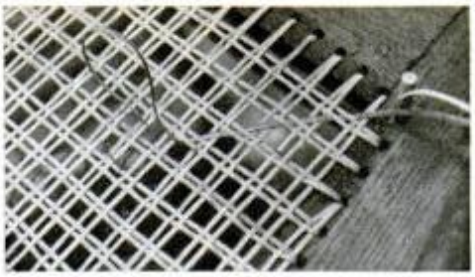
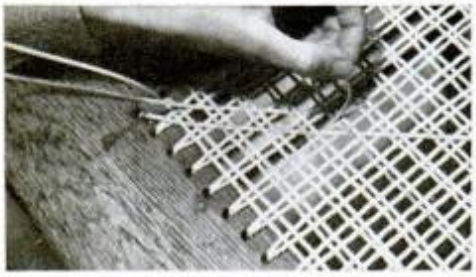
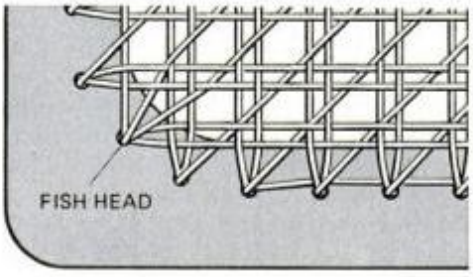
Step 4: Start at the back right side of the chair and weave from side to side, over top cane and under bottom cane.



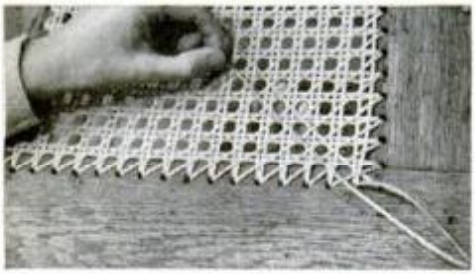
Step 5: Beginning at back corner hole on the right, weave a diagonal over front-to-back strands, under side-to-side ones.



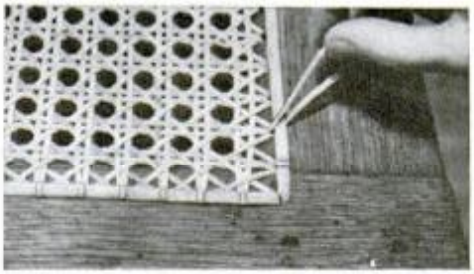
For the second row of Step 5 weave from front to back, again going over front-to-back strands, under side-to-side strands.



When you must use the same hole twice to keep rows straight, a V or "fish head" is made. This often happens in corners.



Step 6: Begin at the back left corner and weave under the strands from back to front and over strands from side to side.



Step 7: Secure binding with weaving cane. It passes up from a hole, over the binding cane and down into same hole.

and 2. However, as you weave, make sure the strands in Step 3 are to the right of those placed in Step 1.

Step 4: Keep the cane pliable by dampening it with a sponge as you continue. Peg a strand of cane into the back hole of the right side of the chair frame. In Step 4 you'll weave from side to side, working toward the front. Weave over the cane on top (Step 3 strands) and under the cane on the bottom (Step 1 strands). When you're halfway across the seat, pull the strand through until it's slightly slack, then continue weaving. Don't raise the strand as you pull. It should be level with the seat for easy sliding.

As you work, straighten the strands from preceding steps. Two dowel pegs used like pincers can help.

On your return weave, work so the strand passes over and under the same canes it did in going across.

Diagonal weaving

Step 5: Begin diagonal weaving in the back corner hole on the right side. Peg the cane strand and lay it across the chair in a straight diagonal to the front left corner hole, then mark that hole with a peg and begin weaving toward it. Weave over the cane that runs from front to back (Steps 1 and 3) and under the cane that runs side to side (Steps 2 and 4). Keep cane moist so the strand you're working with will slide easily.

Continue to weave diagonals, working toward the back section of the frame. Before you start a new row, determine the hole you should work toward on the opposite side.

To keep the diagonals parallel, you may have to use the same hole twice or skip a hole. This is particularly true on curved chair frames and at corners. The V-shape formed by two strands from different rows entering the same hole as shown in the diagram is called a fish head.

From time to time you may have to insert an awl gently to make room in a hole for the additional cane.

Complete the front section of the chair in the same manner as the back. Weave the first row using holes next to those used in weaving the first diagonal of the back section. Work forward, always weaving over the strands from front to back and under the strands from side to side.

Step 6: Weave these diagonals in the opposite direction from those in Step 5. Start in the back left corner hole and weave toward the front right corner. This time, however, weave diagonally under the strands running from front to back (Steps 1 and 3) and over the strands running from side to side (Steps 2 and 4). Complete the front section first. As in Step 5, in order to weave the diagonals parallel, use a hole twice or skip a hole if necessary.

Binding the edges

Tie and cut the cane as you work, and continually check for errors. The cane should form neat hexagonal holes. Continue to the back section and complete the chair weaving.

Step 7: Now you are ready to bind the edge of your cane seat. Be sure you have the binding cane one size wider than the weaving cane. Estimate the amount of binding you'll need. If your seat is square you must use separate pieces for each side because the cane won't stay flat at sharp angles. Cut each piece 3 or 4 in. longer than the side length of the chair. If your chair is curved, chances are you can bind the edge with one long piece.

Soak the binding cane and a piece of weaving cane for about 15 minutes. Then lay the binding flat over the holes on one side of the seat and peg one end in a corner hole.

Tie a moist strand of regular weaving cane under the frame and bring it up through the hole next to the pegged binding. Pass it over the top of the binding and down through the same hole. Bring it up through the next hole, over the binding and down the same hole. Continue around the seat edge.

Keep both canes moist, tight and flat. You may need to use an awl to force an opening for the binding. Be sure the binding is centered over the holes as you continue.

If you're using more than one strand of binding, start the second strand in the same corner hole as the first strand ended and continue binding.

If the seat is round and you use one binding strand, overlap the binding cane for several holes, carefully sliding the end under the section bound first. Flatten the loops and binding by tapping with the awl's wooden handle before the cane dries.

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THE MISSING PLANE

(Continued from page 73)

there were snide suggestions that the search team was doing something wrong, maybe searching the "hole" in the doughnut instead of the doughnut itself, maybe even operating in the wrong ocean. Some experts theorized the plane might have "glided" a considerable distance underwater—as much as seven miles—as it sank. Kutzleb didn't believe it. A 15-ton airplane might "fly" like an anvil, straight down, but no way would it go seven miles, he thought.

As added frustration, the weather had changed so drastically that they were no longer able to maintain their initial east-west runs across the search grid. They laid out a new north-south pattern and started over. Suddenly, on their first pass through the original fix point, the sonar operator let out an excited "Mark!"—contact had been made at last.

Gauging the strength of the echo signal against the almost flat, featureless bottom, it was determined that the contact must be the missing aircraft—only a large man-made object could produce such a pronounced signal with nothing else around.

But this was not to mean success. With food, water and other stores running low and the men at the limit of their endurance, the *Shakori* was forced to abandon the search.

There was one new hope. The NR-1, world's first and only nuclear-powered deep-submergence submarine, had been operating out of Holy Loch, Scotland, and was now available to assist in the recovery. Her captain, Cmdr. Allison J. Holifield, made ready to sail as the *Shakori*, reprovisioned, returned to the search.

Mystery of missing contact

But the contact was not where it had been before—mysteriously it had moved, and the sonar signal was now fuzzy. The aircraft had apparently been caught in the nets of a passing fishing trawler and dragged. The nets, eventually tearing loose from the trawler, had wrapped themselves around the plane, accounting for the obscured sonar image.

This posed a new problem: If either CURV III or the NR-1 approached the snarled plane, it could become entangled in the nets and trapped—a disaster that could cost lives as well as delay the recovery.

First of many failures

It was Oct. 20—more than a month after the sinking—before the weather moderated enough to permit the *Constructor*, with CURV III aboard, and the *Oil Harrier* to make a recovery attempt. The plan was for the *Constructor* to lower CURV (for Cable-controlled Underwater Recovery Vehicle), hook onto the plane, then pass a line to the *Oil Harrier* which, with her powerful winches and open stern well, would make the actual lift. But just as CURV had almost reached the F-14, the underwater power cables guiding the vehicle developed leaks and flooded, shorting out the control system and rendering the craft useless. That was the end of CURV—it would have to return to base for repairs.

It was now up to the NR-1. Arriving that same night, the nuclear sub immediately dove for the bottom, homing in on signals from a transponder dropped by the *Shakori* at the sonar contact point. Powerful floodlights revealed numerous trawl marks gouged in the sea floor but no sign of the F-14. Hours passed, then suddenly an observer at a bow viewing port exclaimed: "I see a wing!"

Slowly the F-14 emerged from the murky depths. It was on its back, apparently flipped over by the trawl nets wrapped around it. As they eased cautiously toward the aircraft, the NR-1 crew made a shocking discovery—the vitally important Phoenix missile was gone. It must have torn loose during the plane's plunge or while the snagged craft was being dragged along the bottom, meaning it could be anywhere. Locating the relatively large aircraft had been tough enough—the thought of trying to find the small missile was frightening.

More problems

The NR-1 was designed primarily for deep-sea research, not recovering airplanes. For one thing, it had only a single mechanical arm, extended from beneath the bow, to perform underwater tasks. With this, the sub's crew managed to hook a 30-foot choker line around one of the F-14's main landing gear in a slip-noose arrangement that would let the line pull up tight around the wheel strut. One crewman described the job as like "wrapping a Christmas present in a cupboard with one hand while wearing a boxing glove."

Again gale-force winds stirred up an angry sea. The *Constructor* could not hold position to drop a lift line. More days passed without success. It was not until Oct. 26 that an attempt could be made. A line was lowered, hooked onto the choker, then passed over to the *Oil Harrier*. The salvage boat's mighty winch began to turn and slowly the F-14 came free.

Victory seemed close at hand, but again the seas said no. With each heaving surge, the stern of the *Oil Harrier* rose and fell as much as 20 feet, putting immense stresses on the lift line. It was decided to tow the plane to shallower waters where divers could attach additional lines. As the *Oil Harrier* came about for shore, there was a loud crack as the line parted and the F-14 sank back to the bottom.

The NR-1, still in the area looking for the missing missile, was asked to make another hookup and a second lift was tried. This time the choker line failed and again the F-14 plunged back into the depths. To complicate things, the plane had now landed right side up with its wheels partially sunk in the soft bottom muck, making it practically impossible to attach another lift line. Murphy's Law was working overtime—anything that could go wrong did.

New strategy needed

Obviously, a new approach was needed. Time was running out—it was Nov. 1 and the inevitable North Atlantic winter was fast moving in. The Navy called in three more ships—the *Boston Halifax*, a British trawler with a heavy steel net, and two West German salvage boats, the *Taurus* and *Twyford*. The *Taurus* had a large-capacity clamshell grabber and a diving sphere or "kugel" for underwater observation.

Meanwhile, there was at least one piece of good news: The NR-1 had finally sighted the Phoenix missile and raised it gently to the surface where it was hoisted safely aboard the NR-1's support ship, USS *Sunbird*. The great advantage of the NR-1's nuclear power was that it allowed the craft virtually unlimited bottom time. Unlike conventional deep submersibles, which must surface periodically to recharge batteries and replenish their life-support systems, the NR-1 could remain down as long as it took to get the job done.

One down, one to go

It was felt that if the F-14 had been caught and dragged once by nets it might be possible to snag it again with a stronger net. The *Boston Halifax*, with its rugged steel net, steamed back and forth over the plane. No luck—the net wouldn't hold it. Next they strung a steel cable between the *Taurus* and *Twyford* and tried dragging it along the bottom. The cable, they hoped, would catch on the plane's landing gear. It was a primitive technique—the ancient Phoenicians had used it in salvage operations centuries ago—but more sophisticated methods had failed.

The hunch paid off—the cable

(Please turn to page 128)

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THE MISSING PLANE

(Continued from page 126)

caught. *Taurus* came to a full stop while *Twyford* continued steaming in circles to put several loops around the plane. Then *Twyford* passed her end of the line to *Taurus*. To keep the turns tightly in place, *Taurus* crewmen cleverly slid a 400-pound shackle down the paired lines to jam them together at the bottom.

Misfortune strikes again

The plan seemed to be working. Gingerly the *Taurus* winched up the cables and F-14 lifted free. But since the seas were still rough, it was necessary to tow the plane to sheltered waters before attempting the final lift to the surface. It was slow going—the *Taurus* was able to make only about four knots against the drag of her heavy, awkward tow—but things were at last looking up. To everyone's relief, the Russian AGI *Krenometr*, an intelligence-gathering ship that had been hovering in the area, now departed, apparently convinced that the recovery operation was well in hand.

Then Murphy's Law struck again. Within sight of the Orkney Islands and only four miles off the entrance to Westray Firth, there was a heavy bump, the *Taurus* was caught up short as if gripped by a mighty giant, and the lift lines went slack. Despite the fact that she had been gradually reeling in to allow for shallower waters near shore, the *Taurus* had somehow managed to bash her precious tow smack into an uncharted pile of rocks. When the lines were winched in, there was a single aircraft wheel at the end—no plane.

The recovery operation was beginning to take on the comic aspects of an old-time Laurel and Hardy farce—except that nothing was funny about it. The plane was relocated by sonar and the *Taurus* immediately went into a four-point moor over it. The kugel diving chamber was lowered with two observers for an inspection. The F-14 was lodged in a pile of huge granite slabs. At least the water at this point was only 130 feet deep—instead of nearly 2000—and by luck the weight of a marker buoy thrown over at the time of the crash had wedged right under the plane's tail, making a perfect position fix. It would be easy for divers to follow the marker line down and attach a new lift cable—or so everyone thought.

Still more troubles

Then the kugel had its own little mishap—to keep the record of continuing misfortunes unblemished. Swaying in strong bottom currents, the sphere smashed into the same rock pile, its ballast weights were knocked off, and it shot wildly to the surface. Fortunately, it missed the underside of the *Taurus*.

Despite the abrupt ending of the kugel's mission, it was decided that enough information had been gained to pursue the recovery task. The *Taurus* sent scuba divers down to make the new attachment. But again, what had seemed relatively simple at first, turned into further frustration. It was found that free divers—hampered by a limited air supply, lack of communications, heavy tidal currents and the ever-present danger of nitrogen narcosis—couldn't do the job. A 130-foot dive is considered deep for scuba gear, right at the edge of Navy safety limits.

Hard-hat divers, with their air hoses, phone lines and extended bottom time, were needed—and the *Taurus* had none on board. Commercial divers, most of whom had gone off to their various homes for the winter, had to be rounded up and flown to the scene. More wasted time.

Finally, the hard-hats did it. On Nov. 11—almost two months after the sinking—a successful attachment was made and the long-sought F-14 was hoisted triumphantly aboard the *Taurus*. As someone reported, "The Tomcat is back in his cage." The terrible ordeal was over—almost.

Not over yet

By this time the F-14—after its many sinkings and batterings—was a smashed-up mass of wreckage, scarcely recognizable as a plane. Experts believe, however, that the remains are nevertheless intact enough to reveal the cause of the strange accident. (At this writing, the malfunction has not yet been determined or, perhaps for security reasons, has not been made public.)

At any rate, the plane and its missile were safely back in U.S. hands—an almost unimaginable feat well worth the $2 million or so it cost. No object as heavy as the F-14 had ever before been raised from such a depth in such foul weather—a tribute to the valiant men and ships involved.

But as with many dramatic sagas, there is a cruel and saddening epilogue. Disaster was to strike one more final blow—this time in the form of a tragic, personal loss. Ironically, the day after the momentous recovery, Fred Anderson, a sonar operator aboard the *Taurus* who had worked almost around the clock during the exhausting search, was found dead in his bunk, the victim of a heart attack. There is no victory without some defeat. ★★★

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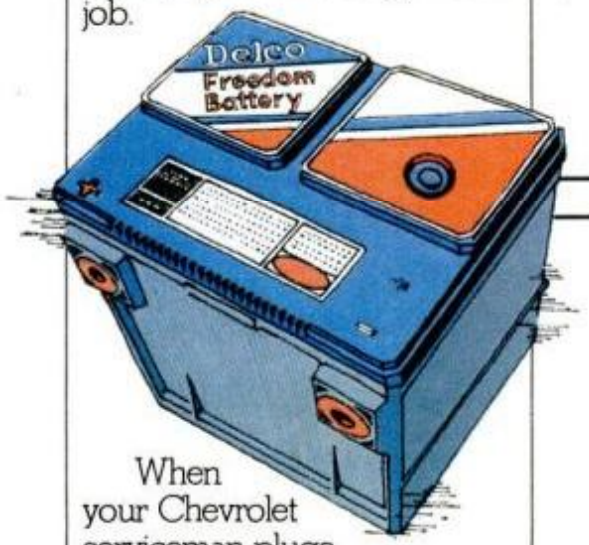

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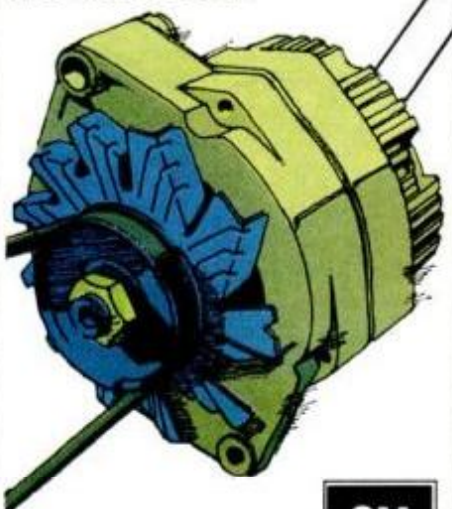

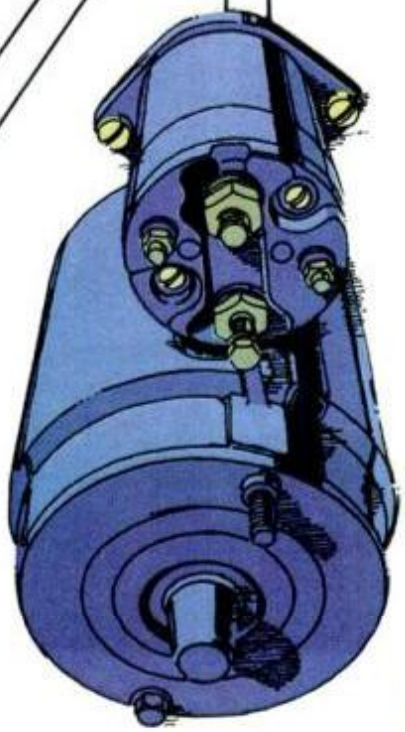

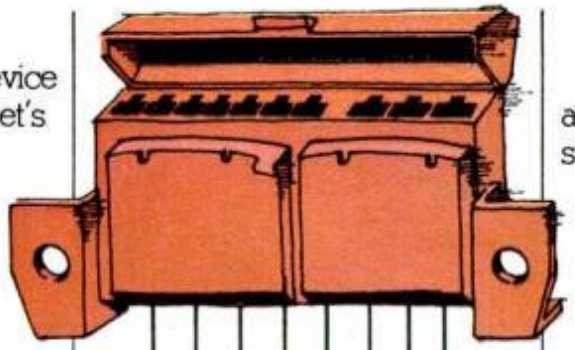

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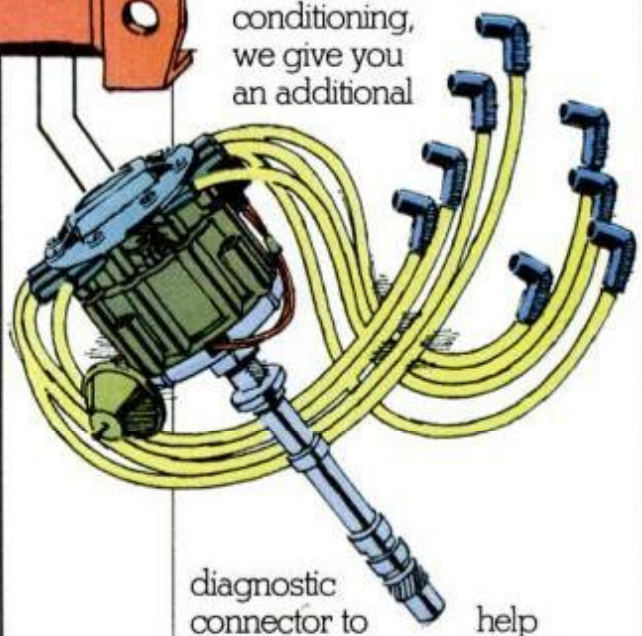

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SCHOOL FOR HOT-DOG SKIERS

(Continued from page 75)

which is a full layout with a twist.

Ski-deck work is practiced on a carpeted conveyor belt set at an 11° angle. It moves at 4 mph over a flat surface and is considered five times more difficult to ski on than snow. Originally developed as an entertainment device, it has evolved into a flexible tool for teaching; students ski on it with short 120-centimeter, Teflon-coated skis, added friction of the carpet gives them the same turning radius as standard 180-cm. skis.

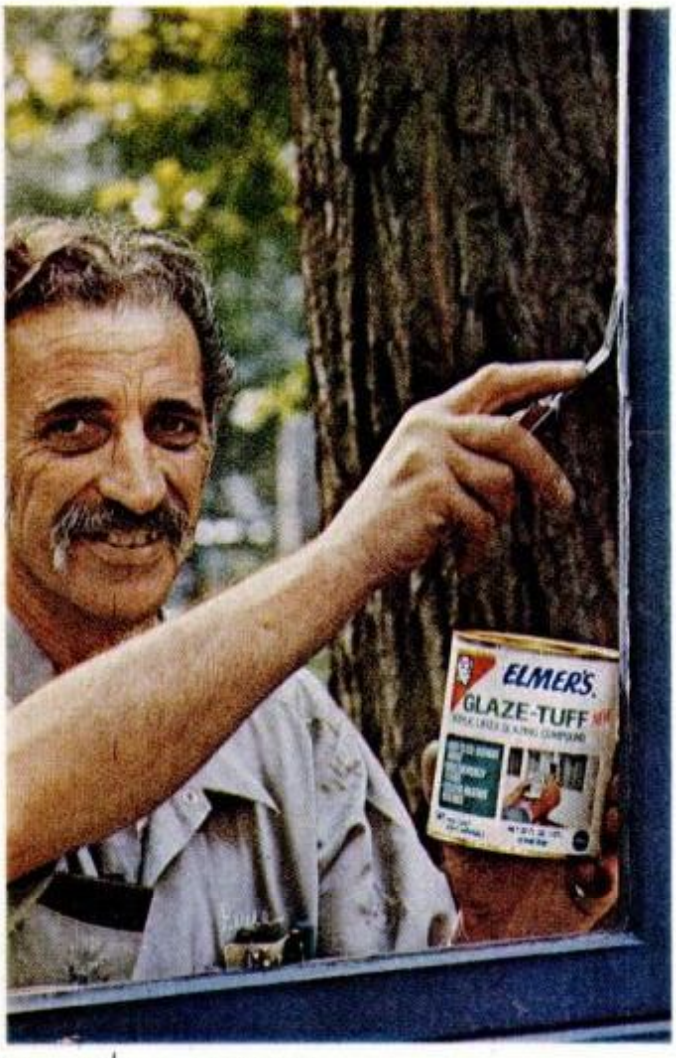
Performers work out most of the complex ballet routines on the ski deck. The constantly moving carpet requires utmost precision, and the smooth surface makes it impossible for you to let up. You must work all the time, and are moving at the equivalent of 12 mph.

Instructors estimate the ski deck makes you compress one day on the slopes into a single hour. An advantage, especially for novice skiers, is the practice bar and mirror at the base of the deck. Since your instructor is always at your side as well, Bill O'Leary claims that 30 hours on his ski deck is worth five years of weekend skiing. "If you can do it on the deck, doing it on the snow is a breeze," says O'Leary. "Snow is very forgiving by comparison."

Skiing 12 mph on the moving deck while standing still behind a practice bar, instructors and free-stylers face a wide mirror to perfect their technique.

Good skiers start over

But people who thought they were good skiers have had to start from scratch when confronted by the deck, though it has been found that almost anyone willing to put in time and effort can master the precision required. No need to be a great athlete or a "natural" to become a highly competent skier using what O'Leary calls his technical skiing method. Prominently displayed at the base of



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each deck are five basic steps for making a parallel turn to the left and right. These must be memorized before anyone is allowed to ski.

They are: 1. Press forward at the knees and ankles so you can use your foot as a lever. 2. Point your knees in the direction you want to go, at the same time pressing the uphill hip forward. 3. Come up to a neutral position with equal weight on both skis. 4. Press forward at the knees and ankles so you can use your foot as a lever. 5. Point your knees in the direction that you want to go, and at the same time press the uphill hip forward.

Most people try to initiate turns with their upper body. O'Leary's technical skiing teaches you to keep the mass of your body weight over the ski you want to work. The top half of your body should remain motionless. Shocks are absorbed by the knees and ankles. If you wish to turn, point your knees instead of your head or shoulders.

These principles are found to be learned rapidly on the moving deck. Excess motion of your upper body will cause your skis to be jerked out from under you much faster than they would be on snow. The ski deck teaches you to blame yourself for your mistakes, not the conditions or your equipment.

Single-ski tricks and edging require such control that snow stunts are easy later.

Then comes ballet skiing

Edge control proves to be very simply taught. Students learn to ski left and right on each foot, using one ski at a time. Once this becomes automatic, it is possible to begin learning the basic ballet movements, such as 360° complete turns and skiing backward.

The ski-deck and gymnastics programs are employed together to teach air-sense and edge-sense. Mastery of technical skiing at the Freestyle School has been found to release creativity and enable you to attempt what you want to do on skis.

Although freestyle skiing was once a stepchild of the U.S. Ski Assn. and looked down upon by purists, it has been rapidly assuming the status of a major sport in the last two years. In 1976-77, between the Professional Freestyle Assn. and the Chevrolet circuits, over $750,000 in prize money was awarded, a good indication of wide spectator appeal. And with large purses at stake, many top hot-doggers have been summer training at Tahoe's Heavenly Valley, an added bonus for beginners and novices who have shared the decks with them.

Lessons in far-out skiing cost under $130 for the minimum 10-hour course. A one-week program is also offered, plus summer camp with room and board for teenagers. Ready for takeoff? Write World Freestyle Training Center, Box 5126, South Lake Tahoe, Calif. 95729. ★★★

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SAW SHARPENING TRICKS

(Continued from page 118)

the teeth straight across (no beveling) until the jointing flats vanish and the teeth have received their correct outline shapes.

Because tooth sizes vary widely, no specific file sizes can be given here. In general, you can probably use one of these files for most crosscut teeth: 4 to 8-in. slim taper, extra slim taper or double extra slim taper. For combination teeth, which usually have less than a 60° face rake angle, a 6 or 8-in. cantsaw file must be used because a slim taper would misshape the cutting edges of the teeth.

For a rip blade (and some large-tooth combination blades), use an 8 or 10-in., two-round-edges mill bastard file—its round edges can shape gullets and teeth—and, again, file straight across. For extra-large gullets you can use a 10-in. round gulleting file.

Setting, filing, dressing

Use a circular-saw blade setter or secure the blade in your clamp for use of a hand set. Set all teeth exactly alike, first setting alternating teeth, then reversing the blade and working in the opposite direction to set the remaining teeth. You can increase or decrease set, but don't exceed half-tooth thickness, and *never* increase the depth of set. The depth should be limited to one-third the tooth height. The hollow-ground blades and rakers on combination and planer blades are never set.

File with the same files used for shaping. File as closely as possible to the original outline until you get a sharp point. Don't file sharp corners into gullets—they can make the blade crack.

Maintain original bevel and angle of teeth when filing crosscut blades. File one slope of one tooth at a time—it's best to give the front and back slopes of the same tooth alternate strokes. File the teeth set toward you, then reverse the blade to finish. File rip-blade teeth straight across. Count strokes to equalize filing of the front and back of each tooth; this will help to retain the original shape.

Cutting teeth of combination blades with rakers are usually filed with a 10° face bevel. Those without rakers are filed straight across the face and with a bevel across the back, generally about 5°.

You can dress or side-joint a circular blade like a handsaw, with the same benefits, merely by passing an oilstone over the sides of the teeth—*lightly.* ★★★

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11 kits with Quadraphonic Stereo and B/W TV...$550

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AT SPEED IN THE PORSCHE 928

(Continued from page 92)

Cockpit of all-new 928 is identifiable as a Porsche by traditional steering wheel.

mands. And perform it really does.

Power comes on with a rush, but smoother and quieter than with the 911. A special twin-disc clutch was developed to handle the torque. Let up your left foot and nail your right and in less than seven seconds you cross the 60-mph point. The 928 body's drag coefficient, a scientific term indicating how slippery the shape makes the car, is the same as that of the 911, long admired as one of the most perfect shapes to grace a wind tunnel. Third gear is good to about 90 mph (and 13 seconds into the mission). Stand on it in fourth to about 118 and in fifth to a maximum of about 140. This Sunday drive, by the way, was in Europe and therefore perfectly legal.

The concentration required for driving at such speeds can be fatiguing (especially on top of jet lag) so I took a turn in the passenger seat. With a colleague at the wheel, somewhere on the autoroute near Nice, at between 120 and 140 mph, I fell asleep—out like a light in the reclined passenger seat. Napping is not usual in testing, but it emphasized for me what a *Grand* Touring car the 928 is!

Safe landings

There are other objectives in designing a safety-fast car. All brakes on the 3200-pound 928, for example, are vented discs, and the 16-inch aluminum wheels have specially made radials with an aspect ratio of 50 percent. Brake and fuel lines are corrosion-resistant, but most unusual is the "floating frame" brake-pad design that keeps friction from heating the temperature of the hydraulic brake fluid above 90° C. This is below the boiling point, so no steam bubbles can form in contaminated hydraulic fluid to cause brake fade. Overengineered? Yes, for most of us. But that's part of what it means to own a $25,000 car.

Another potential lifesafer is the Porsche-engineered suspension. It's a road-holder all right. Under the skin, the 928 chassis sparkles like an Indy racer. Rigid, cast-aluminum trailing arms and front-axle geometry keep the front end pinned the way you want to go even in blowouts and braking on slippery roads.

Specially developed for the 928, is the "Weissach" rear axle named after Porsche's Weissach engineering facility and test track. This linkage compensates for a phenomenon in curves: When you lift off the gas, such as in a left-hand curve, induced rear-wheel toe-out can tend to turn the car deeper into the curve and into oncoming traffic. The Weissach rear axle is designed to toe-in the rear wheels when decelerating and thus cancel the toe-out phenomenon. That took some fancy engineering and Porsche patented it.

Back down to earth

Even the most sophisticated car needs basic battery care, and Porsche provides a Triptick so the do-it-yourselfer can find the battery. There was no room under the hood so it's in a bracket attached to the back of the differential. You reach it through a hatch. This helps weight distribution and the battery weight is said to dampen vibration.

The plastic fuel tank next to the battery holds 86 liters (22.7 gallons). Fuel consumption of the 928 (not yet EPA-rated) should be about 18 mpg; wheelbase is 98.5 inches; overall length, 175.

Those five-hole, lunar-rover wheels are cast alloy. They're odd at first look, but they'll probably become the slick setup.

Now that you've seen it, if the 928 is just too, too slick for your taste, and you'd rather stick to barnstorming, you'll be able to get a 911, says Porsche, for at least another four years. ★★★

Материал, защищенный авторским правом

DIGITAL WATCHES

(Continued from page 79)

Semiconductor has a five-step push and release button to change the time and date information in its memory. You can find out what the watch knows by depressing the display button that produces the hour and minutes. Continuing to press the button displays seconds; two quick taps cause the day and date to appear.

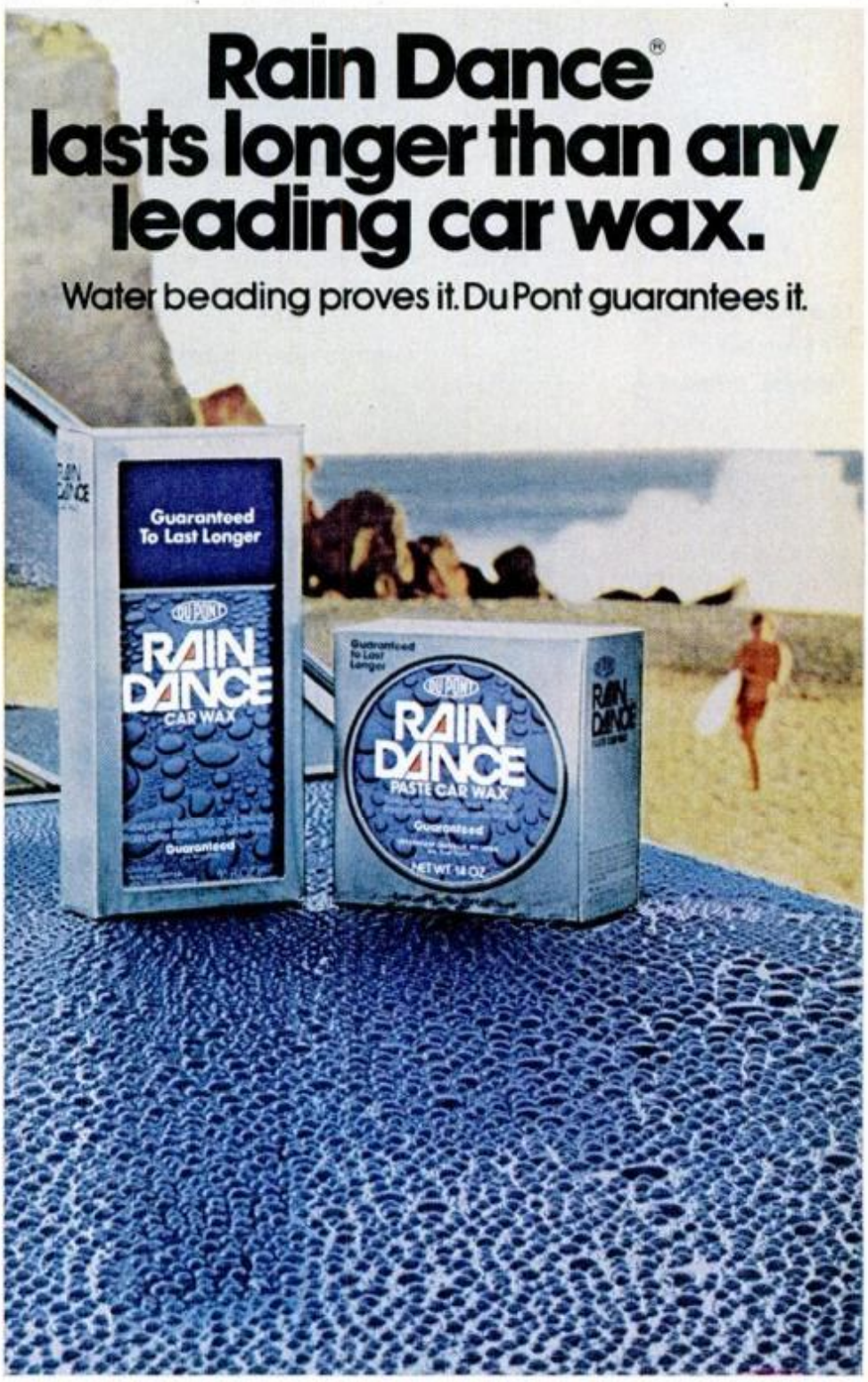
Peelable labels let you change the face of this Texas Instruments youth-model watch. Decals include CB symbols, scenes, special messages for kids.

LCD watches, such as Microma (above), use less battery power than LEDs since LCDs don't shed light when giving time.

The mechanism used to set the time and date on all of these watches is a separate "set" button. While the specific procedure varies from watch to watch, a sequence of operations sets each time factor independently.

Older designs kept counting seconds even as you set minutes. These models hold on 00 so you can set to the next minute and wait to restart.

List prices on these watches range from $19.95 to $24.95, but actual prices vary from store to store. It's easy to find them many places in the $15-$18 range as competition forces discounts. The LCD model is lowest in its field at $29. Where will the price spiral end? ★★★



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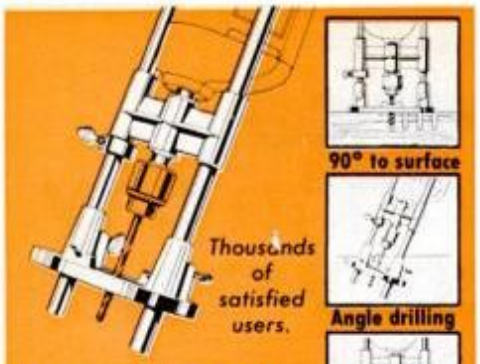
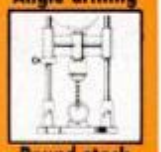


90° to surface

Angle drilling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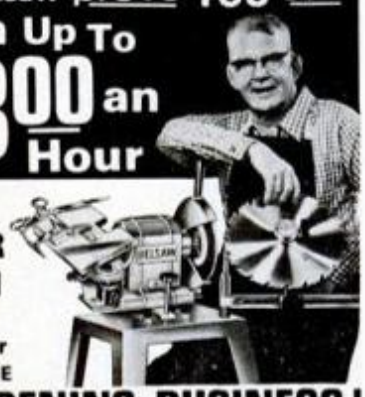

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SNEAKIEST SNEAK PREVIEWS

(Continued from page 81)

of it is available only through personal contact by phone or a visit to the home of the individual. It takes a pretty slick interviewer to find out if Mrs. Housewife is a secret tippler without asking the question directly.

Once the car owner has been fully qualified, he/she receives a written invitation to the preview on the market research company's letterhead.

Guards check guests

Uniformed guards are stationed at entrances and exits to the hall where the showing is held to intercept gatecrashers and to make certain only car owners with a formal invitation gain entry. If there's any doubt the car owner is asked for identification.

The showings are conducted over several days—anywhere from two to five—to give the panelists plenty of time to look at the cars in small groups. The companies don't want all 500 jurymen arriving at the same time or on the same day. To the extent possible, they attempt to limit the number of people in the hall at any one time to small groups of not more than 20 to 25 people.

Small groups are best

"If you put several hundred people in a room at one time," says a veteran of Ford's research staff, "they tend to look at and then visit with each other, instead of looking at the cars. That's normal. People are interested in people. The smaller the group, the more attention they pay to the cars."

The car owners are asked to express their likes and dislikes about the cars in various ways. One method is to give the car owner a batch of rating sheets—a series of sheets for each car on display—and ask him to check the features he likes/dislikes on a scale of 1 to 10. He may be asked to rate the car this way from several angles—front view, back view, profile and interior.

Early version of the Pacer (top) is contrasted to the production model (above) introduced in 1975. Note changes front and rear, and width of B-pillar.

Another method of obtaining the information is by direct questioning. A market research expert is posted at each car and he quizzes the car owners after they have examined the cars.

At one time, before bugging and secret tapings of private conversations became a national scandal, some auto firms concealed miniature recording devices in the cars to pick up off-the-cuff remarks by members of the audience. This practice has apparently been discontinued and no company will admit to it today.

What's the incentive for a car owner to give up a couple hours of time to attend a clinic?

Different lures used

Car manufacturers use different lures depending on the audience and the type of car being evaluated. The most common payoff for the car owner is a merchandise gift—a pen and pencil set or a small appliance. Another reward is to offer the car owner and his guest—wife or girl friend—a night out at the best restaurant in town. Researchers like the night-out approach because it gives them a second crack at talking cars and interviewing the owners in a social setting. Most people become more open and expansive after a glass of wine and a slab of prime rib.

"Those methods won't work if you're trying to put together an audience of Cadillac or Lincoln owners," says a source who has been involved in shows sponsored by GM. "Caddy owners aren't interested in a $10 or $20 prize or a steak dinner at the local gourmet rooms. The way you get the luxury-car buyer is by offering to donate $25 to his favorite charity."

Weeks of work and vast sums of money go into rounding up the bait cars and preparing for a product clinic, so once a show has been assembled, the companies like to get as much mileage as they can out of it. It's not unusual for a company to take the same show to, say, Chicago, then to St. Louis, then to Dallas.

Do the companies really pay attention to the negative things people say about the cars at the clinics?

"That's a dumb question," a GM official replies. "What's the point of spending hundreds of thousands of dollars, weeks of work going through the motions if we ignore criticism we hear at the clinics? *That* doesn't make sense."

Previews bring changes

All automakers cite examples of changes they've made in cars as a result of the secret previews.

When Ford brought out Mustang

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II, a clinic was held at Anaheim, Calif. The audience liked the fastback version, but turned thumbs down on the notchback. Ford then took the car to San Francisco. The results were the other way around: yea on the notchback, nay on the fastback. Ford decided to build both versions.

More recently, in June 1975, Ford took prototypes of the new small cars (Fairmont and Zephyr) it will bring out this fall to a secret showing in Chicago. The cars were slightly reworked after the showing and then previewed a second time in Chicago in August 1975. Last February Ford hauled the cars to Atlanta.

I'm not going to enumerate all the changes made as a result of those showings," a Ford spokesman declares, "but I'll tell you the guys in the design department redid the taillights and made them much bigger than they were on the original car."

Before American Motors introduced Pacer, the car was previewed for an audience of 450 car owners in Atlanta. Following the preview, AMC redid the hood—made it longer—beefed up the center post and made the door on the passenger side wider than the door on the driver's side.

"You bet we listen," says Chrysler's Len Piconke. "I can think of at least one car Chrysler cancelled because of a negative reaction when we showed the prototype."

But the Chrysler exec cautions against taking the results of product clinics cold turkey. They have to be viewed in perspective and related to other developments.

Many factors affect purchase

"The advance showings are valuable," Piconke explains, "but they are just one input among many in arriving at a decision. There are environment changes that can happen between the time we show a car and the time it reaches the market.

"An individual can't really forecast whether he would buy a particular car at the time we show it because he doesn't know and we don't know what the competition will be offering three or four years down the road. So he doesn't have all the facts; we don't have all the facts. That's what I mean by changes in environment."

Getting back to those guys who were stripping the truck at the beginning, they didn't miss a trick. You know how your car keys have the name or logo of the auto company at the top of the key. The last thing the camouflage crew did before the truck pulled out was to switch the keys that came with the truck for a set without a name on them. ★★★

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No. 71,923H(17" DESK MOD.) .....$13.95 Ppd.
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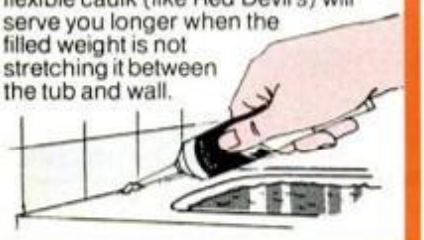
HELPING TO DEVELOP AMERICA'S TECHNOLOGY FOR OVER 30 YEARS.

HANDY IDEAS FROM BIG RED T.M.

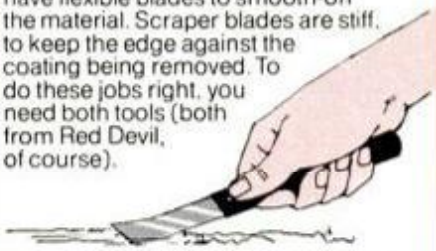
A handy man to have around the house.

More home fix-up tips from the pro.

Fill the tub before you caulk. (Get in if you can, too.) Then, when the tub is empty, it'll rise slightly and squeeze the caulk. Even a good flexible caulk (like Red Devil's) will serve you longer when the filled weight is not stretching it between the tub and wall.



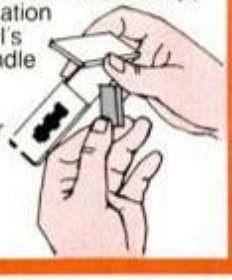
A putty knife is not a scraper. And vice versa. Putty knives (for spackling walls and puttying windows) have flexible blades to smooth-on the material. Scraper blades are stiff, to keep the edge against the coating being removed. To do these jobs right, you need both tools (both from Red Devil, of course).



Give your new bathroom or mosaics a decorator look. Add a touch of color to the grout before you put it between the tiles. Just mix acrylic paint tint (from wherever you buy paint) with Red Devil Instant Tile Grout and see the exciting effect it creates.

You don't cut glass with a glass cutter. You score it to release surface tension. So don't press too hard or go over it a second time. Hold your Red Devil cutter between the index and middle fingers as shown. (a drop of oil on the cutter helps, too). Then, you've got the score.

A razor scraper is only as good as its edge. When it's dull, it won't work. And metal fatigue can make it snap, a dangerous situation at best. Red Devil's new molded-handle razor scraper has a handy compartment for spare blades so you always have a replacement ready.



Stud finders are un-holey. When hanging pictures on a freshly painted or papered wall, don't fill it with holes before you find the wood behind it. Use a Red Devil Stud Finder. It points out where nails are – and where there are nails, there are studs.

Red Devil has hundreds of things to make your home fix-up easier. Look for them wherever you shop for home-care products. And for best results, always follow directions on the package.

Red Devil®

UNION, N.J. 07083

TWO HOT HAM RADIOS

(Continued from page 109)

to make phone calls while walking on streets or in the woods.

Such ham telephone calls use an *autopatch* system built into amateur *repeater* stations. Repeaters are sensitive receivers and high-power transmitters mounted atop tall buildings or mountains. When a weak signal from a portable or mobile transmitter arrives at the repeater, it is retransmitted over a wide area, permitting long-distance contacts between portable stations. Repeaters are built and maintained by local clubs and individual hams as a public service to others in the hobby.

Telephone calls are possible when the club pays for a regular telephone line to its repeater site and connects an autopatch device. When the repeater hears a predetermined code of tones being transmitted from a mobile or portable ham station, it automatically switches the sound into the telephone line as if a phone were lifted off the hook. The ham hears a dial tone coming back to him via radio from the repeater. He then dials a regular phone number and his call is completed. When he is done, other tones command the repeater to disconnect from the telephone line.

Telephone dialer

To use the Heath HW-2036 for autopatch calls, you need a Micoder microphone (Model HD-1982; $49) with built-in tone-dialer. A tone-dialing pad built into the Wilson adds $59 to the price.

Remember that you must have a valid FCC amateur license to operate one of these two-meter ham radios. The second-step *technician* class ticket is required (see *Get Started in Ham Radio the Easy Home-Study Way*, page 270, May '77). For information on ham classes near you, write American Radio Relay League, Inc., 225 Main St., Newington, Conn. 06111. License tests are easy to pass. A little homework will open up a lifetime of entertainment and activity when your station has call letters like my own, K3RXK.

My friend who hunts may save a life one day. He always straps a Wilson to his belt when heading into the woods. If an accident should happen, he would be able to summon help by direct-dial telephone to authorities.

Even if your wife isn't interested in ham radio for herself, she'll get a large charge out of your telephone call from the freeway as you drive home. She'll know how to time dinner and you'll be able to prearrange the slipper-and-pipe scene so it can be ready when you arrive home. ★★★

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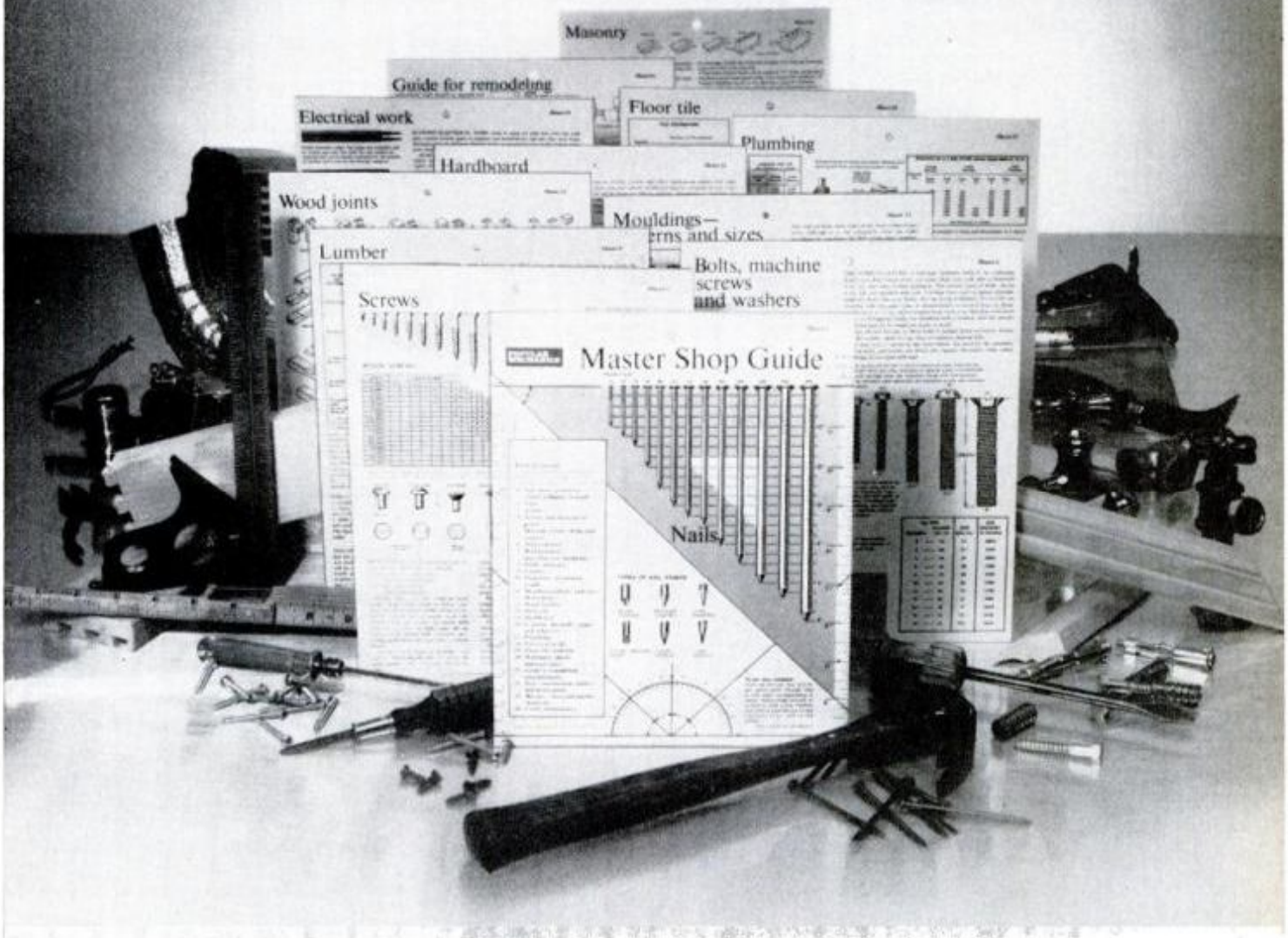
One of the most important tools you'll ever buy.



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Name _____

Address _____

City _____ State _____ Zip _____

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(Continued from page 91)

car—beautiful lines and beautiful interior."

When we asked owners to tell us what changes they'd like to see, 14.1 percent said they'd appreciate better gas mileage. About the same number wanted **better workmanship**. Wagon owners cited third-seat rattles; owners of coupes, more rear-seat legroom.

Most Fury drivers rate workmanship average to good; blame assemblers, not engineers.

No clear conclusion—positive or negative—emerged from our Fury Owners Report. One lady, though—an assembler of GM cars (no less) from Middleport, N.Y.—did wax enthusiastic. She wrote: "This car feels like a Cadillac to ride in and to drive. It's simply fantastic. I'd take this Fury over and above any other car I can think of, and the price doesn't cause a lot of grief the way other auto prices do nowadays. It was love at first sight. My dad's first new car 25 years ago was a Plymouth, and I'm surely sold on this one." ★★★

Summary of 1977 Plymouth Fury Owners Reports*

Total miles driven 752,071

Average miles per gallon
- 225-cu.-in. 6
  - In town (EPA autom. 17) 14.5
  - Long trips (EPA autom. 22) 18.4
- 318-cu.-in. V8
  - In town (EPA man. 14) 11.9
  - Long trips (EPA man. 23) 15.1
- 360-cu.-in. V8
  - In town (EPA autom. 14) 11.6
  - Long trips (EPA autom. 20) 15.7
- 400-cu.-in. V8
  - In town (EPA autom. 11) 10.3
  - Long trips (EPA autom. 19) 13.8

Engine choices:
- 225-cu.-in. 6 9.5%
- 318-cu.-in. V8 59.5
- 360-cu.-in. V8 22.0
- 400-cu.-in. V8 9.0

Body style choices:
- Two-door hardtop coupe 43.9%
- Four-door sedan 38.5
- Four-door station wagon 17.6

Why did you choose the Fury?
- Owned Plymouths before 43.9%
- Liked styling 25.9
- Good price 17.0
- Good size 11.8
- Economy of ownership 7.1

Specific likes:
- Styling 46.6%
- Handling 36.3
- Ride 32.8
- Comfort 30.4
- Performance 12.7

Specific complaints:
- Poor gas mileage 26.9%
- Poor workmanship 16.8
- Carburetor stumble 6.6
- Emissions controls 5.6
- Rattles 5.1

What changes would you like?
- Better gas mileage 14.1%
- Workmanship 13.1
- More trunk room 11.0
- Seat style 8.9

Workmanship opinion:
- Excellent 15.6%
- Good 35.3
- Average 21.6
- Fair 11.9
- Poor 15.6

Comfort opinion (front seat):
- Excellent 39.6%
- Very good 32.7
- Good 19.4
- Fair 5.5
- Poor 2.8

Comfort opinion (rear seat):
- Excellent 21.5%
- Very good 33.5
- Good 23.0
- Fair 12.5
- Poor 9.5

Had any mechanical trouble?
- Yes 62.1%
- No 37.9

What type of trouble?
- Carburetor 30.9%
- Brakes 13.2
- Transmission 10.3
- Electrical 8.1

Did you repair it yourself?
- No 94.9%
- Yes 5.1

Dealer repairs satisfactory?
- Yes 51.2%
- No 48.8

Dealer service opinion:
- Excellent 30.8%
- Good 25.0
- Average 16.8
- Fair 12.5
- Poor 14.9

Number of vehicles owned:
- Fury only 53.4%
- Two cars 34.2
- Three cars 9.1
- Four cars 2.3
- Five or more cars 0.5

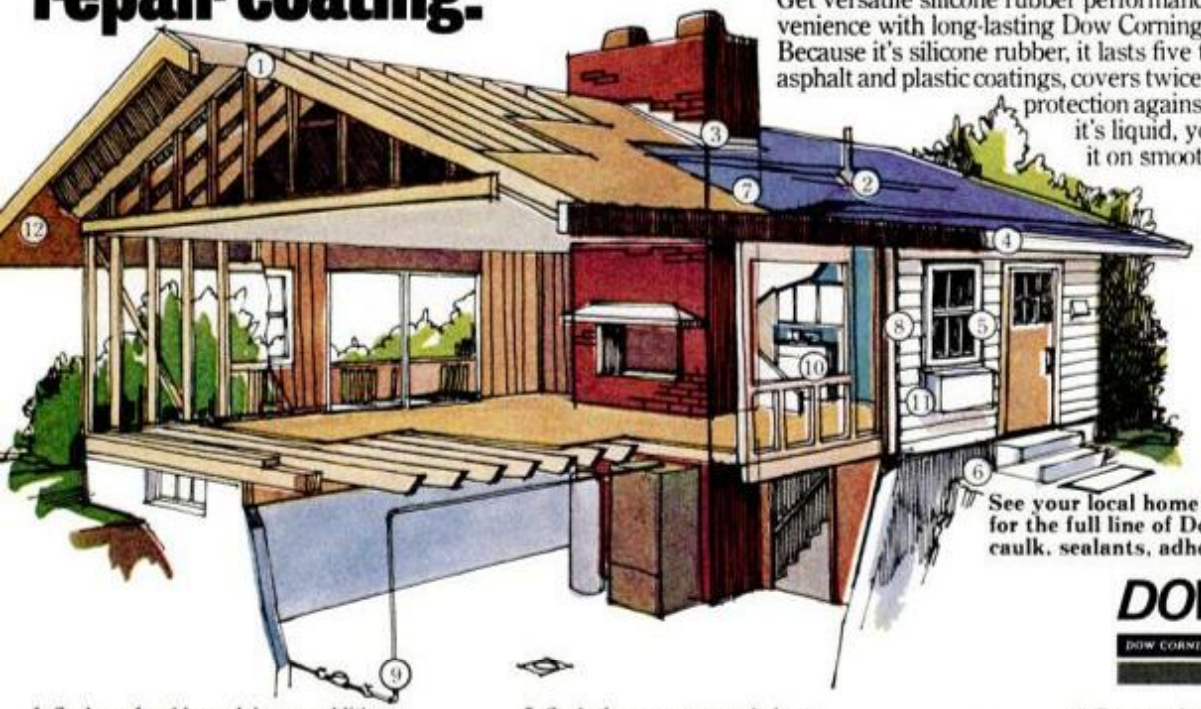
Makes of other cars owned:
- Plymouth 35.3%
- Dodge 16.7
- Chevrolet 15.7
- Ford 12.7
- Chrysler 8.8

Age distribution of owners:
- 15-29 years 17.2%
- 30-49 years 32.2
- 50-plus 50.7

Would you buy another Fury?
- Yes 65.9%
- No 34.1

*Percentages might not equal 100% due to rounding or insufficient data.

Introducing Dow Corning® silicone rubber coating. The roof-to-basement brush-on maintenance/ repair coating.



Get versatile silicone rubber performance with brush-on convenience with long-lasting Dow Corning silicone rubber coating. Because it's silicone rubber, it lasts five times longer than most asphalt and plastic coatings, covers twice the area, and offers lasting protection against weathering. And because it's liquid, you can brush, roll, or spray it on smoothly and easily.

See your local home center or hardware store for the full line of Dow Corning silicone rubber caulk, sealants, adhesives, and coating.

DOW CORNING

1. Seals roof, gable, and dormer additions.
2. Seals roof vents, air ducts, skylights, and eaves.
3. Seals flashings and chimney caps.
4. Seals gutters, troughs, roof valleys.
5. Seals door, casement windows.
6. Patches and repairs masonry, cement, concrete block.
7. Patches and repairs loose shingles.
8. Patches and repairs wood and aluminum siding.
9. Rustproofs drains, plumbing joints.
10. Rustproofs underside of sinks, dishwashers.
11. Weatherproofs air conditioner covers.
12. Rotproofs wood.

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HERE'S A YEAR 'ROUND

Spare Time Business

THAT CAN EARN YOU

$12 to $18

AN HOUR

Started In Spare Time Now Does $300,000 Yearly

A few years ago, Bill Fitzgerald decided to become his own boss. Today he operates a thriving business that employs several people full time. Bill's shop services all makes and types of lawn mowers. The shop does everything from tune-ups to complete repairs. He's a success . . . You can be, too!

All Over America, There's A Demand For Persons Who Can Repair Lawn Mowers

Ideal year 'round money-making opportunity because you can service engines similar to Lawn Mowers, like Snow Blowers, Generators, Mini-bikes, Go-carts, Tillers and many Snowmobiles, Chain Saws, Paint Sprayers and others. All mean money in your pocket!

There are millions of lawn mowers in use today. All requiring periodic maintenance. The number of qualified professionals who can repair these mowers is too few. Many more are needed. With Foley's NEW Lawn Mower Repair Program you can become a qualified professional . . . and cash-in on the big money to be made . . . right in your town.

Build Your Own Security

Foley's Program requires no previous mechanical skills or knowledge. The all-inclusive Foley Manual has been written by top professionals in the field. Everything is in easy-to-understand, non-technical language with many helpful illustrations. In a short time you'll be open for business. You'll be your own boss . . . and never have to worry about being out of work.

Start In Spare Time

A lawn mower repair business is ideal for earning extra cash in your spare time. You decide when to work . . . how hard to work . . . the hours to work. Working evenings and on weekends, you can earn from $12 to $18 an hour. There's almost no limit on the amount of money you can make working full time.

No Franchise Fee

For over 50 years, Foley has been helping people just like you start and operate successful businesses of their own. Foley is always ready to help . . . but the business is entirely your own.

We Finance You

You can start your business in your garage, tool shed or small shop. There's no large inventory to keep. Your earnings will easily cover the low monthly payments.

Earn as You Learn

You can start earning money immediately. The Foley Program shows you how. After a few hours you'll be able to professionally tune-up lawn mower engines. As you become more experienced with small engine repair, you can offer many other services to your customers that will mean more money for you.

We Send You The Equipment You Need

Included is Foley's easy-to-understand lawn mower repair program providing you with the skill and knowledge needed to repair small engines . . . and all the tools necessary to do the work.

Americans are proud of their lawns. They want to be the envy of their neighbors. And their lawn mower is a very important factor in helping a lawn be beautiful. Their equipment needs maintenance and sharpening. These are your customers . . . Each means money in your pocket.

Call Toll Free
800-328-8488
Ask for Lawn Mower Division
or
Send Coupon

Foley Shows You How! . . . and Finances You, Too!

Foley MANUFACTURING COMPANY
616-7M Foley Building, Minneapolis, MN. 55418

Please rush me more information about starting a spare time lawn mower repair business.

Name _____

Address _____

City _____ State _____ Zip _____

My Phone _____

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Digital Watch Breakthrough

There are several big changes taking place in digital watches. Here are all of them in one product.

Your digital watch is either too thick, uses up batteries quickly, has just a few functions or is hard to read under certain lighting conditions. You still have to press a button, flick your wrist, or hold your watch at just the right angle to read the time.

The digital watch industry has gone through four years of rapid change, but the disadvantages cited above have finally been resolved in one totally new product—the Sensor Laser 440 Digital. The Laser 440 is so different that it represents a dramatic departure from conventional digital watches.

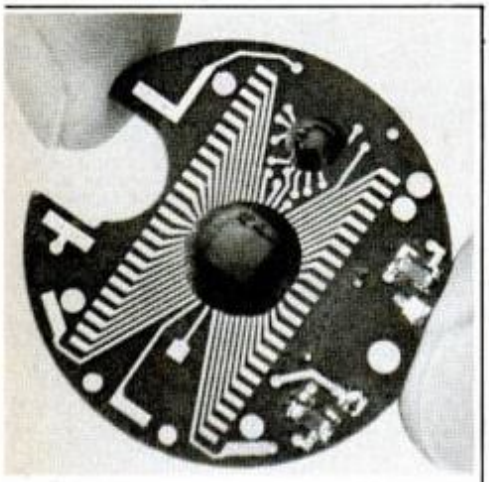
NO BUTTON TO PRESS

There is no button to press since the display glows in the dark. A glass ampoule, charged with tritium and phosphor and sealed by a laser beam, is placed behind the new CDR (crystal diffusion reflection) display. When room lights dim, the self-contained tritium light source will compensate for the absence of light by glowing brightly and illuminating the display.

No matter when you wear your watch—day or night—just a glance will give you the correct time. There's no button to press, no special viewing angle required, and most important, you don't need two hands to read the time.

CHANGE YOUR OWN BATTERIES

The Laser 440 is only 8 millimeters thick—thinner than many of the so called thin digitals being advertised today. The new CDR display draws 100,000 times less current than an LED watch when displaying the time so your single commercially-available Union Carbide battery lasts years longer. In fact, part of our warranty includes all the batteries you'll ever need, free of charge, for five full years. To replace a battery, simply open up the battery hatch on the back of your watch, tap out the old battery and drop in the new one.



Most digital watches have dozens of electronic components. The Laser 440 has only six—two integrated circuits, a crystal and three microcapacitors. All components are bonded directly on the printed circuit board. By hermetically sealing the integrated circuits and using fewer components, the Laser 440 is considerably more reliable than other watches that do not yet have this complete integration.

The new Sensor Laser 440 digital watch glows in the dark so there's never a button to press to read the time in darkness or in sunlight.

THE ULTIMATE ACHIEVEMENT

Other manufacturers have devised unique ways to produce a watch you can read at a glance. The $300 LED Pulsar requires a snap of the wrist to turn on the display, but the Pulsar cannot be read in sunlight and its display uses 100,000 times the current of the Sensor display. The $400 Longine's Gemini combines both an LED and liquid crystal display. (Press a button at night for the LED display, and view it easily in sunlight with the liquid crystal display.) But you must still press a button to read the time. All these applications of existing technology still fail to produce the ultimate digital watch: one you can read under all light conditions without using two hands. Until the new Laser 440.

And if you've owned a digital watch for a year, chances are you've had it in for repair more than once—a very common consumer complaint. The Laser 440 is so service-free and has such high quality that it should rarely, if ever, require service. It is backed by a solid five-year warranty—your assurance of our commitment to this outstanding new product.

The Laser 440 has both time and stop watch functions. Six digits are on display—four large digits and two small ones. You choose between hours, minutes and seconds or hours, minutes and date by pressing a button. The Laser memory remembers the number of days in a month and resets automatically on the first day of the new month.

The 440 is also available in an 11 function chronograph (stop watch) and is truly the ultimate Laser timepiece. You can time two separate laps of a multilap race keeping one lap in memory. You can accumulate time; you can view the time of one lap while continuing to time a lap stored in memory. As a business executive, you can time long distance phone calls and interviews. Lawyers can keep track of their services, and doctors can time the vital signs of their patients. Even while the chronograph is functioning, you can still view the time—something even many of the expensive digital chronographs cannot do.

BUILT DIFFERENTLY

All wires have been replaced with circuitry printed on one single thin surface. On this same surface are two integrated circuits which use gold contacts and are hermetically sealed to protect their several thousand micro components. The American-made Laser is shock resistant and uses a tough mineral glass crystal to protect the rugged electronics from the everyday water and humidity tortures normally given any watch.

NEW QUARTZ BREAKTHROUGH

Digital watch accuracy depends on the quartz crystal. Even the best crystals change frequency with shock or age (especially when first produced). The Laser 440 uses the new and very expensive, tuning fork crystal. It is first aged to not shift frequency more than five parts per million per year (more accurate than most radio or TV time signals) so the extreme accuracy you expect is built into your watch from the first day you wear it. The crystal is cushioned and solidly bonded to the crystal carrier eliminating all fine wires that may break from shock. In short, the advanced design of the crystal will assure guaranteed accuracy greater than 5 seconds per month—year after year after year.

The Laser 440 is ideal for pilots because of its cockpit visibility and chronograph functions, perfect for the businessman who depends on his watch for split-second accuracy and the ultimate watch for anybody who wants unquestionably the finest digital watch ever offered at any price.

The Laser 440 is not only thin but is designed to conform to the contour of your wrist. A bulky digital watch can become annoying to wear—especially if you have a thin wrist.

HOW WE PROVIDE THE FINEST SERVICE

Can our company provide better service than even your local jeweler? We think so. If your Laser malfunctions during its unprecedented five-year warranty, just call us on our toll-free line. We have made arrangements with United Parcel Service to pick up your Laser at your door, at our expense, and we give you a loaner watch to use while your Laser is repaired. You pay nothing to have your watch serviced during its five-year warranty (that is if service is ever required) and we are as close as your phone or door.

WHO WILL BACK YOUR 5 YEAR LIMITED WARRANTY

Two solid companies are behind your new Laser. JS&A is America's largest single source of space-age products—a substantial company and a leader in electronics for over a decade. Our commitment to the consumer and to service is a matter of record. Check with the Better Business Bureau in your very own community, the Northbrook, Illinois Chamber of Commerce (312) 498-5555, or any of the 100 national magazines and newspapers in

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The expensive metal bracelet has the equivalent of 92 finely-hinged links and is completely adjustable. Simply slide the adjustment mechanism to the most comfortable position on the band for your wrist size and lock it into place. Then, whenever you have to put on your watch, simply hook the strap into the already pre-set adjustment mechanism and snap it shut. It's fast and simple and gives you the most comfortable fit of any watch by conforming exactly to the contour of your wrist.

which we advertise. We realize that a quality watch warranteed for five years is a serious investment and our reputation for service and customer satisfaction must be unsurpassed. Most important, check with our customers. For almost two years we have sold and serviced the Sensor watch. We are proud of our record and will gladly share it with anyone who inquires.

The Sensor Laser 440 is manufactured exclusively for JS&A by Micro Display Systems, a leader in the new emerging watch technology and a well-financed company backed by one of the world's major manufacturers.

STANDING BEHIND A PRODUCT

The Laser 440 is everything you would want in a digital watch: a major advance in digital watch technology, all the really important functions you'll need, a service contract so solid that you'll never have to leave your home if service is ever required, and a product of unsurpassed quality and accuracy. But it is only after you receive it that you will convince yourself of its beauty, its design, its fit and the accuracy of our claims. For that reason we give you a one month trial period. Wear the Laser 440 for one full month. Check its accuracy, its feel and show it to others. Compare it to all other digitals. If you are not totally convinced that the new Laser is the finest digital watch at any price, then return it for a prompt and courteous refund.

To order your Laser 440 for a personal trial, simply call our toll-free number below and give us your credit card number or send us your business or personal check. There are no postage or handling charges (Illinois residents add 5% sales tax) and it will be sent to you promptly by United Parcel Service unless you specify otherwise.

A REVOLUTION IN TECHNOLOGY

There is a revolution taking place in the watch industry. Some digitals are getting thinner, some have dozens of new functions and some claim exceptional visibility. None have all the features in one quality timepiece. The new Laser 440 does. Order yours at no obligation today.

White Gold With Time and Date $139
Gold-plated With Time and Date..... 159
White Gold With Chronograph 199
Gold-plated With Chronograph 219

JS&A ranked first among all watch manufacturers in total unit sales of quality digital watches during 1976.

JS&A NATIONAL SALES GROUP®

Dept. PM One JS&A Plaza
Northbrook, Ill. 60062 (312) 564-9000

CALL TOLL-FREE.... 800 323-6400
In Illinois call ..... (312) 498-6900

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IT'S NEW NOW

Real cool suntanner

Luxuriate in pool or lake while acquiring a tan. A new water lounge features covered flotation collar, anodized aluminum frame, drink holders and Ethafoam headrest. Vinyl web resists rot. Kransco Mfg., 50 Forbes, South San Francisco, Calif. 94080.

Pickup tailgate lift

Factory tailgates on standard pickups now can be replaced by a Jet Lift-Gate. It installs in 30 minutes, handles loads to half a ton. From Truckers Supply Int'l, 100 North First, Garland, Tex. 75040.

Pushbutton Wall Street

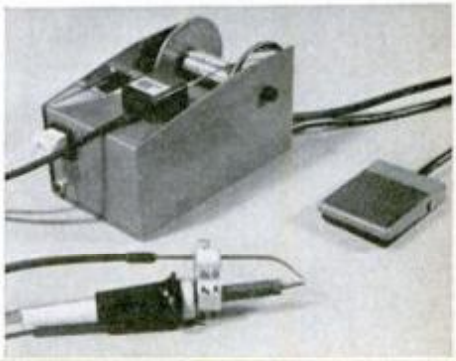
Price and data on over 7000 stocks are displayed at the touch of buttons on the Marketline phone accessory. It provides Dow Jones and other information. $500. Hammacher Schlemmer, 147 East 57 St., New York, N.Y. 10022.

Sprinkle while you cut

Now you can water the lawn as you mow it. A new mower, powered by water running through a garden hose at normal pressure, sprinkles the grass while you cut it. Coolair Group, 21 Bennett Ave., Edwardstown, South Australia 5039.

One-hand soldering

Use one hand to hold work while a motorized spool drives wire solder through a guide to the iron tip. The Freehand Solder Feeder, controlled by foot switch, takes .028 to .064-inch wire solder. Electronic Production Equipment Co., 6 Kane Industrial Dr., Hudson, Mass. 01749.



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New Wide-Track Brake® Roll-On from Mennen...

The big one is here from Mennen.
No more backtracking with dainty ball roll-ons. New Wide-Track Brake Anti-Perspirant, with the easy rolling wide-track applicator, is designed to give you all the daily protection you'll ever need with a few easy strokes.
And new Brake has a non-sticky, anti-stain formula.

A fitting solution to your underarm problems.

SPUTTERING RUN TO BRIGHTON (Continued from page 88)

raise a laugh—quite a different matter from today's Brighton Run, whose machines are carefully restored to the earliest standards, with gleaming coachwork and brass-polished like mirrors.

There are, perhaps, a couple of thousand surviving cars in the world that were made before 1905 and therefore eligible for the Brighton Run. Of these, approximately 300 line up in Hyde Park for the memorable event. The year 1976 saw entries from eight foreign countries—in fact, the oldest car in the event, an 1893 single-cylinder, 1½-hp Benz, came from Los Angeles (how *foreign* can you get?).

Because the oldest start first, this car headed the procession out of the park. In all, there were 11 American-entered cars, of which the most magnificent was Bill Harrah's Panhard-Levassor from Las Vegas. It made a sumptuous contrast to the neighboring Curved Dash Oldsmobile, the car that will go down in history as the first to be mass-produced, with the unbelievable number of 2500 made in in 1902. Selling at a mere $650, it put motoring within reach of the many, and the simplicity of its works supported the advertising slogan "Nothing to Watch but the Road."

No harm in trying

On the principle that there's no harm in trying, I'd written to Lord Montagu—who runs the National Motor Museum at Beaulieu in Hampshire—asking if I could have a ride in one of his cars from London to Brighton on November 7. Rather to my astonishment, he called me long-distance and told me to meet him at 7:00 a.m. in the Cumberland Hotel, and we'd go on from there. The Museum had four other cars entered, one driven by Lady Montagu on her first Run, another by two brothers from Johannesburg, South Africa.

I didn't know until that morning which car I would be in. Then his Lordship told me, Car 22, and I was delighted to see from the program that he was driving it himself. My noble "chauffeur" called for me at the hotel door at 7:45. Wearing appropriate deer-stalker cap and Inverness cape, I put my foot on the brass hub of the wooden rear wheel and swung myself up into the high back seat. There was a slight grating noise as Lord Montagu searched for bottom gear, and then with a little lurch we moved into the stream of modern traffic at Marble Arch.

It was a lovely clear morning in the park and the camera-toting crowds were gathering fast, straying onto the narrow road and threatening to make us late for the start. Lord Montagu frequently had to squeeze the huge rubber horn bulb to blare its ominous warning.

Among first to start

As we dated from 1899, we were among the earliest starters, and drove to our place past a lot of very junior 1900 to 1904 De Dion Boutons, Stanley Steamers, Renaults, Peugeots and Cadillacs.

The sun was just starting to show as the Daimler clattered its solid rear wheels across Westminster Bridge, leaving the Houses of Parliament behind. It was a sparkling morning, and our progress was uneventful, partly because the tramline tracks that gave so much trouble in the movie *Genevieve* were gone.

We met our first hill at Brixton, and that's where the biggest crowds gathered, hoping for radiators that bubbled and steamed, passengers that sweated and pushed, or anything that brought a disruption of the Run's progress. It didn't look much of a hill to me: In my 2-liter Triumph, I wouldn't even have come out of overdrive, but Lord Montagu changed to second gear 300 yards in advance and looked tense as we crawled toward the summit.

We had been on the road for 40 minutes and were just approaching the town of Croydon when Lord Montagu said, "This is where we usually get overtaken by the Stanley Steamer." Sure enough, almost as he spoke, a cloud of white steam whizzed past us at a good 25 mph, making enviably little noise. "But we always get to Brighton first," said Montagu. "That thing's always having to stop for water."

Finally make it into high gear

The old Daimler still seemed to be jerking and throbbing through Croydon, and then, once out of town, Lord Montagu moved a long, shining lever mounted outside the car body, and at last we started to run smoothly, with much less noise—it had taken 40 minutes and 9 miles to find a good stretch of road for changing into top gear. In any case, gear-changing was never an exercise to be undertaken lightly in a veteran car. Synchromesh was unknown and if you muffed a change, you probably had to brake to a halt and start again. When this Daimler was built, it had only two pedals: clutch (left) and brake-plus-

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clutch (right). There was no accelerator; the engine's speed was fixed by a governor. Lord Montagu had an accelerator added to give more control under modern conditions.

Owners of cars with accelerators regarded them as nice gadgetry, rather like overdrives today. The engines were still governed to 750 or 1000 rpm, thus fixing the cruising speed—the accelerator was an occasional device to override the governor, jolly useful when, for instance, you had to double-declutch to change down when climbing a hill.

The old cars have never run so well as today: Modern oils and fuels give far better performance than the old stuff and wear on bearings is dramatically lower now that roads are surfaced and there is no longer a continual intake of dust.

Old days were not so easy

Maintenance was, I suppose, all part of the Edwardian fun. You coated your clutch linings with a mysterious substance called Collan oil and boiled your driving chains in Russian tallow. You lubricated every part individually, and the maker of your motor-car was supposed to tell you (personally, since there were no instruction manuals) how many drops of oil per minute you should put in the cylinders of your particular make of machine. Since the roads were liberally strewn with sharp bits of horseshoe nails, you took with you as many spare tires as you could carry, together with tire levers and a puncture-repair kit. No one carried spare wheels, since car wheels were not readily detachable. (Tires were then the largest single expense of motoring, with a set lasting only 2000 to 5000 miles and replacements costing some $60 per tire.)

Considerable ingenuity attended the growth of the new sport of motoring. It was soon found that a really beastly hill was best tackled in reverse gear; this often gave a more favorable speed ratio, and in any case the petrol ran better toward the carburetors if the engine lay downhill from the fuel tank. Those bold enough to tackle hills in a forward gear usually took the precaution of lowering the sprag, a kind of spike behind the car that would stop the whole contraption from running disastrously backward should a gear change be missed or a chain broken.

The owner-driver had to learn his car—and learn fast. There was hardly any chance of finding anyone capable of diagnosing a fault—although broken parts could often be copied by village blacksmiths. And you carried your spare petrol with you: The first petrol pump in Britain did not appear until 1920. At the beginning of the century, you bought your petrol from a chemist in cans.

What every stubble bum should know.

The closer you cut your stubble, the longer it takes to grow back. The longer it takes to grow back, the less likely you will look like a stubble bum before you have to shave again. Which brings us to Mennen Skin Bracer® Pre-Electric Shave Lotion. It tightens your face, conditions your stubble so you can shave extra close. It even helps lubricate your razor head, and it's got that clean Skin Bracer fragrance. Congratulations. You are soon to join the ranks of the ex-stubble bum.

Trouble with No. 2 plug

We stopped at a filling station and took on a couple of gallons. There was trouble, it seemed. No. 2 plug was oiling up, and Louis Giron, the wiry 74-year-old Belgian who is top wizard at old car engines, stopped our Ford Cortina chase car to put things right. "In all the past Runs, I've been allowed to check all our cars beforehand," he grumbled. "Not this year, though—and look at it!" He held the delinquent plug before me. Louis had, in effect, built this Daimler. Lord Montagu's father bought it originally in 1899, then in 1919 the grand old Daimler was given to the Science Museum in London.

Forty years later, the Museum loaned it back to Lord Montagu's new Motor Museum; it went at once to Louis Giron. There was little sound stuff on the car—just chassis, engine and gearbox; the body had disappeared. Working from an old black-and-white photograph, Louis built the machine back to new condition and patiently gentled the neglected old engine to new life.

"In 1970," Louis told me as he squirted an old-fashioned long-spouted oil can into the glass lubrication chambers, "it did a thousand miles in a week." Mind you, the Daimler was built as a luxury car: It cost 775 pounds, or over $3000, in an era when Daimlers sold for four of five times as much as Cadillacs. Today, the humblest De Dion Bouton (52 were entered for 1976) could scarcely be bought for less than $10,000.

Luggage switch slows progress

We had been a little cramped in the back seat, mainly because of our luggage. Cars were built in the 1890s purely for the *sport* of driving: The owner never seriously expected to *arrive* anywhere (except, if he was lucky, back home), so there was no boot or trunk for his luggage. While I moved our bags into the back of the Ford station wagon, the old cars continued to pass us. Louis pointed out some oddities among them—the single-cylinder, 1½-hp Arnold Dogcart that had actually taken part in the first Emancipation Run of 1896, a Model "C" Ford of 1904, a Sunbeam-Mabley of 1901, a four-wheeler laid out on a diamond design the maker thought skidproof but which capsized at every opportunity, and the Eng-

(Please turn to page 150)

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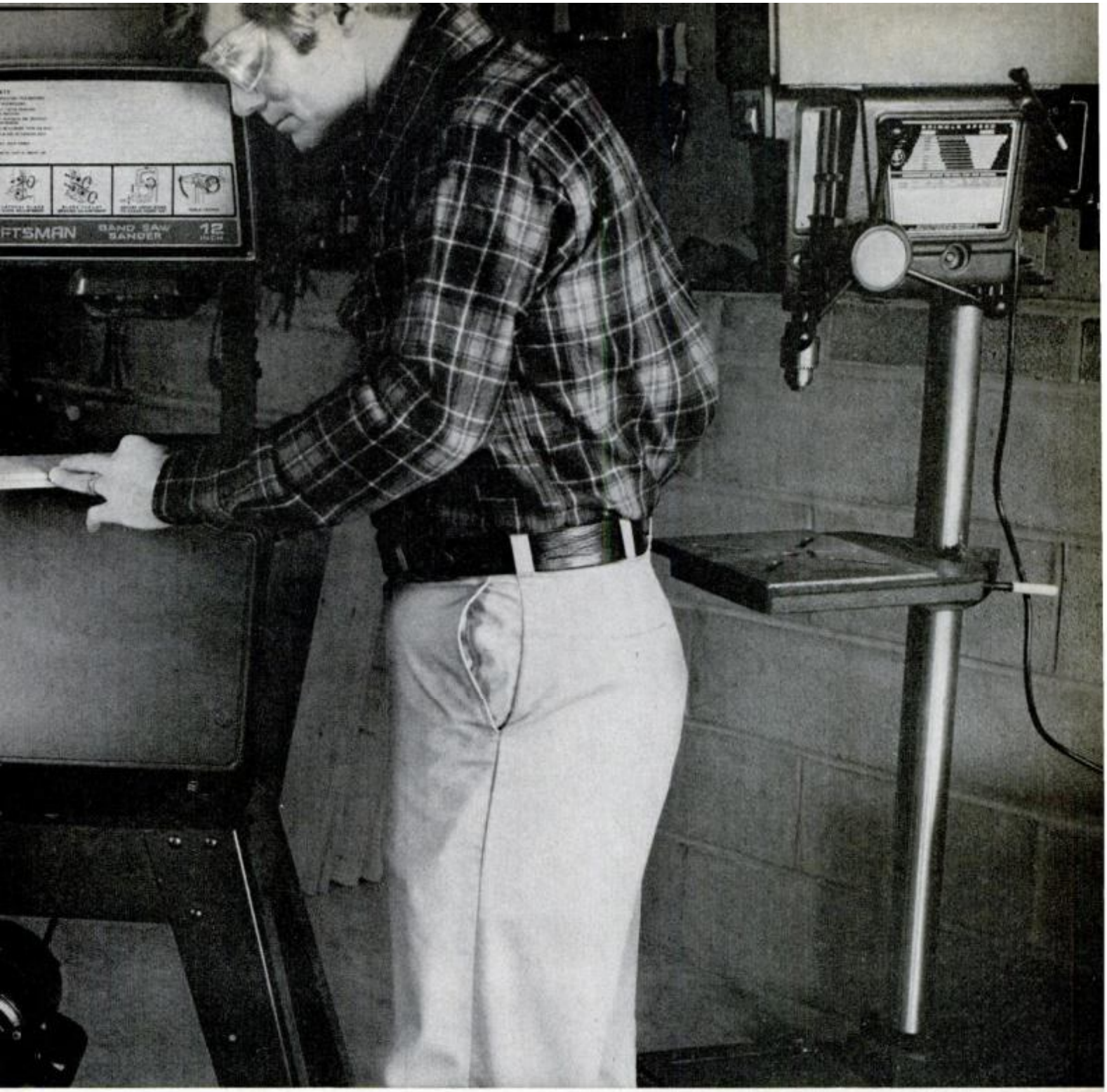

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(Continued from page 147)

lish Mechanic, which as early as 1900 was available from the magazine of that name in the form of plans, leaving primeval DIY buffs to acquire or make the parts somehow themselves.

Off again on the road

Louis gave the starting handle a quick swing. The ancient engine fired the first time and ran sweetly on all four cylinders. I clambered back to my seat, and we set off southward again. Now we were out in the country, and I enjoyed sitting high enough to see over the thick hedgerows into the fields. Then the car jerked a little and the engine spluttered again—we were clearly having more trouble with that No. 2 plug. A substantial hill loomed up. Lord Montagu turned back to me: "I fear you're too heavy," he said. "I'll have to ask you to get out."

Well, I weigh only 180 pounds, I had traveled 400 miles to take part in the Run and I felt like protesting. I was about to say "You can't do this to me," when I realized the third baron and latest of a dozen generations to hold the ancestral estates of Beaulieu, could do just that. I climbed into the Ford and drove miserably along at 15 mph.

Five minutes later, I realized that my own personal lucky imp had once again done me a good turn. A black-and-purple cloud zoomed in from the west and the heavens opened. Nearly all the veteran cars in sight were quite exposed to the elements, as was our Daimler. The rain lashed down until we were on the outskirts of Brighton, when Lord Montagu stopped and invited me to get back on the old Daimler once more.

Crossing finish line in glory

We passed the crest of the last hill and in Brighton's magic way the weather cleared. There was the welcome, salty tang of sea air, borne inland by a gentle southwest breeze. The place was aflutter with flags, and every street carried crowds four or five deep, waving and cheering.

In the brightest of sunshine, and feeling 10 feet tall, I waved at the crowds along the seafront. Shortly before midday we passed the finish line, where the mayor of Brighton presented Lord Montagu with his medal for "punctual arrival"—in other words, for covering 58 miles in less than eight hours.

Lord Montagu parked the Daimler neatly. After four hours of near-divine glory, I again became an ordinary synchromeshed, force-feed-lubricated, self-startered mortal. ★★★

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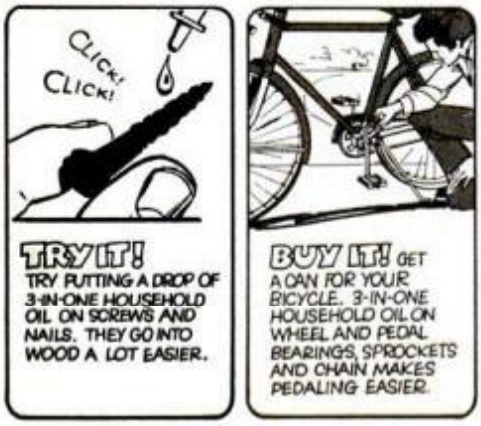


ENERGY FROM OUTER SPACE

(Continued from page 101)

solar energy impinging upon them.

Through a photovoltaic process, each solar cell converts the energy into d.c. electric current that flows through the metal frame of the space island and its mast to the huge movable antenna. There—converted to microwave energy—it is transmitted to a ground-based receiving "rectenna" which reconverts it to electrical energy, changes it to a.c. and feeds it to the power grids.

Equally staggering is Boeing's "Powersat" space station, made up of four huge bowl-shaped solar concentrators, each with about 3000 acres of a reflective plastic film stretched over a light metal framework. Together they comprise a satellite cluster about nine miles long, weighing 100,000 metric tons. Sunlight is focused by each huge bowl into a "cavity absorber" centered above it on a spidery girder arrangement. Here, the concentrated heat is transferred to helium gas in a closed-loop "Brayton Cycle" engine to drive turbogenerators. Waste heat, dumped into the deep-freeze of space via two huge radiator wings, completes the cycle. Electricity is routed through the framework to a transmitter at one end of the satellite, where it is converted to a microwave beam and directed to an earth-based rectenna similar to that described in the SSPS system.

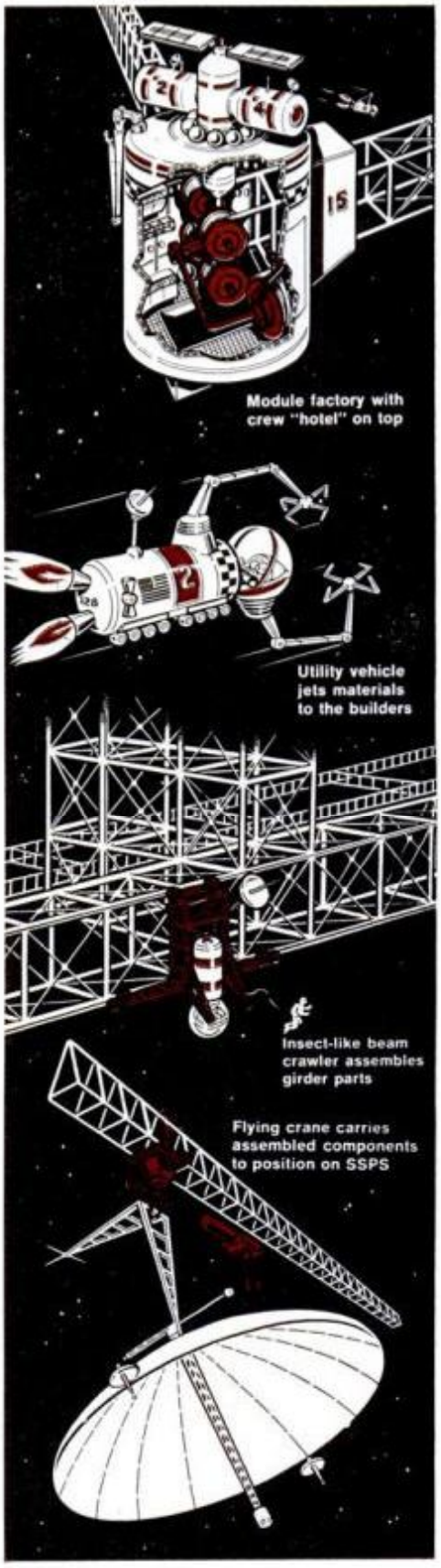
Why microwave transmission?

Why use microwaves for transmission? Why not pinpoint the power on a laser beam, or even focus it to an earthbound energy converter by mirrors?

At Princeton University, E. Michael Campbell, a 25-year-old graduate student, recently developed a remarkable short-wavelength gas laser—eyed as a possible energy transmitter for satellites. But, as Campbell himself admits, "The laser can keep a nice tight beam, but it really can't get through the atmosphere."

Lasers also have low efficiencies in energy conversion from electricity to light frequencies and back again. That, along with their inability to penetrate haze and clouds, rules them out. Mirrors are out of it because too many would be needed to do the job and, as Dr. Glaser notes, ecological problems could result from the interference their reflected sunlight might have on our day and night cycles.

A microwave beam, however, loses little energy in transmission, its power is generated at frequencies



that preclude interference with other RF bands, the beam penetrates any weather factor and it's safe. In 1975 at Goldstone, Calif., JPL and Raytheon radiated 30.4 kilowatts of d.c. electricity through the air with an experimental microwave beam via

(Please turn to page 154)

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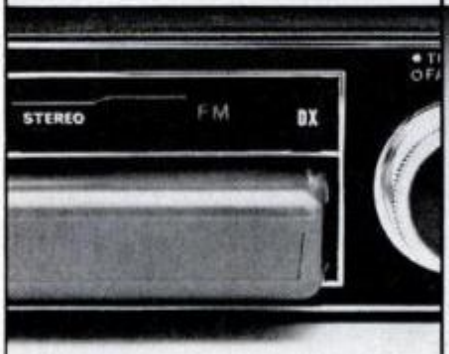

First 8-track with radio started trend toward combination units.

First Graphic Equalizer Booster for car radios gives home quality in the car.

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(Continued from page 152)

an 86-foot dish antenna. A mile away, a 12-by-14-foot rectenna absorbed the energy and converted it to a.c. at 82-percent efficiency at ground level.

Giant rectennas

For both Powersat and SSPS, the receiving system would involve a giant rectenna measuring—depending on whom you ask—between five and 20 miles in diameter, sited either offshore or on low-value land near large metropolitan areas.

Land-based rectennas, Dr. Taylor explains, would be elevated, allowing the land beneath to be farmed. The radio frequency field strength, he claims, would be less than allowable limits under present U.S. safety standards. Birds flying through the beam would be unharmed; air passengers would be shielded by the plane's metal skin. Since the rectenna will absorb more than 90 percent of the energy, people working beneath the structure would be unaffected.

All very well, but how do you get a 40-to-60-million-pound manmade satellite, a little larger than Manhattan Island, into orbit? Both the Powersat and SSPS concepts call for a "Heavy Lift Launch Vehicle" (HLLV).

Boeing's giant transport would be shorter but much larger in diameter than the Saturn V moon rocket. One configuration of this low-cost "space freighter" (already designed) resembles a king-sized Appollo capsule. The rocket is a reusable single-stage vehicle capable of boosting 250 tons of material to low orbit and returning to a rocket-arrested water landing in a shallow artificial lake. Touchdown velocity is less than three meters per second. "It would," says Dr. Taylor, "have a turn-around time between flights of about a day."

A fleet of such space ships would provide from one to several launches a day. Some 150 launches would be needed for each complete satellite.

Space freighters

The giant payloads of the space freighters, Taylor explains, would be delivered to a low Earth orbit assembly station, where several hundred workers would build the Powersat from parts to be prefabricated below.

Once assembled in low orbit, electric rockets, drawing power from already operating solar generators, would propel each module to geosynchronous orbit 22,300 miles high. There, they'd be assembled into four-module clusters that are capable of pouring some 10,000 megawatts of net energy into the nation's power grids.

Proponents of the SSPS concept look to the Space Shuttle—due for operation in the early 1980s—as a transporter-to-orbit of materials for experimental modules. By using the Shuttle, 80-ton payloads of basic material for a test prototype could be ferried to orbit, they note. The material would be fabricated in space into structural members for scaled-down experiments.

Later, a single-stage HLLV, with a 200-ton capacity and resembling a Saturn moon rocket, would carry materials and manufacturing modules to low Earth orbit. Here, construction of the SSPS would take place before moving it to stationary orbit by ion jets.

Manufacturing and construction in space will call for pretty far-out equipment. Engineers have designed a wild assortment of unfamiliar devices to do the job. Manned service vehicles will include everything from simple backpack machines to complex materiel movers and positioners (see sketches, page 100).

Flying cranes

Flying cranes powered by jet thrusters will hold and manipulate structural elements. They'll be guided by operators in pressurized cabs with shirt-sleeve environment. They'd consist of nothing more, actually, than great trussed beams with articulated arms on the underside.

Grumman's plan calls for manufacturing structural components in space. Engineers have designed coiled spools of thin sheet metal that can be unreeled in cylindrical "space factories" and processed through machinery that would form it into structural elements with a triangular cross section. This material would be used to fabricate the trussed girders from which the satellite's framework would be assembled.

"Work vehicles," say planners, "fitted with articulated manipulators would assemble the whole thing, operating remotely from stations which would also house the crews."

Actually, the sky would be acrawl with mechanical monsters during construction. Jet-thruster-powered cranes not unlike multiclawed undersea "Alvins" would hover in space, grabbing collapsed components and unfolding and positioning them for attachment to the huge frameworks

(Please turn to page 157)

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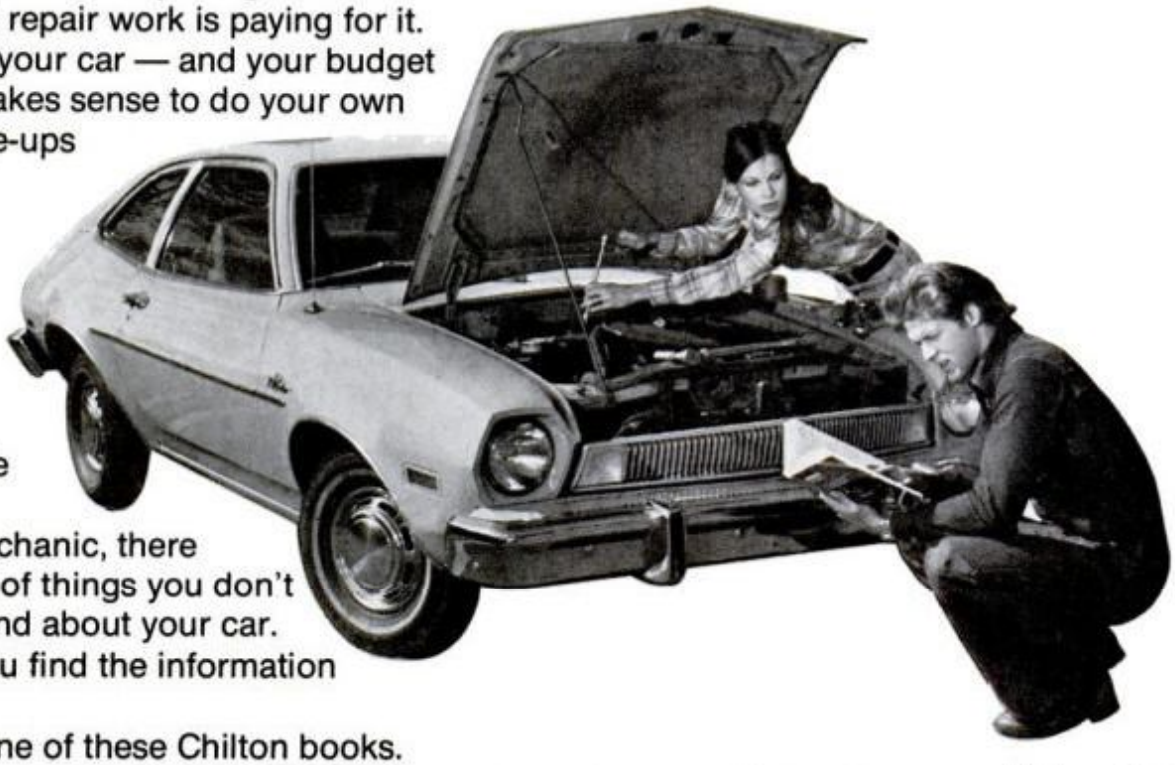

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ENERGY FROM OUTER SPACE

(Continued from page 154)

that will support fields of solar cells.

Other vehicles will ride the horizontal and vertical members of the structure, with manipulating arms drawn up like gargantuan grasshopper legs, fitting and fastening components. Up top, beam crawlers will ride the open framework like railroad work cars, unrolling ribbons of reflective plastic on the ridges along the deck.

A gentle push from jets

Once built, the vast platform would be moved to stationary orbit with a gentle but steady push from a solar-electric ion jet system.

Since solar cells are vulnerable to radiation, Grumman engineers plan to mount them on long blankets of protective material and roll them up like newsprint for the trip through the Van Allen belts. Once in high orbit, they'll be unrolled like window shades by crawlers that will lay the arrays flat in the valleys between ridges. Jet thrusters like those used on the Lunar Lander will nudge the great satellite into operating position.

Maintaining the space islands during their estimated 30-year useful life would be handled by small transient crews. The SSPS, having no moving parts, would need only occasional repairs and replacement of solar cell blankets. One plan calls for fabricating the cells in a triple layer of material. Every 10 years, the top layer would be peeled away to expose a fresh array.

Maintenance crews handling that work, along with repair of meteoroid damage and other deterioration, would live in the work modules used by the construction workers.

A bustle of activity

Boeing's thermal engine concept, with its many moving parts, would see a constant bustle of activity around its "Brayton Cycle" engines. Rotating crews would live in cylindrical "hotels" located on the great structural arms bracketing the giant wings of the waste heat radiators.

When will all this happen? One timetable looks like this:

1980—Space Shuttle hauls materiel to low orbit for construction, in space, of experimental components.

1985—A small space power laboratory unit demonstrates the transmission of power to Earth.

1990—A Heavy Lift Launch Vehicle carries the first 200 tons of construction material into orbit; emplaced manufacturing modules fabricate framing structure for the satellite and transmitting antenna.

1995—Ion engines propel the finished satellite to geosynchronous orbit.

2000—A string of power satellites are in orbit, each delivering enough electricity to Earth to power a city the size of New York.

Would pay off

Wouldn't the cost of this gigantic enterprise far outweigh the returns in energy? Most scientists who have studied the systems think it would pay off. Boeing scientists point out that six Powersats would fill all the present electrical needs for all of Japan. About 35 of them would provide the whole baseload for the entire United States.

"A program which adds one Powersat per year for 30 years would pay for itself if its electricity was sold at the point where it enters the nation's power grid for 25 mills per kilowatt-hour," they claim. That price—2.5 cents—according to these experts, is less than some producers get now for their electricity at the grid junction. ★★★

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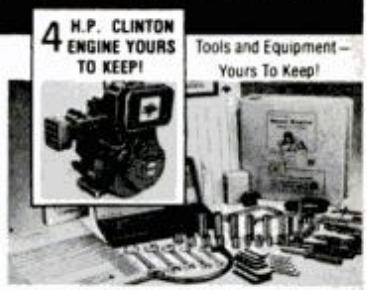

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HOW TO DO THAT ENGINE OVERHAUL YOURSELF

(Continued from page 112)

one from doing any automotive work himself. But I want you to have your eyes wide open before you proceed with this job, and the best way to do that is be investing a few dollars for a service manual that covers your car. Read the "Restoring Valve Guide" and "Engine Overhaul" sections and see what's involved. Then, you can determine whether you're up to the task.

If you decide to go ahead, you will need the service manual to guide you. It contains the essential instructions and specifications.

If you don't proceed with engine work, the service manual is a good publication to have anyway. It outlines details for all work your car may need, including engine tune-up and lubrication.

Service manuals can usually be ordered by writing the manufacturer.

To help you further in deciding whether to tackle the job of restoring your oil-burning clunker yourself, consider these facts:

Valve guide repair

Valve guides in modern engines are an internal part of the cylinder head and in most cases cannot be replaced.

When valve stem-to-valve guide clearance becomes excessive, the normal procedure is to replace valves with new ones having oversize stems. For example, valves are manufactured for Chrysler Corp. engines having oversize stems of .005 inch, .015 inch and .030 inch. Chevrolet engines can be served by valves having oversize stems of .003 inch, .015 inch and .030 inch.

Valve availability information is contained in your service manual.

To repair valve guides, you have to remove the cylinder head(s) and valves. The valve stem guide clearance should be measured. If it is determined that valves with oversize stems are needed, guides have to be reamed out (made larger) to accommodate those stems.

Some special tools you will need for this job and their approximate costs are as follows (prices quoted are from Kent-Moore Tools):

- Valve guide reamer—$7.50.
- Valve spring compressor—$17.
- Valve seal installer and tester—$10.50.

If a professional mechanic were to do this job for you, it would cost in the neighborhood of $250.

Facts about engine overhaul

- It is important in doing a ring job that the cylinder bore be examined closely for ridges. Run your fingernail over the bore. If a ridge can be felt, it will be necessary to ream the ridge out. A reamer costs about $60. Any attempt to install a piston having new rings in a cylinder having a ridge would probably result in new rings being broken.
- When removing connecting-rod caps it is important that you identify them to the cylinder. In some cases, caps and connecting rods are numbered for easy cylinder identification. But if they aren't, use a punch to make identifying marks. For example, one punch mark can serve to identify parts belonging to No. 1 cylinder; three punch marks, No. 3 cylinder and so forth.

Do *not* use a file to make identifying marks.

- Since rods move up and down in pairs, it is convenient to disassemble them in pairs. Rotate the crankshaft until a pair of rod caps are in position, remove rod-bolt nuts and take off the caps. Push the pistons up through the bores, but be careful not to damage the journals.
- Piston rings are available in a variety of sizes to accommodate worn bores. Bores should be measured accurately with a cylinder-bore checking gauge, so the correct size rings may be selected.
- If cylinder bores have a taper of more than .015 inch, you should rebore them and install new pistons and rings. If bores don't have to be honed, a glaze buster should be used to remove glaze before pistons are reinstalled.
- Some special tools you will need (or may need) when you're at work on the piston area of an engine and their approximate prices are as follows:

1. Piston ring compressor to compress rings when installing pistons in bores—$10.
2. Piston ring expander for removing and installing rings—$5.
3. Cylinder bore gauge—$65.
4. Cylinder bore honing tool—$30.

Where to get information

Besides the service manual, your primary source of information, I can recommend two other books to help you overhaul the engine. They are *Auto Engines and Electrical Systems* and *Auto Repair Manual*. Both are published by *Motor* and are available at many libraries and bookstores. If you have trouble getting one or the other volume and wish to order it by mail, address your inquiry to *Motor* Books, Box 2316, New York, N.Y. 10022. ★★★

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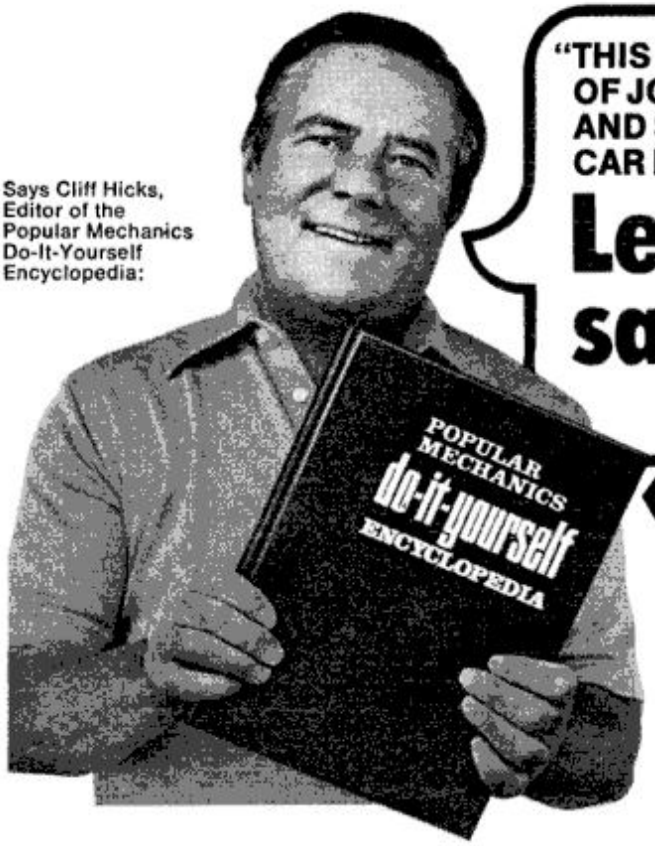

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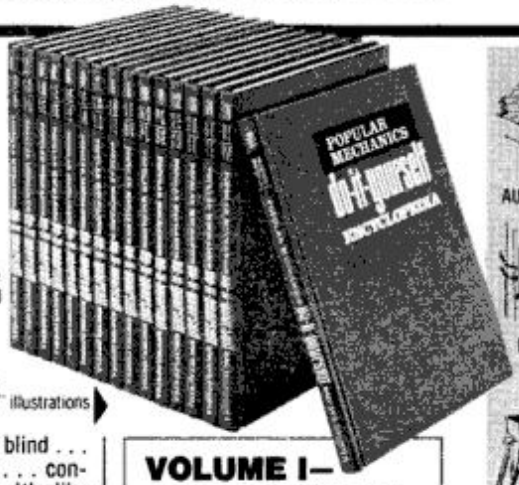

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(Continued from page 115)

kind of refrigerant circuit found in an airconditioner, a freezer or a refrigerator. The refrigerant (usually Freon) boils in an evaporator coil, picking up heat from the air passing over the coil and thus cooling that air. The gaseous refrigerant is then pumped by a compressor into a condenser coil where it becomes liquid again, giving up heat to the air passing over that coil. The liquid then moves on to the evaporator to complete the circuit.

In an airconditioner, the two coils are kept separate—the evaporator indoors and the condenser outdoors—because the aim is to move heat from one space to another.

A dehumidifier has a different purpose, and first cools, then heats the same air, forced through the appliance by a fan. (Air leaving the unit is warmer than air entering because it has also acquired some of the energy put into the compressor.) But when the air is cooled at the evaporator, it loses some of its moisture-holding capacity. The moisture the air can no longer hold condenses onto the evaporator coil, then drips down and is collected in the unit's condensate pan. As a result, the air that comes out of the unit is dryer than the air that goes in.

What to look for

Most dehumidifiers provide two means of disposing of the collected water: a pan, which requires periodic emptying, and a threaded fitting below the evaporator coil to which a garden hose leading to a drain can be attached.

An automatic overflow control will shut off the appliance and turn on a signal light whenever the condensate pan is full; the light goes off and the unit will run again when the empty pan is replaced. This feature is, of course, an unnecessary expense when the dehumidifier is used with a hose to a drain.

A feature that you should definitely invest in is an adjustable humidistat. This control turns the appliance off automatically when humidity in the room falls to the desired level and turns it back on again when humidity exceeds that level. Units without humidistats operate continuously and waste electricity.

Noise a minor problem

Noise is not usually a problem with dehumidifiers, much less so than with room airconditioners, which can set up resonance with the walls in which they're installed. But if the unit is to go into a basement bedroom, you may want to listen to a few models before buying.

Warranties vary from manufacturer to manufacturer, so be sure you understand terms. A basic warranty provides a one-year, unlimited parts and labor agreement and an additional four-year limited agreement. In other words, the maker fixes anything that goes wrong during the first year, and replaces any defective refrigeration-system parts during the next four.

You'll probably want to move your dehumidifier occasionally—at least annually for off-season storage—so it should be equipped with casters or wheels.

Decorative value of the appliance is up to you. The cabinets of some units are very stylish, and this may be important if the dehumidifier is to go into a finished recreation room. But slick styling is a waste of money for a unit occupying a dark part of the basement or in the average home workshop.

Safety allows no compromises. The machine you buy must be UL-listed and should be equipped with a three-wire service cord to assure grounding. If you must use an extension cord, make it a heavy three-wire cord and make sure the grounding plug is connected, not defeated.

Operating tips

To assure most efficient operation of your dehumidifier, follow these general rules:

To avoid overloading the machine, keep outdoor air entering the space to a minimum by keeping doors and windows closed.

In general, do not operate the dehumidifier at temperatures below 65° F. (at 60-percent relative humidity). If the unit is run when either temperature or humidity is too low, ice will form on the evaporator coil, cutting efficiency drastically. A dehumidifier that is kept running while iced can be damaged.

If you're equipped to measure relative humidity (with a hygrometer or a sling psychrometer), you can tell more precisely when to run or not run the unit, by using the graph on page 115. When conditions fall within the shaded portion of the graph, dehumidifiers will ice and should not be run.

When you first get your dehumidifier, set it for continuous-run operation and let it run for two or three weeks to dry out the space. After this initial period, slowly rotate the humidistat dial until the unit shuts

(Please turn to page 164)

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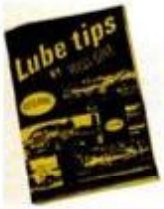

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DEHUMIDIFIERS

(Continued from page 162)

off. If the humidity level indicated by the dial is still on the high side, readjust the dial and let the unit operate to bring humidity down further.

A desirable level is indicated on most dials by the word "normal," but you can follow the rule of thumb that—provided your dehumidifier has sufficient capacity for the space—the setting is correct when evidence of dampness is gone and the unit does not operate continuously but cycles on and off like a refrigerator.

Running the dehumidifier when the space is heated—or any time when its temperature is higher than that outdoors—is wasteful. Relative humidity will be acceptable at these times.

A single dehumidifier should suffice if its capacity is large enough. The exception is when you're trying to dry two areas separated by closed doors and walls an inch thick or more. If communicating doors are kept open or walls are thin partitions, one unit should be adequate for the job.

Always leave a minimum of 6-in. clearance around the unit to permit unrestricted air flow, and place it as near as possible to the center of the space you're drying.

Safety note: If water accumulates around the dehumidifier, pull the fuse or turn off the circuit breaker *at the service panel* before you stand in water or touch the unit.

Maintenance

As with any appliance, you should read, understand and follow owner's-manual instructions, which will be specific—but the following general rules will apply.

Always disconnect the power cord before doing any work on the unit. Clean evaporator and condenser coils periodically. Leave the unit off for an hour to let the evaporator dry, then use a soft bristle brush or a portable vacuum cleaner. Clean fan motor and blade, too.

Apply a few drops of SAE No. 10 oil to the fan motor.

Wipe the cabinet top, sides and grilles with a soft damp cloth.

Wash the condensate pan in warm, soapy water and rinse.

Don't tinker with the refrigeration system—you can void your warranty that way.

When you store your dehumidifier for the off season, make sure all parts are dry to prevent rust. Also dry the condensate pan inside and out. Cover the unit and keep it in a clean, dry area. ★★★

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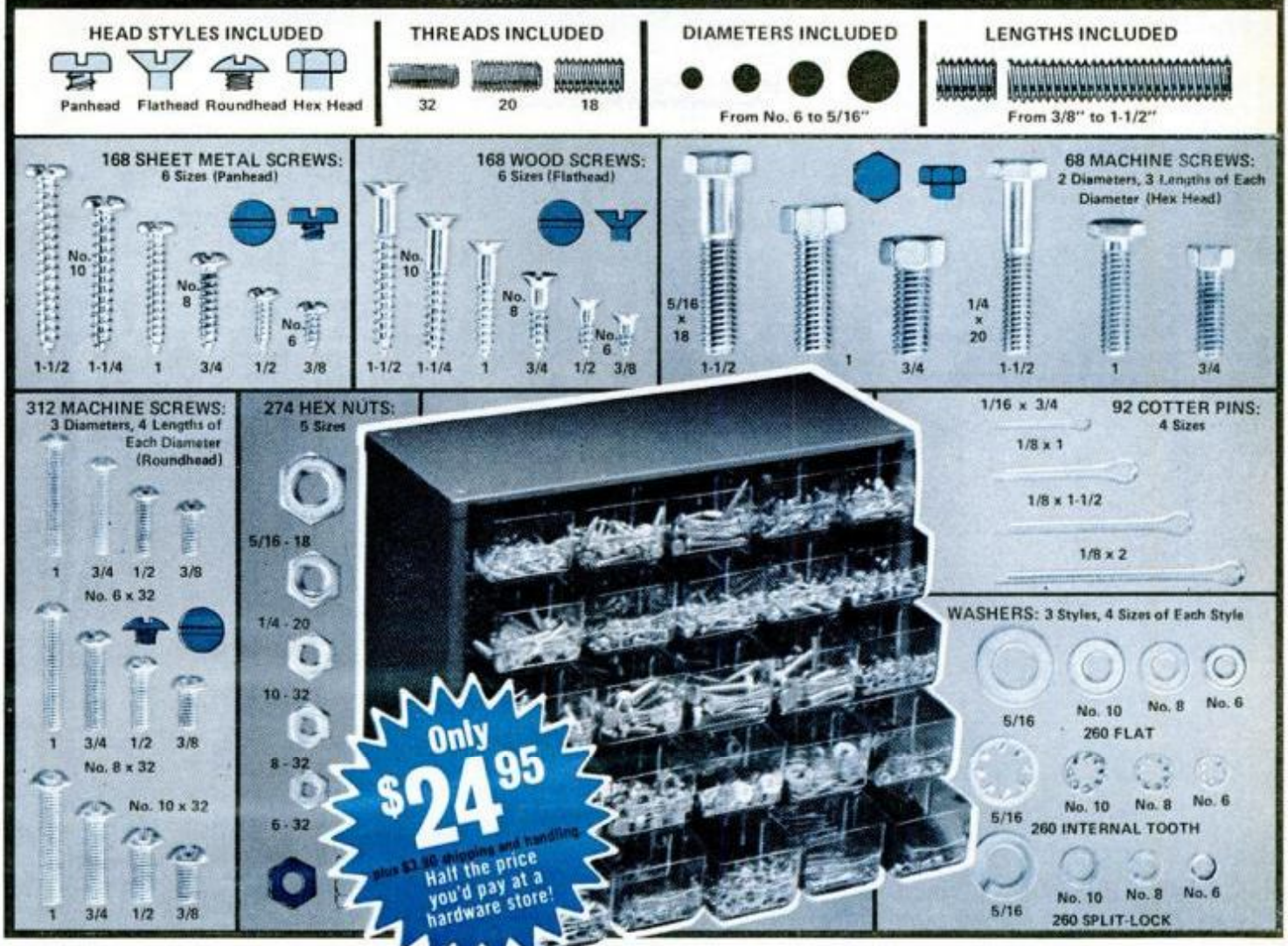

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NEW RIGS FOR ROUGH ACTION

(Continued from page 77)

a couple hundred thousand miles to engine life, some owners claim.

American Motors is also taking a long-range look at diesel power for Jeeps. This spring's Geneva Auto Show in Switzerland displayed a Perkins diesel-powered Jeep to be offered in Europe in 1978. A 50-percent fuel economy increase is predicted, but there seem to be no plans to sell diesel Jeeps in the States.

Jazzy Jeeps

Jazzed-up Jeeps for the American market are available now, however. Limited production of the CJ-5 and CJ-7 Jeeps and the J-10 Jeep pickup come in Golden Eagle models. A large golden eagle decal covers the hood; special striping is on the body and grille, and the exterior color is oakleaf brown. A tan top matches the bucket seats, and steel wheels are gold-colored. A personal recreation vehicle package for the pickup truck includes a grille brush guard and Cibie driving lights. For the standard Jeep CJ-7, the removable molded hardtop comes with metal doors, roll-down windows and steel lift gate.

Ford's better off-road ideas this year start again with the Bronco but include a new version of the F-250 4x4 pickup, sporty options for Courier and a long-bed model.

"Free wheeling" styling with multicolor bodyside striping will be an option for '77 Styleside 4x2 and 4x4 Custom and Ranger 117-inch and 133-inch-wheelbase pickups. There are trailer towing and camper special packages for the F-250 4x4; its cab and tailgate are lower without decreasing ground clearance.

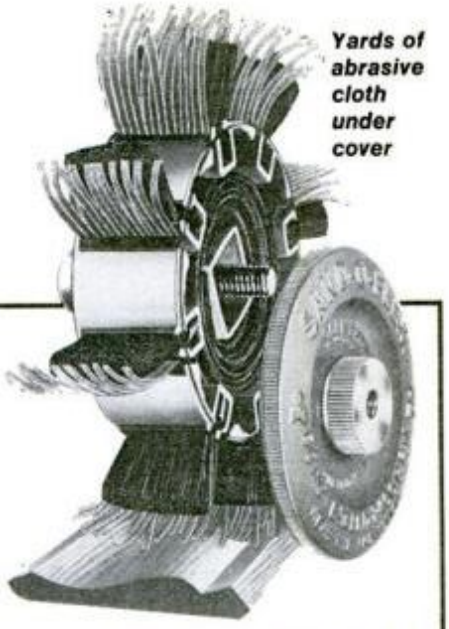
Plenty of 'macho' styling

Chrysler has new "adult toy" vehicles. Plymouth Trailduster and Dodge Ramcharger and Power Wagon 4x4s have Macho packages with sport wheels, big stripes and "super graphics" lettering. For styling a pickup, the Warlock conjures a show model into a production trick truck with oak sideboards.

Besides General Motor's popular Chevy Blazer, the new Chevrolet Luv mini-pickup has increased load capacity, decal options and a choice of five colors. Some duplicates of the official four-tone GMC pickups used at the Indy 500 will be available from GMC dealers. ★★★

Personalized pickup, like Dodge Warlock (top) and True Spirit II, can be bought customized. Scout or Traveler Street Machine (center) can mount a sun roof. Economy lead is claimed for Ford Courier (above) with EPA rating of 40+ mph.

Camping out in a Scout is arranged with tailgate down for sleeping-bag room and a shelter extension rigged over it. ORV Scout II package includes mini-winch, CB.



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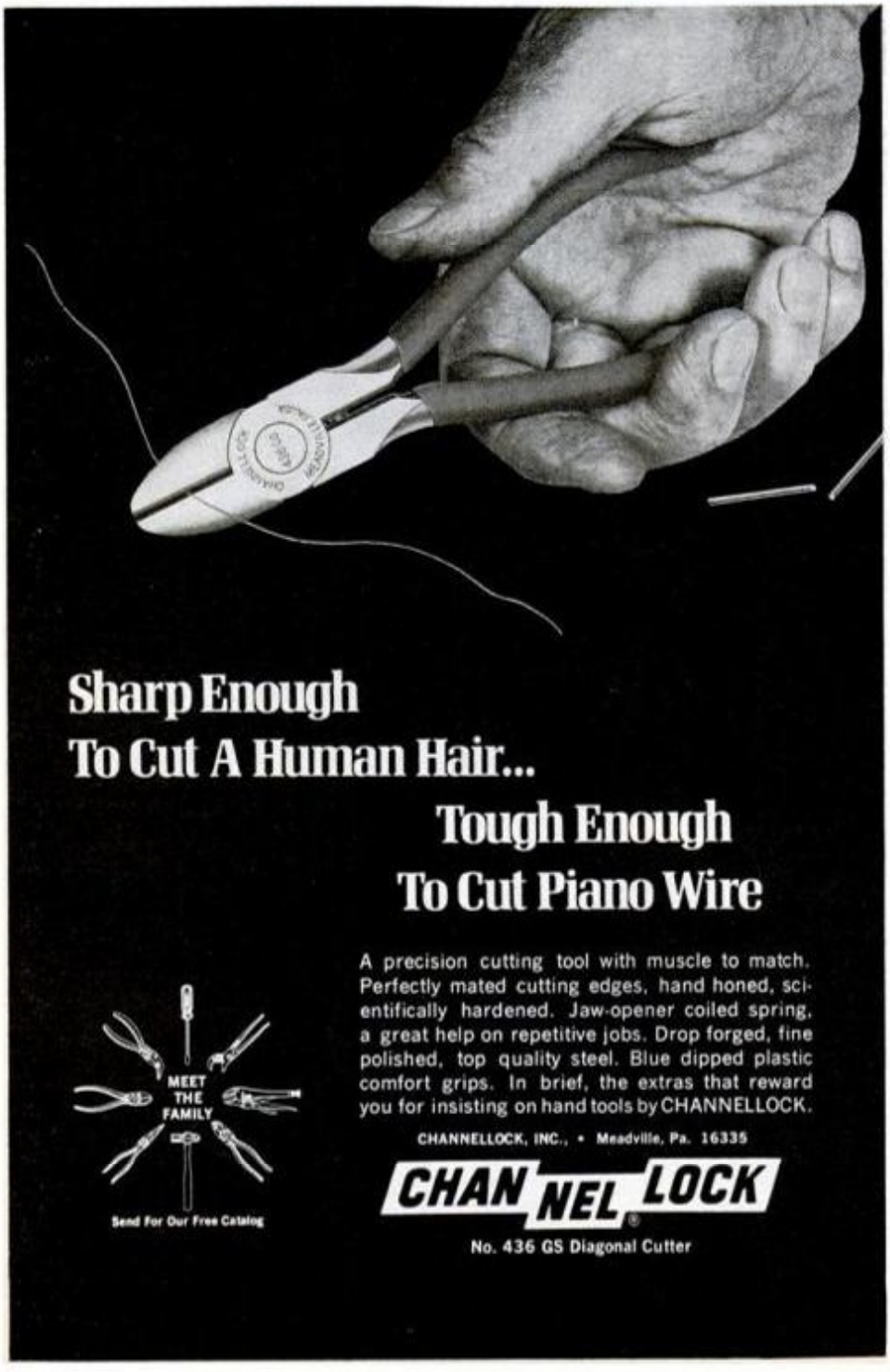

SPEED DASH IN A HOMEMADE JET

(Continued from page 102)

tom at 902.769 mph.) But official or not, Darryl's achievement is generally considered record-breaking.

A do-it-yourself project

What makes the accomplishment even more remarkable is that the jet —while technically a Lockheed F-104—was virtually hand-made by Greenamyer and a small group of helpers. The reason: Because it is illegal to sell military aircraft to civilians, it was not possible for Darryl to obtain a production F-104. It was necessary to scrounge the parts, bit by bit, from wherever they could be found. Greenamyer scoured the country from California to Florida in search of pieces—some outmoded, some damaged, some incomplete—anything he could get his hands on.

Then the gigantic assembly task began. Putting together a 10-ton, 55-foot-long supersonic jet is no simple do-it-yourself job. It has taken more than 10 years of work at a cost of hundreds of thousands of dollars—and it's not finished yet.

One happy "find" was an obsolete, discarded fuselage mid-section originally used for test-bed purposes. Seemed ideal, but it, too, posed problems—all of its sheet metal was fastened on with roundhead rivets that would produce way too much speed-killing drag for a record attempt. Every rivet had to be drilled out and replaced with a flush type for a smooth surface. Even slots in screwheads were filled with epoxy.

Stripped to save weight

To lessen weight and give a better power-to-weight ratio, everything not needed for a strictly speed machine was eliminated—drag chute, dive brakes, underwing ammo pylons, boundary layer controls and other exotic luxuries.

At the same time, some decidedly unmilitary additions had to be made. Because it is impossible for a speed pilot to monitor all the flickering dials on his instrument panel and still concentrate on his flying, a duplicate set of instruments was installed in the fuselage behind the cockpit with a camera to record the readings. By studying the films later, Greenamyer could better tell what adjustments might have to be made.

The result is a dazzling, colorful, restored F-104 painted in a swooping series of red, yellow, orange and white stripes—hardly military, but very striking to the eye. So far as is known, Greenamyer is the only civilian to own and fly a military fighter of this type, designated a

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"double-sonic jet" because it is capable of going twice the speed of sound. (A few earlier military jets, such as F-86s, are privately owned; none are as advanced or powerful as Darryl's.)

Speed dash very costly

But what about that speed attempt? Why not just fly the course again to make the record official? Sounds simple enough, but it's not that easy. Every record attempt requires months of preparation work, both on the plane at at the site where the attempt will be made. A 3-kilometer course (1.864 miles) must be carefully surveyed and marked off to the last fraction of a millimeter. To minimize hazards, and annoyance to populated communities, it must be laid out in a remote region—in Darryl's case, a deserted wilderness area called Mud Lake in Nevada, a former World War II bomber run and emergency landing field for the X-15 rocket plane.

The course must be checked and approved by the Federation Aeronautique Internationale, the worldwide sanctioning body that officiates at such events. Judges, observers, timekeepers and others representing the FAI must be assembled (and paid). Elaborate camera traps must be set up at the ends of the course with experienced technicians to operate them—all for more than $10,000 a day. This is one reason you don't attempt speed records too often.

There are others. Because it is illegal for private pilots to fly supersonically, Greenamyer had to obtain special permission from the FAA to make his speed run—and would have to continue to get approval for each succeeding attempt. In addition, he had to obtain individual permission from every resident in the area whose property he might fly over or near—and this covered a lot more territory than you might imagine.

Must make four runs

According to FAI rules, it is necessary to make two passes through the camera traps in each direction. Then the four times are averaged out to produce the final result. Although the actual course is short—less than 2 miles—Darryl's tremendous speed through the traps requires that he take an additional 15 miles at each end just to get his plane turned around and lined up for the next pass. He thus covers more than 30 miles on each pass—a large area. In fact, his recent attempt lasted 19 minutes, during which he consumed 800 gallons of fuel—nearly a gallon a second!

Because of such costs and compli-

(Please turn to page 170)

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SPEED DASH IN A HOMEMADE JET

(Continued from page 168)

cations, Greenamyer, a member of the Red Baron Racing Team of Idaho Falls, does not plan another low-altitude speed attempt unless conditions make it worthwhile—meaning more sponsor money or that other race pilots might chip in on a jointly used speed course.

Next: an altitude record

What Darryl would really like to do with his pieced-together F-104 is set a new high-altitude record, presently held by a Russian Mig-25 Foxbat fighter at 118,897 feet—approximately 22½ miles. (Other planes have flown higher, but not from a ground takeoff.)

For his altitude attempt—planned for this summer—Greenamyer will not climb in gradual steps or gentle upward spirals. This would take too long, consume too much fuel and allow the stubby-winged F-104 to lose lift and fall off in the thin upper air before it could attain the desired height. Instead, Darryl will try a full-power "zoom climb"—a steep, upward-arcing, rocketlike blast similar to that used by early astronauts simulating weightlessness in space.

He will climb to 40,000 feet, level off, pour on maximum thrust with afterburner, then pull the nose up and just hold it there until it flattens out at the top of the arc—hopefully at about 125,000 feet or more than 23½ miles. The reason Darryl needs this much altitude is based on stringent regulations established by the FAI. Unlike sports events, in which records can be broken by a fraction of an inch or second, new aircraft records must be set by a substantial margin—at least 1 percent for low-level speed attempts and 3 percent for altitude attempts. Darryl needs a minimum of 122,500 feet to break the currently held Russian record.

A risky venture

Taking a conventional aircraft to such heights—even a powerful jet like the F-104—is extremely risky. Regular control surfaces—rudder, ailerons and elevator—lose effectiveness in the rarefied upper atmosphere because they have nothing to push against, and there is a danger that the plane may plunge out of control. Moreover, Darryl figures that by the time he comes out at the top of the arc his speed will be down below 100 mph—way too slow to sustain adequate lift and stability.

To compensate, Greenamyer is installing eight hydrogen peroxide thrusters around the nose of his plane—two aimed upward, two downward and two outward to each side. Using these like the small maneuvering jets on spacecraft, he will attempt to maintain directional control and stability until he can get back down into thicker air.

Darryl also has another trick to combat the thinness of upper air. Jet engines—unlike rockets—are "air breathers" and need reasonably dense air to operate well. As he starts his zoom climb from 40,000 feet, Darryl will activate a water-spray system of 40 small nozzles in each air intake. The tiny jets will spurt out a fine stream of water under 300 pounds per square inch pressure at a rate of 60 gallons a minute.

Water increases air density

As he approaches maximum velocity of Mach 2.5—2½ times the speed of sound—the water density will increase, cooling the intakes and raising the density of air to the engine.

If Darryl realizes his great ambition—in a 20-year-old patchwork plane considered obsolete by modern military standards—it will be a masterful achievement. For this superb pilot, engineer and dreamer, it is an exciting, challenging hobby. ★★★

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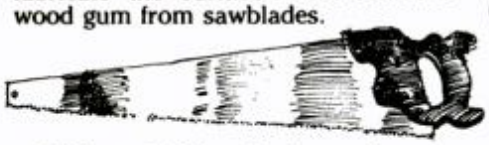

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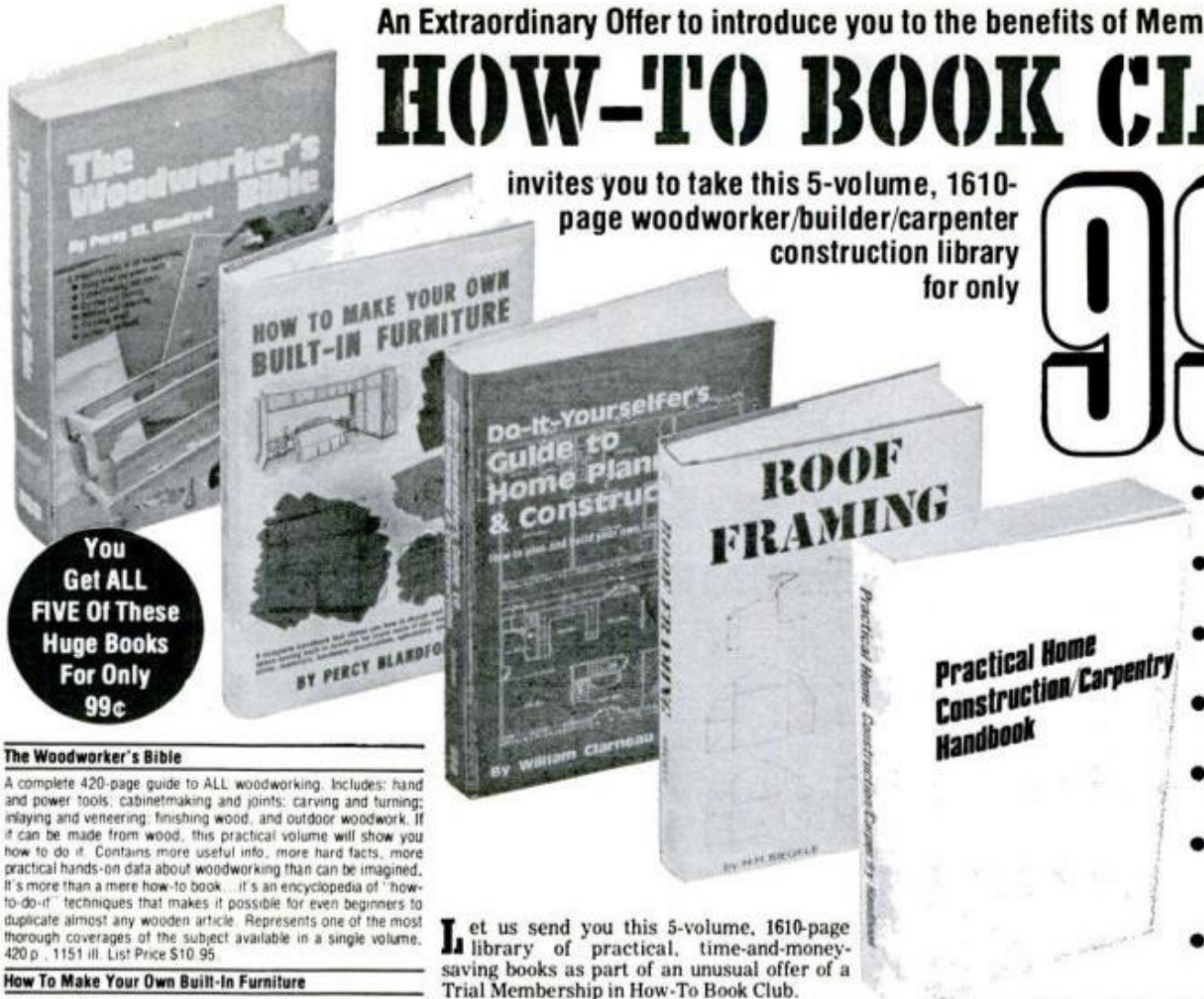

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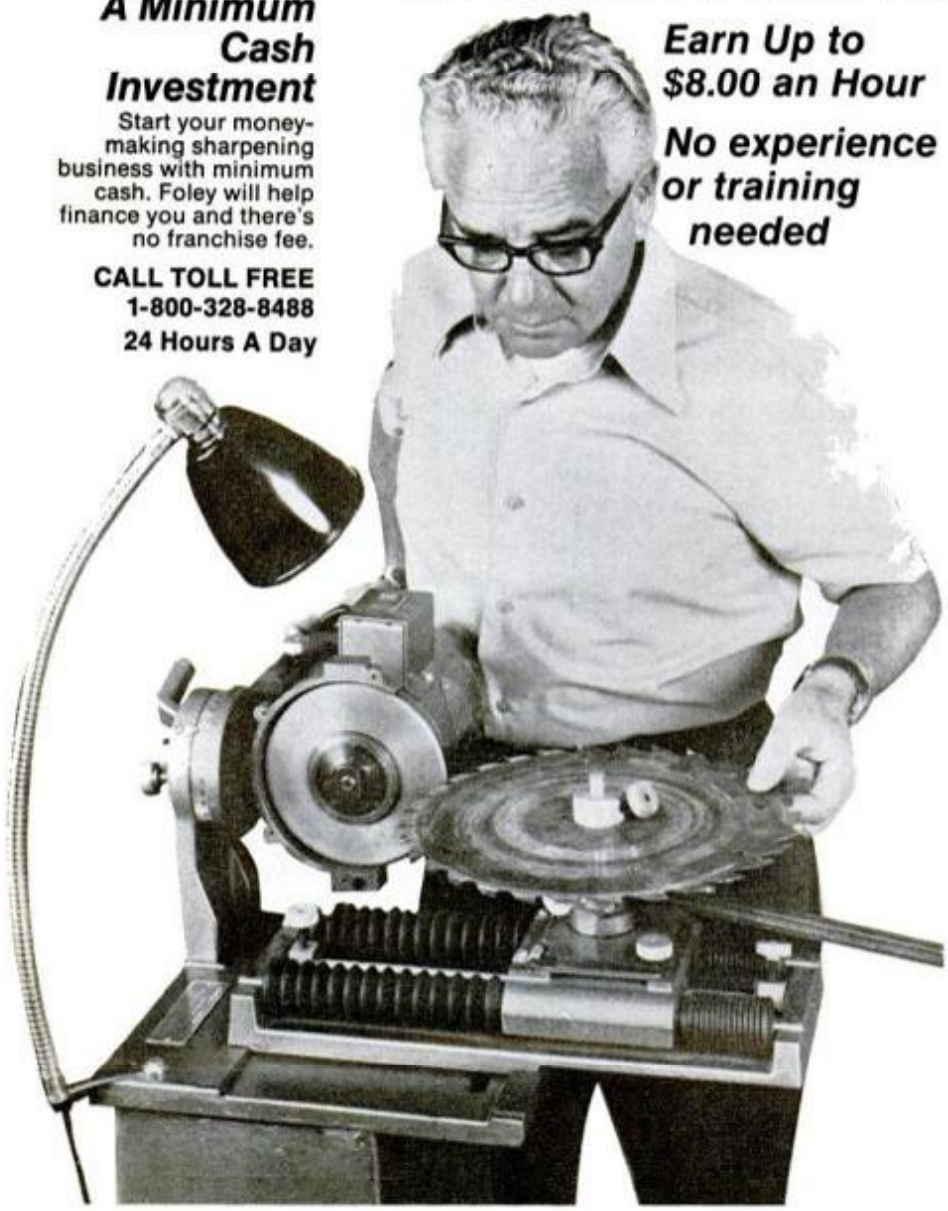

TOOL TEST

Hammer drill does double duty

The hammer drill is no add-on drill accessory. Rather, it's a complete-in-one tool that combines high-rpm drilling with an impact action that kicks the bit into the work with every revolution.

I tested Black & Decker's 3/8-in. single-speed hammer drill on brick, mortar joints and concrete. Its carbide-tipped masonry bit chewed through the brick and mortar joints. But it was slightly slower on concrete. It jammed once—when I applied too much pressure. The shift lever to activate the hammer action is on top.

The housing is double-insulated; you don't need a ground or adapter plug. Possible fault: the lock switch location beneath the trigger. I found it hard to operate at times. All points considered, I evaluate the hammer drill to be a sturdy, basic tool that'll make your present drill seem old-fashioned. At $30, the tool is sure to be a welcome addition to most toolboxes.—*Michael Hinds*

SPECIFICATIONS: B&D 3/8-in. hammer drill

Motor: 3 amps., 1/3 hp
Single speed: 2900 rpm
Diameter capacity: steel, brick, 1/4 in.; masonry, 3/8 in.; wood (using auger, 3/4 in.)
Features: sleeve and needle roller bearings, detachable cord, lock-switch on pistol grip.
Weight: 3 1/2 lbs.
Price: $29.99
Manufacturer: Black & Decker Mfg. Co., Towson, Md. 21204

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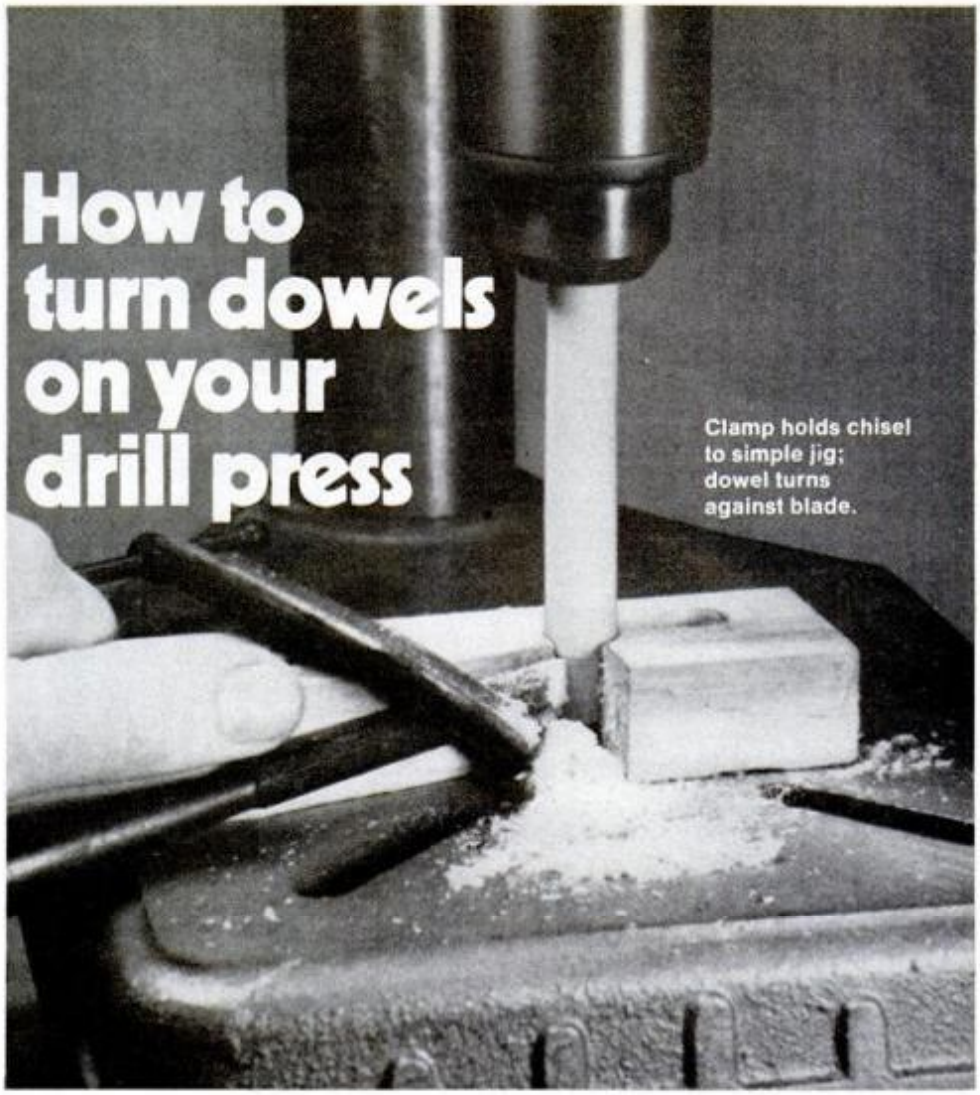
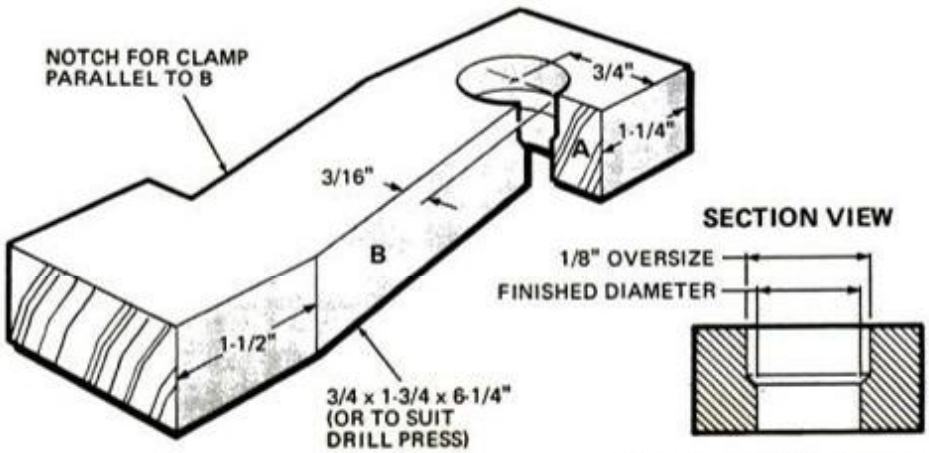
How to turn dowels on your drill press



Right-size dowels for some jobs, especially furniture repairs, can be hard to find. This jig can be used instead of a lathe to turn any odd-size dowel you may need.

Bore a hole slightly larger than the size desired (⅛ in. larger if working from rough stock) halfway through a hardwood block. Then bore all the way through with a bit of desired size, or use a smaller bit and rasp to size. Make radial cut A, then make cut B 3/16 in. inside and parallel to a line tangent to the larger hole, providing a surface for the chisel flat. Parallel notch in block's opposite side is clamp seat. Coat hole with silicone lubricant. Clamp chisel in place, chuck dowel stock, and turn, using low drill-press speed and feeding slowly. Check work and adjust chisel as necessary.

If commercial dowel is not used, rough out blanks with octagonal bevel cuts on the table saw or by planing square stock. If stock diameter exceeds chuck capacity, reduce size of one end. To turn long pieces, swing table or head aside, hold jig by hand. For short lengths, you can hold jig in a vise and chuck the dowel in a brace or portable drill.—*Collin Baker, M.D.*



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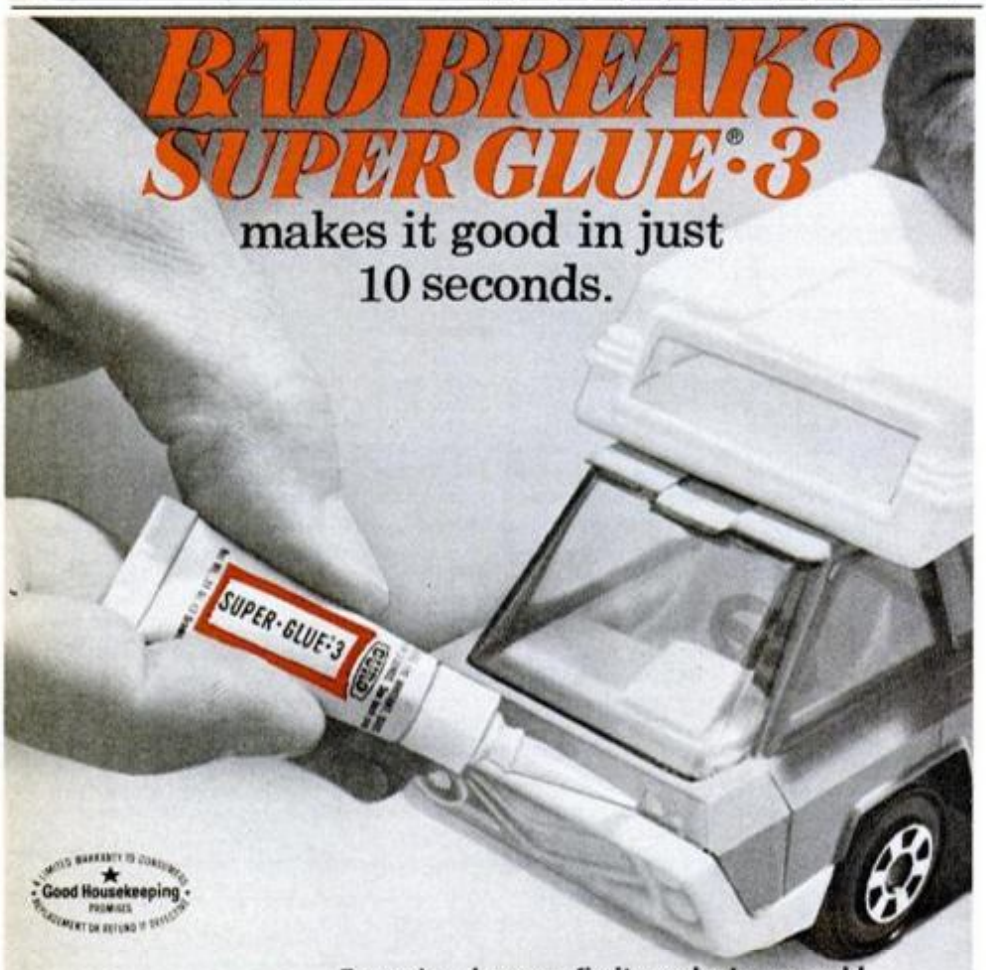

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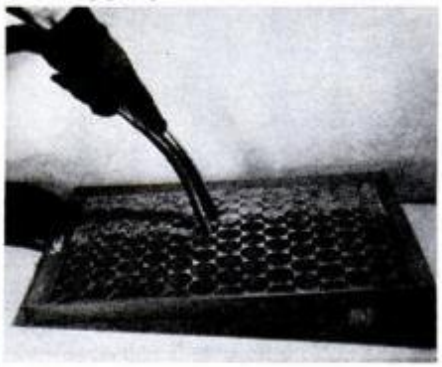
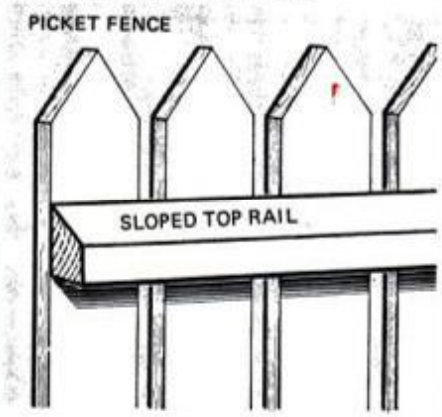
HINTS FROM READERS

Unclogging an air filter



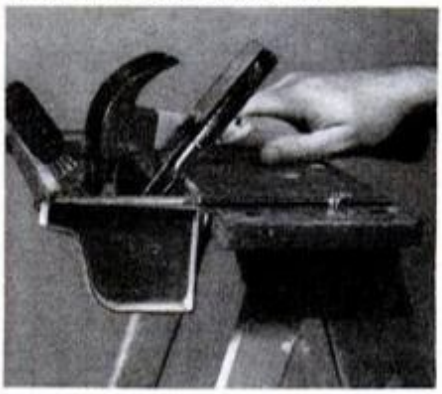
A dirty fiberglass airconditioner filter is cleared by sucking lint and dust with a vacuum cleaner on the air-input side.—*W.E. Burton*

Sloped rail sheds water



To stop rainwater and snow from standing on the top rail of your wooden fence, bevel the rail. The slant does not affect fence strength, but sheds moisture to help prevent rot.—*H.I. Miller*

Gutter section holds tools



A gutter section fastened to a stepladder's top step keeps tools from dropping. Threaded rods—6 in. longer than gutter width—run through gutter ferrules, are held with nuts at one end and to the ladder with heavy staples at the other.—*Ken Patterson*

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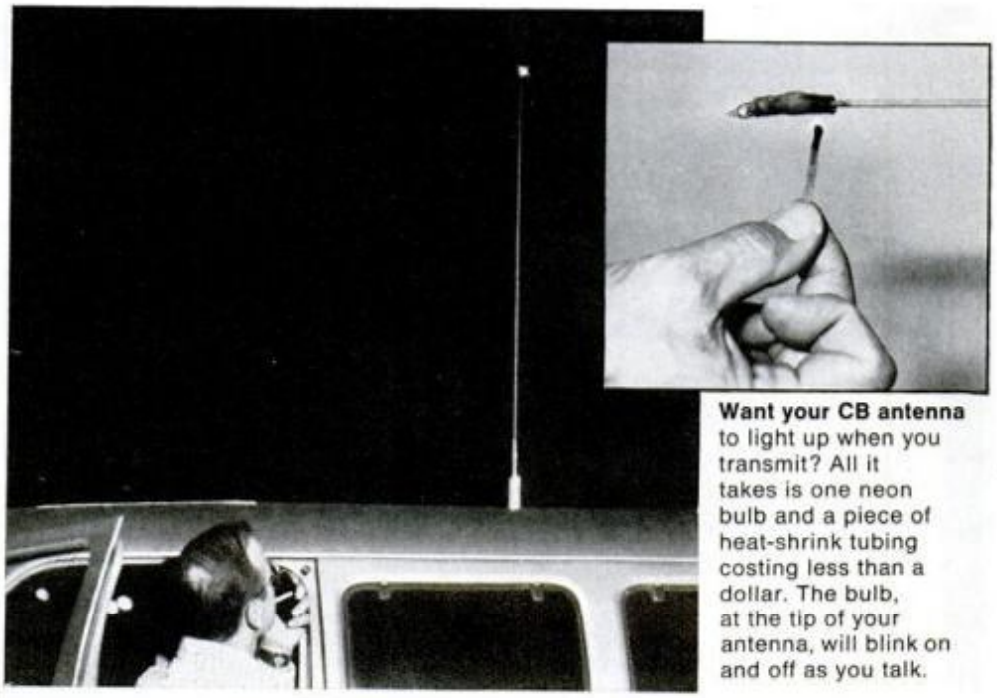
Tell the world you're on the air

How you can add an antenna light to your CB for less than a buck.

by Joseph P. Greeves



Want your CB antenna to light up when you transmit? All it takes is one neon bulb and a piece of heat-shrink tubing costing less than a dollar. The bulb, at the tip of your antenna, will blink on and off as you talk.

I don't know if this antenna light is useful (warning to low-flying aircraft?) or functional (follow the flashing orange light!) or even how it works. But it sure is fun and it's a cinch to make. It uses only a small neon bulb mounted on top of the antenna. It needs no electrical power because it's activated by radio waves when you transmit. The bulb is the kind you find glowing in household voltage testers. The bulbs I bought from Radio Shack came two on a card and cost about 50 cents. I also purchased the "shrink tubing" used to keep the light in place on top of the antenna.

Wrap one wire

The modification couldn't be simpler. The first step is to try the bulb in place to make sure you have the right kind. Just wrap *one* of the wires from the bulb (not two) around the antenna and stick some masking tape over it. Key the mike with the radio on and the light should glow. If it does, clip the second wire off and get ready to mount it. If it doesn't, continue your search for the right type of neon bulb. Remember, the kind with a filament won't work.

After you've checked out the bulb, position it at the very top of the antenna and tape it in place. Double check by keying the mike and, if the bulb lights, position the shrink tubing so that it covers the bottom part of the bulb and the end of the antenna. Hold a match near the tubing and carefully shrink the tubing so that it grips the bulb and the end of the antenna.

Twinkle, twinkle, little light

The final step, of course, is to check your signal-strength meter. Since the length of the antenna has been changed slightly, you may need an adjustment. If so, it is a five-minute operation any CB technician can perform. You should have this done every six months or so anyway in order to maintain maximum performance from your set.

The rest is all fun. Several members of the local van club have added antenna lights, and it's fascinating to watch a convoy of 10 or 12 vans, going down a long, dark highway, twinkling back and forth to each other. The bulb blinks on and off as your voice peaks the power output from your transmitter. Make sure, though, that everything you do about your rig is legal because "Uncle Charley" will now know who is transmitting, for certain, Good Buddy. 10-4? ★★★

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We include the important little things, too. Like Herculon® fabrics—colorful, lasting and fire-retardant. And a handy locking storage trunk—accessible even when the camper's closed.

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How do we keep the price so low? We're the world's largest camper maker. We buy in volume. And our engineering experience also helps us trim down costs.

But we also have a reputation to maintain—and we won't cut back on the things that make our campers strong. Rugged features like our automotive-type suspension. Twelve-inch tires. And our frame-mounted steel rear bumper.

In fact, the Starmate is so tough that you can carry up to 565 lbs. of extra cargo—enough for a

The Starmate's built-in 2.5-cubic-foot ice box is made of durable fiberglass.

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Starmate interior: bright, practical and fully equipped for family living.

lightweight fishing boat or a pair of bicycles.

The roomy compact

And the price is not the only thing that's remarkable about the Starmate. There is also its unusual *versatility.*

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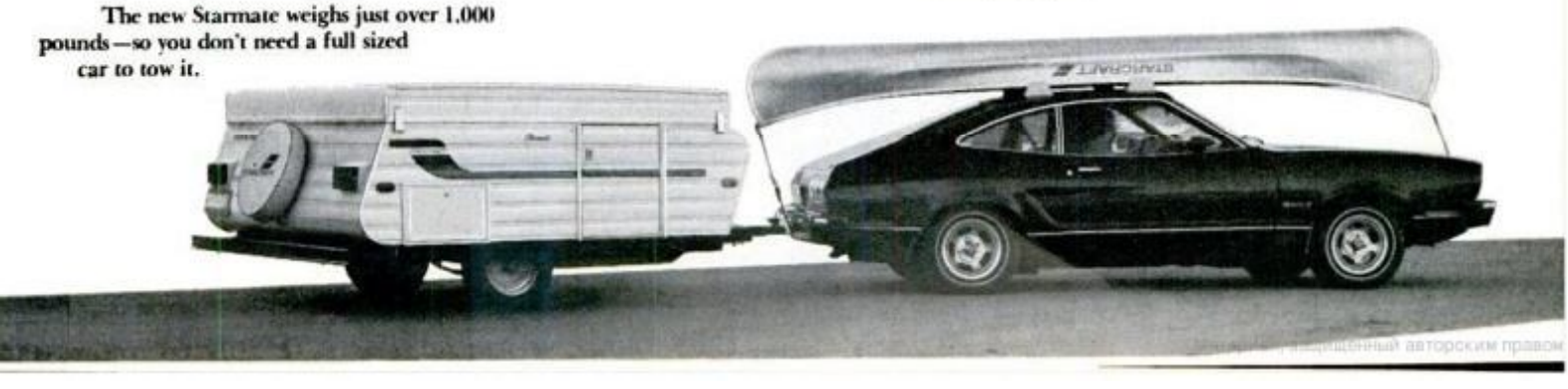

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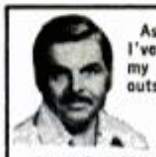

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(Continued from page 105)

the most comfortable and best-riding car we have ever owned."

We next asked owners what they enjoy or appreciate most about their Thunderbirds. Here is a cross section of reactions:

"Handles great," comments a North Carolina highway engineer, "especially with the heavy-duty suspension I ordered. I also like the **big gas tank**—this car gives the best gas mileage I've gotten since the 1950s. Good styling, too, and excellent visibility from the driver's seat."

This tank holds 26 gallons, gives up to 450 miles between fillings. ◀

Notes a Washington teacher: "This car's ride equals our 1976 LTD's. The way people stop and turn to see the new car is interesting. As for me, the 1977 TB is the best-looking car in the United States today and should be recognized by all car magazines for its looks and especially for its cost—$3000 less than in 1976. Ford cut the size, yes, but also the price, whereas GM cut size and **then upped the price."**

Here's quite an endorsement from a man who's a pro. ▶

It's not its size that makes T-Bird less expensive; it's sharing its basic tooling with LTD II. ◀

A Texas medical technologist: "Good looks, good price, good trade-in value, runs well, good service at dealership."

A Michigan bank officer: "Quiet, excellent handling on expressways, effortless acceleration without flooring it. I've never before had a car that seemed so well put together and trouble-free."

We also asked owners to rate their dealers in terms of sales and service. Fully 82.5 percent gave their dealers' sales policies marks of *good* to *excellent*, while only 63.2 percent graded service in those terms. Even that, though, isn't half bad when compared with reports about many competing dealer service departments.

To sum up, here are a few general comments from our questionnaires:

The first comes from a Louisiana truck driver, age 26: "My occupation is driving. When I get out of that big rig after 10 to 12 hours behind the wheel, I'm beat. I almost always feel like just driving my car home. But the 1977 T-Bird is such a pleasure to ride in and to drive that **I sometimes just keep going.** I'm very relaxed in it and very pleased by the way it's put together. It's one of Ford's better 1977 ideas."

The second, from an Arizona life-insurance manager: "I'm in my car a lot. The control of this Thunderbird on the road is great—much better than my old 1975 Cougar, which wasn't bad either. Gas mileage is also better than the Cougar."

And finally, a California housewife: "We originally wanted a Mark V Continental, but no way could we afford one. The T-Bird looked close. Good choice, too. Same smooth ride, super handling on the highway, great looks; in short, it's everything we wanted, and at a reasonable price." ★★★

If you're creative, here's a "money-hobby" that might double your income.

By Ernest P. Weckesser, Ph.D.

with

Edward C. Lane

Several years ago, while I was teaching college in Indiana, I stumbled across a hobby that has changed my life.

Oddly enough, I discovered it while browsing through magazines in a drug store. In almost every magazine there were dozens of small ads selling one basic thing — printed information.

The financial magazines contained small ads for "newsletters," "reports" and "booklets." The science and mechanics magazines were loaded with classified ads for all sorts of "how-to" books, "instructions," "plans," etc.

I was most surprised by the fact that almost all the ads were placed by individuals — not by large companies.

This was too fascinating to resist. I decided to place two small ads myself.

I put together a booklet containing some of my best wine recipes and another about Australia. A few days after the ads appeared I stopped by the post office.

When I looked through the little glass window on my P.O. box, I almost dropped my key. The box was stuffed — jammed — packed full of envelopes. Hundreds of orders containing cash and checks!

$9,450.00 IN 45 DAYS

When the dust finally settled around our house, I talked with other successful advertisers. I discovered . . .

1. A young graduate student in Texas markets a body-building manual for $3.00. He uses one classified ad in six magazines. It's strictly a spare-time activity but he reports earnings of $300.00 monthly.

* * *

2. A retired U.S. Army sergeant in Arizona wrote a 24-page booklet. His three $17.00 classified ads brought him $300.00 in cash orders.

* * *

3. A Kentucky woman selling a 15-page travel booklet for $1.00 was literally swamped with orders. In 87 days her classified ad running in six magazines made a net profit of $2,230.00 from a gross of $3,250.00. She was 69 years of age, widowed and living alone in her apartment at the time.

* * *

4. A husband-wife team in Oregon compiled their own "how-to" booklet. They put a small display ad in one newspaper. Within only 45 days that one ad pulled $9,450.00 in cash orders.

Don't misunderstand. This isn't a get-rich-quick scheme. It's a business and, as such, it's speculative. But test ads are cheap (as low as $13.50 for a national ad) and the profit potential is staggering! An Ohio man I spoke with put a large display ad in a national Sunday supplement. A few days later the orders started pouring in — mail sacks full of cash!

Within the next two months he received over $220,000.00 in CASH orders for his $3.00 booklet.

I realize this all sounds too good to be true. But here's a way you can actually verify what I'm saying in your home or office.

TRY THIS TEST

★ First, obtain several magazines containing classified ads. You don't have to buy them . . . just borrow them from the library.
★ Second, get old copies of the same magazines — at least 10-13 months old.
★ Third, turn to the classified sections of each and place the old magazine beside the new magazine.
★ Fourth, compare both. Cross-check each one to see how many ads in the old magazine are still running in the new edition.

THIS IS AN ABSOLUTE PROFIT TEST.

It has to be. People don't continue running ads for over a year unless they're making money doing so.

WHY NOT YOU?

Consider these facts:

• It's simple to begin . . .just an hour a week can get you started at home.

• It's inexpensive to begin . . . I'll show you how to place a test ad in a national magazine for only $13.50. Your total starting investment can be less than $25.00.

• You don't have to write a booklet yourself. I'll show you an easy way to get hundreds of different books at wholesale prices or below.

• If your test ad produces even a modest profit you can run wild with it. The whole nation is yours.

• Your profit margin may exceed 1,000%! My wine book cost 36 cents to print yet sold for $3.98.

• It's private. Even if you begin making $25,000-$35,000 a year you can run your entire business from your home or apartment.

• It's safe. Information booklets and newsletters aren't breakable, mechanical or chemical. They're easy to mail in small envelopes and can be stored in a closet.

• The market is almost infinite. My own "best-sellers" include . . . **101 Ways To Fix Hamburger, How To Win Contests, How To Stop Smoking, How To Make Champagne At Home,** and others . . .

I want you to see this for yourself. That's why I put everything . . . every secret . . . in a simple, easy-to-follow beginners guide. It's entitled, **Dollars In Your Mailbox.**

It shows you . . .

- **Where to advertise . . . which magazines and newspapers are most profitable.**
- **Where to get national ads for less than $15.00.**
- **Where to get hundreds of books wholesale.**
- **How to have your own booklets printed for less than 12¢ each.**
- **How to save up to 40% on all printing.**
- **How to get "free" advertising and publicity.**
- **How to start with no money in stock or supplies.**
- **How to word your advertisement.**

PLUS

All the forms, lists, and details you'll need to begin.

MONEY-BACK GUARANTEE

When your book arrives, take two weeks (14 days) to examine it. If you're not delighted, just return it. We'll send your refund check within 3 working days — no delays, no nonsense. There is absolutely no risk to you.

Our offices are located on Temple Rd. in Dunkirk, N. Y. just west of Buffalo.
We belong to the Dunkirk Chamber of Commerce and our telephone number is 716-366-8300. We're there from 9 AM - 5 PM weekdays.

You can begin this unusual money hobby for less than $25.00. And if you're creative, it may even double your present income.

Let me show you how to begin in just a few days. First Class mail reaches us within 48 hours.

THE GREEN TREE PRESS,
10576 Temple Rd. Dept. 59
Dunkirk, N.Y. 14048

Send me **Dollars In Your Mailbox** right away. I understand I may keep it for 14 days. If I'm not delighted, I may return it for a complete refund sent to me within three working days.

On that basis, here's my $9.95.

☐ Enclosed is my check or money order.
☐ Charge Master Charge
☐ Charge BankAmericard

Account # ☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐

Expiration Date (month, year) ☐☐☐☐

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For information (including pictures and construction plans) on Dura Float's pontoon kits, send $2.00 to:

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- ***Will the first war in space use killer satellites?***
- ***22 energy-miser tricks that cut living costs***
- ***PM's motor home of the future has unique RV design features***
- ***6 wood projects you can build and enjoy this summer***
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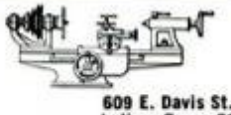

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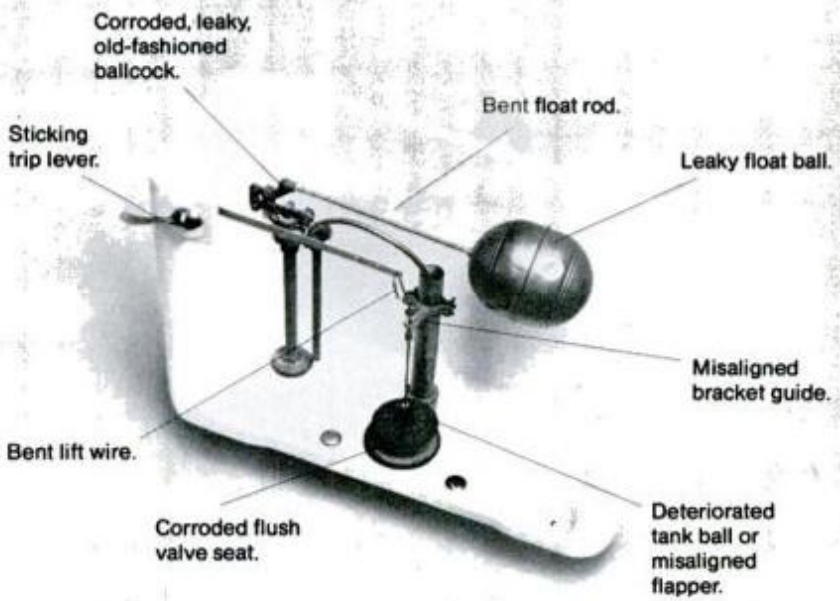
NAME, ADDRESS, ZIP

What makes Johnny run.



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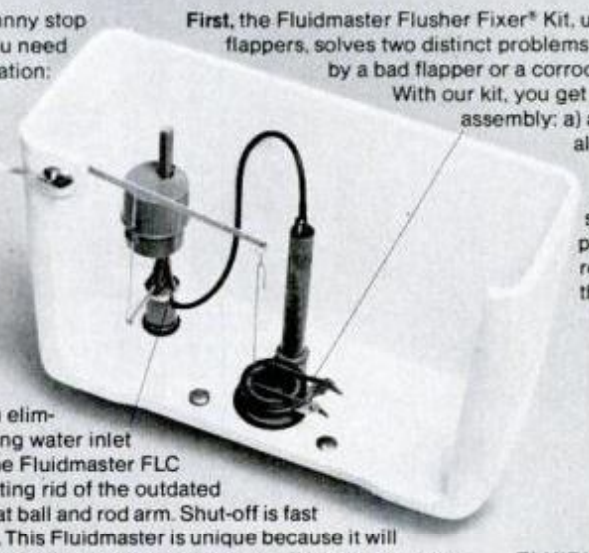

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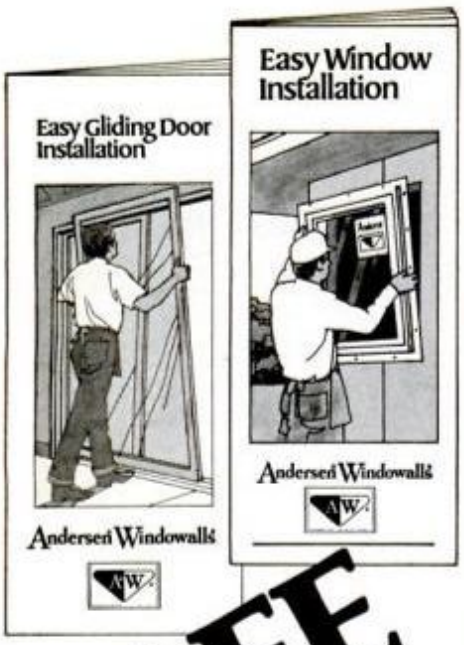

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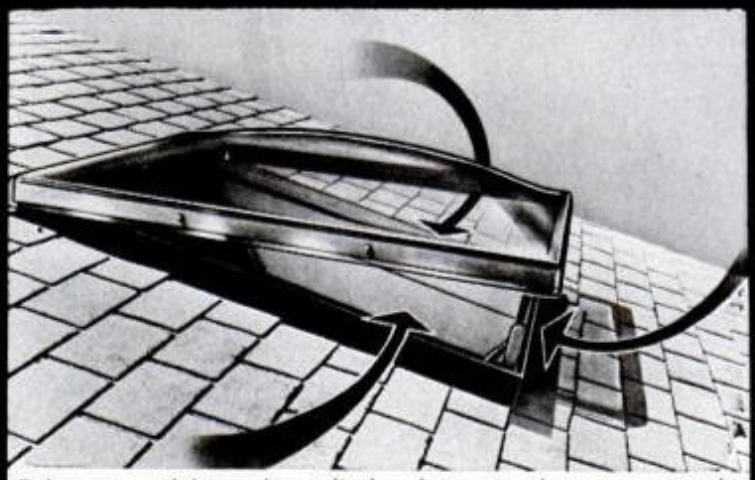

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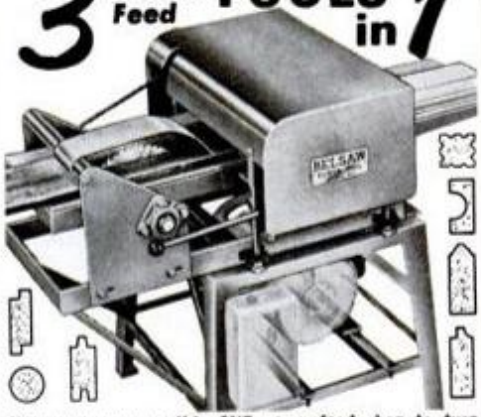

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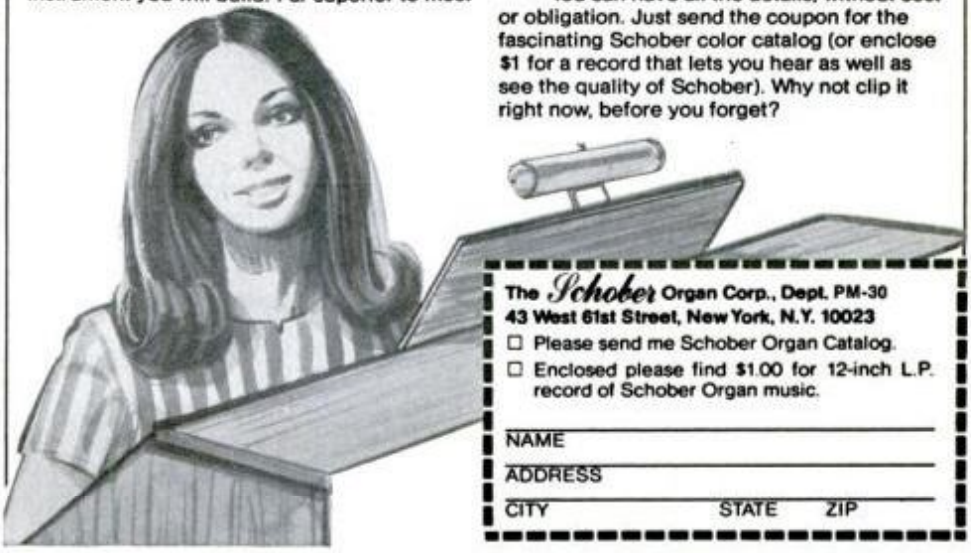

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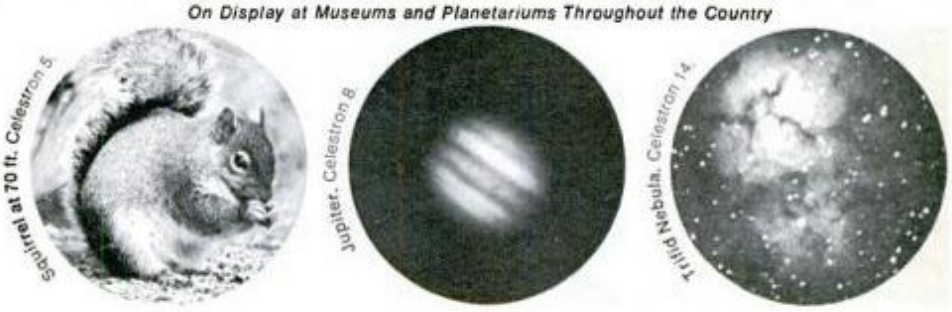

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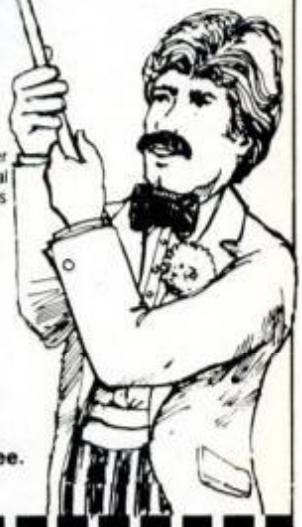

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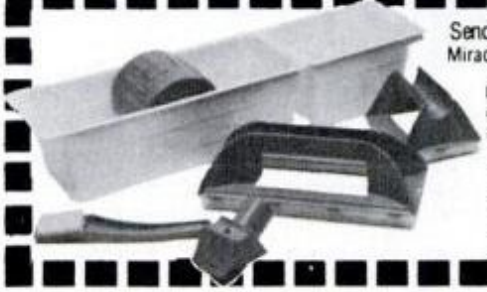

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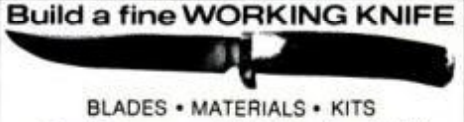

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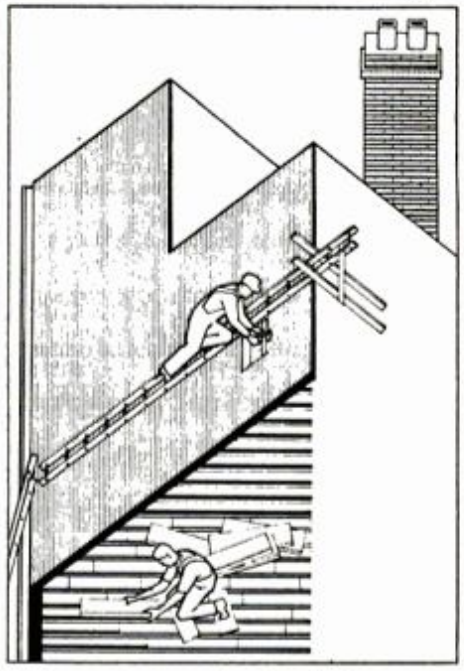

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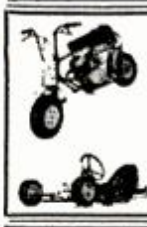

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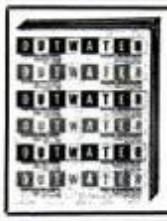

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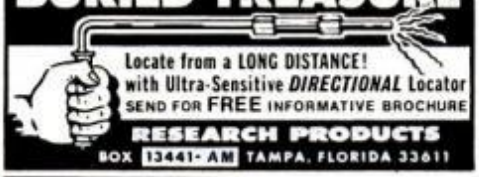

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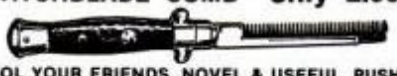

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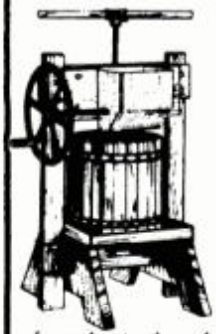

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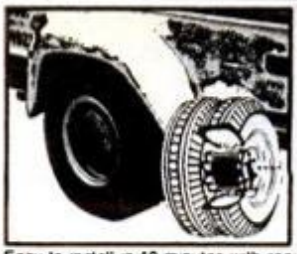

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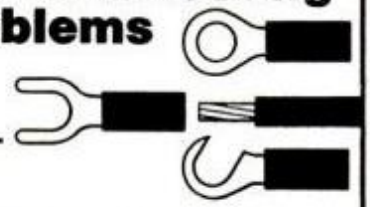

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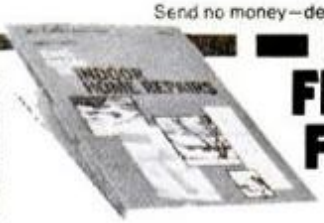

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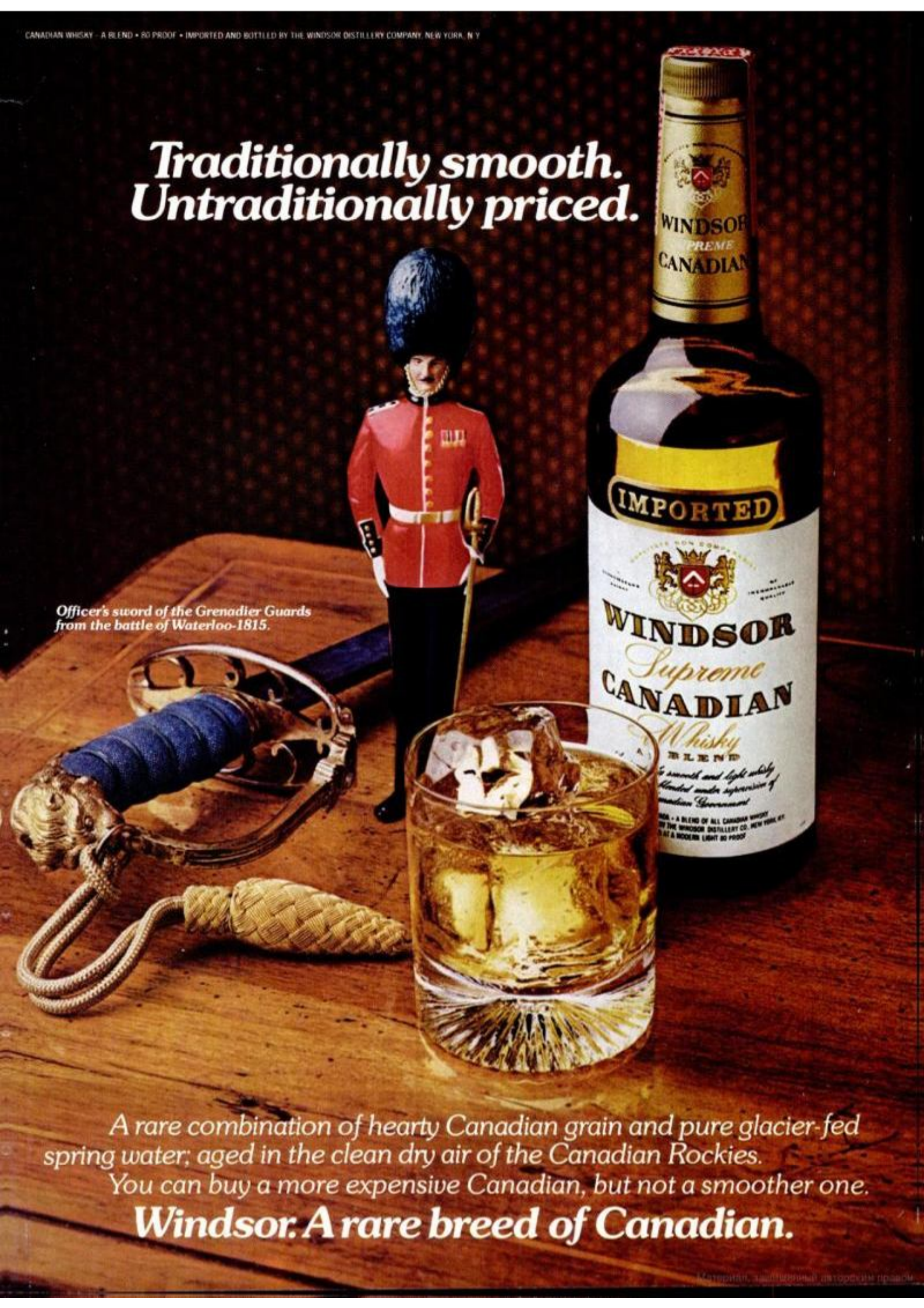

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